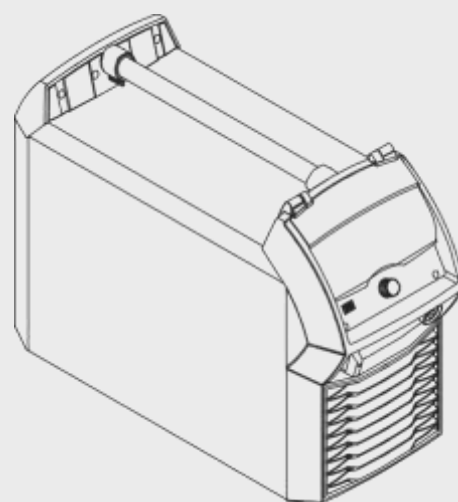


TPS 320i / 400i / 500i / 600i **TPS 400i LSC ADV**

Operating Instructions

MIG/MAG Power source



42,0426,0114,EN 026-11092018



Dear reader,

Introduction

Thank you for the trust you have placed in our company and congratulations on buying this high-quality Fronius product. These instructions will help you familiarise yourself with the product. Reading the instructions carefully will enable you to learn about the many different features it has to offer. This will allow you to make full use of its advantages.

Please also note the safety rules to ensure greater safety when using the product. Careful handling of the product will repay you with years of safe and reliable operation. These are essential prerequisites for excellent results.

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Safety rules

Explanation of safety symbols



DANGER! Indicates immediate and real danger. If it is not avoided, death or serious injury will result.



WARNING! Indicates a potentially dangerous situation. Death or serious injury may result if appropriate precautions are not taken.



CAUTION! Indicates a situation where damage or injury could occur. If it is not avoided, minor injury and/or damage to property may result.



NOTE! Indicates a risk of flawed results and possible damage to the equipment.

IMPORTANT! Indicates tips for correct operation and other particularly useful information. It does not indicate a potentially damaging or dangerous situation.

If you see any of the symbols depicted in the "Safety rules" chapter, special care is required.

General

The device is manufactured using state-of-the-art technology and according to recognised safety standards. If used incorrectly or misused, however, it can cause:

- injury or death to the operator or a third party,
- damage to the device and other material assets belonging to the operating company,
- inefficient operation of the device.

All persons involved in commissioning, operating, maintaining and servicing the device must:

- be suitably qualified,
- have sufficient knowledge of welding and
- read and follow these operating instructions carefully.

The operating instructions must always be at hand wherever the device is being used. In addition to the operating instructions, attention must also be paid to any generally applicable and local regulations regarding accident prevention and environmental protection.

All safety and danger notices on the device

- must be in a legible state,
- must not be damaged,
- must not be removed,
- must not be covered, pasted or painted over.

For the location of the safety and danger notices on the device, refer to the section headed "General" in the operating instructions for the device.

Before switching on the device, rectify any faults that could compromise safety.

This is for your personal safety!

Proper use

The device is to be used exclusively for its intended purpose.

The device is intended solely for the welding processes specified on the rating plate. Any use above and beyond this purpose is deemed improper. The manufacturer shall not be held liable for any damage arising from such usage.

Proper use includes:

- carefully reading and following all the instructions given in the operating instructions
- studying and obeying all safety and danger notices carefully
- performing all stipulated inspection and maintenance work.

Never use the device for the following purposes:

- Thawing out pipes
- Charging batteries
- Starting engines

The device is designed for use in industry and the workshop. The manufacturer accepts no responsibility for any damage caused through use in a domestic setting.

The manufacturer likewise accepts no liability for inadequate or incorrect results.

Mains connection

Devices with a higher rating may affect the energy quality of the mains due to their current consumption.

This may affect a number of types of device in terms of:

- connection restrictions
- criteria with regard to the maximum permissible mains impedance ^{*)}
- criteria with regard to the minimum short-circuit power requirement ^{*)}

^{*)} at the interface with the public grid

see Technical Data

In this case, the plant operator or the person using the device should check whether the device may be connected, where appropriate by discussing the matter with the power supply company.



NOTE! Ensure that the mains connection is earthed properly

Environmental conditions

Operation or storage of the device outside the stipulated area will be deemed as not in accordance with the intended purpose. The manufacturer shall not be held liable for any damage arising from such usage.

Ambient temperature range:

- during operation: -10 °C to + 40 °C (14 °F to 104 °F)
- during transport and storage: -20 °C to +55 °C (-4 °F to 131 °F)

Relative humidity:

- up to 50% at 40 °C (104 °F)
- up to 90% at 20 °C (68 °F)

The surrounding air must be free from dust, acids, corrosive gases or substances, etc.
Can be used at altitudes of up to 2000 m (6561 ft. 8.16 in.)

Obligations of the operator

The operator must only allow persons to work with the device who:

- are familiar with the fundamental instructions regarding safety at work and accident prevention and have been instructed in how to use the device
- have read and understood these operating instructions, especially the section "safety rules", and have confirmed as much with their signatures
- are trained to produce the required results.

Checks must be carried out at regular intervals to ensure that operators are working in a safety-conscious manner.

Obligations of personnel	Before using the device, all persons instructed to do so undertake: - to observe the basic instructions regarding safety at work and accident prevention - to read these operating instructions, especially the "Safety rules" section and sign to confirm that they have understood them and will follow them. Before leaving the workplace, ensure that people or property cannot come to any harm in your absence.
Residual current protective device	Local regulations and national guidelines may require a residual current protective device when connecting equipment to the public grid. The type of residual current protective device recommended by the manufacturer for the equipment is indicated in the technical data.
Protecting yourself and others	Anyone working with the device exposes themselves to numerous risks, e.g. - flying sparks and hot pieces of metal - Arc radiation, which can damage eyes and skin - Hazardous electromagnetic fields, which can endanger the lives of those using cardiac pacemakers - Risk of electrocution from mains current and welding current - Greater noise pollution - Harmful welding fumes and gases Suitable protective clothing must be worn when working with the device. The protective clothing must have the following properties: - Flame-resistant - Insulating and dry - Covers the whole body, is undamaged and in good condition - Safety helmet - Trousers with no turn-ups Protective clothing refers to a variety of different items. Operators should: - Protect eyes and face from UV rays, heat and sparks using a protective visor and regulation filter - Wear regulation protective goggles with side protection behind the protective visor - Wear stout footwear that provides insulation even in wet conditions - Protect the hands with suitable gloves (electrically insulated and providing protection against heat) - Wear ear protection to reduce the harmful effects of noise and to prevent injury Keep all persons, especially children, out of the working area while any devices are in operation or welding is in progress. If, however, there are people in the vicinity: - Make them aware of all the dangers (risk of dazzling by the arc, injury from flying sparks, harmful welding fumes, noise, possible risks from mains current and welding current, etc.) - Provide suitable protective equipment - Alternatively, erect suitable safety screens/curtains.
Noise emission values	The device generates a maximum sound power level of <80 dB(A) (ref. 1pW) when idling and in the cooling phase following operation at the maximum permissible operating point under maximum rated load conditions according to EN 60974-1. It is not possible to provide a workplace-related emission value during welding (or cutting) as this is influenced by both the process and the environment. All manner of different welding parameters come into play, including the welding process (MIG/MAG, TIG welding), the type of power selected (DC or AC), the power range, the type of weld metal, the resonance characteristics of the workpiece, the workplace environment, etc.

Danger from toxic gases and vapours

The fumes produced during welding contain harmful gases and vapours.

Welding fumes contain substances that may, under certain circumstances, cause birth defects or cancer.

Keep your face away from welding fumes and gases.

Fumes and hazardous gases

- must not be breathed in
- must be extracted from the working area using appropriate methods.

Ensure an adequate supply of fresh air with a ventilation rate of at least 20 m³/hour.

Otherwise, a protective mask with an air supply must be worn.

Close the shielding gas cylinder valve or main gas supply if no welding is taking place.

If there is any doubt about whether the extraction capacity is sufficient, the measured toxic emission values should be compared with the permissible limit values.

Amongst others, the following components are responsible for the degree of toxicity of welding fumes:

- Metals used for the workpiece
- Electrodes
- Coatings
- Cleaners, degreasers, etc.

The relevant material safety data sheets and manufacturer's specifications for the listed components should therefore be studied carefully.

Flammable vapours (e.g. solvent fumes) should be kept away from the arc's radiation area.

Danger from flying sparks

Flying sparks may cause fires or explosions.

Never weld close to flammable materials.

Flammable materials must be at least 11 metres (36 ft. 1.07 in.) away from the arc, or alternatively covered with an approved cover.

A suitable, tested fire extinguisher must be available and ready for use.

Sparks and pieces of hot metal may also get into adjacent areas through small gaps or openings. Take appropriate precautions to prevent any danger of injury or fire.

Welding must not be performed in areas that are subject to fire or explosion or near sealed tanks, vessels or pipes unless these have been prepared in accordance with the relevant national and international standards.

Do not carry out welding on containers that are being or have been used to store gases, propellants, mineral oils or similar products. Residues pose an explosive hazard.

Risks from mains current and welding current

An electric shock is potentially life threatening and can be fatal.

Do not touch live parts either inside or outside the device.

During MIG/MAG welding and TIG welding, the welding wire, the wirepool, the feed rollers and all pieces of metal that are in contact with the welding wire are live.

Always set the wirefeeder up on a sufficiently insulated surface or use a suitable, insulated wirefeeder holder.

Make sure that you and others are protected with an adequately insulated, dry temporary backing or cover for the earth or ground potential. This temporary backing or cover must extend over the entire area between the body and the earth or ground potential.

All cables and leads must be secured, undamaged, insulated and adequately dimensioned. Replace loose connections and scorched, damaged or inadequately dimensioned cables and leads immediately.

Use the handle to ensure the power connections are tight before every use.
In the case of power cables with a bayonet connector, rotate the power cable around the longitudinal axis by at least 180° and pre-load.

Do not wrap cables or leads around the body or parts of the body.

The electrode (rod electrode, tungsten electrode, welding wire, etc.) must

- never be immersed in liquid for cooling
 - Never touch the electrode when the power source is switched on.
-

Double the open circuit voltage of a power source can occur between the welding electrodes of two power sources. Touching the potentials of both electrodes at the same time may be fatal under certain circumstances.

Arrange for the mains cable to be checked regularly by a qualified electrician to ensure the ground conductor is functioning properly.

The device must only be operated on a mains supply with a ground conductor and a socket with a ground conductor contact.

Operating the device on a grid without a ground conductor and in a socket without a ground conductor contact will be deemed gross negligence. The manufacturer shall not be held liable for any damage arising from such usage.

If necessary, provide an adequate earth connection for the workpiece.

Switch off unused devices.

Wear a safety harness if working at height.

Before working on the device, switch it off and pull out the mains plug.

Attach a clearly legible and easy-to-understand warning sign to the device to prevent anyone from plugging the mains plug back in and switching it on again.

After opening the device:

- Discharge all live components
 - Ensure that all components in the device are de-energised
-

If work on live parts is required, appoint a second person to switch off the main switch at the right moment.

Meandering welding currents

If the following instructions are ignored, meandering welding currents can develop with the following consequences:

- Fire hazard
 - Overheating of parts connected to the workpiece
 - Irreparable damage to ground conductors
 - Damage to device and other electrical equipment
-

Ensure that the workpiece is held securely by the workpiece clamp.

Attach the workpiece clamp as close as possible to the area that is to be welded.

If the floor is electrically conductive, the device must be set up with sufficient insulating material to insulate it from the floor.

If distribution boards, twin-head mounts, etc., are being used, note the following: The electrode of the welding torch / electrode holder that is not used is also live. Make sure that the welding torch / electrode holder that is not used is kept sufficiently insulated.

In the case of automated MIG/MAG applications, ensure that only an insulated wire electrode is routed from the welding wire drum, large wirefeeder spool or wirepool to the wire-feed unit.

EMC Device Classifications

Devices in emission class A:

- Are only designed for use in industrial settings
 - Can cause line-bound and radiated interference in other areas
-

Devices in emission class B:

- Satisfy the emissions criteria for residential and industrial areas. This is also true for residential areas in which the energy is supplied from the public low-voltage mains.

EMC device classification as per the rating plate or technical data.

EMC measures

In certain cases, even though a device complies with the standard limit values for emissions, it may affect the application area for which it was designed (e.g. when there is sensitive equipment at the same location, or if the site where the device is installed is close to either radio or television receivers).

If this is the case, then the operator is obliged to take appropriate action to rectify the situation.

Check and evaluate the immunity to interference of nearby devices according to national and international regulations. Examples of equipment that may be susceptible to interference from the device include:

- Safety devices
- Power, signal and data transfer lines
- IT and telecommunications devices
- Measuring and calibrating devices

Supporting measures for avoidance of EMC problems:

1. Mains supply
 - If electromagnetic interference arises despite correct mains connection, additional measures are necessary (e.g. use a suitable line filter).
2. Welding power leads
 - must be kept as short as possible
 - must run close together (to avoid EMF problems)
 - must be kept well apart from other leads
3. Equipotential bonding
4. Earthing of the workpiece
 - If necessary, establish an earth connection using suitable capacitors.
5. Shielding, if necessary
 - Shield off other nearby devices
 - Shield off entire welding installation

EMF measures

Electromagnetic fields may pose as yet unknown risks to health:

- effects on the health of others in the vicinity, e.g. wearers of pacemakers and hearing aids
- wearers of pacemakers must seek advice from their doctor before approaching the device or any welding that is in progress
- for safety reasons, keep distances between the welding cables and the welder's head/torso as large as possible
- do not carry welding cables and hosepacks over the shoulders or wind them around any part of the body

Specific hazards

Keep hands, hair, clothing and tools away from moving parts. For example:

- Fans
- Cogs
- Rollers
- Shafts
- Wirespools and welding wires

Do not reach into the rotating cogs of the wire drive or into rotating drive components.

Covers and side panels may only be opened/removed while maintenance or repair work is being carried out.

During operation

- Ensure that all covers are closed and all side panels are fitted properly.
- Keep all covers and side panels closed.

The welding wire emerging from the welding torch poses a high risk of injury (piercing of the hand, injuries to the face and eyes, etc.).

Therefore always keep the welding torch away from the body (devices with wire-feed unit) and wear suitable protective goggles.

Never touch the workpiece during or after welding - risk of burns.

Slag can jump off cooling workpieces. The specified protective equipment must therefore also be worn when reworking workpieces, and steps must be taken to ensure that other people are also adequately protected.

Welding torches and other parts with a high operating temperature must be allowed to cool down before handling.

Special provisions apply in areas at risk of fire or explosion - observe relevant national and international regulations.

Power sources for work in areas with increased electric risk (e.g. near boilers) must carry the "Safety" sign. However, the power source must not be located in such areas.

Risk of scalding from escaping coolant. Switch off cooling unit before disconnecting coolant flow or return lines.

Observe the information on the coolant safety data sheet when handling coolant. The coolant safety data sheet may be obtained from your service centre or downloaded from the manufacturer's website.

Use only suitable load-carrying equipment supplied by the manufacturer when transporting devices by crane.

- Hook chains and/or ropes onto all suspension points provided on the load-carrying equipment.
- Chains and ropes must be at the smallest angle possible to the vertical.
- Remove gas cylinder and wire-feed unit (MIG/MAG and TIG devices).

If the wire-feed unit is attached to a crane holder during welding, always use a suitable, insulated wirefeeder hoisting attachment (MIG/MAG and TIG devices).

If the device has a carrying strap or handle, this is intended solely for carrying by hand. The carrying strap is not to be used if transporting with a crane, counterbalanced lift truck or other mechanical hoist.

All lifting accessories (straps, handles, chains, etc.) used in connection with the device or its components must be tested regularly (e.g. for mechanical damage, corrosion or changes caused by other environmental factors).

The testing interval and scope of testing must comply with applicable national standards and directives as a minimum.

Odourless and colourless shielding gas may escape unnoticed if an adapter is used for the shielding gas connection. Prior to assembly, seal the device-side thread of the adapter for the shielding gas connection using suitable Teflon tape.

Factors affecting welding results

The following requirements with regard to shielding gas quality must be met if the welding system is to operate in a correct and safe manner:

- Size of solid matter particles < 40 µm
- Pressure dew point < -20 °C
- Max. oil content < 25 mg/m³

Filters must be used if necessary.



NOTE! There is an increased risk of soiling if ring mains are being used

Danger from shielding gas cylinders

Shielding gas cylinders contain gas under pressure and can explode if damaged. As the shielding gas cylinders are part of the welding equipment, they must be handled with the greatest of care.

Protect shielding gas cylinders containing compressed gas from excessive heat, mechanical impact, slag, naked flames, sparks and arcs.

Mount the shielding gas cylinders vertically and secure according to instructions to prevent them falling over.

Keep the shielding gas cylinders well away from any welding or other electrical circuits.

Never hang a welding torch on a shielding gas cylinder.

Never touch a shielding gas cylinder with an electrode.

Risk of explosion - never attempt to weld a pressurised shielding gas cylinder.

Only use shielding gas cylinders suitable for the application in hand, along with the correct and appropriate accessories (regulator, hoses and fittings). Only use shielding gas cylinders and accessories that are in good condition.

Turn your face to one side when opening the valve of a shielding gas cylinder.

Close the shielding gas cylinder valve if no welding is taking place.

If the shielding gas cylinder is not connected, leave the valve cap in place on the cylinder.

The manufacturer's instructions must be observed as well as applicable national and international regulations for shielding gas cylinders and accessories.

Danger from escaping shielding gas

Risk of suffocation from the uncontrolled escape of shielding gas

Shielding gas is colourless and odourless and, in the event of a leak, can displace the oxygen in the ambient air.

- Ensure an adequate supply of fresh air with a ventilation rate of at least 20 m³/hour.
- Observe safety and maintenance instructions on the shielding gas cylinder or the main gas supply.
- Close the shielding gas cylinder valve or main gas supply if no welding is taking place.
- Check the shielding gas cylinder or main gas supply for uncontrolled gas leakage before every start-up.

Safety measures at the installation location and during transport

A device toppling over could easily kill someone. Place the device on a solid, level surface such that it remains stable

- The maximum permissible tilt angle is 10°.

Special regulations apply in rooms at risk of fire or explosion

- Observe relevant national and international regulations.

Use internal directives and checks to ensure that the workplace environment is always clean and clearly laid out.

Only set up and operate the device in accordance with the degree of protection shown on the rating plate.

When setting up the device, ensure there is an all-round clearance of 0.5 m (1 ft. 7.69 in.) to ensure that cooling air can flow in and out freely.

When transporting the device, observe the relevant national and local guidelines and accident prevention regulations. This applies especially to guidelines regarding the risks arising during transport.

Do not lift or transport operational devices. Switch off devices before transport or lifting.

Before transporting the device, allow coolant to drain completely and detach the following components:

- Wirefeeder
- Wirespool
- Shielding gas cylinder

After transporting the device, the device must be visually inspected for damage before commissioning. Any damage must be repaired by trained service technicians before commissioning the device.

Safety measures in normal operation

Only operate the device when all safety devices are fully functional. If the safety devices are not fully functional, there is a risk of

- injury or death to the operator or a third party
- damage to the device and other material assets belonging to the operator
- inefficient operation of the device

Any safety devices that are not functioning properly must be repaired before switching on the device.

Never bypass or disable safety devices.

Before switching on the device, ensure that no one is likely to be endangered.

Check the device at least once a week for obvious damage and proper functioning of safety devices.

Always fasten the shielding gas cylinder securely and remove it beforehand if the device is to be transported by crane.

Only the manufacturer's original coolant is suitable for use with our devices due to its properties (electrical conductivity, anti-freeze agent, material compatibility, flammability, etc.).

Only use suitable original coolant from the manufacturer.

Do not mix the manufacturer's original coolant with other coolants.

Only connect the manufacturer's system components to the cooling circuit.

The manufacturer accepts no liability for damage resulting from use of other system components or a different coolant. In addition, all warranty claims will be forfeited.

Cooling Liquid FCL 10/20 does not ignite. The ethanol-based coolant can ignite under certain conditions. Transport the coolant only in its original, sealed containers and keep well away from any sources of ignition.

Used coolant must be disposed of properly in accordance with the relevant national and international regulations. The coolant safety data sheet may be obtained from your service centre or downloaded from the manufacturer's website.

Check the coolant level before starting to weld, while the system is still cool.

Commissioning, maintenance and repair

It is impossible to guarantee that bought-in parts are designed and manufactured to meet the demands made of them, or that they satisfy safety requirements.

- Use only original spare and wearing parts (also applies to standard parts).
- Do not carry out any modifications, alterations, etc. to the device without the manufacturer's consent.
- Components that are not in perfect condition must be replaced immediately.
- When ordering, please give the exact designation and part number as shown in the spare parts list, as well as the serial number of your device.

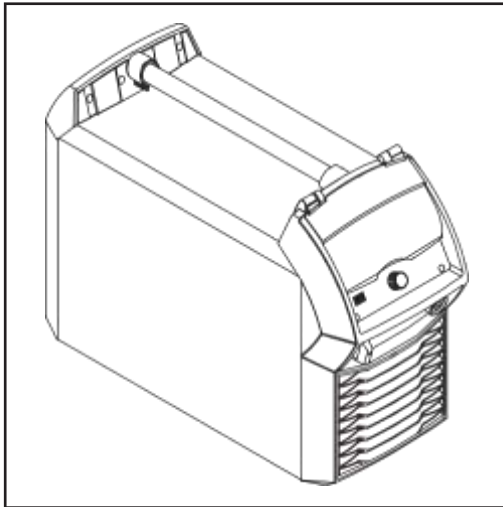
The housing screws provide the ground conductor connection for earthing the housing parts.

Only use original housing screws in the correct number and tightened to the specified torque.

Safety inspection	The manufacturer recommends that a safety inspection of the device is performed at least once every 12 months.
	The manufacturer recommends that the power source be calibrated during the same 12-month period.
	A safety inspection should be carried out by a qualified electrician - after any changes are made - after any additional parts are installed, or after any conversions - after repair, care and maintenance has been carried out - at least every twelve months.
	For safety inspections, follow the appropriate national and international standards and directives.
	Further details on safety inspection and calibration can be obtained from your service centre. They will provide you on request with any documents you may require.
Disposal	Do not dispose of this device with normal domestic waste! To comply with the European Directive on Waste Electrical and Electronic Equipment and its implementation as national law, electrical equipment that has reached the end of its life must be collected separately and returned to an approved recycling facility. Any device that you no longer require must either be returned to your dealer or given to one of the approved collection and recycling facilities in your area. Ignoring this European Directive may have potentially adverse affects on the environment and your health!
Safety symbols	Devices with the CE mark satisfy the essential requirements of the low-voltage and electromagnetic compatibility directives (e.g. relevant product standards of the EN 60 974 series).
	Fronius International GmbH hereby declares that the device is compliant with Directive 2014/53/EU. The full text on the EU Declaration of Conformity can be found at the following address: http://www.fronius.com
	Devices marked with the CSA test mark satisfy the requirements of the relevant standards for Canada and the USA.
Data protection	The user is responsible for the safekeeping of any changes made to the factory settings. The manufacturer accepts no liability for any deleted personal settings.
Copyright	Copyright of these operating instructions remains with the manufacturer.
	The text and illustrations are all technically correct at the time of printing. We reserve the right to make changes. The contents of the operating instructions shall not provide the basis for any claims whatsoever on the part of the purchaser. If you have any suggestions for improvement, or can point out any mistakes that you have found in the instructions, we will be most grateful for your comments.

General information

Device concept



The MIG/MAG power sources TPS 320i, TPS 400i, TPS 500i and TPS 600i are completely digitised, microprocessor-controlled inverter power sources.

The modular design and potential for system add-ons ensure a high degree of flexibility. The devices can be adapted to any specific situation.

Functional principle

The central control and regulation unit of the power sources is coupled with a digital signal processor. The central control and regulation unit and the signal processor control the entire welding process.

During the welding process, the actual data is measured continuously and the device responds immediately to any changes. Control algorithms ensure that the desired target state is maintained.

This results in:

- a precise welding process
- exact reproducibility of all results
- excellent weld properties.

Application areas

The devices are used in workshops and industry for manual and automated applications with classical steel, galvanised sheets, chrome/nickel and aluminium.

The power sources are designed for:

- Automobile and component supply industry
- Machine manufacturing and rail vehicle construction
- Chemical plant construction
- Equipment construction
- Shipyards, etc.

FCC / RSS Compliance

FCC

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC ID: QKWMCU3

Industry Canada RSS

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

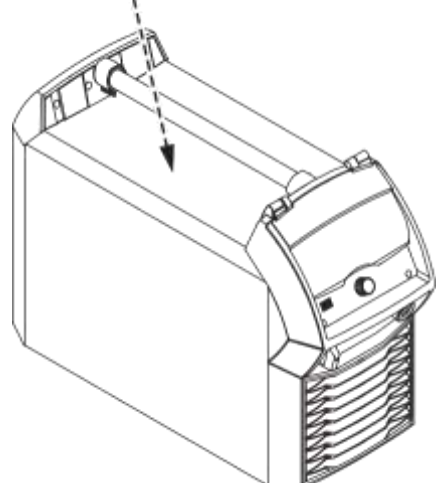
- (1) L'appareil ne doit pas produire de brouillage;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même s'il est susceptible d'en compromettre le fonctionnement.

IC: 12270A-MCU3

Warning notices on the device

Warning notices and safety symbols are affixed to power sources with the CSA test mark for use in North America (USA and Canada). These warnings and safety symbols must not be removed or painted over. They warn against operating the device incorrectly, as this may result in serious injury and damage.

 WARNING		 ARC RAYS can burn eyes and skin; NOISE can damage hearing. • Wear welding helmet with correct filter. • Wear correct eye, ear and body protection.	
Do not Remove, Destroy, Or Cover This Label		 EXPLODING PARTS can injure. • Failed parts can explode or cause other parts to explode when power is applied. • Always wear a face shield and long sleeves when servicing.	
ARC WELDING can be hazardous. • Read and follow all labels and the Owner's Manual carefully. • Only qualified persons are to install, operate, or service this unit according to all applicable codes and safety practices. • Keep children away. • Passmaker wearers keep away. • Welding wire and drive parts may be at welding voltage.		 ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE exists after removal of input power • Always wait 60 seconds after power is turned off before working on unit. • Check input capacitor voltage, and be sure it is near 0 before touching parts.	
 ELECTRIC SHOCK can kill. • Always wear dry insulating gloves. • Insulate yourself from work and ground. • Do not touch live electrical parts. • Disconnect input power before servicing. • Keep all panels and covers securely in place.		 AVERTISSEMENT	
 FUMES AND GASES can be hazardous. • Keep your head out of the fumes. • Ventilate area, or use breathing device. • Read Material Safety Data Sheets (MSDSs) and manufacturer's instructions for materials used.		 UN CHOC ELECTRIQUE peut etre mortel. • Installation et raccordement de cette machine doivent etre conformes a tous les pertinents. SOUDAGE A L'ARC peut etre hasardeux. • Lire le manuel d'instructions avant utilisation. • Ne pas installer sur une surface combustible. • Les fils de soudage et pieces conductrices peuvent etre a la tension de soudage.	
 WELDING can cause fire or explosion. • Do not weld near flammable material. • Watch for fire; keep extinguisher nearby. • Do not locate unit over combustible surfaces. • Do not weld on closed containers.		Read American National Standard Z49.1, "Safety in Welding and Cutting" From American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126; OSHA Safety and Health Standards, 29 CFR 1910, from U.S. Government Printing Office, Washington, DC 20402. CSA, W117-2 M87 Code for Safety in Welding and Cutting. 42-0109-5074	



Safety symbols on the rating plate:

-  Welding is dangerous. The following basic requirements must be met:
- Welders must be sufficiently qualified
 - Suitable protective equipment must be used
 - All persons not involved in the welding process must be kept at a safe distance
-  Do not use the functions described here until you have thoroughly read and understood the following documents:
- these operating instructions
 - all the operating instructions for the system components, especially the safety rules.

Welding processes, procedures and welding characteristics for MIG/MAG welding

General

TPSi power sources contain a selection of welding processes, procedures and welding characteristics that enable a wide range of materials to be processed in the most effective way.

Welding characteristics

Depending on the welding process and shielding gas mix, various process-optimised welding characteristics are available when selecting the filler metal.

Examples of welding characteristics:

- MIG/MAG 3700 PMC Steel 1,0mm M21 - arc blow (*)
- MIG/MAG 3450 PMC Steel 1,0mm M21 - dynamic (*)

The additional designation (*) next to the welding process provides information about the special properties and use of the welding characteristic:

Special welding characteristic properties

arc blow	Characteristics with improved arc break properties by deflecting the external magnetic fields
arcing	Characteristics for a special type of hardfacing on a wet or dry surface (e.g. grinding rollers in the sugar and ethanol industries)
brazе	Characteristics for brazing processes (high brazing speed, reliable wetting and good flow of braze material)
brazе+	Optimised characteristics for brazing processes with special "Braze+" gas nozzle (narrow gas nozzle opening, high shielding gas flow rate)
cladding	Characteristics for cladding with low penetration, low dilution and wide weld seam flow for improved wetting
dynamic	Characteristics for high welding speeds with concentrated arc
galvanized	Characteristics for galvanised sheet surfaces (low zinc pore risk, reduced zinc melting loss)
gap bridging	Characteristics with very low heat input for optimum gap-bridging ability
multi arc	Characteristics for components being welded by several interfering arcs
pipe	Characteristics for pipe applications and positional welding on narrow gap applications
root	Characteristics for root passes with powerful arc
universal	Characteristics for conventional welding tasks
TWIN	Synchronised characteristics for two wire electrodes in a single weld pool (TANDEM welding process)

Mixed process characteristics

mix	Characteristics with process switch between pulsed and dip transfer arc Specifically for welding vertical-up seams with cyclic change between a hot and cold supporting process phase.
PCS	Pulse Controlled Spray Arc Direct transition from the concentrated pulsed arc to a short spray arc. The advantages of pulsed and standard arcs combined in a single characteristic.

Special welding characteristic properties provided by additional hardware

ADV	Additional hardware for the CMT welding process: Inverter module for alternating current processes Negatively poled process phase with low heat input and high deposition rate Additional hardware for the MIG/MAG LSC welding process: Electronic switch for interrupting power Maximum reduction in current caused by opening the circuit in each required process phase Only in combination with TPS 400i LSC ADV
CMT mix	Additional hardware: CMT drive unit Characteristics with process switch between pulsed and CMT, where the CMT process is initiated by wire movement reversal.
mix drive	Additional hardware: PushPull drive unit Characteristics with process switch between pulsed and dip transfer arc, where the dip transfer arc is initiated by wire movement reversal.
ripple drive	Additional hardware: CMT drive unit, RA Drive Characteristics that behave like interval mode for clear weld rippling, especially with aluminium

Summary of MIG/MAG pulse synergic welding

MIG/MAG pulse synergic

MIG/MAG pulse synergic welding is a pulsed-arc process with controlled material transfer. In the base current phase, the energy supply is reduced to such an extent that the arc is only just stable and the surface of the workpiece is preheated. In the pulsing current phase, a precise current pulse ensures the targeted detachment of a droplet of welding material. This principle guarantees a low-spatter weld and precise working across the entire power range, as unwelcome short circuits with simultaneous droplet explosion and uncontrolled welding spatter are virtually eliminated.

**Summary of MIG/
MAG standard
synergic welding**

MIG/MAG standard synergic

The MIG/MAG standard synergic welding process is a MIG/MAG welding process across the entire power range of the power source with the following arc types:

Short circuit arc

Droplet transfer takes place during a short circuit in the lower power range.

Intermediate arc

The droplet increases in size on the end of the wire electrode and is transferred in the mid-power range during the short circuit.

Spray arc

A short circuit-free transfer of material in the high power range.

**Summary of the
PMC process**

PMC = Pulse Multi Control

PMC is a pulsed arc welding process with high-speed data processing, precise recording of the process status and improved droplet detachment. Faster welding possible with a stable arc and even fusion penetration.

**Summary of the
LSC / LSC Ad-
vanced process**

LSC = Low Spatter Control

LSC is a new, low-spatter dip transfer arc process.

The current is reduced before breaking the short-circuit bridge; re-ignition takes place at significantly lower welding current values.

LSC Advanced

The TPS 400i LSC ADV is required for the LSC Advanced process.

The TPS 400i LSC ADV accelerates the reduction in current and improves the LSC properties. The LSC Advanced process is predominantly used when the welding circuit inductivity is higher.

**Summary of Syn-
chroPulse weld-
ing**

SynchroPulse is available for all processes (standard/pulsed/LSC/PMC).

Due to the cyclical change of welding power between two operating points, SynchroPulse achieves a flaking seam appearance and non-continuous heat input.

Summary of the CMT process

CMT = Cold Metal Transfer

A special CMT drive unit is required for the CMT process.

The reversing wire movement in the CMT process results in a droplet detachment with improved dip transfer arc properties.

The advantages of the CMT process are as follows

- Low heat input
- Less spattering
- Reduced emissions
- High process stability

The CMT process is suitable for:

- Joint welding, cladding and brazing – particularly in the case of high requirements in terms of heat input and process stability
- Welding on light-gauge sheet with minimal distortion
- Special connections, such as copper, zinc, and steel/aluminium



NOTE! A CMT reference book is available complete with typical applications; see ISBN 978-3-8111-6879-4.

Short description of the CMT Cycle Step welding process

CMT Cycle Step is the next step in the development of the CMT welding process. A special CMT drive unit is also required for this process.

CMT Cycle Step is the welding process with the lowest heat input.

The CMT Cycle Step welding process switches cyclically between CMT welding and pauses of an adjustable duration.

These pauses in the welding process lower the heat input; the continuity of the weld seam is maintained.

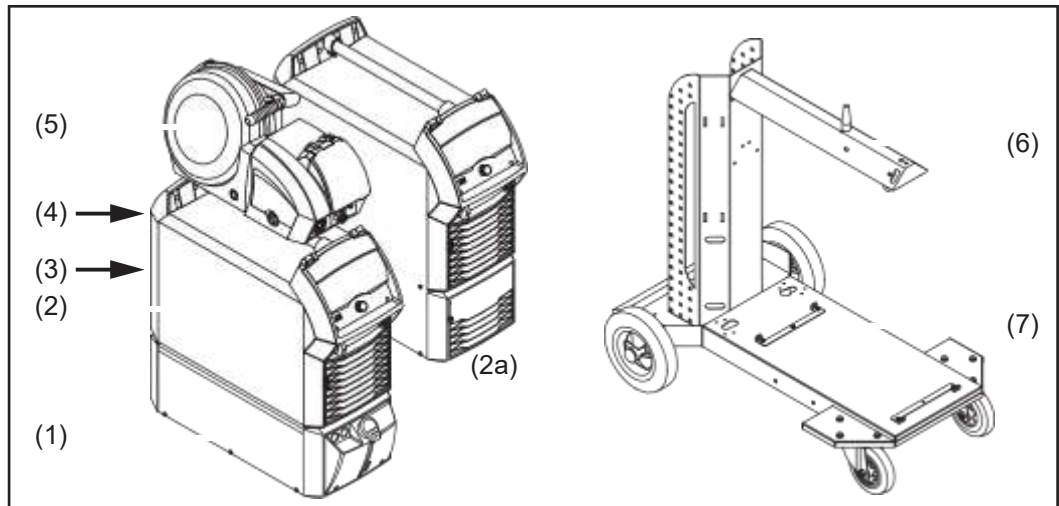
Individual CMT cycles are also possible. The size of the CMT spot welds is determined by the number of CMT cycles.

System components

General

The power sources can be operated with various system components and options. This makes it possible to optimise procedures and to simplify machine handling and operation, as necessitated by the particular field of application in which the power source is to be used.

Overview



- | | | |
|------|--|--|
| (1) | Cooling units | also: |
| (2) | Power sources | - Welding torch |
| (2a) | TPS 400i LSC ADV power source | - Grounding (earthing) cable and electrode cable |
| (3) | Robot accessories | - Dust filter |
| (4) | Interconnecting hosepacks (max. 50 m)* | - Additional current sockets |
| (5) | Wirefeeders | |
| (6) | Wirefeeder holder | |
| (7) | Trolley and gas cylinder holders | |

* Interconnecting hosepacks > 50 m only in combination with optional OPT/i SpeedNet Repeater

Options

OPT/i TPS 2.SpeedNet Connector

Optional second SpeedNet connection socket

Factory-installed on the rear of the power source (but can also be installed on the front of the power source).

OPT/i TPS 4x Switch SpeedNet

Option if more than one additional SpeedNet connection socket is required.

IMPORTANT! The OPT/i TPS 4x Switch SpeedNet option cannot be operated in conjunction with the OPT/i TPS 2. SpeedNet Connector option. If the OPT/i TPS 2.SpeedNet Connector option is installed in the power source, it must be removed.

OPT/i TPS SpeedNet Connector

Expansion of the OPT/i TPS 4x Switch SpeedNet option

Can only be used in conjunction with the OPT/i TPS 4x Switch SpeedNet option, maximum of 2 per power source

OPT/i TPS 2nd NT241 CU 1400i

Where a CU 1400 cooling unit is used, the OPT/i TPS 2nd NT241 CU1400i option must be installed in TPS 320i - 600i power sources. .

OPT/i TPS motor supply +

If three or more drive motors are to be operated in the welding system, the OPT/i TPS motor supply + option must be installed in the TPS320i - 600i power sources.

OPT/i TPS dust filter

IMPORTANT! Use of the OPT/i TPS dust filter option on TPS 320i - 600i power sources shortens the duty cycle.

OPT/i TPS 2nd plus socket PC

2nd (+) current socket (Power Connector) on the front of the power source (option)

OPT/i TPS 2nd earth socket

Optional 2nd (-) current socket (Dinse) on the rear of the power source

OPT/i TPS 2nd DINSE plus socket

2nd (+) current socket (Dinse) on the front of the power source (option)

OPT/i TPS 2nd earth socket PC

Optional 2nd (-) current socket (Power Connector) on the rear of the power source (option)

OPT/i SpeedNet Repeater

Signal amplifier if interconnecting hosepacks or connections from the power source to the wirefeeder are more than 50 m in length

OPT/i Synergic Lines

Option for enabling all special characteristics available on TPSi power sources; this also automatically enables special characteristics created in future.

OPT/i GUN Trigger

Option for special functions in conjunction with the torch trigger

OPT/i Jobs

Option for Job mode

OPT/i Documentation

Option for the documentation function

OPT/i Interface Designer

Option for individual interface configuration

OPT/i WebJobEdit

Option for editing jobs via the SmartManager for the power source

OPT/i Limit Monitoring

Option for specifying the limit values for the welding current, welding voltage and wire speed

OPT/i Custom NFC - ISO 14443A

Option to use a customer-specific frequency band for key cards

OPT/i CMT Cycle Step

Option for adjustable, cyclical CMT welding process

**OPT/i Safety Stop
PL d option**

IMPORTANT! The safety function OPT/i Safety Stop PL d has been designed according to EN ISO 13849-1:2008 + AC:2009 as category 3.
This requires two-channel feed of the input signal.
Bridging of two-channel operation (e.g. with a shorting bar) is not permitted and will result in loss of PL d.

Functional description

The OPT/i Safety Stop PL d option guarantees a safety stop of the power source according to PL d with controlled end of welding in less than one second.
Every time the power source is switched on, the safety function Safety Stop PL d performs a self-test.

IMPORTANT! This self-test must be performed at least once a year to check the operation of the safety shutdown.

If the voltage drops on at least one of 2 inputs, Safety Stop PL d halts the current welding operation; the wirefeeder motor and the welding voltage are switched off.
The power source outputs an error code. Communication via the robot interface or the bus system remains unaffected.
To re-start the welding system, the power must be re-connected. An error must be acknowledged via the torch trigger, display or interface and Weld-Start must be carried out again.

A non-simultaneous shutdown of both inputs (> 750 ms) is output by the system as a critical, non-resettable error.
The power source is permanently switched off.
A reset is carried out by switching the power source off and on again.

Controls, connections and mechanical components

Control panel

General

Welding parameters can be easily changed and selected using the adjusting dial. The parameters are shown on the display while welding is in progress.

The synergic function ensures that other welding parameters are also adjusted whenever an individual parameter is changed.



NOTE! As a result of firmware updates, you may find that your device has certain functions that are not described in these operating instructions, or vice versa. Certain illustrations may also differ slightly from the actual controls on your device, but these controls function in exactly the same way.

Safety



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules

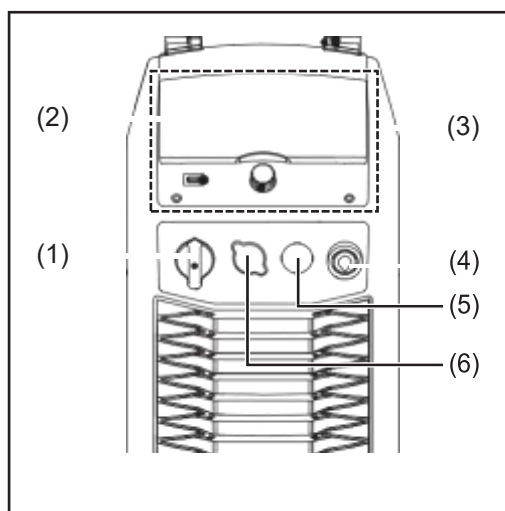
Control panel



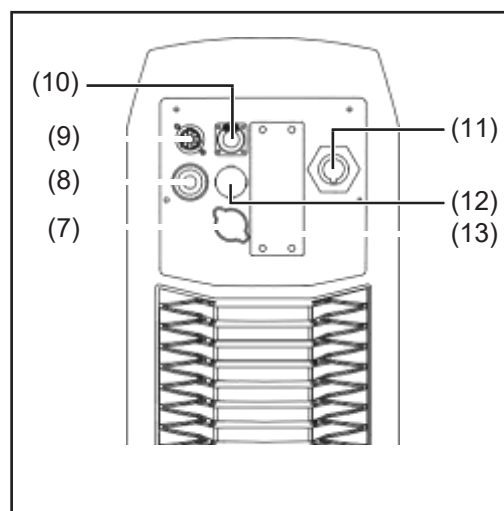
No.	Function
(1)	USB port For connecting USB flash drives (such as service dongles and licence keys). IMPORTANT! The USB port is not electrically isolated from the welding circuit. Therefore, devices that establish an electrical connection with another device must not be connected to the USB port.
(2)	Adjusting dial with turn/press function For selecting elements, setting values and scrolling through lists
(3)	Display (touchscreen) - For operating the power source directly by pressing the buttons on the display - For displaying values - For navigating in the menu
(4)	Key card reader for NFC keys - For locking/unlocking the power source using NFC keys - For logging on different users (with active user management and assigned NFC keys) NFC key = NFC card or NFC key ring
(5)	Wire threading button For threading the wire electrode into the torch hosepack with no accompanying flow of gas or current
(6)	Gas-test button For setting the required gas flow rate on the gas pressure regulator. After pressing this button, gas flows for 30 seconds. Press the button again to stop the gas flow prematurely.

Connections, switches and mechanical components

TPS 320i / 400i /
500i / 600i, TPS
400i LSC ADV
power source



Front



Rear

No.	Function
(1)	Mains switch for switching the power source on and off
(2)	Control panel cover for protecting the control panel
(3)	Control panel with display for operating the power source
(4)	(-) Current socket with bayonet latch for: - connecting the grounding (earthing) cable during MIG/MAG welding
(5)	Blanking cover reserved for the second (+) current socket option with bayonet latch
(6)	Blanking cover reserved for the second SpeedNet connection socket option
(7)	Blanking cover reserved for the second SpeedNet connection socket option
(8)	(+) Current socket with fine-pitch thread (Power Connector) for: - connecting the current cable from the interconnecting hosepack during MIG/MAG welding
(9)	SpeedNet connection socket for connecting the interconnecting hosepack
(10)	Ethernet port
(11)	Mains cable with strain relief device
(12)	Blanking cover reserved for the second (-) current socket option with bayonet latch The second (-) current socket is for: - connecting the interconnecting hosepack during MIG/MAG welding for polarity reversal (e.g. for flux-cored wire welding)
(13)	Blanking cover reserved for the second SpeedNet connection socket option or robot interface RI FB Inside/i

Operating concept

Input options

General



NOTE! As a result of firmware updates, you may find that there are functions available on your device that are not described in these operating instructions or vice versa. Certain illustrations may also differ slightly from the actual controls on your device, but these controls function in exactly the same way.



WARNING! Incorrect operation may result in serious injury or damage. Do not use the functions described here until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules

The following input options are available on the power source control panel:

- Turning/pressing the adjusting dial
- Pressing buttons
- Pressing on the display

Turning/pressing the adjusting dial

Turn/press the adjusting dial to select elements, change values and scroll through lists.



Turn the adjusting dial to:

Select elements from the main area of the display:

- Turning right highlights the next element in the sequence.
- Turning left highlights the preceding element in the sequence.
- In vertical lists, turn right to scroll down and turn left to scroll up.

Change values:

- Turning to the right increases the value.
- Turning to the left decreases the value.
- Slowly turning the adjusting dial changes the value in very small stages, i.e. for precision adjustments.
- Turning the adjusting dial quickly changes the value in disproportionately large stages, i.e. large value changes can be made quickly.

For certain parameters (wire speed, welding current, arc length correction, etc.), a value changed by turning the adjusting dial is applied automatically without having to press the adjusting dial.



Press the adjusting dial to:

Apply highlighted elements, e.g. to change the welding parameter value.

Apply certain welding parameter values.

Pressing buttons

Pressing buttons triggers the following functions:



When the feeder inching button is pressed, the wire electrode is fed into the torch hosepack with no accompanying flow of gas or current.



When the gas test button is pressed, gas will flow out for 30 seconds. Press the button again to stop the gas test flow before the end of this period.

Pressing on the display



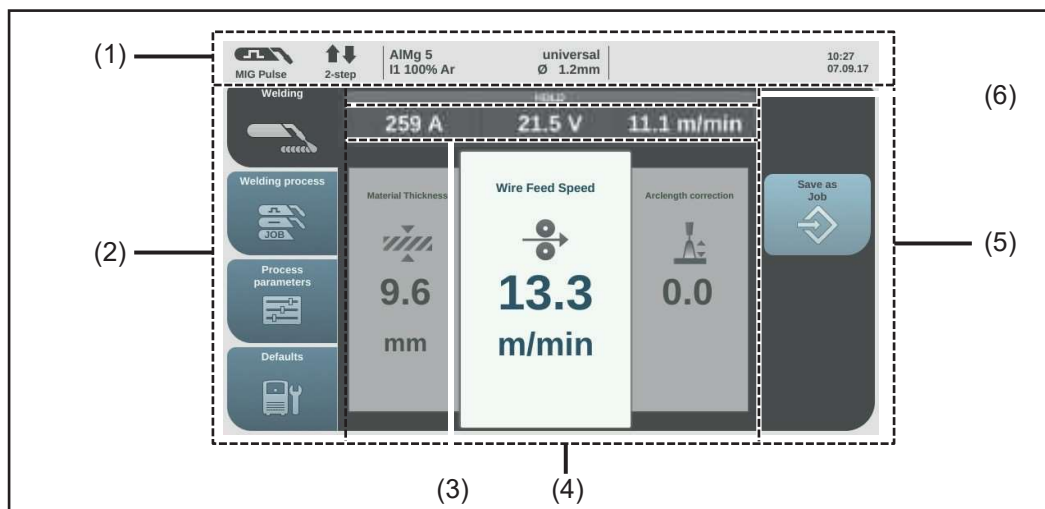
The display can be touched in order to

- navigate,
- trigger functions,
- select options

Pressing on (and therefore selecting) an element on the display highlights this element.

Display and status line

Display



No.	Function
(1)	The status line provides details on: - The current welding process - The current operating mode - The current welding program (material, shielding gas and wire diameter) - Active faults - Time and date
(2)	Left-hand ribbon The left-hand ribbon contains the following buttons: - Welding - Welding process - Process parameters - Defaults The buttons in the left-hand ribbon are actuated by touching the display.
(3)	Actual value display Welding current, welding voltage, wire speed
(4)	Main area The welding parameters, graphics, lists or navigation elements are shown in the main area. The structure of the main area and the elements shown in it vary according to the application. The main area is operated - using the adjusting dial - by touching the display
(5)	Right-hand ribbon Depending on the buttons selected in the left-hand ribbon, the right-hand ribbon may be used as follows: - As a function ribbon containing application and function buttons - For navigating through the 2nd menu level The buttons in the right-hand ribbon are actuated by touching the display.
(6)	HOLD indicator At the end of each welding operation, the actual values for the welding current and voltage are stored - HOLD lights up.

Status bar



The status bar is divided into segments and contains the following information:

- (1) Current welding process
- (2) Current operating mode
- (3) Current welding program (material, shielding gas, characteristic and wire diameter)

- (4) Stabilizers/CMT Cycle Step active indicator



Arc length stabilizer



Penetration stabilizer



CMT Cycle Step (only in combination with the CMT welding process)

Symbol lights up green:

Stabilizer/CMT Cycle Step is active

Symbol is grey:

Stabilizer/CMT Cycle Step is available, but is not being used for welding

- (5) Current logged-on user (with active user management)

or

the key symbol when the power source is locked (e.g. when the "locked" profile/role is active)



- (6) Time and date

Status bar – Current limit reached

If the characteristic-dependent current limit is reached while MIG/MAG welding, a corresponding message appears in the status bar.



- 1** For detailed information, select the status bar

The information appears.

- 2** Select "Hide information" to exit
 - 3** Reduce the wire speed, welding current, welding voltage or material thickness
- or

Increase the distance between the contact tip and the workpiece

Further information on the current limit can be found in the Troubleshooting section on page 205.

Installation and commissioning

Minimum equipment needed for welding task

General

Depending on which welding process you intend to use, a certain minimum equipment level will be needed in order to work with the power source.

The welding processes and the minimum equipment levels required for the welding task are then described.

MIG/MAG gas-cooled welding

- Power source
- Grounding (earthing) cable
- MIG/MAG welding torch, gas-cooled
- Shielding gas supply
- Wire-feed unit
- Interconnecting hosepack
- Wire electrode

MIG/MAG water-cooled welding

- Power source
- Cooling unit
- Grounding (earthing) cable
- MIG/MAG welding torch, water-cooled
- Shielding gas supply
- Wire-feed unit
- Interconnecting hosepack
- Wire electrode

MIG/MAG automated welding

- Power source
- Robot interface or field bus connection
- Grounding cable
- MIG/MAG robot welding torch or automatic MIG/MAG welding torch

A cooling unit is also required with water-cooled robot or machine welding torches.

- Gas connection (shielding gas supply)
- Wirefeeder
- Interconnecting hosepack
- Wire electrode

Manual CMT welding

- Power source
- Standard, Pulse and CMT welding packages enabled on the power source
- Grounding cable
- PullMig CMT welding torch incl. CMT drive unit and CMT wirebuffer

IMPORTANT! For water-cooled CMT applications, a cooling unit is also required!

- OPT/i PushPull
- Wirefeeder
- CMT interconnecting hosepack
- Wire electrode
- Gas connection (shielding gas supply)

- Automated CMT welding**
- Power source
 - Standard, Pulse and CMT welding packages enabled on the power source
 - Robot interface or field bus connection
 - Grounding cable
 - CMT welding torch incl. CMT drive unit
 - Cooling unit
 - Unreeling wirefeeder (WFi REEL)
 - Interconnecting hosepack
 - Torch hosepack
 - Wirefeeding hose
 - Media splitter (e.g. SB 500i R, SB 60i R)
 - CMT wire buffer (included with SB 60i R)
 - Wire electrode
 - Gas connection (shielding gas supply)

- TIG DC welding**
- Power source with built-in OPT/i TPS 2nd plus socket option
 - Grounding (earthing) cable
 - TIG gas-valve torch
 - Gas connection (shielding gas supply)
 - Filler metal (depending on the application)

- MMA welding**
- Power source with built-in OPT/i TPS 2nd plus socket option
 - Grounding (earthing) cable
 - Electrode holder with welding cable
 - Rod electrodes

Before installation and commissioning

Safety



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules

Proper use

The power source may only be used for MIG/MAG, MMA and TIG welding. Any use above and beyond this purpose is deemed improper. The manufacturer shall not be held liable for any damage arising from such usage.

Proper use also includes:

- following all the information in the operating instructions
- carrying out all the specified inspection and servicing work

Setup regulations

The device is tested to IP 23 protection, meaning:

- protection against penetration by solid foreign bodies with diameters > 12.5 mm (0.49 in.)
- protection against direct sprays of water at any angle up to 60° from the vertical

The device can be set up and operated outdoors in accordance with IP23. Avoid direct wetting (e.g. from rain).



WARNING! If one of these devices topples over or falls it could cause serious or even fatal injury. Place devices, upright consoles and trolleys on a solid, level surface in such a way that they remain stable.

The venting duct is a very important safety feature. When choosing the installation location, ensure that the cooling air can enter and exit unhindered through the air ducts on the front and back of the device. Any electroconductive metallic dust (e.g. from grinding work) must not be allowed to get sucked into the device.

Mains connection

- The devices are designed for the mains voltage specified on the rating plate.
- Devices with a nominal voltage of 3 x 575 V must be operated on three-phase systems with earthed star point.
- If your version of the appliance does not come with mains cables and mains plugs ready-fitted, these must be fitted by a qualified person in accordance with national standards.
- The fuse protection for the mains cable is indicated in the technical data.



NOTE! An inadequately dimensioned electrical installation can cause serious damage. The mains cable and its fuse protection must be dimensioned to suit the local power supply. The technical data shown on the rating plate applies.

Generator-powered operation

The power source is generator-compatible.

The maximum apparent power $S_{1\max}$ of the power source must be known in order to select the correct generator output.

The maximum apparent power $S_{1\max}$ of the power source is calculated as follows:

3-phase devices:

$$S_{1\max} = I_{1\max} \times U_1 \times \sqrt{3}$$

Single-phase devices:

$$S_{1\max} = I_{1\max} \times U_1$$

See device rating plate or technical data for $I_{1\max}$ and U_1 values

The generator apparent power S_{GEN} needed is calculated using the following rule of thumb:

$$S_{\text{GEN}} = S_{1\max} \times 1.35$$

A smaller generator may be used when not welding at full power.

IMPORTANT! The generator apparent power S_{GEN} must always be higher than the maximum apparent power $S_{1\max}$ of the power source.

When using single-phase devices with a 3-phase generator, note that the specified generator apparent power is often only available as a whole across all three phases of the generator. If necessary, obtain further information on the single-phase power of the generator from the generator manufacturer.



NOTE! The voltage delivered by the generator must never exceed the upper or lower limits of the mains voltage tolerance range. Details of the mains voltage tolerance can be found in the "Technical data" section.

Information on system components

The steps and activities described below include references to various system components, including:

- Trolleys
- Cooling units
- Wire-feed unit holders
- Wire-feed units
- Interconnecting hosepacks
- Welding torches
- etc.

For more detailed information about installing and connecting the system components, please refer to the appropriate operating instructions.

Connecting the mains cable

General

If no mains cable is connected, a mains cable that is suitable for the connection voltage must be fitted before commissioning.

A universal strain-relief device for cable diameters from 12 - 30 mm (0.47 - 1.18 in.) is fitted to the power source.

Strain-relief devices for other cable cross-sections must be designed accordingly.

Stipulated mains cables

Power source	Mains voltage	Cable cross-section	
		USA / Canada *	Europe
TPS 320i /nc	3 x 400 V	AWG 12	4 G 2.5
	3 x 460 V	AWG 14	4 G 2.5
TPS 320i /MV/nc	3 x 230 V	AWG 10	4 G 4
	3 x 460 V	AWG 14	4 G 2.5
TPS 320i /600V/nc **	3 x 575 V	AWG 14	-
TPS 400i /nc	3 x 400 V	AWG 10	4 G 4
	3 x 460 V	AWG 12	4 G 4
TPS 400i /MV/nc	3 x 230 V	AWG 6	4 G 6
	3 x 460 V	AWG 10	4 G 4
TPS 400i /600V/nc **	3 x 575 V	AWG 12	-
TPS 500i /nc	3 x 400 V	AWG 8	4 G 4
	3 x 460 V	AWG 10	4 G 4
TPS 500i /MV/nc	3 x 230 V	AWG 6	4 G 10
	3 x 460 V	AWG 10	4 G 4
TPS 500i /600V/nc **	3 x 575 V	AWG 10	-
TPS 600i /nc	3 x 400 V	AWG 6	4 G 10
	3 x 460 V	AWG 6	4 G 10
TPS 600i /600V/nc **	3 x 575 V	AWG 6	-

* Cable type for USA / Canada: Extra-hard usage

** Power source without CE mark; not available in Europe

AWG = **A**merican **w**ire **g**auge

Connecting the mains cable - general

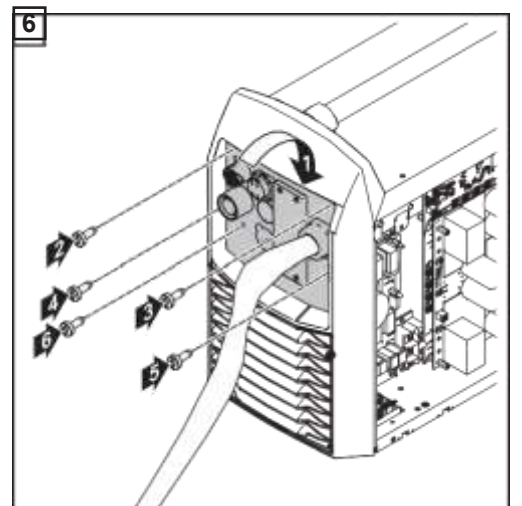
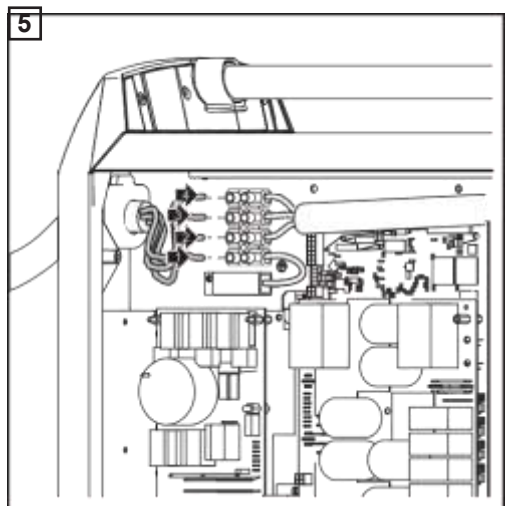
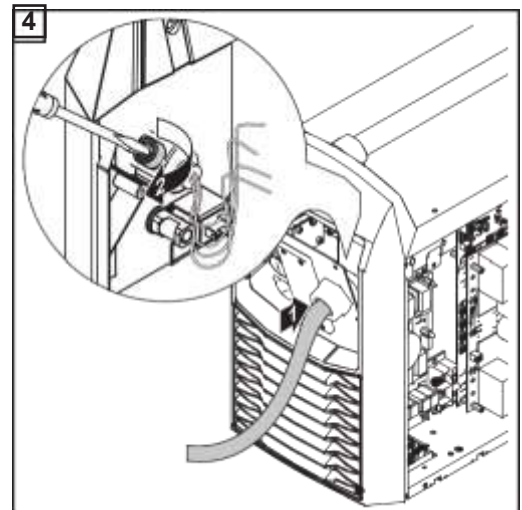
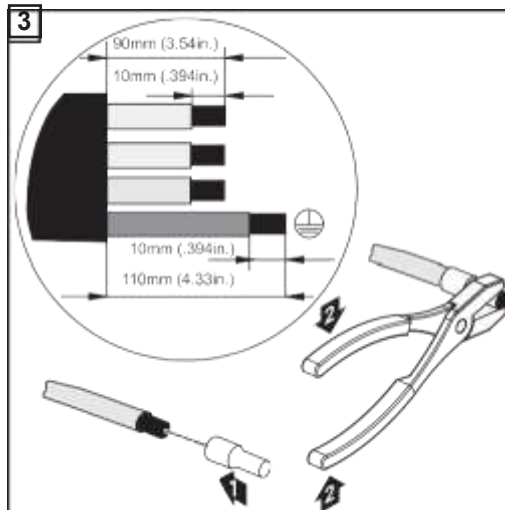
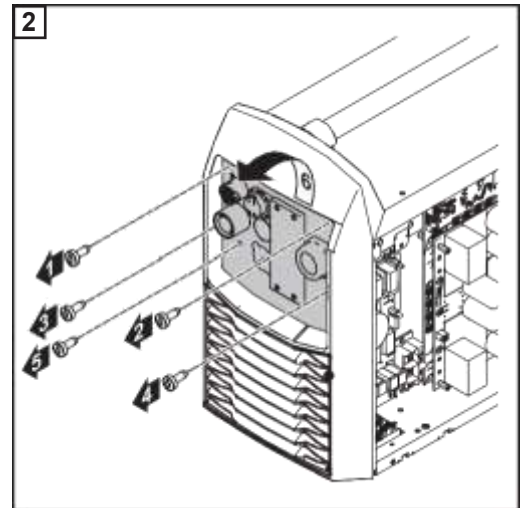
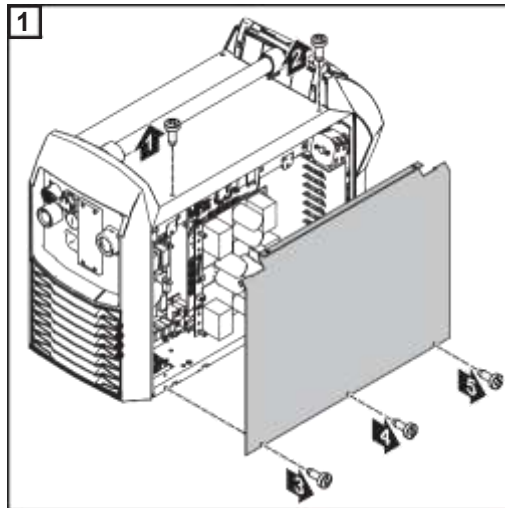


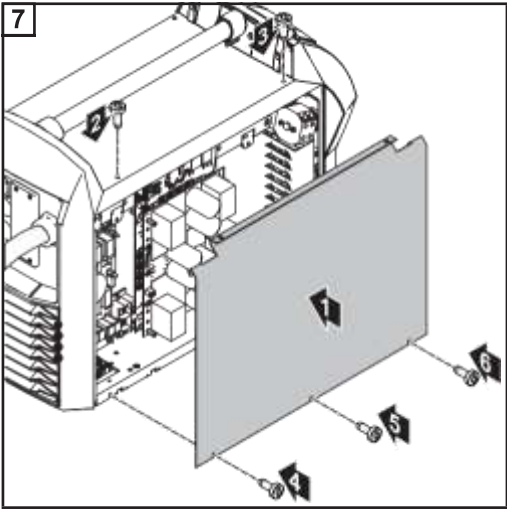
CAUTION! Risk of injury and material damage due to short circuits. Short circuits can occur between the phase conductors or between the phase conductors and the ground conductor unless ferrules are used. Fit ferrules to all phase conductors in an exposed mains cable as well as the ground conductor.



NOTE! Mains cables must be connected to devices in compliance with national standards and guidelines and the work must be carried out by a qualified person.

IMPORTANT! The ground conductor should be approx. 30 mm (1.18 in.) longer than the phase conductors.





Commissioning the TPS 320i / 400i / 500i / 600i, TPS 400i LSC ADV

Safety



WARNING! An electric shock can be fatal. If the power source is connected to the mains electricity supply during installation, there is a high risk of very serious injury and damage. Before carrying out any work on the device make sure that:

- the power source mains switch is in the "O" position
- the power source is unplugged from the mains

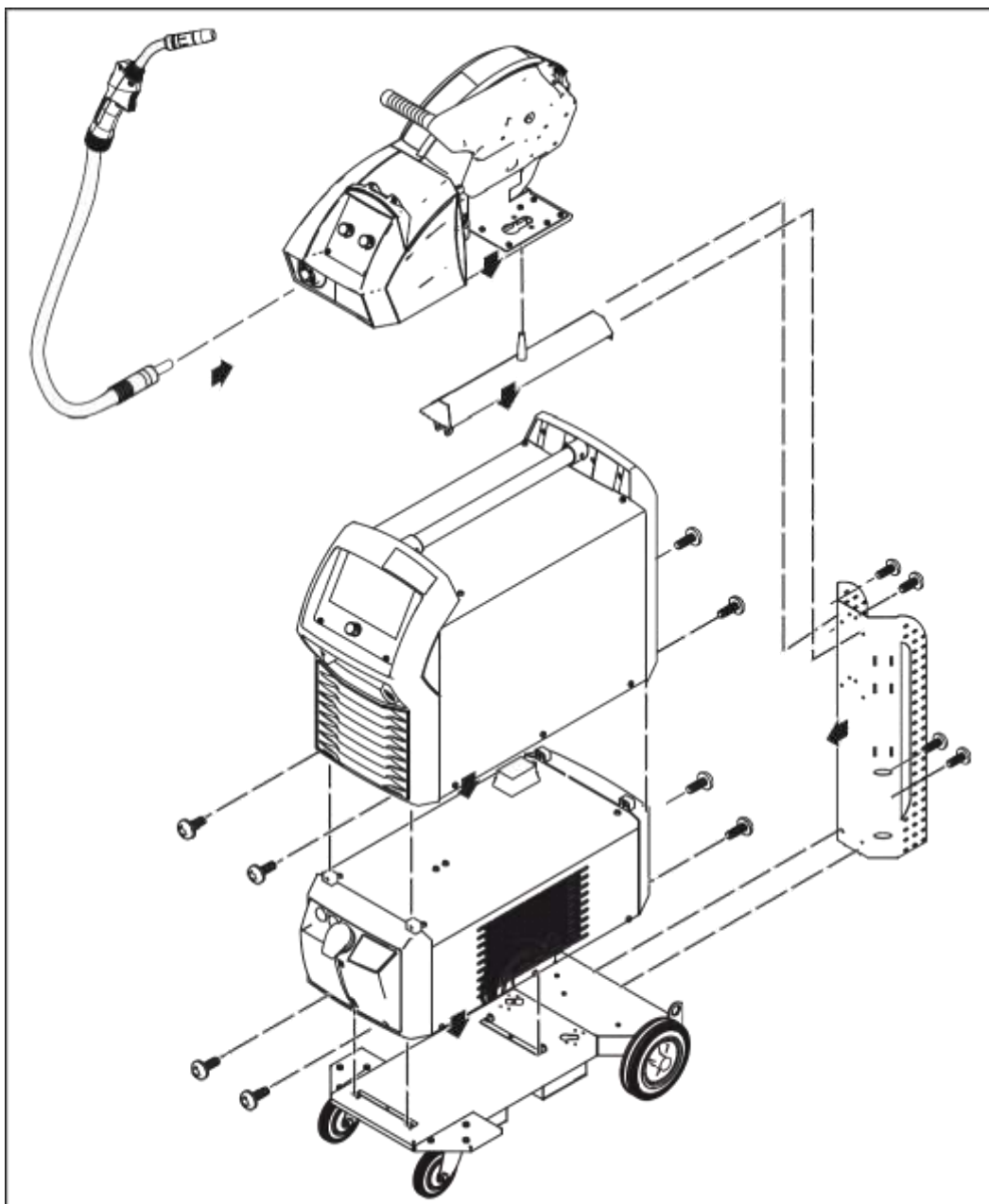
General

A manual water-cooled MIG/MAG application is used to describe how to commission the TPS 320i / 400i / 500i / 600i and TPS 400i LSC ADV power sources.

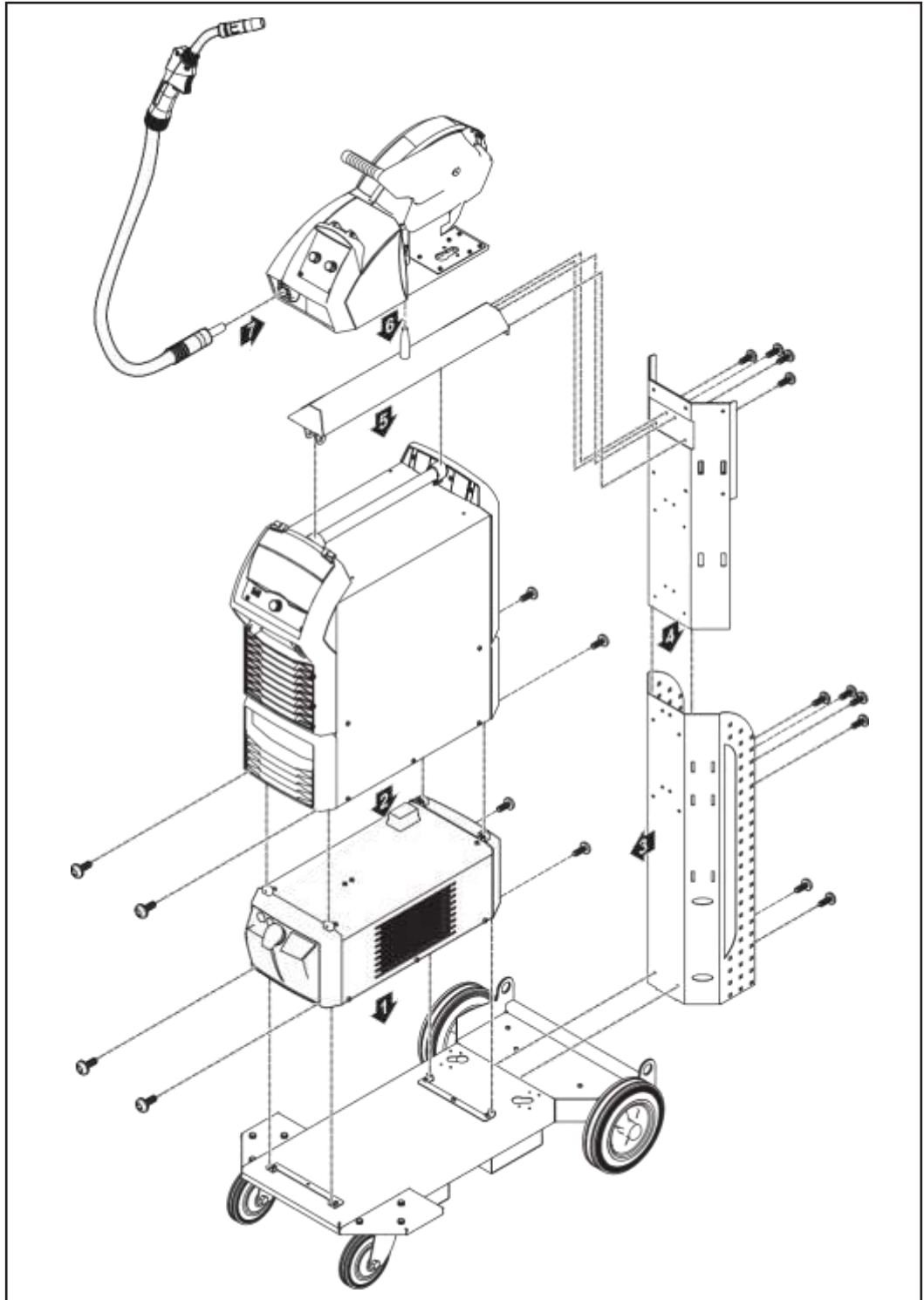
The following illustrations provide an overview of the structure of the individual system components.

Refer to the respective system component operating instructions for detailed information about the various work steps involved.

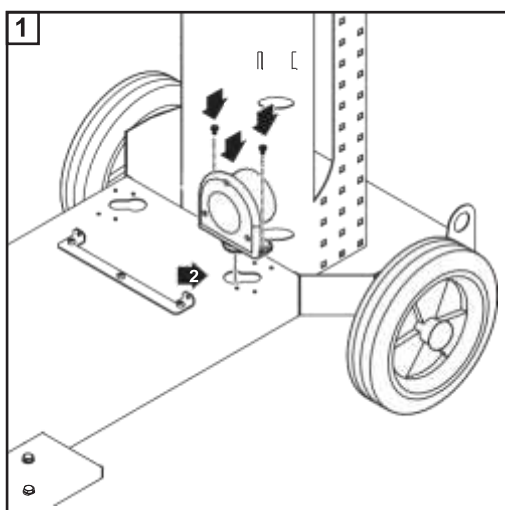
**TPS 320i / 400i /
500i / 600i:
Fitting the system
components
(overview)**



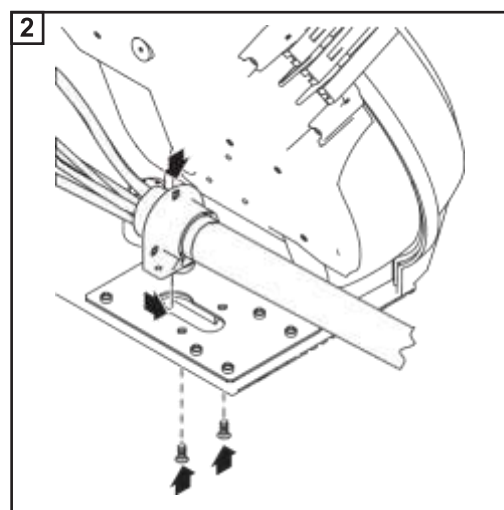
TPS 400i LSC
ADV:
Fitting the system
components
(overview)



Fixing the strain-relief device for the interconnecting hosepack



Fixing the strain-relief device to the trolley

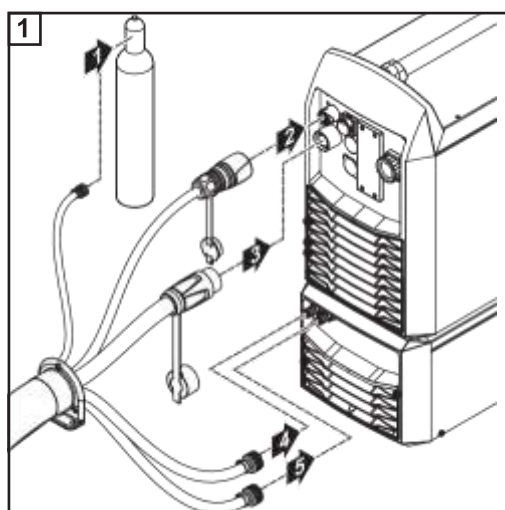


Fixing the strain-relief device to the wire-feed unit

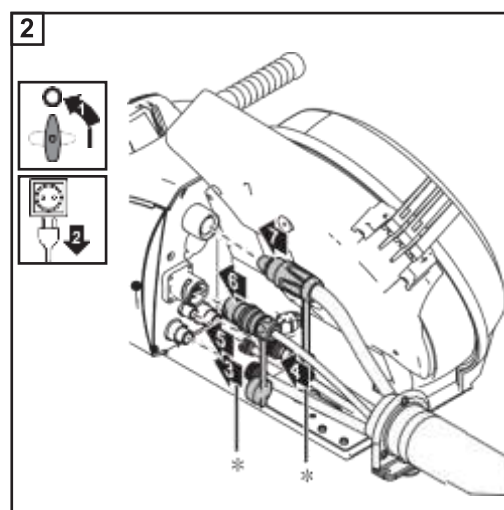
Connecting the interconnecting hosepack



NOTE! There is no cooling unit present in the case of gas-cooled systems. There is no need to attach the water connections in the case of gas-cooled systems.



Connecting the interconnecting hosepack to the power source and cooling unit



Connecting the interconnecting hosepack to the wire-feed unit

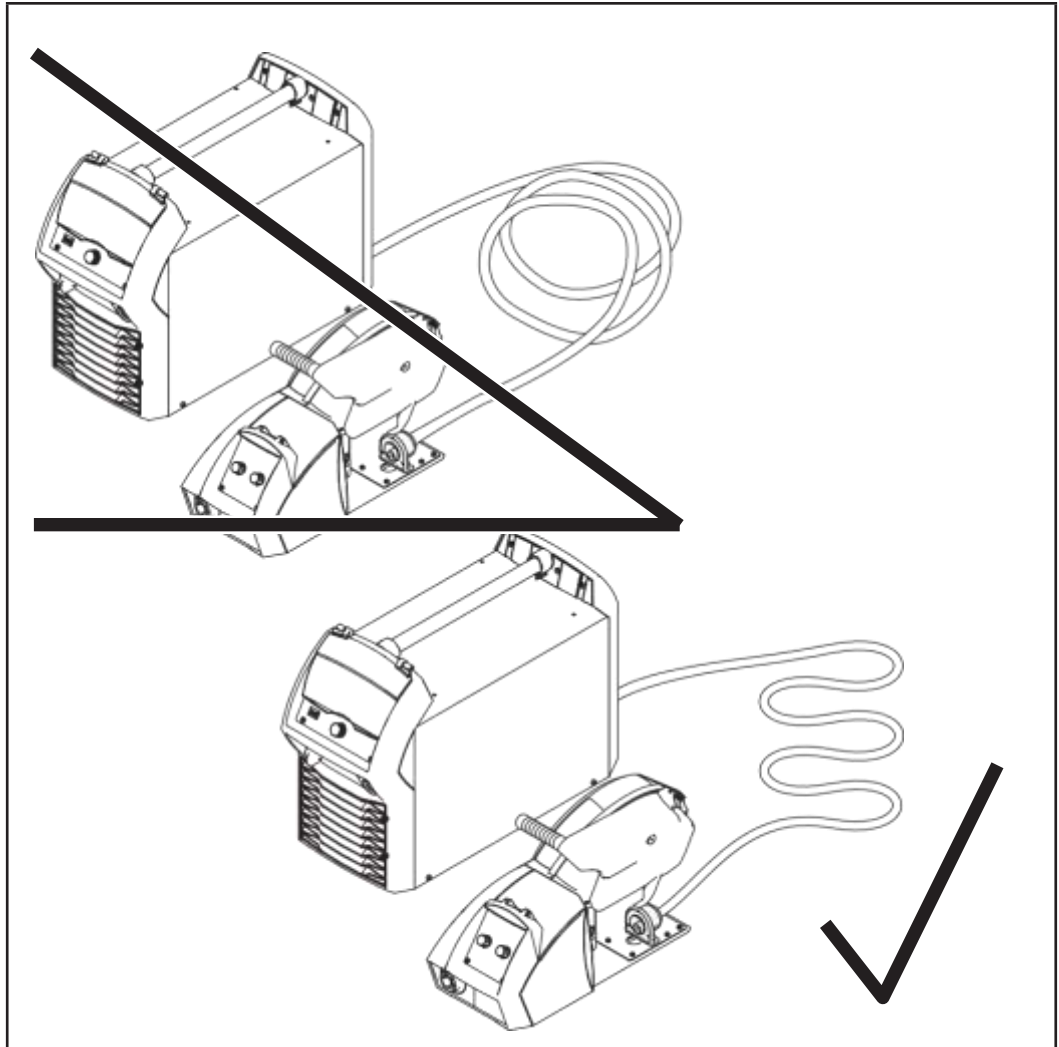
* (only if coolant connections are installed in the wire-feed unit and a water-cooled interconnecting hosepack is being used)

Correct arrangement of the interconnecting hosepack



CAUTION! Risk of damage to components due to overheating posed by laying the interconnecting hosepack incorrectly.

- Lay the interconnecting hosepack without loops
- Do not put anything on top of the interconnecting hosepack
- Do not wind up the interconnecting hosepack next to gas cylinders and do not wind it around gas cylinders



Correct arrangement of the interconnecting hosepack

IMPORTANT:

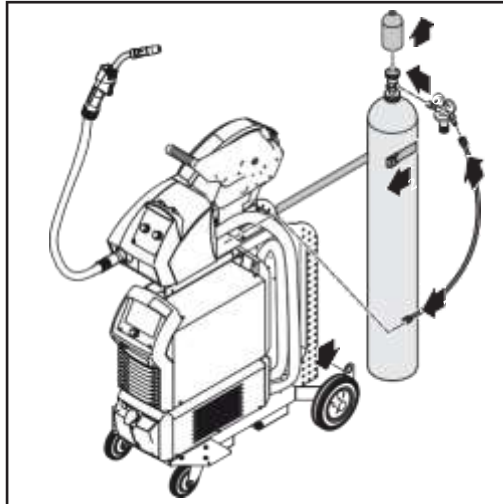
- The duty cycle value (D.C.) for the interconnecting hosepack can only be attained when the interconnecting hosepacks are laid correctly.
- Carry out R/L calibration if the arrangement of an interconnecting hosepack changes (see page 119).
- Magnetically compensated interconnecting hosepacks make it possible to change the arrangement without affecting the welding circuit inductivity. Magnetically compensated interconnecting hosepacks are available from Fronius with a minimum length of 10 m.

Connecting the gas cylinder



WARNING! If gas cylinders topple over, there is a risk of very serious injury and damage. Place gas cylinders on a solid, level surface so that they remain stable. Secure gas cylinders to prevent them from toppling over.

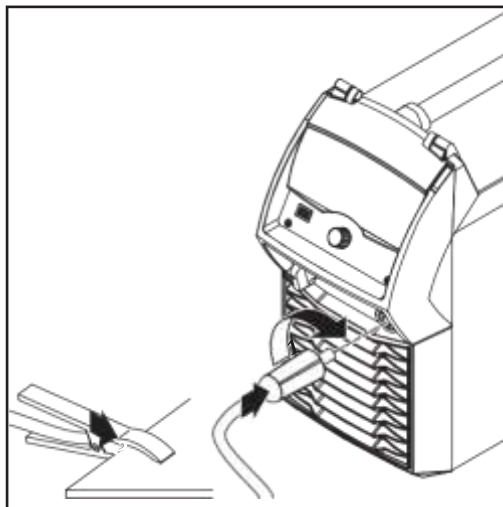
Observe the safety rules of the gas cylinder manufacturer.



Fixing the gas cylinder on the trolley

- 1 Place the gas cylinder on the base of the trolley
- 2 Secure the gas cylinder by fixing the cylinder strap around the upper part of the cylinder (but not around the neck) to prevent it from toppling over
- 3 Take the protective cap off the gas cylinder
- 4 Briefly open the gas cylinder valve to blow off any dust or dirt
- 5 Check the seal on the pressure regulator
- 6 Screw the pressure regulator onto the gas cylinder and tighten it
- 7 Connect the shielding gas hose of the interconnecting hose pack to the pressure regulator using the gas hose

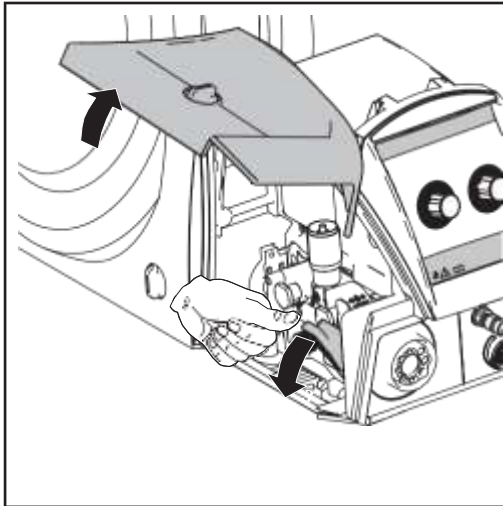
Establishing a ground earth connection



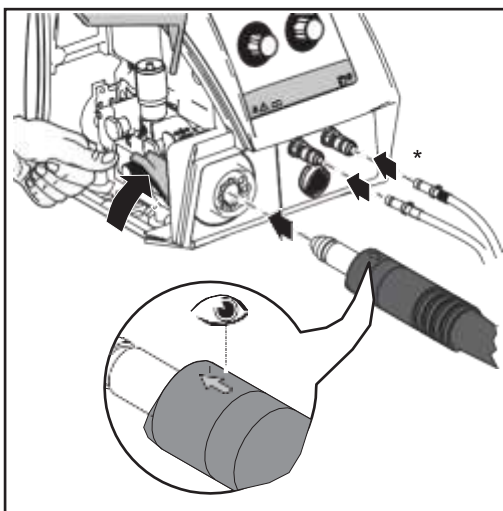
- 1 Plug the grounding (earthing) cable into the (-) current socket and twist to fasten it
- 2 Use the other end of the grounding (earthing) cable to establish a connection to the workpiece

IMPORTANT! For optimum weld properties, route the grounding cable as close as possible to the interconnecting hosepack.

**Connecting MIG/
MAG welding
torches to the
wire-feed unit**



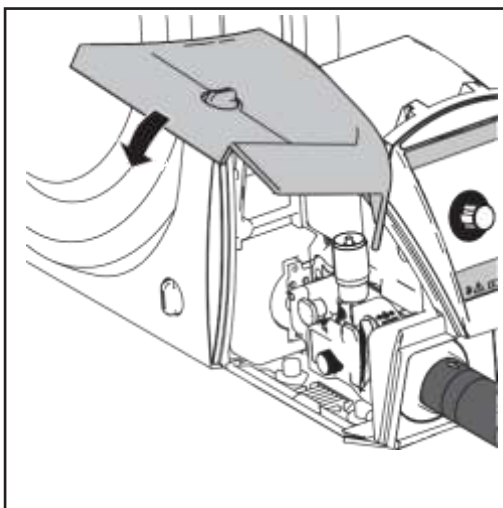
- 1** Check that all cables, leads and hose-packs are undamaged and correctly insulated
- 2** Open the wire drive cover
- 3** Open the clamping lever on the wire drive



- 4** Check that the welding torch is correctly and completely tooled up. Insert it - marking at the top first - into the welding torch connection on the wire-feed unit
- 5** Close the clamping lever on the wire drive

* On water-cooled welding torches:

- 6** Connect the coolant flow hose to the coolant flow connection (blue)
- 7** Connect the coolant return hose to the coolant return connection (red)



- 8** Close the wire drive cover
- 9** Check that all connections are connected properly

Other tasks

Carry out the following steps in accordance with the wirefeeder operating instructions:

- 1** Insert the feed rollers into the wirefeeder
- 2** Insert the wirepool or basket-type spool with adapter into the wirefeeder
- 3** Feed in the wire electrode
- 4** Set the contact pressure
- 5** Adjust the brake

IMPORTANT! For optimum welding results, the manufacturer recommends performing an R/L alignment when starting the device for the first time and when any changes are made to the welding system. More information about the R/L alignment can be found under "R/L alignment" in the "Process parameters" section of the "Welding mode" chapter" (page 119).

Locking and unlocking the power source using the NFC key

General remarks NFC key = NFC card or NFC key ring

The power source can be locked using an NFC key, e.g. to prevent unauthorised access or welding parameters being changed without permission.

A contactless system on the control panel allows the power source to be locked and unlocked.

The power source must be switched on before it can be locked or unlocked.

Locking and unlocking the power source using the NFC key

Locking the power source



1 Hold the NFC key on the NFC key reader

The key symbol appears on the display.

The key symbol is then displayed in the status bar.



The power source is now locked.

Only the welding parameters can be viewed and adjusted using the adjusting dial.

Any attempt to call a locked function will result in a notification being displayed.

Unlocking the power source

1 Hold the NFC key on the NFC key reader

The crossed-out key symbol appears on the display.

The key symbol no longer appears in the status bar.

All power source functions are now available again without restrictions.



NOTE! More information about locking and unlocking the power source can be found in the "Defaults - Administration" section on page 161.

Welding

MIG/MAG modes

General

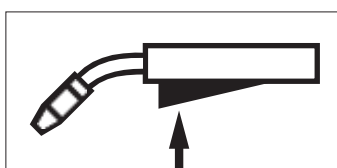


WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

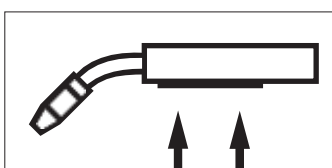
- these operating instructions
- all the operating instructions for the system components, especially the safety rules

See the Setup menu for information on settings, setting range and units of measurement for the available parameters.

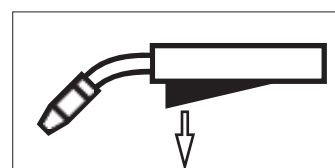
Symbols and their explanations



Press the torch trigger



Hold the torch trigger



Release the torch trigger

GPr

Gas pre-flow

I-S

Starting-current phase: the base material is heated up rapidly, despite the high thermal dissipation that occurs at the start of welding

t-S

Starting current time



Start arc length correction

SL1

Slope 1: the starting current is steadily lowered until it reaches the welding current

I

Welding-current phase: uniform thermal input into the base material, whose temperature is raised by the advancing heat

I-E

Final current phase: to prevent any local overheating of the base material due to heat build-up towards the end of welding. This eliminates any risk of weld seam drop-through.

t-E

Final current time



End arc length correction

SL2

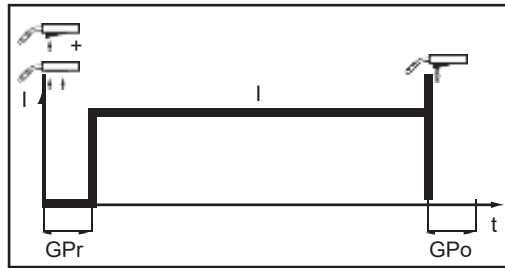
Slope 2: the welding current is steadily lowered until it reaches the final current

GPo

Gas post-flow

A detailed explanation of the parameters can be found in the section headed "Process parameters"

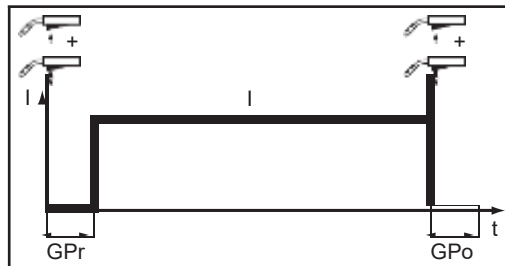
2-step mode



"2-step mode" is suitable for

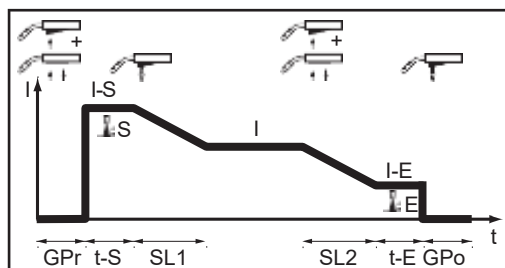
- Tacking work
- Short weld seams
- Automated and robot welding

4-step mode



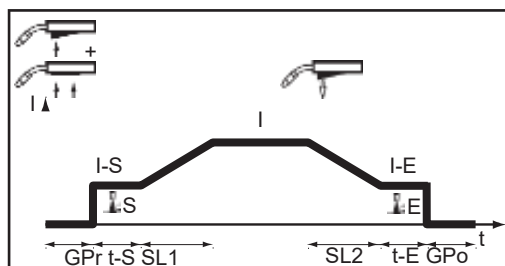
"4-step mode" is suitable for longer weld seams.

Special 4-step mode



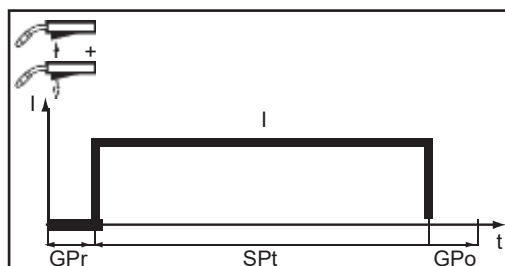
"Special 4-step mode" is particularly suitable for welding aluminium materials. The special slope of the welding current curve takes account of the high thermal conductivity of aluminium.

Special 2-step mode



"Special 2-step mode" is ideal for welding in the higher power range. In special 2-step mode, the arc starts at a low power, which makes it easier to stabilise.

Spot welding



The "Spot welding" mode is suitable for welded joints on overlapped sheets.

MIG/MAG and CMT welding

Safety



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules



WARNING! An electric shock can be fatal. If the power source is connected to the mains electricity supply during installation, there is a high risk of very serious injury and damage. Before carrying out any work on the device make sure that:

- the power source mains switch is in the "O" position
- the power source is unplugged from the mains

MIG/MAG and CMT welding – overview

The "MIG/MAG and CMT welding" section comprises the following steps:

- Switching on the power source
- Selecting the welding process and operating mode
- Selecting the filler metal and shielding gas
- Setting the welding and process parameters
- Setting the shielding gas flow rate
- MIG/MAG or CMT welding



NOTE! If using a cooling unit, follow the safety rules and note the operating conditions in the cooling unit Operating Instructions.

Switching on the power source

1

Connect the mains cable

2

Move the mains switch to the "I" position

A cooling unit connected to the system will begin to operate.

IMPORTANT! For optimum welding results, the manufacturer recommends performing an R/L alignment when starting the device for the first time and when any changes are made to the welding system.

More information about the R/L alignment can be found under "R/L alignment" in the "Process parameters" section of the "Welding mode" chapter (page 119).

Setting the welding process and operating mode

Setting the welding process



* next page: Electrode, TIG

1 Select "Welding process"

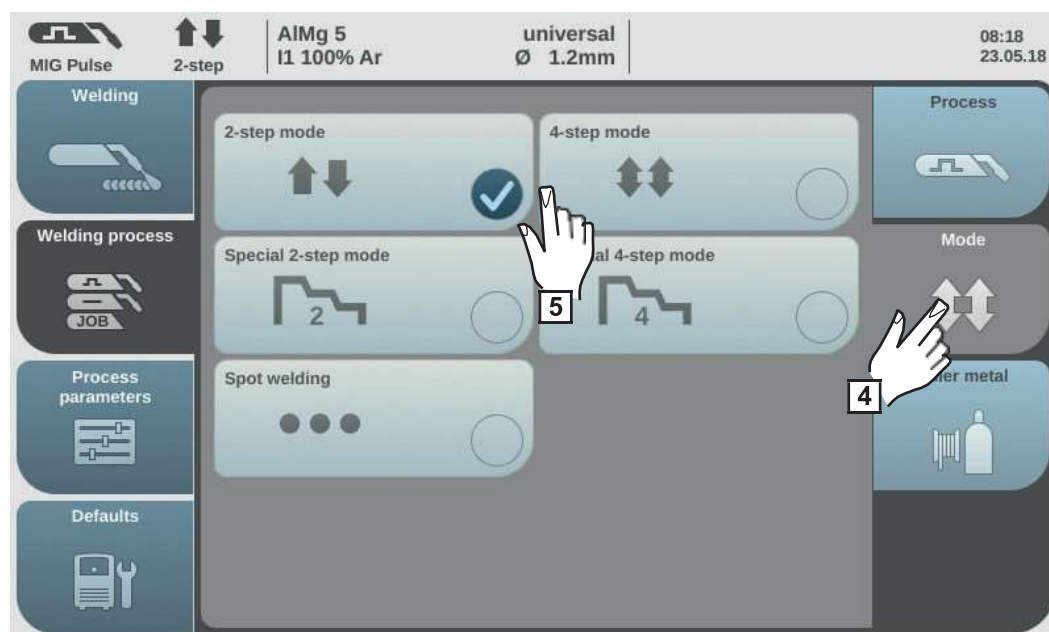
2 Select "Process"

An overview of the welding process is displayed.

Various welding processes are available depending on the power source type or function package installed.

3 Select the desired welding process

Setting the operating mode



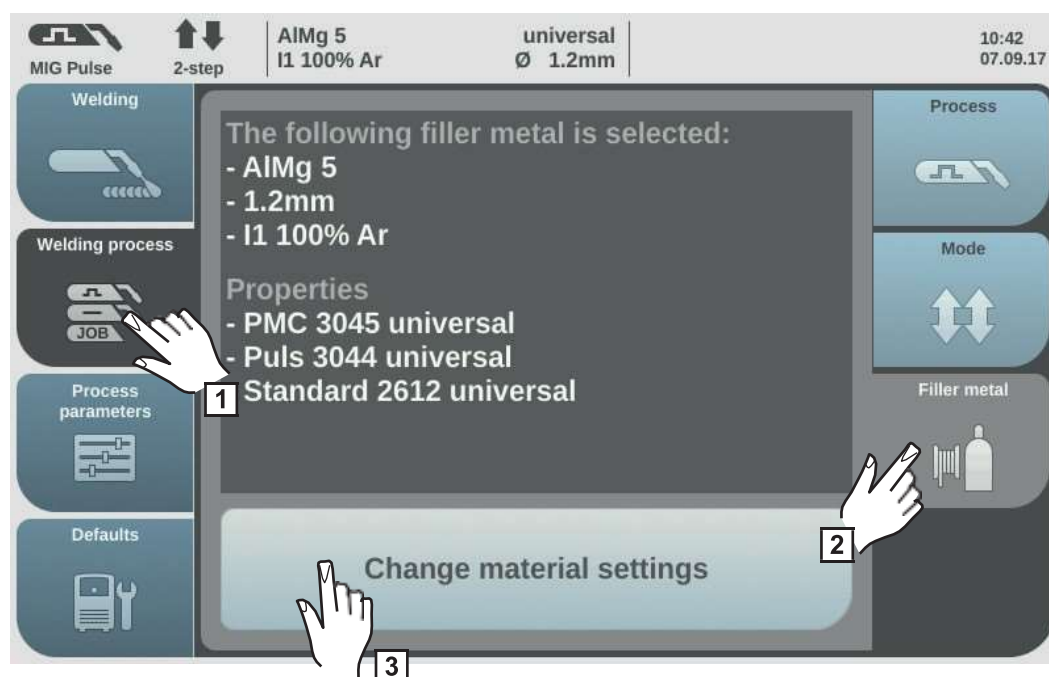
4 Select "Mode"

An overview of the operating modes is displayed:

- 2-step mode
- 4-step mode
- Special 2-step mode
- Special 4-step mode

5 Select the desired operating mode

Selecting the filler metal and shielding gas



- 1** Select "Welding process"
- 2** Select "Filler metal"
- 3** Select "Change material settings"
- 4** Turn the adjusting dial and select the desired filler metal
- 5** Select "Next" / press the adjusting dial
- 6** Turn the adjusting dial and select the desired wire diameter
- 7** Select "Next" / press the adjusting dial
- 8** Turn the adjusting dial and select the desired shielding gas
- 9** Select "Next" / press the adjusting dial



NOTE! The available characteristics per welding process are not displayed if only one characteristic is available for the selected filler metal. In this case, the confirmation step of the filler metal wizard follows immediately; steps 10 - 14 do not apply.

- 10** Turn the adjusting dial and select the desired welding process
- 11** To select the desired characteristic, press the adjusting dial (blue background)
- 12** Turn the adjusting dial and select the desired characteristic
- 13** Press the adjusting dial and apply the selected characteristic (white background)
- 14** Select "Next"

The confirmation step of the filler metal wizard is displayed:

- 15 Select "Save" / press the adjusting dial

The selected filler metal and associated characteristics per welding process will be saved.

Setting the welding parameters



- 1 Select "Welding"
- 2 Select the desired welding parameter by turning the adjusting dial
- 3 Press the adjusting dial to change the welding parameter

The value of the welding parameter is displayed as a horizontal scale:



e.g. wire speed parameter

The value of the selected parameter can now be changed.

- 4 Turn the adjusting dial to change the welding parameter

The adjusted value of the welding parameter is applied immediately. If one of the "Wire speed", "Material thickness", "Current" or "Voltage" parameters is changed during synergic welding, the other welding parameters are immediately adjusted accordingly.

- 5 Press the adjusting dial to call up the welding parameters overview
- 6 Adjust the process parameters accordingly to make user- or application-specific settings on the welding system

Setting the shielding gas flow rate

- 1 Open the gas cylinder valve
- 2 Press the gas test button

Shielding gas flows out

- 3 Turn the adjusting screw on the underside of the pressure regulator until the pressure gauge shows the required shielding gas flow rate
- 4 Press the gas test button

The flow of gas stops.

MIG/MAG or CMT welding



- 1 Select "Welding" to display the welding parameters



CAUTION! Risk of injury and damage from electric shock and from the wire electrode emerging from the torch. When pressing the torch trigger:

- keep the torch away from your face and body
- do not point the welding torch at people
- make sure that the wire electrode does not touch any electrically conducting or earthed (grounded) parts, such as the housing, etc.

- 2 Press the torch trigger and start welding

Whenever welding ends, the actual values for the welding current, welding voltage and wire speed are stored, and HOLD appears on the display.



NOTE! Parameters that have been set on a system component control panel (e.g. wire feed unit or remote control) might not be able to be changed on the power source control panel.

MIG/MAG and CMT welding parameters

Welding parameters for MIG/MAG pulse synergic welding, for CMT welding and PMC welding

The following welding parameters for MIG/MAG pulse synergic welding, CMT welding and PMC welding can be set and displayed by pressing the "Welding" button:

Current ¹⁾

Unit	A
Setting range	Depends on the welding process and welding program selected

Before the start of welding, the machine automatically displays a standard value based on the programmed parameters. The actual value is displayed during welding.

Voltage ¹⁾

Unit	V
Setting range	Depends on the welding process and welding program selected

Before the start of welding, the machine automatically displays a standard value based on the programmed parameters. The actual value is displayed during welding.

Material thickness ¹⁾

Unit	mm	in.
Setting range	0.1 - 30.0 mm ²⁾	0.004 - 1.18 ²⁾

Wire speed ¹⁾

Unit	m/min	ipm
Setting range	0.5 - max. ^{2) 3)}	19.69 - max ^{2) 3)}

Arc length correction

For correcting the arc length

Setting range	-10 - +10
Factory setting	0
-	shorter arc length
0	neutral arc length
+	longer arc length

Pulse/dynamic correction

For correcting the pulsing energy of a pulsed arc

Setting range	-----10 - +10
Factory setting	0
-	lower droplet detachment force
0	neutral droplet detachment force
+	higher droplet detachment force

Welding parameters for MIG/MAG standard synergic welding and LSC welding

The following welding parameters for MIG/MAG standard synergic welding and LSC welding can be set and displayed by selecting the "Welding" menu button:

Current ¹⁾

Unit	A
Setting range	Depends on the welding process and welding program selected

Before the start of welding, the device automatically displays a standard value based on the programmed parameters. During welding, the actual value is displayed.

Voltage ¹⁾

Unit	V
Setting range	Depends on the welding process and welding program selected

Before the start of welding, the device automatically displays a standard value based on the programmed parameters. During welding, the actual value is displayed.

Material thickness ¹⁾

Unit	mm	in.
Setting range	0.1 - 30.0 mm ²⁾	0.004 - 1.18 ²⁾

Feeder command value ¹⁾

for setting a harder, more stable arc

Unit	m/min	ipm.
Setting range	0.5 -max. ²⁾	19.69 -max. ²⁾

Arc length correction

For correcting the arc length, which is preset by the characteristic or the synergic program;

Setting range	-10 - +10
Factory setting	0
-	Shorter arc length
0	Neutral arc length
+	Longer arc length

Pulse/dynamic correction

For influencing the short-circuiting dynamic at the instant of droplet transfer

Setting range-----	10 - +10
Factory setting	0
-	Harder, more stable arc
0	Neutral arc
+	Soft, low-spatter arc

Welding parameters for MIG/MAG standard manual welding

The following welding parameters for MIG/MAG standard manual welding can be set and displayed by selecting the "Welding" menu button:

Voltage

Unit	V
Setting range	Depends on the welding process and welding program selected

Dynamic

For influencing the short-circuiting dynamic at the instant of droplet transfer

Setting range	0 - 10
Factory setting	0

0	Harder, more stable arc
10	Soft, low-spatter arc

Feeder command value

for setting a harder, more stable arc

Unit	m/min	ipm.
Setting range	0.5 -max. ²⁾	19.69 -max. ²⁾

Explanation of footnotes

- 1) Synergic parameter
When a synergic parameter is changed, the synergic function automatically changes all other synergic parameters to match.

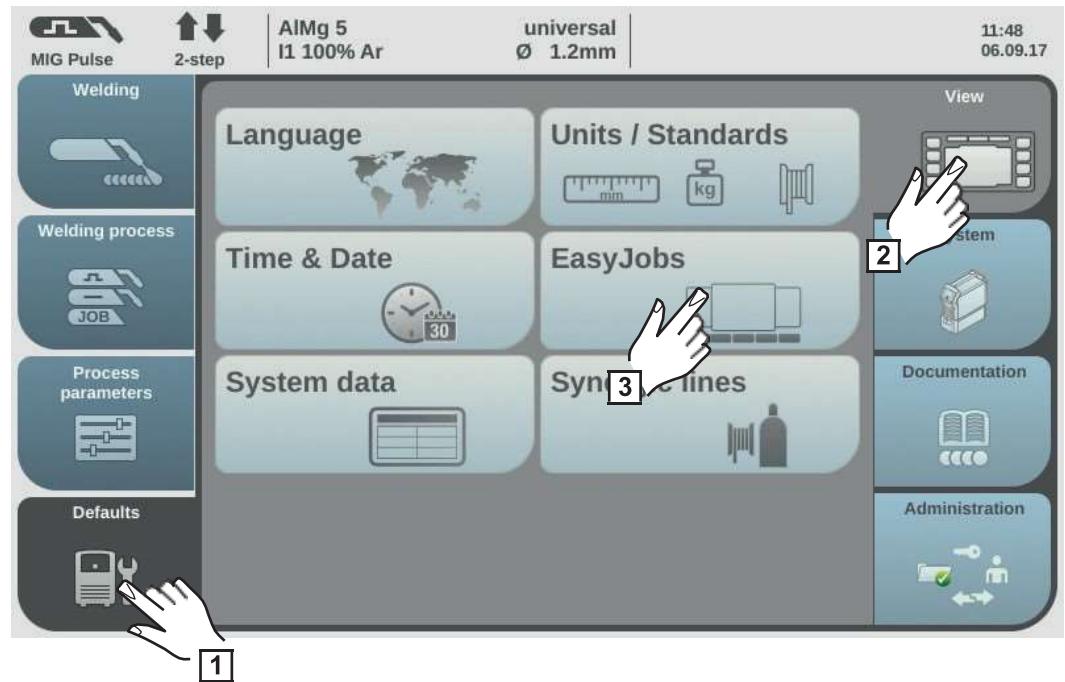
The real setting range depends on power source and wire feeder used and on the welding programm.
- 2) The real setting range depends on the welding program.
- 3) The maximum value depends on the wire feeder used.

EasyJob mode

General

If EasyJob mode has been activated, 5 additional buttons appear on the display. These enable up to 5 operating points to be saved at the touch of a button. The current welding settings are saved.

Activating Easy-Job mode



- 1 Select "Defaults"
- 2 Select "View"
- 3 Select "EasyJobs"

The overview to activate/deactivate EasyJob mode is displayed.

- 4 Select "EasyJobs on"
- 5 Select "OK"

EasyJob mode is activated and the default settings are displayed.

- 6 Select "Welding"

Five "EasyJob" buttons are displayed for the welding parameters.

Storing EasyJob operating points



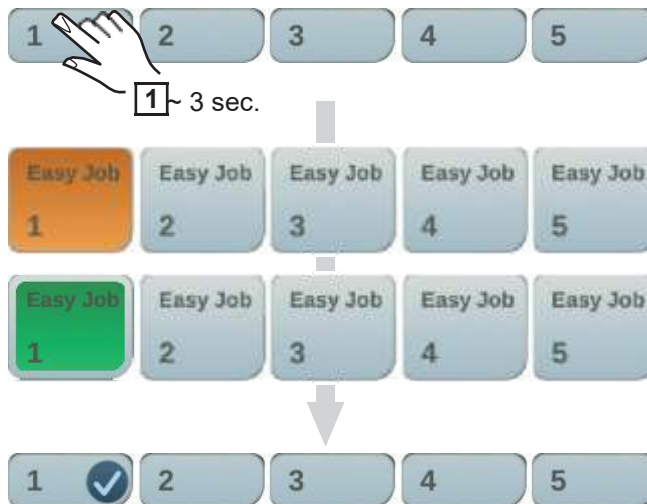
NOTE! EasyJobs are saved under job numbers 1 - 5 and can also be called up in Job mode.

Storing an EasyJob overwrites any other job saved under the same number!

- 1 To store the current welding settings, touch one of the EasyJob buttons for about three seconds

The size and colour of the button changes. After about three seconds, the button is displayed green with a frame.

The settings have now been stored. The most recently stored settings will be active. An active EasyJob is indicated by a tick on the EasyJob button.



Retrieving Easy-Job operating points

- 1 To retrieve a saved EasyJob operating point, touch the corresponding EasyJob button briefly (< 3 seconds)

The size and colour of the button changes briefly; it is then displayed with a tick.



If a tick is not displayed after touching an EasyJob button, this means that there is no operating point saved under this button.

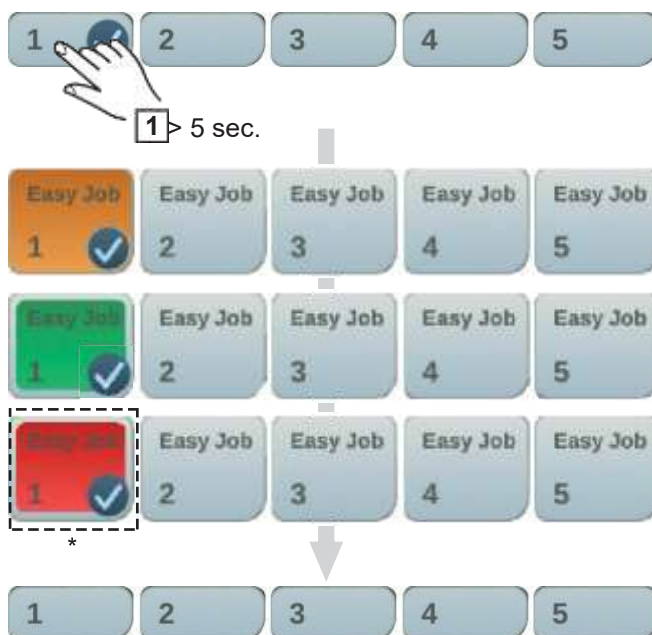
Deleting EasyJob operating points

- 1 To delete an EasyJob operating point, touch the relevant EasyJob button for approximately 5 seconds

The button

- first changes its size and colour;
- is displayed with a frame after about 3 seconds.
The saved operating point is overwritten with the latest settings.
- is highlighted in red (= delete) after a total of 5 seconds.

The EasyJob operating point has been deleted.



* ... highlighted in red

Job mode

General

Up to 1000 jobs can be stored and retrieved in the power source.
This eliminates the need for manual documenting of the welding parameters.
"Job mode" enhances the quality of automated and manual applications.

Jobs can only be stored when in welding mode. When storing jobs, the process parameters and certain machine defaults are taken into account in addition to the present welding settings.

Storing settings as a job

- 1 Set the parameters that are to be stored as a job:
 - Welding parameters
 - Welding process
 - Process parameters
 - Machine defaults (if necessary)



- 2 Select "Save as Job"

The job list is displayed.

To overwrite an existing job, select it by turning and pressing the adjusting dial (or selecting "Next").

The selected job can be overwritten after acknowledging the confirmation prompt.

Select "Create a new Job" to create a new job

- 3 Press the adjusting dial / select "Next"

The next free job number is displayed.

- 4 Turn the adjusting dial and select the desired storage location

- 5 Press the adjusting dial / select "Next"

The keyboard is displayed.

- 6 Enter a job name
- 7 Select "OK" and confirm the job name / press the adjusting dial

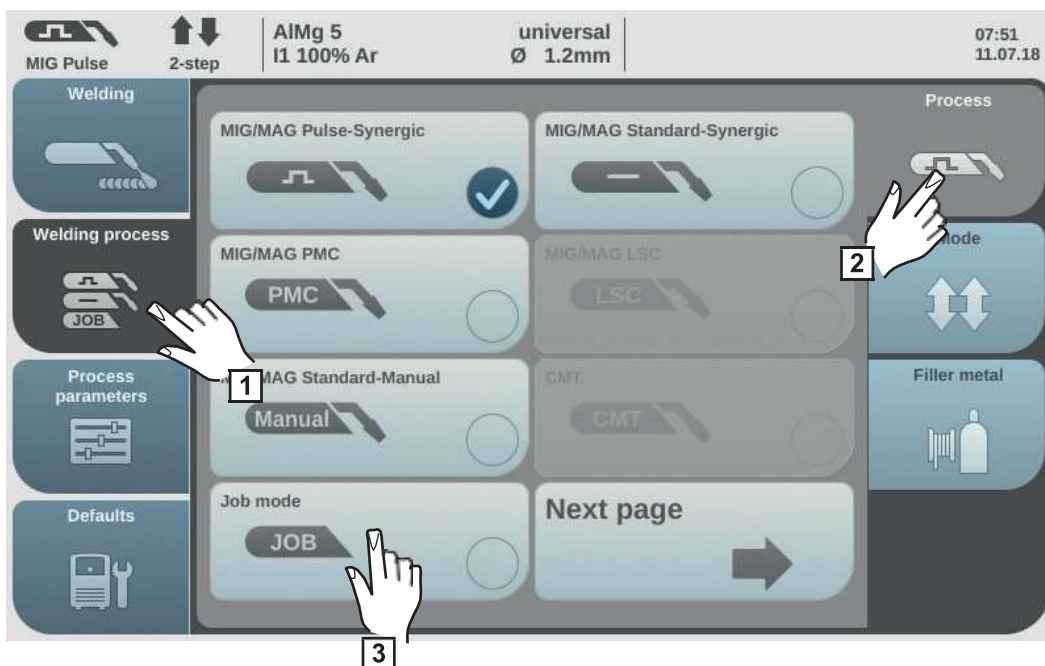
The name is saved and a confirmation that the job has been stored is displayed.

- 8 To exit, select "Finish" / press the adjusting dial

Job welding - retrieving a job



NOTE! Before retrieving a job, make sure that the welding system has been installed and set up for the job.



- 1 Select "Welding process"
- 2 Select "Process"
- 3 Select "Job mode"

Job mode is activated.

"Job welding" and the data from the most recently retrieved job are displayed.

- 4 Select "Job welding"
- 5 Turn the adjusting dial and select "Job number" (white background)
- 6 To select the desired job, press the adjusting dial (blue background)
- 7 Turn the adjusting dial to select the desired job number (blue background)
The name of the selected job is displayed above the actual value display.
- 8 Press the adjusting dial and accept the selected job number (white background)
- 9 Start welding

IMPORTANT! "Job number" is the only parameter that can be altered in Job mode; all the others are read-only.

Renaming a job



- 1 Select "Save as Job"
(also works in Job mode)

The job list is displayed.



- 2 Turn the adjusting dial and select the job to be renamed
- 3 Select "Rename Job"

The keyboard is displayed.

- 4 Change the job name using the keyboard
- 5 Select "OK" and confirm the amended job name / press the adjusting dial

The job name is changed and the job list is displayed.

- 6 To exit, select "Cancel"

Deleting a job



- 1 Select "Save as Job"
(also works in Job mode)

The job list is displayed.



- 2 Turn the adjusting dial and select the job to be deleted
- 3 Select "Delete Job"

A confirmation prompt asking whether you really want to delete the job is displayed.

- 4 Select "Yes" to delete the selected job

The job is deleted, the job list is displayed.

- 5 To exit, select "Cancel"

Loading a job

The load job function can be used to load the data for a saved job or an EasyJob to the welding screen. The relevant data from the job is displayed in the welding parameters and can be changed, saved as a new job or EasyJob, or used to start welding.



- 1 Select "Save as Job"
(also works in Job mode)

The job list is displayed.

- 2 Turn the adjusting dial and select the job to be loaded
- 3 Select "load Job"

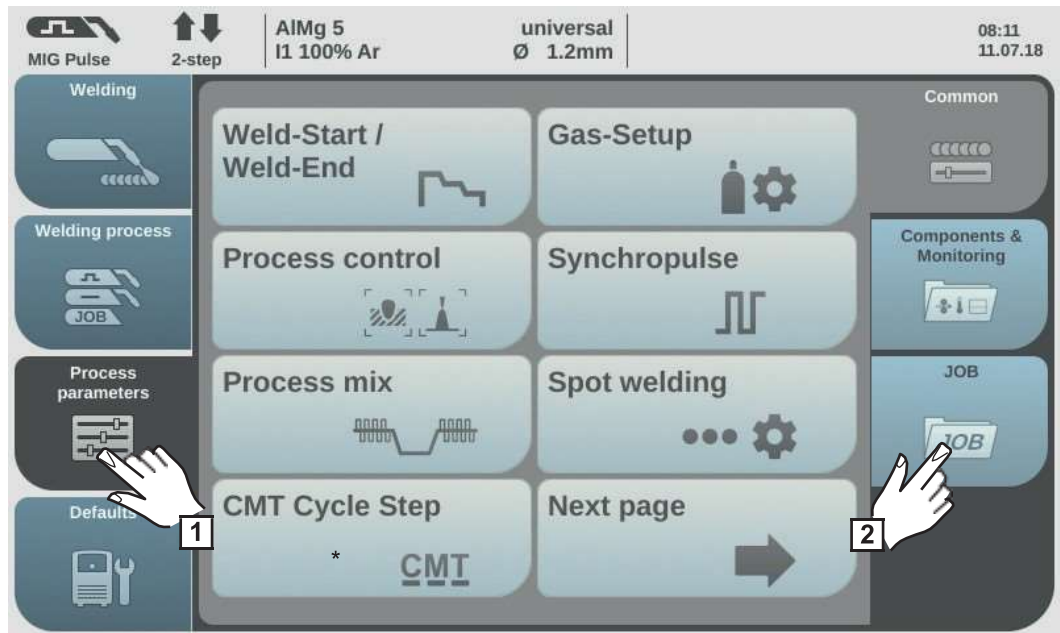
The load job information is shown.

- 4 Select "Yes"

The data for the selected job is loaded onto the welding screen.

The data for the loaded job can now be used for welding (no job mode), changed, or be saved as a new job or an EasyJob.

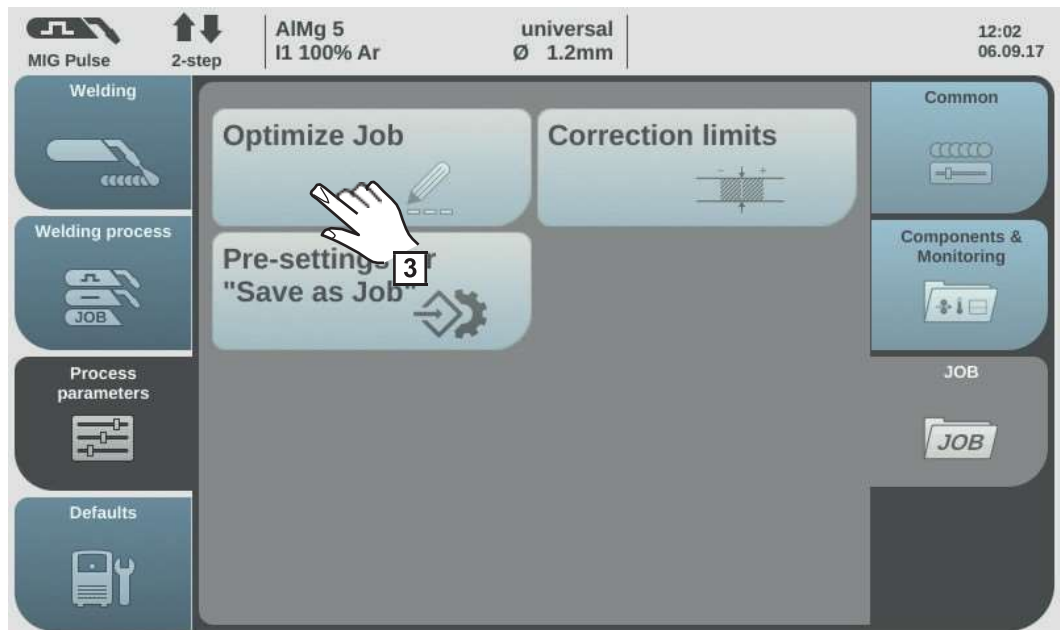
Optimise job



* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

- 1 Select "Process parameters"
- 2 Select "JOB"

An overview of the job functions is displayed.



- 3 Select "Optimize Job"

The overview of the most recently optimised job is displayed.

- 4 Turn the adjusting dial and select either the job or the job welding parameters to be modified

The choice between the job and the job welding parameters can also be made by touching the "Job number / Job parameter" button.



Select job:

- Press the adjusting dial

The job number is highlighted in blue and can now be changed.

- Turn the adjusting dial to select the job to be altered
- Press the adjusting dial to change the job

Select job welding parameters:

- Turn the adjusting dial and select the parameter to be changed
- Press the adjusting dial

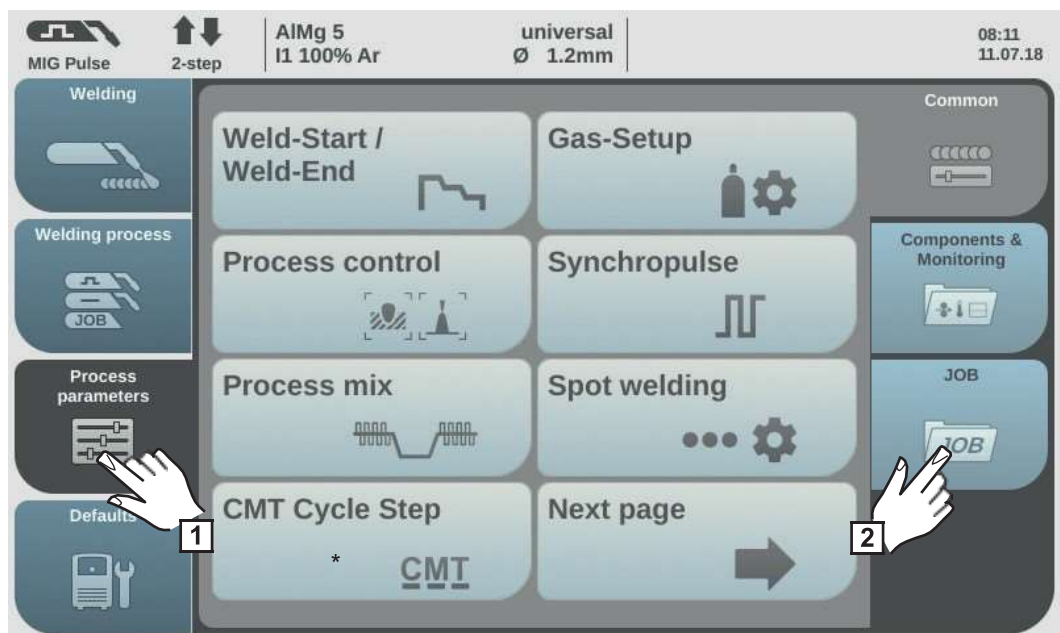
The value of the parameter is highlighted in blue and can now be changed.

- Turn the adjusting dial; the amended value is applied immediately
- Press the adjusting dial to select other parameters

5 Select "Finish"

Setting correction limits for a job

Individual correction limits for welding power and arc length can be defined for each job. If correction limits are defined for a job, the welding power and arc length for the job in question can be corrected within the defined limits while welding.

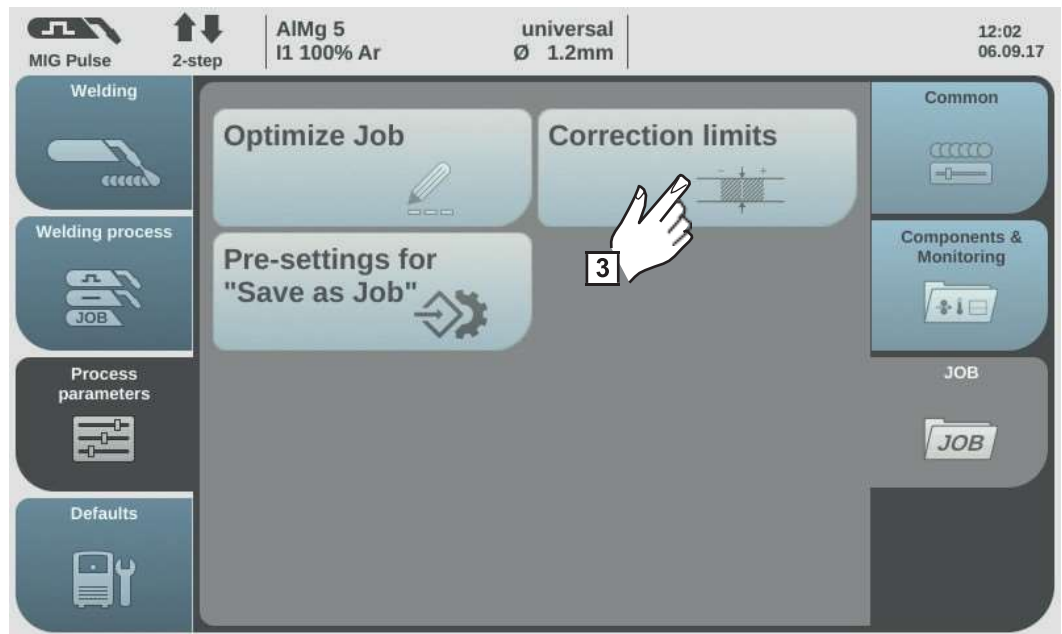


* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

1 Select "Process parameters"

2 Select "JOB"

An overview of the job functions is displayed.



3 Select "Correction limits"

A list of the job correction limits for the last job opened is displayed.

4 Turn the adjusting dial and select either the job or the job limits to be modified

The choice between the job and the job limits can also be made by touching the "Job number / Job parameter" button.



Select job:

- Press the adjusting dial

The job number is highlighted in blue and can now be changed.

- Turn the adjusting dial to select the job to be altered
- Press the adjusting dial to change the job

Select job limits:

- Turn the adjusting dial and select the desired limit group
- Press the adjusting dial

The selected limit group opens.

- Turn the adjusting dial and select the top or bottom limit
- Press the adjusting dial

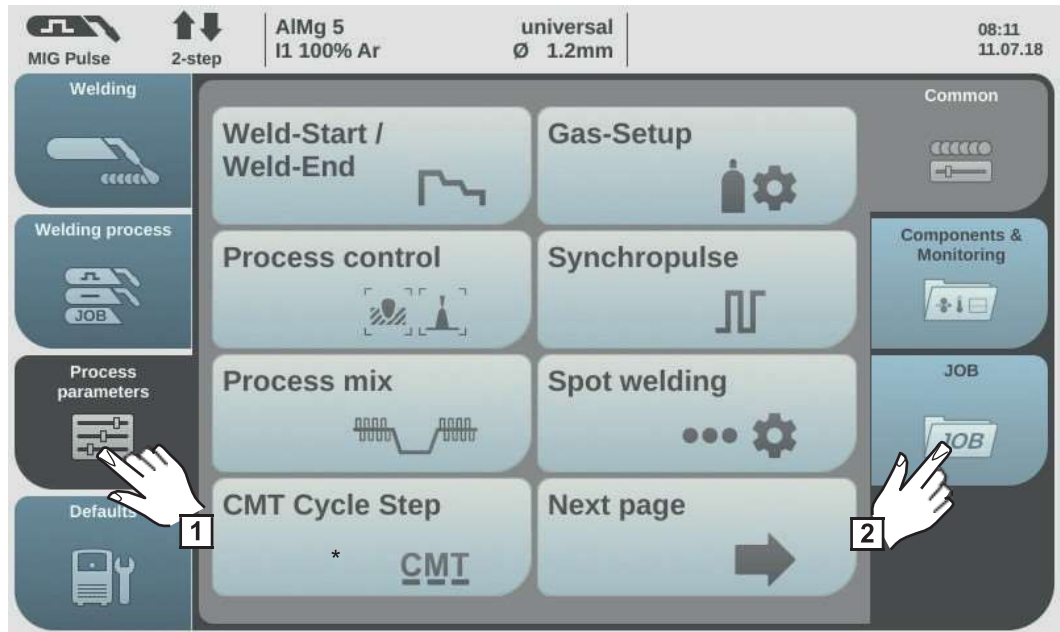
The value of the limit parameter is highlighted in blue and can now be changed.

- Turn the adjusting dial; the amended value is applied immediately
- Press the adjusting dial to select other limit parameters

5 Select "Finish"

Pre-settings for "Save as Job"

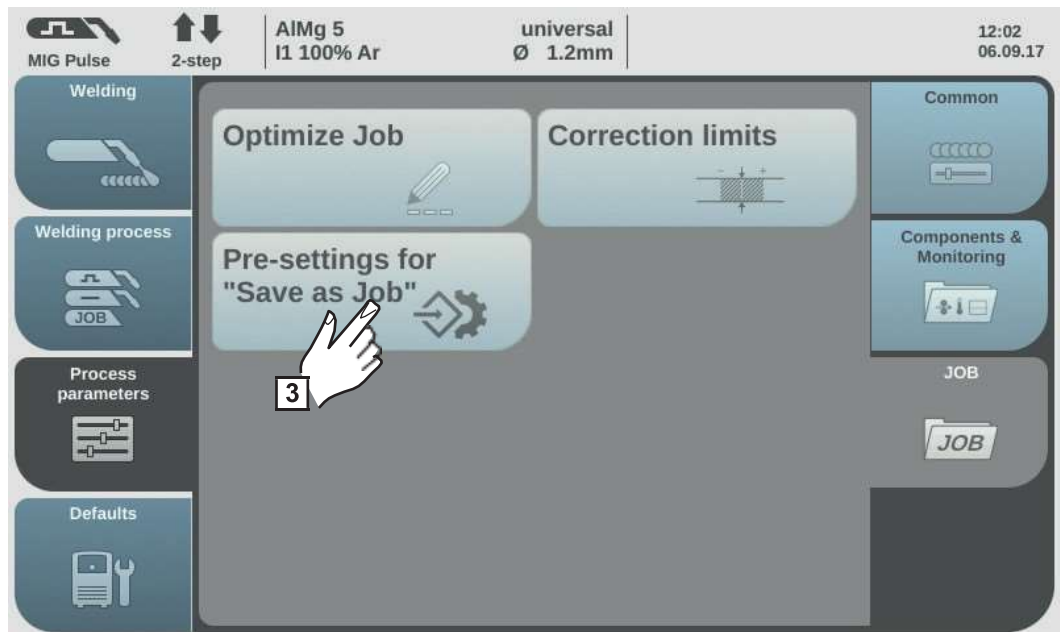
"Pre-settings for Save as Job" is for setting the default values that are assumed for every newly created job.



* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

- 1 Select "Process parameters"
- 2 Select "JOB"

An overview of the job functions is displayed.



- 3 Select "Pre-settings for Save as Job"
- 4 Confirm the displayed information

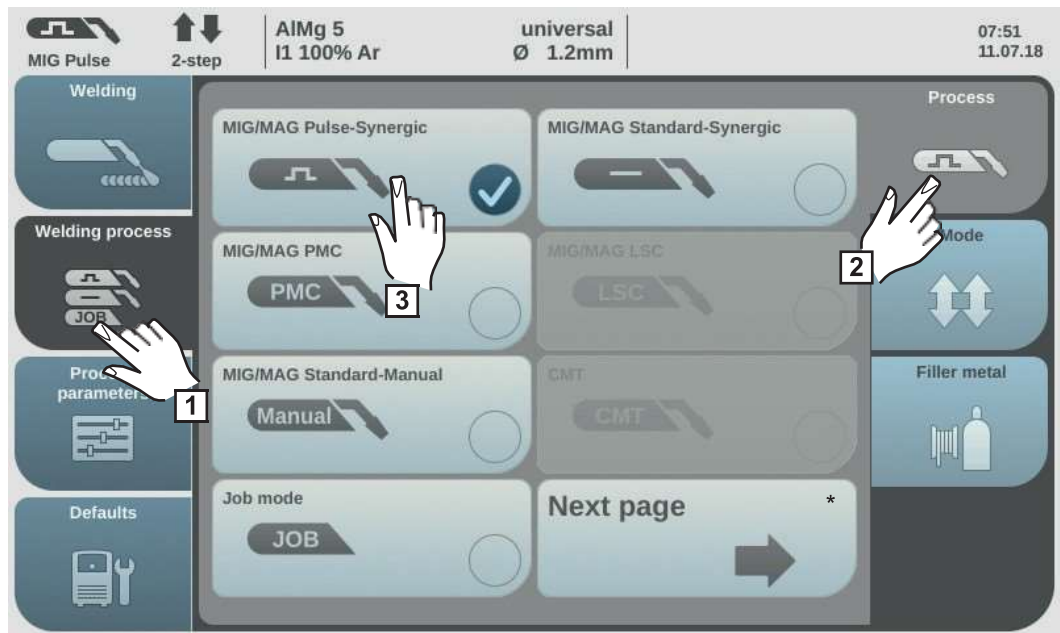
The default settings for saving new jobs are displayed.

- 5 Turn the adjusting dial and select the desired parameter
- 6 Press the adjusting dial

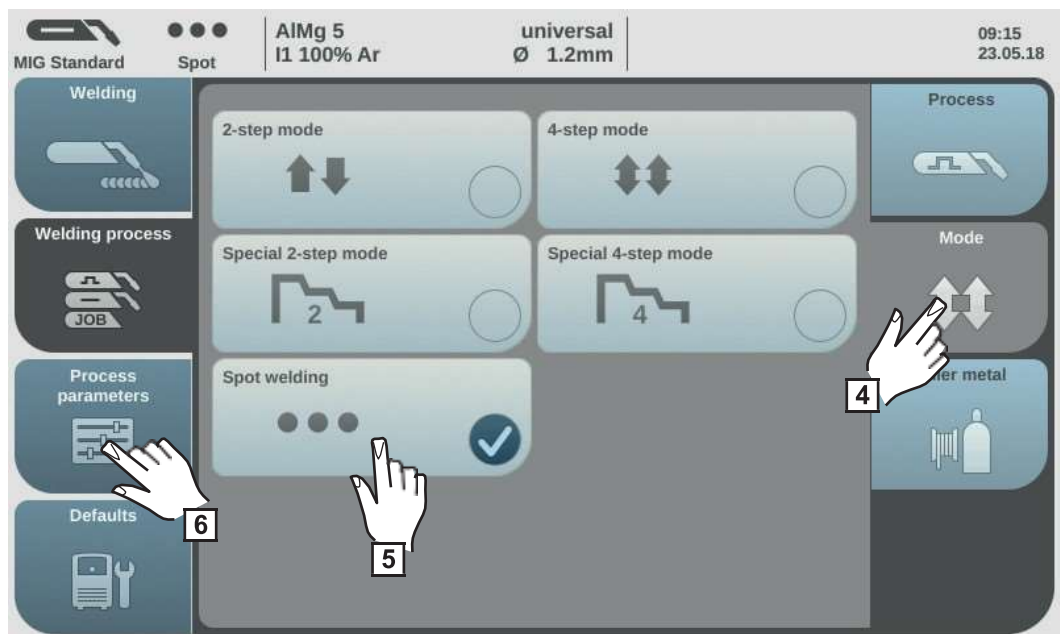
- 7 Turn the adjusting dial and change the value
- 8 Press the adjusting dial
- 9 Select "Finish"

Spot welding

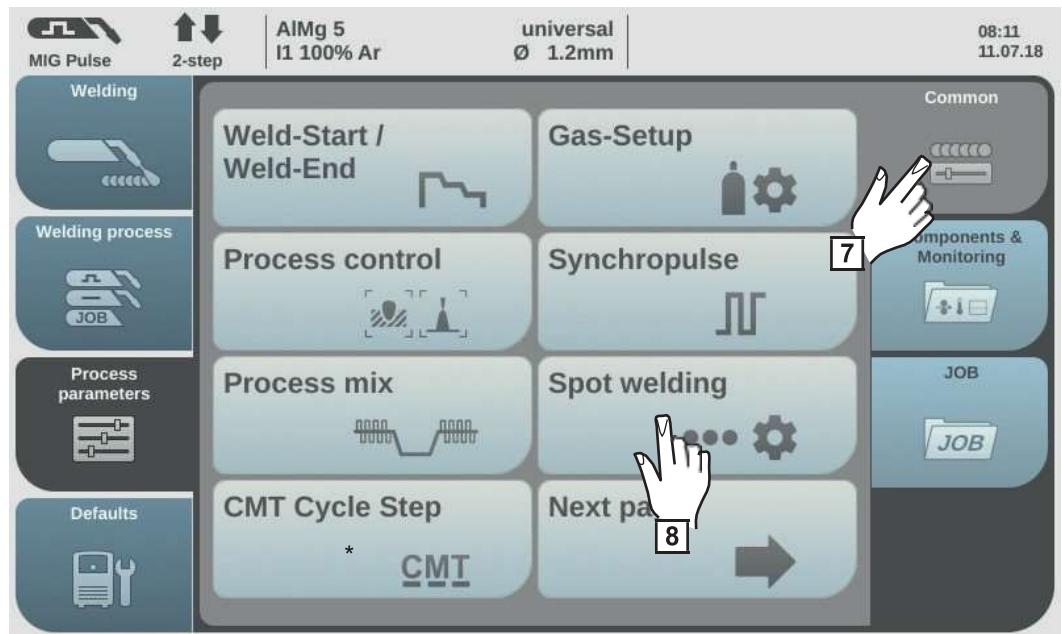
Spot welding



- 1 Select "Welding process"
- 2 Select "Process"
- 3 Select the desired welding process



- 4 Select "Mode"
- 5 Select "Spot welding"
- 6 Select "Process parameters"



* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

- 7 Select "General"
- 8 Select "Spot welding"

The spot welding time parameter is displayed.

- 9 Enter the desired value for the spot welding time: Press and turn the adjusting dial

Setting range: 0.1 - 10.0 s
Factory setting: 1.0 s

- 10 Apply value by pressing OK
- 11 Select the filler metal, wire diameter and shielding gas
- 12 Open the gas cylinder valve
- 13 Setting the shielding gas flow rate



CAUTION! Risk of injury and damage from electric shock and from the wire electrode emerging from the torch. When pressing the torch trigger

- Keep the welding torch away from your face and body
- wear suitable protective goggles
- Do not point the welding torch at people
- make sure that the wire electrode does not touch any conductive or earthed parts (e.g. housing)

- 14 Spot welding

Procedure for welding a spot:

- 1 Hold the welding torch vertical
- 2 Press and release the torch trigger
- 3 Keep the torch in the same position
- 4 Wait for the gas post-flow time
- 5 Lift the torch off the workpiece

TIG welding

Safety



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules



WARNING! An electric shock can be fatal. If the power source is connected to the mains electricity supply during installation, there is a high risk of very serious injury and damage. Before carrying out any work on the device make sure that:

- the power source mains switch is in the "O" position
- the power source is unplugged from the mains

Preparations

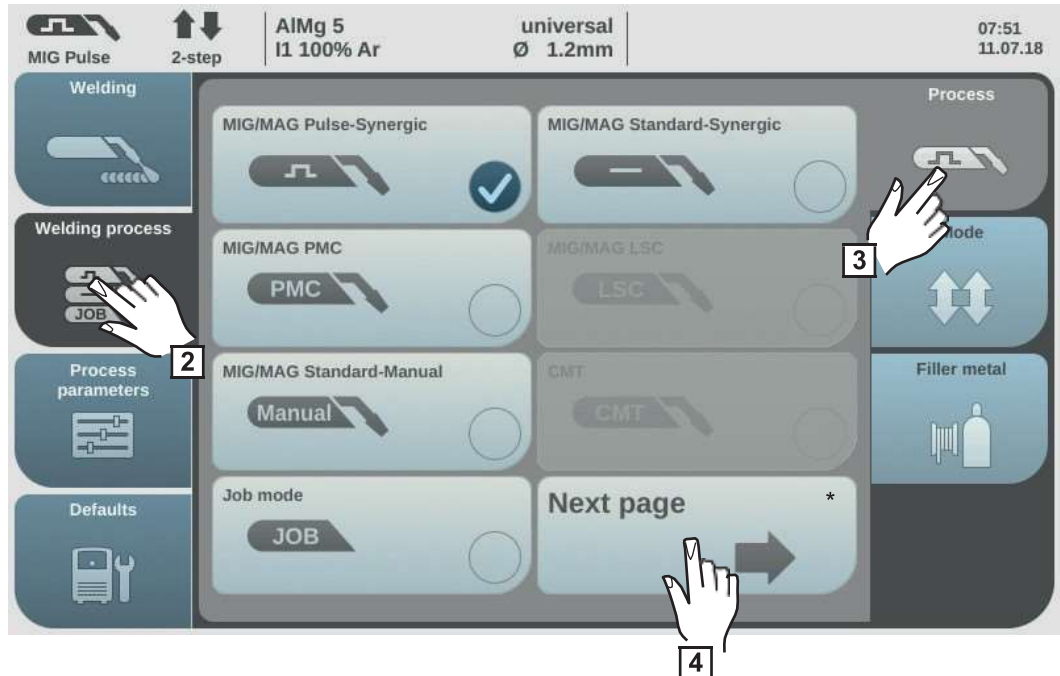
IMPORTANT! For TIG welding, the OPT/i TPS 2nd plus socket option must be installed on the power source.

- 1** Move the mains switch to the "O" position
- 2** Disconnect the mains plug
- 3** Remove the MIG/MAG welding torch
- 4** Disconnect the grounding (earthing) cable from the (-) current socket
- 5** Plug the grounding (earthing) cable into the 2nd (+) current socket and twist to fasten it
- 6** Use the other end of the grounding (earthing) cable to establish a connection to the workpiece
- 7** Plug the bayonet current plug on the TIG gas-valve torch into the (-) current socket and twist it clockwise to fasten it
- 8** Screw the pressure regulator onto the (argon) gas cylinder and tighten it
- 9** Connect the gas hose of the TIG gas-valve torch to the pressure regulator
- 10** Plug in the mains plug



CAUTION! Risk of injury and damage from electric shock. As soon as the mains switch is in the "I" position, the tungsten electrode of the welding torch is live. Make sure that the tungsten electrode does not touch any persons or electrically conductive or earthed parts (e.g. housing, etc.)

- 1 Move the mains switch to the "I" position



* next page: Electrode, TIG

- 2 Select "Welding process"

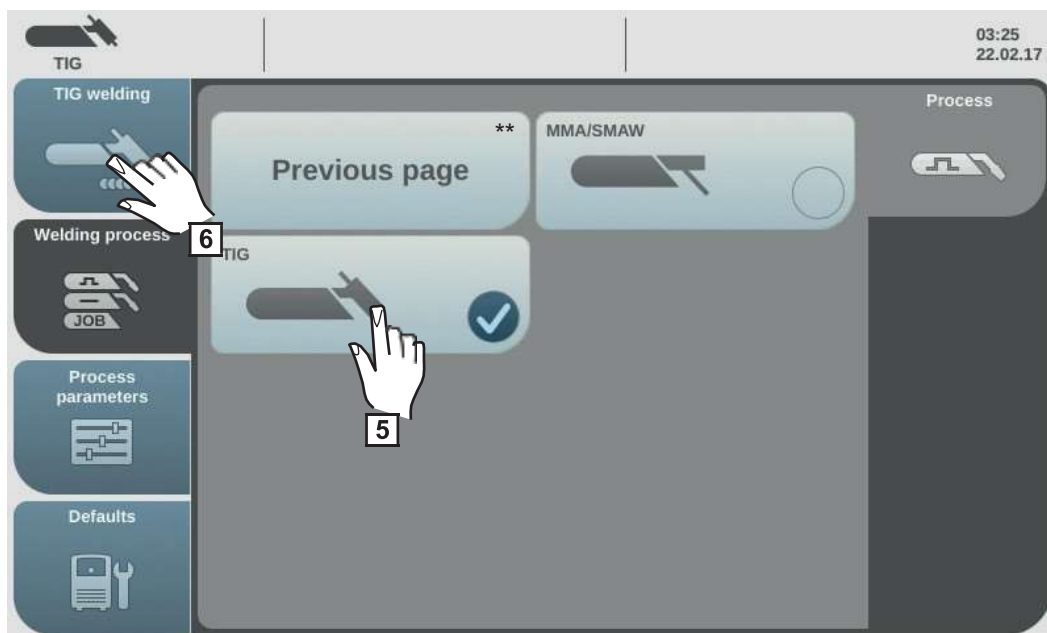
- 3 Select "Process"

An overview of the welding process is displayed.

Various welding processes are available depending on the power source type or function package installed.

- 4 Select "Next page"

The 2nd page of the welding process overview is displayed.



** previous page: MIG/MAG pulse synergic, MIG/MAG standard synergic, MIG/MAG PMC, MIG/MAG LSC, MIG/MAG standard manual, CMT and Job mode

5 Select TIG

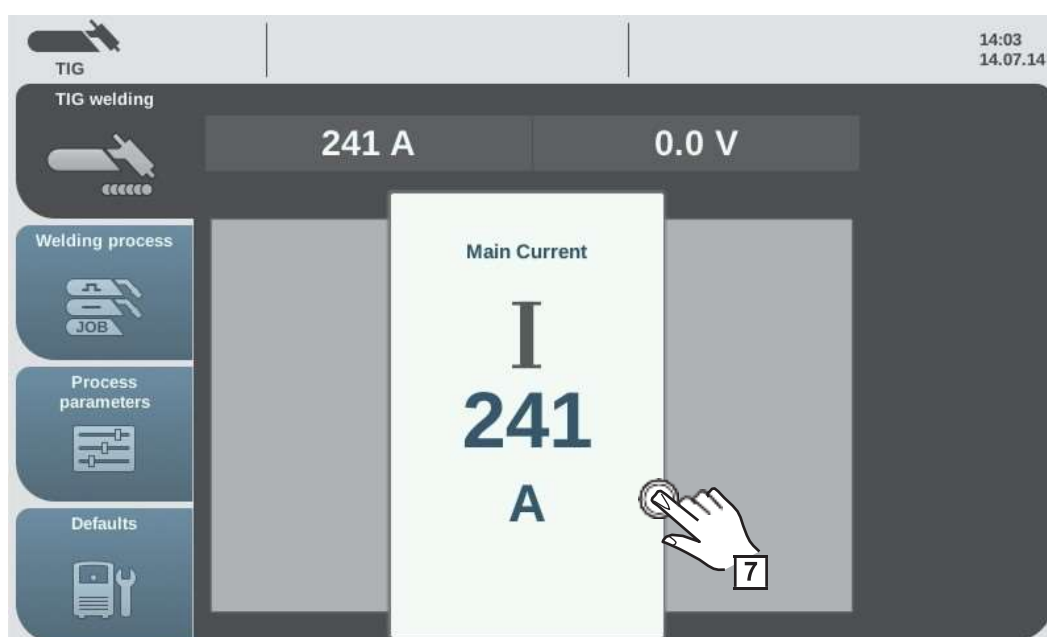
The welding voltage is applied to the welding socket with a three second time lag.



NOTE! Parameters that have been set on a system component control panel (e.g. wire feed unit or remote control) might not be able to be changed on the power source control panel.

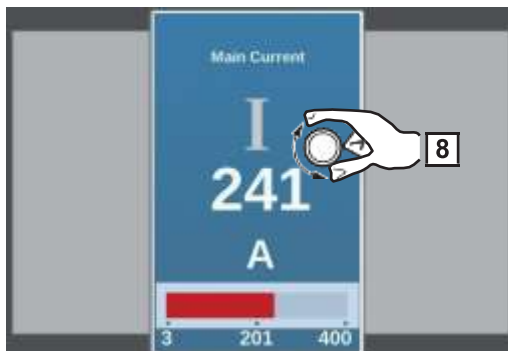
6 Select "TIG welding"

The TIG welding parameters are shown.



7 Press the adjusting dial to change the welding parameter

The value of the welding parameter is displayed as a horizontal scale:

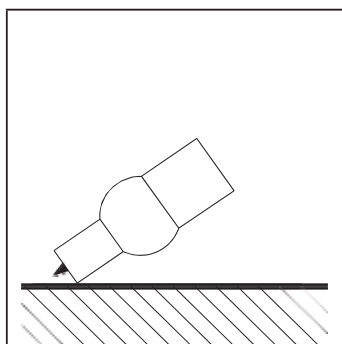


The value of the selected parameter can now be changed.

- 8** Turn the adjusting dial and change the parameter
- 9** Adjust the process parameters accordingly to make user- or application-specific settings on the welding system
- 10** Open the gas stop valve on the TIG gas-valve torch
- 11** Set the desired shielding gas flow rate on the pressure regulator
- 12** Start welding (ignite the arc)

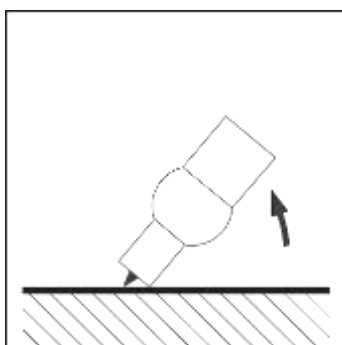
Igniting the arc

The welding arc is ignited by touching the workpiece with the tungsten electrode.



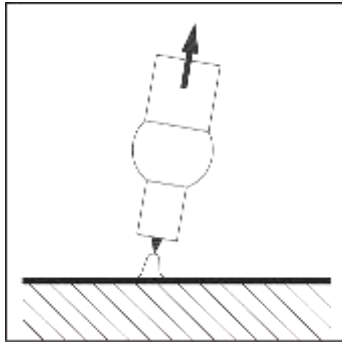
Placing the gas nozzle down

- 1** Place the gas nozzle on the ignition location so that there is a gap of 2-3 mm (0.08 - 0.12 in.) between the tip of the tungsten electrode and the workpiece



Arc ignites when electrode is touched down on workpiece

- 2** Gradually tilt the welding torch up until the tungsten electrode touches the workpiece



Arc ignited - welding commences

- 3** Raise the welding torch and pivot it into the normal position - the arc ignites
- 4** Carry out welding

Finishing welding

- 1** Lift the TIG gas-valve torch away from the workpiece until the arc goes out.

IMPORTANT! To protect the tungsten electrode, ensure that the shielding gas at the end of welding flows for long enough to allow the tungsten electrode to cool sufficiently.

- 2** Close the gas stop valve on the TIG gas-valve torch

MMA welding

Safety



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules



WARNING! An electric shock can be fatal. If the power source is connected to the mains electricity supply during installation, there is a high risk of very serious injury and damage. Before carrying out any work on the device make sure that:

- the power source mains switch is in the "O" position
- the power source is unplugged from the mains

Preparations

IMPORTANT! For MMA welding a grounding (earthing) cable with a Power Connector is required. For other grounding (earthing) cables the OPT/i TPS 2nd plus socket option must be installed on the power source.

- 1 Move the mains switch to the "O" position
- 2 Disconnect the mains plug
- 3 Remove the MIG/MAG welding torch



NOTE! Check the rod electrode packaging or labelling to determine whether the rod electrodes are for positive pole or negative pole welding.

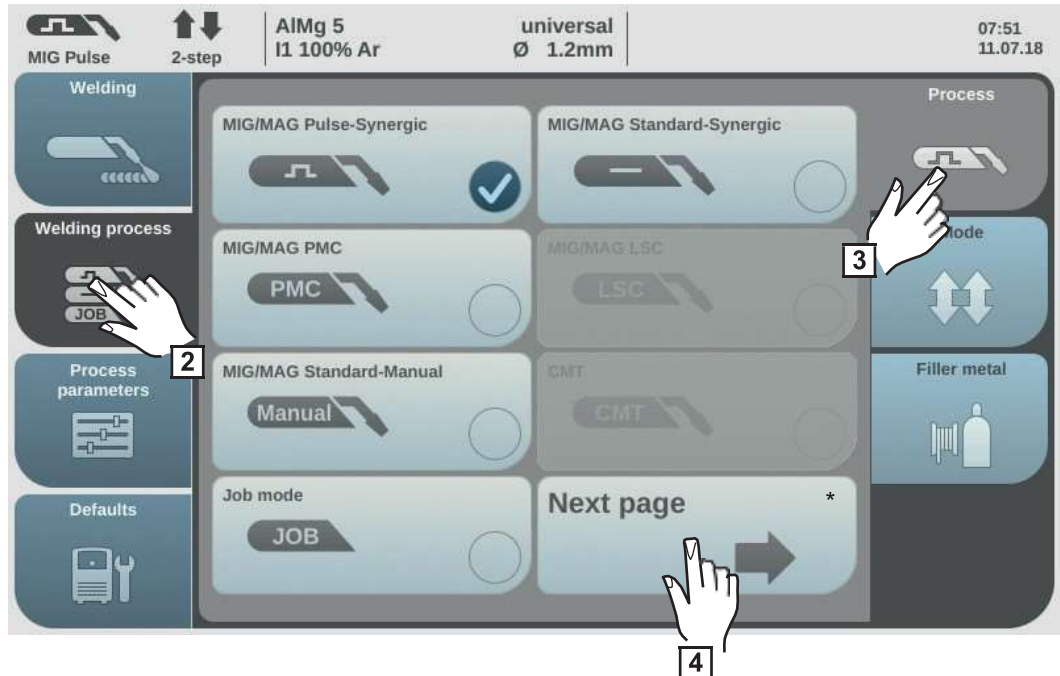
- 4 Plug the grounding (earthing) cable into either the (-) or the (+) current socket depending on the type of electrode, and twist to fasten it
- 5 Use the other end of the grounding (earthing) cable to establish a connection to the workpiece
- 6 Plug the bayonet current plug of the electrode holder cable into the free current socket with the opposite polarity, according to the type of electrode, and twist it clockwise to latch it in place
- 7 Plug in the mains plug

MMA welding



CAUTION! Risk of injury and damage from electric shock. As soon as the mains switch is in the "I" position, the rod electrode in the electrode holder is live. Make sure that the rod electrode does not touch any persons or electrically conductive or earthed parts (e.g. housing, etc.)

- 1 Move the mains switch to the "I" position



* next page: Electrode, TIG

- 2 Select "Welding process"

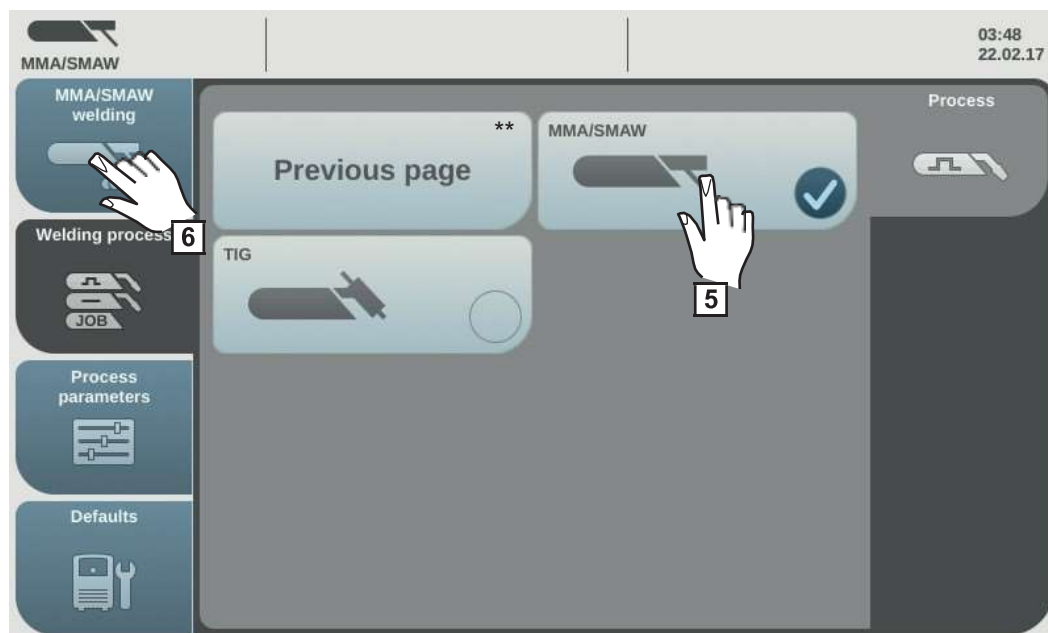
- 3 Select "Process"

An overview of the welding process is displayed.

Various welding processes are available depending on the power source type or function package installed.

- 4 Select "Next page"

The 2nd page of the welding process overview is displayed.



** previous page: MIG/MAG pulse synergic, MIG/MAG standard synergic, MIG/MAG PMC, MIG/MAG LSC, MIG/MAG standard manual, CMT and Job mode

5 Select the MMA/SMAW welding process

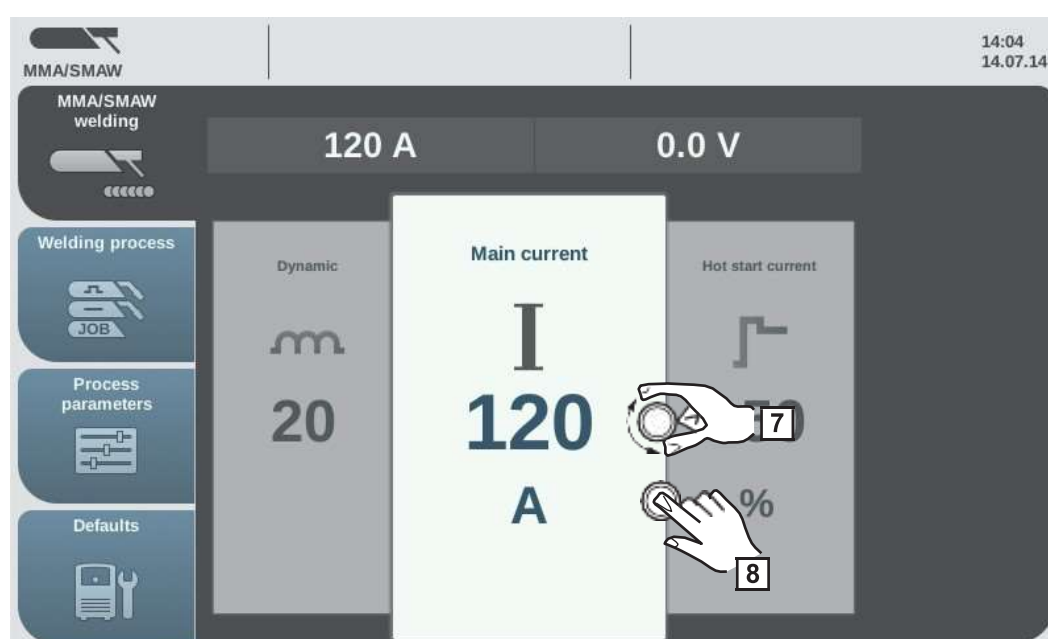
The welding voltage is applied to the welding socket with a three second time lag.

If the MMA/SMAW welding process is selected, any cooling unit present is automatically deactivated. It is not possible to switch it on.

NOTE! Parameters that have been set on a system component control panel (e.g. wire feed unit or remote control) might not be able to be changed on the power source control panel.

6 Select "MMA/SMAW welding"

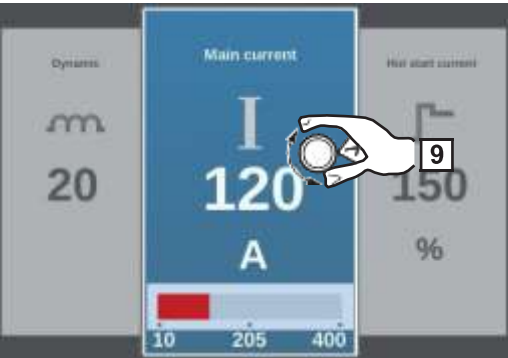
The MMA welding parameters are shown.



7 Turn the adjusting dial and select the desired welding parameter

8 Press the adjusting dial to change the welding parameter

The value of the welding parameter is displayed as a horizontal scale:



The value of the selected parameter can now be changed.

9 Turn the adjusting dial and change the parameter

10 Adjust the process parameters accordingly to make user- or application-specific settings on the welding system

11 Start welding

Welding parameters for manual metal arc welding

The following welding parameters for MMA welding can be set and displayed by pressing the "Welding" button:

Main current	
Unit	A
Setting range	depends on the power source available
Before the start of welding, the device automatically displays a standard value based on the programmed parameters. During welding, the actual value is displayed.	
Starting current	
for setting a starting current value in the range 0 - 200% of the set welding current in order to avoid slag inclusions or incomplete fusion.	
The starting current depends on the electrode type.	
Unit	%
Setting range	0 - 200
Factory setting	150
The starting current is active for the starting current time set under the process parameters.	
Dynamic	
to influence the short-circuiting dynamic at the instant of droplet transfer	
Unit	-
Setting range	0 - 100
Factory setting	20
0	Soft, low-spatter arc
100	Harder, more stable arc

Process parameters

Overview

Overview - Process parameters, Common

The "Process parameters" menu button has the following selection options under "Common":

Weld-Start / Welding-End
Process control
Process Mix
CMT Cycle Step *

Gas-Setup
Synchropulse
Spot welding
Next page

Previous page
TIG/electrode setup

R/L-check / alignment

* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

Overview – components and monitoring process parameters

The "Process parameters" menu item has the following selection options under "Components & monitoring":

Components
Arc break monitoring
Wire stick workpiece
Gas monitoring

System calibration
Wire stick contact tip
Wire end monitoring

Overview – Process parameters, Job

The "Process parameters" menu button has the following selection options under "Job":

Optimize Job
Pre-settings for "Save as Job"

Correction limits

Process parameters, General

Process parameters for start of welding/end of welding

The following process parameters can be set and displayed for the start and end of welding:

Starting current

for setting the starting current for MIG/MAG welding (e.g. aluminium welding start-up)

Unit	% (of welding current)
Setting range	0 - 200
Factory setting	135

Start arc length correction

For correcting the arc length at the start of welding

Unit	% (of welding voltage)
Setting range	-10.0 - +10.0
Factory setting	0.0

-	shorter arc length
0	neutral arc length
+	longer arc length

Starting current time

For setting the length of time for which the starting current is to be active

Unit	s
Setting range	off / 0.1 - 10.0
Factory setting	off

Slope 1

for setting the time during which the starting current is decreased or increased to the welding current

Unit	s
Setting range	0.0 - 9.9
Factory setting	1.0

Slope 2

for setting the time during which the welding current is decreased or increased to the final current.

Unit	s
Setting range	0.0 - 9.9
Factory setting	1.0

Final current

for setting the final current so that

- a) heat build-up towards the end of welding is prevented and
- b) the end-crater can be filled when welding aluminium

Unit	% (of welding current)
Setting range	0 - 200
Factory setting	50

End arc length correction

For correcting the arc length at the end of welding

Unit	% (of welding voltage)
Setting range	-10.0 - +10.0
Factory setting	0.0

-	shorter arc length
0	neutral arc length
+	longer arc length

Final current time

For setting the length of time for which the final current is to be active

Unit	s
Setting range	off / 0.1 - 10.0
Factory setting	off

SFI

to activate/deactivate the SFI function (Spatter Free Ignition)

Unit	-
Setting range	off / on
Factory setting	off

SFI HotStart

For setting a HotStart time in conjunction with the SFI ignition

During SFI ignition, a spray arc phase occurs within the set HotStart time. This increases the heat input irrespective of the mode, thus ensuring deeper penetration right from the very start of welding.

Unit	s
Setting range	off / 0.01 - 2.00
Factory setting	off

Wire withdrawal

for setting the wire withdrawal value (= composite value based on backward movement of wire and a time).

The wire withdrawal depends on the features of the welding torch.

Unit	-
Setting range	0.0 - 10.0
Factory setting	0.0

Ignition current (manual)

for setting the ignition current for MIG/MAG standard manual welding

Unit	A
Setting range	100 - 550 (TPS 320i) 100 - 600 (TPS 400i, TPS 400i LASC ADV) 100 - 650 (TPS 500i, TPS 600i)
Factory setting	500

Wire withdrawal (manual)

for setting the wire withdrawal value (= composite value based on backward movement of wire and a time) for MIG/MAG standard manual welding.

The wire withdrawal depends on the features of the welding torch.

Unit	-
Setting range	0.0 - 10.0
Factory setting	0.0

Process parameters for gas setup

The following process parameters can be set and displayed for gas setup:

Gas pre-flow

for setting the gas flow time before the arc is ignited

Unit	s
Setting range	0 - 9.9
Factory setting	0.1

Gas post-flow

for setting the gas post-flow time after the arc has gone out

Unit	s
Setting range	0 - 60
Factory setting	0.5

Gas set value *

shielding gas flow rate

Unit	l/min
Setting range	0.5 - 30.0
Factory setting	15.0

IMPORTANT! If a high shielding gas flow rate is set (e.g. 30 l/min), ensure that the gas supply line is adequately dimensioned.

Gas factor *

dependent upon the shielding gas used

Unit	-
Setting range	auto / 0.90 - 20.00
Factory setting	auto (the correction factor for standard gases from the Fronius welding database is automatically set)

- * Can only be used in conjunction with the OPT/i gas controller option

In Job mode, the set values of the parameters listed above can be set individually for each job.

Process parameters for process control

The following process parameters can be set and displayed for the process control:

- Penetration stabiliser
- Arc length stabiliser
- Combination of penetration stabiliser and arc length stabiliser

Penetration stabiliser

The penetration stabiliser is used to set the max. permitted change in the wire feed speed to ensure that the welding current and hence the fusion penetration is kept stable or constant with variable stick out.

The penetration stabiliser parameter is only available when the WP PMC (Welding Process Multi Control) or WP LSC (Welding Process Low Spatter Control) option has been enabled on the power source.

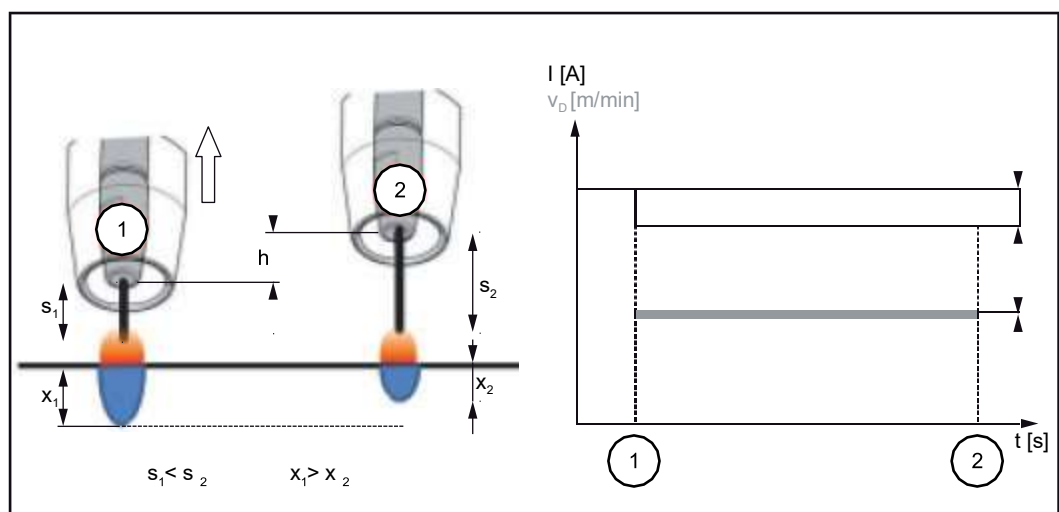
Unit	m/min (ipm)
Setting range	0 - 10.0
Factory setting	0

0 The penetration stabiliser is not activated.
The wire feed speed remains constant.

0.1 - 10.0 The penetration stabiliser is activated.
The welding current remains constant.

Application examples

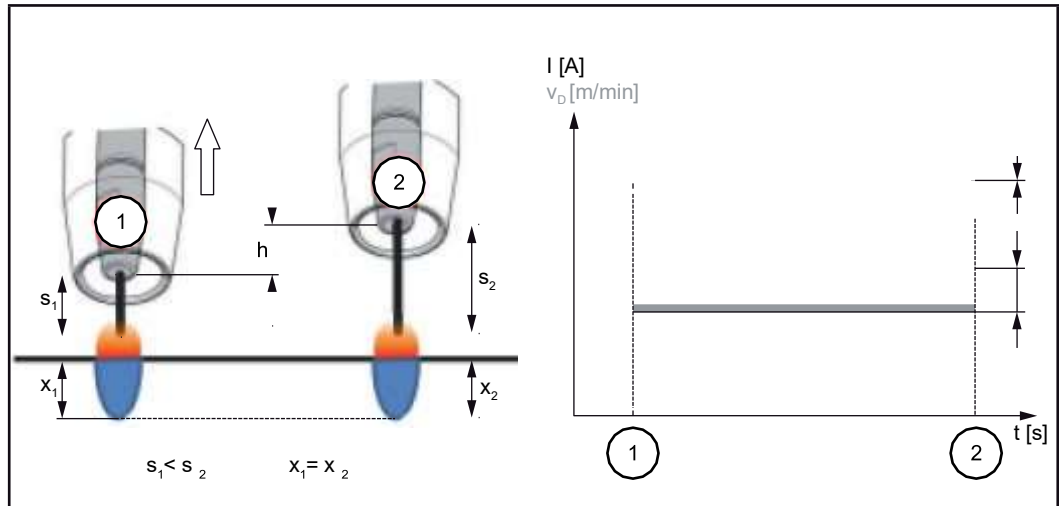
Penetration stabiliser = 0 m/min (not activated)



Changing the contact tube distance (h) alters the resistance in the welding circuit due to the longer stick out (s_2).

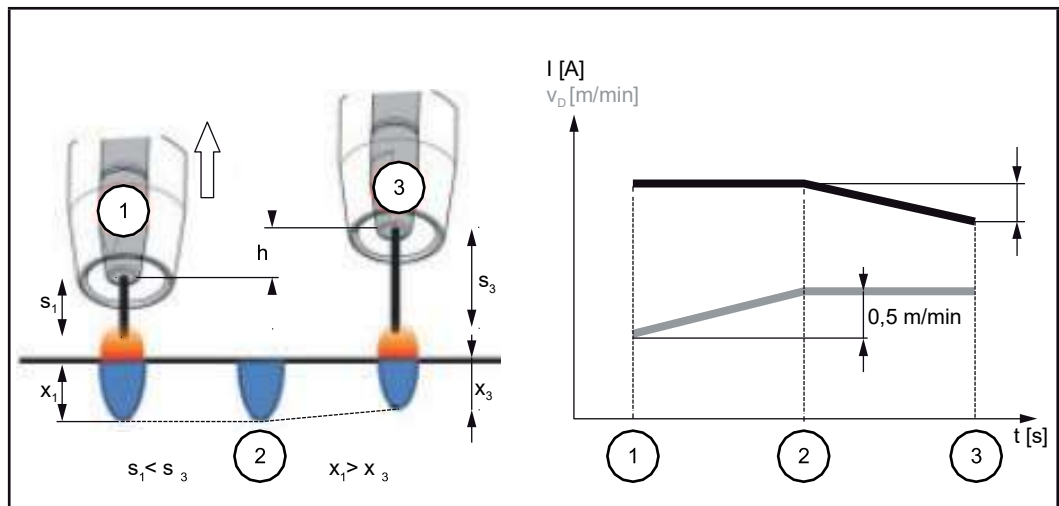
The constant voltage control for constant arc length causes a reduction in the mean current value and hence a smaller penetration (x_2).

Penetration stabiliser = n m/min (activated)



Specifying a value for the penetration stabiliser ensures a constant arc length without large current variations if the stick out is changed ($s_1 \Rightarrow s_2$). The penetration (x_1, x_2) remains virtually unchanged and stable.

Penetration stabiliser = 0.5 m/min (activated)



To minimise the change in welding current if the stick out is changed ($s_1 \Rightarrow s_3$), the wire feed speed is increased or reduced by 0.5 m/min. In the example shown, the stabilising effect is obtained without a change in current up to the set value of 0.5 m/min (Position 2).

I ... Welding current v_D ... Wire feed speed

Arc length stabilizer

Arc length stabilizer

The arc length stabilizer forces short arcs, advantageous for welding, via a short-circuit current control and keeps them stable even with a variable stick out or external interference.

The arc length stabilizer welding parameter is only available on the power source if the WP PMC (Welding Process Pulse Multi Control) option has been enabled.

Unit - (effect of stabilizer)

Setting range 0.0 - 5.0

Factory setting 0.0

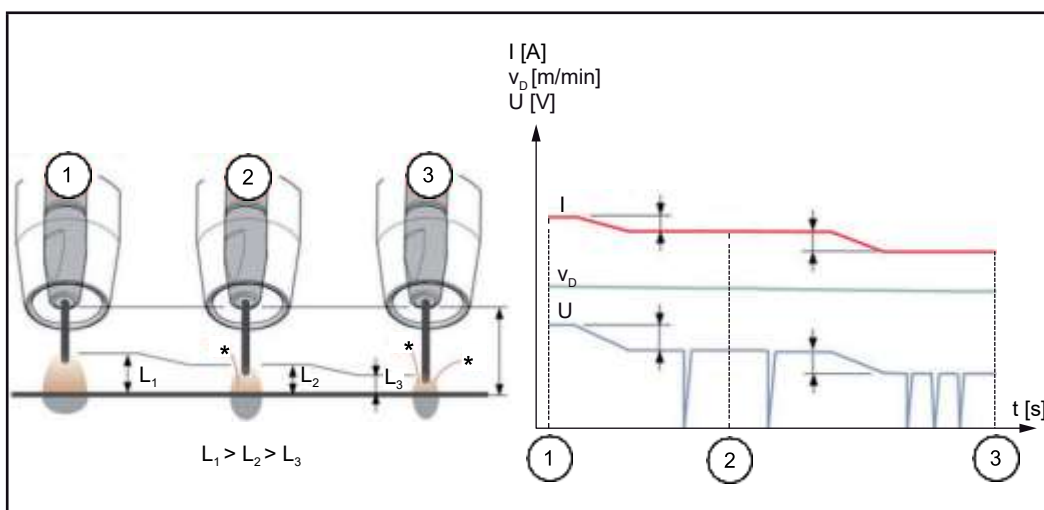
0.0 The arc length stabilizer is deactivated.

0.1 - 5.0 The arc length stabilizer is activated.
The arc length is decreased until short circuits start to occur.

Application examples

Arc length stabilizer = 0 / 0.5 / 2.0

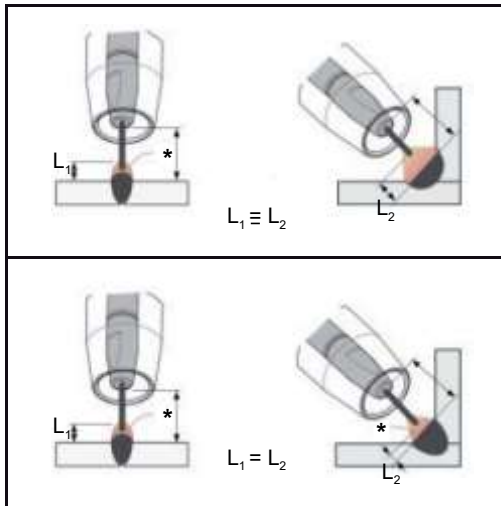
- ① Arc length stabilizer = 0
- ② Arc length stabilizer = 0.5
- ③ Arc length stabilizer = 2



Activating the arc length stabilizer reduces the arc length until short circuits start to occur. The frequency of the short circuits is controlled and kept stable.

Increasing the arc length stabilizer causes a further shortening of the arc length ($L_1 \Rightarrow L_2 \Rightarrow L_3$). The advantages of a short, stable and controlled arc can be used more effectively.

Arc length stabilizer with change of weld seam profile and position



Arc length stabilizer not activated

A change of weld seam profile or welding position can negatively affect the welding result

Arc length stabilizer activated

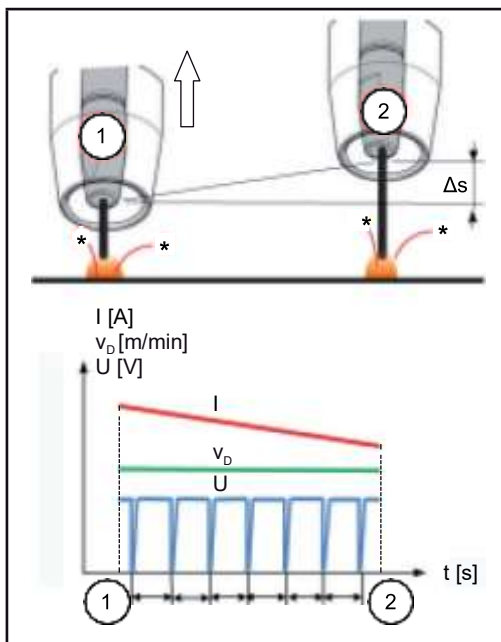
Since the number and duration of the short circuits is controlled, the properties of the arc stay the same if the weld seam profile or welding position is changed.

I ... Welding current v_D ... Wire speed U ... Welding voltage
* ... Number of short circuits

Combination of penetration stabiliser and arc length stabiliser

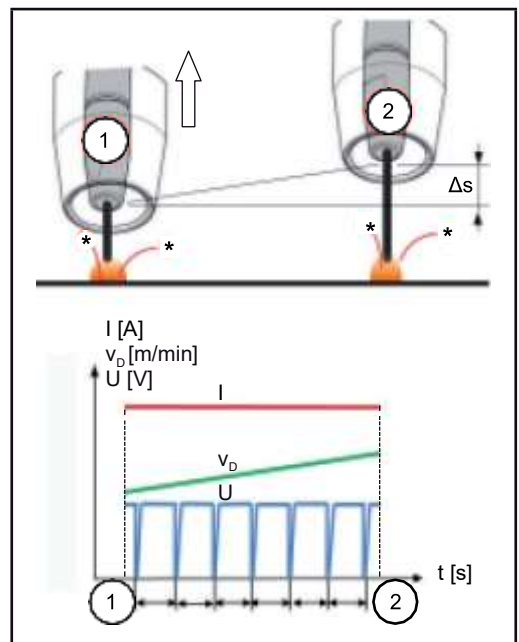
Example: Stick out change

Arc length stabiliser without penetration stabiliser



The advantages of a short arc are maintained even if the stick out is changed, since the short-circuit properties stay the same.

Arc length stabiliser with penetration stabiliser



If the stick out is changed with the penetration stabiliser activated, the penetration also stays the same.

The short circuit behaviour is controlled by the arc length stabiliser.

I ... Welding current v_D ... Wire feed speed U ... Welding voltage
* ... Number of short circuits Δs ... Stick out change

Process parameters for SynchroPulse

The following process parameters can be set for SynchroPulse welding:

(1) Synchropulse

To activate/deactivate SynchroPulse

Unit	-
Setting range	off / on
Factory setting	off

(2) Wire feed speed

For setting the wire speed and therefore the welding power for SynchroPulse

Unit	m/min (ipm)
Setting range	for example: 2 - 25 (depending on wire speed and welding characteristic)
Factory setting	5.0

(3) Delta wire feed

For setting the Delta wire feed:
in SynchroPulse, the set wire speed is alternately increased/reduced by the Delta wire feed. The parameters concerned adapt themselves to this wire speed acceleration/delay accordingly.

Unit	m/min (ipm)
Setting range	0.1 - 6.0 (5 - 235)
Factory setting	2.0

(4) Frequency F

For setting the frequency for SynchroPulse

Unit	Hz
Setting range	0.5 - 3.0
Factory setting	3.0

(5) Duty Cycle (high)

For weighting the duration of the higher operating point in a SynchroPulse period

Unit	%
Setting range	10 - 90
Factory setting	50

(6) Arc-length correction high

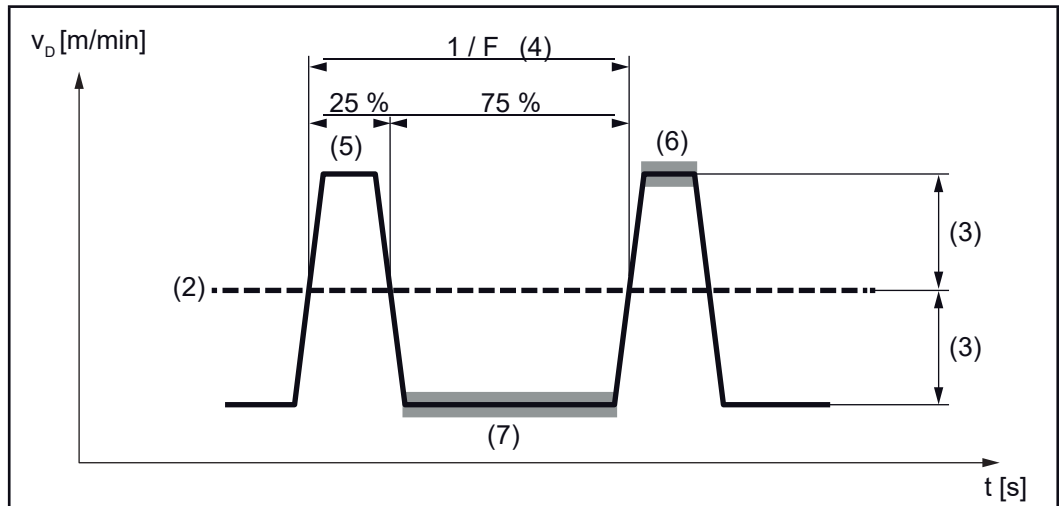
For correcting the arc length for SynchroPulse in the upper operating point (= average wire speed plus Delta wire speed)

Unit	-
Setting range	-10.0 - +10.0
Factory setting	0.0
-	short arc
0	uncorrected arc length
+	longer arc

(7) Arc length correction low

For correcting the arc length for SynchroPulse in the lower operating point (= average wire speed minus Delta wire feed)

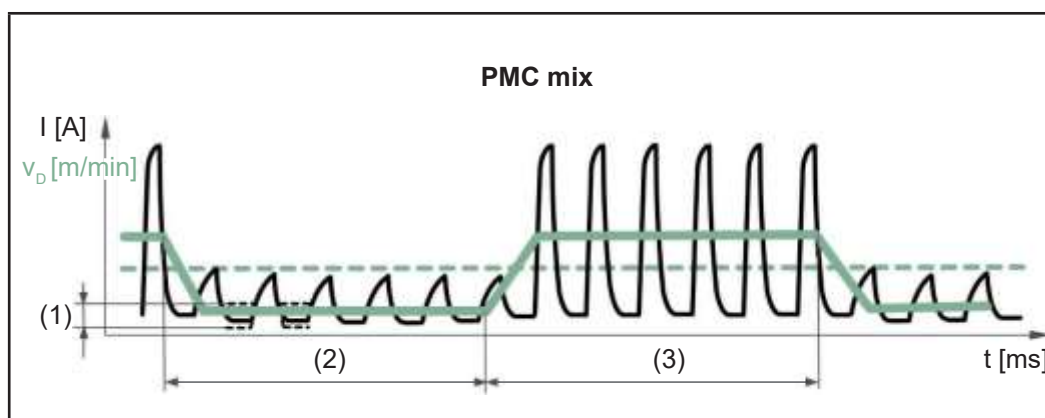
Unit	-
Setting range	-10.0 - +10.0
Factory setting	0.0
-	short arc
0	uncorrected arc length
+	longer arc



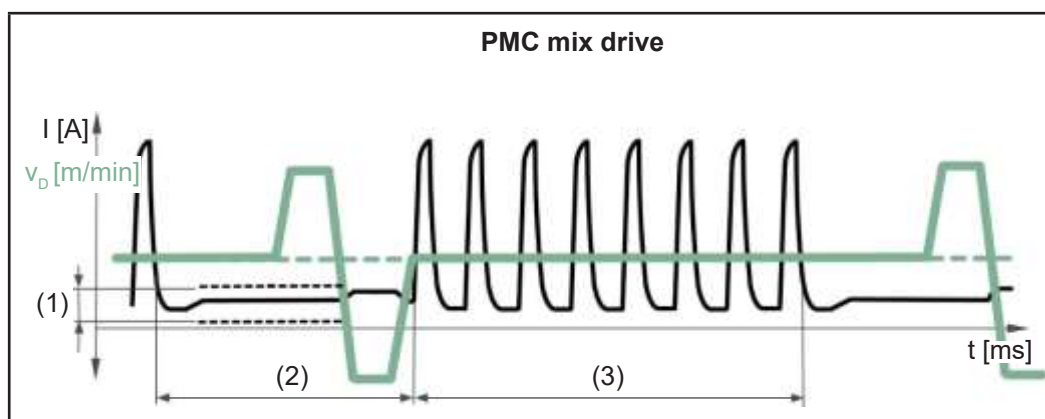
SynchroPulse example, duty cycle (high) = 25%

Process parameters for Process mix

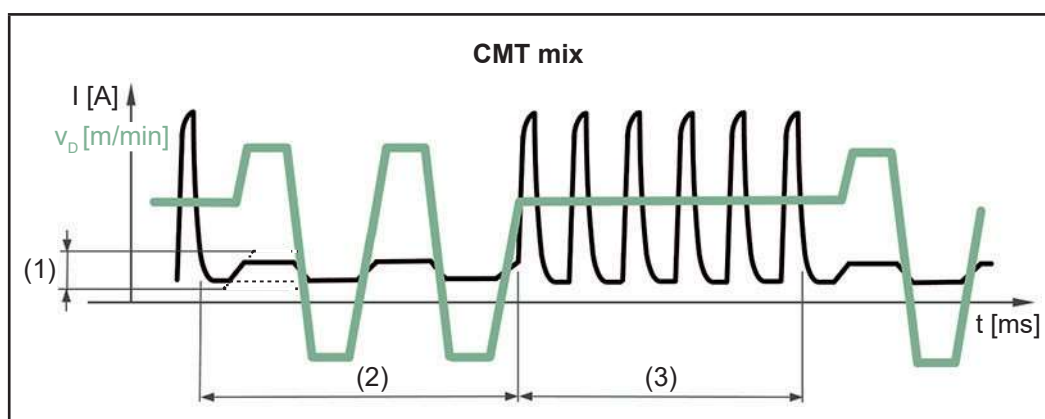
The following process parameters for mixed processes can be set under "Process mix":



Mixed process between PMC and LSC welding process. A cold LSC process phase follows a hot PMC process phase as part of a cycle.



Mixed process between PMC and wire movement reversal using a PushPull drive unit. A cold low current charging phase follows a hot PMC process phase with calibration movement.



Mixed process between CMT and PMC welding process. Cold CMT process phases follow hot PMC process phases.

- (1) Lower power correction
- (2) Lower power time correction
- (3) Upper power time correction

Wire feed speedv_D

Wire speed - taken from the welding parameters

Unit	m/min (ipm)
Setting range	1.0 - 25.0 (40 - 985)

The wire speed value can also be specified or changed in the Process mix parameters.

Arc length correction

is applied from the welding parameters

Setting range	-10.0 - +10.0
---------------	---------------

The arc length correction value can also be specified or changed in the Process mix parameters.

For CMT mix:

Positive correction:	Increase in the pulsed voltage for the PMC phase longer reverse movement in the CMT phase (increases arc length)
Negative correction:	Reduction in the pulsed voltage for the PMC phase shorter reverse movement in the CMT phase (reduces arc length)

Pulse/Arc-force dynamic correction

is taken from the welding parameters

Setting range	-10.0 - +10.0
---------------	---------------

The pulse/dynamic correction value can also be specified or changed in the Process mix parameters.

For CMT mix:

Positive correction:	Increase in the pulse energy (pulse current height, pulse current width) Reduction in the pulse frequency in the PMC phase
Negative correction:	Reduction in the pulse energy (pulse current height, pulse current width) Increase in the pulse frequency in the PMC phase

Upper power time correction

(3)

to set the length of the hot process phase in a mixed process

Setting range	-10.0 - +10.0
Factory setting	0

Upper and lower power time correction is used to define the relationship between hot and cold process phases.

If the upper power time correction is increased, the process frequency reduces and the PMC process phase becomes longer.

If the upper power time correction is reduced, the process frequency increases and the PMC process phase becomes shorter.

Lower power time correction (2)

to set the length of the cold process phase in a mixed process

Setting range -10.0 - +10.0

Factory setting 0

Upper and lower power time correction is used to define the relationship between hot and cold process phases.

If the lower power time correction is increased, the process frequency reduces and the LSC process phase becomes longer.

If the lower power time correction is reduced, the process frequency increases and the LSC process phase becomes shorter.

Lower power correction (1)

to set the energy yield in the cold process phase in a mixed process

Setting range -10.0 - +10.0

Factory setting 0

If the lower power correction is increased, this results in a higher wire speed and therefore higher energy yield in the cold LSC process phase.

Process parameters for spot welding

Spot welding time

Unit s

Setting range 0.1 - 10.0

Factory setting 1.0

Process parameters for CMT Cycle Step



CMT Cycle Step

For activating/deactivating the CMT Cycle Step function

Setting range On / Off



Wire speed

Wire speed, determines the deposition rate during the welding process phase and therefore the size of the spot weld;
value is taken from the welding parameters

Unit m/min (ipm)
Setting range Dependent on the welding characteristic
Factory setting

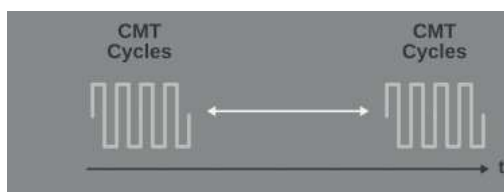
The wire speed value can also be specified or changed in the CMT Cycle Step parameters.



Cycles (spot weld size)

for setting the number of CMT cycles (weld droplets) for a spot weld;
the number of CMT cycles and the set wire speed determine the size of the spot weld.

Setting range 1 - 2000
Factory setting

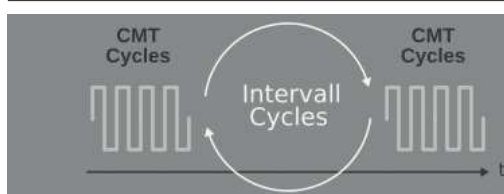


Pause time interval

For setting the time between each spot weld

Unit	s
Setting range	0.01 - 2.00
Factory setting	

The higher the value for the pause time interval, the cooler the welding process is (heavier flaking).



Cycles interval

For setting the number of repeated CMT cycles including pauses until the end of welding

Setting range	constant / 1 - 2000
Factory setting	

constant	The repetitions are carried out continuously; end of welding, for example using "Arc Off"
----------	--

R/L-check / alignment

Align the welding circuit resistance (R) and welding circuit inductivity (L) if one of the following components of the welding system is changed:

- Torch hosepacks
- Interconnecting hosepacks
- Grounding cables, welding power-leads
- Wirefeeders
- Welding torches, electrode holders
- PushPull units

Prerequisites for R/L alignment:

The welding system must be complete: closed welding circuit with welding torch and torch hosepack, wirefeeders, grounding cable, interconnecting hosepacks.

Performing R/L alignment:

- 1** Select Process parameters / General / Next page
- 2** Select "Next page"
- 3** Select "R/L-check / alignment"

The current welding circuit inductivity and welding circuit resistance values are displayed.

- 3** Select "Next" / press the adjusting dial / press the torch trigger

The second step of the R/L alignment wizard appears.

- 4** Follow the displayed instructions

IMPORTANT! Contact between the earthing clamp and workpiece must be established on a cleaned area of the workpiece.

- 5** Select "Next" / press the adjusting dial / press the torch trigger

The third step of the R/L alignment wizard appears.

- 6** Follow the displayed instructions

- 7** Select "Next" / press the adjusting dial / press the torch trigger

The fourth step of the R/L alignment wizard appears.

- 8** Follow the displayed instructions

- 9** Press the torch trigger / select "Next" / press the adjusting dial

After a successful measurement, the current values are displayed.

- 10** Select "Finish" / press the adjusting dial

Process parameters for TIG / MMA/SMAW Setup

The following process parameters can be set and displayed for the TIG and rod electrode welding process:



Process parameters for MMA welding:

Starting current time

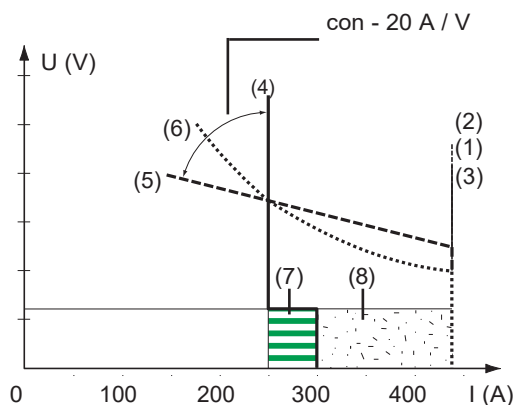
for setting the length of time the starting current is to be active

Unit	s
Setting range	0.0 - 2.0
Factory setting	0.5

Characteristic

for selecting the electrode characteristic

Unit	- / A/V / -
Setting range	I-constant / 0.1 - 20.0 / P-constant
Factory setting	I-constant



- (1) Load line for rod electrode
- (2) Load line for rod electrode where arc length is increased
- (3) Load line for rod electrode where arc length is reduced
- (4) Characteristic where "I-constant" parameter is selected (constant welding current)
- (5) Characteristic where "0.1 - 20" parameter is selected (drooping characteristic with adjustable slope)
- (6) Characteristic where "P-constant" parameter is selected (constant welding power)

(7) Example of pre-set arc-force dynamic where characteristic (4) is selected

(8) Example of pre-set arc-force dynamic where characteristic (5) or (6) is selected

I-constant
(constant welding current)

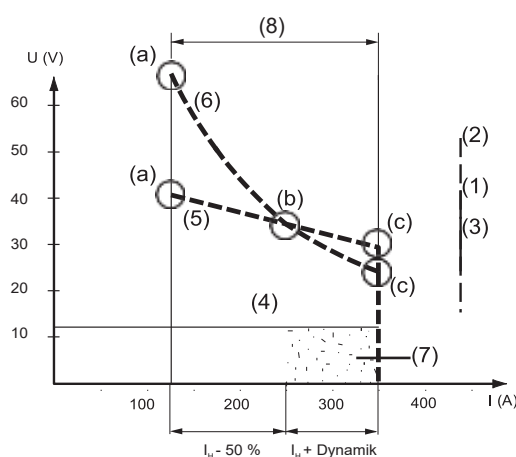
- If the "I-constant" parameter is set, the welding current will be kept constant, irrespective of the welding voltage. This results in a vertical characteristic (4).
- The "I-constant" parameter is particularly suitable for rutile electrodes and basic electrodes.

0.1 - 20.0 A/V
(drooping characteristic with adjustable slope)

- Parameter "0.1 - 20" is used to set a drooping characteristic (5). The setting range extends from 0.1 A / V (very steep) to 20 A / V (very flat).
- Setting a flat characteristic (5) is only advisable for cellulose electrodes.

P-constant
(constant welding power)

- If the "P-constant" parameter is set, the welding power is kept constant, irrespective of the welding voltage and welding current. This results in a hyperbolic characteristic (6).
- The "P-constant" parameter is particularly suitable for cellulose electrodes, as well as for arc air gouging.
 - For arc air gouging, set the arc-force dynamic to "100".



- (1) Load line for rod electrode
- (2) Load line for rod electrode where arc length is increased
- (3) Load line for rod electrode where arc length is reduced
- (4) Characteristic where "I-constant" parameter is selected (constant welding current)
- (5) Characteristic where "0.1 - 20" parameter is selected (drooping characteristic with adjustable slope)
- (6) Characteristic where "P-constant" parameter is selected (constant welding power)

- (8) Example of pre-set arc-force dynamic where characteristic (5) or (6) is selected
- (9) Possible change in the current where characteristic (5) or (6) is selected, as a function of the welding voltage (arc length)
- (a) Operating point where arc length is long
- (b) Operating point where welding current I_H is set
- (c) Operating point where arc length is short

The characteristics (4), (5) and (6) shown here apply when using a rod electrode whose characteristic corresponds - at a given arc length - to the load line (1).

Depending on what welding current (I) has been set, the point of intersection (operating point) of characteristics (4), (5) and (6) will be displaced along the load line (1). The operating point provides information on the actual welding voltage and the actual welding current.

Where the welding current (I_H) is permanently set, the operating point may migrate along the characteristics (4), (5) and (6) according to the welding voltage at a given moment. The welding voltage U is dependent upon the length of the arc.

If the arc length changes (e.g. in accordance with the load line (2)) the resulting operating point will be the point where the corresponding characteristic (4), (5) or (6) intersects with the load line (2).

Applies to characteristics (5) and (6): Depending upon the welding voltage (arc length), the welding current (I) will also become either smaller or larger, even though the value set for I_H remains the same.

Anti-stick

to activate/deactivate the anti-stick function

Unit	-
Setting range	off / on
Factory setting	on

As the arc becomes shorter, the welding voltage may drop so far that the rod electrode will tend to stick. This may also cause the rod electrode to burn out.

The anti-stick function prevents the electrode from burning out. If the rod electrode begins to stick, the power source switches the welding current off after 1.5 seconds. After the rod electrode has been lifted off the workpiece, the welding process can be continued without any problems.

Break voltage

for setting a voltage, at which the welding process can be ended by slightly lifting the rod electrode.

Unit	V
Setting range	20 - 90
Factory setting	90

The arc length depends on the welding voltage. To end the welding process, it is usually necessary to significantly lift the rod electrode away from the workpiece. With the break-voltage parameter, the welding voltage can be limited to a value that makes it possible to end the welding operation simply by lifting the rod electrode slightly.

IMPORTANT! If, during welding, you often find that the welding operation is ended unintentionally, increase the value of the break voltage.



Process parameters for TIG welding:

Break voltage

for setting a voltage, at which the welding process can be ended by slightly lifting the TIG welding torch.

Unit	V
Setting range	10.0 - 30.0
Factory setting	14

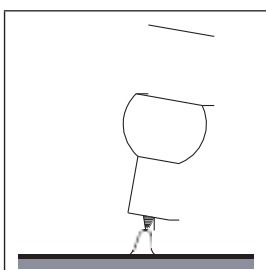
Comfort Stop Sensitivity

to activate/deactivate the TIG Comfort Stop function

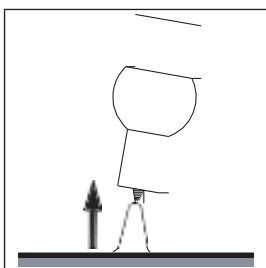
Unit	- / V
Setting range	off / 0.1 - 1.0
Factory setting	0.8

At the end of the welding operation, the welding current is switched off automatically if the length of the arc increases by more than a defined amount. This prevents the arc being unnecessarily elongated when the TIG gas-valve torch is lifted off the workpiece.

Sequence:

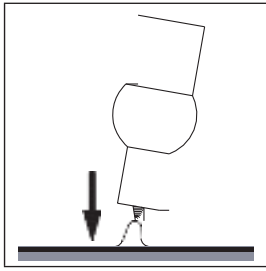


1 Welding

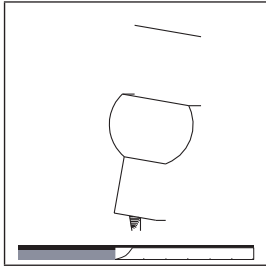


2 At the end of the welding action, briefly raise the welding torch

The arc length is increased significantly.



- 3** Lower the welding torch
- The arc length is reduced significantly
 - The TIG Comfort Stop function is triggered



- 4** Keep the welding torch at the same height
- The welding current is continuously decreased (downslope).
 - The arc goes out.

IMPORTANT! The downslope is preset and cannot be adjusted.

- 5** Raise the welding torch from the workpiece.
-

Components and monitoring process parameters

Process parameters for components

The following process parameters can be set and displayed for the system components of a welding system:

Cooling unit mode

To determine whether a cooling unit is to be switched on or off, or operated automatically

Setting range	eco / auto / on / off (depending on the cooling unit)
Factory setting	auto

Flow sensor filter time

For setting the time from when the flow sensor responds until a warning message is output

Unit	s
Setting range	5 - 25
Factory setting	5

Feeder inching speed

For setting the wire speed at which the wire electrode is threaded into the torch hosepack

Unit	m/min (ipm)
Setting range	e.g.: 2 - 25 (20 - 3935) (depending on wire speed)
Factory setting	10

TouchSensing sensitivity

For setting the TouchSensing sensitivity for various component surfaces and external influences

(TouchSensing = detection of the weld seam position using sensor voltage applied during automated welding)

Unit	-
Setting range	1 - 10
Factory setting	1

1	for bare surfaces, robust and not susceptible to interference
10	for oxidised surfaces, higher measurement-related susceptibility to interference

TouchSensing only works if the relevant option is available in the power source.

Ignition time-out

Length of wire that is fed before the safety cut-out trips

Unit	mm (in.)
Setting range	off / 5 - 100 (0.2 - 3.94)
Factory setting	off



NOTE! The ignition time-out process parameter is a safety function. The length of wire that is fed before the safety cut-out trips may differ from the preset wire length, particularly when the wire is being fed at fast wire speeds.

How it works:

Once the torch trigger is pressed, gas pre-flow begins immediately. Wirefeeding then begins, followed by ignition. If no current starts flowing before the specified length of wire has been fed, the power source cuts out automatically.

To try again, press the torch trigger again.

System calibration

If two motors are used in a welding system, they need to be calibrated to maintain process stability.

System calibration must be carried out on welding systems with PushPull units or unreeling wirefeeders following successful installation or replacement of a wirefeeder.

A notification will be displayed.

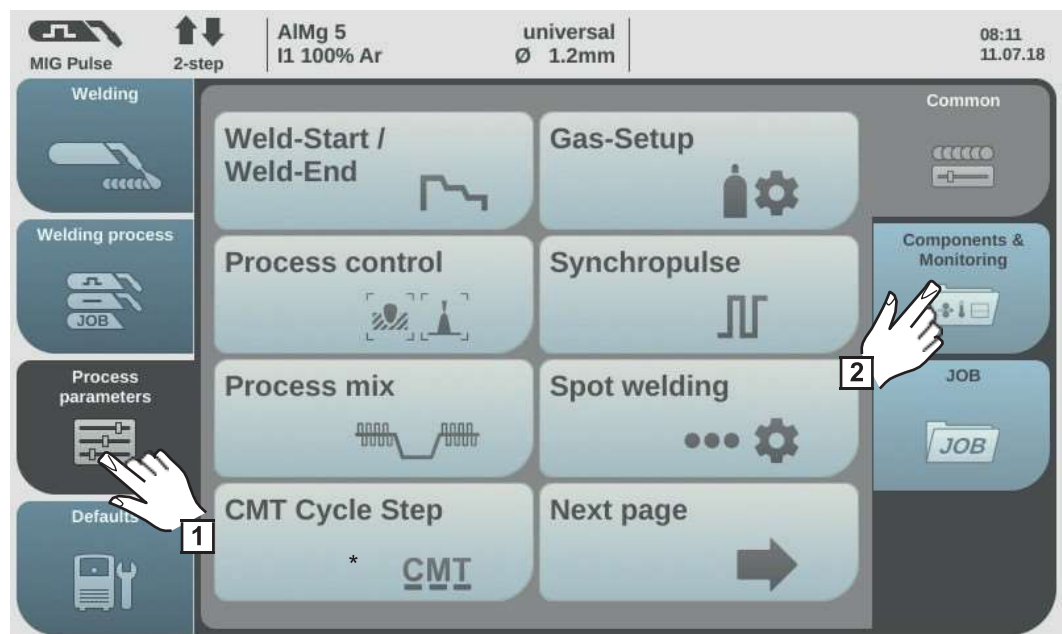
1 Select "OK" and start system calibration

The system calibration wizard starts.

2 Follow the instructions shown

System calibration can also be started manually here.

Perform system calibration:

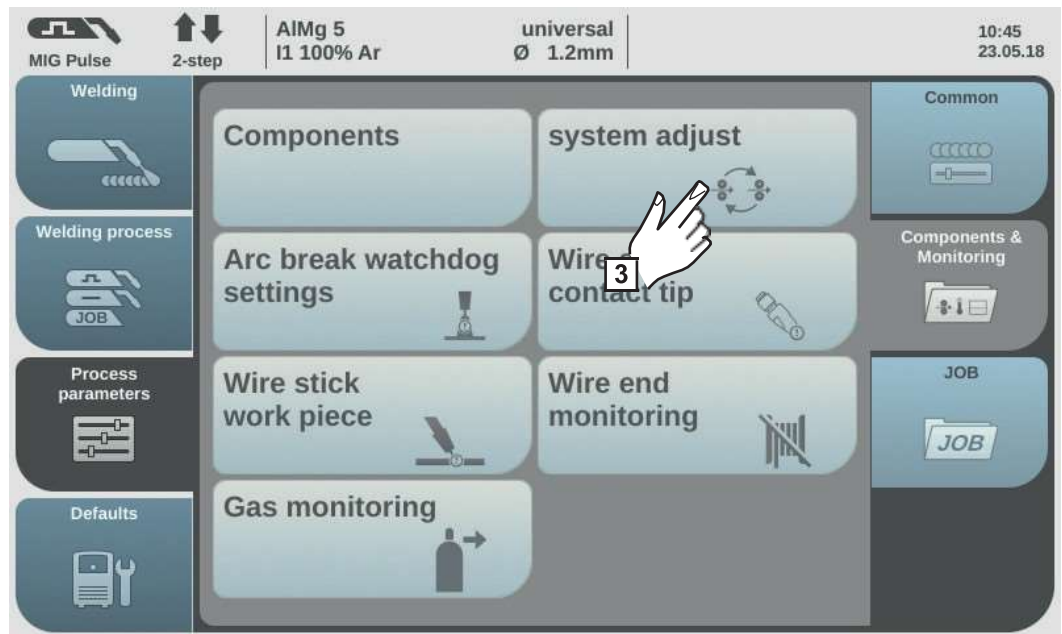


* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

1 Select "Process parameters"

2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:



3 Select "system adjust"

If system calibration is required, the system calibration wizard starts. The first step in the system calibration wizard is displayed:

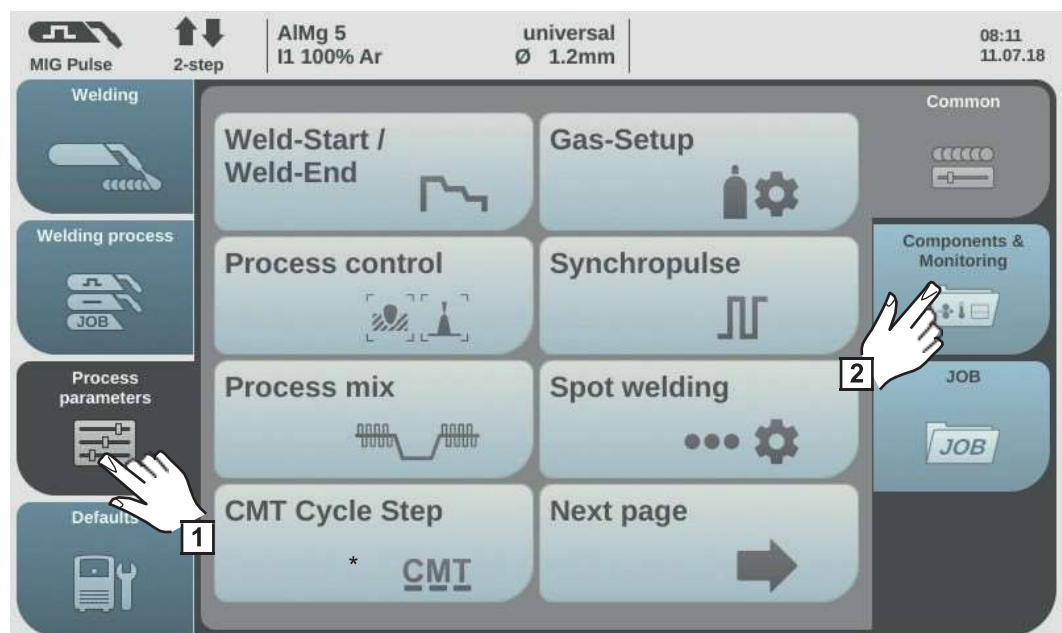
4 Follow the displayed instructions

5 To move to the next step in the wizard, select "Next" / press the adjusting dial

When system calibration has been completed successfully, a confirmation to this effect is displayed.

6 To close the system calibration wizard, select "Finish" / press the adjusting dial

Setting process parameters for arc break monitoring

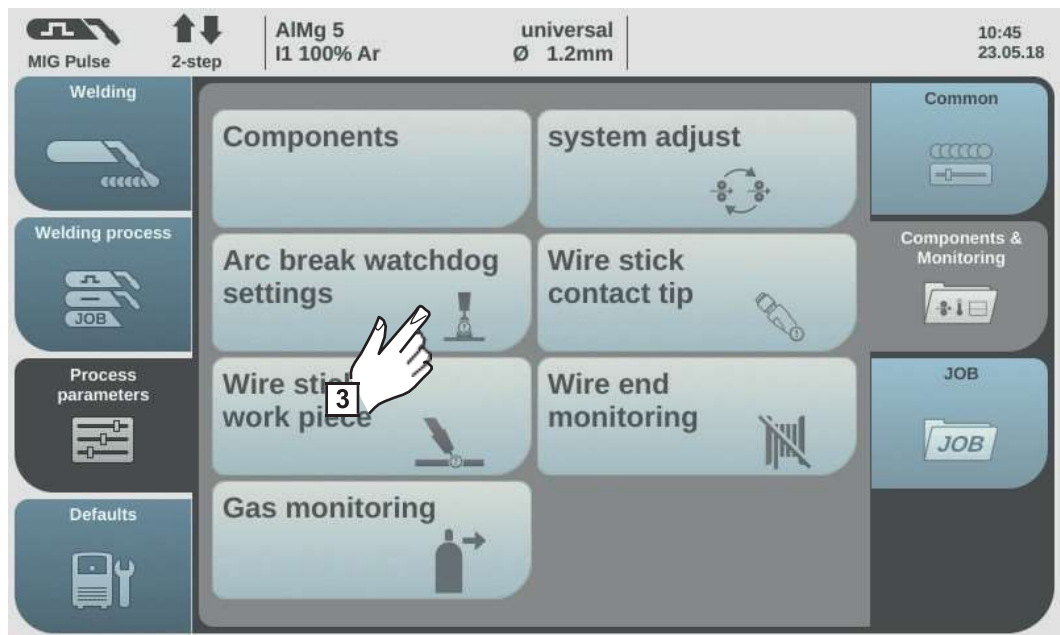


* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

1 Select "Process parameters"

2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:



- 3 Select "Arc break watchdog settings"

An overview of the "Arc break watchdog settings" is displayed.

- 4 Turn the adjusting dial and select the desired parameter
- 5 Press the adjusting dial (blue background)
- 6 Turn the adjusting dial to change the values of the parameter (blue background)

Arc break reaction = ignore(deactivated):

The power source remains active and no error message appears on the display.

Arc break reaction = error (activated):

If the arc break fractures off and no current flow is detected within a set arc break period, the system shuts down automatically and an error message appears on the display.

Factory setting = ignore

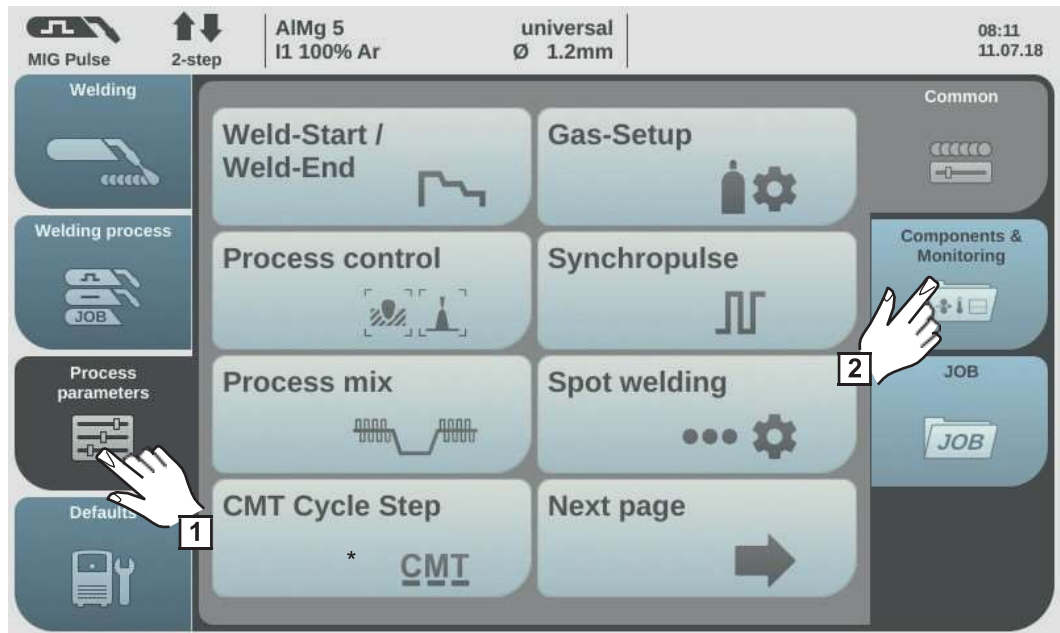
Arc break time = 0–2.00 s

An error is output if the set period is exceeded.

Factory setting = 0.2 s

- 7 Select "OK" to activate arc break monitoring (arc break watchdog)

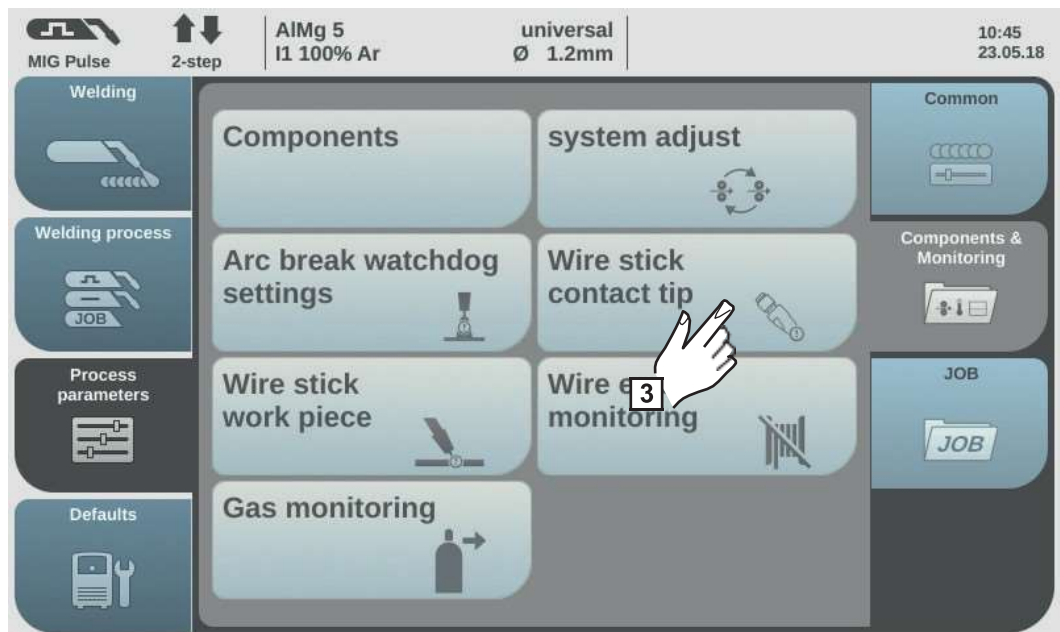
Process parameters for wire stick contact tip



* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

- 1 Select "Process parameters"
- 2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:



- 3 Select "Wire stick contact tip"

The overview "Wire stick contact tip - setup menu" is displayed.

- 4 Turn the adjusting dial and select the desired parameter
- 5 Press the adjusting dial (blue background)
- 6 Turn the adjusting dial and change the value of the parameter (blue background)

Wire stick on contact tip = ignore:

The wire stick check on the contact tip is deactivated.

Wire stick on contact tip = error (activated):

The welding process will be interrupted in the event of wire stick on the contact tip.

IMPORTANT! Monitoring is only possible during dip transfer arc processes.

Factory setting = ignore

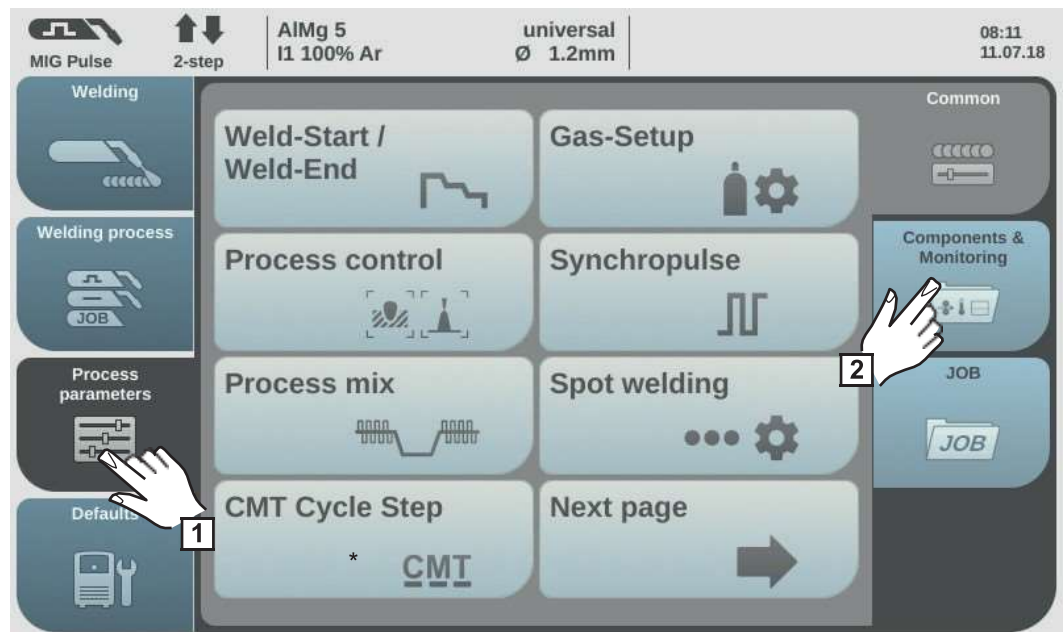
Filter time = 0.5 - 5.0 s

Maximum duration without arc short circuit until welding is interrupted.

Factory setting = 0.5 s

7 Select "OK" to confirm the settings

Process parameters for wire stick work piece

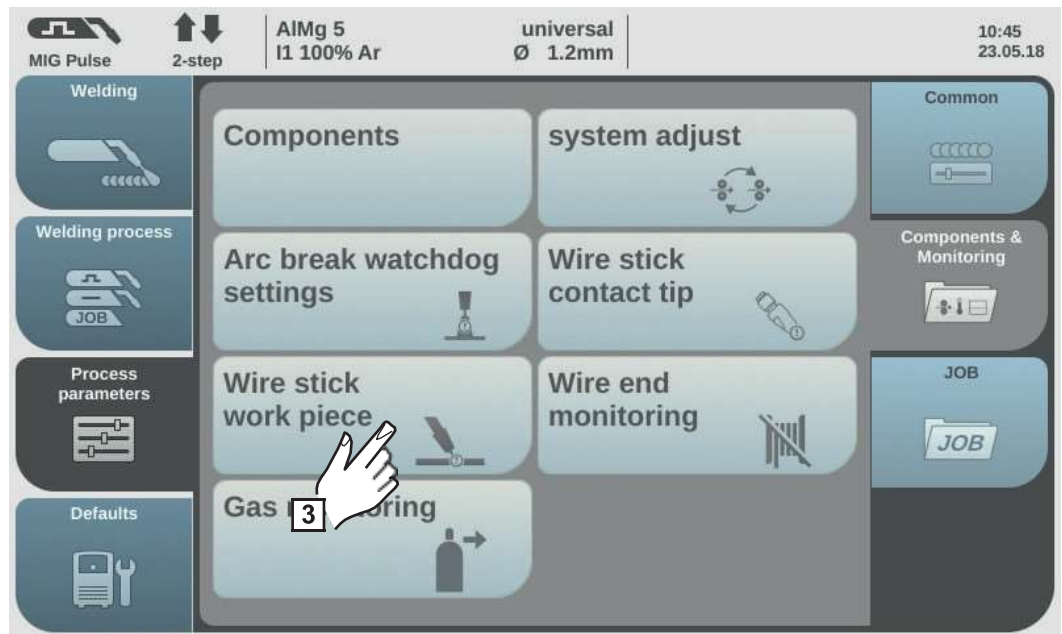


* Only displayed if the OPT/i CMT Cycle Step option is present on the power source.

1 Select "Process parameters"

2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:



- 3 Select "Wire stick work piece"

The overview "Wire stick workpiece - setup menu" is displayed.

- 4 Turn the adjusting dial and select the desired parameter
- 5 Press the adjusting dial (blue background)
- 6 Turn the adjusting dial and change the value of the parameter (blue background)

Wire stick on workpiece = ignore:

Wire stick monitoring on the workpiece is deactivated.

Wire stick on workpiece = error (activated):

The welding process will be interrupted if the wire sticks on the workpiece.

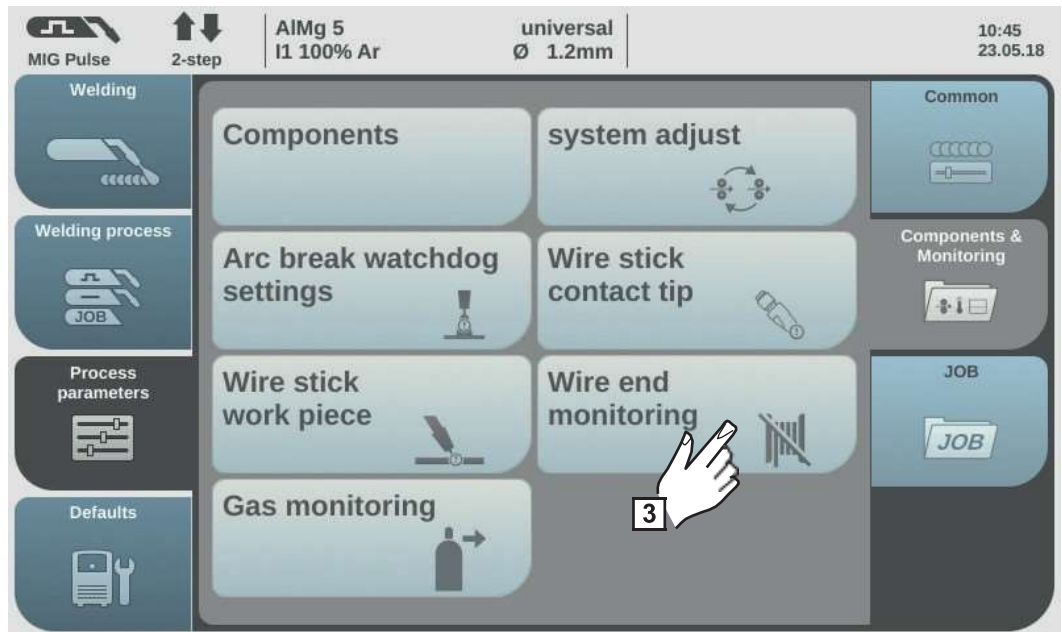
Factory settings = ignore

- 7 Select "OK" to confirm the settings

Process parameter for wire end monitoring

- 1 Select "Process parameters"
- 2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:



- 3 Select "Wire end monitoring"

The overview "Wire end monitoring setup menu" is displayed.

- 4 Turn the adjusting dial and select the desired parameter, depending on the type of wire end monitoring:



- (1) Wire end reaction for OPT/i WF R WE ring sensor 4,100,878,CK
- (2) Wire end reaction for OPT/i WF R WE drum 4,100,879,CK
- (3) Wire end reaction for OPT/i WF R WE wire end 4,100,869,CK

- 5 Press the adjusting dial (blue background)
- 6 Turn the adjusting dial and change the value of the parameter (blue background)

Reaction = Error:

Wire end fault, welding will be interrupted immediately. The fault will be shown on the display.

Reaction = After seam end:

The wire end fault will show on the display after the current welding process has ended.

Reaction= ignore (deactivated):

No reaction at the wire end

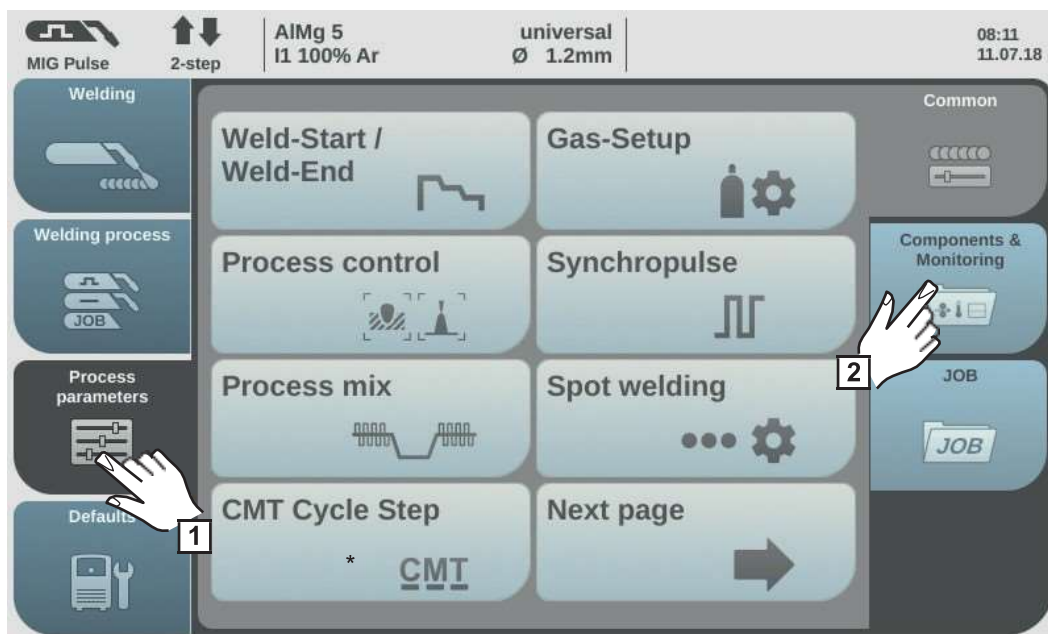
Factory setting = Error

- 7 Select "OK" to confirm the settings

Process parameters for gas monitoring

The gas monitoring parameters are only available when the optional OPT/i gas flow rate sensor is present.

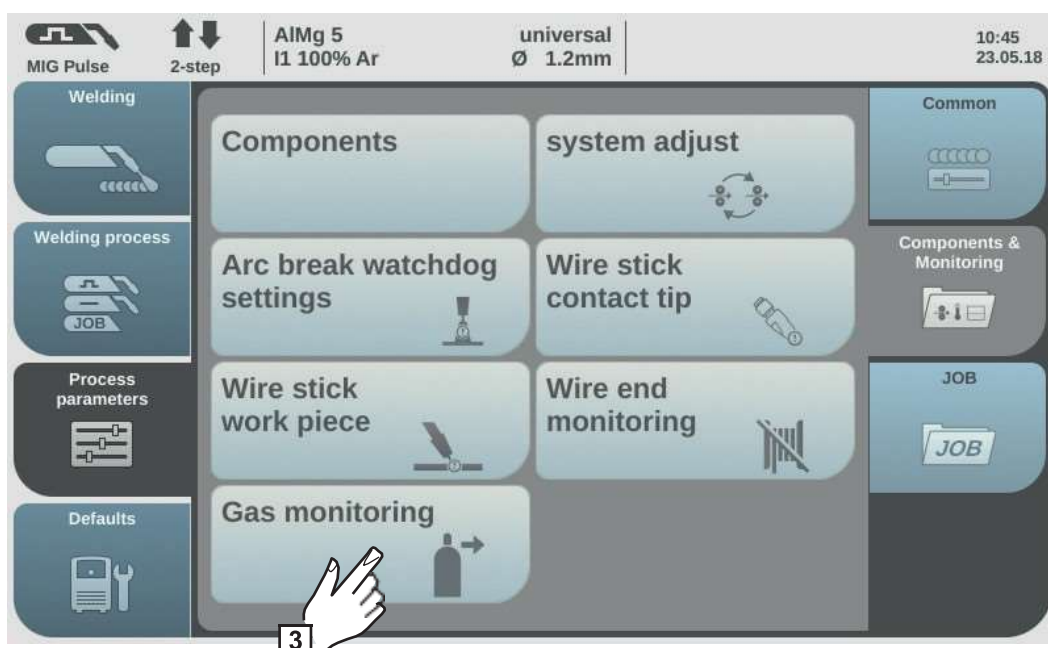
A lower limit for the gas flow rate can be set using gas monitoring. If the gas flow rate drops below this limit for a defined period of time, an error message is immediately issued and the welding operation is halted.



- 1 Select "Process parameters"
- 2 Select "Components & Monitoring"

An overview of the process parameters for components and monitoring is displayed:

- 3 Select "Gas monitoring"



The "Gas monitoring" overview is displayed.

4 Turn the adjusting dial and select the desired parameter:

Lower gas flow rate limit
Setting range: 0.5 - 30.0 l/min
Factory setting: 7.0 l/min

Maximum duration of gas flow deviation
Setting range: off / 0.1 - 10.0 s
Factory setting: 2.0 s

Gas factor sensor
Setting range: auto / 0.90 - 20.00
Factory setting: auto

5 Press the adjusting dial (blue background)

6 Turn the adjusting dial to change the parameter value (blue background)

7 Select "OK" to confirm the settings

Process parameters, Job

Optimising job process parameters

The following process parameters can be set for the job:

Job parameter

Torch mode

For setting the welding mode

Unit	-
Setting range	2-step / 4-step / S2-step / S4-step / spot welding

Wire speed

For adjusting the wire speed

Unit	m/min (ipm)
Setting range	e.g.: 2 - 25 (depending on wire speed and welding characteristic)

Arc length correction

For correcting the arc length

Unit	-
Setting range	-10.0 - +10.0
-	short arc
0	uncorrected arc length
+	longer arc

Pulse/Arc-force dynamic correction

For correcting the pulse energy during pulsed arc welding

Setting range	-10.0 - +10.0
-	lower droplet detachment force
0	neutral droplet detachment force
+	higher droplet detachment force

For influencing the short-circuiting dynamic at the moment of droplet transfer during standard arc welding

-	harder, more stable arc
0	neutral arc
+	soft, low-spatter arc

The other adjustable process parameters correspond to the process parameters already described:

Weld-Start / Weld-End

See page 106

- Starting current
- Start arc length correction
- Starting current time
- Slope 1
- Slope 2
- Final current
- End arc length correction
- SFI
- SFI HotStart
- Wire withdrawal

Spot welding

See page 109

- Spot welding time

Process control

See page 117

- Penetration stabilizer
- Arc length stabilizer

Synchropulse

See page 113

- Synchropulse
- Delta wire feed
- Frequency
- Duty cycle (high)
- Arc length correction high
- Arc length correction low

Process mix

See page 115

- Upper power time correction
- Lower power time correction
- Lower power correction

CMT Cycle Step

See page 118

Only if the OPT/i CMT Cycle Step option is present on the power source.

- CMT Cycle Step
- Cycles (size of spot weld)
- Pause time interval
- Cycles interval

Gas-Setup

See page 108

- Gas pre-flow
- Gas post-flow
- Gas set value
- Gas factor

Jobslope

See page 138

- Jobslope

Documentation

See page 158

- Sampling rate
off / 0.1–100.0 s
Factory setting off

Limit monitoring

(only in conjunction with the OPT/i Limit Monitoring option)

- Voltage set value
- Lower voltage limit
- Upper voltage limit
- Max. duration of voltage deviation
- Current set value
- Lower current limit
- Upper current limit
- Max. duration for current deviation
- Wire speed set value
- Lower wire speed limit
- Upper wire speed limit
- Max. duration of wire stick deviation
- Response to violation of limit values

Components

See page 125

- Feeder inching speed

Further information on optimising jobs can be found in the Welding mode section, under Job Mode on page 87.

Process parameters for correction limits

The following process parameters can be set for the job correction limits:

Power**Upper power correction limit**

For setting the upper power correction limit for a job

Unit	%
Setting range	0 - 20
Factory setting	0

Lower power correction limit

For setting the lower power correction limit for a job

Unit	%
Setting range	-20 - 0
Factory setting	0

Arc length correction**Upper arc length correction limit**

For setting the upper arc length correction limit for a job

Unit	-
Setting range	0.0 - 10.0
Factory setting	0

Lower arc length correction limit

For setting the lower arc length correction limit for a job

Unit	-
Setting range	-10.0 - 0.0
Factory setting	0

Further information on optimising jobs can be found in the Job correction limits section, under Job Mode on page 88.

Process parameters for "Save as Job" pre-settings

After confirming the displayed information, the following process parameters can be set for the "Save as Job" pre-settings:

Jobslope - Pre-settings

Jobslope

Defines the time between the job that is currently selected and the next job

Unit	s
Setting range	0.0 - 10.0
Factory setting	0

Limit monitoring - Pre-settings

(only in conjunction with the OPT/i Limit Monitoring option)

Lower voltage limit

For setting the lower voltage limit as a function of the set value

Unit	V
Setting range	-10.0 - 0.0
Factory setting	0

Upper voltage limit

For setting the upper voltage limit as a function of the set value

Unit	V
Setting range	0.0 - 10.0
Factory setting	0

Maximum duration of voltage deviation

For setting the maximum duration of a voltage deviation

Unit	s
Setting range	off / 0.1 - 10.0
Factory setting	off

Lower current limit

For setting the lower current limit as a function of the set value

Unit	A
Setting range	-100.0 - 0.0
Factory setting	0

Upper current limit

For setting the upper current limit as a function of the set value

Unit	A
Setting range	0.0 - 100.0
Factory setting	0

Maximum duration of current deviation

For setting the maximum duration of a current deviation

Unit	s
Setting range	off / 0.1 - 10.0
Factory setting	off

Lower wire speed limit

For setting the lower wire speed limit

Unit	m/min (ipm)
Setting range	-10.0 - 0.0
Factory setting	0

Upper wire speed limit

For setting the upper wire speed limit

Unit	m/min (ipm)
Setting range	0.0 - 10.0
Factory setting	0

Maximum duration of wire speed deviation

For setting the maximum duration of a wire speed deviation

Unit	s
Setting range	off / 0.1 - 10.0
Factory setting	off

Response to violation of limit values

For setting the reaction if the limit values are exceeded or undercut

Unit	-
Setting range	Ignore/Warning/Error
Factory setting	0

Ignore	Limit values will not be monitored or logged in the logbook
Warning	If the limit values are exceeded or undercut, a warning will show on the display and the welding process will not be interrupted.
Error	If the limit values are exceeded or undercut, the welding process will stop immediately and an error message will show on the display.

Defaults

Defaults

General remarks



NOTE! As a result of firmware updates, you may find that there are functions available on your unit that are not described in these operating instructions or vice versa. Certain illustrations may also differ slightly from the actual control elements on your device. However, these controls function in exactly the same way.



WARNING! Operating the equipment incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:

- these operating instructions
- all the operating instructions for the system components, especially the safety rules

Overview

"Defaults" contains the following options:

Under the "View" button

- | | |
|-------------|-------------------|
| Language | Units / Standards |
| Time & Date | EasyJobs |
| System data | Synergic Lines |

Under the "System" button

- | | |
|-------------------|-----------------------------|
| Information | Restore factory settings |
| Website password | Mode Setup |
| Network settings | Power source configurations |
| Wire feeder setup | Interface setup |

Under the "Documentation" button

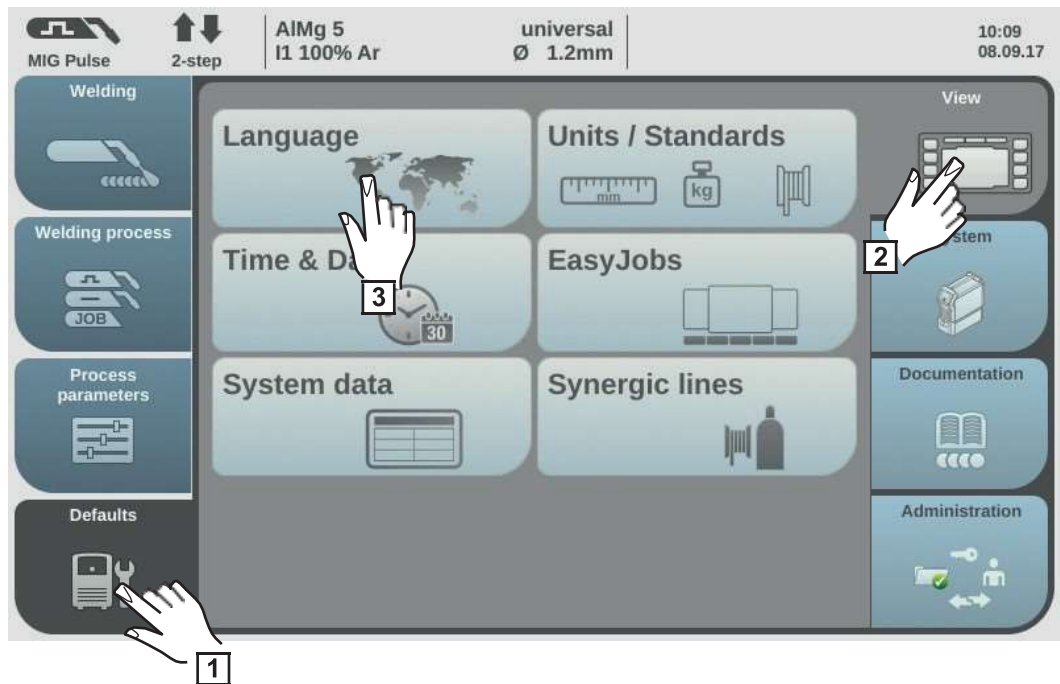
- | | |
|-----------------------------------|---------|
| Basic settings | Logbook |
| Limit value monitoring (on / off) | |

Under the "Administration" button

- User management

Defaults - view

Setting the language



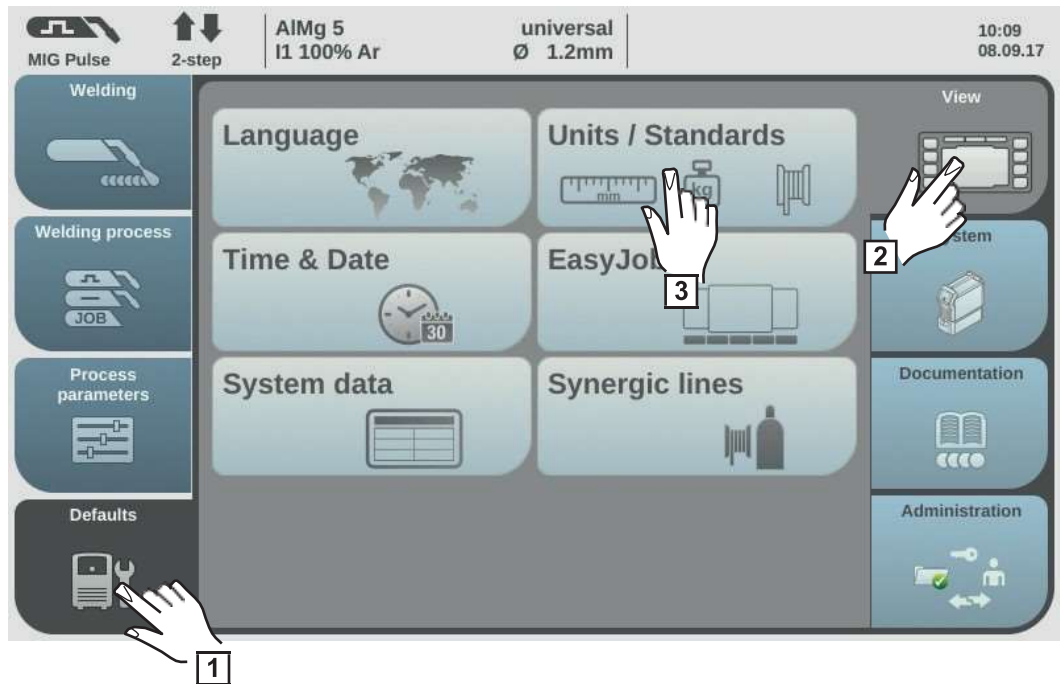
- 1** Select "Defaults"
- 2** Select "View"
- 3** Select "Language"

An overview of the available languages is displayed.

- 4** Turn the adjusting dial and select the desired language
- 5** Select "OK" / press the adjusting dial

The welding parameters are displayed in the selected language.

Setting Units/ Standards



- 1 Select "Defaults"
- 2 Select "View"
- 3 Select "Units / Standards"

An overview of units and standards is displayed.

- 4 Select the desired unit
- 5 Select the desired standard:

EN

Name of filler metal according to European standards
(e.g. AlMg 5, CuSi3, Steel, etc.)

AWS

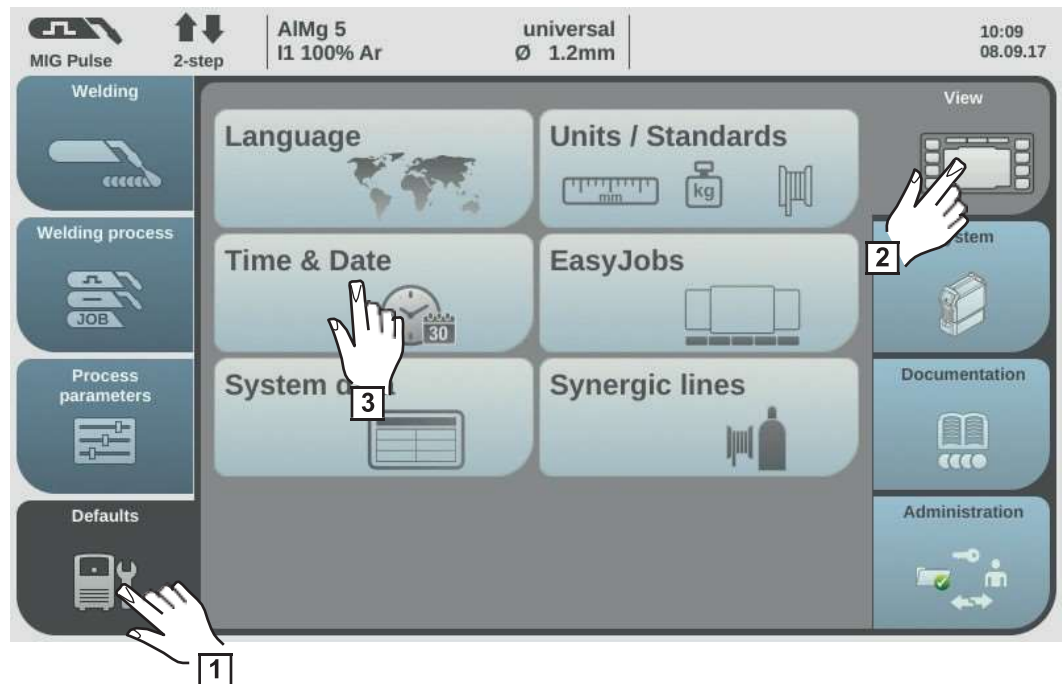
Name of filler metal according to the American Welding Standard
(e.g. ER 5356, ER CuSi-A, ER 70 S-6, etc.)

- 6 Select "OK"

An overview of units and standards is displayed.

Setting the time and date

The time and date can either be set using the NTP (Network Time Protocol) or manually.



- 1 Select "Defaults"
- 2 Select "View"
- 3 Select "Time & Date"

An overview of the time and date is displayed.

Setting the time and date using the NTP

A DNS server must be available, or the network parameters must be configured correctly if setting the time and date manually (see "Setting network parameters manually", page 154).

- 4 Select "Automatic time & date"
- 5 Enter the address of the local time server
Ask your IT administrator for the address of the local time server or use the internet (e.g. pool.ntb.org).
- 6 Enter the time zone
The time zone must correspond to the location of the power source.
- 7 Select "Time server test" to start the time synchronisation

The power source is synchronised with the time on the NTP server. If the NTP has been set up, the time will be synchronised each time the power source is started, as long as a connection to the time server can be established.

- 8 Select "Apply"

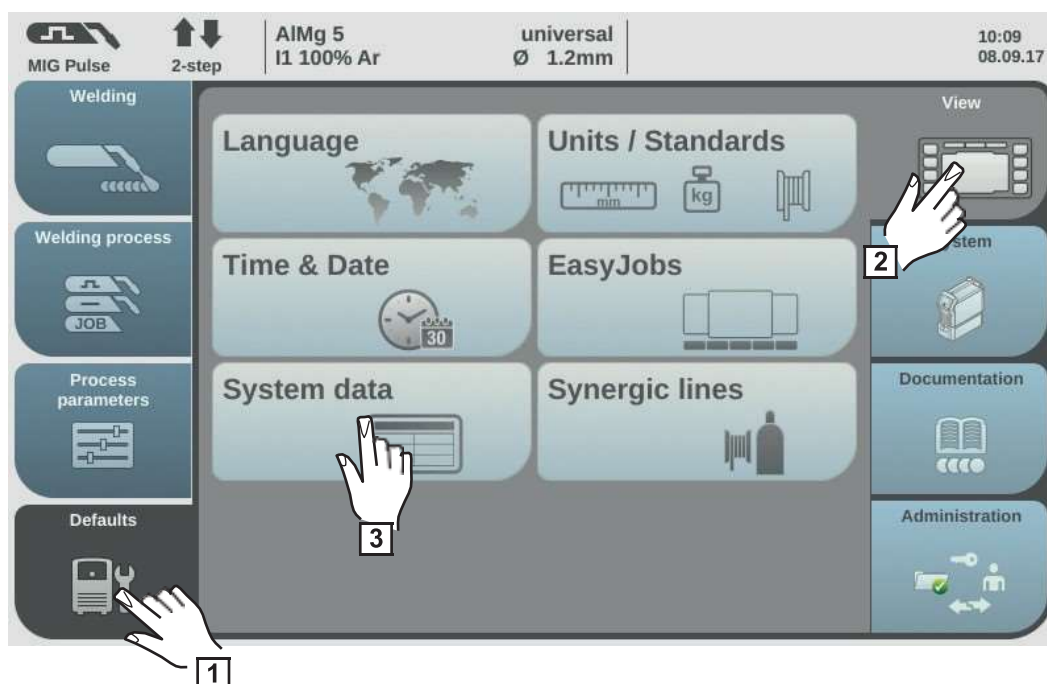
Setting the time and date manually

In order to be able to set the time and date manually, "Automatic Time & Date" must not be selected.

- 4 Turn the adjusting dial and select the desired parameter:
Year / Month / Day / Hour / Minute
(white background)
- 5 Press the adjusting dial to change the parameter (blue background)
- 6 Turn the adjusting dial and set the desired value (blue background)
- 7 Press the adjusting dial and apply the set value (white background)
- 8 Select "OK" / press the adjusting dial

The default view settings are displayed.

Retrieving system data



- 1 Select "Defaults"
- 2 Select "View"
- 3 Select "System data"

The current system data is displayed.



Arc power from real-time values in kW

IP delivers the correct mean value of the arc power due to the high sample measuring rate during non-continuous welding processes.

If the welding speed is known, the electrical energy input can be calculated:

$$E = IP / v_s$$

E Electrical energy input in kJ/cm

IP Arc power in kW

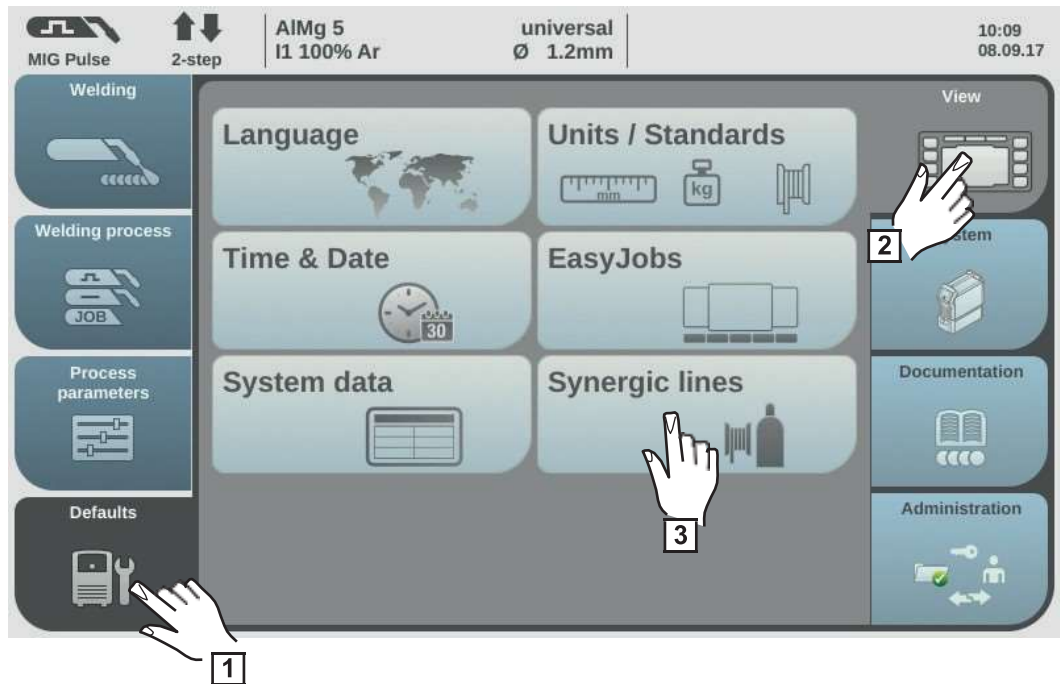
v_s Welding speed in cm/s

	Arc energy in kJ IE delivers the correct total arc energy due to the high sample measuring rate during non-continuous welding processes. The arc energy is total arc power during the entire welding time. If the weld seam length is known, the electrical energy input can be calculated: $E = IE / L$ E Electrical energy input in kJ/cm IE Arc energy in kJ L Length of the weld seam in cm The arc energy is preferably used during manual welding to calculate the energy input.
	Current motor current in A, wirefeeder 1 (wirefeeder next to the arc)
	Current motor current in A, wirefeeder 2 (e.g. the rear wirefeeder in a push-pull system)
	Current motor current in A, wirefeeder 3 (e.g. an unreeling wirefeeder in a push-pull system with unreeling wirefeeder)
	Current flow rate in l/min on the cooling unit (with built-in OPT/i CU flow temperature sensor option) Error output if flow rate < 0.7 l/min
	Current coolant temperature in °C on the cooling unit (with built-in OPT/i CU flow temperature sensor option) Error output if coolant temperature > 70 °C (measured at coolant return)
	Current shielding gas flow rate (with OPT/i gas controller option present)
	Arc time in h
	Total power source operating hours in h

4 Select "OK" to exit the system data

The default view settings are displayed.

Displaying characteristics



- 1 Select "Defaults"
- 2 Select "View"
- 3 Select "Synergic lines"

The options for displaying the characteristics are displayed.

- 4 Select desired display option

Display current characteristics:

Only the current characteristics are displayed in the material settings.

Display replaced characteristics:

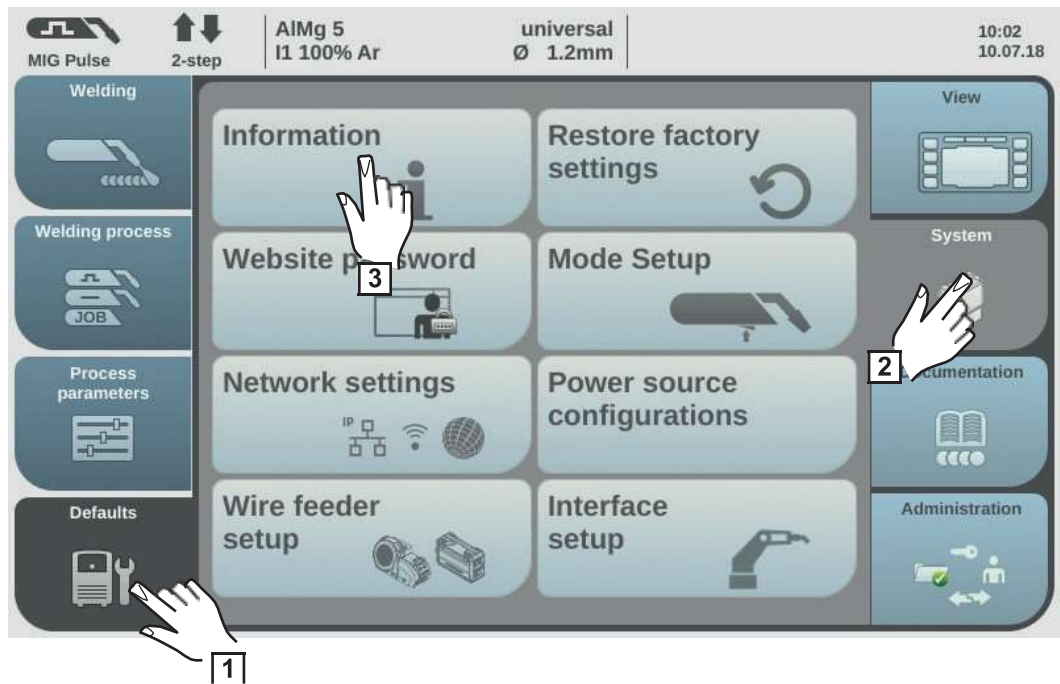
Older characteristics that have been replaced are also displayed in the material settings, as well as the current characteristics. These can also be selected while setting the material settings.

- 5 Select "OK"

The default view settings are displayed.

Defaults - System

Retrieving device information

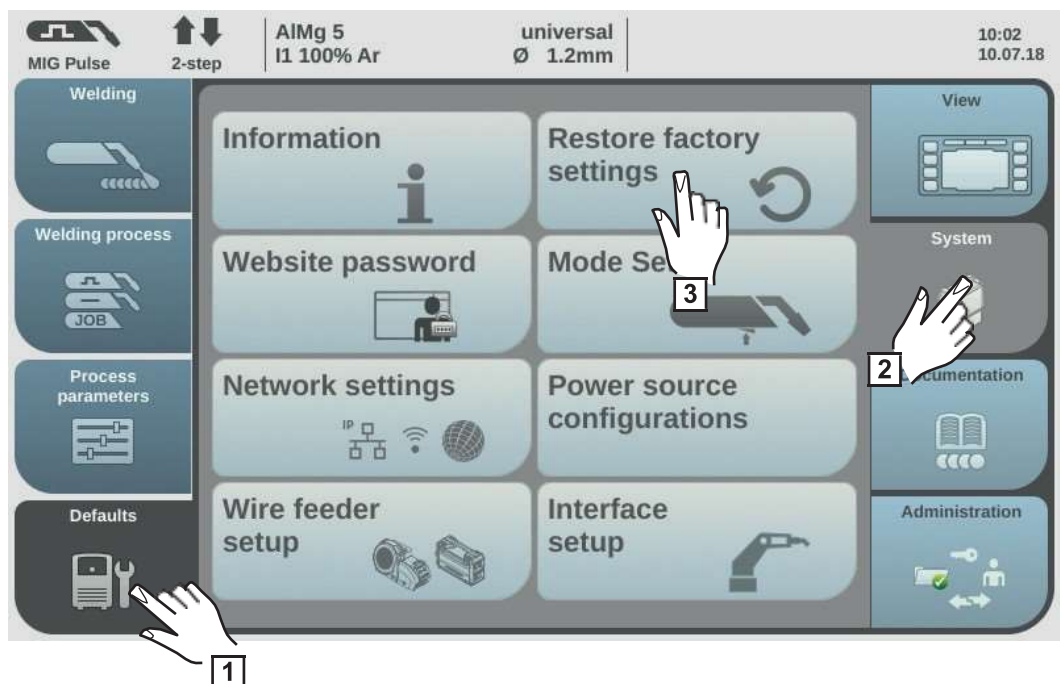


- 1 Select "Defaults"
- 2 Select "System"
- 3 Select "Information"

The device information is displayed.

- 4 Select "OK"

Restoring factory settings



- 1 Select "Defaults"

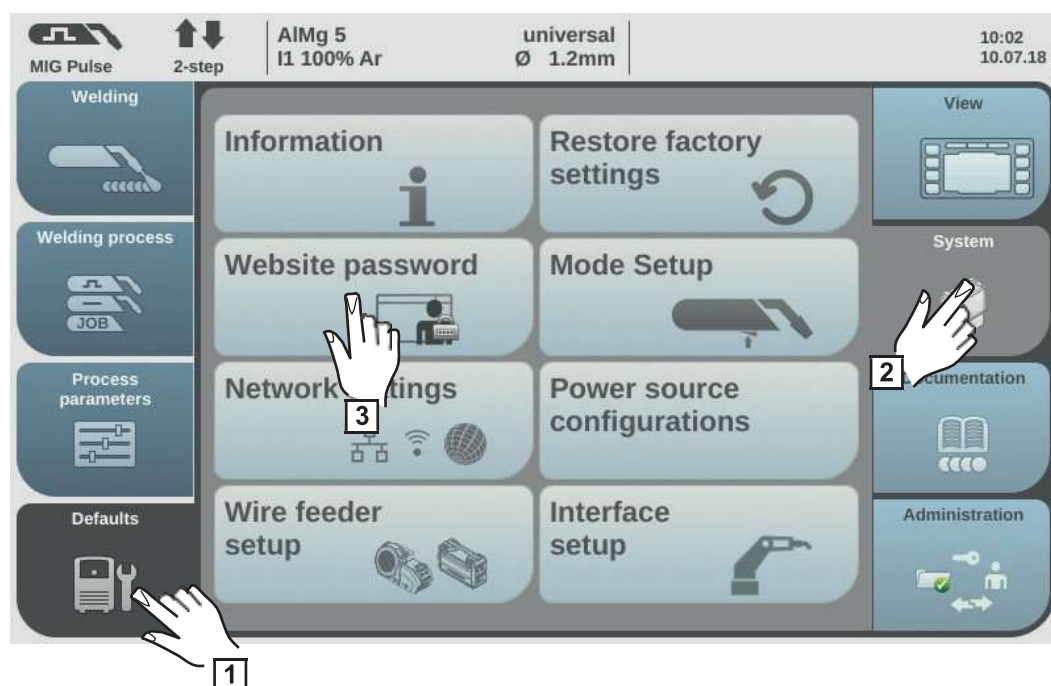
- 2 Select "System"
- 3 Select "Restore factory settings"

A confirmation prompt for the factory settings is displayed.

- 4 Select "Yes" to reset the values to their factory settings

The process parameters and machine preset values are reset to the factory settings, an overview of the machine presets is displayed.

Restoring the website password



- 1 Select "Defaults"
- 2 Select "System"
- 3 Select "Website password"

A confirmation prompt asking whether you really want to reset the website password is displayed.

- 4 Select "Yes" to reset the website password

The website password is reset to the factory setting:

User name = admin

Password = admin

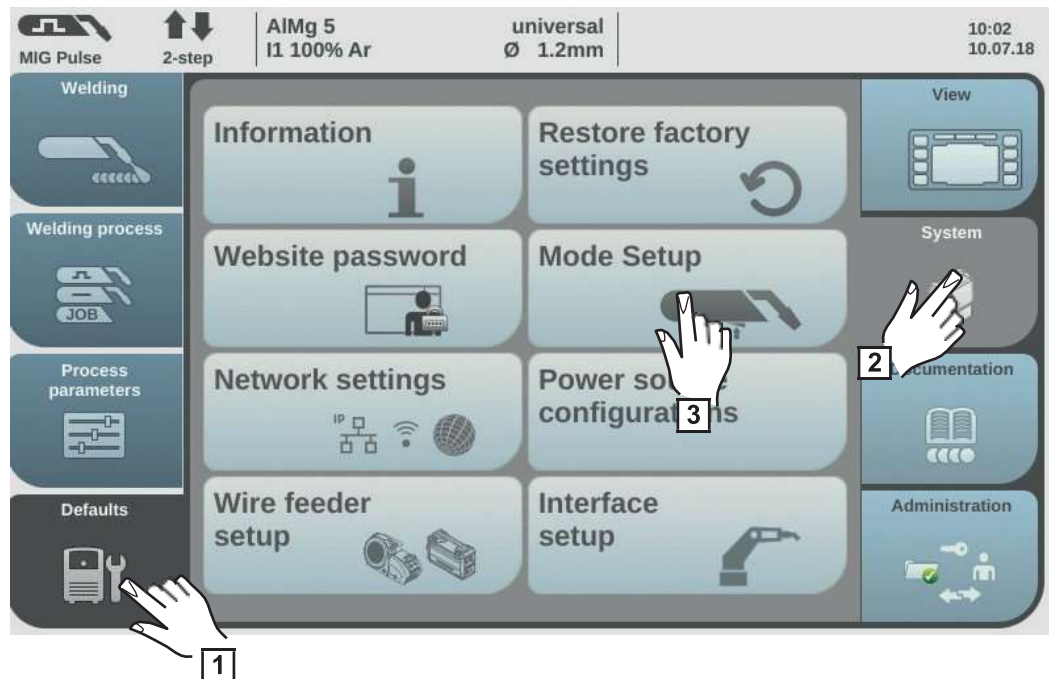
The system overview of the default settings is displayed.

Mode Setup: Activating the special 4-step mode "Guntrigger", special display for JobMaster and torch trigger job selection

In the default settings, the following special functions can be set under "Mode Setup":

- Special 4-step mode "Guntrigger" for a JobMaster welding torch *
- JobMaster special display for a JobMaster welding torch *
- Torch trigger job selection for a welding torch

* Only if the OPT/i GUN Trigger option is available on the power source.



- 1** Select "Defaults"
- 2** Select "System"
- 3** Select "Mode Setup"

The "Mode Setup" overview appears.

- 4** Turn the adjusting dial and select the desired special function (white background)
- 5** Press the adjusting dial (blue background)
- 6** Turn the adjusting dial to activate/deactivate the special function
- 7** Select "OK"

The default settings are displayed.

Special 4-step = Guntrigger

With a JobMaster welding torch and with special 4-step mode selected, this function allows you to change jobs via the torch trigger during welding. Job changing takes place within defined job groups.

A job group is defined by the next non-programmed job.

Example:

Job group 1: Job no. 3 / 4 / 5

Job no. 6 is not assigned ==> End of job group 1

Job group 2: Job no. 7 / 8 / 9

- When welding starts, the job with the lowest number within the job group is automatically selected.
- To change to the job with the next highest number within a job group, press the torch trigger briefly (< 0.5 seconds).
- To stop welding, press the torch trigger for more than 0.5 seconds.
- To change to the next job group, press the parameter setting button on the JobMaster welding torch for more than 5 seconds.



Special display for JobMaster = on

The following can now be set and carried out on the JobMaster welding torch:

- Operating mode
- Synchropulse
- Gas test

Torch trigger job selection = on

This function allows the user to change to the next job using the torch trigger. Job changing takes place within defined job groups.

A job group is defined by the next non-programmed job.

Example:

Job group 1: Job no. 3 / 4 / 5

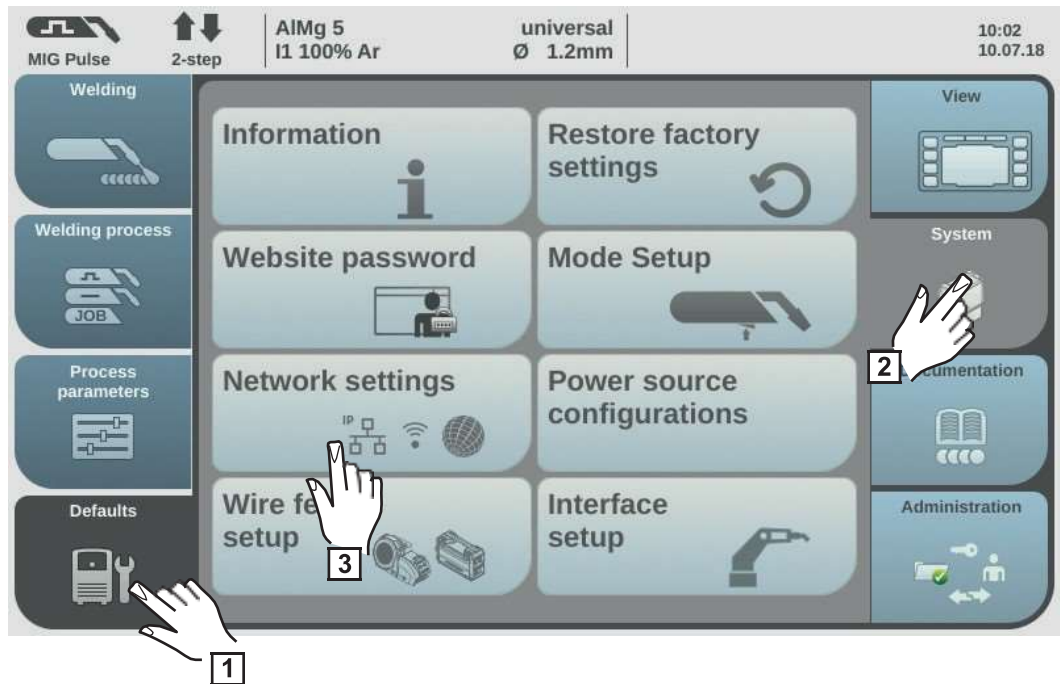
Job no. 6 is not assigned ==> End of job group 1

Job group 2: Job no. 7 / 8 / 9

- When welding starts, the job with the lowest number within the job group is automatically selected.
- To change to the job with the next highest number within a job group, press the torch trigger briefly (< 0.5 seconds).
- To stop welding, press the torch trigger for more than 0.5 seconds.
- To switch to the next job group, press the torch trigger briefly twice (< 0.3 s, 2 x).

You can switch jobs when the device is in standby or during welding.

Setting network parameters manually



- 1 Select "Defaults"
- 2 Select "System"
- 3 Select "Network Setup"

The network setup overview is displayed.

If DHCP is enabled, the IP address, Network mask and Standard gateway network parameters are greyed out and cannot be adjusted.

- 4 Turn the adjusting dial and select "DHCP"
- 5 Press the adjusting dial

DHCP is disabled, the network parameters can now be set.

- 6 Turn the adjusting dial and select the desired network parameter
- 7 Press the adjusting dial

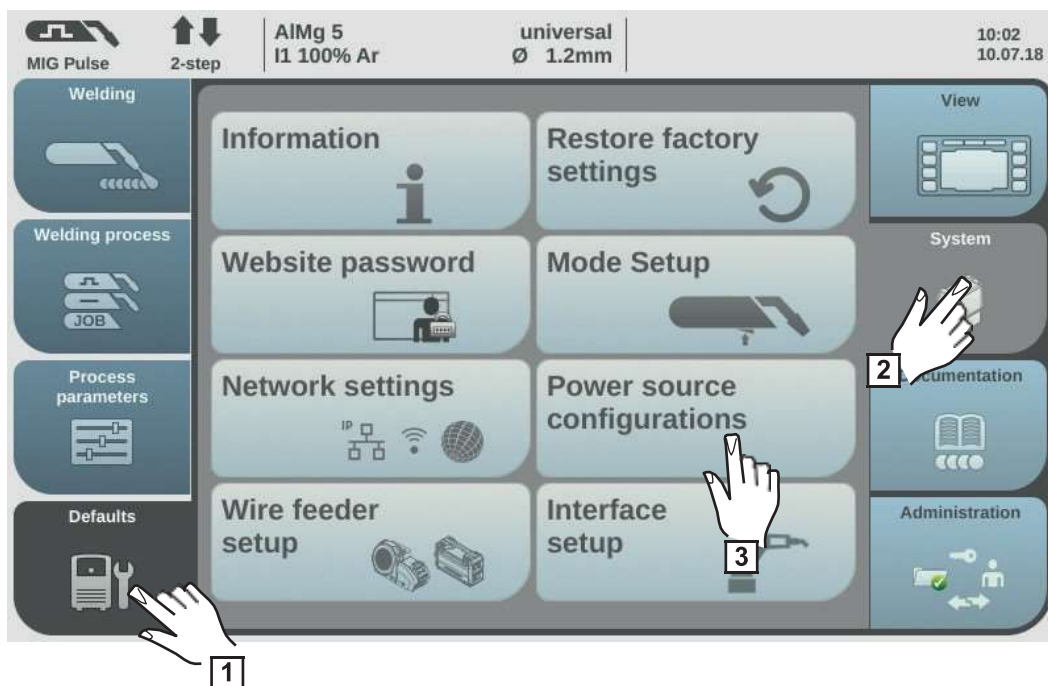
The numerical pad for the selected parameter is displayed.

- 8 Enter a value for the network parameter
- 9 Select "OK" and confirm the value for the network parameter / press the adjusting dial

The value for the network parameter is applied, the network setup overview is displayed.

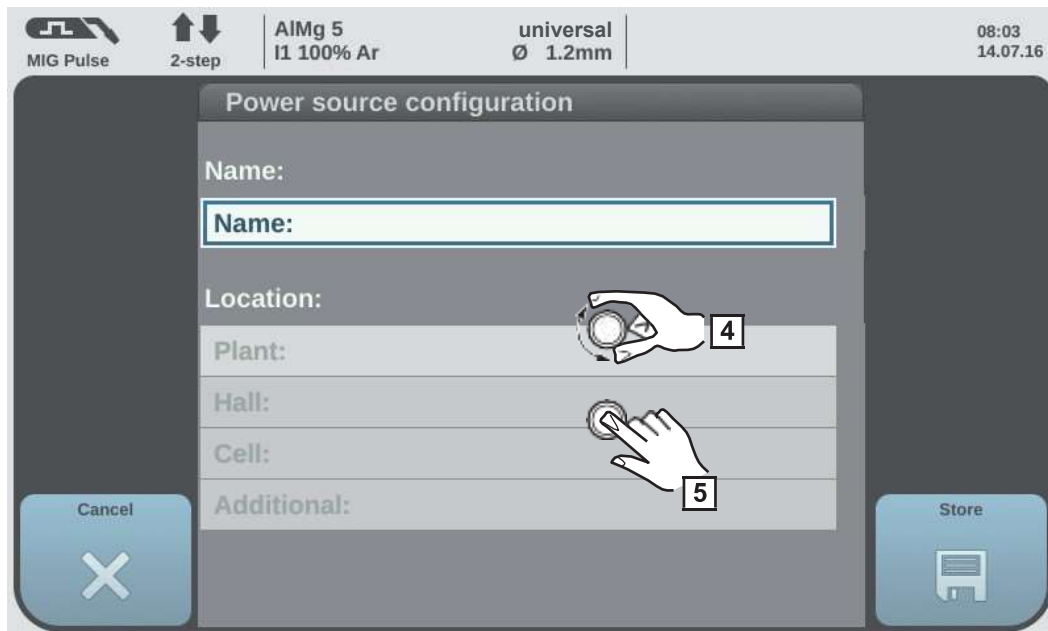
- 10 Select "Store" to apply changes to the network setup

Power source configurations



- 1 Select "Defaults"
- 2 Select "System"
- 3 Select "Power source configurations"

The power source configuration is displayed.



- 4 Turn the adjusting dial and select a configuration location
- 5 Press the adjusting dial

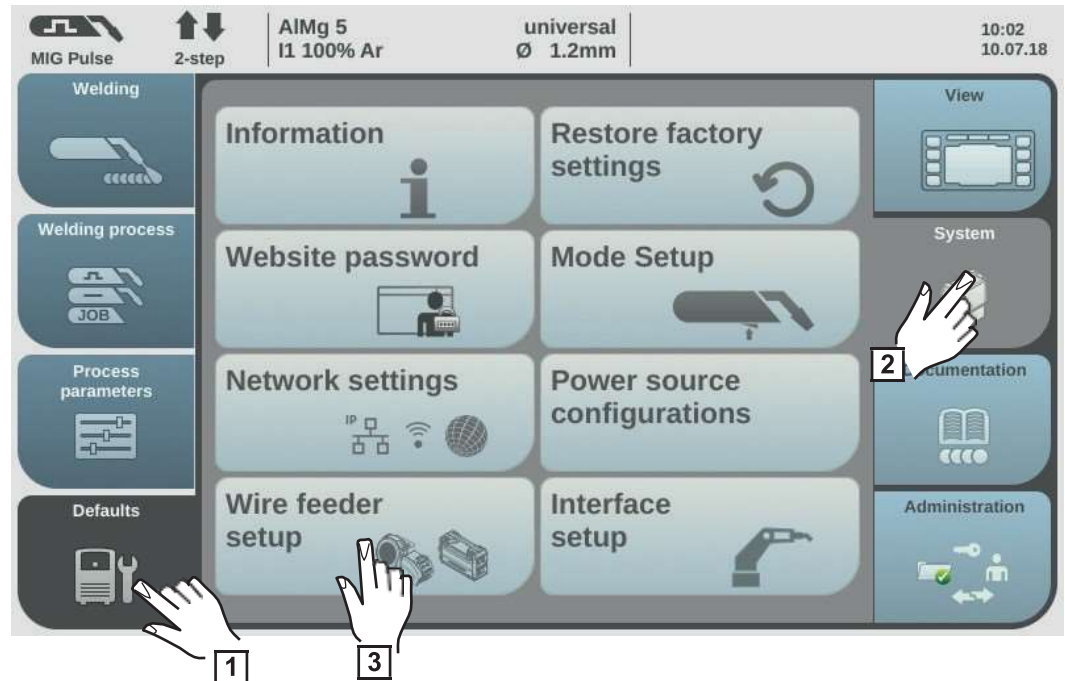
The keyboard is displayed.

- 6 Use the keyboard to enter the desired text (max. 20 characters)
- 7 Select "OK" to confirm the text / press the adjusting dial

The text is applied and the power source configuration is displayed.

- 8 Select "Store" to apply changes

Wire feeder setup Use the Wirefeeder setup to activate or deactivate potentiometers on a wirefeeder.



- 1 Select "Defaults"
- 2 Select "System"
- 3 Select "Wire feeder setup"
- 4 Set the "Wirefeeder Potentiometer" parameter to either "off" or "on"

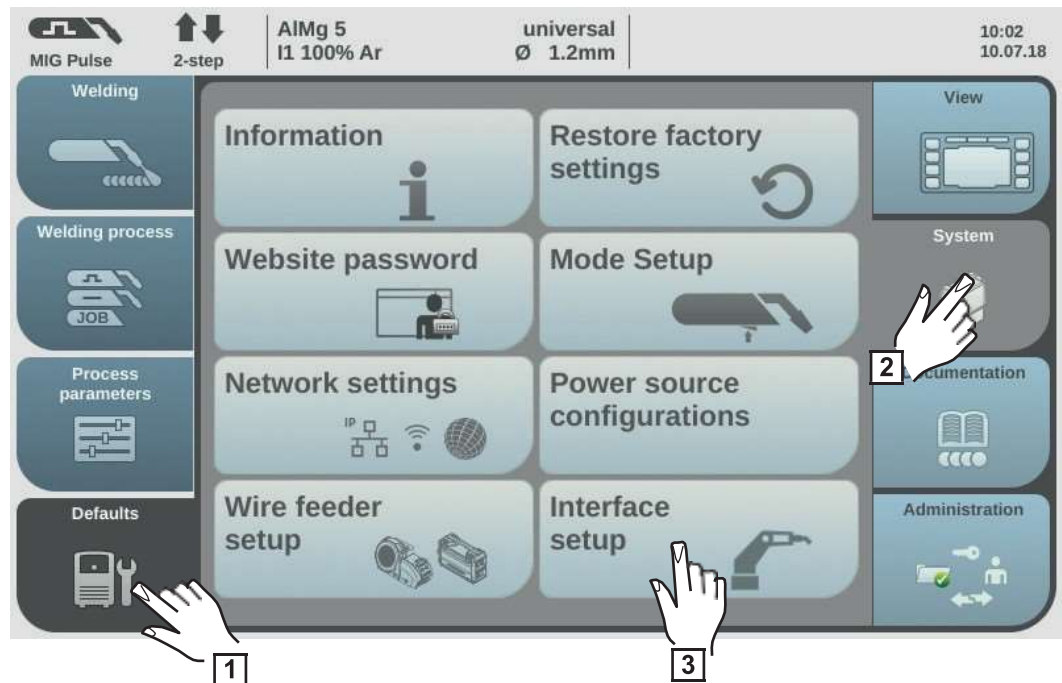
off
The potentiometers on the wirefeeder are deactivated.

on:
The potentiometers on the wirefeeder are activated.

Factory setting:
on

Interface setup

Interface setup can be used to specify whether the welding parameters will be determined externally by the robot control or internally by the power source.



- 1** Select "Defaults"
- 2** Select "System"
- 3** Select "Interface setup"
- 4** Set the "Welding parameter" to "External" or "Internal"

External:

All parameter settings are controlled using the robot control (even the welding parameters).

Internal:

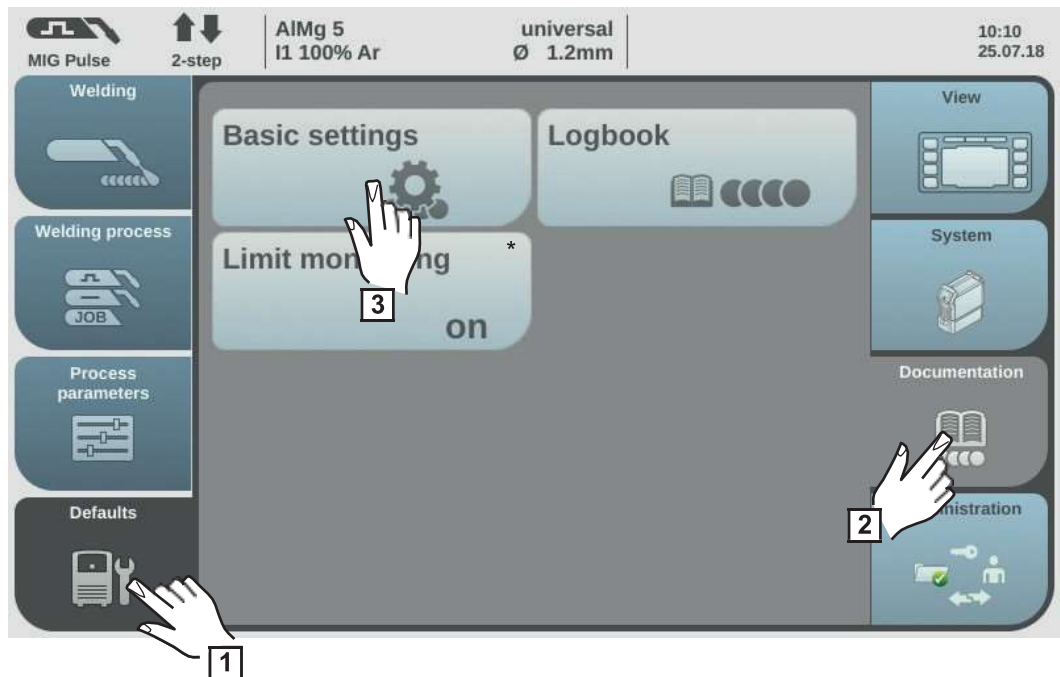
The welding parameters are set using the power source, the control signals are routed through the robot control.

Factory setting:

External

Defaults - Documentation

Setting the sampling rate



* Only in conjunction with the OPT/i limit monitoring option

- 1 Select "Defaults"
- 2 Select "Documentation"
- 3 Select "Basic settings"

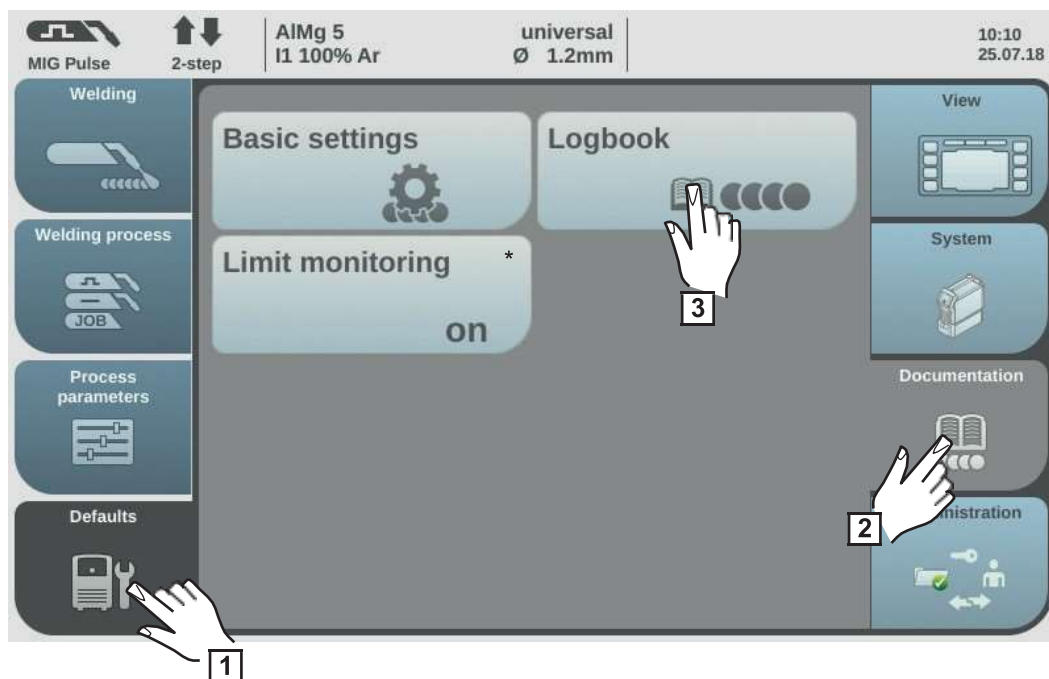
The basic settings documentation is displayed.

- 4 Press the adjusting dial
- 5 Turn the adjusting dial and change the sampling rate value:
 - off
Sampling rate is deactivated; only average values are stored.
 - 0.1–100.0 s
Documentation is stored with the set sampling rate.

- 6 Select "OK" to confirm the sampling rate

The documentation overview is displayed.

Viewing the log-book



* Only in conjunction with the OPT/i limit monitoring option

- 1 Select "Defaults"
- 2 Select "Documentation"
- 3 Select "Logbook"

The logbook is displayed.

Weldings and/or errors and/or events can be displayed using the "Weldings", "Errors" and "Events" buttons.

The following data is also logged:

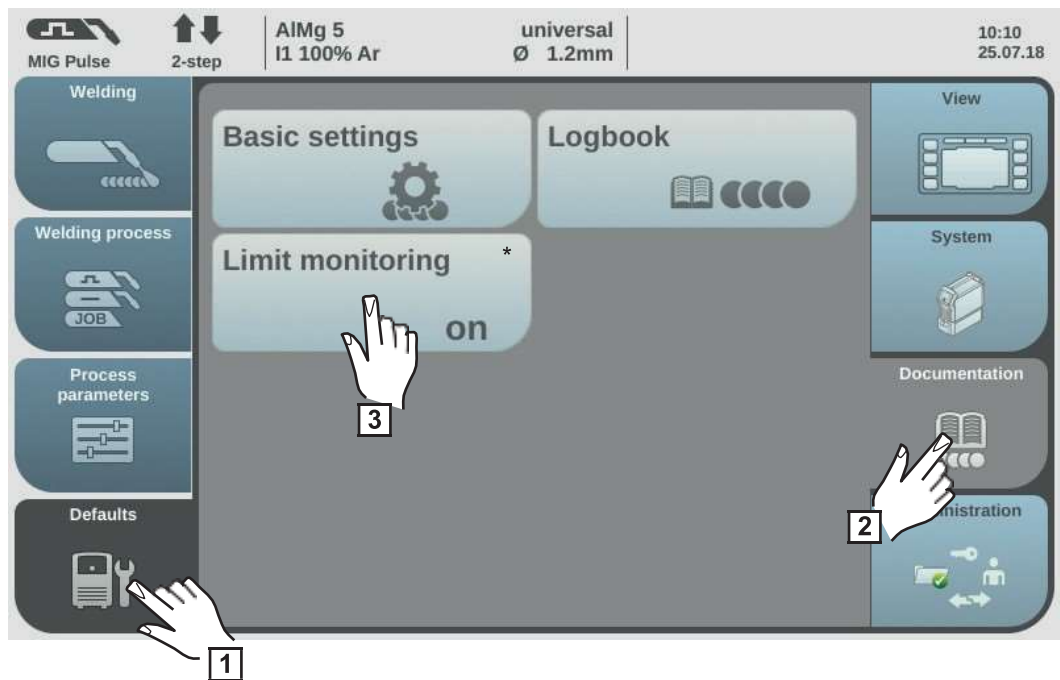
								Job
No.	ddmmyy	hhmmss	s	A	V	m/min	kJ	No.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- | | |
|------------------------------|----------------------------|
| (2) Welding operation number | (7) Welding voltage in V |
| (3) Date (ddmmyy) | (8) Wire speed in m/min |
| (4) Time (hhmmss) | (9) Arc energy in kJ |
| (5) Welding duration in s | (for details see page 147) |
| (6) Welding current in A | (10) Job no. |

Turn the adjusting dial to scroll through the list.

- 4 Select "OK" to exit the Logbook

Activate/deactivate limit value monitoring



* Only in conjunction with the OPT/i limit monitoring option

- 1 Select "Defaults"
- 2 Select "Documentation"
- 3 Select "Limit monitoring"

The settings for limit value monitoring are displayed.

- 4 Press the adjusting dial
- 5 Turn the adjusting dial and change the value for limit monitoring:

off:
The limit value monitoring is deactivated.

on:
The limit values will be monitored according to the settings

Factory setting:
off

- 6 Select "OK" to apply the settings for limit value monitoring

The documentation overview is displayed.

Defaults - Administration

General remarks	User management is advisable if several users work with the same power source. User management works with different roles and the help of NFC keys. Users are assigned different roles depending on their level of training or qualifications.
Explanation of terms used	Administrator An administrator has unlimited access rights to all functions on the power source. The administrator's duties include: - creating roles, - editing and managing user data, - assigning access rights, - updating the firmware, - backing up data, etc. User management User management encompasses all users registered on the power source. Users are assigned different roles depending on their level of training or qualifications. NFC card An NFC card or an NFC key ring is assigned to a certain user who is registered on the power source. NFC cards and NFC key rings will both be referred to under the general term NFC key for the purpose of these Operating Instructions. IMPORTANT! Each user should be assigned their own NFC key. Roles Roles are used for managing registered users (= user management). Users' access rights and permitted activities are defined by their roles.
Pre-defined roles and users	Under Defaults / Administration / User management, 2 roles are predefined as factory settings: administrator with full rights and options The "administrator" role cannot be deleted, renamed or edited. The "administrator" role is assigned the pre-defined "admin" user, which cannot be deleted. The "admin" user can assign names, languages, units, web passwords and NFC keys. As soon as "admin" assigns an NFC key, user management is activated. locked Factory-set with access to welding processes, but not to process parameters and defaults The "locked" role - cannot be deleted or renamed, - cannot be edited to approve different functions according to demand, The "locked" role cannot have any NFC keys assigned to it.

If no NFC key is assigned to the pre-defined user "admin", every NFC key will work to lock and unlock the power source (no user management, see "Locking and unlocking the power source using the NFC key", page 64).

Overview

User management consists of the following sections:

- Administrator and creating roles
- Creating a user
- Editing roles / users, deactivating user management

Administrator and creating roles

Recommendation for creating roles and users

Please proceed systematically when creating roles and NFC keys.

Fronius recommends creating one or two administrator keys. Without administrator rights, it may in the worst-case scenario no longer be possible to operate a power source.

Procedure



NOTE! Losing an NFC administrator key can lead to the power source becoming unusable, depending on the settings. Keep one of the two NFC administrator keys in a safe place.

- 1 Create two equivalent users in the "administrator" role

This means that you will still have access to administrative functions should you lose one of the NFC administrator keys.

- 2 Consider further roles:
 - How many roles are needed?
 - Which rights will be assigned to each role?
 - How many users are there?

- 3 Create roles

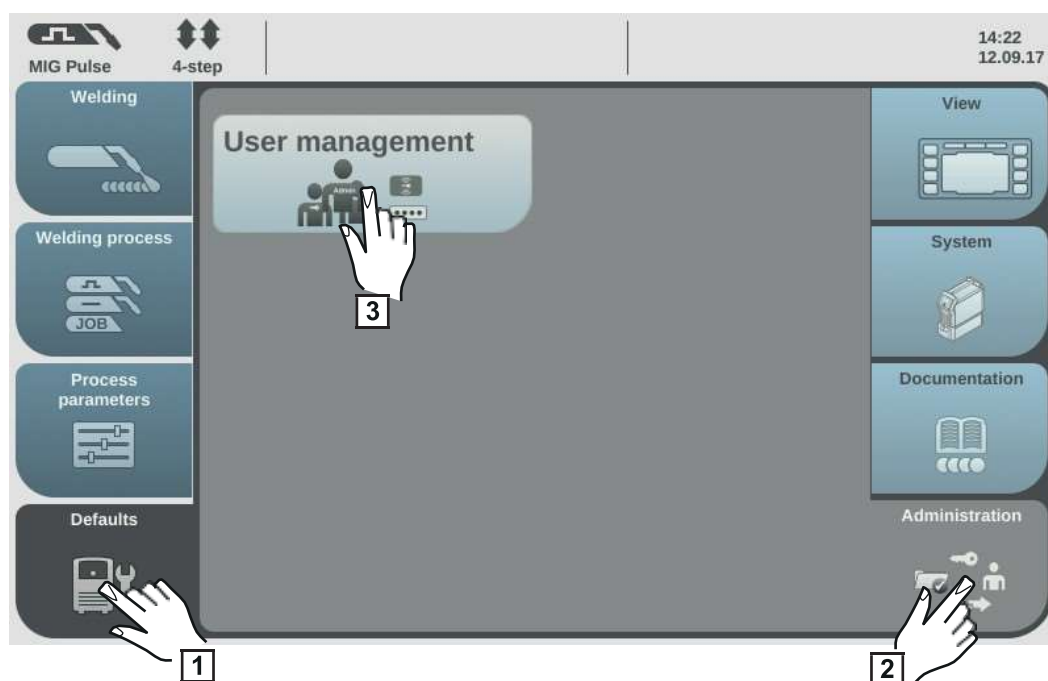
- 4 Assign users to roles

- 5 Check that the created users have access to their respective roles with their NFC keys.

Create administrator key



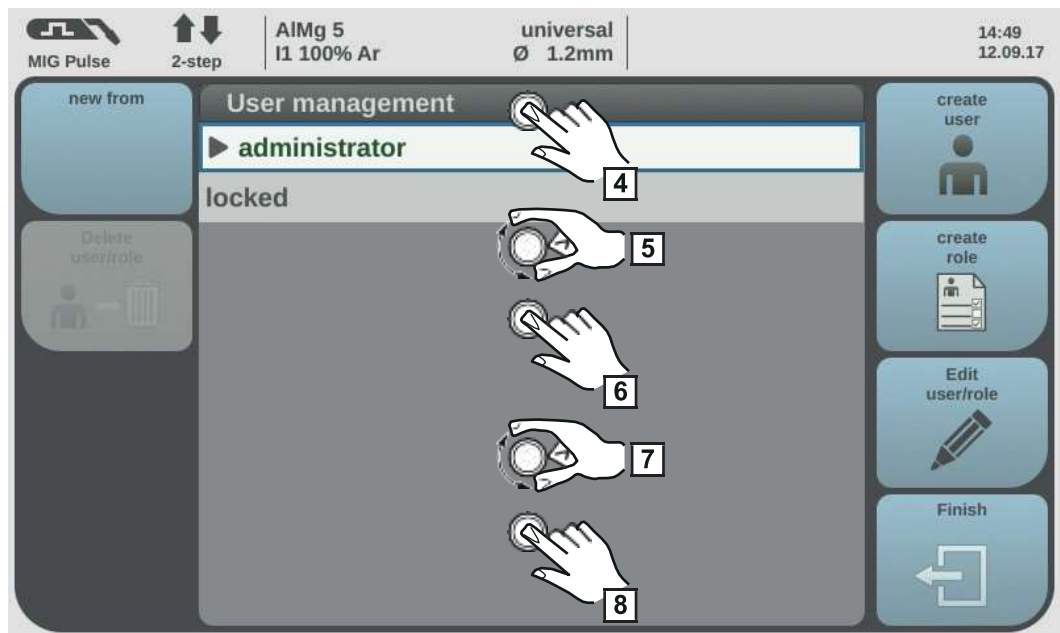
NOTE! Once an NFC key is assigned to the pre-defined "admin" user under Defaults / Administration / User management, user management becomes active.



- 1 Select "Defaults"
- 2 Select "Administration"

3 Select "User management"

User management is displayed, "administrator" is selected.



- 4** Press the adjusting dial
- 5** Turn the adjusting dial and select "admin"
- 6** Press the adjusting dial
- 7** Turn the adjusting dial and select "NFC card"
- 8** Press the adjusting dial

The information to be transferred to the NFC card is displayed.

- 9** Follow the instructions displayed
(hold the new NFC key on the NFC key reader and wait for confirmation of identification)
- 10** Select "OK"

A note concerning the activated user management is displayed.

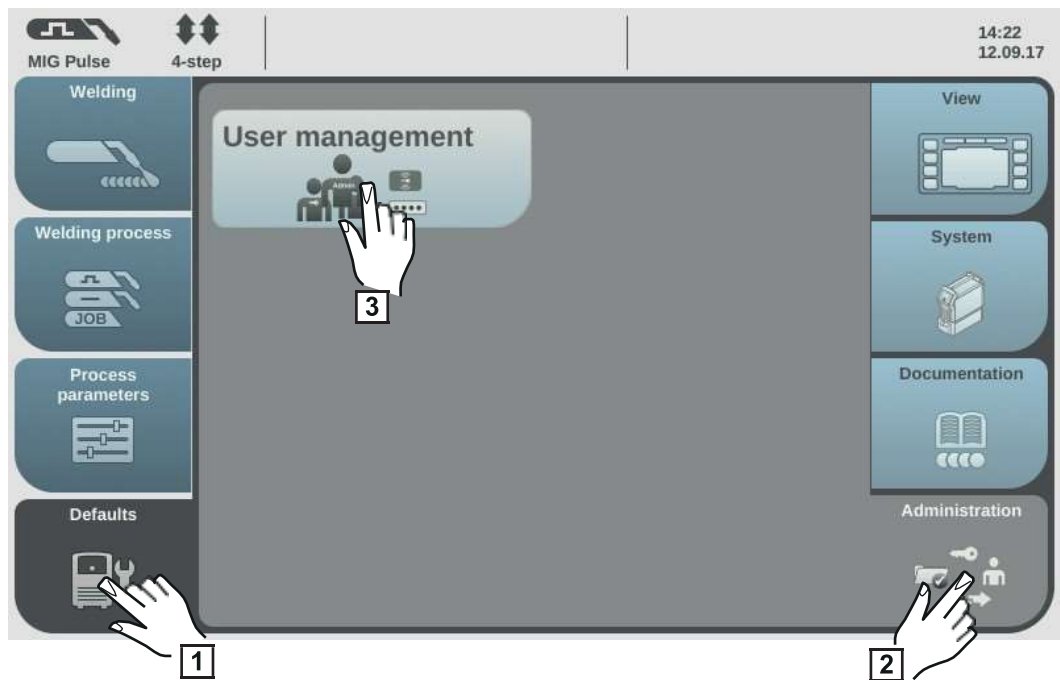
- 11** Select "OK"

Under admin / NFC card, the number of the assigned NFC key is displayed.

To create a second administrator key:

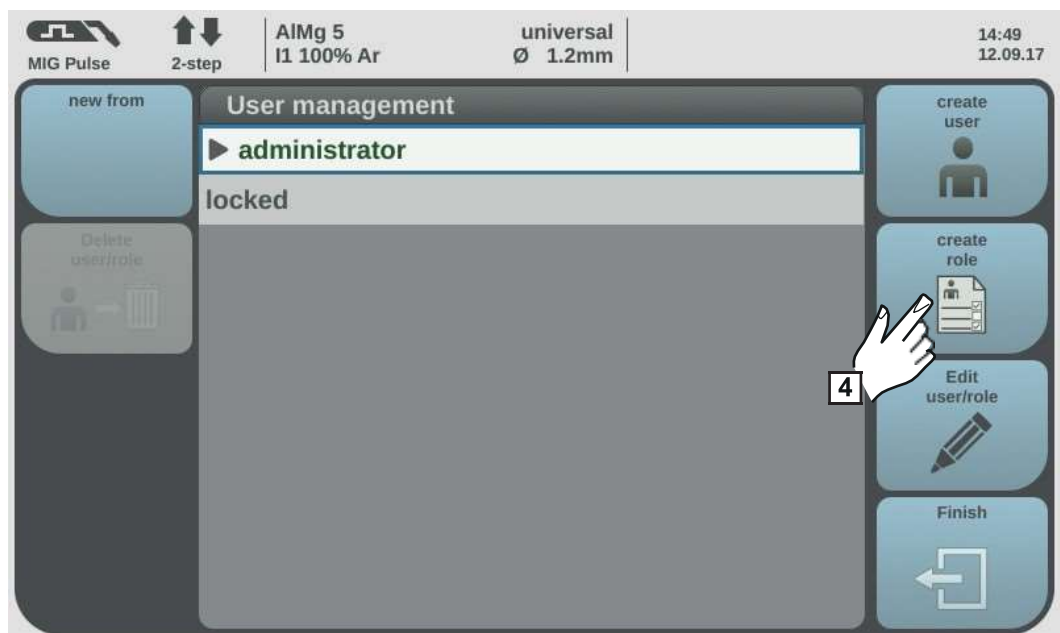
- Copy "admin" (See page 172 for creating a new key from the selection)
- Enter user name
- Assign new NFC card

Creating roles



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

User management appears.



- 4 Select "create role"

The keyboard is displayed.

- 6 Use the keyboard to enter the desired role name (max. 20 characters)
- 7 Select "OK" to confirm the user name / press the adjusting dial

- 8** Specify the functions that a user can carry out in this role
- Select functions by turning the adjusting dial
 - Press the adjusting dial
 - Select settings from the list
 - Press the adjusting dial
- 9** Select "OK"

Executable functions within a role

Function	Setting range
Role name	Editing role name using the keyboard
Time before automatic log off	off / 30s / 60s / 5min / 10min / 30min / 1h
Enable Welding	disabled / enabled
Save job	 / 
Jobs	 /  / 
Optimise job	 /  / 
Correction limits	 /  / 
Save pre-setting for job	 /  / 
Welding Process	 /  / 
Process	 /  / 
Mode	 /  / 
Filler metal	 /  / 
Change the consumables settings	 / 
Process parameters	 /  / 
General	 /  / 
Start/end of welding	 /  / 
Gas-Setup	 /  / 
R/L-check / alignment	 /  / 
Process control	 /  / 
TIG/electrode setup	 /  / 
SynchroPulse	 /  / 
Process mix	 /  / 
Spot welding setup	 /  / 
CMT Cycle Step Mix	 /  / 

Function	Setting range
Components	 /  / 
Components	 /  / 
System calibration	 / 
Arc break monitoring	 /  / 
Wire stick setting	 /  / 
Wire stick work piece	 /  / 
Wire end setting	 /  / 
Gas monitoring	 /  / 
Defaults	 /  / 
View	 /  / 
Language	 /  / 
Units / Standards	 /  / 
Time & Date	 /  / 
Easy job settings	 /  / 
System data	 / 
Characteristics	 /  / 
System	 /  / 
Information	 / 
Restore factory settings	 / 
Website password	 / 
Mode Setup	 /  / 
Remote Support	 / 
Network settings	 /  / 
Power source configurations	 /  / 
Wire feeder setup	 /  / 
Interface setup	 /  / 
TWIN setting	 /  / 
Documentation	 /  / 
Basic settings	 /  / 
Logbook	 / 
Limit value monitoring	 /  / 

Function	Setting range
Administration	 /  / 
User management	 / 
Website	 /  / 
Current system data	 / 
Documentation	 / 
Job data	 /  / 
Power source settings	 /  / 
Process parameters	 /  / 
Defaults	 /  / 
Backup & Restore	 /  / 
Backup & Restore	 / 
Automatic backup	 /  / 
Signal visualisation	 / 
User management	 /  / 
Export & import	 / 
Overview	 / 
Update	 / 
Function packages	 /  / 
Characteristics overview	 / 
Screenshot	 / 
Client websites	 / 



... hidden

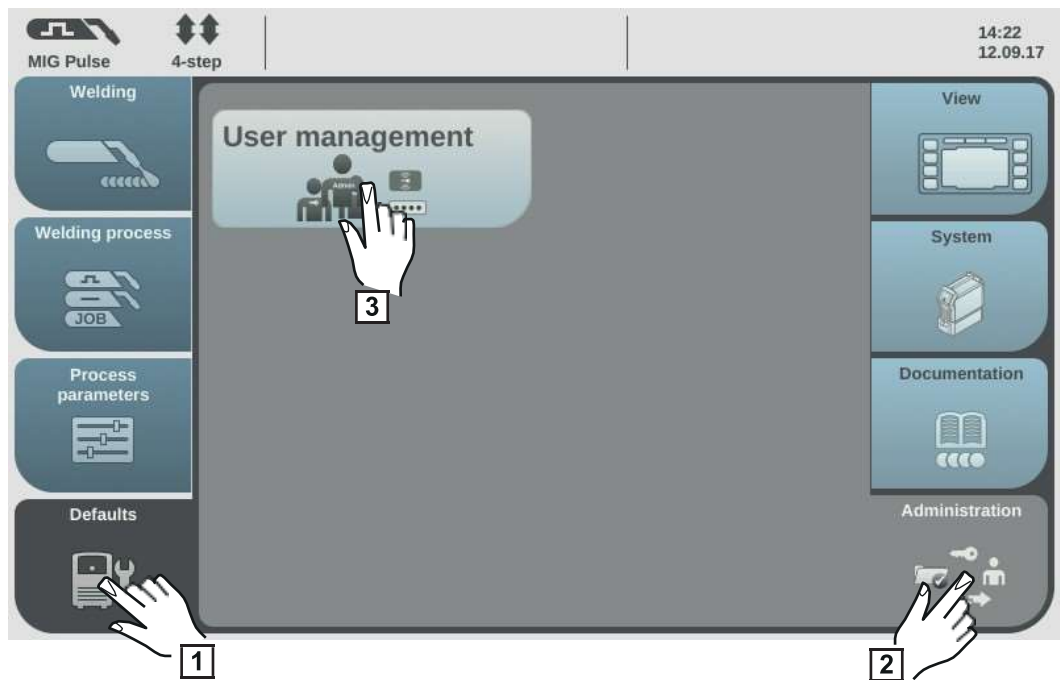


... read only



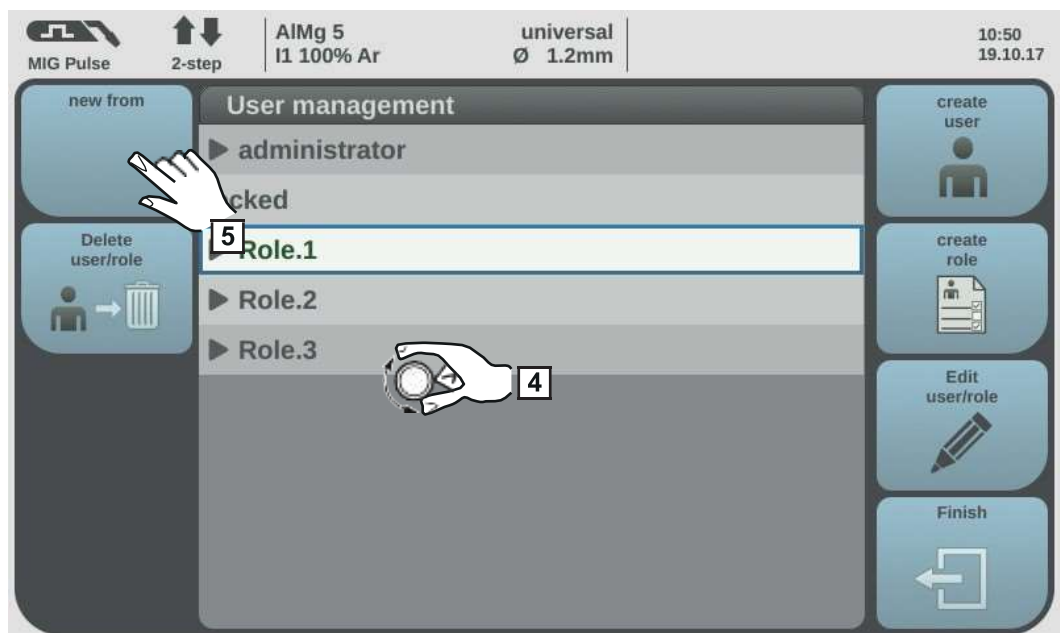
... read and write

Copy roles



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

User management appears.

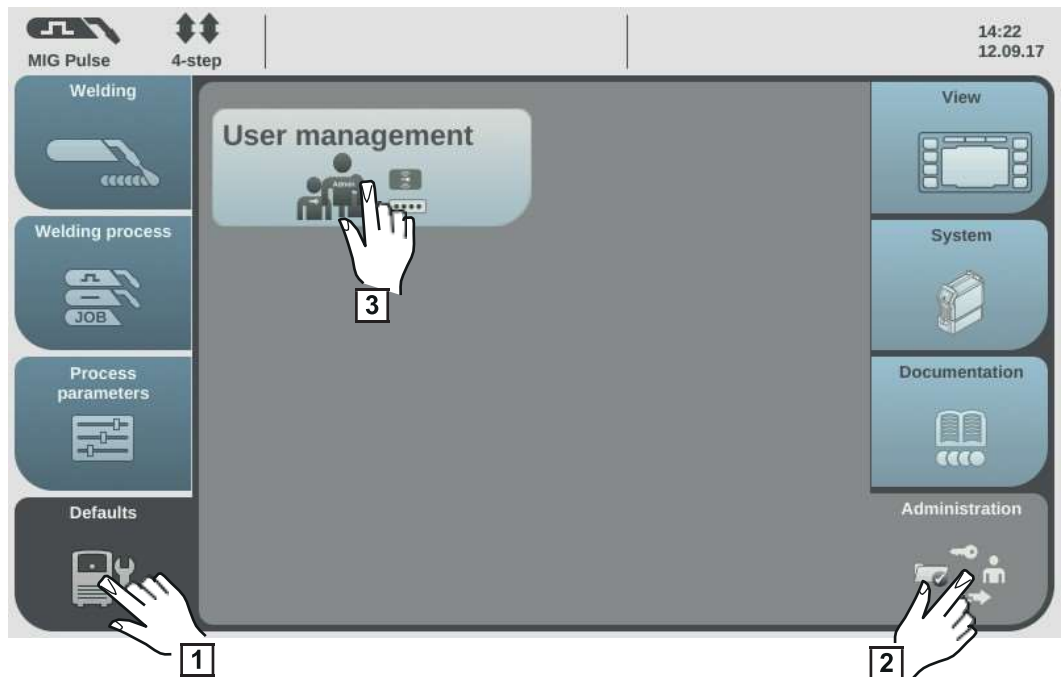


- 4 Turn the adjusting dial and select the role to be copied
- 5 Select "new from"
- 6 Enter a name for the new role using the keyboard
- 7 Select "OK"

- 8** Specify executable functions for the role
 - Select function by turning the adjusting dial
 - Press the adjusting dial
 - Select the settings for the functions from the list
- 9** Select "OK"

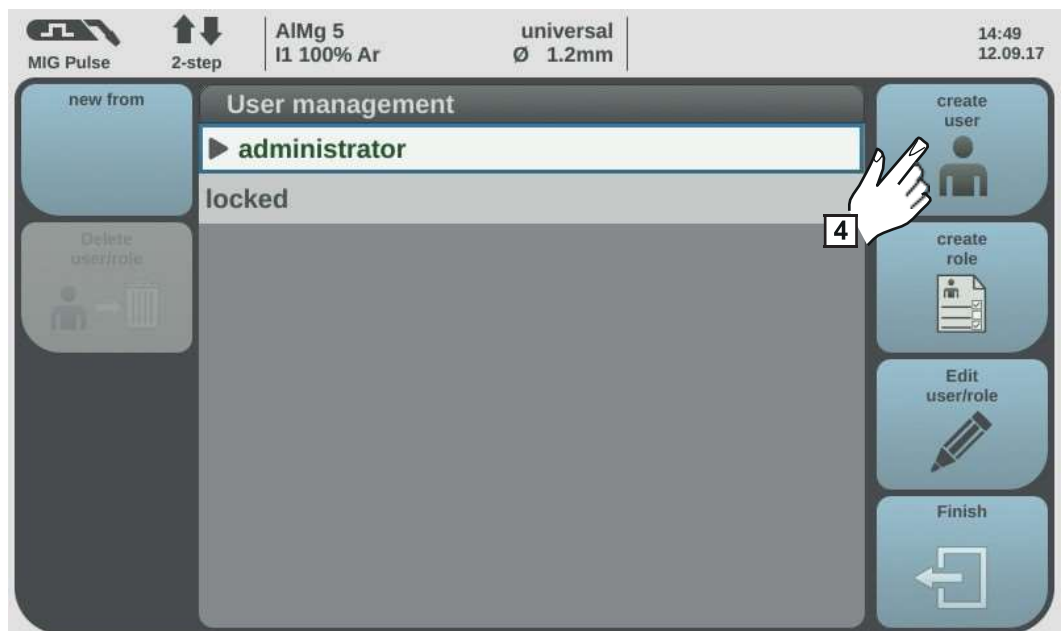
Creating a user

Creating a user



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

User management appears.



- 4 Select "create user"

The keyboard is displayed.

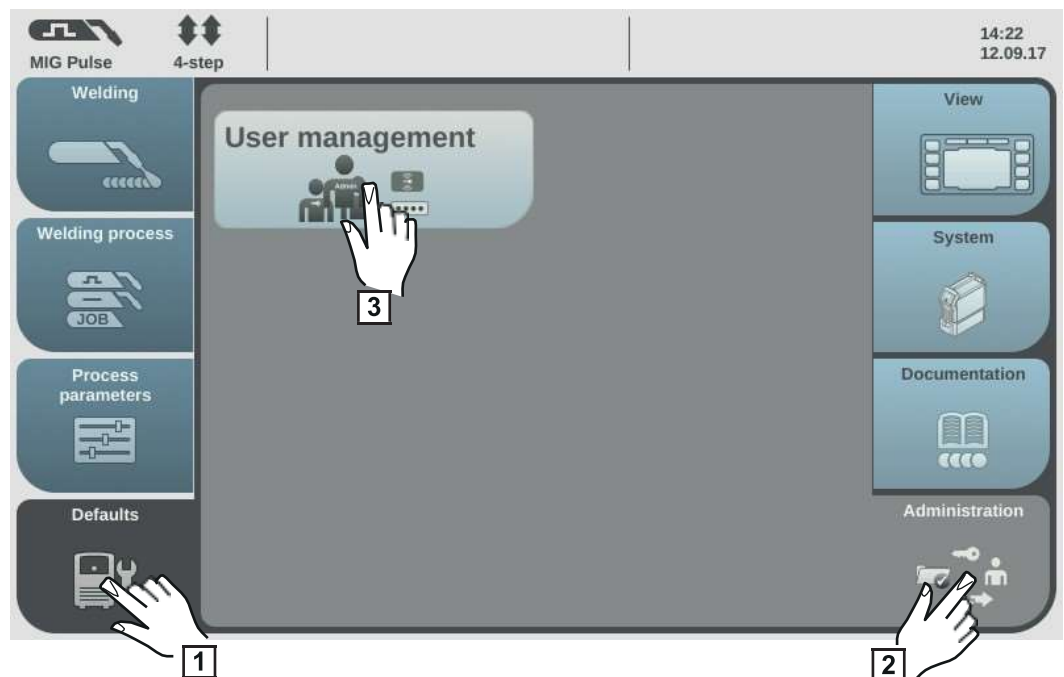
- 5 Use the keyboard to enter the desired user name (max. 20 characters)
- 6 Select "OK" to confirm the user name / press the adjusting dial

- 7 Enter further user data
 - Select parameters by turning the adjusting dial
 - Press the adjusting dial
 - Select role, language, unit and standard (norm) from the list
 - Enter first name, last name and web password by using the keyboard
- 8 Turn the adjusting dial and select "NFC card"
- 9 Press the adjusting dial

The information to be transferred to the NFC card is displayed.

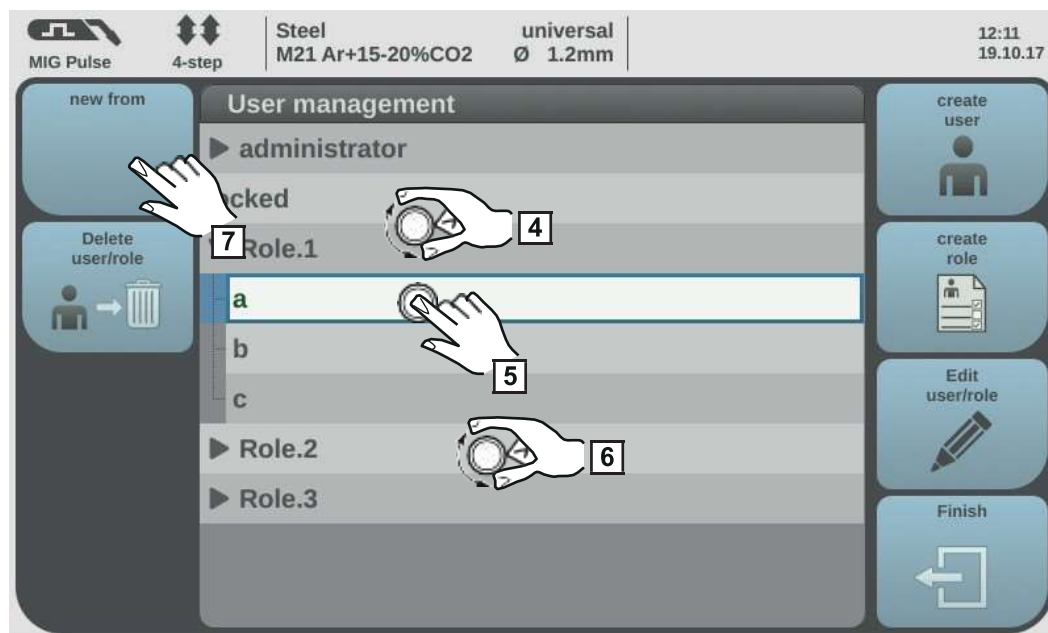
- 10 Follow the instructions displayed
(hold the new NFC key on the NFC key reader and wait for confirmation of identification)

Copying users



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

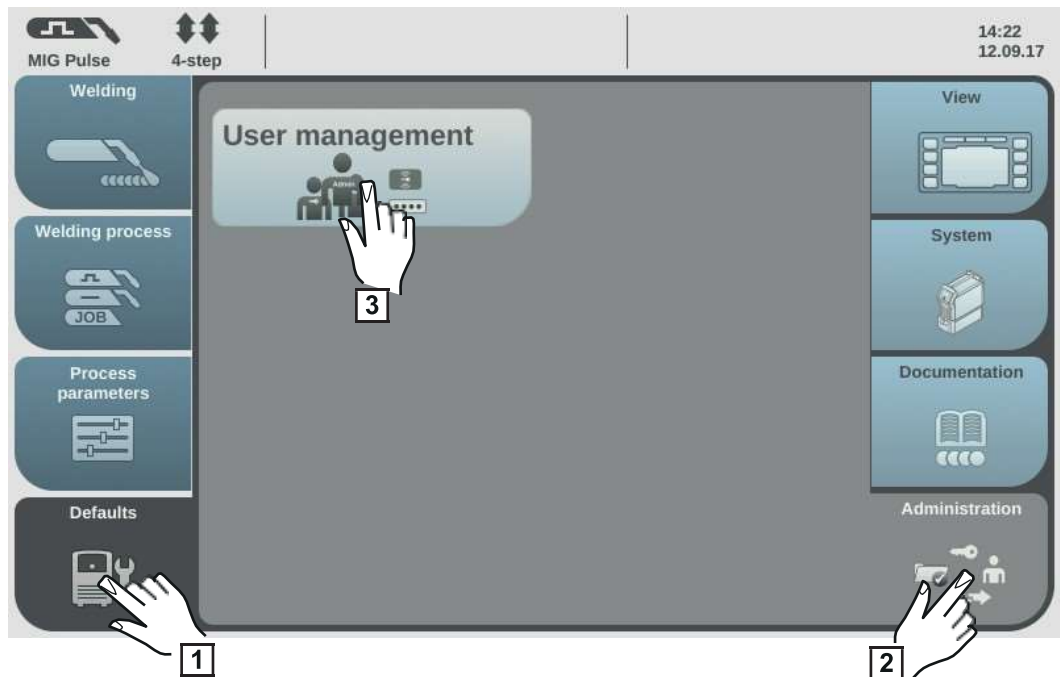
User management appears.



- 4 Turn the adjusting dial and select the role to which the user to be copied is assigned
- 5 Press the adjusting dial
- 6 Turn the adjusting dial and select the user to be copied
- 7 Select "new from"
- 8 Enter a name for the new user using the keyboard
- 9 Select "OK"
- 10 Specify further user data
- 11 Assign new NFC key
- 12 Select "OK"

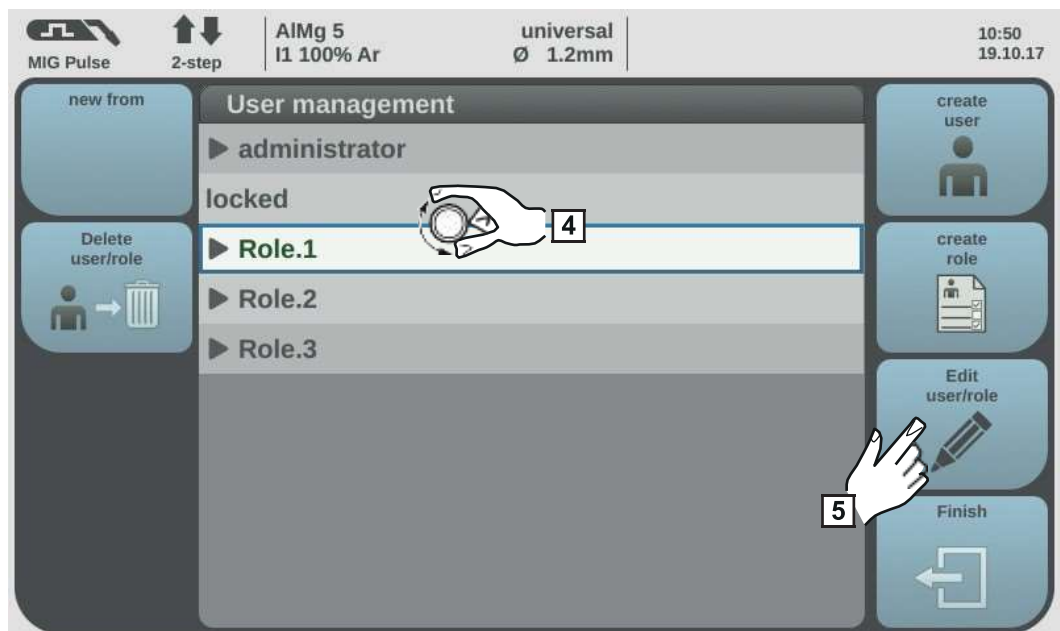
Editing roles / users, deactivating user management

Editing roles



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

User management appears.



- 4 Turn the adjusting dial and select the desired role
- 5 Select "Edit user/role"

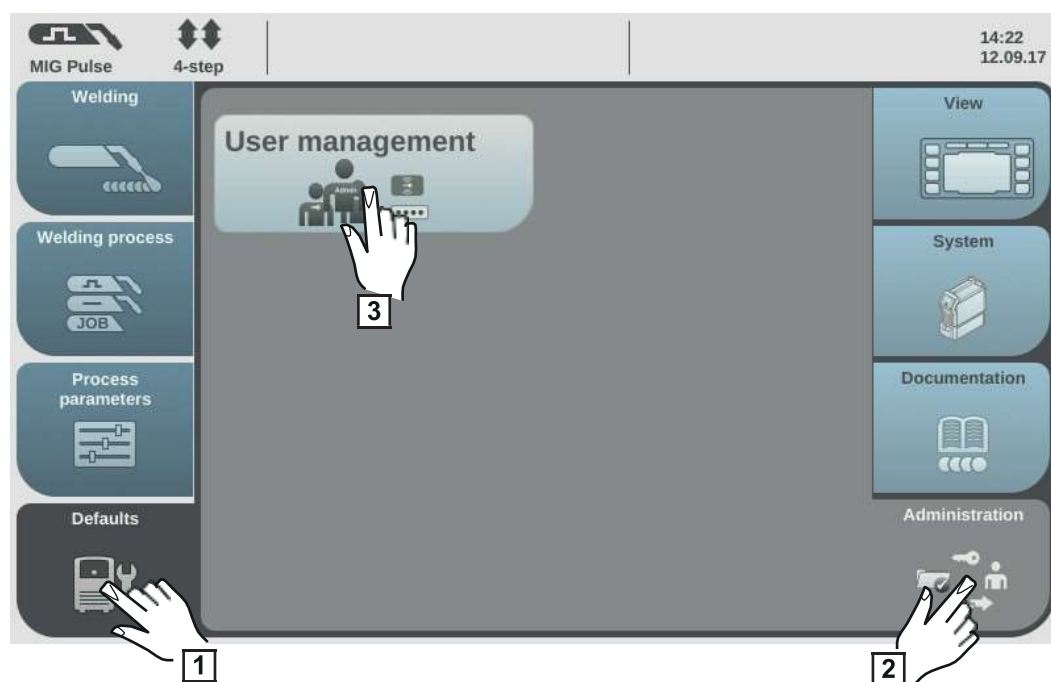
The role will open, the functions can be adjusted:

- Select function by turning the adjusting dial
- Press the adjusting dial
- Change the role name using the keyboard
- Select the settings for the functions from the list

6 Select "OK"

If no user is assigned to a role, then it is possible to start editing the role by pressing the adjusting dial.

Deleting roles



1 Select "Defaults"

2 Select "Administration"

3 Select "User management"

User management appears.



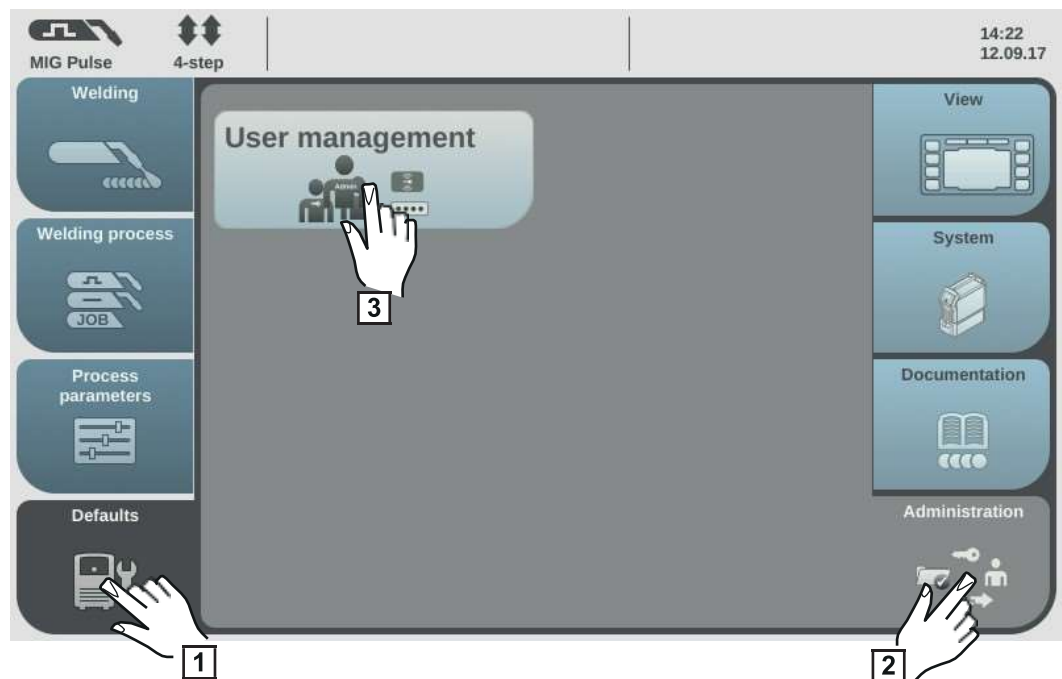
4 Turn the adjusting dial and select the role to be deleted

5 Select "Delete user/role"

6 Confirm when prompted

The role and all assigned users will be deleted.

Editing users

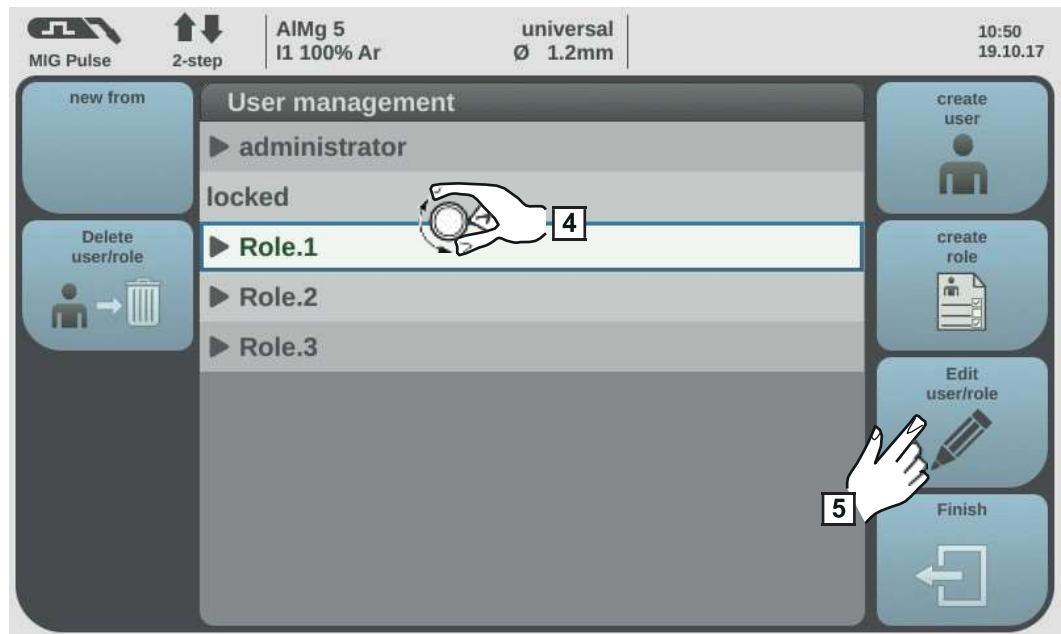


1 Select "Defaults"

2 Select "Administration"

3 Select "User management"

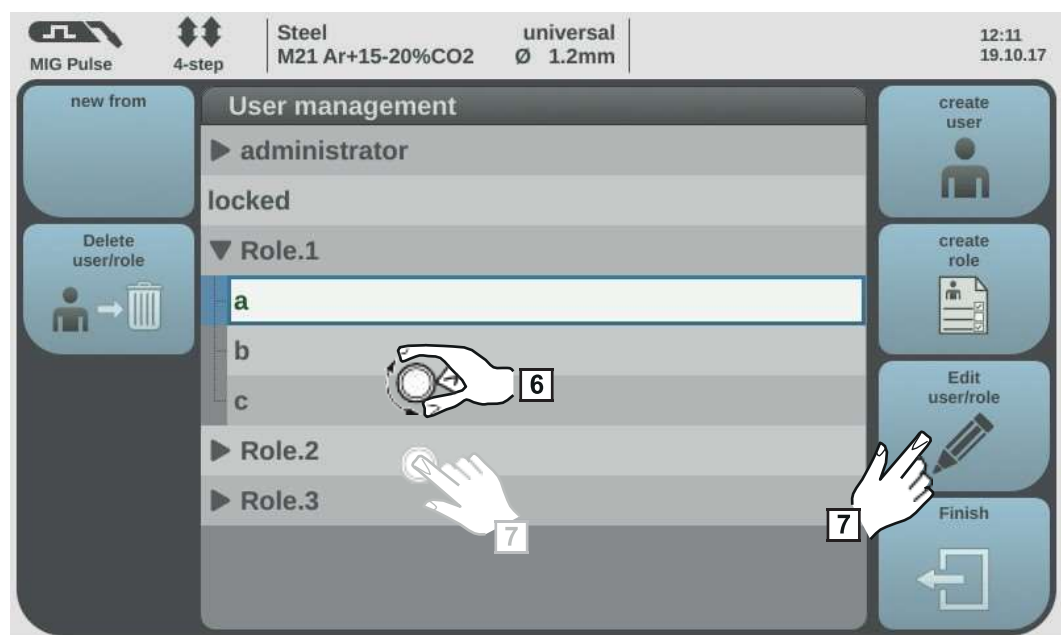
User management appears.



4 Turn the adjusting dial and select the role to which the user to be edited is assigned

5 Press the adjusting dial

The users assigned to the role are displayed.



6 Turn the adjusting dial and select the user to be edited

7 Select "Edit user/role" (or press the adjusting dial)

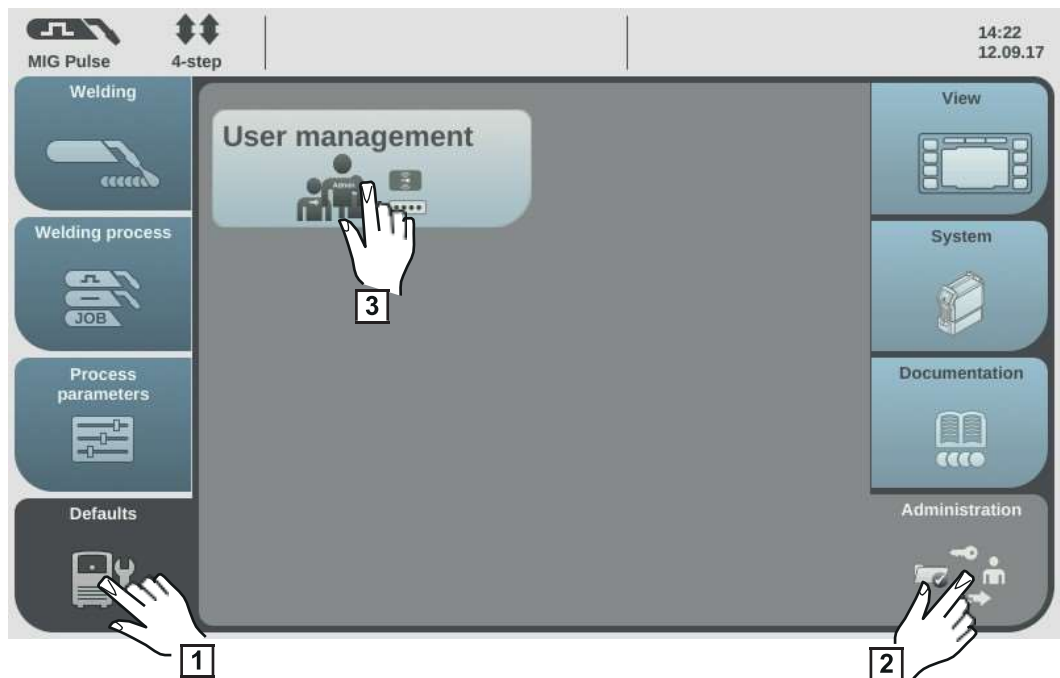
- Select parameters by turning the adjusting dial
- Press the adjusting dial
- Change the name and web password using the keyboard
- Select other settings from the list

Replace NFC card:

- Turn the adjusting dial and select "NFC card"
- Press the adjusting dial
- Select "replace"
- Hold the new NFC key on the NFC key reader and wait for confirmation of identification
- Select OK

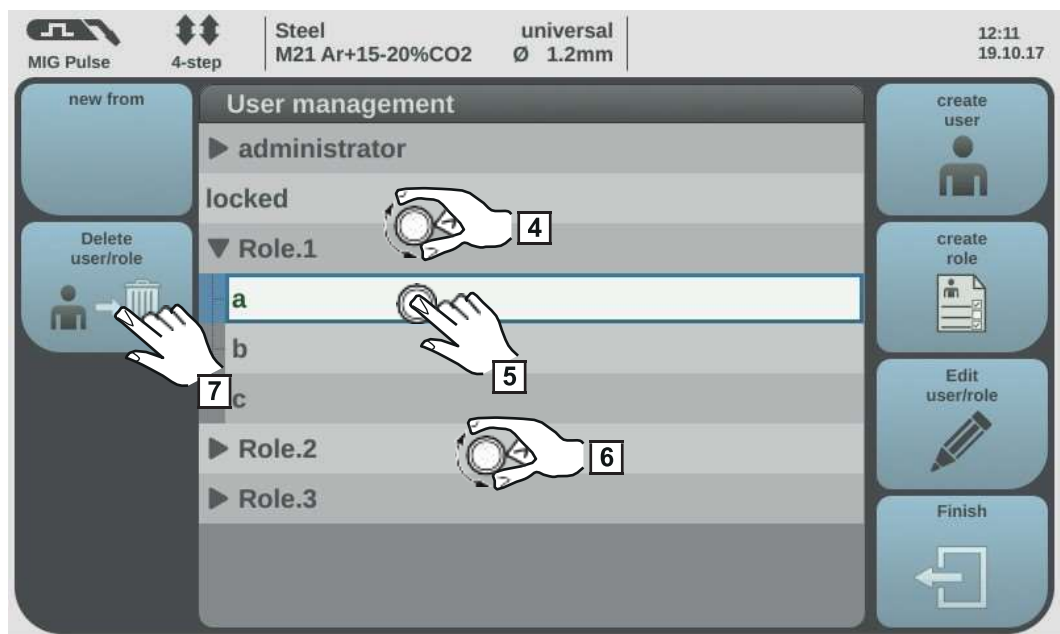
8 Select "OK"

Deleting users



- 1 Select "Defaults"
- 2 Select "Administration"
- 3 Select "User management"

User management appears.



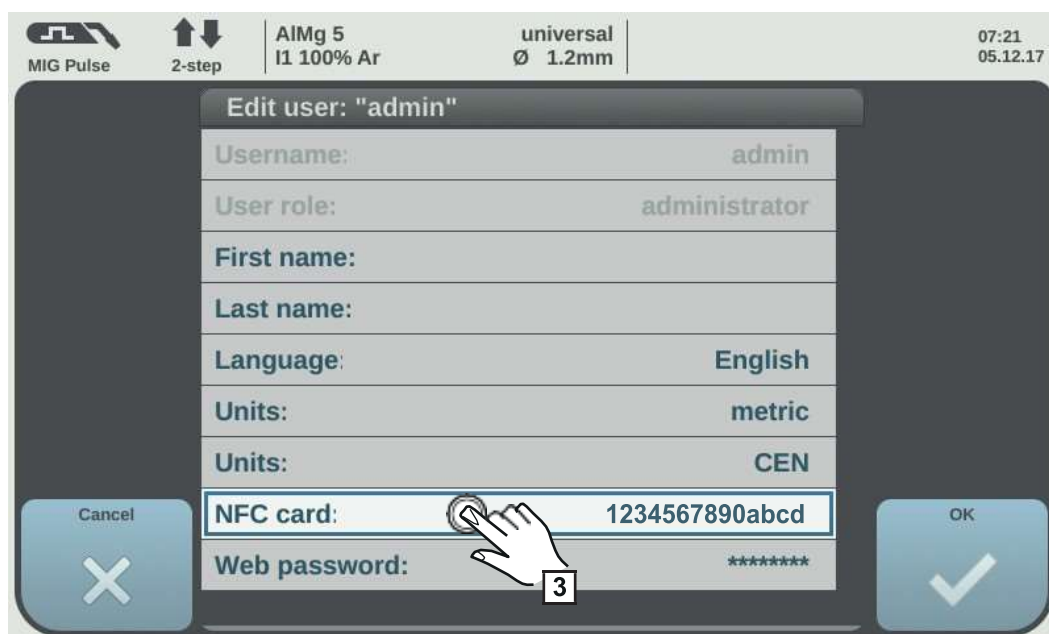
- 4 Turn the adjusting dial and select the role to which the user to be deleted is assigned
- 5 Press the adjusting dial
- 6 Turn the adjusting dial and select the user to be deleted
- 7 Select "Delete user/role"

- 8 Confirm when prompted

The user is deleted.

Deactivating user management

- 1 Select the pre-defined "admin" user under Defaults / Administration / User management
- 2 Turn the adjusting dial and select "NFC card"



- 3 Press the adjusting dial

A confirmation prompt asking whether you want to delete or replace the NFC card is displayed.



NOTE! If the NFC card is deleted by the predefined "admin" user, user management is deactivated.

- 4 Select "delete"

User management is deactivated, the power source is locked.

The power source can be locked and unlocked again with any NFC key (see page 64).

SmartManager - The power source website

SmartManager - The power source website

General remarks

The power source has its own website: SmartManager.

As soon as the power source is connected to a computer with the help of a network cable, or is integrated into a network, the power source's SmartManager can be retrieved using the power source's IP address.

At least IE 10 or a similar modern browser is required to access SmartManager.

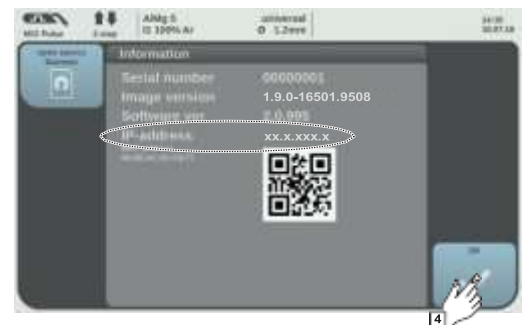
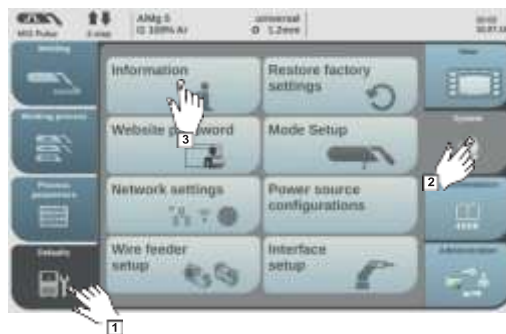
The entries displayed on SmartManager may vary depending on system configuration, software upgrades and available options.

Examples of entries displayed:

- Actual system data
- Documentation
- Job data
- Power source configuration
- Backup & Restore
- User management
- Signal visualisation
- Overview
- Update
- Function packages
- Characteristics overview
- Screenshot
- Robot interface *

* Depending on the available robot interface, the name of the interface will be displayed as an entry on the website.

Opening and logging into the power source SmartManager



1 Settings / System / Information ==> Note down the IP address for the power source

2 Enter the IP address in the browser search field

3 Enter user name and password

Factory setting:

User name = admin

Password = admin

4 Confirm the displayed message

The power source SmartManager is displayed.

Help function, should you be un- able to log in

There are two auxiliary functions when logging on to SmartManager:

- Start unlocking function?
- Forgotten password?

Start unlocking function?

An unintentionally locked power source can be unlocked with this function and all its functions made available.

- 1 Click "Start unlocking function"?
- 2 Create verification file:
click on "Save"

A TXT file with the following name will be saved to the computer's "Downloads" folder:

unlock_SN[serial number]_YYYY_MM_DD_hhmmss.txt

- 3 Send this verification file to Fronius Technical Support by e-mail:
welding.techsupport@fronius.com

Fronius will respond to each e-mail with a one-time unlocking file named as follows:

response_SN[serial number]_YYYY_MM_DD_hhmmss.txt

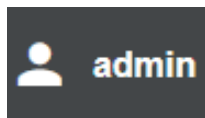
- 4 Save the unlocking file to your computer
- 5 Click on "Search unlocking file"
- 6 Apply unlocking file
- 7 Click on "Install unlocking file"

This will work just once to unlock the power source.

Forgotten password?

After clicking "Forgotten password?" a notice will be displayed explaining that the password can be reset on the power source (see "Resetting the website password", page 151).

Changing pass- word / logging off



By clicking this symbol

- the user password can be changed
- you can log out of SmartManager

Changing the password for the SmartManager:

- 1 Enter the old password
- 2 Enter the new password
- 3 Repeat the new password
- 4 Click on "Save"

Settings



Clicking on this symbol expands the display of characteristics, material specifications and certain welding parameters for the power source's Smart-Manager.

The settings depend on which user is currently logged on.

Language selection



The languages available for SmartManager can be displayed by clicking on the language abbreviation.

Bahasa Indonesia	Čeština	Deutsch
Eesti	English	Español
Français	Hrvatski	Íslenska
Italiano	Latviešu	Lietuviškas
Magyar	Nederlands	Norsk
Polski	Português	Română
Slovenščina	Slovenský	srpski
Suomi	Svenska	tiếng Việt
Türkçe	Русский	Українська
हिन्दी	தமிழ்	ไทย
한국어	中文	日本語

The language that is currently set is highlighted in white.

To change the language, click on the one you would like.

Status indicator

The current status of the power source is shown between the Fronius logo and displayed power source.



Attention / Warning



Fault on the power source *



Power source is welding



The power source is ready (online)



The power source is not ready (offline)

*

In the event of an error, a red error line complete with error number will be displayed above the line with the Fronius logo.
Clicking on the error line will reveal a description of the error.

Fronius



Click on the Fronius logo to open the Fronius homepage:
www.fronius.com

Current system data

Current system data

The welding system's current data is displayed, e.g.

Machine name	Production building	Cell
Installation location		additional information

Welding process

Actual		
Welding current	Welding voltage	Wire speed
Arc length correction	Pulse/dynamic correction	Current arc power
Arc length stabilizer	Penetration stabilizer	Current arc energy
Motor current 1	Motor current 2	
Coolant circulation	Shielding gas flow rate	
Coolant temperature	Arc time	Total operating hours

Operating mode | Filler metal & shielding gas | Characteristic & diameter | ID | Stabilizers, CMT Cycle Step

Set values are displayed, as well as actual values and hold values for the welding current, welding voltage and wire speed. Miscellaneous other actual values are displayed as well as general system data.

Documentation, logbook

Documentation

Welding data from the last 100 welding operations, as well as errors and events, are shown in the Documentation entry.

Press the "Time filter" button to restrict the data to a specific period of time. To do so, the date (yyyy mm dd) and time (hh mm) are entered in the format from – to in each case.

A blank filter loads the latest welding operations again.

The option to show welding operations and events can be disabled.

The following data is displayed:

start time (local ...							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	Welding operation number			(5)	Welding voltage in V		
(2)	Start time (date and time)			(6)	Wire speed in m/min		
(3)	Welding duration in s			(7)	IP – arc power in W		
(4)	Welding current in A			(8)	IE – arc energy in kJ		

If relevant for the system in question, the robot speed and jobs can also be displayed.



Further values can be displayed by clicking on the "Insert column" button:

-I max / I min: maximum/minimum welding current in A

- Max power / Min power: maximum/minimum arc power in W
- Start time (power source time); date and time
- U max / U min: maximum/minimum welding voltage in V
- Vd max / Vd min: maximum/minimum wire speed in m/min

If the OPT/i documentation option is available on the power source, individual welding sections can also be displayed.



This documentation can be exported in the desired format using the "PDF" and "CSV" buttons.

In order to create CSV exports, the OPT/i documentation option must be available on the power source.

Job data

If the OPT/i Jobs option is available on the power source, the following is possible in the Job data entry:

- Existing welding system jobs can be viewed *
- Existing welding system jobs can be optimised
- Jobs stored externally can be transferred to the welding system
- Existing jobs in the welding system can be exported as a PDF * or CSV file

* Viewing and exporting as PDF also works when the OPT/i limit monitoring option is not available on the power source.

Job overview

The job overview lists all jobs stored in the welding system.

Clicking on a job displays the data and parameters stored for this job.

Job data and parameters can only be viewed in the job overview. The column width for parameters and values can be easily dragged and adjusted with the mouse pointer.

Other jobs can easily be added to the list with the data listed by clicking on the "Add job" button.



All added jobs are compared to the job that is currently selected.

Editing a job

Existing welding system jobs can be optimised, provided the OPT/i Jobs option is present on the power source.

- 1 Click on "Edit job"
- 2 Click on the job to be amended in the list of available jobs

The selected job is opened and the following job data is shown:

- **Parameter**
The parameter currently stored in the job
- **Value**
The values of the parameter currently stored in the job
- **Change value to**
For entering the new parameter value
- **Setting range**
Possible setting range for the new parameter values

- 3 Amend the values accordingly
- 4 Save / Delete adjustments, Save as / Delete job



As an aid when editing a job, other jobs can be added with ease to the list with the data displayed by clicking on "Add job".



Creating a new job

- 1 Click on "Create new job"



- 2 Enter job data
- 3 Click on "OK" to apply the new job

Importing a job

This function allows jobs stored externally to be transferred to the welding system, provided the OPT/i Jobs option is available on the power source.

- 1 Click on "Search Job-file"
- 2 Select desired job file

Individual jobs can be selected and new job numbers assigned in the preview of the job import list.

- 3 Click on "Import Job"

If the import is successful, a corresponding confirmation is displayed and the imported jobs appear in the list.

Exporting a job

This function allows jobs from the power source to be stored externally, provided the OPT/i Jobs option is available on the power source.

- 1 Select jobs to be exported
- 2 Click on "Export Job"

The jobs are exported as an XML file into the computer's download folder.

Exporting job(s) as...

Under "Job overview" and "Edit job", existing jobs in the welding system can be exported as PDF or CSV files.
For CSV exports, the jobs OPT/i jobs option must be present on the power source.

- 1 Click on "Export job(s) as..."



The PDF or CSV settings are displayed.

- 2 Select the job(s) to be exported:
current job / all jobs / job numbers
- 3 Click on "Save PDF" or "Save CSV"

A PDF or CSV file containing the selected jobs is created and saved according to the settings of the browser in question.

Power source settings

Power source settings

The process parameters and defaults for the power source can be viewed and changed in the power source settings entry.

Changing process parameters

- 1 Select process parameters
- 2 Click parameter group / welding parameter
- 3 Alter the parameter value directly in the display field
- 4 Save changes

Changing defaults

- 1 Select defaults
- 2 Change values directly in the display field
- 3 Save changes

Backup & Restore

General remarks In the backup & restore entry

- all welding system data can be saved as a backup (e.g. current parameter settings, jobs, user characteristics, defaults, etc.),
- any backups will be restored to the welding system
- You can select which data you would like to be backed up automatically.

Backup & Restore **Starting backup**

- 1 Click on "Start backup" to save a backup of the welding system data

The data is saved in a selected location in the default format MCU1-YYYYMMDDH-
Hmm.fbc.

YYYY = Year
MM = Month
DD = Day
HH = Hour
mm = Minute

The date and time correspond to the power source settings.

Searching for a restore file

- 1 Click on "Search restore file" to transfer an available backup to the power source
- 2 Select the file and click on "Open"

The selected backup file is displayed on the power source SmartManager under "Restore".

- 3 Click on "Start recovery"

Once the data has been successfully restored, a confirmation to this effect is displayed.

Automatic back-up

- 1** Enter data for automatic backup
 - Interval settings
Interval: daily / weekly / monthly
at: Time (hh:mm)
 - Backup target
Protocol: SFTB / SMB
Server, port, storage location, domain/user, password
 - Proxy settings
Server, port, user, password
- 2** Save changes
- 3** Trigger automatic backup

User management

User management

In the user management entry

- created roles and users are saved to the power source's user management,
 - saved roles and users on the power source are transferred into user management.
- The available user management data on the power source is, therefore, overwritten.

User management is created on a power source and can then be saved with the export/import function and transferred to another power source.

Exporting user management from the power source

- 1 Click on "Export"

The user management data from the power source will be saved to the "Downloads" folder on the computer.

File format: userbackup_SNxxxxxxx_YYYY_MM_DD_hhmmss.user

SN = Serial number, YYYY = Year, MM = Month, DD = Day

hh = hour, mm = minute, ss = second

Saving user management to a power source

- 1 Click on "Search user data file"
- 2 Select the file and click "Open"
- 3 Click on "Import"

The user management data will be saved to the power source.

Signal visualisation

Signal visualisation

Signal visualisation is only available if a robot interface is present.
To display the signal visualisation correctly, IE 10 or another modern browser is required.

The signals and commands transferred via a robot interface are displayed.

IN ... Signals from the robot control to the power source

OUT ... Signals from the power source to the robot control

You can search for, sort and filter the displayed signals at any time.

To sort the characteristics in ascending or descending order, click on the arrow next to the respective information. The column widths can be easily dragged and adjusted with the cursor.

The following information is required for a detailed description of the signals:

- Bit position
- Signal name
- Value
- Data type

Overview

Overview

In the overview entry, welding system components and options are displayed with all available information, e.g. firmware version, item number, serial number, production date, etc.

Expand all groups / Reduce all groups

Click the "Expand all groups" button to show more details of the individual system components.

Power source example:

- TPSi Touch: item number
MCU1: item number, version, serial number, production date
Bootloader: version
image: Version
licences: WP Standard, WP Pulse, WP LSC, WP PMC, OPT/i Guntrigger, etc.
- SC2: item number
firmware: version

Click the "Reduce all groups" button to hide the system component details again.

Save as XML-file

Click the "Save as XML-file" button to create an XML file of the system component details. This XML file can either be opened or saved.

Update

Update

The power source firmware can be updated in the "Update" entry.

The current firmware version on your power source is displayed.

Updating the power source firmware:



The update file can be downloaded via the following link, for example:
<http://tps-i.com/index.php/firmware>

- 1 Organise and save the update file
- 2 Click on "Search update file" to start the update process
- 3 Select update file
Click on "Update"

Once the update has been successfully completed, the power source may need to be re-started.

When an update has been completed successfully, a confirmation to this effect is displayed.

Searching for an update file (performing the update)

- 1 After clicking on "Search update file", select the desired firmware (*.ffw)
- 2 Click on "Open"

The selected update file is displayed on the power source SmartManager under "Update".

- 3 Click on "Update"

A progress bar is displayed above the update process.
When this reaches 100%, you will be prompted to restart the power source.



SmartManager is not available during the restart.
After the restart, SmartManager may not be available anymore.
If you select "No", the new software functions are activated when you next switch the device on/off.

- 4 To restart the power source, click on "Yes"

The power source restarts; the display goes black for a short time.
The Fronius logo is shown on the power source display during the restart.

Once the update has been completed successfully, confirmation and the current firmware version are displayed.
Finally, log back on to SmartManager.

Fronius Weld-Connect

The mobile application Fronius WeldConnect can also be called up in the "Update" entry. Fronius WeldConnect helps welders, design engineers and work schedulers to estimate various welding parameters.



Fronius WeldConnect

Fronius WeldConnect is available in the following forms:

- WeldConnect online (direct link)
- As an Android app
- As an Apple/iOS app

The welding parameters established in the mobile app can be transferred as welding jobs to the power source via WLAN (you will need to enter the IP address).

Function Packages

Function Packages	In the Function Packages entry, the function packages, special characteristics, options, etc., present on the power source are displayed. New function packages can also be uploaded.
Welding Packages	Under Welding Packages, the welding packages present on the power source are displayed with their respective item numbers, e.g.: - WP Standard, (MIG/MAG standard synergic welding) - WP Pulse (MIG/MAG pulse synergic welding) - WP LSC (Low Spatter Control, low-spatter dip transfer arc process) - WP PMC (Pulse Multi Control, enhanced pulsed arc welding process) Possible upgrades: - WP CMT - etc.
Special characteristics	Under special characteristics, the available special characteristics present on the power source are displayed with their respective item numbers, e.g.: - PMC - AlMg4,5Mn(Zr) - I3 Ar... - etc.
Options	The options available on the power source are displayed under "Options" with their respective item numbers and possible upgrades, e.g.: Options - OPT/i GUN Trigger - etc. Possible upgrades - OPT/i Jobs - OPT/i Interface Designer ... - etc.
Installing a function package	1 Organise and save a function package 2 Click on "Search function package file" 3 Select the desired function package file (*.xml) 4 Click on "Open" The selected function package file is displayed on the power source SmartManager under "Install function package". 5 Click on "Install function package" Once the function package has been successfully installed, a confirmation to this effect is displayed.

Synergic lines overview

Characteristics overview

In the Characteristics overview entry:

- Available characteristics in the welding system can be displayed: (Available characteristics button).
- Possible characteristics in the welding system can be displayed: (Possible characteristics button).

You can search for, sort and filter the displayed characteristics at any time.

The following information is displayed for the characteristics:

- | | |
|------------|--------------------------|
| - Status | - Replaced by |
| - Material | - SFI |
| - Diameter | - SFI HotStart |
| - Gas | - Penetration stabilizer |
| - Property | - Arc length stabilizer |
| - Process | - CMT Cycle Step |
| - ID | - Special |

To sort the characteristics in ascending or descending order, click on the arrow next to the respective information.

The column widths can be easily dragged and adjusted with the cursor.

Show /hide filter

Show filter



Hide filter



When you click on the "Show filter" symbol, the possible filter criteria are displayed. With the exception of "ID" and "replaced by", the characteristics can be filtered by all the information.

The first checkbox = select all

To hide filter criteria, click the "Hide filter" symbol.

Screenshot

Screenshot

In the Screenshot entry, a digital image of the power source display can be created at any time, irrespective of the navigation or set values.

- 1 Click on "Create screenshot" to capture a screenshot of the display

A screenshot of the currently displayed settings is created.

Different functions are available for saving the screenshot depending on the browser used; the display may vary.

Interface

Interface

If a robot interface is available, the name of the interface will be displayed as an entry on the power source website.

The following welding parameters can be displayed, edited, saved or deleted:

- Characteristic assignment (current allocation of program numbers to characteristics)
- Module configuration (network settings)

Factory settings can be restored and the module can be restarted.

Troubleshooting and maintenance

Troubleshooting

General

The power sources are equipped with an intelligent safety system, meaning it has been possible to dispense with nearly all fuses. After a possible malfunction has been remedied, the power source can be used again as normal.

Possible malfunctions, warning notices or status codes are shown on the display as plain text dialogues.

Safety



WARNING! An electric shock can be fatal. Before opening the device

- Turn the mains switch to the "O" position
- Unplug the machine from the mains
- Prevent it from being switched on again
- Using a suitable measuring instrument, check to make sure that electrically charged components (e.g. capacitors) have discharged



CAUTION! Inadequate PE conductor connections can cause serious injury and damage. The housing screws provide a suitable PE conductor connection for earthing (grounding) the housing and must NOT be replaced by any other screws which do not provide a reliable PE conductor connection.

MIG/MAG welding – Current limit

“Current limit” is a safety function for MIG/MAG welding, whereby

- it is possible to operate the power source at the power limit
- process safety is ensured

If the welding power is too high, the arc gets smaller and smaller and may be extinguished. To stop the arc from being extinguished, the power source reduces the wire speed and therefore the welding power.

A corresponding message appears in the status bar on the display.

Corrective measures

- Reduce one of the following welding power parameters:
Wire speed
Welding current
Welding voltage
Material thickness
- Increase the distance between the contact tip and workpiece

Power source troubleshooting

Power source does not function

Mains switch is on, but indicators are not lit up

Cause: There is a break in the mains lead; the mains plug is not plugged in

Remedy: Check the mains lead, ensure that the mains plug is plugged in

Cause: Mains socket or mains plug faulty

Remedy: Replace faulty parts

Cause:	Mains fuse is faulty
Remedy:	Change the mains fuse

No welding current

mains switch is on, overtemperature is displayed

Cause:	Overload; the duty cycle has been exceeded
Remedy:	Check duty cycle

Cause:	Thermostatic automatic circuit breaker has been tripped
Remedy:	Wait until the power source automatically comes back on after the end of the cooling phase

Cause:	Limited supply of cooling air
Remedy:	Ensure accessibility to cooling-air ducts

Cause:	The fan in the power source is faulty
Remedy:	Replace the fan (After-Sales Service)

No welding current

Mains switch is on and indicators are lit up

Cause:	Grounding (earthing) connection is incorrect
Remedy:	Check the grounding (earthing) connection and terminal for correct polarity

Cause:	There is a break in the power cable in the welding torch
Remedy:	Replace the welding torch

Nothing happens when torch trigger is pressed

Mains switch is on and indicators are lit up

Cause:	The control plug is not plugged in
Remedy:	Plug in the control plug

Cause:	Welding torch or welding torch control line is faulty
Remedy:	Replace the welding torch

Cause:	Interconnecting hosepack is faulty or not connected properly
Remedy:	Check the interconnecting hosepack

No shielding gas

All other functions are OK

Cause:	Gas cylinder is empty
Remedy:	Change the gas cylinder

Cause:	Gas pressure regulator faulty
Remedy:	Replace gas pressure regulator

Cause:	The gas hose is not connected, or is damaged or kinked
Remedy:	Connect/replace the gas hose, or straighten out kinks

Cause: Welding torch is faulty
 Remedy: Change the welding torch

Cause: Gas solenoid valve faulty
 Remedy: Replace gas solenoid valve

Poor weld properties

Cause: Incorrect welding and/or correction parameters
 Remedy: Check the settings

Cause: Poor grounding (earthing) connection
 Remedy: Ensure good contact to workpiece

Cause: Inadequate or no protective gas shield
 Remedy: Check the pressure regulator, gas hose, gas solenoid valve, torch gas connection, etc.

Cause: Welding torch is leaking
 Remedy: Change the welding torch

Cause: Wrong contact tip, or contact tip is worn out
 Remedy: Replace the contact tip

Cause: Wrong wire alloy or wrong wire diameter
 Remedy: Check the wire electrode that has been inserted;
 check the weldability of the base material

Cause: The shielding gas is not suitable for this wire alloy
 Remedy: Use the correct shielding gas

Excessive welding spatter

Cause: Shielding gas, wirefeed, welding torch or workpiece is contaminated or magnetically charged
 Remedy: Perform R/L alignment;
 adjust arc length;
 check whether shielding gas, wirefeed, welding torch position or workpiece is contaminated or magnetically charged

Irregular wire speed

Cause: Braking force has been set too high
 Remedy: Loosen the brake

Cause: Hole in the contact tip is too narrow
 Remedy: Use a suitable contact tip

Cause: Faulty inner liner in welding torch
 Remedy: Check the inner liner for kinks, dirt, etc.

Cause:	The feed rollers are not suitable for the wire electrode being used
Remedy:	Use suitable feed rollers
Cause:	Feed rollers have the wrong contact pressure
Remedy:	Optimise the contact pressure

Wirefeed problems

when using long hosepacks

Cause:	Incorrect arrangement of hosepack
Remedy:	Arrange the hosepack in as straight a line as possible, avoid tight bends

The welding torch becomes very hot

Cause:	Welding torch is inadequately dimensioned
Remedy:	Observe the duty cycle and loading limits
Cause:	Only on water-cooled systems: Inadequate coolant flow
Remedy:	Check coolant fill level, coolant flow, for coolant contamination, etc.

Care, maintenance and disposal

General

Under normal operating conditions, the power source requires only a minimum of care and maintenance. However, it is vital to observe some important points to ensure the welding system remains in a usable condition for many years.

Safety



WARNING! An electric shock can be fatal. Before opening the device

- Turn the mains switch to the "O" position
- Unplug the machine from the mains
- Prevent it from being switched on again
- Using a suitable measuring instrument, check to make sure that electrically charged components (e.g. capacitors) have discharged

At every start-up

- Check mains plug, mains cable, welding torch, interconnecting hosepack and grounding (earthing) connection for damage
- Check whether the all-round clearance of 0.5 m (1 ft. 8 in.) is kept to ensure that the cooling air can easily flow and escape.



NOTE! Air inlets and outlets must never be covered, not even partially.

Every 2 months

- If present: clean air filter

Every 6 months



NOTE! Risk of damage to electronic components. Do not bring air nozzle too close to electronic components.

- open the device
- clean out the device interior using dry compressed air at reduced pressure
- if a lot of dust has accumulated, clean the cooling air ducts.

Updating firm-ware

IMPORTANT! To update the firmware you need a PC or laptop that is connected to the power source via an Ethernet network.

- 1** Get latest firmware (e.g. from the Fronius Download Center)
File format: official_tpsi_x.x.x-xxxx.ffw
- 2** Establish Ethernet connection between PC/laptop and power source
- 3** Open the power source SmartManager (see page 183)
- 4** Transfer the firmware to the power source (see page 197)

Disposal

Dispose of in accordance with the applicable national and local regulations.

Appendix

Technical data

Explanation of the term "duty cycle"

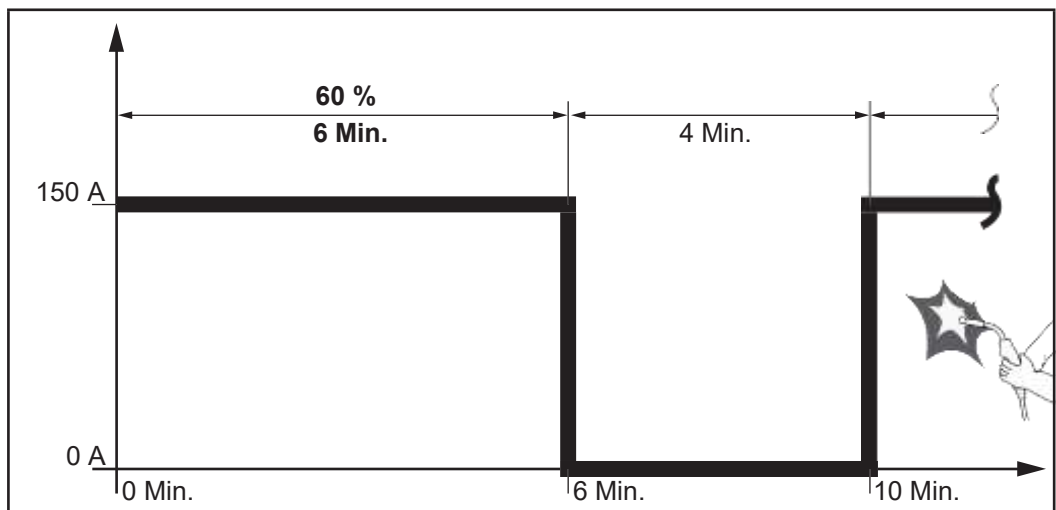
Duty cycle (D.C.) is the proportion of time in a 10-minute cycle at which the device may be operated at its rated output without overheating.



NOTE! The D.C. values specified on the rating plate are based on an ambient temperature of 40°C. If the ambient temperature is higher, either the D.C. or output must be reduced accordingly.

Example: Welding at 150 A at 60% D.C.

- Welding phase = 60% of 10 minutes = 6 minutes
- Cooling phase = remaining time = 4 minutes
- After the cooling phase, the cycle begins anew.



If the device is to be continuously operated without stopping:

- 1 look in the technical data for a D.C. value of 100% for the reigning ambient temperature.
- 2 Reduce the output or amperage in line with this value so that the device can remain in use without observing a cooling phase.

Special voltages

For devices designed for special voltages, the technical data on the rating plate applies.

For all machines with a permitted mains voltage of up to 460 V: The standard mains plug allows the user to operate with a mains voltage of up to 400 V. For mains voltages up to 460 V fit a mains plug permitted for such use or install the mains supply directly.

TPS 320i

Mains voltage (U_1)	3x	400 V
Max. effective primary current ($I_{1\text{eff}}$)		12.3 A
Max. primary current ($I_{1\text{max}}$)		19.4 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/- 15%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Max. permissible mains impedance Z_{max} on PCC ¹⁾		95 mOhm
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 320 A
TIG		3 - 320 A
Rod electrode		10 - 320 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		320 A 260 A 240 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 30.0 V
TIG		10.1 - 22.8 V
Rod electrode		20.4 - 32.8 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		73 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
EMC device class		A ²⁾
Safety symbols		S, CE
Dimensions l x w x h		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		35.0 kg 77.2 lb.
Max. noise emission (LWA)		74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		12.7 A	12.3 A	11.4 A
Max. primary current ($I_{1\text{max}}$)		20.1 A	19.4 A	18.0 A
Mains fuse protection			35 A slow-blow	
Mains voltage tolerance				+/-15%
Mains frequency				50/60 Hz
Cos phi (1)				0.99
Max. permitted mains impedance Z_{max} on PCC ¹⁾				95 mOhm
Recommended earth-leakage circuit breaker				Type B
Welding current range (I_2)				
MIG/MAG				3 - 320 A
TIG				3 - 320 A
Rod electrode				10 - 320 A
Welding current at 10 min/40 °C (104 °F)		40%	60%	100%
$U_1 = 380 - 460 \text{ V}$		320 A	260 A	240 A
Output voltage range according to standard characteristic (U_2)				
MIG/MAG				14.2 - 30.0 V
TIG				10.1 - 22.8 V
Rod electrode				20.4 - 32.8 V
Open circuit voltage (U_0 peak / U_0 r.m.s)				84 V
Degree of protection				IP 23
Type of cooling				AF
Overvoltage category				III
Pollution level according to IEC60664				3
EMC device class				A ²⁾
Safety symbols				S, CE, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm		27.8 x 11.8 x 20.1 in.
Weight				33.7 kg 74.3 lb.
Max. noise emission (LWA)				74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system.
There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated radio-frequency disturbances.

TPS 320i /600V/nc

Mains voltage (U_1)	3 x	575 V
Max. effective primary current ($I_{1\text{eff}}$)		10.6 A
Max. primary current ($I_{1\text{max}}$)		16.7 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-10%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 320 A
TIG		3 - 320 A
Rod electrode		10 - 320 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		320 A 260 A 240 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 30.0 V
TIG		10.1 - 22.8 V
Rod electrode		20.4 - 32.8 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		67 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
Safety symbols		S, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		32.7 kg 72.1 lb.
Max. noise emission (LWA)		74 dB (A)

Mains voltage (U_1)	3 x	200 V	230 V
Max. effective primary current ($I_{1\text{eff}}$)		22.0 A	19.0 A
Max. primary current ($I_{1\text{max}}$)		34.7 A	30.1 A
Mains fuse protection		35 A slow-blow	
Mains voltage (U_1)	3 x	380 V	400 V 460 V
Max. effective primary current ($I_{1\text{eff}}$)		12.0 A	11.6 A 10.7 A
Max. primary current ($I_{1\text{max}}$)		19.0 A	18.3 A 16.8 A
Mains fuse protection		35 A slow-blow	
Mains voltage tolerance		-10 / +15%	
Mains frequency		50/60 Hz	
Cos phi (1)		0.99	
Max. permissible mains impedance Z_{max} on PCC ¹⁾		54 mOhm	
Recommended earth-leakage circuit breaker		Type B	
Welding current range (I_2)			
MIG/MAG			3 - 320 A
TIG			3 - 320 A
Rod electrode			10 - 320 A
Welding current at 10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 200 - 230 \text{ V}$	320 A	260 A	240 A
$U_1 = 380 - 460 \text{ V}$	320 A	260 A	240 A
Output voltage range according to standard characteristic (U_2)			
MIG/MAG			14.2 - 30.0 V
TIG			10.1 - 22.8 V
Rod electrode			20.4 - 32.8 V
Open circuit voltage (U_0 peak / U_0 r.m.s)			68 V
Degree of protection			IP 23
Type of cooling			AF
Overvoltage category			III
Pollution level according to IEC60664			3
EMC device class			A ²⁾
Safety symbols			S, CE, CSA
Dimensions l x w x h			706 x 300 x 510 mm/27.8 x 11.8 x 20.1 in.
Weight			42.8 kg / 94.4 lb.
Max. noise emission (LWA)			74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

TPS 400i

Mains voltage (U_1)	3 x	400 V
Max. effective primary current ($I_{1\text{eff}}$)		15.9 A
Max. primary current ($I_{1\text{max}}$)		25.1 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-15%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Max. permitted mains impedance Z_{max} on PCC ¹⁾		92 mOhm
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 400 A
TIG		3 - 400 A
Rod electrode		10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		400 A 360 A 320 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 34.0 V
TIG		10.1 - 26.0 V
Rod electrode		20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		73 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
EMC device class		A ²⁾
Safety symbols		S, CE
Dimensions (l x w x h)		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		36.5 kg 80.5 lb.
Max. noise emission (LWA)		74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system.
There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated radio-frequency disturbances.

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		16.5 A	15.9 A	14.6 A
Max. primary current ($I_{1\text{max}}$)		26.1 A	25.1 A	23.5 A
Mains fuse protection			35 A slow-blow	
Mains voltage tolerance				+/- 15%
Mains frequency				50/60 Hz
Cos phi (1)				0.99
Max. permissible mains impedance Z_{max} on PCC ¹⁾				92 mOhm
Recommended earth-leakage circuit breaker				Type B
Welding current range (I_2)				
MIG/MAG				3 - 400 A
TIG				3 - 400 A
Rod electrode				10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 380 - 460 \text{ V}$		400 A	360 A	320 A
Output voltage range according to standard characteristic (U_2)				
MIG/MAG				14.2 - 34.0 V
TIG				10.1 - 26.0 V
Rod electrode				20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)				83 V
Degree of protection				IP 23
Type of cooling				AF
Overvoltage category				III
Pollution level according to IEC60664				3
EMC device class				A ²⁾
Safety symbols				S, CE, CSA
Dimensions l x w x h		706 x 300 x 510 mm		27.8 x 11.8 x 20.1 in.
Weight				35.2 kg 77.6 lb.
Max. noise emission (LWA)				74 dB (A)

1) Interface to a 230/400 V, 50 Hz public grid

2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

TPS 400i /600V/nc

Mains voltage (U_1)	3 x	575 V
Max. effective primary current ($I_{1\text{eff}}$)		14.3A
Max. primary current ($I_{1\text{max}}$)		22.6 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-10%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 400 A
TIG		3 - 400 A
Rod electrode		10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		400 A 360 A 320 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 34.0 V
TIG		10.1 - 26.0 V
Rod electrode		20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		68 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
Safety symbols		S, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		34.6 kg 76.3 lb.
Max. noise emission (LWA)		74 dB (A)

Mains voltage (U_1)	3 x	200 V	230 V
Max. effective primary current ($I_{1\text{eff}}$)		30.5 A	26.4 A
Max. primary current ($I_{1\text{max}}$)		48.2 A	41.6 A
Mains fuse protection		35 A slow-blow	
Mains voltage (U_1)	3 x	380 V	400 V 460 V
Max. effective primary current ($I_{1\text{eff}}$)		16.2 A	15.5 A 14.0 A
Max. primary current ($I_{1\text{max}}$)		25.5 A	24.4 A 22.1 A
Mains fuse protection		35 A slow-blow	
Mains voltage tolerance		-10 / +15%	
Mains frequency		50/60 Hz	
Cos phi (1)		0.99	
Max. permissible mains impedance Z_{max} on PCC ¹⁾		74 mOhm	
Recommended earth-leakage circuit breaker		Type B	
Welding current range (I_2)			
MIG/MAG			3 - 400 A
TIG			3 - 400 A
Rod electrode			10 - 400 A
Welding current at 10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 200 - 230 \text{ V}$	400 A	360 A	320 A
$U_1 = 380 - 460 \text{ V}$	400 A	360 A	320 A
Output voltage range according to standard characteristic (U_2)			
MIG/MAG			14.2 - 34.0 V
TIG			10.1 - 26.0 V
Rod electrode			20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)			67 V
Degree of protection			IP 23
Type of cooling			AF
Overvoltage category			III
Pollution level according to IEC60664			3
EMC device class			A ²⁾
Safety symbols			S, CE, CSA
Dimensions l x w x h		706 x 300 x 510 mm/27.8 x 11.8 x 20.1 in.	
Weight		47.1 kg / 103.8 lb.	
Max. noise emission (LWA)		74 dB (A)	

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

**TPS 400i LSC
ADV**

Mains voltage (U_1)	3 x	400 V
Max. effective primary current ($I_{1\text{eff}}$)		16.4 A
Max. primary current ($I_{1\text{max}}$)		25.1 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-15%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Max. permitted mains impedance Z_{max} on PCC ¹⁾		92 mOhm
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 400 A
TIG		3 - 400 A
Rod electrode		10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		400 A 360 A 320 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 34.0 V
TIG		10.1 - 26.0 V
Rod electrode		20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		73 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
EMC device class		A ²⁾
Safety symbols		S, CE
Dimensions (l x w x h)		706 x 300 x 720 mm 27.8 x 11.8 x 28.3 in.
Weight		55.7 kg 122.8 lb.
Max. noise emission (LWA)		77 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system.
There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated radio-frequency disturbances.

TPS 400i LSC
ADV /nc

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		17.1 A	16.4 A	14.8 A
Max. primary current ($I_{1\text{max}}$)		27.0 A	25.9 A	23.4 A
Mains fuse protection			35 A slow-blow	
Mains voltage tolerance				+/-15%
Mains frequency				50/60 Hz
Cos phi (1)				0.99
Max. permitted mains impedance Z_{max} on PCC ¹⁾				92 mOhm
Recommended earth-leakage circuit breaker				Type B
Welding current range (I_2)				
MIG/MAG				3 - 400 A
TIG				3 - 400 A
Rod electrode				10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 380 - 460 \text{ V}$		400 A	360 A	320 A
Output voltage range according to standard characteristic (U_2)				
MIG/MAG				14.2 - 34.0 V
TIG				10.1 - 26.0 V
Rod electrode				20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)				84 V
Degree of protection				IP 23
Type of cooling				AF
Overvoltage category				III
Pollution level according to IEC60664				3
EMC device class				A ²⁾
Safety symbols				S, CE
Dimensions (l x w x h)		706 x 300 x 720 mm		27.8 x 11.8 x 28.4 in.
Weight				54.4 kg 119.9 lb.
Max. noise emission (LWA)				77 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system.
There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated radio-frequency disturbances.

TPS 400i LSC
ADV /600V/nc

Mains voltage (U_1)	3 x	575 V
Max. effective primary current ($I_{1\text{eff}}$)		14.3 A
Max. primary current ($I_{1\text{max}}$)		22.6 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-10%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 400 A
TIG		3 - 400 A
Rod electrode		10 - 400 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		400 A 360 A 320 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 34.0 V
TIG		10.1 - 26.0 V
Rod electrode		20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		70 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
Safety symbols		S, CSA
Dimensions (l x w x h)		706 x 300 x 720 mm 27.8 x 11.8 x 28.4 in.
Weight		50.2 kg 110.7 lb.
Max. noise emission (LWA)		77 dB (A)

Mains voltage (U_1)	3 x	200 V	230 V
Max. effective primary current (I_{1eff})		30.5 A	26.4 A
Max. primary current (I_{1max})		48.2 A	41.6 A
Mains fuse protection		35 A slow-blow	
Mains voltage (U_1)	3 x	380 V	400 V 460 V
Max. effective primary current (I_{1eff})		16.2 A	15.5 A 14.0 A
Max. primary current (I_{1max})		25.5 A	24.4 A 22.1 A
Mains fuse protection		35 A slow-blow	
Mains voltage tolerance		-10 / +15%	
Mains frequency		50/60 Hz	
Cos phi (1)		0.99	
Max. permissible mains impedance Z_{max} on PCC ¹⁾		45 mOhm	
Recommended earth-leakage circuit breaker		Type B	
Welding current range (I_2)			
MIG/MAG			3 - 400 A
TIG			3 - 400 A
Rod electrode			10 - 400 A
Welding current at 10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 200 - 230$ V	400 A	360 A	320 A
$U_1 = 380 - 460$ V	400 A	360 A	320 A
Output voltage range according to standard characteristic (U_2)			
MIG/MAG			14.2 - 34.0 V
TIG			10.1 - 26.0 V
Rod electrode			20.4 - 36.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)			67 V
Degree of protection			IP 23
Type of cooling			AF
Overvoltage category			III
Pollution level according to IEC60664			3
EMC device class			A ²⁾
Safety symbols			S, CE, CSA
Dimensions l x w x h		706 x 300 x 720 mm/27.8 x 11.8 x 28.4 in.	
Weight		63.6 kg / 140.2 lb.	
Max. noise emission (LWA)		77 dB (A)	

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

TPS 500i

Mains voltage (U_1)	3 x	400 V
Max. effective primary current ($I_{1\text{eff}}$)		23.7 A
Max. primary current ($I_{1\text{max}}$)		37.5 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/- 15%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Max. permissible mains impedance Z_{max} on PCC ¹⁾		49 mOhm
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 500 A
TIG		3 - 500 A
Rod electrode		10 - 500 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		500 A 430 A 360 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 39.0 V
TIG		10.1 - 30.0 V
Rod electrode		20.4 - 40.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		71 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
EMC device class		A ²⁾
Safety symbols		S, CE
Dimensions l x w x h		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		38 kg 83.8 lb.
Max. noise emission (LWA)		74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		24.5 A	23.7 A	21.9 A
Max. primary current ($I_{1\text{max}}$)		38.8 A	37.5 A	34.7 A
Mains fuse protection			35 A slow-blow	
Mains voltage tolerance			-10/+15%	
Mains frequency			50/60 Hz	
Cos phi (1)			0.99	
Max. permitted mains impedance Z_{max} on PCC ¹⁾			49 mOhm	
Recommended earth-leakage circuit breaker			Type B	
Welding current range (I_2)				
MIG/MAG				3 - 500 A
TIG				3 - 500 A
Rod electrode				10 - 500 A
Welding current at 10 min/40 °C (104 °F)		40%	60%	100%
$U_1 = 380 - 460 \text{ V}$		500 A	430 A	360 A
Output voltage range according to standard characteristic (U_2)				
MIG/MAG				14.2 - 39.0 V
TIG				10.1 - 30.0 V
Rod electrode				20.4 - 40.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)				82 V
Degree of protection				IP 23
Type of cooling				AF
Overvoltage category				III
Pollution level according to IEC60664				3
EMC device class				A ²⁾
Safety symbols				S, CE, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm		27.8 x 11.8 x 20.1 in.
Weight				36.7 kg 80.9 lb.
Max. noise emission (LWA)				74 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system.
There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated radio-frequency disturbances.

TPS 500i /600V/nc

Mains voltage (U_1)	3 x	575 V
Max. effective primary current ($I_{1\text{eff}}$)		19.7 A
Max. primary current ($I_{1\text{max}}$)		31.2 A
Mains fuse protection		35 A slow-blow
Mains voltage tolerance		+/-10%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 500 A
TIG		3 - 500 A
Rod electrode		10 - 500 A
Welding current at	10 min/40 °C (104 °F)	40% 60% 100%
		500 A 430 A 360 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 39.0 V
MIG/MAG		10.1 - 30.0 V
Rod electrode		20.4 - 40.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		71 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
Safety symbols		S, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		34.9 kg 76.9 lb.
Max. noise emission (LWA)		74 dB (A)

Mains voltage (U_1)	3 x	200 V	230 V
Max. effective primary current ($I_{1\text{eff}}$)		43.5 A	37.4 A
Max. primary current ($I_{1\text{max}}$)		68.8 A	59.2 A
Mains fuse protection		63 A slow-blow	
Mains voltage (U_1)	3 x	380 V	400 V 460 V
Max. effective primary current ($I_{1\text{eff}}$)		22.7 A	21.6 A 19.2 A
Max. primary current ($I_{1\text{max}}$)		35.9 A	34.1 A 30.3 A
Mains fuse protection		35 A slow-blow	
Mains voltage tolerance		-10 / +15%	
Mains frequency		50/60 Hz	
Cos phi (1)		0.99	
Max. permissible mains impedance Z_{max} on PCC ¹⁾		38 mOhm	
Recommended earth-leakage circuit breaker		Type B	
Welding current range (I_2)			
MIG/MAG			3 - 500 A
TIG			3 - 500 A
Rod electrode			10 - 500 A
Welding current at 10 min/40 °C (104 °F)	40%	60%	100%
$U_1 = 200 - 230 \text{ V}$	500 A	430 A	360 A
$U_1 = 380 - 460 \text{ V}$	500 A	430 A	360 A
Output voltage range according to standard characteristic (U_2)			
MIG/MAG			14.2 - 39.0 V
TIG			10.1 - 30.0 V
Rod electrode			20.4 - 40.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)			68 V
Degree of protection			IP 23
Type of cooling			AF
Overvoltage category			III
Pollution level according to IEC60664			3
EMC device class			A ²⁾
Safety symbols			S, E, CSA
Dimensions l x w x h		706 x 300 x 510 mm/27.8 x 11.8 x 20.1 in.	
Weight		47.1 kg / 103.8 lb.	
Max. noise emission (LWA)		74 dB (A)	

1) Interface to a 230/400 V, 50 Hz public grid

2) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

TPS 600i

Mains voltage (U_1)	3 x	400 V
Max. effective primary current ($I_{1\text{eff}}$)		44.4 A
Max. primary current ($I_{1\text{max}}$)		57.3 A
Mains fuse protection		63 A slow-blow
Mains voltage tolerance		+/- 15%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Max. permissible mains impedance Z_{max} on PCC ¹⁾	Possible connection restrictions ²⁾	
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 600 A
TIG		3 - 600 A
Rod electrode		10 - 600 A
Welding current at	10 min/40 °C (104 °F)	60% 100% 600 A 500 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 44.0 V
TIG		10.1 - 34.0 V
Rod electrode		20.4 - 44.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		74 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
EMC device class		A ³⁾
Safety symbols		S, CE
Dimensions l x w x h		706 x 300 x 510 mm/27.8 x 11.8 x 20.1 in.
Weight		50 kg / 100.2 lb.
Max. shielding gas pressure		7.0 bar / 101.5 psi
Coolant		Original Fronius
Max. noise emission (LWA)		83 dB (A)

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) Discuss the matter with the grid operator before connecting the device to the public grid!
- 3) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		46.6 A	44.4 A	39.2 A
Max. primary current ($I_{1\text{max}}$)		60.1 A	57.3 A	50.6 A
Mains fuse protection		63 A slow-blow		
Mains voltage tolerance		- 10 / + 15%		
Mains frequency		50/60 Hz		
Cos phi (1)		0.99		
Max. permissible mains impedance Z_{max} on PCC ¹⁾		Possible connection restrictions ²⁾		
Recommended earth-leakage circuit breaker		Type B		
Welding current range (I_2)				
MIG/MAG		3 - 600 A		
TIG		3 - 600 A		
Rod electrode		10 - 600 A		
Welding current at	10 min/40 °C (104 °F)	60%	100%	
$U_1 = 380 - 460 \text{ V}$		600 A	500 A	
Output voltage range according to standard characteristic (U_2)				
MIG/MAG		14.2 - 44.0 V		
TIG		10.1 - 34.0 V		
Rod electrode		20.4 - 40.0 V		
Open circuit voltage (U_0 peak / U_0 r.m.s)		85 V		
Degree of protection		IP 23		
Type of cooling		AF		
Overvoltage category		III		
Pollution level according to IEC60664		3		
EMC device class		A ³⁾		
Safety symbols		S, CE, CSA		
Dimensions l x w x h		706 x 300 x 510 mm/27.8 x 11.8 x 20.1 in.		
Weight		47.0 kg / 103.6 lb.		
Max. shielding gas pressure		7.0 bar / 101.49 psi		
Coolant		Original Fronius		
Max. noise emission (LWA)		83 dB (A)		

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) Discuss the matter with the grid operator before connecting the device to the public grid!
- 3) An emission class A device is not designed for use in residential areas supplied with power from a public low-voltage grid.
The electromagnetic compatibility can be influenced by conducted or radiated radio frequencies.

TPS 600i /600V/nc

Mains voltage (U_1)	3 x	575 V
Max. effective primary current ($I_{1\text{eff}}$)		37.6A
Max. primary current ($I_{1\text{max}}$)		48.5 A
Mains fuse protection		63 A slow-blow
Mains voltage tolerance		+/-10%
Mains frequency		50/60 Hz
Cos phi (1)		0.99
Recommended earth-leakage circuit breaker		Type B
Welding current range (I_2)		
MIG/MAG		3 - 600 A
TIG		3 - 600 A
Rod electrode		10 - 600 A
Welding current at	10 min/40 °C (104 °F)	60% 100%
		600 A 500 A
Output voltage range according to standard characteristic (U_2)		
MIG/MAG		14.2 - 44.0 V
TIG		10.1 - 34.0 V
Rod electrode		20.4 - 44.0 V
Open circuit voltage (U_0 peak / U_0 r.m.s)		73 V
Degree of protection		IP 23
Type of cooling		AF
Overvoltage category		III
Pollution level according to IEC60664		3
Safety symbols		S, CSA
Dimensions (l x w x h)		706 x 300 x 510 mm 27.8 x 11.8 x 20.1 in.
Weight		42.0 kg 92.6 lb.
Max. shielding gas pressure		7 bar 101.49 psi
Coolant		Original Fronius
Max. noise emission (LWA)		83 dB (A)

Spare parts list: TPS 320i / 400i / 500i / 600i

736 320L	4,075,172
736 320L/QF	4,075,172,800

736 320L /09/QF	4,075,172,830
736 320L /6009/QF	4,075,172,970
736 320L 3XOVH	4,075,178
736 320L 3XOVH /QF	4,075,178,800
736 320L 3XOVH /09/QF	4,075,178,830
736 320L 3XOVH /6009/QF	4,075,178,970

736 400L	4,075,174
736 400L/QF	4,075,174,800

736 400L /09/QF	4,075,174,830
736 400L /6009/QF	4,075,174,970
736 400L 3XOVH	4,075,179
736 400L 3XOVH /QF	4,075,179,800

736 400L 3XOVH /09/QF	4,075,179,830
736 400L 3XOVH /6009/QF	4,075,179,970

736 500L	4,075,176
736 500L/QF	4,075,176,800

736 500L /09/QF	4,075,176,830
736 500L /6009/QF	4,075,176,970
736 500L 3XOVH	4,075,180
736 500L 3XOVH /QF	4,075,180,800

736 500L 3XOVH /09/QF	4,075,180,830
736 500L 3XOVH /6009/QF	4,075,180,970

736 600L	4,075,177
736 600L/QF	4,075,177,800

736 600L /6009/QF	4,075,177,970
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736 600L 3XOVH	4,075,181
736 600L 3XOVH /QF	4,075,181,800

736 600L 3XOVH /6009/QF	4,075,181,970
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42,0201,2966

42,0201,7321

42,0405,0754

42,0405,0691

42,0409,3376 736 320L
42,0409,3377 736 400L
42,0409,3375 736 500L
42,0409,5196 736 600L

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45,0200,1354

42,0405,0692

42,0405,0689

42,0405,0690

45,0200,1354

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43,0004,0782 (600L)

42,0405,2006 - QF

43,0001,1418

42.0300.1511

42,0405,0928

42,0405,0861

42,0405,0692

41,0005,0402 (600L)

42,0405,0927

42,0405,0805

41,0001,0704 (600L)

42,0300,2456

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43,0003,1444

43,0004,4354
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41,0009,0306
33,0024,0051
33,0024,0033 (600L)

42,0405,0846
42,0201,4626 (600L)

43,0004,4340
(QFR-0&8

42,0409,0007 - QF
42,0409,2902

42,0405,0837

42,0405,0838

42,0405,1107

42,0405,0836

43,0006,0295
43,0006,0308 (600L)

42,0405,0844

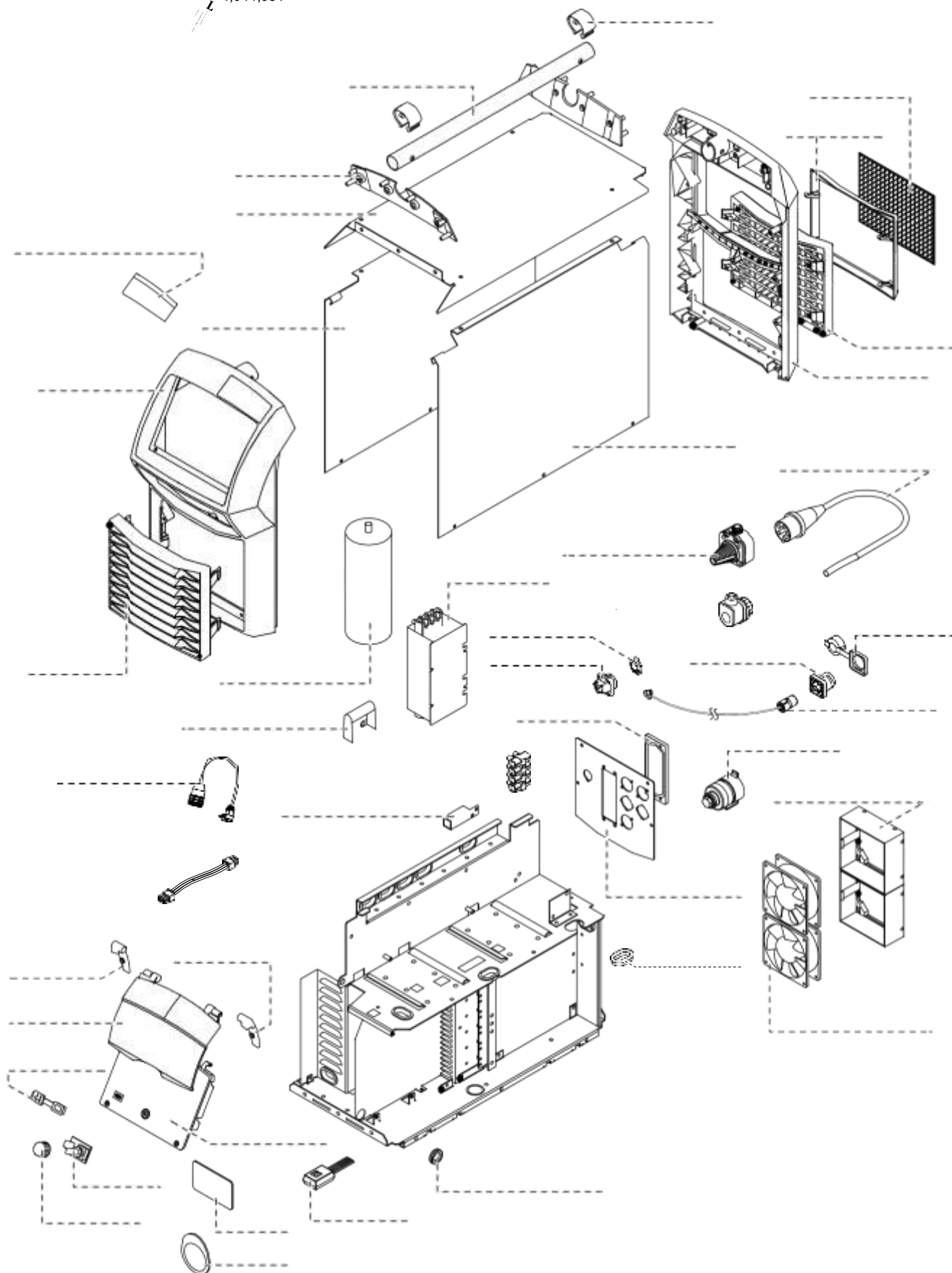
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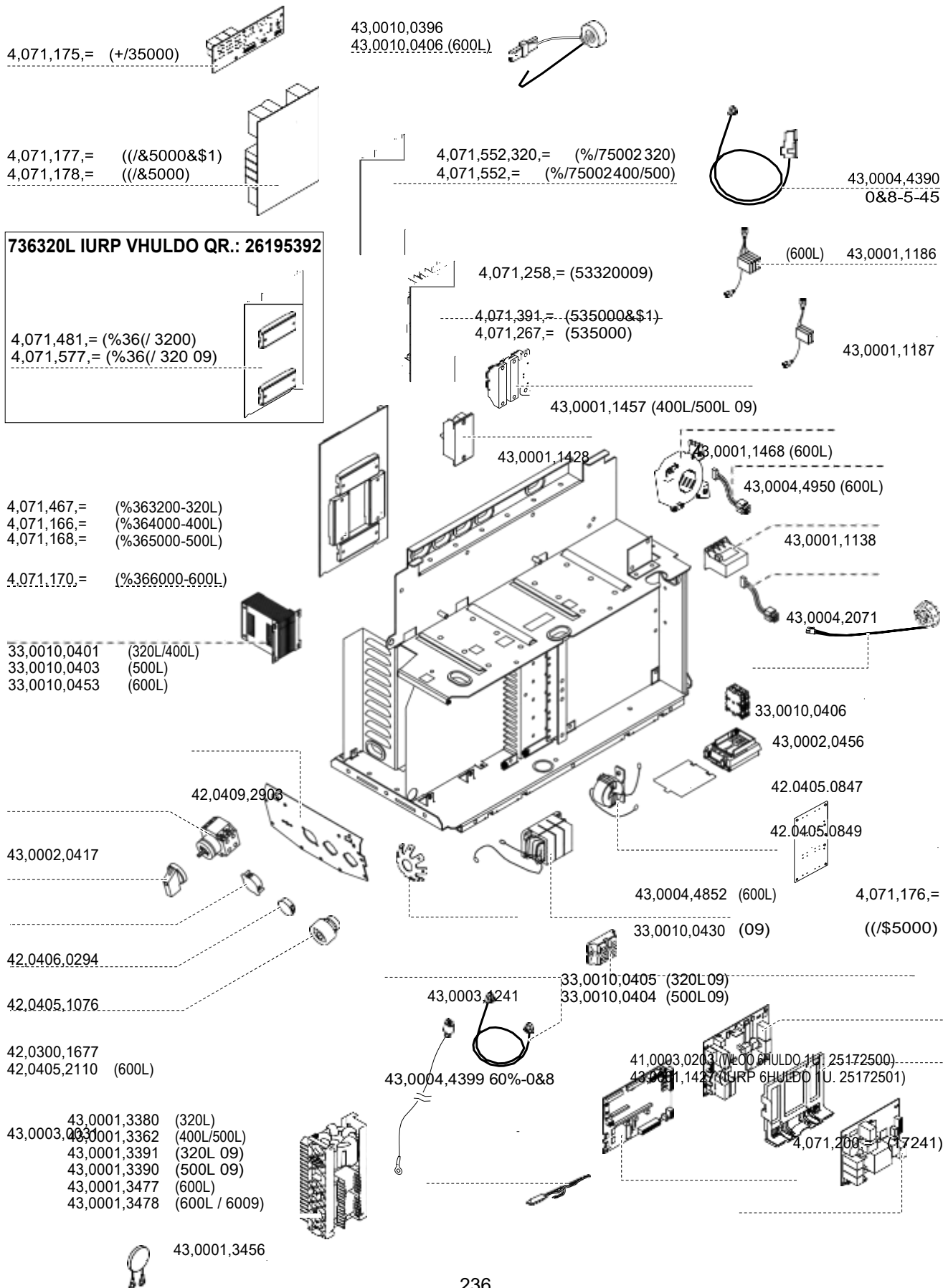
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4,044,031





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42,0405,0828

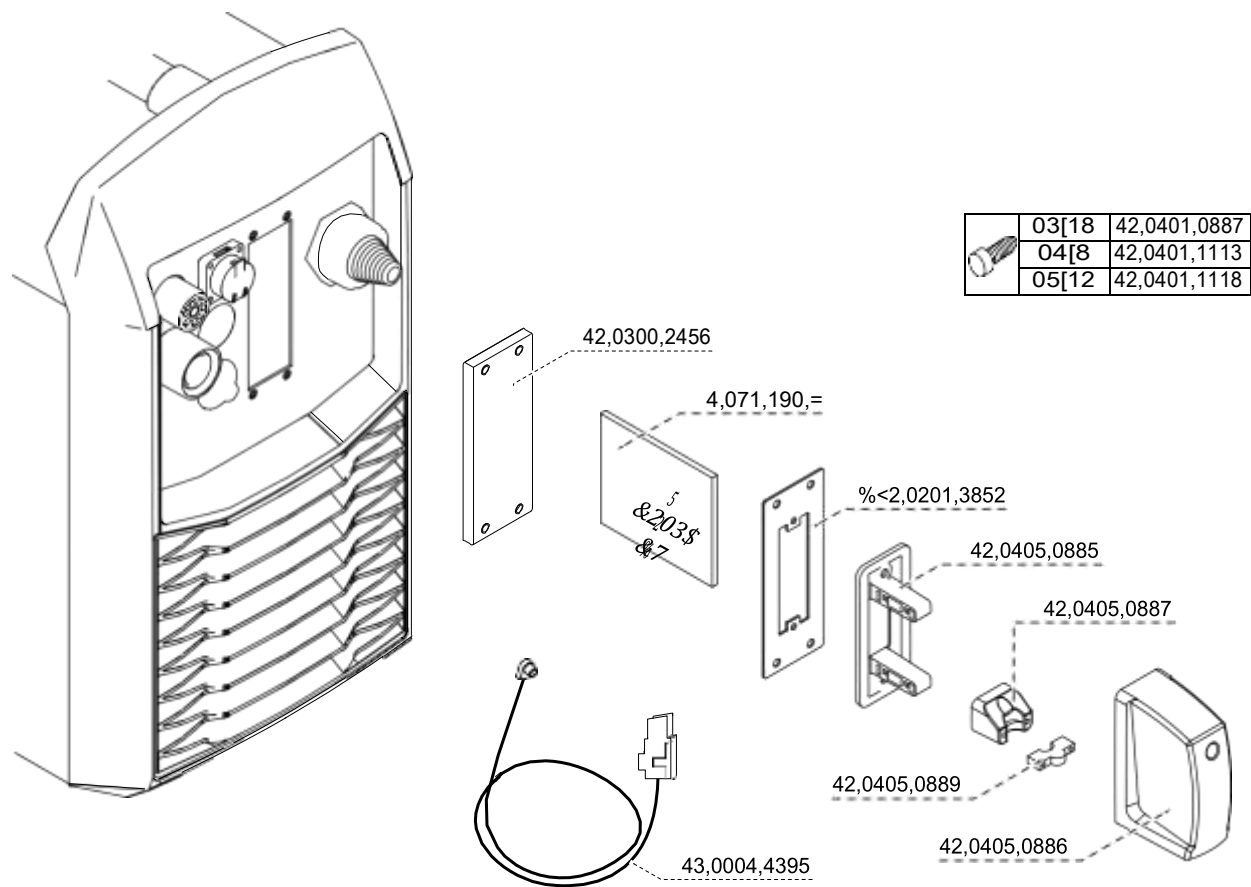
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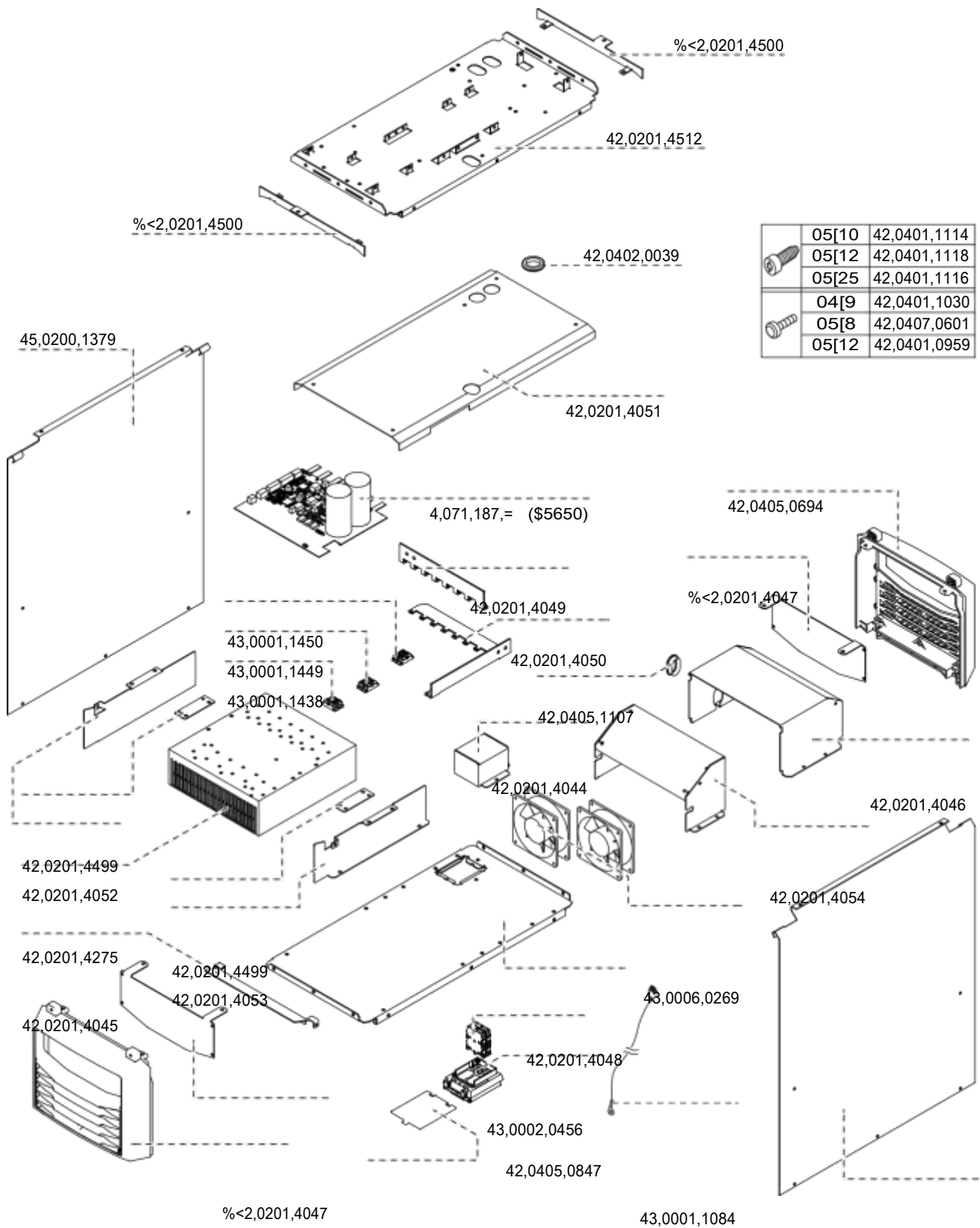
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4,044,014



736 400L /6& \$'9	4,075,175
736 400L /6& \$'9 /QF	4,075,175,800
736 400L /6& \$'9 /09/QF	4,075,175,830
736 400L /6& \$'9 /6009/QF	4,075,175,970



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	05[8	42,0407,0601
	05[12	42,0401,0959

42,0405,0694

42,0405,0849

45,0200,1379



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