Operating instructions

EN

Welding machine

Tetrix 351 Synergic FW
Tetrix 401 Synergic FW
Tetrix 451 Synergic FW
Tetrix 551 Synergic FW

099-000090-EW501 | Observe additional system documents! | 07.11.2017

General instructions

⚠ WARNING

Read the operating instructions!
The operating instructions provide an introduction to the safe use of the products.

- Read and observe the operating instructions for all system components, especially the safety instructions and warning notices!
- Observe the accident prevention regulations and any regional regulations!
- The operating instructions must be kept at the location where the machine is operated.
- Safety and warning labels on the machine indicate any possible risks.
  Keep these labels clean and legible at all times.
- The machine has been constructed to state-of-the-art standards in line with any applicable regulations and industrial standards. Only trained personnel may operate, service and repair the machine.
- Technical changes due to further development in machine technology may lead to a differing welding behaviour.

☞ ***In the event of queries on installation, commissioning, operation or special conditions at the installation site, or on usage, please contact your sales partner or our customer service department on +49 2680 181-0.***

A list of authorised sales partners can be found at www.ewm-group.com.

Liability relating to the operation of this equipment is restricted solely to the function of the equipment. No other form of liability, regardless of type, shall be accepted. This exclusion of liability shall be deemed accepted by the user on commissioning the equipment.
The manufacturer is unable to monitor whether or not these instructions or the conditions and methods are observed during installation, operation, usage and maintenance of the equipment.

An incorrectly performed installation can result in material damage and injure persons as a result. For this reason, we do not accept any responsibility or liability for losses, damages or costs arising from incorrect installation, improper operation or incorrect usage and maintenance or any actions connected to this in any way.

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1 Contents

2 For your safety

2.1 Notes on the use of these operating instructions

⚠ DANGER

Working or operating procedures which must be closely observed to prevent imminent serious and even fatal injuries.

- Safety notes include the "DANGER" keyword in the heading with a general warning symbol.
- The hazard is also highlighted using a symbol on the edge of the page.

⚠ WARNING

Working or operating procedures which must be closely observed to prevent serious and even fatal injuries.

- Safety notes include the "WARNING" keyword in the heading with a general warning symbol.
- The hazard is also highlighted using a symbol in the page margin.

⚠ CAUTION

Working or operating procedures which must be closely observed to prevent possible minor personal injury.

- The safety information includes the "CAUTION" keyword in its heading with a general warning symbol.
- The risk is explained using a symbol on the edge of the page.

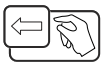
☞ ***Special technical points which users must observe.***

Instructions and lists detailing step-by-step actions for given situations can be recognised via bullet points, e.g.:

- Insert the welding current lead socket into the relevant socket and lock.

2.2 Explanation of icons

Symbol	Description
	Indicates technical aspects which the user must observe.
	Switch off machine
	Switch on machine
	Wrong
	Correct
	Menu entry
	Navigating the menu
	Exit menu
	Time representation (e.g.: wait 4 s/activate)
	Interruption in the menu display (other setting options possible)
	Tool not required/do not use
	Tool required/use

Symbol	Description
	Activate and release/tap/tip
	Release
	Press and keep pressed
	Switch
	Turn
	Numerical value – adjustable
	Signal light lights up in green
	Signal light flashes green
	Signal light lights up in red
	Signal light flashes red

2.3 Part of the complete documentation

☞ ***These operating instructions are part of the complete documentation and valid only in combination with all other parts of these instructions! Read and observe the operating instructions for all system components, especially the safety instructions!***

The illustration shows a general example of a welding system.

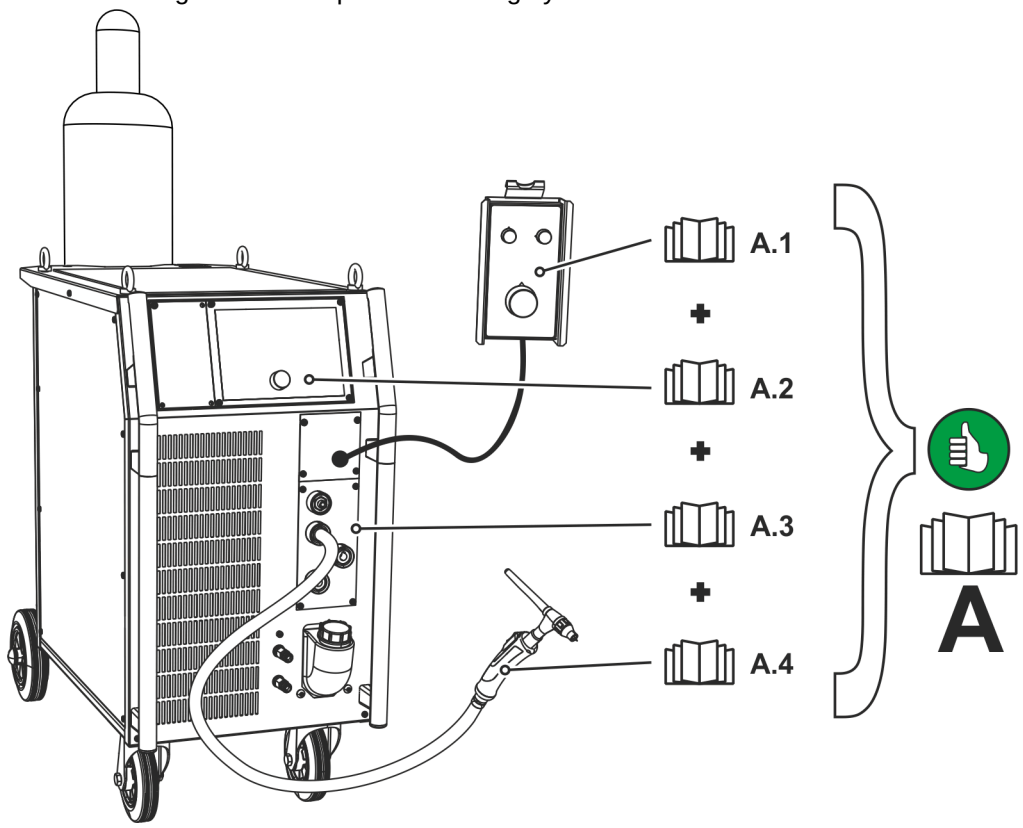


Figure 2-1

Item	Documentation
A.1	Remote control
A.2	Control
A.3	Power source
A.4	Welding torch
A	Complete documentation

2.4 Safety instructions

⚠ WARNING

Risk of accidents due to non-compliance with the safety instructions!
Non-compliance with the safety instructions can be fatal!

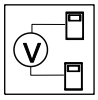
- Carefully read the safety instructions in this manual!
- Observe the accident prevention regulations and any regional regulations!
- Inform persons in the working area that they must comply with the regulations!

⚠ WARNING

Risk of injury from electrical voltage!

Voltages can cause potentially fatal electric shocks and burns on contact. Even low voltages can cause a shock and lead to accidents.

- Never touch live components such as welding current sockets or stick, tungsten or wire electrodes!
- Always place torches and electrode holders on an insulated surface!
- Wear the full personal protective equipment (depending on the application)!
- The machine may only be opened by qualified personnel!



Hazard when interconnecting multiple power sources!

If a number of power sources are to be connected in parallel or in series, only a technical specialist may interconnect the sources as per standard *IEC 60974-9:2010: Installation and use* and German Accident Prevention Regulation BVG D1 (formerly VBG 15) or country-specific regulations.

Before commencing arc welding, a test must verify that the equipment cannot exceed the maximum permitted open circuit voltage.

- Only qualified personnel may connect the machine.
- When taking individual power sources out of operation, all mains and welding current leads must be safely disconnected from the welding system as a whole. (Hazard due to reverse polarity voltage!)
- Do not interconnect welding machines with pole reversing switch (PWS series) or machines for AC welding since a minor error in operation can cause the welding voltages to be combined, which is not permitted.

Risk of injury due to improper clothing!

During arc welding, radiation, heat and voltage are sources of risk that cannot be avoided. The user has to be equipped with the complete personal protective equipment at all times. The protective equipment has to include:

- Respiratory protection against hazardous substances and mixtures (fumes and vapours); otherwise implement suitable measures such as extraction facilities.
- Welding helmet with proper protection against ionizing radiation (IR and UV radiation) and heat.
- Dry welding clothing (shoes, gloves and body protection) to protect against warm environments with conditions comparable to ambient temperatures of 100 °C or higher and arcing and work on live components.
- Hearing protection against harming noise.

Risk of injury due to radiation or heat!

Arc radiation can lead to skin and eye injuries.

Contact with hot workpieces and sparks can lead to burns.

- Use hand shield or welding helmet with the appropriate safety level (depends on the application).
- Wear dry protective clothing (e.g. hand shield, gloves, etc.) in accordance with the applicable regulations of your country.
- Persons who are not directly involved should be protected with a welding curtain or suitable safety screen against radiation and the risk of blinding!

Explosion risk!

Apparently harmless substances in closed containers may generate excessive pressure when heated.

- Move containers with inflammable or explosive liquids away from the working area!
- Never heat explosive liquids, dusts or gases by welding or cutting!

⚠ WARNING

Fire hazard!

Due to the high temperatures, sparks, glowing parts and hot slag that occur during welding, there is a risk of flames.

- Be watchful of potential sources of fire in the working area!
- Do not carry any easily inflammable objects, e.g. matches or lighters.
- Ensure suitable fire extinguishers are available in the working area!
- Thoroughly remove any residue of flammable materials from the workpiece prior to starting to weld.
- Only further process workpieces after they have cooled down. Do not allow them to contact any flammable materials!

⚠ CAUTION

Smoke and gases!

Smoke and gases can lead to breathing difficulties and poisoning. In addition, solvent vapour (chlorinated hydrocarbon) may be converted into poisonous phosgene due to the ultraviolet radiation of the arc!

- Ensure that there is sufficient fresh air!
- Keep solvent vapour away from the arc beam field!
- Wear suitable breathing apparatus if appropriate!

Noise exposure!

Noise exceeding 70 dBA can cause permanent hearing damage!

- Wear suitable ear protection!
- Persons located within the working area must wear suitable ear protection!

According to IEC 60974-10, welding machines are divided into two classes of electromagnetic compatibility (the EMC class can be found in the Technical data) > *see 8 chapter*:

Class A machines are not intended for use in residential areas where the power supply comes from the low-voltage public mains network. When ensuring the electromagnetic compatibility of class A machines, difficulties can arise in these areas due to interference not only in the supply lines but also in the form of radiated interference.

Class B machines fulfil the EMC requirements in industrial as well as residential areas, including residential areas connected to the low-voltage public mains network.

Setting up and operating

When operating arc welding systems, in some cases, electro-magnetic interference can occur although all of the welding machines comply with the emission limits specified in the standard. The user is responsible for any interference caused by welding.

In order to **evaluate** any possible problems with electromagnetic compatibility in the surrounding area, the user must consider the following: (see also EN 60974-10 Appendix A)

- Mains, control, signal and telecommunication lines
- Radios and televisions
- Computers and other control systems
- Safety equipment
- The health of neighbouring persons, especially if they have a pacemaker or wear a hearing aid
- Calibration and measuring equipment
- The immunity to interference of other equipment in the surrounding area
- The time of day at which the welding work must be carried out

Recommendations for **reducing interference emission**

- Mains connection, e.g. additional mains filter or shielding with a metal tube
- Maintenance of the arc welding system
- Welding leads should be as short as possible and run closely together along the ground
- Potential equalization
- Earthing of the workpiece. In cases where it is not possible to earth the workpiece directly, it should be connected by means of suitable capacitors.
- Shielding from other equipment in the surrounding area or the entire welding system

⚠ CAUTION

Electromagnetic fields!

The power source may cause electrical or electromagnetic fields to be produced which could affect the correct functioning of electronic equipment such as IT or CNC devices, telecommunication lines, power cables, signal lines and pacemakers.

- Observe the maintenance instructions > *see 6.3 chapter*!
- Unwind welding leads completely!
- Shield devices or equipment sensitive to radiation accordingly!
- The correct functioning of pacemakers may be affected (obtain advice from a doctor if necessary).

☞ ***Obligations of the operator!***

The respective national directives and laws must be complied with when operating the machine!

- ***Implementation of national legislation relating to framework directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work and associated individual guidelines.***
- ***In particular, directive 89/655/EEC concerning the minimum safety and health requirements for the use of work equipment by workers at work.***
- ***The regulations applicable to occupational safety and accident prevention in the country concerned.***
- ***Setting up and operating the machine as per IEC 60974.-9.***
- ***Brief the user on safety-conscious work practices on a regular basis.***
- ***Regularly inspect the machine as per IEC 60974.-4.***

☞ ***The manufacturer's warranty becomes void if non-genuine parts are used!***

- ***Only use system components and options (power sources, welding torches, electrode holders, remote controls, spare parts and replacement parts, etc.) from our range of products!***
- ***Only insert and lock accessory components into the relevant connection socket when the machine is switched off.***

☞ ***Requirements for connection to the public mains network***

High-performance machines can influence the mains quality by taking current from the mains network. For some types of machines, connection restrictions or requirements relating to the maximum possible line impedance or the necessary minimum supply capacity at the interface with the public network (Point of Common Coupling, PCC) can therefore apply. In this respect, attention is also drawn to the machines' technical data. In this case, it is the responsibility of the operator, where necessary in consultation with the mains network operator, to ensure that the machine can be connected.

2.5 Transport and installation

⚠ WARNING

Risk of injury due to improper handling of shielding gas cylinders!
Improper handling and insufficient securing of shielding gas cylinders can cause serious injuries!

- Observe the instructions from the gas manufacturer and any relevant regulations concerning the use of compressed air!
- Do not attach any element to the shielding gas cylinder valve!
- Prevent the shielding gas cylinder from heating up.

⚠ CAUTION

Risk of accidents due to supply lines!
During transport, attached supply lines (mains leads, control cables, etc.) can cause risks, e.g. by causing connected machines to tip over and injure persons!

- Disconnect all supply lines before transport!

Risk of tipping!
There is a risk of the machine tipping over and injuring persons or being damaged itself during movement and set up. Tilt resistance is guaranteed up to an angle of 10° (according to IEC 60974-1).

- Set up and transport the machine on level, solid ground.
- Secure add-on parts using suitable equipment.

Risk of accidents due to incorrectly installed leads!
Incorrectly installed leads (mains, control and welding leads or intermediate hose packages) can present a tripping hazard.

- Lay the supply lines flat on the floor (avoid loops).
- Avoid laying the leads on passage ways.

☞ ***The units are designed for operation in an upright position!***
Operation in non-permissible positions can cause equipment damage.

- ***Only transport and operate in an upright position!***

☞ ***Accessory components and the power source itself can be damaged by incorrect connection!***

- ***Only insert and lock accessory components into the relevant connection socket when the machine is switched off.***
- ***Comprehensive descriptions can be found in the operating instructions for the relevant accessory components.***
- ***Accessory components are detected automatically after the power source is switched on.***

☞ ***Protective dust caps protect the connection sockets and therefore the machine against dirt and damage.***

- ***The protective dust cap must be fitted if there is no accessory component being operated on that connection.***
- ***The cap must be replaced if faulty or if lost!***

3 Intended use

⚠ WARNING

§ **Hazards due to improper usage!**
The machine has been constructed to the state of the art and any regulations and standards applicable for use in industry and trade. It may only be used for the welding procedures indicated at the rating plate. Hazards may arise for persons, animals and material objects if the equipment is not used correctly. No liability is accepted for any damages arising from improper usage!

- The equipment must only be used in line with its designated purpose and by trained or expert personnel!
- Do not improperly modify or convert the equipment!

3.1 Applications

Arc welding machines for TIG DC welding with lift arc (touch starting) or HF ignition (contactless) and MMA welding as secondary process. It may be possible to expand the functionality by using accessories (see the documentation in the relevant chapter).

3.2 Documents which also apply

3.2.1 Warranty

☞ ***For more information refer to the "Warranty registration" brochure supplied and our information regarding warranty, maintenance and testing at www.ewm-group.com!***

3.2.2 Declaration of Conformity

CE **The labelled machine complies with the following EC directives in terms of its design and construction:**

- Low Voltage Directive (LVD)
- Electromagnetic Compatibility Directive (EMC)
- Restriction of Hazardous Substance (RoHS)

In case of unauthorised changes, improper repairs, non-compliance with specified deadlines for "Arc Welding Equipment – Inspection and Testing during Operation," and/or prohibited modifications which have not been explicitly authorised by the manufacturer, this declaration shall be voided. An original document of the specific declaration of conformity is included with every product.

3.2.3 Welding in environments with increased electrical hazards

S **In compliance with IEC / DIN EN 60974, VDE 0544 the machines can be used in environments with an increased electrical hazard.**

3.2.4 Service documents (spare parts and circuit diagrams)

⚠ WARNING

Do not carry out any unauthorised repairs or modifications!
To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!
The warranty becomes null and void in the event of unauthorised interference.

- Appoint only skilled persons for repair work (trained service personnel)!

Original copies of the circuit diagrams are enclosed with the unit.

Spare parts can be obtained from the relevant authorised dealer.

3.2.5 Calibration/Validation

We hereby confirm that this machine has been tested using calibrated measuring equipment, as stipulated in IEC/EN 60974, ISO/EN 17662, EN 50504, and complies with the admissible tolerances. Recommended calibration interval: 12 months

4 Machine description – quick overview

4.1 Front view

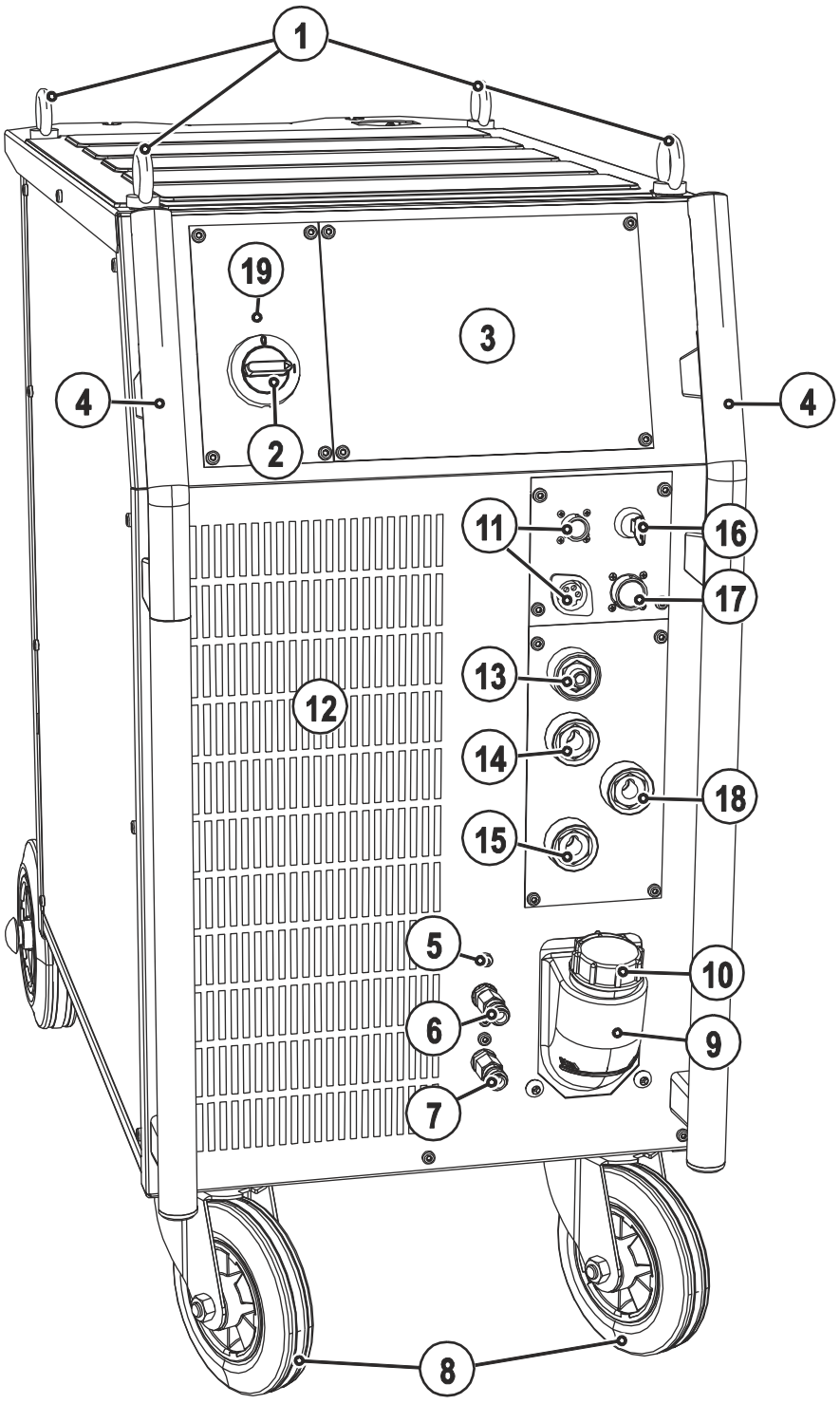


Figure 4-1

Item	Symbol	Description
1		**Lifting lug**
2		**Main switch, machine on/off**
3		**Machine control** > ***see 4.3 chapter***
4		**Carrying handle**
5		**Automatic cut-out of coolant pump key button** press to reset a triggered fuse
6		**Quick connect coupling (red)** coolant return
7		**Quick connect coupling (blue)** coolant supply
8		**Wheels, guide castors**
9		**Coolant tank**
10		**Coolant tank cap**
11		**Connection socket, welding torch control cable** > ***see 5.3.1.1 chapter***
12		**Cooling air inlet**
13		**G¼" connecting nipple, "-" welding current** Shielding gas connection (with yellow insulating cap) for TIG welding torch
14		**Connection socket, "-" welding current** TIG welding torch connection
15		**Connection socket, "+" welding current** Connection for workpiece lead
16		**Key switch to protect against unauthorised use (retrofitting option)** Position 1: changes possible. Position 0: no changes possible. *> see 5.11 chapter*.
17		**Connection socket, 19-pole** Remote control connection
18		**Connection socket, "-" welding current** Electrode holder connection
19		**Operating state signal lamp** Lights up when the machine is ready for use.

4.2 Rear view

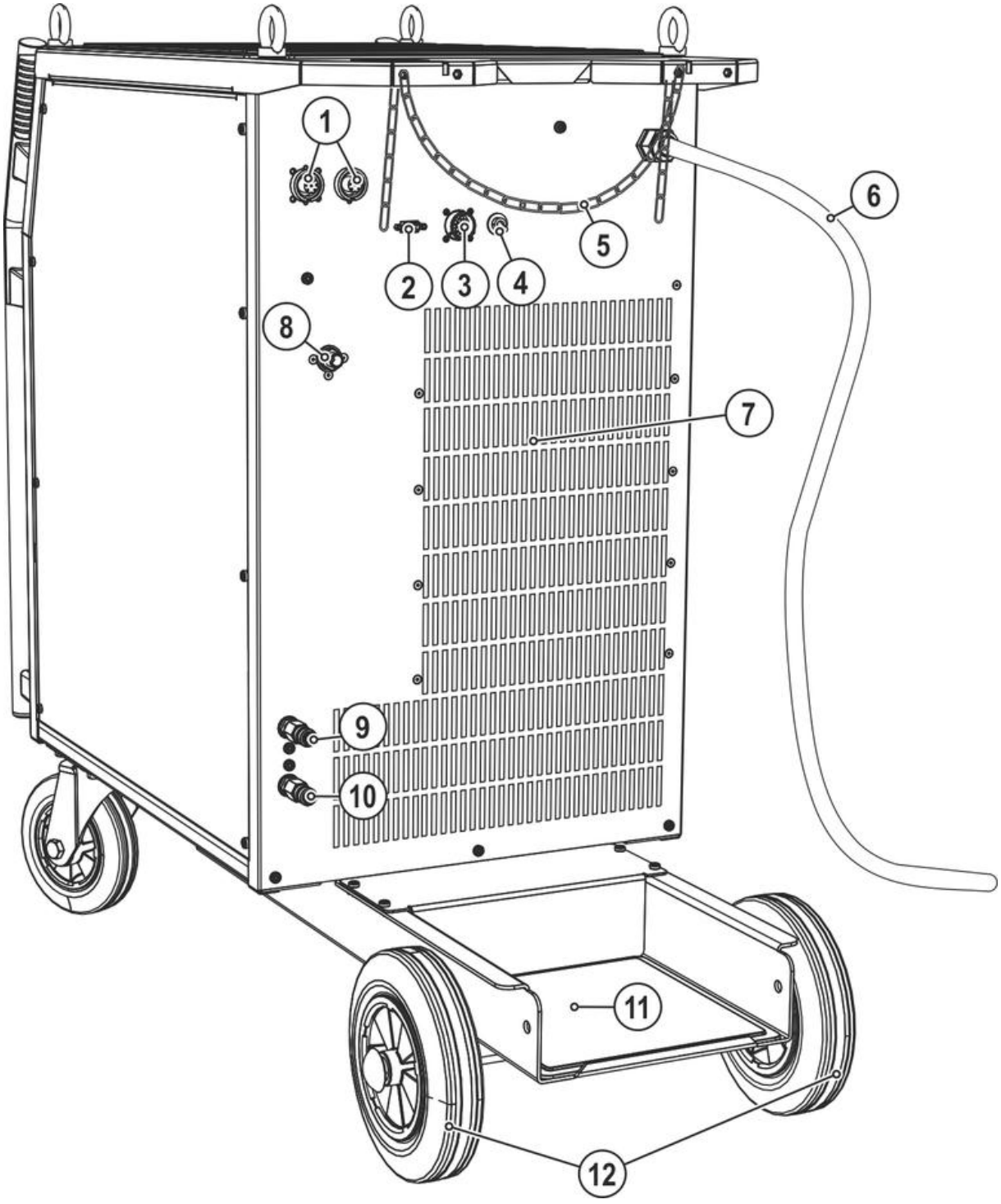


Figure 4-2

Item	Symbol	Description
1		**Connection socket, 7-pole (digital)** To connect digital accessories Retrofitting option > *see 9 chapter*
2		**PC interface, serial (D-Sub connection socket, 9-pole)**
3		**Automation interface 19-pin (analogue)** Option for retrofitting > *see 5.8.1 chapter*
4		**Ignition type changeover switch > *see 5.3.10 chapter*** HF =------ Liftarc (contact ignition) HF = ------ HF ignition
5		**Securing elements for shielding gas cylinder (strap/chain)**
6		**Mains connection cable > *see 5.1.7 chapter***
7		**Cooling air outlet**
8		**G¼" connecting nipple** Shielding gas connection on the pressure regulator.
9		**Quick connect coupling (red)** coolant return
10		**Quick connect coupling (blue)** coolant supply
11		**Bracket for shielding gas cylinder**
12		**Wheels, fixed castors**

4.3 Machine control – Operating elements

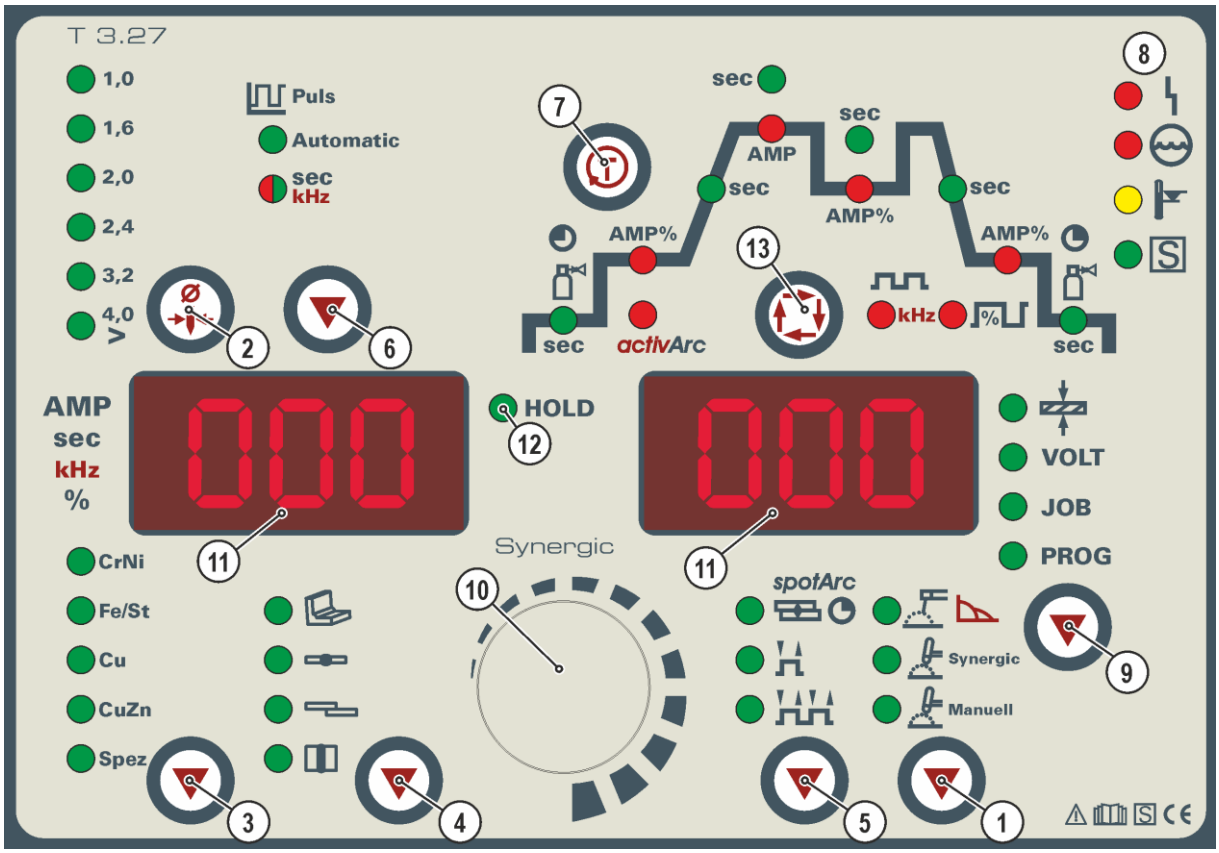


Figure 4-3

Item	Symbol	Description
1	▼	**"Welding process" button** MMA welding, lights up in green / arcforce setting, lights up in red TIG synergic welding (synergic parameter setting) TIG manual welding (manual parameter setting)
2	Ø	**Electrode diameter push-button > *see 5.4.2 chapter*** Ignition optimisation (TIG) > *see 5.3.9 chapter*
3	▼	**"Select material type" button** CrNi ----- Chrome nickel alloys FeSt ----- Iron and steel alloys Cu ------- Copper or copper alloys (bronzes) CuZn ---- Copper zinc alloys (brass) Spez ---- Special (for special custom-built tasks)
4	▼	Select seam type button ------- Fillet weld ------- Butt joint ------ Fillet weld - lap joint -------- Vertical-down
5	▼	**Operating mode / Power-saving mode button** spotArc -- spotArc / spotmatic (spot time setting range) --------- Non-latched ------ Latched Press for 3 s to put machine into power-saving mode. To reactivate, activate one of the operating elements > *see 5.10 chapter*.

Item	Symbol	Description
6	▼	**Pulsing push-button** Automatic -- TIG automated pulsing (frequency and balance) sec kHz -------- Signal light lights up in green: Pulsing (thermal pulsing)/MMA pulse welding sec kHz -------- Signal light lights up in red: kHz pulsing (metallurgical pulsing)
7	Ⓣ	**Gas test/rinse hose package button** ***> see 5.3.2 chapter***
8	● ϟ ● ≈ ● ⊢ ● S	**Error/status indicators** ϟ ------- Collective interference signal light ≈ - Water deficiency signal light (welding torch cooling) ⊢ ---------- Excess temperature signal light S --------- S safety sign signal light
9	▼	**Display switching button** ------- Material thickness display VOLT --- Welding voltage display JOB ----- JOB number display PROG --- Program number display
10	◌	**Welding parameter setting rotary dial** Setting currents, times and parameters.
11	000	**Welding data display (3-digit)** Displays the welding parameters and the corresponding values *> see 5.2 chapter*
12	Hold	**Signal light Status display** After each completed welding task, the last values used in the welding process for the welding current and welding voltage are shown on the displays, and the signal light will be on
13		**Functional sequence *> see 4.3.1 chapter***

4.3.1 Function sequence

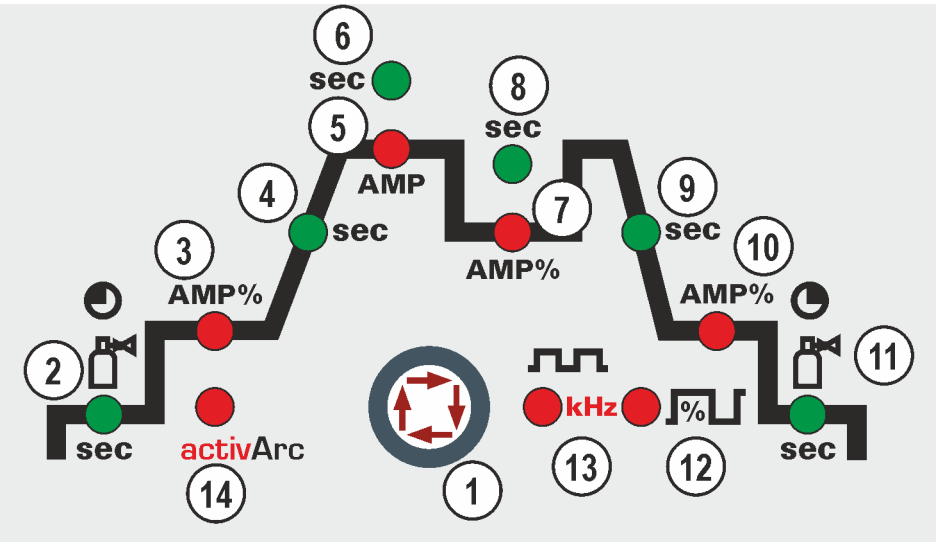


Figure 4-4

Item	Symbol	Description
1	◌	**Select welding parameters button** This button is used to select the welding parameters depending on the welding process and operating mode used.

Item	Symbol	Description	
2		**Gas pre-flow time signal light** GPr	
3	**AMP%**	**Signal light** Ignition current I SE (TIG)/hot start current I hE (MMA)	
4	**sec**	**Signal light** Up-slope time tUP (TIG)/hot start time thE (MMA)	
5	**AMP**	**Main current (TIG) / pulse current** I min to I max (1 A increments)	**Main current (MMA)** I min to I max (1 A increments)
6	sec	**Pulse time t 1 / slope time tS1 from AMP% to AMP / Spot time**	
7	**AMP%**	**Secondary current (TIG)**	
8	sec	**Pulse pause time t 2 / slope time tS2 from AMP to AMP%** The pulse time applies to the secondary current phase (AMP%)	
9	**sec**	**Down-slope time tdn signal light**	
10	**AMP%**	**End current signal light I Ed**	
11		**Gas post-flow time GPt**	
12		**Balance signal light bAL** Pulse balance	
13		**Frequency signal light FrE** Pulse frequency	
14	activArc	**Signal light activArc AA > *see 5.3.14 chapter***	

5 Design and function

⚠ WARNING

Risk of injury from electrical voltage!
Contact with live parts, e.g. power connections, can be fatal!

- Observe the safety information on the first pages of the operating instructions!
- Commissioning must be carried out by persons who are specifically trained in handling power sources!
- Connect connection or power cables while the machine is switched off!

⚠ CAUTION

Risk from electrical current!
If welding is carried out alternately using different methods and if a welding torch and an electrode holder remain connected to the machine, the open-circuit/welding voltage is applied simultaneously on all cables.

- The torch and the electrode holder should therefore always be placed on an insulated surface before starting work and during breaks.

☞ ***Read and observe the documentation to all system and accessory components!***

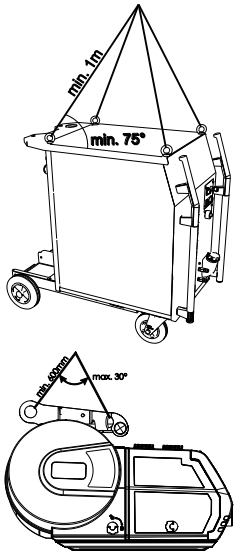
5.1 Transport and installation

5.1.1 Lifting by crane

⚠ WARNING

Risk of injury during lifting by crane!
When lifting the machine by crane, persons may be severely injured by falling machines or mount-on components.

- Simultaneous lifting of system components such as power source, wire feeder or cooling unit without suitable crane components is not allowed. Each system component has to be lifted separately!
- Remove any supply leads and accessories before lifting by crane (e.g. hose package, wire spool, shielding gas cylinder, toolbox, wire feeder, remote control,etc.)!)
- Properly close and lock all casing covers and protective caps before lifting by crane!
- Use the correct number of hoisting equipment of the right size in the correct position! Observe craning principle (see figure)!
- For machines with lifting eyes: always lift all lifting eyes simultaneously!
- When using retrofitted craning frames etc.: always use at least two lifting points positioned as far apart as possible – observe option description.
- Avoid any jerky movements!
- Ensure that the load is distributed evenly! • Use chain hoists and chain slings of the same length only!
- Stay outside the danger zone underneath the machine!
- Observe the regulations regarding occupational safety and accident prevention for the respective country.



Craning principle

5.1.2 Ambient conditions

☞ ***T he machine must not be operated in the open air and must only be set up and operated on a suitable, stable and level base!***

- ***The operator must ensure that the ground is non-slip and level, and provide sufficient lighting for the place of work.***
- ***Safe operation of the machine must be guaranteed at all times.***

☞ ***Unusually high quantities of dust, acid, corrosive gases or substances may damage the equipment.***

- ***Avoid high volumes of smoke, vapour, oil vapour and grinding dust!***
- ***Avoid ambient air containing salt (sea air)!***

5.1.2.1 In operation

Temperature range of the ambient air:

- -25 °C to +40 °C

Relative air humidity:

- Up to 50% at 40 °C
- Up to 90% at 20 °C

5.1.2.2 Transport and storage

Storage in an enclosed space, temperature range of the ambient air:

- -30 °C to +70 °C

Relative air humidity

- Up to 90% at 20 °C

5.1.3 Machine cooling

☞ ***Insufficient ventilation results in a reduction in performance and equipment damage.***

- ***Observe the ambient conditions!***
- ***Keep the cooling air inlet and outlet clear!***
- ***Observe the minimum distance of 0.5 m from obstacles!***

5.1.4 Workpiece lead, general

⚠ CAUTION

Risk of burning due to incorrect welding current connection!
If the welding current plugs (machine connections) are not locked or if the workpiece connection is contaminated (paint, corrosion), these connections and leads can heat up and cause burns when touched!

- Check welding current connections on a daily basis and lock by turning to the right when necessary.
- Clean workpiece connection thoroughly and secure properly. Do not use structural parts of the workpiece as welding current return lead!

5.1.5 Welding torch cooling system

☞ ***Insufficient frost protection in the welding torch coolant!***
Depending on the ambient conditions, different liquids are used for cooling the welding torch > see 5.1.5.1 chapter.
Coolants with frost protection (KF 37E or KF 23E) must be checked regularly to ensure that the frost protection is adequate to prevent damage to the machine or the accessory components.

- ***The coolant must be checked for adequate frost protection with the TYP 1 frost protection tester .***
- ***Replace coolant as necessary if frost protection is inadequate!***

☞ ***Coolant mixtures!***
Mixtures with other liquids or the use of unsuitable coolants result in material damage and renders the manufacturer's warranty void!

- ***Only use the coolant described in this manual (overview of coolants).***
- ***Do not mix different coolants.***
- ***When changing the coolant, the entire volume of liquid must be changed.***

☞ ***Dispose of the coolant in accordance with local regulations and the material safety data sheets (German waste code number: 70104).***
May not be disposed of in household waste.
Prevent entry into sewers.
Absorb with liquid-binding material (sand, gravel, acid-binding agents, universal binding agents, sawdust).

5.1.5.1 Approved coolants overview

Coolant	Temperature range
KF 23E (Standard)	-10 °C to +40 °C
KF 37E	-20 °C to +10 °C

5.1.5.2 Maximal hose package length

	Pump 3.5 bar	Pump 4.5 bar
Machines with or without separate wire feeder	30 m	60 m
Compact machines with additional intermediate drive (example. miniDrive)	20 m	30 m
Machines with separate wire feeder and additional intermediate drive (example: miniDrive)	20 m	60 m

Data as a rule refer to the entire hose package length including welding torch. The pump output is shown on the type plate (parameter: Pmax).

Pump 3.5 bar: Pmax = 0.35 MPa (3.5 bar)

Pump 4.5 bar: Pmax = 0.45 MPa (4.5 bar)

5.1.5.3 Adding coolant

The unit is supplied ex works with a minimum level of coolant.

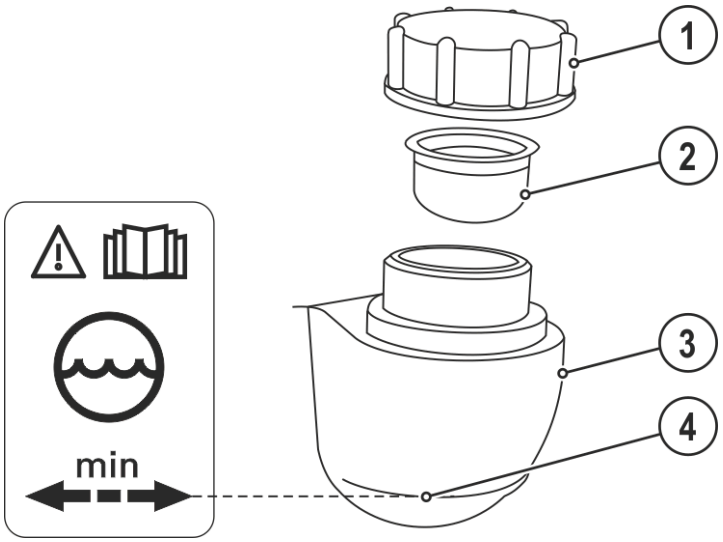


Figure 5-1

Item	Symbol	Description
1		**Coolant tank cap**
2		**Coolant filter sieve**
3		**Coolant tank**
4		**"Min" mark** Minimum coolant level

- Unscrew and remove the coolant tank sealing cover.
- Check filter sieve insert for dirt, clean if necessary and reinsert into position.
- Top up coolant to the filter sieve insert, close sealing cover again.

☞ ***If the cooling system is empty or only insufficiently filled with coolant, the coolant pump is automatically switched off after approx. one minute (protection against destruction). At the same time, the welding data display signals the lack of coolant or low coolant level.***

- ***Reset the coolant error, fill coolant and repeat the operation.***

☞ ***The level of coolant must never fall below the “min” mark.***

☞ ***If there is less coolant in the coolant tank than the minimum required you may need to vent the coolant circuit. In this case the welding machine will automatically shut down the coolant pump and signal an error, > see 7.6 chapter.***

5.1.6 Notes on the installation of welding current leads

☞ ***Incorrectly installed welding current leads can cause faults in the arc (flickering).***

Lay the workpiece lead and hose package of power sources without HF igniter (MIG/MAG) for as long and as close as possible in parallel.

Lay the workpiece lead and hose package of power sources with HF igniter (TIG) for as long as possible in parallel with a distance of 20 cm to avoid HF sparkover.

Always keep a distance of at least 20 cm to leads of other power sources to avoid interferences

Always keep leads as short as possible! For optimum welding results max. 30 m (welding lead + intermediate hose package + torch lead).

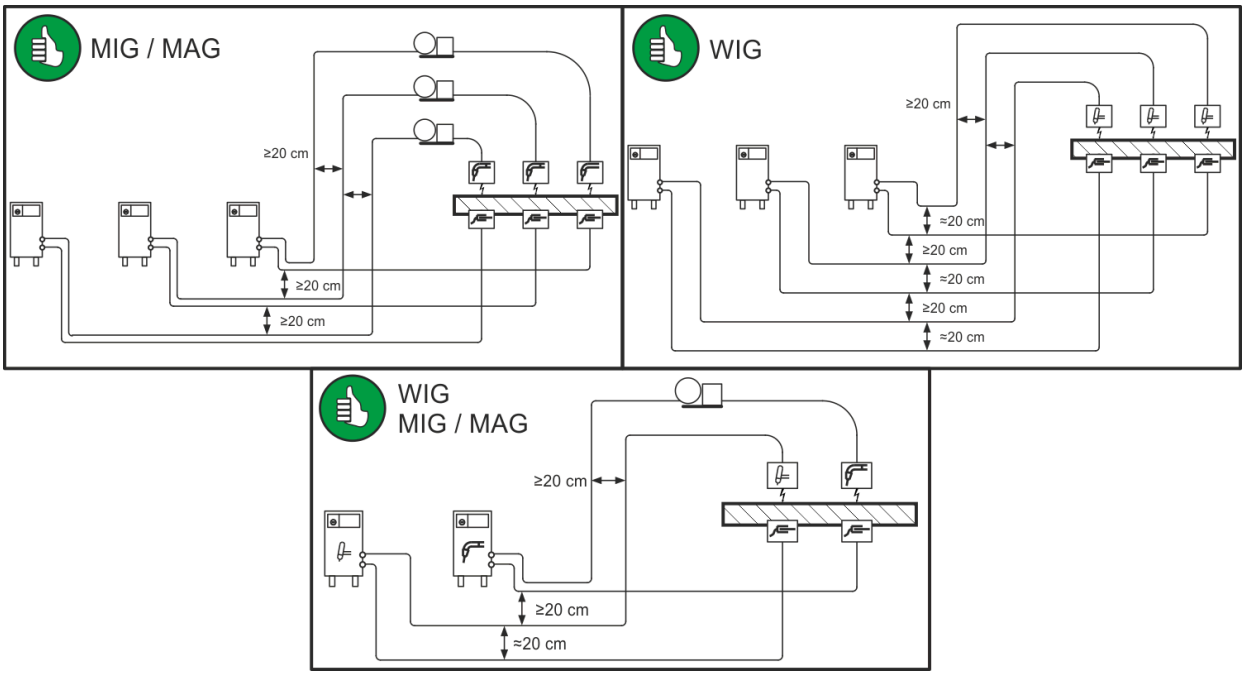


Figure 5-2

☞ ***Use an individual welding lead to the workpiece for each welding machine!***

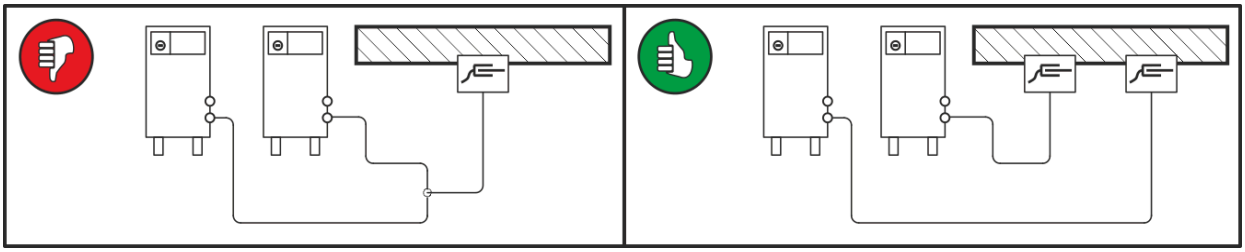


Figure 5-3

☞ ***Fully unroll welding current leads, torch hose packages and intermediate hose packages. Avoid loops!***

☞ ***Always keep leads as short as possible!***

☞ ***Lay any excess cable lengths in meanders.***

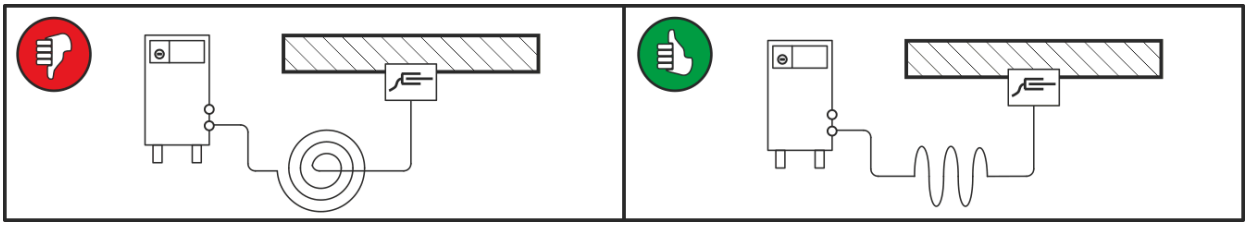


Figure 5-4

5.1.6.1 Stray welding currents

⚠ WARNING

Risk of injury due to stray welding currents!
Stray welding currents can destroy protective earth conductors, damage machines and electronic devices and cause overheating of components, leading to fire.

- Check that all welding current connections are firmly secured and electrical connections are in perfect condition.
- Set up, attach or suspend all conductive power source components such as casing, transport vehicles and crane frames so they are insulated.
- Do not place any other electronic devices such as drills or angle grinders on the power source, transport vehicle or crane frames unless they are insulated.
- Always put welding torches and electrode holders on an insulated surface when they are not in use.

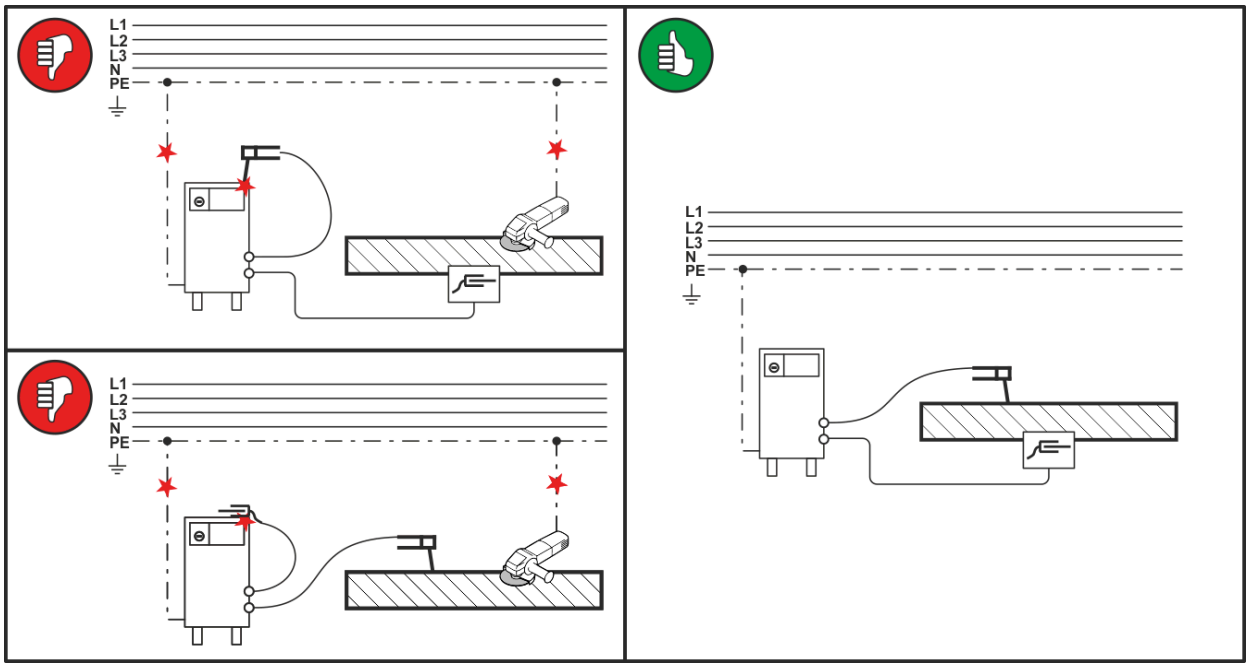


Figure 5-5

5.1.7 Mains connection

⚠ DANGER

Hazards caused by improper mains connection!
An improper mains connection can cause injuries or damage property!

- Only operate machine using a socket that has correctly fitted protective earth.
- The mains voltage indicated on the rating plate must match the supply voltage.
- If a new mains plug must be fitted, only an electrician may do so as per the relevant national legislation or regulations.
- Mains plug, socket and lead must be checked by an electrician on a regular basis.
- When operating the generator, always ensure it is earthed as stipulated in the operating instructions. The network created must be suitable for operating machines according to protection class I.

5.1.7.1 Mains configuration

☞ ***The machine may be connected to:***

- ***a three-phase system with four conductors and an earthed neutral conductor***
- ***a three-phase system with three conductors of which any one can be earthed, e.g. the outer conductor***

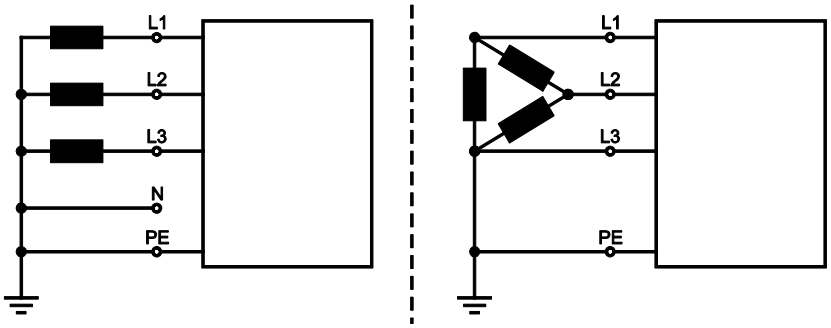


Figure 5-6

Legend

Item	Designation	Colour code
L1	Outer conductor 1	brown
L2	Outer conductor 2	black
L3	Outer conductor 3	grey
N	Neutral conductor	blue
PE	Protective conductor	green-yellow

- Insert mains plug of the switched-off machine into the appropriate socket.

5.2 Welding data display

The following welding parameters can be displayed before (nominal values), during (actual values) or after welding (hold values):

Parameter	Before welding (nominal values)	During welding (actual values)	After welding (hold values)
	left-hand display		
Welding current	☑	☑	☑
Parameter times	☑	☐	☐
Parameter currents	☑	☐	☐
	right-hand display		
Hot wire power	☑	☑	☑
Welding voltage	☑	☑	☑
JOB number	☑	☐	☐
Program number	☑	☐	☐

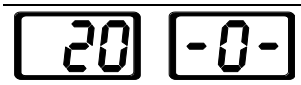
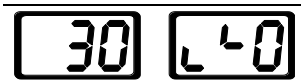
When the settings are changed (e.g. welding current) after welding when the hold values are displayed, the display will be switched to the relevant nominal values.

If the "Program number" signal light is on in addition to the " Hot wire power " signal light, the user is in program mode > *see 5.6 chapter*.

If the "JOB-number" signal light is on in addition to the " Hot wire power " light, the user is in a JOB in the free memory > *see 5.5.2 chapter*.

5.2.1 Welding parameter setting

During the welding parameter setting process, the parameter value being set is displayed on the left-hand display. The right-hand display shows the “Factory setting” or a variation of it upwards or downwards. Displays, e.g. when setting the ignition current, and their meanings:

Display	Meaning of the symbols shown in the right-hand display
	Increase parameter value To restore the factory settings.
	Factory setting Parameter value is on the optimum setting
	Reduce parameter value To restore the factory settings.

5.2.2 Setting the welding current (absolute/percentage)

The welding current for the ignition, secondary, end and hot start current can be set as a percentage of the main current AMP or as an absolute value. To select the display use the parameter  in the configuration menu <dg _ref_source_inline>Gerätekonfigurationsmenü</dg_ref_source_inline>.

> see 5.12 chapter

5.3 TIG welding

5.3.1 Welding torch and workpiece line connection

Prepare welding torch according to the welding task in hand (see operating instructions for the torch).

☞ ***Equipment damage due to improperly connected coolant pipes!***
If the coolant pipes are not properly connected or a gas-cooled welding torch is used, the coolant circuit is interrupted and equipment damage can occur.

- ***Connect all coolant pipes correctly!***
- ***Completely unroll the hose package and the torch hose package!***
- ***Observe maximal hose package length > see 5.1.5.2 chapter.***
- ***When using a gas-cooled welding torch, use a hose bridge to establish the coolant circuit > see 9 chapter.***

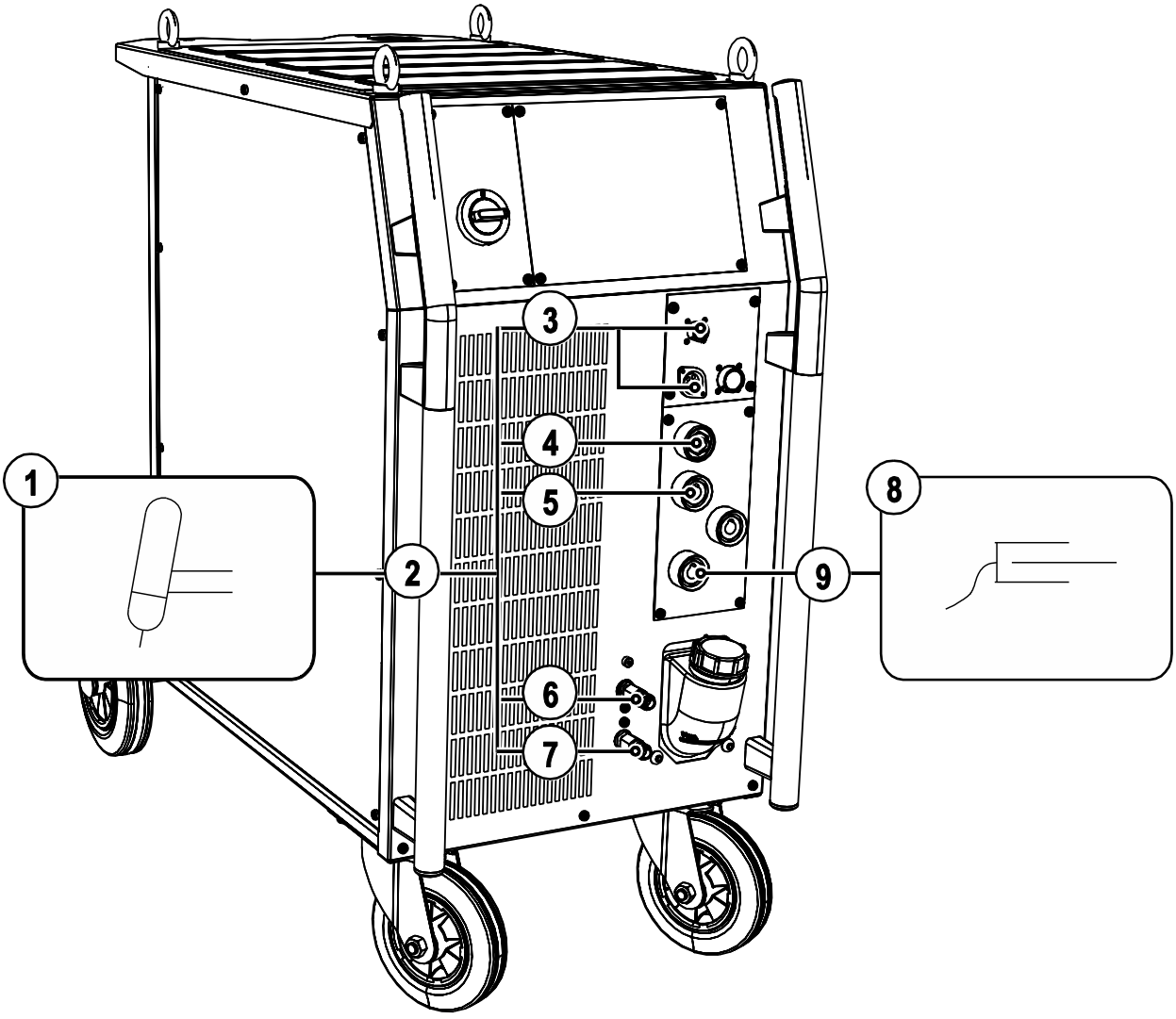
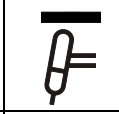


Figure 5-7

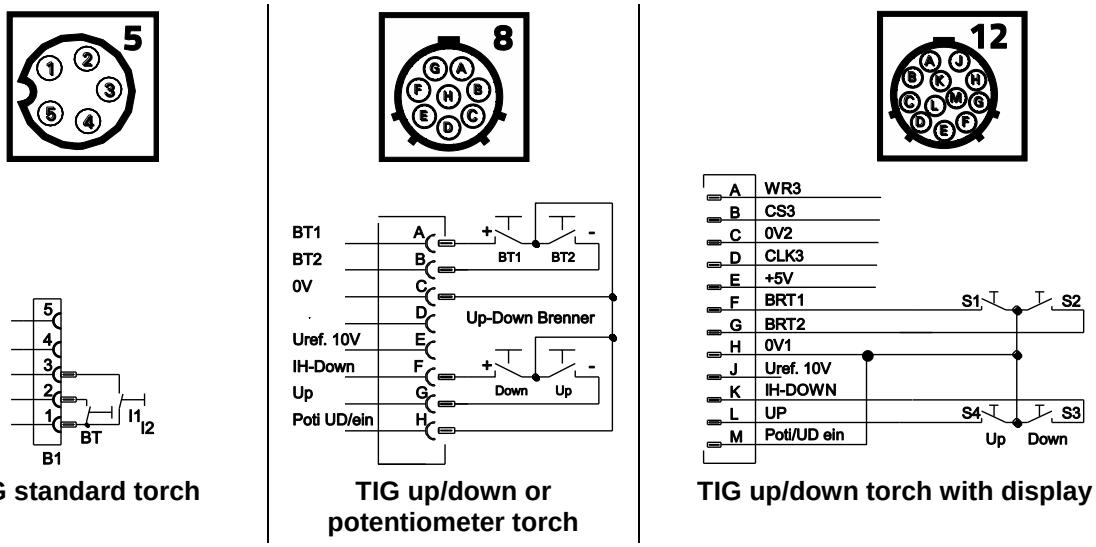
Item	Symbol	Description
1		**Welding torch**
2		**Welding torch hose package**
3		**Connection socket, welding torch control cable** ***> see 5.3.1.1 chapter***
4		**G¼" connecting nipple, "-" welding current** Shielding gas connection (with yellow insulating cap) for TIG welding torch

Item	Symbol	Description
5		**Connection socket, “-” welding current** TIG welding torch connection
6		**Quick connect coupling (red)** coolant return
7		**Quick connect coupling (blue)** coolant supply
8		**Workpiece**
9		**Connection socket, “+” welding current** Connection for workpiece lead

- Insert the welding current plug on the welding torch into the welding current connection socket and lock by turning to the right.
- Screw welding torch shielding gas connection tightly onto the G¼" connection nipple, welding current “-”.
- Plug the welding torch control cable plug into the welding torch control cable connection socket and secure.
- Lock connecting nipples of the cooling water tubes into the corresponding quick connect couplings: Return line red to quick connect coupling, red (coolant return) and supply line blue to quick connect coupling, blue (coolant supply).
- Insert the cable plug on the work piece lead into the "+" welding current connection socket and lock by turning to the right.

5.3.1.1 Connection assignment, welding torch control cable

TIG welding machines are equipped ex works with a dedicated connection socket for the welding torch control cable (5- or 8-pole). As mobile machines offer more free space, they may even feature two control cable connection sockets. The functionality increases with the number of poles. One of these connection sockets may be converted or retrofitted > *see 9 chapter*.



TIG standard torch | **TIG up/down or potentiometer torch** | **TIG up/down torch with display**

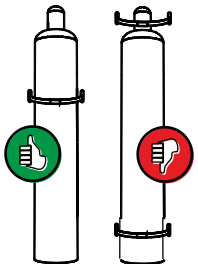
Figure 5-8

5.3.2 Shielding gas supply (shielding gas cylinder for welding machine)

⚠ WARNING

Risk of injury due to improper handling of shielding gas cylinders!
Improper handling and insufficient securing of shielding gas cylinders can cause serious injuries!

- Place shielding gas cylinder into the designated holder and secure with fastening elements (chain/belt)!
- Attach the fastening elements within the upper half of the shielding gas cylinder!
- The fastening elements must tightly enclose the shielding gas cylinder!



☞ ***An unhindered shielding gas supply from the shielding gas cylinder to the welding torch is a fundamental requirement for optimum welding results. In addition, a blocked shielding gas supply may result in the welding torch being destroyed.***

- ***Always re-fit the yellow protective cap when not using the shielding gas connection.***
- ***All shielding gas connections must be gas tight.***

5.3.2.1 Connecting the shielding gas supply

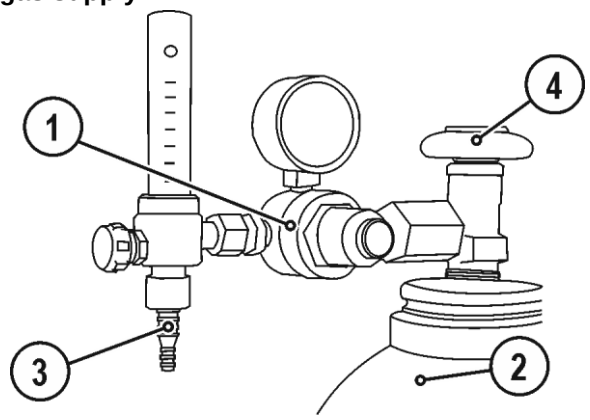


Figure 5-9

Item	Symbol	Description
1		Pressure regulator
2		Shielding gas cylinder
3		Output side of the pressure regulator
4		Cylinder valve

- Before connecting the pressure regulator to the gas cylinder, open the cylinder valve briefly to blow out any dirt.
- Tighten the pressure regulator screw connection on the gas bottle valve to be gas-tight.
- Screw gas hose connection crown nut onto the output side of the pressure regulator.
- Install gas hose with G1/4" crown nut at the correct welding machine connection so that it is gas-tight.

5.3.3 TIG Synergic operating principle

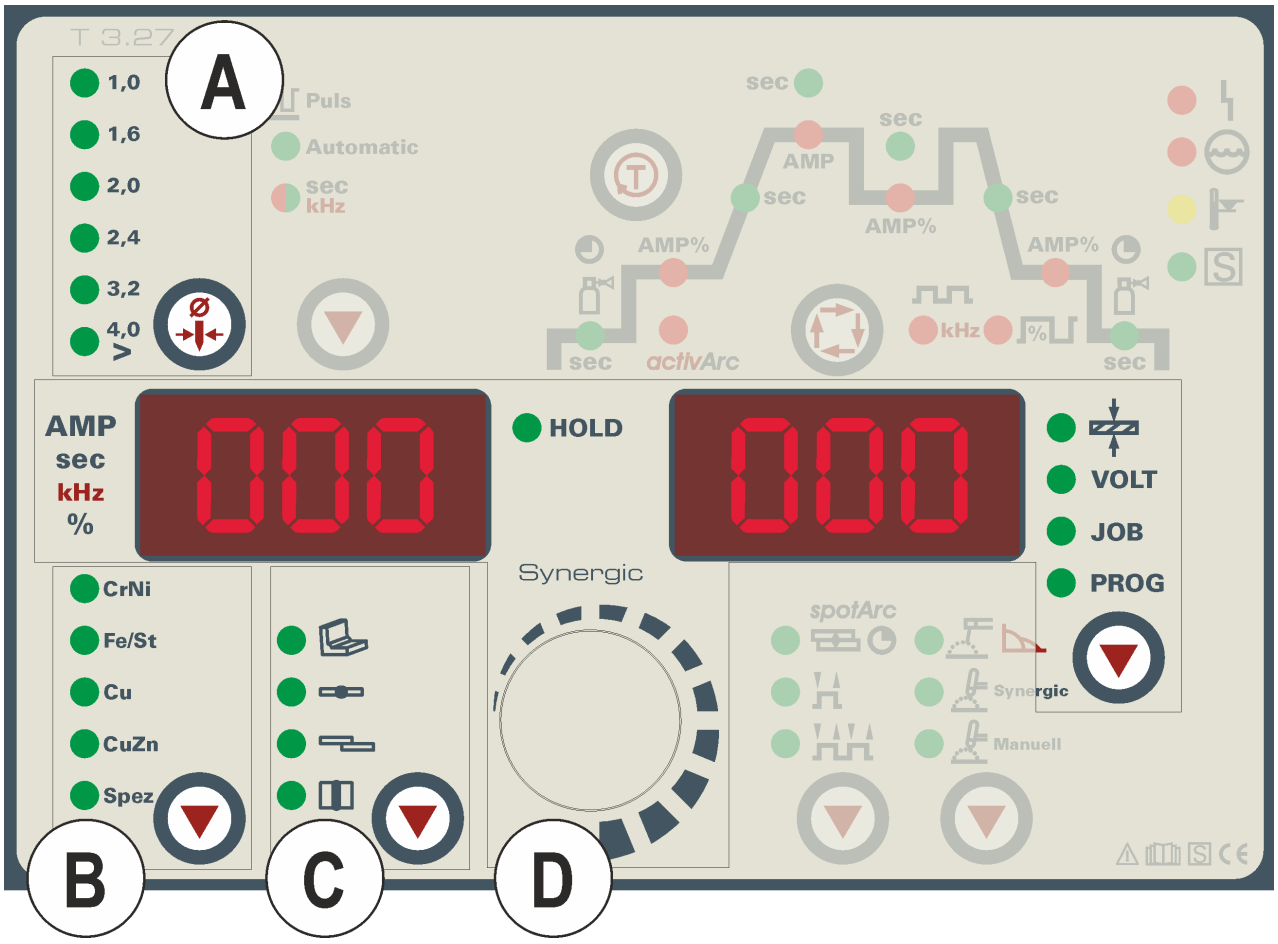


Figure 5-10

The machine is operated according to the TIG Synergic operating principle:
In a similar way to the MIG machines with Synergic operation, three basic parameters –

- Tungsten electrode diameter (A),
- Material type (B) and
- Seam type (C)

are used to select the welding task (JOB).

All welding parameters specified here are the optimum settings for a variety of applications, but they can also be modified individually.

The required welding current can be set as the sheet metal thickness or conventionally as the welding current (D).

The parameters and functions described here can also be programmed by PC using the Tetrix PC300.NET welding parameter software.

The Tetrix machine range has been designed to be very easy and quick to operate, whilst still providing all the functions one could ever need.

5.3.4 Synergic parameter setting in the functional sequence

When setting the welding current, all the necessary welding parameters are adjusted automatically during the functional sequence > *see 4.3.1 chapter* with the exception of the gas pre-flow time. These welding parameters can also be set in the conventional way if required (regardless of the welding current) > *see 5.6.3 chapter*.

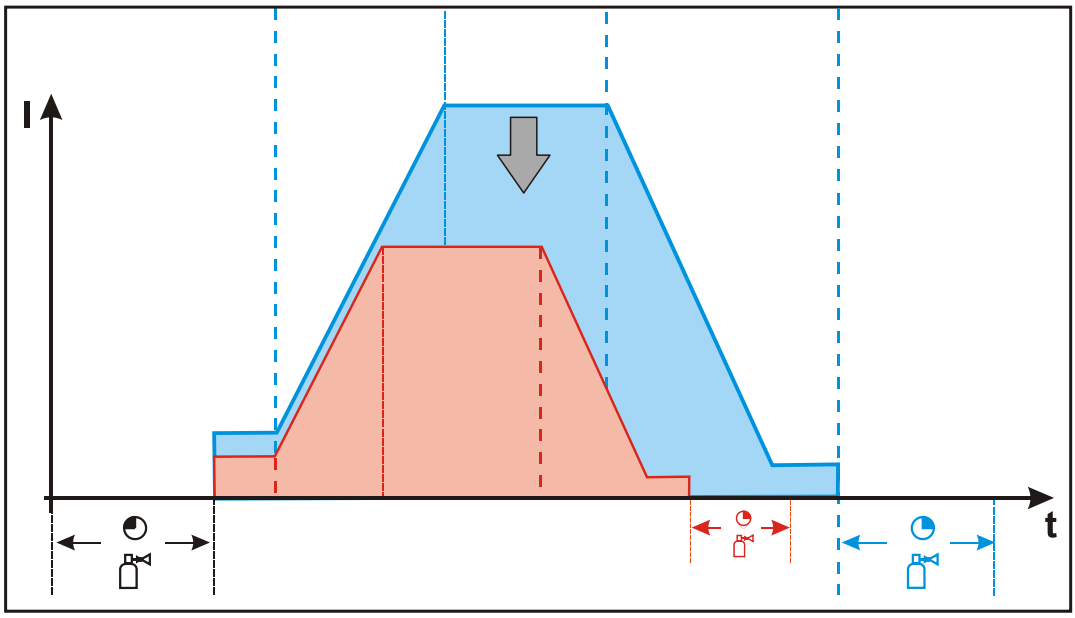


Figure 5-11

5.3.5 Conventional parameter setting in the functional sequence

All welding parameters in the functional sequence can also be adjusted, regardless of the welding current set. This means that if the welding current is changed, the values for the down slope time or gas post-flow time remain unchanged, for example. The welding task still needs to be selected as before using the three basic parameters of tungsten electrode diameter, material type and seam type.

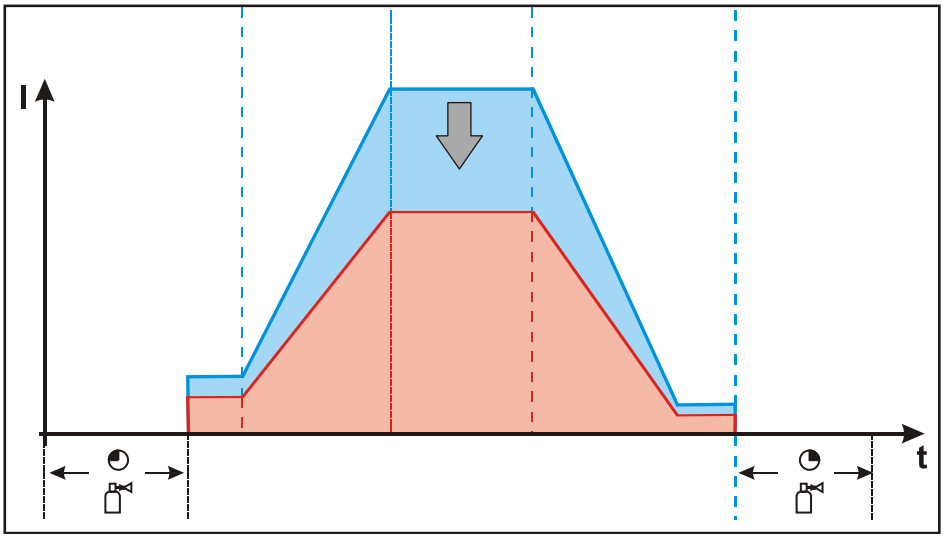


Figure 5-12

☞ ***The parameters for the ignition, secondary and end currents can be set and displayed as percentage values or absolute values > see 5.12 chapter.***

5.3.5.1 Set the operating principle (conventional/synergic)

☞ ***The settings are defined in the machine configuration menu > see 5.12 chapter.***

5.3.6 Welding task selection

The following welding task selection is an example of use. In general, the selection process always has the same sequence. Signal lights (LED) will show the selected combination.

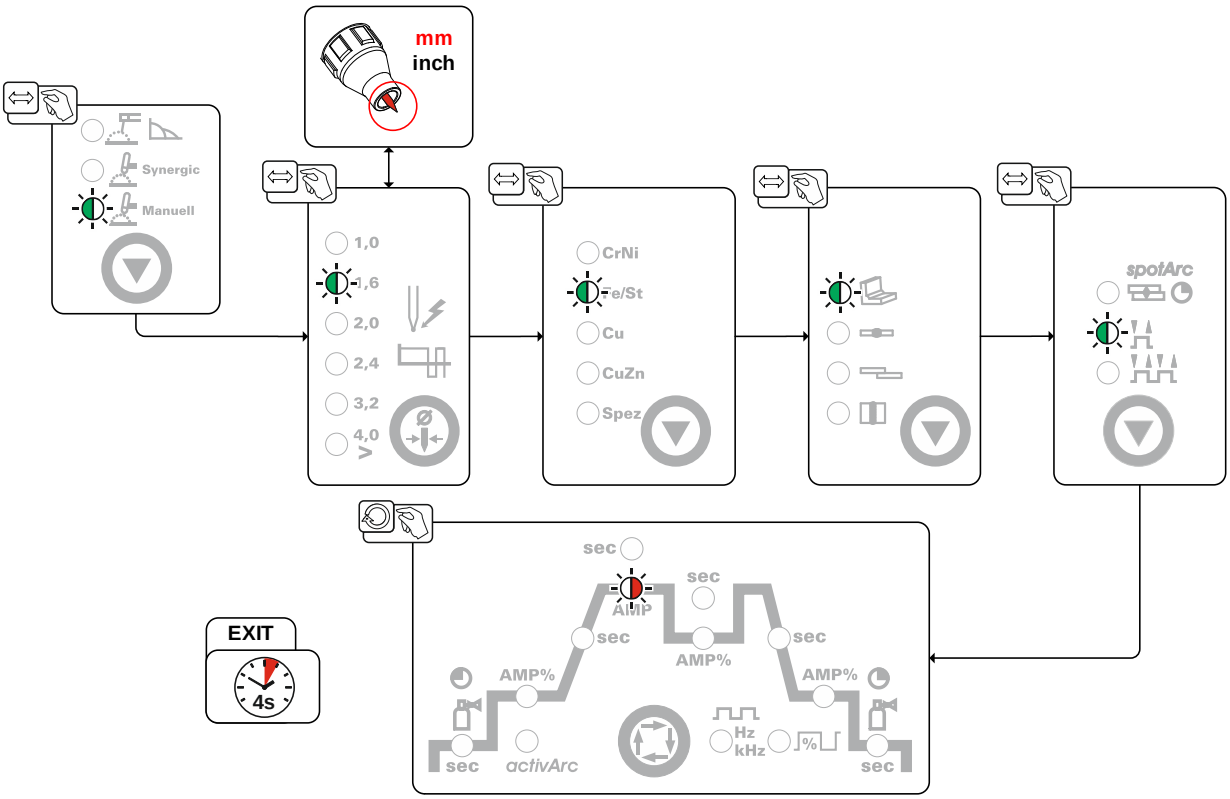


Figure 5-13

5.3.7 Select welding current

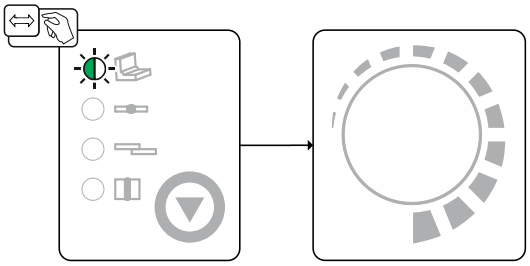


Figure 5-14

5.3.8 Gas test or "rinse hose package"

Rule of thumb for the gas flow rate:

Diameter of gas nozzle in mm corresponds to gas flow in l/min.
Example: 7mm gas nozzle corresponds to 7l/min gas flow.

If the shielding gas setting is too low or too high, this can introduce air to the weld pool and may cause pores to form. Adjust the shielding gas quantity to suit the welding task!

- Slowly open the gas cylinder valve. Conduct a gas test *> see 5.3.8.1 chapter*
- Set the required amount of shielding gas on the pressure reducer, about 4 - 15 l/min depending on the current strength and the material.

5.3.8.1 Gas test

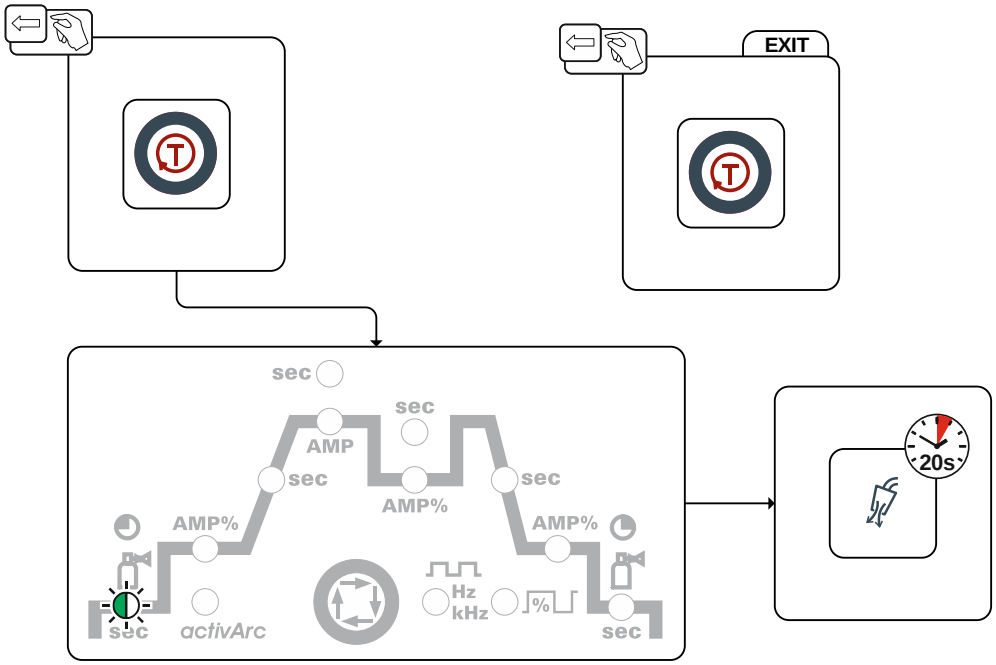


Figure 5-15

- Set the required shielding gas quantity at the pressure regulator.

5.3.8.2 “Purge hose package” function

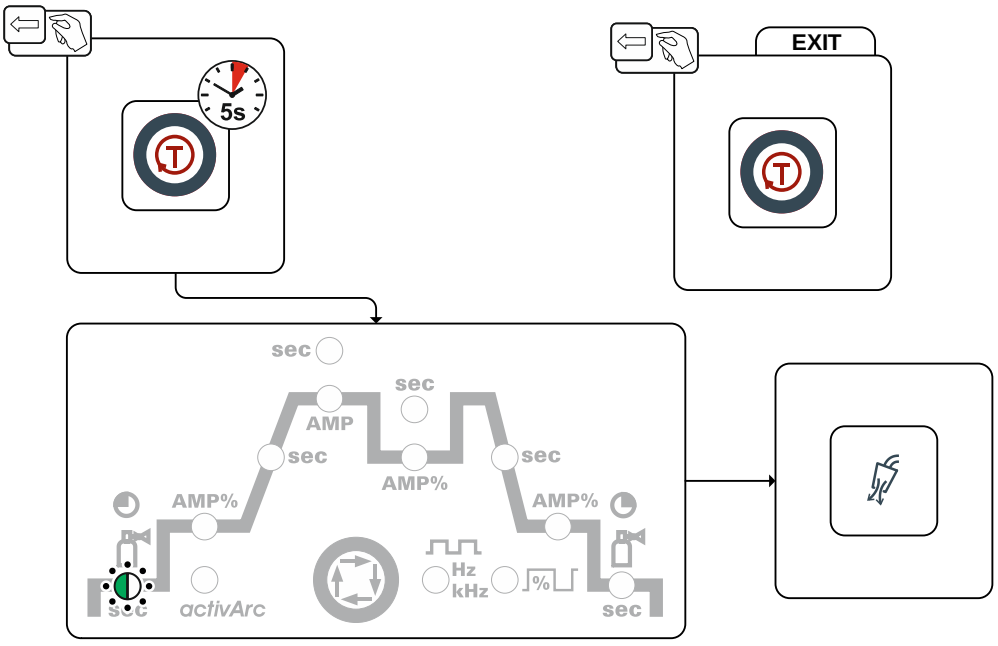


Figure 5-16

☞ ***If the "Rinse hose package" function is not ended by pressing the "Gas and current parameters" button again, shielding gas will flow until the gas cylinder is empty!***

5.3.9 Optimising the ignition characteristics for pure tungsten electrodes

The best ignition and stabilisation of the arc (DC, AC) and optimum spherical cup formation in the tungsten electrode depend on the electrode diameter being used.

The set value should correspond to the diameter of the tungsten electrode. The value can of course be adjusted in line with different requirements.

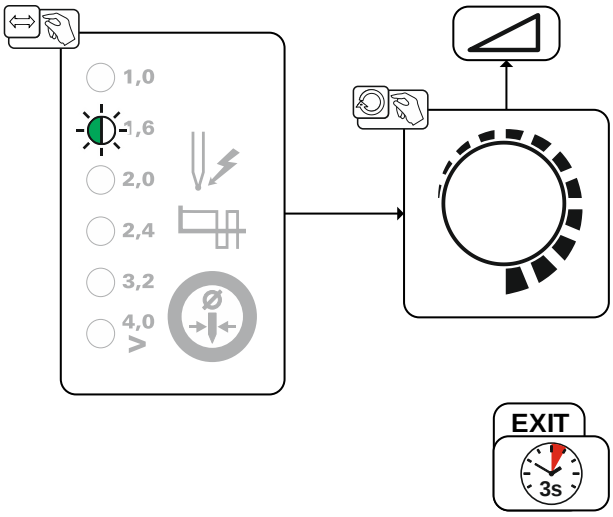


Figure 5-17

5.3.9.1 Tungsten balling function

Tungsten balling ensures optimum ignition and welding results for AC welding.

Optimum tungsten balling requires a sharpened electrode (about 15–25°) and the set electrode diameter on the machine control. The set electrode diameter affects the current for tungsten balling and, consequently, also the ball size.

Tungsten balling should be performed on a test component as surplus tungsten may be melted and this may lead to impurities on the weld seam.

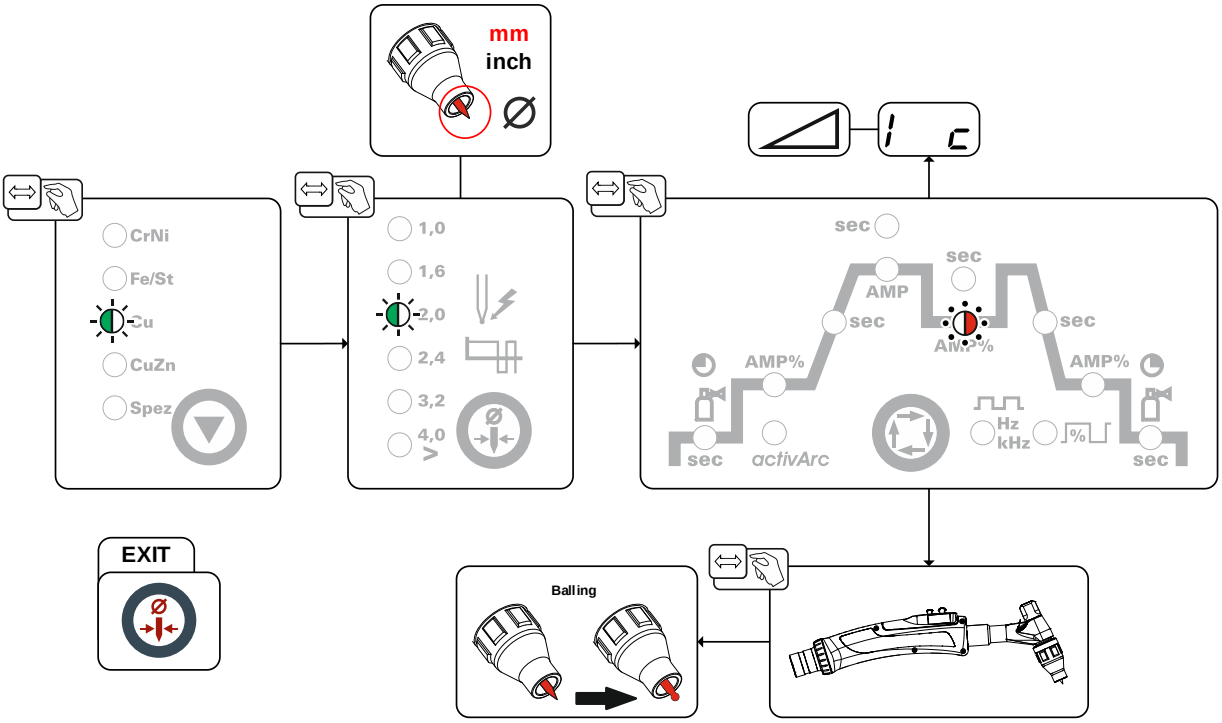


Figure 5-18

5.3.10 Arc ignition

5.3.10.1 HF ignition

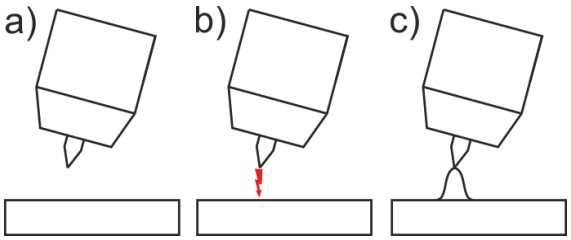


Figure 5-19

The arc is started without contact from high-voltage ignition pulses.

a) Position the welding torch in welding position over the workpiece (distance between the electrode tip and workpiece should be approx. 2-3mm).
b) Press the torch trigger (high voltage ignition pulses ignite the arc).
c) Ignition current flows, and the welding process is continued depending on the operating mode selected.

End the welding process: Release or press the torch trigger depending on the operating mode selected.

5.3.10.2 Liftarc

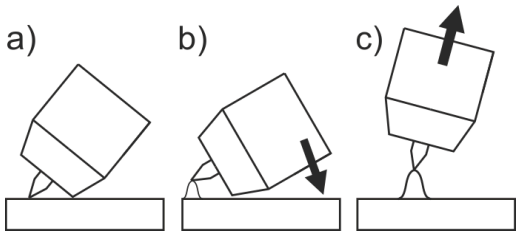


Figure 5-20

The arc is ignited on contact with the workpiece:

a) Carefully place the torch gas nozzle and tungsten electrode tip onto the workpiece and press the torch trigger (liftarc current flowing, regardless of the main current set).
b) Incline the torch over the torch gas nozzle to produce a gap of approx. 2-3 mm between the electrode tip and the workpiece. The arc ignites and the welding current is increased, depending on the operating mode set, to the ignition or main current set.
c) Lift off the torch and swivel to the normal position.

Ending the welding process: Release or press the torch trigger depending on the operating mode selected.

5.3.10.3 Automatic cut-out

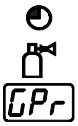
Once the fault periods have elapsed, the automatic cut-out stops the welding process when it has been triggered by one of two states:

- During ignition
  3 s after the start of the welding process, no welding current flows (ignition error).
- During welding
  The arc is interrupted for more than 3 s (arc interruption). You can disable or set the time for re-ignition after an arc interruption in the machine configuration menu > *see 5.12 chapter* (parameter LtA).

5.3.11 Operating modes (functional sequences)

The parameters that can be set in the function sequence of the machine control depend on the selected welding task. This means that if for example you have not selected a pulse variant, then you cannot set any pulse times in the function sequence.

5.3.11.1 Explanation of symbols

Symbol	Meaning
	Press torch trigger 1
	Release torch trigger 1
I	Current
t	Time
	Gas pre-flow
	Ignition current
	Up-slope time
	Spot time
 **AMP**	Main current (minimum to maximum current)
 **AMP%**	Secondary current
	Pulse time
	Pulse pause time
	Down-slope time
	End-crater current
	Gas post-flow
	Balance
	Frequency

5.3.11.2 Non-latched mode

Selection

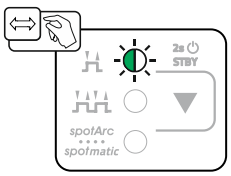


Figure 5-21

Sequence

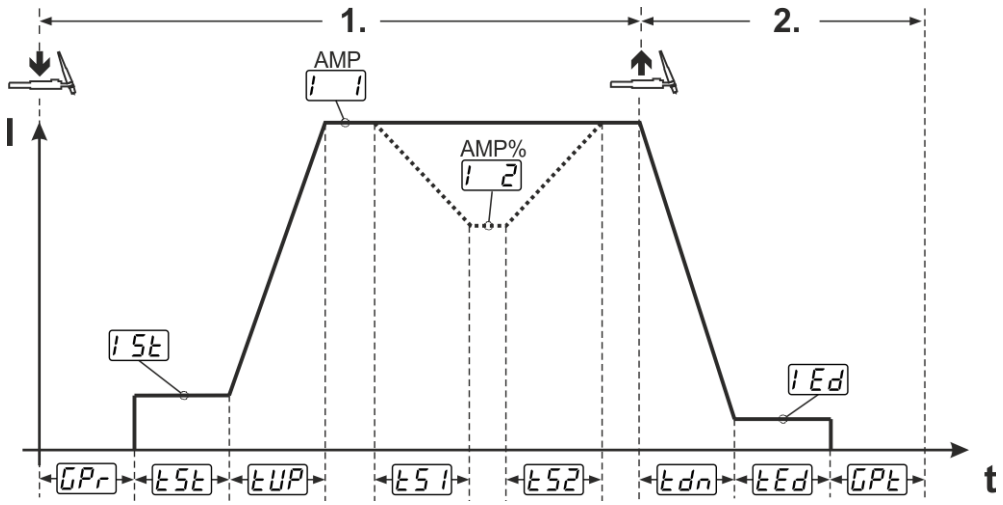


Figure 5-22

1st cycle:

- Press torch trigger 1 and hold down.
- Gas pre-flow time GPr elapses.
- HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- The welding current flows and immediately assumes the value of the ignition current I St.
- HF switches off.
- The welding current ramps up to the main current I 1 (AMP) in the selected up-slope time t UP.

If torch trigger 2 is pressed together with torch trigger 1 during the main current phase, the welding current decreases to the secondary current I 2 (AMP%) in the set slope time t S1.

If torch trigger 2 is released, the welding current increases again to the main current AMP in the set slope time t S2. The parameters t S1 and t S2 can be set in the Expert menu (TIG) > *see 5.3.15 chapter*.

2nd cycle:

- Release torch trigger 1.
- The main current falls to the end-crater current I Ed (minimum current) in the set down-slope time t dn.

If the 1st torch trigger is pressed during the down-slope time,
the welding current returns to the set main current AMP

- Main current reaches the end-crater current I Ed; the arc is extinguished.
- Set gas post-flow time GPt elapses.

When the foot-operated remote control is connected, the machine switches automatically to non-latched operation. The up- and down-slopes are switched off.

5.3.11.3 Latched mode

Selection

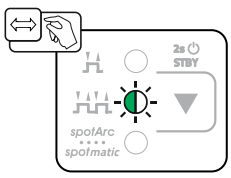


Figure 5-23

Sequence

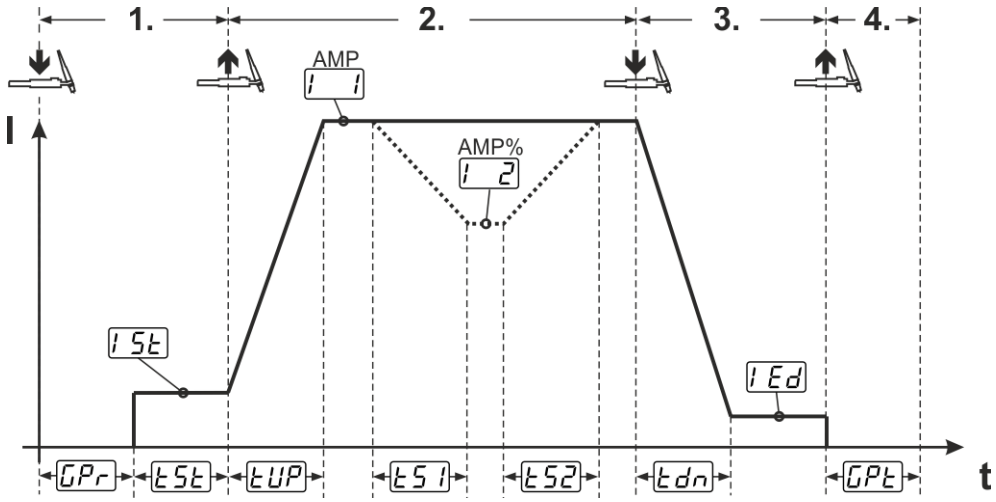


Figure 5-24

1st cycle

- Press torch trigger 1 GPr, the gas pre-flow time elapses.
- HF start pulses jump from the electrode to the workpiece. The arc ignites.
- Welding current flows and immediately assumes the set ignition current I St (search arc at minimum setting). HF switches off.

2nd cycle

- Release torch trigger 1.
- The welding current ramps up to the main current I 1 (AMP) in the selected up-slope time t UP.

Switching from the main current AMP to secondary current I 2 (AMP%):

- Press torch trigger 2 or
- Tap torch trigger 1 (torch modes 1–6).

If torch trigger 2 is pressed together with torch trigger 1 during the main current phase, the welding current decreases to the secondary current I 2 (AMP%) in the set slope time t S1.

Once torch trigger 2 is released, the welding current increases again to the main current AMP in the set slope time t S2. The parameters t S1 and t S2 can be set in the Expert menu (TIG) > *see 5.3.15 chapter*.

3rd cycle

- Press torch trigger 1.
- The main current decreases to the end-crater current I Ed within the set down-slope time t dn.

Once the main current phase I 1 AMP has been reached, you can shorten the welding sequence by tapping torch trigger 1 (third cycle will be omitted).

4th cycle

- Release torch trigger 1; arc is extinguished.
- Set gas post-flow time GPt runs.

When the foot-operated remote control is connected, the machine switches automatically to non-latched operation. The up- and down-slopes are switched off.

Alternative welding start (tapping start):

For the alternative welding start, the durations of the first and second cycle are defined by the set process times only (tapping the torch trigger in the gas pre-low phase GPr).

To activate this function, set a two-digit torch mode (11-1x) at the machine control. This function can also be deactivated completely when required (welding stop by tapping remains active). To do so, the tPS parameter must be switched to oFF in the machine configuration menu > *see 5.12 chapter*.

5.3.11.4 spotArc

This process is suitable for tack welding or joint welding of metal sheets made from steel and CrNi alloys up to a thickness of approximately 2.5 mm. Metal sheets of different thicknesses can also be welded on top of one another. As this is a one-sided process, it is also possible to weld metal sheets onto tubular sections such as round or square pipes. In arc spot welding, the arc melts through the upper metal sheet and the lower metal sheet is melted onto it. This produces flat, fine-textured welding tacks which require little or no post weld work, even in visible areas.

The spot welding operating modes (spotArc/Spotmatic) can be used with two different intervals, i.e. a "long" or "short" interval, which are defined as follows:

Interval	Setting range	Up-/down-slope	Pulsing	AC	Display	Display
Long	0.01–20.0 s (10 ms)	Yes	Yes	Yes	StS	oFF
Short	5–999 ms (1 ms)	No	No	No	StS	on

When selecting the spotArc operating mode, the long interval is automatically preselected. When selecting the Spotmatic operating mode, the short interval is automatically preselected. The user can change the interval in the Configuration menu > *see 5.12 chapter*.

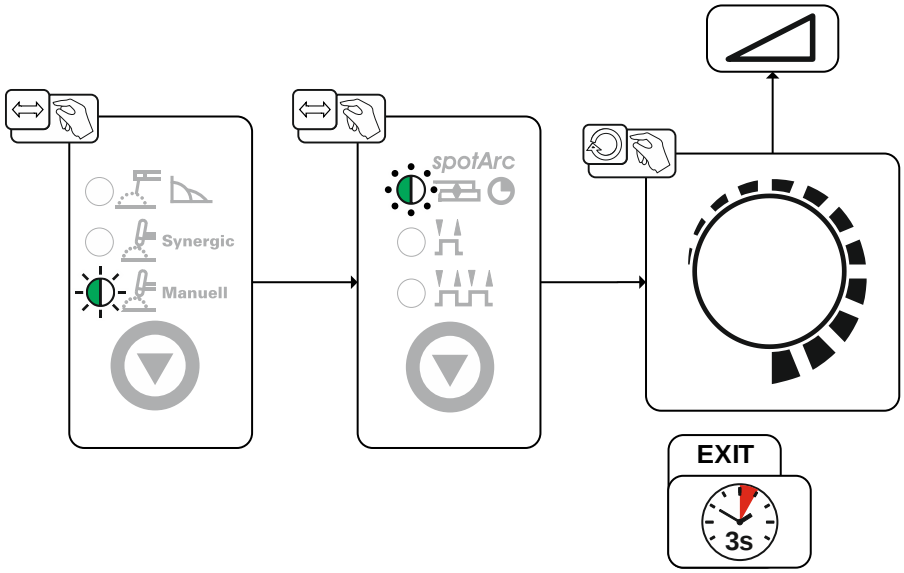


Figure 5-25

☞ ***The up-slope and down-slope times should be set to “0” to achieve an effective result.***

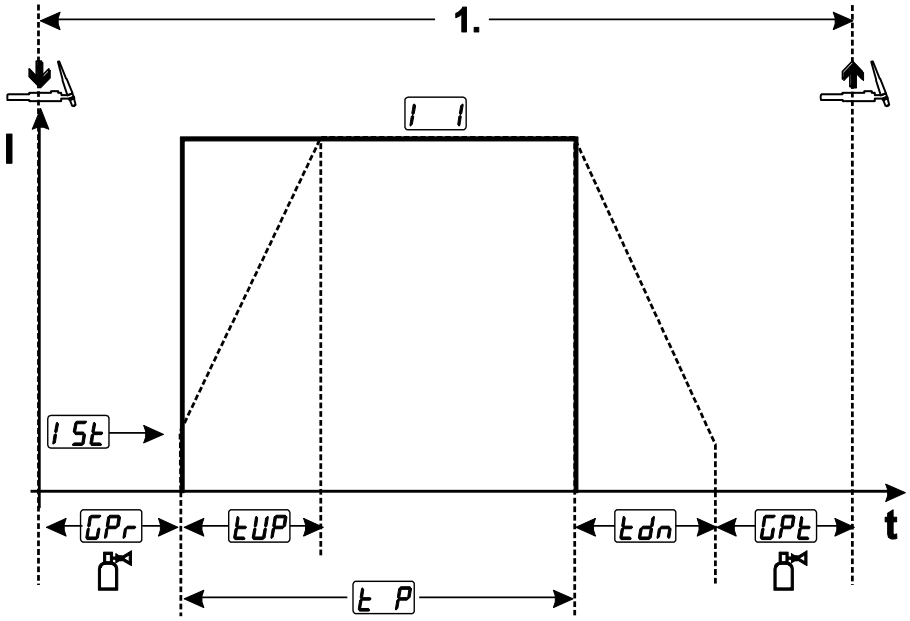


Figure 5-26

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however > *see 5.3.10.2 chapter*.

Sequence:

- Press and hold torch trigger 1.
- The gas pre-flow time elapses.
- HF ignition pulses jump from the electrode to the workpiece, the arc ignites.
- The welding current flows and immediately assumes the value set for the ignition current I St.
- HF is switched off.
- The welding current increases in the adjusted up-slope time to the main current I 1.

The process ends when the set spotArc.time elapses or by releasing the torch trigger.

When switching on the spotArc function, Automatic pulsing is switched on as well. Any other pulsing variant can be selected as well, or no pulsing at all.

5.3.11.5 spotmatic

In contrast to the spotArc operating mode, the arc is not ignited by pressing the torch trigger as is usual, but by briefly touching the tungsten electrode against the workpiece. The torch trigger is used for welding process activation. Activation is indicated by flashing of the spotArc/spotmatic signal light. The process can be activated separately for each spot or also on a permanent basis. The setting is controlled using the SSP process activation parameter in the configuration menu > *see 5.12 chapter*:

- Separate process activation (SSP > on):
  The welding process has to be reactivated for every arc ignition by pressing the torch trigger. Process activation is automatically terminated after 30 s of inactivity.
- Permanent process activation (SSP > oFF):
  The welding process is activated by pressing the torch trigger once. The following arc ignitions are initiated by shortly touching the tungsten electrode against the workpiece. Process activation is terminated either by pressing the torch trigger again or automatically after 30 s of inactivity.

For spotmatic the separate process activation and the short spot time setting range are enabled by default.

Ignition by touching the tungsten electrode against the workpiece can be disabled in the machine configuration menu with parameter SPn. In this case the function works as with spotArc, but the spot time setting range can be selected in the machine configuration menu.

The duration is set in the machine configuration menu using parameter StS > *see 5.12 chapter*

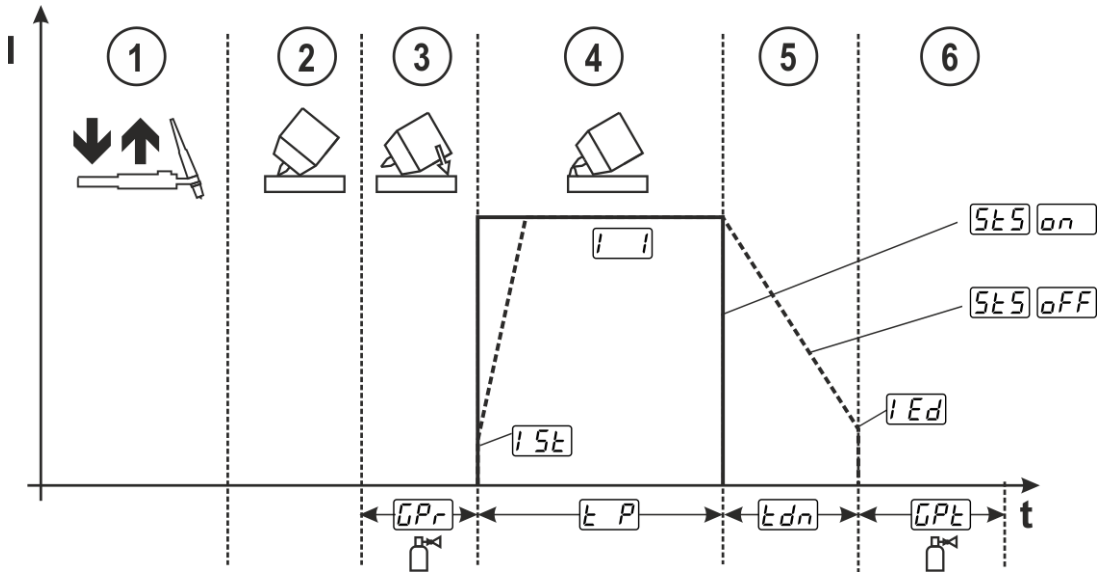


Figure 5-27

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however *> see 5.3.10.2 chapter*.

Selecting the process activation type for the welding process *> see 5.12 chapter*.

Up-slope and down-slope times possible for long spot time setting range (0.01–20.0 s) only.

① Press and release torch trigger (tap) to activate the welding process.

② Touch the torch gas nozzle and tungsten electrode tip carefully against the workpiece.

③ Incline the welding torch over the torch gas nozzle until there is a gap of approx. 2–3 mm between the electrode tip and the workpiece. Shielding gas flows during the set gas pre-flow time GPr. The arc ignites and the previously set ignition current I St flows.

④ The main current phase I 1 ends when the set t P spot time elapses.

⑤ For long-time spot welding only (parameter StS = oFF):
The welding current decreases to the end-crater current I Ed within the set down-slope time tdn.

⑥ The gas post-flow time GPt elapses and the welding process ends.

Press and release the torch trigger (tap) to reactivate the welding process (only for separate process activation). Touching the welding torch with the tungsten electrode tip against the workpiece again will initiate the next welding processes.

5.3.11.6 Non-latched operation, version C

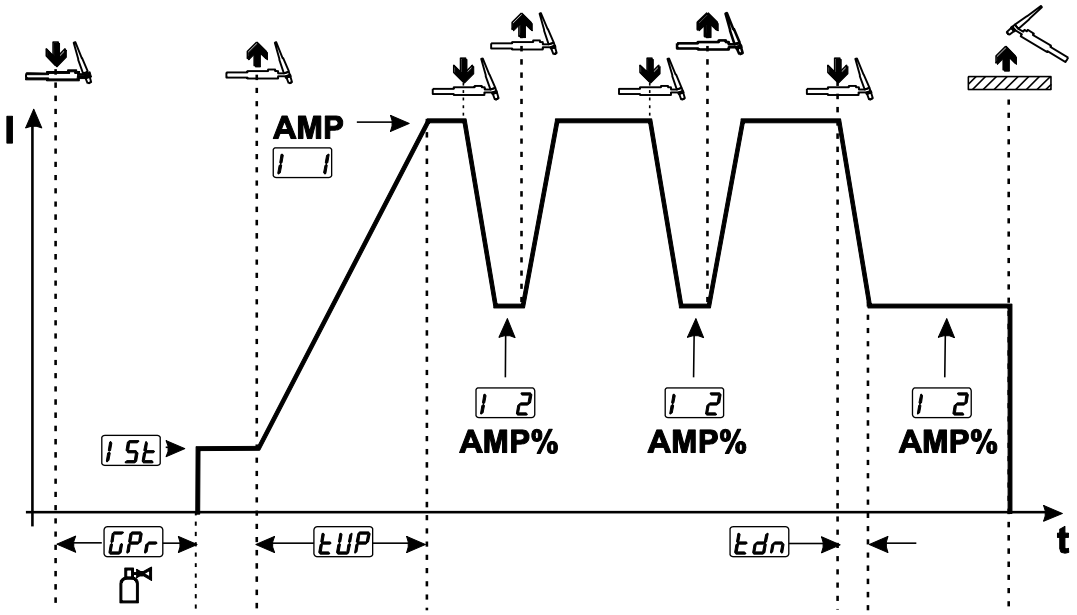


Figure 5-28

1st cycle

- Press torch trigger 1 GPr, the gas pre-flow time elapses.
- HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- Welding current flows and immediately assumes the set ignition current I St (search arc at minimum setting). HF switches off.

2nd cycle

- Release torch trigger 1.
- The welding current ramps up to the main current AMP in the selected up-slope time tUP.

Pressing torch trigger 1 starts the slope tS1 from main current AMP to secondary current I 2 AMP%. Releasing the torch trigger starts the slope tS2 from the secondary current AMP% and back to the main current AMP. This process can be repeated as frequently as required.
The welding process is stopped by interrupting the arc in the secondary current (remove the welding torch from the workpiece until the arc is extinguished, no re-ignition).
The slope times tS1 and tS2 can be set in the Expert menu > *see 5.3.15 chapter*.

☞ ***This operating mode must be enabled (parameter 2tc) > see 5.12 chapter.***

5.3.12 Pulse welding

The following pulse types can be selected:

- Automated pulsing
- Thermal pulsing
- Metallurgical pulsing

5.3.12.1 Automated pulses

The automated pulses are used with tacking and spot welding of workpieces in particular.
An oscillation in the molten pool is produced by the current-dependent pulse frequency and balance, which positively influences the ability to bridge the air gap. The pulse parameters required are automatically specified by the machine control.

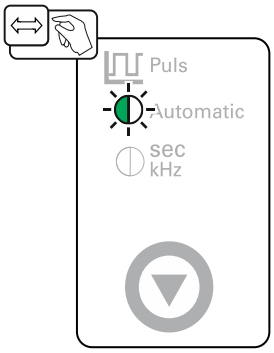


Figure 5-29

5.3.12.2 Thermal pulsing

The operation sequences basically match the standard welding sequences, but there is an additional switching back and forth between the main current AMP (pulse current) and the secondary current AMP% (pulse pause current) at the set times. Pulse and pause times and the pulse edges (t51 and t52) are entered in seconds on the control.

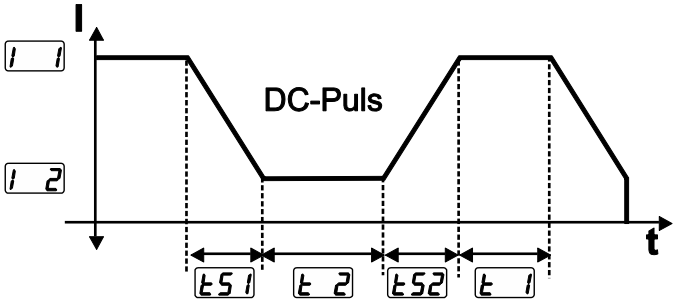


Figure 5-30

☞ ***The pulse function can also be deactivated if necessary during the up-slope and down-slope phases (parameter PUO) > see 5.12 chapter.***

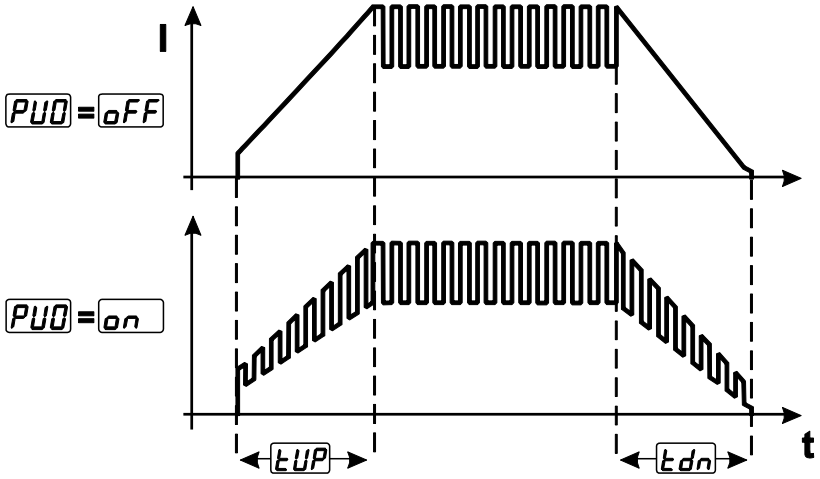


Figure 5-31

Selection

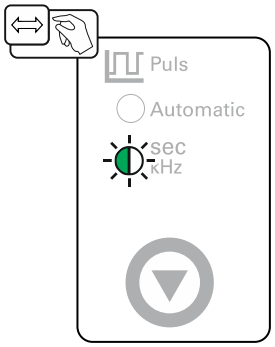


Figure 5-32

Pulse time setting

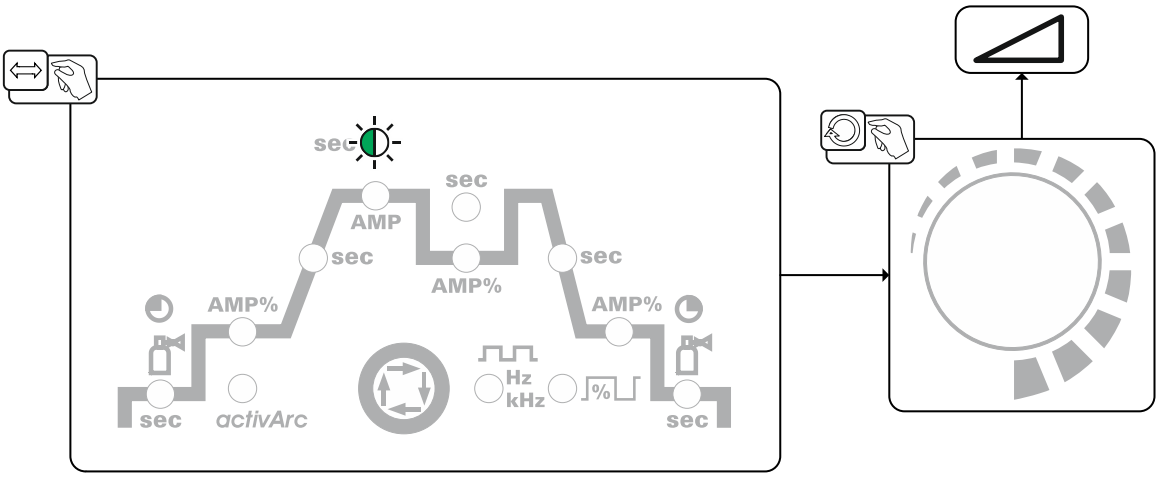


Figure 5-33

Pulse pause setting

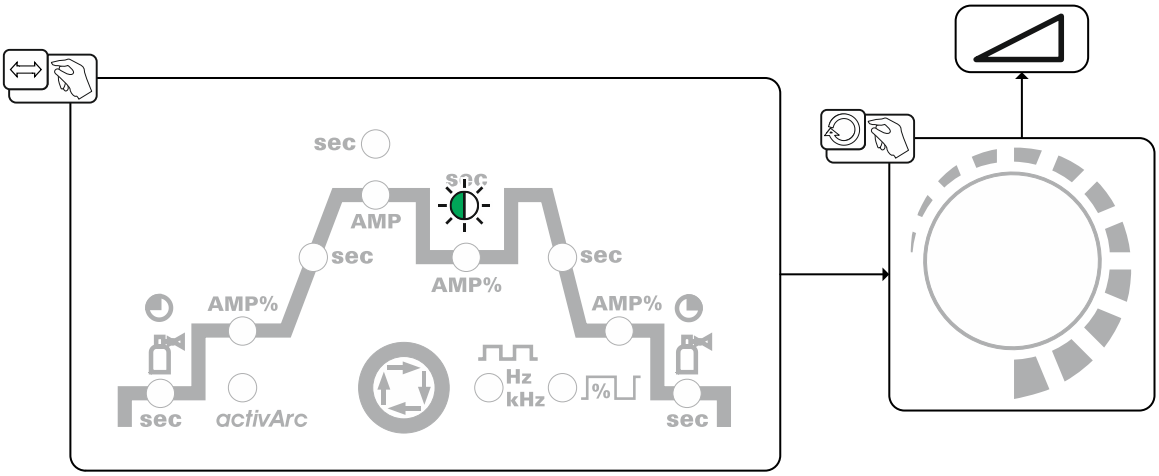


Figure 5-34

Pulse edge setting

The t51 and t52 pulse edges can be set in the Expert menu (TIG) > *see 5.3.15 chapter*.

5.3.12.3 Metallurgical pulsing (kHz pulsing)

Metallurgical pulsing (kHz pulsing) uses the plasma force (arc force) occurring at high currents which allows you to achieve a constricted arc with concentrated heat input. Unlike thermal pulsing, no times are set; a frequency FrE and the balance bAL are set instead. The pulsing process also occurs during the up-slope and down-slope phase.

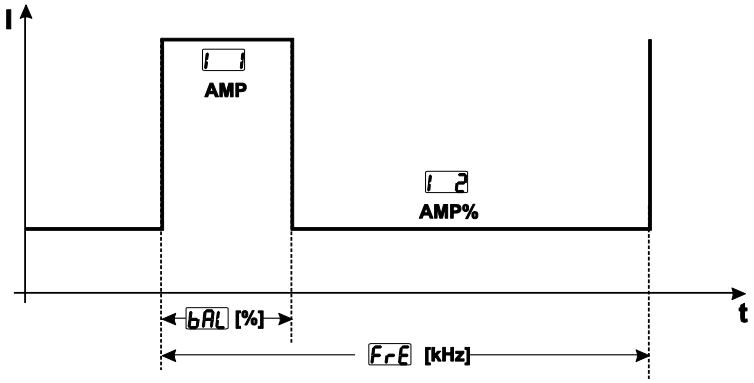


Figure 5-35

Selection

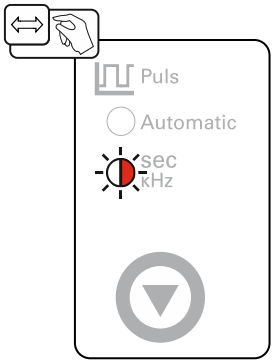


Figure 5-36

Balance setting

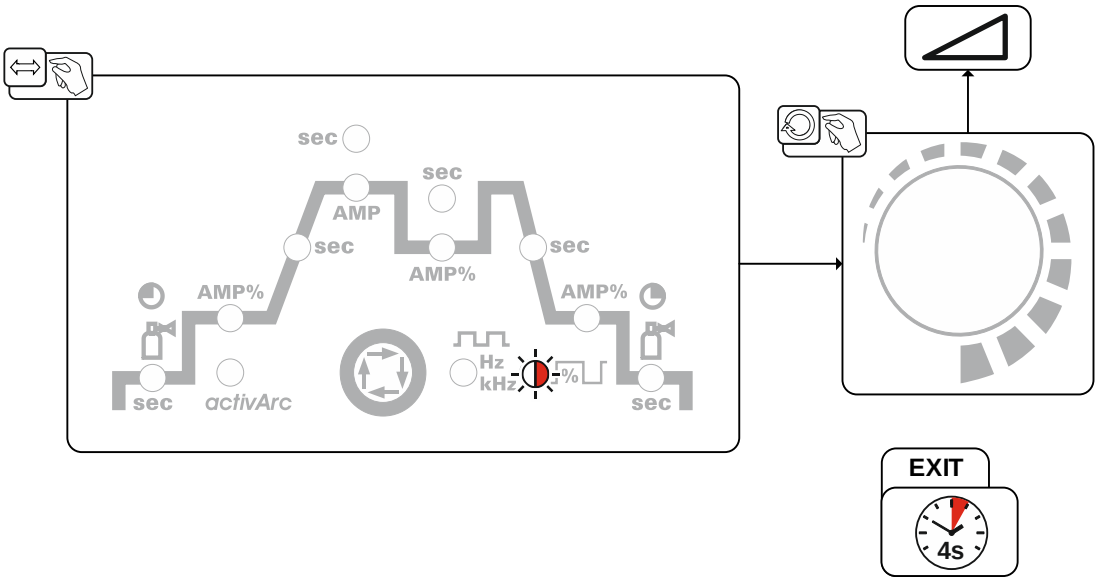


Figure 5-37

Frequency setting

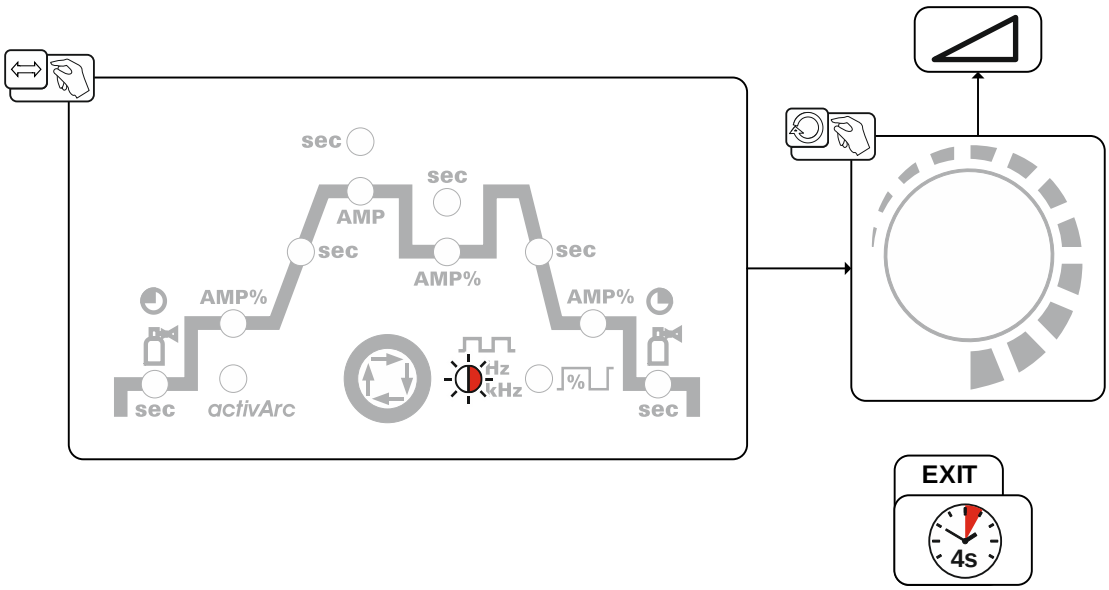


Figure 5-38

5.3.13 TIG antistick

The function prevents uncontrolled re-ignition following the sticking of the tungsten electrode in the weld pool by switching off the welding current. In addition, wear at the tungsten electrode is reduced.

After triggering the function the machine immediately switches to the gas post-flow process phase. The welder starts the new process again at the first cycle. The user can switch the function on or off (parameter tAS) > *see 5.12 chapter*.

5.3.14 activArc

The EWM activArc process, thanks to the highly dynamic controller system, ensures that the power supplied is kept virtually constant in the event of changes in the distance between the welding torch and the weld pool, e.g. during manual welding. Voltage losses as a result of a shortening of the distance between the torch and molten pool are compensated by a current rise (ampere per volt - A/V), and vice versa. This helps prevents the tungsten electrode sticking in the molten pool and the tungsten inclusions are reduced.

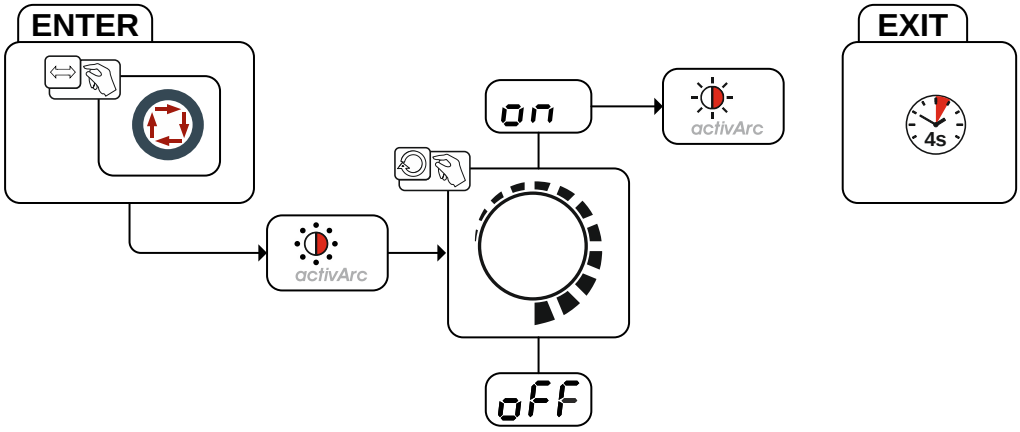


Figure 5-39

Parameter setting

The activArc parameter (control) can be adjusted specifically for the welding task (panel thickness) > *see 5.3.15 chapter*.

5.3.15 Expert menu (TIG)

The Expert menu has adjustable parameters stored that don't require regular setting. The number of parameters shown may be limited, e.g. if a function is deactivated.

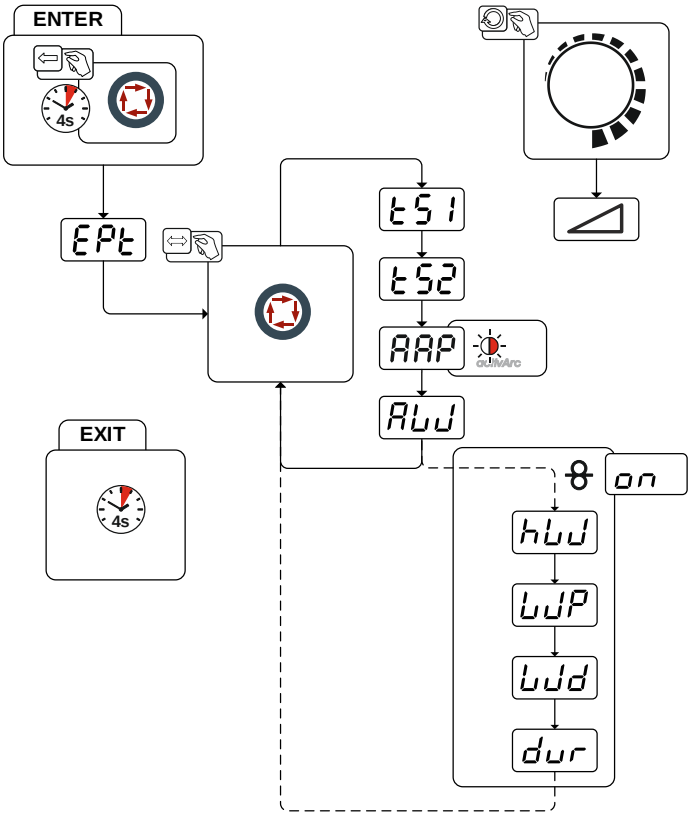


Figure 5-40

Display	Setting/selection
EPt	**Expert menu**
t51	**Slope time (main current to secondary current)**
t52	**Slope time (main current to secondary current)**
AAP	**activArc parameter** Parameter also adjustable after TIG activArc welding is activated.
AUJ	**Filler wire process (cold/hot wire)** on------ filler wire activated oFF------ filler wire deactivated (factory setting)
hUJ	**Hot wire process (start signal for hot wire power source)** on------- Function enabled oFF------- Function disabled (ex works)
UJP	**Wire/pulse function (wire feeding behaviour when using pulsed TIG welding)** **Wire feeding can be disabled during pulse pauses (not the case for automated pulsing or kHz pulsing).** on------- Function disabled oFF------- Function enabled (ex works)

Display	Setting/selection
	**Filler wire diameter (manual setting)** Setting the wire diameter between 0.6 mm to 1.6 mm. The character "d" preceding the wire diameter on the display (d0.8) indicates a pre-programmed characteristics (correction operating mode "KORREKTUR"). If there is no characteristics for the selected wire diameter, the parameters have to be set manually (manual operating mode "MANUELL"). To select the operating mode.
	**Wire return** • Increase value = more wire return • Decrease value = less wire return

5.4 MMA welding

5.4.1 Connecting the electrode holder and workpiece lead

⚠ CAUTION

Risk of crushing and burns!

When changing stick electrodes there is a risk of crushing and burns!

- Wear appropriate and dry protective gloves.
- Use an insulated pair of tongs to remove the used stick electrode or to move welded workpieces.

Shielding gas connection!

During MMA welding open circuit voltage is applied at the shielding gas connection (G¼" connecting nipple).

- Place yellow insulating cap on the G¼" connection nipple (protects against electrical voltage and dirt).

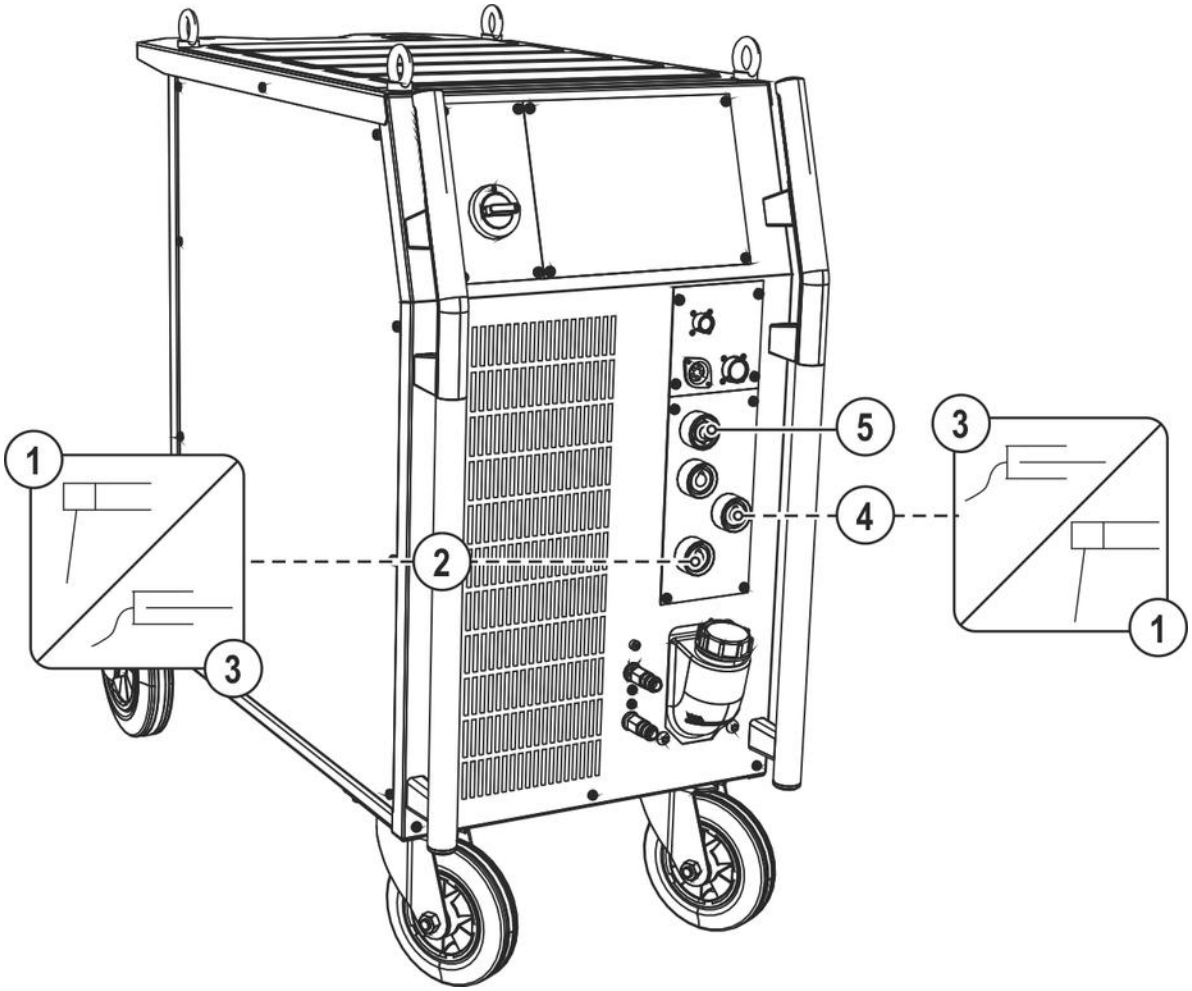


Figure 5-41

Item	Symbol	Description
1		**Workpiece**
2		**Connection socket, “+” welding current** Connection for workpiece lead
3		**Electrode holder**
4		**Connection socket, “-” welding current** Electrode holder connection
5		**G¼" connecting nipple** Shielding gas connection (with yellow insulating cap) for TIG welding torch

☞ ***Polarity depends on the instructions from the electrode manufacturer given on the electrode packaging.***

- Insert cable plug of the electrode holder into either the "+" or "-" welding current connection socket and lock by turning to the right.
- Insert cable plug of the workpiece lead into either the "+" or "-" welding current connection socket and lock by turning to the right.
- Fit yellow protective cap onto G¼" connecting nipple.

5.4.2 Welding task selection

The following welding task selection is an example of use. In general, the selection process always has the same sequence. Signal lights (LED) will show the selected combination.

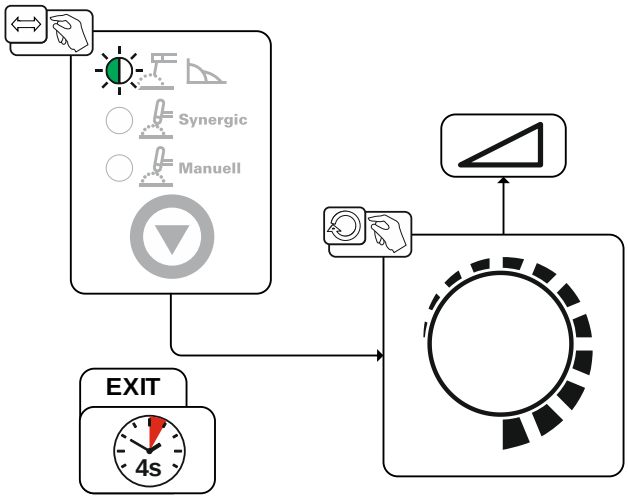
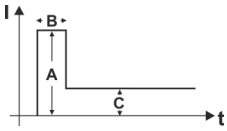


Figure 5-42

5.4.3 Hotstart

The hot start function improves the arc striking.

After striking the stick electrode, the arc ignites at the increased hot start current and decreases to the set main current once the hot start time has elapsed.



A = Hot start current
B = Hot start time
C = Main current
I = Current
t = Time

Figure 5-43

5.4.3.1 Hotstart current

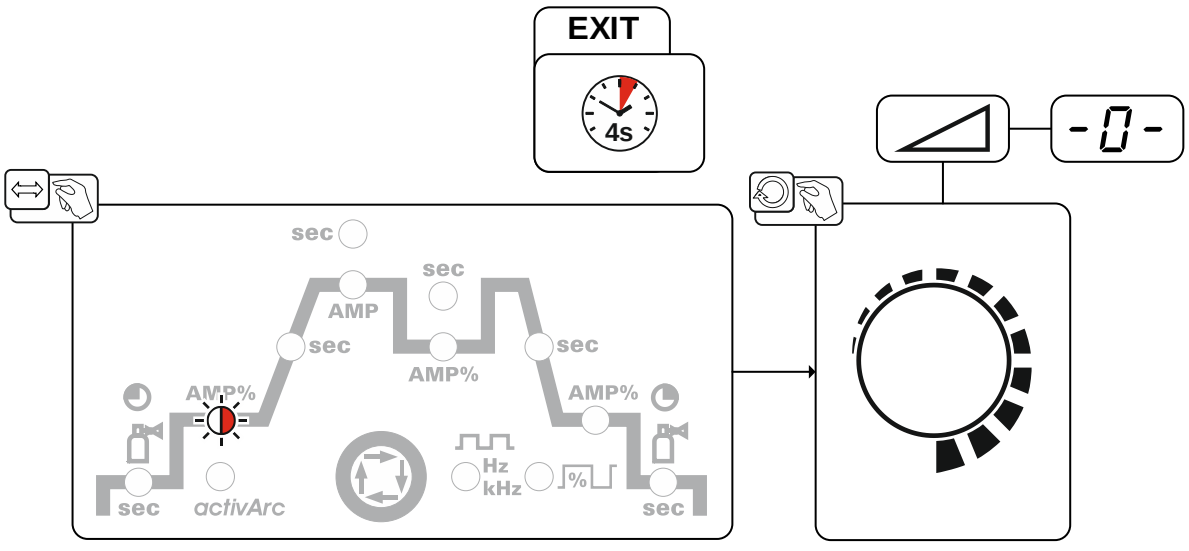


Figure 5-44

5.4.3.2 Hotstart time

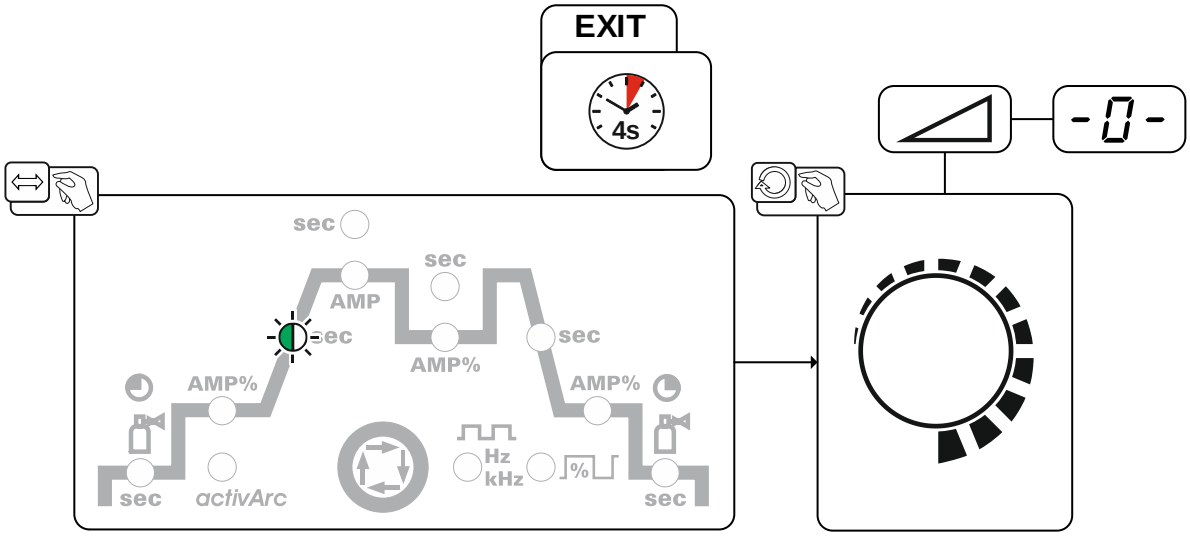


Figure 5-45

5.4.4 Arcforce

During the welding process, arcforce prevents the electrode sticking in the weld pool with increases in current. This makes it easier to weld large-drop melting electrode types at low current strengths with a short arc in particular.

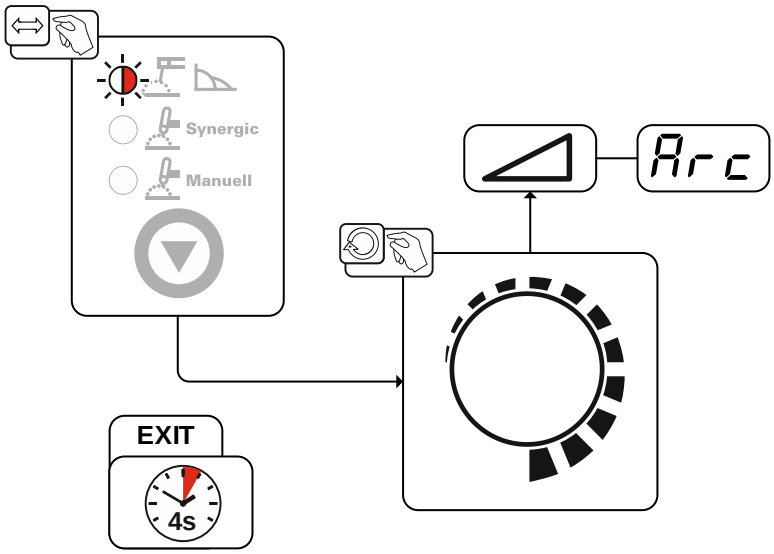
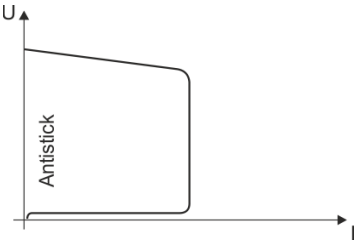


Figure 5-46

5.4.5 Antistick



The Antistick feature prevents the electrode from annealing.
Should the electrode stick despite the Arcforce feature, the machine automatically switches to the minimum current within approx. one second. This prevents the electrode from annealing. Check the welding current setting and correct for the welding task in hand.

Figure 5-47

5.4.6 Average value pulsing in the vertical-up position (PF)

Welding characteristics:

- Especially suitable for root welding
- Fine-flaked weld surface with a TIG look for final passes
- Less finishing work thanks to less spatter
- Highly suitable for difficult electrodes
- Outstanding gap bridging with no sagging of the root side
- Less distortion thanks to controlled heat input

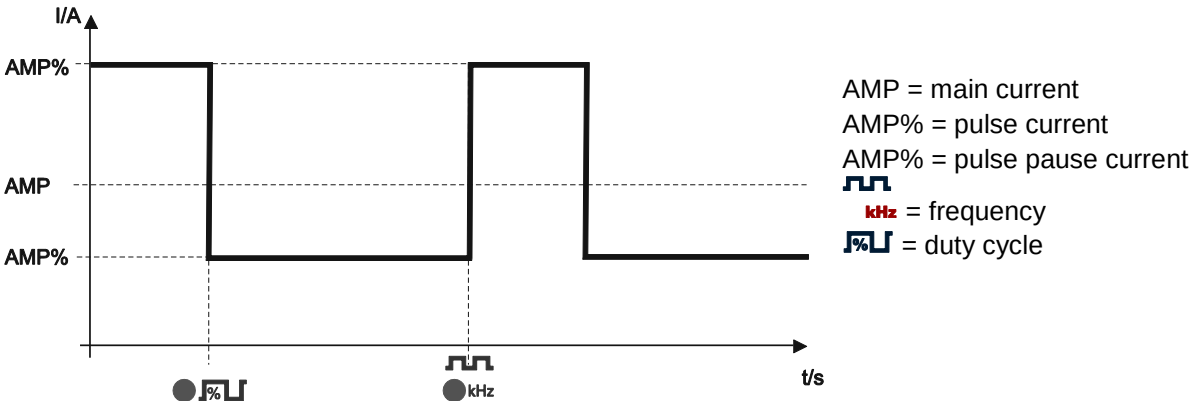


Figure 5-48

Selection

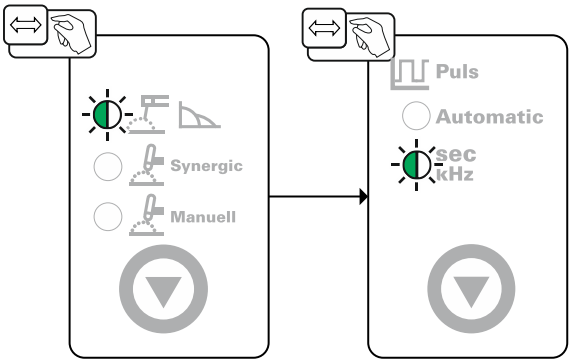


Figure 5-49

Pulse current setting

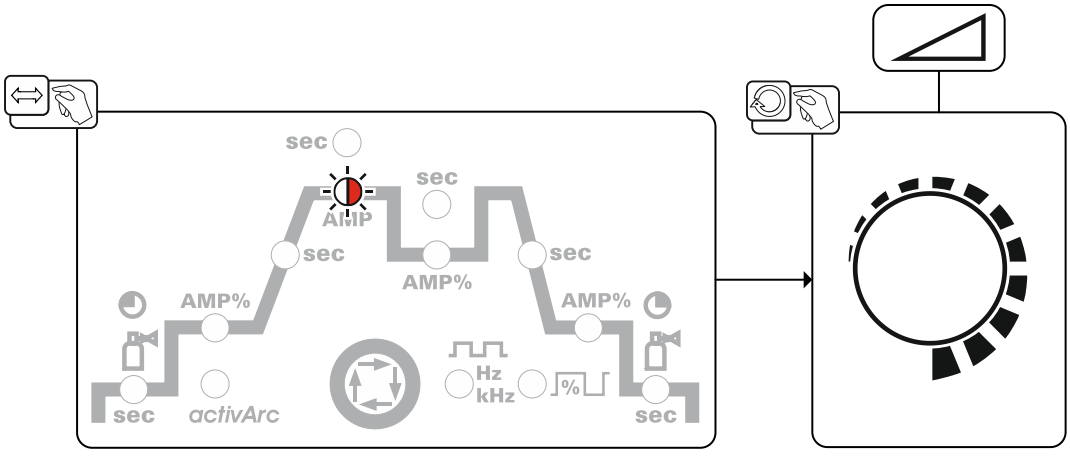


Figure 5-50

Pulse pause current setting

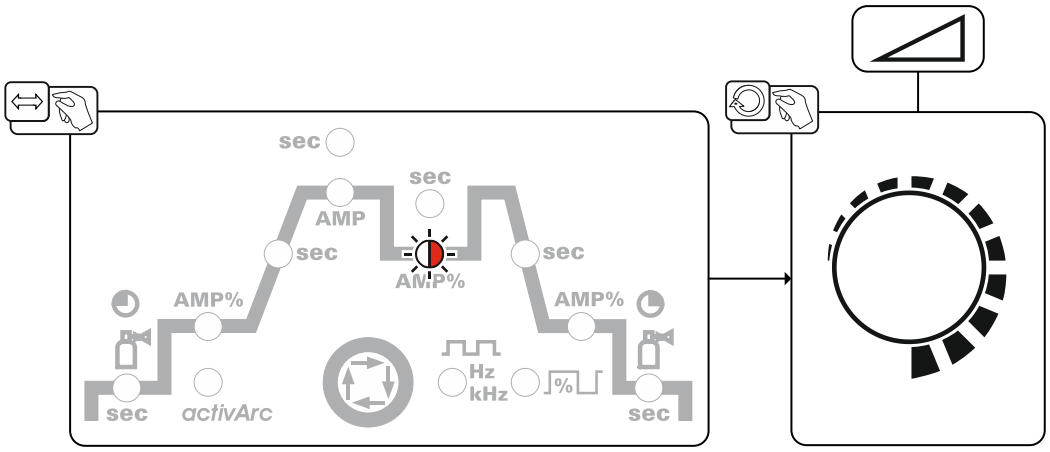


Figure 5-51

Balance setting

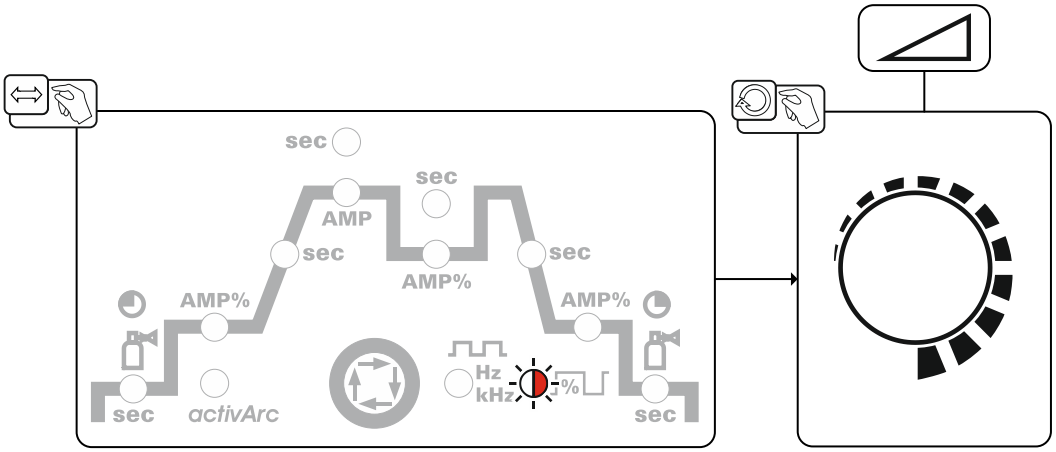


Figure 5-52

Frequency setting

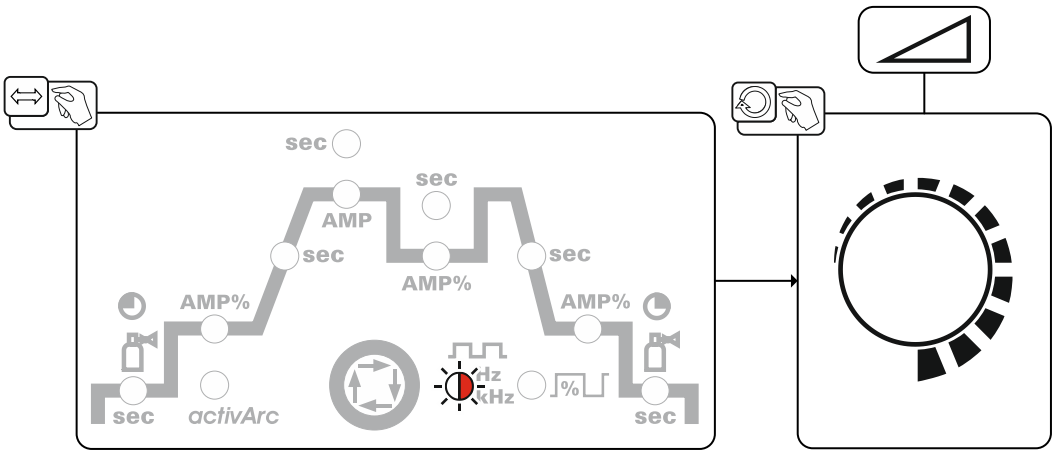


Figure 5-53

☞ ***The default pulse parameters are pre-set in such a way that the welding current average value corresponds to the pre-selected main current AMP.***

Changes in the pulse parameters result in changes to welding current average value AMP.

5.5 Organising welding tasks (Mode "JOB Manager")

☞ ***After carrying out any of the actions described, the machine switches back to the default parameters such as current and voltage.***

To ensure that all the changes are active, the welding machine should only be switched off after 5 seconds have elapsed.

The JOB Manager can be used to load, copy or save JOBs.

A JOB is a welding task defined using the 4 main welding parameters

- welding process,
- material type,
- electrode diameter and
- seam type.

One program sequence can be defined in each JOB.

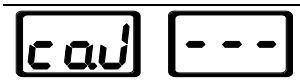
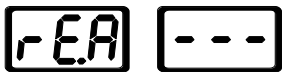
Up to 16 programs (P0 to P15) can be set in each program sequence.

The user has a total of 249 JOBs available. 121 of these JOBs are pre-programmed. A further 128 JOBs can be freely defined.

A distinction is made between two memory sectors:

- 121 factory-set, pre-programmed, permanent JOBs. Permanent JOBs are not loaded but are defined by the welding task (each welding task is permanently assigned a JOB number).
- 128 freely definable JOBs (JOBs 129 to 256)

5.5.1 Explanation of symbols

Display	Meaning
	Load JOB
	Copy JOB
	Reset JOB
	Reset all JOBs

5.5.2 Creating a new JOB in the memory or copying a JOB

Copying a pre-defined welding task from the fixed memory (JOBs 1 to 128) to the free memory (JOBs 129-256):

☞ ***It is normally possible to adjust all 256 JOBs individually. However, it is a good idea to assign specific JOB numbers in the free memory (JOB 128 to 256) for specific welding tasks.***

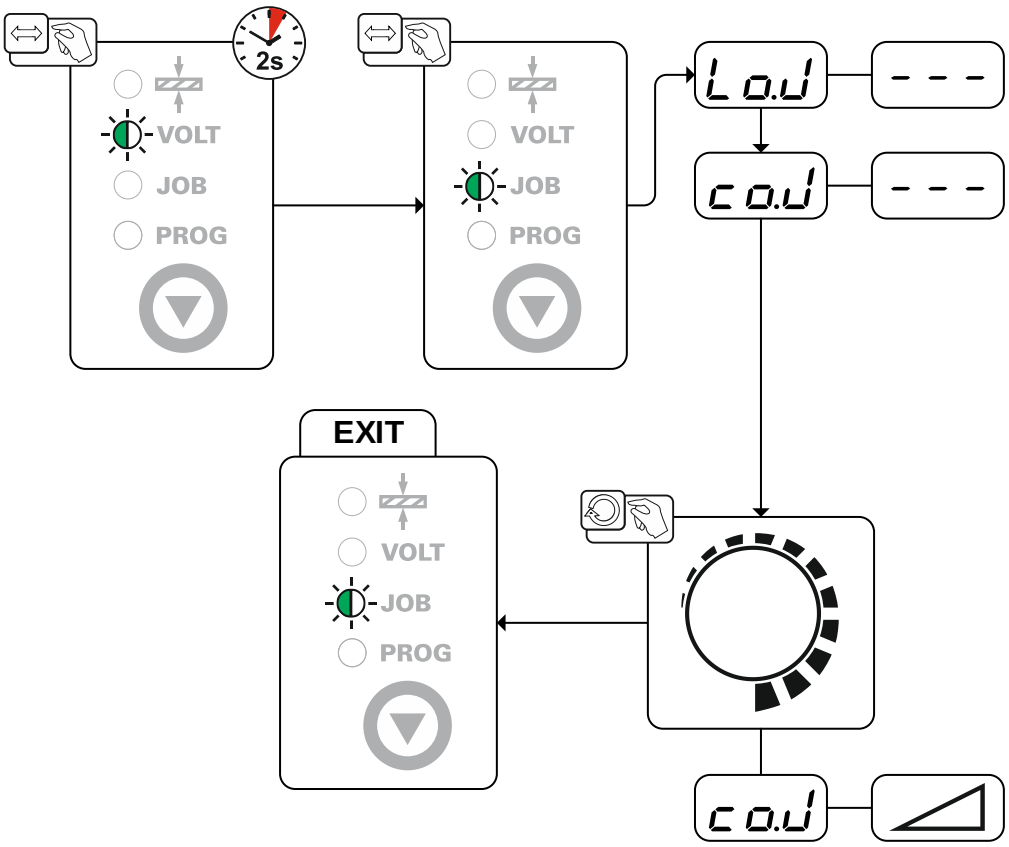


Figure 5-54

5.5.3 Loading an existing JOB from the free memory

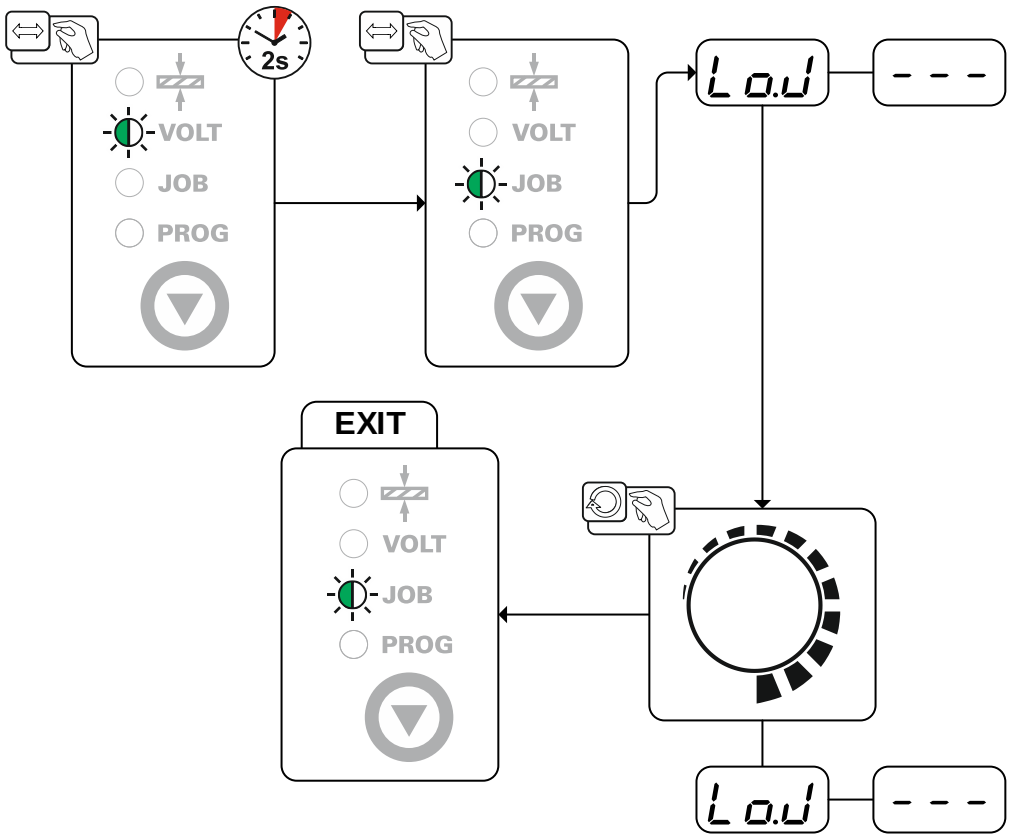


Figure 5-55

5.5.4 Resetting an existing JOB to the factory setting (Reset JOB)

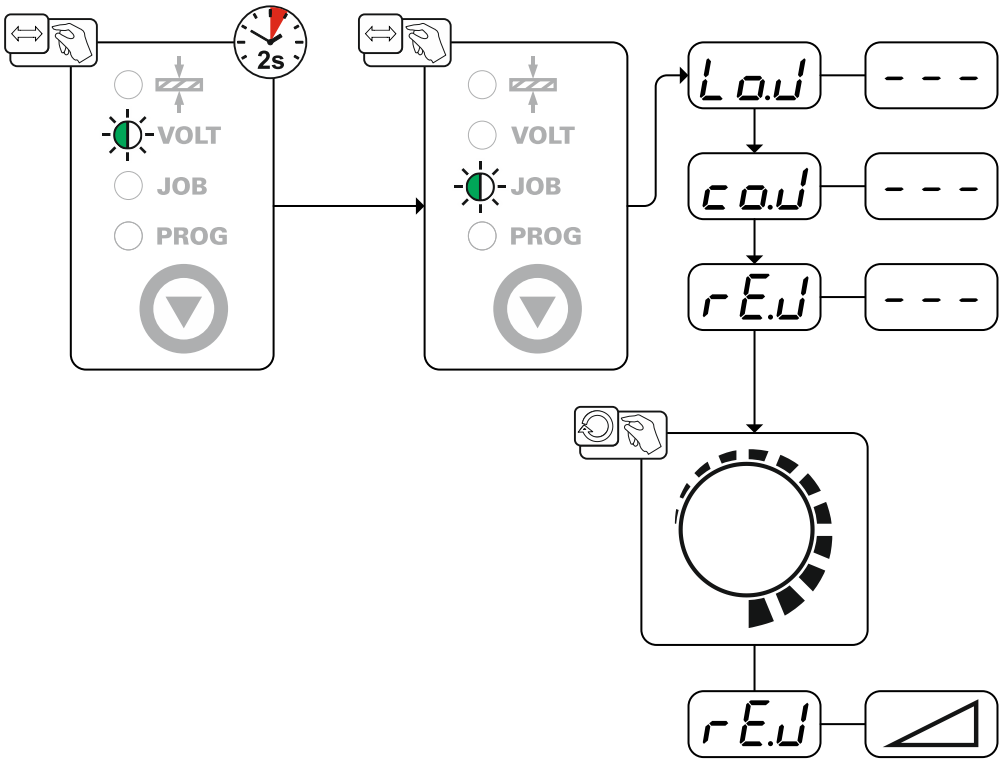


Figure 5-56

5.5.5 Resetting JOBs 1-128 to the factory setting (Reset All JOBs)

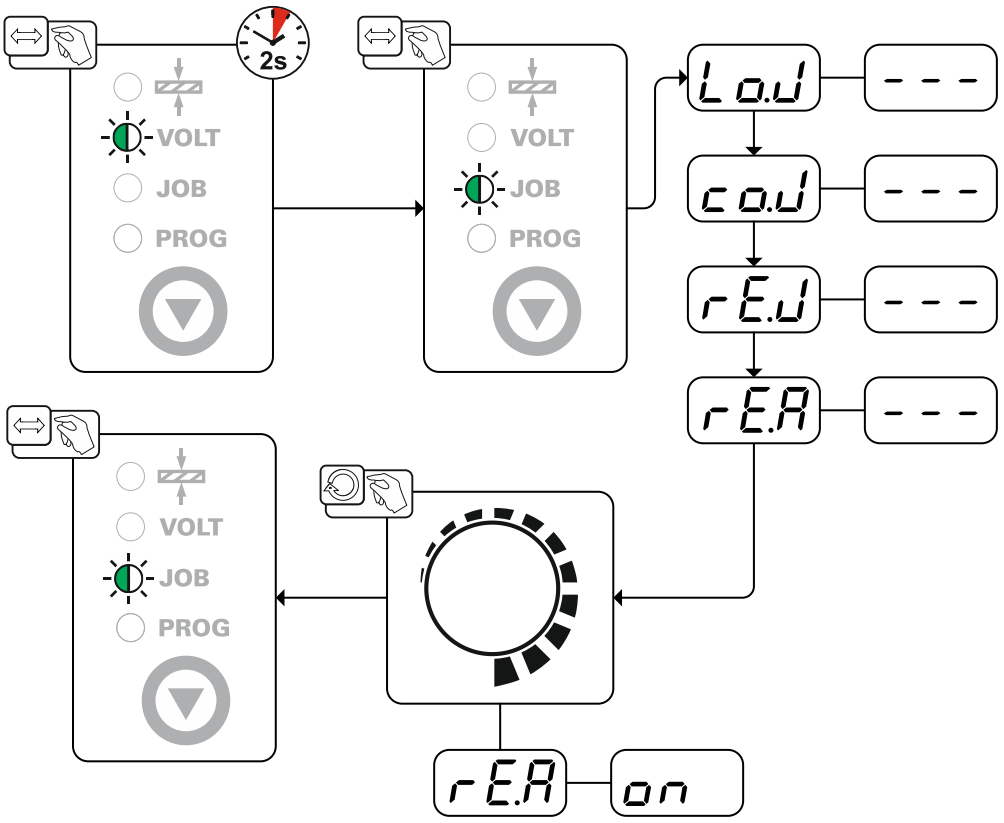


Figure 5-57

5.5.6 Exit JOB Manager without changes

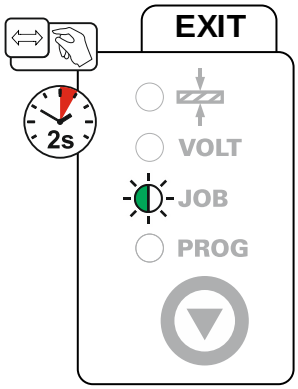


Figure 5-58

5.6 Welding programs

☞ ***Changes made to the other welding parameters during the course of the program have the equivalent effect on all programs.***
The change to the welding parameters is saved immediately in the JOB.

The welding machine has 16 programs, which you can change during welding.
In each selected welding task (JOB), *> see 5.3.6 chapter*, 16 programs can be set, saved and called up. In program “0” (default setting) the welding current can be infinitely adjusted across the entire range. In programs 1-15, 15 different welding currents (incl. operating mode and pulse function) are defined.

Example:

Program number	Welding current	Operating mode	Pulse function
1	80A	Non-latched	Pulses on
2	70A	Latched	Pulses off

The operating mode cannot be changed during the welding process. If welding is started with program 1 (non-latched operating mode), program 2 controls the setting of ignition program 1 despite the latched setting and is implemented to the end of the welding process.
The pulse function (pulses off, pulses on) and the welding currents are transferred from the corresponding programs.

5.6.1 Selection and adjustment

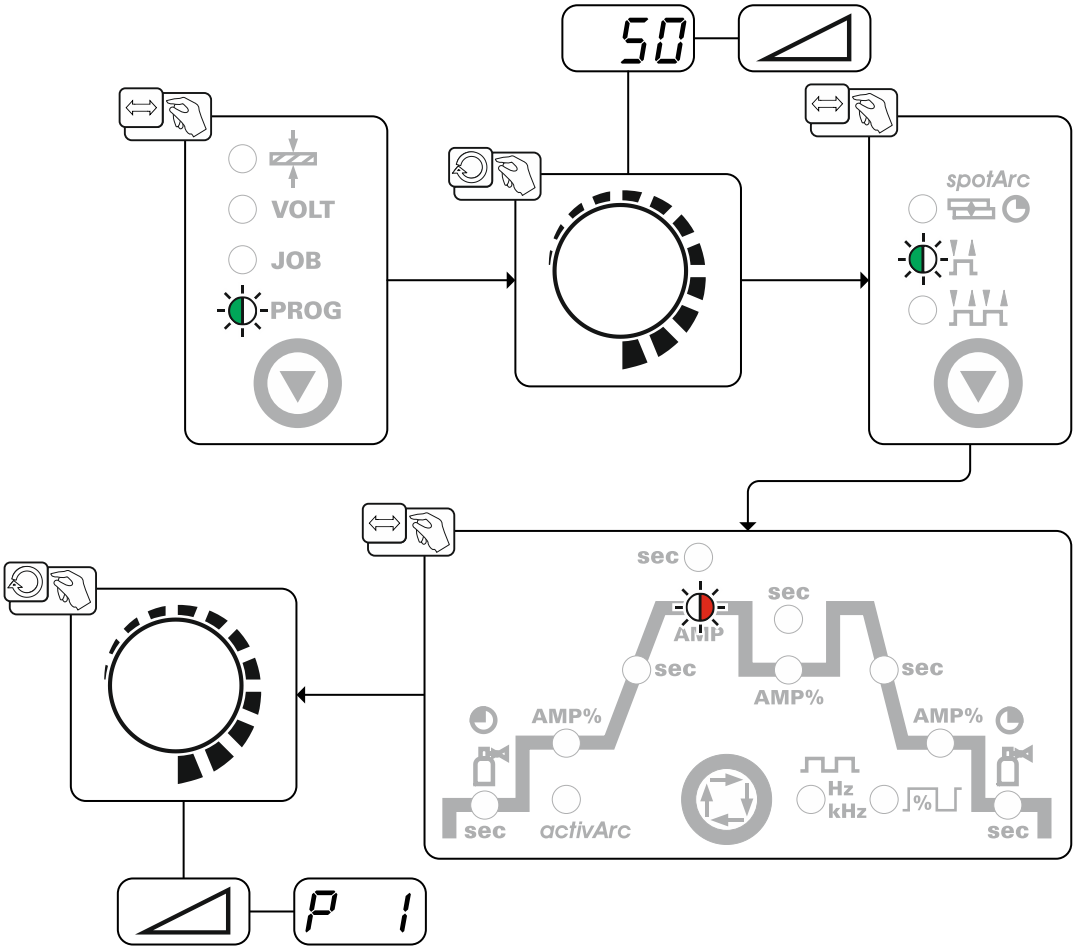


Figure 5-59

☞ ***When connecting a potentiometer torch or up/down torch or operating a standard torch in up/down mode, the program changeover to the welding machine control is blocked!***

5.6.2 Example "Program with synergetic setting"

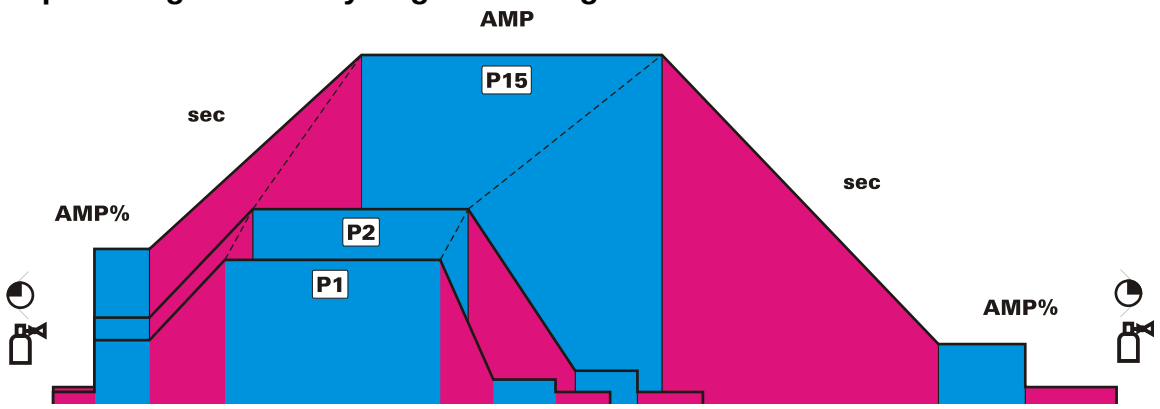


Figure 5-60

5.6.3 Example "Program with conventional setting"

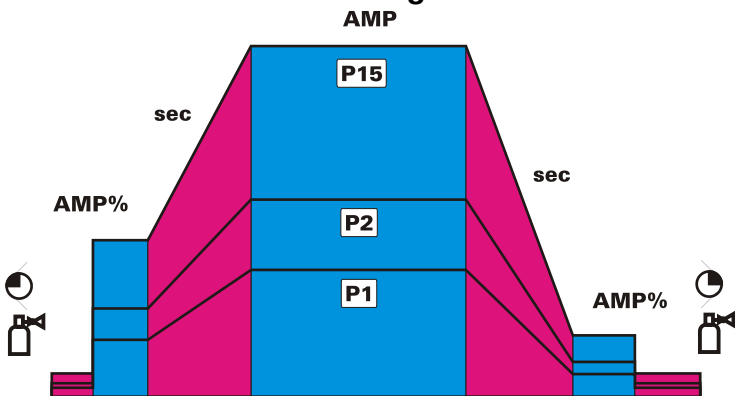


Figure 5-61

5.6.4 Accessories for switching over programs

The user can change, retrieve and save programs using the following components.

	Programs	
Component	**create and change**	**call up**
Welding machine control	**16**	**16**
PC with PC 300 welding parameter software	**16**	**16**
Tablet PC RC 300 with PC 300 welding parameters	**16**	**16**
Tetrix RINT robot interface	**-**	**16**
BUSINT X10 industrial bus interface	**-**	**16**

5.7 Remote control

☞ ***The remote controls are operated on the 19-pole remote control connection socket (analogue).***

5.7.1 RT1 19POL

Functions

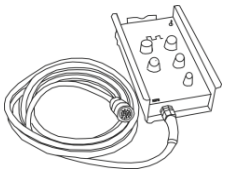
- Infinitely adjustable welding current (0% to 100%) depending on the preselected main current on the welding machine.

5.7.2 RTG1 19POL

Functions

- Infinite setting of the welding current (0% to 100%) depending on the main current preselected at the welding machine

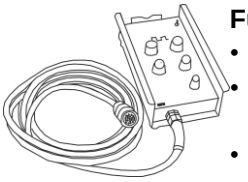
5.7.3 RTP1 19POL



Functions

- TIG/MMA
- Infinitely adjustable welding current (0% to 100%) depending on the preselected main current on the welding machine.
- Pulse/spot/normal
- Pulse, spot and break times are infinitely adjustable.

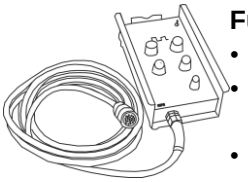
5.7.4 RTP2 19POL



Functions

- TIG/MMA.
- Infinitely adjustable welding current (0% to 100%) depending on the preselected main current on the welding machine.
- Pulse/spot/normal
- Frequency and spot times infinitely adjustable.
- Coarse adjustment of the cycle frequency.
- Pulse/pause ratio (balance) adjustable from 10% to 90%.

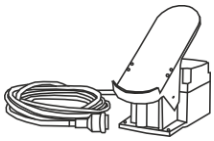
5.7.5 RTP3 spotArc 19POL



Functions

- TIG / MMA.
- Infinitely adjustable welding current (0% to 100%) depending on the preselected main current on the welding machine.
- Pulse / SpotArc spots / normal
- Frequency and spot time infinitely adjustable.
- Coarse adjustment of the pulse frequency.
- Pulse/pause ratio (balance) adjustable from 10% to 90%.

5.7.6 RTF1 19POL



Functions

- Infinitely adjustable welding current (0% to 100%) depending on the preselected main current on the welding machine.
- Start/stop welding operation (TIG)

ActivArc welding is not possible in combination with the foot-operated remote control.

5.7.6.1 RTF start ramp

The RTF start ramp function prevents the energy input at the start of welding from being too high and too fast should the user press the remote control pedal too fast and too strongly.

Example:
The user sets the main current at the welding machine to 200 A. The user presses the remote control pedal very quickly down by approx. 50% of the pedal travel.

- RTF switched on: The welding current increases in a linear (slow)ramp to approx. 100 A.
- RTF switched off: The welding current immediately jumps to approx. 100 A.

The RTF start ramp function is activated/deactivated by the parameter FFr in the machine configuration menu > *see 5.12 chapter*.

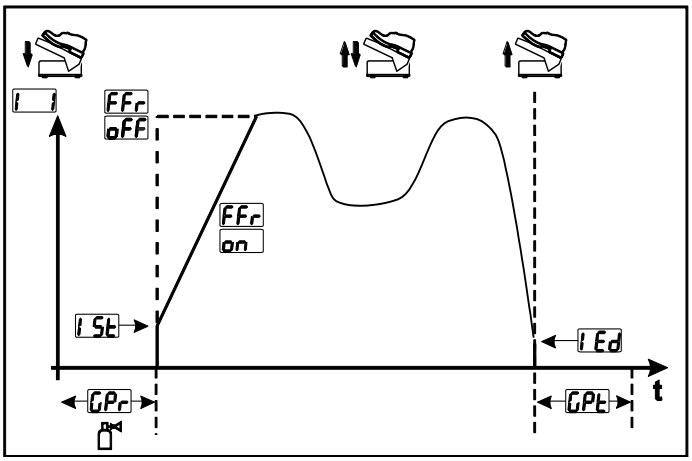


Figure 5-62

Symbol	Meaning
	**Actuate foot-operated remote control (start welding process)**
	**Operate foot-operated remote control (set welding current according to application)**
	**Release foot-operated remote control (end welding process)**
Display	**Setting/selection**
FFr	**RTF start ramp > *see 5.7.6.1 chapter*** on ------- Welding current rises to the specified main current level in a ramp function (ex works) oFF ------- Welding current immediately jumps to the specified main current level
GPr	**Gas pre-flow time**
I St	**Ignition current (as percentage, dependent on main current)**
I Ed	**End-crater current** Setting range in percent: depending on main current Setting range, absolute: Imin to Imax.
GPt	**Gas post-flow time**

5.7.6.2 RTF response

This function controls the current response during the main current phase. The user can choose between linear and logarithmic response. The logarithmic setting is especially suited for welding with low currents, e.g. for thin panels, as the logarithmic response enables a better control of the welding current.

In the machine configuration menu, the RTF response function Frt can be toggled between linear response Lin and logarithmic response LoG (ex works) > *see 5.12 chapter*.

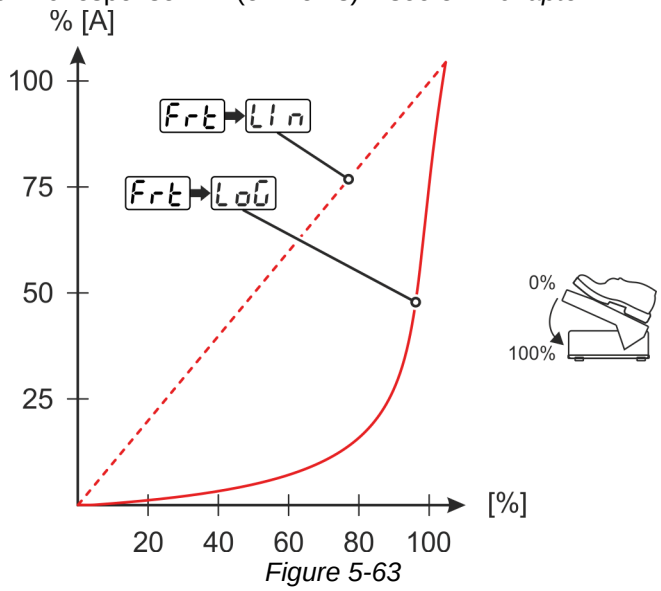


Figure 5-63

5.7.7 Welding torch (operating variants)

Different torch versions can be used with this machine.

Functions on the operating elements, such as torch triggers (BRT), rockers or potentiometers, can be modified individually via torch modes.

Explanation of symbols for operating elements:

Symbol	Description
	Press torch trigger
	Tap torch trigger
	Tap and press torch trigger

5.7.7.1 Tapping function (tap torch trigger)

Tapping function: Swiftly tap the torch trigger to change the function. The set torch mode determines the operating mode.

5.7.7.2 Torch mode setting

Modes 1 to 6 and 11 to 16 are available to the user. Modes 11 to 16 feature the same functionality as 1 to 6, but without the tapping function > *see 5.12 chapter* for the secondary current.

The functionality of the individual modes can be found in the corresponding torch type tables.

The torch modes are set using the torch configuration parameters "trd" in the machine configuration menu > torch mode "tod" > *see 5.7.7.1 chapter*.

☞ ***Only the modes listed are suitable for the corresponding torch types.***

5.7.7.3 Up/down speed

Functionality

Press and hold the up push-button:
Increase current up to the maximum value (main current) set in the power source.

Press and hold the down push-button:
Decrease current to the minimum value.

Use the machine configuration menu > *see 5.12 chapter* to set the up/down speed parameter uUd which determines the speed with which a current change becomes effective.

5.7.7.4 Current jump

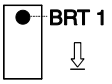
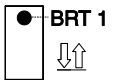
By tapping the corresponding torch trigger the welding current can be determined in an adjustable jump range. Each tap will cause the welding current to jump up or down by the defined value.

The “current jump” parameter dI is set in the machine configuration menu > *see 5.12 chapter*.

5.7.7.5 Standard TIG torch (5-pole)

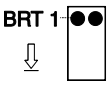
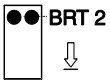
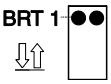
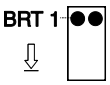
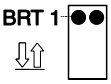
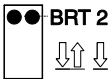
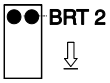
Standard torch with one torch trigger

Figure	Operating elements	Explanation of symbols
		BRT1 = torch trigger 1 (welding current on/off; secondary current via tapping function)

Functions	Mode	Operating elements
Welding current on/off	**1 (ex works)**	
Secondary current (latched operation)		

Standard torch with two torch triggers

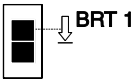
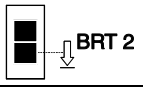
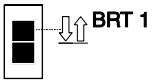
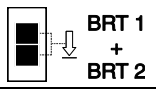
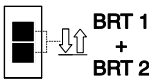
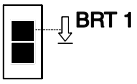
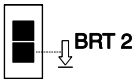
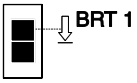
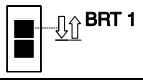
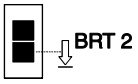
Figure	Operating elements	Explanation of symbols
		BRT1 = torch trigger 1 BRT2 = torch trigger 2

Functions	Mode	Operating elements
Welding current on/off	**1 (ex works)**	
Secondary current		
Secondary current (tapping function)[1])/(latched operating mode)		
Welding current on/off	**3**	
Secondary current (tapping function)[1])/(latched operating mode)		
Up function[2]		
Down function[2]		

[1] ***> see 5.7.7.1 chapter***
[2] ***> see 5.7.7.3 chapter***

Standard torch with one rocker (rocker, two torch triggers)

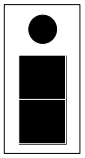
Figure	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1 BRT 2 = torch trigger 2

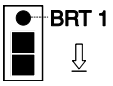
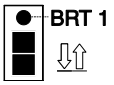
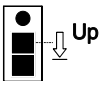
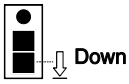
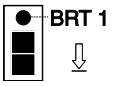
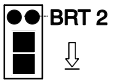
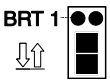
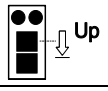
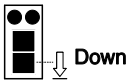
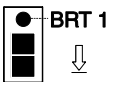
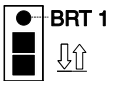
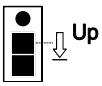
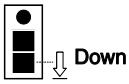
Functions	Mode	Operating elements
Welding current on/off	**1 (ex works)**	
Secondary current		
Secondary current (tapping function)[1])/(latched operating mode)		
Welding current on/off	**2**	
Secondary current (tapping function[1])		
Up function[2]		
Down function[2]		
Welding current on/off	**3**	
Secondary current (tapping function)[1])/(latched operating mode)		
Up function[2]		
Down function[2]		

[1] ***> see 5.7.7.1 chapter***
[2] ***> see 5.7.7.3 chapter***

5.7.7.6 TIG up/down torch (8-pole)

Up/down torch with one torch trigger

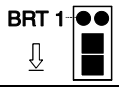
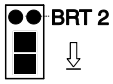
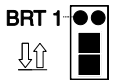
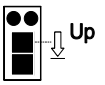
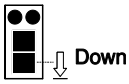
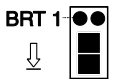
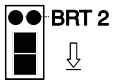
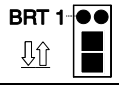
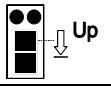
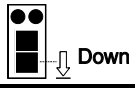
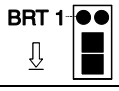
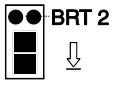
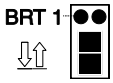
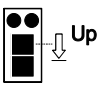
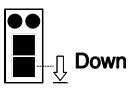
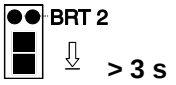
Image	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1

Functions	Mode	Operating elements
Welding current on/off	1 (ex works)	
Secondary current (tapping function)[1])/(latched operating mode)		
Increase welding current (up function[2])		
Decrease welding current (down function[2])		
Welding current on/off	2	
Secondary current		
Secondary current (tapping function[1])		
Program selection upwards		
Program selection downwards		
Welding current on/off	4	
Secondary current (tapping function)[1])/(latched operating mode)		
Increase welding current via current jump[3]		
Decrease welding current via current jump[3]		

[1] ***> see 5.7.7.1 chapter***
[2] ***> see 5.7.7.3 chapter***
[3] ***> see 5.7.7.4 chapter***

Up/down torch with two torch triggers

Figure	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1 (left) BRT 2 = torch trigger 2 (right)

Functions	Mode	Operating elements
Welding current on/off	1 (ex works)	
Secondary current		
Secondary current (tapping function)[1]/(latched operation)		
Increase welding current (up function[2])		
Decrease welding current (down function[2])		
Welding current on/off	2	
Secondary current		
Secondary current (tapping function[1])		
Program selection upwards		
Program selection downwards		
Welding current on/off	4	
Secondary current		
Secondary current (tapping function[1])		
Increase welding current via current jump[3]		
Decrease welding current via current jump[3]		
Gas test	4	 **> 3 s**

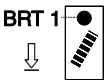
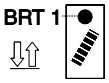
[1] ***> see 5.7.7.1 chapter***
[2] ***> see 5.7.7.3 chapter***
[3] ***> see 5.7.7.4 chapter***

5.7.7.7 Potentiometer torch (8-pole)

☞ ***The welding machine needs to be configured for operation with a potentiometer torch > see 5.7.7.8 chapter.***

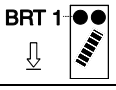
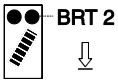
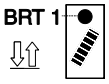
Potentiometer torch with one torch trigger

Figure	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1

Functions	Mode	Operating elements
Welding current on/off	3	
Secondary current (tapping function[1])		
Increase welding current		
Decrease welding current		

Potentiometer torch with two torch triggers

Figure	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1 BRT 2 = torch trigger 2

Functions	Mode	Operating elements
Welding current on/off	3	
Secondary current		
Secondary current (tapping function[1])		
Increase welding current		
Decrease welding current		

[1] ***> see 5.7.7.1 chapter***

5.7.7.8 Configuring the TIG potentiometer torch connection

⚠ DANGER

Risk of injury due to electrical voltage after switching off!
Working on an open machine can lead to fatal injuries!
Capacitors are loaded with electrical voltage during operation. Voltage remains present for up to four minutes after the mains plug is removed.

1. Switch off machine.
2. Remove the mains plug.
3. Wait for at last 4 minutes until the capacitors have discharged!

⚠ WARNING

Do not carry out any unauthorised repairs or modifications!
To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!
The warranty becomes null and void in the event of unauthorised interference.

- Appoint only skilled persons for repair work (trained service personnel)!

☞ ***Before reconnection, "Inspection and Testing during Operation" according to IEC/BS EN 60974-4 "Arc welding systems – Inspection and Testing during Operation" has to be performed!***

When connecting a potentiometer torch, jumper JP27 on PCB T320/1 inside the welding machine should be unplugged.

Welding torch configuration	Setting
Prepared for TIG standard or up/down torch (factory setting)	☒ JP27
Prepared for potentiometer torches	☐ JP27

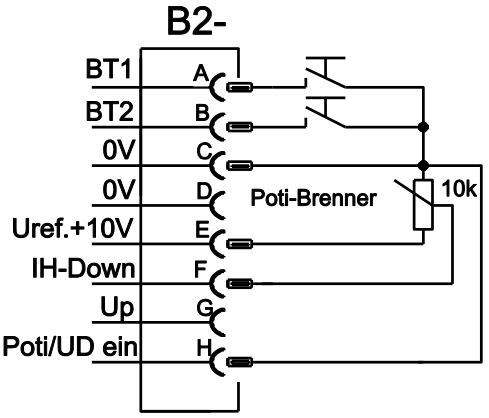
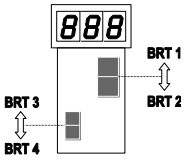


Figure 5-64

☞ ***This torch type requires the welding machine to be set to torch mode 3 > see 5.7.7.2 chapter.***

5.7.7.9 RETOX TIG torch (12-pole)

☞ ***For operation with this welding torch, the welding machine must be equipped with the retrofit option "ON 12POL RETOX TIG" (12-pole torch connection socket)!***

Diagram	Operating elements	Explanation of symbols
		TT= torch trigger

Functions	Mode	Operating elements
Welding current on/off	1 (ex works)	**TT 1**
Secondary current		**TT 2**
Secondary current (tapping function)		**TT 1 (tapping)**
Increase welding current (up function)		**TT 3**
Reduce welding current (down function)		**TT 4**
Modes 2 and 3 are not used with this type of torch or, respectively, are not appropriate.		
Welding current on/off	4	**TT 1**
Secondary current		**TT 2**
Secondary current (tapping function)		**TT 1 (tapping)**
Raise welding current in stages (setting the first increment)		**TT 3**
Decrease welding current in stages (setting the first decrement)		**TT 4**
Switchover between Up-Down and JOB changeover		**TT 2 (tapping)**
Increase JOB number		**TT 3**
Decrease JOB number		**TT 4**
Gas test		**TT 2 (3 s)**
Welding current on/off	6	**TT 1**
Secondary current		**TT 2**
Secondary current (tapping function)		**TT 1 (tapping)**
Increase welding current, infinite adjustment (up function)		**TT 3**
Reduce welding current, infinite adjustment (down function)		**TT 4**
Switchover between Up-Down and JOB changeover		**TT 2 (tapping)**
Increase JOB number		**TT 3**
Decrease JOB number		**TT 4**
Gas test		**TT 2 (3 s)**

5.7.7.10 Specifying max. no. of accessible JOBs

This function can be used to specify the maximum number of JOBs which can be retrieved from the free memory. The factory setting is for 10 JOBs to be accessible on the welding machine, but this figure can be increased to up to 128 if required.

The first JOB in the free memory is JOB 129. With the factory setting of 10 JOBs, this equates to JOB numbers 129 to 138. The first JOB can be set as required.

The following graphic gives an example with the settings for max. JOBs available = 5 and first available JOB = 145. This gives the available JOBs 145 to 150.

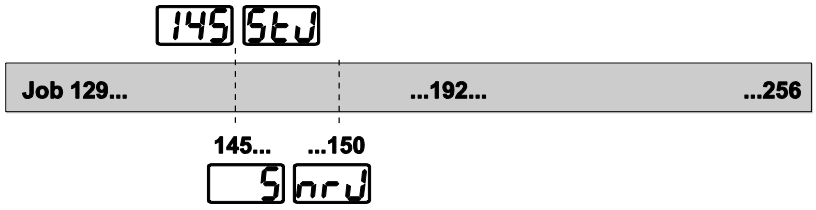


Figure 5-65

Display	Setting/selection
StJ	**Start JOB** Set first JOB to get (setting: 129 to 256, factory setting 129).
nrJ	**Get JOB number** Set maximum selectable jobs (setting: 1 to 128, factory setting 10). Additional parameter after activating the BLOCK JOB function.

☞ ***The settings are defined in the machine configuration menu > see 5.12 chapter.***

☞ ***The setting of the max. number of JOBs is intended solely for torch modes 4, 5 and 6 or 14, 15 and 16 (no tapping function).***

5.8 Interfaces for automation

⚠ WARNING

Do not carry out any unauthorised repairs or modifications!
To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!
The warranty becomes null and void in the event of unauthorised interference.

- Appoint only skilled persons for repair work (trained service personnel)!

☞ ***Damage to the machine due to improper connection!***

Unsuitable control leads or incorrect connection of input and output signals can cause damage to the machine.

- ***Only use shielded control leads!***
- ***If the machine is to be operated with control voltages connection via suitable isolation amplifiers is required!***
- ***To control the main or secondary current via control voltages, the relevant inputs must be enabled (see specification for activation of control voltage).***

5.8.1 Automation interface

⚠ WARNING

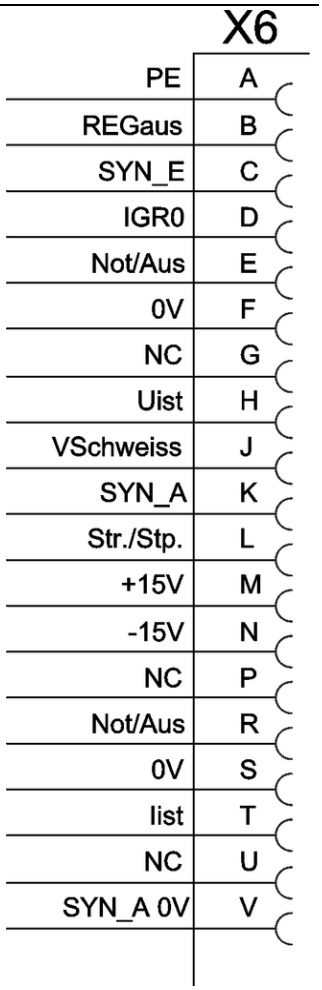
No function of the external interrupt equipment (emergency stop switch)!
If the emergency stop circuit has been set up using an external interrupt equipment connected to the interface for automated welding, the machine must be configured for this setup. If this is not observed, the power source will ignore the external interrupt equipment and will not shut down!

- Remove jumper 1 on the T320/1, M320/1 or M321 PCB!

☞ ***These accessory components can be retrofitted as an option > see 9 chapter.***

Pin	Signal shape	Designation
A	Output	PE Connection for cable screen
B	Output	REGaus For servicing purposes only
C	Input	SYN_E Synchronisation for master/slave operation
D	Input (no c.)	IGRO Current flows signal I>0 (maximum load 20mA / 15V) 0V = welding current flowing
E **+** **R**	Input Output	Not/Aus Emergency stop for higher level shut-down of the power source. To use this function, jumper 1 must be unplugged on PCB T320/1 in the welding machine. Contact open = welding current off
F	Output	0V Reference potential
G	-	NC Not assigned
H	Output	Uist Actual welding voltage, measured on pin F, 0-10V (0V = 0V, 10V = 100V)
J		Vschweiss Reserved for special purposes
K	Input	SYN_A Synchronisation for master/slave operation
L	Input	Str/Stp Start / stop welding current, same as torch trigger. Only available in non-latched operating mode. +15V = start, 0V = stop
M	Output	+15V Voltage supply +15V, max. 75mA
N	Output	-15V Voltage supply -15V, max. 25mA
P	-	NC Not assigned
S	Output	0V Reference potential
T	Output	Iist Actual welding current, measured on pin F; 0-10V (0V = 0A, 10V = 1000A)
U		NC
V	Output	SYN_A 0V Synchronisation for master/slave operation

Diagram



5.8.2 Remote control connection socket, 19-pole

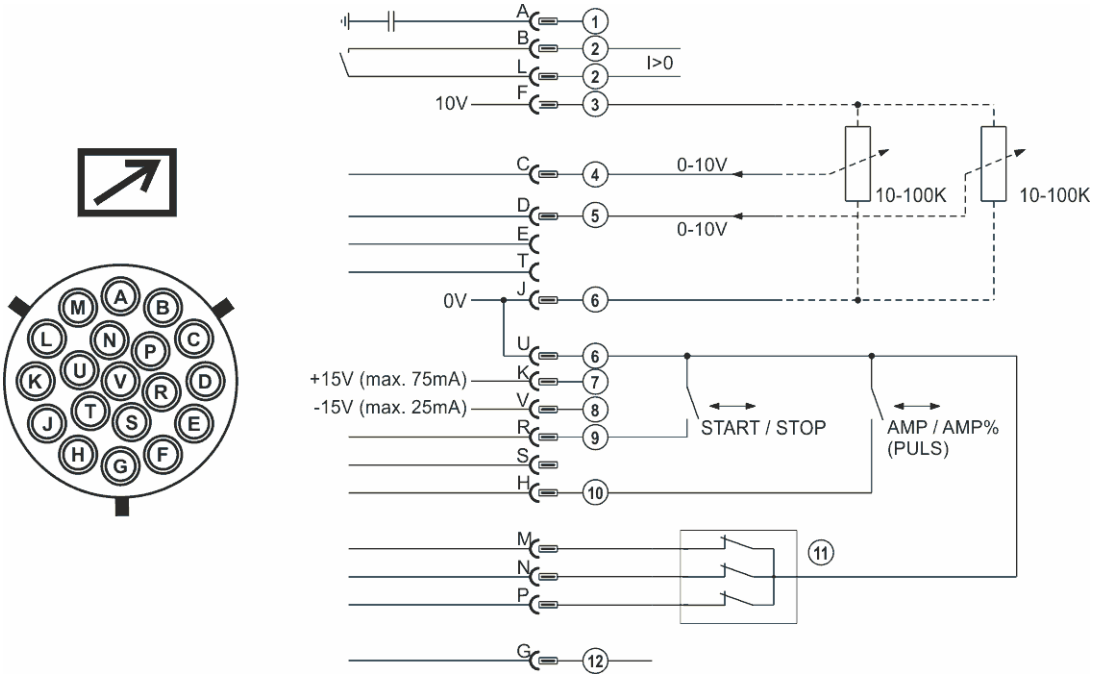


Figure 5-66

Pos.	Pin	Signal shape	Designation
1	A	Output	Connection for cable screen (PE)
2	B/L	Output	Current flows signal I>0, galvanically isolated (max. +- 15V/100mA)
3	F	Output	Reference voltage for potentiometer 10V (max. 10mA)
4	C	Input	Control value specification for main current, 0-10V (0V = I_{min}, 10V = I_{max})
5	D	Input	Control value specification for secondary current, 0-10V (0V = I_{min}, 10V = I_{max})
6	J/U	Output	Reference 0V
7	K	Output	Power supply +15V, max. 75mA
8	V	Output	Power supply -15V, max. 25mA
9	R	Input	Start/Stop welding current
10	H	Input	Switching between main and secondary welding currents (pulses)
11	M/N/P	Input	Activation of control voltage specification Set all 3 signals to reference potential 0V to activate external control voltage specification for main and secondary currents
12	G	Output	Measured value $I_{SETPOINT}$ (1V = 100A)

5.8.3 RINT X12 robot interface

The standard digital interface for mechanised applications
(optional, retrofitting on the machine or external fitting by the customer)

Functions and signals:

- Digital inputs: start/stop, operating modes, JOB and program selection, inching, gas test
- Analogue inputs: control voltages, e.g. for welding performance, welding current, etc.
- Relay outputs: process signal, ready for welding, system composite fault, etc.

5.8.4 BUSINT X11 Industrial bus interface

The solution for easy integration with automated production with e.g.

- Profinet/Profibus
- EnthernetIP/DeviceNet
- EtherCAT

etc.

5.9 PC interface

PC 300 welding parameter software

Set all welding parameters on the PC and simply transfer to one or more welding machines (accessory, set consisting of software, interface, connection leads)

- Manage up to 510 JOBs
- Exchange JOBs with the welding machine
- Online data communication
- Default settings for welding data monitoring
- Always up-to-date thanks to standard update function for new welding parameters
- Data backup by easy communication between power source and PC

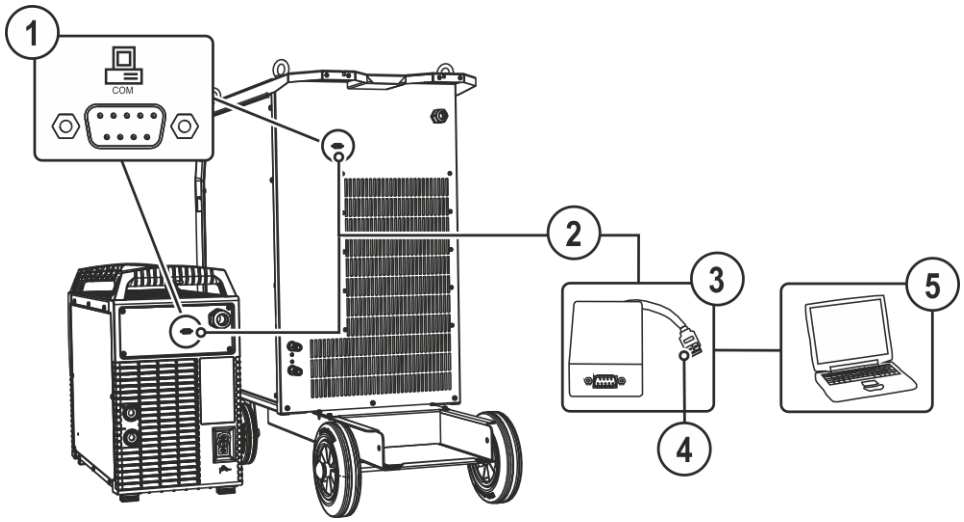


Figure 5-67

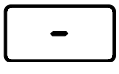
Item	Symbol	Description
1	COM	**PC interface, serial (D-Sub connection socket, 9-pole)**
2		**SECINT X10 USB**
3		**USB connection**
4		**Windows PC**

☞ ***Equipment damage or faults may occur if the PC is connected incorrectly!***
Not using the SECINT X10USB interface results in equipment damage or faults in signal transmission. The PC may be destroyed due to high frequency ignition pulses.

- ***Interface SECINT X10USB must be connected between the PC and the welding machine!***
- ***The connection must only be made using the cables supplied (do not use any additional extension cables)!***

5.10 Power-saving mode (Standby)

You can activate the power-saving mode by either pressing the push-button > *see 4.3 chapter* for a prolonged time or by setting a parameter in the machine configuration menu (time-controlled power-saving mode SbA) > *see 5.12 chapter*.



When power-saving mode is activated, the machine displays show the horizontal digit in the centre of the display only.

Pressing any operating element (e.g. turning a rotary knob) deactivates power-saving mode and the machine is ready for welding again.

5.11 Access control

☞ ***These accessory components can be retrofitted as an option > see 9 chapter.***

To protect against unauthorised or unintentional adjustment of the welding parameters on the machine, the control input can be locked with the aid of a key switch.

Key position 1 = All parameters can be set

Key position 0 = Only the following operating elements are functional:

- “Operating mode” button
- “Welding parameter setting” rotary transducer
- “Display switching” button
- “TIG pulse welding” button
- “Select welding parameters” button
- “Gas test” button

5.12 Machine configuration menu

Basic machine settings are defined in the machine configuration menu.

5.12.1 Selecting, changing and saving parameters

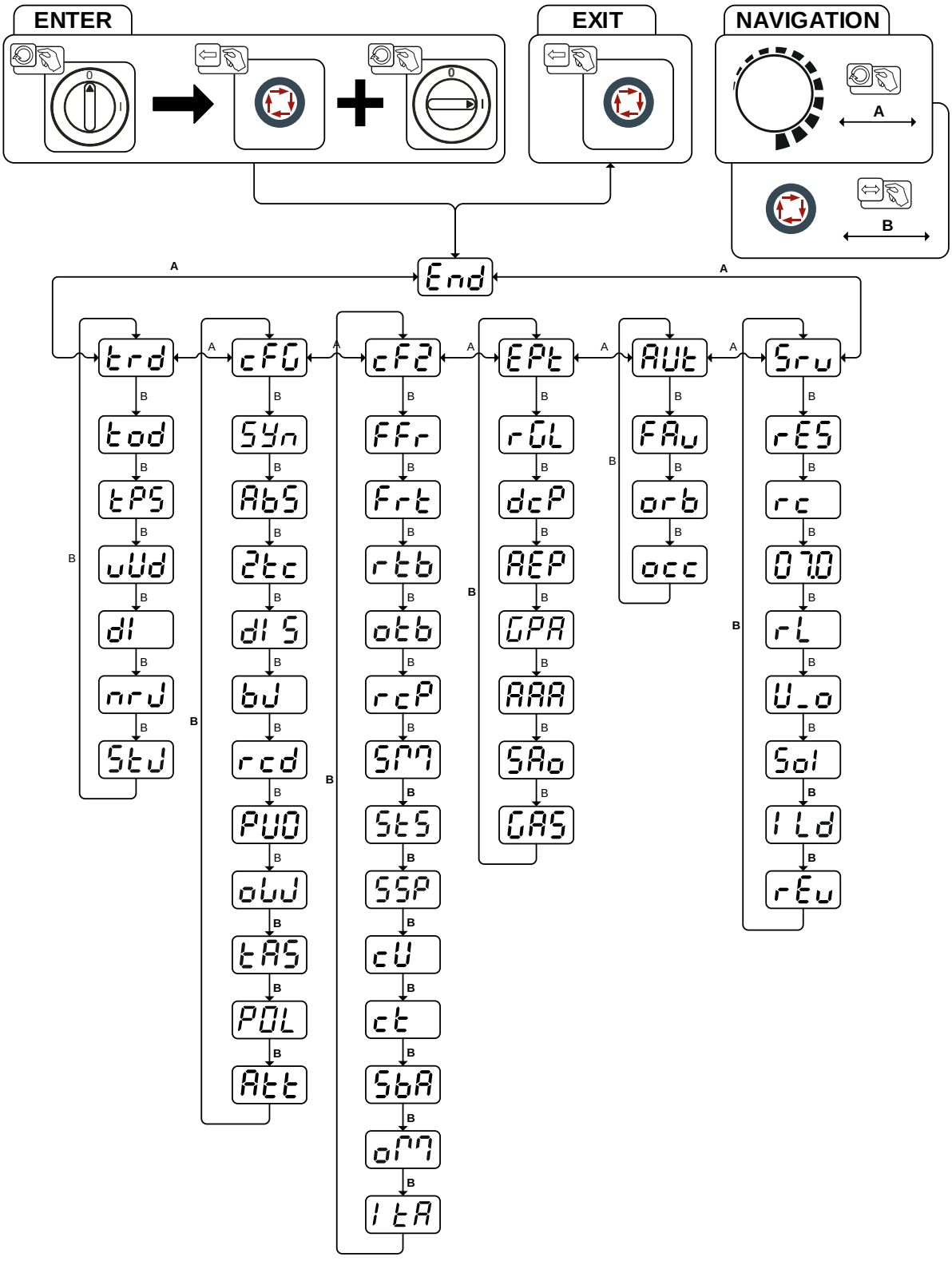


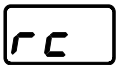
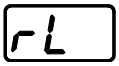
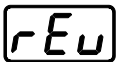
Figure 5-68

Display	Setting/selection
End	**Exit the menu** Exit

Display	Setting/selection
trd	**Torch configuration menu** Set welding torch functions
tod	**Torch mode (ex works 1) > *see 5.7.7.2 chapter***
tPS	**Alternative welding start – tapping start** Available from torch mode 11 (welding stop by tapping remains active). on------- Function enabled (ex works) oFF------- Function disabled
uUd	**Up/down speed > *see 5.7.7.3 chapter*** Increase value > rapid current change Decrease value > slow current change
dI	**Current jump > *see 5.7.7.4 chapter*** Current jump setting in ampere
nrJ	**Get JOB number** Set maximum selectable jobs (setting: 1 to 128, factory setting 10). Additional parameter after activating the BLOCK JOB function.
StJ	**Start JOB** Set first JOB to get (setting: 129 to 256, factory setting 129).
cFG	**Machine configuration** Settings for machine functions and parameter display
SYn	**Operating principle** on------ synergic parameter setting (factory setting) oFF------ conventional parameter setting
AbS	**Absolute value setting (ignition, secondary, end and hot start current) > *see 5.2.2 chapter*** on------- Welding current setting, absolute oFF------- Welding current setting, as a percentage of the main current (ex works)
2tc	**Non-latched operation (version C) > *see 5.3.11.6 chapter*** on------- Function enabled oFF------- Function disabled (ex works)
diS	**Setting for the primary setpoint value display** Defines the priority display for setpoint values: bld------panel thickness uol------welding voltage (factory setting)
bJ	**RINT X12, JOB control for automation solutions** on------ on oFF------ off (factory setting)
rcd	**Current display switching (MMA)** on------- Actual value display oFF------- Nominal value display (ex works)
PUO	**Pulsed welding in the upslope and downslope phases > *see 5.3.12 chapter*** on------- Function enabled (ex works) oFF------- Function disabled
oUJ	**Filler wire welding, operating mode** [2] I-0------- Filler wire operation for automated applications, wire is fed when current flows 2t------- Non-latched operating mode (ex works) 3t------- 3rd cycle operating mode 4t------- Latched operating mode
tAS	**TIG antistick > *see 5.3.13 chapter*** on------- function active (factory setting). oFF------- function inactive.

Display	Setting/selection
POL	**Program 0 block** With machines with access block, program 0 can be disabled. When the access block has been enabled, programs 1–x only can be switched. oFF -------All programs can be selected (ex works) on -------Programs 1–x can be selected (program 0 disabled)
AtE	**Show warnings > *see 7.2 chapter*** oFF -------Function disabled (ex works) on -------Function enabled
cF2	**Machine configuration (second part)** Settings for machine functions and parameter display
FFr	**RTF start ramp > *see 5.7.6.1 chapter*** on -------Welding current rises to the specified main current level in a ramp function (ex works) oFF -------Welding current immediately jumps to the specified main current level
FrE	**RTF response > *see 5.7.6.2 chapter*** Lin -------Linear response LoG -------Logarithmic responsive (ex works)
rtb	**Tungsten balling with RT AC remote control** [1] oFF -------Function disabled on -------Function enabled (in addition, the "AC balance" rotary knob at the RT AC remote control has to be turned to the left stop) (ex works)
otb	**Tungsten balling (old variant)** on -------Function enabled oFF -------Function disabled (ex works)
rcP	**Welding current polarity switching** [1] on -------polarity switching at the RT PWS 1 19POL remote control (ex works) oFF -------polarity switching at the welding machine control
SPM	**spotmatic operating mode > *see 5.3.11.5 chapter*** Ignition by contact with the workpiece on -------Function enabled (ex works) oFF -------Function disabled
StS	**Spot time setting > *see 5.3.11.5 chapter*** on -------Short spot time, setting range 5 ms to 999 ms, increments of 1 ms (ex works) oFF -------Long spot time, setting range 0.01 s to 20.0 s, increments of 10 ms (ex works)
SSP	**Process activation setting > *see 5.3.11.5 chapter*** on -------Separate process activation (ex works) oFF -------Permanent process activation
cU	**Torch cooling mode** AUt -------Automatic operation (ex works) on -------Permanently enabled oFF -------Permanently disabled
ct	**Welding torch cooling, post-flow time** Setting 1–60 min. (ex works 5 min.)
SbA	**Time-based power-saving mode > *see 5.10 chapter*** Time to activation of the power-saving mode in case of inactivity. Setting oFF = disabled or numerical value 5– 60 min. (ex works: 20).
oPM	**Operating mode switching via interface for automated welding** 2t -------Non-latched 2tS -------Special non-latched
itA	**Re-ignition after arc interruption > *see 5.3.10.3 chapter*** oFF -------Function disabled or numerical value 0.1 s–5.0 s (ex works: 3 s).

Display	Setting/selection
EPt	**Expert menu**
rGL	**AC average value controller** [1] on ------- Function enabled (ex works) oFF ------- Function disabled
dcP	**Welding current polarity switch (dc+) with TIG DC** [1] on ------- Polarity switch released oFF ------- Polarity switch blocked; protects the tungsten electrode from being permanently damaged (ex works).
AEP	**Reconditioning pulse (tungsten ball stability)** [1] Cleaning effect of the tungsten ball at the end of welding. on ------- Function enabled (ex works) oFF ------- Function disabled
GPA	**Automatic gas post-flow** on ------- function on (factory setting) oFF ------- function off
AAA	**activArc voltage measuring** on ------- Function enabled (ex works) oFF ------- Function disabled
SAo	**Error output to interface for automated welding, contact SYN_A** oFF ------- AC synchronisation or hot wire (ex works) FSn ------- Error signal, negative logic FSP ------- Error signal, positive logic Auc ------- AVC (Arc voltage control) connection
GAS	**Gas monitoring** Depending on where the gas sensor is situated, the use of a pilot static tube and the welding process monitoring phase. oFF ------- Function disabled (ex works). 1 ------- Monitoring during the welding process. Gas sensor between gas valve and welding torch (with pilot static tube). 2 ------- Monitoring prior to the welding process. Gas sensor between gas valve and welding torch (without pilot static tube). 3 ------- Permanent monitoring Gas sensor between gas cylinder and gas valve (with pilot static tube).
AUt	**Automation menu** [3]
FAu	**Fast take-over of control voltage (automation)** [3] on ------- Function enabled oFF ------- Function disabled (ex works)
orb	**Orbital welding** [3] oFF ------- Function disabled (ex works) on ------- Function enabled
occ	**Orbital welding** [3] Correction value for orbital current
Sru	**Service menu** Any changes to the service menu should be agreed with the authorised service personnel.
rES	**Reset (to factory setting)** oFF ------- Disabled (ex works) cFG ------- Reset the values in the machine configuration menu cPL ------- Complete reset of all values and settings Resetting is performed when exiting the menu (End).

Display	Setting/selection
	**Automated/Manual (rC on/off) operating mode** [3] Select machine/function control on------with external control voltages/signals oFF------with machine control
	**Software version query (example)** 07.= ------system bus ID
	03c0= ----version number System bus ID and version number are separated by a dot.
	**Cable resistance alignment > *see 5.12.2 chapter***
	**Only qualified service personnel may change the parameters!**
	**TIG HF start (soft/hard) switching** on -------soft ignition (factory setting). oFF -------hard ignition.
	**Ignition pulse limit** Setting 0 ms–15 ms (increments of 1 ms)
	**PCB state – qualified service personnel only!**

[1] for AC welding machines only.
[2] For machines with filler wire (AW) only.
[3] for components for automated welding (RC) only.

5.12.2 Aligning the cable resistance

To ensure optimum welding properties, the electric cable resistance should be aligned again whenever an accessory component such as the welding torch or the intermediate hose package (AW) has been changed. The resistance value of the cables can be set directly or can be aligned by the power source. In the delivery state the cable resistance is set to the optimum values. To optimise the welding properties for other cable lengths, an alignment process (voltage correction) is necessary.

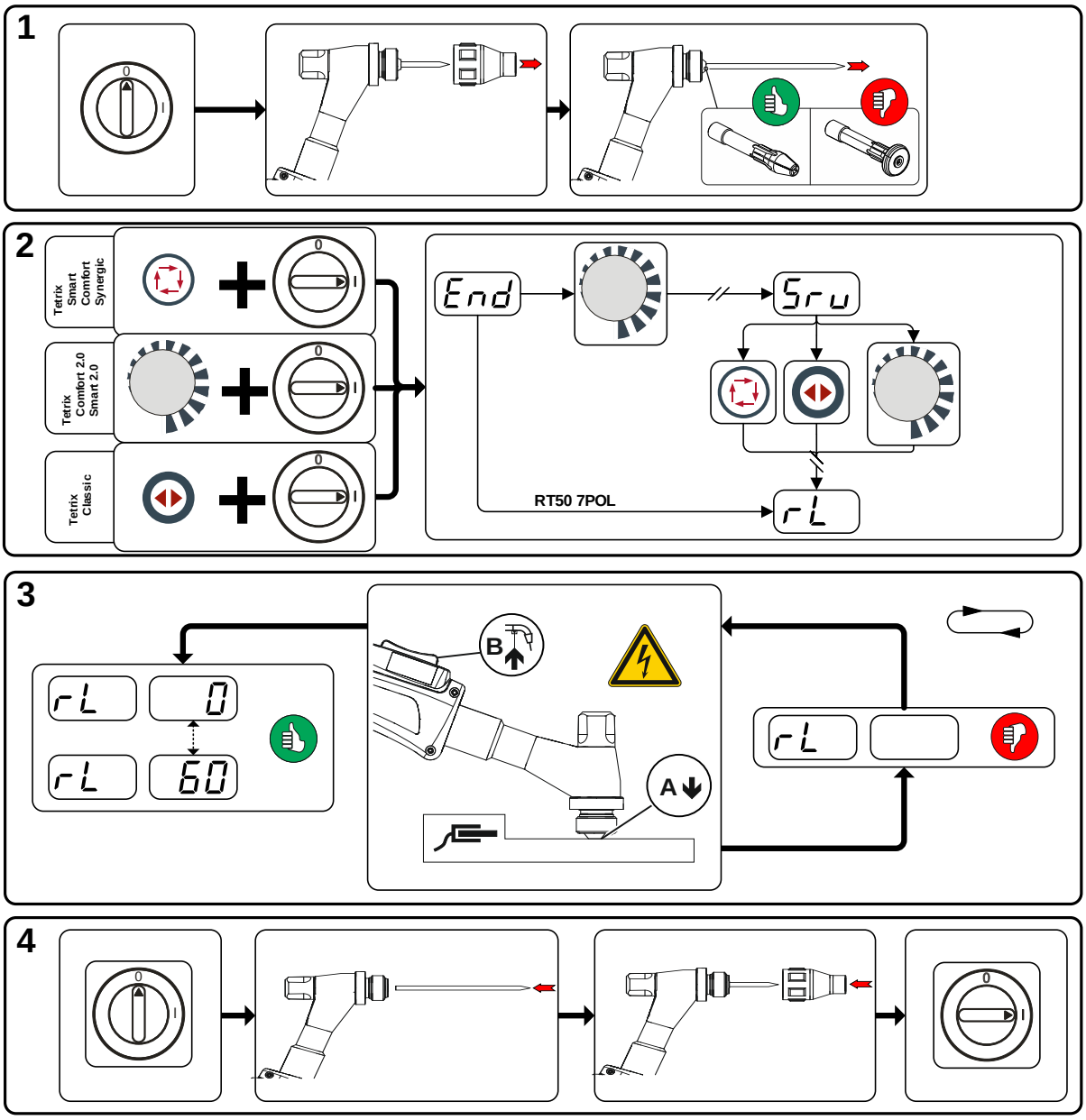


Figure 5-69

1 Preparation

- Switch off the welding machine.
- Unscrew the gas nozzle from the welding torch.
- Unfasten the tungsten electrode and extract.

2 Configuration

- Press the  or  (Tetrix Classic) push-button while simultaneously switching on the welding machine.
- Release push-button.
- The required parameter can now be selected using the  rotary knob.

3 Adjustment/measurement

- Applying slight pressure, press the welding torch with the collet against a clean, purged location on the workpiece and then press the torch trigger for approx. 2 seconds. A short-circuit current will flow briefly, which is used to determine and display the cable resistance. The value can be between 0 mΩ and 60 mΩ. The new value is immediately saved without requiring further confirmation. If no value is shown on the right-hand display, then measurement failed. The measurement must be repeated.

4 Restoring welding standby mode

- Switch off the welding machine.
- Lock the tungsten electrode in the collet again.
- Screw the gas nozzle onto the welding torch.
- Switch on the welding machine

6 Maintenance, care and disposal

6.1 General

⚠ DANGER

Risk of injury due to electrical voltage after switching off!
Working on an open machine can lead to fatal injuries!
Capacitors are loaded with electrical voltage during operation. Voltage remains present for up to four minutes after the mains plug is removed.

1. Switch off machine.
2. Remove the mains plug.
3. Wait for at last 4 minutes until the capacitors have discharged!

⚠ WARNING

Incorrect maintenance, testing and repair!
Maintenance, testing and repair of the machine may only be carried out by skilled and qualified personnel. A qualified person is one who, because of his or her training, knowledge and experience, is able to recognise the dangers that can occur while testing welding power sources as well as possible subsequent damage, and who is able to implement the required safety procedures.

Observe the maintenance instructions > *see 6.3 chapter*.

- In the event that the provisions of one of the below-stated tests are not met, the machine must not be operated again until it has been repaired and a new test has been carried out!

Repair and maintenance work may only be performed by qualified authorised personnel; otherwise the right to claim under warranty is void. In all service matters, always consult the dealer who supplied the machine. Return deliveries of defective equipment subject to warranty may only be made through your dealer. When replacing parts, use only original spare parts. When ordering spare parts, please quote the machine type, serial number and item number of the machine, as well as the type designation and item number of the spare part.

Under the specified ambient conditions and normal working conditions this machine is essentially maintenance-free and requires just a minimum of care.

Contamination of the machine may impair service life and duty cycle. The cleaning intervals depend on the ambient conditions and the resulting contamination of the machine. The minimum interval is every six months.

6.2 Cleaning

- Clean the outer surfaces with a moist cloth (no aggressive cleaning agents).
- Purge the machine venting channel and cooling fins (if present) with oil- and water-free compressed air. Compressed air may overspeed and destroy the machine fans. Never direct the compressed air directly at the machine fans. Mechanically block the fans, if required.
- Check the coolant for contaminants and replace, if necessary.

6.2.1 Dirt filter

The duty cycle of the welding machine decreases as an effect of the reduced cooling air volume. Depending on the amount of dirt building up (at least every two months), the dirt filter has to be uninstalled and cleaned regularly (e.g. by purging with compressed air).

6.3 Maintenance work, intervals

6.3.1 Daily maintenance tasks

Visual inspection

- Mains supply lead and its strain relief
- Gas cylinder securing elements
- Check hose package and power connections for exterior damage and replace or have repaired by specialist staff as necessary!
- Gas tubes and their switching equipment (solenoid valve)
- Check that all connections and wearing parts are hand-tight and tighten if necessary.
- Check correct mounting of the wire spool.
- Wheels and their securing elements
- Transport elements (strap, lifting lugs, handle)
- Other, general condition

Functional test

- Operating, message, safety and adjustment devices (Functional test)
- Welding current cables (check that they are fitted correctly and secured)
- Gas tubes and their switching equipment (solenoid valve)
- Gas cylinder securing elements
- Check correct mounting of the wire spool.
- Check that all screw and plug connections and replaceable parts are secured correctly, tighten if necessary.
- Remove any spatter.
- Clean the wire feed rollers on a regular basis (depending on the degree of soiling).

6.3.2 Monthly maintenance tasks

Visual inspection

- Casing damage (front, rear and side walls)
- Wheels and their securing elements
- Transport elements (strap, lifting lugs, handle)
- Check coolant tubes and their connections for impurities

Functional test

- Selector switches, command devices, emergency stop devices, voltage reducing devices, message and control lamps
- Check that the wire guide elements (inlet nipple, wire guide tube) are fitted securely.
- Check coolant tubes and their connections for impurities
- Check and clean the welding torch. Deposits in the torch can cause short circuits and have a negative impact on the welding result, ultimately causing damage to the torch.

6.3.3 Annual test (inspection and testing during operation)

A periodic test according to IEC 60974-4 "Periodic inspection and test" has to be carried out. In addition to the regulations on testing given here, the relevant local laws and regulations must also be observed.

☞ ***For more information refer to the "Warranty registration" brochure supplied and our information regarding warranty, maintenance and testing at www.ewm-group.com!***

6.4 Disposing of equipment

☞ ***Proper disposal!***

The machine contains valuable raw materials, which should be recycled, and electronic components, which must be disposed of.

- ***Do not dispose of in household waste!***
- ***Observe the local regulations regarding disposal!***

- According to European provisions (Directive 2012/19/EU on Waste of Electrical and Electronic Equipment), used electric and electronic equipment may no longer be placed in unsorted municipal waste. It must be collected separately. The symbol depicting a waste container on wheels indicates that the equipment must be collected separately.
  This machine has to be disposed of, or recycled, in accordance with the waste separation systems in use.
- According to German law (law governing the distribution, taking back and environmentally correct disposal of electric and electronic equipment (ElektroG)), used machines are to be placed in a collection system separate from unsorted municipal waste. The public waste management utilities (communities) have created collection points at which used equipment from private households can be disposed of free of charge.
- Information about returning used equipment or about collections can be obtained from the respective municipal administration office.
- In addition to this, returns are also possible throughout Europe via EWM sales partners.

7 Rectifying faults

All products are subject to rigorous production checks and final checks. If, despite this, something fails to work at any time, please check the product using the following flowchart. If none of the fault rectification procedures described leads to the correct functioning of the product, please inform your authorised dealer.

7.1 Checklist for rectifying faults

☞ ***The correct machine equipment for the material and process gas in use is a fundamental requirement for perfect operation!***

Legend	Symbol	Description
	🗲	Fault/Cause
	🛠	Remedy

Mains fuse triggers

🗲 Unsuitable mains fuse

🛠 Set up recommended mains fuse > *see 8 chapter*.

Functional errors

🗲 Insufficient coolant flow

🛠 Check coolant level and refill if necessary

🛠 Eliminate kinks in conduit system (hose packages)

🛠 Reset automatic cutout of the coolant pump by activating

🗲 Air in the coolant circuit

🛠 Vent coolant circuit > *see 7.6 chapter*

🗲 Several parameters cannot be set (machines with access block)

🛠 Entry level is blocked, disable access lock > *see 5.11 chapter*

🗲 All machine control signal lights are illuminated after switching on

🗲 No machine control signal light is illuminated after switching on

🗲 No welding power

🛠 Phase failure > check mains connection (fuses)

🗲 Connection problems

🛠 Make control lead connections and check that they are fitted correctly.

Welding torch overheated

🗲 Loose welding current connections

🛠 Tighten power connections on the torch and/or on the workpiece

🛠 Tighten contact tip correctly

🗲 Overload

🛠 Check and correct welding current setting

🛠 Use a more powerful welding torch

No arc ignition

🗲 Incorrect ignition type setting.

🛠 Ignition type: Select “HF start”. Depending on the machine, the setting is defined by the changeover switch for ignition types or the hF parameter in one of the machine menus (see the “Control operating instructions”, if applicable).

Bad arc ignition

🗲 Material inclusions in the tungsten electrode due to contact with filler material or workpiece

🛠 Regrind or replace the tungsten electrode

🗲 Bad current transfer on ignition

🛠 Check the setting on the "Tungsten electrode diameter/Ignition optimisation" rotary dial and increase if necessary (higher ignition energy).

Unstable arc

- Material inclusions in the tungsten electrode due to contact with filler material or workpiece
  - 🛠 Regrind or replace the tungsten electrode
- Incompatible parameter settings
  - 🛠 Check settings and correct if necessary

Pore formation

- Inadequate or missing gas shielding
  - 🛠 Check shielding gas setting and replace shielding gas cylinder if necessary
  - 🛠 Shield welding site with protective screens (draughts affect the welding result)
  - 🛠 Use gas lens for aluminium applications and high-alloy steels
- Unsuitable or worn welding torch equipment
  - 🛠 Check size of gas nozzle and replace if necessary
- Condensation (hydrogen) in the gas tube
  - 🛠 Purge hose package with gas or replace

7.2 Warnings

☞ ***A warning is denoted by the letter A on the machine display, or Att in case of multiple machine displays. The possible cause of the warning is signalled by the respective warning code (see table).***

☞ ***The display of possible warning numbers depends on the machine version (interfaces/functions).***

- In case of multiple warnings, these are displayed in sequence.
- Document machine warning and inform service personnel, if required.

Warning code	Possible cause	Remedy
1	Machine excess temperature	Allow the machine to cool down
2	Half-wave failures	Check process parameters
3	Welding torch cooling warning	Check coolant level and refill if necessary
4	Gas warning	Check gas supply
5	See warning number 3	-
6	Welding consumable (wire electrode) fault	Check wire feeding (with machines with filler wire)
7	CAN bus failure	Inform service
32	Encoder malfunction, drive	Inform service
33	Drive is operating under overload conditions	Adjust mechanical load
34	JOB unknown	Select alternative JOB

The warnings can be reset by pressing a push-button (see table):

Welding machine control	Smart	Classic	Comfort	Smart 2 Comfort 2	Synergic
Push-button					

7.3 Error messages

☞ ***A welding machine error is indicated by an error code being displayed (see table) on the display on the machine control.***
In the event of a machine error, the power unit is shut down.

☞ ***The display of possible error numbers depends on the machine version (interfaces/functions).***

- If multiple errors occur, these are displayed in succession.
- Document machine errors and inform service staff as necessary.

Error message	Possible cause	Remedy
Err 3	Tacho error	Check wire guide/hose package
	Wire feeder is not connected	• Switch off cold wire mode in the machine configuration menu (off status) • Connect the wire feeder
Err 4	Temperature error	Allow the machine to cool down
	Error in emergency stop circuit (interface for automated welding)	• Check the external interrupt equipment • Check jumper JP 1 on PCB T320/1
Err 5	Overvoltage	Switch off machine and check the mains voltage
Err 6	Low voltage	
Err 7	Coolant error (with connected cooling unit only)	Check coolant level and refill if necessary
Err 8	Gas error	Check gas supply
Err 9	Secondary overvoltage	Switch the machine off and on again. If the error persists, contact service.
Err 10	PE error	
Err 11	FastStop position	Acknowledge error via robot interface (if available)
Err 12	VRD error	Switch the machine off and on again. If the error persists, contact service.
Err 16	Pilot arc current	Check welding torch
Err 17	Filler wire error Excess current or deviation of nominal/actual wire value	Check wire feed mechanism (drive, hose packages, torch, process wire feed speed and robot movement speed) and adjust, if required
Err 18	Plasma gas error Nominal value specification differs considerably from the actual value.	Check plasma gas supply (tightness, kinks, guide, connections, closure)
Err 19	Shielding gas error Nominal value specification differs considerably from the actual value	Check plasma gas supply (tightness, kinks, guide, connections, closure)
Err 20	Coolant flow Coolant flow volume too low	Check cooling circuit (coolant level, tightness, kinks, guide, connections, closure)
Err 22	Cooling circuit excess temperature	Check cooling circuit (coolant level, nominal temperature value)
Err 23	HF choke excess temperature	• Allow the machine to cool down • Adjust processing cycle times if necessary
Err 24	Pilot arc ignition error	Check plasma torch consumables
Err 32	Electronics error (I>0 error)	Switch the machine off and on again. If the error persists, contact service.
Err 33	Electronics error (Uact error)	
Err 34	Electronics error (A/D channel error)	
Err 35	Electronics error (edge error)	
Err 36	Electronics error (S-Sign)	
Err 37	Electronics error (temperature error)	Allow the machine to cool down.

Error message	Possible cause	Remedy
Err 38	---	Switch the machine off and on again. If the error persists, contact service.
Err 39	Electronics error (secondary overvoltage)	
Err 40	Electronics error (I>0 error)	Inform service
Err 48	Ignition error	Check welding process
Err 49	Arc interruption	Inform service
Err 51	Error in emergency stop circuit (interface for automated welding)	• Check the external interrupt equipment • Check jumper JP 1 on PCB T320/1
Err 57	Auxiliary drive error, tacho error	Check the auxiliary drive (tacho – no signal, M3.51 defective > inform service)
Err 59	Incompatible component	Replace component

7.4 Resetting welding parameters to the factory settings

☞ ***All customised welding parameters that are stored will be replaced by the factory settings.***

To reset the welding parameters or machine settings to the factory settings, select parameter rES in the service menu SrU > *see 5.12 chapter*.

7.5 Display machine control software version

The query of the software versions only serves to inform the authorised service staff. It is available in the machine configuration menu > *see 5.12 chapter*.

7.6 Vent coolant circuit

☞ ***Coolant tank and quick connect coupling of coolant supply and return are only fitted in machines with water cooling.***

☞ ***To vent the cooling system always use the blue coolant connection, which is located as deep as possible inside the system (close to the coolant tank)!***

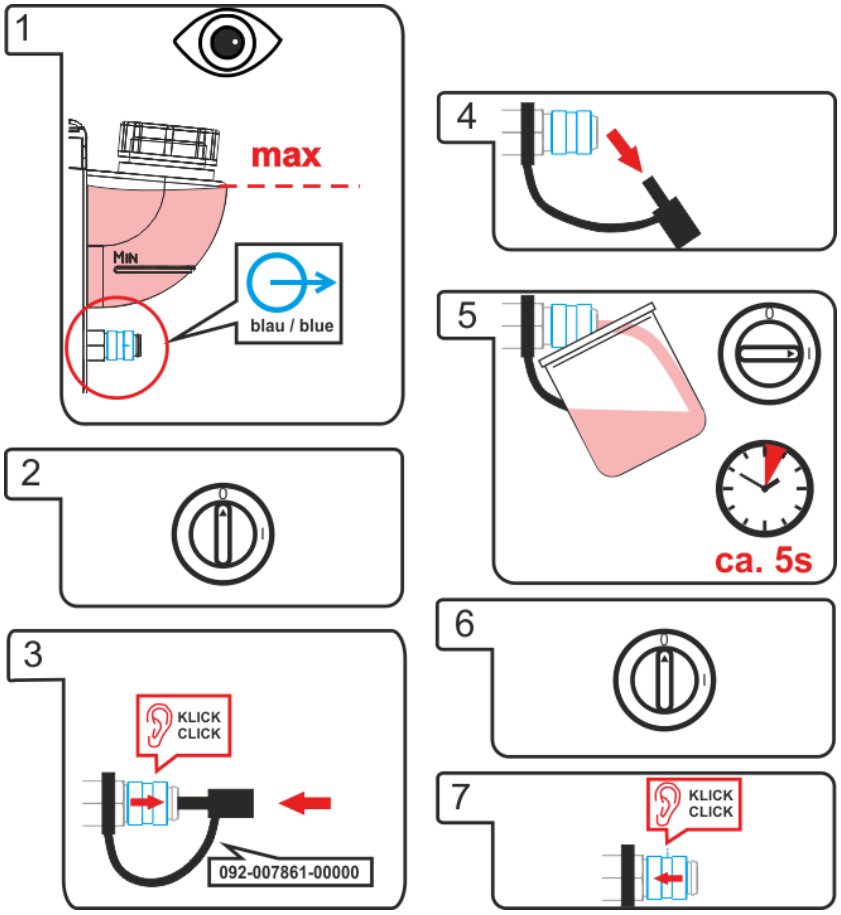


Figure 7-1

8 Technical data

☞ ***Performance specifications and guarantee only in connection with original spare and replacement parts!***

8.1 Tetrix 351 FW

	TIG	MMA
Welding current	5 A–350 A	
Welding voltage	10.2 V–24.0 V	20.2 V–34.0 V
Duty cycle at 40 °C	350 A (100% DC)	
Load cycle	10 min. (60% DC ≙ 6 min. welding, 4 min. pause)	
Open circuit voltage	79 V	
Mains voltage (tolerances)	3 x 400 V (–25% to +20%)	
Frequency	50/60 Hz	
Mains fuse (safety fuse, slow-blow)	3 x 16 A	3 x 25 A
Mains connection lead	H07RN-F4G6	
Max. connected load	10.9 kVA	15.4 kVA
Recommended generator rating	20.8 kVA	
cosφ/efficiency	0.99 (90%)	
Insulation class/protection classification	H/IP 23	
Ambient temperature	–25 °C to +40 °C [1]	
Machine cooling/torch cooling	Fan/gas or water	
Noise level	< 70 dB(A)	
Cooling capacity at 1 l/min.	1500 W	
Max. flow rate	5 l/min.	
Coolant outlet pressure	Max. 3.5 bar	
Max. tank capacity	12 l	
Workpiece lead	70 mm^2	
Dimensions L/W/H	1085 mm x 450 mm x 1003 mm 42.7 inch x 17.7 inch x 39.5 inch	
Weight	131 kg 289 lb	
EMC class	A	
Safety identification	EAC / S / CE	
Harmonised standards used	see declaration of conformity (machine documentation)	

[1] Ambient temperature dependent on coolant! Observe the coolant temperature range of the torch cooling

8.2 Tetrix 401 FW

	TIG	MMA
Welding current	5 A–400 A	
Welding voltage	10.2 V–26.0 V	20.2 V–36.0 V
Duty cycle at 40 °C	400 A (100% DC)	
Load cycle	10 min. (60% DC ≙ 6 min. welding, 4 min. pause)	
Open circuit voltage	79 V	
Mains voltage (tolerances)	3 x 400 V (–25% to +20%)	
Frequency	50/60 Hz	
Mains fuse (safety fuse, slow-blow)	3 x 20 A	3 x 32 A
Mains connection lead	H07RN-F4G6	
Max. connected load	13.5 kVA	18.5 kVA
Recommended generator rating	25.0 kVA	
cosφ/efficiency	0.99 (90%)	
Insulation class/protection classification	H/IP 23	
Ambient temperature	–25 °C to +40 °C [1]	
Machine cooling/torch cooling	Fan/gas or water	
Noise level	< 70 dB(A)	
Cooling capacity at 1 l/min.	1500 W	
Max. flow rate	5 l/min.	
Coolant outlet pressure	Max. 3.5 bar	
Max. tank capacity	12 l	
Workpiece lead	70 mm^2	
Dimensions L/W/H	1085 mm x 450 mm x 1003 mm 42.7 inch x 17.7 inch x 39.5 inch	
Weight	131 kg 289 lb	
EMC class	A	
Safety identification	EAC / S / CE	
Harmonised standards used	see declaration of conformity (machine documentation)	

[1] Ambient temperature dependent on coolant! Observe the coolant temperature range of the torch cooling

8.3 Tetrix 451 FW

	TIG	MMA
Welding current	5 A–450 A	
Welding voltage	10.2 V–28.0 V	20.2 V–38.0 V
Duty cycle at 40 °C	450 A (80% DC) 420 A (100% DC)	
Load cycle	10 min. (60% DC ≙ 6 min. welding, 4 min. pause)	
Open circuit voltage	79 V	
Mains voltage (tolerances)	3 x 400 V (–25% to +20%)	
Frequency	50/60 Hz	
Mains fuse (safety fuse, slow-blow)	3 x 25 A	3 x 32 A
Mains connection lead	H07RN-F4G6	
Max. connected load	16.3 kVA	22.0 kVA
Recommended generator rating	29.7 kVA	
cosφ/efficiency	0.99 (90%)	
Insulation class/protection classification	H/IP 23	
Ambient temperature	–25 °C to +40 °C [1]	
Machine/torch cooling	Fan/gas or water	
Noise level	< 70 dB(A)	
Cooling capacity at 1 l/min.	1500 W	
Max. flow rate	5 l/min.	
Coolant outlet pressure	Max. 3.5 bar	
Max. tank capacity	12 l	
Workpiece lead	70 mm^2	
Dimensions L/W/H	1085 mm x 450 mm x 1003 mm 42.7 inch x 17.7 inch x 39.5 inch	
Weight	131 kg 289 lb	
EMC class	A	
Safety identification	EAC / S / CE	
Harmonised standards used	see declaration of conformity (machine documentation)	

[1] Ambient temperature dependent on coolant! Observe the coolant temperature range of the torch cooling

8.4 Tetrix 551 FW

	TIG	MMA
Welding current	5 A–550 A	
Welding voltage	10.2 V–32.0 V	20.2 V–42.0 V
Duty cycle at 40 °C	550 A (60% DC) 420 A (100% DC)	
Load cycle	10 min. (60% DC ≙ 6 min. welding, 4 min. pause)	
Open circuit voltage	79 V	
Mains voltage (tolerances)	3 x 400 V (–25% to +20%)	
Frequency	50/60 Hz	
Mains fuse (safety fuse, slow-blow)	3 x 25 A	3 x 32 A
Mains connection lead	H07RN-F4G6	
Max. connected load	22.6 kVA	29.5 kVA
Recommended generator rating	39.8 kVA	
cosφ/efficiency	0.99 (90%)	
Insulation class/protection classification	H/IP 23	
Ambient temperature	–25 °C to +40 °C [1]	
Machine cooling/torch cooling	Fan/gas or water	
Noise level	< 70 dB(A)	
Cooling capacity at 1 l/min.	1500 W	
Max. flow rate	5 l/min.	
Coolant outlet pressure	Max. 3.5 bar	
Max. tank capacity	12 l	
Workpiece lead	95 mm^2	
Dimensions L/W/H	1085 mm x 450 mm x 1003 mm 42.7 inch x 17.7 inch x 39.5 inch	
Weight	131 kg 289 lb	
EMC class	A	
Constructed to standard	EAC / S / CE	
Harmonised standards used	see declaration of conformity (machine documentation)	

[1] Ambient temperature dependent on coolant! Observe the coolant temperature range of the torch cooling

9 Accessories

☞ ***Performance-dependent accessories like torches, workpiece leads, electrode holders or intermediate hose packages are available from your authorised dealer.***

9.1 Remote controls and accessories

Type	Designation	Item no.
RTF1 19POL 5 M	Foot-operated remote control current with connection cable	094-006680-00000
RT1 19POL	Remote control current	090-008097-00000
RTG1 19POL 5m	Remote control, current	090-008106-00000
RTG1 19POL 10m	Remote control, current	090-008106-00010
RTP1 19POL	Remote control spot welding / pulses	090-008098-00000
RTP2 19POL	Remote control spot welding / pulses	090-008099-00000
RTP3 spotArc 19POL	spotArc remote control for spot welding / pulses	090-008211-00000
RT50 7POL	Remote control, full functionality	090-008793-00000
RA5 19POL 5M	Remote control e.g. connection cable	092-001470-00005
RA10 19POL 10M	Remote control e.g. connection cable	092-001470-00010
RA20 19POL 20M	Remote control e.g. connection cable	092-001470-00020
RV5M19 19POLE 5M	Extension cable	092-000857-00000

9.2 Welding torch cooling system

Type	Designation	Item no.
KF 23E-10	Coolant (-10 °C), 9.3 l	094-000530-00000
KF 23E-200	Coolant (-10 °C), 200 litres	094-000530-00001
KF 37E-10	Coolant (-20 °C), 9.3 l	094-006256-00000
KF 37E-200	Coolant (-20 °C), 200 l	094-006256-00001
TYP 1	Frost protection tester	094-014499-00000
HOSE BRIDGE UNI	Tube bridge	092-007843-00000

9.3 Options

Type	Designation	Item no.
ON 7pol	Optional 7-pole retrofit connection socket Accessory components and digital interfaces	092-001826-00000
ON 19pol 351/451/551	Optional 19-pole retrofit connection socket Accessory components and analogue A interface	092-001951-00000
ON 12pol Retox Tetrix 300/400/401/351/451/551	Optional 12-pole retrofit connection socket	092-001807-00000
ON Filter T/P	Retrofit option contamination filter for air inlet	092-002092-00000
ON LB Wheels 160x40MM	Retrofit option for locking brake for machine wheels	092-002110-00000
ON Key Switch	Optional retrofit kit for key switch	092-001828-00000
ON Tool Box	Retrofit option tool box	092-002138-00000
ON HS XX1	Mount for hose packages and remote control	092-002910-00000
ON Holder Gas Bottle <50L	Holding plate for gas cylinders smaller than 50 litres	092-002151-00000
ON Shock Protect	Ram protection retrofit option	092-002154-00000

9.4 General accessories

Type	Designation	Item no.
DM 842 Ar/CO2 230bar 30l D	Pressure regulator with manometer	394-002910-00030
GH 2X1/4" 2M	Gas hose	094-000010-00001
32A 5POLE/CEE	Machine plug	094-000207-00000
ADAP 8-5 POL	8 to 5-pole adapter	092-000940-00000

9.5 Computer communication

Type	Designation	Item no.
PC300.Net	PC300.Net welding parameter software kit incl. cable and SECINT X10 USB interface	090-008777-00000

10 Appendix A

10.1 JOB-List

JOB	Process				Material	Wire					Seam position				Tungsten electrode Ø
						Ø									
	TIG	TIG hot wire	TIG cold wire	MMA		0,6	0,8	1,0	1,2	1,6	Fillet weld	Butt joint	Fillet weld lap joint	Vertical-down weld	
1	Reserved														
2	☑				CrNi						☑				1
3	☑				CrNi						☑				1.6
4	☑				CrNi						☑				2
5	☑		☑		CrNi		☑	☑	☑		☑				2.4
6	☑		☑		CrNi		☑	☑	☑		☑				3.2
7	☑		☑		CrNi		☑	☑	☑		☑				>3.2
8	☑				CrNi							☑			1
9	☑				CrNi							☑			1.6
10	☑				CrNi							☑			2
11	☑		☑		CrNi		☑	☑	☑			☑			2.4
12	☑		☑		CrNi		☑	☑	☑			☑			3.2
13	☑		☑		CrNi		☑	☑	☑			☑			>3.2
14	☑				CrNi								☑		1
15	☑				CrNi								☑		1.6
16	☑				CrNi								☑		2
17	☑		☑		CrNi		☑	☑	☑				☑		2.4
18	☑		☑		CrNi		☑	☑	☑				☑		3.2
19	☑		☑		CrNi		☑	☑	☑				☑		>3.2
20	☑				CrNi									☑	1
21	☑				CrNi									☑	1.6
22	☑				CrNi									☑	2
23	☑		☑		CrNi		☑	☑	☑					☑	2.4
24	☑		☑		CrNi		☑	☑	☑					☑	3.2
25	☑		☑		CrNi		☑	☑	☑					☑	>3.2
26	☑				Fe/St						☑				1
27	☑				Fe/St						☑				1.6
28	☑				Fe/St						☑				2
29	☑		☑		Fe/St		☑	☑	☑		☑				2.4
30	☑		☑		Fe/St		☑	☑	☑		☑				3.2
31	☑		☑		Fe/St		☑	☑	☑		☑				>3.2
32	☑				Fe/St							☑			1
33	☑				Fe/St							☑			1.6
34	☑				Fe/St							☑			2
35	☑		☑		Fe/St		☑	☑	☑			☑			2.4

JOB	Process				Material	Wire					Seam position				Tungsten electrode ∅
	TIG	TIG hot wire	TIG cold wire	MMA		∅ 0,6	∅ 0,8	∅ 1,0	∅ 1,2	∅ 1,6	Fillet weld	Butt joint	Fillet weld lap joint	Vertical-down weld	
36	☑		☑		Fe/St		☑	☑	☑			☑			3.2
37	☑		☑		Fe/St		☑	☑	☑			☑			>3.2
38	☑				Fe/St								☑		1
39	☑				Fe/St								☑		1.6
40	☑				Fe/St								☑		2
41	☑		☑		Fe/St		☑	☑	☑				☑		2.4
42	☑		☑		Fe/St		☑	☑	☑				☑		3.2
43	☑		☑		Fe/St		☑	☑	☑				☑		>3.2
44	☑				Fe/St									☑	1
45	☑				Fe/St									☑	1.6
46	☑				Fe/St									☑	2
47	☑		☑		Fe/St		☑	☑	☑					☑	2.4
48	☑		☑		Fe/St		☑	☑	☑					☑	3.2
49	☑		☑		Fe/St		☑	☑	☑					☑	>3.2
50	☑				Cu						☑				1
51	☑				Cu						☑				1.6
52	☑				Cu						☑				2
53	☑		☑		Cu			☑			☑				2.4
54	☑		☑		Cu			☑			☑				3.2
55	☑				Cu						☑				>3.2
56	☑				Cu							☑			1
57	☑				Cu							☑			1.6
58	☑				Cu							☑			2
59	☑		☑		Cu			☑				☑			2.4
60	☑		☑		Cu			☑				☑			3.2
61	☑				Cu							☑			>3.2
62	☑				Cu								☑		1
63	☑				Cu								☑		1.6
64	☑				Cu								☑		2
65	☑		☑		Cu			☑					☑		2.4
66	☑		☑		Cu			☑					☑		3.2
67	☑				Cu								☑		>3.2
68	☑				Cu									☑	1
69	☑				Cu									☑	1.6
70	☑				Cu									☑	2
71	☑		☑		Cu			☑						☑	2.4
72	☑		☑		Cu			☑						☑	3.2
73	☑				Cu									☑	>3.2

JOB	Process				Material	Wire					Seam position				Tungsten electrode Ø
	TIG	TIG hot wire	TIG cold wire	MMA		Ø 0,6	Ø 0,8	Ø 1,0	Ø 1,2	Ø 1,6	Fillet weld	Butt joint	Fillet weld lap joint	Vertical-down weld	
74	☑				CuZn						☑				1
75	☑				CuZn						☑				1.6
76	☑				CuZn						☑				2
77	☑		☑		CuZn			☑			☑				2.4
78	☑		☑		CuZn			☑			☑				3.2
79	☑				CuZn						☑				>3.2
80	☑				CuZn							☑			1
81	☑				CuZn							☑			1.6
82	☑				CuZn							☑			2
83	☑		☑		CuZn			☑				☑			2.4
84	☑		☑		CuZn			☑				☑			3.2
85	☑				CuZn							☑			>3.2
86	☑				CuZn								☑		1
87	☑				CuZn								☑		1.6
88	☑				CuZn								☑		2
89	☑		☑		CuZn			☑					☑		2.4
90	☑		☑		CuZn			☑					☑		3.2
91	☑				CuZn								☑		>3.2
92	☑				CuZn									☑	1
93	☑				CuZn									☑	1.6
94	☑				CuZn									☑	2
95	☑		☑		CuZn			☑						☑	2.4
96	☑		☑		CuZn			☑						☑	3.2
97	☑				CuZn									☑	>3.2
98	☑				Special						☑				1
99	☑				Special						☑				1.6
100	☑				Special						☑				2
101	☑				Special						☑				2.4
102	☑				Special						☑				3.2
103	☑				Special						☑				>3.2
104	☑				Special							☑			1
105	☑				Special							☑			1.6
106	☑				Special							☑			2
107	☑				Special							☑			2.4
108	☑				Special							☑			3.2
109	☑				Special							☑			>3.2
110	☑				Special								☑		1
111	☑				Special								☑		1.6

JOB	Process				Material	Wire					Seam position				Tungsten electrode ∅
	TIG	TIG hot wire	TIG cold wire	MMA		∅ 0,6	∅ 0,8	∅ 1,0	∅ 1,2	∅ 1,6	Fillet weld	Butt joint	Fillet weld lap joint	Vertical-down weld	
112	☑				Special								☑		2
113	☑				Special								☑		2.4
114	☑				Special								☑		3.2
115	☑				Special								☑		>3.2
116	☑				Special									☑	1
117	☑				Special									☑	1.6
118	☑				Special									☑	2
119	☑				Special									☑	2.4
120	☑				Special									☑	3.2
121	☑				Special									☑	>3.2
122	TIG manual/TIG classic														
123	Classic electrode														
124	Reserved														
125	Reserved														
126	Reserved														
127	Electrode JOB														
128	Reserved														
129-179	Free JOBs or SCO (e.g. plasma)														
180	☑	☑			CrNi		☑	☑	☑		☑				2.4
181	☑	☑			CrNi		☑	☑	☑		☑				3.2
182	☑	☑			CrNi		☑	☑	☑		☑				>3.2
183	☑	☑			FeSt		☑	☑	☑		☑				2.4
184	☑	☑			FeSt		☑	☑	☑		☑				3.2
185	☑	☑			FeSt		☑	☑	☑		☑				>3.2
186	☑	☑			CuSi			☑			☑				2.4
187	☑	☑			CuSi			☑			☑				3.2
188-207	Free JOBs or special customer order (SCO)/TIG Comfort (with Smart 200 only)														
208-215	Free JOBs or special customer order (SCO)/electrode Comfort (with Smart 208 only)														
216-254	Free JOBs or special customer order (SCO)														
255	DC- with DC+ ignition														
256	Test job: 5 A to Imax														

☐ not possible
☑ possible

11 Appendix B

11.1 Parameter overview – setting ranges

11.1.1 TIG welding

Parameter TIG/plasma	Display		Setting range				Comment
	Code	Unit	Standard	Min.		Max.	
Gas pre-flow time	GPr	s	0,5	0	-	20	
Ignition current AMP%	I St	%	20	1	-	200	% of main current AMP
Up-slope time	tUP	s	1,0	0,0	-	20,0	
Pulse time	t 1	s	0,01	0,00	-	20,0	
Slope time	tS1	s	0,10	0,00	-	20,0	Time from main current AMP to secondary current AMP%
Secondary current AMP%	I 2	%	50	1		200	% of main current AMP
Pulse pause time	t 2	s	0,01	0,00	-	20,0	
Slope time	tS2	s	0,10	0,00	-	20,0	Period from secondary current AMP% to main current AMP
Down-slope time	tdn	s	1,0	0,0	-	20,0	
End current AMP%	I Ed	%	20	1	-	200	% of main current AMP
Gas post-flow time	GPt	s	8	0,0	-	40,0	
spotArc time	t P	s	2	0,01	-	20,0	
spotmatic time (StS > on)	t P	ms	200	5	-	999	
spotmatic time (StS > oFF)	t P	s	2	0,01	-	20,0	
activArc	AAP			0	-	100	
Up/down speed	uUd	%	10	1	-	100	x0.01% of main current AMP
Current jump	dI	A	1	1	-	20	
Pulse balance	bAL	%		1	-	99	Pulsing, metallurgical
Pulse frequency	FrE	Hz	50	5	-	15000	Pulsing, metallurgical

11.1.2 MMA welding

Parameter MMA	Display		Setting range				Comment
	Code	Unit	Standard	Min.		Max.	
Hot start current	I ht	%	120	1	-	200	% of main current AMP (set parameter AbS to oFF)
Hot start time	tht	s	0,5	0,0	-	10,0	
Arcforce	Arc		0	-40	-	40	
Pulse frequency	FrE	Hz	1.2	0.2	-	500	
Pulse balance	bAL		30	1	-	99	

12 Appendix C

12.1 Overview of EWM branches

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⚙ Plants ⌂ Branches ● More than 400 EWM sales partners worldwide