

TransSteel 3500 Syn
TransSteel 5000 Syn

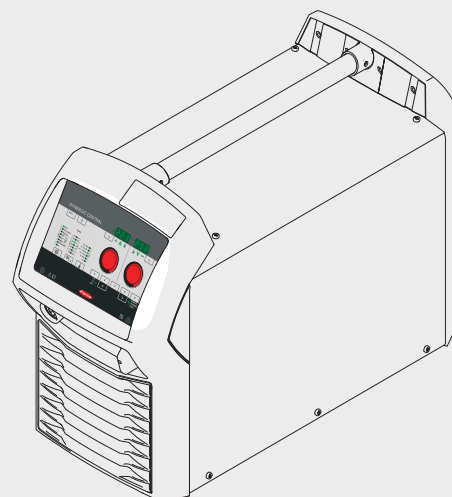
EN

Operating instructions

MIG/MAG power source



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Safety rules

Explanation of safety notices

DANGER!

Indicates **immediate danger**.

- ▶ If not avoided, death or serious injury will result.

WARNING!

Indicates a **potentially hazardous situation**.

- ▶ If not avoided, death or serious injury may result.

CAUTION!

Indicates a **situation where damage or injury could occur**.

- ▶ If not avoided, minor injury and/or damage to property may result.

NOTE!

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

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.

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.

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 device types 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.

IMPORTANT! Ensure that the mains connection is earthed properly

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.

Danger from toxic gases and vapours

The fumes produced during welding contain harmful gases and vapours.

Welding fumes contain substances that cause cancer, as stated in Monograph 118 of the International Agency for Research on Cancer.

Use at-source extraction and a room extraction system.

If necessary, use a welding torch with an integrated extraction device.

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. Ensure that there is a ventilation rate of at least 20 m³ per hour at all times.

Otherwise, a welding helmet with an air supply must be worn.

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.

The following components are responsible, amongst other things, for the degree of toxicity of welding fumes:

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

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

Recommendations for trade fair scenarios, risk management measures and for identifying working conditions can be found on the European Welding Association website under Health & Safety (<https://european-welding.org>).

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

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

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 wirespool, 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 base or cover for the earth or ground potential. This base 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 pretension.

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.

Protection class I devices require a mains supply with ground conductor and a connector system with ground conductor contact for proper operation.

Operation of the device on a mains supply without ground conductor and on a socket without ground conductor contact is only permitted if all national regulations for protective separation are observed.

Otherwise, this is considered gross negligence. The manufacturer shall not be held liable for any damage arising from such usage.

If necessary, provide adequate earthing 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.

Position the device with sufficient insulation against electrically conductive environments, e.g. Insulation against conductive floor or insulation to conductive racks.

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 wirespool to the wirefeeder.

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.

Requirement for the shielding gas

Especially with ring lines, contaminated shielding gas can cause damage to equipment and reduce welding quality.

Meet the following requirements regarding shielding gas quality:

- Solid particle size < 40 µm
 - Pressure condensation point < -20 °C
 - Max. oil content < 25 mg/m³
-

Use filters if necessary.

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 effects 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.

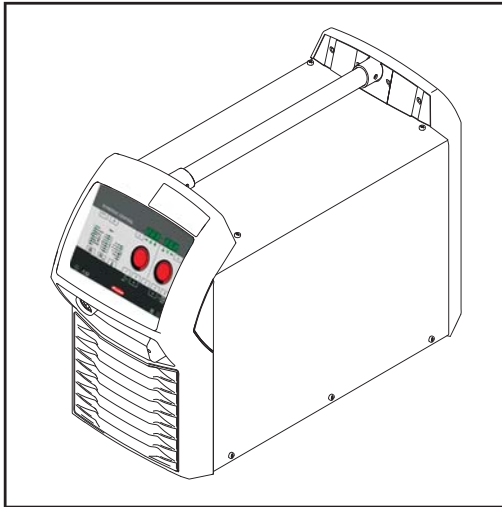
Data protection The user is responsible for the safekeeping of any changes made to the factory settings. The manufacturer accepts no liability for any deleted personal settings.

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



TransSteel 3500 / 5000 Syn

The TransSteel (TSt) 3500 Syn and TSt 5000 Syn power sources are fully digitised, microprocessor-controlled inverter power sources.

The modular design and potential for system add-ons ensure a high degree of flexibility.

The devices are designed for the welding of steel and the following welding processes:

- MAG welding
- MMA welding

The device has a "Power limitation" safety feature. This means that the power source can be operated at the power limit without compromising process safety. For more information, see the "Welding mode" section.

Functional principle

The central control and regulation unit of the power source is coupled with a digital signal processor. The central control and regulation unit and 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 command values are kept.

This results in:

- a precise welding process,
- a high degree of reproducibility of all results,
- excellent weld properties.

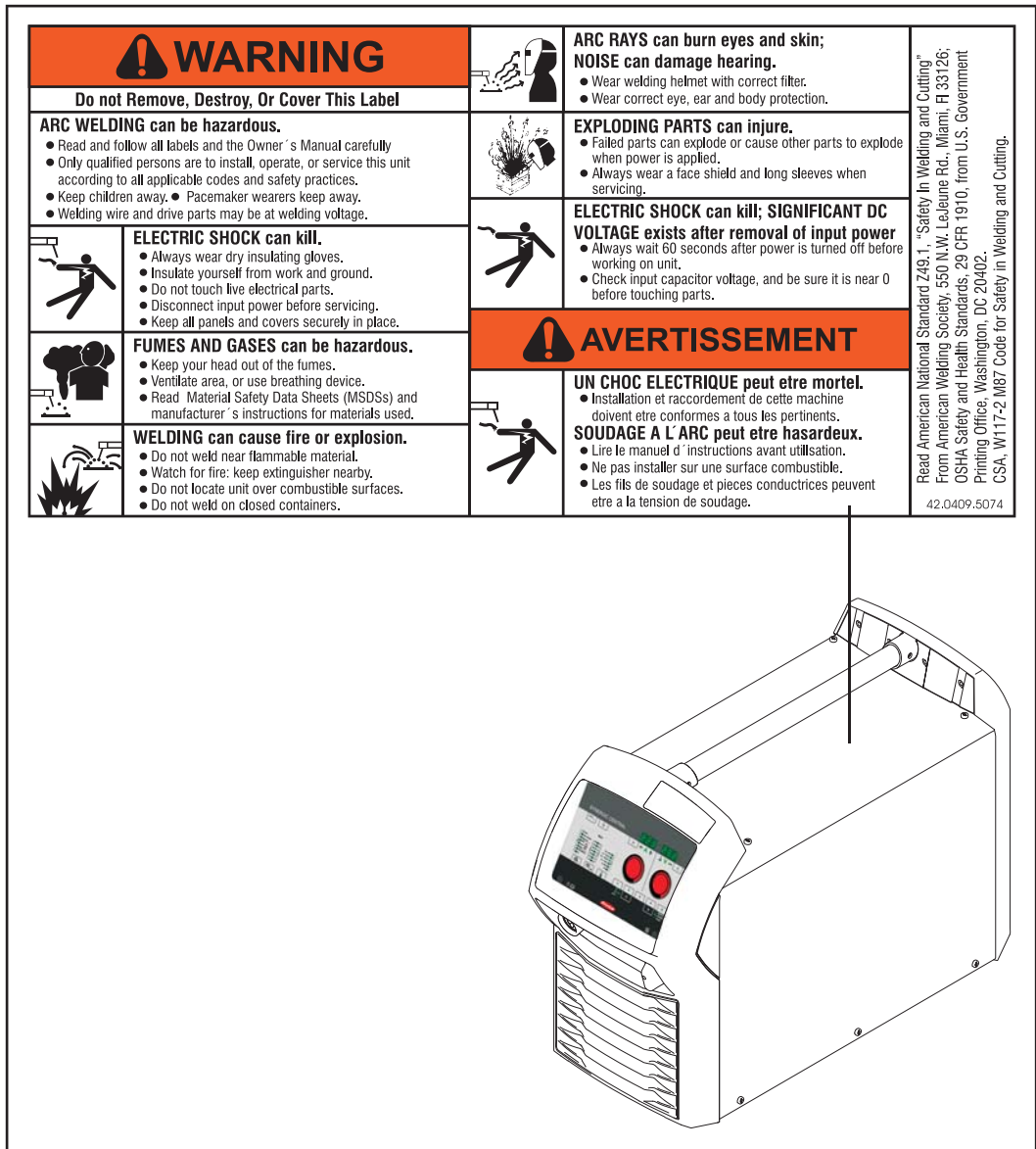
Application areas

The devices are used in the commercial sector for manual and automated applications with classical steel and galvanised sheets:

- Machine and equipment construction
- Steelwork
- Plant and container construction
- Shipyards and the offshore industry
- Metal and gantry construction
- Rail vehicle construction
- Metalworking trades

Warning notices on the device

Warning notices and safety symbols are affixed to the power source. These warning notices and safety symbols must not be removed or painted over. They warn against incorrect operation, as this may result in serious injury and damage.



Warning notices affixed to the power source



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 fully 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 Power sources offer 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 When selecting the filler metal, various process-optimised welding characteristics are available depending on the welding process and shielding gas combination. The supplementary label for the welding process provides information about certain properties and the use of the welding characteristic:

Special welding characteristic properties:

Steel	Characteristics for conventional welding tasks
Steel root	Characteristics for root passes with powerful arc
Steel dynamic	Characteristics for high welding speeds with concentrated arc

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:

Dip transfer 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.

Short description of arc air gouging

During arc air gouging, an arc is ignited between a carbon electrode and the workpiece, and the base material is melted and cleaned with compressed air.

The operating parameters for arc air gouging are defined in a special characteristic.

Applications:

- Removing shrink holes, pores, or slag inclusions from workpieces
- Detaching sprue or finishing entire workpiece surfaces in casting operations
- Edge preparation for heavy plates
- Preparation and repair of weld seams
- Working out root passes or defects
- Production of air gaps

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.

Safety

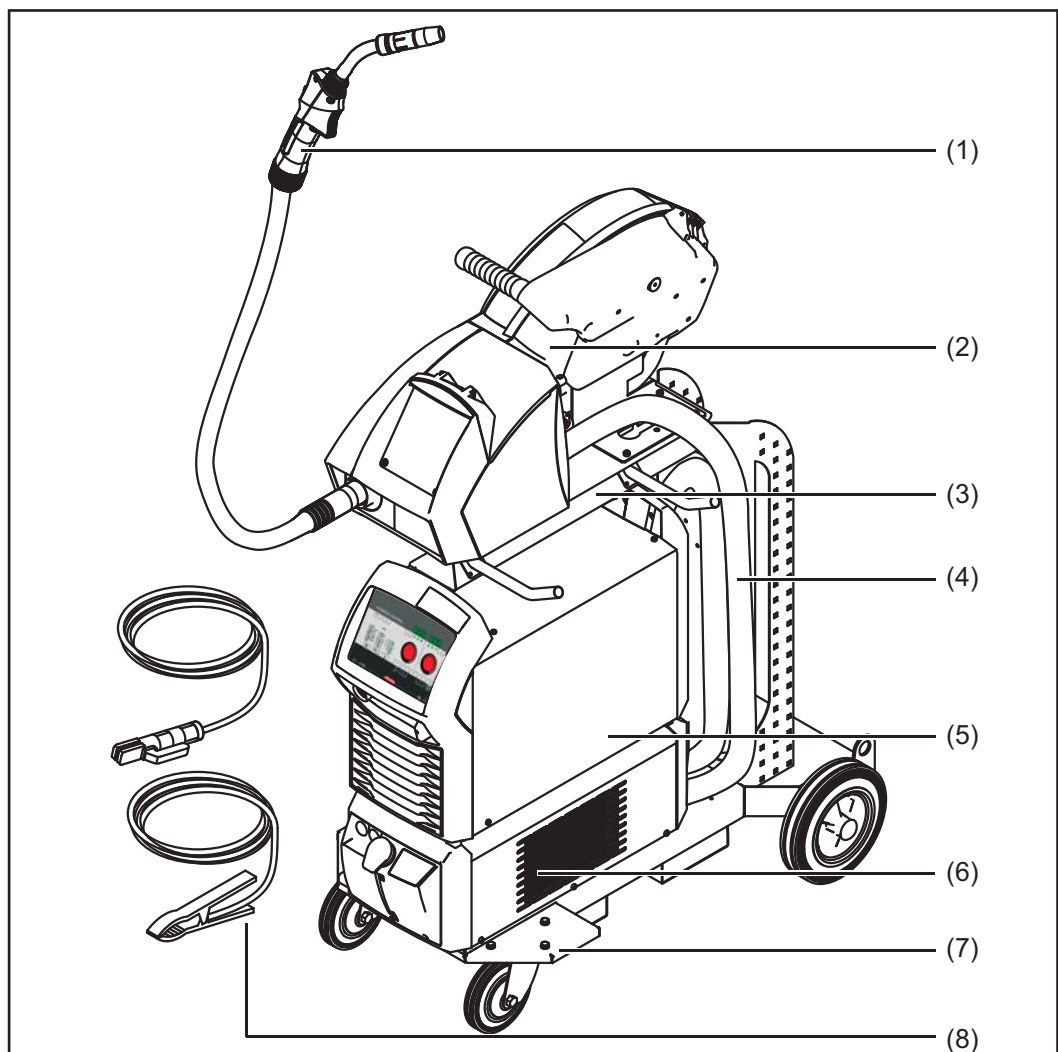
⚠ WARNING!

Danger from incorrect operation.

Possible serious injury and damage to property.

- ▶ Do not use the functions described here until you have read and completely understood these Operating Instructions.
- ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions for the system components, in particular the safety rules!

Overview



- (1) Welding torch
- (2) Wirefeeder
- (3) Wirefeeder holder
- (4) Interconnecting hosepacks
- (5) Power source
- (6) Cooling unit
- (7) Trolley and gas cylinder holders
- (8) Grounding cable and electrode cable

Options

General The options listed below are available with all power source variants.

Machine interface The machine interface connects the power source to the machine control. The following signals can be transmitted across the machine interface:

Signal input: Start of welding / end of welding

- Signal input for a floating contact (sensor, relay, etc.) between pin X1:1 and pin X1:2
- The machine control signal input is processed by the power source in the same way as a welding torch signal input. Ensure that the correct mode is set (2-step or 4-step)
- Use gold-plated contacts for optimum signal transmission

Signal output: Current flow signal

- Floating contact between pin X1:3 and pin X1:4

NOTE!

The machine interface isolates the welding circuit up to a maximum of 500 V DC.

To ensure reliable isolation from the welding circuit, use a relay with an insulation voltage greater than 1500 V DC.

Technical data - start/end of welding signal input

$U_{\max AC}$	5 V
---------------	-----

I_{\max}	4 mA
------------	------

Technical data - current flow signal output

U_{\max}	24 V
------------	------

I_{\max}	20 mA
------------	-------

Gas preheater CO2 connection External gas preheaters for gas pressure regulators can be connected to the gas preheater CO2 connection. Gas preheaters have a 36 V supply.

NOTE!

Voltage is only supplied to gas preheaters during welding operations.

The power of the gas preheaters must not exceed 150 W.

The gas preheater supply is protected against overloads and short-circuits.

Technical data

U_A	36 V _{AC}
-------	--------------------

$P_{A, \max}$	150 W
---------------	-------

Keylock switch

An optional keylock switch is available for the power source to prevent the settings from being inadvertently changed on the control panel. If the keylock switch is in the horizontal position,

- no settings can be set on the control panel,
- only parameter settings can be retrieved,
- any assigned "Save" button can be retrieved provided that an assigned "Save" button was selected when the keylock was enabled.

Keylock activated:

"CLO | SEd" appears on the display

Keylock deactivated:

"OP | En" appears on the display

VRD: safety function

A Voltage Reduction Device (VRD) is an optional safety device for reducing the voltage. It is recommended for environments in which the risk of an electric shock or electrical accident is increased considerably during arc welding:

- Due to a low human body resistance of the welder
- If the welder is exposed to a clear risk of touching the workpiece or other parts of the welding circuit

A low human body resistance is possible when there is:

- water in the area
- humidity
- heat, particularly ambient temperatures in excess of 32°C (89.6°F)

In wet, damp or hot locations, humidity or sweat can significantly reduce the skin resistance and the insulation resistance of protective equipment and clothing.

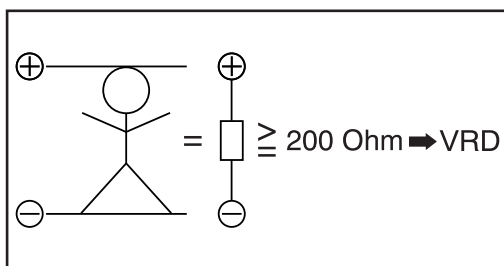
Such environments can include:

- Temporary dams for draining certain areas of a site during construction work (cofferdams)
- Trenches
- Mines
- Rain
- Areas partly submerged by water
- Spraywater areas

The VRD option reduces the voltage between the electrode and the workpiece. In safe conditions, the indicator for the currently selected welding process is permanently lit. A safe condition is defined as follows:

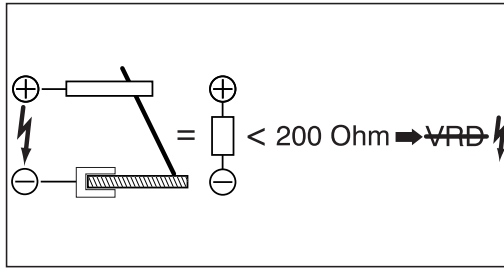
- The output voltage in an open circuit is limited to 35 V.

For as long as the welding operation is active (welding circuit resistance < 200 Ohm), the indicator of the currently selected welding process flashes and the output voltage may exceed 35 V.

VRD: safety principle

The welding circuit resistance is greater than the minimum human body resistance (greater than or equal to 200 Ohm):

- VRD is active
- Open circuit voltage is limited to 35 V
- Unintentional contact with the output voltage does not put the welder at risk



The welding circuit resistance is less than the minimum human body resistance (less than 200 Ohm):

- VRD is inactive
- Output voltage not restricted in order to ensure sufficient welding power
- Example: Welding starts

In MMA welding mode:

Within 0.3 seconds of end of welding:

- VRD is active again
- The output voltage is limited to 35 V once more

Control elements and connections

Synergic control panel

General

The functions on the control panel are all arranged in a logical way. The various welding parameters can easily be selected using buttons and can just as easily be

- altered using buttons or the adjusting dial
- displayed on the digital display during welding

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

NOTE!

Due to software updates, you may find that your device has certain functions that are not described in these operating instructions or vice versa.

Individual illustrations may also differ slightly from the actual controls on your device, but these controls function in exactly the same way.

The power source uses the Synergic control panel and certain general items of data such as sheet thickness, filler metal, wire diameter and shielding gas to calculate the best welding parameters. As a result, stored knowledge is available at all times. All the parameters can be adjusted manually. The Synergic control panel also allows parameters to be set manually.

Safety



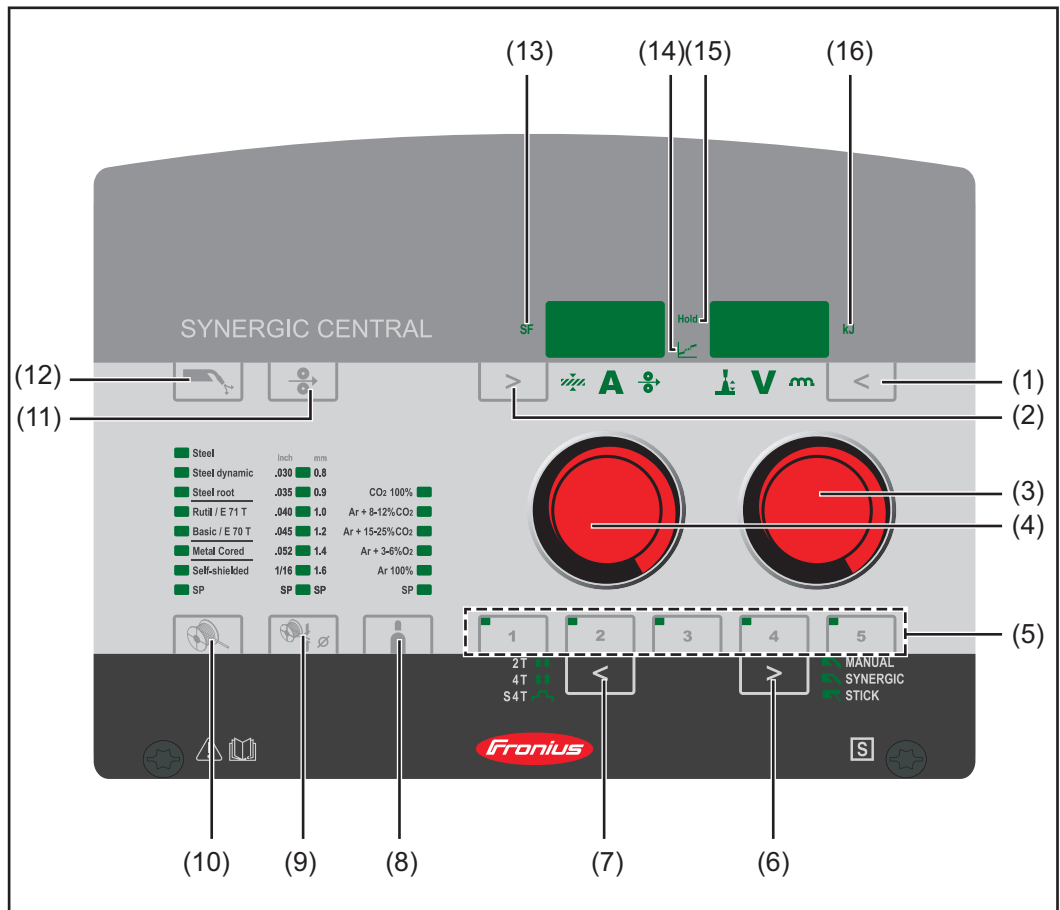
WARNING!

Danger due to incorrect operation and incorrectly performed work.

This can result in serious injury and damage to property.

- ▶ Read and understand this document.
 - ▶ Read and understand all the Operating Instructions for the system components, especially the safety rules.
-

Synergic control panel



(1) **"Parameter selection" button (right)**

a) for selecting the following welding parameters



Arc length correction

for correcting the arc length



Welding voltage in V *)

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



Arc-force dynamic

for influencing the short-circuiting dynamic at the moment of droplet transfer

- ... harder, more stable arc

0 ... neutral arc

+ ... soft, low-spatter arc

b) for changing parameters in the Setup menu

(2) **"Parameter selection" button (left)**

a) for selecting the following welding parameters



Sheet thickness

Sheet thickness in mm or in.

If the welding current to be selected is not known, it is sufficient to enter the sheet thickness. The required welding current and any other parameters marked with *) will then be adjusted automatically.

A Welding current *)

Welding current in A

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

**Wire speed *)**

Wire speed in m/min or ipm.

b) for changing parameters in the Setup menu

(3) Adjusting dial (right)

for changing the arc length correction, welding voltage and arc-force dynamic parameters

for changing welding parameters in the Setup menu

(4) Adjusting dial (left)

for changing the sheet thickness, welding current and wire speed parameters

for selecting welding parameters in the Setup menu

(5) "Save" buttons (Easy Job)

zum Speichern von bis zu 5 Arbeitspunkten

(6) "Process" button **)

for saving up to 5 operating points



MANUAL - MIG/MAG standard manual welding



SYNERGIC - MIG/MAG standard synergic welding



STICK - Manual metal arc (MMA) welding

(7) "Mode" button

for selecting the operating mode



2 T - 2-step mode



4 T - 2-step mode



S 4 T - Special 4-step mode

(8) "Shielding gas" button

for selecting the shielding gas to be used. The SP parameter is reserved for additional shielding gases.

When a shielding gas is selected, the LED behind the relevant shielding gas lights up.

(9) "Wire diameter" button

for selecting the wire diameter to be used. The SP parameter is reserved for additional wire diameters.

When a wire diameter is selected, the LED behind the relevant wire diameter lights up.

(10) "Material" button

for selecting the filler metal to be used. The SP parameter is reserved for additional filler metals

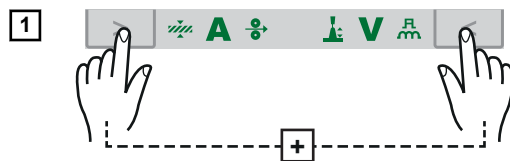
When a material is selected, the LED behind the relevant filler metal lights up.

-
- (11) **"Wire threading" button**
Press and hold the button:
gasless wire threading into the torch hosepack
- While the button is being held, the wire drive operates at feeder inching speed.
-
- (12) **"Gas-test" button**
For setting the necessary gas flow rate on the pressure regulator.
Press the button once: shielding gas flows out
Press the button again: shielding gas flow stops
- If the "Gas-test" button is not tapped again, the shielding gas flow will stop after 30 s.
-
- (13) **SF - spot / stitch welding indicator**
lights up if a value has been entered for the spot / stitch welding time Setup parameter (SPt) (spot or stitch welding operating mode is enabled)
-
- (14) **Intermediate arc indicator**
A spatter-prone "intermediate arc" occurs between the dip transfer arc and the spray arc. The intermediate arc indicator lights up to alert you to this critical range.
-
- (15) **HOLD indicator**
At the end of each welding operation, the actual values for welding current and welding voltage are stored - the "HOLD" indicator lights up.
-
- (16) **Real Energy Input**
for displaying the energy applied during the welding operation.
- The Real Energy Input display must be activated in level 2 of the Setup menu - EnE parameter. The value continuously rises during welding in line with the permanently increasing energy yield. The final value at the end of welding remains stored until welding starts again or the power source is switched back on - the HOLD indicator lights up.
-
- *) If one of these parameters is selected in the MIG/MAG standard synergic welding process, then the synergic function ensures that all other parameters, including the welding voltage parameter, are adjusted automatically.
- **) In conjunction with the VRD option, the currently selected welding process indicator is simultaneously an additional indicator:
- The indicator is permanently lit: The Voltage Reduction Device (VRD) is active and is limiting the output voltage to less than 35 V.
 - The indicator starts to flash as soon as a welding action starts in which the output voltage can exceed 35 V.

Service parameters

Various service parameters can be retrieved by pressing the "Parameter selection" buttons at the same time.

Opening the display



The first parameter ("Firmware version") is displayed, e.g. "1.00 | 4.21"

Selecting parameters



Use the "Mode" and "Process" buttons or the left-hand adjusting dial to select the required Setup parameter

Available parameters

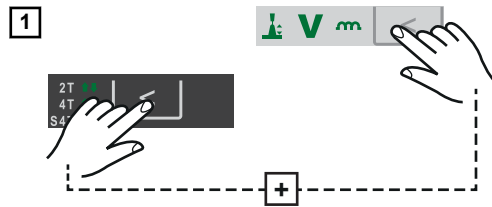
	Explanation
Example: 1.00 4.21	Firmware version
Example: 2 491	Welding program configuration
Example: r 2 290	Number of the currently selected welding program
654 32.1 = 65,432.1 hours = 65,432 hours 6 mins	Indicates the actual arc time since using for the first time Note: The arc time indicator is not suitable as a basis for calculating hiring fees, warranty services, etc.
Example: iFd 0.0	Motor current for wire drive in A The value changes as soon as the motor is running.
2nd	Second menu level for service technicians

Keylock

A keylock can be selected to prevent the settings from being inadvertently changed on the control panel. As long as the keylock is active

- No settings can be made on the control panel
- Only parameter settings can be retrieved
- Any assigned "Save" button can be retrieved provided that an assigned "Save" button was selected when the keylock was enabled

To activate/deactivate the keylock:



Keylock activated:

The message "CLO | SEd" appears on the displays.

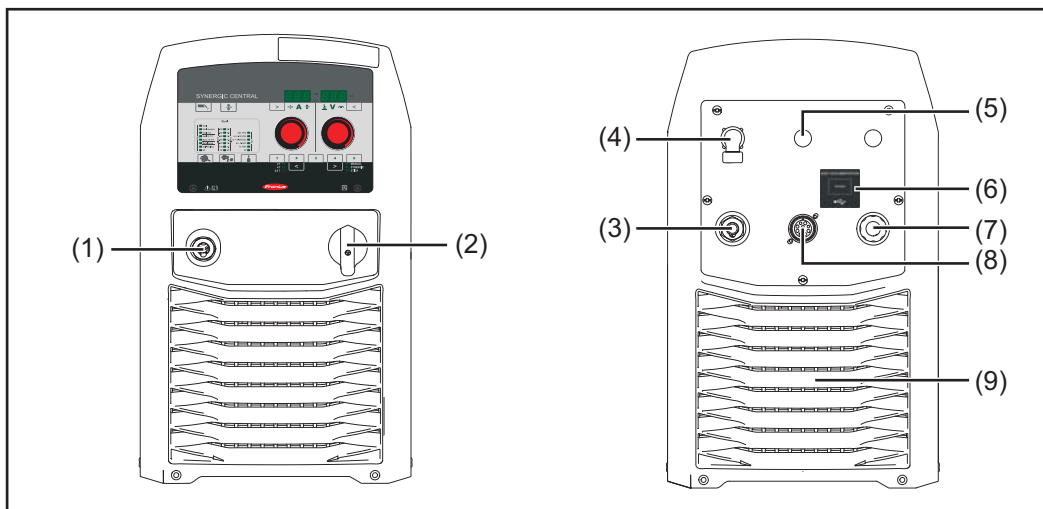
Keylock deactivated:

The message "OP | En" appears on the displays.

The keylock can be activated and deactivated using the keylock switch option.

Connections, switches and mechanical components

TSt 3500/5000
Syn power
source



-
- (1) **(-) - current socket with bayonet latch**
Used for
- Connecting the grounding cable during MIG/MAG welding
 - Connecting the electrode cable or grounding cable during manual metal arc welding (depending on the type of electrode used)
-
- (2) **Mains switch**
For switching the power source on and off
-
- (3) **(+) - current socket with bayonet latch**
Used for
- Connecting the current cable from the interconnecting hosepack during MIG/MAG welding
 - Connecting the electrode cable or grounding cable during manual metal arc welding (depending on the type of electrode used)
-
- (4) **Gas preheater socket (option)**
-
- (5) **Machine interface (optional)**
-
- (6) **EASY DOCUMENTATION sticker**
-
- (7) **Mains cable with strain relief device**
-
- (8) **LocalNet port**
Standardised connection socket for the wirefeeder (interconnecting hosepack)
-
- (9) **Air filter**
Remove from the side for cleaning
-

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.

Gas-cooled MIG/MAG welding

- Power source
 - Grounding cable
 - MIG/MAG welding torch, gas-cooled
 - Gas connection (shielding gas supply)
 - Wirefeeder (VR 5000 Remote)
 - Interconnecting hosepack, gas-cooled
 - Wire electrode
-

MIG/MAG weld- ing, water-cooled

- Power source
 - Cooling unit
 - Grounding cable
 - MIG/MAG welding torch, water-cooled
 - Gas connection (shielding gas supply)
 - Wirefeeder (VR 5000 Remote)
 - Water-cooling option (for VR 5000 Remote)
 - Interconnecting hosepack, water-cooled
 - Wire electrode
-

MMA welding

- Power source
- Grounding cable
- Electrode holder
- 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
-



WARNING!

An electric shock can be fatal.

If the machine is plugged into the mains electricity supply during installation, there is a high risk of very serious injury and damage. Do not carry out any work on the device unless

- ▶ the mains switch is in the "O" position,
 - ▶ the device is unplugged from the mains.
-

Utilisation for intended purpose only

The power source may only be used for MIG/MAG and MMA welding. Any other form of usage is deemed "not in accordance with the intended purpose". The manufacturer shall not be held liable for any damages arising from such usage.

Utilisation in accordance with the "intended purpose" also comprises

- 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 mm (0.49 in.)
- Protection against spraywater at any angle up to 60° to the vertical

The device can be set up and operated outdoors in accordance with degree of protection IP 23.

Avoid direct wetting (e.g. from rain).



WARNING!

Toppling or falling devices can cause life-threatening injuries.

- ▶ Place devices on a solid, level surface so that they remain stable.
-



WARNING!

Danger from electrical current due to electrically conductive dust in the device.

This can result in serious injury and damage to property.

- ▶ Only operate the device with an air filter fitted. The air filter is a very important safety device for achieving IP 23 protection.
-

The venting duct is a very important safety device. 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. 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. If your version of the appliance does not come with mains cables and plugs ready-fitted, these must be fitted in accordance with national regulations and standards. For details of fuse protection of the mains lead, please see the technical data.



CAUTION!

An inadequately dimensioned electrical installation can cause serious damage.

- ▶ The mains lead and its fuse must be dimensioned to suit the local power supply. The technical data shown on the rating plate applies.
-

Connecting the mains cable

Safety

WARNING!

Danger due to work that has been carried out incorrectly.

This can result in serious injury and damage to property.

- ▶ The work described below must only be carried out by trained and qualified personnel.
- ▶ Observe national standards and directives.

CAUTION!

Danger due to improperly prepared mains cable.

This can cause short circuits and damage.

- ▶ Fit ferrules to all phase conductors and the ground conductor of the stripped 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 strain-relief device for the following cable cross-sections is fitted to the power source:

Power source	Cable cross-section fitted strain-relief device for	
	Canada / US	Europe
TSt 3500 Syn	AWG 12 *)	4G2.5
TSt 5000 Syn	AWG 10 *)	4G4
TSt 3500 MV Syn	AWG 10 *)	4G4
TSt 5000 MV Syn	AWG 6 *)	4G10

*) Canada / US cable type: Extra-hard usage

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

Stipulated mains cables and strain-relief devices

Power source	Mains voltage	Cable cross-section	
		Canada / US	Europe
TSt 3500 Syn	3 x 380 / 400 V	AWG 12 *)	4G2.5
	3 x 460 V	AWG 12 *)	4G2.5
TSt 5000 Syn	3 x 380 / 400 V	AWG 8 *)	4G4
	3 x 460 V	AWG 10 *)	4G4
TSt 3500 MV Syn	3 x 208 / 230 / 400 / 460 V	AWG 10 *)	4G4
TSt 5000 MV Syn	3 x 208 / 230 / 400 / 460 V	AWG 6 *)	4G10

*) Canada / US cable type: Extra-hard usage

The item numbers of the different cables can be found in the Spare Parts List of the device.

Connecting the mains cable

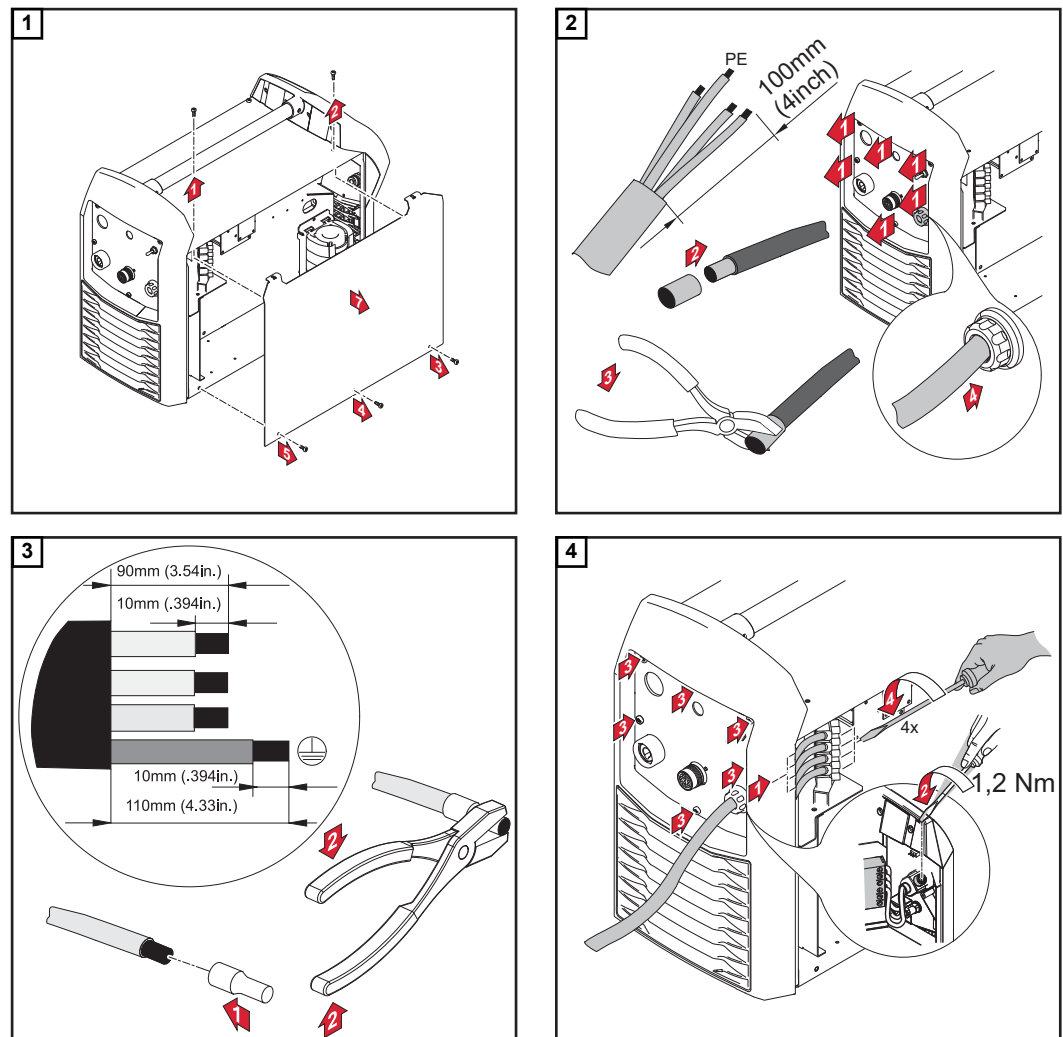
If no mains cable is connected, a mains cable that is suitable for the connection voltage must be fitted before commissioning.

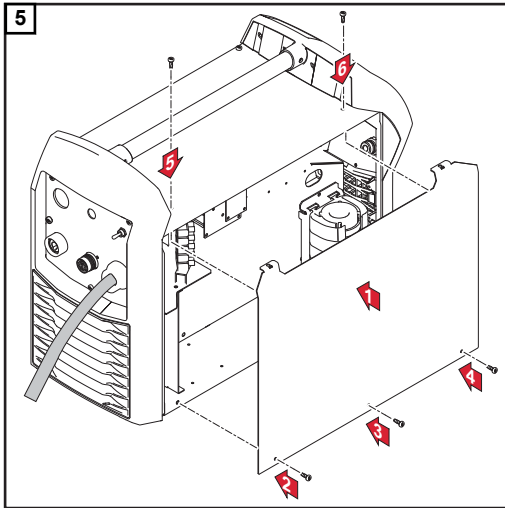
The ground conductor should be approx. 10 - 15 mm (0.4 - 0.6 in.) longer than the phase conductors.

An illustration of the mains cable connection can be found in the following sections: "Fitting the strain-relief device" or "Fitting the strain-relief device for Canada / US". To connect the mains cable, proceed as follows:

- 1 Remove the side panel from the device
- 2 Push the mains cable in far enough to make it possible to connect the ground conductor and the phase conductors to the block terminal properly.
- 3 Fit ferrules to the ground conductor and phase conductors
- 4 Connect the ground conductor and phase conductors to the block terminal
- 5 Use the strain-relief device to secure the mains cable
- 6 Fit the side panel of the device

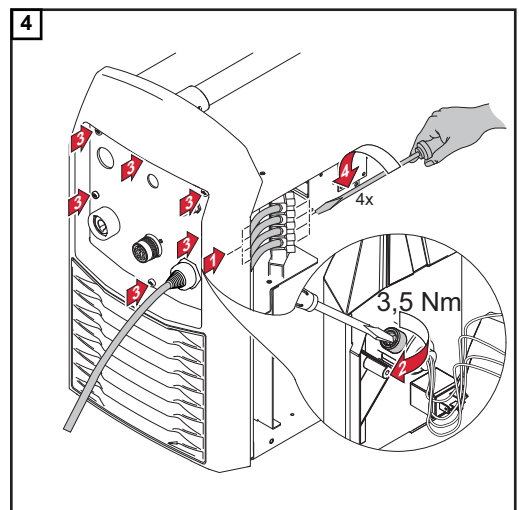
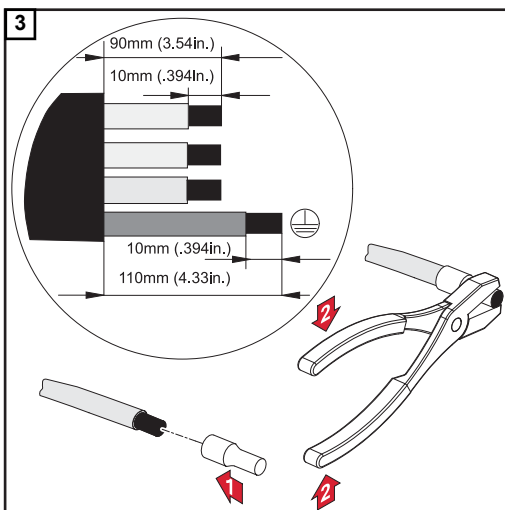
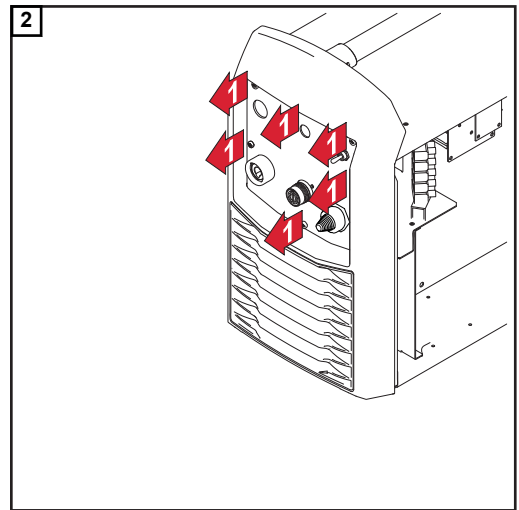
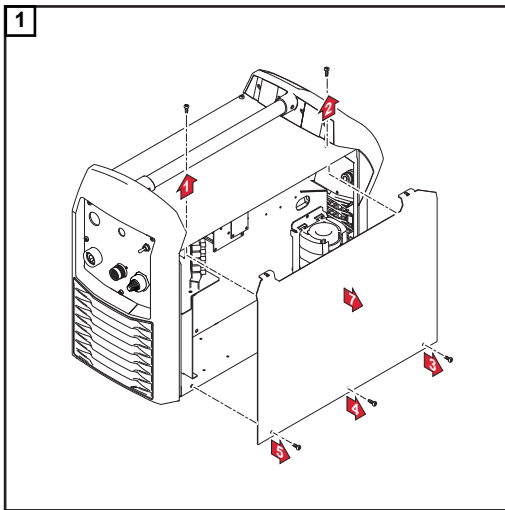
Fitting the Europe strain-relief device

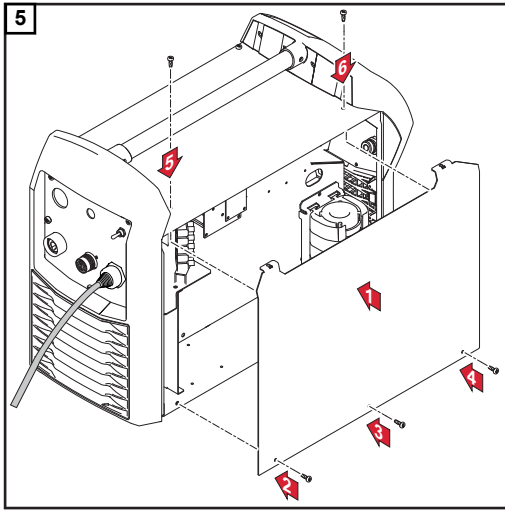




IMPORTANT! Tie the phase conductors near the block terminals using cable ties.

**Fitting the
Canada/US
strain-relief
device**





IMPORTANT! Tie the phase conductors near the block terminals using cable ties.

Generator-powered operation

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.

Start-up

General

Commissioning a power source is described by reference to a manual water-cooled MIG/MAG application.

Information on system components

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

- trolley
- upright console
- cooling units
- 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.

Assembling the system components (overview)

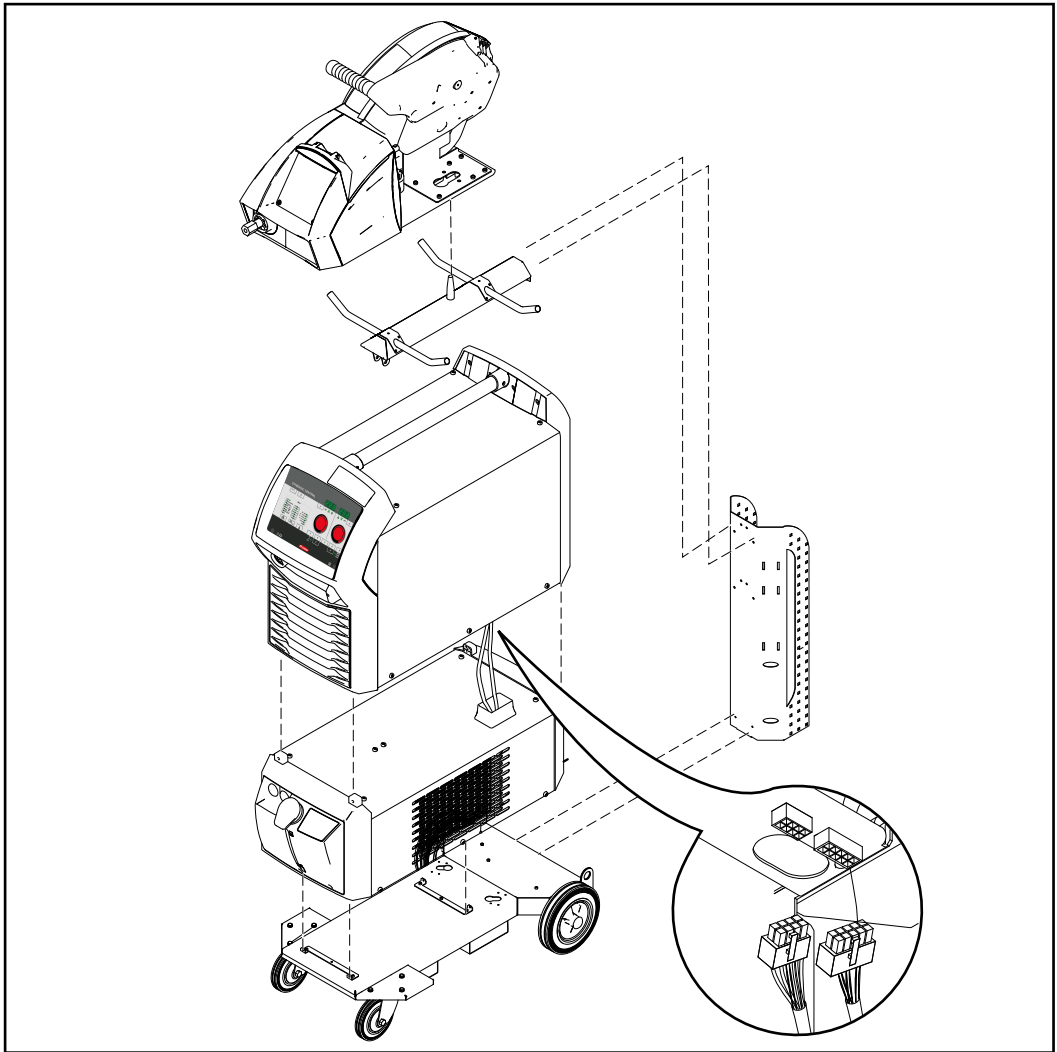


WARNING!

Work that is carried out incorrectly can cause serious injury and damage.

- ▶ The following activities must only be carried out by trained and qualified personnel.
 - ▶ All instructions in the section headed "Safety rules" must be observed.
-

The diagram below is intended to show you how to fit the individual system components.

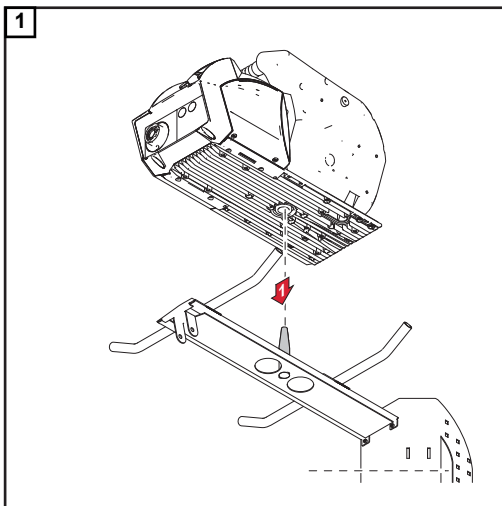


Placing the wirefeeder on the power source

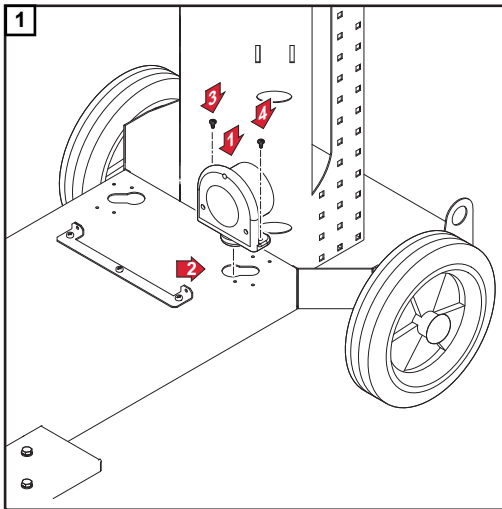
⚠ CAUTION!

Risk of injury and material damage from falling wirefeeder.

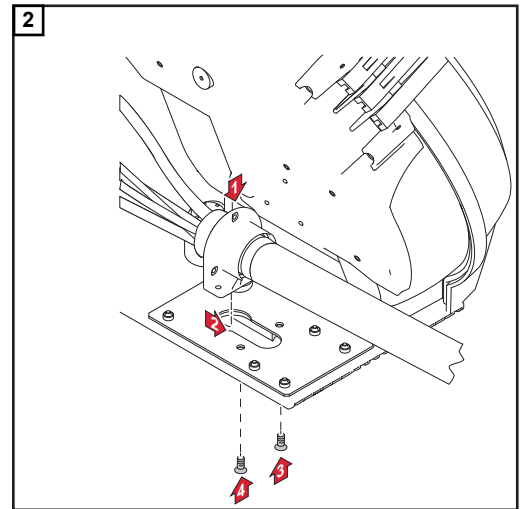
- ▶ Make sure that the wirefeeder is located securely on the swivel pin and that the devices, upright consoles and trolleys are stable.



Fitting the interconnecting hosepack strain-relief device



Fitting the strain-relief device to the trolley



Fitting the strain-relief device to the wirefeeder

IMPORTANT! To prevent wear and tear, leave some slack when connecting the cables. A strain-relief device is not provided for 1.2 m (3 ft 11.24 in.) interconnecting hosepacks.

Connecting the interconnecting hosepack

⚠ WARNING!

Fitting the equipment incorrectly can cause serious injury and damage.

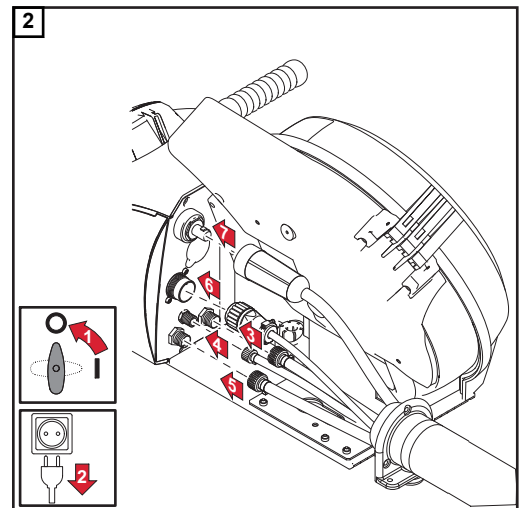
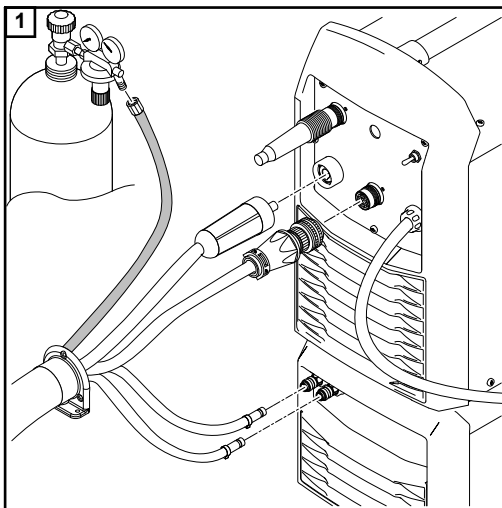
- ▶ Do not carry out the steps described here until you have read and completely understood all the Operating Instructions.

NOTE!

When connecting the interconnecting hosepack, check that

- ▶ all connections are connected properly
- ▶ all cables, leads and hosepacks are undamaged and correctly insulated

IMPORTANT! 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.



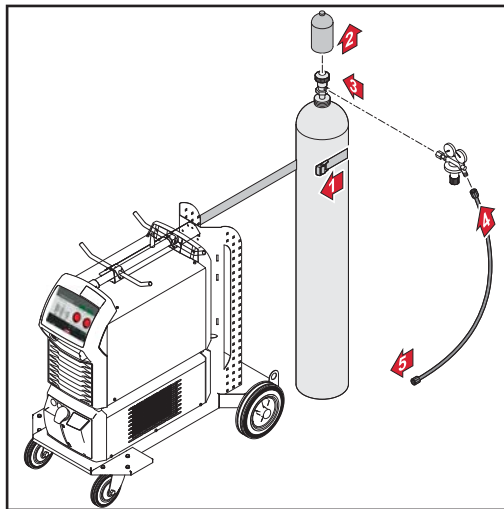
Connecting the gas cylinder

WARNING!

There is a high risk of very serious injury and damage if a gas cylinder falls over.

When using gas cylinders:

- ▶ Place them on a solid, level surface in such a way that they remain stable
- ▶ Secure the gas cylinders to prevent them from falling over
- ▶ Fit the VR holder option
- ▶ Observe the safety rules of the gas cylinder manufacturer



- 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 remove any dust or dirt
- 5 Inspect the seal on the gas pressure regulator
- 6 Screw the pressure regulator onto the gas cylinder and tighten it
- 7 Connect the shielding gas hose of the interconnecting hosepack to the pressure regulator using the gas hose

NOTE!

US devices are supplied with an adapter for the gas hose:

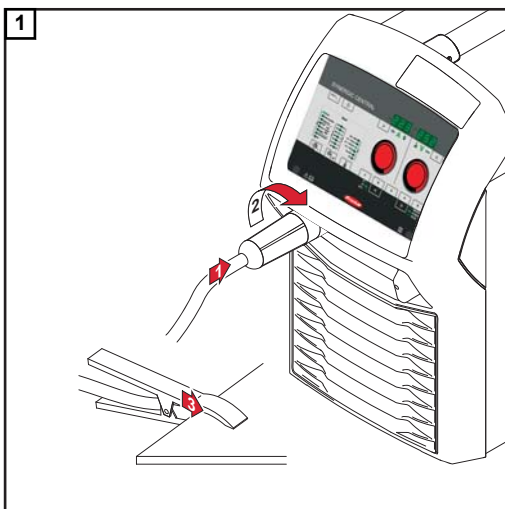
- ▶ Seal male thread spacers on the gas solenoid valve using suitable means before screwing on the adapter.
- ▶ Test the adapter to ensure that it is gas-tight.

Establishing a ground earth connection

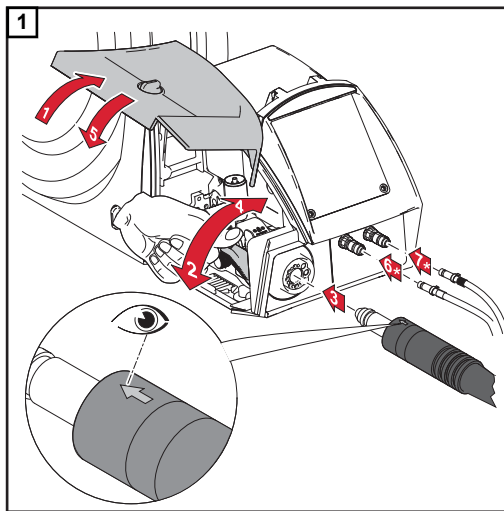
NOTE!

When establishing a ground earth connection, observe the following points:

- ▶ Use a separate grounding cable for each power source
- ▶ Keep the plus cable and grounding cable together as long and as close as possible
- ▶ Physically separate the welding circuits of individual power sources
- ▶ Do not route several grounding cables in parallel;
if parallel routing cannot be avoided, keep a minimum distance of 30 cm between the welding circuits
- ▶ Keep the grounding cable as short as possible, provide a large cable cross-section
- ▶ Do not cross grounding cables
- ▶ Avoid ferromagnetic materials between the grounding cable and the interconnecting hosepack
- ▶ Do not wind up long grounding cables - coil effect!
Lay long grounding cables in loops
- ▶ Do not route grounding cables in iron pipes, metal cable conduits or on steel rails,
avoid cable ducts;
(routing of plus cables and grounding cables together in an iron pipe does not cause any problems)
- ▶ If there are several grounding cables, separating the grounding points on the component so that they are as far away from one another as possible is recommended, as well as preventing crossed current paths from occurring underneath the individual arcs.
- ▶ Use compensated interconnecting hosepacks (interconnecting hosepacks with integrated grounding cable)



**Connecting
MIG/MAG welding
torches**



* when the optional water connection and the water-cooled welding torch are fitted

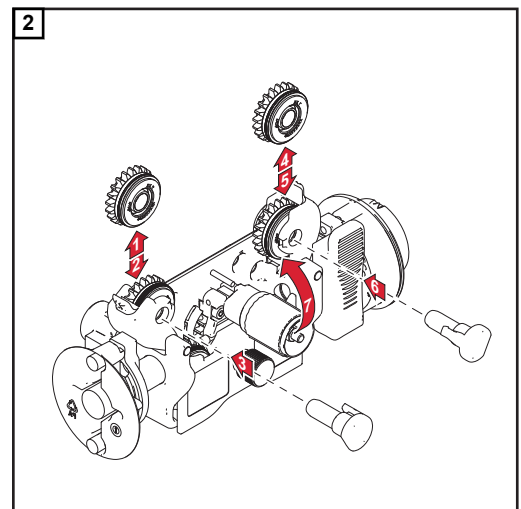
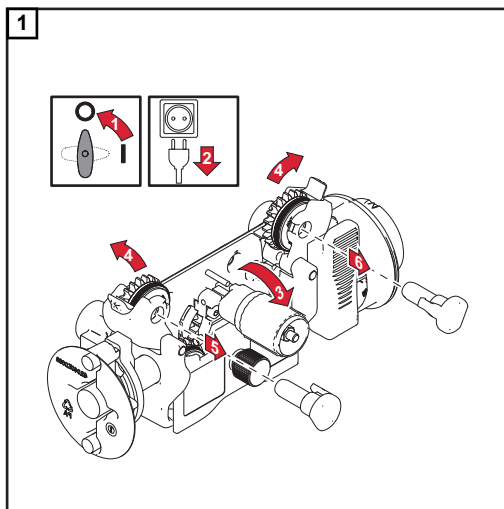
**Inserting/repla-
cing feed rollers**

⚠ CAUTION!

Danger from feed roller holders flying upwards.

This can result in severe injuries.

- ▶ When unlocking the clamping lever, keep fingers away from the area to the left and right of the lever.

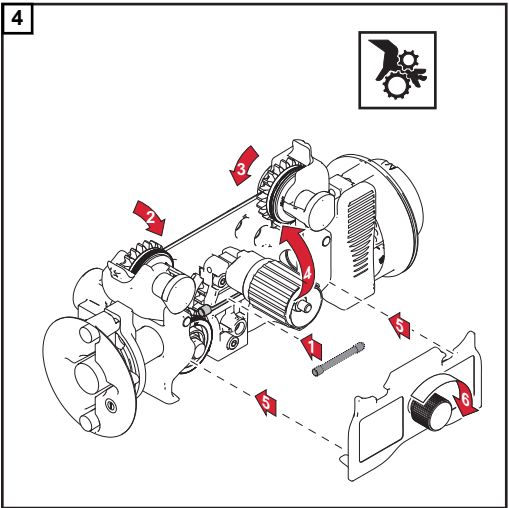
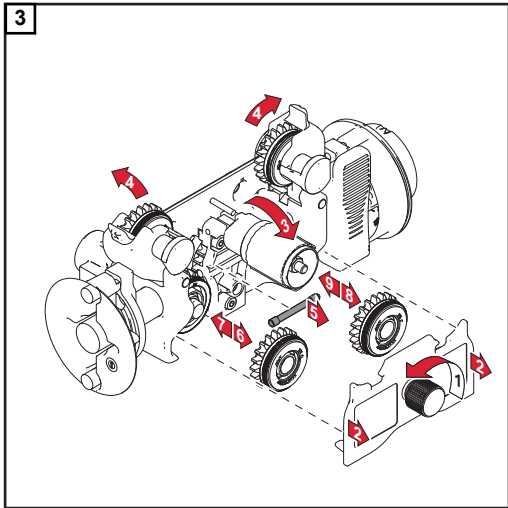


⚠ CAUTION!

Danger from exposed feed rollers.

This can result in severe injuries.

- ▶ Always fit the protective cover of the 4-roller drive after inserting or replacing a feed roller.



Inserting the wirespool

⚠ CAUTION!

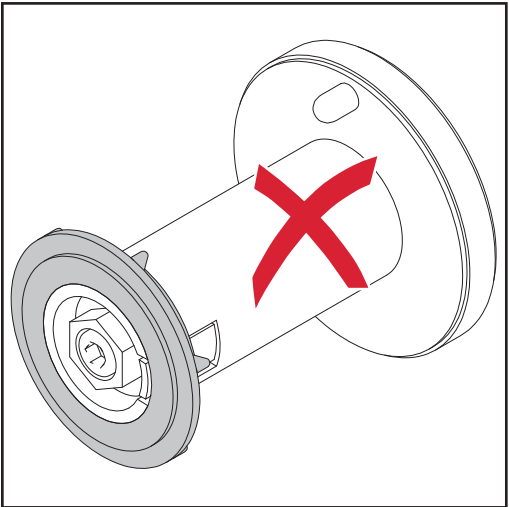
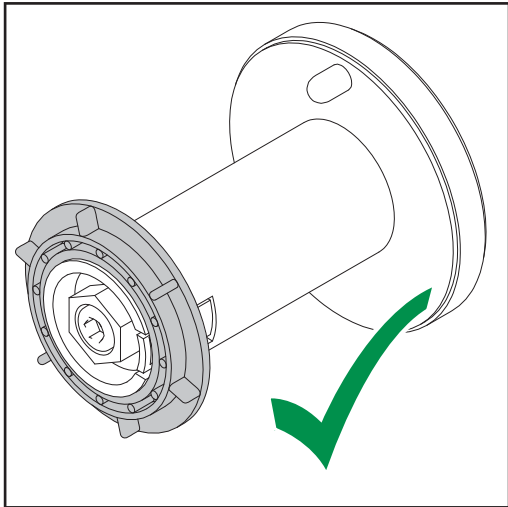
Risk of injury due to springiness of spooled wire electrode.
 ► While inserting the wirespool, hold the end of the wire electrode firmly to avoid injuries caused by the wire springing back.

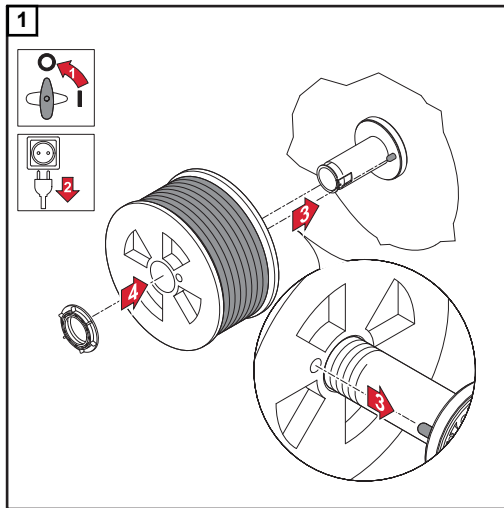
⚠ CAUTION!

Risk of injury from falling wirespool.
 ► Make sure the wirespool sits securely on the wirespool holder.

⚠ CAUTION!

Risk of injury and material damage if the wirespool topples over because the locking ring has been placed the wrong way around.
 ► Always position the locking ring as shown in the diagram on the left.





Inserting the basket-type spool

⚠ CAUTION!

Risk of injury due to springiness of spooled wire electrode.

- ▶ When inserting the basket-type spool, hold the end of the wire electrode firmly to avoid injuries caused by the wire springing back.

⚠ CAUTION!

Risk of injury from falling basket-type spool.

- ▶ Make sure that the basket-type spool and basket-type spool adapter are fitted securely to the wirespool holder.

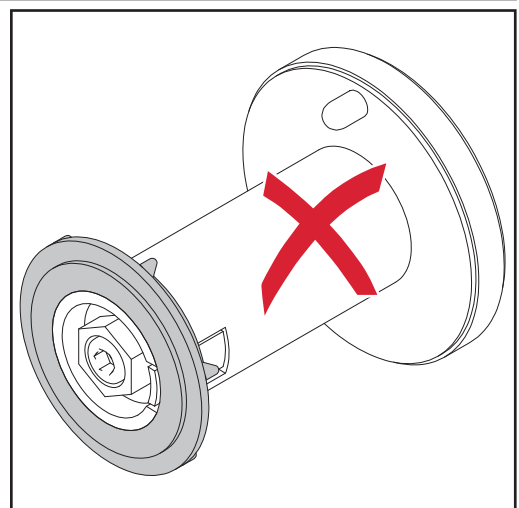
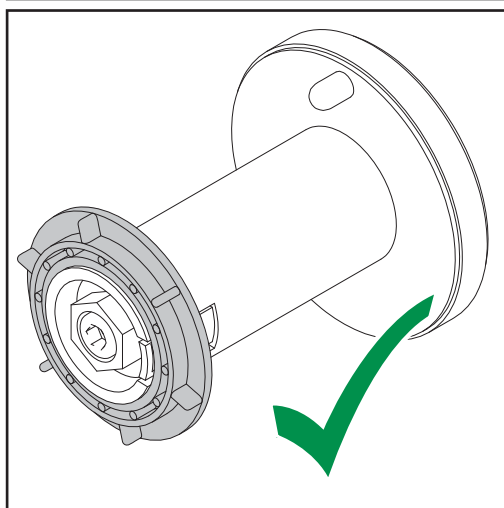
NOTE!

When working with basket-type spools, only use the basket-type spool adapter included in the scope of supply.

⚠ CAUTION!

Risk of injury and material damage if the basket-type spool topples over because the locking ring has been placed the wrong way round.

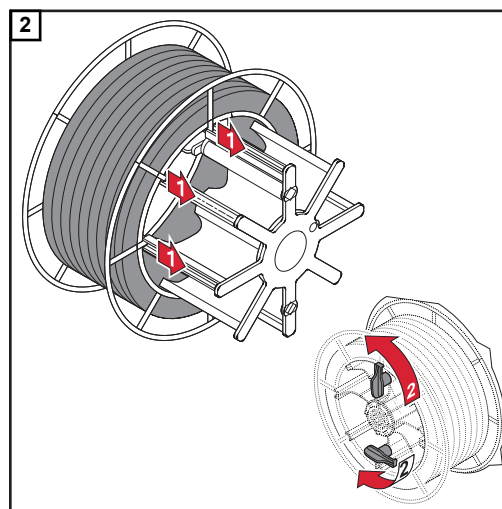
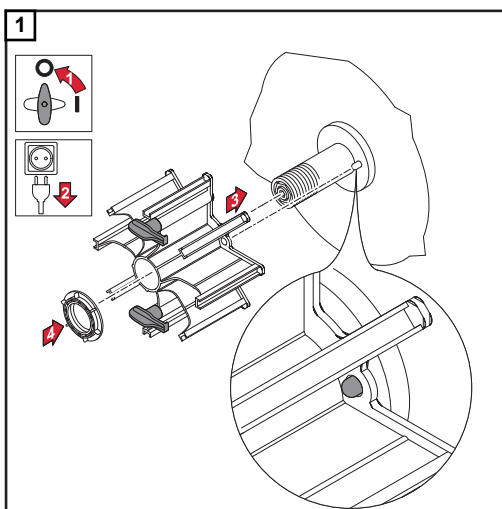
- ▶ Always position the locking ring as shown in the diagram on the left.



⚠ CAUTION!

Risk of injury and material damage from falling basket-type spool.

- ▶ Place the basket-type spool on the adapter provided in such a way that the bars on the spool are inside the adapter guideways.



Feeding in the wire electrode

⚠ CAUTION!

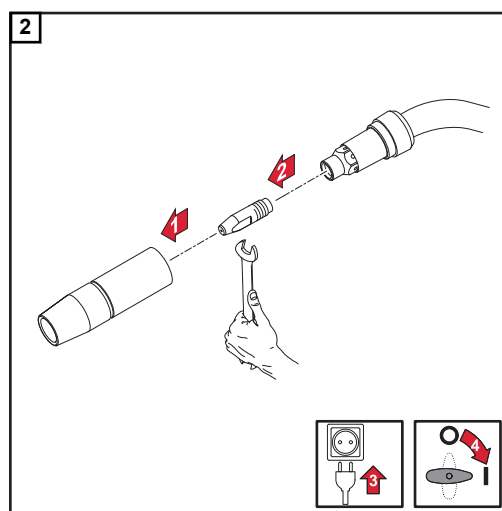
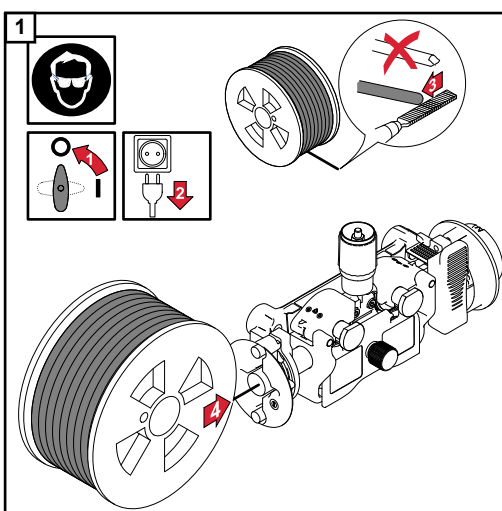
Risk of injury due to springiness of spooled wire electrode.

- ▶ When inserting the wire electrode into the 4-roller drive, hold the end of the wire electrode firmly to avoid injuries caused by the wire springing back.

⚠ CAUTION!

Risk of damage to the welding torch from sharp end of wire electrode.

- ▶ Deburr the end of the wire electrode well before threading in.

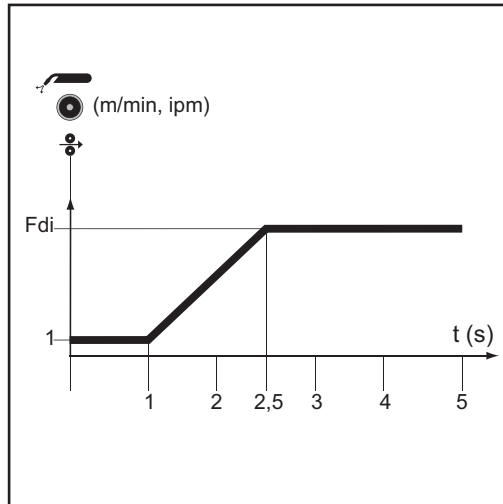


⚠ CAUTION!

Risk of injury from emerging wire electrode.

- ▶ When pressing the wire threading button or the torch trigger, keep the welding torch away from your face and body, and wear suitable protective goggles.

IMPORTANT! To facilitate the exact positioning of the wire electrode, the following sequences are possible when the wire threading button is pressed and held down.



- Hold the button for up to **one second** ... the wire speed stays at 1 m/min or 39.37 ipm for the first second.
- Hold the button for up to **2.5 seconds** ... after one second has elapsed, the wire speed increases at a uniform rate over the next 1.5 seconds.
- Hold the button for **more than 2.5 seconds** ... after 2.5 seconds, the wire is fed at a constant rate equal to the wire speed set for the Fdi welding parameter.

If the "Wire threading" button is released and pressed again before one second has elapsed, the sequence starts again from the beginning. This makes it possible to continuously position the wire at a low wire speed of 1 m/min or 39.37 ipm where necessary.

If there is no "Wire threading" button, the **torch trigger** can be used in the same way. Before using the torch trigger for wire threading, proceed as follows:

- 1 Press the "Mode" button to select 2-step mode
- 2 Set the "Ito" parameter to "Off" in the Setup menu

⚠ CAUTION!

Risk of injury and damage from electric shock and from the wire electrode emerging from the torch.

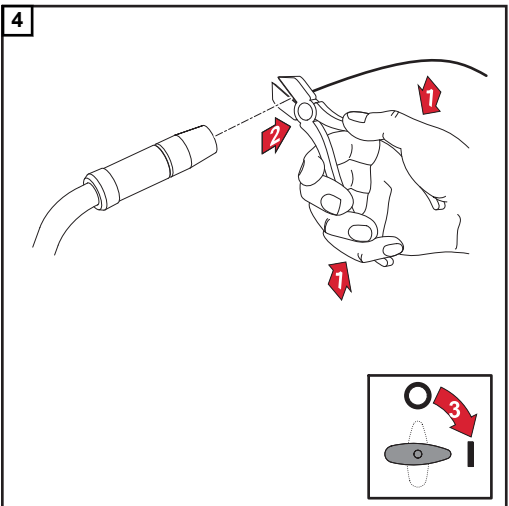
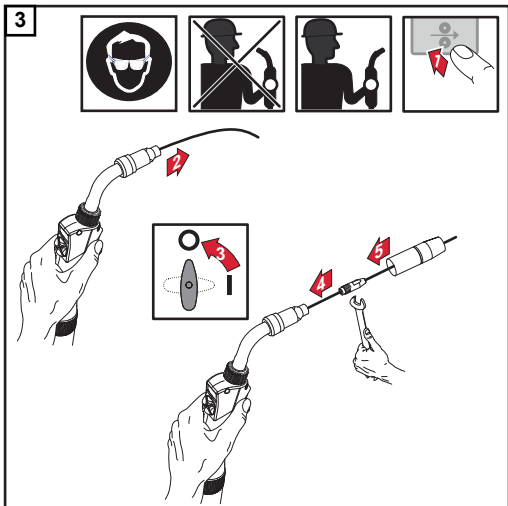
When pressing the torch trigger:

- ▶ 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)

IMPORTANT! If the **torch trigger** is pressed instead of the "Wire threading" button, the welding wire runs at the feeder creep speed (depending on the welding program) for the first 3 seconds. After these 3 seconds, wirefeeding is briefly interrupted.

The welding system detects that the welding process should not start, but that the wire is to be fed in. At the same time, the gas solenoid valve closes, and the welding voltage on the wire electrode is switched off.

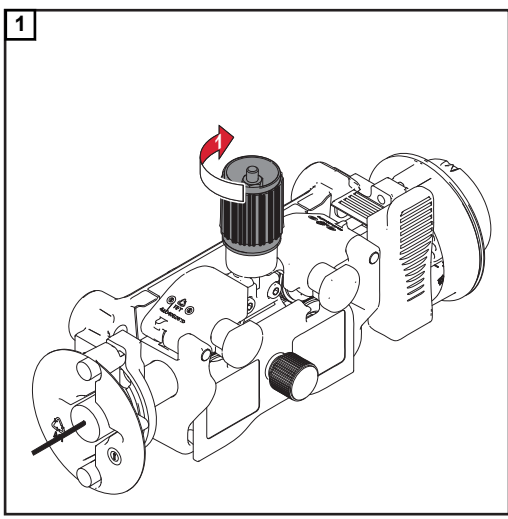
If the torch trigger is held down, wirefeeding restarts immediately without shielding gas and welding voltage, and the process continues as described above.



Setting the contact pressure

⚠ CAUTION!

Risk from excessive contact pressure.
 This can result in severe damage to property and poor weld properties.
 ► Set the contact pressure in such a way that the wire electrode is not deformed but nevertheless ensures proper wirefeeding.



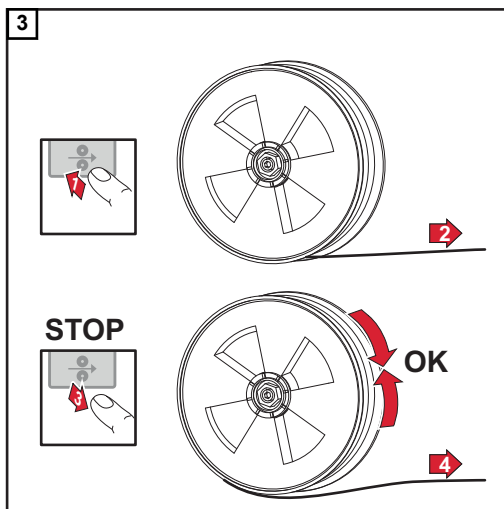
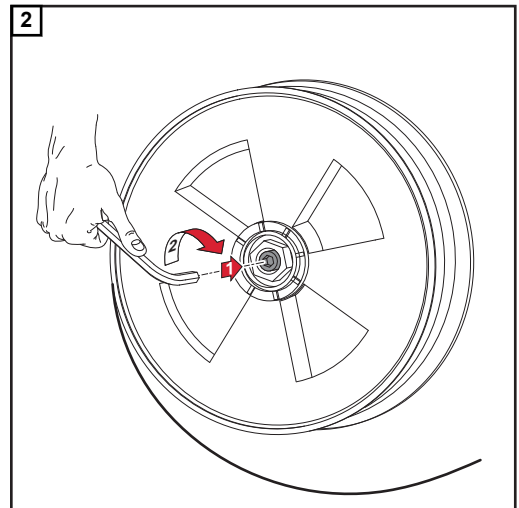
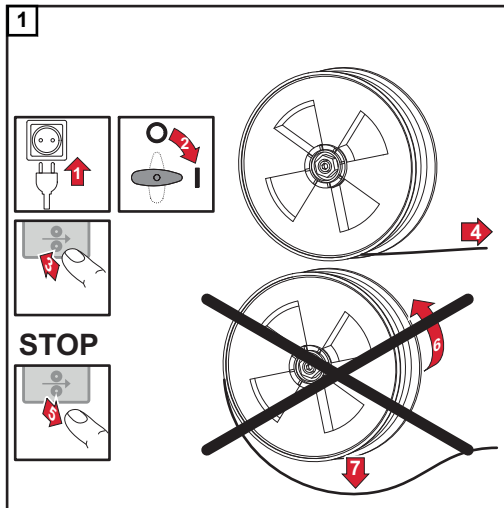
Contact pressure preferred values for U-groove rollers:

- Steel: 4 - 5
- CrNi: 4 - 5
- Tubular cored electrodes: 2 - 3

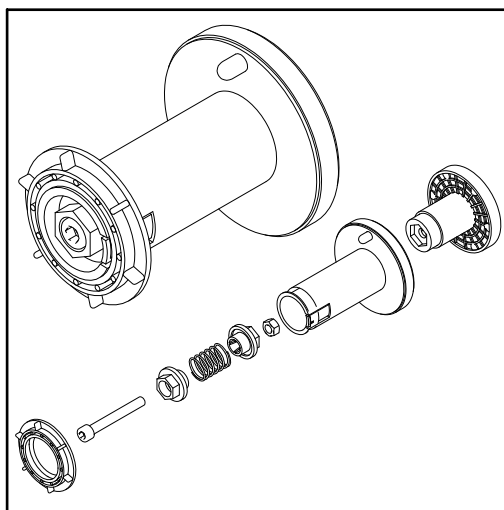
Adjusting the brake

NOTE!

After releasing the "Wire threading" button, the wirespool should stop unreeling.
 ► If it continues unreeling, readjust the brake.



Design of the brake



⚠ WARNING!

Danger from incorrect installation.

This can result in severe personal injury and damage to property.

- ▶ Do not dismantle the brake.
- ▶ Maintenance and servicing of brakes is to be carried out by trained, qualified personnel only.

The brake is only available as a complete unit. This illustration is for information purposes only.

Welding

Power limitation

Safety function

"Power limitation" is a safety function for MIG/MAG welding. This means that the power source can be operated at the power limit whilst maintaining process safety.

Wire speed is a determining parameter for welding power. If it is too high, the arc gets smaller and smaller and may be extinguished. In order to prevent this, the welding power is lowered.



For the selected "MIG/MAG standard synergic welding" process, the symbol for the "Wire speed" parameter flashes as soon as the safety function trips. The flashing continues until the next welding start-up, or until the next parameter change.

For example, if the "Wire speed" parameter is selected, the reduced value for wire speed is displayed.

MIG/MAG modes

General



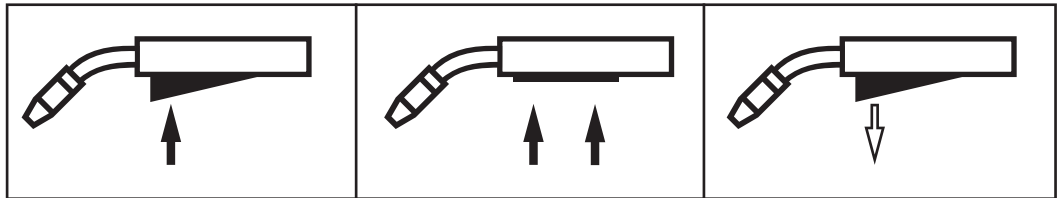
WARNING!

Operating the equipment incorrectly can cause serious injury and damage.

- ▶ Do not use the functions described here until you have read and completely understood these Operating Instructions.
- ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions for the system components, in particular the safety rules.

For details of the meaning, settings, setting range and units of the available welding parameters (e.g. gas pre-flow time), please refer to the "Setup parameters" chapter.

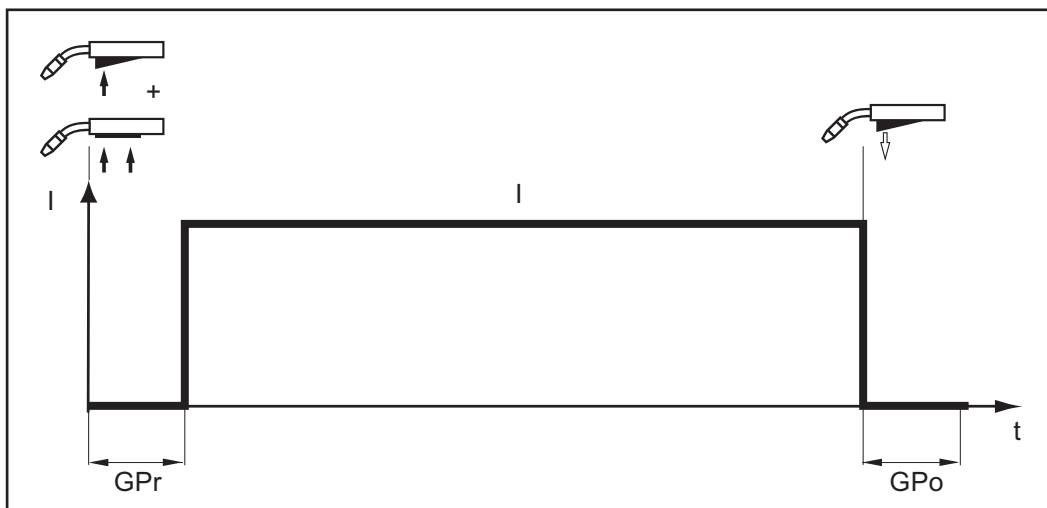
Symbols and their explanations



Press the torch trigger | Hold the torch trigger | Release the torch trigger

GPr	Gas pre-flow time
I-S	Starting current Can be increased or decreased depending on the application
SL	Slope The starting current is continuously lowered as far as the welding current and the welding current as far as the final current
I	Welding current phase Uniform thermal input into the base material, whose temperature is raised by the advancing heat
I-E	Final current To fill the end-crater
GPo	Gas post-flow time
SPt	Spot welding time / interval welding time
SPb	Interval pause time

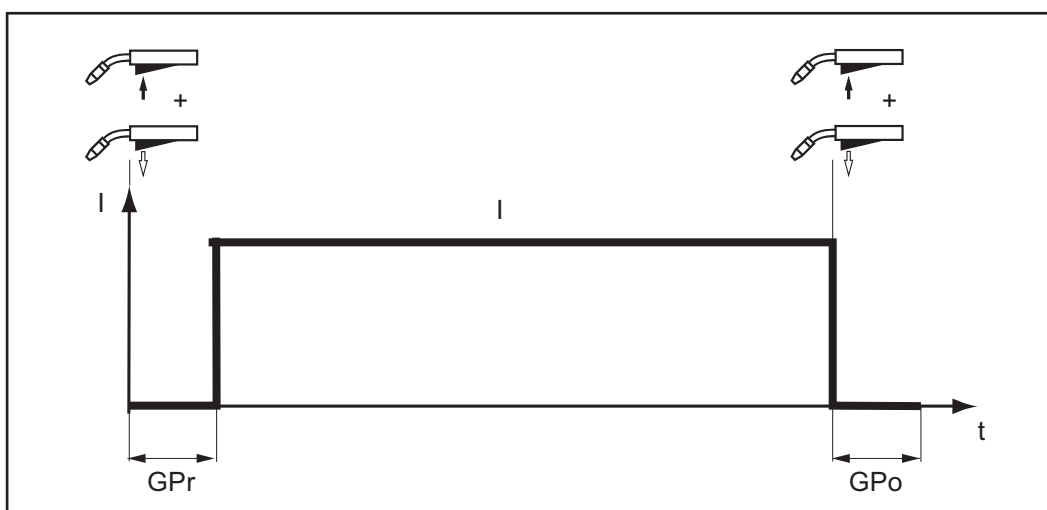
2-step mode



"2-step mode" is suitable for

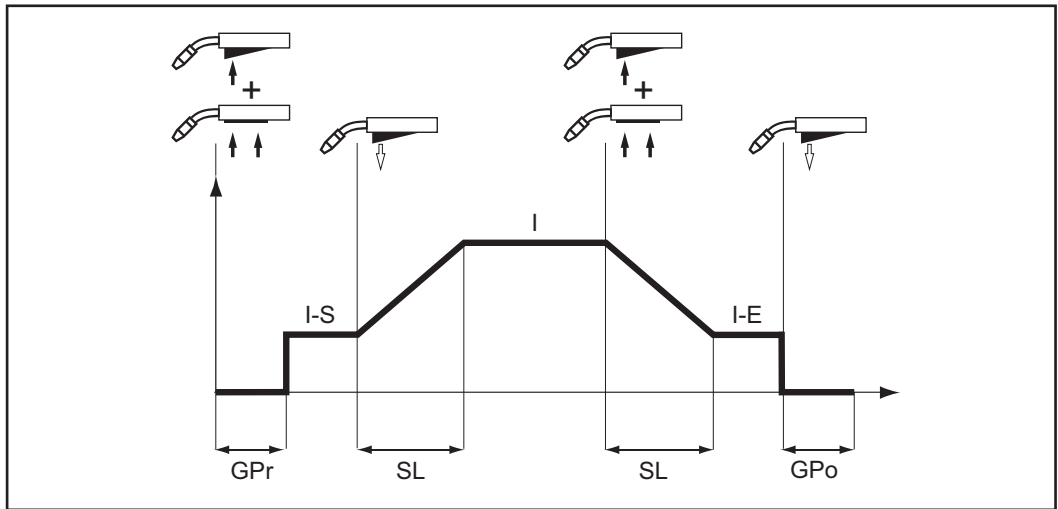
- Tacking work
- Short weld seams
- Automated and robot welding

4-step mode



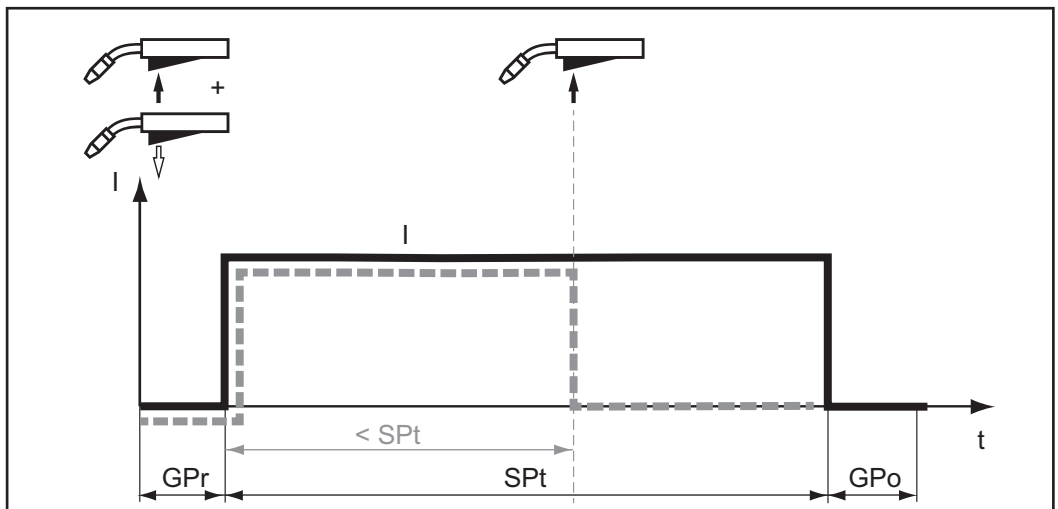
"4-step mode" is suitable for longer weld seams.

Special 4-step mode



Special 4-step mode allows the starting and final current to be configured in addition to the advantages of 4-step mode.

Spot welding

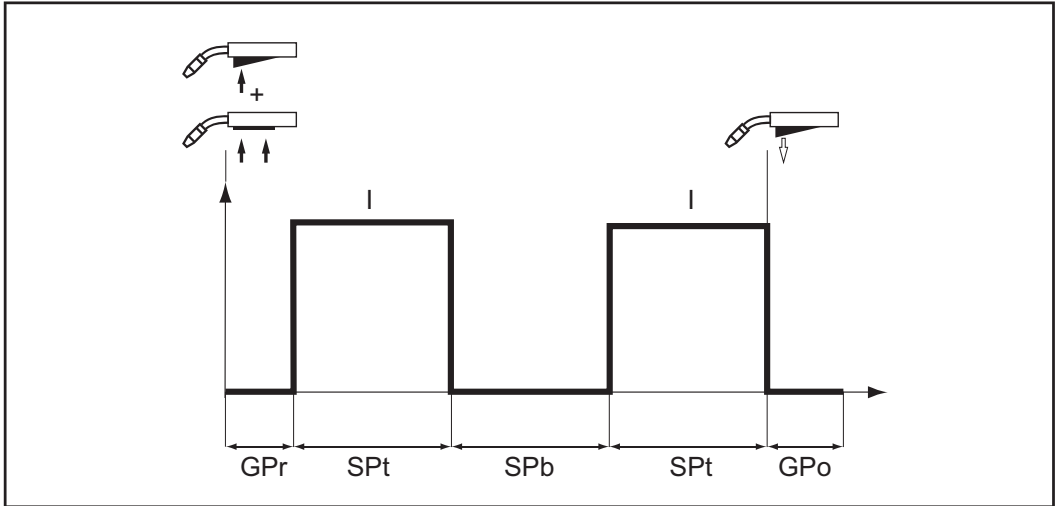


The "Spot welding" mode is suitable for welded joints on overlapped sheets.

Start by pressing and releasing the torch trigger - GPr gas pre-flow time - Welding current phase for the duration of the Spt spot welding time - GPo gas post-flow.

If the torch trigger is pressed again before the end of the spot welding time (< Spt), the process is cancelled immediately.

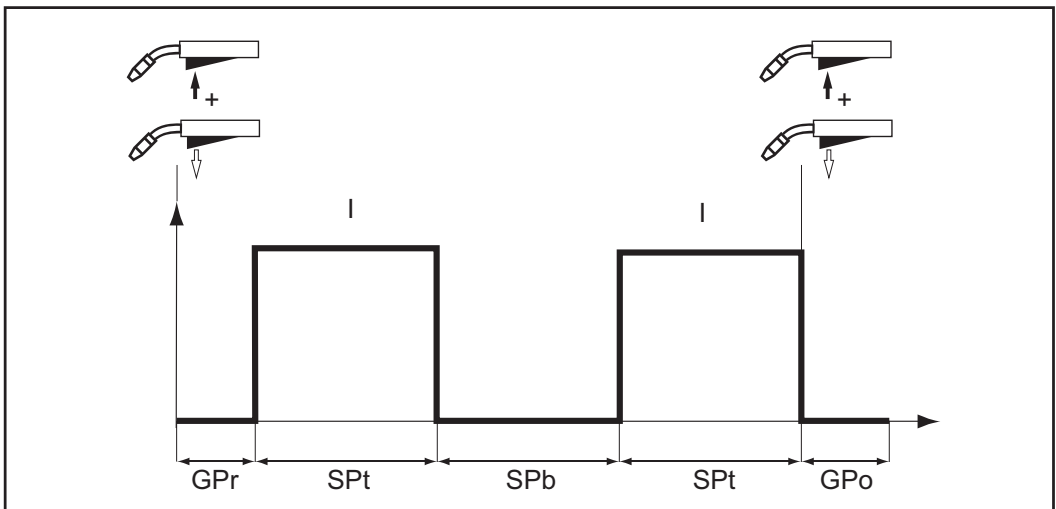
2-step stitch welding



2-step stitch welding

The "2-step stitch welding" mode is suitable for welding short weld seams on thin sheets, to prevent the weld seams from dropping through the base material.

4-step stitch welding



4-step stitch welding

The "4-step stitch welding" mode is suitable for welding longer weld seams on thin sheets, to prevent the weld seams from dropping through the base material.

MIG/MAG welding

Safety



WARNING!

Operating the equipment incorrectly can cause serious injury and damage.

- ▶ Do not use the functions described here until you have read and completely understood these Operating Instructions.
 - ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions for the system components, in particular 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
 - ▶ Before carrying out any work on the device make sure that the power source is unplugged from the mains
-

Preparatory work

- 1 Connect welding torch water hoses to the correct connections on the wirefeeder (when using a cooling unit and water-cooled welding torch)
- 2 Plug in the mains plug
- 3 Move the mains switch to the "I" position:
 - all the indicators on the control panel light up briefly
 - where applicable, the cooling unit starts to run

IMPORTANT! Follow the safety rules and note operating conditions in the cooling unit Operating Instructions.

Overview

MIG/MAG welding is composed of the following sections:

- MIG/MAG standard synergic welding
- MIG/MAG standard manual welding
- Spot and stitch welding

MIG/MAG standard synergic welding

MIG/MAG standard synergic welding

- 1 Press the "Material" button to select the filler metal to be used.
- 2 Press the "Wire diameter" button to select the diameter of the wire electrode used.
- 3 Press the "Shielding gas" button to select the shielding gas to be used.
The assignment of the SP position is in the welding program tables in the appendix.
- 4 Press the "Process" button to select the desired welding process:

 MIG/MAG standard synergic welding

- 5 Press the "Mode" button to select the desired MIG/MAG mode:

 2-step mode

 4-step mode

 Special 4-step mode


IMPORTANT!

Under certain circumstances, it may not be possible to change welding parameters that have been set on the control panel of a system component (TR 2000 or TR 3000 remote control) on the control panel of the power source.

- 6 Use the "Parameter selection" buttons to select the welding parameters to be used to specify the welding power:

 Sheet thickness

A Welding current

 Wire speed

V Welding voltage

- 7 Use the appropriate adjusting dial to set the relevant welding parameters.

The welding parameter values are shown in the digital display located above them.

All welding parameter set values remain stored until the next time they are changed. This applies even if the power source is switched off and on again. To display the actual welding current during welding, select the welding current parameter.

- 8 Open the gas cylinder valve
- 9 Setting the shielding gas flow rate:
 - Tap the "Gas-test" button
 - Turn the adjusting screw on the underside of the pressure regulator until the pressure gauge shows the required gas flow rate
 - Tap the "Gas-test" button again



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)
-

10 Press the torch trigger and start welding

Corrections during welding

The arc length correction and arc-force dynamic parameters can be used to optimise the welding result.

Arc length correction:

- = shorter arc, reduced welding voltage
- 0 = neutral arc
- + = longer arc, increased welding voltage

Arc-force dynamic:

To influence the short-circuiting dynamic at the instant of droplet transfer

- = hard, stable arc
- 0 = neutral arc
- + = soft, low-spatter arc

MIG/MAG standard manual welding

General

The MIG/MAG standard manual welding process is a MIG/MAG welding process with no synergic function.

Changing one parameter does not result in any automatic adjustments to the other parameters. All of the variable parameters must therefore be adjusted individually, as dictated by the welding process in question.

Available parameters

The following parameters are available in MIG/MAG manual welding:



Wire feed speed

1 m/min (39.37 ipm) - maximum wire feed speed, e.g. 25 m/min (984.25 ipm)



Welding voltage

TSt 3500: 15.5 - 31.5 V

TSt 5000: 14.5 - 39 V



Dynamic

for influencing the short-circuiting dynamic at the moment of particle transfer



Welding current

only for displaying the actual value

MIG/MAG standard manual welding

1 Press the "Process" button to select the desired welding process:



MIG/MAG standard manual welding

2 Press the "Mode" button to select the desired MIG/MAG mode:



2-step mode



4-step mode

In MIG/MAG standard manual welding, special 4-step mode corresponds to conventional 4-step mode.

IMPORTANT! Under certain circumstances, it may not be possible to change welding parameters that have been set on the control panel of a system component (TR 2000 or TR 3000 remote control) on the control panel of the wirefeeder.

3 Press the "Parameter selection" button to select the wire speed parameter

4 Use the adjusting dial to set the desired value for the wire speed

5 Press the "Parameter selection" button to select the welding voltage parameter

6 Use the adjusting dial to set the desired value for the welding voltage

The welding parameter values are shown in the digital display located above them.

All welding parameter set values remain stored until the next time they are changed. This applies even if the power source is switched off and on again. To display the actual welding current during welding, select the welding current parameter.

To display the actual welding current during welding:

- Press the "Parameter selection" button to select the welding current parameter
- The actual welding current is shown on the digital display during welding.

7 Open the gas cylinder valve

8 Setting the shielding gas flow rate:

- Tap the "Gas-test" button
- Turn the adjusting screw on the underside of the pressure regulator until the pressure gauge shows the required gas flow rate
- Tap the "Gas-test" button again



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)

9 Press the torch trigger and start welding

Corrections during welding

To obtain the best possible welding results, the arc-force dynamic parameter will sometimes need to be adjusted.

1 Press the "Parameter selection" button to select the arc-force dynamic parameter

2 Use the adjusting dial to set the desired arc-force dynamic value

The welding parameter value is shown in the digital display located above it.

Spot and stitch welding

General

The spot and stitch welding modes are MIG/MAG welding processes. The spot and stitch welding modes can be activated in the Setup menu.

Spot welding is used on overlapping sheets that are only accessible on one side.

Stitch welding is used for light-gauge sheets.

As the wire electrode is not fed continuously, the weld pool can cool down during the intervals. Local overheating leading to the base material being melted through is largely avoided.




Spot welding

Activating spot welding mode:

- For the SPt Setup parameter (spot / stitch welding time), enter a value > OFF

As soon as a value is entered for the SPt Setup parameter, spot welding mode is activated. The spot / stitch welding indicator (SF) lights up on the control panel.

Preparations:

- 1 Set the spot / stitch welding time (SPT) in the Setup menu
- 2 Select the filler metal, wire diameter and shielding gas being used with the relevant buttons
- 3 Select the desired welding process:
 -  MIG/MAG standard manual welding
 -  MIG/MAG standard synergic welding
- 4 Select the desired MIG/MAG mode:
 -  2-step mode

(For spot welding mode, only 2-step mode is available)
- 5 Depending on the selected welding process, select the desired welding parameters using the relevant adjusting dial
- 6 Open the gas cylinder valve
- 7 Set 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)

-
- 12 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





Stitch welding

Activating stitch welding mode:

- For the SPt Setup parameter (spot / stitch welding time), enter a value > OFF
- For the SPt Setup parameter (spot pause time), enter a value > OFF

As soon as a value is entered for the SPt Setup parameter, the spot / stitch welding indicator (SF) lights up.

Preparations:

- 1 Set the spot / stitch welding time (SPt) in the Setup menu
- 2 Set the spot pause time (SPb) in the Setup menu
- 3 Select the filler metal, wire diameter and shielding gas being used with the relevant buttons
- 4 Select the desired welding process:
 -  MIG/MAG standard manual welding
 -  MIG/MAG standard synergic welding
- 5 Select the desired MIG/MAG mode for stitch welding mode:
 -  2-step mode
 -  4-step mode
- 6 Depending on the selected welding process, select the desired welding parameters using the relevant adjusting dial
- 7 Open the gas cylinder valve
- 8 Set 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)

-
- 10 Stitch welding

Procedure for stitch welding:

- 1 Hold the welding torch vertical

- 2 Depending on the selected mode:
press and hold the torch trigger (2-step mode)
press and release the torch trigger (4-step mode)
- 3 Keep the torch in the same position
- 4 Wait for the welding interval
- 5 Position the welding torch at the next point
- 6 To end stitch welding, depending on the selected mode:
release the torch trigger (2-step mode)
press and release the torch trigger (4-step mode)
- 7 Wait for the gas post-flow time
- 8 Lift the torch off the workpiece

EasyJob mode

General

The "Save" buttons allow up to 5 EasyJob operating points to be saved. Every operating point matches the settings on the control panel.

EasyJobs can be stored for each welding process.

IMPORTANT! Setup parameters are not saved at this time.

Storing EasyJob operating points

- 1 Press and hold one of the "Save" buttons to save the current settings on the control panel, e.g.:



- The left indicator displays "Pro"
- After a short time, the left indicator switches to the original value

- 2 Release the "Save" button
-

Retrieving EasyJob operating points

- 1 To retrieve saved settings, press the corresponding "Save" button briefly, e.g.:



- The control panel will show the saved settings
-

Deleting EasyJob operating points

- 1 Press and hold the relevant "Save" button to delete the memory content of that "Save" button, e.g.:



- The left indicator displays "Pro".
- After a short time, the left indicator switches to the original value

- 2 Keep the "Save" button held down
 - The left display shows "CLr".
 - After a while, both displays show "---"

- 3 Release the "Save" button
-

Retrieving EasyJob operating points on the Up/Down welding torch

One of the "Save" buttons on the control panel must be pressed in order to retrieve the saved settings using the Up/Down welding torch.











- 1 Press one of the "Save" buttons on the control panel, e.g.:



The control panel will show the saved settings.

The "Save" buttons can now be selected using the buttons on the Up/Down welding torch. Vacant "Save" buttons are skipped.

In addition to the "Save" button number lighting up, a number is displayed directly on the Up/Down welding torch:

Indicator on the Up/Down welding torch	EasyJob operating point on the control panel
	
	
	
	
	

MMA welding

Safety

WARNING!

Operating the equipment incorrectly can cause serious injury and damage.

- ▶ Do not use the functions described here until you have read and completely understood these Operating Instructions.
 - ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions for the system components, in particular the safety rules.
-

WARNING!

An electric shock can be fatal.

If the device is plugged into the mains during installation, there is a high risk of very serious injury and damage.

- ▶ Only carry out work on the device if the mains switch is in the "O" position.
 - ▶ Only carry out work on the charger when it has been disconnected from the mains supply.
-

Preparation

- 1 Move the mains switch to the "O" position
- 2 Disconnect the mains plug
- 3 Detach all cables to the wirefeeder at the power source

IMPORTANT! Check the rod electrode packaging to determine whether the rod electrodes are for (+) or (-) welding.

- 4 Plug the grounding cable into either the (-) or the (+) current socket, depending on the type of electrode, and lock in place
 - 5 Use the other end of the grounding 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. the housing, etc.)
-

- 1 Move the mains switch to the "I" position: all the indicators on the control panel will briefly light up

- 2 Press the "Process" button to select the MMA welding process:



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

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

NOTE!

Under certain circumstances, it may not be possible to change welding parameters that have been set on a system component (such as remote control or wirefeeder) from the control panel of the power source.

- 3 Press the "Parameter selection" button to select the amperage parameter.
4 Use the adjusting dial to set the desired amperage.

The amperage value is displayed in the left-hand digital display.

All welding parameter set values that have been set using the adjusting dial remain stored until the next time they are changed. This applies even if the power source was switched off and on again in the interim.

- 5 Start welding

To display the actual welding current during welding:

- Press the "Parameter selection" button to select the welding current parameter
- The actual welding current is shown on the digital display during welding.

Corrections during welding

To obtain the best possible welding results, the arc-force dynamic parameter will sometimes need to be adjusted.

- 1 Press the "Parameter selection" button to select the arc-force dynamic parameter
2 Use the adjusting dial to set the desired arc-force dynamic value

The welding parameter value is shown in the digital display located above it.

Influence of the short-circuiting dynamic at the instant of droplet transfer:

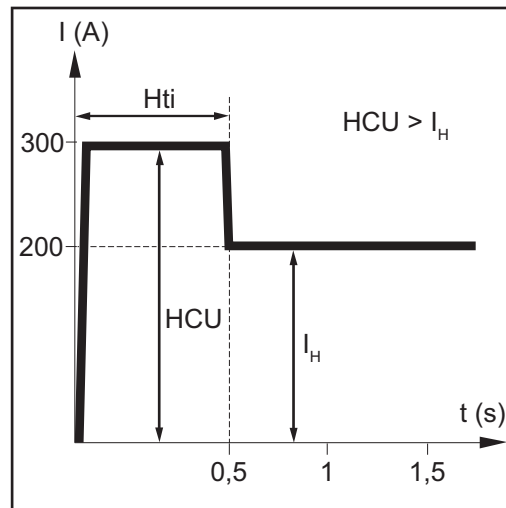
- = hard, stable arc
- 0 = neutral arc
- + = soft, low-spatter arc

HotStart function To obtain optimum welding results, it will sometimes be necessary to adjust the HotStart function.

Advantages

- Improved ignition properties, even when using electrodes with poor ignition properties
- Better fusion of the base material during the start-up phase, meaning fewer cold-shut defects
- Largely prevents slag inclusions

For details on setting the available welding parameters, please refer to "Setup parameters", "Setup menu - level 2".



Legend

- Hti Hot-current time,
0 - 2 s,
factory setting: 0.5 s
- HCU HotStart current,
100 - 200 %,
factory setting 150 %
- I_H Main current = set welding current

Function

During the specified hot-current time (Hti), the welding current is increased to a certain value. This value (HCU) is higher than the selected welding current (I_H).

Anti-stick function

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.

Electrode burn-out is prevented by activating the anti-stick function. If the rod electrode begins to stick, the power source immediately switches the welding current off. After the rod electrode has been detached from the workpiece, the welding process can be continued without any problems.

The anti-stick function (Ast) can be activated and deactivated in the Setup menu with the Setup parameters for manual metal arc welding.

Arc Air Gauging (TSt 5000 Syn)

Safety

WARNING!

Operating the equipment incorrectly can cause serious injury and damage.

- ▶ Do not use the functions described here until you have read and completely understood these Operating Instructions.
- ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions for the system components, in particular the safety rules.

WARNING!

An electric shock can be fatal.

If the device is plugged into the mains during installation, there is a high risk of very serious injury and damage.

- ▶ Only carry out work on the device if the mains switch is in the "O" position.
- ▶ Only carry out work on the charger when it has been disconnected from the mains supply.

Preparation

IMPORTANT! A grounding cable with a cable cross-section of 120 mm² is required for arc air gouging.

- 1 Move the mains switch to the "O" position
- 2 Disconnect the mains plug
- 3 Remove the MIG/MAG welding torch
- 4 Plug the grounding cable into the (-) current socket and twist to fasten it
- 5 Use the other end of the grounding cable to establish a connection to the workpiece
- 6 Plug the bayonet current plug of the arc air gouging torch into the (+) current socket and twist it clockwise to fasten it
- 7 Connect the compressed air connection of the arc air gouging torch to the compressed air supply
Working pressure: 5 - 7 bar (constant)
- 8 Clamp the carbon electrode so that the electrode tip protrudes approximately 100 mm out of the arc air gouging torch;
the air outlet openings of the arc air gouging torch must be located at the bottom
- 9 Plug in the mains plug

Arc air gouging

CAUTION!

Risk of injury and damage from electric shock.

As soon as the mains switch is in the "I" position, the electrode in the arc air gouging torch is live.

- ▶ Make sure the electrode does not touch any persons or electrically conducting or earthed parts (e.g. the housing, etc.).

 **CAUTION!**

Risk of personal injury due to loud operating noise.

- ▶ Use suitable ear protection during arc air gouging!

- 1 Move the mains switch to the "I" position: all the indicators on the control panel will briefly light up
- 2 Press the "Process" button to select the MMA welding process:



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

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

IMPORTANT! Under certain circumstances, it may not be possible to change welding parameters that have been set on a control panel of a system component (such as remote control or wirefeeder) from the control panel of the power source.

- 3 In the setup menu for MMA welding, set the AAG parameter to "on";
To enter the setup menu, see page [91](#).

NOTE!

Settings for the break voltage and the starting current time are ignored.

- 4 Exit the setup menu for MMA welding
- 5 Press the "Parameter selection" button to select the amperage parameter.
- 6 Using the adjusting dial, adjust the main current according to the electrode diameter as indicated on the electrode packaging

The amperage value is displayed in the left-hand digital display.

NOTE!

At higher amperages, guide the arc air gouging torch with both hands!

- ▶ Use a suitable welding helmet.

- 7 Open the compressed air valve on the handle of the arc air gouging torch
- 8 Initiate processing

The tilt angle of the carbon electrode and the gouging speed determine the depth of an air gap.

The arc air gouging parameters are the same as the welding parameters for MMA welding, see page [94](#).

Easy Documentation

General

If the Easy Documentation option is available on the power source, the most important welding data for each weld can be documented and saved as a CSV file on a USB flash drive.

A Fronius signature is stored with the welding data which can be used to check and guarantee the authenticity of the data.

Easy Documentation is activated / deactivated by plugging / unplugging the supplied Fronius USB flash drive with FAT32 formatting into the back of the power source.

IMPORTANT! To document the welding data, the date and time must be set correctly.

Documented welding data

The following data is also documented:

Device type

File name

Item number

Serial number

Firmware version of power source

Firmware of PC board DOCMAG (Easy Documentation)

Docu version

<https://www.easydocu.weldcube.com> (a PDF report of selected welding data can be created under this link)

Nr.	Counter Start by plugging in the USB flash drive; When switching the power source off and on, the counter continues at the last weld seam number. A new CSV file is created after 1000 welds.
Date	Date yyyy-mm-dd
Time	Time hh:mm:ss at start of current flow
Duration	Duration in [s] from start of current flow to end of current (current flow signal)
I	Welding current * in [A]
U	Welding voltage * in [V]
vd	Wire speed * in [m/min]
wfs	Wire speed * in [ipm]
IP	Power * from instantaneous values in [W]
IE	Energy from instantaneous values in [kJ] across the entire weld
I-Mot	Motor current * in [A]
Synid	Characteristic number per weld
Job	EasyJob number per weld seam
Process	Welding process

Mode	Operating mode
Status	PASS: regular welding IGN: Welding interrupted during the ignition phase Err xxx: Welding interrupted due to a fault; the corresponding service code is documented
Interval	Weld seam number for "Interval" operating mode
Signature	Signature per weld seam number

* In each case from the main process phase;
In the event of termination in the ignition phase, the average value in the ignition phase is stored and a identifier is output to indicate that the main process phase has been reached

The welding data is documented as average values in the main process phase and per weld.

New CSV file

A new CSV file is generated:

- if the USB flash drive is disconnected and reconnected while the power source is on
- If the date and time are changed
- From 1000 welds
- During a firmware update
- if the USB flash drive is disconnected and reconnected to another power source (= change of serial number).

PDF report / Fronius signature



By scanning the link on the left

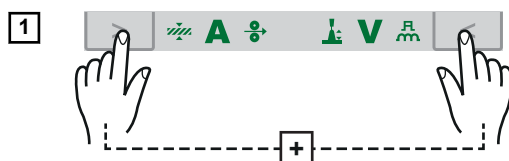
- A PDF report of the selected welding data can be created
- The authenticity of the data can be checked and guaranteed via the Fronius signature read out with the welding data.

<https://easydocu.weldcube.com>

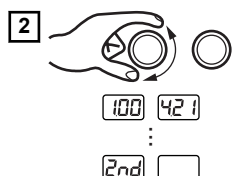
Activating / deactivating Easy Documentation

Setting the date and time

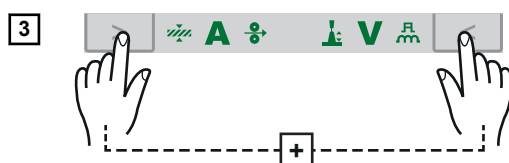
The date and time are set in the 2nd level of the service menu.



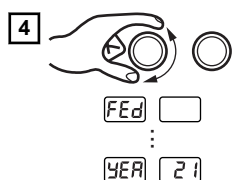
The first parameter in the service menu is displayed.



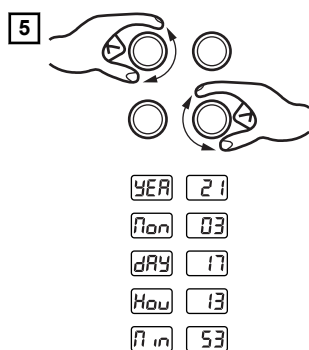
Select the "2nd" setup parameter using the left-hand adjusting dial



The first parameter in the 2nd level of the service menu is displayed.



Select the "yEA" (= year) setup parameter using the left-hand adjusting dial



To set the date and time:

- Left-hand adjusting dial:
Select parameter
- Right-hand adjusting dial:
Change values

Setting ranges:

yEA	Year (20yy; 0 - 99)
Mon	Month (mm; 1 -1 12)
dAY	Day (dd; 1 - 31)
Hou	Hour (hh; 0 - 24)
Min	Minute (mm; 0 - 59)

NOTE!

If the power source is reset to factory settings via setup parameter FAC, the date and time remain stored.

Deactivating Easy Documentation

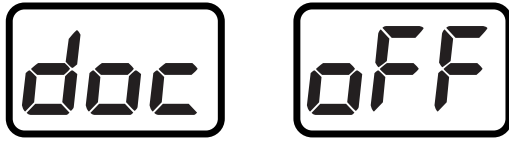
⚠ CAUTION!

Risk of data loss or data damage due to premature disconnection of the USB flash drive

- ▶ Do not disconnect the USB flash drive until approx. 10 seconds after the end of the last weld to ensure correct data transfer.

- 1 Unplug the USB flash drive from the power source

The following appears on the power source display:



Easy Documentation is deactivated.

- 2 Confirm the display by pressing the arrow key



Setup settings

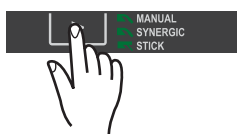
Setup menu

General remarks The Setup menu provides simple access to expert knowledge in the power source and to additional functions. The Setup menu can be used to make simple adjustments of the parameters to suit the various job settings.

Operation Access to the setup menu is described based on the MIG/MAG standard synergic welding process. Access is the same for the other welding processes.

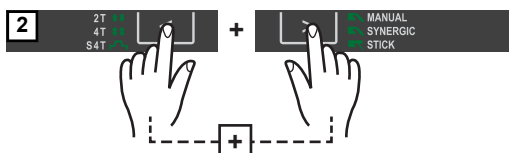
Accessing the Setup menu

1



Use the "Process" button to select the "MIG/MAG standard synergic welding" process

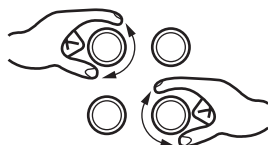
2



The control panel is now in the Setup menu for the "MIG/MAG standard synergic welding" process - the last setup parameter that was selected is displayed.

Changing welding parameters

1

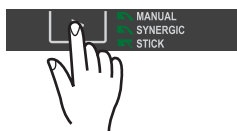


Select the desired setup parameter using the left-hand adjusting dial

Alter the setup parameter value using the right-hand adjusting dial

Exiting the Setup menu

1



Setup parameters for MIG/MAG standard manual welding

"Min." and "max." are used for setting ranges that differ according to power source, welding program, etc.

GPr Gas pre-flow time
Unit: s
Setting range: 0 - 9.9
Factory setting: 0.1

GPo Gas post-flow time
Unit: s
Setting range: 0 - 9.9
Factory setting: 0.5

Fdi Feeder inching speed
Unit: m/min (ipm)
Setting range: 1 - max. (39.37 - max.)

Factory setting: 10 (393.7)

bbc **Burn-back time correction**
Burn-back time effect due to a delayed switch-off of the welding current after the wire electrode stops being fed forward. A ball forms on the wire electrode.

Unit: s

Setting range: AUt, 0 - 0.3

Factory setting: AUt

IGC **Ignition current**

Unit: A

Setting range: 100 - 650

Factory setting: 500

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

Unit: mm (in.)

Setting range: OFF, 5 - 100 (OFF, 0.2 - 3.94)

Factory setting: OFF

NOTE!

The lto function (wire length up to safety cut-out) is a safety function.

The length of wire that is fed before the safety cut-out trips may differ from the pre-set wire length, particularly when the wire is being fed at fast wire speeds.

SPt **Spot welding time / interval welding time**

Unit: s

Setting range: 0.3 - 5

Factory setting: 0.3

SPb **Interval pause time**

Unit: s

Setting range: OFF, 0.3 - 10 (in 0.1 s increments)

Factory setting: OFF

Int **Interval**

Displayed only if a value has been set for SPb

Unit: -

Setting range: 2T (2-step), 4T (4-step)

Factory setting: 2T (2-step)

FAC **Reset power source to factory settings**

Press and hold down one of the "Parameter selection" buttons for 2 s to restore the factory settings

- when "PrG" appears on the digital display, the power source has been reset

IMPORTANT! When the power source is reset, all personal settings in the Setup menu are lost.

Operating points that were saved using the "Save" buttons are retained when the power source is reset. The functions in the second level of the Setup menu (2nd) are also not deleted. Exception: Ignition time-out function parameter (lto).

2nd **Second level of the Setup menu (see "Setup menu - level 2")**

**Setup parameters
for MIG/MAG
standard syner-
gic welding**

"Min." and "max." are used for setting ranges that differ according to power source, welding program, etc.

GPr	Gas pre-flow time Unit: s Setting range: 0 - 9.9 Factory setting: 0.1
GPo	Gas post-flow time Unit: s Setting range: 0 - 9.9 Factory setting: 0.5
SL	Slope (special 4-step mode only) Unit: s Setting range: 0 - 9.9 Factory setting: 0.1
I-S	I (current) - Starting - Starting current (special 4-step mode only) Unit: % (of welding current) Setting range: 0 - 200 Factory setting: 100
I-E	I (current) - End: Final current (special 4-step mode only) Unit: % (of welding current) Setting range: 0 - 200 Factory setting: 50
t-S	t (time) - Starting - Starting current duration (special 4-step mode only) Unit: s Setting range: OFF, 0.1 - 9.9 Factory setting: OFF
t-E	t (time) - End: Final current duration (special 4-step mode only) Unit: s Setting range: OFF, 0.1 - 9.9 Factory setting: OFF
Fdi	Feeder inching - feeder inching speed Unit: m/min (ipm) Setting range: 1 - max. (39.37 - max.) Factory setting: 10 (393.7)
bbc	Burn-back time correction - burn-back effect Wire burn-back effect through wire withdrawal at end of welding, regardless of the selected characteristic Unit: s Setting range: Aut, 0 - 0.3 Factory setting: Aut
Ito	Ignition time-out function - length of wire that is fed before the safety cut-out trips Unit: mm (in.) Setting range: OFF, 5 - 100 (OFF, 0.2 - 3.94) Factory setting: OFF

NOTE!**The "Ignition time-out" function (ito) is a safety function.**

The length of wire that is fed before the safety cut-out trips may differ from the pre-set wire length, particularly when the wire is being fed at fast wire speeds.

SPt Spot time - spot / stitch welding time

Unit: s

Setting range: OFF, 0.1 - 5

Factory setting: OFF

SPb Spot break - stitch pause time

Unit: s

Setting range: OFF, 0.1 - 10 (in 0.1 s increments)

Factory setting: OFF

FAC Reset power source to factory setting

Press and hold down one of the "Parameter selection" buttons for 2 s to restore the factory settings

- when "PrG" appears on the digital display, the power source has been reset.

IMPORTANT! When the power source is reset, all personal settings in the Setup menu are lost.

When the power source is reset, operating points that were saved using the "Save" buttons are not deleted, but are retained in the memory. The functions in the second level of the Setup menu (2nd) are also not deleted. Exception: Ignition time-out function parameter (ito).

2nd Second level of the set-up menu (see "Set-up menu - Level 2")**Setup parameters for MMA welding**

IMPORTANT! If you reset the power source using the FAC factory setup parameter, the hot-current time (Hti) and HotStart current (HCU) setup parameters are also reset.

HCU HotStart current

Unit: %

Setting range: 100 - 200

Factory setting: 150

Hti Hot current time

Unit: s

Setting range: 0 - 2.0

Factory setting: 0.5

ASt Anti-stick

Unit: -

Setting range: On, OFF

Factory setting: OFF

AAG Gouging (Arc Air Gauging)

Arc air gouging with a carbon electrode, e.g., for joint preparation

Unit: -

Setting range: on / oFF

Factory setting: oFF

FAC Reset power source to factory settings

Press and hold down one of the "Parameter selection" buttons for 2 s to restore the factory settings - when "PrG" appears on the digital display, the power source has been reset.

IMPORTANT! When the power source is reset, all personal settings are lost.

When the power source is reset, operating points that were saved using the "Save" buttons are not deleted, but are retained in the memory. The functions in the second level of the Setup menu (2nd) are also not deleted. Exception: Ignition time-out function parameter (ito).

2nd Second level of the set-up menu (see "Set-up menu - Level 2")

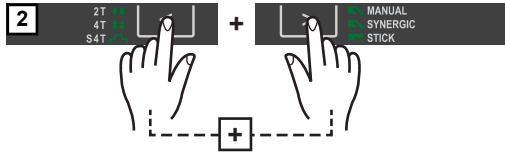
Setup menu - Level 2

Operation (level 2 Setup menu)

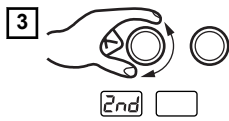
To access the Level 2 Setup menu:



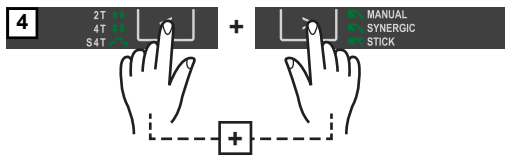
Use the "Process" button to select the "MIG/MAG standard synergic welding" process



The control panel is now in the Setup menu for the "MIG/MAG standard synergic welding" process - the last setup parameter that was selected is displayed.

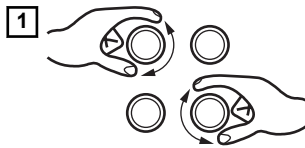


Select the "2nd" setup parameter using the left-hand adjusting dial



The control panel is now in the second level of the setup menu for the "MIG/MAG standard synergic welding" process - the last setup parameter that was selected is displayed.

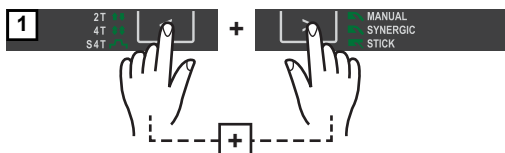
Changing welding parameters



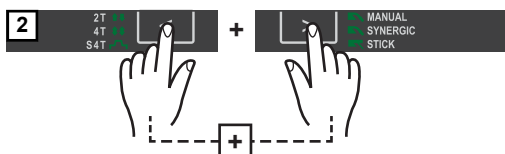
Select the desired setup parameter using the left-hand adjusting dial

Alter the setup parameter value using the right-hand adjusting dial

Exiting the Setup menu



A parameter is displayed in the first level of the Setup menu.



**Parameters for
MIG/MAG welding
in the Setup
menu level 2**

C-C	<p>Cooling unit Control (only with connected cooling unit)</p>
	<p>Unit: - Setting range: Aut, On, OFF Factory setting: Aut</p>
	<p>Aut: The cooling unit cuts out after a 2-minute welding off-time.</p>
	<p>IMPORTANT! If the coolant temperature and flow monitoring options have been installed in the cooling unit, the cooling unit cuts out as soon as the return-flow temperature drops below 50 °C, but at the earliest after a 2-minute welding off-time.</p>
	<p>On: The cooling unit is always ON OFF: The cooling unit is always OFF</p>
	<p>IMPORTANT! If the FAC welding parameter is used, the C-C parameter is not reset to the factory setting. If the MMA welding process is selected, the cooling unit is always switched off, even if the switch is in the "On" position.</p>
C-t	<p>Cooling Time (only with connected cooling unit) Time from when flow monitoring is triggered until the "no H2O" service code is output. For example, if there are air bubbles in the cooling system, the cooling unit will not cut out until the end of this preset time.</p>
	<p>Unit: s Setting range: 5 - 25 Factory setting: 10</p>
	<p>IMPORTANT! Every time the power source is switched on, the cooling unit carries out a test run for 180 seconds.</p>
SEt	<p>Setting - country-specific setting (Standard/USA), etc. Std/US</p>
	<p>Unit: - Setting range: Std, US (Standard/USA) Factory setting: Standard version: Std (measurements: cm/mm) USA version: US (measurements: inches)</p>
r	<p>r (resistance) - welding circuit resistance (in mOhm) see "Measuring welding circuit resistance r"</p>
L	<p>L (inductivity) - welding circuit inductivity (in microhenry) see "Displaying welding circuit inductivity L"</p>

EnE Real Energy Input – electrical energy of the arc relative to the welding speed

Unit: kJ
Setting range: ON / OFF
Factory setting: OFF

Since the full range of values (1 kJ - 99999 kJ) cannot be displayed on the three-digit display, the following display format has been selected:

Value in kJ / indicator on display:
1 to 999 / 1 to 999
1000 to 9999 / 1.00 to 9.99 (without "ones" digit, e.g. 5270 kJ -> 5.27)
10000 to 99999 / 10.0 to 99.9
(without "ones" and "tens" digits, e.g. 23580 kJ -> 23.6)

ALC Arc Length Correction - correction of the arc length via the welding voltage

Setting range: ON / OFF
Factory setting: OFF

The arc length depends on the welding voltage. the welding voltage can be adjusted to suit individual needs in Synergic operation.

If the ALC parameter is set to "OFF", the welding voltage cannot be adjusted. The welding voltage is automatically determined by the selected welding current or wire speed. If the arc length correction is adjusted, the voltage changes, but the welding current and wire speed remain the same. When setting the arc length correction using the adjusting dial, the left display is used for the correction value of the arc length. The welding voltage value on the right display changes simultaneously. Afterwards the left display shows the original value, e.g. welding current.

Parameters for manual metal arc (MMA) welding in the Setup menu level 2

r (resistance) - welding circuit resistance (in mOhm)
See "Measuring welding circuit resistance r" from page **99**.

L (inductivity) - welding circuit inductivity (in microhenry)
see "Displaying welding circuit inductivity L" from page **101**.

Measuring welding circuit resistance r

General

Measuring the welding circuit resistance makes it possible to have a consistent welding result at all times, even with hosepacks of different lengths. The welding voltage at the arc is then always precisely regulated, regardless of the length and cross-sectional area of the hosepack. The use of arc length correction is no longer required.

The calculated welding circuit resistance is shown on the display.

r = welding circuit resistance in milliohm (mOhm)

If the welding circuit resistance has been measured correctly, the set welding voltage will correspond exactly to the welding voltage at the arc. If you manually measure the voltage on the output jacks of the power source, this voltage will be higher than the welding voltage at the arc - that is, higher by the same amount as the voltage drop of the hosepack.

The welding circuit resistance depends on the hosepack used:

- If the length or cross-sectional area of the hosepack has changed, measure the welding circuit resistance again
- Measure the welding circuit resistance for every welding process separately with the appropriate welding power-leads

Measuring welding circuit resistance (MIG/MAG welding)

NOTE!

Risk of incorrect measurement of the welding circuit resistance.

This may negatively affect the welding result.

- ▶ Ensure that the workpiece in the area of the earthing clamp provides an optimal contact surface (cleaned surface, free from rust, etc.).

- 1 Ensure that the MANUAL or SYNERGIC process has been selected
- 2 Establish a grounding (earthing) connection to the workpiece
- 3 Access the Level 2 (2nd) Setup menu
- 4 Select parameter "r"
- 5 Remove the gas nozzle from the welding torch
- 6 Screw on the contact tip
- 7 Make sure the wire electrode does not protrude from the contact tip

NOTE!

Risk of incorrect measurement of the welding circuit resistance.

This may negatively affect the welding result.

- ▶ Ensure that the workpiece provides an optimal contact surface for the contact tip (cleaned surface, free from rust, etc.).

- 8 Place the contact tip flush against the workpiece surface
- 9 Press the torch trigger briefly
 - The welding circuit resistance is calculated. "run" is shown on the display during the measurement

The measurement is finished when the welding circuit resistance is shown on the display in mOhm (for example, 11.4).

10 Fit the gas nozzle back onto the welding torch

Retrieving the welding circuit inductivity L

General

Laying of the hosepacks has a significant effect on welding circuit inductivity and therefore affects the welding process. It is important to lay the hosepacks correctly in order to obtain the best possible welding result.

Displaying welding circuit inductivity

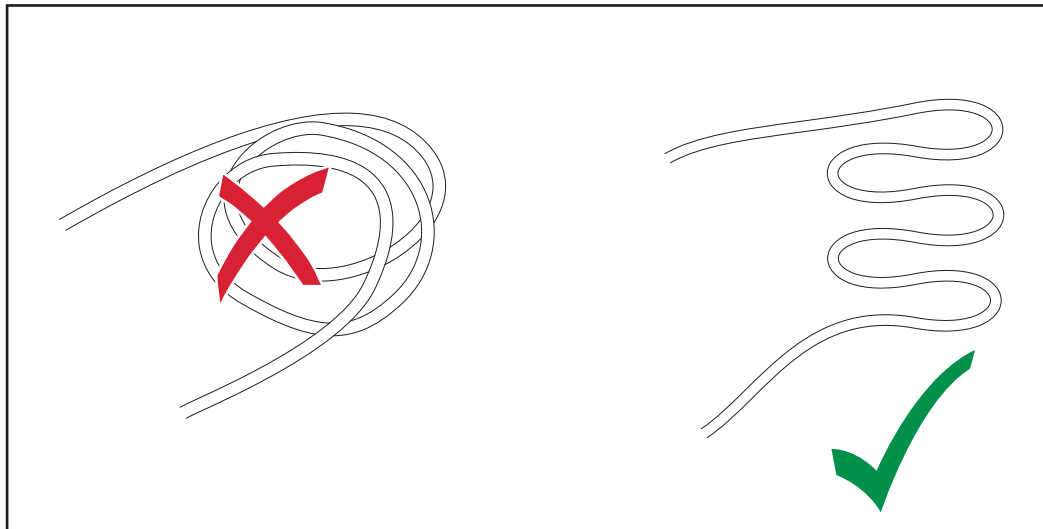
The setup parameter "L" is used to display the most recently calculated welding circuit inductivity. The welding circuit inductivity is calibrated at the same time as the welding circuit resistance is measured. Detailed information can be found in the "Measuring welding circuit resistance" section.

- 1 Access the Level 2 (2nd) Setup menu
- 2 Select parameter "L"

The most recently calculated welding circuit inductivity L is shown on the right-hand digital display.

L ... Welding circuit inductivity (in microhenry)

Laying the hosepacks correctly



Troubleshooting and maintenance

Troubleshooting

General

The devices are equipped with an intelligent safety system. This means that to a large extent it has been possible to dispense with melting-type fuses. Melting-type fuses therefore no longer need to be replaced. After a possible malfunction has been remedied, the device is ready for use again.

Safety



WARNING!

Work that is carried out incorrectly may result in serious injury or damage to property.

- ▶ The activities described below must only be carried out by trained and qualified personnel.
 - ▶ Observe the safety rules in the power source Operating Instructions.
-



WARNING!

An electric shock can be fatal.

Before opening the unit

- ▶ Turn the mains switch to the "O" position
 - ▶ Unplug the device from the mains
 - ▶ Put up an easy-to-understand warning sign to stop anybody inadvertently switching it back on again
 - ▶ Using a suitable measuring device, check to make sure that electrically charged components (e.g. capacitors) have discharged
-



WARNING!

Danger from inadequate ground conductor connection.

Possible serious injury and damage to property.

- ▶ The housing screws provide a suitable ground conductor connection for earthing the housing and must NOT be replaced by any other screws that do not provide a reliable ground conductor connection.
-

Fault diagnosis

Make a note of the serial number and configuration of the device and contact our After-Sales Service team with a detailed description of the error, if

- errors occur that are not listed below
- the troubleshooting measures listed are unsuccessful

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 protection

Remedy: Change the mains fuse protection

Cause: Short circuit on the 24 V supply of SpeedNet connection socket or external sensor

Remedy: Unplug connected components

Nothing happens when the torch trigger is pressed

Power source mains switch is ON and indicators are lit up

Cause: Only for welding torches with an external control plug: 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 welding torch

Nothing happens when the torch trigger is pressed

Power source mains switch is on, power source ON indication is lit up on the power source, indications on wire-feed unit are not lit up

Cause: The interconnecting hosepack is faulty or not connected properly

Remedy: Check interconnecting hosepack

No welding current

Mains switch is on, one of the overtemperature service codes "to" is displayed. Detailed information on the service codes "to0" to "to6" can be found in the section "Displayed service codes".

Cause: Overload

Remedy: Take the duty cycle into account

Cause: Thermostatic safety cut-out has 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: Remove air filter on the rear of the housing from the side and clean. Ensure that the cooling air ducts are accessible.

Cause: The fan in the power source is faulty

Remedy: Contact 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 for correct polarity

Cause: There is a break in the power cable in the welding torch

Remedy: Replace the welding torch

No protective gas shield

All other functions are OK

Cause: Gas cylinder is empty

Remedy: Change the gas cylinder

Cause: The gas pressure regulator is faulty

Remedy: Replace the gas pressure regulator

Cause: Gas hose is not fitted or is damaged

Remedy: Fit or change the gas hose

Cause: Welding torch is faulty

Remedy: Change the welding torch

Cause: Gas solenoid valve is faulty

Remedy: Contact After-Sales Service

Irregular wire feed 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. and replace if necessary

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 applications with long welding torch hosepacks

Cause: Incorrect arrangement of welding torch hosepack

Remedy: Arrange the welding torch hosepack in as straight a line as possible, avoiding bends

Welding torch becomes very hot

Cause: The specification of the welding torch is inadequate

Remedy: Observe the duty cycle and loading limits

Cause: Only on water-cooled systems: Inadequate coolant flow

Remedy: Check coolant level, coolant flow, for coolant contamination, etc. For further information refer to the cooling unit operating instructions.

Poor weld properties

Cause: Incorrect welding parameters

Remedy: Check the settings

Cause: Poor ground earth 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

Cause: Wrong wire alloy or wrong wire diameter

Remedy: Check weldability of the base material

Cause: The shielding gas is not suitable for this wire alloy

Remedy: Use the correct shielding gas

Displayed service codes

If an error message that is not described here appears on the displays, proceed as follows to resolve the problem:

1 Turn the power source mains switch to the "O" position

2 Wait 10 seconds

3 Move the mains switch to the I position

If the error occurs again despite several attempts to eliminate it, or if the troubleshooting measures listed here are unsuccessful.

1 Make a note of the error message displayed

2 Note down the configuration of the power source

3 Contact our After-Sales Service team with a detailed description of the error

ESr | 20

Cause: The selected cooling unit is not compatible with the power source

Remedy: Connect compatible cooling unit

Cause: An invalid welding process was called up on the robot interface (no. 37) or an empty flag was selected (no. 32)

Remedy: Call up a valid welding process or select assigned "Save" button

ELn | 8

Cause: The connected wire-feed unit is not supported

Remedy: Connect supported wire-feed unit

ELn | 12

Cause: Different control panels for selecting materials are in the system

Remedy: Connect similar control panels to select materials

ELn | 13

Cause: Invalid change of welding process during welding

Remedy: During welding do not carry out any illegal change of the welding process, reset error message by pressing any button

ELn | 14

Cause: More than only one robot interface is connected

Remedy: Only one robot interface may be connected, check the system configuration

ELn | 15

Cause: More than only one remote control unit is connected

Remedy: Only one remote control unit may be connected, check the system configuration

Err | IP

Cause: The power source control has detected a primary overvoltage

Remedy: Check the mains voltage.
If the service code is still present, turn off the power source, wait 10 seconds, and then turn on the power source.
If the fault persists, contact After-Sales Service

Err | PE

Cause: The earth current watchdog has triggered the safety cut-out of the power source.

Remedy: Switch off the power source
Place the power source on an insulating surface
Connect the grounding (earthing) cable to a section of the workpiece that is closer to the arc
Wait for 10 seconds and then switch the power source on again

If you have tried this several times and the error keeps recurring, contact After-Sales Service

Err | Ur

Cause: If the VRD option is available, the open circuit voltage limit of 35 V has been exceeded.

Remedy: Switch off power source
Wait for 10 seconds and then switch the power source on again

no | Url

Cause: The VRD option has tripped too early.

Remedy: Check whether all welding power-leads and control lines are connected.

Switch off the power source

Wait 10 seconds and switch the power source back on again

If the error occurs again - contact After Sales Service.

E-Stop

Cause: "External stop" has tripped

Remedy: Remedy the event that triggered the external stop

-St | oP-

Cause: At the robot interface the flag was not deleted by the robot

Remedy: Delete the signal robot ready at the robot interface

PHA | SE1

Cause: The power source is operated in single-phase mode.

Remedy: -

PHA | SE3

Cause: The power source is operated in 3-phase mode

Remedy: -

Err | 51

Cause: Mains undervoltage: The mains voltage has fallen below the tolerance range

Remedy: Check the mains voltage, if the error keeps recurring, contact the After-Sales Service

Err | 52

Cause: Mains overvoltage: The mains voltage has risen above the tolerance range

Remedy: Check the mains voltage, if the error keeps recurring, contact the After-Sales Service

EFd 5

Cause: Incorrect wire-feed unit connected

Remedy: Connect correct wire-feed unit

EFd 8

Cause: Overtemperature on the wire-feed unit

Remedy: Allow wire-feed unit to cool down

EFd | 81, EFd | 83

Cause: Fault in the wire feed system (overcurrent in wire-feed unit drive)

Remedy: Arrange the hosepack in as straight a line as possible; check that there are no kinks or dirt in the inner liner; check the contact pressure on the 4 roller drive

Cause: Wire-feed unit motor is sticking or defective

Remedy: Check the wire-feed unit motor or contact After-Sales Service

to0 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature in the primary circuit of the power source

Remedy: Allow power source to cool down, check air filter and clean if necessary, check that fan is on

to1 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature on the booster located in the power source

Remedy: Allow power source to cool down, check air filter and clean if necessary, check that fan is on

to2 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature in the secondary circuit of the power source

Remedy: Allow power source to cool down, check that fan is on

to3 | xxx

Remark: xxx stands for a temperature value

Cause: Overtemperature in the wire-feed unit motor

Remedy: Allow wire-feed unit to cool down

to4 | xxx

Remark: xxx stands for a temperature value

Cause: Overtemperature in welding torch

Remedy: Allow welding torch to cool down

to5 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature in cooling unit

Remedy: Allow cooling unit to cool down, check that fan is on

to6 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature at the transformer of the power source

Remedy: Allow power source to cool down, check air filter and clean if necessary, check that fan is on

to7 | xxx

Note: xxx stands for a temperature value

Cause: Overtemperature in the power source

Remedy: Allow power source to cool down, check air filter and clean if necessary, check whether the fan is running

tu0 | xxx

Remark: xxx stands for a temperature value

Cause: Undertemperature in the power source primary circuit

Remedy: Place power source in a heated room and allow to warm up

tu1 | xxx

Note: xxx stands for a temperature value

Cause: Undertemperature on the booster located in the power source

Remedy: Place power source in a heated room and allow it to warm up

tu2 | xxx

Remark: xxx stands for a temperature value

Cause: Undertemperature in the power source secondary circuit

Remedy: Place power source in a heated room and allow to warm up

tu3 | xxx

Remark: xxx stands for a temperature value

Cause: Undertemperature in the wire-feed unit motor

Remedy: Place wire-feed unit in a heated room and allow to warm up

tu4 | xxx

Remark: xxx stands for a temperature value

Cause: Undertemperature in the welding torch

Remedy: Place welding torch in a heated room and allow to warm up

tu5 | xxx

Remark: xxx stands for a temperature value

Cause: Undertemperature in the cooling unit

Remedy: Place cooling unit in a heated room and allow to warm up

tu6 | xxx

Note: xxx stands for a temperature value

Cause: Undertemperature on the transformer of the power source

Remedy: Place power source in a heated room and allow it to warm up

tu7 | xxx

Note: xxx stands for a temperature value

Cause: Undertemperature in the power source

Remedy: Place power source in a heated room and allow it to warm up

no | H2O

Cause: Coolant flow rate too low

Remedy: Check coolant flow rate and cooling unit, including cooling circuit (for minimum coolant flow, see "Technical Data" section in the device operating instructions)

hot | H2O

Cause: The coolant temperature is too high

Remedy: Allow cooling unit and cooling circuit to cool down, until "hot | H2O" is no longer displayed. Open the cooling unit and clean the cooler, check fan is working properly. Robot interface or field bus coupler: before resuming welding, set the "Source error reset" signal.

no | Prg

Cause: No preconfigured program has been selected

Remedy: Select a configured program

no | IGn

Cause: "Ignition time-out" function is active; current did not start flowing before the length of wire specified in the set-up menu had been fed. The power source safety cut-out has tripped

Remedy: Shorten the free wire end, press the torch trigger again; clean the workpiece surface; if necessary, set the "lto" parameter in the Setup menu

EPG | 17

Cause: The welding program selected is invalid

Remedy: Select valid welding program

EPG | 29

Cause: The required wire-feed unit is not available for the selected characteristic

Remedy: Connect correct wire-feed unit, check plug connections for the hosepack

EPG | 35

Cause: Measurement of the welding circuit resistance failed

Remedy: Check grounding cable, current cable or hosepack and replace if necessary; remeasure welding circuit resistance

no | GAS

Cause: The Gas watchdog option has detected that there is no gas pressure

Remedy: Connect a new gas cylinder or open the gas cylinder valve/pressure regulator, restart "Gas watchdog" option, reset "no | GAS" error message by pressing any button.

Displayed service codes in connection with OPT Easy Documentation

no | dAt

Welding is not possible.

Cause: Date and time are not set on the power source

Remedy: To reset the service code, press the arrow key; Set the date and time in the 2nd level of the service menu; see page [87](#)

bAt | Lo

Welding is possible

Cause: The battery of OPT Easy Documentation is low

Remedy: To reset the service code, press the arrow key; Contact service (to change the battery)

bAt | oFF

Welding is not possible.

Cause: The battery of the OPT Easy Documentation is empty

Remedy: To reset the service code, press the arrow key - the display shows no | dAt;
Contact service (to change the battery);
After changing the battery, set the date and time in the 2nd level of the service menu;
see page [87](#)

Err | doc

Welding is not possible.

Cause: Error writing data;
Internal documentation error;
Communication error;

Remedy: Switch the power source off and back on

Err | USB

Welding is not possible.

Cause: Invalid file system on USB flash drive;
General USB error

Remedy: Unplug USB flash drive

USB | full

Welding is not possible.

Cause: The plugged in USB flash drive is full

Remedy: Unplug USB flash drive, plug in new USB flash drive

Care, maintenance and disposal

General Under normal operating conditions, the welding system 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 device from the mains
- ▶ Ensure the device cannot be switched back on
- ▶ Using a suitable measuring instrument, check to make sure that electrically charged components (e.g. capacitors) have been discharged

WARNING!

Work that is carried out incorrectly can cause serious injury and damage.

- ▶ The following activities must only be carried out by trained and qualified personnel.
- ▶ All instructions in the section headed "Safety rules" must be observed.

At every start-up

- Check mains plug, mains cable, welding torch, interconnecting hosepack and ground earth connection for damage
- Check that the device has an all-round clearance of 0.5 m (1 ft. 8 in.) to ensure that cooling air can flow in and out freely

NOTE!

The air inlets and outlets must never be covered, not even partially.

Every 2 months

CAUTION!

Risk of damage.

- ▶ The air filter must only be fitted when dry.
- ▶ If required, clean air filter using dry compressed air or by washing it.

Every 6 months

CAUTION!

Danger due to the effect of compressed air.

This can result in damage to property.

- ▶ Do not bring the air nozzle too close to electronic components.

- 1 Dismantle device side panels and clean inside of device with dry, reduced compressed air
- 2 If a lot of dust has accumulated, clean the cooling air ducts



WARNING!

An electric shock can be fatal!

Risk of electric shock from improperly connected ground cables and equipment grounds.

- ▶ When reassembling the side panels, make sure that grounding cables and equipment grounds are properly connected.
-

Disposal

Dispose of in accordance with the applicable national and local regulations.

Appendix

Average consumption values during welding

Average wire electrode consumption during MIG/MAG welding

Average wire electrode consumption at a wire speed of 5 m/min			
	1.0 mm wire electrode diameter	1.2 mm wire electrode diameter	1.6 mm wire electrode diameter
Steel wire electrode	1.8 kg/h	2.7 kg/h	4.7 kg/h
Aluminium wire electrode	0.6 kg/h	0.9 kg/h	1.6 kg/h
CrNi wire electrode	1.9 kg/h	2.8 kg/h	4.8 kg/h

Average wire electrode consumption at a wire speed of 10 m/min			
	1.0 mm wire electrode diameter	1.2 mm wire electrode diameter	1.6 mm wire electrode diameter
Steel wire electrode	3.7 kg/h	5.3 kg/h	9.5 kg/h
Aluminium wire electrode	1.3 kg/h	1.8 kg/h	3.2 kg/h
CrNi wire electrode	3.8 kg/h	5.4 kg/h	9.6 kg/h

Average shielding gas consumption during MIG/MAG welding

Wire electrode diameter	1.0 mm	1.2 mm	1.6 mm	2.0 mm	2 x 1.2 mm (TWIN)
Average consumption	10 l/min	12 l/min	16 l/min	20 l/min	24 l/min

Average shielding gas consumption during TIG welding

Gas nozzle size	4	5	6	7	8	10
Average consumption	6 l/min	8 l/min	10 l/min	12 l/min	12 l/min	15 l/min

Technical data

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.

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.

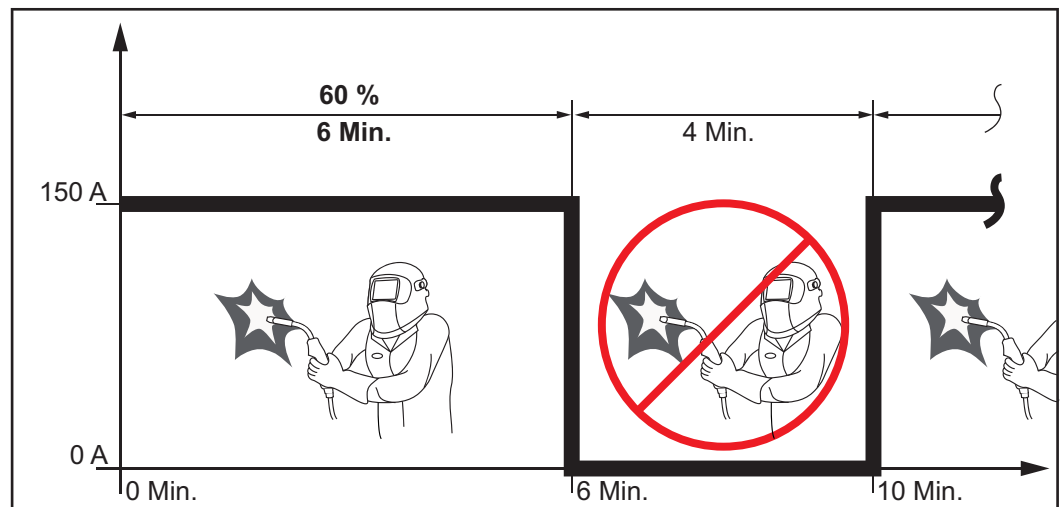
NOTE!

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.

TSt 3500 Syn

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		15.0 A	14.4 A	12.6 A
Max. primary current ($I_{1\text{max}}$)		23.6 A	22.7 A	19.8 A
Mains fuse protection		35 A slow-blow		
Mains voltage tolerance		-10 / +15%		
Grid frequency		50 / 60 Hz		
Cos phi (1)		0.99		
Max. permissible mains impedance Z_{max} on PCC ¹⁾		77 mOhm		
Recommended earth-leakage circuit breaker		Type B		
Welding current range (I_2)				
MIG / MAG		10 - 350 A		
Rod electrode		10 - 350 A		
Welding current at	10 min / 40 °C (104 °F)	40%	60%	100%
		350 A	300 A	250 A
Output voltage range according to standard characteristic (U_2)				
MIG / MAG		14.5 - 31.5 V		
Rod electrode		20.4 - 35.0 V		
Open circuit voltage (U_0 peak / U_0 r.m.s)		60 V		
Apparent power	at 400 V AC / 350 A / 40 % ED ²⁾	15,67 kVA		
Degree of protection		IP 23		
Type of cooling		AF		
Insulation class		B		
Overvoltage category		III		
Pollution level according to IEC60664		3		
Safety symbols		S, CE, CSA		
Dimensions l x w x h		747 x 300 x 497 mm 29.4 x 11.8 x 19.6 in.		
Weight		29 kg 63.5 lb.		
Max. noise emission (L_{WA})		72 dB (A)		
Idle state power consumption at 400 V		35,7 W		
Power source efficiency at 350 A / 34 V		91 %		

1) Interface to a 230/400 V, 50 Hz public grid

2) ED = duty cycle

TSt 3500 MV Syn

Mains voltage (U_1)	3 x	200 V	230 V	
Max. effective primary current ($I_{1\text{eff}}$)		24.1 A	20.8 A	
Max. primary current ($I_{1\text{max}}$)		38.1 A	32.9 A	
Mains fuse protection		35 A slow-blow		
Mains voltage (U_1)	3 x	400 V	460 V	
Max. effective primary current ($I_{1\text{eff}}$)		11.9 A	10.6 A	
Max. primary current ($I_{1\text{max}}$)		18.7 A	16.7 A	
Mains fuse protection		35 A slow-blow		
Mains voltage tolerance		-10 / +15%		
Grid frequency		50 / 60 Hz		
Cos phi (1)		0.99		
Max. permissible mains impedance Z_{max} on PCC ¹⁾		122 mOhm		
Recommended earth-leakage circuit breaker		Type B		
Welding current range (I_2)	MIG / MAG	10 - 350 A		
	Rod electrode	10 - 350 A		
Welding current at	10 min / 40 °C (104 °F)	40%	60%	100%
U_1 : 200 - 460 V		350 A	300 A	250 A
Output voltage range according to standard characteristic (U_2)	MIG / MAG	14.5 - 31.5 V		
	Rod electrode	20.4 - 35 V		
Open circuit voltage (U_0 peak / U_0 r.m.s)		50 V		
Apparent power	at 200 V AC / 350 A / 40 % ED ²⁾	13,18 kVA		
	at 400 V AC / 350 A / 40 % ED ²⁾	12,96 kVA		
Degree of protection		IP 23		
Type of cooling		AF		
Insulation class		B		
Overvoltage category		III		
Pollution level according to IEC60664		3		
Safety symbols		S, CE, CSA		
Dimensions l x w x h		747 x 300 x 497 mm 29.4 x 11.8 x 19.6 in.		
Weight		37.3 kg 82 lb.		
Max. noise emission (L_{WA})		74 dB (A)		
Idle state power consumption at 400 V		35,7 W		
Power source efficiency at 350 A / 34 V		91 %		

1) Interface to a 230/400 V, 50 Hz public grid

2) ED = duty cycle

TSt 5000 Syn

Mains voltage (U_1)	3 x	380 V	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)		27 A	25.9 A	23.2 A
Max. primary current ($I_{1\text{max}}$)		42.7 A	41.0 A	36.7 A
Mains fuse protection		35 A slow-blow		
Mains voltage tolerance		-10 / +15%		
Grid frequency		50 / 60 Hz		
Cos phi (1)		0.99		
Max. permissible mains impedance Z_{max} on PCC ¹⁾		11 mOhm		
Recommended earth-leakage circuit breaker		Type B		
Welding current range (I_2)				
MIG / MAG		10 - 500 A		
Rod electrode		10 - 500 A		
Welding current at	10 min / 40 °C (104 °F)	40%	60%	100%
		500 A	420 A	360 A
Output voltage range according to standard characteristic (U_2)				
MIG / MAG		14.3 - 39 V		
Rod electrode		20.2 - 40 V		
Open circuit voltage (U_0 peak / U_0 r.m.s)		65 V		
Apparent power	at 400 V AC / 500 A / 40 % ED ²⁾	28,36 kVA		
Degree of protection		IP 23		
Type of cooling		AF		
Insulation class		B		
Overvoltage category		III		
Pollution level according to IEC60664		3		
Safety symbols		S, CE, CSA		
Dimensions l x w x h		747 x 300 x 497 mm 29.4 x 11.8 x 19.6 in.		
Weight		32.3 kg 71.2 lb.		
Max. noise emission (L_{WA})		74 dB (A)		
Idle state power consumption at 400 V		31,2 W		
Power source efficiency at 500 A / 40 V		91 %		

1) Interface to a 230/400 V, 50 Hz public grid

2) ED = duty cycle

TSt 5000 MV Syn

Mains voltage (U_1)		3 x	200 V	230 V
Max. effective primary current ($I_{1\text{eff}}$)			39.5 A	36.3 A
Max. primary current ($I_{1\text{max}}$)			66.7 A	57.4 A
Mains fuse protection			63 A slow-blow	
Mains voltage (U_1)		3 x	400 V	460 V
Max. effective primary current ($I_{1\text{eff}}$)			20.6 A	18.1 A
Max. primary current ($I_{1\text{max}}$)			32.5 A	28.6 A
Mains fuse protection			35 A slow-blow	
Mains voltage tolerance			-10 / +15%	
Grid frequency			50 / 60 Hz	
Cos phi (1)			0.99	
Max. permissible mains impedance Z_{max} on PCC ¹⁾			63 mOhm	
Recommended earth-leakage circuit breaker			Type B	
Welding current range (I_2)	MIG / MAG		10 - 500 A	
	Rod electrode		10 - 500 A	
Welding current at	10 min / 40 °C (104 °F)	35%	60%	100%
U_1 : 200 V		500 A	420 A	360 A
Welding current at	10 min / 40 °C (104 °F)	40%	60%	100%
U_1 : 208 - 460 V		500 A	420 A	360 A
Output voltage range according to standard characteristic (U_2)	MIG / MAG		14.3 - 39 V	
	Rod electrode		20.2 - 40 V	
Open circuit voltage (U_0 peak / U_0 r.m.s)			57 V	
Apparent power	at 200 V AC / 500 A / 40 % ED ²⁾		23,08 kVA	
	at 400 V AC / 500 A / 40 % ED ²⁾		22,49 kVA	
Degree of protection			IP 23	
Type of cooling			AF	
Insulation class			B	
Overvoltage category			III	
Pollution level according to IEC60664			3	
Safety symbols			S, CE, CSA	
Dimensions l x w x h			747 x 300 x 497 mm 29.4 x 11.8 x 19.6 in.	
Weight			43.6 kg / 96.1 lb.	
Max. noise emission (L_{WA})			75 dB (A)	
Idle state power consumption at 400 V			82,7 W	
Power source efficiency at 500 A / 40 V			90 %	

1) Interface to a 230/400 V, 50 Hz public grid

2) ED = duty cycle

Overview with critical raw materials, year of production of the device**Overview with critical raw materials:**

An overview of which critical raw materials are contained in this device can be found at the following Internet address.

www.fronius.com/en/about-fronius/sustainability.

To calculate the year of production of the device:

- Each device is provided with a serial number
- The serial number consists of 8 digits - for example 28020099
- The first two digits give the number from which the year of production of the device can be calculated
- This figure minus 11 gives the year of production
 - For example: Serial number = 28020065, calculation of the year of production = 28 - 11 = 17, year of production = 2017

Welding program tables

TransSteel 3500 Syn - Euro welding program tables

Welding programs are active if

- the Setup parameter "SET" is set to "Std" (Standard), or
- the VR 5000 Remote wirefeeder is fitted with the Synergic Steel control panel option.

Welding program database: UID 3431

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		
3	Steel root	.035	0.9	CO ₂ 100%	A
4	Rutil / E 71 T	.040	1.0	Ar + 8-12%CO ₂	B
5	Basic / E 70 T	.045	1.2	Ar + 15-25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 3-6%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP		F

Welding program table on the power source control panel

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		
3	Steel root	.035	0.9	CO ₂ 100%	A
4	Rutil Flux	.040	1.0	Ar + ~8%CO ₂	B
5	Basic Cored	.045	1.2	Ar + ~18%CO ₂	C
6	Metal Wire	.052	1.4	Ar + ~4%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP		F

Welding program table on the Synergic Steel (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO ₂	2290	2300	2310	2322	2334		
1	Steel	B	Ar + 8 % CO ₂	2288	2298	2308	2324	2332		
1	Steel	C	Ar + 18 % CO ₂	2485	2486	2487	2488	2489		
1	Steel	D	Ar + 4 % O ₂	2285	2297	2307	2323	2331		
2	Steel dynamic	B	Ar + 8 % CO ₂	2292	2302	2312	2326	2336		
2	Steel dynamic	C	Ar + 18 % CO ₂	2293	2303	2313	2327	2337		
2	Steel dynamic	D	Ar + 4 % O ₂	2291	2301	2311	2325	2335		
3	Steel root	A	100 % CO ₂	2502	2501	2499	2500			
3	Steel root	B	Ar + 8 % CO ₂	2295	2305	2315	2329	2339		
3	Steel root	C	Ar + 18 % CO ₂	2296	2306	2316	2330	2340		
3	Steel root	D	Ar + 4 % O ₂	2294	2304	2314	2328	2338		
4	Rutil FCW	A	100 % CO ₂		2410		2321	2391	2345	
4	Rutil FCW	C	Ar + 18 % CO ₂		2411		2320	2390	2344	
5	Basic FCW	A	100 % CO ₂				2317	2433	2342	
5	Basic FCW	C	Ar + 18 % CO ₂				2318	2432	2341	
6	Metal cored	B	Ar + 8 % CO ₂		2420		2385	2387	2415	
6	Metal cored	C	Ar + 18 % CO ₂		2421		2536	2388	2343	
7	Self-shielded		Self-shielded		2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Stainless Steel	F	Ar + 2,5 % CO2	2427	2402	2426	2405			
3	Stainless Steel root	F	Ar + 2,5 % CO2	2440	2441	2442	2443			
8	FCW Stainless Steel	C	Ar + 18 % CO2		2423		2424		2425	
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092*
8	CuSi 3	F	SP	2496	2495	2493	2497			

* Diameter = 1,2 mm (0.45 in.)

**TransSteel 5000
Syn - Euro weld-
ing program
tables**

Welding programs are active if

- the Setup parameter "SEt" is set to "Std" (Standard),
or
- the VR 5000 Remote wirefeeder is fitted with the Synergic Steel control panel option.

Welding program database: UID 3430

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	Rutil / E 71 T	.040	1.0	Ar + 8-12%CO ₂	B
5	Basic / E 70 T	.045	1.2	Ar + 15-25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 3-6%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP	SP	F

Welding program table on the power source control panel

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	Rutil	.040	1.0	Ar + ~8%CO ₂	B
5	Basic Cored	.045	1.2	Ar + ~18%CO ₂	C
6	Metal Wire	.052	1.4	Ar + ~4%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP	SP	F

Welding program table on the Synergic Steel (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO ₂	2290	2300	2310	2322	2334	2347	
1	Steel	B	Ar + 8 % CO ₂	2288	2298	2308	2324	2332	2394	
1	Steel	C	Ar + 18 % CO ₂	2485	2486	2487	2488	2489	2490	
1	Steel	D	Ar + 4 % O ₂	2285	2297	2307	2323	2331	2395	
2	Steel dynamic	B	Ar + 8 % CO ₂	2292	2302	2312	2326	2336		
2	Steel dynamic	C	Ar + 18 % CO ₂	2293	2303	2313	2327	2337		
2	Steel dynamic	D	Ar + 4 % O ₂	2291	2301	2311	2325	2335		
3	Steel root	A	100 % CO ₂	2502	2501	2499	2500		2529	
3	Steel root	B	Ar + 8 % CO ₂	2295	2305	2315	2329	2339		
3	Steel root	C	Ar + 18 % CO ₂	2296	2306	2316	2330	2340		
3	Steel root	D	Ar + 4 % O ₂	2294	2304	2314	2328	2338		
4	Rutil FCW	A	100 % CO ₂		2410		2321	2391	2345	
4	Rutil FCW	C	Ar + 18 % CO ₂		2411		2320	2390	2344	
5	Basic FCW	A	100 % CO ₂				2317	2433	2342	
5	Basic FCW	C	Ar + 18 % CO ₂				2318	2432	2341	
6	Metal cored	B	Ar + 8 % CO ₂		2420		2385	2387	2415	
6	Metal cored	C	Ar + 18 % CO ₂		2421		2536	2388	2343	
7	Self-shielded		Self-shielded		2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Stainless Steel	F	Ar + 2,5 % CO2	2427	2402	2426	2405		2428	
3	Stainless Steel root	F	Ar + 2,5 % CO2	2440	2441	2442	2443			
8	FCW Stainless Steel	C	Ar + 18 % CO2		2423		2424		2425	
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092 *
8	CuSi 3	F	SP	2496	2495	2493	2497		2498	

* Diameter = 1,2 mm (0.45 in.)

**TransSteel 3500
Syn - US welding
program tables**

Welding programs are active if

- the Setup parameter "SET" is set to "US" (USA),
or
- the VR 5000 Remote wirefeeder is fitted with the Synergic US control panel option.

Welding program database: UID 3431

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	Rutil / E 71 T	.040	1.0	Ar + 8-12%CO ₂	B
5	Basic / E 70 T	.045	1.2	Ar + 15-25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 3-6%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP		F

Welding program table on the power source control panel

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	E 71 T Flux	.040	1.0	Ar + 10%CO ₂	B
5	E 70 T Cored	.045	1.2	Ar + 25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 5%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP		F

Welding program table on the Synergic US (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO ₂	2290	2300	2310	2322	2334		
1	Steel	B	Ar + 10 % CO ₂	2418	2370	2308	2377	2409		
1	Steel	C	Ar + 25 % CO ₂	2419	2369	2309	2376	2333		
1	Steel	D	Ar + 5 % O ₂	2372	2371	2307	2378	2408		
2	Steel dynamic	B	Ar + 10 % CO ₂	2374	2367	2312	2380	2336		
2	Steel dynamic	C	Ar + 25 % CO ₂	2375	2366	2313	2379	2337		
2	Steel dynamic	D	Ar + 5 % O ₂	2373	2368	2311	2381	2335		
2	Steel dynamic	B	Ar + 10 % CO ₂		2462					
3	Steel root	A	100 % CO ₂	2502	2501	2499	2500			
3	Steel root	B	Ar + 10 % CO ₂	2295	2364	2315	2383	2339		
3	Steel root	C	Ar + 25 % CO ₂	2296	2363	2316	2382	2340		
3	Steel root	D	Ar + 5 % O ₂	2294	2365	2314	2384	2338		
4	Rutil FCW	A	100 % CO ₂		2471		2472	2467	2469	
4	Rutil FCW	C	Ar + 25 % CO ₂		2470		2456	2466	2468	
5	Basic FCW	A	100 % CO ₂				2474	2433	2476	
5	Basic FCW	C	Ar + 25 % CO ₂				2473	2432	2475	
6	Metal cored	B	Ar + 10 % CO ₂		2420		2385	2387	2415	
6	Metal cored	C	Ar + 25 % CO ₂		2421		2386	2388	2416	
7	Self-shielded		Self-shielded		2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
3	Stainless Steel root	F	Ar + 2,5 % CO2	2440	2441	2442	2443			
6	FCW Stainless Steel	F	Ar + 18 % CO2		2423		2424		2425	
8	Stainless Steel	A	Ar + 90 % He + 2,5 % CO2		2404		2407			
8	Stainless Steel	B	Ar + 33 % He + 1 % CO2		2403		2406			
8	Stainless Steel	C	Ar + 2,5 % CO2	2427	2402	2426	2405			
8	FCW MAP409Ti	D	Ar + 2 % O2				2464	2465		
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092*
8	CuSi 3	F	SP	2496	2495	2493	2497			

* Diameter = 1,2 mm (0.45 in.)

**TransSteel 5000
Syn - US welding
program tables**

Welding programs are active if

- the Setup parameter "SET" is set to "US" (USA),
or
- the VR 5000 Remote wirefeeder is fitted with the Synergic US control panel option.

Welding program database: UID 3430

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	Rutil / E 71 T	.040	1.0	Ar + 8-12%CO ₂	B
5	Basic / E 70 T	.045	1.2	Ar + 15-25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 3-6%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP	SP	F

Welding program table on the power source control panel

Pos.	Material	inch	mm	Gas	Pos.
1	Steel				
2	Steel dynamic	.030	0.8		A
3	Steel root	.035	0.9	CO ₂ 100%	
4	E 71 T Flux	.040	1.0	Ar + 10%CO ₂	B
5	E 70 T Cored	.045	1.2	Ar + 25%CO ₂	C
6	Metal Cored	.052	1.4	Ar + 5%O ₂	D
7	Self-shielded	1/16	1.6	Ar 100%	E
8	SP	SP	SP	SP	F

Welding program table on the Synergic US (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO ₂	2290	2300	2310	2322	2334	2347	
1	Steel	B	Ar + 10 % CO ₂	2418	2370	2308	2377	2409	2394	
1	Steel	C	Ar + 25 % CO ₂	2419	2369	2309	2376	2333	2346	
1	Steel	D	Ar + 5 % O ₂	2372	2371	2307	2378	2408	2395	
2	Steel dynamic	B	Ar + 10 % CO ₂	2374	2367	2312	2380	2336		
2	Steel dynamic	C	Ar + 25 % CO ₂	2375	2366	2313	2379	2337		
2	Steel dynamic	D	Ar + 5 % O ₂	2373	2368	2311	2381	2335		
2	Steel dynamic	B	Ar + 10 % CO ₂		2462					
3	Steel root	A	100 % CO ₂	2502	2501	2499	2500		2529	
3	Steel root	B	Ar + 10 % CO ₂	2295	2364	2315	2383	2339		
3	Steel root	C	Ar + 25 % CO ₂	2296	2363	2316	2382	2340		
3	Steel root	D	Ar + 5 % O ₂	2294	2365	2314	2384	2338		
4	Rutil FCW	A	100 % CO ₂		2471		2472	2467	2469	
4	Rutil FCW	C	Ar + 25 % CO ₂		2470		2456	2466	2468	
5	Basic FCW	A	100 % CO ₂				2474	2433	2476	
5	Basic FCW	C	Ar + 25 % CO ₂				2473	2432	2475	
6	Metal cored	B	Ar + 10 % CO ₂		2420		2385	2387	2415	
6	Metal cored	C	Ar + 25 % CO ₂		2421		2386	2388	2416	
7	Self-shielded		Self-shielded		2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
3	Stainless Steel root	F	Ar + 2,5 % CO2	2440	2441	2442	2443			
6	FCW Stainless Steel	F	Ar + 18 % CO2		2423		2424		2425	
8	Stainless Steel	A	Ar + 90 % He + 2,5 % CO2		2404		2407			
8	Stainless Steel	B	Ar + 33 % He + 1 % CO2		2403		2406			
8	Stainless Steel	C	Ar + 2,5 % CO2	2427	2402	2426	2405		2428	
8	FCW MAP409Ti	D	Ar + 2 % O2				2464	2465		
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092*
8	CuSi 3	F	SP	2496	2495	2493	2497		2498	

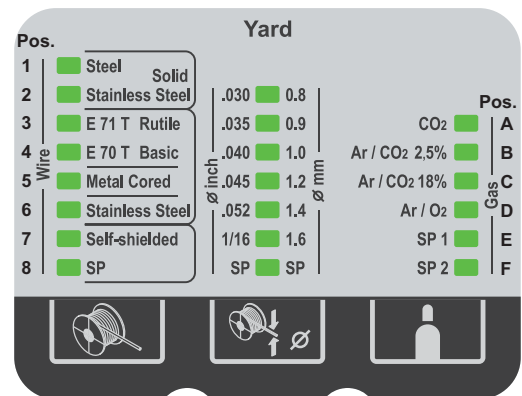
* Diameter = 1,2 mm (0.45 in.)

**TransSteel 3500
Yard welding program tables**

Welding programs are active if a VR 5000 Remote wirefeeder with the Synergic YARD control panel option is in the system.

Welding program database: UID 3431

In this case, the welding program display on the power source is deactivated. The welding program is only shown on the VR 5000 Remote.



Welding program table on the Synergic YARD (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO2	2290	2300	2310	2322	2334		
1	Steel	D	Ar + O2	2285	2297	2307	2323	2331		
2	Stainless Steel	B	Ar + 2,5 % CO2	2427	2402	2426	2405			
3	E71T Rutile	A	100 % CO2		2410		2321	2391	2345	
3	E71T Rutile	C	Ar + 18 % CO2		2411		2320	2390	2344	
4	E70T Basic	A	100 % CO2				2317	2433	2342	
4	E70T Basic	C	Ar + 18 % CO2				2318	2432	2341	
5	Metal cored	C	Ar + 18 % CO2		2421		2386	2388	2343	
6	FCW Stainless Steel	C	Ar + 18 % CO2		2423		2424		2425	
7	Self-shielded				2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel Primer	C	Ar + 18 % CO2	2419	2430	2429	2376	2431		
1	Steel root	E	Ar + 18 % CO2	2296	2306	2316	2330	2340		
1	Steel dynamic	F	Ar + 18 % CO2	2293	2303	2313	2327	2337		
2	Stainless Steel root	E	Ar + 2,5 % CO2	2293	2303	2313	2327	2337		
8	Steel root	A	100 % CO2	2502	2501	2499	2500			
8	Steel	C	Ar + 18 % CO2	2485	2486	2487	2488	2489		
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092*

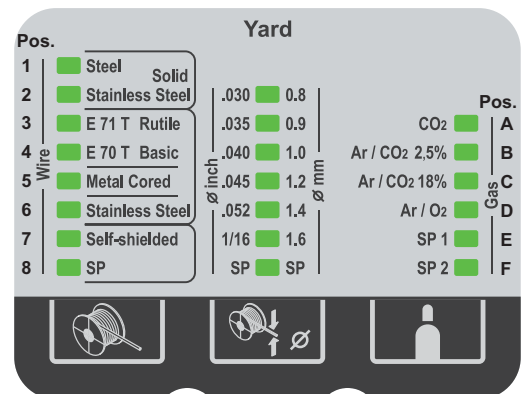
* Diameter = 1.2 mm (0.45 in.)

TransSteel 5000 Yard welding program tables

Welding programs are active if a VR 5000 Remote wirefeeder with the Synergic YARD control panel option is in the system.

Welding program database: UID 3430

In this case, the welding program indication on the power source is deactivated. The welding program is only shown on the VR 5000 Remote.



Welding program table on the Synergic YARD (VR 5000 Remote) control panel

Standard Programs										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel	A	100 % CO2	2290	2300	2310	2322	2334	2347	
1	Steel	D	Ar + O2	2285	2297	2307	2323	2331	2395	
2	Stainless Steel	B	Ar + 2,5 % CO2	2427	2402	2426	2405		2428	
3	E71T Rutile	A	100 % CO2		2410		2321	2391	2345	
3	E71T Rutile	C	Ar + 18 % CO2		2411		2320	2390	2344	
4	E70T Basic	A	100 % CO2				2317	2433	2342	
4	E70T Basic	C	Ar + 18 % CO2				2318	2432	2341	
5	Metal cored	C	Ar + 18 % CO2		2421		2386	2388	2343	
6	FCW Stainless Steel	C	Ar + 18 % CO2		2423		2424		2425	
7	Self-shielded				2350		2349		2348	

Special assignment										
Material		Gas		Diameter						
Pos.		Pos.		0,8 mm .030"	0,9 mm .035"	1,0 mm .040"	1,2 mm .045"	1,4 mm .052"	1,6 mm 1/16"	SP
1	Steel Primer	C	Ar + 18 % CO2	2419	2430	2429	2376	2431	2346	
1	Steel root	E	Ar + 18 % CO2	2296	2306	2316	2330	2340		
1	Steel dynamic	F	Ar + 18 % CO2	2293	2303	2313	2327	2337		
2	Stainless Steel root	E	Ar + 2,5 % CO2	2293	2303	2313	2327	2337		
8	Steel root	A	100 % CO2	2502	2501	2499	2500		2529	
8	Steel	C	Ar + 18 % CO2	2485	2486	2487	2488	2489	2490	
8	AlMg 5	E	100 % Ar				2444			
8	AlSi	E	100 % Ar							3092*

* Diameter = 1,2 mm (0.45 in.)

Standard value tables for MIG/MAG standard manual welding

Settings tables

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 0.8 mm (.03 in.)
- Ignition current: 400 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	2.1 m/min (82.68 ipm)	13.7 V	4
1 mm (.04 in.)	2.8 m/min (110.24 ipm)	15.8 V	4
1.5 mm (.06 in.)	5.9 m/min (232.28 ipm)	17 V /	3
2 mm (.08 in.)	6.5 m/min (255.91 ipm)	18 V	3
3 mm (.12 in.)	10.8 m/min (425.20 ipm)	20 V	2
4 mm (.16 in.)	14 m/min (551.18 ipm)	23.4 V	1
5 mm (.2 in.)	16.7 m/min (657.48 ipm)	27 V	0
6 mm (.24 in.)	19 m/min (748.03 ipm)	27.8 V	0
8 mm (.31 in.)	21 m/min (826.77 ipm)	30.4 V	0
10 mm (.39 in.)	23 m/min (905.51 ipm)	32.6 V	0
12 mm (.47 in.)	25 m/min (984.25 ipm)	34 V	0

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 0.9 mm (.035 in.)
- Ignition current: 450 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1.6 m/min (62.99 ipm)	13.3 V	4
1 mm (.04 in.)	1.9 m/min (74.8 ipm)	14 V	4
1.5 mm (.06 in.)	2.5 m/min (98.43 ipm)	15 V	3
2 mm (.08 in.)	4.5 m/min (177.17 ipm)	16.5 V	3
3 mm (.12 in.)	6.2 m/min (244.09 ipm)	17 V	2
4 mm (.16 in.)	7.5 m/min (295.28 ipm)	19.5 V	2
5 mm (.2 in.)	11 m/min (433.07 ipm)	24 V	1
6 mm (.24 in.)	12.4 m/min (488.19 ipm)	25.5 V	0
8 mm (.31 in.)	13 m/min (511.81 ipm)	26 V	0
10 mm (.39 in.)	16 m/min (629.92 ipm)	28 V	0
12 mm (.47 in.)	19.1 m/min (751.97 ipm)	30 V	0
15 mm (.59 in.)	22 m/min (866.14 ipm)	32 V	0
20 mm (.79 in.)	25 m/min (984.25 ipm)	34 V	0

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 1.0 mm (.04 in.)
- Ignition current: 500 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1.6 m/min (62.99 ipm)	14.3 V	2.5
1 mm (.04 in.)	2 m/min (78.74 ipm)	14.5 V	2.5
1.3 mm (.05 in.)	2.5 m/min (98.43 ipm)	14.6 V	3
1.5 mm (.06 in.)	3.1 m/min (122.05 ipm)	15.9 V	3
2 mm (.08 in.)	4.5 m/min (177.17 ipm)	16.4 V	3
3 mm (.12 in.)	6.2 m/min (244.09 ipm)	17.5 V	3
4 mm (.16 in.)	7.5 m/min (295.28 ipm)	18.1 V	2
5 mm (.2 in.)	11 m/min (433.07 ipm)	26.6 V	1
6 mm (.24 in.)	12.4 m/min (488.19 ipm)	27.3 V	0
8 mm (.31 in.)	13 m/min (511.81 ipm)	29.5 V	0
10 mm (.39 in.)	16 m/min (629.92 ipm)	32.5 V	0
12 mm (.47 in.)	19.1 m/min (751.97 ipm)	34 V	0
15 mm (.59 in.)	22 m/min (866.14 ipm)	35 V	0
20 mm (.79 in.)	25 m/min (984.25 ipm)	36.9 V	0

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 1.2 mm (.045 in.)
- Ignition current: 580 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1 mm (.04 in.)	1.6 m/min (62.99 ipm)	15.5 V	3
1.5 mm (.06 in.)	2.4 m/min (94.49 ipm)	16 V	3
2 mm (.08 in.)	3.5 m/min (137.8 ipm)	17.4 V	3
3 mm (.12 in.)	4.7 m/min (185.04 ipm)	18.5 V	3
4 mm (.16 in.)	5.6 m/min (220.47 ipm)	19.8 V	2.5
5 mm (.2 in.)	7.2 m/min (283.46 ipm)	20.5 V	2
6 mm (.24 in.)	8.1 m/min (318.9 ipm)	24.3 V	1
8 mm (.31 in.)	8.8 m/min (346.46 ipm)	28 V	0
10 mm (.39 in.)	9.3 m/min (366.14 ipm)	29 V	0
12 mm (.47 in.)	10.8 m/min (425.2 ipm)	32 V	0
15 mm (.59 in.)	11.5 m/min (452.76 ipm)	33 V	0
20 mm (.79 in.)	18 m/min (708.66 ipm)	34 V	0
25 mm (.98 in.)	22 m/min (866.14 ipm)	36 V	0
30 mm (1.18 in.)	25 m/min (984.25 ipm)	37.5 V	0

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 1.4 mm (.06 in.)
- Ignition current: 650 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1 mm (.04 in.)	1.2 m/min (47.24 ipm)	13.7 V	4
1.5 mm (.06 in.)	1.7 m/min (66.93 ipm)	15 V	4
2 mm (.08 in.)	2.2 m/min (86.61 ipm)	16 V	3
3 mm (.12 in.)	3.2 m/min (125.98 ipm)	17 V	3
4 mm (.16 in.)	3.8 m/min (149.61 ipm)	17.8 V	2
5 mm (.2 in.)	4.3 m/min (169.29 ipm)	18.6 V	2
6 mm (.24 in.)	4.8 m/min (188.98 ipm)	21.5 V	1
8 mm (.31 in.)	5.5 m/min (216.54 ipm)	26 V	0
10 mm (.39 in.)	7 m/min (275.59 ipm)	27.5 V	0
12 mm (.47 in.)	9 m/min (354.33 ipm)	30 V	0
15 mm (.59 in.)	10.3 m/min (405.51 ipm)	31.8 V	0
20 mm (.79 in.)	12.5 m/min (492.13 ipm)	33 V	0
25 mm (.98 in.)	15 m/min (590.55 ipm)	36.8 V	0
30 mm (1.18 in.)	18 m/min (708.66 ipm)	40 V	0

- Shielding gas: Argon + CO₂ *
- Material: G3 Si 1
- Wire diameter: 1.6 mm (1/16 in.)
- Ignition current: 650 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1.5 mm (.06 in.)	1.2 m/min (47.24 ipm)	16 V	4
2 mm (.08 in.)	1.4 m/min (55.12 ipm)	16.4 V	3
3 mm (.12 in.)	2.2 m/min (86.61 ipm)	16.9 V	3
4 mm (.16 in.)	2.8 m/min (110.24 ipm)	17.9 V	2
5 mm (.2 in.)	5.3 m/min (208.66 ipm)	18.7 V	2
6 mm (.24 in.)	4 m/min (157.48 ipm)	20.7 V	1
8 mm (.31 in.)	4.5 m/min (177.17 ipm)	24 V	1
10 mm (.39 in.)	5.3 m/min (208.66 ipm)	26.9 V	0
12 mm (.47 in.)	5.6 m/min (220.47 ipm)	27.2 V	0
15 mm (.59 in.)	6.7 m/min (263.78 ipm)	29.1 V	0
20 mm (.79 in.)	8.5 m/min (334.65 ipm)	31 V	0
25 mm (.98 in.)	12 m/min (472.44 ipm)	36.5 V	0
30 mm (1.18 in.)	15 m/min (590.55 ipm)	40 V	0

* Argon + 18 % CO₂ (M21)

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 0.8 mm (.3 in.)
- Ignition current: 400 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1.5 m/min (59.06 ipm)	16 V	4
1 mm (.04 in.)	3 m/min (118.11 ipm)	16.8 V	4
1.5 mm (.06 in.)	5 m/min (196.85 ipm)	18.6 V	3
2 mm (.08 in.)	6.4 m/min (251.97 ipm)	19.5 V	3
3 mm (.12 in.)	9.5 m/min (374.02 ipm)	22.3 V	2
4 mm (.16 in.)	11.1 m/min (437.01 ipm)	23.1 V	2
5 mm (.2 in.)	15.2 m/min (598.43 ipm)	25.8 V	1
6 mm (.24 in.)	17.5 m/min (688.98 ipm)	26.1 V	1
8 mm (.31 in.)	20 m/min (787.40 ipm)	27 V	0
10 mm (.39 in.)	22 m/min (866.14 ipm)	28.5 V	0
12 mm (.47 in.)	25 m/min (984.25 ipm)	31.5 V	0

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 0.9 mm (.035 in.)
- Ignition current: 450 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1.4 m/min (55.12 ipm)	17.1 V	4
1 mm (.04 in.)	2.2 m/min (86.61 ipm)	17.4 V	4
1.5 mm (.06 in.)	2.7 m/min (106.3 ipm)	18.6 V	4
2 mm (.08 in.)	4 m/min (157.48 ipm)	19.2 V	4
3 mm (.12 in.)	6 m/min (236.22 ipm)	20.5 V	3
4 mm (.16 in.)	9 m/min (354.33 ipm)	21.5 V	3
5 mm (.2 in.)	10 m/min (393.7 ipm)	24 V	3
6 mm (.24 in.)	11.5 m/min (452.76 ipm)	24.9 V	2
8 mm (.31 in.)	13 m/min (511.81 ipm)	25.5 V	2
12 mm (.47 in.)	15 m/min (590.55 ipm)	29.5 V	1
15 mm (.59 in.)	17 m/min (669.29 ipm)	32 V	0
20 mm (.79 in.)	22 m/min (866.14 ipm)	34 V	0

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 1.0 mm (.04 in.)
- Ignition current: 500 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1.6 m/min (62.99 ipm)	16.7 V	3
1 mm (.04 in.)	2 m/min (78.74 ipm)	17.6 V	3

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1.3 mm (.05 in.)	2.6 m/min (102.36 ipm)	18.9 V	3
1.5 mm (.06 in.)	3.2 m/min (125.98 ipm)	20.4 V	2.5
2 mm (.08 in.)	4.8 m/min (188.98 ipm)	20.8 V	2.5
3 mm (.12 in.)	6 m/min (236.22 ipm)	21.4 V	2.5
4 mm (.16 in.)	8 m/min (314.96 ipm)	22.5 V	2.5
5 mm (.2 in.)	10 m/min (393.7 ipm)	24.8 V	2.5
6 mm (.24 in.)	12 m/min (472.44 ipm)	27.1 V	2.5
8 mm (.31 in.)	14 m/min (551.18 ipm)	28.8 V	1.5
10 mm (.39 in.)	17.5 m/min (688.98 ipm)	30.9 V	0
12 mm (.47 in.)	20 m/min (787.4 ipm)	33.3 V	0
15 mm (.59 in.)	25 m/min (984.25 ipm)	38.2 V	0

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 1.2 mm (.045 in.)
- Ignition current: 580 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
0.8 mm (.03 in.)	1 m/min (39.37 ipm)	17.5 V	1.5
1 mm (.04 in.)	1.5 m/min (59.06 ipm)	18.0 V	2
2 mm (.08 in.)	2 m/min (78.74 ipm)	18.8 V	2.5
3 mm (.12 in.)	3 m/min (118.11 ipm)	19.3 V	3
4 mm (.16 in.)	4.5 m/min (177.17 ipm)	20.5 V	3
5 mm (.2 in.)	6 m/min (236.22 ipm)	22.5 V	3
6 mm (.24 in.)	7 m/min (275.59 ipm)	23 V	3
8 mm (.31 in.)	8.5 m/min (334.65 ipm)	25.9 V	3
12 mm (.47 in.)	10 m/min (393.70 ipm)	29.7 V	3
15 mm (.59 in.)	15 m/min (590.55 ipm)	36 V	2
20 mm (.79 in.)	22 m/min (866.14 ipm)	41 V	0

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 1.4 mm (.06 in.)
- Ignition current: 650 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1 mm (.04 in.)	1.4 m/min (55.12 ipm)	18.2 V	4
1.5 mm (.06 in.)	1.7 m/min (66.93 ipm)	19.1 V	3
2 mm (.08 in.)	2.2 m/min (86.61 ipm)	20 V	3
3 mm (.12 in.)	3.1 m/min (122.05 ipm)	22.6 V	2
4 mm (.16 in.)	4.2 m/min (165.35 ipm)	23.9 V	2
5 mm (.2 in.)	5.1 m/min (200.79 ipm)	25.1 V	1

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
6 mm (.24 in.)	6 m/min (236.22 ipm)	26.2 V	1
8 mm (.31 in.)	7.5 m/min (295.28 ipm)	29.9 V	0
12 mm (.47 in.)	10 m/min (393.7 ipm)	33.9 V	0
15 mm (.59 in.)	12.5 m/min (492.13 ipm)	36.2 V	0
20 mm (.79 in.)	15 m/min (590.55 ipm)	38 V	0
25 mm (.98 in.)	18 m/min (708.66 ipm)	40 V	0

- Shielding gas: CO₂
- Material: G3 Si 1
- Wire diameter: 1.6 mm (1/16 in.)
- Ignition current: 650 A

Sheet thickness	Wire feed speed	Welding voltage	Dynamic
1.5 mm (.06 in.)	1.2 m/min (47.24 ipm)	19.8 V	4
2 mm (.08 in.)	1.4 m/min (55.12 ipm)	20.5 V	4
3 mm (.12 in.)	1.9 m/min (74.8 ipm)	21.3 V	4
4 mm (.16 in.)	2.3 m/min (90.55 ipm)	21.8 V	3
5 mm (.2 in.)	2.7 m/min (106.3 ipm)	23 V	3
6 mm (.24 in.)	3 m/min (118.11 ipm)	23.9 V	3
8 mm (.31 in.)	3.6 m/min (141.73 ipm)	24.9 V	2
12 mm (.47 in.)	4.7 m/min (185.04 ipm)	26.5 V	2
15 mm (.59 in.)	5.6 m/min (220.47 ipm)	30 V	2
20 mm (.79 in.)	7.1 m/min (279.53 ipm)	33 V	1
25 mm (.98 in.)	9 m/min (354.33 ipm)	40 V	1

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