



Control

T 4.00 - Comfort 2.0

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General instructions

CAUTION



Read the operating instructions!

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

- Read the operating instructions for all system components!
- Observe accident prevention regulations!
- Observe all local regulations!
- Confirm with a signature where appropriate.



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1 Contents

| | | |
|----------|---|-----------|
| 1 | Contents | 3 |
| 1.1 | Notes on the use of these operating instructions | 5 |
| 1.2 | Complete documentation | 5 |
| 1.3 | Explanation of icons | 6 |
| 2 | Machine control – Operating elements | 7 |
| 2.1 | Overview of control sections | 7 |
| 2.1.1 | Control section A | 8 |
| 2.1.2 | Control section B | 10 |
| 2.1.3 | Control section C | 11 |
| 2.2 | Machine display | 12 |
| 2.2.1 | Welding current representation (in per cent/absolute) | 12 |
| 2.3 | Operating the machine control | 13 |
| 2.3.1 | Main screen | 13 |
| 2.3.2 | Welding power setting | 13 |
| 2.3.3 | Welding parameter setting in the operation sequence | 13 |
| 2.3.4 | Setting advanced welding parameters (Expert menu) | 13 |
| 2.3.5 | Changing basic settings (machine configuration menu) | 13 |
| 3 | Welding procedure | 14 |
| 3.1 | TIG welding | 14 |
| 3.1.1 | Welding task selection | 14 |
| 3.1.1.1 | Recurring welding tasks (JOB 1–7) | 15 |
| 3.1.2 | Tungsten balling function | 16 |
| 3.1.3 | Function sequences/operating modes | 17 |
| 3.1.3.1 | Explanation of symbols | 17 |
| 3.1.3.2 | Non-latched mode | 18 |
| 3.1.3.3 | Latched mode | 19 |
| 3.1.3.4 | spotArc | 20 |
| 3.1.3.5 | spotmatic | 22 |
| 3.1.3.6 | Non-latched operation, version C | 24 |
| 3.1.4 | TIG activArc welding | 25 |
| 3.1.5 | TIG antistick | 25 |
| 3.1.6 | Pulse welding | 26 |
| 3.1.6.1 | Thermal pulsing | 26 |
| 3.1.6.2 | Metallurgical pulsing (kHz pulsing) | 28 |
| 3.1.6.3 | Average value metallurgical pulsing | 30 |
| 3.1.6.4 | Automated pulses | 31 |
| 3.1.6.5 | AC special | 31 |
| 3.1.7 | Welding torch (operating variants) | 32 |
| 3.1.7.1 | Tap torch trigger (tapping function) | 32 |
| 3.1.8 | Torch mode and up/down speed setting | 32 |
| 3.1.8.1 | Standard TIG torch (5-pole) | 33 |
| 3.1.8.2 | TIG up/down torch (8-pole) | 35 |
| 3.1.8.3 | Potentiometer torch (8-pole) | 37 |
| 3.1.8.4 | Configuring the TIG potentiometer torch connection | 38 |
| 3.1.8.5 | RETOX TIG torch (12-pole) | 39 |
| 3.1.8.6 | Setting the first increment | 40 |
| 3.1.9 | Alternating current waveforms | 41 |
| 3.1.9.1 | Ramp function foot-operated remote control RTF 1 | 42 |
| 3.1.10 | Automatic AC frequency | 43 |
| 3.1.11 | AC commutation optimisation | 43 |
| 3.1.12 | Simultaneous welding on both sides, synchronisation types | 44 |
| 3.1.12.1 | Synchronisation via mains voltage (50Hz / 60Hz) | 44 |
| 3.1.13 | Expert menu (TIG) | 44 |
| 3.1.14 | Aligning the cable resistance | 47 |
| 3.2 | MMA welding | 49 |
| 3.2.1 | Welding task selection | 49 |
| 3.2.2 | Hotstart | 50 |

| | | |
|----------|---|-----------|
| 3.2.2.1 | Hotstart current..... | 50 |
| 3.2.2.2 | Hotstart time | 50 |
| 3.2.3 | Arcforce..... | 51 |
| 3.2.4 | Antistick..... | 51 |
| 3.2.5 | Welding current polarity reversal (polarity reversal) | 51 |
| 3.2.6 | Pulse welding..... | 52 |
| 3.2.7 | Average value pulse welding | 53 |
| 3.3 | Filler wire welding..... | 54 |
| 3.3.1 | Configuring the welding machine for mechanical arc fusion welding | 54 |
| 3.3.1.1 | Selecting a welding task by means of the JOB list | 54 |
| 3.3.1.2 | Select wire speed operating mode (KORREKTUR / MANUELL)..... | 54 |
| 3.3.1.3 | Setting the welding current and wire speed | 54 |
| 3.3.2 | Function sequences/operating modes..... | 55 |
| 3.3.2.1 | Explanation of symbols | 55 |
| 3.3.2.2 | Non-latched mode | 56 |
| 3.3.2.3 | 3-cycle operation | 57 |
| 3.3.2.4 | Latched mode..... | 57 |
| 3.4 | Power-saving mode (Standby)..... | 58 |
| 3.5 | Access control | 58 |
| 3.6 | Voltage reducing device..... | 58 |
| 3.7 | Machine configuration menu | 58 |
| 3.7.1 | Selecting, changing and saving parameters..... | 58 |
| 4 | Rectifying faults..... | 64 |
| 4.1 | Warnings (power source)..... | 64 |
| 4.2 | Error messages (power source)..... | 65 |
| 4.3 | Resetting welding parameters to the factory settings | 67 |
| 4.4 | Display machine control software version..... | 67 |
| 5 | Appendix A..... | 68 |
| 5.1 | Parameter overview – setting information..... | 68 |
| 5.1.1 | TIG welding..... | 68 |
| 5.1.2 | MMA welding | 69 |
| 6 | Appendix B..... | 70 |
| 6.1 | Overview of EWM branches..... | 70 |

1.1 Notes on the use of these operating instructions

1.2 Complete documentation



WARNING



Validity of the document!

This document is part of the complete documentation and valid only in combination with the "Power source" operating instructions for the product being used!

- Read and observe the operating instructions for all system components, especially the safety instructions!

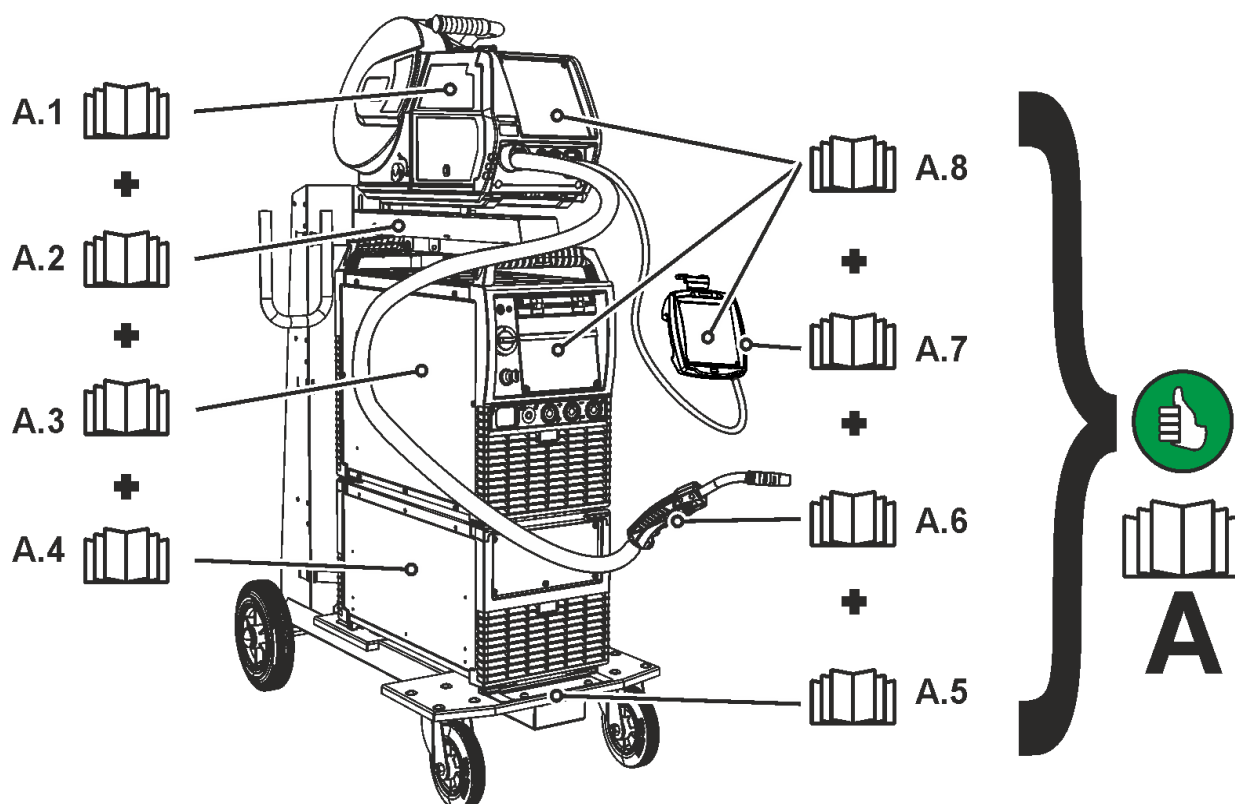



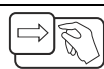













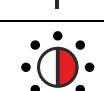





Figure 1-1

The illustration shows a general example of a welding system.

| Item | Documentation |
|------|--|
| A.1 | Wire feeder |
| A.2 | Conversion instructions |
| A.3 | Power source |
| A.4 | Cooling unit, voltage converter, tool box etc. |
| A.5 | Trolley |
| A.6 | Welding torch |
| A.7 | Remote control |
| A.8 | Control |
| A | Complete documentation |

1.3 Explanation of icons

| Symbol | Description | Symbol | Description |
|---|---|--|---------------------------------|
|  | Indicates technical aspects which the user must observe. |  | Activate and release/tap/tip |
|  | Switch off machine |  | Release/do not activate |
|  | Switch on machine |  | Press and hold/switch |
|  | Wrong |  | Turn |
|  | Correct |  | Numerical value – adjustable |
|  | Menu entry |  | Signal light lights up in green |
|  | Navigating the menu |  | Signal light flashes green |
|  | Exit menu |  | Signal light lights up in red |
|  | Time representation (e.g.: wait 4 s/activate) |  | Signal light flashes red |
|  | Interruption in the menu display (other setting options possible) | | |
|  | Tool not required/do not use | | |
|  | Tool required/use | | |

2 Machine control – Operating elements

2.1 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.

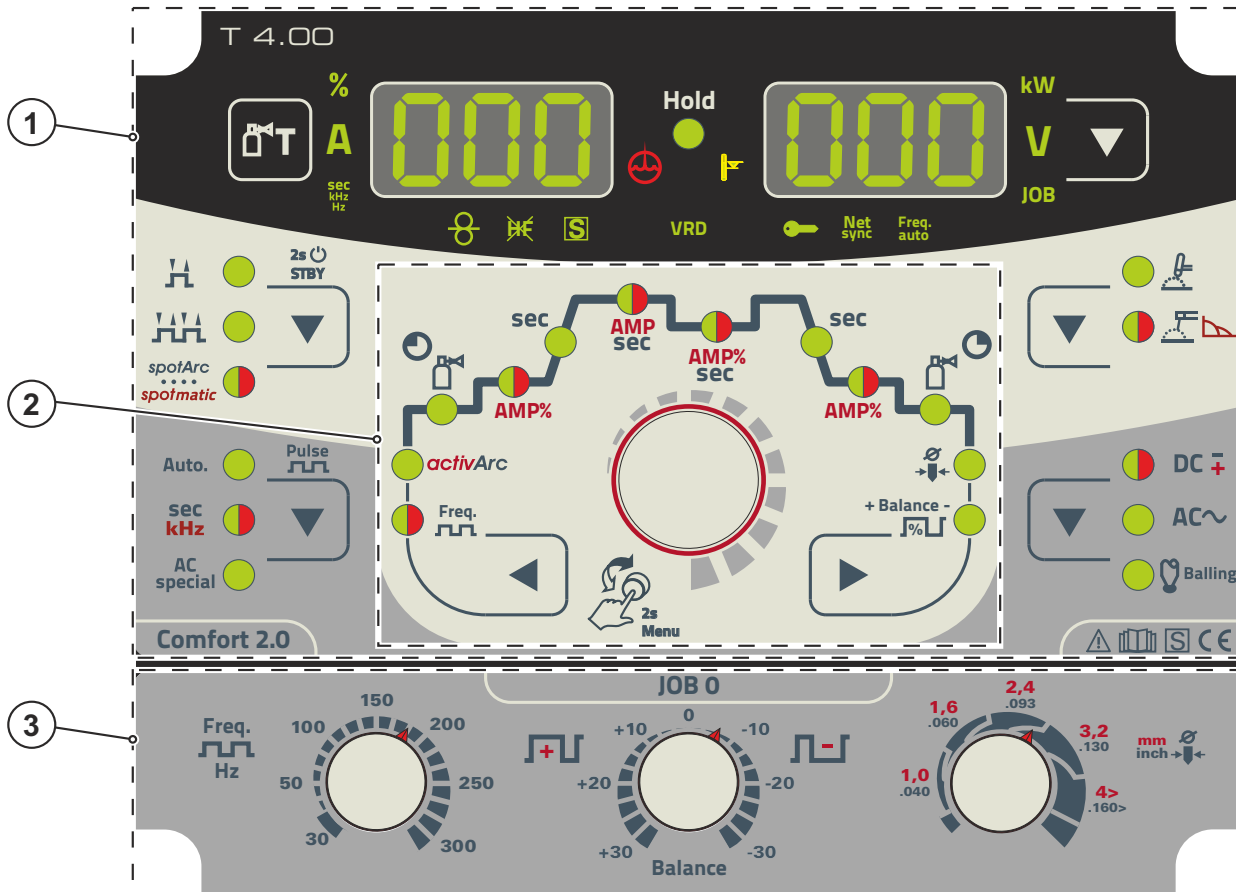


Figure 2-1

| Item | Symbol | Description |
|------|--------|-------------------|
| 1 | | Control section A |
| 2 | | Control section B |
| 3 | | Control section C |

2.1.1 Control section A

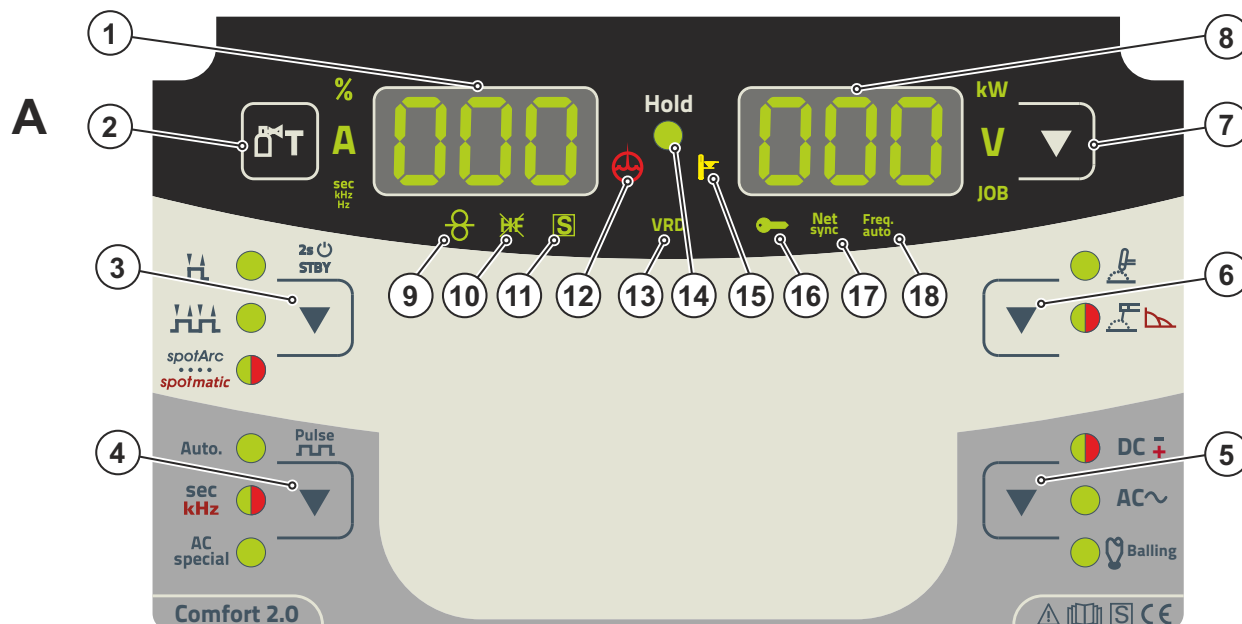
















Figure 2-2

| Item | Symbol | Description |
|------|--------|--|
| 1 | | Welding data display (3-digit) Displays the welding parameters and the corresponding values > see 2.2 chapter |
| 2 | | Gas test/purge push-button <ul style="list-style-type: none"> ----- Setting the shielding gas quantity (gas test): Shielding gas will flow for approximately 25 seconds after pressing the push-button once. Press the button again to cancel the process early. ----- Purging for long hose packages (purging): Press push-button for about 5 sec: Shielding gas flows continuously until the gas test push-button is pressed again. |
| 3 | | Operating mode/power-saving mode push-button <ul style="list-style-type: none"> ----- Latched ----- Non-latched ----- spotArc spot welding procedure – signal light turns green ----- spotmatic spot welding procedure –signal light turns red ----- Press button for long interval to put machine into power-saving mode. Activate one of the operating elements to reactivate. |
| 4 | | Pulsing push-button <ul style="list-style-type: none"> ----- Automated pulsing (frequency and balance) ----- Signal light turns green: Thermal pulsed TIG welding/MMA pulse welding ----- Signal light turns red: Metallurgical pulsed TIG welding (kHz pulsing) ----- Special TIG AC |
| 5 | | Welding current polarity/tungsten balling push-button <ul style="list-style-type: none"> ----- Signal light turns green: DC welding with negative polarity on the electrode holder or welding torch. ----- Signal light turns red: MMA DC welding with positive polarity on the electrode holder. ----- Alternating current welding/alternating current forms ----- Tungsten balling current |

| Item | Symbol | Description |
|------|---|--|
| 6 |  | Welding procedure push-button  ----- TIG welding  ----- MMA welding (signal light turns green)  ----- Arcforce setting (signal light turns red) |
| 7 |  | Display switching push-button kW ----- Welding power display V ----- Welding voltage display JOB ----- Display and setting of the JOB number with the control button |
| 8 |  | Welding data display (3-digit) Displays the welding parameters and the corresponding values > see 2.2 chapter |
| 9 |  | Filler wire welding signal light For machines with filler wire only (AW) |
| 10 |  | 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). |
| 11 |  | 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. |
| 12 |  | Coolant fault signal light Comes on when pressure is lost in the coolant circuit. Check coolant level and ensure that coolant circuit is leak-tight. |
| 13 | VRD | Voltage reduction device (VRD) signal light The VRD signal light is illuminated when the voltage reduction device is operating without fault and the output voltage is reduced to a value specified in the relevant standard (see technical data). The voltage reduction device is only active on VRD machine versions. |
| 14 | Hold | Signal light Status display After each completed welding task, the last values used in the welding process for the welding current and welding voltage are shown on the displays, and the signal light will be on |
| 15 |  | 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. |
| 16 |  | Access control active signal light Signal light is on when access control is active on the machine control. |
| 17 |  | Simultaneous AC welding on both sides, signal light This signal light indicates that the function is active. |
| 18 |  | Automatic AC frequency |

2.1.2 Control section B

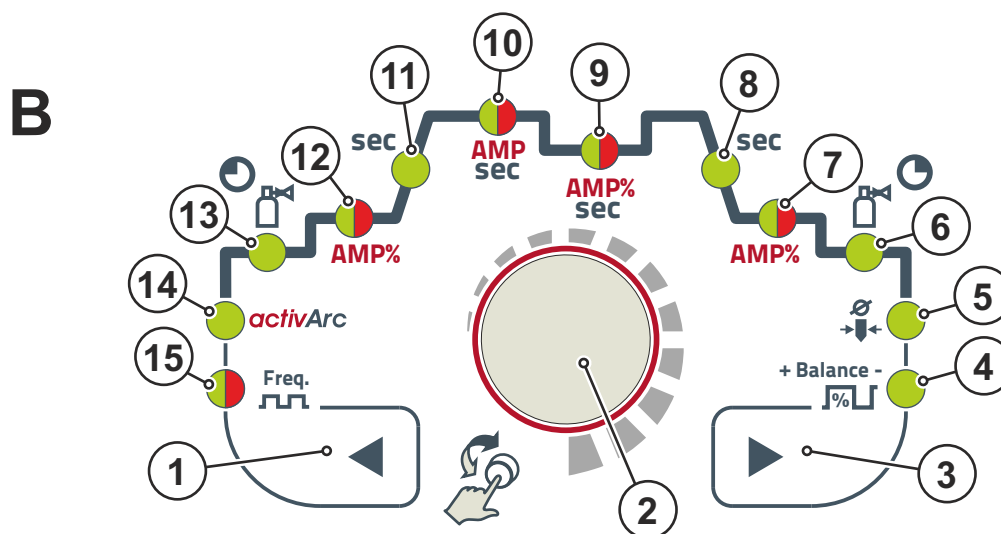


Figure 2-3

| Item | Symbol | Description |
|------|---------------------|---|
| 1 | | Parameter selection push-button, left The welding sequence parameters are selected one after another in a clockwise direction. |
| 2 | | Control button Central control button to be pressed or turned > see 2.3 chapter. |
| 3 | | Parameter selection push-button, right The welding sequence parameters are selected one after another in an anti-clockwise direction. |
| 4 | | Balance signal light AC balance (JOB 1–7), pulse balance or amplitude balance |
| 5 | | Electrode diameter signal light Ignition optimisation (TIG)/tungsten balling basic setting |
| 6 | | Gas post-flow time |
| 7 | AMP% | Signal light, two colour Red: End current Green: End current time (Expert menu) |
| 8 | sec | Down-slope time signal light |
| 9 | AMP% sec | Signal light, two colour Red: Secondary or pulse pause current (% of AMP) Green: Pulse pause time /slope time (Expert menu) |
| 10 | AMP sec | Signal light, two colour Red: Main or pulse current Green: Pulse time /slope time (AMP to AMP%) |
| 11 | sec | Signal light Up-slope time (TIG)/hot start time (MMA) |
| 12 | AMP% | Signal light Ignition current (TIG)/hot start current (MMA) |
| 13 | | Gas pre-flow time signal light |

| Item | Symbol | Description |
|------|-----------------|--|
| 14 | activArc | activArc TIG welding process <ul style="list-style-type: none"> Switch activArc on <> off Correct the activArc characteristic (setting range: 0 to 100) |
| 15 | Freq. | Signal light, two colour FRE Green: AC frequency (TIG)/pulse frequency (MMA) Red: Pulse frequency (TIG, kHz pulsing) |

2.1.3 Control section C

C

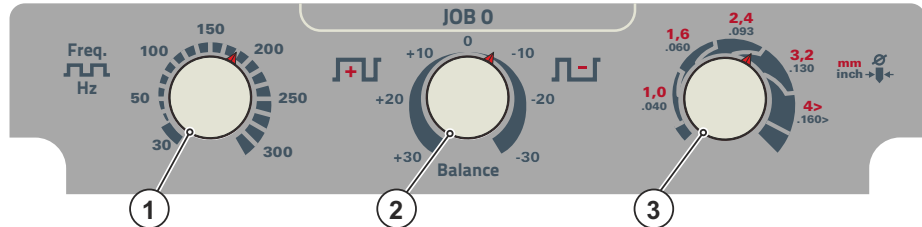


Figure 2-4

| Item | Symbol | Description |
|------|----------------|--|
| 1 | Freq. | AC frequency rotary knob (JOB 0) |
| 2 | Balance | AC balance rotary knob (JOB 0) |
| 3 | Ø | Tungsten electrode diameter rotary knob (JOB 0) |

2.2 Machine display

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

| "left display" | | | |
|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Parameter | Before welding (nominal values) | During welding (actual values) | After welding (hold values) |
| Welding current | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Parameter times | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Parameter currents | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Frequency, balance | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| "right display" | | | |
| Welding power | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Welding voltage | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| JOB number | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

When the hold values are displayed after welding and the settings are then changed (e.g. welding current), the display will switch to the relevant nominal values.

☒ possible

☐ not possible

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

2.2.1 Welding current representation (in per cent/absolute)

The welding current for the start, secondary, end and hot start current can be set as a percentage of the main current AMP or as an absolute value. To select the display use the parameter `5EE<dg` in the configuration menu_ref_source_inline>Gerätekonfigurationsmenü</dg_ref_source_inline>.

> see 3.7 chapter

2.3 Operating the machine control

2.3.1 Main screen

The machine control switches to the main screen after it has been turned on or a setting has been completed. This means that the previously selected settings (indicated by signal lights where applicable) and the nominal value for the current (A) are displayed in the left-hand welding data display. The right-hand display shows the nominal value for the preselected welding voltage (V). The control always switches back to the main screen after 4 sec. of inactivity.

2.3.2 Welding power setting

The welding power is set using the control button. You can also adjust the parameters in the operation sequence or settings in the different machine menus.

2.3.3 Welding parameter setting in the operation sequence

A welding parameter can be set in two ways in the operation sequence.

1. Push the "left" or "right" arrow keys (flashing signal light will indicate your selection). Turn the control button to set the parameter value.
2. Press briefly on the control button (operation sequence selection) and then turn the button (navigate to the required parameter). Press again to apply the selected parameter as the setting (corresponding signal light flashes). Turn the button to set the parameter value.

The welding parameter setting is shown on the left-hand display while it is being set. A parameter abbreviation or a deviation in the specified parameter value upwards or downwards is shown on the right-hand display:

| Display | Meaning |
|---------|--|
| | Increase the parameter value To return to the factory settings. |
| | Factory setting (example value = 20) Parameter is set to optimum value |
| | Decrease the parameter value To return to the factory settings. |

2.3.4 Setting advanced welding parameters (Expert menu)

The Expert menu contains functions and parameters which cannot be set directly in the machine control or which do not need to be set on a regular basis. The number and display of these parameters depends on the previously selected welding procedure or the functions.

To select them hold the control button for more than 2 sec. Select the required parameter/menu item by turning (navigate) and pressing (confirm) the control button.

You can also or alternatively use the push-buttons to the left and right of the control button to navigate.

2.3.5 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 3.7 chapter

3 Welding procedure

3.1 TIG welding

3.1.1 Welding task selection

The tungsten electrode diameter setting has a direct effect on the machine functions. The set value should correspond to the tungsten electrode diameter. Obviously, the value can also be adjusted to different needs.

The following welding task is an example of use:

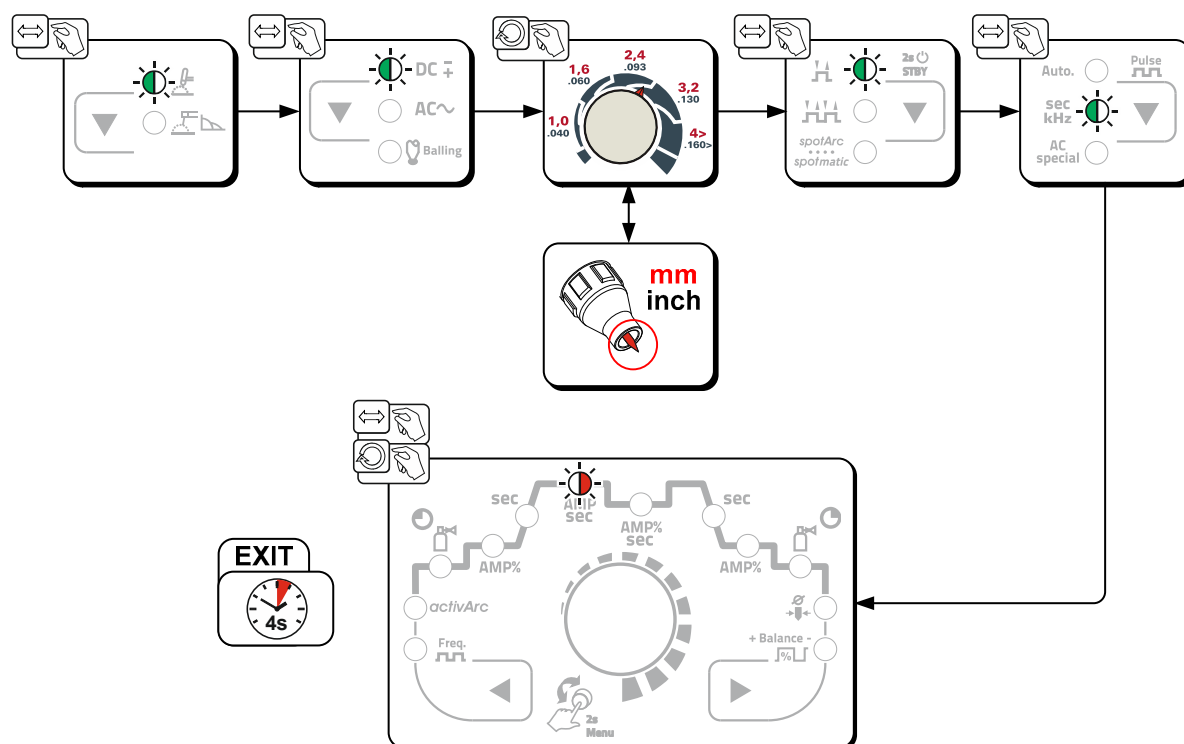


Figure 3-1

3.1.1.1 Recurring welding tasks (JOB 1–7)

The user has 7 more 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 1–7) and the welding task is set as described previously.

The three rotary knobs for AC frequency, AC balance and the tungsten electrode diameter are exceptions. These settings are made in the operation sequence (signal lights with same name).

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

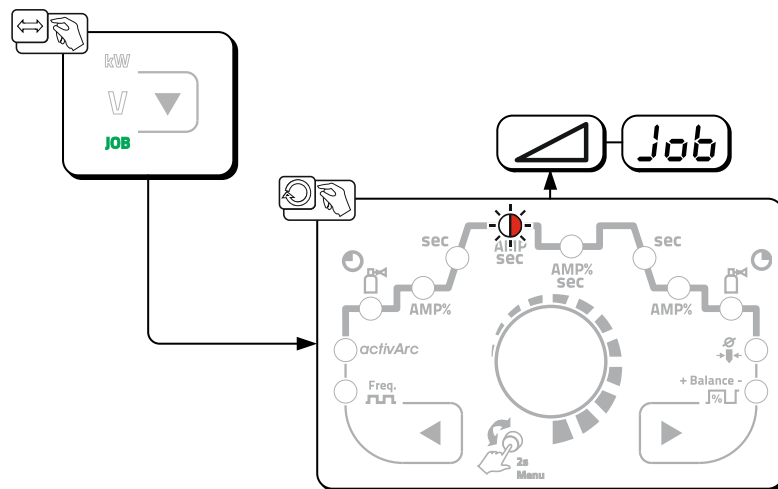



Figure 3-2

When one or more of the recurring welding tasks (JOB 1–7) has been selected the JOB signal light comes on.

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

Press the tungsten balling push-button to activate the function. If required, this current can be adjusted on an individual basis using the  parameter (+/- 30 A). The user presses the torch trigger and the function is started by non-contact ignition (HF start). The balling end is formed and the function then ends. Tungsten balling should be performed on a test component as surplus tungsten may be melted and this may lead to impurities on the weld seam.

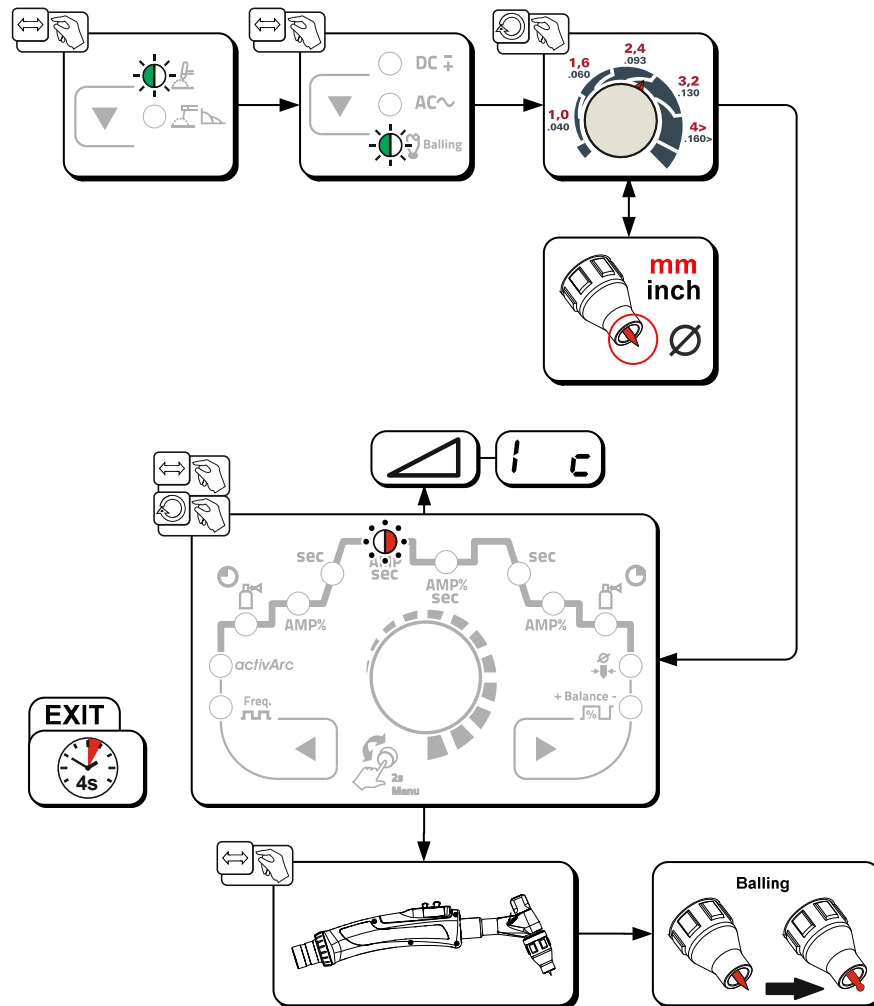



















Figure 3-3

3.1.3 Function sequences/operating modes

3.1.3.1 Explanation of symbols

| Symbol | Meaning |
|--|---|
|  | Press torch trigger 1 |
|  | Release torch trigger 1 |
| I | Current |
| t | Time |
|   | Gas pre-flow |
|  | Ignition current |
|  | Up-slope time |
|  | Spot time |
| AMP | Main current (minimum to maximum current) |
| AMP% | Secondary current (0% to 100% of AMP) |
|  | Pulse time |
|  | Pulse pause time |
|  | Pulsed TIG welding: Slope time from main current (AMP) to secondary current (AMP%) |
|  | Pulsed TIG welding: Slope time from secondary current (AMP%) to main current (AMP%) |
|  | Down-slope time |
|  | End-crater current |
|   | Gas post-flow |
|  | Balance |
|  | Frequency |

3.1.3.2 Non-latched mode

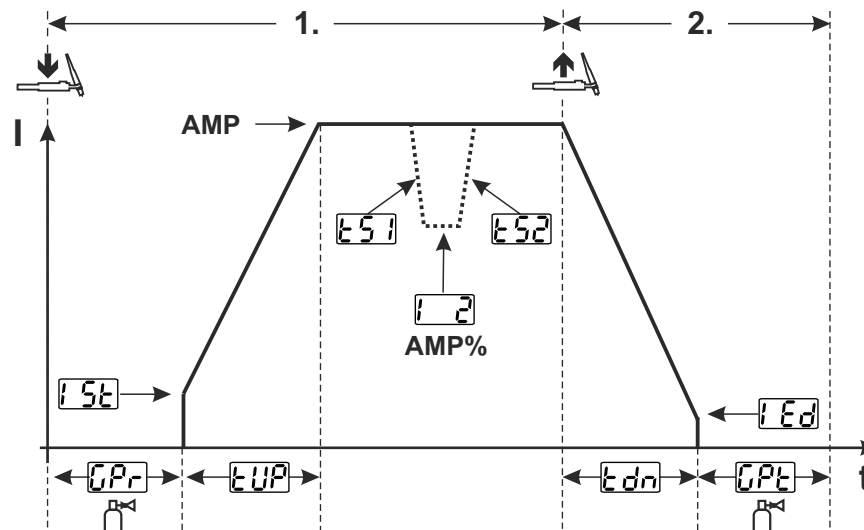


Figure 3-4

1st cycle:

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

If torch trigger 2 is pressed together with torch trigger 1 during the main current phase, the welding current decreases to the secondary current $I2$ (AMP%) in the set slope time $tS1$.

If torch trigger 2 is released, the welding current increases again to the main current AMP in the set slope time $tS2$. The parameters $tS1$ and $tS2$ can be set in the Expert menu (TIG).

2nd cycle:

- Release torch trigger 1.
- The main current falls to the end-crater current IEd (minimum current) in the set down-slope time tDn .

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

- Main current reaches the end-crater current IEd ; the arc is extinguished.
- Set gas post-flow time GPe elapses.

 **When the foot-operated remote control RTF is connected, the machine switches automatically to non-latched operation.**

The up- and down-slopes are switched off.

3.1.3.3 Latched mode

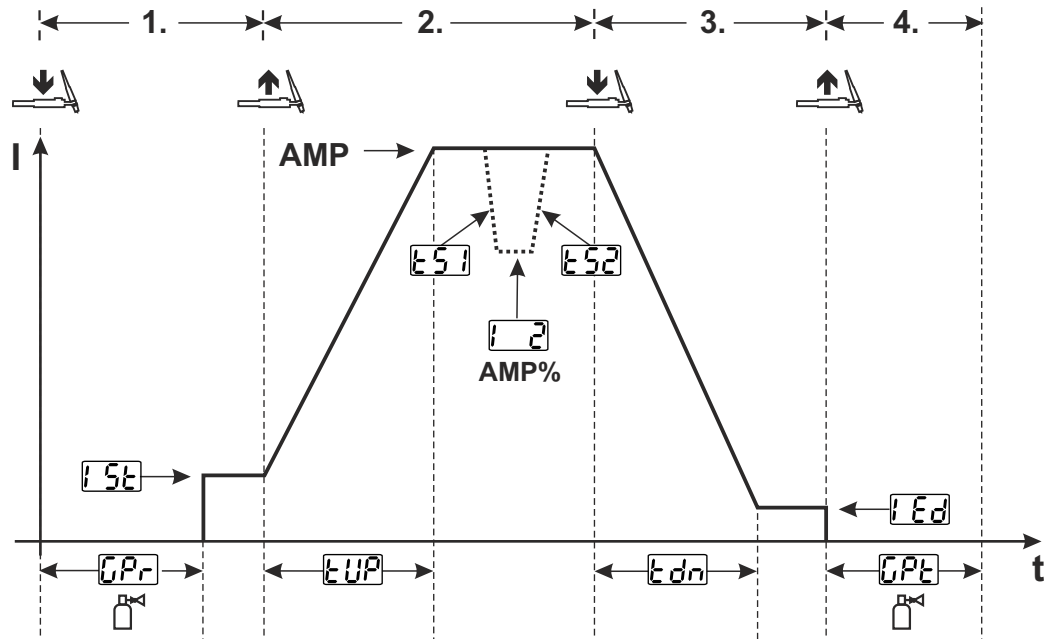


Figure 3-5

1st cycle

- Press torch trigger 1; gas pre-flow time t_{Pr} elapses.
- HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- Welding current flows and immediately assumes the set ignition current I_{SE} (search arc at minimum setting). HF switches off.

2nd cycle

- Release torch trigger 1.
- The welding current ramps up to the main current I_{AMP} (AMP) in the selected up-slope time t_{UP} .

Switching from the main current AMP to secondary current $I_{AMP\%}$ (AMP%):

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

The slope times t_{S1} and t_{S2} can be set.

3rd cycle

- Press torch trigger 1.
- The main current decreases to the end-crater current I_{Ed} within the set down-slope time t_{Dn} .

4th cycle

- Release torch trigger 1; arc is extinguished.
- Set gas post-flow time t_{Pe} runs.

Ending the welding process immediately without a down-slope or end-crater current:

- Press the 1st torch trigger briefly > 3rd and 4th cycles (torch modes 11–16).
Current drops to zero and the gas post-flow time begins.



When the foot-operated remote control RTF is connected, the machine switches automatically to non-latched operation.

The up- and down-slopes are switched off.



A double-digit torch mode (11-x) needs to be set at the welding machine control to use the alternative welding start (tapping start). The number of torch modes available depends on the machine type.

From mode 11 upwards, the tapping start function can also be deactivated when required (welding stop by tapping remains active). To do so, the t_{S1} parameter must be switched to OFF in the machine configuration menu.

3.1.3.4 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.

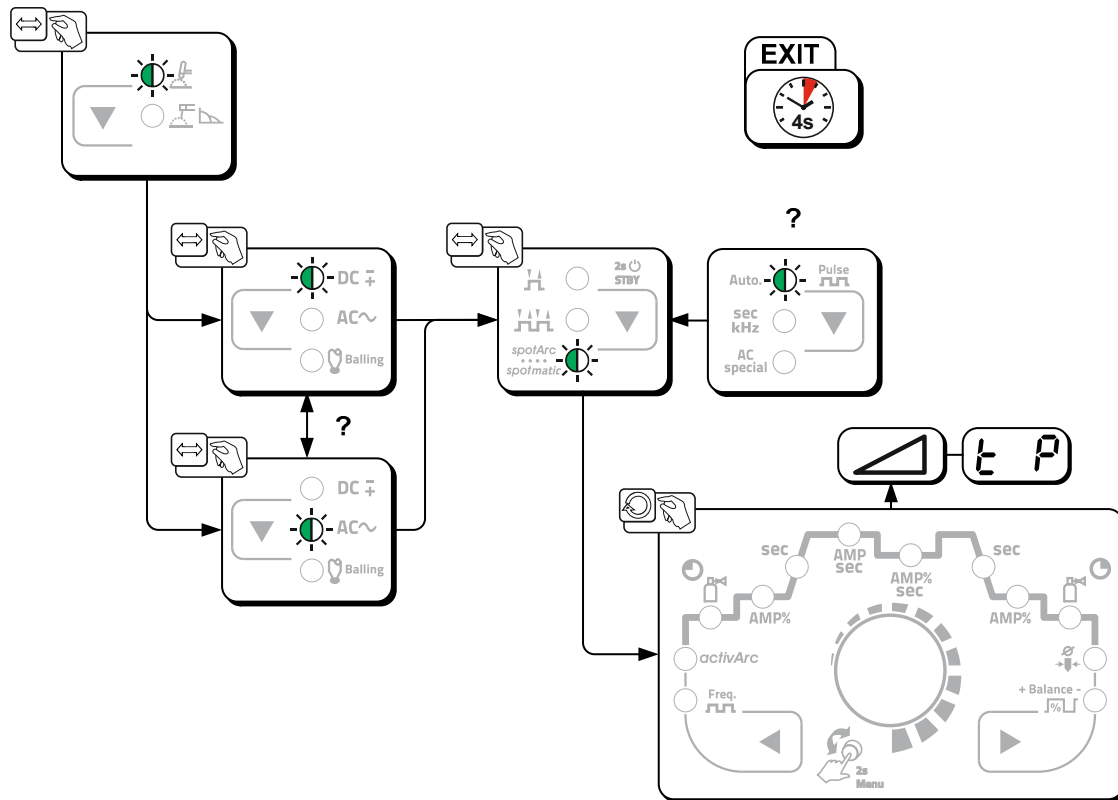


Figure 3-6

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

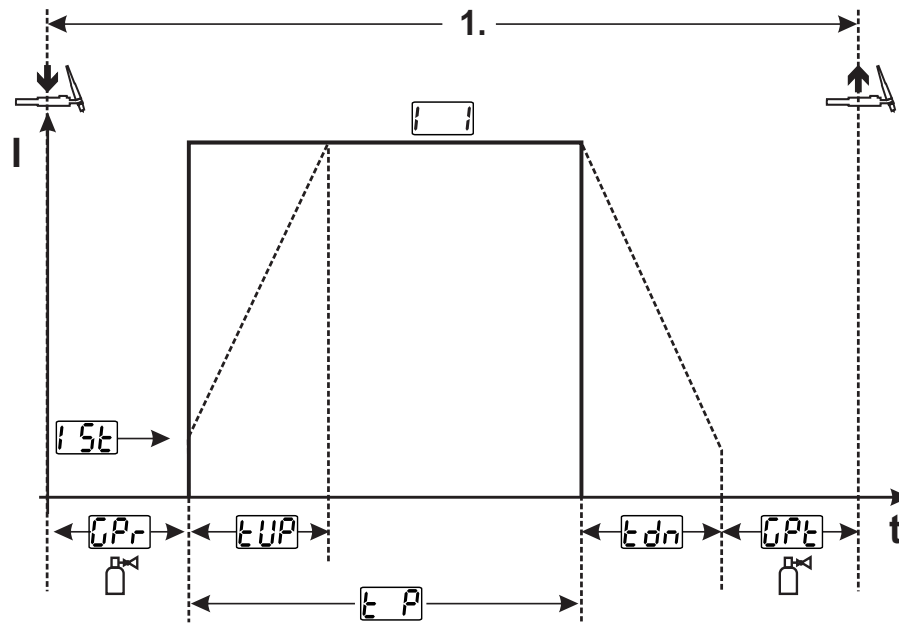


Figure 3-7

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however.

Sequence:

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



The process ends when the set spotArc time elapses or if the torch trigger is released prematurely.

spotArc/pulse variants table:

| Process | Pulse variants | |
|---------|------------------------------|------------------------------------|
| TIG DC | Automatic | Automated pulses (factory setting) |
| | sec kHz (lights up in green) | Pulses (thermal pulses) |
| | sec kHz (lights up in red) | kHz pulse (metallurgic pulses) |
| | No pulses | |
| TIG AC | sec kHz (lights up in green) | Pulses (thermal pulses) |
| | AC special | AC special |
| | No pulses | |

3.1.3.5 spotmatic

In contrast to spotArc operating mode, the arc is not ignited by pressing the torch trigger as is usual, but by briefly touching the tungsten electrode against the workpiece. The torch trigger is used for welding process activation. The process can be activated separately for each spot or also on a permanent basis. The setting is controlled using the process activation (55P) parameter in the configuration menu:

- Separate process activation (55P > 0n):
The welding process has to be reactivated for every arc ignition by pressing the torch trigger.
- Permanent process activation (55P > 0FF):
The welding process is activated by pressing the torch trigger once. The following arc ignitions are initiated by briefly touching the tungsten electrode against the workpiece.

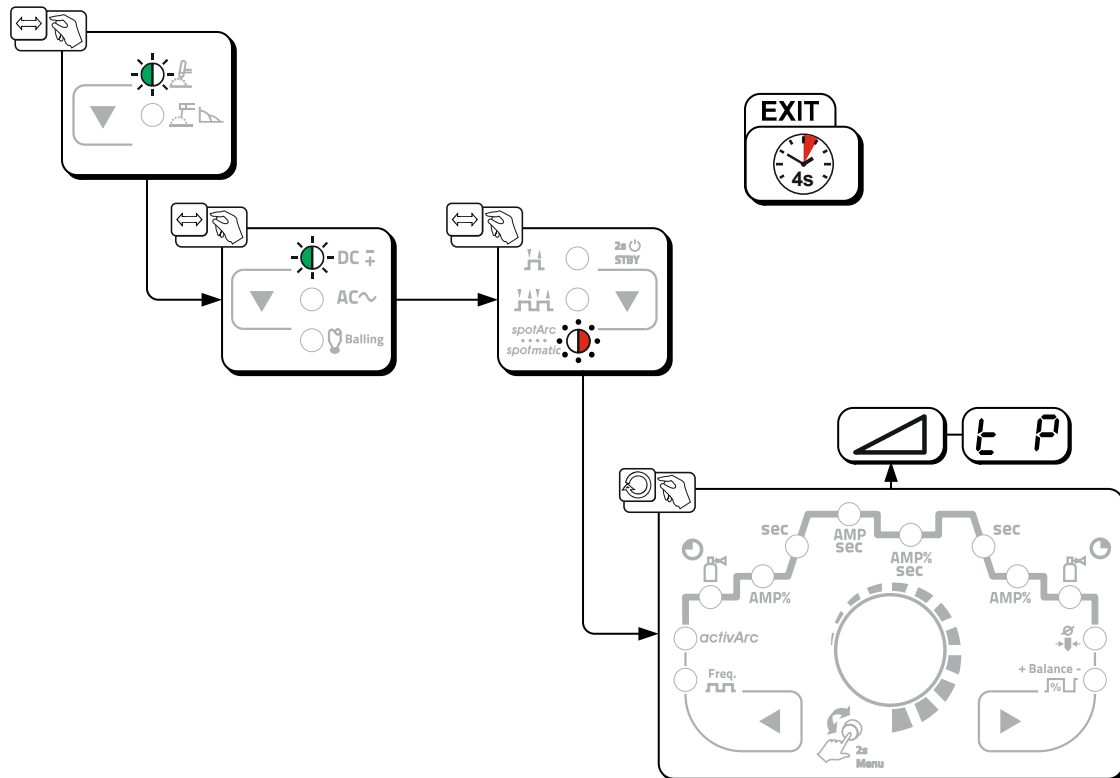


Figure 3-8

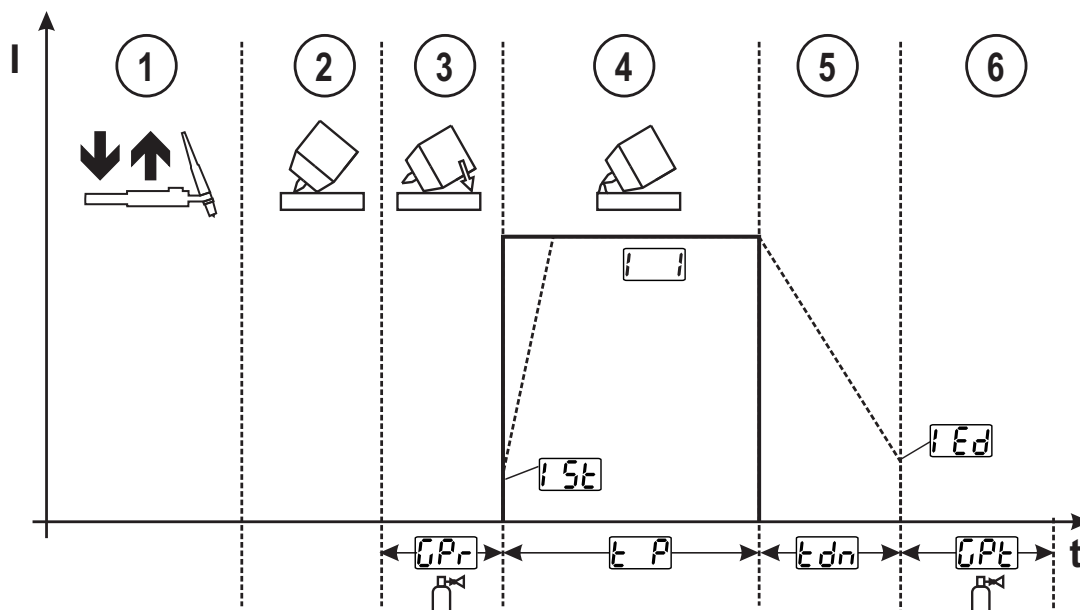


Figure 3-9

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however.

Selecting the process activation type for the welding process.

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

- ① Press and release torch trigger (tap) to activate the welding process.
- ② Touch the torch gas nozzle and tungsten electrode tip carefully against the workpiece.
- ③ Incline the welding torch over the torch gas nozzle until there is a gap of approx. 2–3 mm between the electrode tip and the workpiece. Shielding gas flows during the set gas pre-flow time GPr . The arc ignites and the previously set ignition current ISt flows.
- ④ The main current phase I ends when the set spotArc time tP elapses.
- ⑤ The welding current decreases to the end current level within the set down-slope time IEd .
- ⑥ The gas post-flow time GPl elapses and the welding process ends.

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

3.1.3.6 Non-latched operation, version C

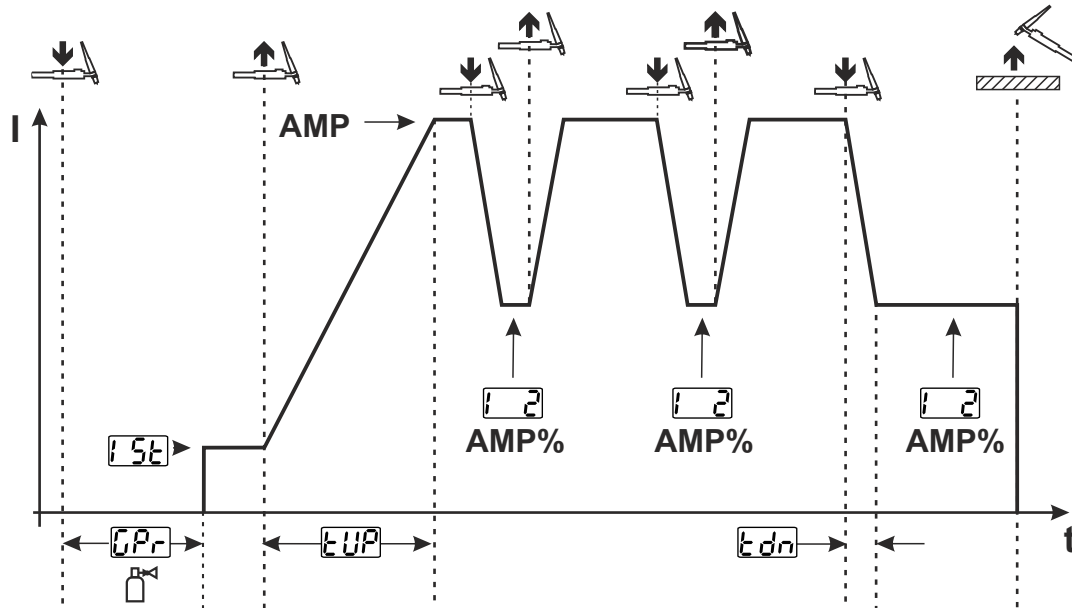


Figure 3-10

1st cycle

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

2nd cycle

- Release torch trigger 1.
- The welding current ramps up to the main current AMP in the selected up-slope time t_{UP} .



Pressing torch trigger 1 starts the slope t_{S1} from main current AMP to secondary current I_{2} AMP%. Releasing the torch trigger starts the slope t_{S2} from the secondary current AMP% and back to the main current AMP. This process can be repeated as frequently as required. The welding process is ended by arc interruption in the secondary current (remove the welding torch from the workpiece until the arc is extinguished). The slope times t_{S1} and t_{S2} can be set in the Expert menu.



This operating mode must be enabled (parameter t_{Ec}).

3.1.4 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 prevent the tungsten electrode sticking in the molten pool and the tungsten inclusions are reduced. This is particularly useful in tacking and in spot welding.

Selection

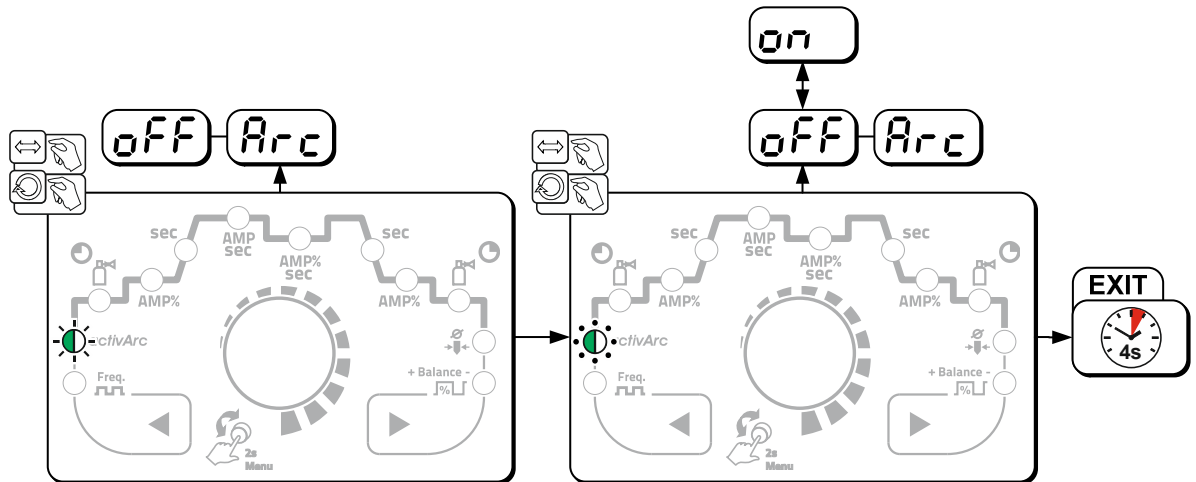


Figure 3-11

Setting

Parameter setting

The activArc parameter (control) can be adjusted specifically for the welding task (panel thickness) > see 3.1.13 chapter.

3.1.5 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 **ERS**) > see 3.7 chapter.

3.1.6 Pulse welding

The following pulse types can be selected:

- Thermal pulsing (TIG AC or TIG DC)
- Metallurgical pulsing (TIG DC)
- Average value metallurgical pulsing (TIG DC)
- Automated pulsing (TIG DC)
- AC special (TIG AC)

3.1.6.1 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.

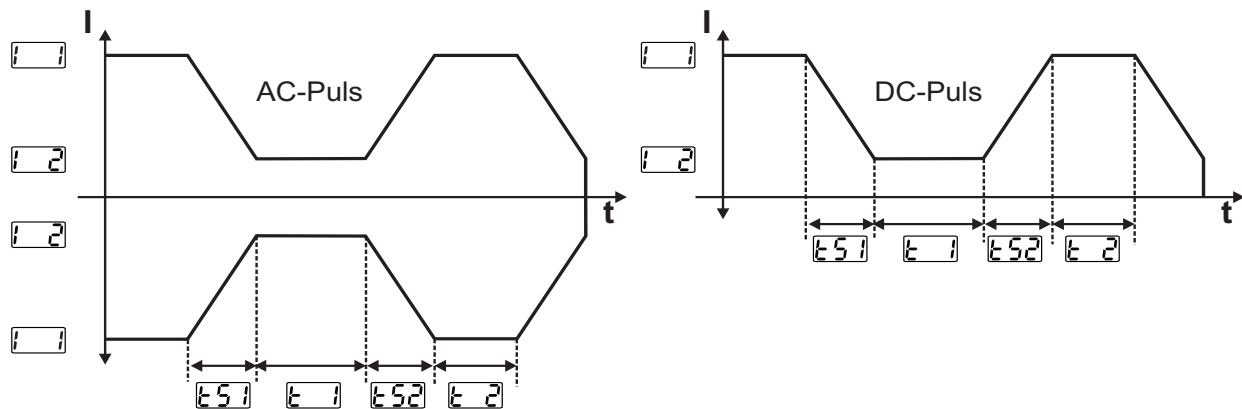


Figure 3-12



The pulse function can also be deactivated if necessary during the up-slope and down-slope phases (parameter PUD).

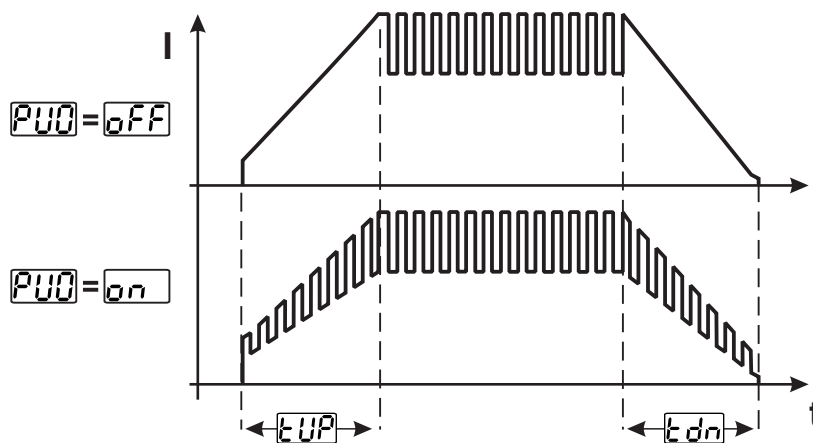


Figure 3-13

Selection

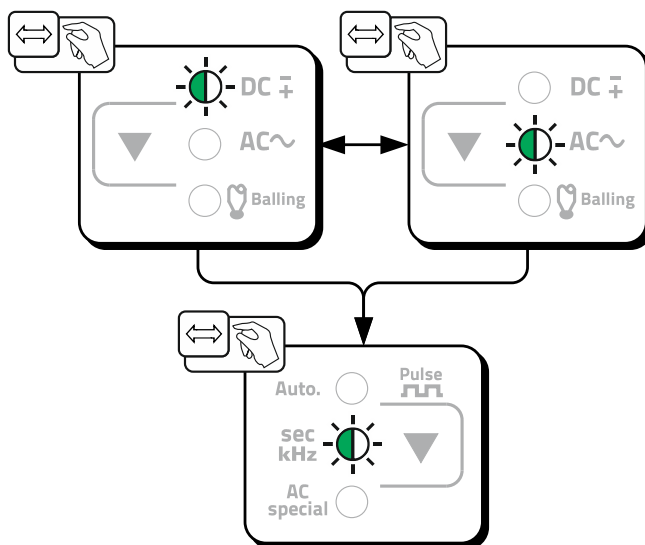


Figure 3-14

Pulse time setting

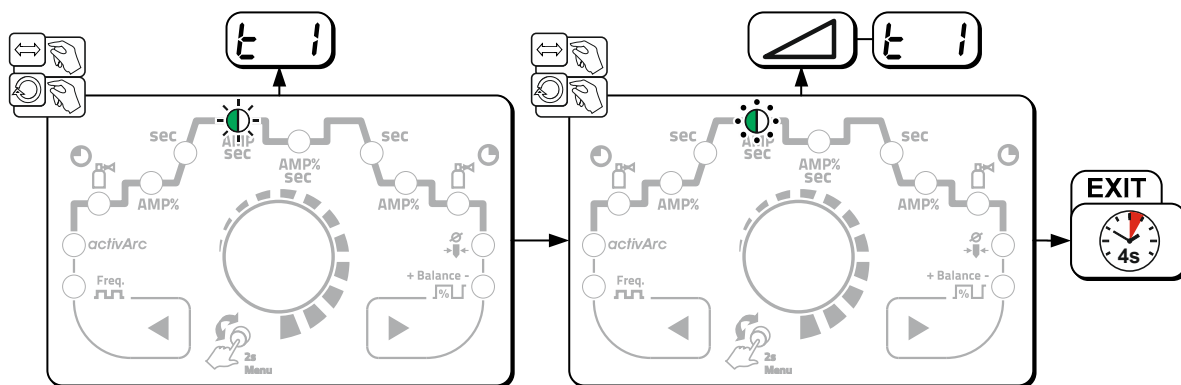


Figure 3-15

Pulse pause setting

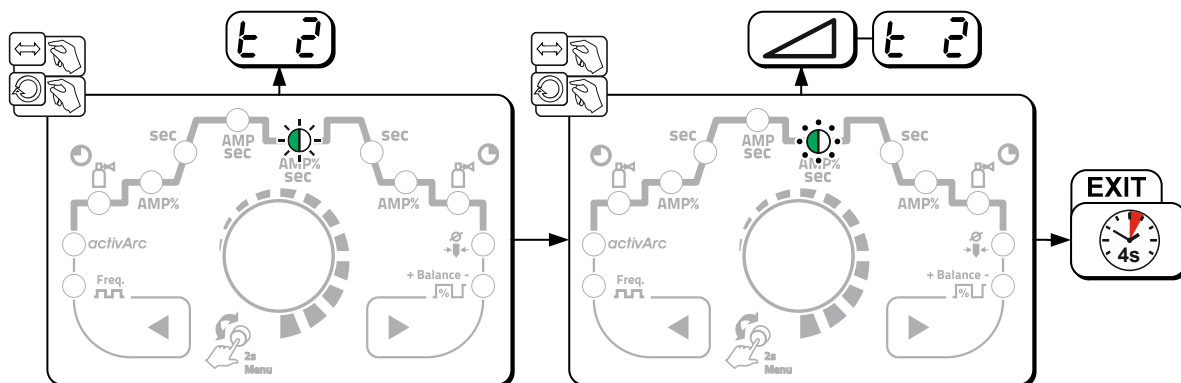


Figure 3-16

Pulse edge setting

The **E51** and **E52** pulse edges can be set in the Expert menu (TIG).

> see 3.1.13 chapter

3.1.6.2 Metallurgical pulsing (kHz pulsing)

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

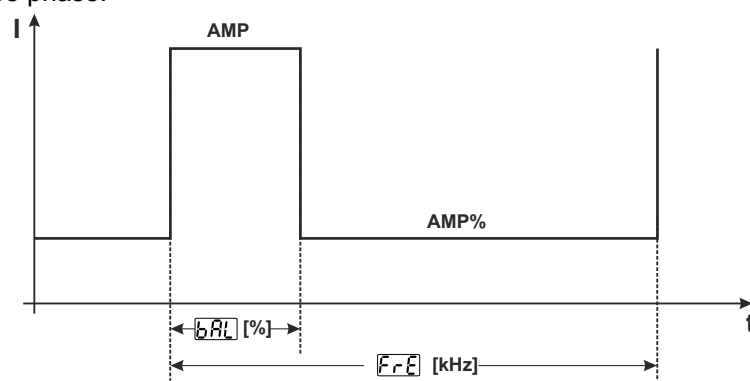


Figure 3-17

Selection

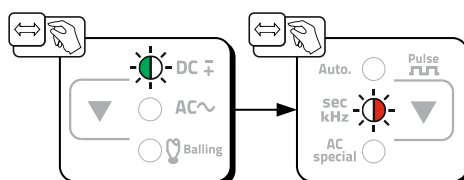


Figure 3-18

Balance setting

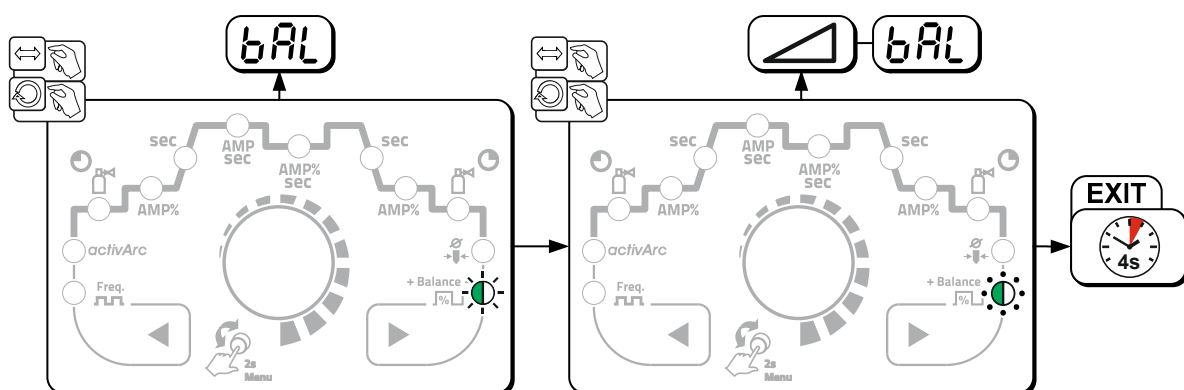


Figure 3-19

Frequency setting

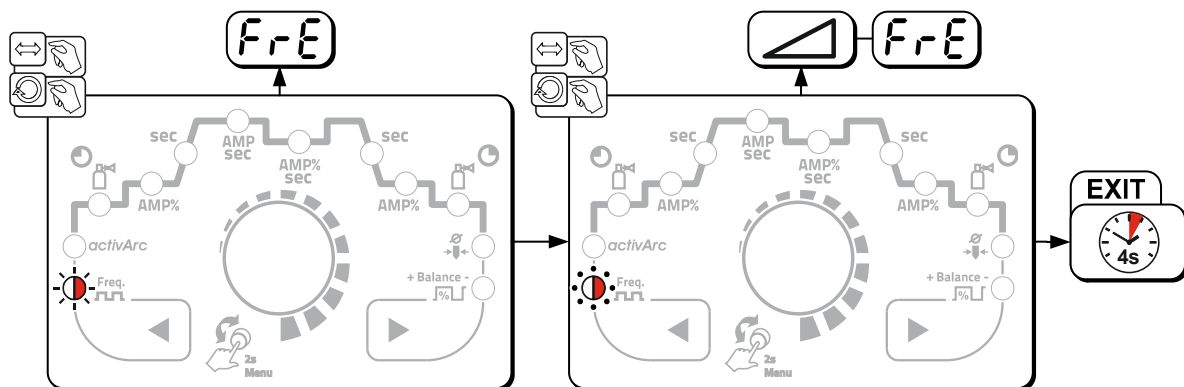


Figure 3-20

3.1.6.3 Average value metallurgical pulsing

The parameter PUL must be switched to ON in the machine configuration menu to enable this pulse variant. See the "Metallurgical pulsing" pulse variant for other parameter settings.

Once the function is activated, the red signal lights for the main current AMP and secondary current AMP% light up at the same time.

Average value pulse welding means that the system switches between two currents periodically, an average current value (AMP), a pulse current (Ipuls), a balance (BR_L) and a frequency (FRE) having been defined first. The predefined ampere current average value is decisive, the pulse current (Ipuls) is defined by the PL parameter as a percentage of the average current value (AMP). The parameter PL is set in the Expert menu.

The pulse pause current (IPP) is not set; the machine control calculates the value instead to ensure that the average value of the welding current (AMP) is maintained.

> see 3.1.13 chapter

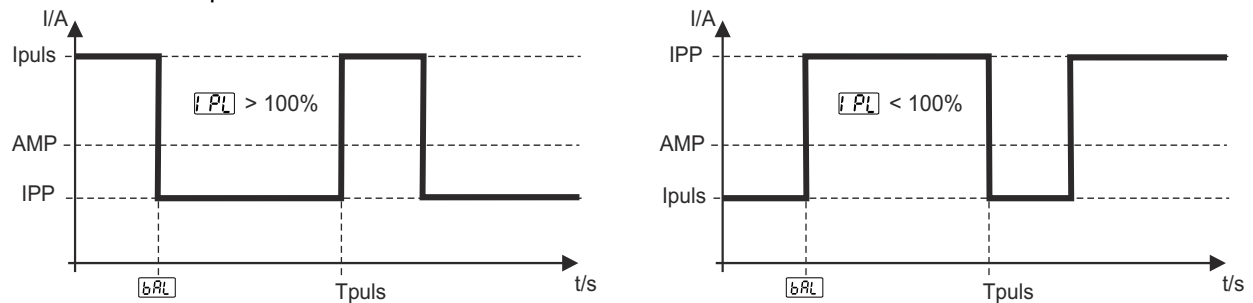


Figure 3-21

AMP = main current (average value), e.g. 100 A

Ipuls = pulse current = $PL \times AMP$, e.g. $140\% \times 100 \text{ A} = 140 \text{ A}$

IPP = pulse pause current

Tpuls = duration of one pulse cycle = $1/FRE$, e.g. $1/100 \text{ Hz} = 10 \text{ ms}$

BR_L = balance = $BR_L \times Tpuls$, e.g. $30\% \times 1 \text{ s} = 0.3 \text{ s}$

Selection

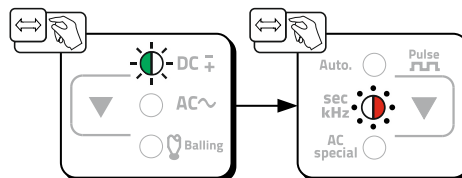


Figure 3-22

3.1.6.4 Automated pulses

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

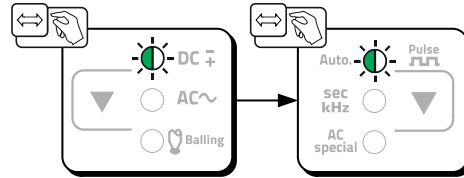


Figure 3-23

3.1.6.5 AC special

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

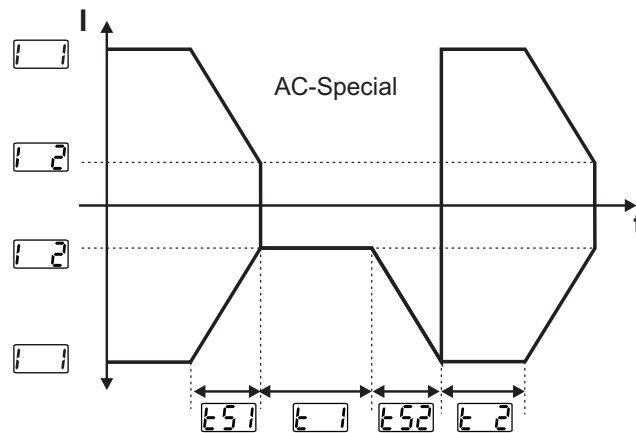


Figure 3-24

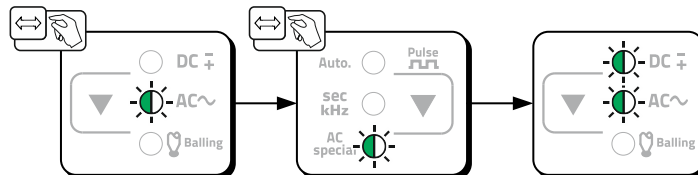


Figure 3-25

The t_{S1} and t_{S2} pulse edges can be set in the Expert menu (TIG).

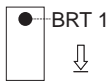
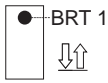
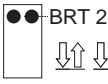
> see 3.1.13 chapter

3.1.7 Welding torch (operating variants)

Different torch versions can be used with this machine.

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

Explanation of symbols for operating elements:

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

3.1.7.1 Tap torch trigger (tapping function)



Swiftly tap the torch trigger to change the function.

The torch mode set determines the operating mode of the tapping function.

3.1.8 Torch mode and up/down speed setting

Modes 1 to 6 and 11 to 16 are available to the user. Modes 11 to 16 feature the same function options as 1 to 6, but without the tapping function for the secondary current.

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





The torch modes are set using the torch configuration parameters "**Ed**" in the machine configuration menu > torch mode "**Ed**".




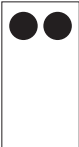
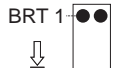
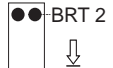
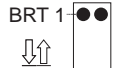
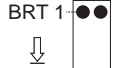
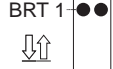
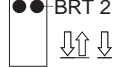
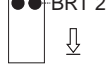
Only the modes listed are suitable for the corresponding torch types.

3.1.8.1 Standard TIG torch (5-pole)



Standard torch with one torch trigger:












| Diagram | Operating elements | Explanation of symbols |
|---|---|---|
|  |  | BRT1 = Torch trigger 1 (welding current on/off; secondary current via tapping function) |
| Functions | mode | Operating elements |
| Welding current On/Off | 1 (factory-set) |  |
| Secondary current (Latched mode) | |  |

Standard torch with two torch triggers:

| Diagram | Operating elements | Explanation of symbols |
|---|--|---|
|  |  | BRT1 = torch trigger 1 BRT2 = torch trigger 2 |
| Functions | mode | Operating elements |
| Welding current On/Off | 1 (factory-set) |  |
| Secondary current | |  |
| Secondary current (tapping mode) / (latched mode) | |  |
| Welding current On/Off | 3 |  |
| Secondary current (tapping mode) / (latched mode) | |  |
| Up function | |  |
| Down function | |  |



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

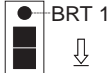
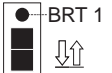
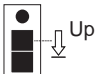

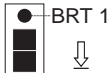

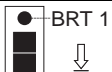



| Diagram | Operating elements | Explanation of symbols |
|---|---|--|
|  |  | BRT 1 = torch trigger 1 BRT 2 = torch trigger 2 |

| Functions | mode | Operating elements |
|---|---------------------------|---|
| Welding current On/Off | 1 (factory-set) |  |
| Secondary current | |  |
| Secondary current (tapping mode) / (latched mode) | |  |
| Welding current On/Off | 2 |  |
| Secondary current (tapping mode) | |  |
| Up function | |  |
| Down function | |  |
| Welding current On/Off | 3 |  |
| Secondary current (tapping mode) / (latched mode) | |  |
| Up function | |  |
| Down function | |  |


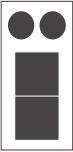
3.1.8.2 TIG up/down torch (8-pole)















Up/down torch with one torch trigger

| Diagram | Operating elements | Explanation of symbols |
|---|---|------------------------|
|  |  | TT 1 = torch trigger 1 |

| Functions | Mode | Operating elements |
|---|---------------------------|---|
| Welding current on/off | 1 (factory-set) |  |
| Secondary current (tapping mode) / (latched mode) | |  |
| Increase welding current, infinite adjustment (up function) | |  |
| Reduce welding current, infinite adjustment (down function) | |  |
| Welding current on/off | 2 |  |
| Secondary current (tapping mode) | |  |
| Welding current on/off | 4 |  |
| Secondary current (tapping mode) / (Latched mode) | |  |
| Increase welding current by an increment * | |  |
| Reduce welding current by an increment * | |  |

Up/down torch with two torch triggers

| Diagram | Operating elements | Explanation of symbols |
|---|---|---|
|  |  | TT 1 = torch trigger 1 (left) TT 2 = torch trigger 2 (right) |

| Functions | Mode | Operating elements |
|---|----------------------------|---|
| Welding current on/off | 1 (factory-set) | BRT 1  |
| Secondary current | |  BRT 2 |
| Secondary current (tapping mode) / (latched mode) | | BRT 1  |
| Increase welding current, infinite adjustment (up function) | |  Up |
| Reduce welding current, infinite adjustment (down function) | |  Down |
| Welding current on/off | 2 | BRT 1  |
| Secondary current | |  BRT 2 |
| Secondary current (tapping mode) | | BRT 1  |
| Welding current on/off | 4 | BRT 1  |
| Secondary current | |  BRT 2 |
| Secondary current (tapping mode) | | BRT 1  |
| Increase welding current by an increment * | |  Up |
| Reduce welding current by an increment * | |  Down |
| Gas test | 4 |  BRT 2 > 3 s |

* > see 3.1.8.6 chapter

3.1.8.3 Potentiometer torch (8-pole)



The welding machine needs to be configured for operation with a potentiometer torch > see 3.1.8.4 chapter.

Potentiometer torch with one torch trigger:

| Diagram | Operating elements | Explanation of symbols |
|---|--------------------|-------------------------|
| | | BRT 1 = torch trigger 1 |
| Functions | Mode | Operating elements |
| Welding current On/Off | 3 | |
| Secondary current (tapping mode) | | |
| Increase welding current, infinite adjustment | | |
| Reduce welding current, infinite adjustment | | |

Potentiometer torch with two torch triggers:

| Diagram | Operating elements | Explanation of symbols |
|---|--------------------|--|
| | | BRT 1 = torch trigger 1 BRT 2 = torch trigger 2 |
| Functions | Mode | Operating elements |
| Welding current On/Off | 3 | |
| Secondary current | | |
| Secondary current (tapping mode) | | |
| Increase welding current, infinite adjustment | | |
| Reduce welding current, infinite adjustment | | |

3.1.8.4 Configuring the TIG potentiometer torch connection



DANGER



Risk of injury due to electrical voltage after switching off!

Working on an open machine can lead to fatal injuries!

Capacitors are loaded with electrical voltage during operation. Voltage remains present for up to four minutes after the mains plug is removed.

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



WARNING



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!

CAUTION



Test!

Before re-commissioning, it is essential that an "inspection and test during operation" is carried out conforming to IEC / DIN EN 60974-4 "Arc welding devices - inspection and testing during operation"!

- For detailed instructions, please see the standard operating instructions for the welding machine.

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

| Welding torch configuration | Setting |
|--|--|
| Prepared for TIG standard or up/down torch (factory setting) | <input checked="" type="checkbox"/> JP27 |
| Prepared for potentiometer torches | <input type="checkbox"/> JP27 |

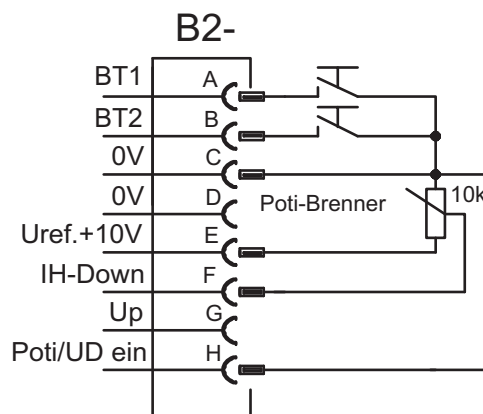


Figure 3-26



For this torch type the welding machine has to be set to torch mode 3 > see 3.1.8 chapter.

3.1.8.5 RETOX TIG torch (12-pole)



For machines with 12-pole torch connection socket only.

| Diagram | Operating elements | Explanation of symbols |
|---------|--------------------|------------------------|
| | | TT= torch trigger |

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

3.1.8.6 Setting the first increment



This function is only available when using up/down torches in modes 4 and 14!

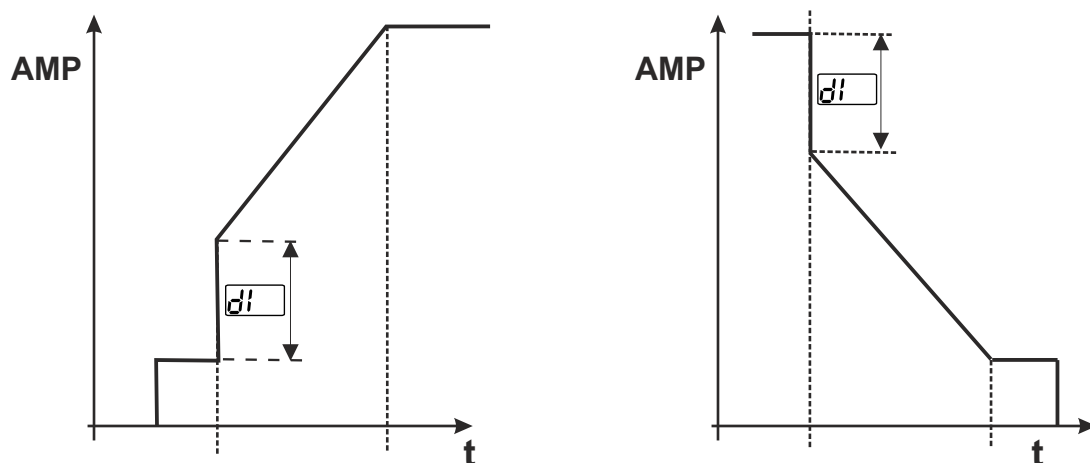


Figure 3-27

The parameter to set the 1st increment di is in the machine configuration menu.

> see 3.7 chapter

3.1.9 Alternating current waveforms Selection

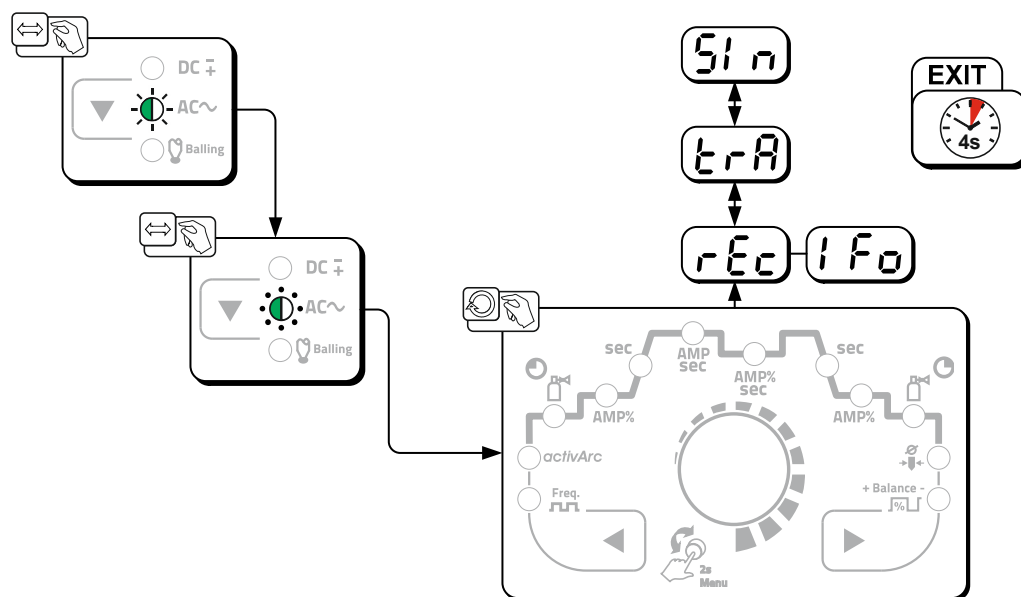


Figure 3-28

| Display | Setting/selection |
|------------|--|
| lFo | Alternating current waveforms rEc -----Square trA -----Trapezoidal Sin -----Sine |
| rEc | Alternating current welding with rectangular current waveform Maximum power loading and safe welding |
| trA | Alternating current welding with trapezoidal current waveform An all-rounder, suitable for most applications |
| Sin | Alternating current welding with sinusoidal current waveform Low noise level |

3.1.9.1 Ramp function foot-operated remote control RTF 1

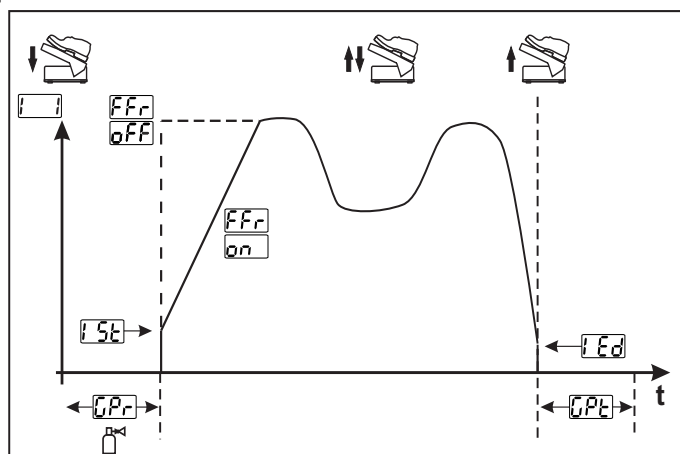





Figure 3-29

| Symbol | Meaning |
|--|---|
|  | Actuate foot-operated remote control (start welding process) |
|  | Operate foot-operated remote control (set welding current according to application) |
|  | Release foot-operated remote control (end welding process) |
| FFr | The parameter can be changed in the machine configuration menu. |

3.1.10 Automatic AC frequency

The function is activated with the parameter \overline{RFA} in the Expert menu. The signal light $\overset{\text{Freq.}}{\text{auto}}$ comes on when the function is activated.

The machine control adjusts or sets the AC frequency in relation to the set main current. The lower the welding current, the higher the frequency and vice versa. This ensures a concentrated, directionally stable arc is achieved when welding currents are low. The load from the tungsten electrode is minimised when the welding currents are high, ensuring a higher service life.

The AC frequency rotary knob (JOB 0) or manual setting of the frequency in the functional sequence (JOB 1–7)) cannot be used when this function is activated.

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

> see 3.1.13 chapter

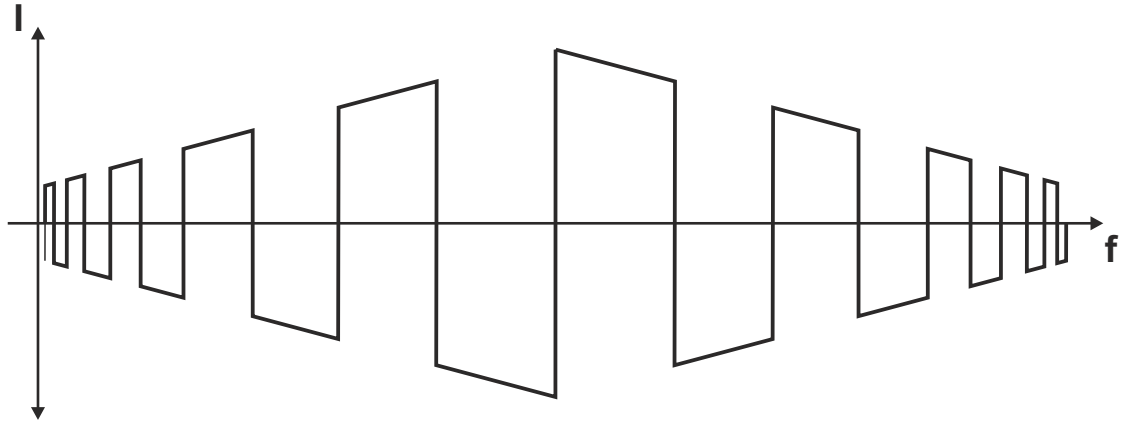


Figure 3-30

3.1.11 AC commutation optimisation

The AC commutation assistance function can help to increase process stability when welding materials such as pure aluminium. If half-wave failures should occur during the welding process, the parameter can be increased, counteracting half-wave failures.

The \overline{CO} parameter must first be switched on in the machine configuration menu. The parameter value can then be selected and set in the Expert menu.

> see 3.7 chapter

> see 3.1.13 chapter



3.1.12 Simultaneous welding on both sides, synchronisation types

This function is important, if two power sources are used to simultaneously weld on both sides, as is sometimes required for welding thick aluminium materials in the PF position. This ensures that, with alternating currents, the positive and negative pole phases are present on both power sources simultaneously, thus avoiding the arcs negatively influencing each other.

3.1.12.1 Synchronisation via mains voltage (50Hz / 60Hz)

Phase sequences and rotating magnetic fields in the supply voltages must be the same for both welding machines. If this is not the case, the energy input into the weld pool will be negatively affected.

Some machine types can be optionally retrofitted with a rotary switch to set the phase position (ON NETSYNCHRON). Use this rotary switch to correct the phase difference in increments of 60° (0°, 60°, 120°, 180°, 240° and 300°). Optimum phase correction will directly achieve better welding results.

The synchronisation via mains voltage function is enabled in the Expert menu (TIG). The parameter  must be switched to  here (signal light Netsync lights up).

3.1.13 Expert menu (TIG)

The expert menu includes functions and parameters which are either not set on the machine control, or which do not require regular setting.



ENTER (Enter the menu)

- **Keep the control button pressed for 2 s.**

NAVIGATION (Navigate the menu)

- **Parameters are selected by turning the main control button or pressing the "Parameter selection left/right" push-button.**
- **Change parameters by pressing (parameter selection) and turning (parameter setting) the main control button.**

EXIT (Exit the menu)

- **The machine will return automatically to the ready-to-operate status after 4 sec.**

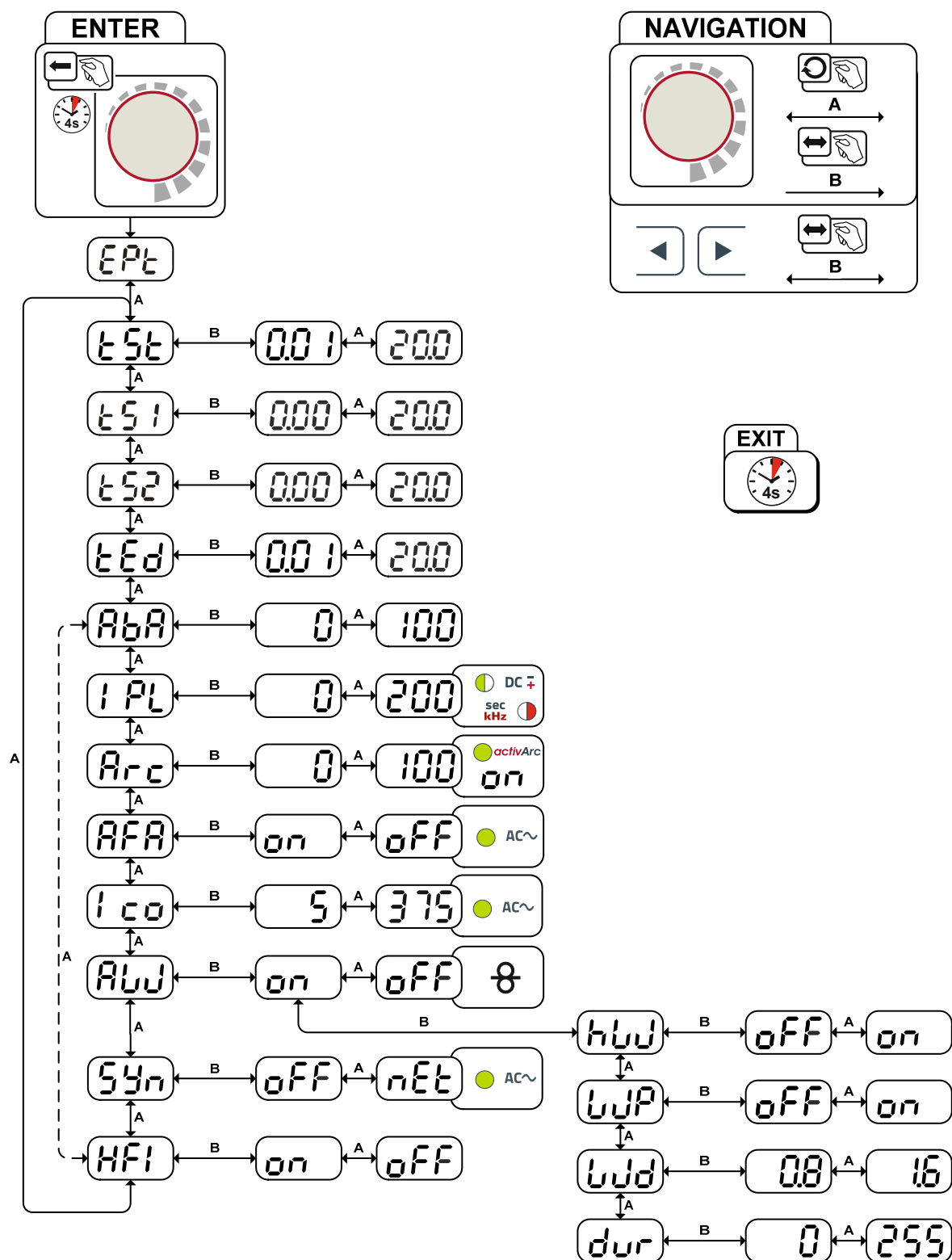



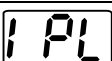
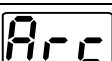

















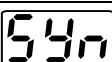







Figure 3-31

| Display | Setting/selection |
|---------|--|
| EPt | Expert menu |
| tS1 | Slope time (main current to secondary current) |
| tS1 | Slope time (main current to secondary current) |

| | |
|---|---|
|  | Slope time (secondary current to main current) |
|  | Slope time (main current to secondary current) |
|  | Amplitude balance |
|  | Pulse current |
|  | activArc parameter Parameter also adjustable after TIG activArc welding is activated. |
|  | Automatic AC frequency  ----- Function enabled  ----- Function disabled (ex works) |
|  | AC commutation optimisation  ----- Function enabled  ----- Function disabled (ex works) |
|  | Filler wire process (cold/hot wire)  ----- filler wire activated  ----- filler wire deactivated (factory setting) |
|  | Hot wire process (start signal for hot wire power source)  ----- Function enabled  ----- Function disabled (ex works) |
|  | Wire/pulse function (wire feeding behaviour when using pulsed TIG welding) Wire feeding can be disabled during pulse pauses (not the case for automated pulsing or kHz pulsing).  ----- Function disabled  ----- Function enabled (ex works) |
|  | Filler wire diameter (manual setting) Setting the wire diameter between 0.6 mm to 1.6 mm. The character "d" preceding the wire diameter on the display (d0.8) indicates a pre-programmed characteristics (correction operating mode "KORREKTUR"). If there is no characteristics for the selected wire diameter, the parameters have to be set manually (manual operating mode "MANUELL"). To select the operating mode > see 3.3.1.2 chapter. |
|  | Wire return • Increase value = more wire return • Decrease value = less wire return |
|  | Simultaneous AC welding on both sides, synchronisation types  ----- Function disabled (ex works)  ----- Synchronisation via mains voltage (50 Hz/60 Hz) |
|  | Ignition type (TIG)  ----- HF start active (ex works)  ----- Lift arc ignition active |

3.1.14 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.

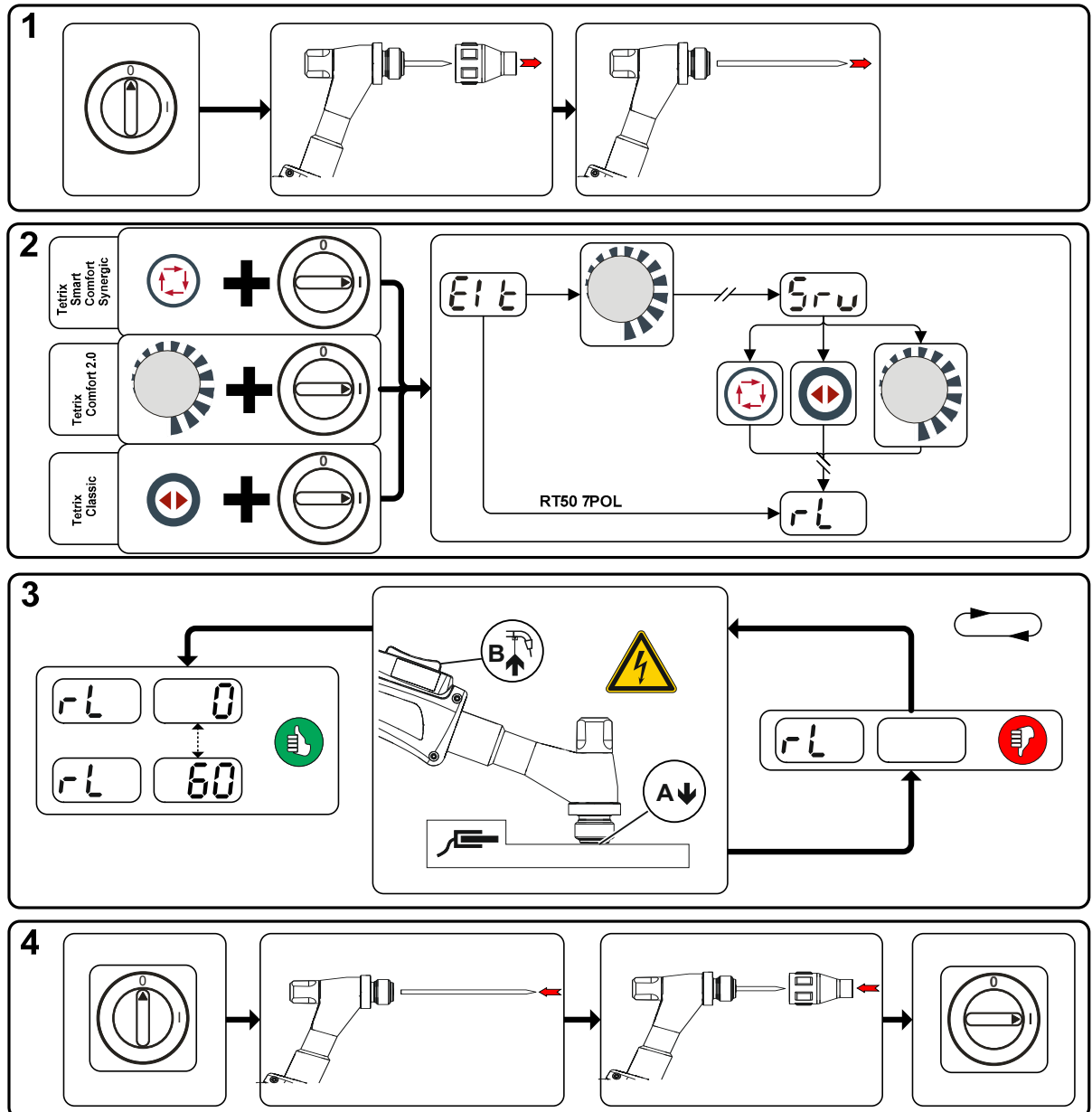




Figure 3-32

1 Preparation

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

2 Configuration

- Activate the  rotary knob while switching on the welding machine at the same time.
- Release rotary knob.
- You can now use the  rotary knob (rotate and press) to select the 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.
- > see 3.7 chapter

3.2 MMA welding

3.2.1 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 [dg_ref_source_inline>Zugriffssteuerung](#).**

The welding task is selected using the buttons on the machine control on the welding machine.
Signal lights (LED) display the welding parameter selection.

Set the welding task in the following order:

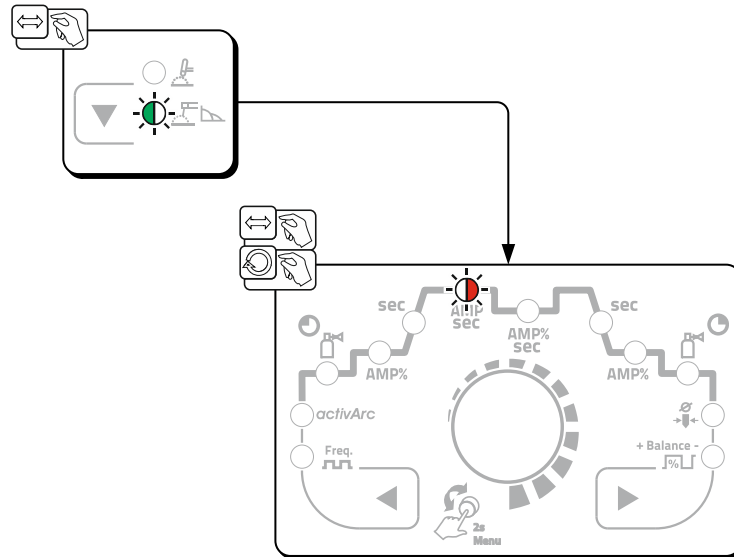


Figure 3-33

3.2.2 Hotstart

The hot start device ensures that stick electrodes ignite more effectively thanks to a greater hot start current. After selecting the stick electrode, the arc ignites with the hot start current I_{ht} for the preset hot start time t_{ht} and then reverts to the main current I (AMP).

The parameter values for hot start current and time can be optimised for the electrode types used.

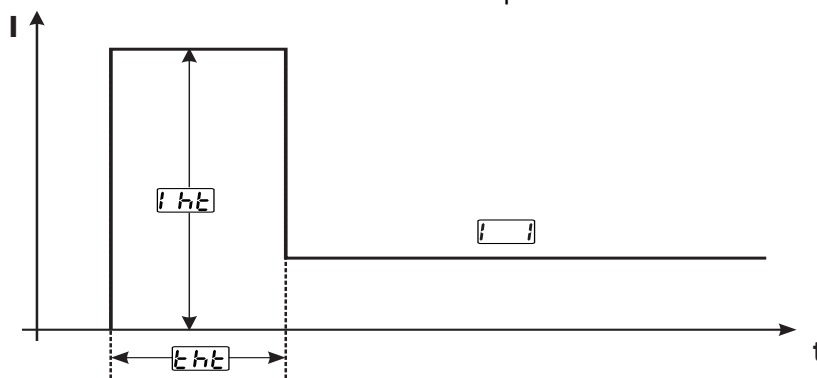


Figure 3-34

3.2.2.1 Hotstart current

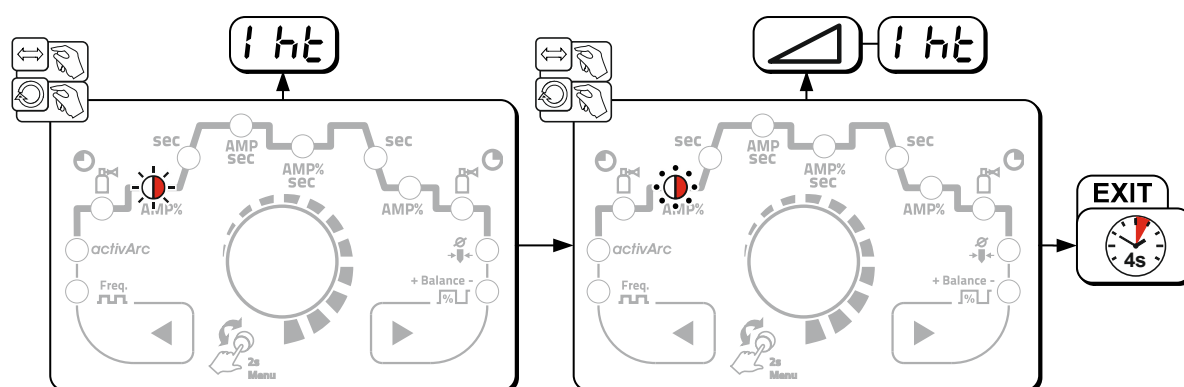


Figure 3-35

3.2.2.2 Hotstart time

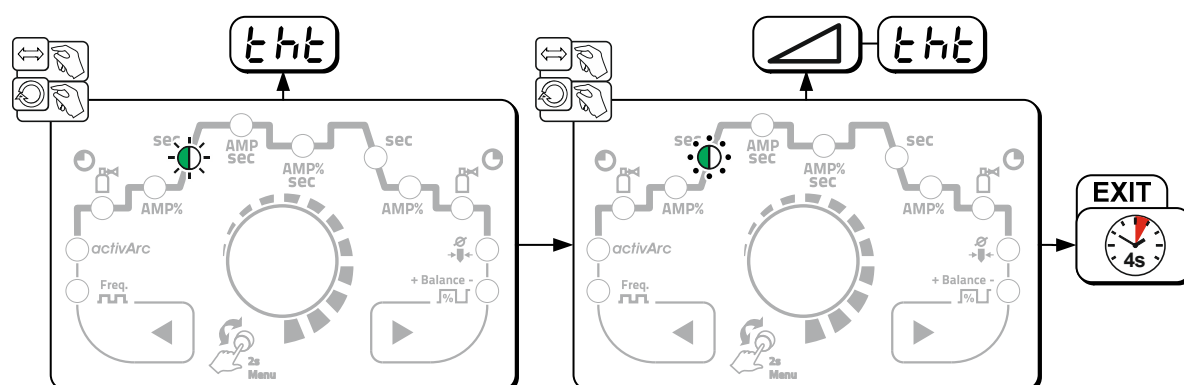


Figure 3-36

3.2.3 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.

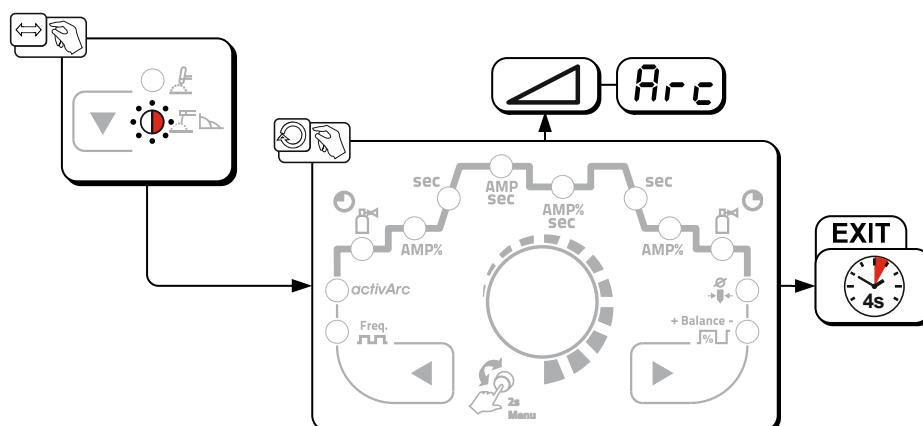
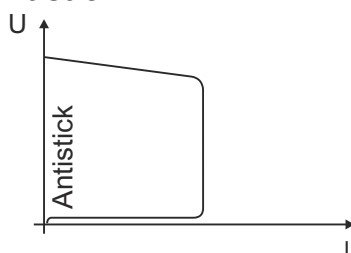


Figure 3-37

3.2.4 Antistick



Anti-stick prevents the electrode from annealing.

If the electrode sticks in spite of the Arcforce device, the machine automatically switches over to the minimum current within about 1 second to prevent the electrode from overheating. Check the welding current setting and correct according to the welding task!

Figure 3-38

3.2.5 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.

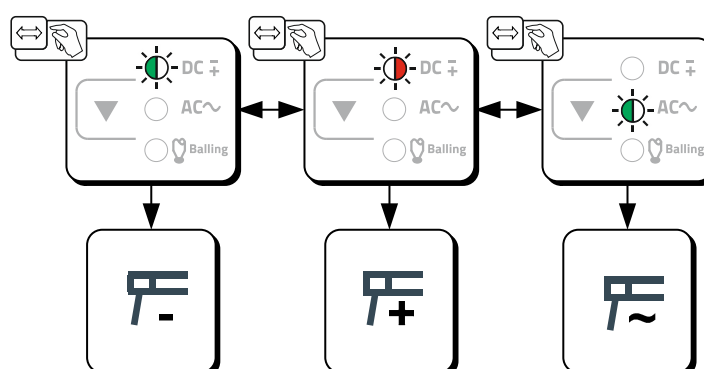


Figure 3-39

3.2.6 Pulse welding

Pulse welding means that the system switches between two currents periodically with a pulse current (I_{puls}), a pulse pause current (IPP), a balance (b_{RL}) and a frequency (f_{rE}) having been defined first.

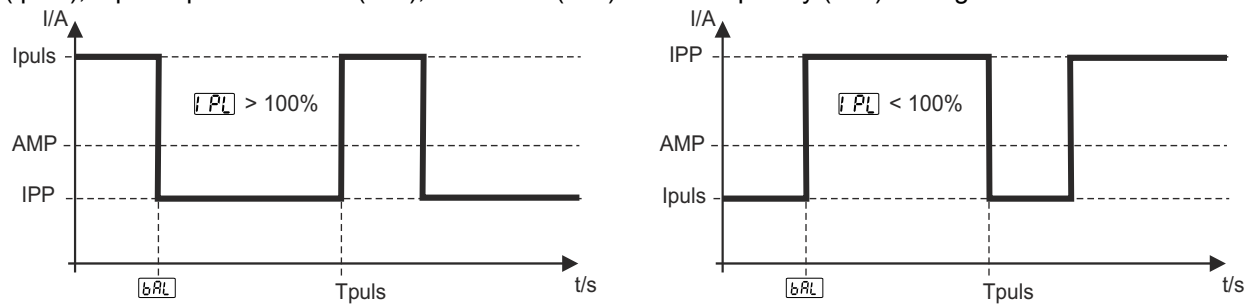


Figure 3-40

AMP = main current, e.g. 100 A

I_{puls} = pulse current = I_{PL} x AMP, e.g. 140% x 100 A = 140 A

IPP = pulse pause current = 1–200% of AMP

T_{puls} = duration of one pulse cycle = $1/f_{rE}$, e.g. 1/100 Hz = 10 ms

b_{RL} = balance = b_{RL} x T_{puls} , e.g. 30% x 1 s = 0.3 s

Selection

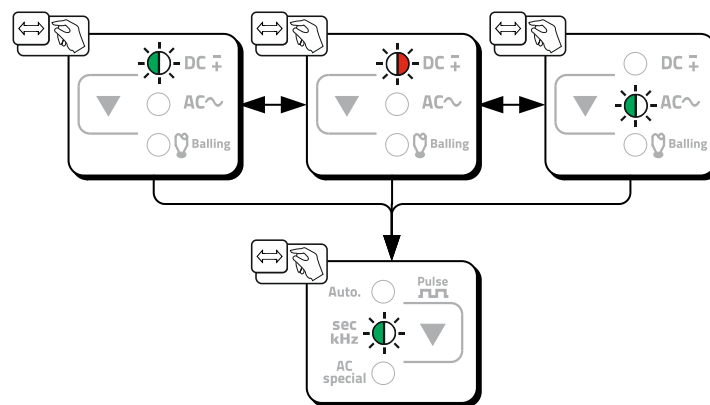


Figure 3-41

3.2.7 Average value pulse welding

Average value pulse welding means that two currents are switched periodically, a current average value (AMP), a pulse current (I_{puls}), a balance (bAL) and a frequency (FrE) having been defined first. The predefined ampere current average value is decisive, the pulse current (I_{puls}) is defined by the IP_L 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.

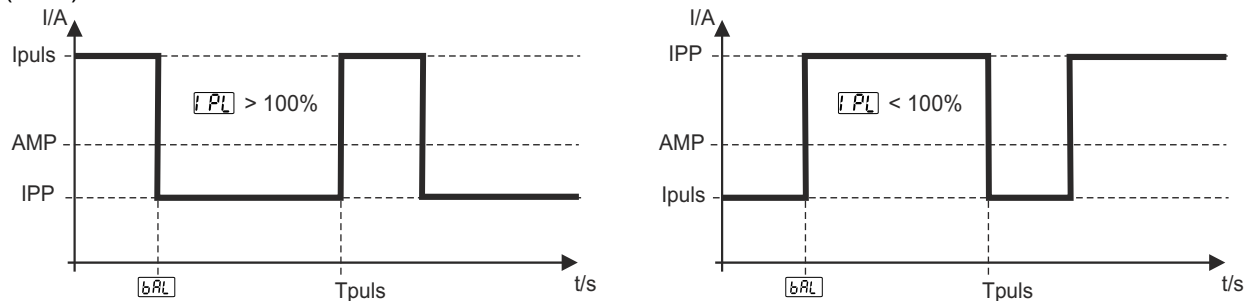


Figure 3-42

AMP = Main current; e.g. 100 A

$IPL = Pulse\ current = IP1 \times AMP$; e.g. $170\% \times 100\ A = 170\ A$

IPP = Pulse pause current

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

$bAL = Balance = bAL \times Tpuls$; e.g. $30\% \times 1\ s = 0.3\ s$

3.3 Filler wire welding

3.3.1 Configuring the welding machine for mechanical arc fusion welding

Before the welding machine is commissioned it has to be configured for mechanical arc fusion welding (cold or hot wire welding). The following basic settings are made in the Expert menu:

1. Activate filler wire process (**AW = on**).
2. Hot wire or cold wire selection (**HW = on/off**)

In addition, wire diameter and wire return can be adjusted if required.



Please note the relevant documentation of the accessory components.

3.3.1.1 Selecting a welding task by means of the JOB list

- Select material, tungsten electrode \emptyset and seam position on the welding machine controls.



The welding task number (JOB number) results from the chosen basic parameters. If no wire speed is assigned to this JOB-number (> see 3.3.1.2 chapter), wire feeding will not take place. In order to carry out the chosen welding task, the wire feed unit must be switched to the **MANUELL operating mode .**

3.3.1.2 Select wire speed operating mode (**KORREKTUR / MANUELL**)

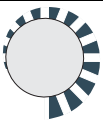



The wire speed can be set in two different operating modes:

MANUAL: The wire speed can be selected on the wire feed unit as an absolute value across the entire setting range.

CORRECTION: The wire speed is approximately specified by the welding machine control and can be corrected as a percentage on the wire feed unit

In the wire feed unit underneath the cap is a switch for selecting the operating mode.

3.3.1.3 Setting the welding current and wire speed

| Operating element | Action | Result |
|---|---|--|
|  |  | Set welding current on the welding machine |
|  |  | Set wire speed MANUAL operating mode (outer scale): The wire speed can be selected on the wire feed unit as an absolute value across the entire setting range. CORRECTION operating mode (inner scale): The wire speed is specified largely by the welding machine control and can be corrected as a percentage on the wire feed unit |

3.3.2 Function sequences/operating modes



The welding current operating mode must be set to latched on the welding machine. The welding current is infinitely adjustable by means of torch triggers 3 and 4 (BRT 3 and BRT 4). Torch trigger 2 (BRT 2) switches the welding current on or off. Torch trigger 1 (BRT 1) switches the wire feed on or off. The operator can choose between three operating modes (see following function sequences).

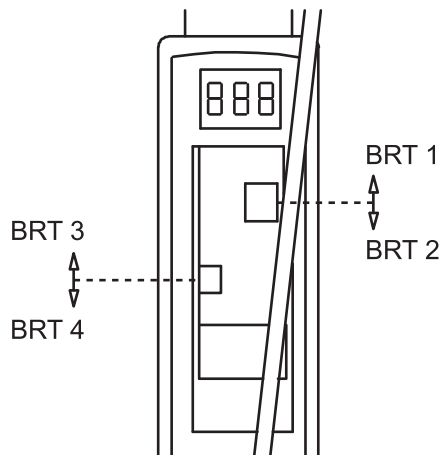













Figure 3-43

3.3.2.1 Explanation of symbols

| Symbol | Meaning |
|---|--|
|  | Press torch trigger |
|  | Release torch trigger |
|  | Tap torch trigger (press briefly and release) |
|  | Shielding gas flowing |
| I | Welding output |
|  | Gas pre-flows |
|  | Gas post-flows |
|  | Non-latched |
|  | Special, non-latched |
|  | Latched |
|  | Special, latched |
| t | Time |
| P _{START} | Ignition program |
| P _A | Main program |
| P _B | Reduced main program |
| P _{END} | End program |
| tS1 | Slope duration from P _{START} to P _A |
|  | Wire feed |

3.3.2.2 Non-latched mode

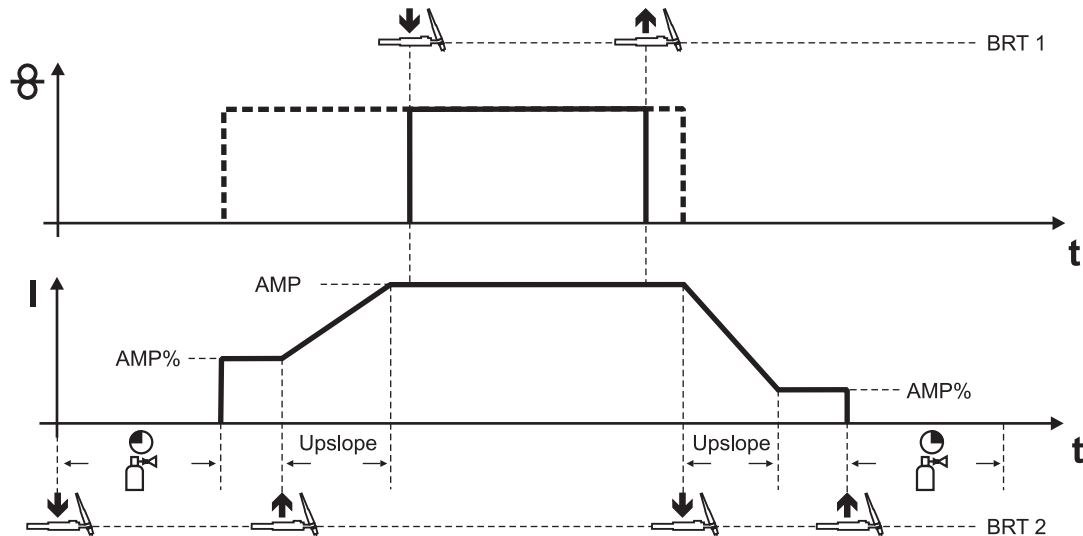


Figure 3-44

1st cycle (current)

- Press torch trigger 2 (BRT 2), the gas pre-flow time elapses.
- HF ignition pulses jump from the tungsten electrode to the workpiece. The arc ignites.
- Welding current flows and immediately assumes the set ignition current AMP% (search arc at minimum setting). HF switches off.

2nd cycle (current)

- Release BRT 2.
- The welding current ramps up to the main current AMP in the selected up-slope time.

1st cycle (wire)

- Press torch trigger 1 (BRT 1).
Wire electrode is advanced.

2nd cycle (wire)

- Release BRT 1.
Wire electrode advance stops.

3rd cycle (current)

- Press BRT 2.
- The main current ramps down to the end-crater current I_{end} (AMP%) in the selected down-slope time.

4th cycle (current)

- Release BRT 2. Arc extinguishes.
- Shielding gas continues to flow for the selected gas post-flow time.

Ending the welding process without down-slope time and end-crater current:

- Tap BRT 2 (tapping function).
Shielding gas continues to flow for the selected gas post-flow time.



Swiftly tap the torch trigger to change the function.

The torch mode set determines the operating mode of the tapping function.

3.3.2.3 3-cycle operation

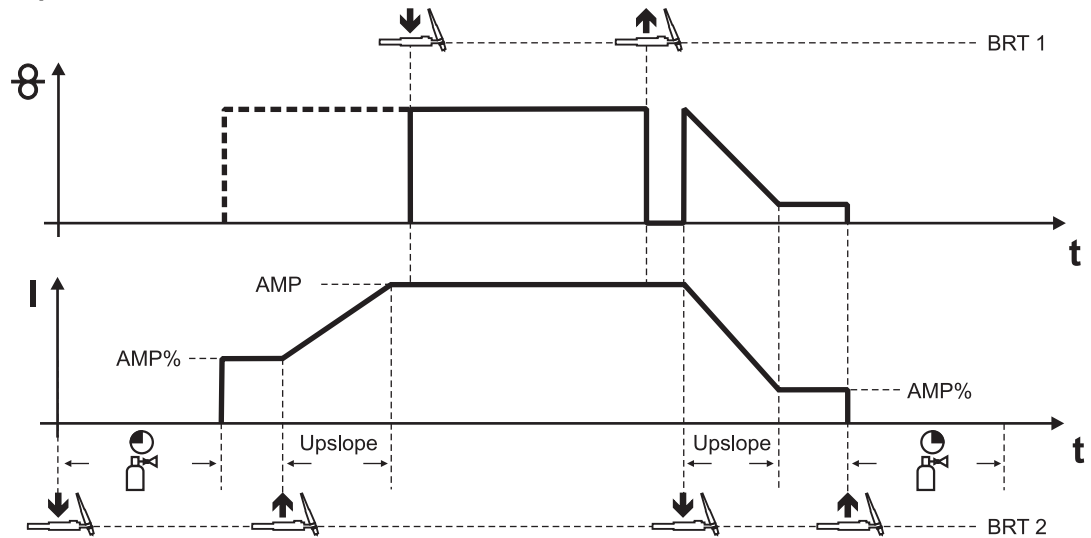


Figure 3-45

This operating mode differs from non-latched operation in the following ways:

- Once the third cycle (current) has started, the wire electrode is fed, corresponding to the welding current, until the welding process ends.

3.3.2.4 Latched mode

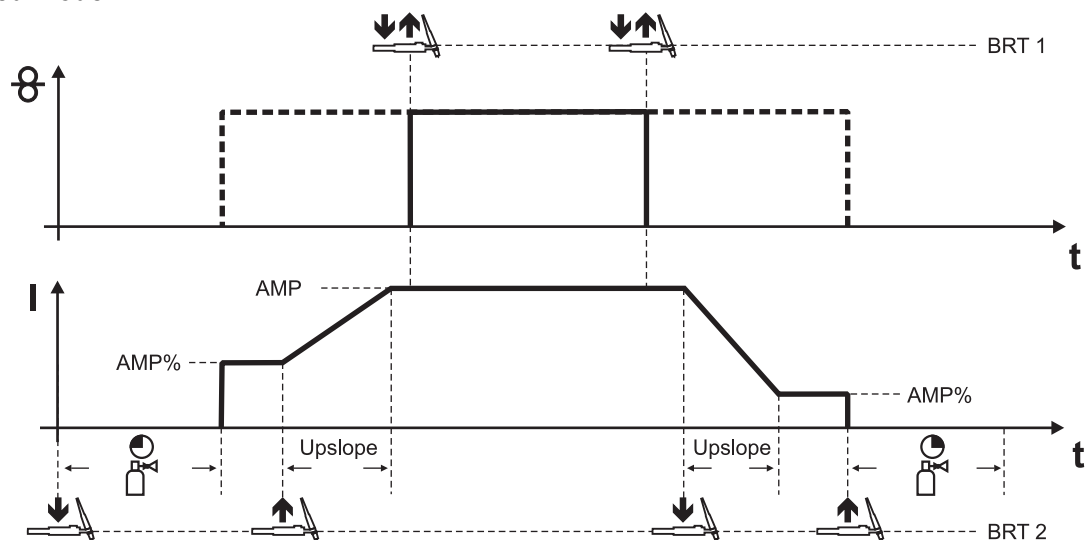


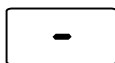
Figure 3-46

This operating mode differs from non-latched operation in the following ways:

- Wire feeding is started by pressing and releasing (tapping) the BRT 1.
- By pressing and releasing (tapping) the BRT 1 again, wire feeding will stop. (It is not necessary to keep the torch trigger pressed. This is especially helpful with long welding seams.)

3.4 Power-saving mode (Standby)

You can activate the power-saving mode by either pressing the push-button > see 2.1.1 chapter for a prolonged time or by setting a parameter in the machine configuration menu (time-controlled power-saving mode) > see 3.7 chapter.



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

Pressing any operating element (e.g. tapping the torch trigger) deactivates power-saving mode and the machine is ready for welding again.

3.5 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.

Enabling access block

- Assign the access code for the access block: Select parameter `Accd` and select a number code (0–999).
- Enable access block: Set parameter `Stw` to access block enabled `EL5`.

The access block activation is indicated by the "Access block active" signal light.

Disabling access block

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

3.6 Voltage reducing device

The machine can be equipped with a VRD (Voltage-reducing device) to increase safety, particularly in hazardous environments such as those in shipbuilding, pipe construction or mining (identified with name prefix "VRD").

The VRD signal light comes on when the voltage reduction device is operating perfectly and the output voltage is reduced to the value specified in the relevant technical standard..

3.7 Machine configuration menu

The machine menu includes basic functions such as torch modes, display settings and the service menu.

3.7.1 Selecting, changing and saving parameters



ENTER (Enter the menu)

- **Switch off the machine at the main switch.**
- **Press and hold the control button while switching the machine on again at the same time.**

NAVIGATION (Navigate the menu)

- **Parameters are selected by pressing the control button.**
- **Set or change the parameters by turning the control button.**

EXIT (Exit the menu)

- **Select menu item `EL5`.**
- **Press control button (settings will be applied, machine changes to the ready-to-operate status).**

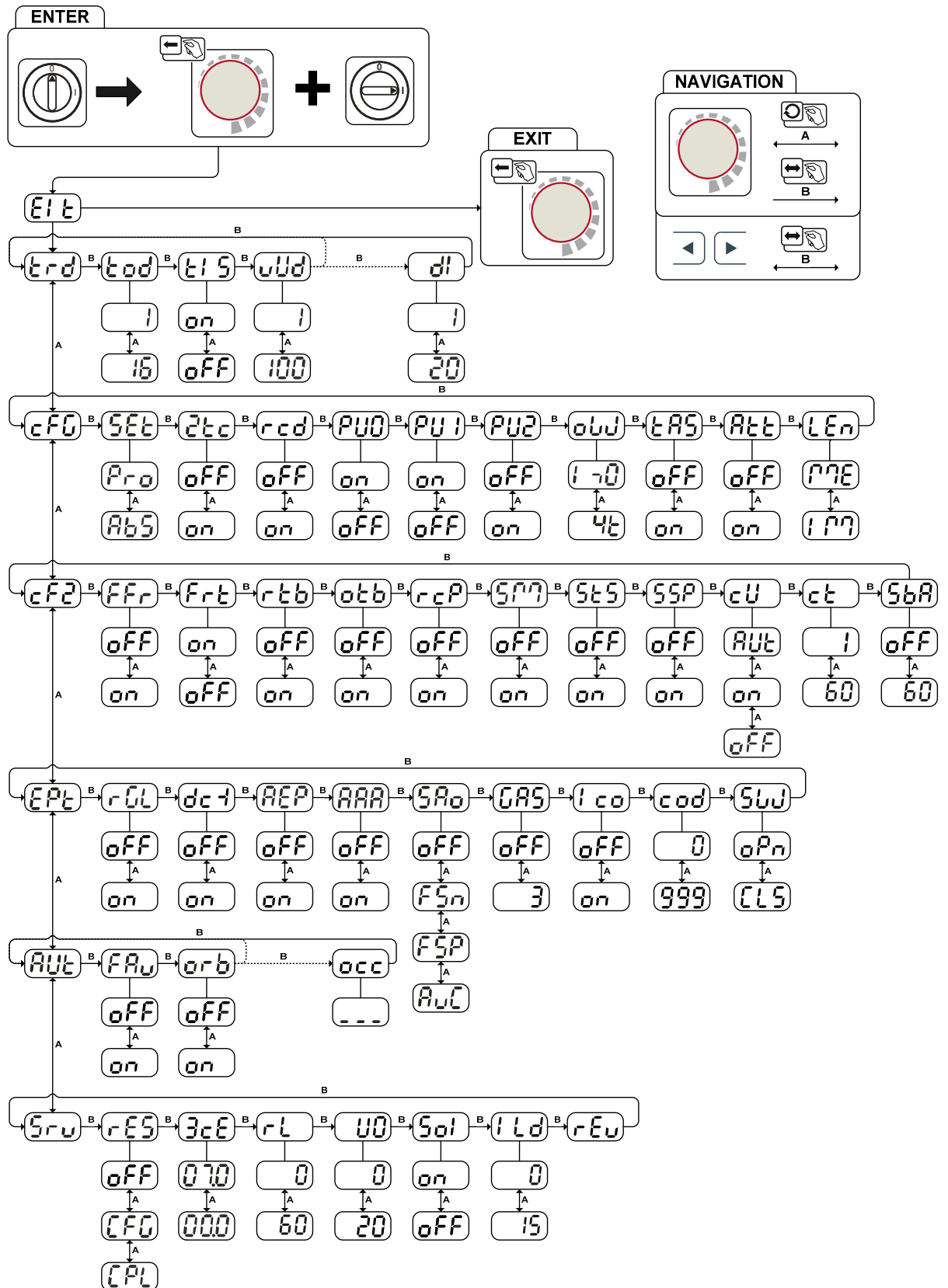


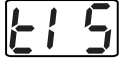



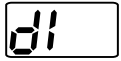
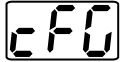
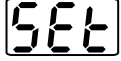


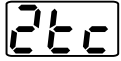


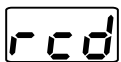








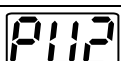










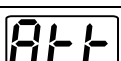


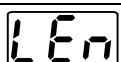


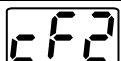



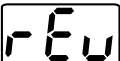
Figure 3-47

| Display | Setting/selection |
|-------------|-----------------------|
| El t | Exit the menu Exit |

| Display | Setting/selection |
|---|---|
|  | Torch configuration menu Set welding torch functions |
|  | Torch mode (ex works 1) |
|  | Alternative welding start – tapping start Available from torch mode 11 and upwards (welding stop by tapping to remains active).  ----- Function enabled (ex works)  ----- Function disabled |
|  | Up/down speed Numerical setting 1–100 (ex works 10). Increase value > rapid current change Decrease value > slow current change |
|  | Setting the first increment Numerical setting 1–20 (ex works 1) |
|  | Machine configuration Settings for machine functions and parameter display |
|  | Welding current display (start, secondary, end and hot start current)  ----- Welding current display as a percentage of the main current (ex works)  ----- Absolute welding current display |
|  | Non-latched operation (version C)  ----- Function enabled  ----- Function disabled (ex works) |
|  | Current display switching (MMA)  ----- Actual value display  ----- Nominal value display (ex works) |
|  | Pulsed TIG welding (thermic) in the upslope and downslope phases  ----- Function enabled (ex works)  ----- Function disabled |
|  | MMA pulse shape  ----- Average value MMA pulse welding (ex works)  ----- MMA pulse welding |
|  | TIG pulse shape (metallurgical)  ----- Average value metallurgical pulsing active  ----- Metallurgical pulsing active (ex works) |
|  | Filler wire welding, operating mode  ----- Filler wire operation for automated applications, wire is fed when current flows  ----- Non-latched operating mode (ex works)  ----- 3rd cycle operating mode  ----- Latched operating mode |
|  | TIG antistick > see 3.1.5 chapter  ----- function active (factory setting).  ----- function inactive. |
|  | Show warnings  ----- Function disabled (ex works)  ----- Function enabled |
|  | Setting the system of units  ----- Units of length in mm, m/min. (metric system)  ----- Unit of length in inches, ipm (imperial system) |
|  | Machine configuration (second part) Settings for machine functions and parameter display |

| Display | Setting/selection |
|------------|---|
| FFr | Ramp function foot-operated remote control <input type="checkbox"/> on -----Welding current rises to the specified main current level in a ramp function <input type="checkbox"/> off -----Welding current immediately jumps to the specified main current level |
| Frt | Foot-operated remote control response behaviour <input type="checkbox"/> lin -----Linear response behaviour <input type="checkbox"/> log -----Logarithmic response behaviour (lower welding currents controlled more effectively) |
| rtb | Tungsten balling with RT AC remote control <input type="checkbox"/> off -----Function switched off (factory setting) <input type="checkbox"/> on -----Function switched on (in addition, the "AC Balance" rotary knob at the RT AC remote control has to be turned to the left stop) |
| otb | Tungsten balling (old variant) <input type="checkbox"/> on -----Function enabled <input type="checkbox"/> off -----Function disabled (ex works) |
| rcP | Welding current polarity switching <input type="checkbox"/> on -----polarity switching at the RT PWS 1 19POL remote control (ex works) <input type="checkbox"/> off -----polarity switching at the welding machine control |
| SPn | spotMatic operating mode > see 3.1.3.5 chapter <input type="checkbox"/> on -----Function enabled (ex works) <input type="checkbox"/> off -----Function disabled |
| StS | Spot time setting <input type="checkbox"/> on -----Short spot time, setting range 5 ms to 999 ms, increments of 1 ms (ex works) <input type="checkbox"/> off -----Long spot time, setting range 0.01 s to 20.0 s, increments of 10 ms (ex works) |
| SSP | Process activation setting <input type="checkbox"/> on -----Separate process activation <input type="checkbox"/> off -----Permanent process activation (ex works) |
| cu | Torch cooling mode <input type="checkbox"/> aut -----Automatic operation (ex works) <input type="checkbox"/> on -----Permanently enabled <input type="checkbox"/> off -----Permanently disabled |
| ct | Welding torch cooling post-flow time Setting 1–60 min (ex works 5) |
| SbA | Time-based power-saving mode > see 3.4 chapter 5 min.–60 min. = Time to activation of power-saving mode in case of inactivity. <input type="checkbox"/> off -----inactivated |
| EPl | Expert menu |
| rcL | AC average value controller <input type="checkbox"/> on -----Function enabled (ex works) <input type="checkbox"/> off -----Function disabled |
| dc1 | Welding current polarity switch (dc+) with TIG DC <input type="checkbox"/> on -----Polarity switch released <input type="checkbox"/> off -----Polarity switch blocked; protects the tungsten electrode from being permanently damaged (ex works). |
| ACP | Reconditioning pulse (tungsten ball stability) <input type="checkbox"/> on -----Function enabled (ex works) <input type="checkbox"/> off -----Function disabled |
| AAA | activArc voltage measuring <input type="checkbox"/> on -----Function enabled (ex works) <input type="checkbox"/> off -----Function disabled |

| Display | Setting/selection |
|------------|---|
| SAd | Error output to interface for automated welding, contact SYN_A <input type="checkbox"/> FF----- AC synchronisation or hot wire (ex works) <input type="checkbox"/> Sn----- Error signal, negative logic <input type="checkbox"/> SP----- Error signal, positive logic <input type="checkbox"/> Av----- AVC (Arc voltage control) connection |
| GAS | Gas monitoring Depending on where the gas sensor is situated, the use of a pilot static tube and the welding process monitoring phase. <input type="checkbox"/> FF----- Function disabled (ex works). <input type="checkbox"/> 1----- Monitoring during the welding process. Gas sensor between gas valve and welding torch (with pilot static tube). <input type="checkbox"/> 2----- Monitoring prior to the welding process. Gas sensor between gas valve and welding torch (without pilot static tube). <input type="checkbox"/> 3----- Permanent monitoring Gas sensor between gas cylinder and gas valve (with pilot static tube). |
| lco | AC commutation optimisation <input type="checkbox"/> on----- Function enabled <input type="checkbox"/> FF----- Function disabled (ex works) |
| cod | Access control – access code Setting: 0 to 999 (0 ex works) |
| SLU | Enable/disable access control <input type="checkbox"/> Pn----- Access control disabled (ex works) <input type="checkbox"/> LS----- Access control enabled |
| AUT | Automation menu |
| FAU | Fast take-over of control voltage (automation) <input type="checkbox"/> on----- Function enabled <input type="checkbox"/> FF----- Function disabled (ex works) |
| orb | Orbital welding <input type="checkbox"/> FF----- Function disabled (ex works) <input type="checkbox"/> on----- Function enabled |
| occ | Orbital welding Correction value for orbital current |
| Srv | Service menu Any changes to the service menu should be agreed with the authorised service personnel. |
| rES | Reset (to factory setting) <input type="checkbox"/> FF----- Disabled (ex works) <input type="checkbox"/> FD----- Reset the values in the machine configuration menu <input type="checkbox"/> PL----- Complete reset of all values and settings Resetting is performed when exiting the menu (EIE). |
| 070 | Software version query (example) 07.=----- system bus ID |
| 3c0 | 03c0= --- version number System bus ID and version number are separated by a dot. |
| rL | Only qualified service personnel may change the parameters! |
| U0 | Only qualified service personnel may change the parameters! |
| SoI | Soft ignition <input type="checkbox"/> on----- Function enabled (ex works) <input type="checkbox"/> FF----- Function disabled |

| Display | Setting/selection |
|---|--|
|  | Ignition pulse limit Setting 0 ms–15 ms (increments of 1 ms) |
|  | PCB state – qualified service personnel only! |

4 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.

4.1 Warnings (power source)


- A warning is denoted by the letter A on the machine display, or Att in case of multiple machine displays. The possible cause of the warning is signalled by the respective warning code (see table).**
- The display of possible warning numbers depends on the machine version (interfaces/functions).**
- In case of multiple warnings, these are displayed in sequence.
 - Document machine warning and inform service personnel, if required.

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

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

| Welding machine control | Smart | Classic | Comfort | Comfort 2 | Synergic |
|-------------------------|-------|---------|------------------------|--------------------|-----------------------------|
| Push-button | | | AMP VOLT JOB | kW V JOB | VOLT JOB PROG |

4.2 Error messages (power source)

 **A welding machine error is indicated by the collective fault signal lamp (A1) lighting up and an error code (see table) being displayed in the machine control display. In the event of a machine error, the power unit shuts down.**

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

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

| Error message | Possible cause | Remedy |
|---------------|---|--|
| Err 3 | Speedometer error | Check wire guide/hose package |
| | Wire feeder is not connected | <ul style="list-style-type: none"> • Switch off cold wire mode in the device configuration menu (off status) • Connect the wire feeder |
| Err 4 | Temperature error | Allow the machine to cool down |
| | Error in emergency stop circuit (interface for automated welding) | <ul style="list-style-type: none"> • Check the external interrupt equipment • Check jumper JP 1 on PCB T320/1 |
| Err 5 | Overvoltage | Switch off machine and check the mains voltage |
| Err 6 | Low voltage | |
| Err 7 | Coolant error (with connected cooling unit only) | Check coolant level and refill if necessary |
| Err 8 | Gas error | Check gas supply |
| Err 9 | Secondary overvoltage | Switch machine off and on again, inform the service department if the error continues |
| Err 10 | PE error | |
| Err 11 | FastStop position | Edge 'Acknowledge error' signal (0 to 1) via robot interface (if available) |
| Err 12 | VRD error | Switch the machine off and on again. If the error persists, inform the service dept. |
| Err 16 | Pilot arc current | Check welding torch |
| Err 17 | Cold wire error Excess current limit of a motor control card has been triggered Cold wire error – a permanent deviation between wire nominal value and actual value or a blocked drive has been detected in the process | Inspect the wire feed system (drives, tube packages, torch): <ul style="list-style-type: none"> • Check cold wire on the torch / work piece (moved against work piece?) • Check relation of process wire feed speed to robot travel speed, and correct if necessary • Check wire feed for stiffness with wire inching function (resolve by checking wire guides section by section) Reset error via robot interface (reset error) |
| Err 18 | Plasma gas error Nominal value significantly different from actual value -> No plasma gas? | <ul style="list-style-type: none"> • Check plasma gas supply; use the plasma gas test function on "cold wire feed unit" if necessary • Check guiding / connections of the gas supply hose for leaks / kinks • Check that the gas supply lead of the plasma torch is not blocked Reset error via robot interface (reset error) |
| Err 19 | Shielding gas Nominal value significantly different from actual value -> No shielding gas? | |

| Error message | Possible cause | Remedy |
|---------------|--|---|
| Err 20 | Coolant The flow quantity of the torch coolant has fallen below the permissible minimum -> the coolant flow is dirty or cut off because the tube package has been unsuitably installed The flow quantity of the torch coolant has fallen below the permissible level | Check coolant level and refill if necessary <ul style="list-style-type: none"> Check coolant level in the reverse cooler Check coolant lines for leaks and kinks Check that the coolant inlet and outlet on the plasma torch is not blocked Reset error via robot interface (reset error) |
| Err 22 | Excess temperature in coolant circuit Coolant temperature exceeded The temperature of the coolant is too high | <ul style="list-style-type: none"> Check coolant level in the reverse cooler Check temperature nominal value on the cooling unit Reset error via robot interface (reset error) |
| Err 23 | HF choke excess temperature High frequency blocking inductor excess temperature The excess temperature of the high frequency blocking inductor has triggered | <ul style="list-style-type: none"> Allow equipment to cool down Adjust processing cycle times if necessary Reset error via robot interface (reset error) |
| Err 24 | Pilot arc ignition error | Check plasma torch replacement parts |
| Err 32 | Electronics error (I>0 error) | Switch the machine off and on again. If the error persists, inform the service dept. |
| Err 33 | Electronics error (Uactual error) | |
| Err 34 | Electronics error (A/D channel error) | |
| Err 35 | Electronics error (edge error) | |
| Err 36 | Electronics error (S sign) | |
| Err 37 | Electronics error (temperature error) | Allow machine to cool down. |
| Err 38 | --- | Switch the machine off and on again. If the error persists, inform the service dept. |
| Err 39 | Electronics error (secondary overvoltage) | |
| Err 40 | Electronic error (I>0 error) | Inform service |
| Err 48 | Ignition error | Check welding process |
| Err 49 | Arc interruption | Inform the Service department |
| Err 51 | Error in emergency stop circuit (interface for automated welding) | <ul style="list-style-type: none"> Check the external interrupt equipment Check jumper JP 1 on PCB T320/1 |
| Err 57 | Auxiliary drive error, tacho error | Check auxiliary drive No signal from tachometer. M3.51 defective > Inform service |

4.3 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 **RE5** in the service menu **Srv**.

> see 3.7 chapter

4.4 Display machine control software version



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

Select the "software version query" sub-item in the service menu **Srv** to view the machine control software version.

> see 3.7 chapter











5 Appendix A

5.1 Parameter overview – setting information

5.1.1 TIG welding

| Parameter TIG/plasma | Display | | Setting range | | | Comment |
|------------------------------|---------|------|---------------|------|---------|--|
| | Code | Unit | Standard | Min. | Max. | |
| Main current | 1 1 | A | | 5 | - 300 | |
| Gas pre-flow time | GPp | s | 0,5 | 0 | - 20 | |
| Ignition current AMP% | 1 5t | % | 20 | 1 | - 200 | % of main current AMP |
| Start time | t 5t | s | 0,01 | 0,00 | - 20,0 | |
| Up-slope time | tUP | s | 1,0 | 0,0 | - 20,0 | |
| Pulse current | 1 PL | % | 140 | 1 | 200 | |
| Pulse time | t 1 | s | 0,01 | 0,00 | - 20,0 | |
| Slope time | t 5 1 | s | 0,00 | 0,00 | - 20,0 | Time from main current AMP to secondary current AMP% |
| Secondary current AMP% | 1 2 | % | 50 | 1 | 200 | % of main current AMP |
| Pulse pause time | t 2 | s | 0,01 | 0,00 | - 20,0 | |
| Slope time | t 5 2 | s | 0,00 | 0,00 | - 20,0 | Time from main current AMP to secondary current AMP% |
| Down-slope time | t dn | s | 1,0 | 0,0 | - 20,0 | |
| End current AMP% | 1 Ed | % | 20 | 1 | - 200 | % of main current AMP |
| End current time | t Ed | s | 0,01 | 0,00 | - 20,0 | |
| Gas post-flow time | GPo | s | 8 | 0,0 | - 40,0 | |
| Electrode diameter, metric | ndA | mm | 2,4 | 1,0 | - 4,0 | |
| Electrode diameter, imperial | ndA | mil | 92 | 40 | - 160 | |
| spotArc time | t P | s | 2 | 0,01 | - 20,0 | |
| spotmatic time (5t5 > on) | t P | ms | 200 | 5 | - 999 | |
| spotmatic time (5t5 > off) | t P | s | 2 | 0,01 | - 20,0 | |
| AC balance (JOB 0) | bAL | % | | -30 | - +30 | Rotary knob |
| AC balance (JOB 1-7) | bAL | % | | 1 | - 99 | |
| AC commutation optimisation | 1 co | | | 5 | - 375 | |
| Pulse balance | bAL | % | | 1 | - 99 | Pulsing, metallurgical |
| Pulse frequency | FrE | Hz | 50 | 5 | - 15000 | Pulsing, metallurgical |
| AC frequency (JOB 0) | FrE | Hz | - | 30 | - 300 | |
| AC frequency (JOB 1-7) | FrE | Hz | 50 | 30 | - 300 | |
| activArc | Arc | | | 0 | - 100 | |
| Amplitude balance | AbA | | | 70 | - 130 | |

5.1.2 MMA welding
Parameter
MMA

| | Display | | Setting range | | Comment |
|---------------------|---|------|---------------|----------------|---|
| | Code | Unit | Standard | Min. Max. | |
| Main current |  | A | | 5 - 300 | |
| Hot start current |  | % | 120 | 1 - 200 | % of main current AMP (parameter  to setting ) |
| Hot start time |  | s | 0.5 | 0.0 - 10.0 | |
| Arcforce |  | | 0 | -40 - 40 | |
| Pulse pause current |  | % | 50 | 1 - 200 | |
| Pulse current |  | | 142 | 1 - 200 | |
| Pulse frequency |  | Hz | 1.2 | 0.2 - 500 | |
| Pulse balance |  | | 30 | 1 - 99 | |

6 Appendix B

6.1 Overview of EWM branches

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