Operating instructions

EN

Control

T5.00 - AC/DC Comfort 3.0

099-00T500-EW501 | Observe additional system documents! | 15.02.2024

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/en/specialist-dealers.

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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The content of this document has been prepared and reviewed with all reasonable care. The information provided is subject to change; errors excepted.

Data security

The user is responsible for backing up data of all changes from the factory setting. The user is liable for erased personal settings. The manufacturer does not assume any liability for this.

1 Contents

2 For your safety

2.1 Notes on using 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.

☞ ***Technical aspects which the user must observe to avoid material or equipment damage.***

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	Symbol	Description
	Indicates technical aspects which the user must observe.		Activate and release / Tap / Tip
	Switch off machine		Release
	Switch on machine		Press and hold
	Incorrect / Invalid		Switch
	Correct / Valid		Turn
	Input		Numerical value – adjustable
	Navigation		Signal light lights up in green
	Output		Signal light flashes green
	Time representation (e.g.: wait 4 s / actuate)		Signal light lights up in red
	Interruption in the menu display (other setting options possible)		Signal light flashes red
	Tool not required/do not use		Signal light lights up in blue
	Tool required/use		Signal light flashes blue

2.3 Safety instructions

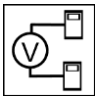
⚠ WARNING

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!

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!
- The device must not be used to defrost pipes!



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 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!

⚠ WARNING

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.

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!

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 may lead to shortness of breath and poisoning! The ultraviolet radiation of the arc may also convert solvent vapours (chlorinated hydrocarbon) into poisonous phosgene.

- Ensure sufficient fresh air!
- Keep solvent vapours away from the arc beam field!
- Wear suitable respiratory protection if necessary!
- To prevent the formation of phosgene, residues of chlorinated solvents on workpieces must first be neutralised using appropriate measures.

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):

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

Electromagnetic fields!

The power source can create electrical or electromagnetic fields that may impair the function of electronic systems such as EDP and CNC devices, telecommunication, power and signal lines as well as pacemakers and defibrillators.

- Follow the maintenance instructions > *see 6 chapter*!
- Unwind the welding leads completely!
- Shield radiation-sensitive equipment or facilities appropriately!
- The function of pacemakers may be impaired (seek medical advice if necessary).

⚠ CAUTION

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.

2.4 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.

Risk of injury from heated coolant and its connections!
The coolant used and its connection or connection points can heat up significantly during operation (water-cooled version). When opening the coolant circuit, escaping coolant may cause scalding.

- Open the coolant circuit only when the power source or cooling unit is switched off!
- Wear proper protective equipment (protective gloves)!
- Seal open connections of the hose leads with suitable plugs.

☞ ***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

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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 Use and operation solely with the following machines

- Tetrix XQ 230 puls AC/DC

3.2 Software version

The software version of the machine control can be displayed in the machine configuration menu (menu Srv) > *see 5.12 chapter*.

3.3 Documents which also apply

3.3.1 Warranty

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

3.3.2 Declaration of Conformity

CE This product corresponds in its design and construction to the EU directives listed in the declaration. The product comes with a relevant declaration of conformity in the original.
The manufacturer recommends carrying out the safety inspection according to national and international standards and guidelines every 12 months (from commissioning).

3.3.3 Welding in environments with increased electrical hazards

S Power sources with this marking can be used for welding in an environment with increased electrical hazard (e.g. boilers). For this purpose, appropriate national or international regulations must be followed. The power source must not be placed in the danger zone!

3.3.4 Service documents (spare parts and circuit diagrams)

⚠ WARNING

No improper repairs and modifications!
To prevent injuries and damage to the machine, only competent personnel (authorised service personnel) are allowed to repair or modify the machine.
Unauthorised manipulations will invalidate the warranty!

- Instruct competent personnel (authorised service personnel) to repair the machine.

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

Spare parts can be obtained from the relevant authorised dealer.

3.3.5 Calibration/Validation

An original certificate is enclosed with the product. The manufacturer recommends calibration / validation at intervals of 12 months (from commissioning).

3.3.6 Part of the complete documentation

This document is 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.

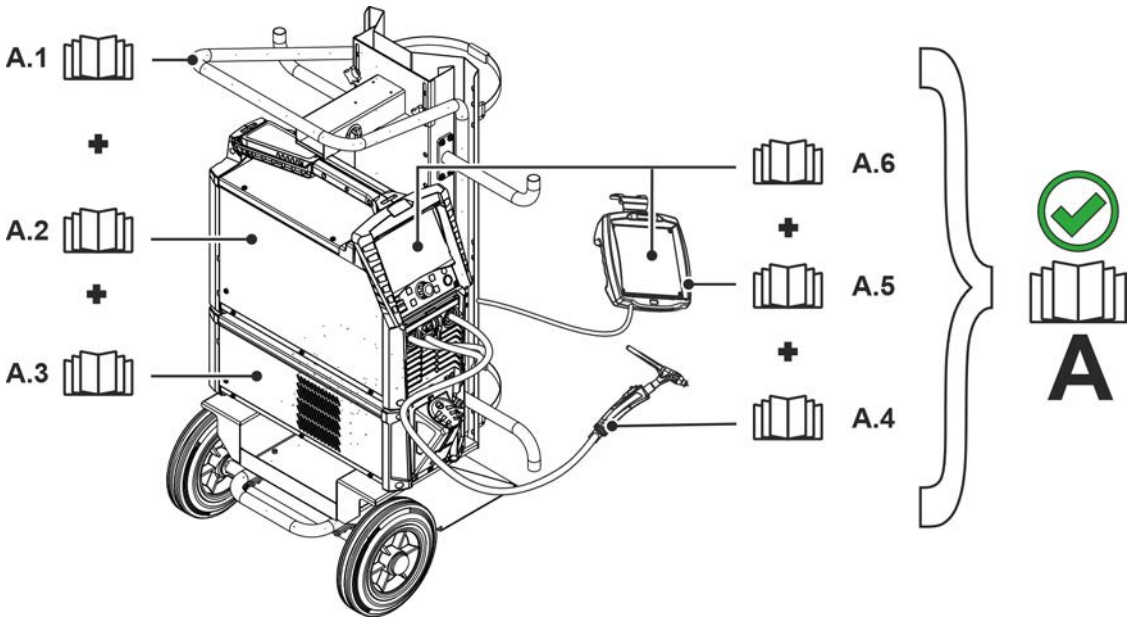


Figure 3-1

Item	Documentation
A.1	Transport vehicle
A.2	Power source
A.3	Cooling unit
A.4	Welding torch
A.5	Remote control
A.6	Control
A	Complete documentation

4 Machine control – Operating elements

4.1 Overview of control sections

For description purposes, the machine control has been divided into three sections (A, B, C) to ensure maximum clarity. The setting range for the parameter values are summarised in the parameter overview section > *see 8.1 chapter*.

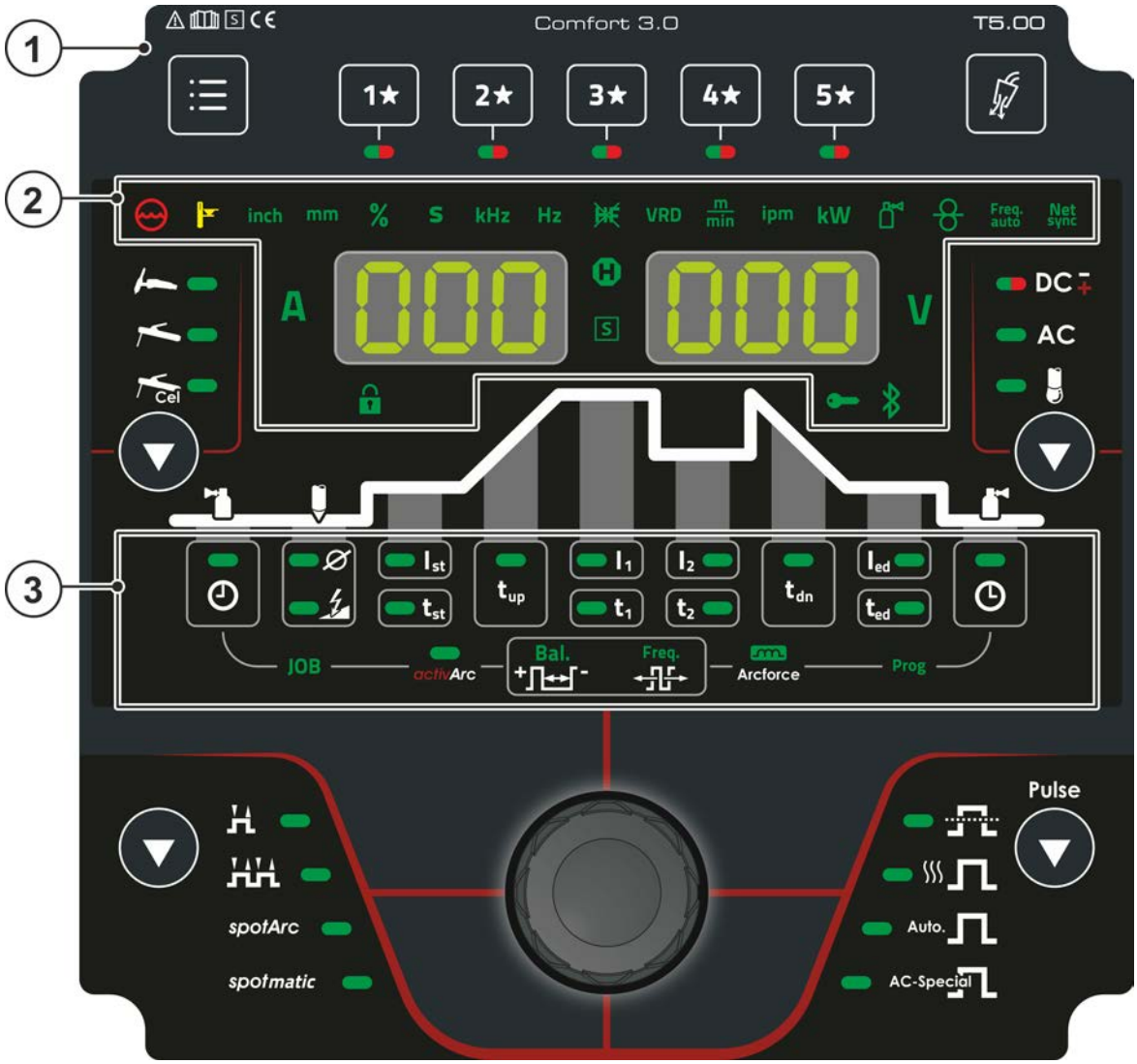


Figure 4-1

Item	Symbol	Description
1		**Control section A** *> see 4.1.1 chapter*
2		**Control section B** *> see 4.1.2 chapter*
3		**Control section C** *> see 4.1.3 chapter*

4.1.1 Control section A

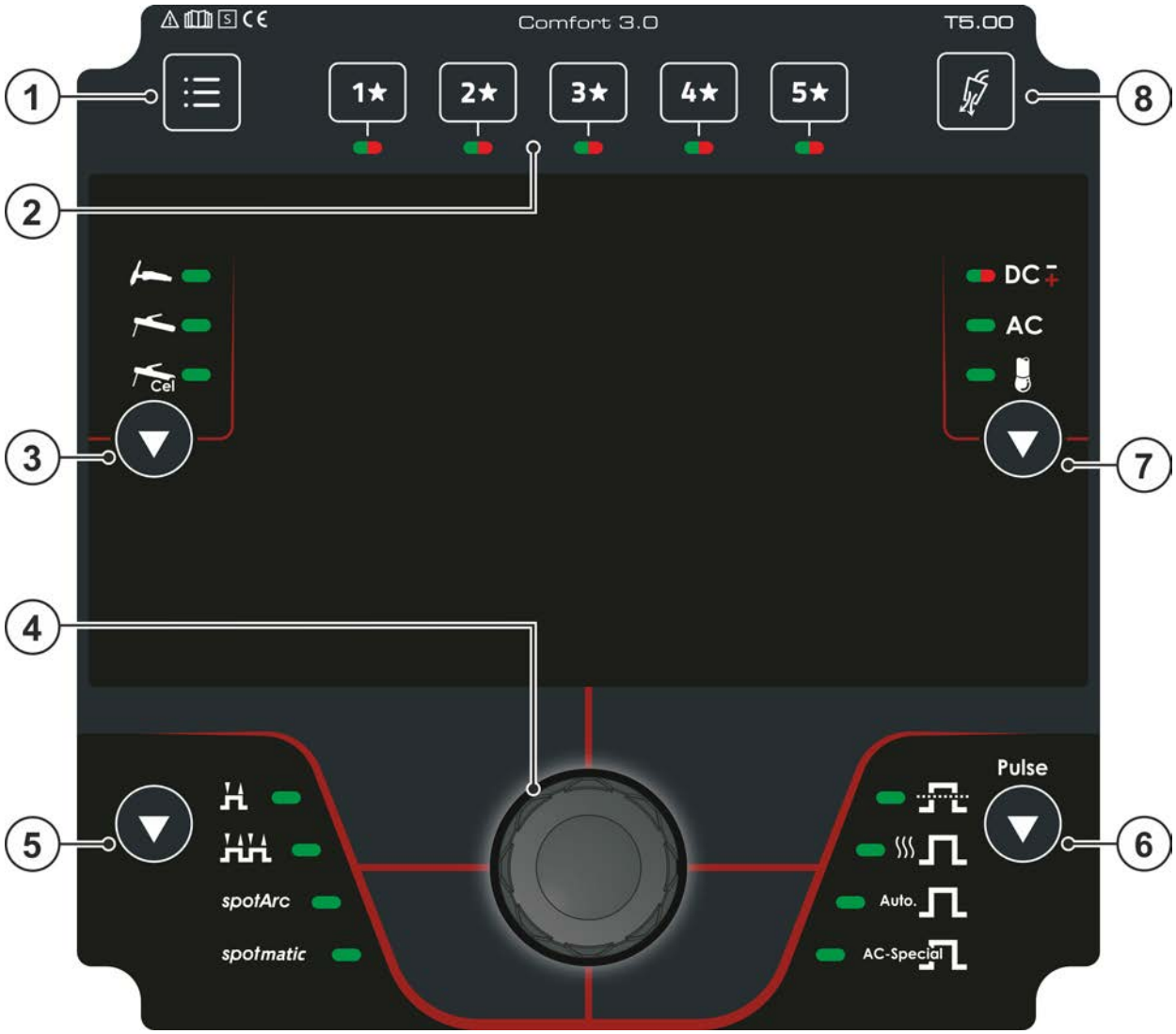


Figure 4-2

Item	Symbol	Description
1		**System push-button** •----------Quick access to various device configuration parameters. For the complete parameter list, see the machine configuration menu > *see 5.12 chapter* •----------Lock function - protection against accidental adjustment > *see 4.3.6 chapter*
2		**push-button - JOB Favourites > *see 5.5 chapter*** •----------Pressing the push-button briefly: Loading Favourites •----------Press and hold the push-button (>2 s): Saving as a Favourite •----------Press and hold the push-button (>12 s): Deleting a Favourite
3		**Push-button for welding procedure** --------TIG-welding -------MMA welding --------MMA Cel welding (characteristics for cellulose electrode)
4		**Click wheel** •----------Setting the welding power •----------Navigate through menu and parameters •----------Setting the parameter values depending on the preselection.

Item	Symbol	Description
5	▼	**Push-button for operating modes > *see 5.2.5 chapter*** H--------- Non-latched HHH------- Latched *spotArc* - Spot welding procedure spotArc *spotmatic* Spot welding procedure spotmatic
6	▼	**Pulsing push-button > *see 5.2.8 chapter*** ------ Average value pulsing ----- Thermal pulsing Auto. -- Automated pulsing AC-Special- AC special
7	▼	**Push-button for welding current polarity / tungsten balling** DC ------ DC welding with either negative or positive polarity on the welding torch or electrode holder (activation in the machine configuration menu is required for TIG-DC+). **AC** ------ AC welding / AC forms > *see 5.2.3.1 chapter* ---------- Tungsten balling > *see 5.2.3.2 chapter*
8		**Push-button gas test / rinse hose package > *see 5.1.1 chapter***

4.1.2 Control section B

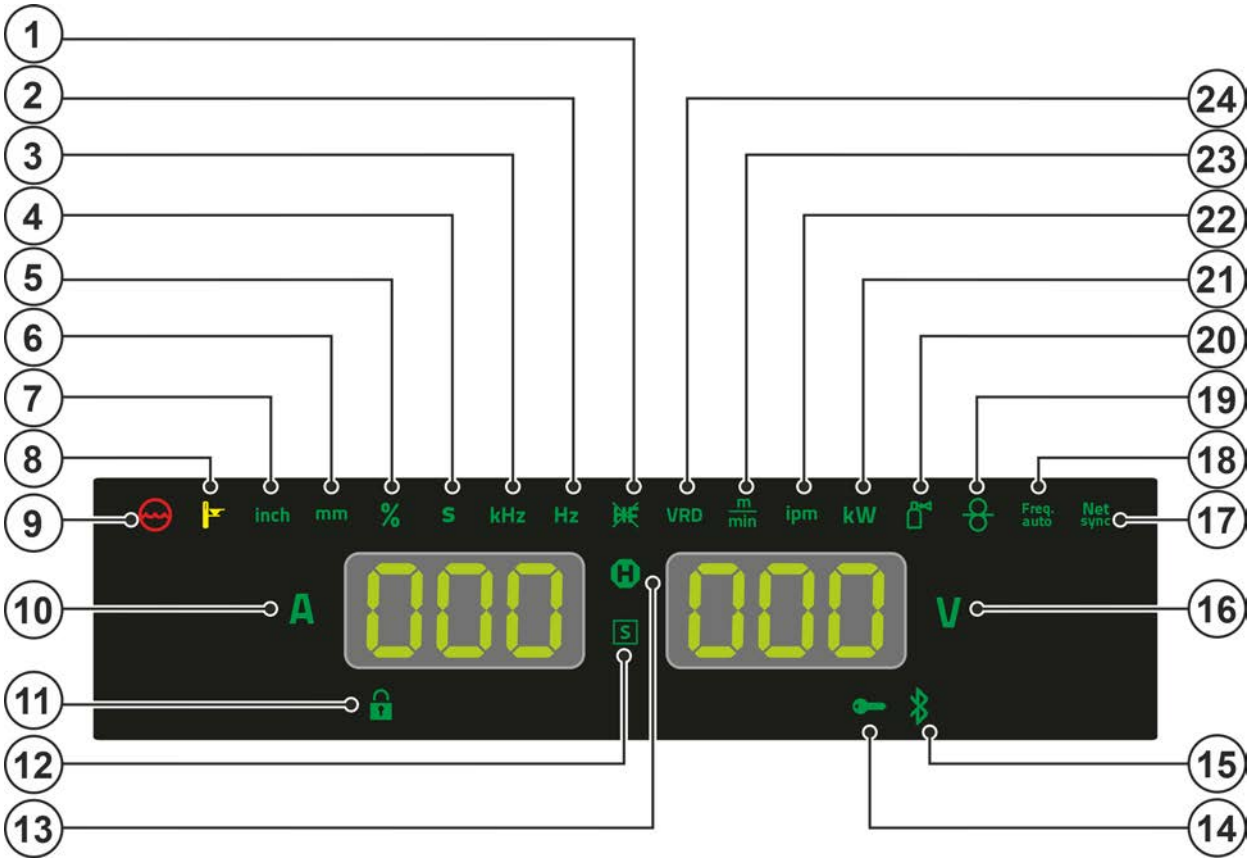


Figure 4-3

Item	Symbol	Description
1		**TIG ignition type signal light** Signal light on: Lift arc ignition active/HF start off. You can switch the ignition type in the Expert menu (TIG) > *see 5.2.4 chapter*.
2	Hz	**Signal light - display value in hertz**
3	kHz	**Signal light - display value in kilohertz**
4	s	**Signal light - display value in seconds**
5	%	**Signal light - display value in per cent**
6	mm	**Signal light - display value in millimetres**
7	inch	**Signal light - display value in inch**
8		**Excess temperature signal light** In case of excess temperature, temperature monitors de-activate the power unit, and the excess temperature control lamp comes on. Once the machine has cooled down, welding can continue without any further measures.
9		**Coolant fault signal light** Signals pressure loss or low coolant level in the coolant circuit.
10	A	**Welding current signal light** Display of the welding current in amperes.
11		**Signal light for lock function > *see 4.3.6 chapter***
12	S	**Character S function signal light** Indicates that it is possible to weld in an environment with major electric hazards, such as in boilers. Service must be informed if this signal light is not on.

Item	Symbol	Description
13		**Signal light for status display** After each completed welding process, the last values used for welding current and voltage are shown in the displays and the signal light is on.
14		**Access control active signal light** Signal light is on when access control is active on the machine control > *see 5.8 chapter*.
15		**Without function in this machine version.**
16	V	**Signal light welding voltage** Illuminates when the welding voltage is displayed in volts.
17	Net sync	**Signal light for synchronous welding (AC)** Two-sided simultaneous welding > *see 5.11 chapter*
18	Freq. auto	**Automatic AC frequency > *see 5.2.3.5 chapter***
19		**Without function in this machine version.**
20		**Without function in this machine version.**
21		**Without function in this machine version.**
22	ipm	**Signal light - display value in Inches per minute**
23	m/min	**Signal light - display value in metres per minute**
24	VRD	**Voltage reduction device (VRD) signal light > *see 5.9 chapter***

4.1.3 Control section C

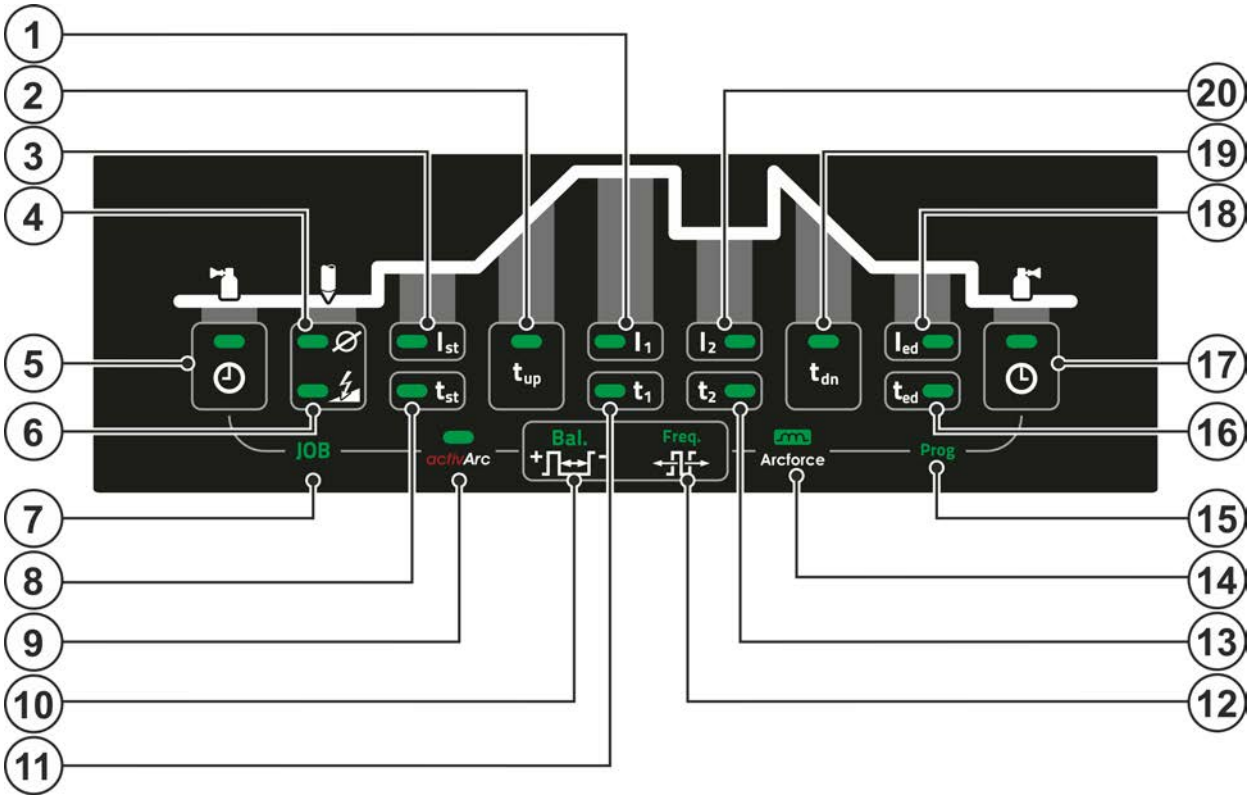


Figure 4-4

Item	Symbol	Description
1	I_1	**Signal light for main current** [I 1] **/pulse current** [I PL]
2	t_{up}	**Signal light for up-slope time** [tUP]
3	I_{st}	**Signal light for start current** [I St]
4	⌀	**Signal light for electrode diameter** [ndA]
5	🕘	**Signal light for gas pre-flow time** [GPr]
6	⚡	**Signal light for ignition optimisation (TIG)** [cor]
7	JOB	**Signal light for welding task (JOB)**
8	t_{st}	**Signal light for start current time** [tSt]
9	activArc	**Signal light activArc** [AA] **> *see 5.2.6 chapter***
10	Bal.	**Signal light for balance** [bAL]
11	t_1	**Signal light for pulse time** [t 1]
12	Freq.	**Signal light for frequency** [FrE]
13	t_2	**Signal light for pulse time** [t 2]
14	Arcforce	**Signal light for Arcforce (welding characteristics) > *see 5.3.3 chapter***
15	Prog	**Signal light for the welding program > *see 5.2 chapter*** Display of the current program number in the welding data display.
16	t_{ed}	**Signal light for end current time** [tEd]
17	🕘	**Signal light for gas post-flow time** [GPt]
18	I_{ed}	**Signal light for end current** [I Ed]
19	t_{dn}	**Signal light for down-slope time** [tdn]
20	I_2	**Signal light for secondary current** [I 2]

4.2 Machine display

The following welding parameters can be displayed before (nominal values), during (actual values) or after welding (hold values). The display of the hold values is indicated by the signal light H:

Parameter	Before welding (nominal values)	During welding (actual values)	After welding (hold values)
Welding current	✓	✓ [2]	✓ [3]
Parameter times	✓	✓	✗
Parameter currents	✓	✓	✗
Frequency, balance	✓	✓	✗
JOB number	✓	✗	✗
Welding voltage	✓ [1]	✓	✓

[1] not for MMA welding

[2] The actual value display of the welding current for MMA can be switched on or off with the parameter rcd.

[3] The behaviour of the hold value display can be set with the parameters hLt for TIG and hLE for MMA.

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

The parameters that can be set in the machine control function sequence are dependent on the welding task selected. This means that if no pulse variant was selected, for example, no pulse parameters will be available to set in the function sequence.

4.3 Operating the machine control

4.3.1 Main screen

After switching on the machine or finishing a setting, the machine control changes to the main screen. This means that the previously selected settings are accepted (if necessary, indicated by signal lights) and the nominal value of the current (A) is shown in the welding data display on the left. The welding data display on the right shows the nominal value for the preselected welding voltage (V). The control changes back to the main screen after 4 s.

4.3.2 Setting the welding current (absolute/percentage)

The welding current is set with the control button (click wheel).

The welding current setting can be made as a percentage (dependent on the main current) or as an absolute value:

TIG: Start current, secondary current or end current and lower limit of foot-operated remote control.

MMA: Hot start current.

The selection is made in the machine configuration menu using the parameter AbS > *see 5.12 chapter*.

4.3.3 Welding parameter setting in the operation sequence

Set a welding parameter in the functional sequence by clicking (select) and turning the click wheel (navigate to the desired parameter). Press again to apply the selected parameter as the setting (corresponding parameter value and signal light flash). Then turn to set the parameter value.

During welding parameter setting, the parameter value to be set flashes in the left hand display. A parameter abbreviation or a deviation in the specified parameter value upwards or downwards is shown on the right-hand display:

Display	Meaning
10 07	**Increase the parameter value** To return to the factory settings.
20 -0-	**Factory setting (example value = 20)** Parameter is set to optimum value
30 L-0	**Decrease the parameter value** To return to the factory settings.

4.3.4 Setting advanced welding parameters (Expert menu)

The Expert menu contains functions and parameters that cannot be set directly on the machine control or for which regular settings are not required. The number and display of these parameters depend on the previously selected welding procedure or functions.

To select, press and hold the click wheel (> 2 s). Select the appropriate parameter / menu item by turning (navigating) and pressing (confirming) the click wheel.

4.3.5 Changing basic settings (machine configuration menu)

The basic welding system functions can be adjusted in the machine configuration menu. Only experienced users should change the settings > *see 5.12 chapter*.

4.3.6 Lock function

The lock function protects against accidental changes to the machine settings. All operating elements are deactivated when the function is activated and the signal light of the lock function is on. Press and hold (> 2 s) the push-button to enable or disable the function.

5 Functional characteristics

5.1 TIG welding

5.1.1 Setting the shielding gas volume (gas test)/rinse hose package

- Slowly open the gas cylinder valve.
- Open the pressure regulator.
- Switch on the power source at the main switch.
- Set the relevant gas quantity for the application on the pressure regulator.
- Press the push-button “gas test / flush” to activate the gas test > *see 5.1.1 chapter*.

Setting the shielding gas quantity (gas test)

- Shielding gas flows for 20 s or until the push-button is pressed again.

Purging long hose packages (purging)

- Press push-button for about 5 s. • Shielding gas flows for approx. 5 min. or until the push-button is pressed again.

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!

Setting instructions: The gas nozzle diameter in mm corresponds to the gas flow in l/min.

Helium-rich gas mixtures require a higher gas volume!

The table below can be used to correct the gas volume calculated where necessary:

Shielding gas	Factor
75% Ar/25% He	1.14
50% Ar/50% He	1.35
25% Ar/75% He	1.75
100% He	3.16

For connecting the shielding gas supply and handling the shielding gas cylinder refer to the power source operating instructions.

5.1.1.1 Automatic gas post-flow

When the function is enabled, the machine control adjusts the gas post-flow time depending on the output. The adjustable gas post-flow time relates to the maximum possible current of the power source and decreases linearly.

Example: With the automatic gas post-flow function enabled, a gas post-flow time of 10 s has been set. This means that with a welding current of 230 A, the gas post-flow time is 10 s. At a welding current of 115 A, the gas post-flow time is reduced to 5 s.

The automatic gas post-flow function GPA can be enabled or disabled in the machine configuration menu > *see 5.12 chapter*. With the function enabled, the parameters GPt and AUt for automatic are displayed alternately when the gas post-flow time is selected.

5.1.2 Welding task selection

By setting the tungsten electrode diameter ndA, the TIG ignition behaviour (ignition energy), machine functions and minimum current limit are preset optimally. Smaller electrode diameters require less ignition energy than larger electrode diameters.

If necessary, the ignition energy > *see 5.1.3 chapter* can also be adapted to each welding task (for example to reduce the ignition energy when using thin sheet metal). With the selection of the electrode diameter, a minimum current limit is set that in turn affects the start, main and secondary currents. Minimum current limits prevent an unstable arc at impermissibly low currents. If necessary, the minimum current limits can be disabled with the parameter cLI in the machine configuration menu > *see 5.12 chapter*. When using a foot-operated remote control, the minimum current limits are disabled by default.

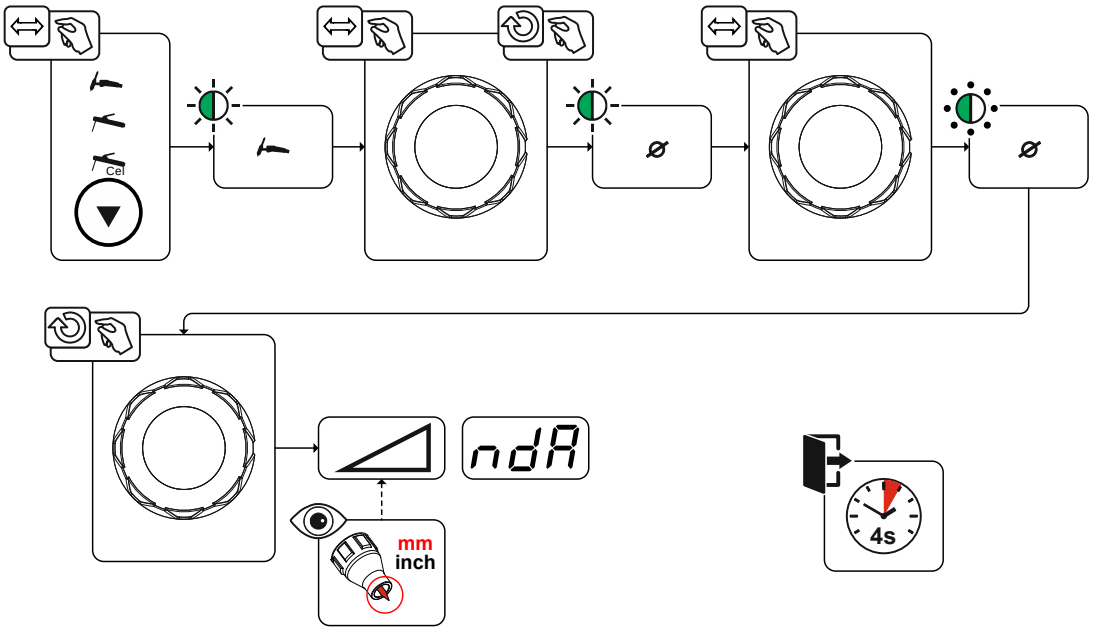


Figure 5-1

5.1.3 Ignition correction

The ignition energy can be optimised for the welding task using the ignition correction cor parameter. Should it be necessary to set the ignition energy outside the existing correction limits, this can also be configured manually for ignition current and ignition current time > *see 5.1.4 chapter*.

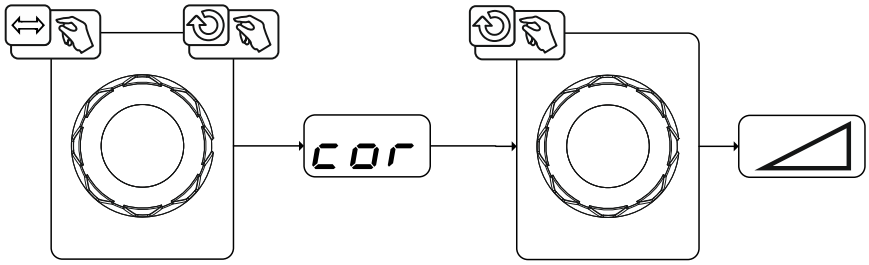


Figure 5-2

5.1.4 Manual ignition setting

When the special ignition is selected, the dependency of the minimum current limits on the electrode diameter is disabled. The ignition energy can now be set independently with the parameters ignition current I c and ignition time I t. The ignition time is set absolutely in milliseconds. The setting of the ignition current differs in the setting variants SP1 and SP2.

- In the variant SP1, the ignition current is set absolutely in ampere [A].
- In the variant SP2, the ignition current is set as a percentage of the set main current.

The parameters for manual setting of the ignition energy are selected and enabled with “left stop” when setting the electrode diameter (minimum value > SP1 > SP2).

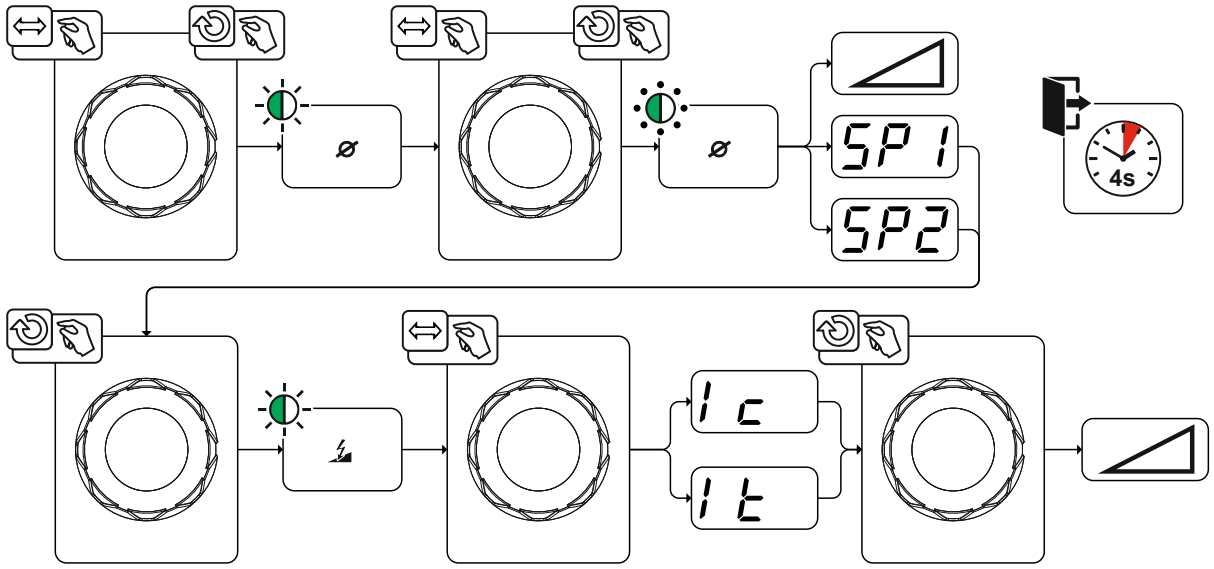


Figure 5-3

5.1.4.1 Recurring welding tasks (JOB 1-100)

The user has 100 additional memory locations at their disposal to save recurring or different welding tasks on a permanent basis. To do so, simply select the required memory location (JOB 1-100) and set the welding task as described previously.

With the JOB manager > *see 5.6 chapter*, welding tasks can be copied to any preset or reset to the factory settings.

The desired JOB can also be assigned to a quick access button (favourites button) > *see 5.5 chapter*.

Switching a JOB is only possible if no welding current flows. Up-slope and down-slope times can be set individually for latched and non-latched operation.

Selection

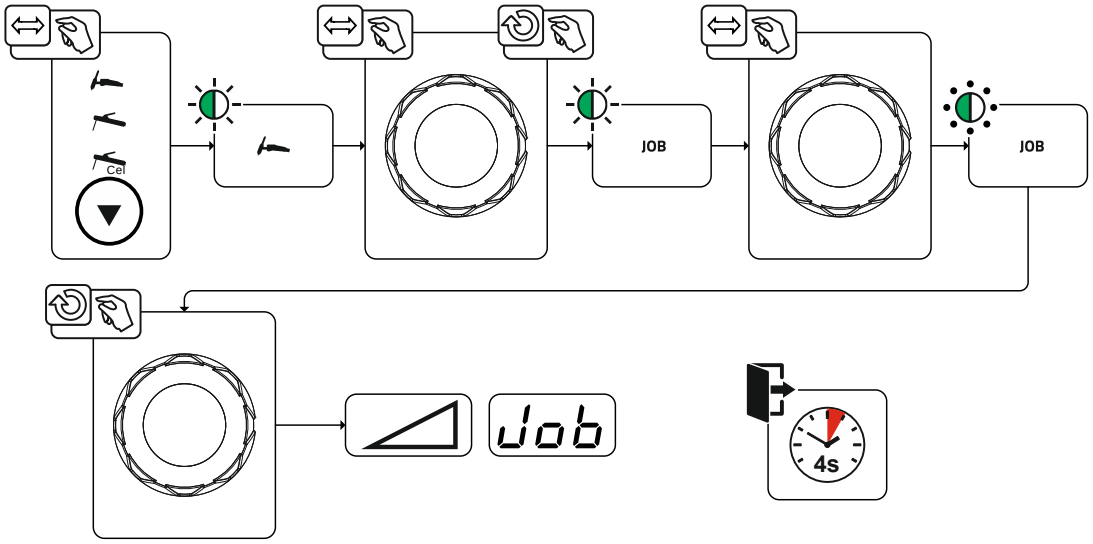


Figure 5-4

When one or more of the recurring welding tasks has been selected, the JOB signal light comes on.

5.2 Welding programs

The welding programs function is factory set to disabled and must be activated for use with the parameter PRG in the machine configuration menu > *see 5.12 chapter*.

In each selected welding task (JOB), > *see 5.1.2 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.

The welding machine has 16 programs, which you can change during welding.

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.

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.

5.2.1 Selection and adjustment

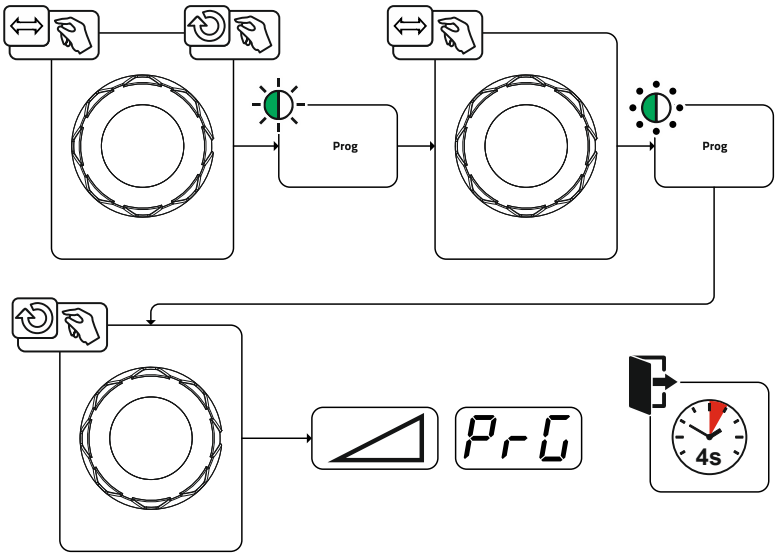


Figure 5-5

5.2.2 Specifying max. no. of accessible programs

This function can be used to specify the maximum number of programs which can be called up (only applies to the welding torch). According to the factory setting, all 16 programs can be called up. If necessary these can be limited to a specific number.

To limit the number of programs, the welding current needs to be set to 0A for the next, unused program. For example, if only programs 0 to 3 are being used, the welding current is set to 0A in program 4. A maximum of programs 0 to 3 can then be called up on the welding torch.

5.2.3 AC welding

The welding of aluminium and aluminium alloys is made possible by the periodic change of polarity on the tungsten electrode.

The negative pole (negative half-wave) of the tungsten electrode determines the penetration characteristics and has a lower electrode load compared to the positive half-wave. The negative half-wave is also called "cold half-wave".

Whereas the positive polarity, i.e. the positive half-wave, breaks up the oxide layer on the material surface (the so-called cleaning effect). At the same time, the tungsten electrode tip melts into a ball (the so-called balled end) due to the high thermal effect of the positive half-wave. The size of the balled end depends on the length (balance setting > *see 5.2.3.3 chapter*) and the current amplitude (amplitude balance > *see 5.2.3.4 chapter*) of the positive phase. It should be noted that a balled end that is too large may lead to an unstable and diffuse arc resulting in a low penetration profile. Therefore, the relationship between the current amplitude and the balance of the task must be adjusted accordingly.

5.2.3.1 Alternating current waveforms

Selection

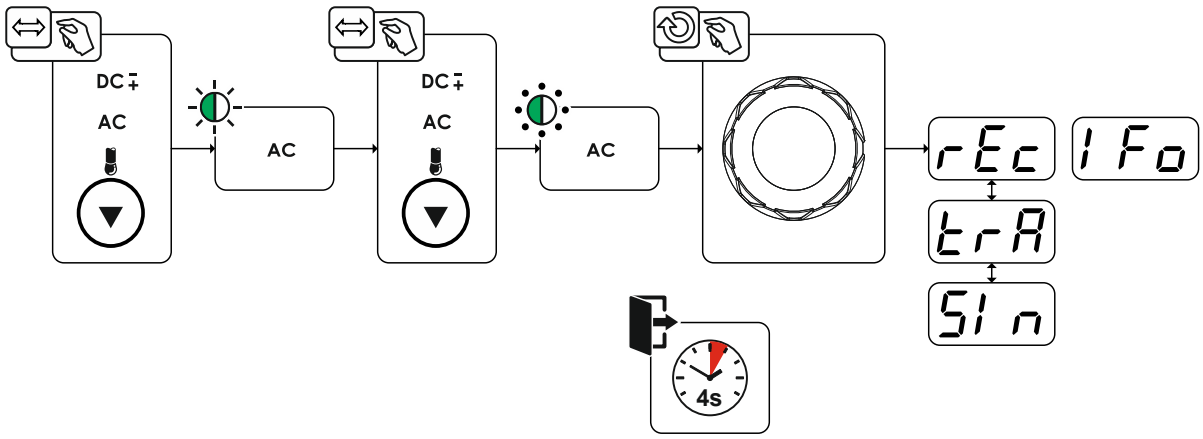


Figure 5-6

Display	Setting/selection
IFo	**Alternating current waveforms** [1] rEc ------ Rectangular - Highest energy input (ex works) trA ------ Trapezoidal - An all-rounder, suitable for most applications SIn ------ Sine - Low noise level

[1] for AC welding machines only.

5.2.3.2 Tungsten balling function

The tungsten balling function achieves an optimal balled end enabling the best ignition and welding results for AC welding.

Optimal 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 used for tungsten balling and thus the balled end size.

The function is enabled by pressing the push-button tungsten balling and indicated by the flashing of the corresponding signal light. If required, this current can be adjusted individually using the I c parameter (+/- 30 A).

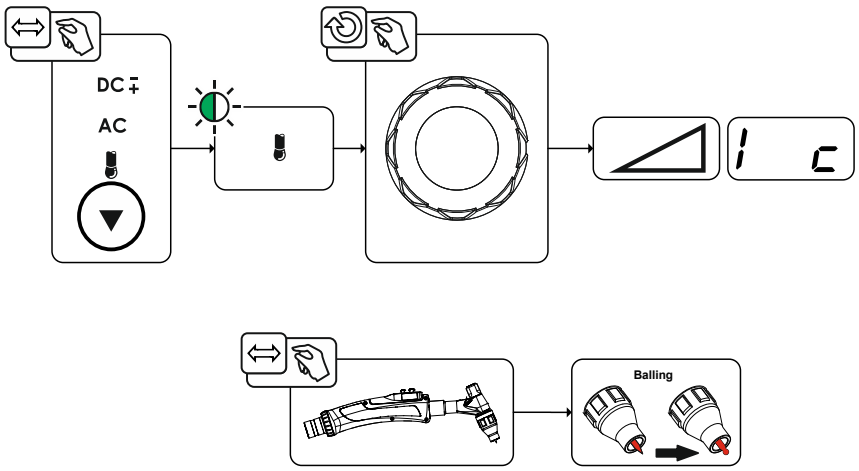


Figure 5-7

The user presses the torch trigger and the function is started by non-contact ignition (HF start). The balled end is formed and the function automatically terminated after the gas post-flow time has elapsed.

The tungsten balling should be carried out on a test component as any excess tungsten is melted off possibly leading to impurities on the weld seam.

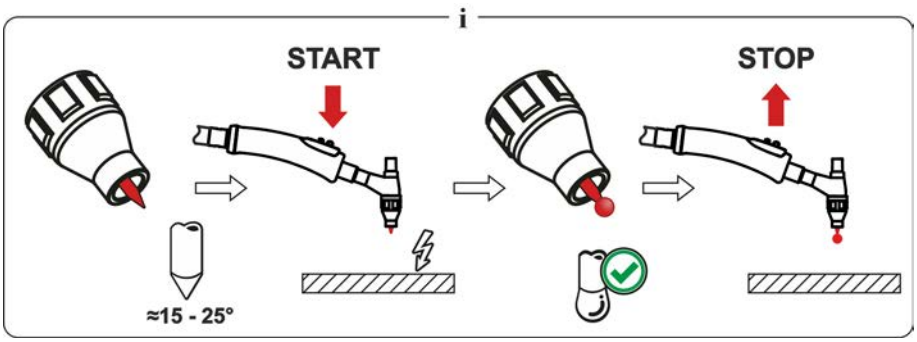


Figure 5-8

5.2.3.3 AC balance (optimise cleaning effect and penetration characteristics)

It is important to choose the right time relationship (balance) between the positive phase (cleaning effect, balled end size) and the negative phase (penetration depth). This may differ from the factory setting depending on the material and task. This requires the AC balance setting. The default setting (factory setting, zero setting) of the balance is 65 % and always refers to the negative half-wave. The positive half-wave is adjusted accordingly (negative half-wave = 65 %, positive half-wave = 35 %).

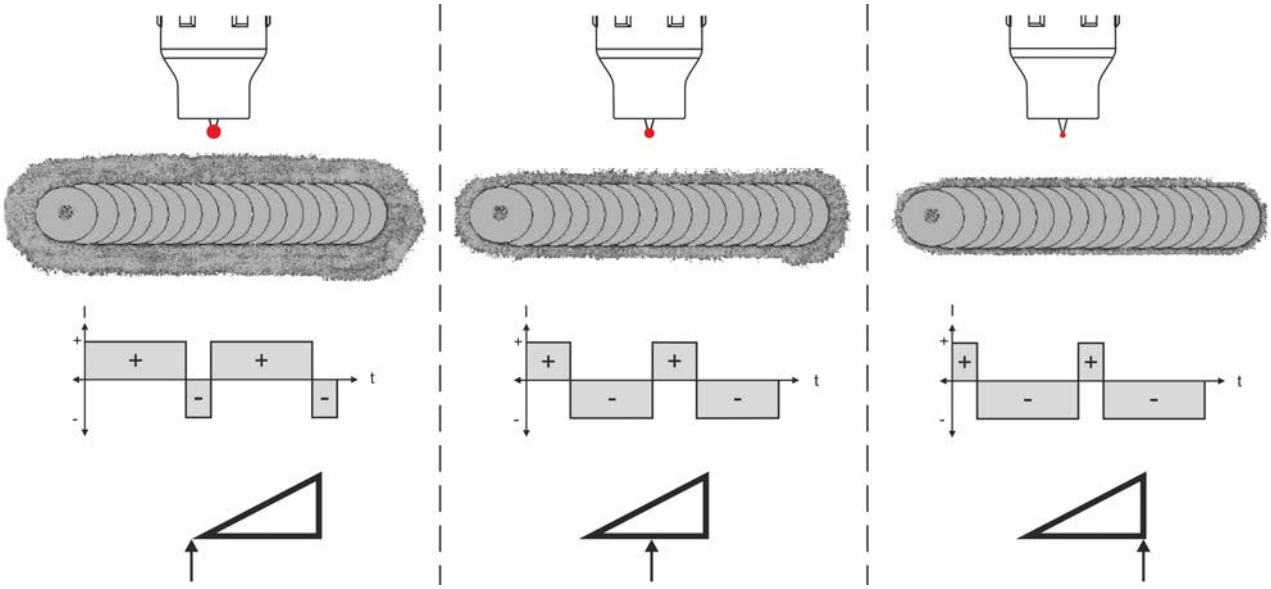


Figure 5-9

5.2.3.4 Amplitude balance

As with AC balance, durations (balance) for positive phase and negative phase are set for AC amplitude balance. The balance changes in terms of the current amplitude.

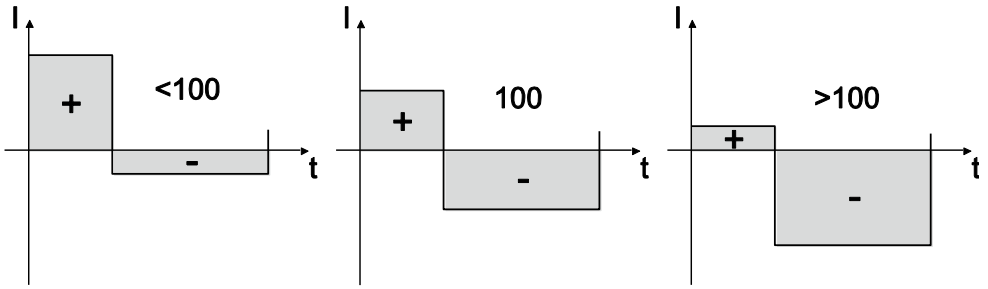


Figure 5-10

The AC amplitude balance can be set in the Expert menu (TIG) using parameter
AbA > *see 5.2.11 chapter*.

Increasing the current amplitude in the positive half-wave facilitates the cleaning effect and the cracking of the oxide layer.

Raising the negative current amplitude increases the penetration.

5.2.3.5 Automatic AC frequency

Activation takes place in the functional sequence using the parameter frequency Freq.. By turning to the left, the parameter value is reduced until the parameter AUt (AC frequency automatic) is shown in the display. The signal light Freq. auto comes on when the function is enabled.

The machine control takes over the regulation or setting of the alternating current frequency depending on the set main current. The lower the welding current, the higher the frequency and vice versa. This achieves a concentrated, directionally stable arc when welding currents are low. The load on the tungsten electrode is minimised when the welding currents are high ensuring a longer service life.

The use of a foot-operated remote control with this function reduces manual intervention by the user during the welding process to a minimum.

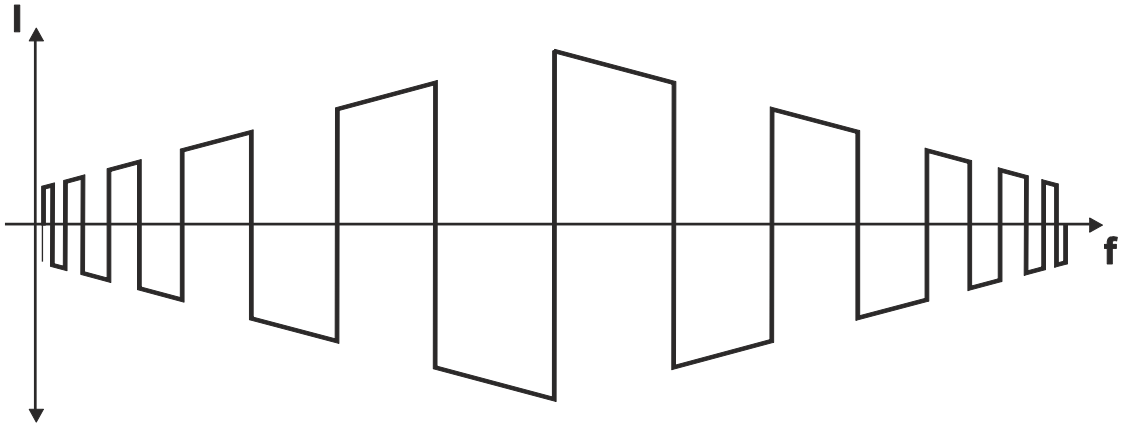


Figure 5-11

Selection

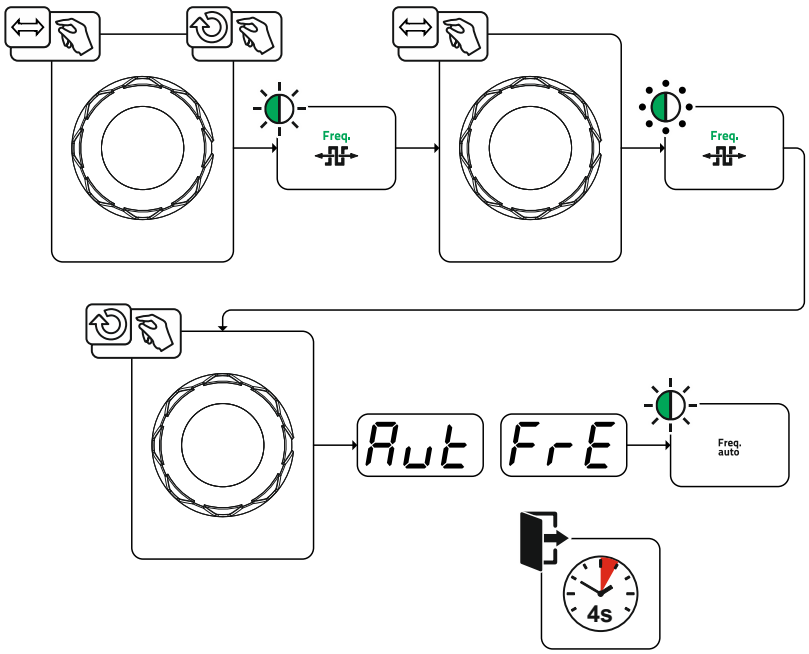


Figure 5-12

5.2.3.6 Commutation optimisation

With AC welding, a periodic change between positive and negative half-wave takes place. This pole change is called commutation. External influences such as low-alloy aluminium materials (such as Al 99.5) or gases that are difficult to ionize (Ar/He mixtures) may compromise the commutation and lead to lower arc stability and higher noise levels.

The power source has intelligent commutation optimization that is divided into automatic operation (left stop) and manual operation (1-100):

- Automatic mode (factory setting)
  The commutation optimisation is set to “Auto” as standard. The power source can therefore evaluate the commutation and automatically ensures the highest possible arc stability, safe penetration and oxide-free seams for every welding task. Automatic mode is the preferred choice for almost every application.
- Manual mode (1-100):
  If the result in automatic mode is not satisfactory in rare cases, the commutation optimisation can be adjusted in manual mode. In this case, the following schematic representation can be used as a setting aid.

Figure 5-13

5.2.4 Arc ignition

The type of ignition (parameter hF) can be set in the system menu (push-button ☰). The HF intensity (parameter hFL) can be adjusted in the machine configuration menu if necessary > *see 5.12 chapter*.

5.2.4.1 HF ignition

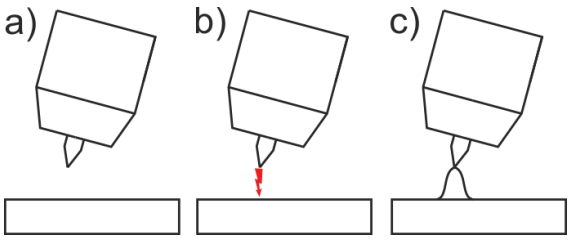


Figure 5-14

The arc is started without contact using high-voltage ignition pulses:

a) Position the welding torch in the welding position above the workpiece (distance between the electrode tip and the workpiece approx. 2-3 mm).

b) Press the torch trigger (high-voltage ignition pulses start the arc).

c) Depending on the selected operating mode, the welding current flows with the set start or main current.

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

5.2.4.2 Liftarc

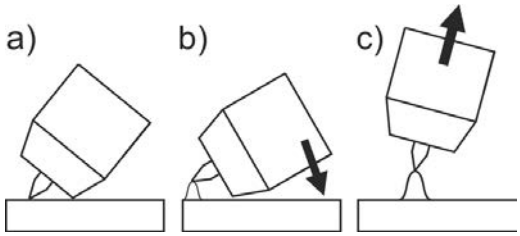


Figure 5-15

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.

5.2.4.3 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
  5 s after the start of the welding process, no welding current flows (ignition error).
- During welding
  The arc is interrupted for more than 5 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 LEA).

5.2.5 Operating modes (functional sequences)

5.2.5.1 Explanation of symbols

Symbol	Meaning
	Press torch trigger 1
	Release torch trigger 1
I	Current
t	Time
	Gas pre-flow
I St	Start current
t St	Start time
t UP	Up-slope time
t P	Spot time
I 1 **AMP**	Main current (minimum to maximum current)
I 2 **AMP%**	Secondary current
t 1	Pulse time
t 2	Pulse pause time
I PL	Pulse current
t S1	Latched operating mode: Slope time from main current (AMP) to secondary current (AMP%) TIG - thermal pulsing: Slope time from pulse current to pulse pause current
t S2	Latched operating mode: Slope time from secondary current (AMP%) to main current (AMP) TIG - thermal pulsing: Slope time from pulse pause current to pulse current
t dn	Down-slope time
I Ed	End-crater current
t Ed	End-crater time
	Gas post-flow
bAL	Balance
Fr E	Frequency

5.2.5.2 Non-latched mode

Sequence

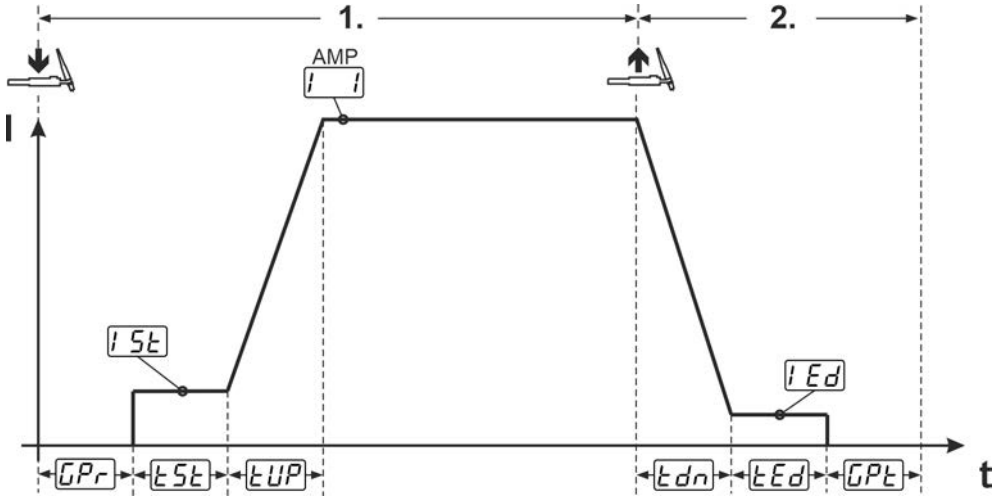


Figure 5-16

1st cycle:

- Press and hold torch trigger 1.
- The gas pre-flow time GPr expires (shielding gas flows).
- The arc is ignited (HF ignition).
- The start current I St flows for the start time tSt (the HF ignition shuts down).
- The welding current increases in the up-slope time tUP to the main current I 1.

2nd cycle:

- Release torch trigger 1.
- The main current I 1 drops during the down-slope time tdn to the end current I Ed.
  When the 1st torch trigger is pressed during the down-slope time tdn, the current increases back to the main current I 1.
- The end current I Ed flows for the end current time tEd.
- The arc extinguishes.
- The gas post-flow time GPt expires (the shielding gas is shut down).

5.2.5.3 Latched mode

Sequence

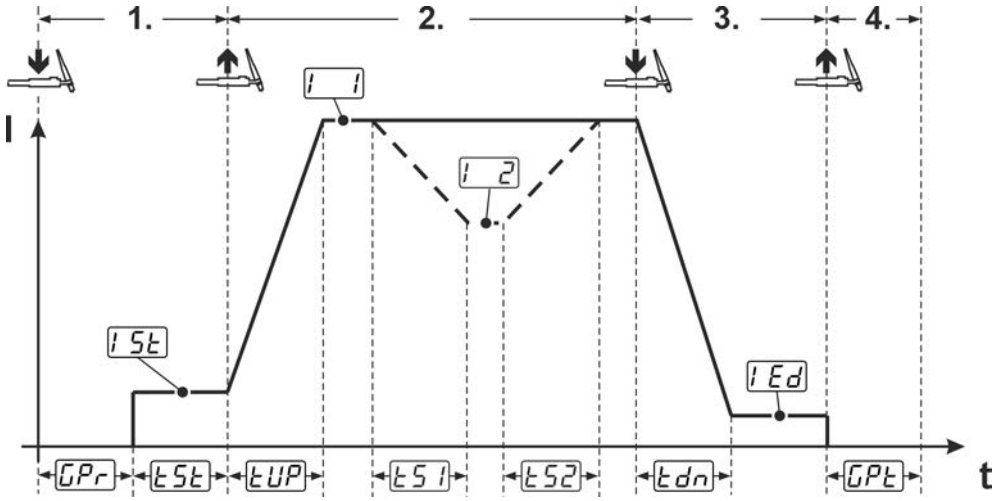


Figure 5-17

1st cycle

- Press the torch trigger 1
- The gas pre-flow time GPr expires (shielding gas flows).
- The arc is ignited (HF ignition).
- The start current I St flows as long as the torch trigger is held, but at least for the start time tSt (the HF ignition shuts down).

2nd cycle

- Release torch trigger 1.
- The welding current increases in the up-slope time tUP to the main current I 1.

During the main current phase, you can switch to the secondary current I 2 in two ways: Either tap torch trigger 1 or press and hold torch trigger 2. Lowering to the secondary current I 2 takes place using the slope time tS1.

By tapping torch trigger 1 again or releasing torch button 2, the welding current increases with the slope time tS2 back to the main current I 1. The slope times tS1 and tS2 are set in the Expert menu > *see 5.2.11 chapter*).

3rd cycle

- Press torch trigger 1.
- The main current I 1 drops during the down-slope time tdn to the end current IEd.

4th cycle

- Release torch trigger 1.
- The arc extinguishes.
- The gas post-flow time GPt expires (the shielding gas is shut down).

Alternative welding start (tap start):

The tap start function tPS must be switched on before using it. With the alternative welding start, the duration of the first and second cycle is only specified by the set process times (tapping the torch trigger in the gas pre-low phase GPr).

Alternative welding end (tap end):

With the alternative welding end, the process is ended immediately by tapping the torch trigger in the main-current phase (gas post-flow time expires).

The tap end function tPE must be switched on before using it (this disables tapping on the secondary current).

5.2.5.4 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.

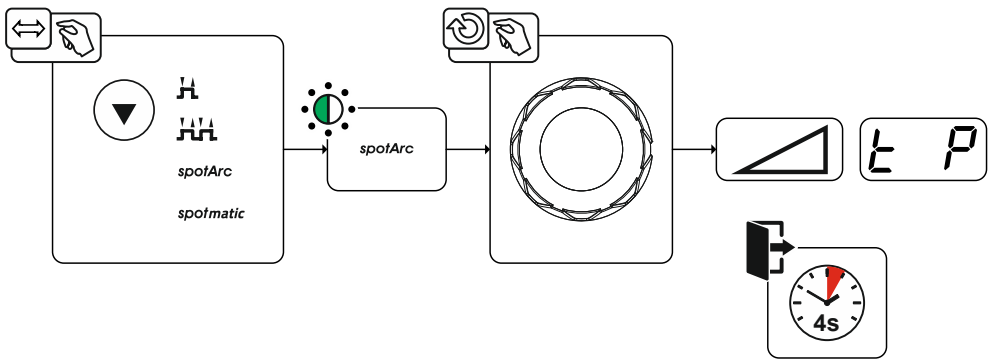


Figure 5-18

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

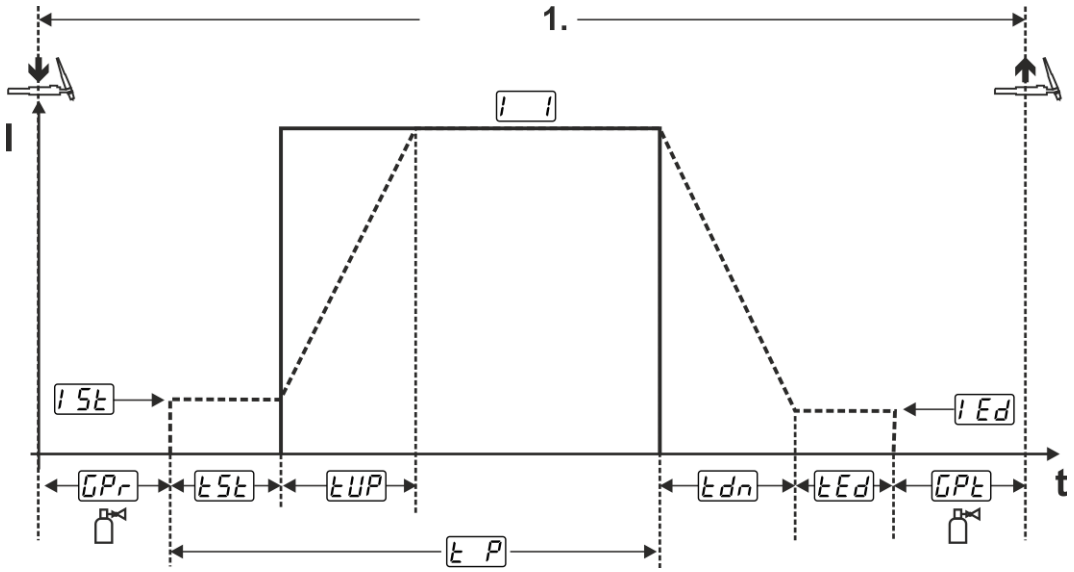


Figure 5-19

Example display with factory settings of the parameters:

Procedure:

- Press and hold the torch trigger.
- The gas pre-flow time elapses.
- The HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- HF switches off.
- The welding current flows and immediately assumes the value of the start current I St.
- The start current I St flows for the ignition current time tSt.
- The welding current ramps up to the main current tUP within the set up-slope time I 1.
- The process ends when the set spotArc time t P expires or by releasing the torch trigger prematurely.

The process ends when the set spotArc.time elapses or by releasing the torch trigger. With the spotArc function enabled, the Automatic Puls pulse variant is activated as well. If required, the function can be disabled by pressing the pulsed welding push-button.

5.2.5.5 spotmatic

In contrast to the spotArc operating mode, the arc is not started by pressing the torch trigger as in the conventional method, but by briefly placing the tungsten electrode SPn on the workpiece. The torch trigger is used to enable the welding process. The activation is indicated by flashing of the spotArc®/spotmatic signal light. The separate process activation SSP and the short setting range StS of the spot time t P are activated by default with spotmatic.

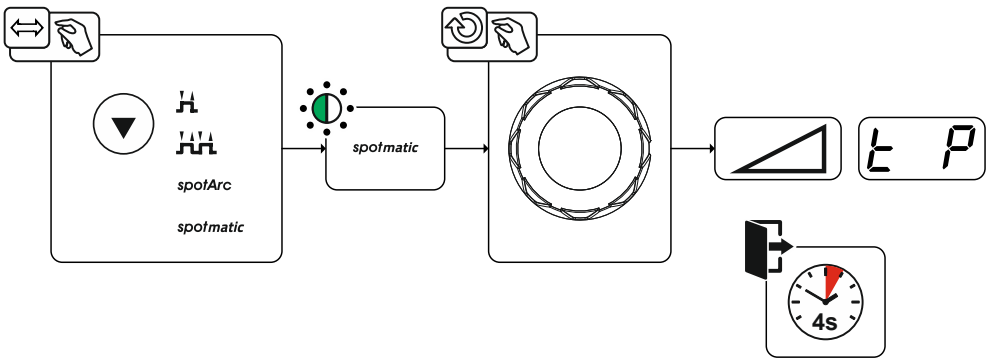


Figure 5-20

Example display with factory settings of the parameters:

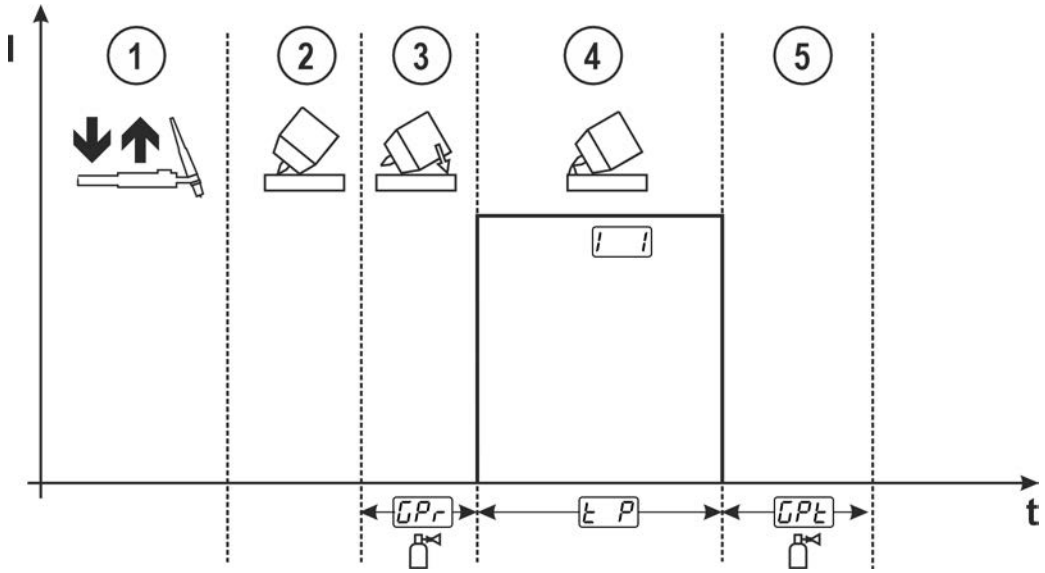


Figure 5-21

① Tap the torch trigger to activate the welding process.

② Place the torch gas nozzle and tungsten electrode tip carefully on 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 with the set gas pre-flow time GPr. The arc ignites and the previously set main current I 1 flows.

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

⑤ The gas post-flow time GPt elapses and the welding process ends.

The following parameter settings can be adjusted in the machine configuration menu:

- Separate process activation (SSP > on):
  The welding process must be re-enabled before each arc striking by tapping the torch trigger. Process activation is automatically terminated after 30 s of inactivity.
- Permanent process activation (SSP > oFF):
  The welding process is enabled by tapping the torch trigger once. The following arc striking processes are initiated by briefly placing the tungsten electrode on the workpiece. Process activation is terminated either by tapping the torch trigger again or automatically after 30 s of inactivity.
- Process start by placing the tungsten electrode on the workpiece (SPn > on).
- Process start by tapping the torch trigger (SPn > oFF).
- Short setting range of spot time (StS > on).
- Long setting range of spot time (StS > oFF).
  In this case, the procedure is the same as for spotArc.

5.2.5.6 Non-latched operation, version C

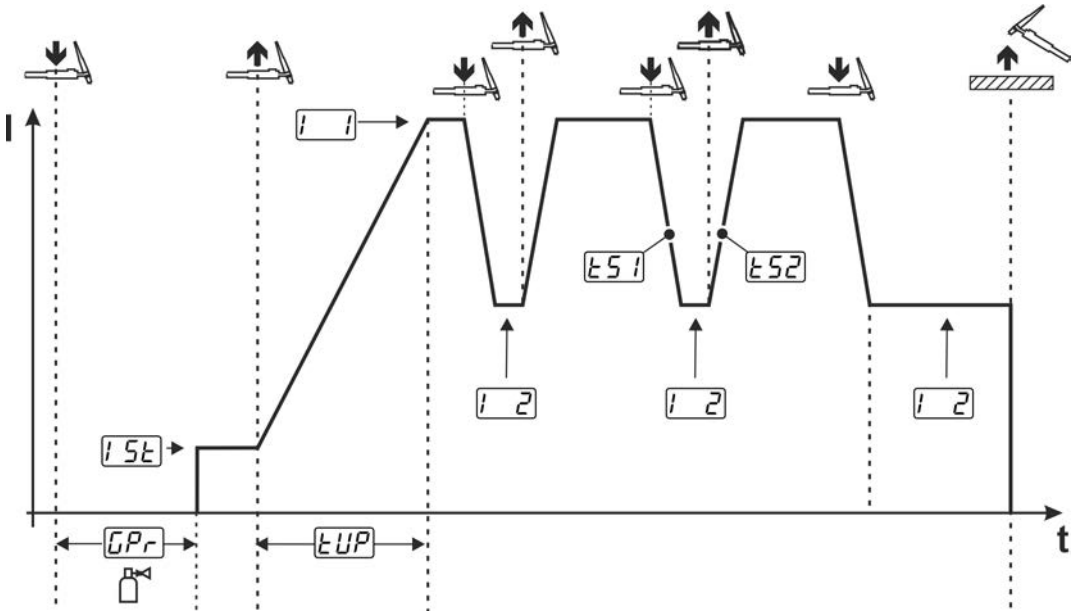


Figure 5-22

1st cycle

- Press and hold torch trigger 1. The gas pre-flow time GPr elapses.
- The HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- The welding current flows and immediately moves to the preselected start current value I St (search arc at minimum setting). The HF start is switched off.

2nd cycle

- Release torch trigger 1.
- The welding current increases at the set up-slope time tUP to the main current I 1.

Pressing torch trigger 1 starts the slope tS1 from the main current I 1 to the secondary current I 2. Releasing the torch trigger starts the slope tS2 from the secondary current I 2 and back to the main current I 1. This process can be repeated any number of times.

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 of the arc).

The slope times tS1 and tS2 can be set in the Expert menu > *see 5.2.11 chapter*.

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

5.2.6 TIG activArc welding

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.

Selection

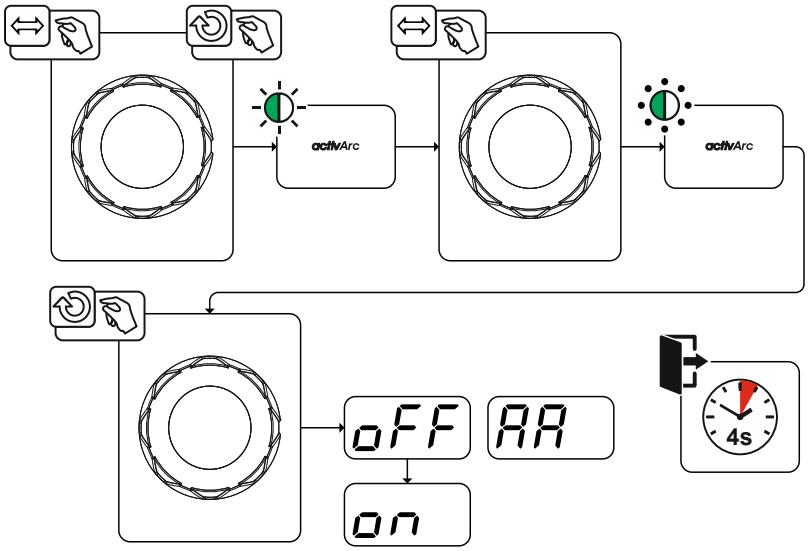


Figure 5-23

Setting

Parameter setting

The activArc parameter (control) can be adjusted specifically for the welding task (panel thickness) > *see 5.2.11 chapter*.

5.2.7 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*.

5.2.8 Pulse welding

The following pulse types can be selected:

- Average value pulsing (TIG AC up to 5 Hz and WIG DC up to 20 kHz)
- Thermal pulsing (TIG AC or TIG DC)
- Auto. Automated pulsing (TIG DC)
- AC-Special AC special (TIG AC)

5.2.8.1 Average value pulse welding

A special feature with average value pulses is that the power source will always maintain the preset average value. This makes this method especially suitable for welding according to welding procedure specifications.

For average value pulsing, switching takes place periodically between two currents whereby an average current value (AMP), a pulse current (Ipuls), pulse balance (bAL) and pulse frequency (FrE) must be specified. The set average current value in ampere is decisive; the pulse current (Ipuls) is specified with the parameter IPL as a percentage of the average current (AMP).

The pulse pause current (IPP) is not set. This value is calculated by the machine control to ensure that the average value of the welding current (AMP) is maintained.

With the parameter PFo, the waveform of the pulse can be adapted in the Expert menu to the existing welding task. Especially in the lower frequency range, the adjustable pulse shapes show their effect on the arc characteristics (only TIG DC).

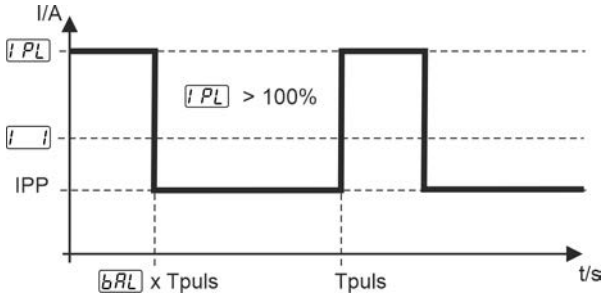


Figure 5-24

Setting the pulse frequency and pulse balance

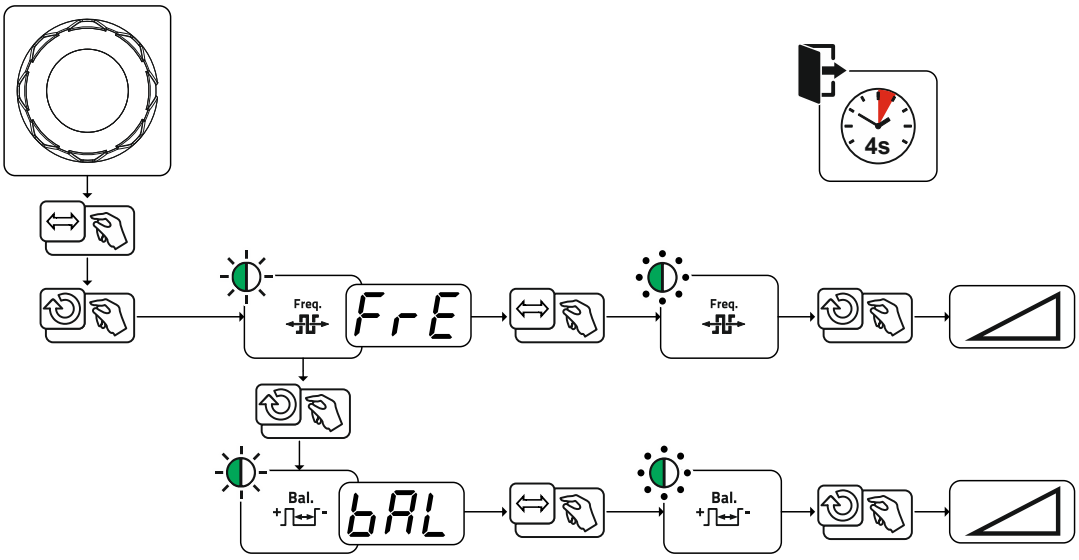


Figure 5-25

5.2.8.2 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 (t S1 and t S2) are entered in seconds on the control.

The t S1 and t S2 pulse edges can be set in the Expert menu (TIG) > *see 5.2.11 chapter*.

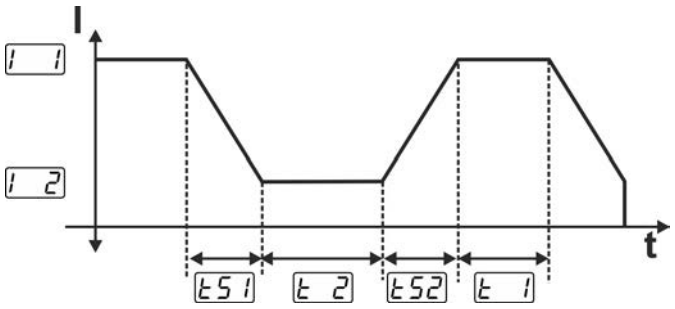


Figure 5-26

Setting the pulse and pulse pause time

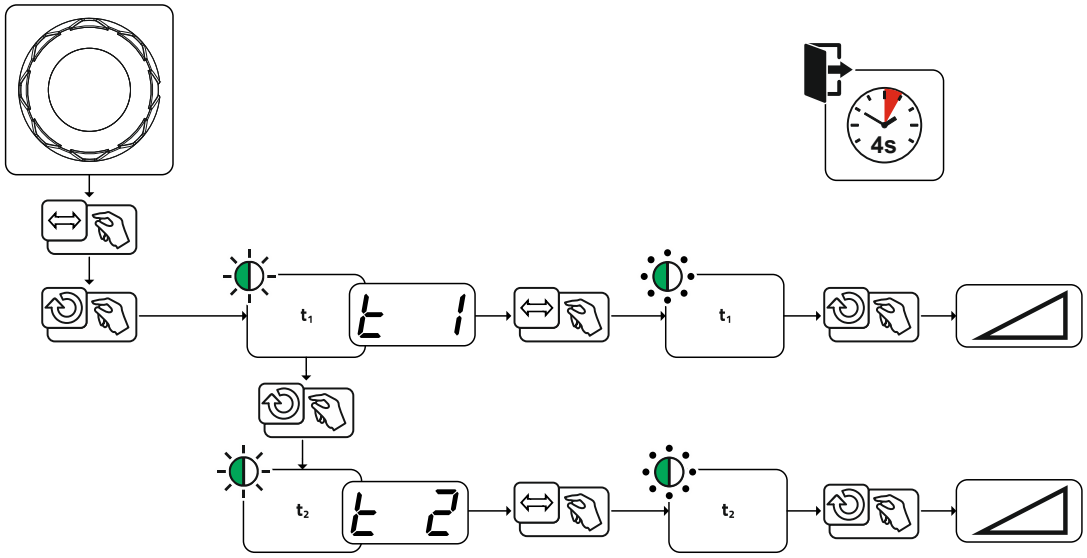


Figure 5-27

5.2.8.3 Automated pulses

The automated pulsing pulse variant is only activated for DC welding in combination with the spotArc operating mode. The current-dependent pulse frequency and balance create vibrations in the weld pool that have a positive effect on the gap bridging. The required pulse parameters are automatically defined by the machine control. If required, the function can be disabled by pressing the pulsed welding push-button.

5.2.8.4 AC special

Is e.g. used to join metal sheets of different thickness.

Pulse time setting

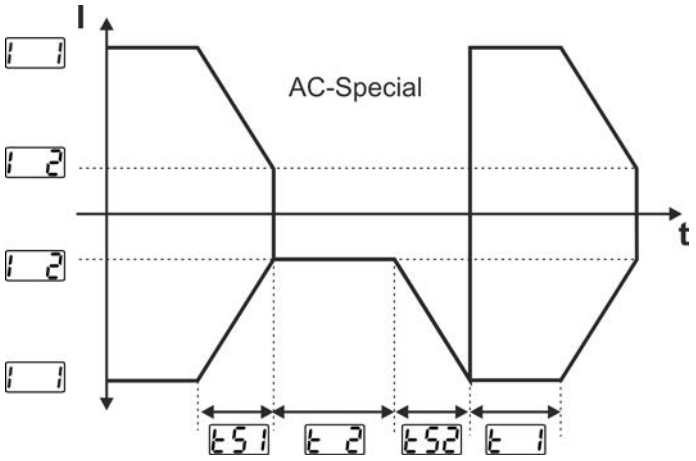


Figure 5-28

The t S1 and t S2 pulse edges can be set in the Expert menu (TIG) > *see 5.2.11 chapter*.

5.2.8.5 Pulsing in an upslope/downslope

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

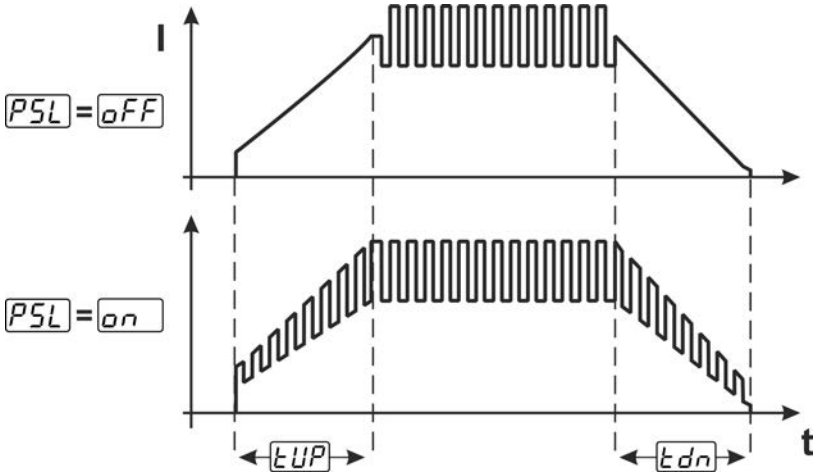


Figure 5-29

5.2.9 Welding torch (operating variants)

5.2.9.1 Welding torch mode

The operating elements (torch triggers or rockers) and their function can be individually adapted using various torch modes. Up to six modes are available to the user. The tables for the corresponding torch types describe the functional options.

Explanation of symbols for welding torch:

Symbol	Description
⇩	Press torch trigger
⇩⇧	Tap torch trigger
⇩⇧⇩	Tap torch trigger and then press
BRT 1, 2	Torch trigger 1 or 2
UP	Torch trigger UP - increase the value
DOWN	Torch trigger DOWN - decrease the value

The torch modes are set using the torch configuration parameters "trd" in the machine configuration menu > torch mode "tod" > *see 5.12 chapter*.

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

Welding torch with one torch trigger

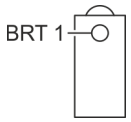


Figure 5-30

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	1
Secondary current (in latched operation)		⇩⇧	

Welding torch with two torch triggers or rocker

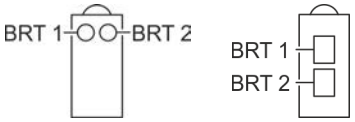


Figure 5-31

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	1
Secondary current (in latched operation)	BRT 2	⇩	
Secondary current (in latched operation)	BRT 1	⇩⇧	
Welding current On / Off	BRT 1	⇩	3
Increase welding current (up/down speed)	BRT 2	⇩⇧⇩	
Decrease welding current (up/down speed)	BRT 2	⇩	
Secondary current (in latched operation)	BRT 1	⇩⇧	

Welding torch with one torch trigger and up/down push-buttons

Figure 5-32

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	1
Secondary current (in latched operation)		⇩⇧	
Increase welding current (up/down speed)	UP	⇩	
Decrease welding current (up/down speed)	DOWN	⇩	
Welding current On / Off	BRT 1	⇩	4
Secondary current (in latched operation)		⇩⇧	
Increase welding current in steps (current jump)	UP	⇩	
Decrease welding current in steps (current jump)	DOWN	⇩	

Welding torch with two torch triggers and up/down push-buttons

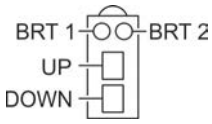


Figure 5-33

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	1
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Increase welding current (up/down speed)	UP	⇩	
Decrease welding current (up/down speed)	DOWN	⇩	
Welding current On / Off	BRT 1	⇩	4
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Increase welding current in steps (current jump)	UP	⇩	
Decrease welding current in steps (current jump)	DOWN	⇩	
Gas test	BRT 2	⇩ 3 s	

TIG function torch, Retox XQ

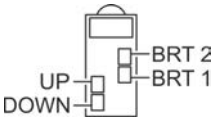


Figure 5-34

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	1
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Increase welding current (up/down speed)	UP	⇩	
Decrease welding current (up/down speed)	DOWN	⇩	
Welding current On / Off	BRT 1	⇩	4
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Increase welding current in steps (current jump)	UP	⇩	
Decrease welding current in steps (current jump)	DOWN	⇩	
Switching between current jump and JOB	BRT 2	⇩⇧	
Increase JOB number	UP	⇩	
Decrease JOB number	DOWN	⇩	
Gas test	BRT 2	⇩ 3 s	
Welding current On / Off	BRT 1	⇩	5
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Increase program number	UP	⇩	
Decrease program number	DOWN	⇩	
Switching between program and JOB	BRT 2	⇩⇧	
Increase JOB number	UP	⇩	
Decrease JOB number	DOWN	⇩	
Gas test	BRT 2	⇩ 3 s	

Function	Operation		Mode
Welding current On / Off	BRT 1	⇩	6
Secondary current (in latched operation)		⇩⇧	
Secondary current (in latched operation)	BRT 2	⇩	
Infinitely variable increase of welding current (up/down speed)	UP	⇩	
Infinitely variable decrease of welding current (up/down speed)	DOWN	⇩	
Switching between up/down speed and JOB number	BRT 2	⇩⇧	
Increase JOB number	UP	⇩	
Decrease JOB number	DOWN	⇩	
Gas test	BRT 2	⇩ 3 s	

5.2.9.2 Tapping function (tap torch trigger)

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

The tapping function can be selected separately for each torch mode for the start of welding with parameter tPS and for the end of welding with parameter tPE. If parameter tPE is activated, there is no need to tap the secondary current.

5.2.9.3 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.

5.2.9.4 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*.

5.2.10 RTF 1 foot-operated remote control

Upon connection of the foot-operated remote control, the basic settings below apply:

- **The non-latched operating mode is activated (the operating modes latched, spotArc® and spotmatic are disabled).**
- **Start/stop operation and the end program are deactivated.**
- **The start program is activated.**

5.2.10.1 Working area

The working area of the foot-operated remote control can be freely defined within the power source limits. The lower limit “FPU” is used to set the starting point. The upper limit is used to set the start point and upper limit (main current “I I”) of the end point of the foot-operated remote control. The entire pedal travel is distributed according to the set limits. The parameter “Welding current setting” “AbS” can be used to set the lower limit as a percentage of the upper limit (factory setting) or as an absolute value.

Application example:

Lower limit	Upper limit	Working area of the foot-operated remote control 0 %-100 %
≥ 60 %	100 A	between 60 A and 100 A
≥ 60 %	200 A	between 120 A and 200 A

5.2.10.2 Response

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

The responsiveness function can be switched in the machine configuration menu between the parameters for linear and logarithmic responsiveness (factory set) > *see 5.12 chapter*.

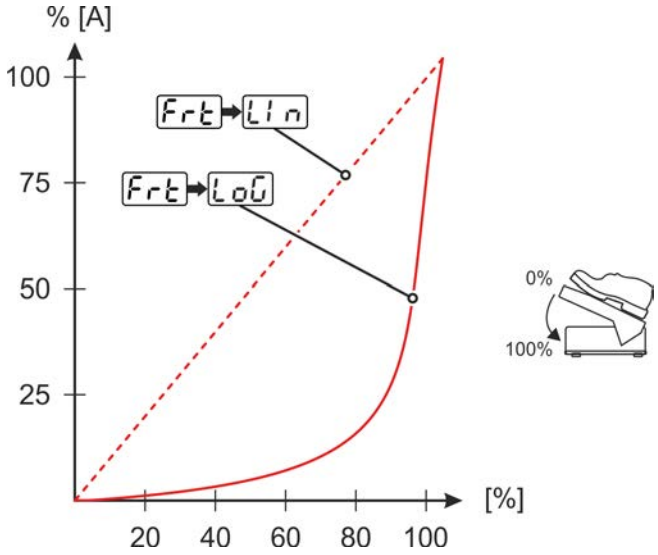


Figure 5-35

5.2.10.3 Start program

The start program "SFr" can be enabled or disabled in the machine configuration menu > *see 5.12 chapter*.

Enabled start program

At the start of the process, the start program ensures the necessary arc stability until the main current "I 1" is reached. The start current "I St", the ignition current time "t St" and the ramp "tUP" can be adjusted individually according to the welding task. In the main program, the welding current can be freely regulated using the foot-operated remote control (factory setting).

Disabled start program

Without the start program, the current jumps immediately to the main current (according to the specification of the foot-operated remote control). The start current "I St" can be used for arc stabilisation. In this case, the operation with the foot-operated remote control is only enabled when the start current is exceeded. Until then, the welding current corresponds to the start current "I St".

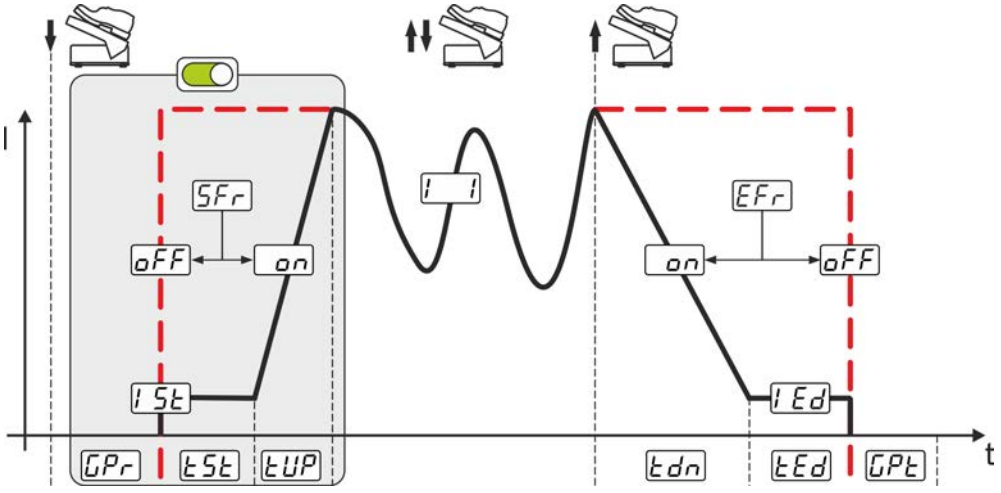


Figure 5-36

5.2.10.4 End program

The end program "EFr" can be enabled or disabled in the machine configuration menu > *see 5.12 chapter*.

Enabled end program

The activation of the end program is suitable for adjusting the working area (lower limit increased) for the end-crater fill. The down-slope time "tdn", the end current "I Ed" and the end current time "tEd" can be adjusted individually. The end program starts with the down-slope time on ending the control by using foot-operated remote control (release).

Disabled end program

When the end program is deactivated after releasing the foot-operated remote control, the welding process ends according to the set lower limit (factory setting).

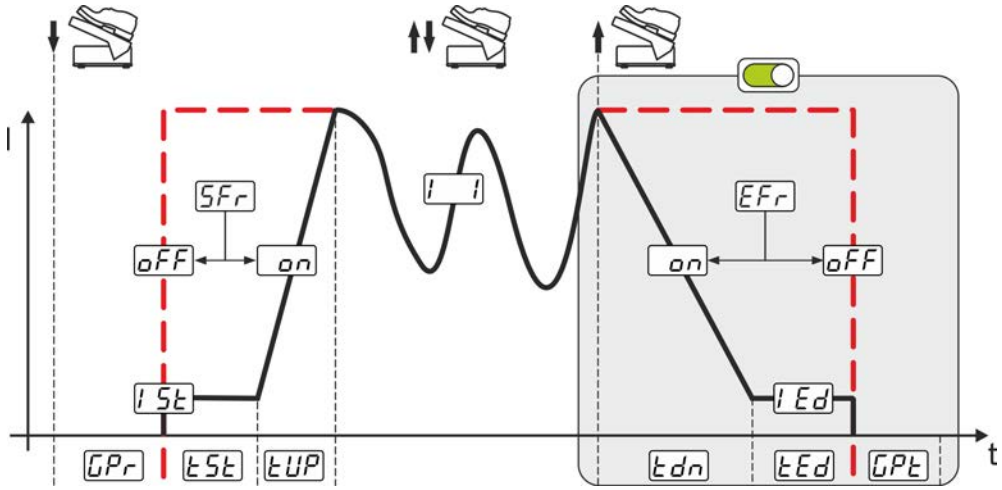


Figure 5-37

5.2.10.5 Start/stop operation

Start/stop operation "FtO" can be enabled or disabled in the machine configuration menu > *see 5.12 chapter*.

Enabled start/stop operation

The foot-operated remote control is no longer used to specify the welding current, but rather starts or ends the welding process (see torch trigger). As in normal operation, the welding current is specified using the power source control or the welding torch with the up/down function. All operating modes (non-latched, latched, etc.) can be selected.

Disabled start/stop operation

The welding current is specified using the foot-operated remote control. In this setting, only the non-latched operating mode is possible. (factory setting).

5.2.11 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.

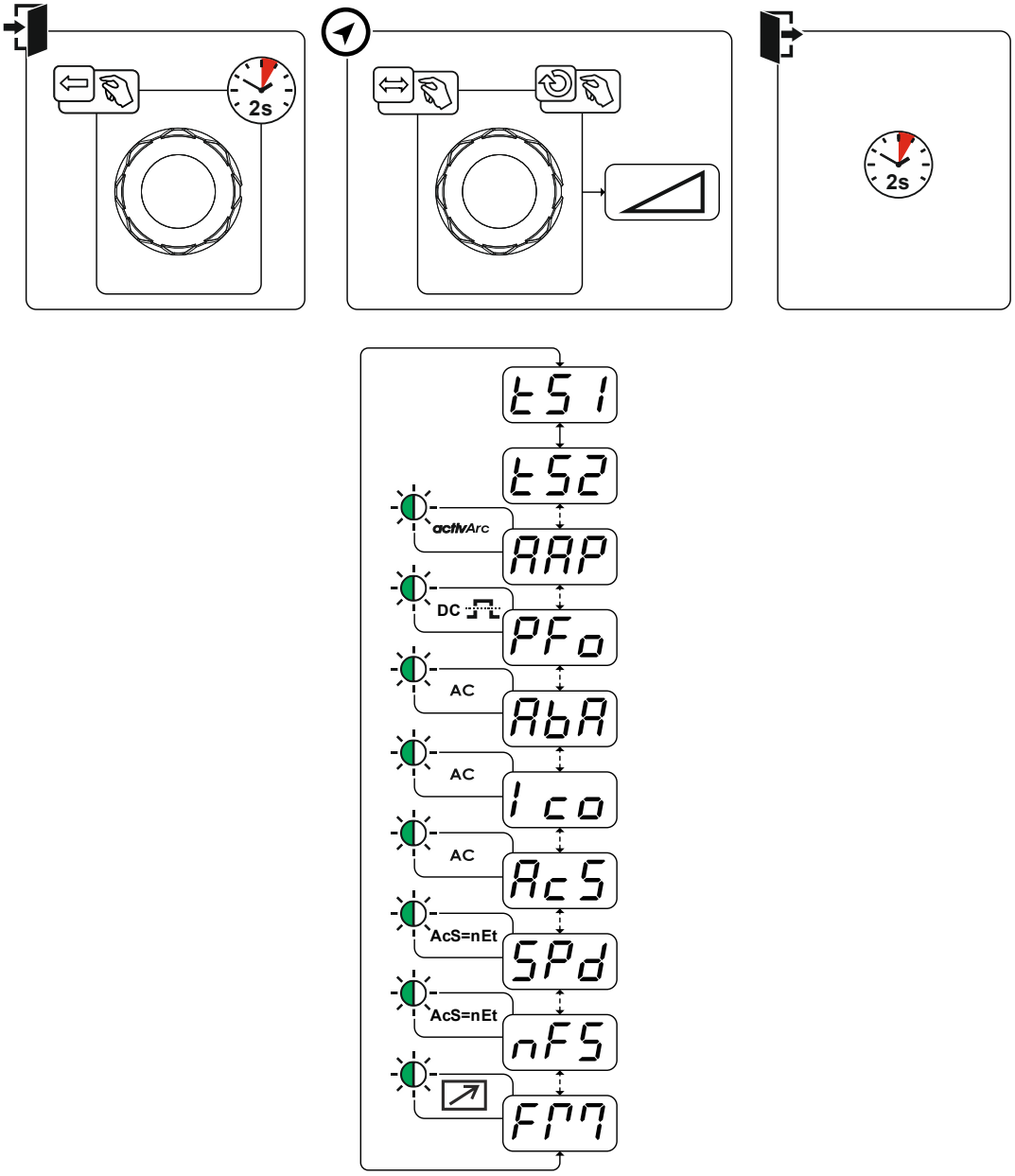


Figure 5-38

Display	Setting/selection
tS1	**Slope time (main current to secondary current)**
tS2	**Slope time (secondary current to main current)**
AAP	**Parameter activArc > *see 5.2.6 chapter*** Setting the intensity
PFo	**Pulse shape** hrd ------ hard rectangular current curve and high arc force that however generates a louder arc noise (factory setting) rnd ------ rectangular current curve with rounded edges and low noise. For universal welding tasks SFt ------ heavily rounded current curve, lower arc force and low arc noise

Display	Setting/selection
AbA	**Amplitude balance > *see 5.2.3.4 chapter***
Ico	**Commutation optimisation (AC) > *see 5.2.3.6 chapter*** AUt ------- Automatic mode (factory setting). / ------- Manual mode (1-100).
AcS	**Synchronous welding (AC) > *see 5.11 chapter*** oFF ------- Function disabled (factory setting) nEt ------- Synchronisation via mains voltage (50 Hz / 60 Hz)
SPd	**Synchronous welding (AC) - phase difference setting**
nFS	**Synchronous welding (AC) - phase fine-tuning setting**
FM	**Remote control for lower current limit > *see 5.2.10.1 chapter***

5.2.12 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.

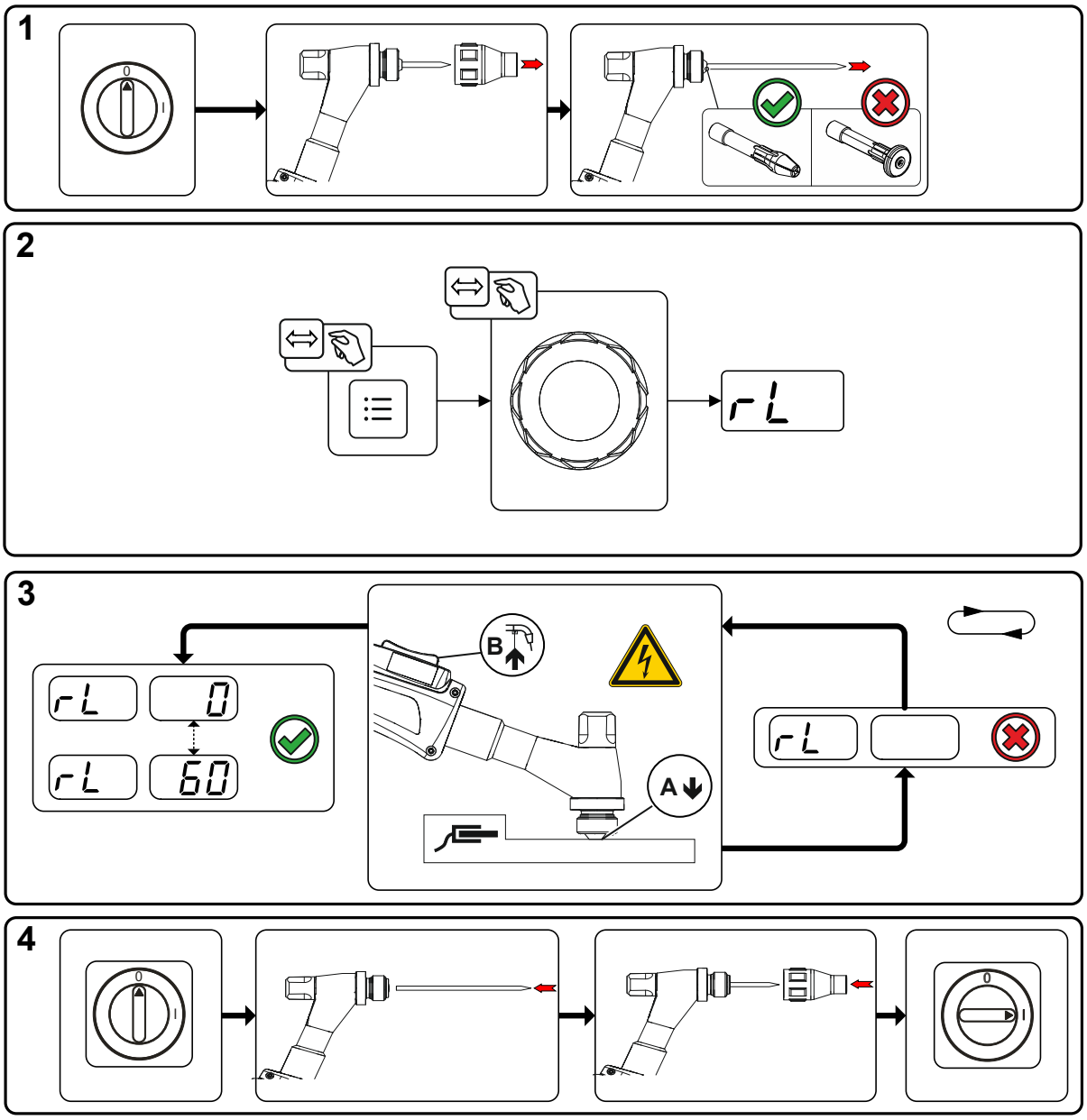


Figure 5-39

1 Preparation

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

2 Configuration

- Press push-button .
- Press the rotary button and select parameter rL .

3 Alignment / 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.

5.3 MMA welding

5.3.1 Welding task selection

It is only possible to change the basic parameters when no welding current is flowing and any possible access control is disabled > *see 5.8 chapter*.

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.

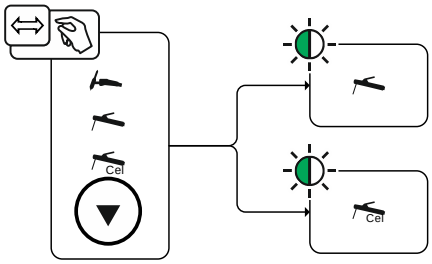
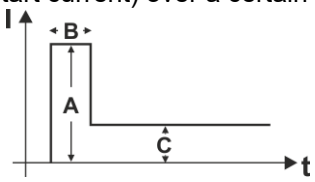


Figure 5-40

5.3.2 Hotstart

The function hot start ensures a secure igniting of the arc and a sufficient heating to the still cold parent metal at the beginning of the welding process. The ignition takes place here with increased current (hot start current) over a certain time (hot start time).



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

Figure 5-41

5.3.2.1 Selection and adjustment

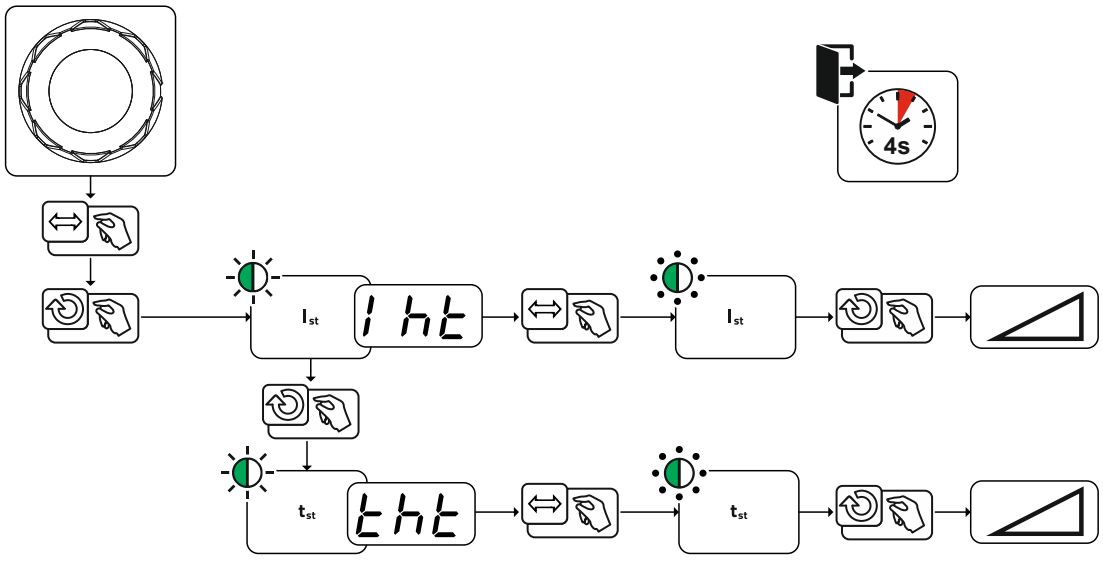


Figure 5-42

5.3.3 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.

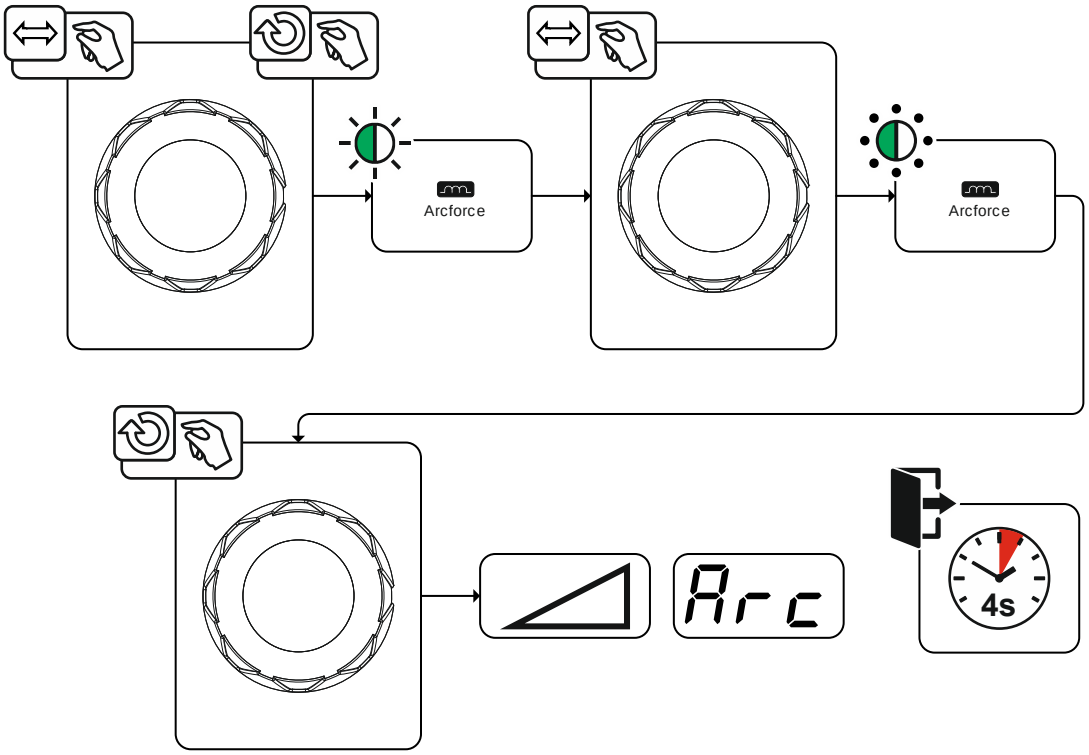
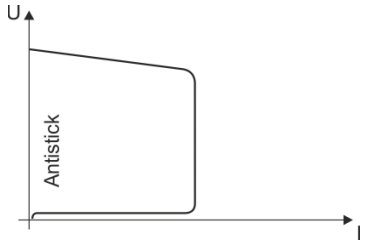


Figure 5-43

5.3.4 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 5-44

5.3.4.1 Welding current polarity reversal (polarity reversal)

This function can be used to reverse the welding current polarity electronically.

For example, when welding with different electrode types for which different polarities are stipulated by the manufacturer, the welding current polarity can be switched easily on the control.

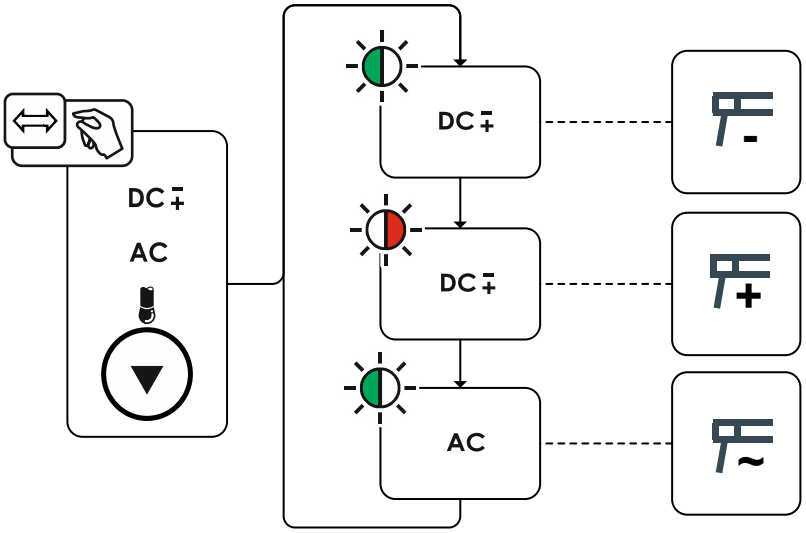


Figure 5-45

5.3.5 AC welding

5.3.5.1 Automatic AC frequency

Activation takes place in the functional sequence using the parameter frequency Freq. By turning to the left, the parameter value is reduced until the parameter AUt (AC frequency automatic) is shown in the display. The signal light Freq auto comes on when the function is enabled.

The machine control takes over the regulation or setting of the alternating current frequency depending on the set main current. The lower the welding current, the higher the frequency and vice versa. This achieves a concentrated, directionally stable arc when welding currents are low. The load on the tungsten electrode is minimised when the welding currents are high ensuring a longer service life.

The use of a foot-operated remote control with this function reduces manual intervention by the user during the welding process to a minimum.

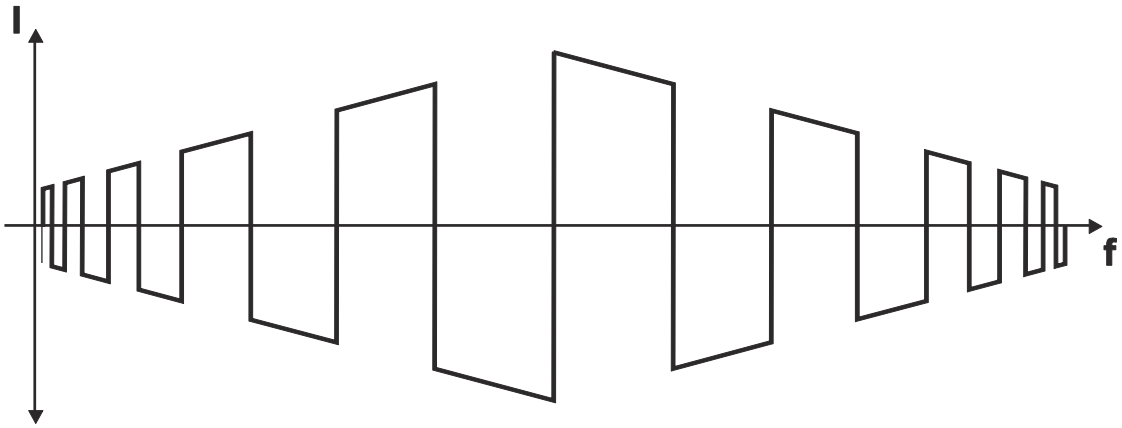


Figure 5-46

Selection

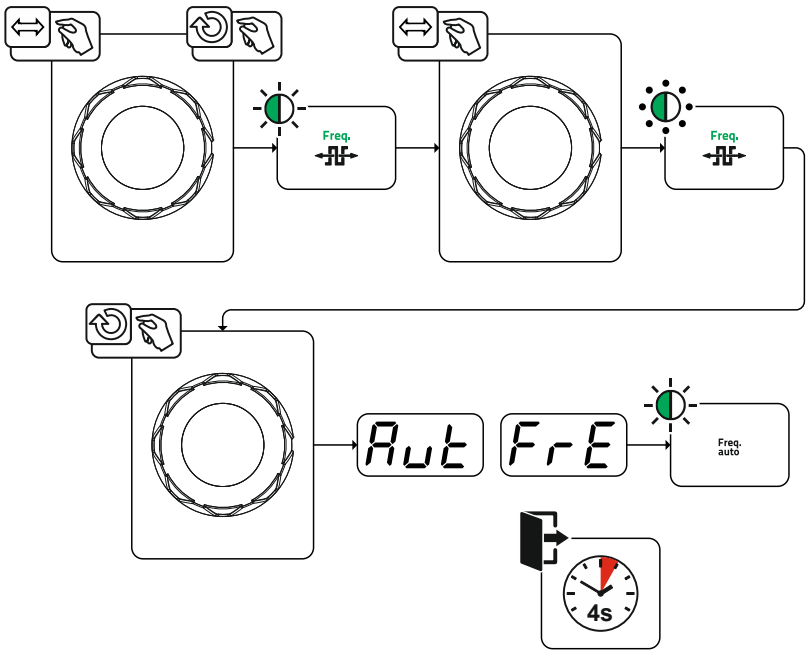


Figure 5-47

5.3.6 Pulse welding

5.3.6.1 Average value pulse welding

Average value pulse welding means that two currents are switched periodically, a current average value (AMP), a pulse current (Ipuls), a balance (bAL) and a frequency (FrE) having been defined first. The predefined ampere current average value is decisive, the pulse current (Ipuls) is defined by the I PL parameter as a percentage of the current average value (AMP). The pulse pause current (IPP) requires no setting. This value is calculated by the machine control, so that the welding current average value (AMP) is maintained at all times.

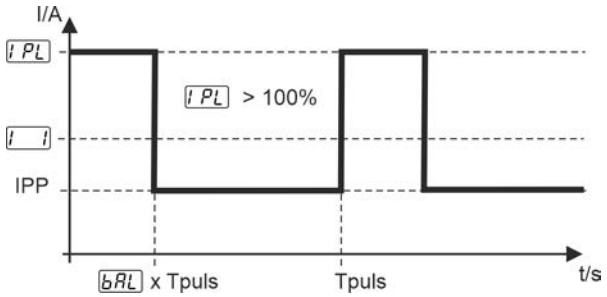


Figure 5-48

AMP = Main current; e.g. 100 A

Ipuls = Pulse current = I PL x AMP; e.g. 140% x 100 A = 140 A

IPP = Pulse pause current

Tpuls = Duration of one pulse cycle = 1/FrE; e.g. 1/1 Hz = 1 s

bAL = Balance

5.4 Arc length restriction (USP)

The arc length restriction USP function stops the welding process when an excessive arc voltage is detected (unusually large gap between electrode and workpiece). The function can be switched on or off depending on the process > *see 5.12 chapter*.

5.5 JOB favourites

Favourites are additional locations for storing and loading frequently used welding tasks, programs and their settings. The status of the Favourites (loaded, changed, not loaded) is indicated by signal lights.

- Five Favourites are available to save any settings.
- As required, the access control can be adjusted with the key switch or Xbutton function.

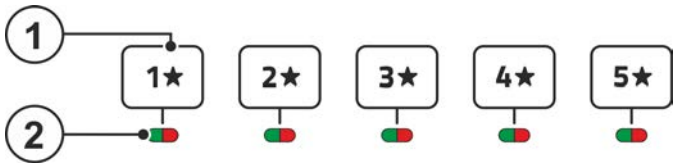


Figure 5-49

Item	Symbol	Description
1		**push-button - JOB Favourites > *see 5.5 chapter***
		•----------Pressing the push-button briefly: Loading Favourites
		•----------Press and hold the push-button (>2 s): Saving as a Favourite
		•----------Press and hold the push-button (>12 s): Deleting a Favourite
2		**Signal light of Favourite status**
		----------Signal light is green: Favourite loaded, settings of the Favourite and the current device settings are identical
		----------Signal light is red: Favourite loaded, but settings of the Favourite and the current device settings are not identical (for example, the operating point has been changed)
		----------Signal light is off: Favourite not loaded (e.g. JOB number has been changed)

5.5.1 Saving current settings to Favourites

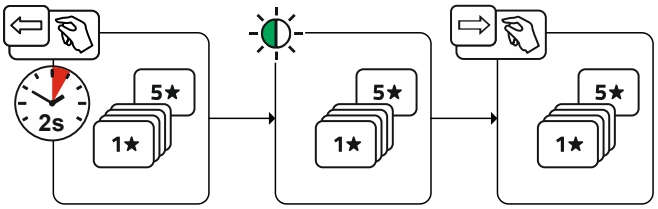


Figure 5-50

- Press and hold the favourite memory push-button for 2 s (the signal light of the favourite status is green).

5.5.2 Loading saved Favourites

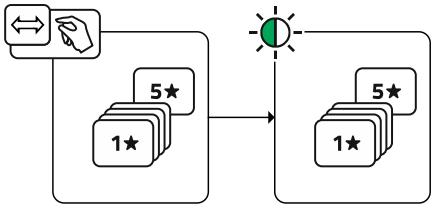


Figure 5-51

- Press the favourite memory push-button (the signal light of the favourite status is green).

5.5.3 Deleting saved Favourites

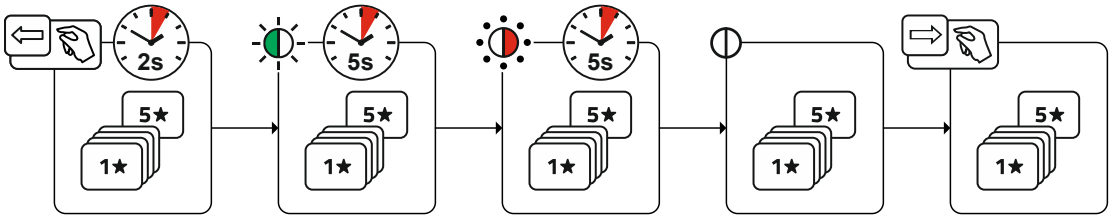


Figure 5-52

- Press and hold the favourite memory push-button.
  After 2 seconds, the signal light of the favourite status turns green
  after another 5 s, the signal light starts flashing red
  after another 5 s the signal light goes out
- Release the favourite memory push-button.

5.6 Managing welding tasks (JOB manager)

5.6.1 Copying welding tasks (JOB)

Use this function to copy the JOB data of the currently selected JOB to a target -JOB to be specified.

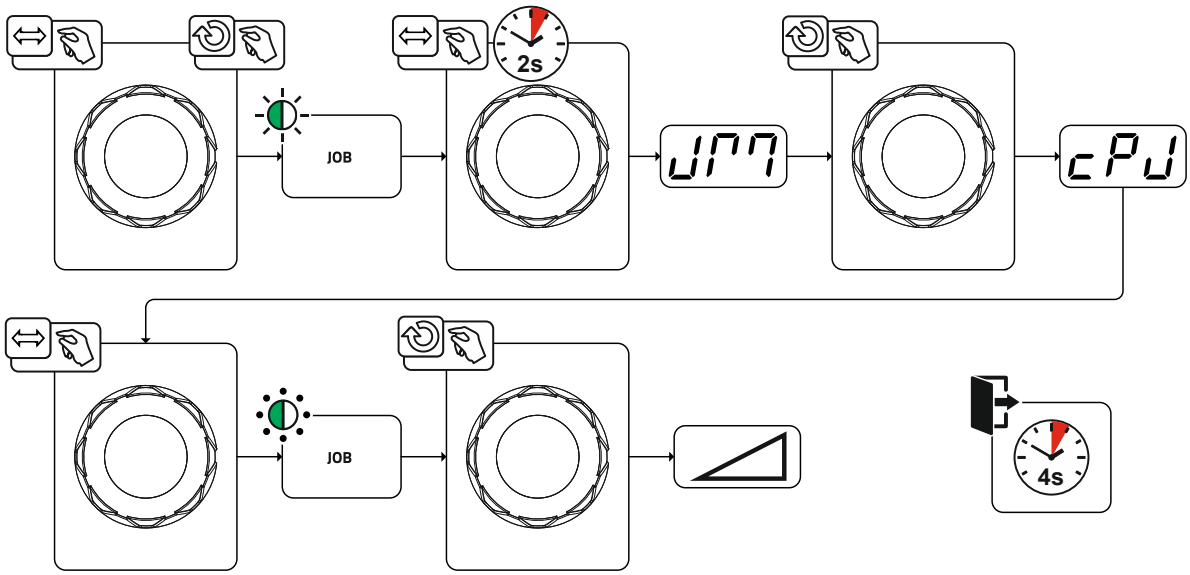


Figure 5-53

5.6.2 Reset welding task (JOB) to the factory setting

This function resets the JOB data of a welding task (JOB) to be selected to the factory settings.

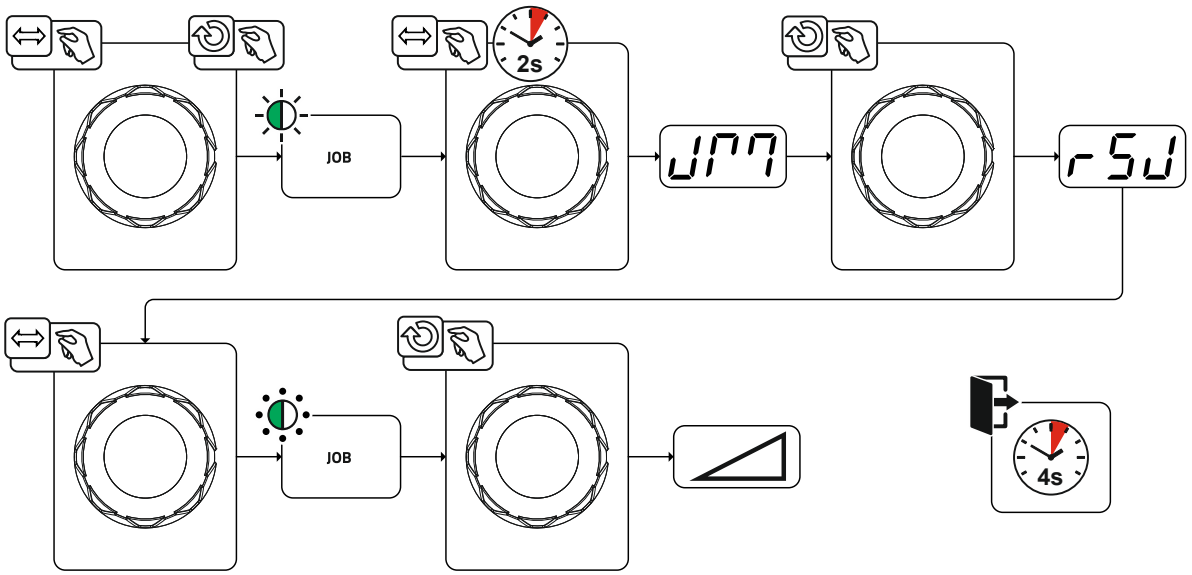
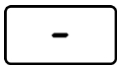


Figure 5-54

5.7 Power-saving mode (Standby)

Using the parameter SbA in the machine configuration menu, the time for the power-saving mode can be set or the mode can be deactivated > *see 5.12 chapter*.



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

Actuating any operating element (e.g., turning a rotary knob) cancels the power-saving mode and the machine switches back to ready-to-weld mode.

5.8 Access control

The machine control can be locked to secure it against unauthorised or unintentional adjustment. The access block has the following effect:

- The parameters and their settings in the machine configuration menu, Expert menu and operation sequence can only be viewed but not changed.
- Welding procedure and welding current polarity cannot be changed.

The parameters for setting the access block are configured in the machine configuration menu > *see 5.12 chapter*.

Enabling access block

- Assign the access code for the access block: Select parameter cod and select a number code (0–999).
- Enable access block: Set parameter Loc to access block enabled on.

The access block activation is indicated by the "Access block active" signal light > *see 4 chapter*.

Disabling access block

- Enter the access code for the access block: Select parameter cod and enter the previously selected number code (0–999).
- Disable access block: Set parameter Loc to access block disabled oFF. The only way to disable the access block is to enter the selected number code.

5.9 Voltage reducing device

The voltage reduction device (VRD) is used to increase safety, especially in dangerous environments (such as shipbuilding, pipeline construction, mining).

The use of a voltage reduction device is mandatory in some countries and specified in many in-house safety regulations for welding power sources.

The VRD > *see 4.1.2 chapter* signal light lights up when the voltage reducing device is working properly and the output voltage has been reduced to the values specified in the relevant standard (technical data).

5.10 Dynamic power adjustment

This requires use of the appropriate mains fuse.

Observe mains fuse specification!

This function enables aligning the machine to the mains connection fusing. This may counteract frequent tripping of the mains fuse. The maximum input power of the machine is limited with an exemplary value for the existing mains fuse (infinitely variable).

You can predefine this value in the machine configuration menu > *see 5.12 chapter* using parameter FUS.

The function automatically adjusts the welding power to an uncritical level for the corresponding mains fuse.

☞ ***When using a 25-A mains fuse, a suitable mains plug has to be installed by a qualified electrician.***

5.11 Synchronous welding (AC)

This function is important when welding with two power sources on both sides, simultaneously with alternating current, as is the case, for example, with thick aluminium materials in position PF. This ensures that with alternating current, the positive and negative pole phases occur simultaneously on both power sources (are synchronised) and the arcs, therefore, do not affect one another.

Figure 5-55

The phase sequences and rotating fields of the supply voltages (50Hz / 60Hz) must be identical to ensure that the energy is introduced into the weld pool interference-free during synchronous welding. The required parameters can be set directly on the machine control (no turning or reconnecting of the mains connection plugs is required). Wiring differences in the supply network are also compensated. Optimum phase compensation immediately shows better welding results.

The Expert menu (TIG) > *see 5.2.11 chapter* is used to activate and set the device function “Synchronisation via mains voltage”. The parameter AcS must be set to nEt (signal light Netsync lights up).

Two EWM power sources can be synchronised using the phase shift SPd parameter in steps of 60° (0°, 60°, 120°, 180°, 240° and 300°).

When synchronising with a third-party product (power source), the parameter Phase fine-tuning nFS can be adjusted in steps of 1° (-30° to 0° to +30°) in addition to the phase position.

5.12 Machine configuration menu

Basic machine settings are defined in the machine configuration menu.

5.12.1 Selecting, changing and saving parameters

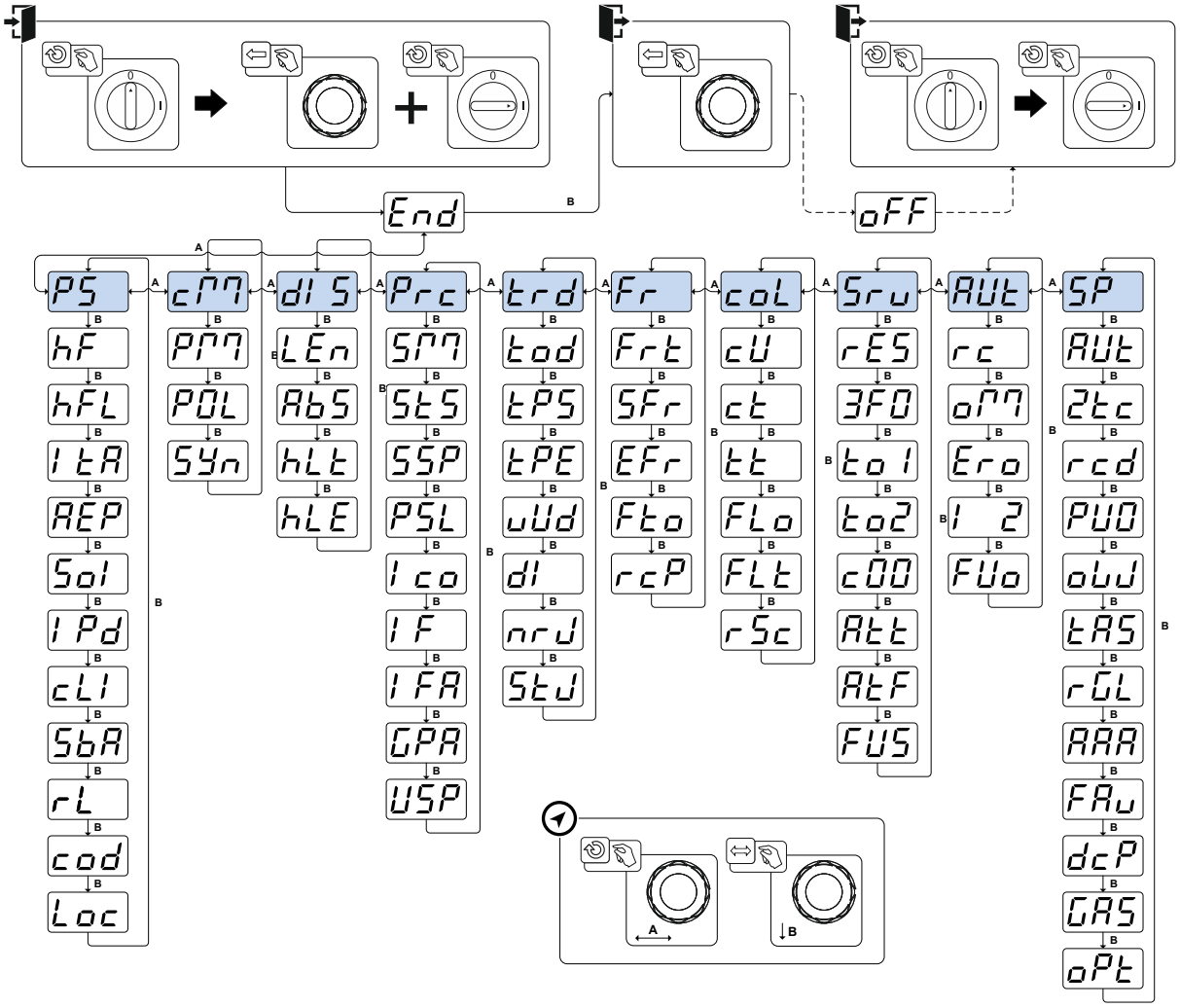


Figure 5-56

Display	Setting/selection
End	**Exit the menu** Exit
oFF	**Switching the machine off and on** Required for applying various configuration parameters
PS	**Power source menu**
hF	**Switch ignition mode** on ------ HF ignition oFF ------ Liftarc
hFL	**HF intensity** Std ------ Standard: Maximum value for the high-voltage ignition pulse Up rEd ------ Reduced: Reduced value for the high-voltage ignition pulse Up
ItA	**Re-ignition after arc interruption > *see 5.2.4.3 chapter*** Job ------ JOB-dependent time (ex works 5 s). oFF ------ Function disabled or numerical value 0.1–5.0 s.

Display	Setting/selection
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
Sol	**TIG HF start (soft/hard) switching** on ------- soft ignition (factory setting). oFF ------- hard ignition.
IPd	**Ignition pulse dynamics** on ------- Function enabled (factory setting) oFF ------- Function disabled
cLI	**Minimum current limit (TIG) > *see 5.1.2 chapter*** Depending on the set tungsten electrode diameter oFF ------- Function disabled on ------- Function enabled (ex works)
SbA	**Time-based power-saving mode > *see 5.7 chapter*** Time to activation of the power-saving mode in case of inactivity. Setting oFF = disabled or numerical value 5-60 min..
rL	**Cable resistance alignment > *see 5.2.12 chapter***
cod	**Access control – access code** Setting: 000 to 999 (000 ex works)
Loc	**Access control > *see 5.8 chapter*** on ------- Function enabled oFF ------- Function disabled (ex works)
cMn	**Operating mode menu**
PMn	**Program mode** oFF ------- Function disabled (factory setting) on ------- Function enabled
POL	**Program lock (P0)** The program P0 is locked when locking with the key switch. It is only possible to switch between programs P1 to P15. oFF ------- Function disabled (factory setting) on ------- Function enabled
Syn	**Operating principle** on ------ synergic parameter setting (factory setting) oFF ------ conventional parameter setting
dIS	**Machine display menu**
LEn	**Setting the system of units** mm ------- Units of length in mm, m/min. (metric system) Inn ------- Unit of length in inches, ipm (imperial system)
Abs	**Absolute value setting (ignition, secondary, end and hot start current) > *see 4.3.2 chapter*** on ------- Welding current setting, absolute oFF ------- Welding current setting, as a percentage of the main current (ex works)
HLt	**Hold value (TIG)** on ------- Hold value is displayed until activated by rotary transducer or welding start (factory setting) Aut ------- Hold value is only displayed for a defined time oFF ------- Function disabled

Display	Setting/selection
hLE	**Hold value (MMA)** AUt ------ Hold value is only displayed for a defined time (factory setting) oFF ------ Function disabled
Prc	**Process menu**
SPn	**spotmatic operating mode** Ignition by contact with the workpiece on ------ Function enabled (ex works) oFF ------ Function disabled
StS	**Setting the spot time** on ------ Short spot time oFF ------ Long spot time
SSP	**Process activation setting** on ------ Separate process activation (ex works) oFF ------ Permanent process activation
PSL	**Pulsing in an upslope/downslope** > ***see 5.2.8.5 chapter*** on ------ Function enabled (factory setting) oFF ------ Function disabled
Ico	**Commutation optimisation (AC) > *see 5.2.3.6 chapter*** [1] on ------ Function enabled oFF ------ Function disabled (factory setting)
IF	**Waveform automatic (AC)** [1] mAn ------ Manual setting of the waveform (factory setting) AUt ------ Synergetic to current (requirement: Xconnect)
IFA	**Waveform (AC) - advanced** [1] oFF ------ Function disabled (factory setting) on ------ Function enabled
GPA	**Automatic gas post-flow function > *see 5.1.1.1 chapter*** on ------ Function on oFF ------ Function off (factory setting)
USP	**Arc length restriction > *see 5.4 chapter*** on ------ Function switched on oFF ------ Function switched off
trd	**Torch configuration menu** Set welding torch functions
tod	**Torch mode (ex works 1) > *see 5.2.9.1 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
tPE	**Alternative welding end - Tap End (see the chapter Latched operating mode)** on ------ Function enabled. oFF ------ Function disabled (factory setting).
uUd	**Up/down speed > *see 5.2.9.3 chapter*** Increase value > rapid current change Decrease value > slow current change
dI	**Current jump > *see 5.2.9.4 chapter*** Current jump setting in ampere
nrJ	**Get JOB number** Set maximum selectable JOBs for function torch Retox XQ (setting: 1 to 100, factory setting 10).

Display	Setting/selection
StJ	**Start JOB** Set first retrievable JOB (setting: 1 to 100, factory setting 1).
Fr	**Remote control menu**
FrE	**Responsiveness > *see 5.2.10.2 chapter*** Lin------- Linear responsiveness LoG------- Logarithmic responsiveness (factory setting)
SFr	**Start program of foot-operated remote control > *see 5.2.10.3 chapter*** on ------- Function enabled (factory setting). oFF------- Function disabled.
EFr	**End program of foot-operated remote control > *see 5.2.10.4 chapter*** on ------- Function enabled. oFF------- Function disabled (factory setting).
Fto	**Start / stop operation > *see 5.2.10.5 chapter*** on ------- Function enabled. oFF------- Function disabled (factory setting).
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
coL	**Torch cooling menu**
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.)
tt	**Temperature error limit** Setting 50 - 80°C / 122 - 176°F (factory setting 70°C / 158°F)
FLo	**Flow monitoring** oFF------- Function disabled on ------- Function enabled (factory setting)
FLt	**Flow error limit** Setting 0.5 l - 2.0 l / 0.13 gal - 0.53 gal (factory setting 0.6 l / 0.16 gal)
rSc	**Reset Cool** on ------- Function enabled oFF------- Function disabled (factory setting)
Sru	**Service menu** Any changes to the service menu should be agreed with the authorised service personnel.
rES	**Reset (resetting to factory settings)** oFF------- Switched off (factory setting) cFG------- Reset of values in the machine configuration menu cPL------- Complete reset of all values and settings to ------- Reset of operating time ti ------- Reset of arc time toi------- Reset of operating time and arc time Resetting is performed when exiting the menu (End).
	Software version query System bus ID and version number are separated by a dot. Example: 07.0040 = 07 (system bus ID) 0.0.4.0 (version number)

Display	Setting/selection
to 1	**Operating time/arc time (resettable)** to 1 ------ Display of the resettable operating time in hours and minutes (can be reset using the parameter rES). tI 1 ------ Display of resettable arc time in hours and minutes (can be reset using the parameter rES)
to2	**Operating time/arc time (total)** to2 ------ Display of the operating time in hours and minutes (total) tI 2 ------ Display of the arc time in hours and minutes (total)
c00	**List of sensors** Abfrage diverser Gerätesensoren (c00-c31)
Att	**Show warnings > *see 7.1 chapter*** oFF ------ Function disabled (ex works) on ------ Function enabled
AtF	**Fuse protection warning** oFF ------ Function disabled (factory setting) on ------ Function enabled
FUS	**Dynamic power adjustment > *see 5.10 chapter***
AUt	**Automation menu** [3]
rc	**Automated/Manual (rC on/off) operating mode** [3] Select machine/function control on ------with external control voltages/signals oFF ------with machine control
oMM	**Operating mode switching via interface for automated welding** 2t ----- Non-latched 2tS ------ Special non-latched
Ero	**Error output (relay)** [3] Potential-free relay contact no ------Relay contact for error message is open (factory setting) nc ------Relay contact for error message is closed
I 2	**Setting for pulse pause current I2** [3] The pulse pause current (I2) is set either relative or absolute to the main current (I1). Pro ------Percentage setting (factory setting) Abs ------Absolute setting
FUo	**Function output** [3] Potential-afflicted open-drain output that can emit various, adjustable signals through active-low levels. oFF ------ Switched off (factory setting) Auc ------ Connection to AVC (Arc voltage control) hWJ ------ AC synchronisation or hot wire USh ------ Notification of a short circuit in the sensor voltage
SP	**Special parameters menu**
AUt	**Displaying and releasing the automation parameters** oFF ------ Function disabled (factory setting) on ------ Function enabled
2tc	**Non-latched operation (version C) > *see 5.2.5.6 chapter*** on ------ Function enabled oFF ------ Function disabled (ex works)

Display	Setting/selection
rcd	**Welding current actual value display > *see 4.2 chapter***
	on ------- Actual value display
	oFF ------- Nominal value display
PUO	**Pulsed TIG welding (thermal)**
	on ------- Function enabled (ex works)
	oFF ------- For special applications only
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 5.2.7 chapter***
	on ------- function active (factory setting).
	oFF ------- function inactive.
rGL	**Average value controller (AC)** [1]
	on ------- Function enabled (factory setting)
	oFF ------- Function disabled
AAA	**activArc voltage measuring**
	on ------- Function enabled (ex works)
	oFF ------- Function disabled
FAu	**Fast take-over of control voltage (automation)** [3]
	on ------- Function enabled
	oFF ------- Function disabled (ex works)
dcP	**Welding procedure DC+ (TIG)** [1]
	Protection against an accidental selection of polarity DC+ and the associated destruction of the tungsten electrode (factory setting).
	on ------- Polarity switching to DC+ is possible.
	oFF ------- Polarity switching is disabled (factory setting).
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).
oPt	**Arc detection for welding helmets (TIG)**
	Modulated waviness for better arc detection
	0 ------- Function disabled
	1 ------- Medium intensity
	2 ------- High intensity

[1] for AC welding machines only.

[2] For machines with filler wire (AW) only.

[3] only for machines with an interface for automated welding or appropriate automation components.

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

Improper maintenance, testing and repairs!
Maintenance, testing and repair of the machine may only be carried out by skilled and qualified personnel (authorised service personnel). A competent person is someone who, based on training, knowledge and experience, can recognize the hazards and possible consequential damage that may occur when testing power sources and can take the necessary safety precautions.

- Follow the maintenance instructions.
- If any of the test requirements below are not met, the unit must not be put back into operation until it has been repaired and tested again.

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 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!**

In addition to the national or international regulations mentioned below, it is mandatory to follow the respective national laws and regulations on 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 electrical 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.

The deletion of personal data is the responsibility of the end user.

Lamps, batteries or accumulators must be removed and disposed of separately before disposing of the device. The type of battery or accumulator and its composition is marked on the top (type CR2032 or SR44). The following EWM products may contain batteries or accumulators:

- Welding helmets
  Batteries or accumulators are easy to remove from the LED cassette.
- Device controls
  Batteries or accumulators are located on the back of these in corresponding sockets on the circuit board and are easy to remove. The controls can be removed using standard tools.

Information on returning used equipment or collections can be obtained from the respective municipal administration office. Devices can also be returned to EWM sales partners across Europe.

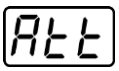
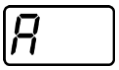
Further information on the topic of the disposal of electrical and electronic equipment can be found on our website at: https://www.ewm-group.com/de/nachhaltigkeit.html.

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 Warnings

Depending on the display options of the machine display, a warning message is displayed as follows:

Display type - machine control	Display
Graphic display	
two 7-segment displays	
one 7-segment display	

The cause of the warning is indicated by a corresponding warning number (see table).

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

Warning		Potential cause / remedy
1	Excess temperature	A shutdown is imminent due to excess temperature.
2	Half-wave failures	Check process parameters.
3	Torch cooling warning	Check coolant level and top up if necessary.
4	Shielding gas	Check shielding gas supply.
5	Coolant flow	Check min. flow rate. [2]
6	Wire reserve	Only a small amount of wire is left on the spool.
7	CAN bus failure	Wire feeder not connected; automatic circuit-breaker of wire feed motor (reset the tripped automatic circuit-breaker by actuating).
8	Welding circuit	The inductance of the welding circuit is too high for the selected welding task.
9	WF configuration	Check WF configuration.
10	Partial inverter	One of several partial inverters is not supplying welding current.
11	Excess temperature of the coolant [1]	Check temperature and switching thresholds. [2]
12	Welding monitoring	The actual value of a welding parameter is outside the specified tolerance field.
13	Contact error	The resistance in the welding circuit is too high. Check earth connection.
14	Alignment error	Switch the machine off and on. If the error persists, notify Service.
15	Mains fuse	The power limit of the mains fuse is reached and the welding power is reduced. Check the fuse setting.
16	Shielding gas warning	Check the gas supply.
17	Plasma gas warning	Check the gas supply.
18	Forming gas warning	Check the gas supply.
19	Gas warning 4	reserved

Warning		Potential cause / remedy
20	Coolant temperature warning	Check coolant level and top up if necessary.
21	Excess temperature 2	reserved
22	Excess temperature 3	reserved
23	Excess temperature 4	reserved
24	Coolant flow warning	Check coolant supply. Check coolant level and top up if necessary. Check flow and switching thresholds. [2]
25	Flow 2	reserved
26	Flow 3	reserved
27	Flow 4	reserved
28	Wire stock warning	Check wire feeding.
29	Low wire 2	reserved
30	Low wire 3	reserved
31	Low wire 4	reserved
32	Tacho error	Fault of wire feeder - permanent overload of the wire drive.
33	Excess current on the wire feed motor	Excess current detected on wire feed motor.
34	JOB unknown	JOB selection was not carried out because the JOB number is unknown.
35	Excess current on the wire feed motor slave	Excess current detected on wire feed motor slave (push/push system or intermediate drive).
36	Slave tacho error	Fault of wire feeder - permanent overload of the wire drive (push/push system or intermediate drive).
37	FAST bus failure	Wire feeder not connected (reset by actuating the automatic circuit-breaker of the wire feed motor).
38	Incomplete component information	Check the XNET component management.
39	Mains half-wave failure	Check supply voltage.
40	Weak power grid	Check supply voltage.
41	Cooling unit not recognised	Check the cooling unit connection.
47	Battery (remote control, type BT)	Battery level is low (replace battery)

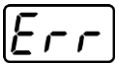
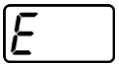
[1] only for the XQ machine series

[2] See technical data for values and other switching thresholds.

7.2 Error messages (power source)

The possible error numbers displayed depend on the machine series and version!

Depending on the options of the machine display, a fault is shown as follows:

Display type - machine control	Display
Graphic display	
two 7-segment displays	
one 7-segment display	

The possible cause of the fault is signalled by a corresponding fault number (see table). In the case of an error, the power unit shuts down.

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

Reset error (category legend)

[A] The error message disappears when the error is eliminated.

[B] The error message can be reset by pressing a push-button ◀.

All other error messages can only be reset by switching the machine off and on again.

Error 3: Tacho error

Categories A, B

- Fault in the wire feeder.
  - Check the electrical connections (connectors, lines).
- Permanent overload of the wire drive.
  - Do not lay the liner in tight radii.
  - Check the wire in the liner for ease of movement.

Error 4: Excess temperature

Category A

- The power source is overheating.
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check the fan and clean or replace.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.

Error 5: Mains overvoltage

Category A [1]

- Mains voltage is too high.
  - Check the mains voltages and compare them with the connection voltages of the power source.

Error 6: Mains undervoltage

Category A [1]

- Mains voltage is too low.
  - Check the mains voltages and compare them with the connection voltages of the power source.

Error 7: Low coolant level

Category B

- Low flow rate.
  - Fill with coolant.
  - Check coolant flow - remove kinks in the hose package.
  - Adjust the flow threshold [2].
  - Clean the cooler.
- Pump does not turn.
  - Turn the pump shaft.
- Air in the coolant circuit.
  - Vent the coolant circuit.
- The hose package is not filled with coolant.
  - Switch the machine off and on > pump running > filling process.
- Operation with a gas-cooled welding torch.
  - Deactivate the torch cooling.
  - Connect the coolant feed and return with a hose bridge.

Error 8: Shielding gas error

Categories A, B

- No gas.
  - Check the gas supply.
- The pre-pressure is too low.
  - Remove kinks in the hose package (nominal value: 4-6 bar pre-pressure).

Error 9: Secondary overvoltage

- Overvoltage at the output: Inverter error.
  - Request service.

Error 10: Earth fault (PE error)

- Connection between welding wire and machine casing.
  - Remove the electrical connection.
- Connection between welding circuit and machine casing.
  - Check the connection and routing of the earth wire / welding torch.

Error 11: Fast shutdown

Categories A, B

- Remove the logical signal "Robot ready" during the process.
  - Eliminate errors in the higher-level control.

Error 16: Pilot arc power source - collective error

Category A

- The external emergency stop circuit has been interrupted.
  - Check the emergency stop circuit and eliminate the cause of the error.
- The emergency stop circuit of the power source has been activated (internally configurable).
  - Deactivate the emergency stop circuit.
- The power source is overheating.
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check the fan and clean or replace.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.
- Short circuit on welding torch.
  - Check the welding torch.
  - Request service.

Error 17: Cold wire error

Category B

- Fault in the wire feeder.
  - Check the electrical connections (connectors, lines).
- Permanent overload of the wire drive.
  - Do not lay the liner in tight radii.
  - Check the liner for ease of movement.

Error 18: Plasma gas error

Category B

- No gas.
  - Check the gas supply.
- The pre-pressure is too low.
  - Remove kinks in the hose package (nominal value: 4-6 bar pre-pressure).

Error 19: Shielding gas error

Category B

- No gas.
  - Check the gas supply.
- The pre-pressure is too low.
  - Remove kinks in the hose package (nominal value: 4-6 bar pre-pressure).

Error 20: Low coolant level

Category B

- Low flow rate.
  - Fill with coolant.
  - Check coolant flow - remove kinks in the hose package.
  - Adjust the flow threshold [2].
  - Clean the cooler.
- Pump does not turn.
  - Turn the pump shaft.
- Air in the coolant circuit.
  - Vent the coolant circuit.
- The hose package is not filled with coolant.
  - Switch the machine off and on > pump running > filling process.
- Operation with a gas-cooled welding torch.
  - Deactivate the torch cooling.
  - Connect the coolant feed and return with a hose bridge.

Error 22: Excess coolant temperature

Category B

- Coolant is overheating [2].
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check, clean or replace the fan.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.

Error 23: Excess temperature

Category A

- External component (e.g. HF ignition units) overheated.
- The power source is overheating.
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check the fan and clean or replace.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.

Error 24: Pilot arc ignition error

Category B

- The pilot arc cannot ignite.
  - Check the welding torch equipment.

Fault 25: Forming gas error

Category B

- No gas.
  - Check the gas supply.
- The pre-pressure is too low.
  - Remove kinks in the hose package (nominal value: 4-6 bar pre-pressure).

Error 26: Excess pilot arc module temperature

Category A

- The power source is overheating.
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check the fan and clean or replace.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.

Error 32: Error I>0

- Current recording is faulty.
  - Request service.

Error 33: Error UIST

- Voltage recording is faulty.
  - Eliminate the short circuit in the welding circuit.
  - Remove the external sensor voltage.
  - Request service.

Error 34: Electronics error

- A/D channel error
  - Switch the machine off and on.
  - Request service.

Error 35: Electronics error

- Slope error
  - Switch the machine off and on.
  - Request service.

Error 36: S error

- S conditions violated.
  - Switch the machine off and on.
  - Request service.

Error 37: Excess temperature / electronics error

- The power source is overheating.
  - Allow the switched-on machine to cool.
- Fan is blocked, dirty or faulty.
  - Check the fan and clean or replace.
- Air inlet or outlet is blocked.
  - Check the air inlet and outlet.

Error 38: Error IIST

- Short circuit in the welding circuit before welding.
  - Eliminate the short circuit in the welding circuit.
  - Request service.

Error 39: Electronics error

- Secondary overvoltage
  - Switch the machine off and on.
  - Request service.

Error 40: Electronics error

- Error I>0
  - Request service.

Error 47: Radio link (BT)

Category B

- Connection error between welding machine and peripheral unit.
  - Note the documentation for the data interface with radio transmission.

Error 48: Ignition error

Category B

- No ignition at process start (automated machines).
  - Check the wire feeding
  - Check the load cable connections in the welding circuit.
  - Clean corroded surfaces on the workpiece before welding if necessary.

Error 49: Arc interruption

Category B

- An arc interruption occurred during welding with an automated system.
  - Check the wire feeding.
  - Adjust the welding speed.

Error 50: Program number

Category B

- Internal error.
  - Request service.

Error 51: Emergency stop

Category A

- The external emergency stop circuit has been interrupted.
  - Check the emergency stop circuit and eliminate the cause of the error.
- The emergency stop circuit of the power source has been activated (internally configurable).
  - Deactivate the emergency stop circuit.

Error 52: No wire feeder

- After switching on the automated system, no wire feeder (DV) was detected.
  - Check or connect the control cables of the wire feeders.
  - Check the identification number of the automated wire feeder (for 1DV: number 1, for 2DV: each a wire feeder with number 1 and a wire feeder with number 2).

Error 53: No wire feeder 2

Category B

- Wire feeder 2 was not detected.
  - Check the control cable connections.

Error 54: VRD error

- Error in the open-circuit voltage reduction.
  - If necessary, disconnect the external machine from the welding circuit.
  - Request service.

Error 55: Excess wire feeder current

Category B

- Excess current detected in the wire feed mechanism.
  - Do not lay the liner in tight radii.
  - Check the liner for ease of movement.

Error 56: Mains phase failure

- One phase of the mains voltage has failed.
  - Check the mains connection, mains plug and mains fuses.

Error 57: Slave tacho error

Category B

- Fault in the wire feeder (slave drive).
  - Check the connections (connectors, lines).
- Permanent overload of the wire drive (slave drive).
  - Do not lay the liner in tight radii.
  - Check the liner for ease of movement.

Error 58: Short circuit

Category B

- Short circuit in the welding circuit.
  - Eliminate the short circuit in the welding circuit.
  - Place the welding torch on an insulated surface.

Error 59: Incompatible machine

- A machine connected to the system is not compatible.
  - Disconnect the incompatible machine from the system.

Error 60: Incompatible software

- The software of a machine is not compatible.
  - Disconnect the incompatible machine from the system
  - Request service.

Error 61: Welding monitoring

- The actual value of a welding parameter is outside the specified tolerance range.
  - Maintain the tolerance ranges.
  - Adjust the welding parameters.

Error 62: System component

- The system component was not found.
  - Request service.

Error 63: Mains voltage error

- Operating and mains voltage are incompatible.
  - Check or adjust the operating and mains voltage.

[1] only Picotig 220 pulse

[2] See technical data for values and other switching thresholds.

7.3 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*.

7.4 Software version of the machine control

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*.

8 Appendix

8.1 Parameter overview – setting ranges

8.1.1 TIG welding

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Gas pre-flow time	GPr	0,5	s	0	-	20
Electrode diameter (metric)	ndA	2,4	mm	1,0	-	4,8
Electrode diameter (imperial)	ndA	93	mil	40	-	187
Ignition optimisation	cor	100	%	25	-	175
Start current (per cent of I 1)	I St	50	%	1	-	200
Start current (absolute, power source dependent)	I St	-	A	-	-	-
Start time	tSt	0,01	s	0,01	-	20,0
Slope time (time from I St to I 1)	tUP	0,00	s	0,00	-	20,0
Main current (power source dependent)	I 1	-	A	-	-	-
Slope time (time from I 1 to I 2)	tS1	0,00	s	0,00	-	20,0
Slope time (time from I 2 to I 1)	tS2	0,00	s	0,00	-	20,0
Secondary current (per cent of I 1)	I 2	50	%	1		200
Secondary current (absolute, power source dependent)	I 2	-	A	-		-
Slope time (time from I 1 to I Ed)	tdn	0,00	s	0,00	-	20,0
End current (per cent of I 1)	I Ed	20	%	1	-	200
End current (absolute, power source dependent)	I Ed	-	A	-	-	-
End current time	tEd	0,01	s	0,01	-	20,0
Gas post-flow time	GPt	8	s	0,0	-	40,0
activArc (main current dependent)	AAP			0	-	100
Welding tasks (JOB)	Job	1		1	-	100
spotArc time	t P	2	s	0,01	-	20,0
spotmatic time (StS > on)	t P	200	ms	5	-	999
spotmatic time (StS > oFF)	t P	2	s	0,01	-	20,0
JOB presets	cPJ	-		1		100

8.1.1.1 Pulse parameters

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Pulse current (average value pulsing)	I PL	140	%	1		200
Pulse time (thermal pulsing)	t 1	0,01	s	0,00	-	20,0
Pulse pause time (thermal pulsing)	t 2	0,01	s	0,00	-	20,0
Pulse balance (average value pulsing, AC and DC)	bAL	50,0	%	0,1	-	99,9
Pulse frequency (average value pulsing, DC)	FrE	2,00	Hz	0,10	-	20000
Pulse frequency (average value pulsing, AC)	FrE	2,00	Hz	0,10	-	5,00

8.1.1.2 AC parameters

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Balance	bAL	65	%	40	-	90
Frequency	FrE	50	Hz	30	-	300
AC commutation optimisation	I co	auto		1	-	100
Amplitude balance	AbA	100	%	70	-	160

8.1.2 MMA welding

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Hot start current (per cent of I 1)	I ht	120	%	1	-	200
Hot start current (absolute, power source dependent)	I ht	-	A	-	-	-
Hot start time	t ht	0,5	s	0,0	-	10,0
Main current (power source dependent)	I 1	-	A	-	-	-
Arcforce	Arc	0		-40	-	40
JOB presets	cPJ	-		101	-	108
JOB presets (CEL)	cPJ	-		109	-	116

8.1.2.1 Pulse parameters

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Pulse current (average value pulsing)	I PL	142		1	-	200
Pulse balance (average value pulsing, AC and DC)	bAL	30	%	0,1	-	99,9
Pulse frequency (average value pulsing, DC)	FrE	1,2	Hz	0,1	-	500
Pulse frequency (average value pulsing, AC)	FrE	1,2	Hz	0,1	-	5

8.1.2.2 AC parameters

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Frequency	FrE	100	Hz	30	-	300
Balance	bAL	60	%	40	-	90

8.1.2.3 Global parameters

Name	Display			Setting range		
	Code	Standard	Unit	min.		max.
Standby	SbA	20	min	5	-	60
Re-ignite after arc interruption	I tA	Job	s	0,1	-	5
Torch mode	tod	1	-	1	-	6
Up/down speed	uUd	10	-	1	-	100
Current jump	dI	1	A	1	-	20
Retrieval of JOB number	nrJ	100	-	1	-	100
Start JOB	StJ	1	-	1		100
Minimum current - foot-operated remote control (AC)	I Fr	10	A	3	-	50
Torch cooling, follow-up time	ct	7	-	1	-	60
Welding torch cooling, temperature error limit	tt	70	C	50	-	80
Welding torch cooling, temperature error limit (imperial)	tt	158	F	122	-	176
Welding torch cooling, flow error limit	FLo	0,6	l	0,5	-	2,0
Welding torch cooling, flow error limit (imperial)	FLo	0.16	gal	0.13	-	0.53
Dynamic power adjustment	FUS	16	-	10	-	32
Welding helmet adjustment (TIG)	oPt	0	-	0	-	2

8.2 Searching for a dealer

Sales & service partners
www.ewm-group.com/en/specialist-dealers

"More than 400 EWM sales partners worldwide"