

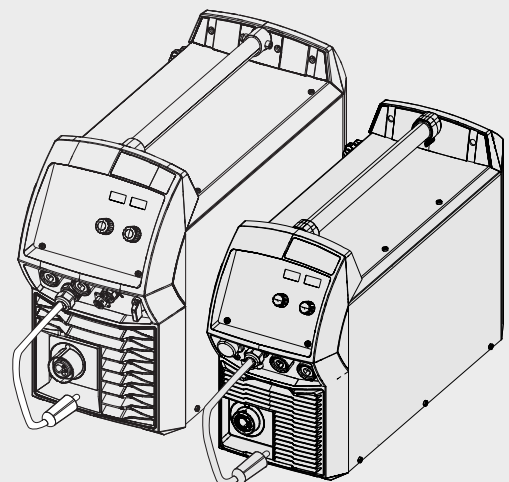


**TransSteel 2700c MultiProzess**  
**TransSteel 2700c MV MultiProzess**  
**TransSteel 3500c MultiProzess**

EN-US

Operating instructions

MIG/MAG power source



42,0426,0322,EA 009-11012021



# Table of contents

Safety Instructions.....	7
Explanation of Safety Instructions.....	7
General.....	7
Intended Use.....	7
Environmental Conditions.....	8
Obligations of the Operating Company.....	8
Obligations of Personnel.....	8
Grid Connection.....	8
Personal Protection and Protection of Others.....	9
Danger from toxic gases and vapors.....	9
Danger from Flying Sparks.....	10
Risks from grid current and welding current.....	10
Stray welding currents.....	11
EMC Device Classifications.....	12
EMC Measures.....	12
EMF measures.....	13
Particular Hazard Areas.....	13
Requirement for the shielding gas.....	14
Danger from Shielding Gas Cylinders.....	14
Danger Posed by Shielding Gas Leak.....	15
Safety Measures at the Setup Location and During Transport.....	15
Safety Measures in Normal Operation.....	15
Maintenance and repair.....	16
Safety Inspection.....	16
Disposal.....	16
Safety Symbols.....	17
Data backup.....	17
Copyright.....	17
<b>General information</b> .....	<b>19</b>
General.....	21
Device Concept.....	21
Available welding processes.....	21
Operating Principle.....	22
Applications.....	23
Warning notices on the device.....	23
Description of the warnings on the device.....	25
System components.....	27
General.....	27
Safety.....	27
Overview.....	27
<b>Operating controls and connections</b> .....	<b>29</b>
Control Panel.....	31
General.....	31
Safety.....	31
Synergic control panel.....	32
Service parameters.....	35
Keylock.....	36
Connections, Switches, and Mechanical Components.....	37
TSt 2700c MP.....	37
TSt 3500c MP.....	38
<b>Installation</b> .....	<b>41</b>
Minimum equipment for welding operations.....	43
General.....	43
Gas-cooled MIG/MAG welding.....	43
Water-cooled MIG/MAG welding.....	43

Manual metal arc welding.....	43
TIG DC Welding.....	43
Before installation and initial operation.....	44
Safety.....	44
Intended Use.....	44
Setup regulations.....	44
Grid Connection.....	45
Generator-Powered Operation.....	46
Generator-Powered Operation.....	46
TSt 2700c MV MP - Single-Phase Operation.....	47
Single-phase operation.....	47
Explanation of the Term "Duty Cycle" in Single-Phase Operation.....	48
Welding time in single-phase operation.....	50
Connecting the Mains Cable.....	51
Safety.....	51
General.....	51
Stipulated Grid Cables and Strain-Relief Devices.....	51
Connecting the Grid Cable, TSt 2700c MV, Single-Phase Operation.....	52
Connecting the Grid Cable, TSt 2700c MP MV.....	53
Connecting the Grid Cable, TSt 3500c nc MP.....	54
Fitting/Connecting the System Components.....	56
Information on System Components.....	56
Mounting on the Trolley.....	56
Connecting the Gas Cylinder.....	57
<b>MIG/MAG.....</b>	<b>59</b>
Commissioning.....	61
General.....	61
Connecting MIG/MAG Welding Torches.....	61
Inserting/changing feed rollers.....	62
Inserting the wirepool/basket-type spool.....	63
Connecting the Gas Cylinder.....	64
Connecting the Polarity Reverser and Establishing a Ground Earth Connection.....	65
Feeding in the wire electrode.....	66
Setting the contact pressure.....	68
Adjusting the brake.....	69
Design of the Brake.....	69
Power Limitation.....	70
Safety function.....	70
MIG/MAG Operating Modes.....	71
General.....	71
Symbols and explanations.....	71
2-step mode.....	72
4-step mode.....	72
Special 4-step mode.....	73
Spot welding.....	73
2-step stitch welding.....	74
4-step stitch welding.....	74
MIG/MAG Standard Synergic Welding.....	75
MIG/MAG Standard Synergic Welding.....	75
Corrections During Welding.....	76
MIG/MAG Standard Manual Welding.....	77
General.....	77
Available parameters.....	77
MIG/MAG Standard Manual Welding.....	77
Corrections During Welding.....	78
Spot and Stitch Welding.....	79
General.....	79
Spot Welding.....	79
Stitch Welding.....	80

<b>Rod Electrode</b>	<b>81</b>
Commissioning.....	83
Safety.....	83
Preparation.....	83
Manual Metal Arc Welding.....	85
Manual Metal Arc Welding.....	85
Functions for Optimizing the Welding Process.....	86
Arc-Force Dynamic.....	86
HotStart (Hti) function.....	86
Anti-stick (Ast) function.....	86
<b>TIG</b>	<b>89</b>
Commissioning.....	91
Start-up.....	91
TIG Welding.....	93
TIG Welding.....	93
Pulse welding.....	94
Applications.....	94
Operating principle.....	94
Activating pulse welding.....	95
<b>EasyJobs</b>	<b>97</b>
Saving and Retrieving EasyJobs.....	99
General.....	99
Saving an EasyJob.....	99
Retrieving an EasyJob.....	99
Deleting an EasyJob.....	99
Retrieving operating points on the Up/Down welding torch.....	100
<b>Easy Documentation (TransSteel 3500c MP)</b>	<b>101</b>
General.....	103
General.....	103
Documented welding data.....	103
New CSV file.....	104
PDF report / Fronius signature.....	104
Activating / deactivating Easy Documentation.....	105
Setting the date and time.....	105
Deactivating Easy Documentation.....	105
<b>Setup Settings</b>	<b>107</b>
Setup Menu.....	109
General.....	109
Operation.....	109
Parameters for MIG/MAG standard synergic welding.....	109
Parameters for MIG/MAG Standard Manual Welding.....	111
Parameters for MMA Welding.....	112
Parameters for TIG welding.....	112
Setup Menu 2nd Level.....	114
Limitations.....	114
Operation (Setup Menu 2nd Level).....	114
Parameters for MIG/MAG Standard Synergic Welding (Setup Menu 2nd Level).....	115
Parameters for MIG/MAG Standard Manual Welding (Setup Menu 2nd Level).....	116
Parameters for stick welding (SMAW).....	118
Parameters for TIG Welding (Setup Menu 2nd Level).....	118
Measuring the Welding Circuit Resistance r.....	120
General.....	120
Measuring the welding circuit resistance (MIG/MAG welding).....	120
Displaying the Welding Circuit Inductivity L.....	122
General.....	122

Displaying the welding circuit inductivity .....	122
Laying the hosepacks correctly .....	122
<b>Troubleshooting and Maintenance</b>	<b>123</b>
Troubleshooting .....	125
General .....	125
Safety .....	125
Troubleshooting .....	125
Displayed Service Codes .....	128
Displayed service codes in connection with OPT Easy Documentation .....	133
Service, maintenance and disposal .....	135
General .....	135
Safety .....	135
At every start-up .....	135
Whenever Required .....	135
Every 2 Months .....	135
Every 6 Months .....	136
Disposal .....	136
<b>Appendix</b>	<b>137</b>
Average consumption values during welding .....	139
Average wire electrode consumption during MIG/MAG welding .....	139
Average shielding gas consumption during MIG/MAG welding .....	139
Average shielding gas consumption during TIG welding .....	139
Technical data .....	140
Special Voltage .....	140
Explanation of the Term Duty Cycle .....	140
TSt 2700c MP .....	141
TransSteel 2700c MV MP .....	143
TSt 3500c MP .....	146
Overview with critical raw materials, year of production of the device .....	147
Welding program tables .....	148
TSt 2700c MP welding program table .....	148
TSt 2700c MP USA welding program table .....	149
TSt 3500c MP welding program table .....	150
TSt 3500c MP USA welding program table .....	151

# Safety Instructions

## Explanation of Safety Instructions

### **DANGER!**

Indicates an immediate danger.

- ▶ Death or serious injury may result if appropriate precautions are not taken.

### **WARNING!**

Indicates a possibly dangerous situation.

- ▶ Death or serious injury may result if appropriate precautions are not taken.

### **CAUTION!**

Indicates a situation where damage or injury could occur.

- ▶ Minor injury or damage to property may result if appropriate precautions are not taken.

### **NOTE!**

Indicates the possibility of flawed results and damage to the equipment.

## General

The device has been manufactured using state-of-the-art technology and according to recognized 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 equipment

All persons involved in the commissioning, operation, maintenance, and servicing of the device must

- Be suitably qualified
- Have knowledge of welding
- Have completely read and followed these Operating Instructions

The Operating Instructions must always be at hand wherever the device is being used. In addition to the Operating Instructions, all applicable local rules and regulations regarding accident prevention and environmental protection must also be followed.

All safety and danger notices on the device must

- Be kept in a legible state
- Not be damaged/marked
- Not be removed
- 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, remove any faults that could compromise safety.

**Your personal safety is at stake!**

## Intended Use

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

The device is intended exclusively for the welding process specified on the rating plate. Utilization for any other purpose, or in any other manner, shall be deemed to be "not in accordance with the intended purpose." The manufacturer is not responsible for any damage resulting from improper use.

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Proper use also means

- Completely reading and obeying all instructions in the Operating Instructions
  - Completely reading and obeying all safety instructions and danger notices
  - Carrying out all the specified inspection and servicing work
- 

Never use the device for the following applications:

- Thawing pipes
  - Charging batteries
  - Starting motors
- 

The device is designed for operation in industry and business. The manufacturer shall not be liable for any damage resulting from use in a living area.

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The manufacturer shall also not be liable for faulty or incorrect work 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 accepts no liability for any damage resulting from improper use.

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Temperature range of the ambient air:

- 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)
- 

Ambient air: free of dust, acids, corrosive gases or substances, etc.

Altitude above sea level: up to 2000 m (6561 ft. 8.16 in.)

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## **Obligations of the Operating Company**

- The operating company must only allow persons to work with the device if they
- Are familiar with the basic occupational safety and accident prevention regulations and are trained in handling the device
  - Have read and understood these Operating Instructions, especially the section "Safety Rules," and have confirmed this with their signature
  - Are trained according to the requirements for the work results
- 

The safety-conscious work of the personnel must be checked regularly.

---

## **Obligations of Personnel**

All persons who are assigned to work with the device must do the following before beginning the work:

- Follow the basic regulations for occupational safety and accident prevention
  - Read these Operating Instructions, especially the section "Safety Rules," and confirm that they have understood and will follow them by signing
- 

Before leaving the workplace, ensure that no personal injury or property damage can occur in one's absence.

---

## **Grid Connection**

Devices with a high output can influence the energy quality of the grid due to their current consumption.

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

- connection restrictions
- criteria regarding maximum permissible grid impedance \*)
- criteria regarding the minimum required short-circuit power \*)

\*) both at the interface with the public grid

See technical data

In this case, the operator or the person using the device should check whether or not the device is allowed to be connected, where appropriate through discussion with the power supply company.

**IMPORTANT!** Ensure secure grounding of the grid connection!

**Personal Protection and Protection of Others**

You are exposed to numerous hazards while handling the device, for example:

- Flying sparks and pieces of hot metal
- Arc radiation that poses a risk of injury to the eyes and skin
- Hazardous electromagnetic fields that pose a risk of death for individuals with pacemakers
- Electrical risks from grid current and welding current
- Increased noise exposure
- Harmful welding fumes and gases

Wear suitable protective clothing when dealing with the device. The protective clothing must have the following properties:

- Flame resistant
- Insulating and dry
- Covering the entire body and in good condition with no damage
- Safety helmet
- Cuffless pants

Protective clothing involves the following:

- Protecting the face and eyes from UV radiation, heat and flying sparks with a face guard featuring a regulation-compliant filter
- Wearing regulation-compliant protective goggles with side protection behind the face guard
- Wearing rigid, wet-insulating footwear
- Protecting hands with appropriate gloves (featuring electrical insulation and thermal protection)
- Wearing ear protection to reduce noise exposure and protect against injury

Keep persons, especially children, away during the operation of the devices and during the welding process. If persons are in the vicinity, however:

- Instruct them about all hazards (blinding hazard due to arcs, risk of injury from flying sparks, welding fumes hazardous to health, noise exposure, possible hazard due to grid current or welding current, etc.)
- Provide suitable protective equipment or
- Construct suitable protective walls and curtains.

**Danger from toxic gases and vapors**

The fumes produced during welding contain toxic gases and vapors.

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

Use at-source extraction source and a room extraction system.  
If possible, use a welding torch with an integrated extraction device.

Keep your head out of the welding fumes and gases.

Take the following precautionary measures for fumes and harmful gases:

- Do not breathe them in.
- Extract them from the work area using appropriate equipment.

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Ensure that there is a sufficient supply of fresh air. Ensure that there is a ventilation flow rate of at least 20 m<sup>3</sup> per hour.

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Use a welding helmet with air supply if there is insufficient ventilation.

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If there is uncertainty as to whether the extraction capacity is sufficient, compare the measured toxic emission values against the permissible limit values.

---

The following components are factors that determine how toxic the welding fumes are:

- The metals used for the workpiece
- Electrodes
- Coatings
- Cleaning agents, degreasers, and the like
- The welding process used

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Consult the corresponding material safety data sheets and manufacturer's instructions for the components listed above.

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

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Keep flammable vapors (such as solvent vapors) out of the arc radiation range.

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When no welding is taking place, close the valve of the shielding gas cylinder or the main gas supply.

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### **Danger from Flying Sparks**

Flying sparks can cause fires and explosions.

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Never undertake welding near flammable materials.

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Flammable materials must be kept at least 11 meters (36 ft. 1.07 in.) from the arc or protected with a certified cover.

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Keep suitable, tested fire extinguishers on hand.

---

Sparks and pieces of hot metal may also get into surrounding areas through small cracks and openings. Take appropriate measures to ensure that there is no risk of injury or fire.

---

Do not undertake welding in areas at risk of fire and explosion, or on sealed tanks, drums, or pipes if these have not been prepared in accordance with corresponding national and international standards.

---

Do not undertake welding on containers in which gases, fuels, mineral oils, and the like are/were stored. Residues pose a risk of explosion.

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### **Risks from grid current and welding current**

An electric shock can be fatal.

---

Do not touch voltage-carrying parts inside or outside the device.

---

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

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Always place the wirefeeder on a sufficiently insulated base or use a suitable insulating wirefeeder holder.

---

Ensure suitable personal protection with dry temporary backing or cover with sufficient insulation against the ground potential. The temporary backing or cover must completely cover the entire area between the body and the 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.

Before every use, check power connections for secure fit by hand.

In the case of power cables with bayonet connectors, turn the power cable by at least 180° around the longitudinal axis and pretension.

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

Concerning the electrode (rod electrode, tungsten electrode, welding wire, etc.)

- Never immerse it in liquids to cool it
- Never touch it when the power source is switched on.

The open circuit voltage of a welding system may double, for example, between the electrodes of two welding systems. Touching the potentials of both electrodes at the same time may be life-threatening in some cases.

Have the grid and device supply lead regularly inspected by an electrician to ensure that the ground conductor is functioning properly.

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

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

Otherwise, this is considered gross negligence. The manufacturer accepts no liability for any damage resulting from improper use.

Use suitable equipment to ensure that the workpiece is sufficiently grounded if necessary.

Switch off unused devices.

When working at elevated heights, wear a safety harness to prevent falls.

Before working on the device, switch off the device and remove the grid plug.

Secure the device to prevent the grid plug from being connected and switched on again by applying a clearly legible and understandable warning sign.

After opening the device:

- Discharge all electrically charged components
- Ensure that all components are disconnected from the power supply.

If work is needed on voltage-carrying parts, bring in a second person who will switch off the main switch at the correct time.

### Stray welding currents

If the following instructions are not observed, stray welding currents may occur, which pose a risk of the following:

- Fire
- Overheating of components connected to the workpiece
- Destruction of ground conductors
- Damage to the device and other electrical equipment

Ensure that the workpiece terminal is securely connected to the workpiece.

Secure the workpiece terminal as close to the spot to be welded as possible.

Position the device with sufficient insulation against electrically conductive environments, e.g., insulation against electrically conductive floors or electrically conductive mounts.

---

Observe the following when using electrical distributors, double-headed retainers, etc.: Even the electrode of the welding torch/electrode holder not in use carries electric potential. Ensure that there is sufficient insulation when the unused welding torch/electrode holder is stored.

---

In automated MIG/MAG applications, only guide the wire electrode from the welding wire drum, large spool or wirespool to the wirefeeder with insulation.

---

## **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 grid.
- 

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

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## **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 operating company is obliged to take appropriate action to rectify the situation.

---

Test and assess the immunity of equipment in the vicinity of the device in accordance with national and international provisions. Examples of interference-prone equipment that could be affected by the device:

- Safety devices
  - Grid power lines, signal lines and data transfer lines
  - EMC and telecommunications equipment
  - Devices for measuring and calibrating
- 

Supporting measures to avoid EMC problems:

1. Grid power supply
  - If electromagnetic interference occurs despite a grid connection that complies with regulations, take additional measures (e.g., use a suitable grid filter).
2. Welding power-leads
  - Keep them as short as possible
  - Route them close together (also to avoid EMF problems)
  - Route them far from other lines
3. Equipotential bonding
4. Workpiece grounding
  - If necessary, establish grounding using suitable capacitors
5. Shield, if necessary
  - Shield other devices in the vicinity
  - Shield the entire welding installation

**EMF measures**

Electromagnetic fields may cause health problems that are not yet known:

- Effects on the health of persons close by, e.g., those with pacemakers and hearing aids
- Persons with pacemakers must seek advice from their doctor before staying in the immediate vicinity of the device and the welding process
- Keep distances between welding cables and the head/torso of the welder as large as possible for safety reasons
- Do not carry welding cables and hosepacks over one's shoulder or wrap them around one's body or body parts

**Particular Hazard Areas**

Keep hands, hair, loose clothing, and tools away from moving parts, such as:

- fans
- gears
- rollers
- shafts
- wirepools and welding wires.

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Do not reach into rotating gears of the wire drive or into rotating drive parts.

---

Covers and side parts must only be opened/removed during maintenance and repair work.

---

During operation:

- Ensure that all covers are closed, and all side parts have been mounted properly.
  - Keep all covers and side parts closed.
- 

The protrusion of welding wire from the welding torch represents a high risk of injury (cuts to the hand, facial and eye injuries, etc.)

---

Therefore always hold the welding torch away from the body (devices with wirefeeder) and use suitable protective goggles.

---

Do not touch the workpiece during or after welding—burning hazard.

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Slag may fly off cooling workpieces. Therefore, also wear regulation-compliant protective equipment when reworking workpieces and ensure that other persons are sufficiently protected.

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Leave the welding torch and other parts with a high operating temperature to cool before working on them.

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Special regulations apply in areas at risk of fire or explosion  
– follow the appropriate national and international regulations.

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Power sources for work in areas with increased electrical hazard (e.g. boilers) must be labeled with the symbol (Safety). However, the power source may not be located in such areas.

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Risk of scalding due to leaking coolant. Switch off the cooling unit before disconnecting connections for the coolant supply or return.

---

When handling coolant, observe the information on the coolant safety data sheet. The coolant safety data sheet can be obtained from your service center or via the manufacturer's website.

---

Only use suitable load-carrying equipment from the manufacturer when transporting devices by crane.

- Attach chains or ropes to all designated attachments of the suitable load-carrying equipment.
- Chains or ropes must be the smallest angle possible from vertical.
- Remove gas cylinder and wirefeeder (MIG/MAG and TIG devices).

---

In the event of crane attachment of the wirefeeder during welding, always use a suitable, insulating wirefeeder hoisting attachment (MIG/MAG and TIG devices).

---

If the device is equipped with a carrier belt or handle, then this is used exclusively for transport by hand. The carrier belt is not suitable for transport by crane, counterbalanced lift truck or other mechanical lifting tools.

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All lifting equipment (belts, buckles, chains, etc.), which is used in association with the device or its components, must be checked regularly (e.g. for mechanical damage, corrosion, or changes due to other environmental influences).

The test interval and scope must at least comply with the respective valid national standards and guidelines.

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There is a risk of colorless, odorless shielding gas escaping without notice if an adapter is used for the shielding gas connection. Use suitable Teflon tape to seal the thread of the shielding gas connection adapter on the device side before installation.

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**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/m<sup>3</sup>
- 

Use filters if necessary.

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**Danger from Shielding Gas Cylinders**

Shielding gas cylinders contain compressed gas and may explode if damaged. Shielding gas cylinders are an integral part of the welding equipment, so they must be handled very carefully.

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

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Mount the shielding gas cylinders vertically and secure them in accordance with instructions so they cannot fall over.

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

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Never hang a welding torch on a shielding gas cylinder.

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Never touch a shielding gas cylinder with an electrode.

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Risk of explosion: Never weld on a compressed shielding gas cylinder.

---

Always use suitable shielding gas cylinders for the application in question and the correct matching accessories (controller, hoses, and fittings, etc.) Only use shielding gas cylinders and accessories that are in good condition.

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If a valve on a shielding gas cylinder is open, turn your face away from the outlet.

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When no welding is taking place, close the valve of the shielding gas cylinder.

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Leave the cap on the valve of the shielding gas cylinder when the cylinder is not connected.

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Follow the manufacturer's instructions and applicable national and international provisions for shielding gas cylinders and accessories.

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### Danger Posed by Shielding Gas Leak

Risk of asphyxiation due to uncontrolled shielding gas leak

Shielding gas is colorless and odorless and may suppress the oxygen in the ambient air in the event of leakage.

- Ensure there is a sufficient supply of fresh air with a ventilation flow rate of at least 20 m<sup>3</sup> per hour.
- Please observe the safety and maintenance information for the shielding gas cylinder or the main gas supply.
- When no welding is taking place, close the valve of the shielding gas cylinder or the main gas supply.
- Always check the shielding gas cylinder or main gas supply for uncontrolled gas leakage before each start-up.

### Safety Measures at the Setup Location and During Transport

A toppling device can be deadly! Set up the device securely on an even, solid surface

- The maximum permitted tilt angle is 10°.

Special regulations apply in areas at risk of fire or explosion

- Follow the appropriate national and international regulations.

Use instructions and checks within the company to ensure that the vicinity of the workplace is always clean and organized.

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

When setting up the device, ensure that there is an all-round clearance of 0.5 m (1 ft. 7.69 in.) to allow cooling air to circulate unhindered.

Take care to ensure that the applicable national and regional guidelines and accident prevention regulations are observed when transporting the device, especially guidelines concerning hazards during transport and shipment.

Do not lift or transport any active devices. Switch off devices before transport or lifting.

Before transporting the device, completely drain the coolant and dismantle the following components:

- wirefeeder
- wirespool
- shielding gas cylinder

It is essential to conduct a visual inspection of the device to check for damage after it has been transported but before commissioning. Have any damage 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 danger of:

- 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

Safety devices that are not fully functional must be repaired before the device is switched on.

Never bypass or disable safety devices.

Before switching on the device, ensure that no one can be put in danger.

The device must be examined at least once a week for externally detectable damage and functionality of the safety devices.

---

Always secure the shielding gas cylinder well and remove before transporting by crane.

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

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Only use appropriate original coolant from the manufacturer.

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Do not mix original coolant from the manufacturer with other coolants.

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Only connect system components from the manufacturer to the cooling unit circuit.

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If there is damage due to use of other system components or other coolants, the manufacturer accepts no liability for this and all warranty claims are forfeited.

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Cooling Liquid FCL 10/20 is not flammable. The ethanol-based coolant is flammable in certain conditions. Only transport the coolant in closed original containers and keep away from sources of ignition.

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Properly dispose of used coolant according to national and international regulations. The coolant safety data sheet can be obtained from your service center or via the manufacturer's website.

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When the system is cool, always check the coolant level before starting welding.

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## 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 be performed at least every 12 months.

---

The manufacturer recommends calibrating power sources within the same 12-month interval.

---

A safety inspection by a certified electrician is recommended:

- After changes
  - After alterations
  - After repair, care, and maintenance
  - At least every 12 months
- 

For the safety inspection, follow the appropriate national and international standards and guidelines.

---

You can obtain more information about the safety inspection and calibration from your service center. The service center will provide the necessary documents upon request.

---

---

## 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 be returned to your dealer, or you must locate 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 label satisfy the essential requirements of the low-voltage and electromagnetic compatibility directive (e.g. relevant product standards of the EN 60974 series).

Fronius International GmbH declares that the device complies with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available on the following website: <http://www.fronius.com>

---

Devices marked with the CSA test mark satisfy the requirements of the relevant standards for Canada and the USA.

---

**Data backup**

The user is responsible for backing up 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.

---

Text and illustrations were accurate at the time of printing. Fronius reserves 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 Operating Instructions, we will be most grateful for your comments.

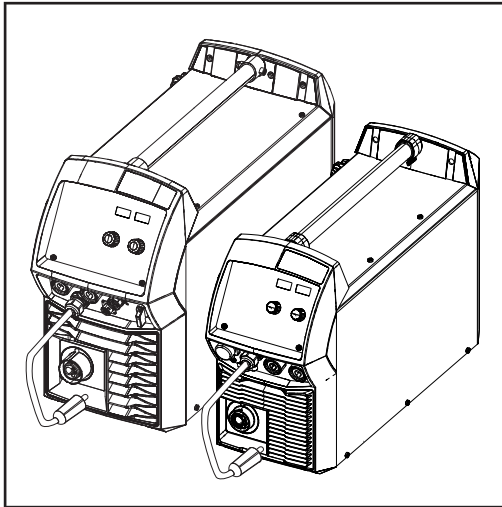


# **General information**



# General

## Device Concept



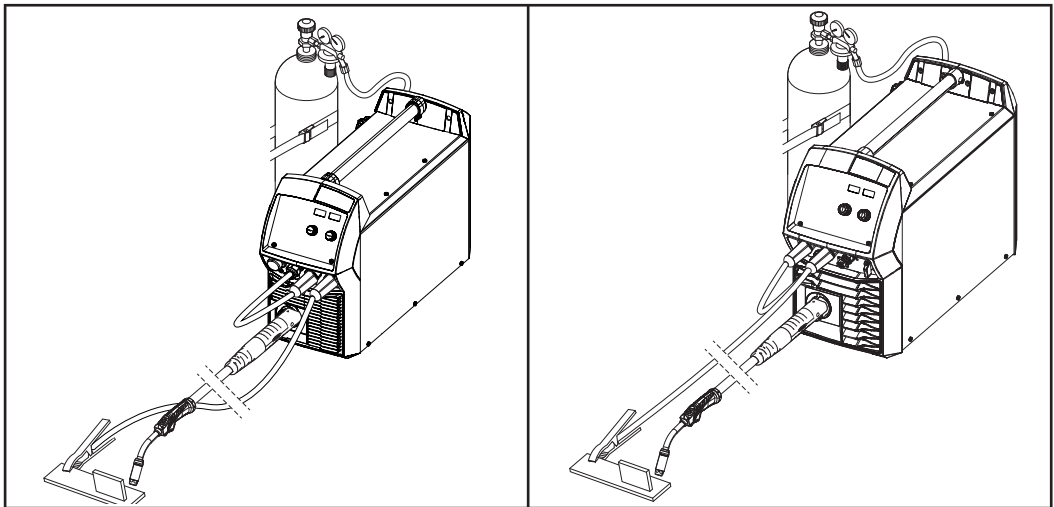
The TransSteel (TSt) 2700c MP and TSt 3500c MP power sources are fully digitized, microprocessor-controlled inverter power sources.

A modular design and easy ability to extend the system guarantee a high degree of flexibility. The devices are designed for the welding of steel.

## Available welding processes

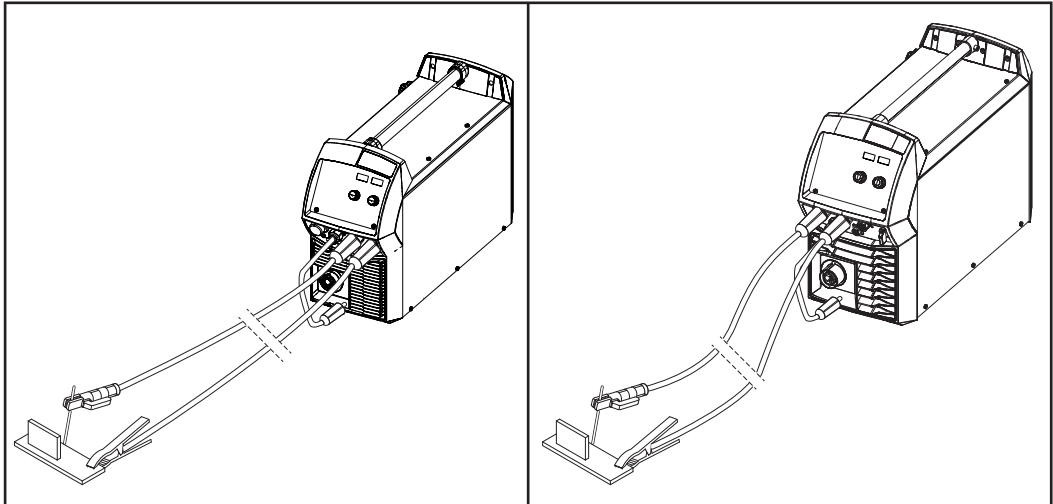
The following welding processes are available on the power sources:

### MIG/MAG welding



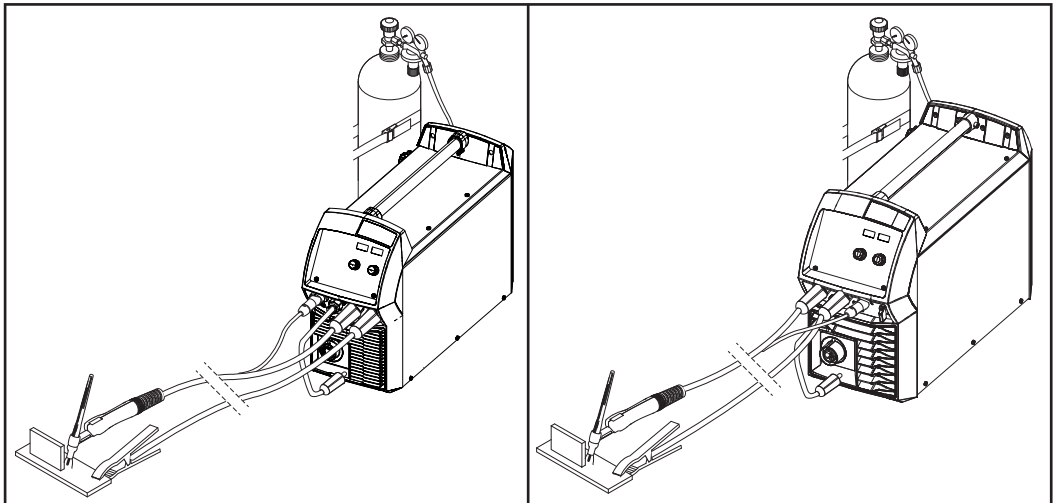
*TSt 2700c MP TSt 3500c MP*

## Manual metal arc welding



*TSt 2700c MP TSt 3500c MP*

## TIG welding with touchdown ignition



*TSt 2700c MP TSt 3500c MP*

### Operating Principle

The central control and regulation unit of the power sources is coupled with a digital signal processor. The central control and regulation unit and 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 status is maintained.

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.

This results in:

- A precise welding process,
- A high degree of reproducibility on all results
- Excellent weld properties.

**Applications**

The devices are used in trade and industry for manual applications with classical steel and galvanized sheets.

The TSt 2700c MP is primarily used in light-gage steel sheet (light steelwork) applications.

Repair, maintenance, and assembly work in shipyards, automotive suppliers, workshops or the furniture construction industry are among the typical application areas. The TSt 2700c MP power source thus positions itself in its power category between the trade/workshop and the industry sector.

The TSt 3500c MP power source is designed for:

- Mechanical and equipment engineering
- Steel construction
- Plant and container construction
- Metal and portal construction
- Rail vehicle construction

**Warning notices on the device**

There are warning notices and safety symbols on the power sources. 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 property damage.

<b>WARNING</b>		<p><b>ARC RAYS can burn eyes and skin; NOISE can damage hearing.</b></p> <ul style="list-style-type: none"> <li>● Wear welding helmet with correct filter.</li> <li>● Wear correct eye, ear and body protection.</li> </ul>	<p>Read American National Standard Z49.1, "Safety in Welding and Cutting" From American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126; OSHA Safety and Health Standards, 29 CFR 1910, from U.S. Government Printing Office, Washington, DC 20402. CSA, W117-2 M87 Code for Safety in Welding and Cutting.</p>
<p style="margin: 0;">Do not Remove, Destroy, Or Cover This Label</p>		<p><b>EXPLODING PARTS can injure.</b></p> <ul style="list-style-type: none"> <li>● Failed parts can explode or cause other parts to explode when power is applied.</li> <li>● Always wear a face shield and long sleeves when servicing.</li> </ul>	
<p><b>ELECTRIC SHOCK can kill.</b></p> <ul style="list-style-type: none"> <li>● Always wear dry insulating gloves.</li> <li>● Insulate yourself from work and ground.</li> <li>● Do not touch live electrical parts.</li> <li>● Disconnect input power before servicing.</li> <li>● Keep all panels and covers securely in place.</li> </ul>	<p><b>ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE exists after removal of input power</b></p> <ul style="list-style-type: none"> <li>● Always wait 60 seconds after power is turned off before working on unit.</li> <li>● Check input capacitor voltage, and be sure it is near 0 before touching parts.</li> </ul>		
<b>AVERTISSEMENT</b>		<p><b>UN CHOC ELECTRIQUE peut etre mortel.</b></p> <ul style="list-style-type: none"> <li>● Installation et raccordement de cette machine doivent etre conformes a tous les pertinents.</li> </ul> <p><b>SOUDAGE A L'ARC peut etre hasardeux.</b></p> <ul style="list-style-type: none"> <li>● Lire le manuel d' instructions avant utilisation.</li> <li>● Ne pas installer sur une surface combustible.</li> <li>● Les fils de soudage et pieces conductrices peuvent etre a la tension de soudage.</li> </ul>	
<p><b>FUMES AND GASES can be hazardous.</b></p> <ul style="list-style-type: none"> <li>● Keep your head out of the fumes.</li> <li>● Ventilate area, or use breathing device.</li> <li>● Read Material Safety Data Sheets (MSDSs) and manufacturer's instructions for materials used.</li> </ul>			
<p><b>WELDING can cause fire or explosion.</b></p> <ul style="list-style-type: none"> <li>● Do not weld near flammable material.</li> <li>● Watch for fire: keep extinguisher nearby.</li> <li>● Do not locate unit over combustible surfaces.</li> <li>● Do not weld on closed containers.</li> </ul>			

Safety symbols on the rating plate:



Welding is dangerous. The following basic requirements must be met:

- Adequate welding qualifications
- Appropriate protective equipment
- Exclusion of unauthorized persons



Do not use the functions described here until you have fully read and understood the following documents:

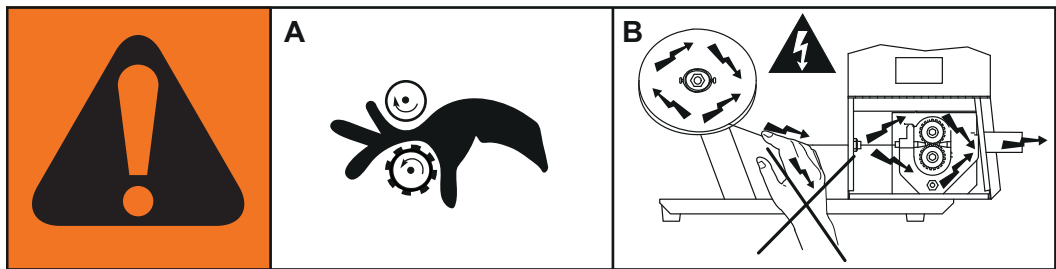
- These Operating Instructions
- All system component Operating Instructions, especially the safety rules



**Description of the warnings on the device**

Warning notices are attached to the device for certain device versions.

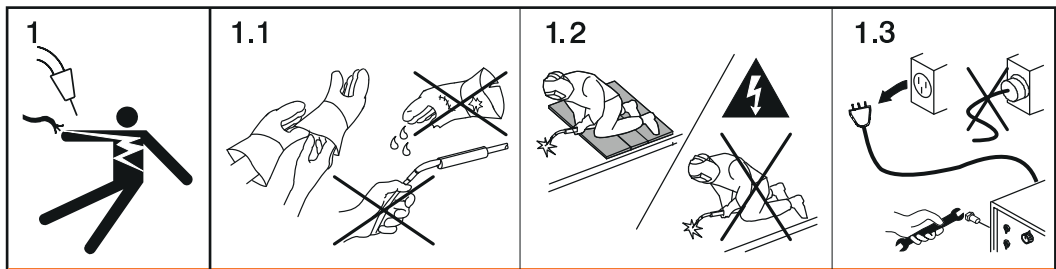
The arrangement of the symbols may vary.



**! Warning! Caution!**  
**The symbols represent possible dangers.**

A Drive rollers can injure fingers.

B The welding wire and drive parts are under welding voltage during operation. Keep hands and metal objects away!

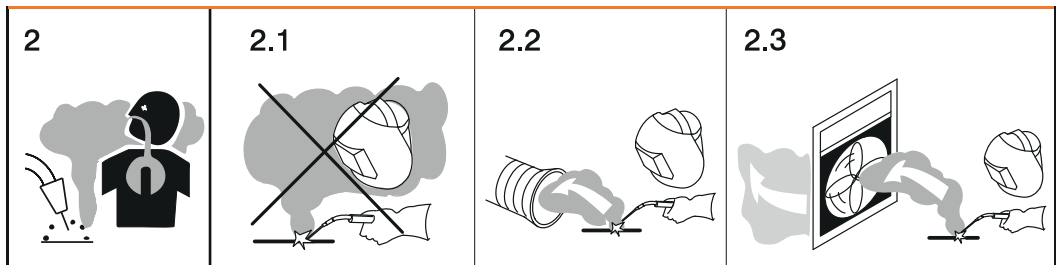


1. An electric shock can be fatal.

1.1 Wear dry, insulating gloves. Do not touch the wire electrode with bare hands. Do not wear wet or damaged gloves.

1.2 Use a base that is insulated from the floor and work area to protect against electric shock.

1.3 Before working on the device, switch off the device and remove the mains plug or disconnect the power supply.

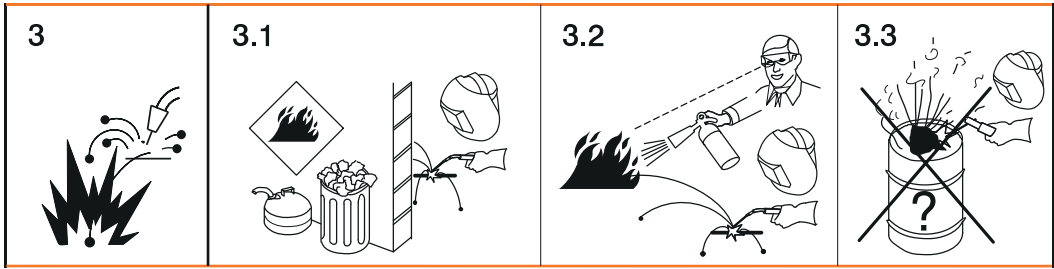


2. Inhalation of welding fumes can be harmful to health.

2.1 Keep your face away from any welding fumes.

2.2 Use forced-air ventilation or local extraction to remove welding fumes.

2.3 Remove welding fumes with a fan.

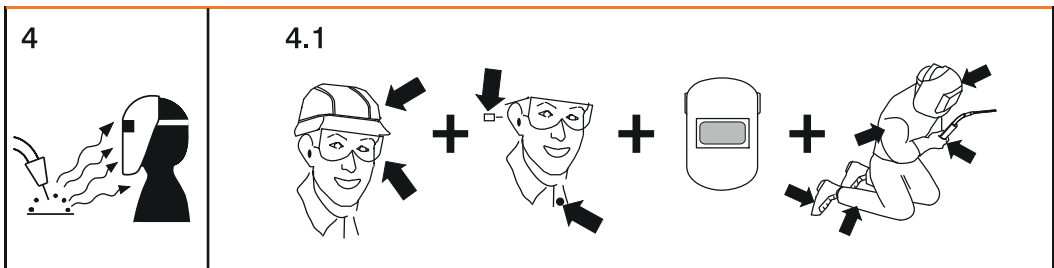


3 Welding sparks can cause an explosion or fire.

3.1 Keep flammable materials away from the welding process. Do not perform welding near flammable materials.

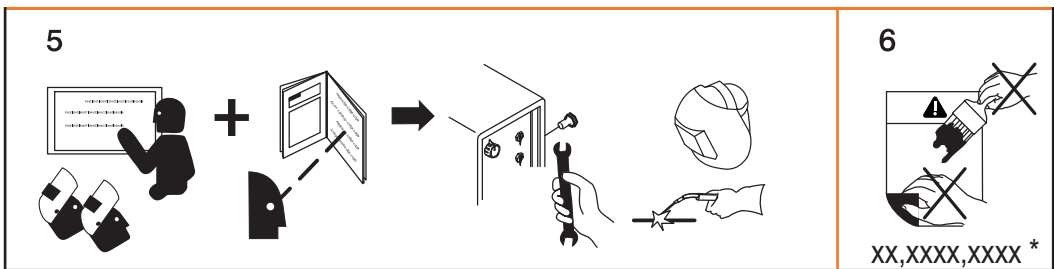
3.2 Welding sparks can cause a fire. Have fire extinguishers ready. If necessary, have a supervisor ready who can operate the fire extinguisher.

3.3 Do not weld on drums or closed containers.



4. Arc rays can burn the eyes and injure the skin.

4.1 Wear headgear and protective goggles. Use ear protection and wear a shirt collar with button. Use a welding helmet with the correct tinting. Wear suitable protective clothing over the entire body.



5. Before working on the machine or welding: undertake training on the device and read the instructions!

6. Do not remove or paint over the sticker with the warnings.

\* Manufacturer order number of the sticker

# System components

## General

The power sources can be operated with various system components and options. This makes it possible to optimize procedures and to simplify machine handling and operation, depending on the field of application for the power source.

## Safety

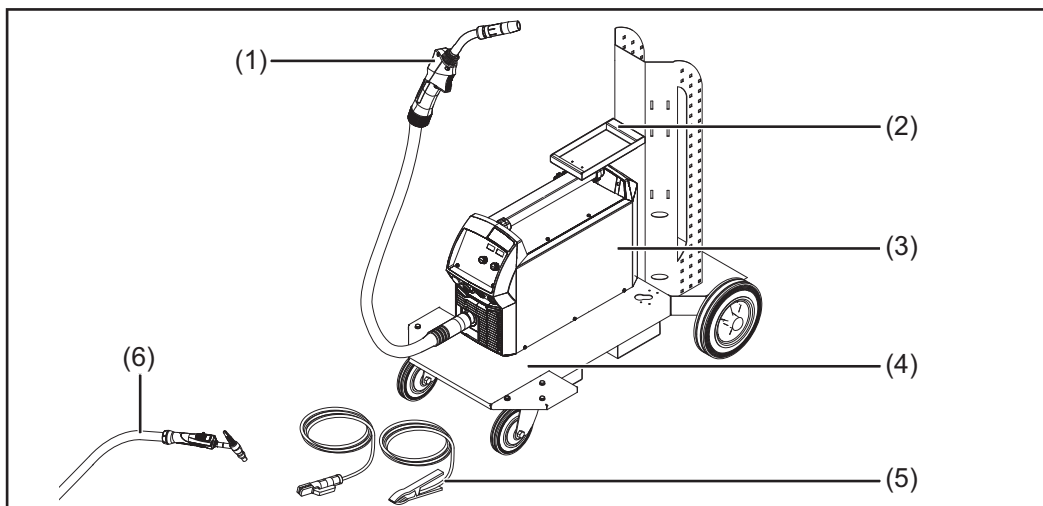
**⚠ WARNING!**

### Danger due to incorrect operation.

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

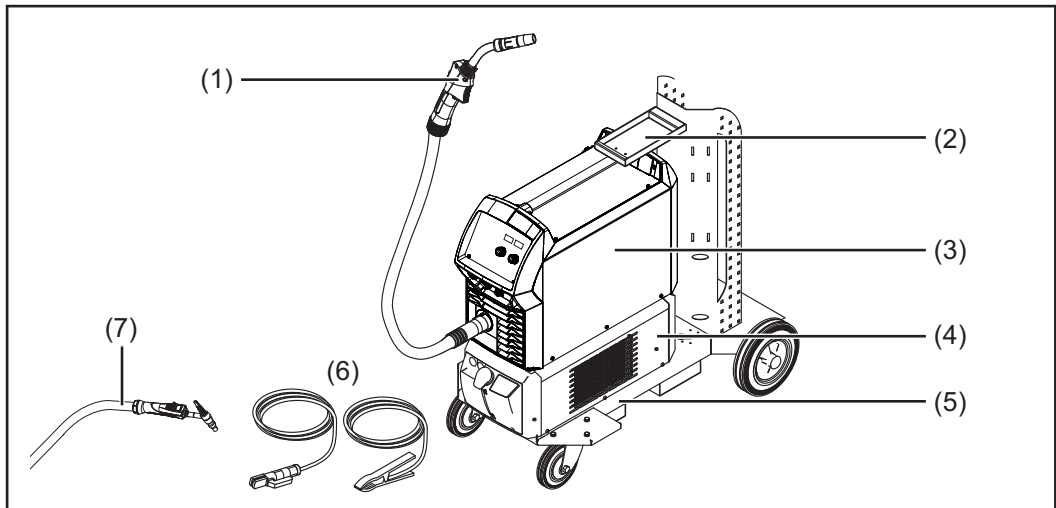
- ▶ Do not use the functions described here until you have fully read and understood the Operating Instructions.
- ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions of the system components, especially the safety rules.

## Overview



TSt 2700c MP

No.	Function
(1)	MIG/MAG welding torch
(2)	Stabilization of the gas cylinder holder
(3)	Power source
(4)	Trolley and gas cylinder holder
(5)	Grounding and electrode cable
(6)	TIG welding torch



TSt 3500c MP

No.	Function
(1)	MIG/MAG welding torch
(2)	Stabilization of the gas cylinder holder
(3)	Power source
(4)	Cooling unit only TSt 3500c
(5)	Trolley and gas cylinder holder
(6)	Grounding and electrode cable
(7)	TIG welding torch

# **Operating controls and connections**



# Control Panel

---

## General

The functions are all arranged in a logical way on the control panel. The individual parameters required for welding can be

- easily selected using buttons
- changed using buttons or the selection dial
- shown on the digital display during welding

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 expert knowledge is available at all times. All the parameters can be corrected manually. The Synergic control panel also allows entirely manual configuration of parameters.

### NOTE!

**Because of software updates, certain functions may be available for your device but not described in these Operating Instructions or vice versa.**

In addition, individual figures may also differ slightly from the operating elements of your device. However, the function of these operating elements is identical.

---

## Safety



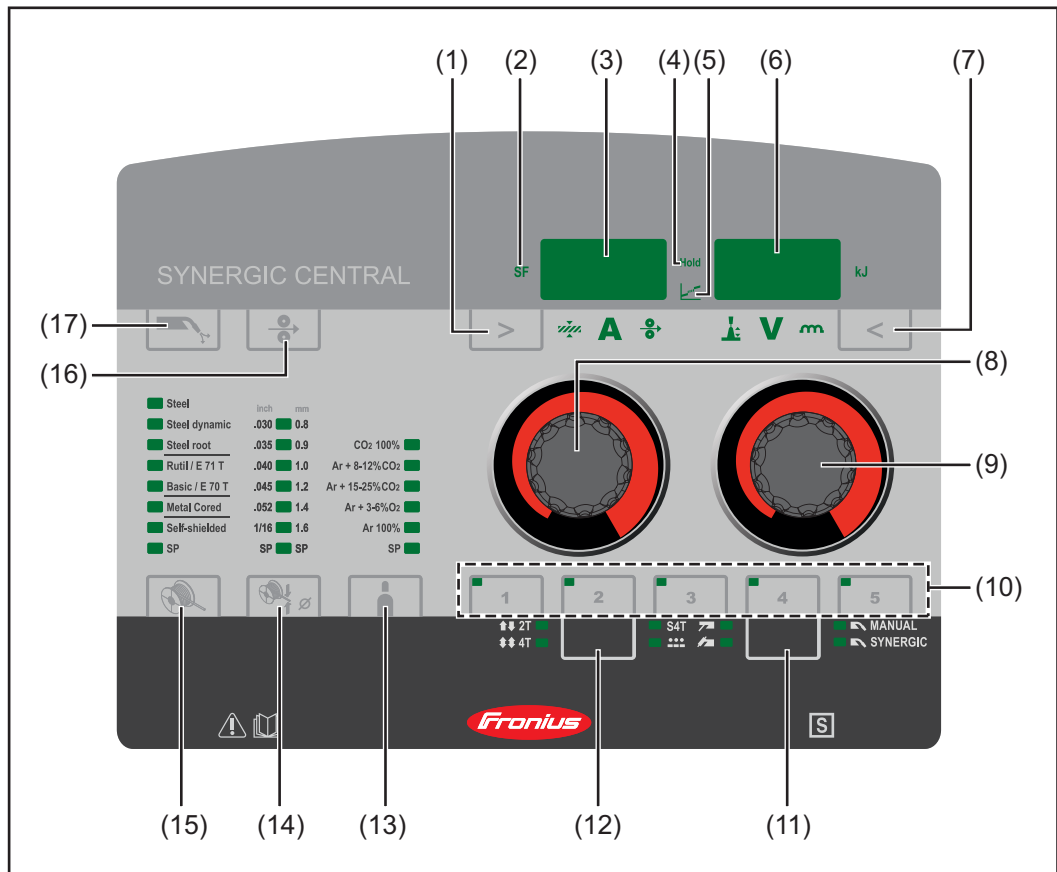
### WARNING!

**Danger from incorrect operation and work that is not carried out properly.**

Serious personal injury and damage to property may result.

- ▶ 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 (left)**

For selecting the following welding parameters and for changing parameters in the Setup menu

The relevant symbol lights up when a welding parameter is selected.



**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.



**Welding current in A \*)**

Before welding begins, the device automatically displays a standard value based on the programmed parameters. The actual value is displayed during welding.



**Wire speed in m/min or ipm \*)**

(2) **SF - spot/stitch welding indicator**

lights up if a value has been entered for the spot/interval welding time Setup parameter (SPt) (spot or stitch welding operating mode is enabled)

(3) **Left digital display**

(4) **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.



- 
- (5) **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 area.
- 

(6) **Right digital display**

---

- (7) **"Parameter selection" button (right)**  
For selecting the following welding parameters and for changing parameters in the Setup menu  
The relevant symbol lights up when a welding parameter is selected.



**Arc length correction**

For correcting the arc length



**Welding voltage in V \*)**

Before welding begins, the device automatically displays a standard value based on the programmed parameters. The actual value is displayed during welding.



**Arc-force dynamic**

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

- ... Harder and more stable arc

0 ... Neutral arc

+ ... Soft and low-spatter arc



**Real Energy Input**

For displaying the energy applied during the welding operation. \*\*)

---

- (8) **Selection dial (left)**  
For changing the sheet thickness, welding current and wire speed parameters and for changing parameters in the Setup menu
- 

- (9) **Selection dial (right)**  
For changing the arc length correction, welding voltage and arc-force dynamic parameters and for changing parameters in the Setup menu
- 

- (10) **"Save" buttons (Easy Job)**  
For saving up to 5 operating points
- 

- (11) **"Process" button**  
For selecting the welding process



MANUAL - MIG/MAG standard manual welding



SYNERGIC - MIG/MAG standard synergic welding



Manual metal arc welding



TIG welding

---

- (12) **"Mode" button**  
For selecting the operating mode



2 T - 2-step mode



4 T - 4-step mode



Special 4-step mode

(13) **"Shielding gas" button**

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

The LED next to the selected shielding gas lights up.

---

(14) **"Wire diameter" button**

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

The LED next to the selected wire diameter lights up.

---

(15) **"Material" button**

For selecting the filler metal used. The SP parameter is reserved for additional materials.

The LED next to the selected filler metal lights up.

---

(16) **"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.

---

(17) **Gas-test button**

For setting the required gas volume on the gas pressure regulator.

Tap button once: shielding gas flows out

Tap button again: shielding gas flow stops

If the Gas-test button is not tapped again, the shielding gas flow will stop after 30 s.

---

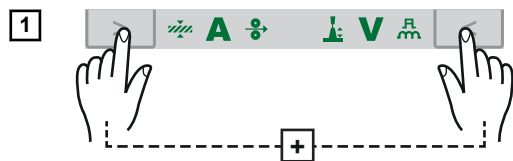
\*) In the MIG/MAG standard synergic welding process, if one of these parameters is selected, then the synergic function ensures that all other parameters, including the welding voltage parameter, are adjusted automatically.

\*\*\*) The Real Energy Input indicator 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 input. The final value is stored after welding ends until welding starts again or the power source is switched back on - the HOLD indicator lights up.

**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" will be displayed, e.g., "1.00 | 4.21"

**Selecting parameters**



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

**Available parameters**

>  A  V  m <	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
Example: 654   32.1 = 65,432.1 hours = 65,432 hours 6 mins	Indicates the actual arc time since first use Note: The arc time indicator is not suitable as a basis for calculating hiring fees or for warranty purposes, 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

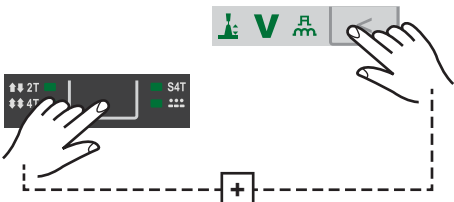
## Keylock

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

- Settings cannot be adjusted 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

### Activating/deactivating the keylock:

1



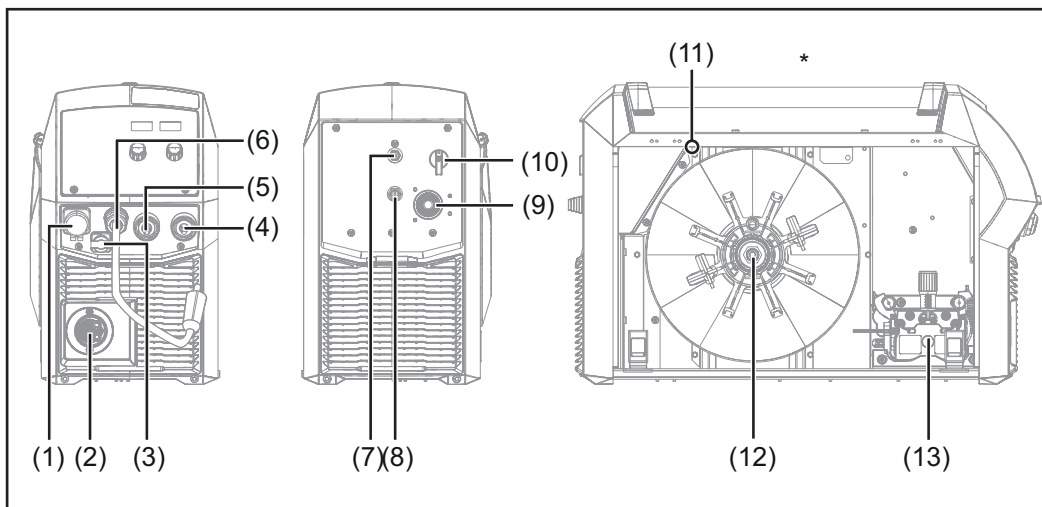
Keylock activated:  
The message "CLO | SEd" appears on the displays.

Keylock deactivated:  
The message "OP | En" appears on the displays.

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

# Connections, Switches, and Mechanical Components

## TSt 2700c MP

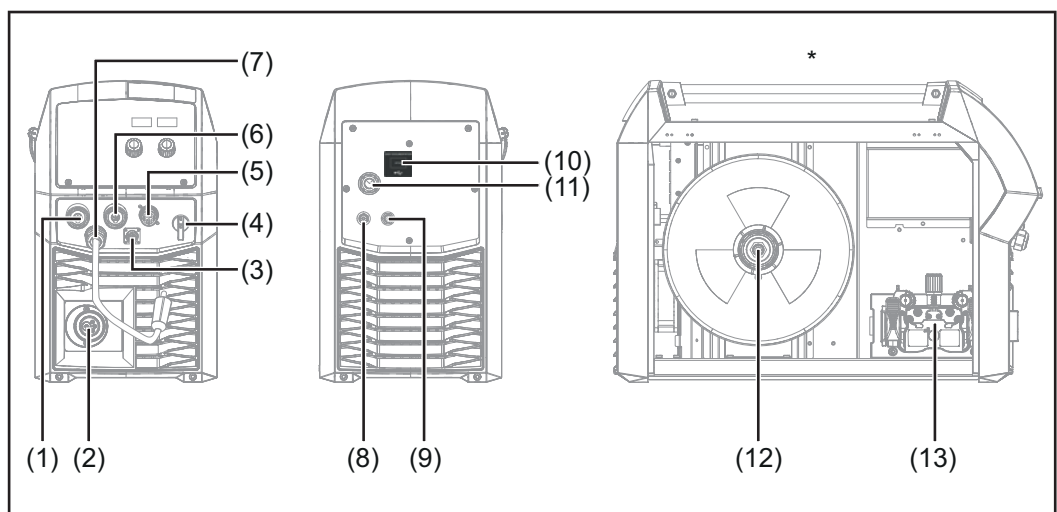


\* Side panel not shown

- 
- (1) **LocalNet connection**  
Standardized connection for remote control
- 
- (2) **Welding torch connection**  
For connecting the welding torch
- 
- (3) **TIG Multi Connector**  
For connecting the TIG welding torch
- 
- (4) **(+) Current socket with bayonet latch**  
Used for
- Connecting the polarity reverser or grounding cable for MIG/MAG welding (depending on the wire electrode used)
  - Connecting the electrode cable or grounding cable for MMA welding (depending on the type of electrode used)
  - Connecting the grounding cable for TIG welding
- 
- (5) **(-) Current socket with bayonet latch**  
Used for
- Connecting the grounding cable or polarity reverser for MIG/MAG welding (depending on the wire electrode used)
  - Connecting the electrode cable or grounding cable for MMA welding (depending on the type of electrode used)
  - Connecting the TIG welding torch
- 
- (6) **Polarity reverser**  
For selecting the welding potential on the MIG/MAG welding torch
- 
- (7) **MIG/MAG shielding gas connection socket**  
For the shielding gas supply to the welding torch connection (2)
- 
- (8) **TIG shielding gas connection socket**  
For the shielding gas supply for the (-) current socket (5)

- 
- (9) **Grid cable with strain relief device**  
Not prefitted on all models
- 
- (10) **Power switch**  
For switching the power source on and off
- 
- (11) **LED wirespool interior lighting**  
with the setup parameter LED the turn-off time is adjustable
- 
- (12) **Wirespool holder with brake**  
For holding standard wirespools with a max. diameter of 300 mm (11.81 in.) and a max. weight of 19 kg (41.89 lbs.)
- 
- (13) **4-roller drive**
- 

**TSt 3500c MP**



\* Side panel not shown

- 
- (1) **(-) Current socket with bayonet latch**  
Used for
- Connecting the grounding cable or polarity reverser for MIG/MAG welding (depending on the wire electrode used)
  - Connecting the electrode cable or grounding cable for MMA welding (depending on the type of electrode used)
  - Connecting the TIG welding torch
- 
- (2) **Welding torch connection**  
For connecting the welding torch
- 
- (3) **TIG Multi Connector**  
For connecting the TIG welding torch
- 
- (4) **Power switch**  
For switching the power source on and off
- 
- (5) **LocalNet connection**  
Standardized connection for remote control
- 
- (6) **(+) Current socket with bayonet latch**  
Used for

- Connecting the polarity reverser or grounding cable for MIG/MAG welding (depending on the wire electrode used)
- Connecting the electrode cable or grounding cable for MMA welding (depending on the type of electrode used)
- Connecting the grounding cable for TIG welding

---

<b>(7)</b>	<b>Polarity reverser</b> For selecting the welding potential on the MIG/MAG welding torch
<b>(8)</b>	<b>MIG/MAG shielding gas connection socket</b> For the shielding gas supply to the welding torch connection (2)
<b>(9)</b>	<b>TIG shielding gas connection socket</b> For the shielding gas supply for the (-) current socket (5)
<b>(10)</b>	<b>EASY DOCUMENTATION label</b>
<b>(11)</b>	<b>Grid cable with strain relief device</b> Not prefitted on all models
<b>(12)</b>	<b>Wirespool holder with brake</b> For holding standard wirespools with a max. diameter of 300 mm (11.81 in.) and a max. weight of 19 kg (41.89 lbs.)
<b>(13)</b>	<b>4-roller drive</b>

---





# Installation



# Minimum equipment for welding operations

---

**General**

Depending on the welding process, a minimum level of equipment is required to work with the power source.

The following describes the welding processes and the corresponding minimum equipment for welding operations.

---

**Gas-cooled  
MIG/MAG welding**

- Power source
  - Grounding cable
  - Gas-cooled MIG/MAG welding torch
  - Gas connection (shielding gas supply)
  - Wire electrode
- 

**Water-cooled  
MIG/MAG welding**

- Power source
  - Cooling unit including coolant
  - Grounding cable
  - Water-cooled MIG/MAG welding torch
  - Gas connection (shielding gas supply)
  - Wire electrode
- 

**Manual metal arc  
welding**

- Power source
  - Grounding cable
  - Electrode support
  - Rod electrode
- 

**TIG DC Welding**

- Power source
- Grounding cable
- TIG welding torch with or without rocker switch
- Gas connection (shielding gas supply)
- Filler metal depending on application

# Before installation and initial operation

---

## Safety



### WARNING!

**Operating the device incorrectly can cause serious injury and damage to property.**

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



### WARNING!

**An electric shock can be fatal.**

If the power source is connected to the grid during installation, there is a danger of serious personal injury and property damage.

- ▶ Only carry out work on the device when the power source's power switch is in the - O - position.
  - ▶ Only carry out work on the device when the power source has been disconnected from the grid.
- 

## Intended Use

The power source is only intended for MIG/MAG, MMA and TIG welding. Any other use is deemed to be "not in accordance with the intended purpose." The manufacturer shall not be liable for any damage resulting from such improper use.

Intended use also means:

- Following all instructions in the Operating Instructions
  - Carrying out all the specified inspection and maintenance work
- 

## Setup regulations

The device has been tested according to degree of protection IP 23. This means:

- Protection against penetration by solid foreign bodies with diameters > 12 mm (0.49 in.)
- Protection against spraywater at any angle up to 60° from the vertical

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

Direct moisture (e.g., from rain) must be avoided.



### WARNING!

**Toppling or falling devices can be deadly.**

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



### WARNING!

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

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

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

The ventilation channel is a very important safety device. When selecting the setup location, ensure that the cooling air can enter or exit unhindered through the vents on the front and back. Any electrically conductive dust (e.g., from grinding work) must not be allowed to be sucked into the device.

---

### Grid Connection

The devices are designed for the grid voltage stated on the rating plate. If the mains cable or mains plug has not been attached to your version of the appliance, these must be installed according to national standards. Fuse protection for the grid lead can be found in the technical data.



#### **CAUTION!**

**An inadequately dimensioned electrical installation can lead to serious damage.**

- ▶ The grid lead and its fuse protection should be designed to suit the existing power supply. The technical data on the rating plate should be followed.
-

# 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:

**Three-phase devices:**  $S_{1\max} = I_{1\max} \times U_1 \times \sqrt{3}$

**Single-phase devices:**  $S_{1\max} = I_{1\max} \times U_1$

$I_{1\max}$  and  $U_1$  according to the device rating plate and technical data

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

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

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

**IMPORTANT!** The generator apparent power  $S_{\text{GEN}}$  must not be less than the maximum apparent power  $S_{1\max}$  of the power source!

When single phase devices are being operated with a 3-phase generator, note that the stated apparent power of the generator is often just the total that can be present across all three phases of the generator. If necessary, obtain further information about the single-phase power of the generator from the generator manufacturer.

### NOTE!

**The voltage delivered by the generator must never fall outside of the mains voltage tolerance range.**

The mains voltage tolerance is specified in the "Technical Data" section.

---

# TSt 2700c MV MP - Single-Phase Operation

## Single-phase operation

As an alternative to three-phase operation, the multivoltage variant (MV) of the power source enables a welding operation with limited power or duration from just a single-phase supply. The maximum possible welding power is limited by the dimensioning of the mains fuse protection, which determines the safety cut-out of the power source.

If the grid lead has a 20 A or 30 A fuse, the FUS parameter may be changed to 20 A or 30 A. Welding with a higher maximum power or for longer periods is therefore possible. The FUS welding parameter can be found in the Setup menu 2nd level and can be set when the US setting is enabled or a single-phase supply is being used (SEt welding parameter set to US).

In order to use the power source in single-phase operation, the following prerequisite must be fulfilled:

- Correct single-phase power source supply in accordance with the chapter "Installation" section "Connecting the mains cable" from page [52](#).

The following table shows which grid voltages and fuse ratings limit the welding current in single-phase operation:

Grid voltage Fuse rating	Welding process	D.C. [%]	Welding current limitation [A]
230 V 10 A	MIG/MAG	40 100 *	160 100
	Rod electrode	40 100 *	140 100
	TIG	35 100 *	180 120
230 V 13 A	MIG/MAG	40 100 *	170 120
	Rod electrode	40 100 *	140 120
	TIG	35 100 *	210 150
230 V 16 A	MIG/MAG	40 100 *	180 145
	Rod electrode	40 100 *	150 130
	TIG	35 100 *	220 170
240 V 15 A	MIG/MAG	40 100 *	180 145
	Rod electrode	40 100 *	40 125
	TIG	35 100 *	220 170

Grid voltage Fuse rating	Welding process	D.C. [%]	Welding current limitation [A]
240 V 20 A	MIG/MAG	40 100 *	200 160
	Rod electrode	40 100 *	180 140
	TIG	35 100 *	260 180
240 V 30 A	MIG/MAG	40 100 *	220 170
	Rod electrode	40 100 *	180 140
	TIG	35 100 *	260 180

D.C. = Duty cycle

\* The 100% values relate to welding with no time limits and without cooling breaks.

The welding current data applies at an ambient temperature of 40 °C (104 °F).

At a grid voltage of 240 V and a fuse rating of 30 A, the maximum value of 220 A is possible for MIG/MAG welding with a duty cycle of 40% for example.

In single-phase operation, a safety cut-out prevents the fuse from tripping at higher welding powers. The safety cut-out is active at fuse ratings of 15 A, 16 A and 20 A and determines the possible welding duration, without the fuse being tripped. If the precalculated weld time is exceeded, thus causing the welding current to switch off, the service code "toF" is displayed. A countdown immediately appears next to the "toF" indicator, which shows the remaining time until the power source is ready for welding again. After this time, the message disappears, and the power source is ready for operation again.

At a fuse rating of 30 A, the temperature monitoring for the power source ensures the welding current is promptly switched off. A service code from "to1" to "to7" is displayed. Detailed information on the service codes "to1" to "to7" can be found in the "Troubleshooting" chapter under "Displayed service codes". If there is no fault or the cooling components are not dirty, then the device will be ready for welding again after an appropriate welding pause.

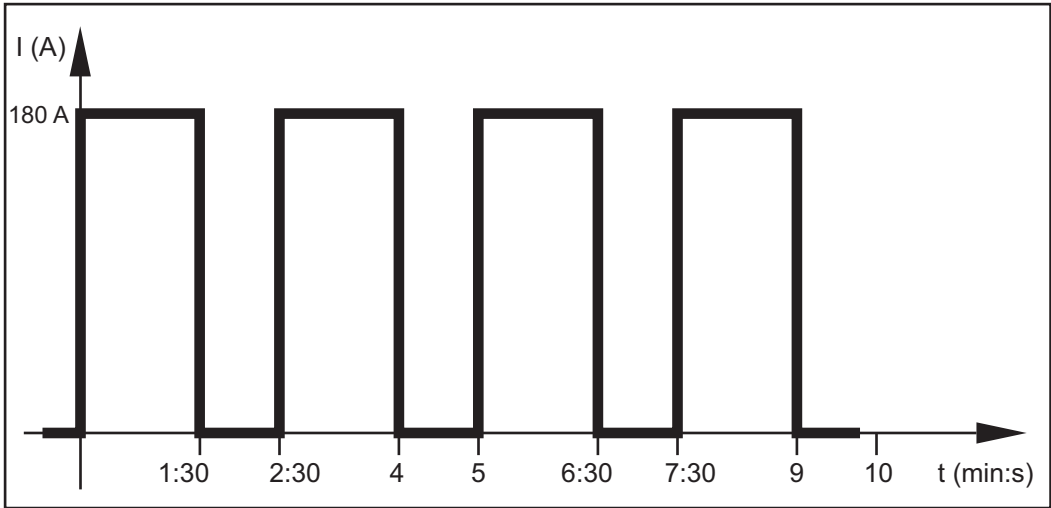
### Explanation of the Term "Duty Cycle" in Single-Phase Operation

For single-phase operation, the "Technical Data" chapter specifies duty cycle values as a function of the fuse rating and the welding current. Although the percentages of these duty cycle values are also based on the ten-minute cycle explained in the "Technical Data" chapter for general duty cycles, the cooling phase of the fuse, however, is calculated at approx. 60 s only. Afterwards, the power source is once again ready for use.

Due to technical standards, in single-phase operation, the duty cycle is only specified up to the end (switch off) of the first welding cycle. If the relationship to the ten-minute cycle normally used when specifying the duty cycle was also established with respect to the cooling phases, in practice there would be longer welding phases than those stated. The values are actually based on cooling phases of approx. 60 s only, after which the power source is ready for further use.

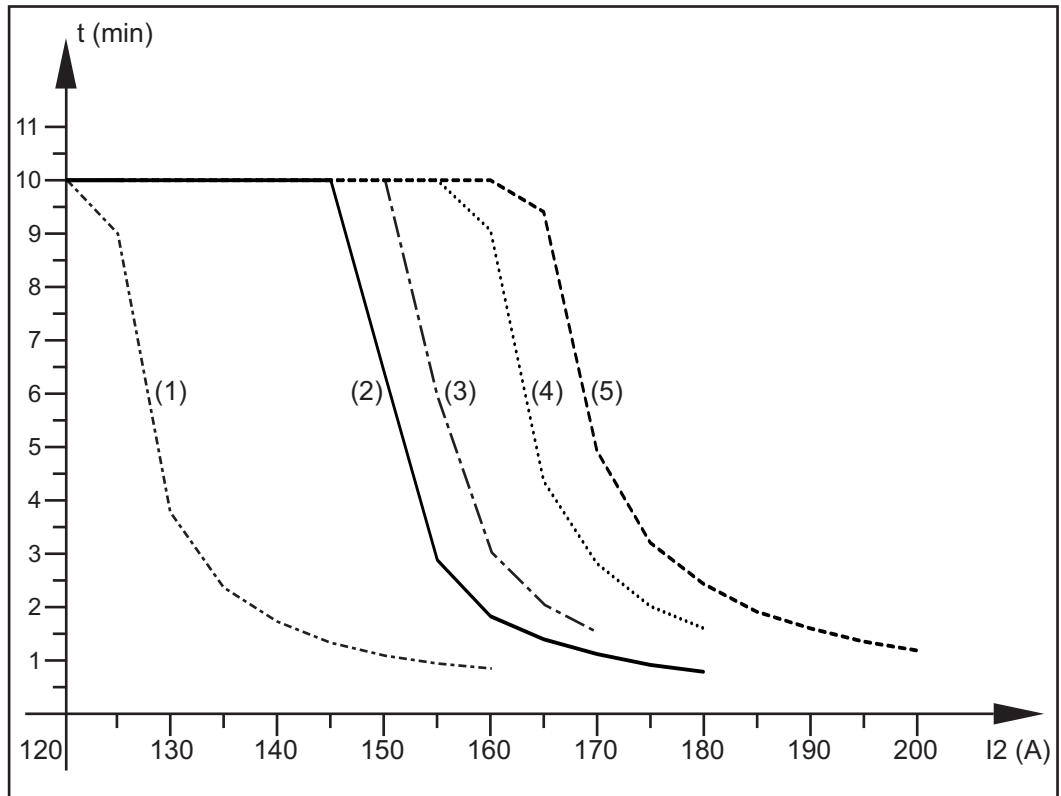
The following example shows the welding and pause cycles as defined in the relevant standards, with a welding current of 180 A and a duty cycle of 15%.





**Welding time in single-phase operation**

The following diagram shows the possible welding time in accordance with standards, depending on the fuse rating and welding current.



- (1) 10 A mains fuse protection (2) 13 A mains fuse protection (3) 15 A mains fuse protection  
(4) 16 A mains fuse protection (5) 20 A mains fuse protection

# Connecting the Mains Cable

## Safety

 **WARNING!**

**Danger from work that is not carried out properly.**

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

- ▶ The work described below may only be performed by trained specialist personnel.
- ▶ Follow national standards and guidelines.

 **CAUTION!**

**Danger from improperly prepared mains cable.**

Short circuits and damage to property may result.

- ▶ Fit ferrules to all phase conductors and the ground conductor of the stripped mains cable.

## General

A strain-relief device for the following cable cross-sections is fitted to the power source:

Power source	Cable cross-section	
	Canada / US	Europe
TSt 2700c MP	AWG 14 to AWG 6 *)	4G2.5
TSt 3500c MP	AWG 12 *)	4G2.5

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

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

## Stipulated Grid Cables and Strain-Relief Devices

Power source	Grid voltage	Cable cross-section	
		Canada / US	Europe
TSt 2700c MP	1 x 230 / 240 V	AWG 14 (15 A) *)	3G2.5 (16 A)
TSt 2700c MP	1 x 240 V	AWG 12 (20 A) *)	-
TSt 2700c MP	1 x 240 V	AWG 12 (30 A) *)	-
TSt 2700c MP	3 x 200 V	AWG 12	4G2.5
TSt 2700c MP	3 x 230 / 240 V	AWG 14	4G2.5
TSt 2700c MP	3 x 380 / 400 V	AWG 14 *)	4G2.5
	3 x 460 V	AWG 14 *)	4G2.5
TSt 3500c MP	3 x 380 / 400 V	AWG 12 *)	4G2.5
	3 x 460 V	AWG 12 *)	4G2.5

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

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

### American Wire Gauge

## Connecting the Grid Cable, TSt 2700c MV, Single-Phase Operation

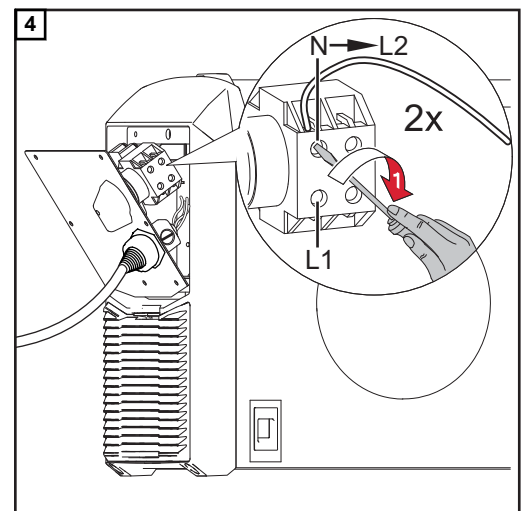
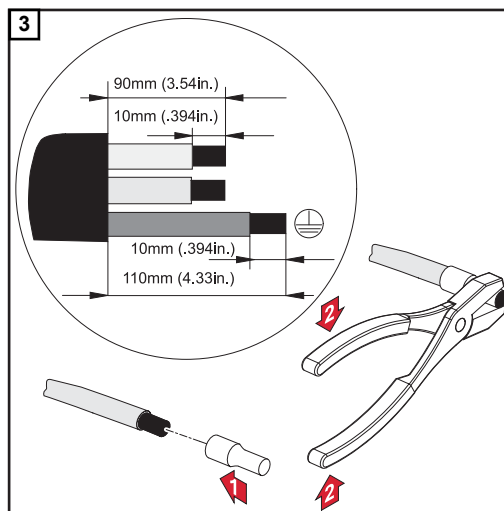
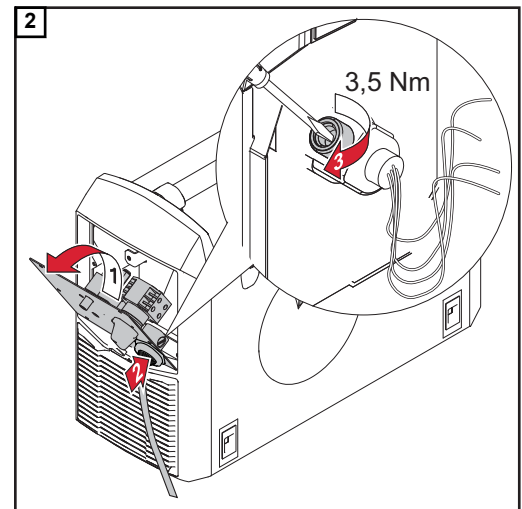
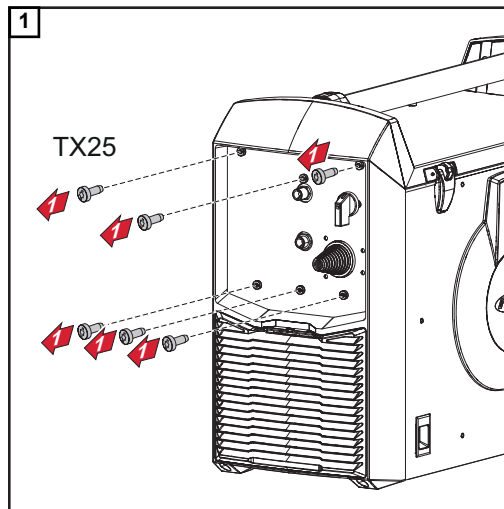
If no grid cable is connected, a grid cable that is suitable for the connection voltage must be fitted before commissioning.

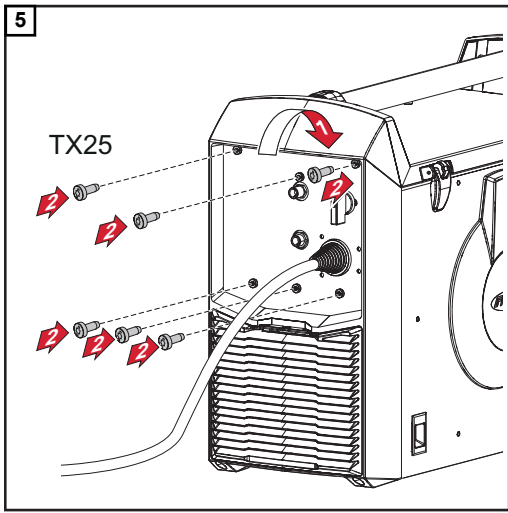
### CAUTION!

If no ferrules are used, there is a risk of injury and damage from short circuits between the phase conductors or between the phase conductors and the ground conductor.

- Fit ferrules to all phase conductors and the ground conductor of the stripped grid cable.

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





**IMPORTANT!** Tie the phase conductors near the strain-relief device using cable ties.

**Connecting the Grid Cable, TSt 2700c MP MV**

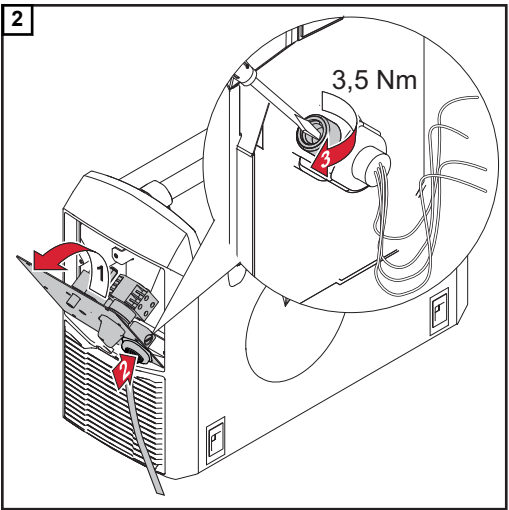
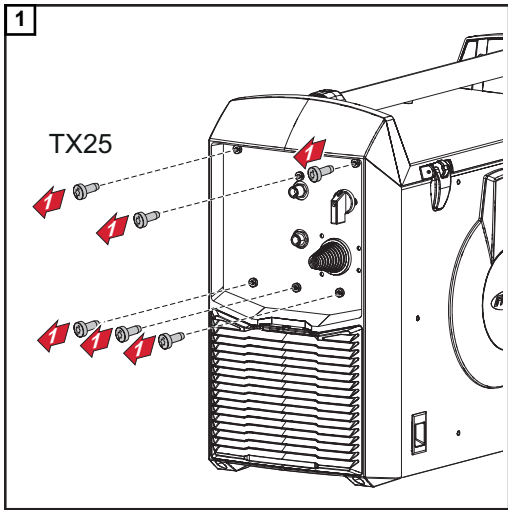
If no grid cable is connected, a grid cable that is suitable for the connection voltage must be fitted before commissioning.

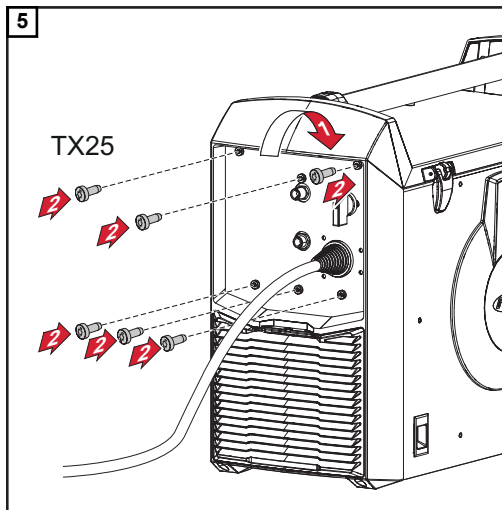
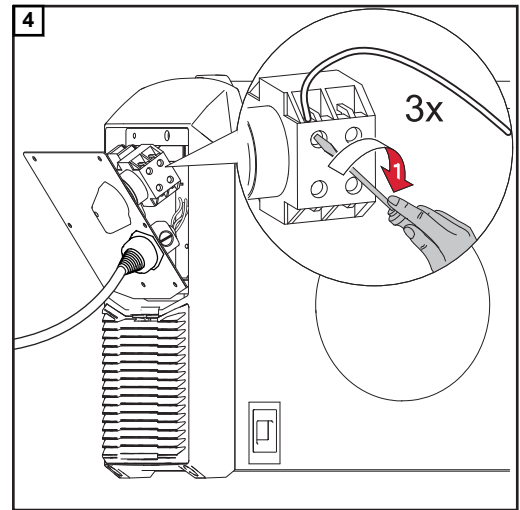
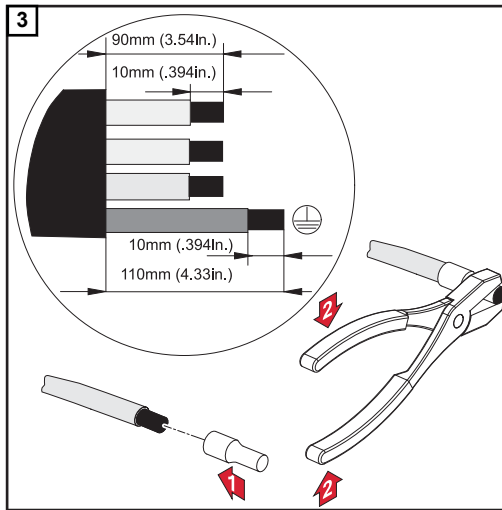
**⚠ CAUTION!**

**If no ferrules are used, there is a risk of injury and damage from short circuits between the phase conductors or between the phase conductors and the ground conductor.**

- Fit ferrules to all phase conductors and the ground conductor of the stripped grid cable.

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





**IMPORTANT!** Tie the phase conductors near the strain-relief device using cable ties.

### Connecting the Grid Cable, TSt 3500c nc MP

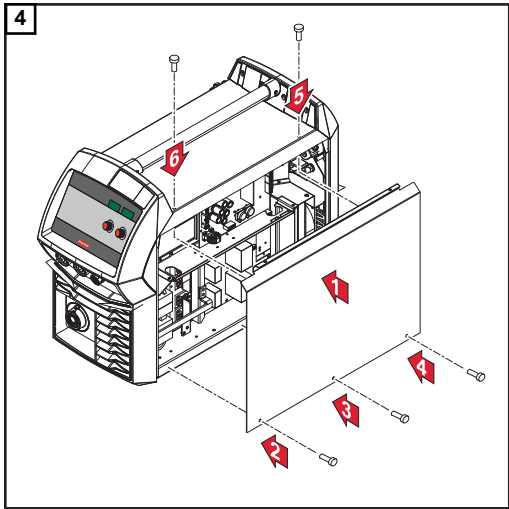
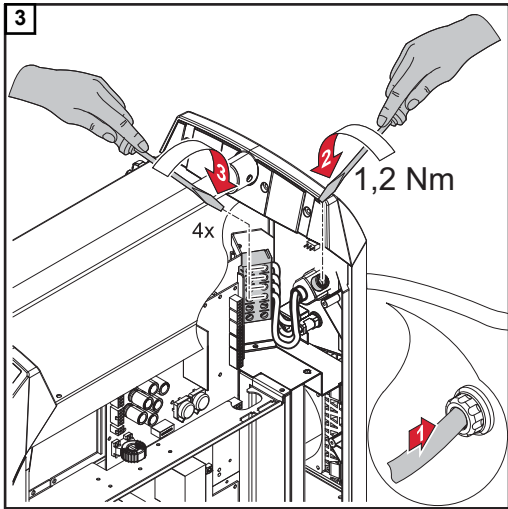
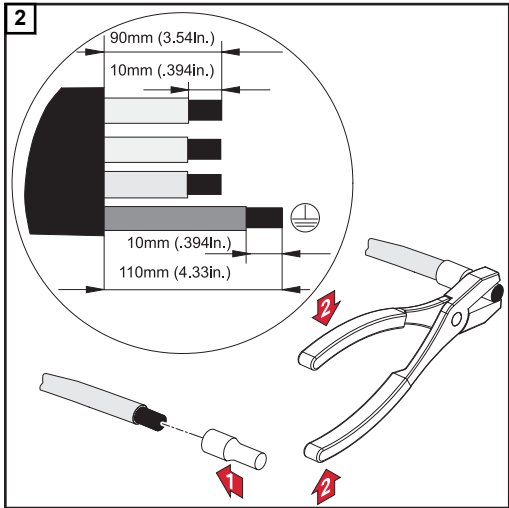
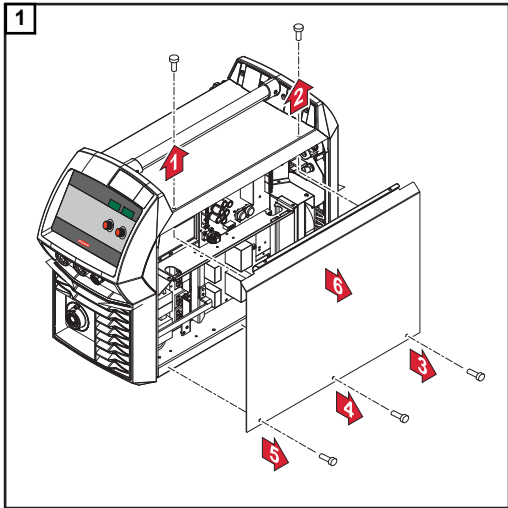
If no grid cable is connected, a grid cable that is suitable for the connection voltage must be fitted before commissioning.

#### **⚠ CAUTION!**

**If no ferrules are used, there is a risk of injury and damage from short circuits between the phase conductors or between the phase conductors and the ground conductor.**

- ▶ Fit ferrules to all phase conductors and the ground conductor of the stripped grid cable.

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



**IMPORTANT!** Tie the phase conductors near the luster terminal using cable ties.

# Fitting/Connecting the System Components

## Information on System Components

The steps and activities described below include references to various system components, such as

- Trolley
- Cooling units (TSt 3500c only)
- Welding torches, etc.

For more detailed information about installing and connecting the system components, please refer to the appropriate Operating Instructions for the system components.

## Mounting on the Trolley

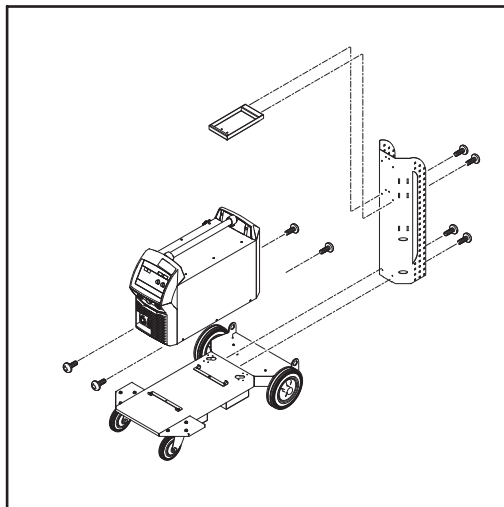
### **WARNING!**

**Work performed incorrectly can cause serious injury and damage.**

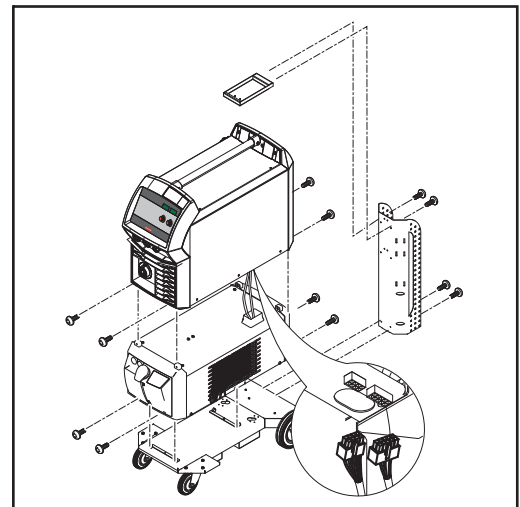
- ▶ The following activities must only be carried out by trained and qualified personnel.
- ▶ Please note the information in the "Safety instructions" chapter!

The following diagram shows an overview of how the individual system components are put together.

For detailed information about the individual steps, please refer to the corresponding Operating Instructions for the system components.



TSt 2700c MP



TSt 3500c MP



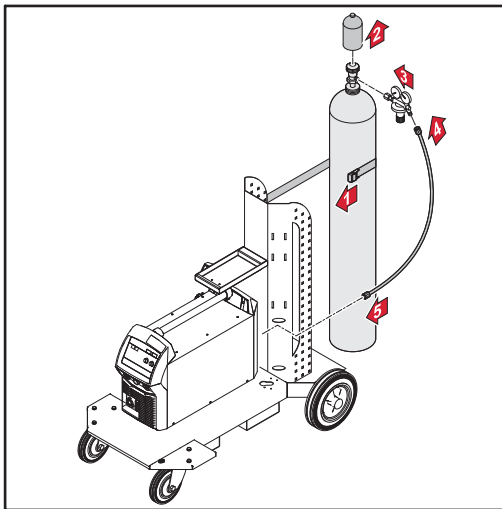
## Connecting the Gas Cylinder

**⚠ WARNING!**

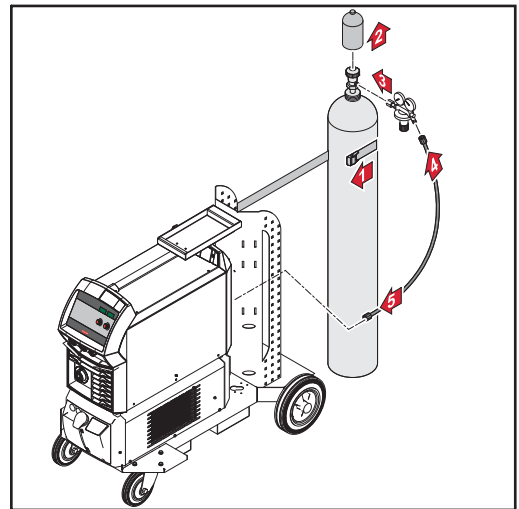
**Danger of severe injury and damage to property if gas cylinders fall over.**

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 optional wirefeeder holder
- ▶ Follow the gas cylinder manufacturer's safety rules.



TSt 2700c MP



TSt 3500c MP

- 1 Secure the gas cylinder with a strap
- 2 Briefly open the gas cylinder valve to remove any dust or dirt
- 3 Inspect the seal on the gas pressure regulator

**NOTE!**

**US devices (TSt 3500c only) are supplied with an adapter for the gas hose:**

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



# **MIG/MAG**



# Commissioning

## General

**WARNING!**

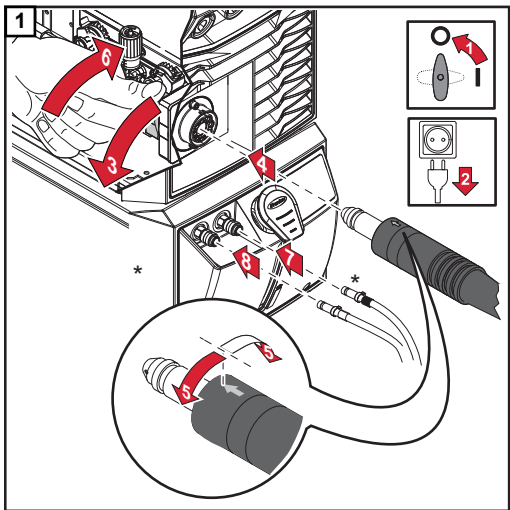
- Operating the device incorrectly can cause serious injury and damage to property.**
- ▶ Do not use the functions described here until you have fully read and understood the Operating Instructions.
  - ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions of the system components, especially the safety rules.

The device is started up by pressing the torch trigger (for manual applications).

## Connecting MIG/MAG Welding Torches

**NOTE!**

- When connecting the welding torch, check that**
- ▶ all connections are connected properly
  - ▶ all cables, leads and hosepacks are undamaged and correctly insulated.



\* The TSt 3500c MP can be optionally equipped with a cooling unit. Coolant hoses are only available on water-cooled welding torches.

## Inserting/changing feed rollers

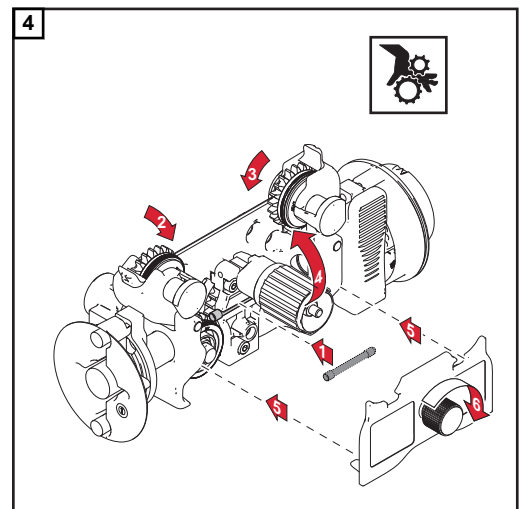
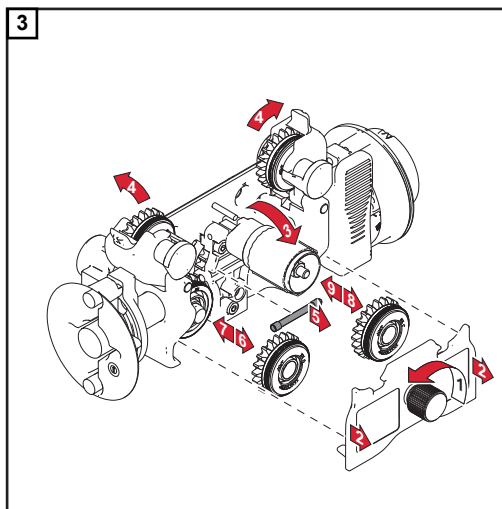
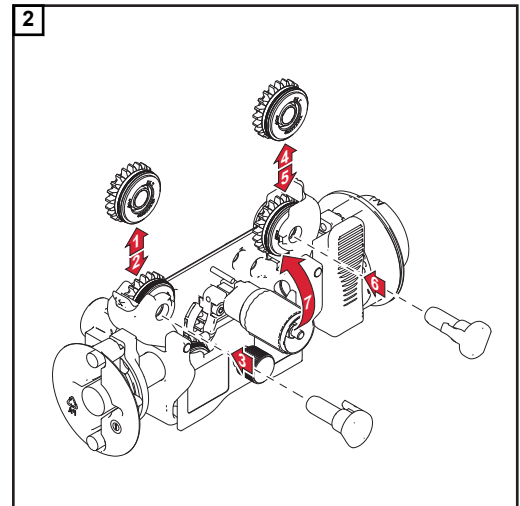
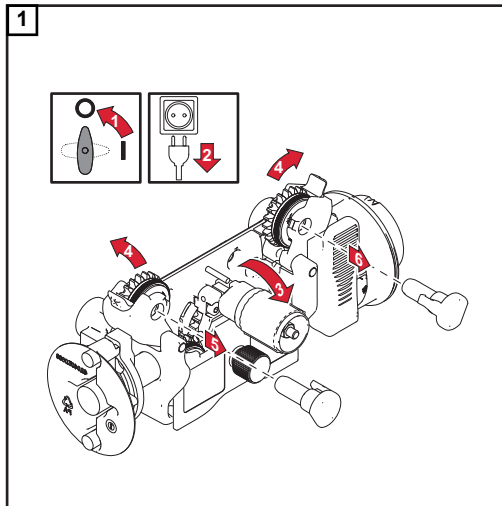
### CAUTION!

#### Risk of injury due to feed roller holders shooting upwards.

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

In order to achieve optimum wire electrode feed, the feed rollers must be suitable for the diameter and alloy of the wire being welded.

An overview of the available feed rollers can be found in the Spare Parts Lists.



### Inserting the wirepool/basket-type spool

**⚠ CAUTION!**

**Risk of injury due to springiness of spooled wire electrode.**

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

**⚠ CAUTION!**

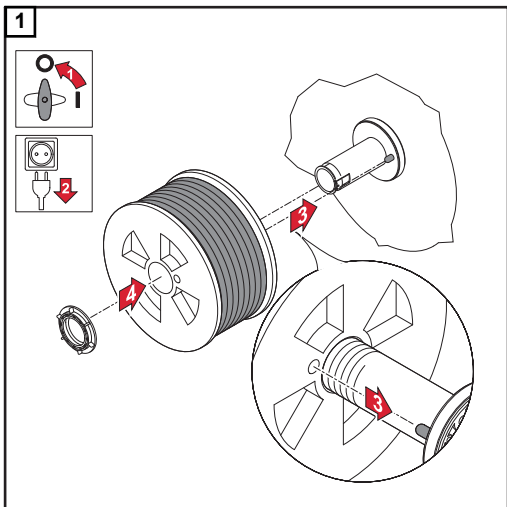
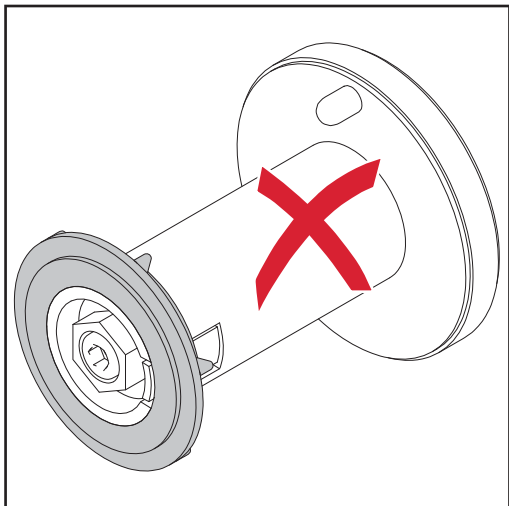
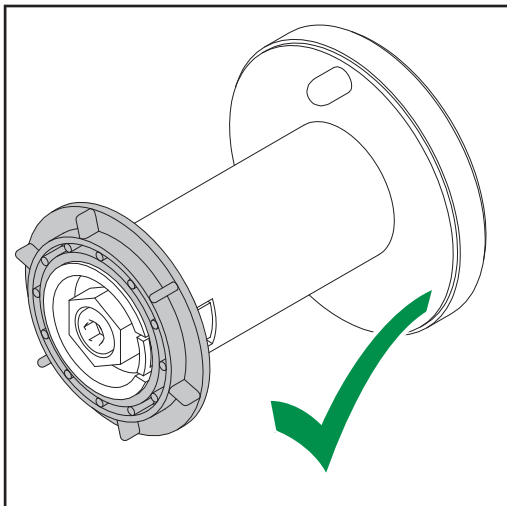
**Risk of injury from falling wirepool/basket-type spool.**

- ▶ Make sure that the wirepool or basket-type spool with basket-type spool adapter is fitted securely to the wirepool holder.

**⚠ CAUTION!**

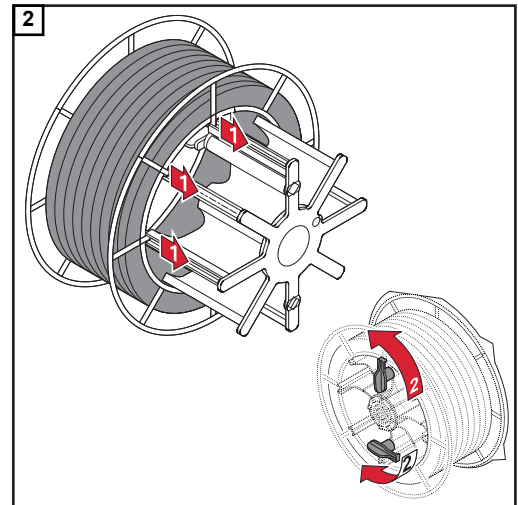
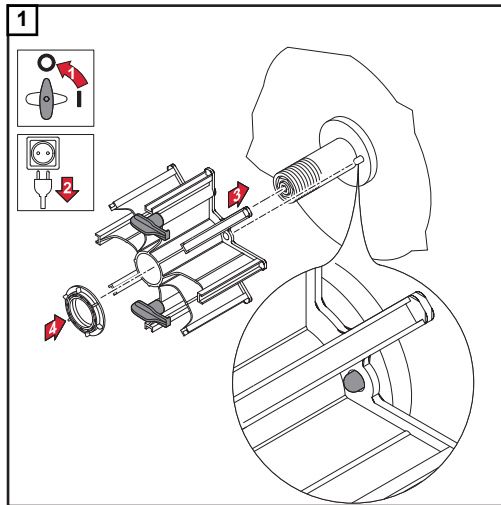
**Danger of injury and material damage if the wirepool/basket-type spool topples over because the locking ring has been placed the wrong way round.**

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



**NOTE!**

When working with basket-type spools, only use the basket-type spool adapter supplied with the device.



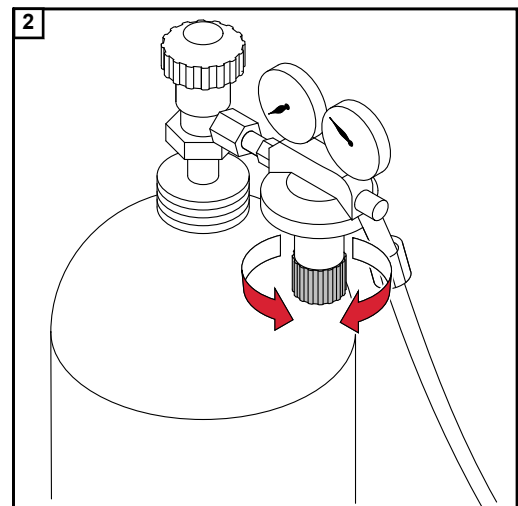
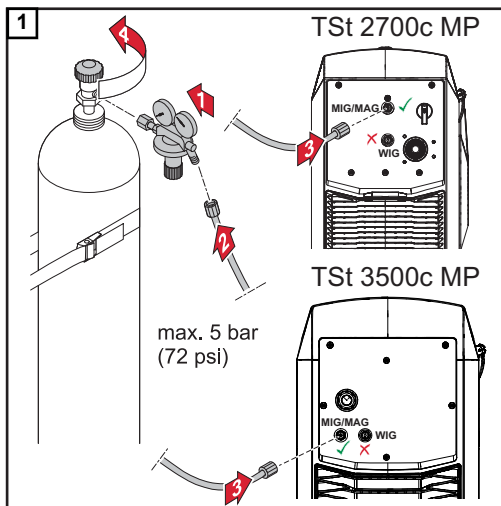
**Connecting the Gas Cylinder**

**⚠ WARNING!**

**Danger from falling gas cylinders.**

Serious personal injury and damage to property may result.

- ▶ Place gas cylinders on a solid, level surface so that they remain stable.
- ▶ Secure the gas cylinders to prevent them from falling over
- ▶ Please observe the gas cylinder manufacturer's safety rules.





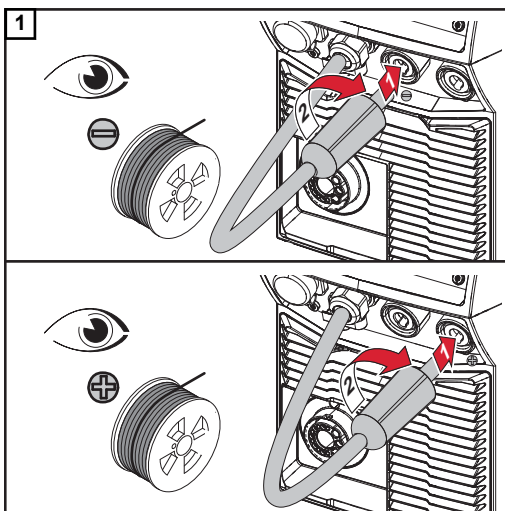
## Connecting the Polarity Reverser and Establishing a Ground Earth Connection

### Connecting the Polarity Reverser

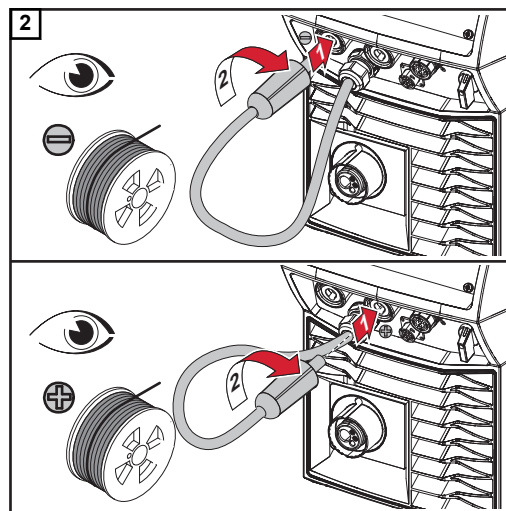
**NOTE!**

If the polarity reverser is incorrectly connected, it can result in poor-quality weld properties.

- ▶ Connect the polarity reverser according to the wire electrode used. Check the wire electrode packaging to determine whether the wire electrode is for (+) or (-) welding.



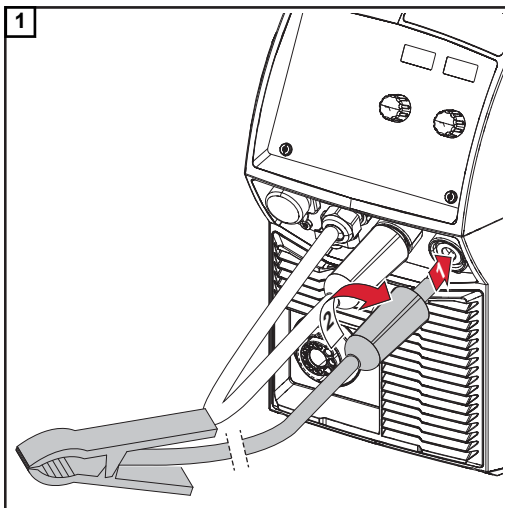
TSt 2700c MP



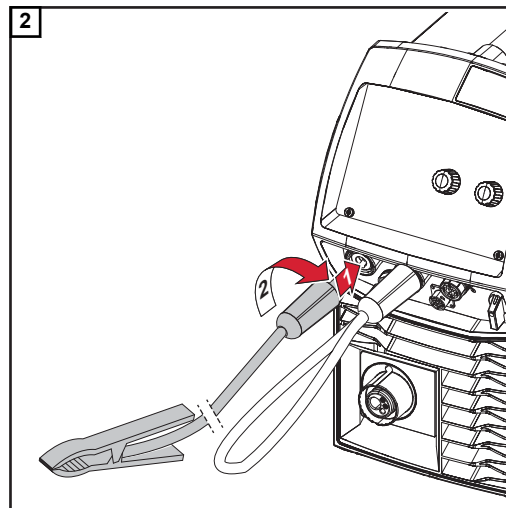
TSt 3500c MP

### Establishing a Ground Earth Connection

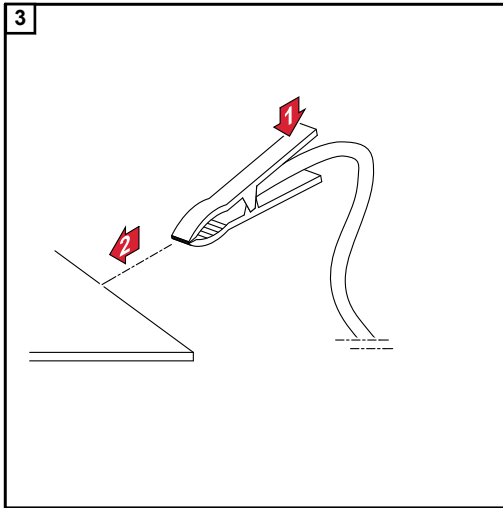
Connect grounding cable to the free current socket



TSt 2700c MP: Example of ground connection to the (+) current socket



TSt 3500c MP: Example of ground connection to the (-) current socket



**Feeding in the wire electrode**

**⚠ CAUTION!**

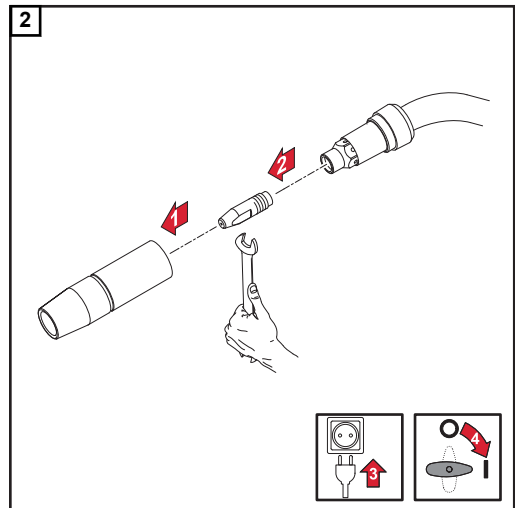
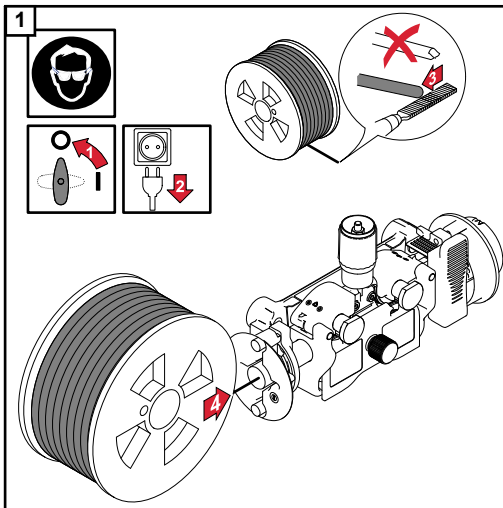
**Risk of injury due to springiness of spooled wire electrode.**

- ▶ 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 electrode 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.

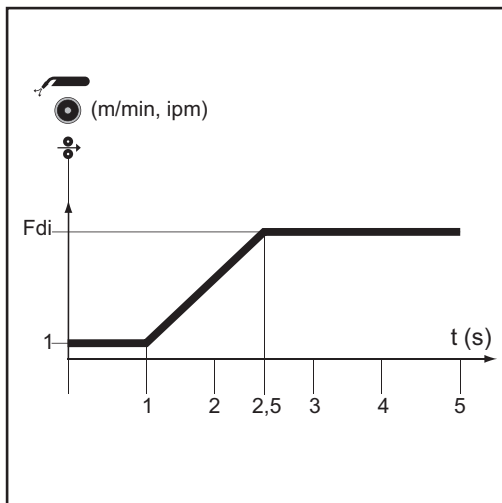


**⚠ CAUTION!**

**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 wire threading, the following procedure is 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, the wire speed increases 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 you release the "Wire threading" button and press it 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" / "Gas-test" button, the **torch trigger** can be used in a similar 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!

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

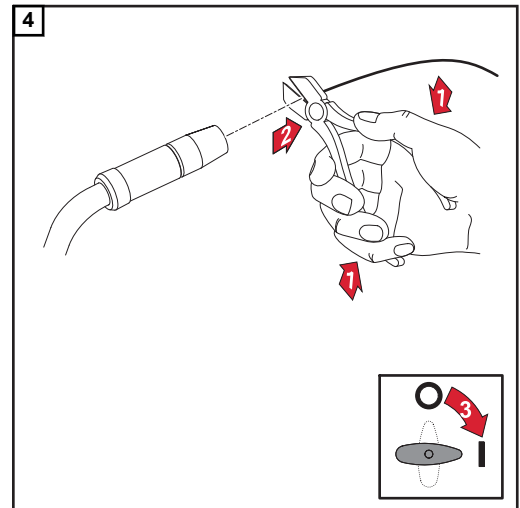
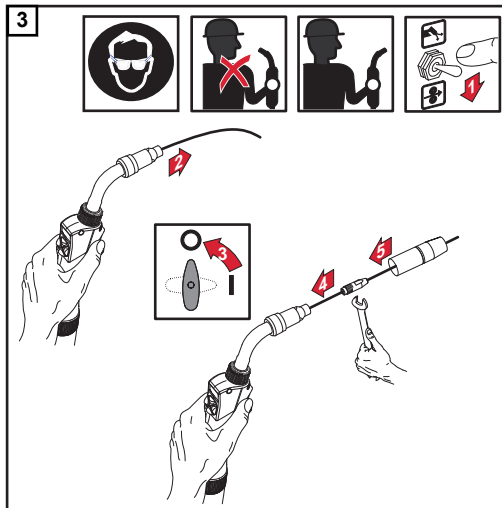
When you press the torch trigger:

- ▶ 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 grounded parts (e.g., housing, etc.)

**IMPORTANT!** If the **torch trigger** is pressed instead of the "Wire threading"/"Gas-test" 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 threaded in. At the same time, the gas solenoid valve closes, and the welding voltage on the wire electrode is switched off.

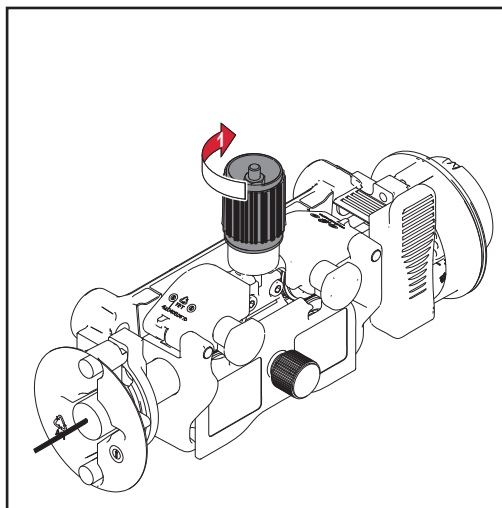
If the torch trigger is kept pressed, wirefeeding restarts immediately without shielding gas and welding voltage, and the process continues as described above.



**Setting the contact pressure**

**NOTE!**

Set the contact pressure in such a way that the wire electrode is not deformed but nevertheless ensures proper wirefeeding.



**Standard values for the U-groove rollers:**

Steel: 4 - 5

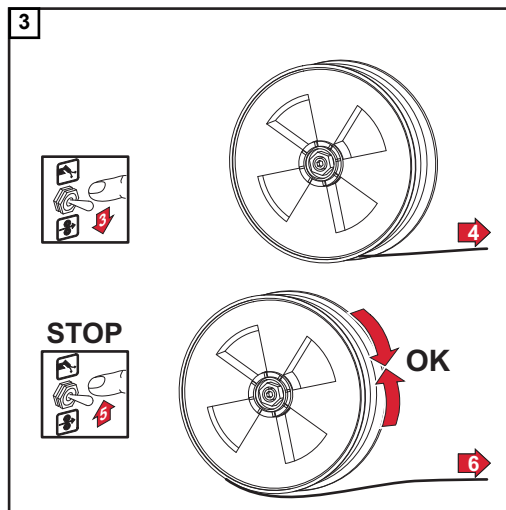
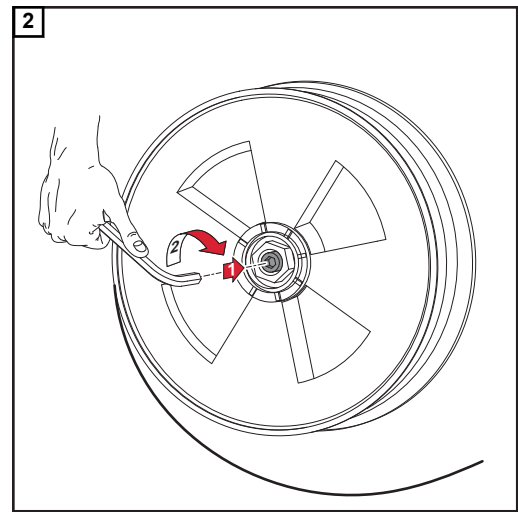
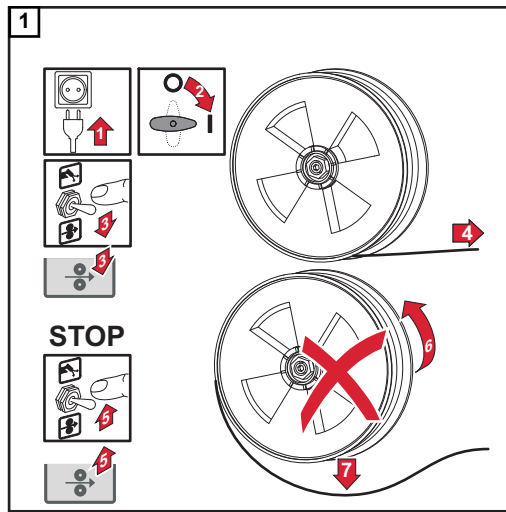
CrNi: 4 - 5

Tubular covered electrodes: 2 - 3

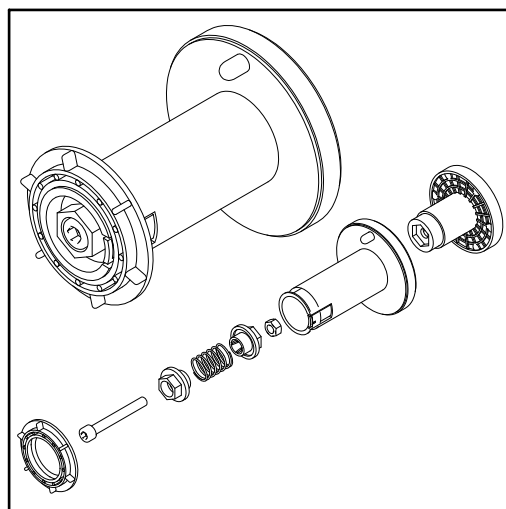
### Adjusting the brake

**NOTE!**

After releasing the torch trigger the wirepool must stop unreeling. If it continues unreeling, readjust the brake.



### Design of the Brake



**⚠ WARNING!**

**Danger from incorrect installation.**

Serious personal injury and damage to property may result.

- ▶ 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.

# 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.



If the "MIG/MAG standard synergic welding" process is selected, 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.

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

# MIG/MAG Operating Modes

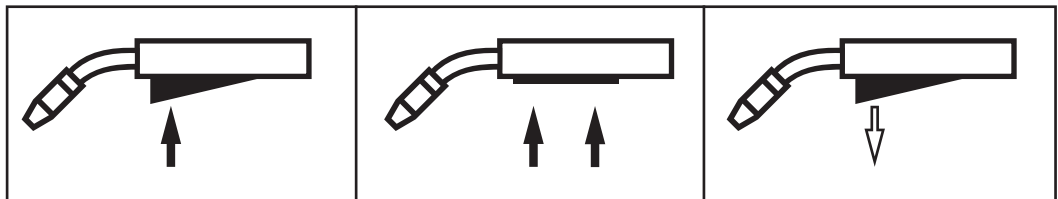
## General

**⚠ WARNING!**

- Operating the device incorrectly can cause serious injury and damage to property.**
- ▶ Do not use the functions described here until you have fully read and understood the Operating Instructions.
  - ▶ Do not use the functions described here until you have fully read and understood all of the Operating Instructions of the system components, especially 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.

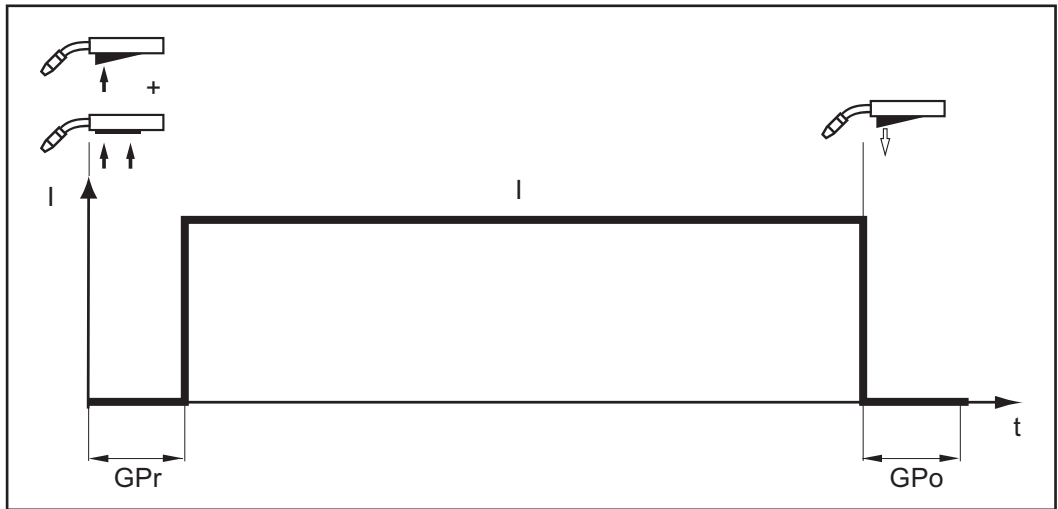
## Symbols and explanations



*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 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 Even heat input into the parent material whose temperature is raised by the advancing heat
I-E	Final current To fill up end-craters
GPo	Gas post-flow time
SPt	Spot welding time / interval welding time
SPb	Interval pause time

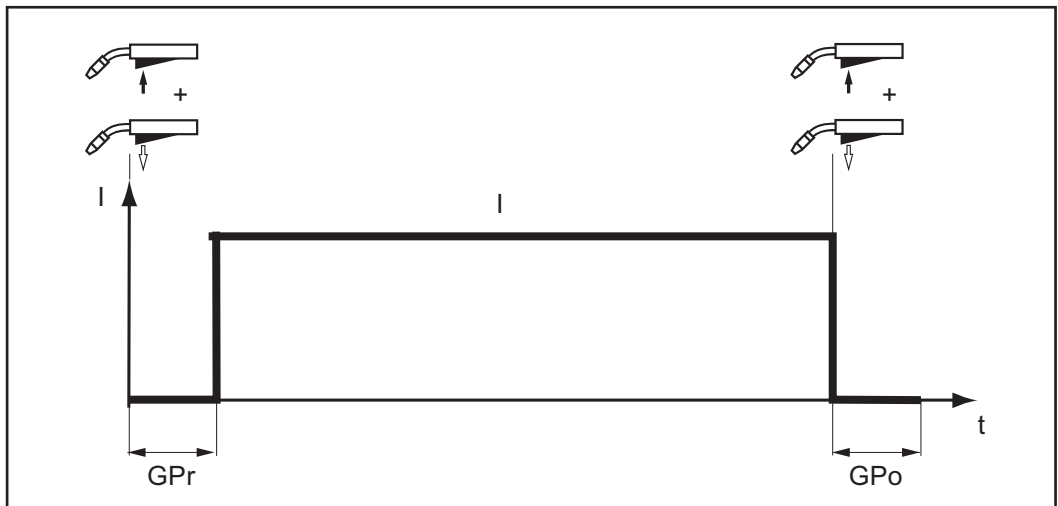
## 2-step mode



"2-step mode" is suitable for

- Tacking work
- Short weld seams
- Automatic and robot operation

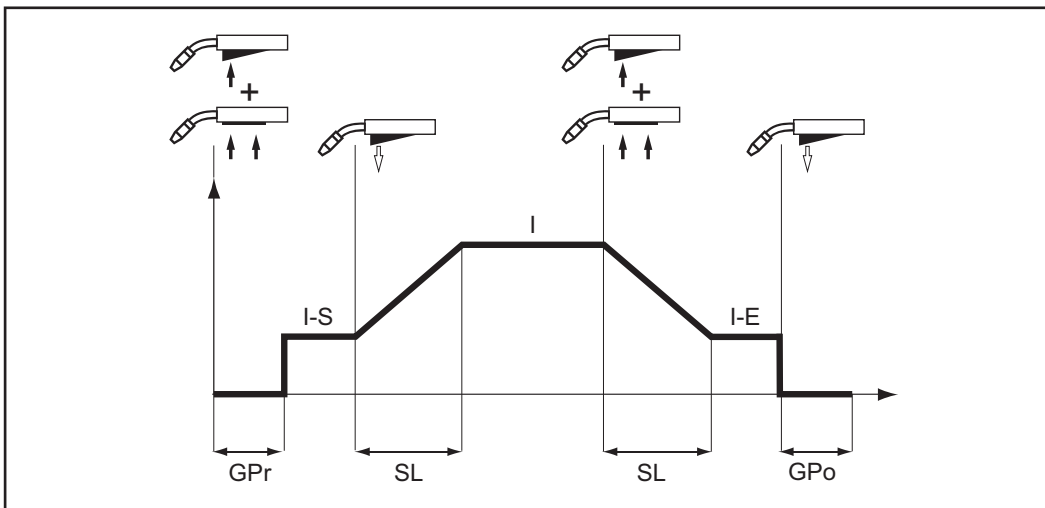
## 4-step mode



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

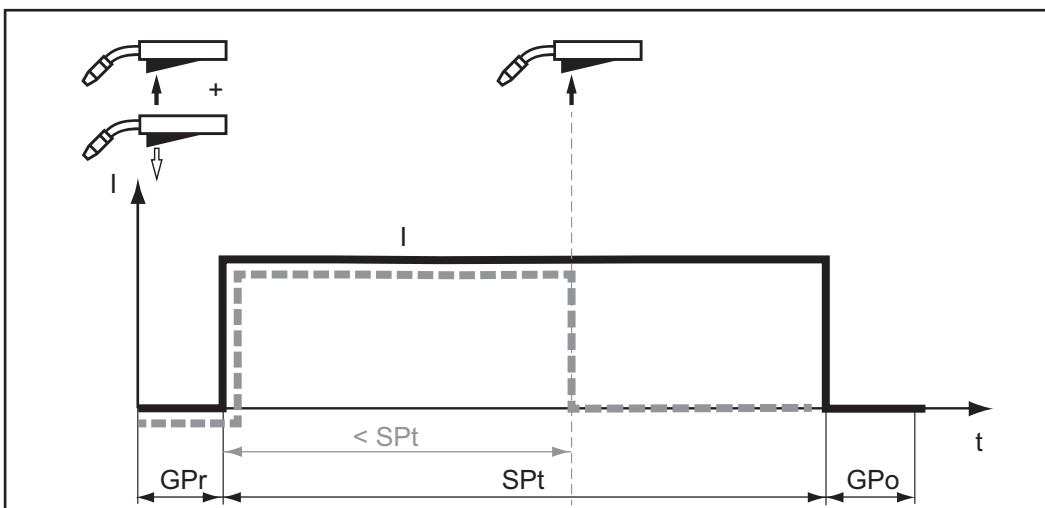


**Special 4-step mode**



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

**Spot welding**

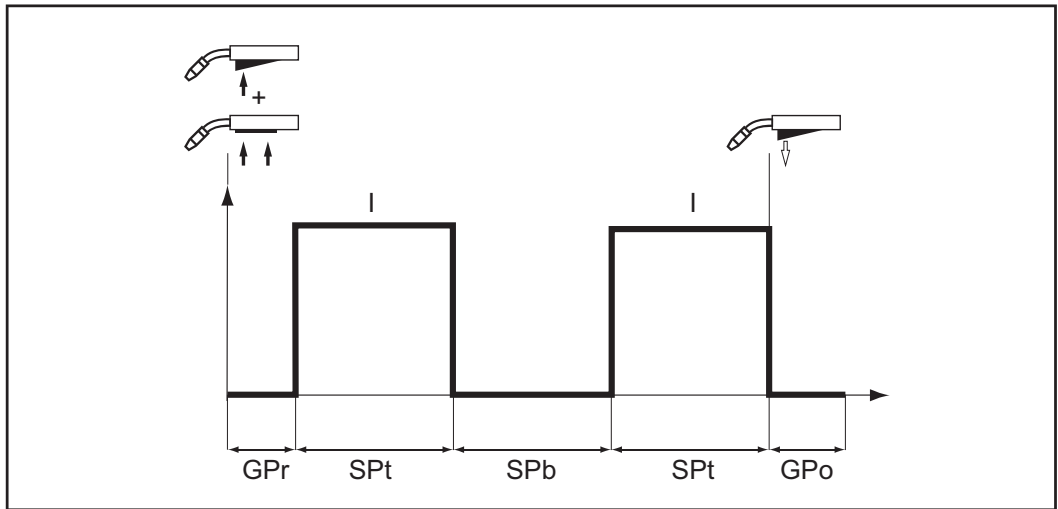


The "Spot welding" mode is suitable for welded joints on overlapped sheets.

Start by pressing and releasing the torch trigger - GPr gas pre-flow time - welding current phase over the SPt spot welding time duration - GPo gas post-flow time.

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

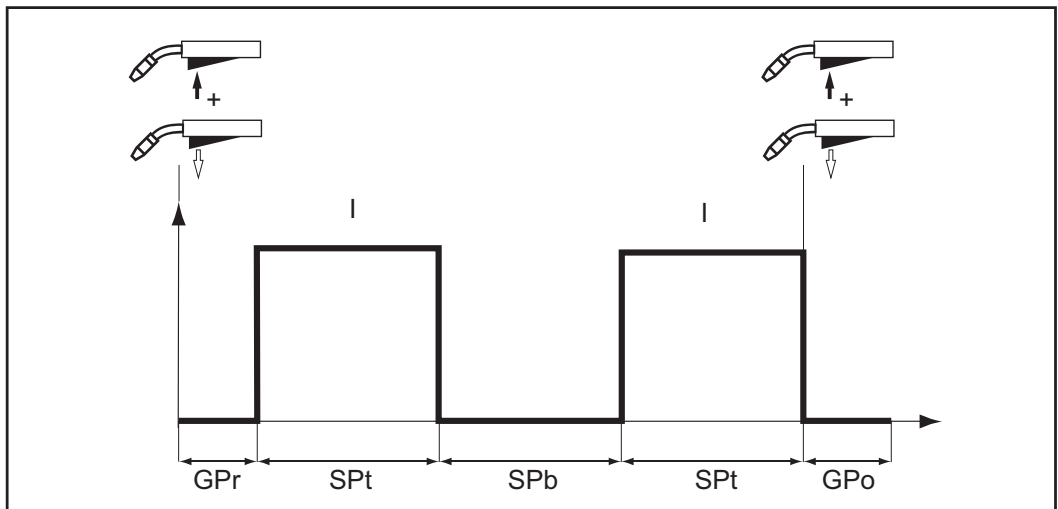
## 2-step stitch welding



*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 parent 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 parent material.

# 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 "MIG/MAG standard synergic" welding process:

### SYNERGIC

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

 2-step mode


 4-step mode

**S4T** Special 4-step mode


### NOTE!

**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 in Synergic operation:

 Sheet thickness  
or

**A** Welding current  
or

 Wire speed  
or

**V** Welding voltage

- 7 Use the appropriate selection dial to set the welding parameter

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

All welding parameter set values remain stored until the next time they are changed. This is still true if the power source has been turned off and on again in the meantime. To display the actual welding current during welding, select the welding current parameter.

- 8 Open the gas cylinder valve
- 9 Adjust quantity of shielding gas:
  - Tap the Gas-test button
  - Turn the adjusting screw on the bottom of the gas pressure regulator until the manometer displays the desired quantity of gas
  - Tap the Gas-test button again

 **CAUTION!**

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

When you press 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 grounded parts (e.g., housing)
- 

**10** Press the torch trigger and start welding

---

**Corrections During Welding**

To obtain the best possible welding results, the arc length correction and arc-force dynamic welding parameters will sometimes need to be corrected.

- 1** Press the "Parameter selection" buttons to select the parameters you wish to correct.
- 2** Use the selection dials to set the selected welding parameters to the required values.

Welding parameter values are shown in the displays located above them.

# 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 for MIG/MAG manual welding:



### Wire speed

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



### Welding voltage

TSt 2700c MP: 14.4–34.9 V  
TSt 3500c MP: 14.5–38.5 V



### Arc-force dynamic

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



### Welding current

Only the actual value is displayed

## MIG/MAG Standard Manual 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 "MIG/MAG standard manual" welding process:

### MANUAL

- 5 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.

### NOTE!

**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 parameter (wire speed)
- 7 Use the appropriate selection dial to set the wire speed

- 8 Use the "Parameter selection" buttons to **V** select the welding parameter (welding voltage)
- 9 Use the appropriate selection dial to set the welding voltage

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

All welding parameter set values remain stored until the next time they are changed. This is still true if the power source has been turned off and on again in the meantime. 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.

- 10 Open the gas cylinder valve
- 11 Adjust quantity of shielding gas:
  - Tap the Gas-test button
  - Turn the adjusting screw on the bottom of the gas pressure regulator until the manometer displays the desired quantity of gas
  - Tap the Gas-test button again

 **CAUTION!**

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

When you press 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 grounded parts (e.g., housing)

- 12 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 selection 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.

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

Stitch welding is used for light-gage sheets.

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

---


## Spot 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:

 **MANUAL**

 **SYNERGIC**

- 5 Press the "Mode" button to select the spot welding/stitch welding mode:

 (spot welding/stitch welding)

- 6 Set the SPt parameter in the Setup menu (spot welding time/interval welding time) to the desired value
- 7 Ensure that the ground earth connection has been established
- 8 Ensure that the shielding gas supply has been established

The power source is ready for welding.


---

## Stitch 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:

 **MANUAL**

 **SYNERGIC**

- 5 Press the "Mode" button to select the spot welding/stitch welding mode:  
  
 (spot welding/stitch welding)
- 6 Set the SPt parameter in the Setup menu (spot welding time/interval welding time) to the desired value
- 7 Set the SPb parameter in the Setup menu (spot welding/stitch pause time) to the desired value
- 8 Set the Int parameter (interval) in the Setup menu to the desired value
- 9 Ensure that the ground earth connection has been established
- 10 Ensure that the shielding gas supply has been established

The power source is ready for welding.



# Rod Electrode



# Commissioning

## Safety

**⚠ WARNING!**

**Operating the device incorrectly can cause serious injury and damage to property.**

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

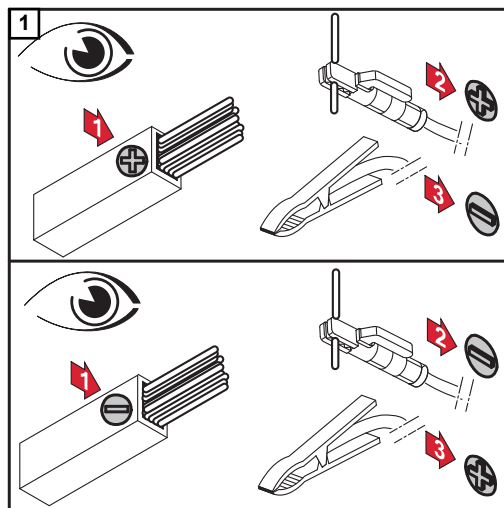
**⚠ WARNING!**

**An electric shock can be fatal.**

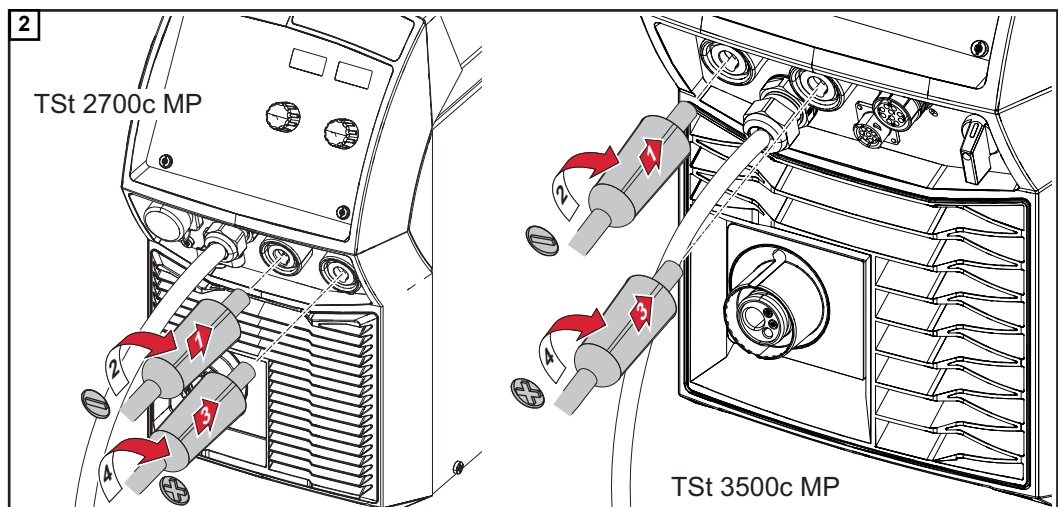
If the unit is connected to the grid during installation, there is a danger of serious injury and damage to property.

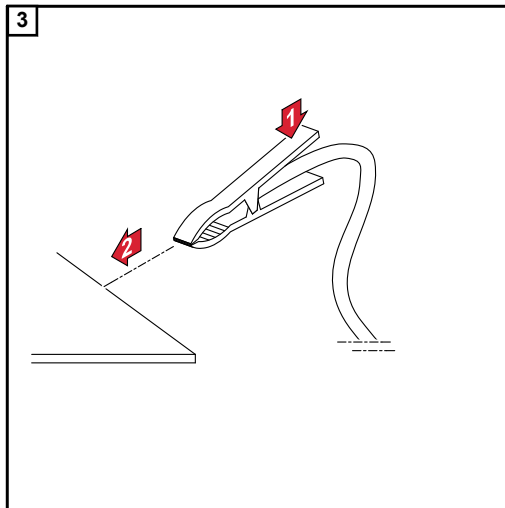
- ▶ Only carry out work on the device if the power switch is in the - O - position.
- ▶ Only carry out work on the device when it has been disconnected from the grid.

## Preparation



Check the rod electrode packaging to determine whether the rod electrode is for (+) or (-) welding.





**⚠ CAUTION!**

**Danger due to welding processes starting unintentionally.**

Personal injury and damage to property may result.

- ▶ As soon as the power source is switched on, ensure that the rod electrode does not unintentionally/accidentally touch electrically conductive or grounded parts (such as housing).

---

**4** Plug the grid cable into the grid

**5** Switch on the power source

# Manual Metal Arc Welding

---

## Manual Metal Arc Welding

- 1 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.

### **NOTE!**

**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) on the control panel of the power source.**

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

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

All welding parameter set values remain stored until the next time they are changed. This is still true if the power source has been turned off and on again in the meantime.

- 4 Initiate welding process

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.

# Functions for Optimizing the Welding Process

## Arc-Force Dynamic

### Arc-force dynamic:

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

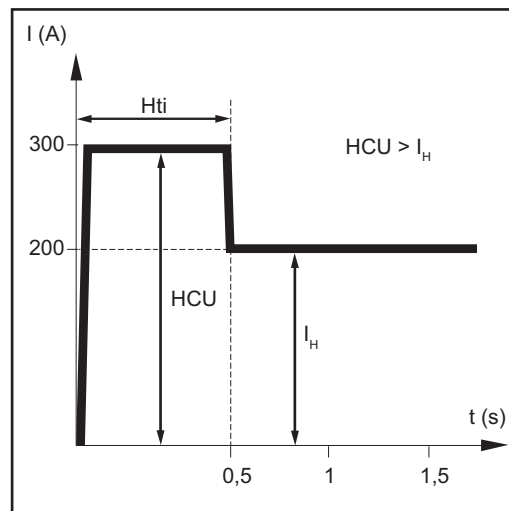
- = hard, stable arc
- 0 = neutral arc
- + = soft, low-spatter arc

## HotStart (Hti) function

This function is activated at the factory.

### Advantages

- Improved ignition properties, even when using electrodes with poor ignition properties
- Better fusion of the parent material during the start-up phase, meaning fewer cold-shut defects
- Slag inclusions largely avoided



### Key

- $H_{ti}$  Hot-current time, 0 - 2 s, factory setting 0.5 s
- $H_{CU}$  HotStart current, 100 - 200%, factory setting 150%
- $I_H$  Main current = set welding current

The  $H_{ti}$  and  $H_{CU}$  parameters can be set in the Setup menu. For a parameter description see section [Parameters for MMA Welding](#) from page 112.

### Function

During the specified hot-current time ( $H_{ti}$ ), the welding current is increased to a certain value. This value ( $H_{CU}$ ) is higher than the selected welding current ( $I_H$ ).

## Anti-stick (Ast) function

This function is activated at the factory.

As the arc becomes shorter, the welding voltage may also fall so that the rod electrode is more likely to stick to the workpiece. 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. The welding process can be resumed without problems once the rod electrode has been detached from the workpiece.

Deactivating the function:

- 1 Set the Ast (anti-stick) setup parameter to OFF

For a parameter description see section [112](#) from page [112](#).



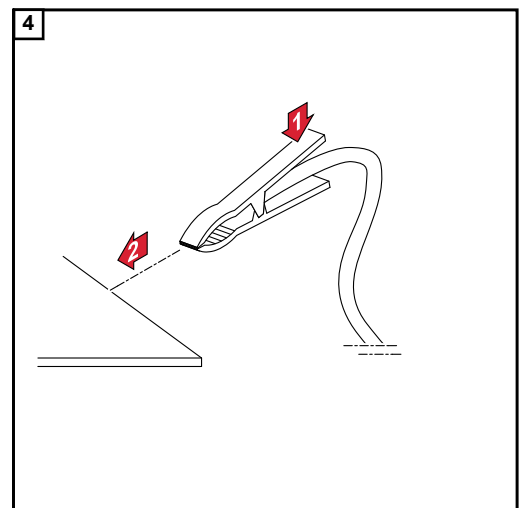
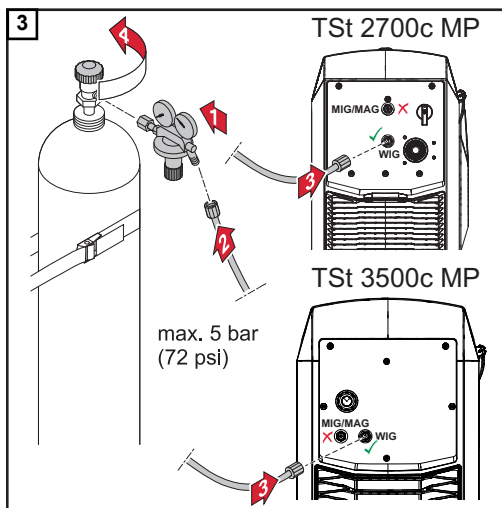
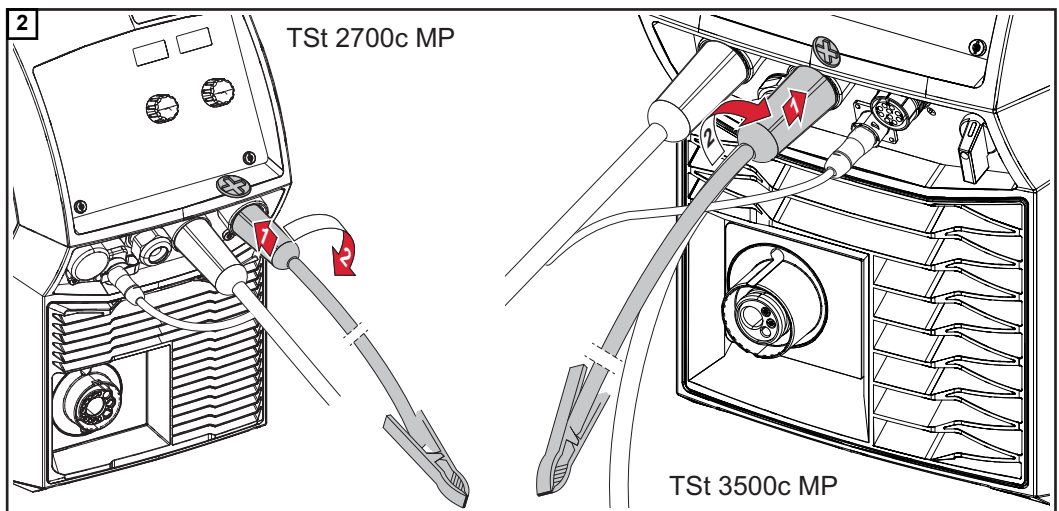
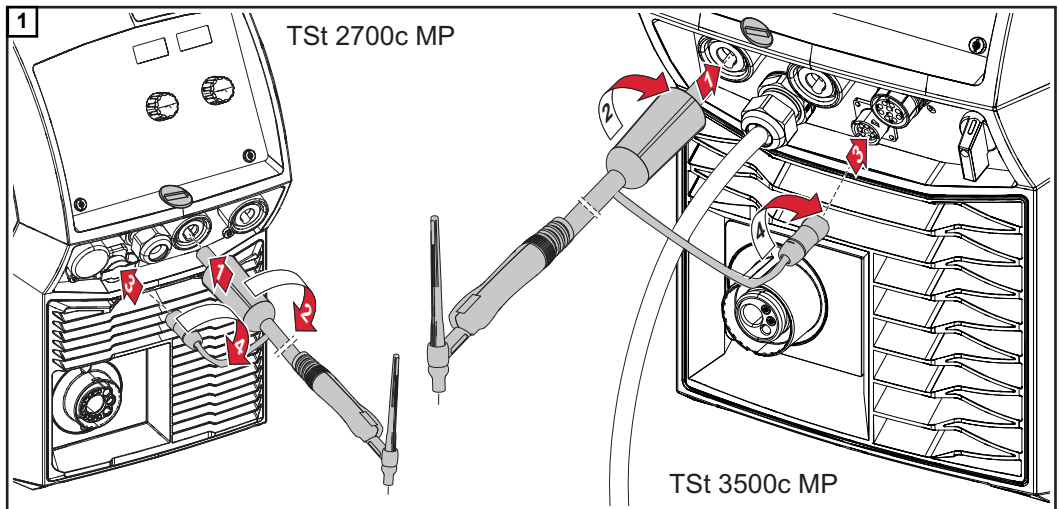


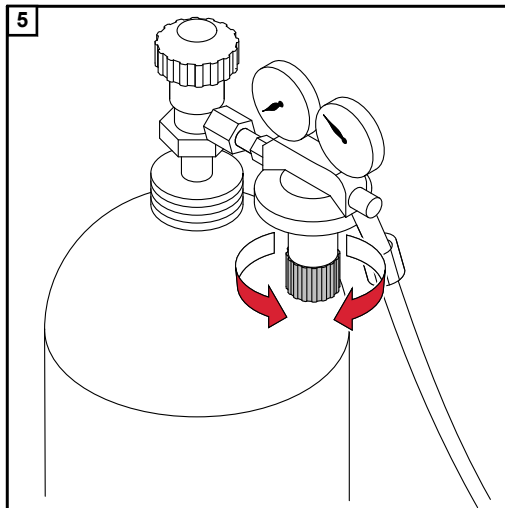
**TIG**



# Commissioning

## Start-up





**⚠ CAUTION!**

**Danger due to welding processes starting unintentionally.**

Personal injury and damage to property may result.

- ▶ As soon as the power source is switched on, ensure that the tungsten electrode does not unintentionally/accidentally touch electrically conductive or grounded parts (such as housing).


---

**6** Plug the grid cable into the grid

**7** Switch on the power source

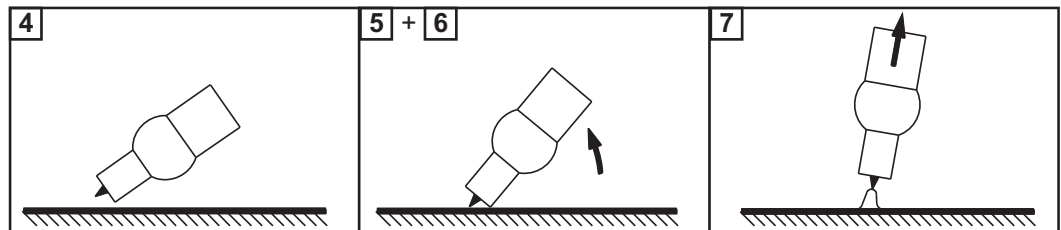
# TIG Welding

## TIG Welding

- 1 Press the "Process" button to select the TIG welding process: 
- 2 Press the "Parameter selection" button to select the amperage parameter.
- 3 Use the selection dial to set the desired amperage.  
The amperage value is shown on the left-hand digital display.

All the parameter set values are saved until the next time they are changed. This is still true if the power source has been turned off and on again in the meantime.

### When using a welding torch with a torch trigger and TIG Multi Connector plug (with 2-step mode factory setting):



- 4 Position the gas nozzle at the ignition point so that there is a distance of approximately 2 to 3 mm (0.078 to 0.118 in.) between the tungsten electrode and the work-piece
- 5 Slowly straighten the welding torch until the tungsten electrode touches the work-piece
- 6 Pull back the torch trigger and hold it in this position  
Shielding gas flows.
- 7 Raise the welding torch and tilt it into the normal position  
The arc now ignites.
- 8 Carry out welding

# Pulse welding

## Applications

Pulsed welding is welding with a pulsing welding current. It is used to weld steel pipes out-of-position or to weld thin sheet metal.

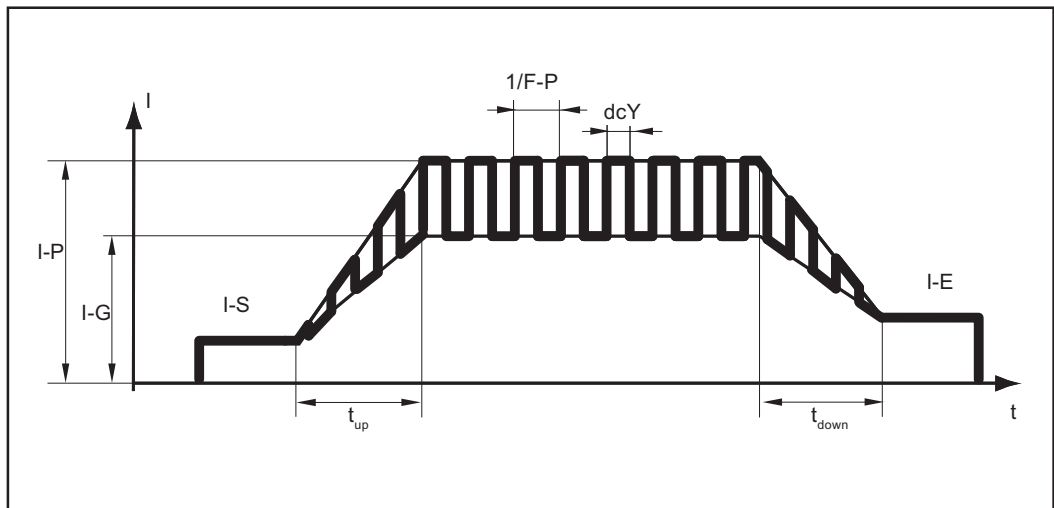
In these applications, the welding current set at the start of welding is not always optimum for the entire welding process:

- If the amperage is too low, the parent material will not be melted enough
- If overheating occurs, there is a danger that the liquid weld pool may drip.

## Operating principle

- A low base current I-G rises steeply to the significantly higher pulse current I-P and drops back to the base current I-G after the Duty cycle dcY time.
- This results in an average current that is lower than the set pulse current I-P.
- During pulse welding, small sections of the welding location melt quickly and then rapidly re-solidify.

The power source controls the "Duty cycle dcY" and "Base current I-G" parameters according to the set pulse current (welding current) and pulse frequency.



Welding current progression curve

### Adjustable parameters:

I-S **Starting current**

I-E **Final current**

F-P **Pulse frequency (1/F-P = Time between two pulses)**

I-P **Pulse current (set welding current)**

### Fixed parameters:

t<sub>up</sub> **UpSlope**

t<sub>down</sub> **DownSlope**

dcY **Duty cycle**

I-G **Base current**

---

**Activating pulse welding**

- 1 Set a value for the F-P setup parameter (pulse frequency)
  - Setting range: 1 - 990 Hz

For a parameter description see section [Parameters for TIG welding](#) from page 112.





# EasyJobs



# Saving and Retrieving EasyJobs

## General

The "Save" buttons allow five EasyJobs to be saved. The adjustable parameters on the control panel are saved as EasyJobs.

### NOTE!

**Setup parameters are not saved as EasyJobs.**

## Saving an Easy-Job

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



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

- 2 Release the "Save" button



## Retrieving an EasyJob

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



- The control panel will show the saved settings

## Deleting an Easy-Job

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



- 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 indicator displays "CLr"
- After a while, both indicators display "---"

- 3 Release the "Save" button



**Retrieving operating points on the Up/Down welding torch**

Press one of the "Save" buttons on the control panel 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:



Number 1



Number 2



Number 3



Number 4



Number 5

# **Easy Documentation (TransSteel 3500c MP)**



# General

## General

If the Easy Documentation option is available on the power source, the most important welding data for each welding operation can be documented and saved as a CSV file on a USB thumb 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 thumb 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 are documented:

Device type

File name

Part number

Serial number

Firmware version of power source

Firmware of PC board DOCMAG (Easy Documentation)

Document version

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

Nr.	Meter Start by plugging in the USB thumb drive; when switching the power source off and on, the meter continues at the last weld seam number. A new CSV file is created after 1000 welding operations.
Date	Date yyyy-mm-dd
Time	Time hh:mm:ss at the 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 current values in [W]
IE	Energy from instantaneous values in [kJ] over the entire welding operation
I-Mot	Motor current * in [A]
Synid	Characteristic number for each welding operation
Job	EasyJob number per weld seam
Process	Welding process

Mode	Operating mode
Status	PASS: regular welding IGN: Welding canceled during the ignition phase Err   xxx: Welding canceled due to an error; the corresponding service code is documented
Interval	Weld seam number for "Interval" operating mode
Signature	Signature for each 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 an identifier is output to indicate that the main process phase has been reached

The welding data are documented as average values in the main process phase and for each welding operation.

### New CSV file

A new CSV file is generated

- When the USB thumb drive is disconnected and reconnected with the power source switched on
- When the date and time are changed
- From 1000 welding operations
- During a firmware update
- When the USB thumb drive is disconnected and reconnected to another power source (= change of serial number).

### PDF report / Fronius signature



By scanning this link...

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

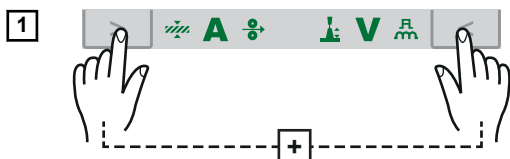
<https://easydocu.weldcube.com>



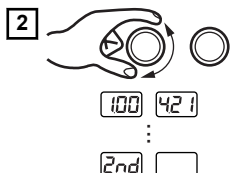
# Activating / deactivating Easy Documentation

## Setting the date and time

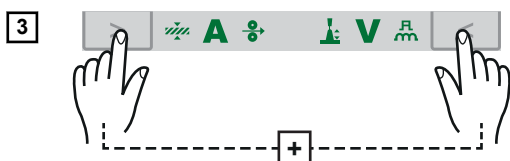
Setting the date and time is carried out in the 2nd level of the service menu.



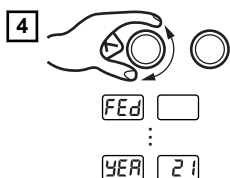
The first parameter in the service menu is displayed.



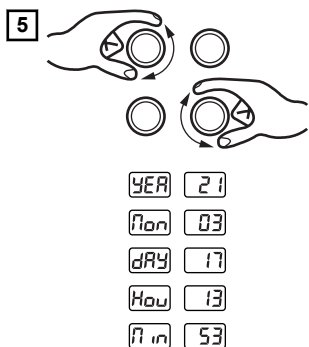
Select the "2nd" setup parameter using the left-hand selection dial



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



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



To set the date and time:

- Left-hand selection dial: Select parameter
- Right-hand selection 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

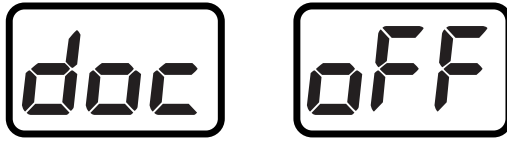
**⚠ CAUTION!**

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

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

- 1 Unplug the USB thumb drive from the power source

The power source display shows:



Easy Documentation is deactivated.

- 2 Acknowledge the display by pressing the arrow key



# Setup Settings



# Setup Menu

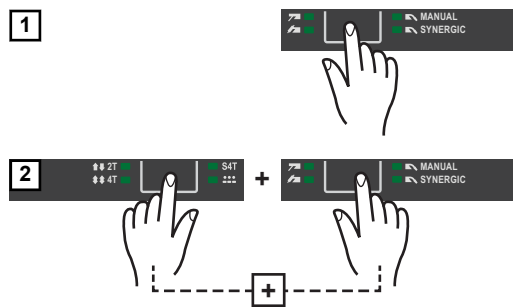
## General

The Setup menu offers easy access to expert knowledge related to the power source, as well as additional functions. The Setup menu makes it possible to easily adjust the parameters for various tasks.

## Operation

Accessing the Setup menu is described with reference to the MIG/MAG standard synergic welding process. Access is the same for the other welding processes.

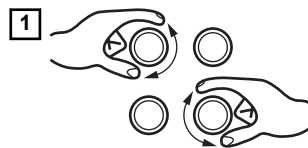
### Accessing the Setup menu



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

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

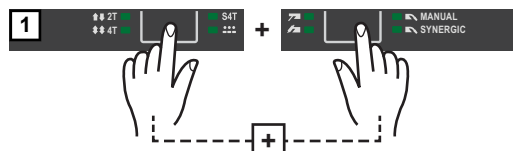
### Adjusting parameters



1 Select the desired setup parameter using the left-hand selection dial

Change the setup parameter value using the right-hand selection dial

### Exiting the Setup menu



## Parameters for MIG/MAG standard synergic welding

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

---

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

---

- SL Slope**  
 Unit: seconds  
 Setting range: 0 - 9.9  
 Factory setting: 1

I-S	<p><b>Starting current</b>  Unit: % of welding current  Setting range: 0 - 200  Factory setting: 100</p>
I-E	<p><b>Final current</b>  Unit: % of welding current  Setting range: 0 - 200  Factory setting: 50</p>
t-S	<p><b>Start current duration</b>  Unit: seconds  Setting range: 0 - 9.9  Factory setting: 0</p>
t-E	<p><b>Final current duration</b>  Unit: seconds  Setting range: 0 - 9.9  Factory setting: 0</p>
Fdi	<p><b>Feeder inching speed</b>  Unit: m/min (ipm)  Setting range: 1 - 18.5 (39.37 - 728.35)  Factory setting: 10 (393.7)</p>
Ito	<p><b>Length of wire that is fed before the safety cut-out trips</b>  Unit: mm (in.)  Setting range: OFF, 5 - 100 (OFF, 0.2 - 3.94)  Factory setting: OFF</p> <p>The "Ignition time-out" function (Ito) is a safety function. If the power source determines that no ignition has occurred after the preset wire length has been fed, wirefeeding is stopped.</p>
SPt	<p><b>Spot welding time</b>  Unit: seconds  Setting range: 0.3 - 5  Factory setting: 1</p>
SPb	<p><b>Spot pause time</b>  Unit: seconds  Setting range: OFF, 0.3 - 10 (in 0.1 s increments)  Factory setting: OFF</p>
Int	<p><b>Interval</b>  Unit: -  Setting range: 2T (2-step), 4T (4-step)  Factory setting: 2T (2-step)</p>
FAC	<p><b>Reset power source to factory settings</b>  Press and hold one of the "Parameter selection" buttons for two seconds to restore the factory settings  - when "PrG" appears on the digital display, the power source has been reset.</p>

When the power source is reset, the majority of the applied settings are deleted.

The following values remain:

- Welding circuit resistance and welding circuit inductivity
- Country-specific setting

---

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

---

**Parameters for  
MIG/MAG Stand-  
ard Manual Weld-  
ing**

GPr	<p><b>Gas pre-flow time</b> Unit: seconds Setting range: 0 - 9.9 Factory setting: 0.1</p>
GPo	<p><b>Gas post-flow time</b> Unit: seconds Setting range: 0 - 9.9 Factory setting: 0.5</p>
Fdi	<p><b>Feeder inching speed</b> Unit: m/min (ipm) Setting range: 1 - 18.5 (39.37 - 728.35) Factory setting: 10 (393.7)</p>
IGc	<p><b>Ignition current</b> Unit: Ampere Setting range: 100 - 390 Factory setting: 300</p>
Ito	<p><b>Length of wire that is fed before the safety cut-out trips</b> Unit: mm (in.) Setting range: OFF, 5 - 100 (OFF, 0.2 - 3.94) Factory setting: OFF</p> <p>The ignition time-out function (Ito) is a safety feature. If the power source determines that no ignition has occurred after the preset wire length has been fed, wirefeeding is stopped.</p>
SPt	<p><b>Spot welding time</b> Unit: seconds Setting range: OFF, 0.3 - 5 Factory setting: 1</p>
SPb	<p><b>Spot pause time</b> Unit: seconds Setting range: OFF, 0.3 - 10 (in 0.1 s increments) Factory setting: OFF</p>
Int	<p><b>Interval</b> Unit: - Setting range: 2T (2-step), 4T (4-step) Factory setting: 2T (2-step)</p>
FAC	<p><b>Reset power source to factory settings</b> Press and hold one of the "Parameter selection" buttons for two seconds to restore the factory settings - when "PrG" appears on the digital display, the power source has been reset</p>

When the power source is reset, the majority of the applied settings are deleted.  
 The following values remain:

- Welding circuit resistance and welding circuit inductivity
- Country-specific setting

---

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

---

**Parameters for  
MMA Welding**

---

HCU **HotStart current**  
 Unit: %  
 Setting range: 100 - 200  
 Factory setting: 150

---

Hti **Hot current time**  
 Unit: seconds  
 Setting range: 0 - 2.0  
 Factory setting: 0.5

---

Ast **Anti-stick function**  
 Unit: -  
 Setting range: On, OFF  
 Factory setting: On

---

FAC **Reset power source to factory settings**  
 Press and hold one of the "Parameter selection" buttons for two seconds to restore the factory settings

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

When the power source is reset, the majority of the applied settings are deleted.  
 The following values remain:

- Welding circuit resistance and welding circuit inductivity
- Country-specific setting

---

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

---

**Parameters for  
TIG welding**

---

F-P **Pulse frequency**  
 Unit: Hertz  
 Setting range: OFF; 1 - 990  
 (up to 10 Hz: in 0.1 Hz increments)  
 (up to 100 Hz: in 1 Hz increments)  
 (over 100 Hz: in 10 Hz increments)  
 Factory setting: OFF

---

tUP **UpSlope**  
 Unit: seconds  
 Setting range: 0.01 - 9.9  
 Factory setting: 0.5

---

tdo **DownSlope**  
 Unit: seconds



	Setting range: 0.01 - 9.9 Factory setting: 1
I-S	<b>Starting current</b> Unit: % of main current Setting range: 1 - 200 Factory setting: 35
I-2	<b>Lowering current</b> Unit: % of main current Setting range: 1 - 100 Factory setting: 50
I-E	<b>Final current</b> Unit: % of main current Setting range: 1 - 100 Factory setting: 30
GPo	<b>Gas post-flow time</b> Unit: seconds Setting range: 0 - 9.9 Factory setting: 9.9
tAC	<b>Tacking</b> Unit: seconds Setting range: OFF, 0.1 - 9.9 Factory setting: OFF
FAC	<b>Reset power source to factory settings</b> Press and hold one of the "Parameter selection" buttons for two seconds to restore the factory settings - when "PrG" appears on the digital display, the power source has been reset.  When the power source is reset, the majority of the applied settings are deleted. The following values remain: - Welding circuit resistance and welding circuit inductivity - Country-specific setting
2nd	<b>Second level of the Setup menu (see "Setup Menu 2nd Level")</b>

# Setup Menu 2nd Level

## Limitations

The following restrictions occur in relation to the Setup menu 2nd level:

Setup menu 2nd level cannot be selected:

- during welding
- if the "Gas test" function is active
- if the "Wire threading" function is active
- if the "Wire withdrawal" function is active
- if the "Gas purging" function is active

If level 2 of the Setup menu is selected, the following functions are not available, even in robot mode:

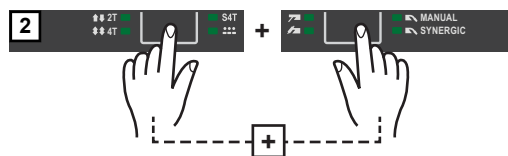
- Welding start-up - the "Power source ready" signal will not be emitted for robot mode
- Gas test
- Wire inching
- Wire withdrawal
- Gas purging

## Operation (Setup Menu 2nd Level)

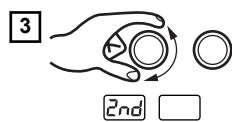
To access the 2nd level of the Setup menu:



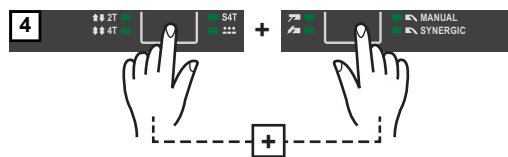
Press the "Process" button to select the "MIG/MAG standard synergic welding" process



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

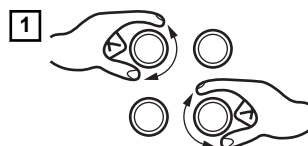


Select the "2nd" setup parameter using the left-hand selection dial



The control panel is now located in the 2nd level of the Setup menu of the "MIG/MAG standard synergic welding" process - the last selected setup parameter is displayed.

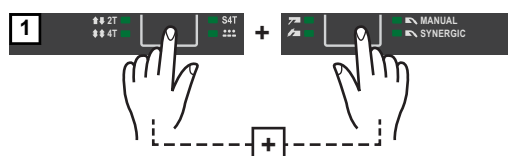
## Adjusting parameters



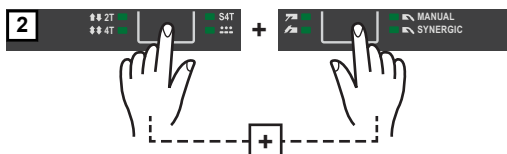
Select the desired setup parameter using the left-hand selection dial

Change the setup parameter value using the right-hand selection dial

## Exiting the Setup menu



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



## Parameters for MIG/MAG Stand- ard Synergic Welding (Setup Menu 2nd Level)

- 
- C-C Cooling unit control**  
(only with TST 3500c MP and if cooling unit is connected)  
Unit: -  
Setting range: Aut, On, OFF  
Factory setting: Aut  
Aut: The cooling unit cuts out after a 2-minute welding off-time.  
**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.  
On: The cooling unit is permanently ON  
OFF: The cooling unit is always OFF  
**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.
- 
- C-t Cooling time**  
(only with TST 3500c MP and if cooling unit is connected)  
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.  
Unit: s  
Setting range: 5 - 25  
Factory setting: 10  
**IMPORTANT!** Every time the power source is switched on, the cooling unit carries out a test run for 180 seconds.
- 
- SEt Country-specific setting (Standard/USA) ... Std/US**  
Unit: -  
Setting range: Std, US (Standard/USA)  
If Std is selected, the Euro welding programs are used as stated in the welding program table.  
If US is selected, the US welding programs are used as stated in the welding program table.  
Factory setting:  
Standard version: Std (measurements in cm/mm)  
USA version: US (measurements: inches)
- 
- FUS Mains fuse**  
The maximum possible welding power is limited by the rating of the mains fuse protection used.  
Unit: A  
The available mains fuse ratings are determined by the SEt parameter setting:  
SEt parameter set as Std: OFF / 10 / 13 / 16  
SEt parameter set as US: OFF / 15 / 20 (only for 120 V grid voltage)  
Factory setting: OFF

---

LED	<p><b>Time delay for the cut-off of the wirepool interior lighting</b>  The time delay starts with the last key operation.  Unit: Minutes  Setting range: ON / OFF / 0-100  Factory setting: 10  only at TSt 2700c MP</p>
<hr/>	
r	<p><b>Welding circuit resistance (in mOhm)</b>  See "Measuring the Welding Circuit Resistance r"</p>
<hr/>	
L	<p><b>Welding circuit inductivity (in microhenrys)</b>  See "Displaying the Welding Circuit Inductivity L"</p>
<hr/>	
EnE	<p><b>Real Energy Input</b>  Unit: kJ  Setting range: ON / OFF  Factory setting: OFF  Since the full range of values (1 kJ - 99,999 kJ) cannot be displayed on the three-digit display, the following display format has been selected:  Value in kJ: 1 to 999 / indicator on display: 1 to 999  Value in kJ: 1000 to 9999 / indicator on display: 1.00 to 9.99 (without unit digit, e.g., 5270 kJ -&gt; 5.27)  Value in kJ: 10,000 to 99,999 / indicator on display: 10.0 to 99.9 (without unit digit or tens digit, e.g., 23,580 kJ -&gt; 23.6)</p>
<hr/>	
ALC	<p><b>Arc length correction display</b>  (For setting how the arc length correction parameter is displayed)  Setting range: ON / OFF  Factory setting: OFF  If set to ON, if the welding voltage parameter is selected and set on the control panel,  the left-hand display shows the arc correction value for three seconds,  the right-hand display shows the value for the welding voltage at the same time.</p>

---

**Parameters for  
MIG/MAG Stand-  
ard Manual Weld-  
ing (Setup Menu  
2nd Level)**

---

C-C	<p><b>Cooling unit control</b>  (only with TST 3500c MP and if cooling unit is connected)  Unit: -  Setting range: Aut, On, OFF  Factory setting: Aut  Aut: The cooling unit cuts out after a 2-minute welding off-time.  <b>IMPORTANT!</b> 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.  On: The cooling unit is permanently ON  OFF: The cooling unit is always OFF  <b>IMPORTANT!</b> 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>
<hr/>	
C-t	<p><b>Cooling time</b>  (only with TST 3500c MP and if cooling unit is connected)</p>

---

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.

Unit: s

Setting range: 5 - 25

Factory setting: 10

**IMPORTANT!** Every time the power source is switched on, the cooling unit carries out a test run for 180 seconds.

**SEt Country-specific setting (Standard/USA) ... Std/US**

Unit: -

Setting range: Std, US (Standard/USA)

If Std is selected, the Euro welding programs are used as stated in the welding program table.

If US is selected, the US welding programs are used as stated in the welding program table.

Factory setting:

Standard version: Std (measurements in cm/mm)

USA version: US (measurements: inches)

**FUS Mains fuse**

The maximum possible welding power is limited by the rating of the mains fuse protection used.

Unit: A

The available mains fuse ratings are determined by the SEt parameter setting:

SEt parameter set as Std: OFF / 10 / 13 / 16

SEt parameter set as US: OFF / 15 / 20 (only for 120 V grid voltage)

Factory setting: OFF

**LED Time delay for the cut-off of the wirepool interior lighting**

The time delay starts with the last key operation.

Unit: Minutes

Setting range: ON / OFF / 0-100

Factory setting: 10

only at TSt 2700c MP

**r Welding circuit resistance (in mOhm)**

See "Measuring the Welding Circuit Resistance r"

**L Welding circuit inductivity (in microhenrys)**

See "Displaying the Welding Circuit Inductivity L"

**EnE Real Energy Input**

Unit: kJ

Setting range: ON / OFF

Factory setting: OFF

Since the full range of values (1 kJ - 99,999 kJ) cannot be displayed on the three-digit display, the following display format has been selected:

Value in kJ: 1 to 999 / indicator on display: 1 to 999

Value in kJ: 1000 to 9999 / indicator on display: 1.00 to 9.99 (without unit digit, e.g., 5270 kJ -> 5.27)

Value in kJ: 10,000 to 99,999 / indicator on display: 10.0 to 99.9 (without unit digit or tens digit, e.g., 23,580 kJ -> 23.6)

---

**Parameters for  
stick welding  
(SMAW)**

---

SEt	<b>Country-specific setting (Standard/USA) ... Std/US</b> Unit: - Setting range: Std, US (Standard/USA) Factory setting: Standard device: Std (measurements in cm/mm) USA device: US (measurements: inches)
r	<b>Welding circuit resistance (in mOhm)</b> See section <a href="#">Measuring the welding circuit resistance (MIG/MAG welding)</a> from page <a href="#">120</a>
L	<b>Welding circuit inductivity (in microhenrys)</b> See section <a href="#">Displaying the welding circuit inductivity</a> from page <a href="#">122</a>
FUS	<b>Mains fuse protection</b> The maximum possible welding power is limited by the rating of the mains fuse protection used. Unit: A The available mains fuse ratings are determined by the SEt parameter setting: SEt parameter set as Std: OFF / 10 / 13 / 16 SEt parameter set as US: OFF / 15 / 20 (only for 120 V grid voltage) Factory setting: OFF

---

---

**Parameters for  
TIG Welding  
(Setup Menu 2nd  
Level)**

---

C-C	<b>Cooling unit control</b> (only with TST 3500c MP and if cooling unit is connected) Unit: - Setting range: Aut, On, OFF Factory setting: Aut Aut: The cooling unit cuts out after a 2-minute welding off-time. <b>IMPORTANT!</b> 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. On: The cooling unit is permanently ON OFF: The cooling unit is always OFF <b>IMPORTANT!</b> 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.
C-t	<b>Cooling time</b> (only with TST 3500c MP and if cooling unit is connected) 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. Unit: s Setting range: 5 - 25 Factory setting: 10 <b>IMPORTANT!</b> Every time the power source is switched on, the cooling unit carries out a test run for 180 seconds.
SEt	<b>Country-specific setting (Standard/USA) ... Std/US</b>

---

Unit: -

Setting range: Std, US (Standard/USA)

If Std is selected, the Euro welding programs are used as stated in the welding program table.

If US is selected, the US welding programs are used as stated in the welding program table.

Factory setting:

Standard version: Std (measurements in cm/mm)

USA version: US (measurements: inches)

---

**FUS Mains fuse**

The maximum possible welding power is limited by the rating of the mains fuse protection used.

Unit: A

The available mains fuse ratings are determined by the SEt parameter setting:

SEt parameter set as Std: OFF / 10 / 13 / 16

SEt parameter set as US: OFF / 15 / 20 (only for 120 V grid voltage)

Factory setting: OFF

---

# Measuring the Welding Circuit Resistance r

## General

Measuring the welding circuit resistance makes it possible to have a constant 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 the welding circuit resistance (MIG/MAG welding)

### NOTE!

#### Risk of incorrect measurement of the welding circuit resistance.

This can have a negative effect on the welding results.

- ▶ Ensure that the workpiece has an optimum contact surface in the area of the earthing clamp (clean surface, no rust, etc.).

- 1 Ensure that either the MANUAL or SYNERGIC welding process is selected
- 2 Establish a ground earth connection to the workpiece
- 3 Access the Setup menu 2nd level (2nd)
- 4 Select parameter "r"
- 5 Remove the gas nozzle from the welding torch
- 6 Screw on the contact tip
- 7 Ensure that the wire electrode does not protrude from the contact tip

### NOTE!

#### Risk of incorrect measurement of the welding circuit resistance.

This can have a negative effect on the welding results.

- ▶ Ensure that the workpiece has an optimum contact surface for the contact tip (clean surface, no 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

# Displaying the Welding Circuit Inductivity L

---

## General

The way that the hosepack is arranged has a very significant effect on the 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 the welding circuit inductivity

The setup parameter "L" is used to display the most recently calculated welding circuit inductivity. The welding circuit inductivity is adjusted when the welding circuit resistance is measured. Detailed information in this regard can be found under the "Welding circuit resistance" chapter.

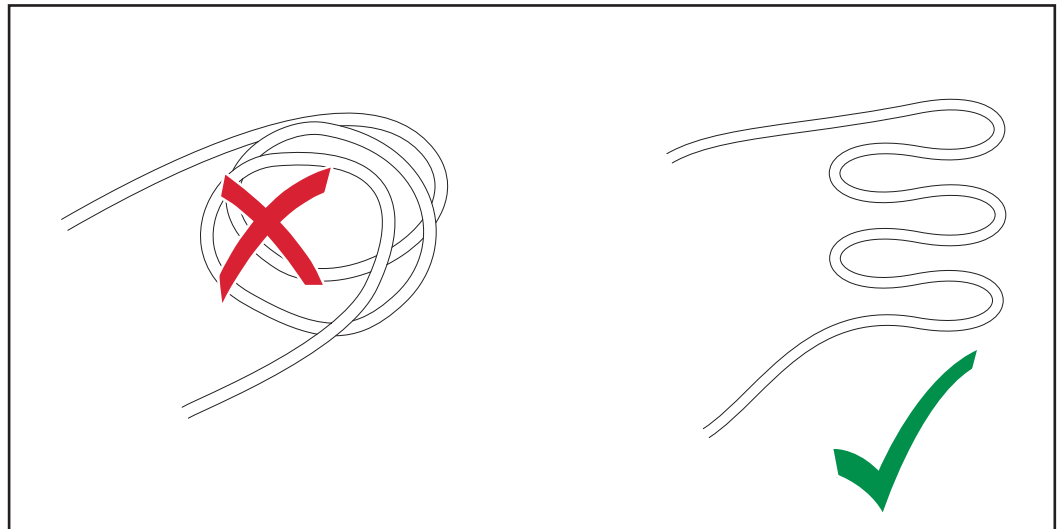
- 1 Access the Setup menu 2nd level (2nd)
- 2 Select parameter "L"

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

L ... Welding circuit inductivity (in microhenrys)

---

## Laying the hosepacks correctly



# **Troubleshooting and Maintenance**



# Troubleshooting

## General

The devices are equipped with an intelligent safety system, which largely negates the need for 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 performed incorrectly can cause serious injury and damage to property.**

- ▶ Only trained and qualified personnel may carry out the activities described in the following.
- ▶ Follow the safety rules in the power source Operating Instructions



### WARNING!

**An electric shock can be fatal.**

Before opening the device:

- ▶ Set the power switch to - O -
- ▶ Unplug the device from grid power
- ▶ Attach a clear warning sign advising others not to switch the power source back on
- ▶ Use a suitable measuring instrument to ensure that electrically charged components (e.g., capacitors) are discharged



### WARNING!

**Danger due to insufficient ground conductor connection!**

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

- ▶ The housing screws provide an adequate ground conductor connection for grounding the housing and should not be replaced under any circumstances by other screws that do not provide a reliable ground conductor connection.

## Troubleshooting

Make a note of the serial number and configuration of the device, and provide the service team with a detailed error description if:

- Errors occur that are not covered in this document
- The troubleshooting measures provided in this document 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

---

**No function after pressing torch trigger**

Power source power switch is ON and indicators are lit up

Cause: Only for welding torches with an external control plug: Control plug not plugged in

Remedy: Plug in control plug

Cause: Welding torch or welding torch control line faulty

Remedy: Replace welding torch

---

**No function after pressing torch trigger**

Power source power switch is on, power source ON indicator is lit up on the power source, indicators on wirefeeder are not lit up

Cause: Interconnecting hosepack faulty or not connected correctly

Remedy: Check interconnecting hosepack

---

**No welding current**

Power 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: Overloading

Remedy: Observe the duty cycle

Cause: Thermal automatic circuit breaker 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: Fan in the power source is faulty

Remedy: Inform After-Sales Service

---

**No welding current**

Power source switched on, displays illuminate

Cause: Incorrect ground connection

Remedy: Check ground connection for polarity

Cause: Power cable in welding torch damaged or broken.

Remedy: Replace welding torch

---

**no shielding gas**

all other functions present

Cause: Gas cylinder empty

Remedy: Change gas cylinder

Cause: Gas pressure regulator faulty

Remedy: Replace gas pressure reducer

Cause: Gas hose not attached, or damaged

Remedy: Attach or replace gas hose

Cause: Welding torch faulty

Remedy: Change welding torch

Cause: Gas solenoid valve faulty

Remedy: Inform the service team

---

**Irregular wire speed**

Cause: Braking force has been set too high

Remedy: Loosen the brake

Cause: Contact tip hole too narrow

Remedy: Use suitable contact tip

Cause: Inner liner in the welding torch faulty

Remedy: Check the inner liner for kinks, dirt, etc. and replace if necessary

Cause: Feed rollers not suitable for wire electrode used

Remedy: Use suitable feed rollers

Cause: Feed rollers have the wrong contact pressure

Remedy: Optimize contact pressure

---

**Wirefeed problems**

when using 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 tight bends

---

**Welding torch gets very hot**

Cause: Welding torch is inadequately sized

Remedy: Observe duty cycle and load limits

Cause: For water-cooled systems only: Coolant circulation too low

Remedy: Check coolant level, coolant flow volume, coolant contamination etc. More details can be found in the cooling unit's Operating Instructions

---

**Poor-quality weld properties**

Cause: Incorrect welding parameters

Remedy: Check settings

Cause: Poor ground earth connection

Remedy: Establish good contact with workpiece

Cause: Too little or no shielding gas

Remedy: Check gas pressure regulator, gas hose, gas solenoid valve, welding torch gas connection, etc.

Cause: Welding torch leaks

Remedy: Change welding torch

Cause: Incorrect or heavily worn contact tip

Remedy: Change contact tip

Cause: Incorrect wire alloy or incorrect wire diameter

Remedy: Check wire electrode in use

Cause: Incorrect wire alloy or incorrect wire diameter

Remedy: Check weldability of the base material

Cause: Shielding gas not suitable for wire alloy

Remedy: Use correct shielding gas

---

---

**Displayed Service Codes**

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

- 1 Switch the power source power switch to the -O- position
- 2 Wait 10 seconds
- 3 Switch the power 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 cooling unit used 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 wirefeeder is not supported

Remedy: Connect supported wirefeeder

---

**ELn | 12**

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

Remedy: Connect similar control panels to select materials

---

**ELn | 13**

Cause: Impermissible change of welding process during welding

Remedy: During welding do not make any impermissible change to the welding process, reset error message by pressing any button

---

**ELn | 14**

Cause: More than one robot interface is connected

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

---

**ELn | 15**

Cause: More than one remote control is connected

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

---

**Err | IP**

Cause: The power source control has detected a primary overvoltage

Remedy: Check the grid voltage.

If the service code persists, switch off the power source, wait for 10 seconds and then switch the power source on again.

If the error still persists, contact the After-Sales Service team

---

**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 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 the After-Sales Service team

---

**Err | Ur**

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

Remedy: Switch off the 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 the After-Sales Service team.

---

**E-Stop**

Cause: "External stop" option has tripped

Remedy: Remedy the event that triggered the external stop

---

---

**-St | oP-**

Cause: Flag on the robot interface was not deleted from the robot

Remedy: Delete the "Robot ready" signal on the robot interface

---

**PHA | SE**

Cause: Phase failure

**with TSt 2500c / TSt 2700c in particular:**

If the failure occurs during welding, the welding operation stops.

**with TSt 2500 MV / TSt 2700 MV in particular:**

A single-phase operation with limited power is possible:

When switching on the power source, "PHA | SE1" is displayed in order to show that a power reduction will be in effect.

If a change in supply from three-phase to single-phase occurs during welding (display: "PHA | SE1") or from single-phase to three-phase (display: "PH | ASE 3"), the welding operation stops.

Remedy: Check the mains fuse, grid lead and mains plug.

Switch off the power source, wait 10 seconds and switch the power source back on again.

---

**PHA | SE1**

Cause: The power source is being used in single-phase mode

Remedy: -

---

**PHA | SE3**

Cause: The power source is being used in three-phase mode

Remedy: -

---

**Err | 51**

Cause: Mains undervoltage: the grid voltage has fallen below the tolerance range

Remedy: Check the grid voltage. If the service code persists, contact the After-Sales Service team

---

**Err | 52**

Cause: Mains overvoltage: the grid voltage has risen above the tolerance range

Remedy: Check the grid voltage. If the service code persists, contact the After-Sales Service team

---

**EFd 5**

Cause: Incorrect wirefeeder connected

Remedy: Connect correct wirefeeder

---

**EFd 8**

Cause: Wirefeeder overtemperature

Remedy: Allow wirefeeder to cool down

---

**EFd | 81, EFd | 83**

Cause: Fault in the wirefeed system (overcurrent in wirefeeder 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: Wirefeeder motor is sticking or faulty

Remedy: Check the wirefeeder motor or contact the After-Sales Service team

---

---

**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**

Note: xxx stands for a temperature value

Cause: Overtemperature in wirefeeder motor

Remedy: Allow wirefeeder to cool down

---

**to4 | xxx**

Note: 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 on the power source transformer

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 that fan is on

---

**toF | xxx**

Cause: With the TSt 2500c MV / TSt 2700c MV power source operating in single-phase mode, the power source safety cut-out has tripped in order to prevent the mains fuse from tripping.

Remedy: After a pause in welding of around 60 s, the message disappears and the power source is operational again.

---

**tu0 | xxx**

Note: xxx stands for a temperature value

Cause: Undertemperature in the power source primary circuit

Remedy: Place power source in a heated room and allow it 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**

Note: xxx stands for a temperature value

Cause: Undertemperature in the power source secondary circuit

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

---

**tu3 | xxx**

Note: xxx stands for a temperature value

Cause: Undertemperature in the wirefeeder motor

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

---

**tu4 | xxx**

Note: 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**

Note: 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 power source transformer

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 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" chapter in the Operating Instructions for the device)

---

**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 fieldbus 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 Setup menu had been fed. The power source safety cut-out has tripped

Remedy: Shorten the wire stick-out; press the torch trigger again; clean the surface of the workpiece; if necessary, set the "lto" parameter in the Setup menu

---

**EPG | 17**

Cause: The selected welding program is invalid

Remedy: Select a valid welding program

---

**EPG | 29**

Cause: The required wirefeeder is not available for the selected characteristic

Remedy: Connect the correct wirefeeder, check the 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, re-measure the 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, replace "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 date and time in the 2nd level of the service menu: see page [105](#)

---

---

**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, the date and time in the are displayed in the 2nd  
level of the service menu:  
see page [105](#)

---

**Err | doc**

Welding is not possible

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

Remedy: Turn power source off and on again

---

**Err | USb**

Welding is not possible

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

Remedy: Unplug the USB thumb drive

---

**USB | full**

Welding is not possible

Cause: The plugged in USB thumb drive is full

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

---

# Service, maintenance and disposal

**General** Under normal operating conditions, the welding system requires only a minimum of care and maintenance. However, several points must be observed in order for the welding system to remain operational for years to come.

## Safety

### **WARNING!**

#### **An electric shock can be fatal.**

Before opening the device

- ▶ Set power switch to - O - on the welding power supply
- ▶ Unplug the welding power supply from mains power
- ▶ Secure against anyone turning on power again
- ▶ Use a suitable measuring instrument to ensure that electrically charged components (e.g., capacitors) are discharged

### **WARNING!**

#### **Work performed incorrectly can cause serious injury and damage.**

- ▶ The following activities must only be carried out by trained and qualified personnel.
- ▶ Please note the information in the "Safety instructions" chapter!

**At every start-up**

- Check mains plug and mains cable, as well as the welding torch, interconnecting hosepack, and ground earth connection for damage
- Check if the all-round clearance of the device is 0.5 m (1 ft. 8 in.) so that cooling air can circulate unimpeded

### **NOTE!**

**Air inlet and outlet openings must not be blocked or even partially covered.**

## **Whenever Required**

Depending on the dust accumulation:

TSt 2500c / TSt 2700c

- Remove the fin element on the rear of the housing
- Detach the air filter located behind it and clean it

TSt 3500c

- Remove the air filter on the rear of the housing from the side and clean it

## **Every 2 Months**

### **CAUTION!**

#### **Danger of damage to property.**

- ▶ 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 parts.

- 
- 1 Dismantle device side panels and blow the inside of the device clean with dry, reduced compressed air
  - 2 Also clean the cooling air ducts if there is a large accumulation of dust

 **WARNING!**

**An electric shock can be fatal.**

Danger of electric shock due to grounding cable and device grounding points not being connected properly.

- ▶ When refitting the side panels, ensure that the grounding cable and device grounding points are properly connected.
- 

---

**Disposal**

Materials should be disposed of according to valid local and national regulations.



# Appendix



# Average consumption values during welding

**Average wire electrode consumption during MIG/MAG welding**

<b>Average wire electrode consumption at a wire speed of 5 m/min</b>			
	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
Aluminum 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

<b>Average wire electrode consumption at a wire speed of 10 m/min</b>			
	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
Aluminum 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 Voltage** For devices designed for special voltages, the technical data on the rating plate applies.

The following applies for all devices with a permitted grid voltage of up to 460 V: The standard mains plug allows the user to operate with a grid voltage of up to 400 V. For grid 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

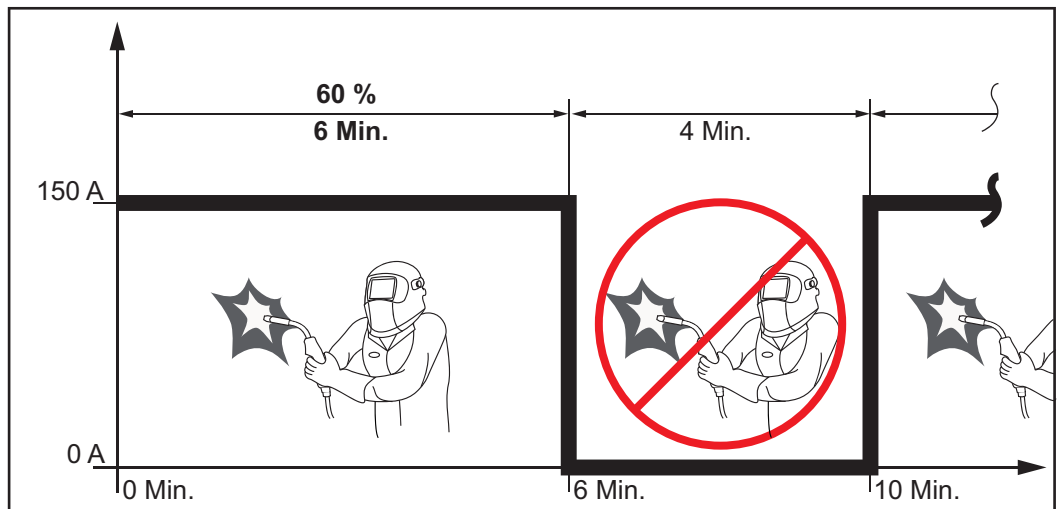
The duty cycle (D.C.) is the period of a ten minute cycle in which the device may be operated at the stated power without overheating.

### NOTE!

**The D.C. values cited on the rating plate relate to an ambient temperature of 40 °C.** If the ambient temperature is higher, the D.C. or power must be lowered accordingly.

Example: Welding with 150 A at 60% D.C.

- Welding phase = 60% of 10 mins = 6 mins
- Cool-down phase = rest time = 4 mins
- Following the cool-down phase, the cycle begins again.



To use the device without interruptions:

- 1 Search for a 100% D.C. value in the technical data, which corresponds to the existing ambient temperature.
- 2 Reduce the power or amperage value correspondingly so that the device can operate without a cool-down phase.

## TSt 2700c MP

Grid voltage ( $U_1$ )	3 x	380 V	400 V	460 V
Max. effective primary current ( $I_{1\text{eff}}$ )		7 A	6.7 A	5.8 A
Max. primary current ( $I_{1\text{max}}$ )		13.7 A	13.0 A	11.2 A
Mains fuse			16 A slow-blow	
Apparent power	At 400 V AC			9.0 kVA
Mains voltage tolerance				-10 / +15%
Grid frequency				50 / 60 Hz
cos phi (1)				0.99
Max. permitted grid impedance $Z_{\text{max}}$ on PCC <sup>1)</sup>				220 mOhm
Welding current range ( $I_2$ )				
MIG/MAG				10 - 270 A
MMA				10 - 270 A
TIG				10 - 270 A
Welding current at	10 min / 40 °C (104 °F)	30%	60%	100%
$U_1 = 3 \times 380 - 400 \text{ V}$	MIG/MAG	270 A	210 A	170 A
$U_1 = 3 \times 460 \text{ V}$	MIG/MAG	270 A	210 A	170 A
$U_1 = 3 \times 380 - 400 \text{ V}$	MMA	270 A	210 A	170 A
$U_1 = 3 \times 460 \text{ V}$	MMA	270 A	210 A	170 A
$U_1 = 3 \times 380 - 400 \text{ V}$	TIG	270 A	210 A	170 A
$U_1 = 3 \times 460 \text{ V}$	TIG	270 A	210 A	170 A
Output voltage range according to standard characteristic ( $U_2$ )				
MIG/MAG				14.3 - 27.5 V
MMA				10.4 - 20.8 V
TIG				20.4 - 30.8 V
Open circuit voltage ( $U_0$ peak)				85 V
Degree of protection				IP 23
Insulation class				B
Overvoltage category				III
Pollution degree according to IEC60664				3
EMC device class				A <sup>2)</sup>
Safety markings				S, CE
Dimensions l x w x h				687 x 276 x 445 mm 27.1 x 10.9 x 17.5 in.
Weight				30 kg 66.14 lb.

Max. shielding gas pressure	7 bar 101.49 psi
Wire speed	1 - 25 m/min 40 - 980 ipm
Wirefeeder	4-roller drive
Wire diameter	0.8 - 1.6 mm 0.03 - 0.06 in.
Wirespool diameter	max. 300 mm max. 11.81 in.
Wirespool weight	max. 20.0 kg max. 44.09 lb.
Idle state power consumption at 400 V	38,3 W
Power source efficiency at 270 A / 30,8 V	89 %

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A device in emissions class A is not intended for use in residential areas in which the power is supplied via a public low-voltage grid.  
The electromagnetic compatibility may be influenced by conducted or radiated radio frequencies.

**TransSteel 2700c  
MV MP**

Mains voltage (U <sub>1</sub> )	3 x	230 V	380 V	460 V	
Max. effective primary current (I <sub>1eff</sub> )		12.6 A	7.5 A	6.2 A	
Max. primary current (I <sub>1max</sub> )		23.0 A	13.7 A	11.1 A	
Mains fuse protection (slow-blow)		32.0 A	16.0 A	16.0 A	
Apparent power at 380 V AC				9.02 kVA	
<hr/>					
Mains voltage (U <sub>1</sub> )	1 x		230 V	240 V	
Max. effective primary current (I <sub>1eff</sub> )			18.1 A	18.1 A	
Max. primary current (I <sub>1max</sub> )			24.9 A	28.1 A	
Mains fuse protection (slow-blow)			16 A	30 A	
Apparent power			5.98 kVA	6.74 kVA	
<hr/>					
Mains voltage tolerance				-10 / +15%	
Grid frequency				50 / 60 Hz	
cos phi (1)				0.99	
Max. permitted grid impedance Z <sub>max</sub> on PCC <sup>1)</sup>				228 mOhm	
<hr/>					
Welding current range (I <sub>2</sub> )					
MIG/MAG				10 - 270 A	
MMA				10 - 270 A	
TIG				10 - 270 A	
<hr/>					
Welding current range (I <sub>2</sub> ) in single-phase operation <sup>2)</sup>					
MIG/MAG				10 - 220 A	
MMA				10 - 180 A	
TIG				10 - 260 A	
<hr/>					
Welding current at	10 min / 40 °C (104 °F)		30%	60%	100%
U <sub>1</sub> = 3 x 200 - 230 V:	MIG/MAG		270 A	200 A	170 A
U <sub>1</sub> = 3 x 380 - 460 V:	MIG/MAG		270 A	215 A	185 A
U <sub>1</sub> = 3 x 200 - 230 V:	MMA		270 A	200 A	170 A
U <sub>1</sub> = 3 x 380 - 460 V:	MMA		270 A	200 A	170 A
U <sub>1</sub> = 3 x 200 - 230 V:	TIG (35%)		270 A	220 A	185 A
U <sub>1</sub> = 3 x 380 - 460 V:	TIG (35%)		270 A	230 A	195 A
<hr/>					
Welding current in single-phase operation <sup>2)</sup> at	10 min / 40 °C (104 °F)		40%		100%
U <sub>1</sub> = 1 x 230 V:	MIG / MAG, fuse 16 A		180 A		145 A
U <sub>1</sub> = 1 x 240 V:	MIG / MAG, fuse 30 A		220 A		170 A

Welding current in single-phase operation <sup>2)</sup> at	10 min / 40 °C (104 °F)	40%	100%
U <sub>1</sub> = 1 x 230 V:	MMA, fuse 16 A	150 A	130 A
U <sub>1</sub> = 1 x 240 V:	MMA, fuse 30 A	180 A	140 A
Welding current in single-phase operation <sup>2)</sup> at	10 min / 40 °C (104 °F)	35%	100%
U <sub>1</sub> = 230 V:	TIG, fuse 16 A	220 A	170 A
U <sub>1</sub> = 240 V:	TIG, fuse 30 A	260 A	180 A
Output voltage range according to standard characteristic (U <sub>2</sub> )			
MIG/MAG			14.5 - 27.5 V
MMA			20.4 - 30.8 V
TIG			10.4 - 20.8 V
Output voltage range according to standard characteristic (U <sub>2</sub> ) in single-phase operation <sup>2)</sup>			
MIG/MAG			14.5 - 25.0 V
MMA			20.4 - 27.2 V
TIG			10.4 - 20.4 V
Open circuit voltage (U <sub>0</sub> peak)			85 V
Protection class			IP 23
Insulation class			B
Overvoltage category			III
Pollution degree according to IEC60664			3
EMC device class			A <sup>3)</sup>
Safety symbols			S, CE, CSA
Dimensions l x w x h		687 x 276 x 445 mm 27.1 x 10.9 x 17.5 in.	
Weight			31.8 kg 70.11 lb.
Max. shielding gas pressure			7 bar 101.49 psi
Wire speed			1 - 25 m/min 40 - 980 ipm
Wire drive			4-roller drive
Wire diameter			0.8 - 1.6 mm 0.03 - 0.06 in.
Wirespool diameter			max. 300 mm max. 11.81 in.



Wirespool weight	max. 20.0 kg max. 44.1 lb.
Idle state power consumption at 400 V	38.5 W
Power source efficiency at 270 A / 30.8 V	89%

- 1) Interface to a 230/400-V and 50-Hz public grid
- 2) Detailed information on the duty cycle in single-phase operation can be found in the "Installation" chapter under "TransSteel 2700c MV MP - Single-Phase Operation" from page [48](#).
- 3) A device in emissions class A is not intended for use in residential areas in which the power is supplied via a public low-voltage grid.  
The electromagnetic compatibility may be influenced by conducted or radiated radio frequencies.

**TSt 3500c MP**

Grid voltage ( $U_1$ )	3 x	380 V	400 V	460 V
Max. effective primary current ( $I_{1\text{eff}}$ )		14.8 A	14.1 A	12.7 A
Max. primary current ( $I_{1\text{max}}$ )		23.8 A	23.1 A	21.1 A
Mains fuse		35 A slow-blow		
Mains voltage tolerance		-10 / +15%		
Grid frequency		50 / 60 Hz		
cos phi (1)		0.99		
Max. permitted grid impedance $Z_{\text{max}}$ on PCC <sup>1)</sup>		77 mOhm		
Recommended residual-current circuit breaker		Type B		
Welding current range ( $I_2$ )				
MIG/MAG		10 - 350 A		
MMA		10 - 350 A		
TIG		10 - 350 A		
Welding current at	10 min / 40 °C (104 °F)	40%	60%	100%
MIG/MAG		350 A	300 A	250 A
MMA		350 A	300 A	250 A
TIG		350 A	300 A	250 A
Output voltage range according to standard characteristic ( $U_2$ )				
MIG/MAG		14.5 - 31.5 V		
MMA		20.4 - 34.0 V		
TIG		10.4 - 24.0 V		
Open circuit voltage ( $U_0$ peak)		59 V		
Apparent power at 400 V AC		15.87 kVA		
Degree of protection		IP 23		
Type of cooling		AF		
Insulation class		B		
Overvoltage category		III		
Pollution degree according to IEC60664		3		
EMC device class		A <sup>2)</sup>		
Safety markings		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		36 kg 79.4 lb.		

Max. shielding gas pressure	5 bar 72.52 psi
Coolant	Original Fronius
Wire speed	1 - 25 m/min 40 - 980 ipm
Wirefeeder	4-roller drive
Wire diameter	0.8 - 1.6 mm 0.03 - 0.06 in.
Wirespool diameter	max. 300 mm max. 11.81 in.
Wirespool weight	max. 19.0 kg max. 41.9 lb.
Max. noise emission (L <sub>WA</sub> )	72 dB (A)
Idle state power consumption at 400 V	36,5 W
Power source efficiency at 350 A / 34 V	90 %

- 1) Interface to a 230/400 V, 50 Hz public grid
- 2) A device in emissions class A is not intended for use in residential areas in which the power is supplied via a public low-voltage grid.  
The electromagnetic compatibility may be influenced by conducted or radiated radio frequencies.

#### 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](http://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

## TSt 2700c MP welding program table

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

## UID 3788 welding program database

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 <sub>2</sub>	3813	3812	3811	2322			3814*
1	Steel	B	Ar + 8-12 % CO <sub>2</sub>	2288	2298	2308	2324			
1	Steel	C	Ar + 15-25 % CO <sub>2</sub>	3809	3808	3806	2488			3810*
1	Steel	D	Ar + 3-6 % O <sub>2</sub>	2285	2297	2307	2323			
2	Steel dynamic	B	Ar + 8-12 % CO <sub>2</sub>	2292	2302	2312	2326			
2	Steel dynamic	C	Ar + 15-25 % CO <sub>2</sub>	2293	2303	2313	2327			
2	Steel dynamic	D	Ar + 3-6 % O <sub>2</sub>	2291	2301	2311	2325			
3	Steel root	A	100 % CO <sub>2</sub>	2502	2501	2499	2500			
3	Steel root	B	Ar + 8-12 % CO <sub>2</sub>	2295	2305	2315	2329			
3	Steel root	C	Ar + 15-25 % CO <sub>2</sub>	2296	2306	2316	2330			
3	Steel root	D	Ar + 3-6 % O <sub>2</sub>	2294	2304	2314	2328			
4	Rutil FCW	A	100 % CO <sub>2</sub>		2410		2321			
4	Rutil FCW	C	Ar + 15-25 % CO <sub>2</sub>		2411		2320			
5	Basic FCW	A	100 % CO <sub>2</sub>				2317			
5	Basic FCW	C	Ar + 15-25 % CO <sub>2</sub>				2318			
6	Metal cored	B	Ar + 8-12 % CO <sub>2</sub>		2420		2385			
6	Metal cored	C	Ar + 15-25 % CO <sub>2</sub>		2421		2536			
7	Self-shielded				2350		2349			

\* Diameter = 0.6 mm (0.024 inch)

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 % CO <sub>2</sub>	2427	2402	2426	2405			
3	Stainless Steel root	F	Ar + 2,5 % CO <sub>2</sub>	2440	2441	2442	2443			
8	FCW Stainless Steel	C	Ar + 18 % CO <sub>2</sub>		2423		2424			
8	AlMg5	E	100 % Ar			3639	3643			
1	AlSi5	E	100 % Ar			3640	3092			
8	CuSi3	F	100 % Ar (Ar + 2,5 % CO <sub>2</sub> )	2496	2495	2493	2497			

**TSt 2700c MP  
USA welding pro-  
gram table**

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

**UID 3826 welding program database**

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 <sub>2</sub>	2290	2300	2310	2322			
1	Steel	B	Ar + 8-12 % CO <sub>2</sub>	2418	2370	2308	2377			
1	Steel	C	Ar + 15-25 % CO <sub>2</sub>	2419	2369	2309	2376			
1	Steel	D	Ar + 3-6 % O <sub>2</sub>	2372	2371	2307	2378			
2	Steel dynamic	B	Ar + 8-12 % CO <sub>2</sub>	2374	2367	2312	2380			
2	Steel dynamic	C	Ar + 15-25 % CO <sub>2</sub>	2375	2366	2313	2379			
2	Steel dynamic	D	Ar + 3-6 % O <sub>2</sub>	2373	2368	2311	2381			
3	Steel root	A	100 % CO <sub>2</sub>	2502	2501	2499	2500			
3	Steel root	B	Ar + 8-12 % CO <sub>2</sub>	2295	2364	2315	2383			
3	Steel root	C	Ar + 15-25 % CO <sub>2</sub>	2296	2363	2316	2382			
3	Steel root	D	Ar + 3-6 % O <sub>2</sub>	2294	2365	2314	2384			
4	Rutil FCW	A	100 % CO <sub>2</sub>		2471		2472			
4	Rutil FCW	C	Ar + 15-25 % CO <sub>2</sub>		2470		2456			
5	Basic FCW	A	100 % CO <sub>2</sub>				2474			
5	Basic FCW	C	Ar + 15-25 % CO <sub>2</sub>				2473			
6	Metal cored	B	Ar + 8-12 % CO <sub>2</sub>		2420		2385			
6	Metal cored	C	Ar + 15-25 % CO <sub>2</sub>		2421		2386			
7	Self-shielded				2350		2349			

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
2	Steel dynamic	F	Ar + 8-12 % CO <sub>2</sub>		2462					
3	Stainless Steel root	F	Ar + 2,5 % CO <sub>2</sub>	2440	2441	2442	2443			
6	FCW Stainless Steel	F	Ar + 18 % CO <sub>2</sub>		2423		2424			
8	Stainless Steel	A	Ar + 90He + 2,5 % CO <sub>2</sub>		2404		2407			
8	Stainless Steel	B	Ar + 33He + 1 % CO <sub>2</sub>		2403		2406			
8	Stainless Steel	C	Ar + 2,5 % CO <sub>2</sub>	2427	2402	2426	2405			
6	FCW Stainless Steel	F	Ar + 18 % CO <sub>2</sub>		2423		2424			
8	FCW MAP409Ti	D	Ar + 2 % O <sub>2</sub>				2464			
8	AlMg5	E	100 % Ar			3639	3643			
1	AlSi5	E	100 % Ar			3640	3092			
8	CuSi3	F	100 % Ar (Ar + 2,5 % CO <sub>2</sub> )	2496	2495	2493	2497			

**TSt 3500c MP  
welding program  
table**

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

**UID 3787 welding program database**

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 <sub>2</sub>	3813	3812	3811	2322	2334		3814*
1	Steel	B	Ar + 8 % CO <sub>2</sub>	2288	2298	2308	2324	2332		
1	Steel	C	Ar + 18 % CO <sub>2</sub>	3809	3808	3806	2488	2489		3810*
1	Steel	D	Ar + 4 % O <sub>2</sub>	2285	2297	2307	2323	2331		
2	Steel dynamic	B	Ar + 8 % CO <sub>2</sub>	2292	2302	2312	2326	2336		
2	Steel dynamic	C	Ar + 18 % CO <sub>2</sub>	2293	2303	2313	2327	2337		
2	Steel dynamic	D	Ar + 4 % O <sub>2</sub>	2291	2301	2311	2325	2335		
3	Steel root	A	100 % CO <sub>2</sub>	2502	2501	2499	2500			
3	Steel root	B	Ar + 8 % CO <sub>2</sub>	2295	2305	2315	2329	2339		
3	Steel root	C	Ar + 18 % CO <sub>2</sub>	2296	2306	2316	2330	2340		
3	Steel root	D	Ar + 4 % O <sub>2</sub>	2294	2304	2314	2328	2338		
4	Rutil FCW	A	100 % CO <sub>2</sub>		2410		2321	2391	2345	
4	Rutil FCW	C	Ar + 18 % CO <sub>2</sub>		2411		2320	2390	2344	
5	Basic FCW	A	100 % CO <sub>2</sub>				2317	2433	2342	
5	Basic FCW	C	Ar + 18 % CO <sub>2</sub>				2318	2432	2341	
6	Metal cored	B	Ar + 8 % CO <sub>2</sub>		2420		2385	2387	2415	
6	Metal cored	C	Ar + 18 % CO <sub>2</sub>		2421		2536	2388	2343	
7	Self-shielded		Self-shielded		2350		2349		2348	

\* Diameter = 0.6 mm (0.024 inch)

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 % CO <sub>2</sub>	2427	2402	2426	2405		2428	
3	Stainless Steel root	F	Ar + 2,5 % CO <sub>2</sub>	2440	2441	2442	2443			
8	FCW Stainless Steel	C	Ar + 18 % CO <sub>2</sub>		2423		2424		2425	
8	AlMg 5	E	100 % Ar			3639	3643			
1	AlSi	E	100 % Ar			3640	3092			
8	CuSi 3	F	SP	2496	2495	2493	2497		2498	

**TSt 350c MP  
USA welding pro-  
gram table**

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

**UID 3787 welding program database**

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 <sub>2</sub>	2290	2300	2310	2322	2334		
1	Steel	B	Ar + 10 % CO <sub>2</sub>	2418	2370	2308	2377	2409		
1	Steel	C	Ar + 25 % CO <sub>2</sub>	2419	2369	2309	2376	2333		
1	Steel	D	Ar + 5 % O <sub>2</sub>	2372	2371	2307	2378	2408		
2	Steel dynamic	B	Ar + 10 % CO <sub>2</sub>	2374	2367	2312	2380	2336		
2	Steel dynamic	C	Ar + 25 % CO <sub>2</sub>	2375	2366	2313	2379	2337		
2	Steel dynamic	D	Ar + 5 % O <sub>2</sub>	2373	2368	2311	2381	2335		
3	Steel root	A	100 % CO <sub>2</sub>	2502	2501	2499	2500			
3	Steel root	B	Ar + 10 % CO <sub>2</sub>	2295	2364	2315	2383	2339		
3	Steel root	C	Ar + 25 % CO <sub>2</sub>	2296	2363	2316	2382	2340		2643*
3	Steel root	D	Ar + 5 % O <sub>2</sub>	2294	2365	2314	2384	2338		
4	Rutil FCW	A	100 % CO <sub>2</sub>		2471		2472	2467	2469	
4	Rutil FCW	C	Ar + 25 % CO <sub>2</sub>		2470		2456	2466	2468	
5	Basic FCW	A	100 % CO <sub>2</sub>				2474	2433	2476	
5	Basic FCW	C	Ar + 25 % CO <sub>2</sub>				2473	2432	2475	
6	Metal cored	B	Ar + 10 % CO <sub>2</sub>		2420		2385	2387	2415	
6	Metal cored	C	Ar + 25 % CO <sub>2</sub>		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
2	Steel dynamic	F	Ar + 10 % CO2		2462					
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			3639	3643			
1	AlSi	E	100 % Ar			3640	3092			
8	CuSi 3	F	SP	2496	2495	2493	2497			

\* Diameter = 1.2 mm (0.45 inch)









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