Operating instructions

EN

Control

T 4.04/4.10 - AC/DC Smart 2.0

099-00T404-EW501 | Observe additional system documents! | 10.11.2017

General instructions

⚠ WARNING

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

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

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

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

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

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

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Germany

1 Contents

2 For your safety

2.1 Notes on the use of these operating instructions

⚠ DANGER

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

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

⚠ WARNING

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

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

⚠ CAUTION

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

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

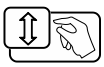
☞ ***Special technical points which users must observe.***

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

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

2.2 Explanation of icons

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

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

2.3 Part of the complete documentation

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

The illustration shows a general example of a welding system.

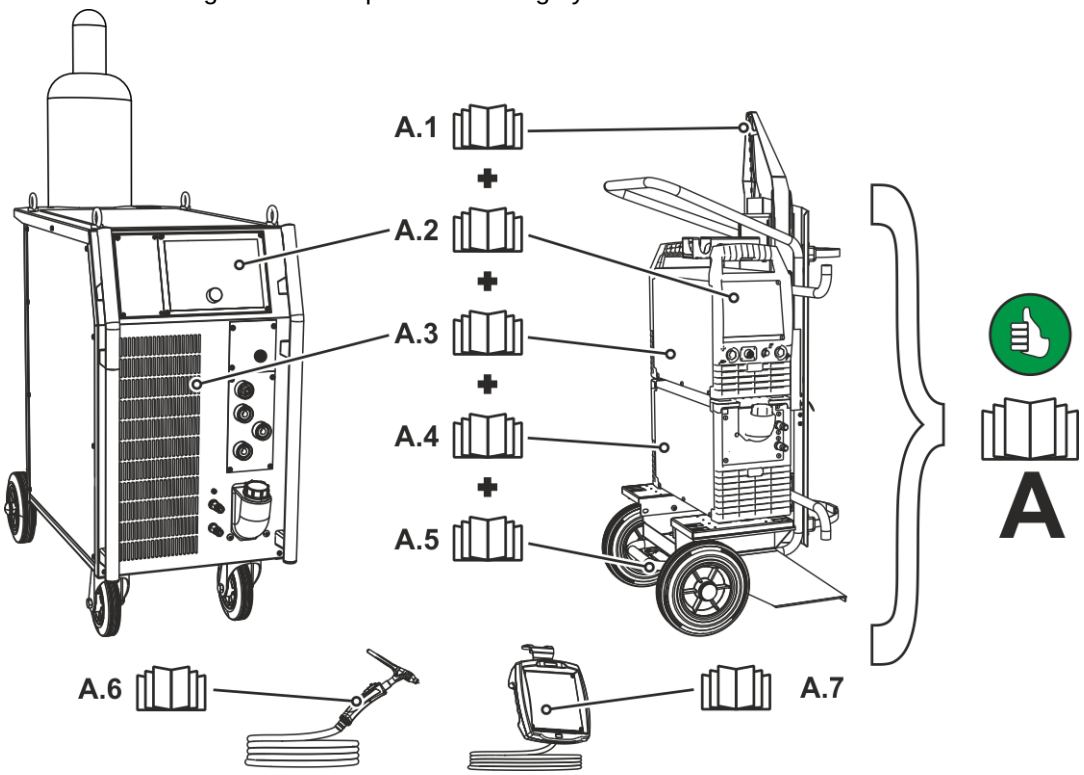


Figure 2-1

Item	Documentation
A.1	Options conversion instructions
A.2	Control
A.3	Power source
A.4	Cooling unit, voltage converter, tool box etc.
A.5	Transport cart
A.6	Welding torch
A.7	Remote control
A	Complete documentation

3 Machine control – Operating elements

3.1 Overview of control sections

☞ ***For description purposes, the machine control has been divided into two sections (A, B) to ensure maximum clarity. The setting ranges for the parameter values are summarised in the parameter overview section > see 6.1 chapter.***

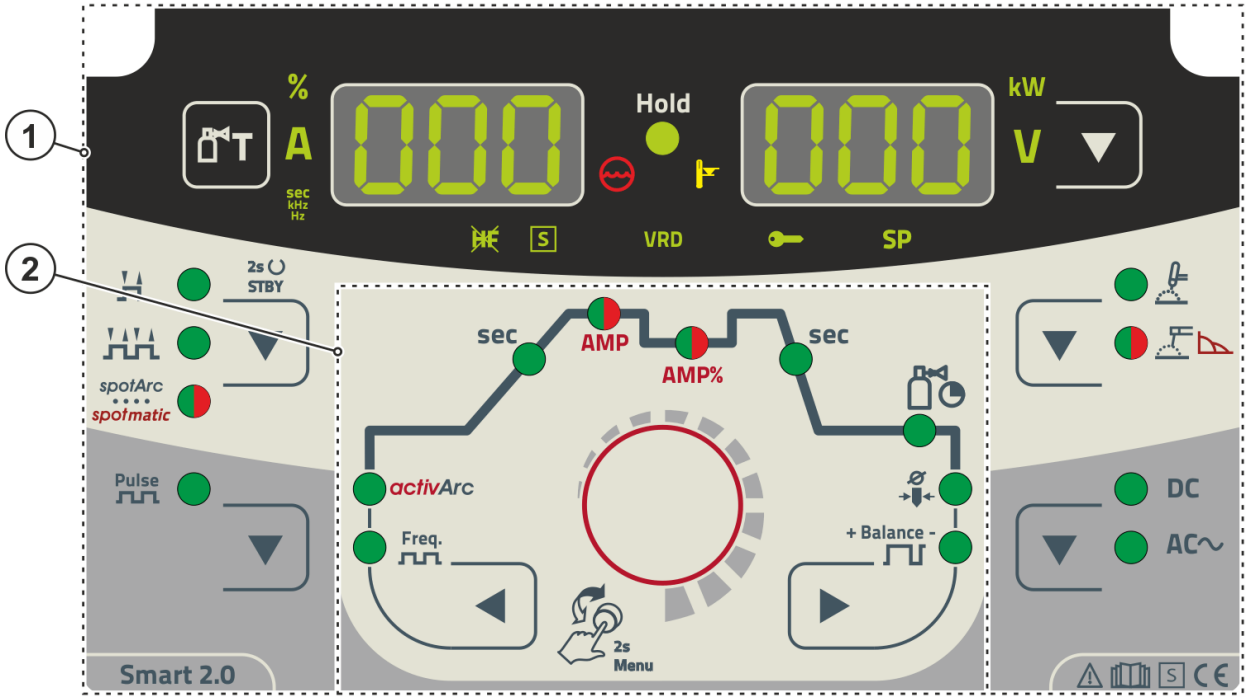


Figure 3-1

Item	Symbol	Description
1		**Control section A** *> see 3.1.1 chapter*
2		**Control section B** *> see 3.1.2 chapter*

3.1.1 Control section A

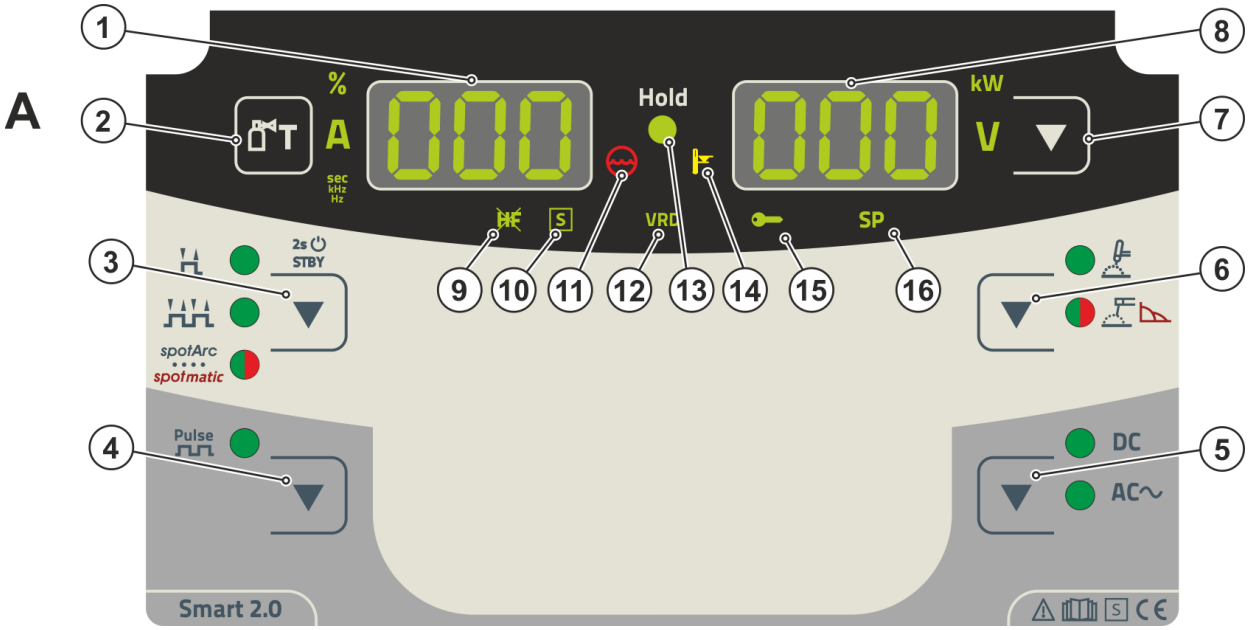


Figure 3-2

Item	Symbol	Description
1	000	**Welding data display (3-digit)** Displays the welding parameters and the corresponding values > *see 3.2 chapter*
2		**Push-button gas test / rinse hose package > *see 4.1.1 chapter***
3		**Operating mode > *see 4.1.5 chapter* / power-saving mode push-button > *see 4.3 chapter*** 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		**Pulsed welding push-button** TIG pulsed welding > *see 4.1.6 chapter* MMA pulsed welding > *see 4.2.5 chapter*
5		**Welding current polarity push-button** DC DC welding with negative polarity at the torch (or electrode holder) with respect to the workpiece. AC Alternating current welding/alternating current forms > *see 4.1.3.3 chapter*
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
8	000	**Welding data display (3-digit)** Displays the welding parameters and the corresponding values > *see 3.2 chapter*
9		**TIG ignition type signal light** Signal light on: Lift arc ignition active/HF start off. You can switch the ignition type in the Expert menu (TIG) > *see 4.1.11 chapter*.

Item	Symbol	Description
10	S	**Character S function signal light** Indicates that it is possible to weld in an environment with major electric hazards, such as in boilers. Service must be informed if this signal light is not on.
11		**Coolant fault signal light** Signals pressure loss or low coolant level in the coolant circuit.
12	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) > *see 4.5 chapter*. The voltage reduction device is only active on VRD machine versions.
13	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
14		**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.
15		**Access control active signal light** Signal light is on when access control is active on the machine control > *see 4.4 chapter*.
16		**Without function in this machine version.**

3.1.2 Control section B

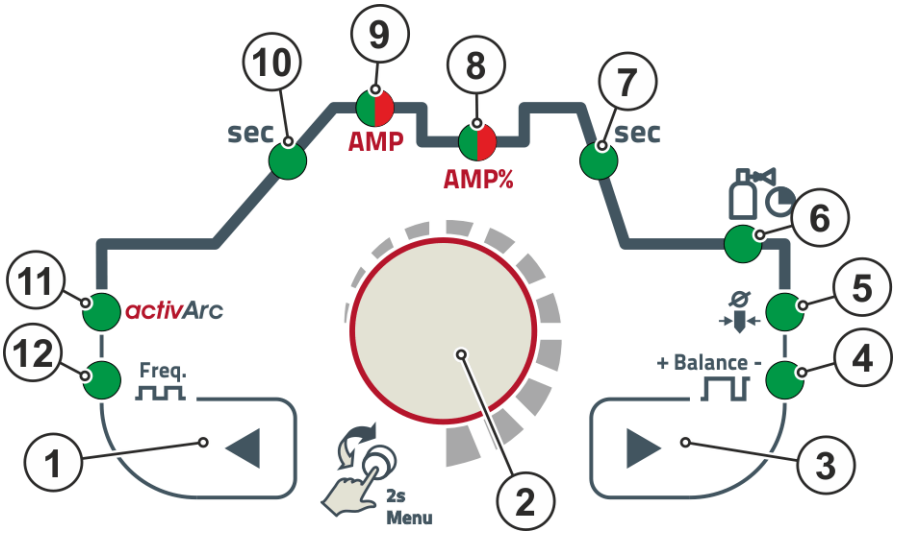


Figure 3-3

Item	Symbol	Description
1	◀	**Parameter selection push-button, left** The welding sequence parameters are selected one after another in an anti-clockwise direction.
2		**Control button** Central control button to be pressed or turned > *see 3.3 chapter*.
3	▶	**Parameter selection push-button, right** The welding sequence parameters are selected one after another in a clockwise direction.
4	+ Balance -	**Balance signal light bAL** Pulse balance

Item	Symbol	Description
5		**Electrode diameter signal light** ndA Ignition optimisation (TIG)/tungsten balling basic setting
6		**Gas post-flow time** CPt
7	**sec**	**Down-slope time** tdn **signal light**
8	**AMP%** **sec**	**Signal light, two colour** Red: Secondary or pulse pause current I 2 (% of AMP) Green: Pulse pause time t 2/slope time tS2 (Expert menu)
9	**AMP** **sec**	**Signal light, two colour** Red: Main or pulse current I 1 Green: Pulse time t 1/slope time tS1 (AMP to AMP%, Expert menu)
10	**sec**	**Signal light** Up-slope time tUP (TIG)
11	activArc	**Signal light activArc** AA ***> see 4.1.7 chapter***
12	Freq.	FrE **signal light**

3.2 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	☑	☑	☑
Parameter times	☑	☐	☐
Parameter currents	☑	☐	☐
Frequency, balance	☑	☐	☐
	"right display"		
Welding power	☐	☑	☑
Welding voltage	☑	☑	☑

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.

3.2.1 Setting the welding current (absolute/percentage)

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

> see 4.6 chapter

3.3 Operating the machine control

3.3.1 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. Depending on the selection, the right-hand display shows the welding voltage (V) nominal value or the welding power (kW) actual value. The control always switches back to the main screen after 4 sec. of inactivity.

3.3.2 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.

3.3.3 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 parameter value and signal light flash). Turn the button to set the parameter value.

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

Display	Meaning
	**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.

3.3.4 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 et 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.

3.3.5 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 4.6 chapter*.

4 Functional characteristics

4.1 TIG welding

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

- Slowly open the gas cylinder valve.
- Open the pressure regulator.
- Switch on the power source at the main switch.
- Set the relevant gas quantity for the application on the pressure regulator.
- The gas test can be activated at the machine control by pressing the "Gas test/purge "GT push-button > *see 3.1.1 chapter*.

Setting the shielding gas quantity (gas test)

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

Purging long hose packages (purging)

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

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

Setting instructions

Welding process	Recommended shielding gas quantity
MAG welding	Wire diameter x 11.5 = l/min
MIG brazing	Wire diameter x 11.5 = l/min
MIG welding (aluminium)	Wire diameter x 13.5 = l/min (100 % argon)
TIG	Gas nozzle diameter in mm corresponds to l/min gas throughput

Helium-rich gas mixtures require a higher gas volume!

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

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

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

4.1.1.1 Automatic gas post-flow

If the function is active, the gas post-flow time is defined by the machine control unit in dependence on power output. The defined gas post-flow time can also be adjusted if required. This value is then saved for the current welding task. The automatic gas post-flow function can be activated or deactivated in the machine configuration menu > *see 4.6 chapter*.

4.1.2 Welding task selection

The setting of the tungsten electrode diameter has a direct influence on the machine functionality, TIG ignition behaviour and minimum current limits. The ignition energy is controlled by the set electrode diameter. Smaller electrode diameters requires less ignition current and less ignition current time than greater electrode diameters. The set value should correspond to the tungsten electrode diameter. The value can also be set to meet individual requirements, e.g. for thin panels a smaller diameter is recommended to reduce the ignition energy.

The electrode diameter setting determines the minimum current limit, which in turn affects the ignition, main and secondary current. The minimum current limits have a positive effect on the ignition behaviour and ensure a very high arc stability for each electrode diameter selected. The minimum current limit function is enabled ex works, but can be disabled with parameter cLI in the machine configuration menu > *see 4.6 chapter*.

For foot-operated remote control mode, minimum current limits are disabled by default.

The following welding task is an example of use:

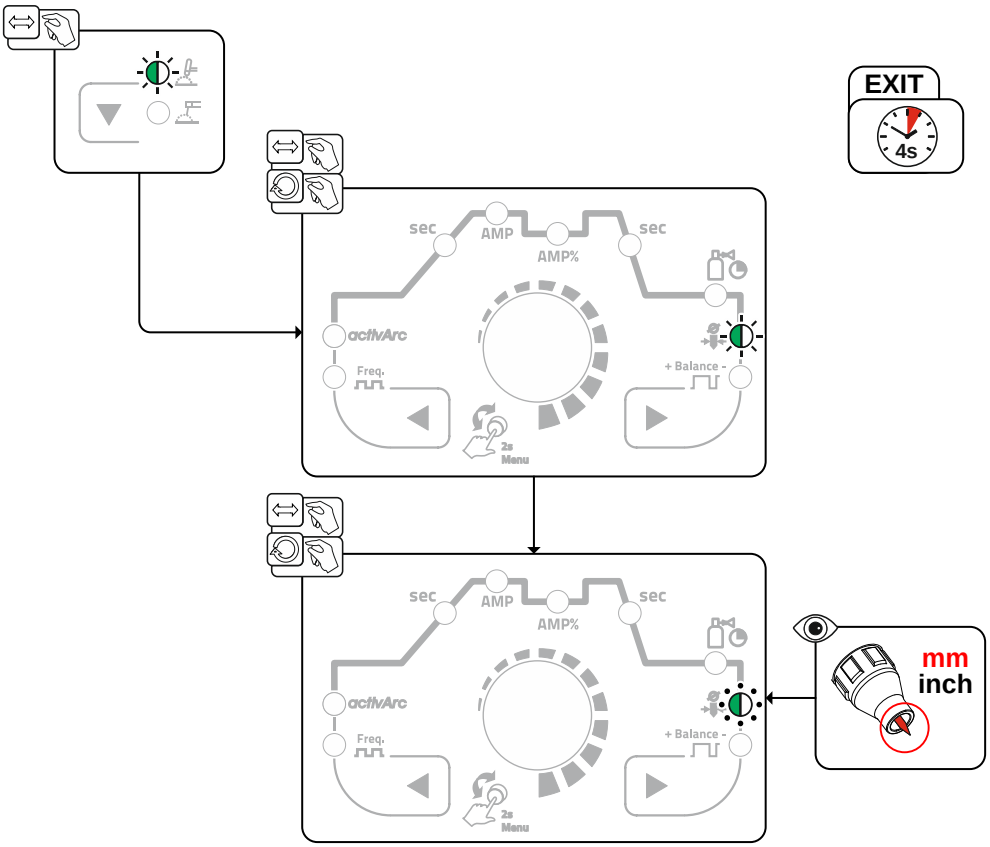


Figure 4-1

4.1.3 AC welding

4.1.3.1 AC balance (optimise cleaning effect and penetration characteristics)

To weld aluminium and aluminium alloys, AC welding is used in combination with a continuous change in polarity of the tungsten electrode. The process encompasses two phases (half-waves): a positive and a negative one. The positive phase cracks the aluminium oxide layer on the material surface (so called cleaning effect).

At the same time, tungsten balling occurs at the tip of the tungsten electrode. The size of this balled end depends on the length of the positive phase. Please note that an excessively big balled end will cause the arc to become unstable and diffuse, with low penetration. In the negative phase, the tungsten electrode is cooled and the required penetration is realised. Make sure to select the correct durations (balance) for positive phase (cleaning effect, balled end size) and negative phase (penetration depth) by setting the AC balance. The default (zero setting) balance setting is 65%, referring to the duration of the negative half-wave.

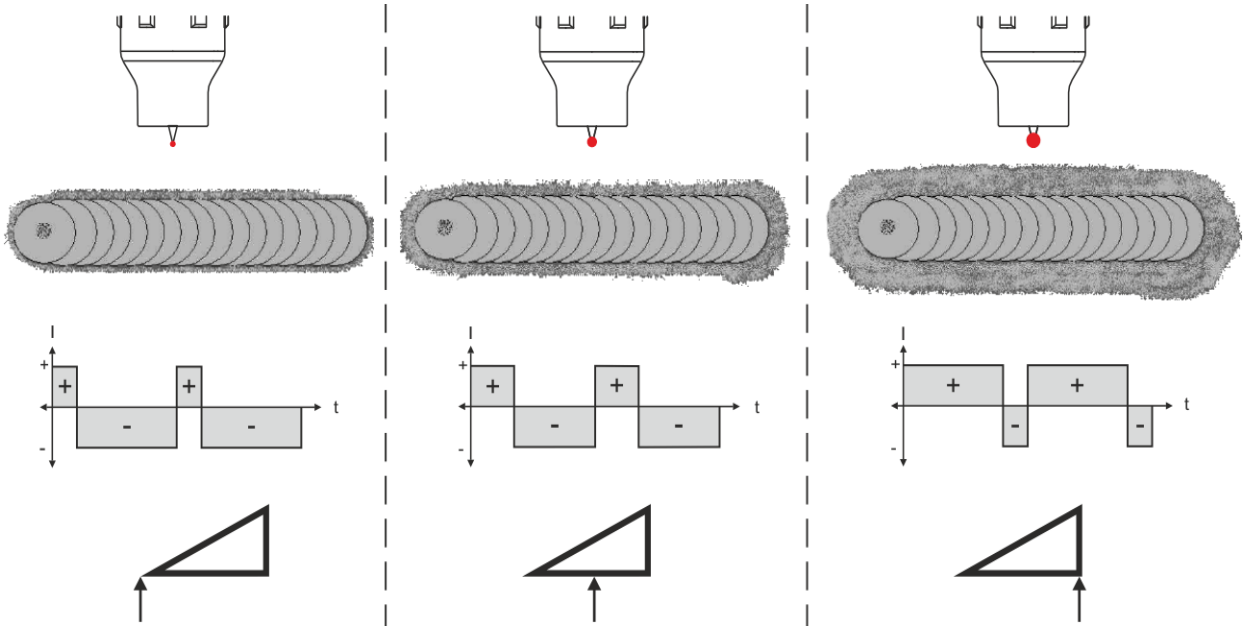


Figure 4-2

4.1.3.2 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 Aco parameter must first be switched on in the machine configuration menu > *see 4.6 chapter*. The parameter value can then be selected and set in the Expert menu > *see 4.1.11 chapter*.

4.1.3.3 Alternating current waveforms

Selection

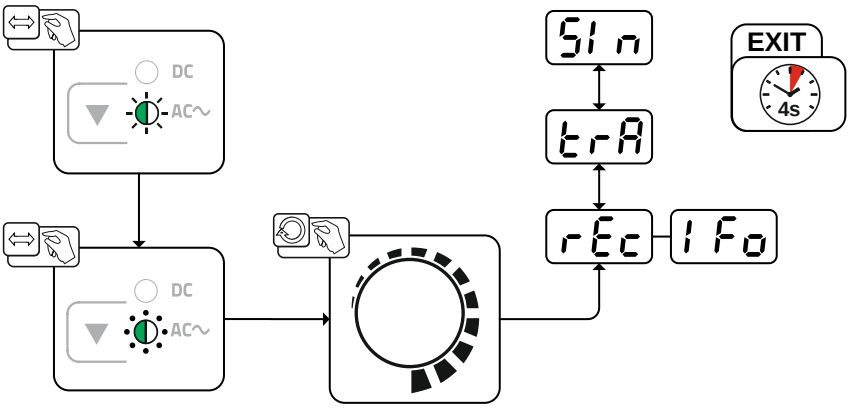


Figure 4-3

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

[1] for AC welding machines only.

4.1.4 Arc ignition

To change the ignition type, use parameter HF to switch between HF start (on) and lift arc (oFF) in the Expert menu > *see 4.1.11 chapter*.

4.1.4.1 HF ignition

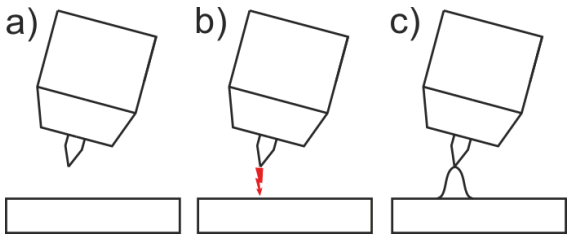


Figure 4-4

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

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

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

4.1.4.2 Liftarc

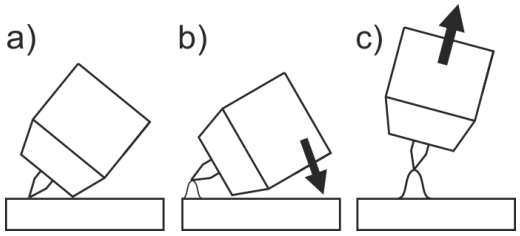


Figure 4-5

The arc is ignited on contact with the workpiece:

a) Carefully place the torch gas nozzle and tungsten electrode tip onto the workpiece and press the torch trigger (liftarc current flowing, regardless of the main current set).

b) Incline the torch over the torch gas nozzle to produce a gap of approx. 2-3 mm between the electrode tip and the workpiece. The arc ignites and the welding current is increased, depending on the operating mode set, to the ignition or main current set.

c) Lift off the torch and swivel to the normal position.

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

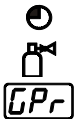
4.1.4.3 Automatic cut-out

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

- During ignition
  5 s after the start of the welding process, no welding current flows (ignition error).
- During welding
  The arc is interrupted for more than 5 s (arc interruption). You can disable or set the time for re-ignition after an arc interruption in the machine configuration menu > *see 4.6 chapter* (parameter ILEA). If the machine offers storable welding tasks (JOB), you can define the times for each JOB separately (software PC 300).

4.1.5 Operating modes (functional sequences)

4.1.5.1 Explanation of symbols

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

4.1.5.2 Non-latched mode

Selection

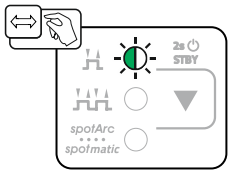


Figure 4-6

Sequence

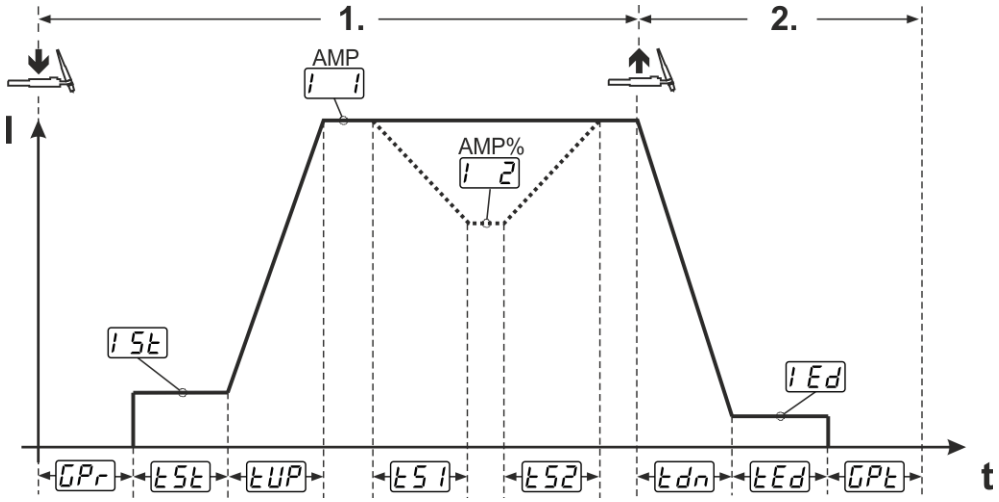


Figure 4-7

1st cycle:

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

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

If torch trigger 2 is released, the welding current increases again to the main current AMP in the set slope time t S2. The parameters t S1 and t S2 can be set in the Expert menu (TIG) > *see 4.1.11 chapter*.

2nd cycle:

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

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

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

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

4.1.5.3 Latched mode

Selection

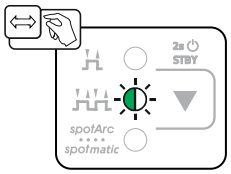


Figure 4-8

Sequence

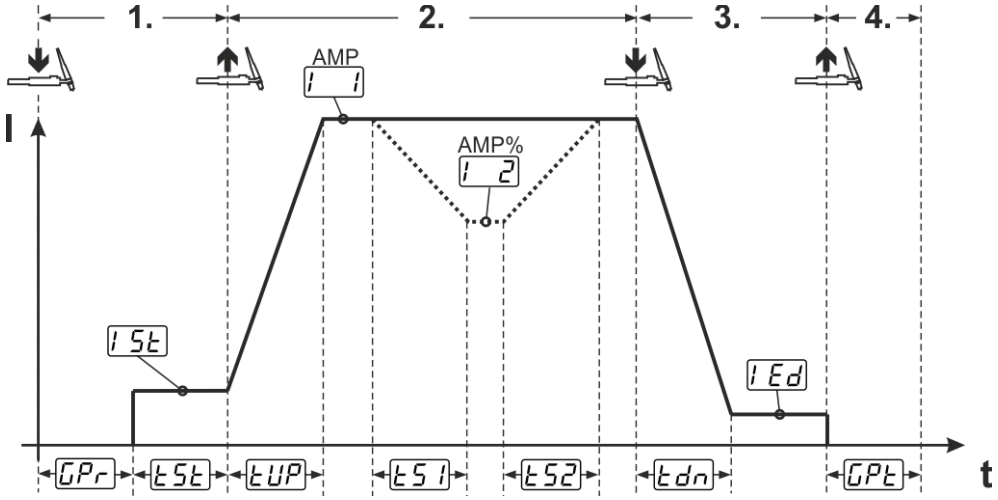


Figure 4-9

1st cycle

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

2nd cycle

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

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

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

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

Once 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) > *see 4.1.11 chapter*.

3rd cycle

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

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

4th cycle

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

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

Alternative welding start (tapping start):

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

To activate this function, set a two-digit torch mode (11-1x) at the machine control. This function can also be deactivated completely when required (welding stop by tapping remains active). To do so, the tPS parameter must be switched to oFF in the machine configuration menu > *see 4.6 chapter*.

4.1.5.4 spotArc

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

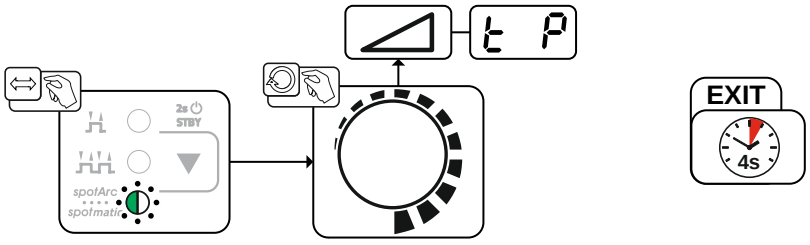


Figure 4-10

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

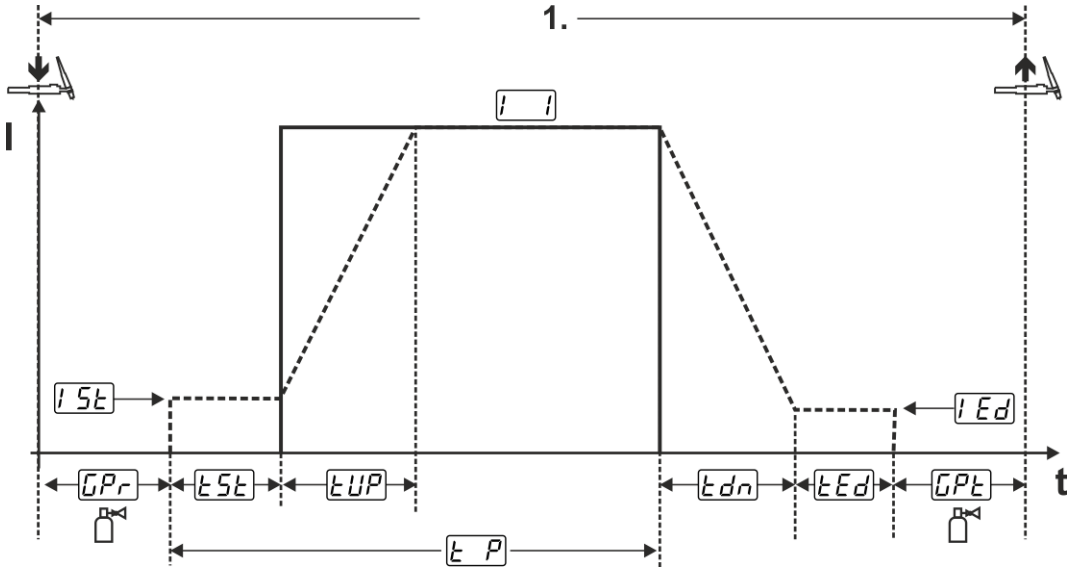


Figure 4-11

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however > *see 4.1.4 chapter*.

Sequence:

- Press torch trigger and hold down.
- The gas pre-flow time elapses.
- HF start pulses jump from the electrode to the workpiece. The arc ignites.

The welding current flows and immediately assumes the value of the ignition current I St

- HF switches off.
- The welding current ramps up to the main current I 1 (AMP) within the set up-slope time t UP.

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

4.1.5.5 spotmatic

In contrast to the spotArc operating mode, the arc is not ignited by pressing the torch trigger as is usual, but by briefly touching the tungsten electrode against the workpiece. The torch trigger is used for welding process activation. Activation is indicated by flashing of the spotArc/spotmatic signal light. The process can be activated separately for each spot or also on a permanent basis. The setting is controlled using the SSP process activation parameter in the configuration menu > *see 4.6 chapter*:

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

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

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

The duration is set in the machine configuration menu using parameter StS > *see 4.6 chapter*

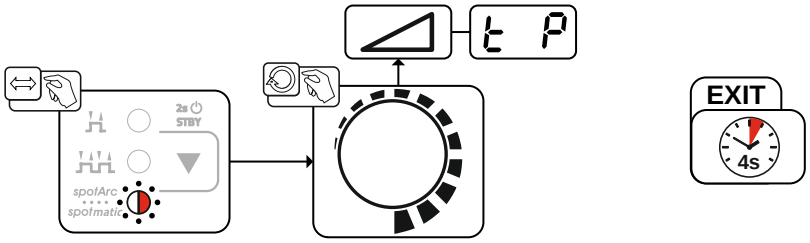


Figure 4-12

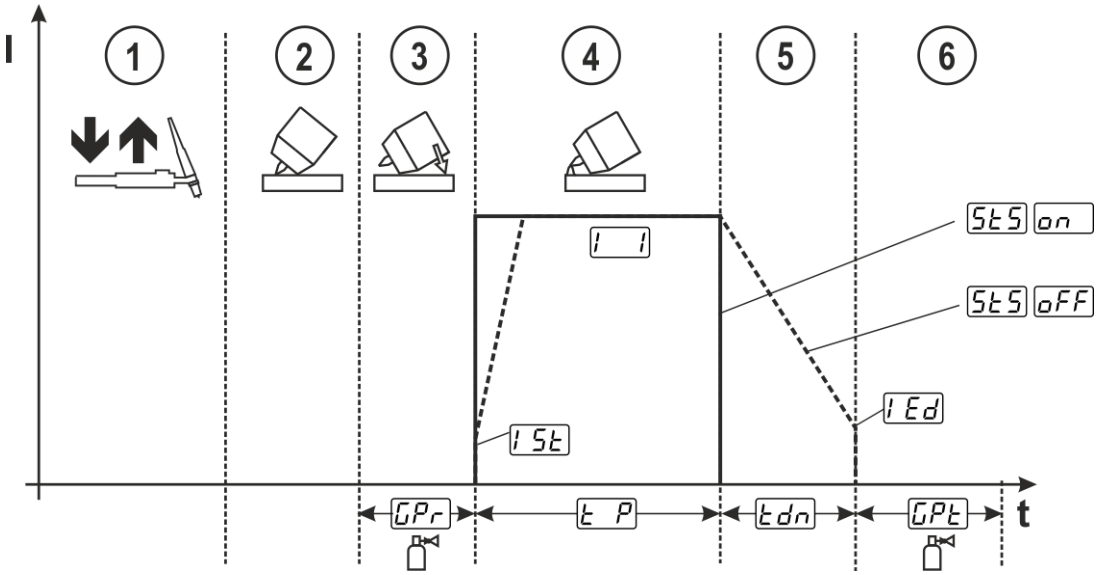


Figure 4-13

As an example the process is shown with HF ignition. Arc ignition with lift arc is also possible, however > *see 4.1.4 chapter*.

Selecting the process activation type for the welding process > *see 4.6 chapter*.

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

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

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

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

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

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

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

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

4.1.5.6 Non-latched operation, version C

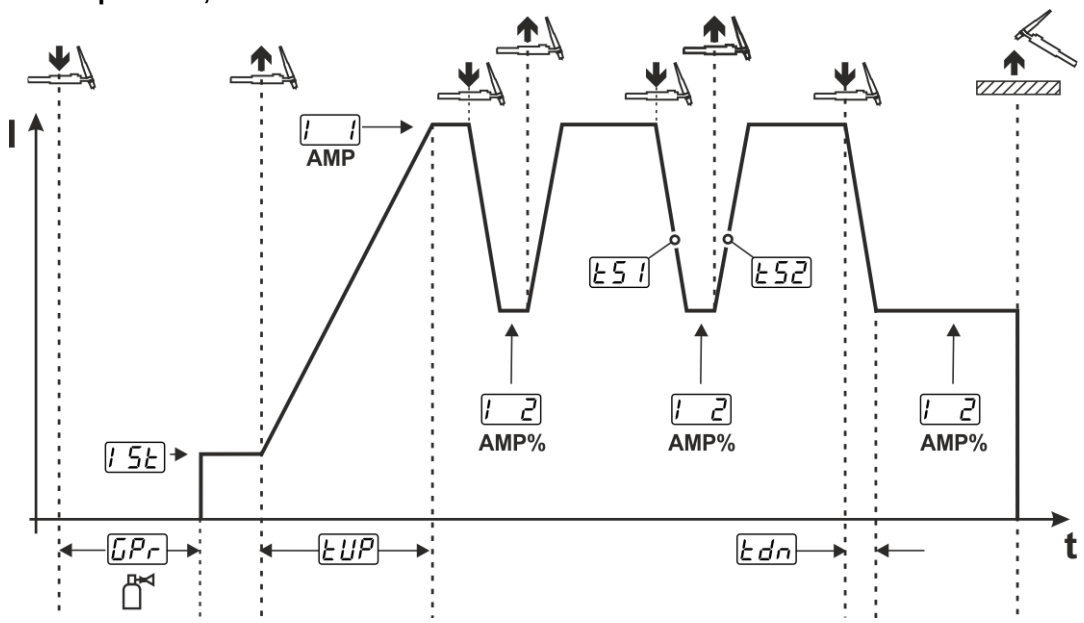


Figure 4-14

1st cycle

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

2nd cycle

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

Pressing torch trigger 1 starts the slope 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 stopped by interrupting the arc in the secondary current (remove the welding torch from the workpiece until the arc is extinguished, no re-ignition).
The slope times t S1 and t S2 can be set in the Expert menu > *see 4.1.11 chapter*.

☞ ***This operating mode must be enabled (parameter 2tc) > see 4.6 chapter.***

4.1.6 Average value pulse welding

Once the pulse function is activated, the red signal lights for the main current AMP and secondary current AMP% light up at the same time. Average value pulsing means that the system switches between two currents periodically, an average current value (AMP), a pulse current (Ipuls), a balance (bAL) and a frequency (FrE) having been defined first. The predefined ampere current average value is decisive, the pulse current (Ipuls) is defined by the IPL parameter as a percentage of the average current value (AMP).

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. For average value pulsing, the I 2 current is the secondary current only, activated with the torch trigger.

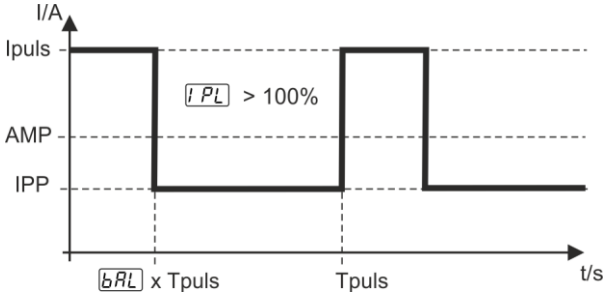


Figure 4-15

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

Ipuls = pulse current = IPL x AMP, e.g. 140% x 100 A = 140 A

IPP = pulse pause current

Tpuls = duration of one pulse cycle = 1/FrE, e.g. 1/100 Hz = 10 ms

bAL = balance

Selection

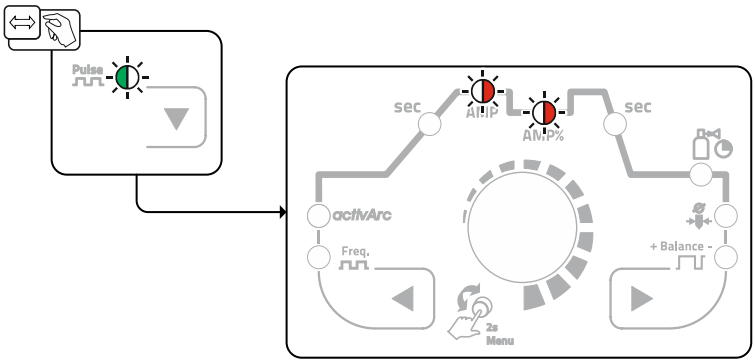


Figure 4-16

Pulse current

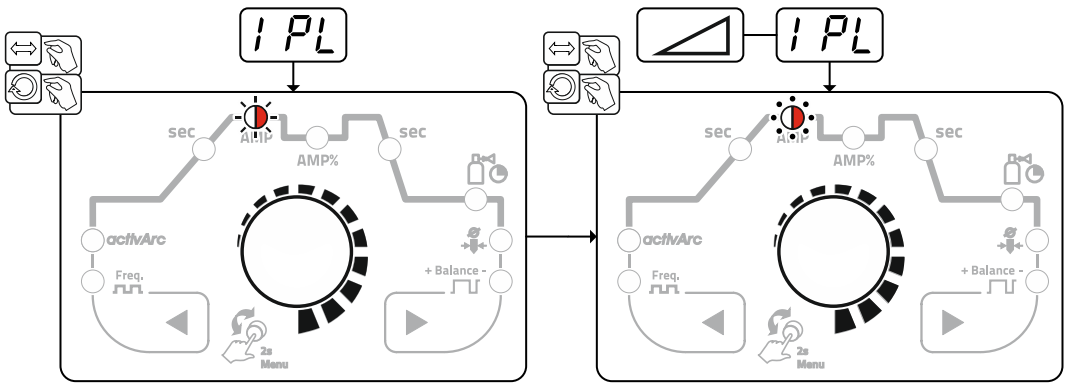


Figure 4-17

Pulse balance

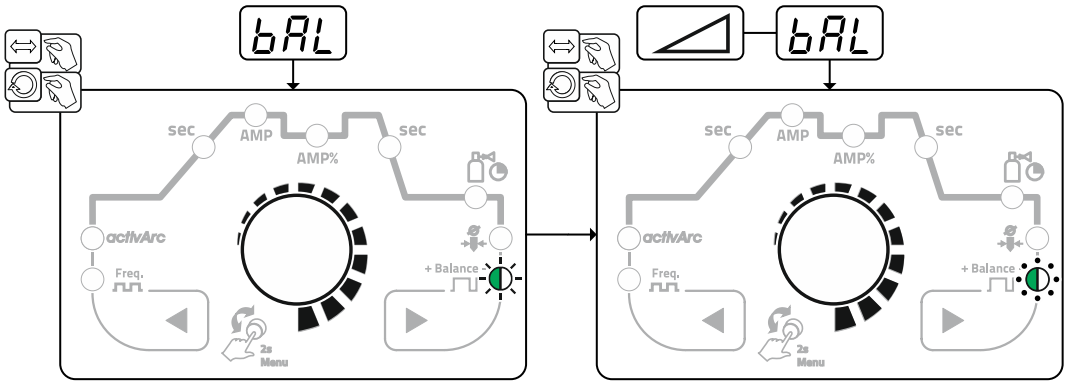


Figure 4-18

Pulse frequency

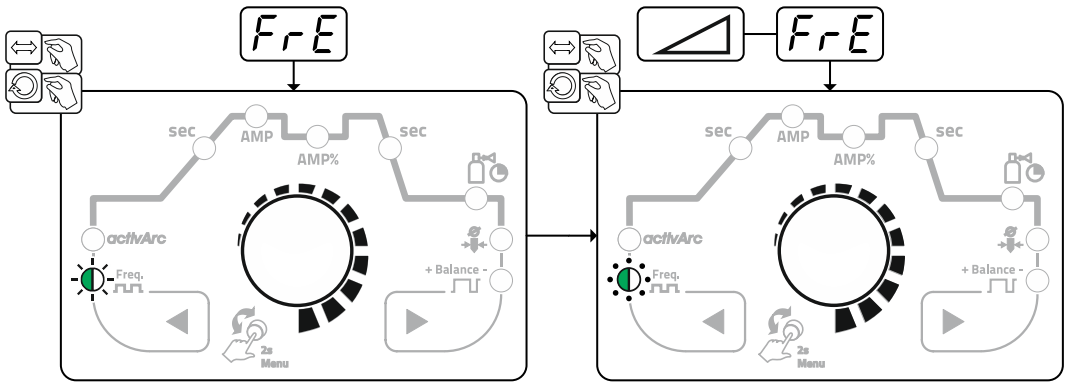


Figure 4-19

4.1.6.1 Pulsed welding in the upslope and downslope phases

☞ ***The pulse function can also be deactivated if necessary during the up-slope and down-slope phases (parameter PSL) > see 4.6 chapter.***

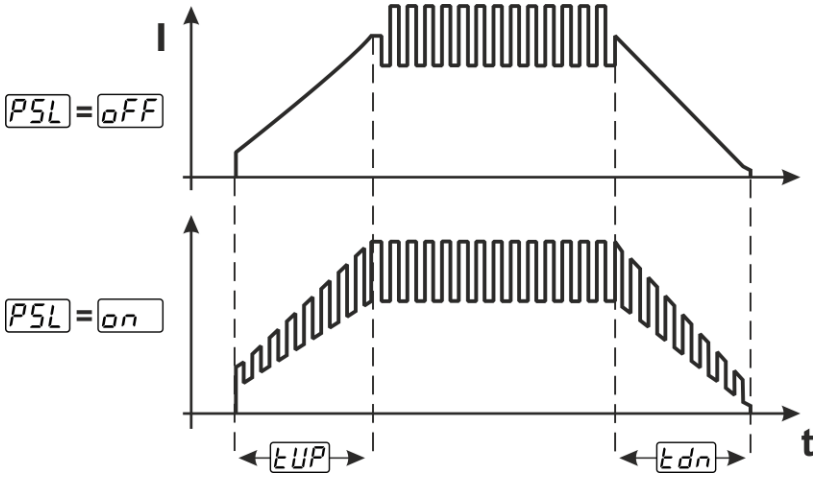


Figure 4-20

4.1.6.2 Automated pulses

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

4.1.7 TIG activArc welding

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

Selection

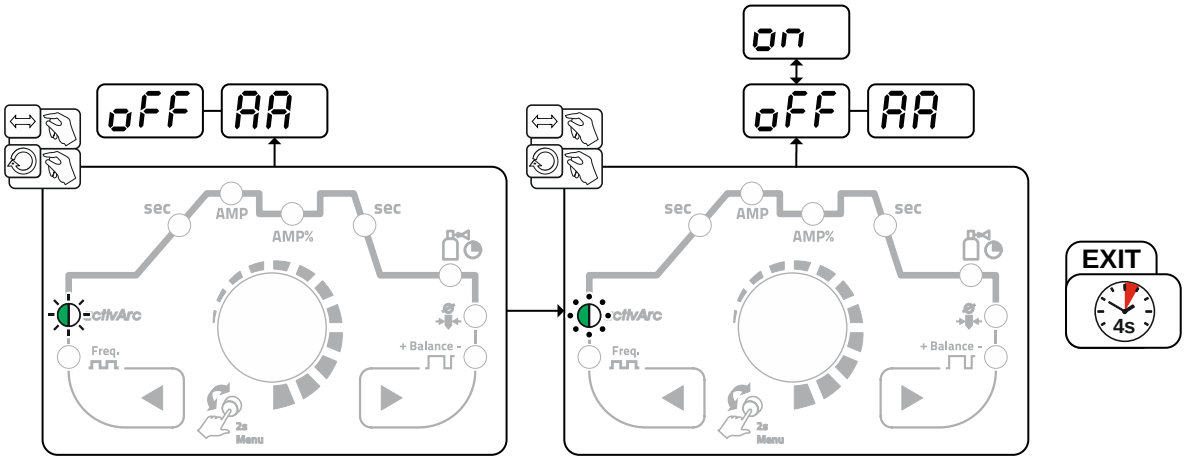


Figure 4-21

Setting

Parameter setting

The activArc parameter (control) can be adjusted specifically for the welding task (panel thickness) > *see 4.1.11 chapter*.

4.1.8 TIG antistick

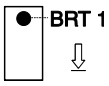
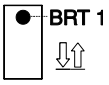
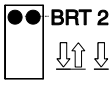
The function prevents uncontrolled re-ignition following the sticking of the tungsten electrode in the weld pool by switching off the welding current. In addition, wear at the tungsten electrode is reduced.

After triggering the function the machine immediately switches to the gas post-flow process phase. The welder starts the new process again at the first cycle. The user can switch the function on or off (parameter tAS) > *see 4.6 chapter*.

4.1.9 Welding torch (operating variants)

Different torch versions can be used with this machine.
Functions on the operating elements, such as torch triggers (BRT), rockers or potentiometers, can be modified individually via torch modes.

Explanation of symbols for operating elements:

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

4.1.9.1 Tapping function (tap torch trigger)

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

4.1.9.2 Torch mode setting

Modes 1 to 6 and 11 to 16 are available to the user. Modes 11 to 16 feature the same functionality as 1 to 6, but without the tapping function > *see 4.1.9.1 chapter* for the secondary current.

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

The torch modes are set using the torch configuration parameters "trd" in the machine configuration menu > torch mode "tod" > *see 4.6 chapter*.

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

4.1.9.3 Up/down speed

Functionality

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

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

Use the machine configuration menu > *see 4.6 chapter* to set the up/down speed parameter uUd which determines the speed with which a current change becomes effective.

4.1.9.4 Current jump

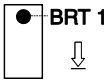
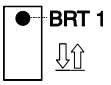
By tapping the corresponding torch trigger the welding current can be determined in an adjustable jump range. Each tap will cause the welding current to jump up or down by the defined value.

The “current jump” parameter dI is set in the machine configuration menu > *see 4.6 chapter*.

4.1.9.5 Standard TIG torch (5-pole)

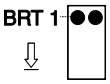
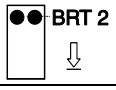
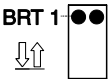
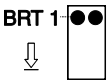
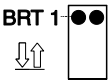
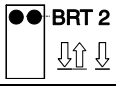
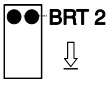
Standard torch with one torch trigger

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

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

Standard torch with two torch triggers

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

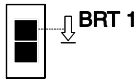
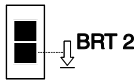
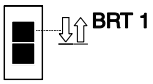
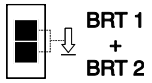
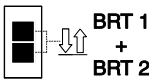
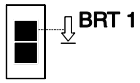
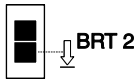
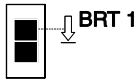
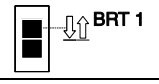
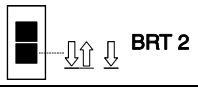
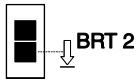
Functions	Mode	Operating elements
Welding current on/off	**1 (ex works)**	
Secondary current		
Secondary current (tapping function)[1])/(latched operating mode)		
Welding current on/off	**3**	
Secondary current (tapping function)[1])/(latched operating mode)		
Up function[2]		
Down function[2]		

[1] ***> see 4.1.9.1 chapter***

[2] ***> see 4.1.9.3 chapter***

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

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

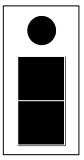
Functions	Mode	Operating elements
Welding current on/off	**1 (ex works)**	
Secondary current		
Secondary current (tapping function)[1])/(latched operating mode)		
Welding current on/off	**2**	
Secondary current (tapping function[1])		
Up function[2]		
Down function[2]		
Welding current on/off	**3**	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

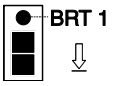
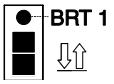
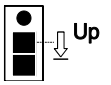
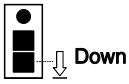
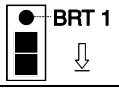
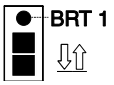
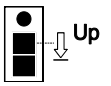
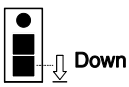
[1] ***> see 4.1.9.1 chapter***

[2] ***> see 4.1.9.3 chapter***

4.1.9.6 TIG up/down torch (8-pole)

Up/down torch with one torch trigger

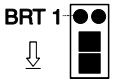
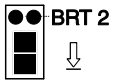
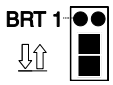
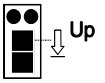
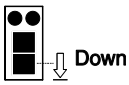
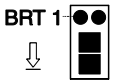
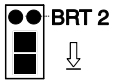
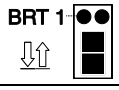
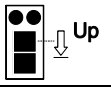
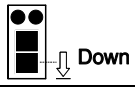
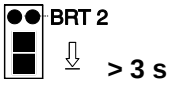
Figure	Operating elements	Explanation of symbols
		BRT 1 = torch trigger 1

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

[1] ***> see 4.1.9.1 chapter***
[2] ***> see 4.1.9.3 chapter***
[3] ***> see 4.1.9.4 chapter***

Up/down torch with two torch triggers

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

Functions	Mode	Operating elements
Welding current on/off	1 (ex works)	
Secondary current		
Secondary current (tapping function)[1])/(latched operating mode)		
Increase welding current (up function[2])		
Decrease welding current (down function[2])		
Modes 2 and 3 are not used with this type of torch or, respectively, are not appropriate.		
Welding current on/off	4	
Secondary current		
Secondary current (tapping function[1])		
Increase welding current via current jump[3]		
Decrease welding current via current jump[3]		
Gas test		 **> 3 s**

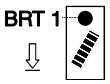
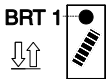
[1] ***> see 4.1.9.1 chapter***
[2] ***> see 4.1.9.3 chapter***
[3] ***> see 4.1.9.4 chapter***

4.1.9.7 Potentiometer torch (8-pole)

☞ ***The welding machine needs to be configured for operation with a potentiometer torch > see 4.1.9.8 chapter.***

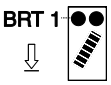
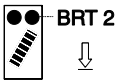
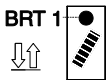
Potentiometer torch with one torch trigger

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

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

Potentiometer torch with two torch triggers

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

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

[1] ***> see 4.1.9.1 chapter***

4.1.9.8 Configuring the TIG potentiometer torch connection

⚠ DANGER

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

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

⚠ WARNING

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

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

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

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

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

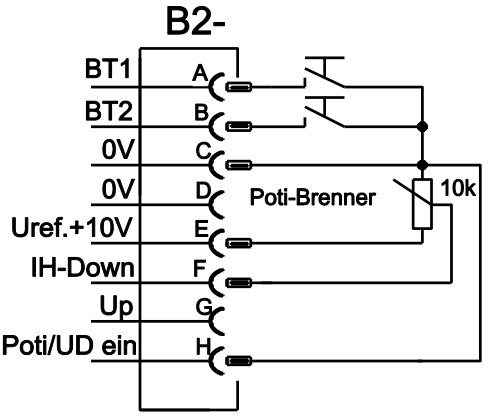


Figure 4-22

☞ ***This torch type requires the welding machine to be set to torch mode 3 > see 4.1.9.2 chapter.***

4.1.10 RTF 1 foot-operated remote control

4.1.10.1 RTF start ramp

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

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

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

The RTF start ramp function is activated/deactivated by the parameter FFr in the machine configuration menu > *see 4.6 chapter*.

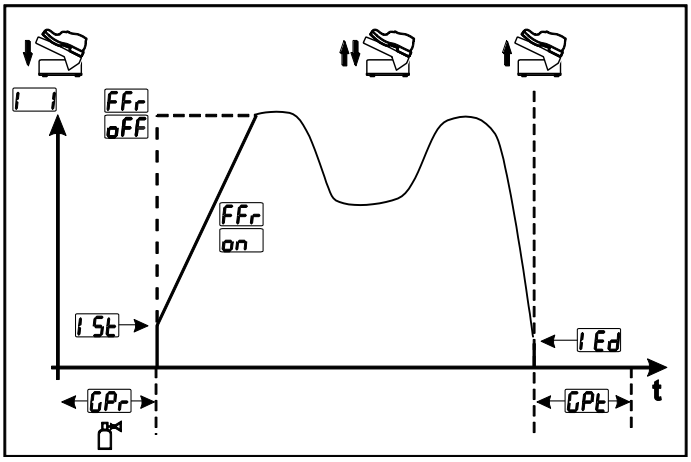


Figure 4-23

Display	Setting/selection
FFr	**RTF start ramp > *see 4.1.10.1 chapter*** on -------Welding current rises to the specified main current level in a ramp function (ex works) oFF -------Welding current immediately jumps to the specified main current level
GPr	**Gas pre-flow time**
I St	**Ignition current (as percentage, dependent on main current)**
I Ed	**End-crater current** Setting range in percent: depending on main current Setting range, absolute: Imin to Imax.
GPt	**Gas post-flow time**

4.1.10.2 RTF response

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

In the machine configuration menu, the RTF response function Frt can be toggled between linear response Lin and logarithmic response LoG (ex works) > *see 4.6 chapter*.

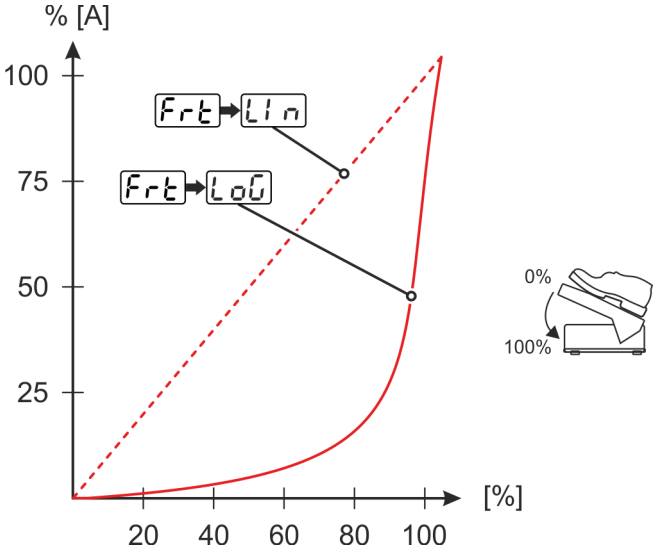


Figure 4-24

4.1.11 Expert menu (TIG)

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

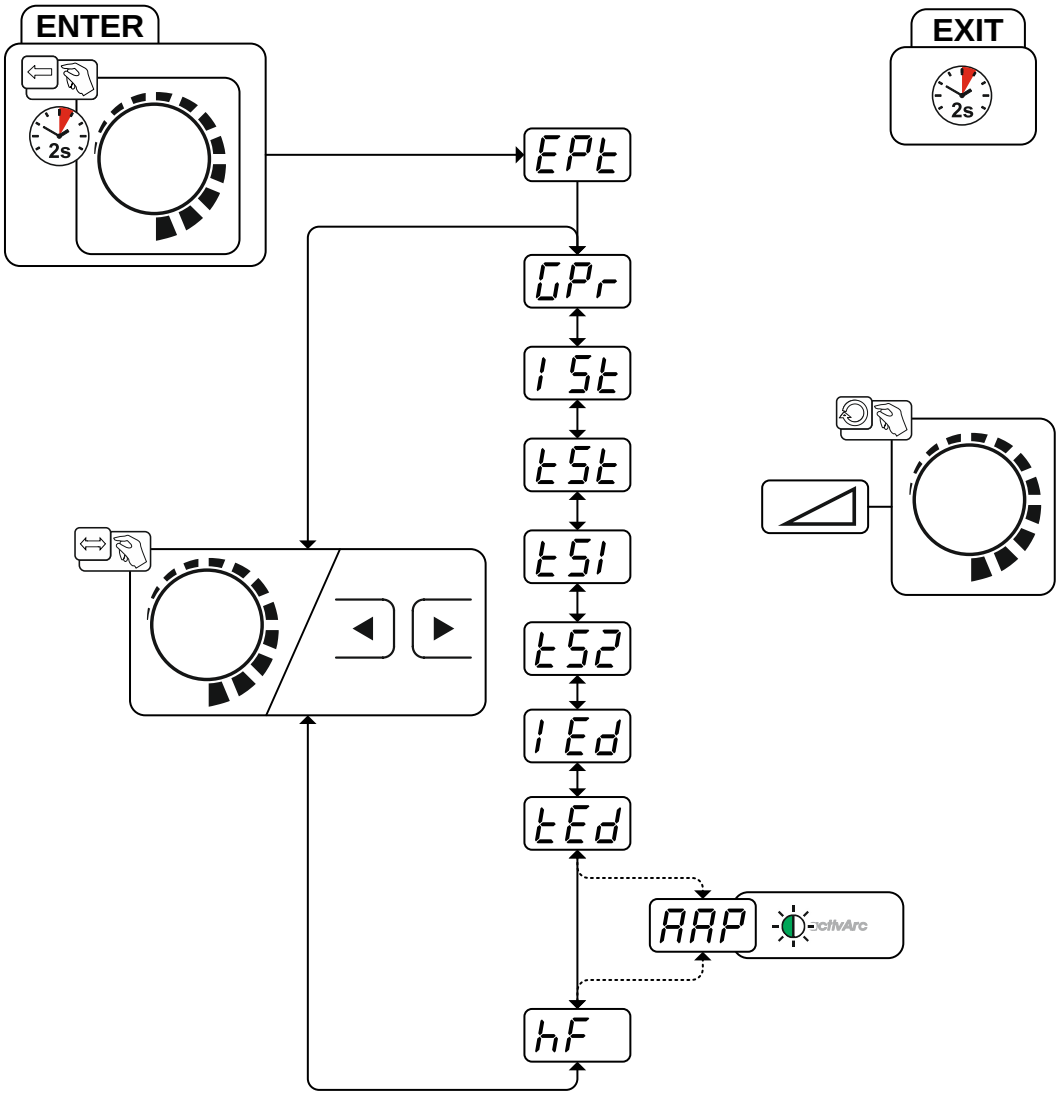


Figure 4-25

Display	Setting/selection
EPt	**Expert menu**
GPr	**Gas pre-flow time**
1St	**Ignition current** Setting range in percent: depending on main current Setting range, absolute: Imin to Imax.
tSt	**Slope time (main current to secondary current)**
tS1	**Slope time (main current to secondary current)**
tS2	**Slope time (main current to secondary current)**
1Ed	**End-crater current** Setting range in percent: depending on main current Setting range, absolute: Imin to Imax.

Display	Setting/selection
tEd	**Slope time (main current to secondary current)**
AAP	**activArc parameter** Parameter also adjustable after TIG activArc welding is activated.
hF	**Ignition type (TIG)** on ------- HF start active (ex works) oFF ------- Lift arc ignition active

4.1.12 Aligning the cable resistance

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

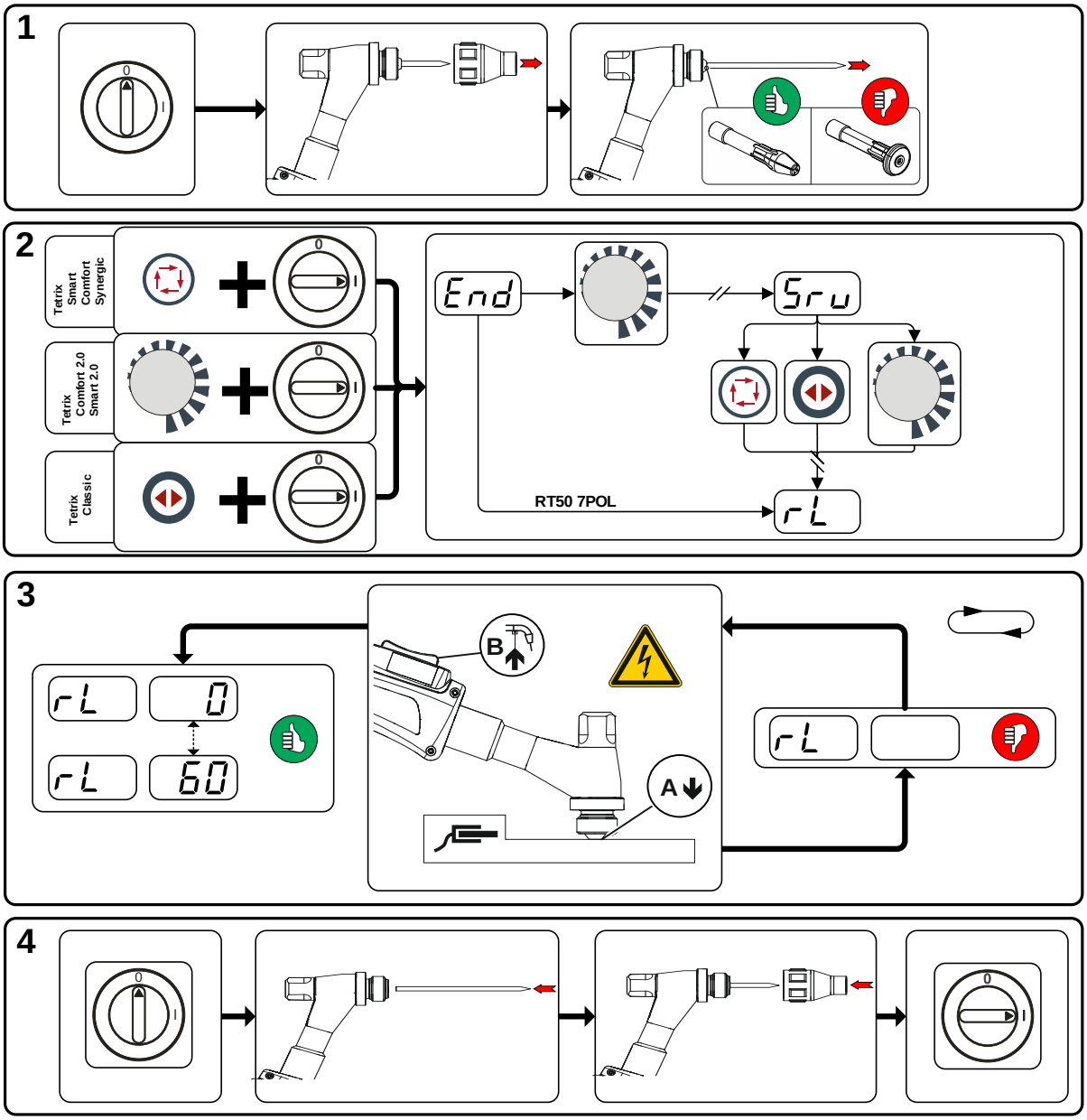


Figure 4-26

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 > *see 4.6 chapter*.

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.

4.2 MMA welding

4.2.1 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 > see 4.4 chapter.***

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

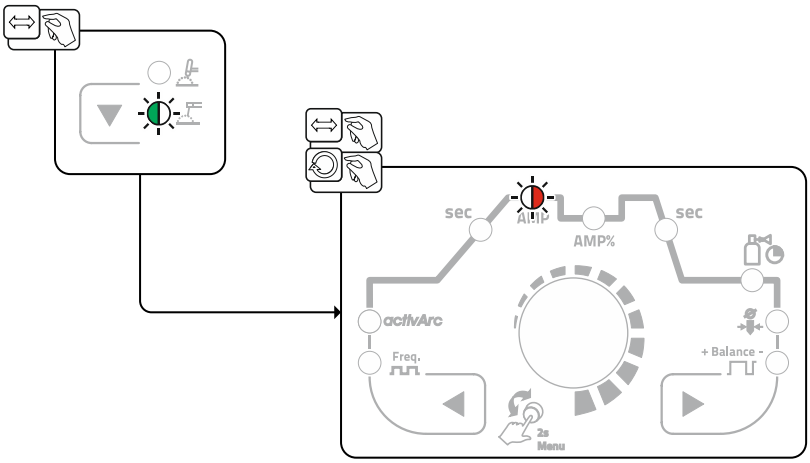


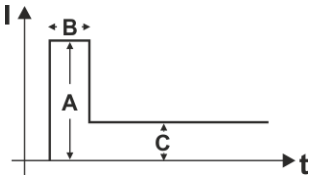
Figure 4-27

4.2.2 Hotstart

The hot start function improves the arc striking.

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

☞ ***For parameter setting, > see 4.2.6 chapter.***



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

Figure 4-28

4.2.3 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.

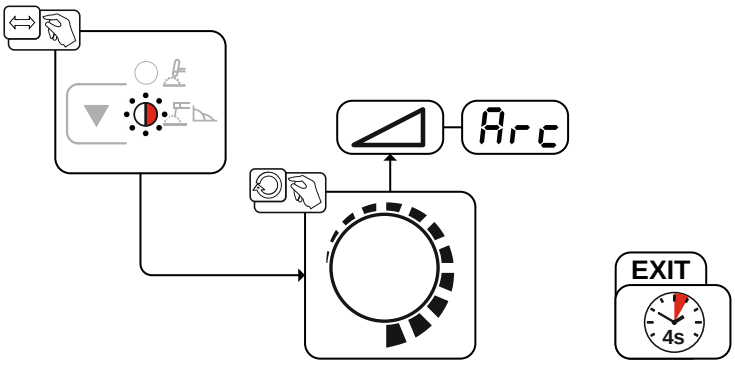
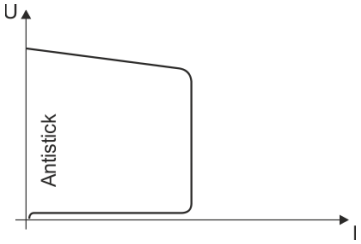


Figure 4-29

4.2.4 Antistick



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

Figure 4-30

4.2.5 Average value pulse welding

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

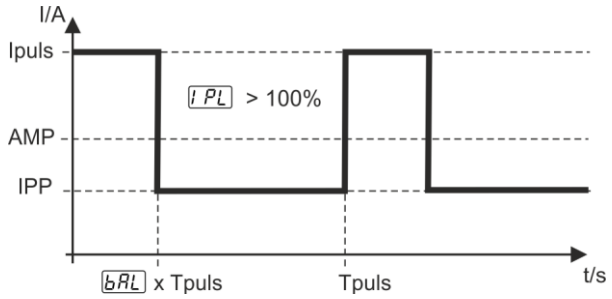


Figure 4-31

AMP = Main current; e.g. 100 A

IPL = Pulse current = IP1 x AMP; e.g. 170% x 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

Selection

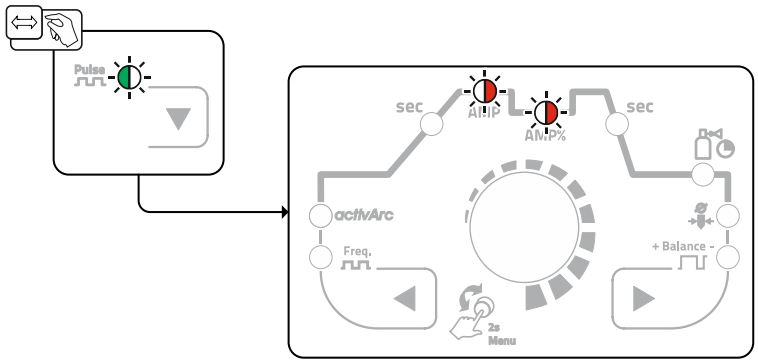


Figure 4-32

Pulse current

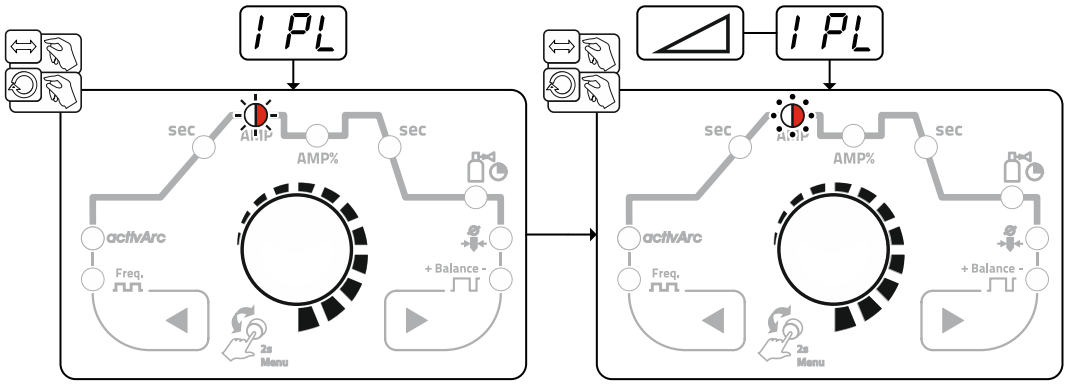


Figure 4-33

Pulse balance

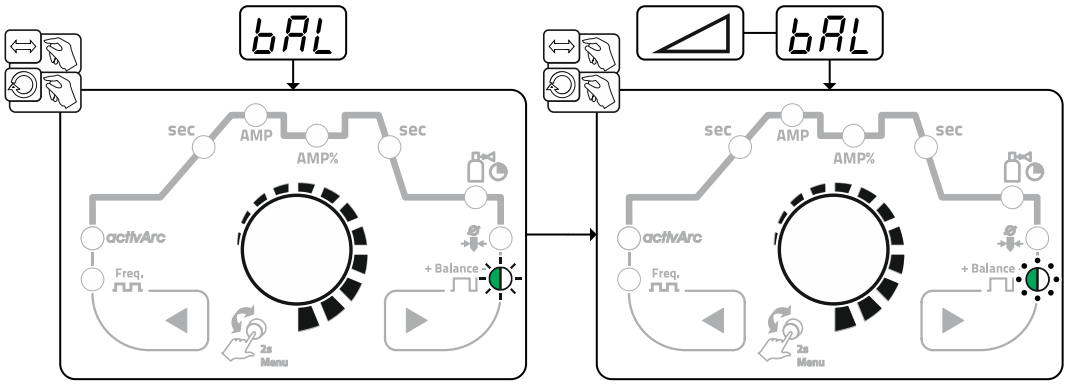


Figure 4-34

Pulse frequency

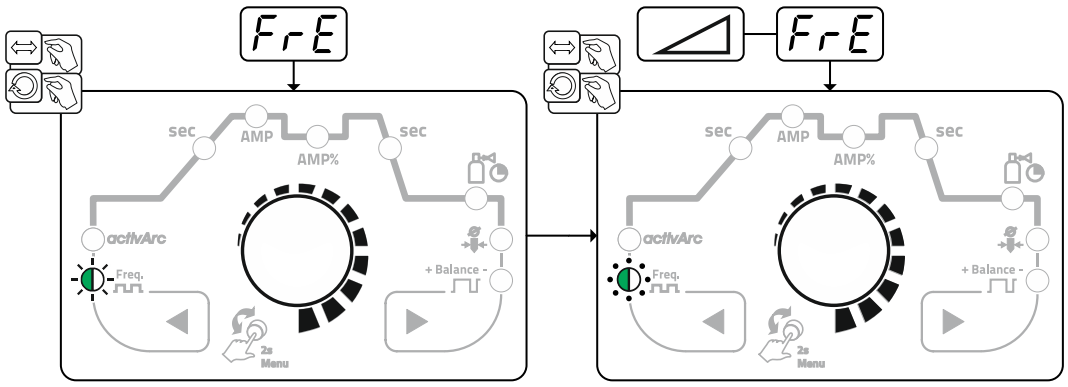


Figure 4-35

4.2.6 Expert menu (MMA)

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

The setting ranges for the parameter values are summarised in the Parameter overview section > *see 6.1 chapter*.

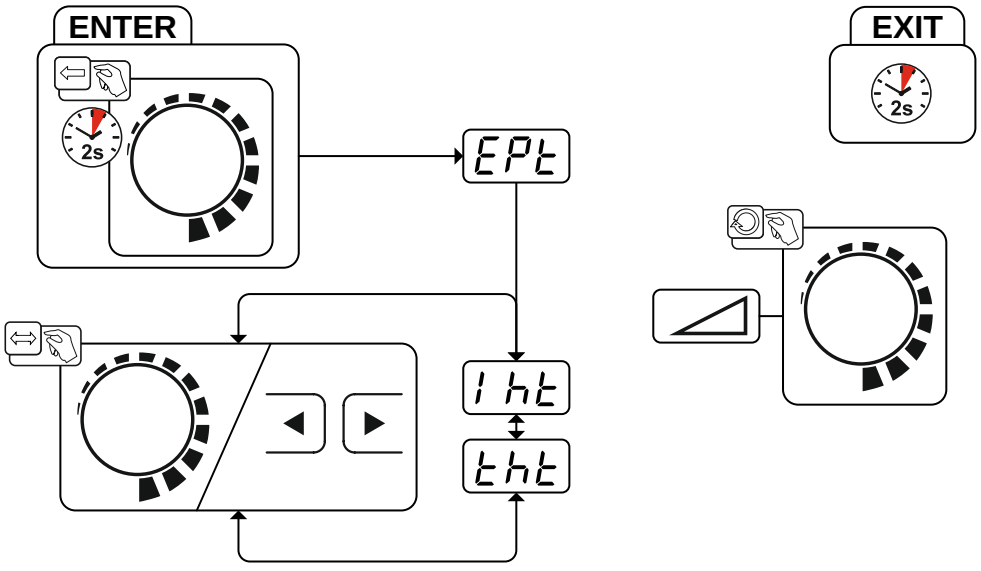
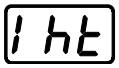
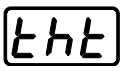


Figure 4-36

Display	Setting/selection
EPt	**Expert menu**

Display	Setting/selection
	**Hotstart current**
	**Hotstart time**

4.3 Power-saving mode (Standby)

You can activate the power-saving mode by either pressing the push-button > *see 3 chapter* for a prolonged time or by setting a parameter in the machine configuration menu (time-controlled power-saving mode SbA) > *see 4.6 chapter*.

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

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

4.4 Access control

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

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

The parameters for setting the access block are configured in the machine configuration menu > *see 4.6 chapter*.

Enabling access block

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

The access block activation is indicated by the "Access block active" signal light > *see 3 chapter*.

Disabling access block

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

4.5 Voltage reducing device

Only machine variants with the (VRD/AUS/RU) code are equipped with a voltage reduction device (VRD). The VRD is used for increased safety, especially in hazardous environments such as shipbuilding, pipe construction or mining.

A VRD is mandatory in some countries and required by many on-site safety instructions for power sources.

The VRD > *see 3 chapter* 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).

4.6 Machine configuration menu

Basic machine settings are defined in the machine configuration menu.

4.6.1 Selecting, changing and saving parameters

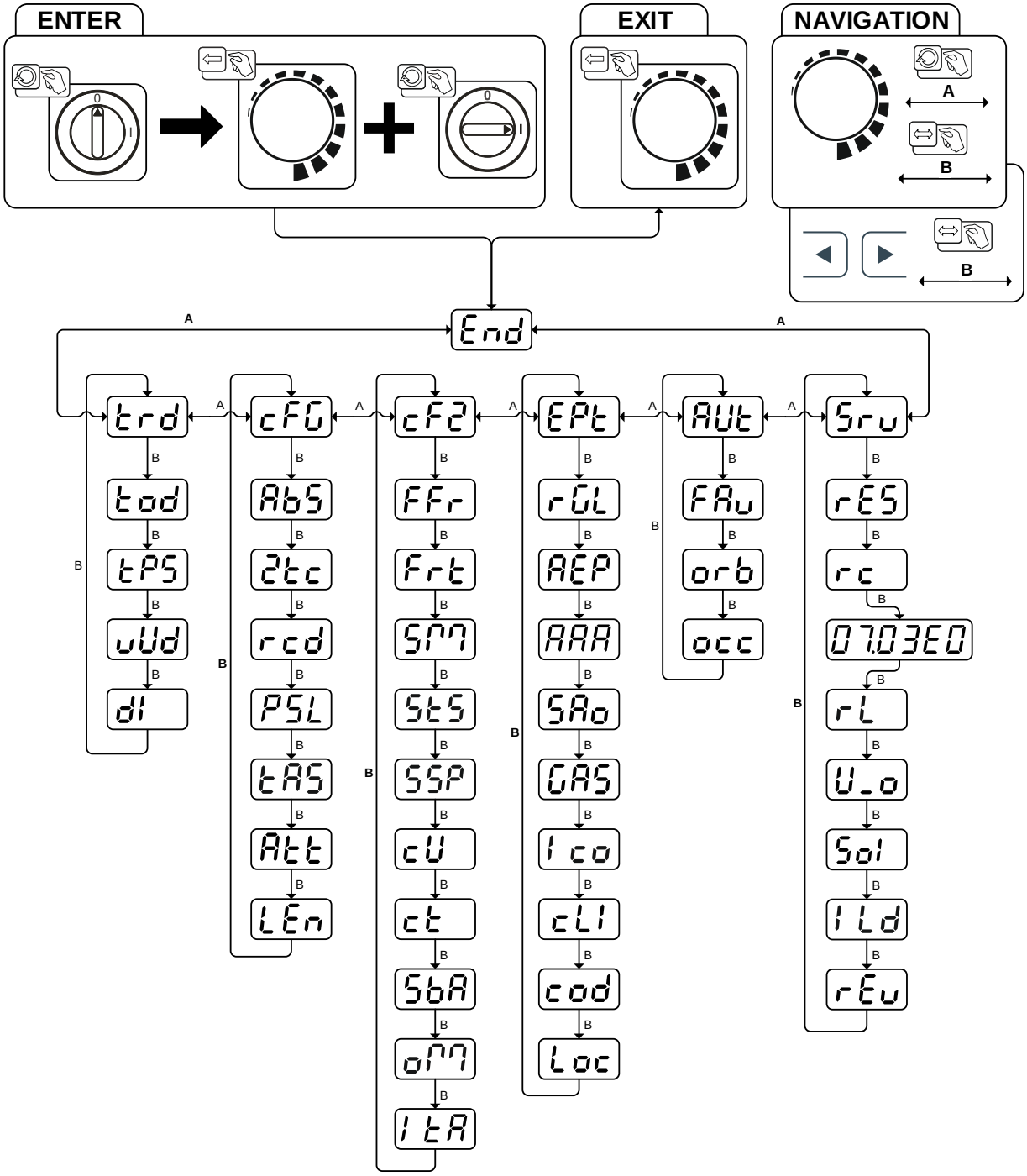


Figure 4-37

Display	Setting/selection
End	**Exit the menu** Exit
trd	**Torch configuration menu** Set welding torch functions
tod	**Torch mode (ex works 1) > *see 4.1.9.2 chapter***

Display	Setting/selection
tPS	**Alternative welding start – tapping start** Available from torch mode 11 (welding stop by tapping remains active). on -------Function enabled (ex works) oFF -------Function disabled
uUd	**Up/down speed > *see 4.1.9.3 chapter*** Increase value > rapid current change Decrease value > slow current change
dI	**Current jump > *see 4.1.9.4 chapter*** Current jump setting in ampere
cFG	**Machine configuration** Settings for machine functions and parameter display
AbS	**Absolute value setting (ignition, secondary, end and hot start current) > *see 3.2.1 chapter*** on -------Welding current setting, absolute oFF -------Welding current setting, as a percentage of the main current (ex works)
2tc	**Non-latched operation (version C) > *see 4.1.5.6 chapter*** on -------Function enabled oFF -------Function disabled (ex works)
rcd	**Current display switching (MMA)** on -------Actual value display oFF -------Nominal value display (ex works)
PSL	**Pulsed TIG welding (thermic) in the upslope and downslope phases > *see 4.1.6.1 chapter*** on -------Function enabled (ex works) oFF -------Function disabled
tAS	**TIG antistick > *see 4.1.8 chapter*** on -------function active (factory setting). oFF -------function inactive.
Att	**Show warnings > *see 5.1 chapter*** oFF -------Function disabled (ex works) on -------Function enabled
LEn	**Setting the system of units** mE -------Units of length in mm, m/min. (metric system) Inn -------Unit of length in inches, ipm (imperial system)
cF2	**Machine configuration (second part)** Settings for machine functions and parameter display
FFr	**RTF start ramp > *see 4.1.10.1 chapter*** on -------Welding current rises to the specified main current level in a ramp function (ex works) oFF -------Welding current immediately jumps to the specified main current level
FrE	**RTF response > *see 4.1.10.2 chapter*** Lin -------Linear response Log -------Logarithmic responsive (ex works)
SMn	**spotmatic operating mode > *see 4.1.5.5 chapter*** Ignition by contact with the workpiece on -------Function enabled (ex works) oFF -------Function disabled
StS	**Spot time setting > *see 4.1.5.5 chapter*** on -------Short spot time, setting range 5 ms to 999 ms, increments of 1 ms (ex works) oFF -------Long spot time, setting range 0.01 s to 20.0 s, increments of 10 ms (ex works)

Display	Setting/selection
SSP	**Process activation setting > *see 4.1.5.5 chapter*** on ------ Separate process activation (ex works) oFF ------ Permanent process activation
cU	**Torch cooling mode** AUt------- Automatic operation (ex works) on ------ Permanently enabled oFF ------ Permanently disabled
ct	**Welding torch cooling, post-flow time** Setting 1–60 min. (ex works 5 min.)
SbA	**Time-based power-saving mode > *see 4.3 chapter*** Time to activation of the power-saving mode in case of inactivity. Setting oFF = disabled or numerical value 5– 60 min. (ex works: 20).
oMM	**Operating mode switching via interface for automated welding** 2t ------ Non-latched 2tS ------ Special non-latched
ItA	**Re-ignition after arc interruption > *see 4.1.4.3 chapter*** Job ------ JOB-dependent time (ex works 5 s). oFF ------ Function disabled or numerical value 0.1–5.0 s.
EPt	**Expert menu**
rGL	**AC average value controller** [1] on ------ Function enabled (ex works) oFF ------ Function disabled
AEP	**Reconditioning pulse (tungsten ball stability)** [1] Cleaning effect of the tungsten ball at the end of welding. on------- Function enabled (ex works) oFF------- Function disabled
AAA	**activArc voltage measuring** on ------ Function enabled (ex works) oFF ------ Function disabled
SAo	**Error output to interface for automated welding, contact SYN_A** oFF ------ AC synchronisation or hot wire (ex works) FSn ------ Error signal, negative logic FSP------- Error signal, positive logic Auc------- AVC (Arc voltage control) connection
GAS	**Gas monitoring** Depending on where the gas sensor is situated, the use of a pilot static tube and the welding process monitoring phase. oFF ------ Function disabled (ex works). 1------- Monitoring during the welding process. Gas sensor between gas valve and welding torch (with pilot static tube). 2 ------ Monitoring prior to the welding process. Gas sensor between gas valve and welding torch (without pilot static tube). 3 ------ Permanent monitoring Gas sensor between gas cylinder and gas valve (with pilot static tube).
Ico	**AC commutation optimisation > *see 4.1.3.2 chapter*** [1] on ------ Function enabled oFF ------ Function disabled (ex works)
cLI	**Minimum current limit (TIG) > *see 4.1.2 chapter*** Depending on the set tungsten electrode diameter oFF------- Function disabled on------- Function enabled (ex works)

Display	Setting/selection
cod	**Access control – access code** Setting: 000 to 999 (000 ex works)
Loc	**Access control > *see 4.4 chapter*** on -------Function enabled oFF -------Function disabled (ex works)
AUt	**Automation menu** [3]
FAu	**Fast take-over of control voltage (automation)** [3] on -------Function enabled oFF -------Function disabled (ex works)
orb	**Orbital welding** [3] oFF -------Function disabled (ex works) on -------Function enabled
occ	**Orbital welding** [3] Correction value for orbital current
Sru	**Service menu** Any changes to the service menu should be agreed with the authorised service personnel.
rES	**Reset (to factory setting)** oFF -------Disabled (ex works) cFG -------Reset the values in the machine configuration menu cPL -------Complete reset of all values and settings Resetting is performed when exiting the menu (End).
rc	**Automated/Manual (rC on/off) operating mode** [3] Select machine/function control on ------with external control voltages/signals oFF ------with machine control
07.0	**Software version query (example)** 07.= ------system bus ID 03c0= ----version number System bus ID and version number are separated by a dot.
3c0	
rL	**Cable resistance alignment > *see 4.1.12 chapter***
U_o	**Only qualified service personnel may change the parameters!**
Sol	**TIG HF start (soft/hard) switching** on -------soft ignition (factory setting). oFF -------hard ignition.
ILd	**Ignition pulse limit** Setting 0 ms–15 ms (increments of 1 ms)
rEu	**PCB state – qualified service personnel only!**

[1] for AC welding machines only.

[2] not used

[3] for components for automated welding (RC) only.

5 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.

5.1 Warnings

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

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

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

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

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

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

5.2 Error messages

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

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

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

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

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

5.3 Resetting welding parameters to the factory settings

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

To reset the welding parameters or machine settings to the factory settings, select parameter rES in the service menu SrU > *see 4.6 chapter*.

5.4 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 > *see 4.6 chapter*.

6 Appendix A

6.1 Parameter overview – setting ranges

6.1.1 TIG welding

Name	Display			Setting range		
	Code	Standard	Unit	Min.		Max.
Main current AMP, depending on power source	I 1	-	A	-	-	-
Gas pre-flow time	GPr	0,5	s	0	-	20
Ignition current, percentage of AMP	I St	20	%	1	-	200
Ignition current, absolute, depending on power source	I St	-	A	-	-	-
Start time	t St	0,01	s	0,01	-	20,0
Up-slope time	t UP	1,0	s	0,0	-	20,0
Pulse current	I PL	140	%	1		200
Slope time (time from main current AMP to secondary current AMP%)	t S1	0,00	s	0,00	-	20,0
Secondary current, percentage of AMP	I 2	50	%	1		200
Secondary current, absolute, depending on power source	I 2	-	A	-		-
Slope time (time from secondary current AMP% to main current AMP)	t S2	0,00	s	0,00	-	20,0
Down-slope time	t dn	1,0	s	0,0	-	20,0
End current, percentage of AMP	I Ed	20	%	1	-	200
End current, absolute, depending on power source	I Ed	-	A	-	-	-
End current time	t Ed	0,01	s	0,01	-	20,0
Gas post-flow time	GPt	8	s	0,0	-	40,0
Electrode diameter, metric	ndA	2,4	mm	1,0	-	4,0
Electrode diameter, imperial	ndA	92	mil	40	-	160
spotArc time	t P	2	s	0,01	-	20,0
spotmatic time (StS > on)	t P	200	ms	5	-	999
spotmatic time (StS > oFF)	t P	2	s	0,01	-	20,0
AC commutation optimisation [1]	I co	250		5	-	375
AC balance [1]	bAL	65	%	40	-	90
Pulse balance	bAL	50	%	1	-	99
Pulse frequency (DC)	FrE	2,8	Hz	0,2	-	2500
Pulse frequency (AC) [1]	FrE	2,8	Hz	0,2	-	5
AC frequency [1]	FrE	50	Hz	30	-	300
activArc, depending on main current	AAP	-		0	-	100

[1] for AC welding machines only.

6.1.2 MMA welding

Name	Display			Setting range		
	Code	Standard	Unit	Min.		Max.
Main current AMP, depending on power source	I 1	-	A	-	-	-
Hot start current, percentage of AMP	I ht	120	%	1	-	200
Hot start current, absolute, depending on power source	I ht	-	A	-	-	-
Hot start time	t ht	0,5	s	0,0	-	10,0
Arcforce	Arc	0		-40	-	40
AC frequency [1]	FrE	100	Hz	30	-	300
AC balance [1]	bAL	60	%	40	-	90
Pulse current	I PL	142		1	-	200
Pulse frequency (DC)	FrE	1,2	Hz	0,2	-	500
Pulse frequency (AC) [1]	FrE	1,2	Hz	0,2	-	5
Pulse balance	bAL	30		1	-	99

[1] for AC welding machines only.

7 Appendix B

7.1 Overview of EWM branches

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