■ Operating instructions

ewm®

Power sources for automated applications

Phoenix 352, 452, 552 RC Puls
Phoenix 352, 452, 552 Puls

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General instructions

<table>
<tr><td colspan="2" align="center">**CAUTION**</td></tr>
<tr><td></td><td>**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.</td></tr>
</table>

<table>
<tr><td colspan="2" align="center">*NOTE*</td></tr>
<tr><td>☞</td><td>**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.</td></tr>
</table>

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.

1   Contents

Contents

2 Safety instructions

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.

CAUTION

Working and operating procedures which must be followed precisely to avoid damaging or destroying the product.
- The safety information includes the "CAUTION" keyword in its heading without a general warning symbol.
- The hazard is explained using a symbol at the edge of the page.

NOTE

Special technical points which users must observe.
- Notes include the "NOTE" keyword in the heading without a general warning symbol.

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
	Press
	Do not press
	Turn
	Switch
	Switch off machine
	Switch on machine
ENTER	**ENTER (enter the menu)**
NAVIGATION	**NAVIGATION (Navigating in the menu)**
EXIT	**EXIT (Exit the menu)**
4 s	**Time display (example: wait 4s/press)**
—//—	**Interruption in the menu display (other setting options possible)**
	Tool not required/do not use
	Tool required/use

2.3   General

> ⚠ **DANGER**
>
> **Electric shock!**
> **Welding machines use high voltages which can result in potentially fatal electric shocks and burns on contact. Even low voltages can cause you to get a shock and lead to accidents.**
> - Do not touch any live parts in or on the machine!
> - Connection cables and leads must be free of faults!
> - Switching off alone is not sufficient!
> - Place welding torch and stick electrode holder on an insulated surface!
> - The unit should only be opened by specialist staff after the mains plug has been unplugged!
> - Only wear dry protective clothing!
> - Wait for 4 minutes until the capacitors have discharged!
>
> **Electromagnetic fields!**
> **The power source may cause electrical or electromagnetic fields to be produced which could affect the correct functioning of electronic equipment such as IT or CNC devices, telecommunication lines, power cables, signal lines and pacemakers.**
> - Observe the maintenance instructions! (see Maintenance and Testing chapter)
> - Unwind welding lines completely!
> - Shield devices or equipment sensitive to radiation accordingly!
> - The correct functioning of pacemakers may be affected (obtain advice from a doctor if necessary).
>
> **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)!

> ## ⚠ WARNING
>
> **Risk of accidents if these safety instructions are not observed!**
> **Non-observance of these safety instructions is potentially fatal!**
> * Carefully read the safety information in this manual!
> * Observe the accident prevention regulations in your country.
> * Inform persons in the working area that they must observe the regulations!
>
> **Risk of injury due to radiation or heat!**
> **Arc radiation results in injury to skin and eyes.**
> **Contact with hot workpieces and sparks results in burns.**
> * Use welding shield or welding helmet with the appropriate safety level (depending on the application)!
> * Wear dry protective clothing (e.g. welding shield, gloves, etc.) according to the relevant regulations in the country in question!
> * Protect persons not involved in the work against arc beams and the risk of glare using safety curtains!
>
> **Explosion risk!**
> **Apparently harmless substances in closed containers may generate excessive pressure when heated.**
> * Move containers with inflammable or explosive liquids away from the working area!
> * Never heat explosive liquids, dusts or gases by welding or cutting!
>
> **Smoke and gases!**
> **Smoke and gases can lead to breathing difficulties and poisoning. In addition, solvent vapour (chlorinated hydrocarbon) may be converted into poisonous phosgene due to the ultraviolet radiation of the arc!**
> * Ensure that there is sufficient fresh air!
> * Keep solvent vapour away from the arc beam field!
> * Wear suitable breathing apparatus if appropriate!
>
> **Fire hazard!**
> **Flames may arise as a result of the high temperatures, stray sparks, glowing-hot parts and hot slag produced during the welding process.**
> **Stray welding currents can also result in flames forming!**
> * Check for fire hazards in the working area!
> * Do not carry any easily flammable objects such as matches or lighters.
> * Keep appropriate fire extinguishing equipment to hand in the working area!
> * Thoroughly remove any residue of flammable substances from the workpiece before starting welding.
> * Only continue work on welded workpieces once they have cooled down.
>   Do not allow to come into contact with flammable material!
> * Connect welding leads correctly!

> ## ⚠ CAUTION
>
> **Noise exposure!**
> **Noise exceeding 70 dBA can cause permanent hearing damage!**
> * Wear suitable ear protection!
> * Persons located within the working area must wear suitable ear protection!

<table>
<tr><td colspan="2" align="center">**CAUTION**</td></tr>
<tr><td></td><td>

Obligations of the operator!

The respective national directives and laws must be observed for operation of the machine!

- National implementation of the framework directive (89/391/EWG), as well as the associated individual directives.
- In particular, directive (89/655/EWG), on the minimum regulations for safety and health protection when staff members use equipment during work.
- The regulations regarding work safety and accident prevention for the respective country.
- Setting up and operating the machine according to IEC 60974-9.
- Check at regular intervals that users are working in a safety-conscious way.
- Regular checks of the machine according to IEC 60974-4.

Damage due to the use of non-genuine parts!

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

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

Electromagnetic interference!

The machines are intended to be used in industrial areas, according to IEC 60974-10. If they are used in residential areas, for example, problems may occur with ensuring electromagnetic compatibility.

- Check whether interference is caused to other machines!
</td></tr>
</table>

2.4   Transport and installation

> ⚠ **WARNING**
>
> **Incorrect handling of shielding gas cylinders!**
> **Incorrect handling of shielding gas cylinders can result in serious and even fatal injury.**
> * Observe the instructions from the gas manufacturer and in any relevant regulations concerning the use of compressed air!
> * Place shielding gas cylinders in the holders provided for them and secure with fixing devices.
> * Avoid heating the shielding gas cylinder!

> ⚠ **CAUTION**
>
> **Risk of tipping!**
> **There is a risk of the machine tipping over and injuring persons or being damaged itself during movement and set up. Tilt resistance is guaranteed up to an angle of 10° (according to EN 60974-A2).**
> * Set up and transport the machine on level, solid ground!
> * Secure add-on parts using suitable equipment!
> * Replace damaged transport rollers and their fixing elements!
> * Fix external wire feed units during transport (avoid uncontrolled rotation)!
>
> **Damage due to supply lines not being disconnected!**
> **During transport, supply lines which have not been disconnected (mains supply leads, control leads, etc.) may cause hazards such as connected equipment tipping over and injuring persons!**
> * Disconnect supply lines!

> **CAUTION**
>
> **Equipment damage when not operated in an upright position!**
> **The units are designed for operation in an upright position!**
> **Operation in non-permissible positions can cause equipment damage.**
> * Only transport and operate in an upright position!

2.4.1 Lifting by crane

⚠ **DANGER**

⚠ **Risk of injury during lifting by crane!**
When lifting the equipment by crane, serious injuries can be inflicted by falling equipment or add-on units.

- Transport on all lifting lugs at the same time (see Fig. Lifting principle)!
- Ensure that there is an even load distribution! Only use ring chains or suspension ropes of the same length!
- Observe the lifting principle (see Fig.)!
- Remove all accessory components before lifting (e.g. shielding gas cylinders, tool boxes, wire feed units, etc.)!
- Avoid jerky movements when raising or lowering!
- Use shackles and load hooks of the appropriate size!
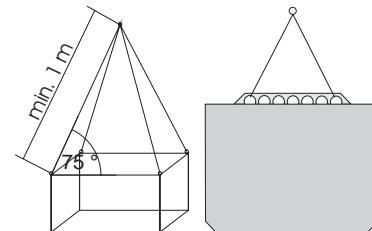
Fig. Lifting principle

⚠ **Risk of injury due to unsuitable ring screws!**
In case of improper use of ring screws or the use of unsuitable ring screws, persons can be seriously damaged by falling equipment or add-on components!

- The ring screw must be completely screwed in!
- The ring screw must be positioned flat onto and in full contact with the supporting surfaces!
- Check that the ring screws are securely fastened before use and check for any damage (corrosion, deformation)!
- Do not use or screw in damaged ring screws!
- Avoid lateral loading of the ring screws!

2.5   Ambient conditions

> ⚠ **CAUTION**
>
> **Installation site!**
> **The machine must not be operated in the open air and must only be set up and operated on a suitable, stable and level base!**
> • The operator must ensure that the ground is non-slip and level, and provide sufficient lighting for the place of work.
> • Safe operation of the machine must be guaranteed at all times.

> **CAUTION**
>
> **Equipment damage due to dirt accumulation!**
> **Unusually high quantities of dust, acid, corrosive gases or substances may damage the equipment.**
> • Avoid high volumes of smoke, vapour, oil vapour and grinding dust!
> • Avoid ambient air containing salt (sea air)!
>
> **Non-permissible ambient conditions!**
> **Insufficient ventilation results in a reduction in performance and equipment damage.**
> • Observe the ambient conditions!
> • Keep the cooling air inlet and outlet clear!
> • Observe the minimum distance of 0.5 m from obstacles!

2.5.1   In operation

Temperature range of the ambient air:
• -20 °C to +40 °C

Relative air humidity:
• Up to 50% at 40 °C
• Up to 90% at 20 °C

2.5.2   Transport and storage

Storage in an enclosed space, temperature range of the ambient air:
• -25 °C to +55 °C

Relative air humidity
• Up to 90% at 20 °C

3 Intended use

This machine has been manufactured according to the latest developments in technology and current regulations and standards. It must only be operated in line with the instructions on correct usage.

> ⚠️ **WARNING**
>
> **Hazards due to improper usage!**
> **Hazards may arise for persons, animals and material objects if the equipment is not used correctly. No liability is accepted for any damages arising from improper usage!**
> - The equipment must only be used in line with proper usage and by trained or expert staff!
> - Do not modify or convert the equipment improperly!

3.1 Applications

3.1.1 MIG/MAG standard welding

Metal arc welding using a wire electrode whereby gas from an external source surrounds the arc and the molten pool to protect them from the atmosphere.

3.1.2 forceArc

Welding with a powerful forced arc, deep fusion penetration and virtually spatter-free weld seams of the highest quality.

3.1.3 rootArc

Stable, soft, short arc even with long welding leads; ideal for simple, reliable root welding without pool support, easy gap bridging.

3.1.4 MIG/MAG pulse welding

Welding process for optimum welding results when joining stainless steel and aluminium thanks to controlled drop transfer and targeted, adapted heat input.

3.2 Use and operation solely with the following machines

	Phoenix 352 puls	Phoenix 352 RC puls	Phoenix 452 puls	Phoenix 452 RC puls	Phoenix 552 puls	Phoenix 552 RC puls	Phoenix 1002 RC puls
RC Panel	☐	☑	☐	☑	☐	☑	☑
M Drive 4 Rob 2 WE	☑	☑	☑	☑	☑	☑	☑
M Drive 4 Rob 2 WI	☑	☑	☑	☑	☑	☑	☑
M Drive 4 Rob 2 MF	☑	☑	☑	☑	☑	☑	☑
M Drive 4 Rob 3 LI	☑	☑	☑	☑	☑	☑	☑
M Drive 4 Rob 3 RE	☑	☑	☑	☑	☑	☑	☑
Cool 82 U44	☑	☑	☑	☑	☑	☑	☑
Cool 82 U45	☑	☑	☑	☑	☑	☑	☑

3.2.1 Operation with two wire feed units

For operation with two wire feed units the welding machine has to be set-up accordingly ex works and be equipped with a cooling module with two coolant circuits in addition to the two wire feed units. The operation with two wire feed units can e.g. be useful in robot systems with automated torch changing.

	Phoenix 352 puls	Phoenix 352 RC puls	Phoenix 452 puls	Phoenix 452 RC puls	Phoenix 552 puls	Phoenix 552 RC puls	Phoenix 1002 RC puls
RINT X12	☑	☑	☑	☑	☑	☑	☑
BUSINT X11	☑	☑	☑	☑	☑	☑	☑
OW DV Switch	☑	☑	☑	☑	☑	☑	☑
OW ASM 2 Rob DV	☑	☑	☑	☑	☑	☑	☑
M Drive 4 Rob 3 LI + M Drive 4 Rob 3 RE	☑	☑	☑	☑	☑	☑	☑
Cool 82 U45 2Rob	☑	☑	☑	☑	☑	☑	☑

3.3 Documents which also apply

3.3.1 Warranty

NOTE
☞ **For further information, please see the accompanying supplementary sheets "Machine and Company Data, Maintenance and Testing, Warranty"!**

3.3.2 Declaration of Conformity

C E **The designated machine conforms to EC Directives and standards in terms of its design and construction:**
  • EC Low Voltage Directive (2006/95/EC),
  • EC EMC Directive (2004/108/EC),

This declaration shall become null and void in the event of unauthorised modifications, improperly conducted repairs, non-observance of the deadlines for the repetition test and / or non-permitted conversion work not specifically authorised by the manufacturer.
The original copy of the declaration of conformity is enclosed with the unit.

3.3.3 Welding in environments with increased electrical hazards

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

3.3.4 Service documents (spare parts and circuit diagrams)

⚠ **DANGER**
Do not carry out any unauthorised repairs or modifications! **To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!** **The warranty becomes null and void in the event of unauthorised interference.** • Appoint only skilled persons for repair work (trained service personnel)!

Original copies of the circuit diagrams are enclosed with the unit.
Spare parts can be obtained from the relevant authorised dealer.

4 Machine description – quick overview
4.1 Phoenix 352, 452, 552 RC Puls forceArc
4.1.1 Front view
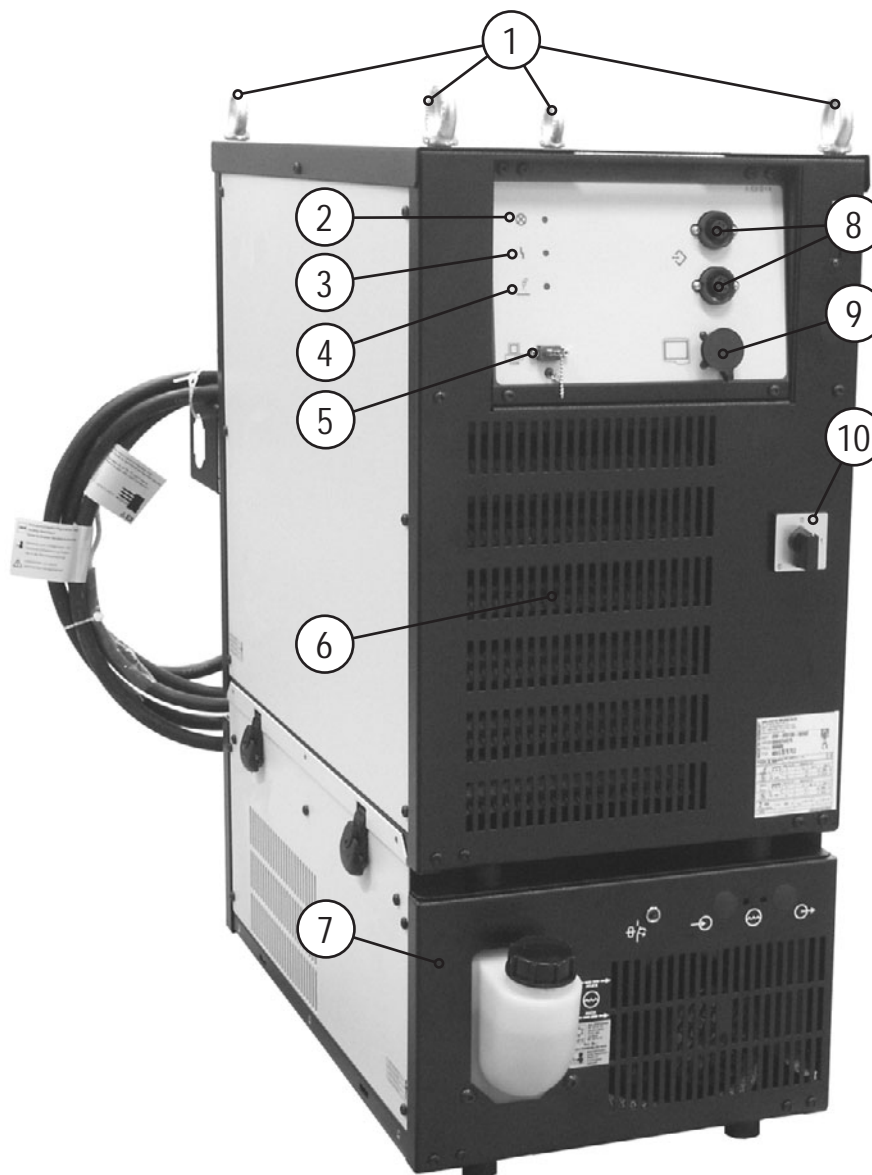
Figure 4-1

Item	Symbol	Description
1		**Lifting lug**
2	⊗	**Operating state signal lamp** Lights up when the machine is ready for use.
3		**"Fault" display** "Collective interference" signal light If the signal light is on, the power unit is automatically switched off. Because some interference is short-term and one-off (e.g. excess temperature), the signal light will go off again and the welding machine will be ready for welding. If the signal light is still on after a reasonable amount of time, see the chapter on "Operating errors, causes and remedies".
4		**Welding process signal lamp** Lights up when the welding process runs.
5	COM	**PC interface, serial (D-Sub connection socket, 9-pole)**
6		**Cooling air inlet**
7		**Cooling module**
8		**7-pole connection socket (digital)** For connecting digital accessory components
9		**12-pole connection socket (digital)** Operating panel connection lead connection
10		**Main switch, machine on/off**

4.1.2 Rear view
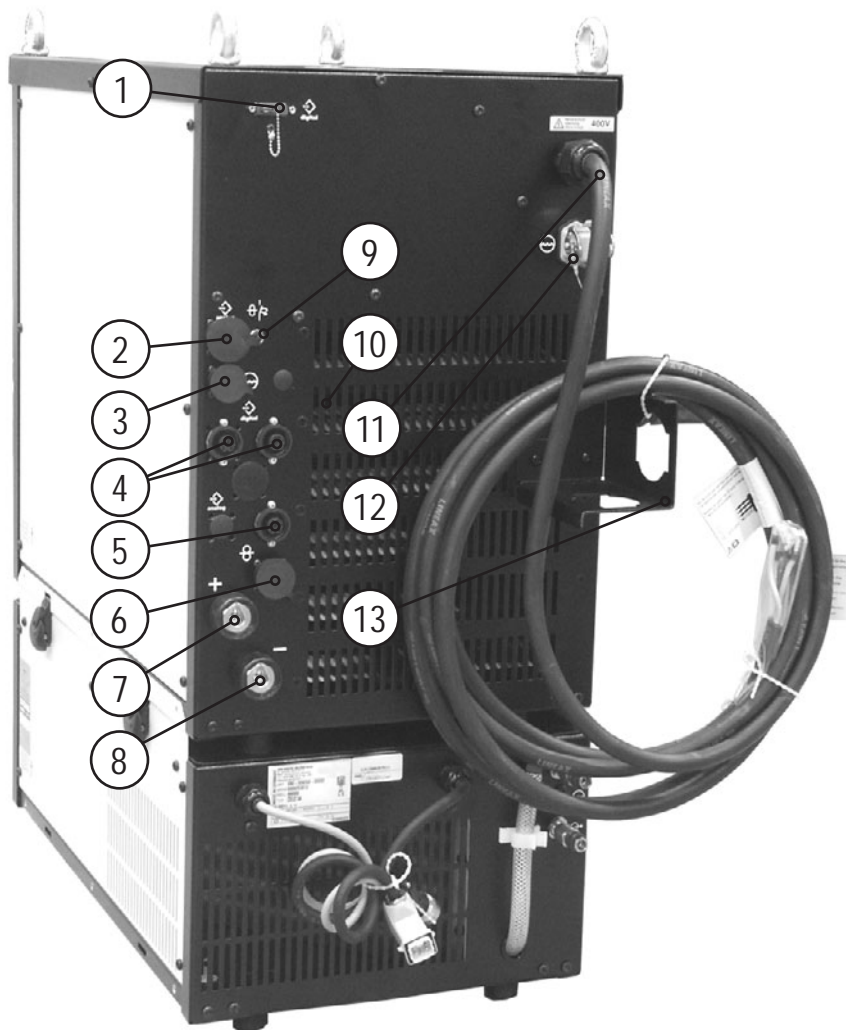
Figure 4-2

Item	Symbol	Description
1	digital	**Interfaces (customer specific)** • RINTX12 robot interface • BUSINTX11 industrial bus interface
2	analog	**19-pole mechanised welding interface (analogue)** (See chapter entitled "Design and function > interfaces".)
3		**8-pole connection socket** Cooling unit control lead
4		**7-pole connection socket (digital)** For connecting digital accessory components
5		**7-pole connection socket (digital)** Wire feed unit connection
6		**12-pole connection socket (analogue)** Connection socket for analogue control signals (collision protection, etc.) between the welding torch and the power source
7		**Connector plug, welding current "+"** Welding current connection on wire feed unit
8		**Connection socket, "-" welding current** Workpiece connection
9	42V/4A	**Key button, automatic cutout** Wire feed motor supply voltage fuse press to reset a triggered fuse
10		**Cooling air outlet**
11		**Mains connection cable**
12		**Connection socket, 5-pole** Cooling unit voltage supply
13		**Intermediate tube package strain relief**

4.2 Phoenix RC1

4.2.1 Front and rear views
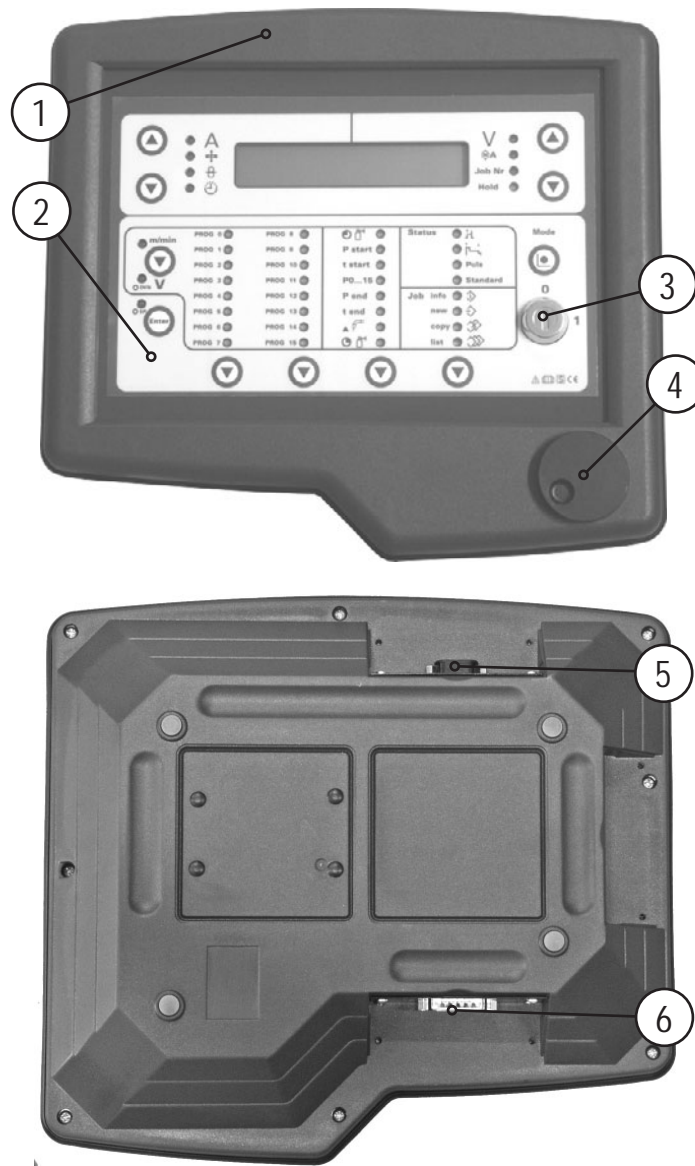
Figure 4-3

Item	Symbol	Description
1		**Operating panel**
2		**Machine control** See Machine control – operating elements chapter
3		**Key switch for protection against unauthorised use** Position "1" > changes possible, Position "0" > changes not possible. Please take note of chapter "Protecting welding parameters from unauthorised access"
4		**"Welding parameter" rotary dial** Select and change the welding parameters
5	COM	**PC interface, serial (D-Sub connection socket, 9-pole)**
6	digital	**15-pole connection socket (digital)** Connection of the connection lead to the power source

4.3 Machine control – Operating elements

NOTE
☞ **The machine control can be built in the front of the machine or in an external panel!**
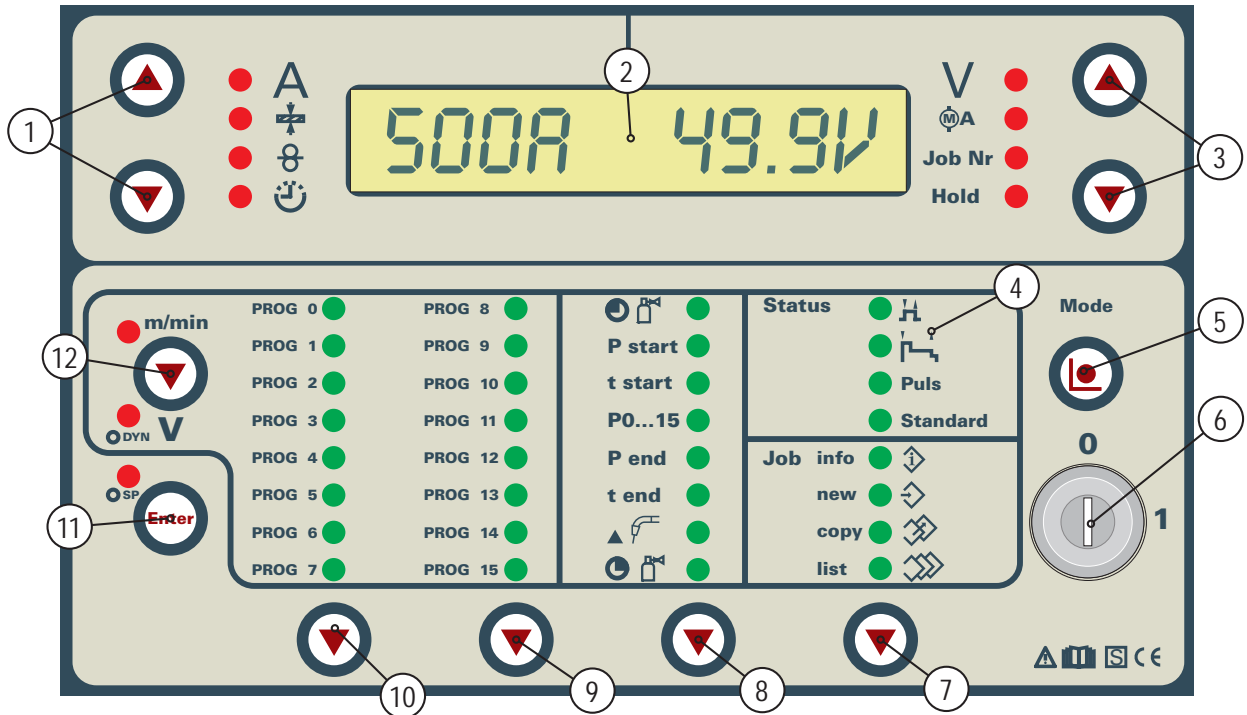
Figure 4-4

Item	Symbol	Description
1	▲ ▼	**Buttons switching digital display, left** A Welding current (nominal, actual and hold values) ⟊ Material thickness (nominal value) ୫ Wire speed (nominal, actual and hold values) ⏱ Operating hour counter Selection of further welding parameters in lower programming levels.
2	500A 49,9V	**Display, 16-digit** **Display of all welding parameters and their values**
3	▲ ▼	**Switching of the digital display Buttons, right** V Welding voltage (nominal / actual values) Ⓜ A Motor current (actual value) **Job Nr** JOB number **Hold** After each completed welding process, the last parameter values used for the welding process are shown on the display in the main program; the signal light is on.
4		**Status** Display of the current parameters specified by the robot control. Ⱨ Non-latched ⎍ Special, non-latched **Puls** Pulse welding **Standard** Standard welding
5	⦿	**Button, Mode** Select further programming levels (program steps mode, main program A mode, JOB Manager, JOB Info)

Item	Symbol	Description
6	**0** ⊘ **1**	**Key switch for protection against unauthorised use** Position "1" > changes possible, Position "0" > changes not possible. Please take note of chapter "Protecting welding parameters from unauthorised access"
7	▼	**"JOB Manager" button (organise welding tasks)** Job info ⓘ Display information on the current welding task selected new ⇗ Define new welding task copy ≫ Copy welding task list ≫ Display information on any welding task (job)
8	▼	**Button, "Program sequence"** During operation, the current position in the program sequence is shown. Outside, the values can be selected and welding parameters changed by means of the rotary dial. 🕐 ⌼ Gas pre-flows (0.0 to 20.0 sec) **P start** Start program (WFstart 0% to 200% / Ustart) **t start** Start time (0.0 to 20.0 sec) **P0...15** Current program display **P end** End program (0% to 200%) **t end** End time (0.0 to 20.0 sec) ▲ ⌐ Wire burn-back (2 to 500) 🕐 ⌼ Gas post-flow time (0.0 s to 20.0 s)
9	▼	**Button, "Program selection 8 to 15"** Display the selected program during the welding process and select program outside the welding process.
10	▼	**Button, "Program selection 0 to 7"** Display the selected program during the welding process and select program outside the welding process.
11	Enter	**"ENTER" button** Confirmation, e.g.: of JOB parameters O SP Superpuls
12	▼	**Button, "Program A" (operating point)** **m/min** Wire speed V Voltage correction O DYN Dynamics (signal light flashing)

5 Design and function

NOTE
☞ Observe documentation of other system components when connecting!

5.1 General

⚠ DANGER
Risk of injury from electric shock!
Contact with live parts, e.g. welding current sockets, is potentially fatal!
• Follow safety instructions on the opening pages of the operating instructions.
• Commissioning may only be carried out by persons who have the relevant expertise of working with arc welding machines!
• Connection and welding leads (e.g. electrode holder, welding torch, workpiece lead, interfaces) may only be connected when the machine is switched off!

⚠ CAUTION
Risk of burns on the welding current connection!
If the welding current connections are not locked, connections and leads heat up and can cause burns, if touched!
• Check the welding current connections every day and lock by turning in clockwise direction, if necessary.
Risk of injury due to moving parts!
The wire feed units are equipped with moving parts, which can trap hands, hair, clothing or tools and thus injure persons!
• Do not reach into rotating or moving parts or drive components!
• Keep casing covers closed during operation!
Risk of injury due to welding wire escaping in an unpredictable manner!
Welding wire can be conveyed at very high speeds and, if conveyed incorrectly, may escape in an uncontrolled manner and injure persons!
• Before mains connection, set up the complete wire guide system from the wire spool to the welding torch!
• Remove the counter pressure rollers from the wire feed unit if no welding torch is fitted!
• Check wire guide at regular intervals!
• Keep all casing covers closed during operation!
Risk from electrical current!
If welding is carried out alternately using different methods and if a welding torch and an electrode holder remain connected to the machine, the open-circuit/welding voltage is applied simultaneously on all cables.
• The torch and the electrode holder should therefore always be placed on an insulated surface before starting work and during breaks.

CAUTION

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

⚡ **Using protective dust caps!**
Protective dust caps protect the connection sockets and therefore the machine against dirt and damage.
- The protective dust cap must be fitted if there is no accessory component being operated on that connection.
- The cap must be replaced if faulty or if lost!

5.2   Connection plan
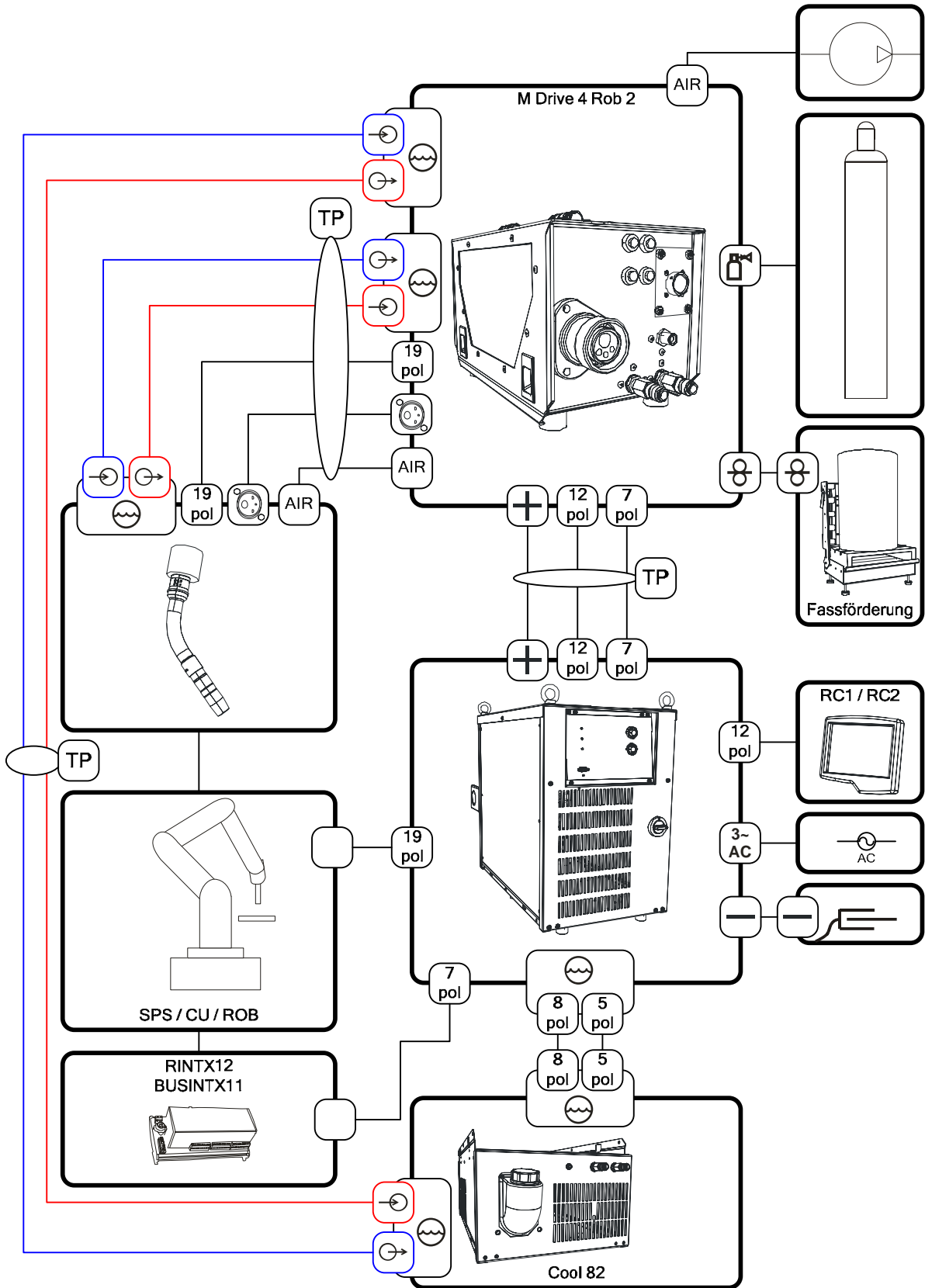
Figure 5-1

5.2.1 Legend

	Wire feed
	Welding current (minus potential, workpiece)
	Shielding gas
	Welding torch coolant
	Cooling water input
	Cooling water output
3~ AC	**Welding machine supply voltage**
	Welding current (plus potential)
19 pol	**19-pole mechanised welding interface**
12 pol	**Wire feed unit control lead (12-pole)**
7 pol	**Wire feed unit control lead/RINTX12, BUSINTX11 (7-pole)**
5 pol	**Cooling unit supply voltage connection (5-pole)**
	Central connection (Euro)
8 pol	**Cooling unit control lead (8-pole)**
AIR	**Compressed air connection to clean the welding torch nozzles**
TP	**Hose package (TP = tube package)**

5.3 Installation

> ⚠️ **CAUTION**
>
> **Installation site!**
> **The machine must not be operated in the open air and must only be set up and operated on a suitable, stable and level base!**
> • The operator must ensure that the ground is non-slip and level, and provide sufficient lighting for the place of work.
> • Safe operation of the machine must be guaranteed at all times.

5.4 Machine cooling

To obtain an optimal duty cycle from the power components, the following precautions should be observed:

• Ensure that the working area is adequately ventilated.
• Do not obstruct the air inlets and outlets of the machine.
• Do not allow metal parts, dust or other objects to get into the machine.

5.5 Workpiece lead, general

> ⚠️ **CAUTION**
>
> **Risk of burns due to incorrect connection of the workpiece lead!**
> **Paint, rust and dirt on the connection restrict the power flow and may lead to stray welding currents.**
> **Stray welding currents may cause fires and injuries!**
> • Clean the connections!
> • Fix the workpiece lead securely!
> • Do not use structural parts of the workpiece as a return lead for the welding current!
> • Take care to ensure faultless power connections!

5.6 Welding torch cooling system

5.6.1 General

<div>

CAUTION

⚠️ **Coolant mixtures!**
Mixtures with other liquids or the use of unsuitable coolants result in material damage and renders the manufacturer's warranty void!
• Only use the coolant described in this manual (overview of coolants).
• Do not mix different coolants.
• When changing the coolant, the entire volume of liquid must be changed.

❄️ **Insufficient frost protection in the welding torch coolant!**
Depending on the ambient conditions, different liquids are used for cooling the welding torch (see overview of coolants).
Coolants with frost protection (KF 37E or KF 23E) must be checked regularly to ensure that the frost protection is adequate to prevent damage to the machine or the accessory components.
• The coolant must be checked for adequate frost protection with the TYP 1 frost protection tester (see accessories).
• Replace coolant as necessary if frost protection is inadequate!

</div>

<div>

NOTE

☞ **The disposal of coolant must be carried out according to official regulations and observing the relevant safety data sheets (German waste code number: 70104)!**
• Coolant must not be disposed of together with household waste.
• Coolant must not be discharged into the sewerage system.
• Recommended cleaning agent: water, if necessary with cleaning agent added.

</div>

5.6.2 List of coolants

The following coolants may be used (for item nos., please see the Accessories chapter):

Coolant	Temperature range
KF 23E (Standard)	-10 °C to +40 °C
KF 37E	-20 °C to +10 °C
DKF 23E (for plasma machines)	0 °C to +40 °C

5.7 Mains connection

> **⚠ DANGER**
>
> **Hazard caused by improper mains connection!**
> **An improper mains connection can cause injuries or damage property!**
> - Only use machine with a plug socket that has a correctly fitted protective conductor.
> - If a mains plug must be fitted, this may only be carried out by an electrician in accordance with the relevant national provisions or regulations (any phase sequence for three-phase machines)!
> - Mains plug, socket and lead must be checked regularly by an electrician!
> - When operating the generator always ensure it is earthed as stated in the operating instructions. The resulting network has to be suitable for operating devices according to protection class 1.

5.7.1 Mains configuration

> *NOTE*
>
> ☞ **The machine may be connected to:**
> - **a three-phase system with four conductors and an earthed neutral conductor**
> - **a three-phase system with three conductors of which any one can be earthed,**
> **e.g. the outer conductor**
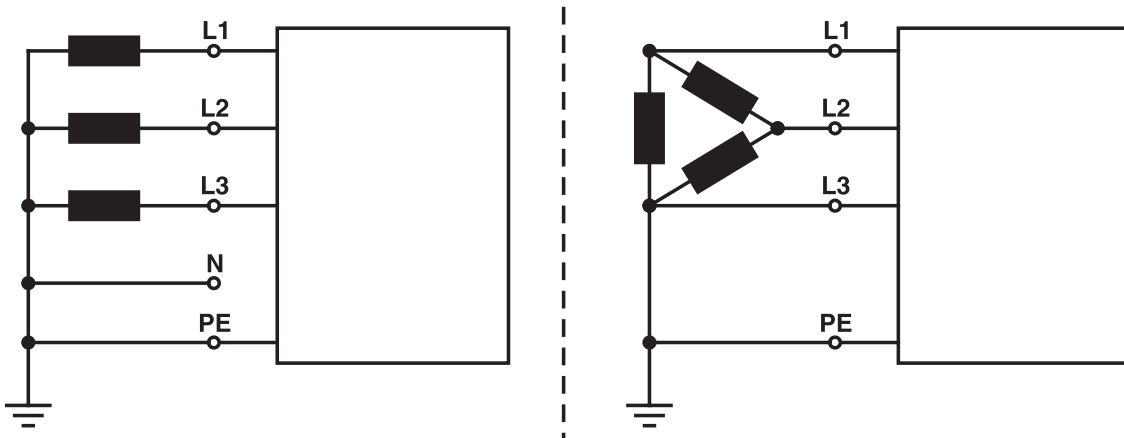
Figure 5-2

Legend

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

> **CAUTION**
>
> **Operating voltage - mains voltage!**
> **The operating voltage shown on the rating plate must be consistent with the mains voltage, in order to avoid damage to the machine!**
> - For mains fuse protection, please refer to the "Technical data" chapter!

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

5.8 Intermediate hose package connection

NOTE
☞ **Note the polarity of the welding current!** **Some wire electrodes (e.g. self-shielding cored wire) are welded using negative polarity. In this case, the welding current lead should be connected to the "-" welding current socket, and the workpiece lead should be connected to the "+" welding current socket.** • Observe the information from the electrode manufacturer!
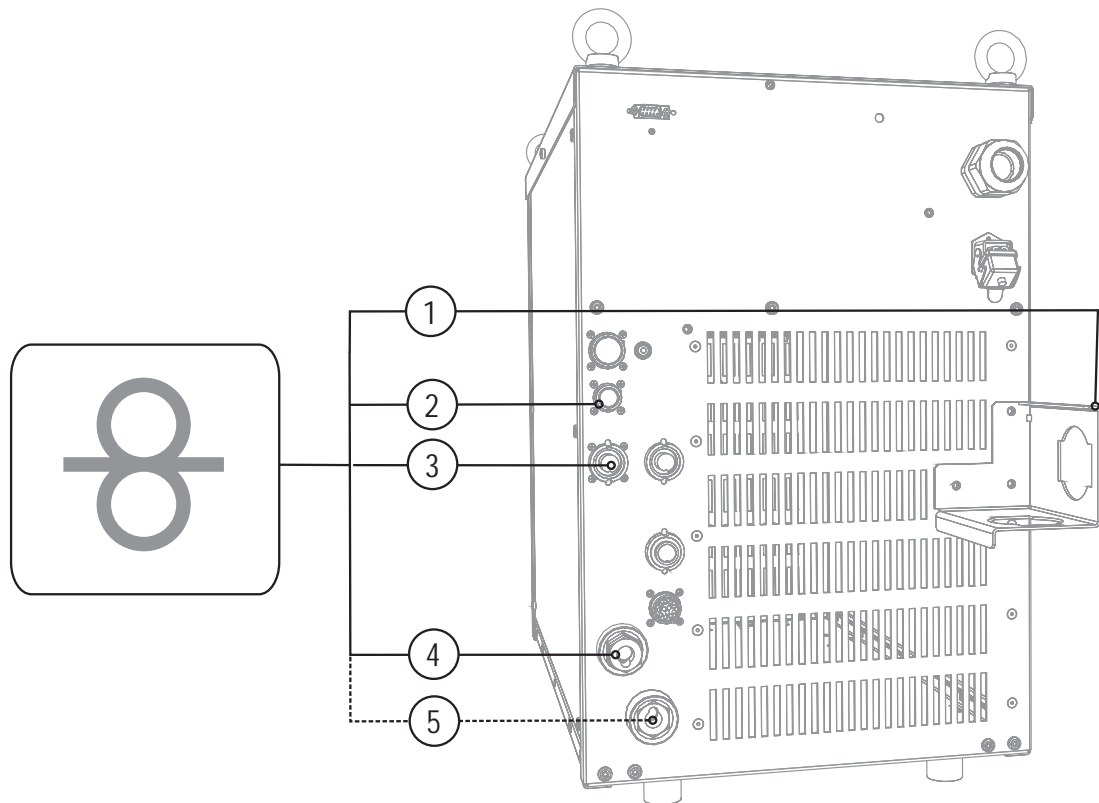
Figure 5-3

Item	Symbol	Description
1		**Intermediate tube package strain relief**
2	⧖	**12-pole connection socket (analogue)** Connection socket for analogue control signals (collision protection, etc.) between the welding torch and the power source
3	⧖	**7-pole connection socket (digital)** Wire feed unit connection
4	**+**	**Connection socket, "+" welding current** • MIG/MAG welding: Welding current to wire feed/torch
5	**—**	**Connection socket, "-" welding current** • MIG/MAG cored wire welding: Welding current to wire feed/torch

• Insert the end of the tube package through the intermediate tube package strain relief and lock by turning to the right. If applicable, follow the instructions from the third party manufacturer of the strain relief.

• Insert the welding current plug of the WF unit in the "+" welding current connection socket and lock by turning to the right.

• Insert the wire feed control lead plug into the 7-pole connection socket (digital) and lock.

• Insert the analogue control signal cable plug into the 12-pole (analogue) connection socket and lock by turning to the right.

5.9   Connection for workpiece lead

NOTE

☞   **Note the polarity of the welding current!**
Some wire electrodes (e.g. self-shielding cored wire) are welded using negative polarity. In this case, the welding current lead should be connected to the "-" welding current socket, and the workpiece lead should be connected to the "+" welding current socket.
  • Observe the information from the electrode manufacturer!
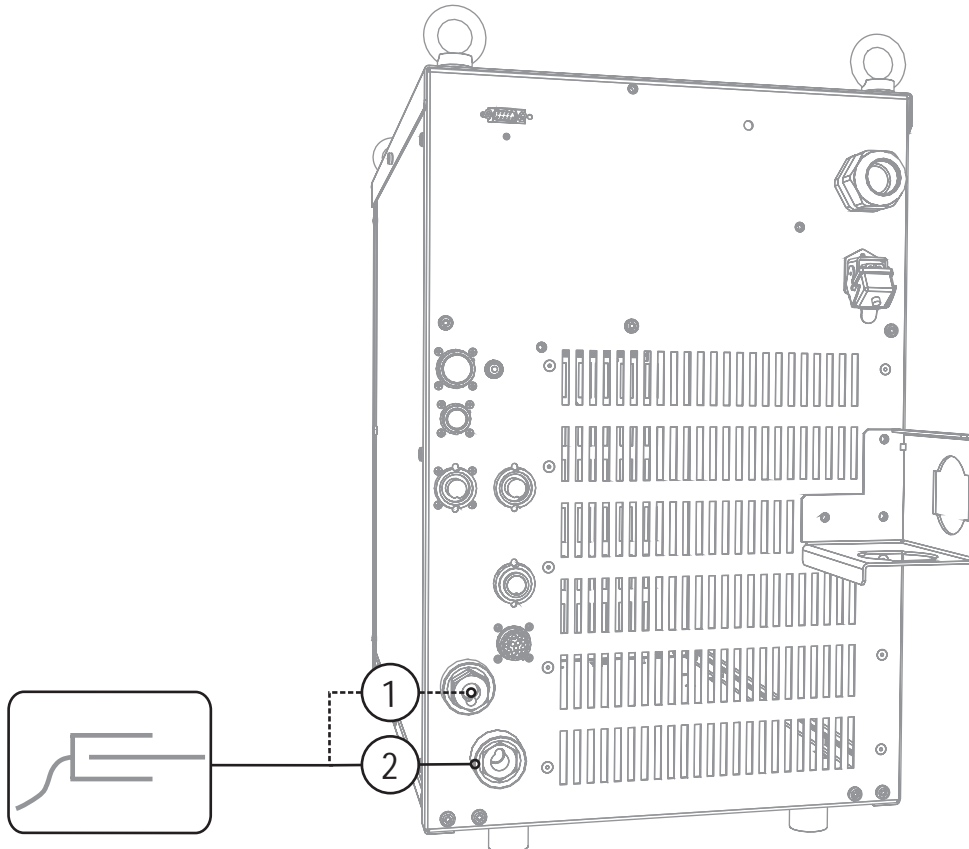
Figure 5-4

Item	Symbol	Description
1	**+**	**Connection socket, "+" welding current**
		• MIG/MAG cored wire welding: Workpiece connection
2	**—**	**"-" welding current connection socket**
		• MIG/MAG welding: Workpiece connection

• Insert the plug on the workpiece lead into the "-" welding current connection socket and lock.

5.10 Connect the cooling module to the power source

NOTE
☞ **Observe the fitting and connection instructions given in the relevant operating instructions for the cooling unit.**
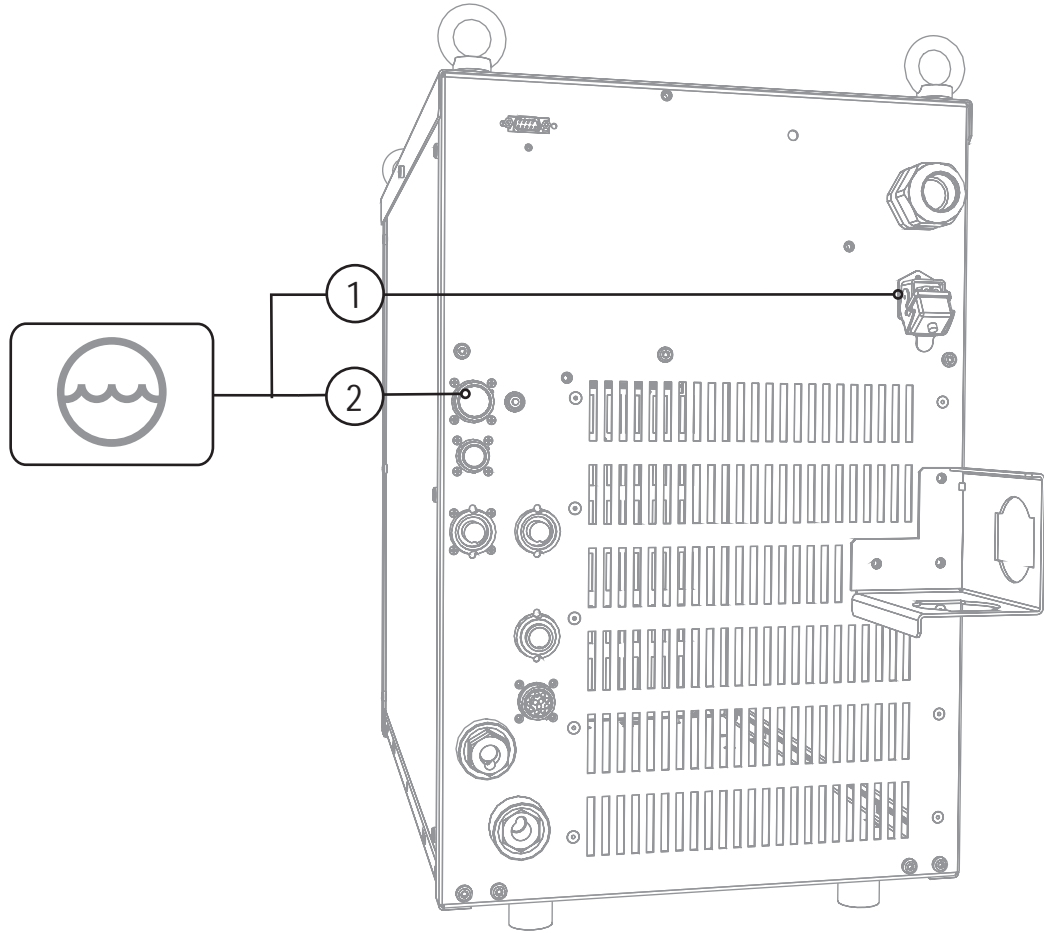
Figure 5-5

Item	Symbol	Description
1		**8-pole connection socket** Cooling unit control lead
2		**Connection socket, 5-pole** Cooling unit voltage supply

• Insert and lock the 8-pole control lead plug on the cooling unit into the 8-pole connection socket on the welding machine.

• Insert and lock the 5-pole supply plug on the cooling unit into the 5-pole connection socket on the welding machine.

5.11 Connect the Phoenix RC 1 to the power source
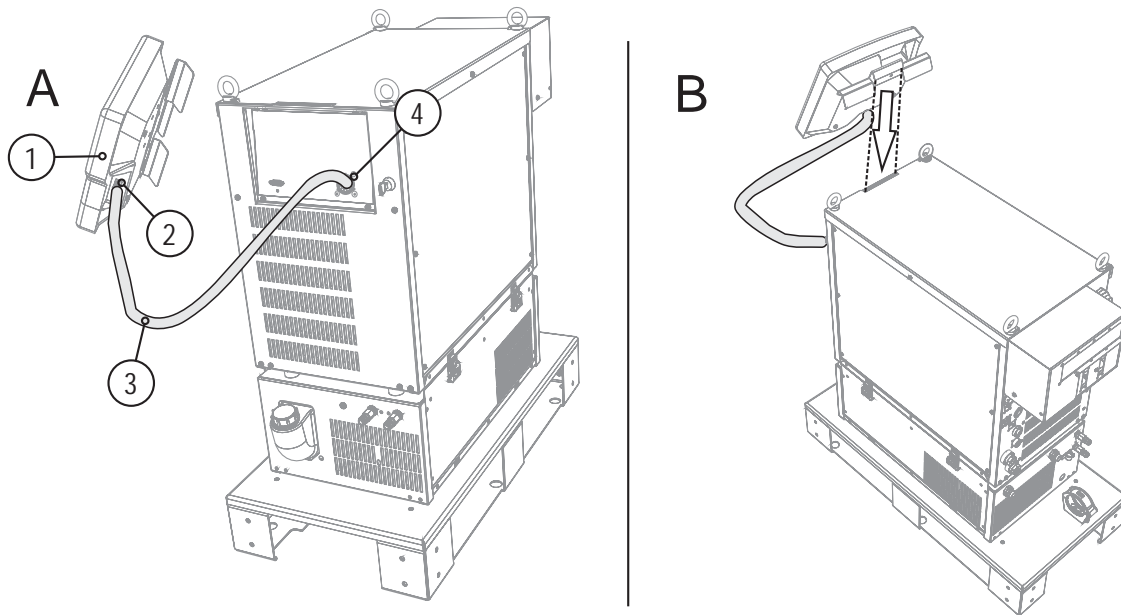
Figure 5-6

Item	Symbol	Description
1		**Phoenix RC1 / alpha Q RC2**
2	⬦ digital	**15-pole connection socket (digital)** Connection of the connection lead to the power source
3		**Connection cable**
4		**12-pole connection socket (digital)** Operating panel connection lead connection

5.12 Shielding gas supply

5.12.1 Connecting the shielding gas supply

⚠ **WARNING**

Incorrect handling of shielding gas cylinders!
Incorrect handling of shielding gas cylinders can result in serious and even fatal injury.
- Observe the instructions from the gas manufacturer and in any relevant regulations concerning the use of compressed air!
- Place shielding gas cylinders in the holders provided for them and secure with fixing devices.
- Avoid heating the shielding gas cylinder!

CAUTION

Faults in the shielding gas supply.
An unhindered shielding gas supply from the shielding gas cylinder to the welding torch is a fundamental requirement for optimum welding results. In addition, a blocked shielding gas supply may result in the welding torch being destroyed.
- Always re-fit the yellow protective cap when not using the shielding gas connection.
- All shielding gas connections must be gas tight.

NOTE

☞ **Before connecting the pressure reducer to the gas cylinder, open the cylinder valve briefly to expel any dirt.**
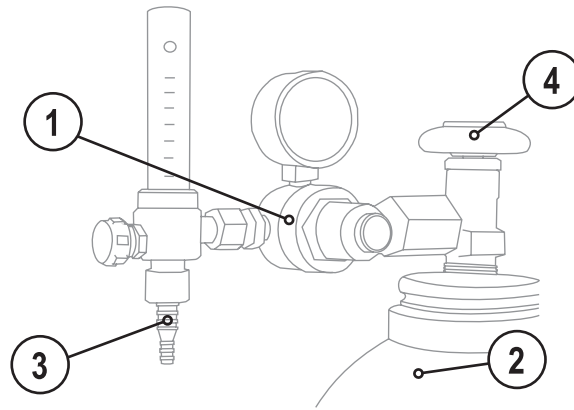
Figure 5-7

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

• Place the shielding gas cylinder in the cylinder holder and secure it from tipping over using the securing chain!
• Before connecting the pressure reducer to the gas cylinder, open the cylinder valve briefly to blow out any dirt.
• Mount the pressure regulator on the gas cylinder valve.
• Screw gas hose connection crown nut onto the output side of the pressure reducer.
• Screw the gas hose connection nipple onto the G¼" connection nipple.
• Tighten gas hose on pressure reducer to be gas tight.
• Fit the gas hose and G1/4" crown nut onto the relevant connection on the welding machine, and fit the wire feed unit (if present on this version).

5.12.2 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

NOTE

☞ **Incorrect shielding gas setting!**
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!

5.13 Interfaces

5.13.1 Connecting the RINT X11 robot interface/BUSINT X11 industrial bus interface

⚠	**CAUTION**

⚠	**Damage due to the use of non-genuine parts!**

The manufacturer's warranty becomes void if non-genuine parts are used!
- Only use system components and options (power sources, welding torches, electrode holders, remote controls, spare parts and replacement parts, etc.) from our range of products!
- Only insert and lock accessory components into the relevant connection socket when the machine is switched off.

Damage due to incorrect connection!
Accessory components and the power source itself can be damaged by incorrect connection!
- Only insert and lock accessory components into the relevant connection socket when the machine is switched off.
- Comprehensive descriptions can be found in the operating instructions for the relevant accessory components.
- Accessory components are detected automatically after the power source is switched on.

The interfaces can be operated directly on the power source in a separate interface casing or externally, e.g. in a robot control cabinet or via a data cable.

5.13.1.1 RINT X11 robot interface

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

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

5.13.1.2 BUSINT X11 industrial bus interface

The solution for integration into mechanised production lines, with for example
- Profibus
- CAN-Open, CAN DeviceNet
- Interbus systems with copper and optical fibre connection (FSMA/Rugged Line)

	NOTE
☞	**Only one variant can ever be operated at any one time.**
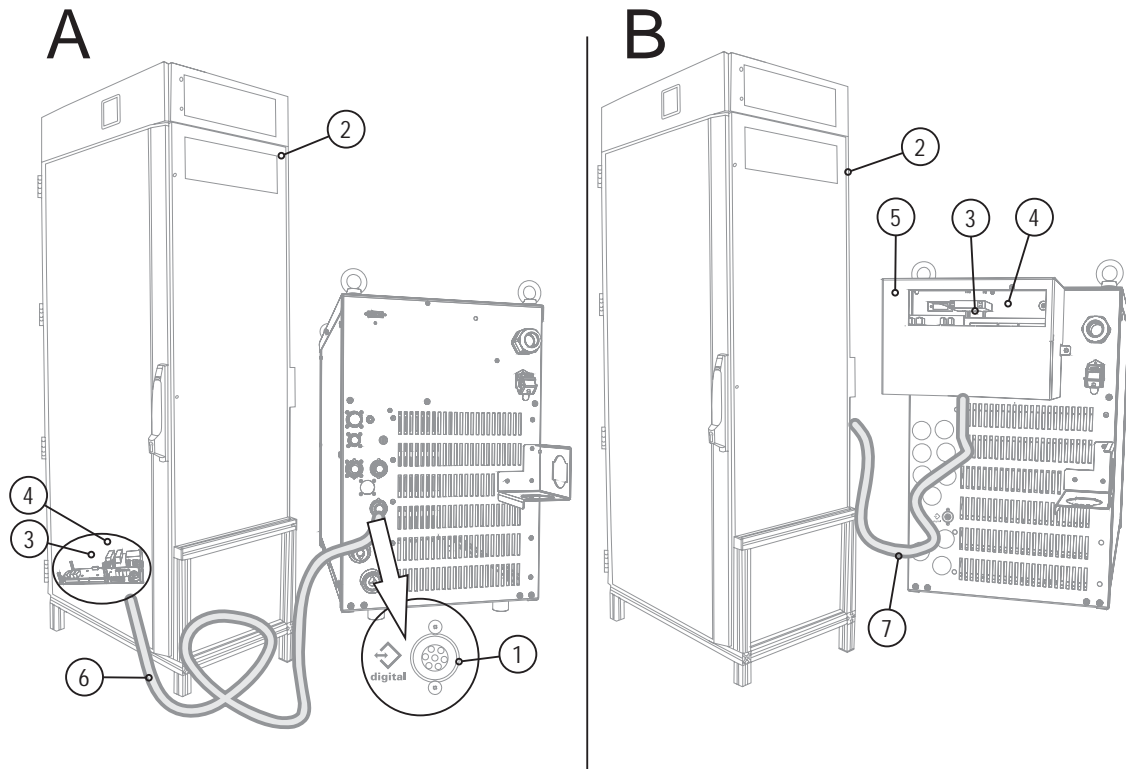
Figure 5-8

Item	Symbol	Description
1	⬙	**7-pole connection socket (digital)** For connecting digital accessory components
2		**Switching cabinet**
3		**Robot interface, Tetrix / Phoenix / alpha Q, RINT X12**
4		**Industrial bus interface, Tetrix / Phoenix / alpha Q, BUSINT X11**
5		**Interface casing**
6		**Connection cable, 7-pole** Connection between switching cabinet and power source
7		**Connection cables, 12-, 19- and 23-pole** Connection between interface casing and switching cabinet

5.13.2 Connecting the PC 300.net welding parameterisation software

Create all welding parameters quickly on the PC and easily transfer them to one or more welding machines (accessories, set consisting of software, interface, connection leads)
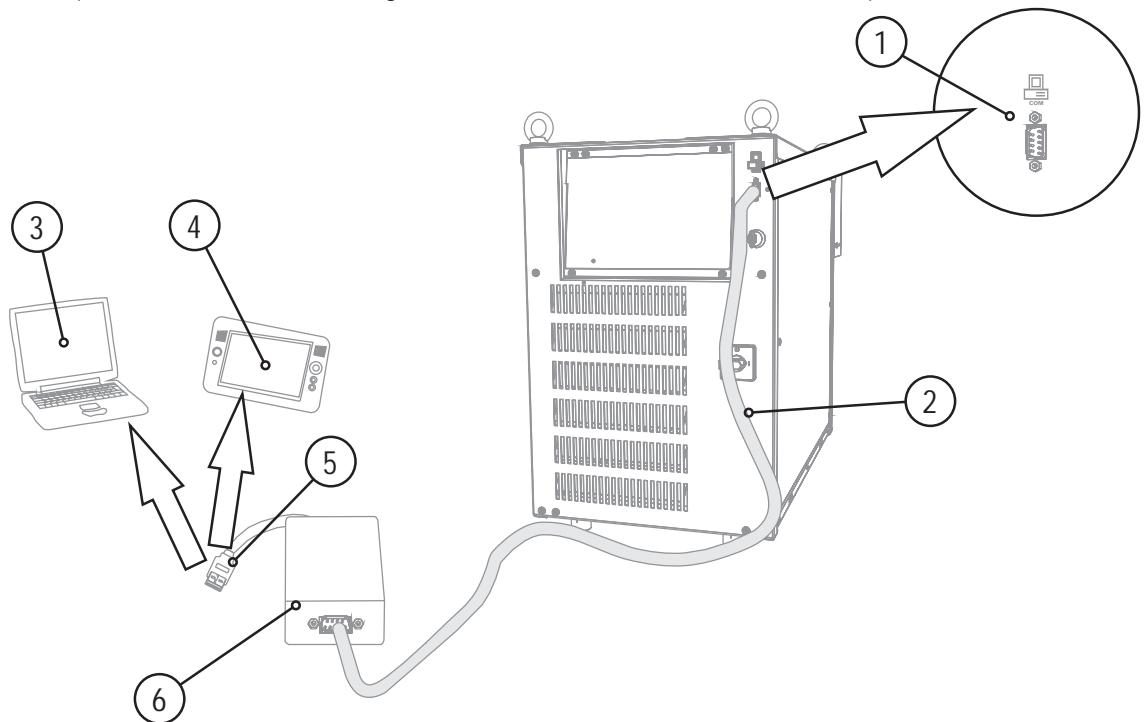
Figure 5-9

Item	Symbol	Description
1		**PC interface, serial (D-Sub connection socket, 9-pole)**
2		**Connection cable, 9-pole, serial**
3		**Windows PC**
4		**RC300 tablet PC**
5		**USB connection**
6		**SECINT X10 USB**

CAUTION

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

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

5.13.3 Connecting the Q-DOC 9000 welding data documentation software

(Accessories: Set consisting of software, interface, connection leads)

The ideal tool for welding data documentation of, for example:
welding voltage and current, wire speed and motor current.
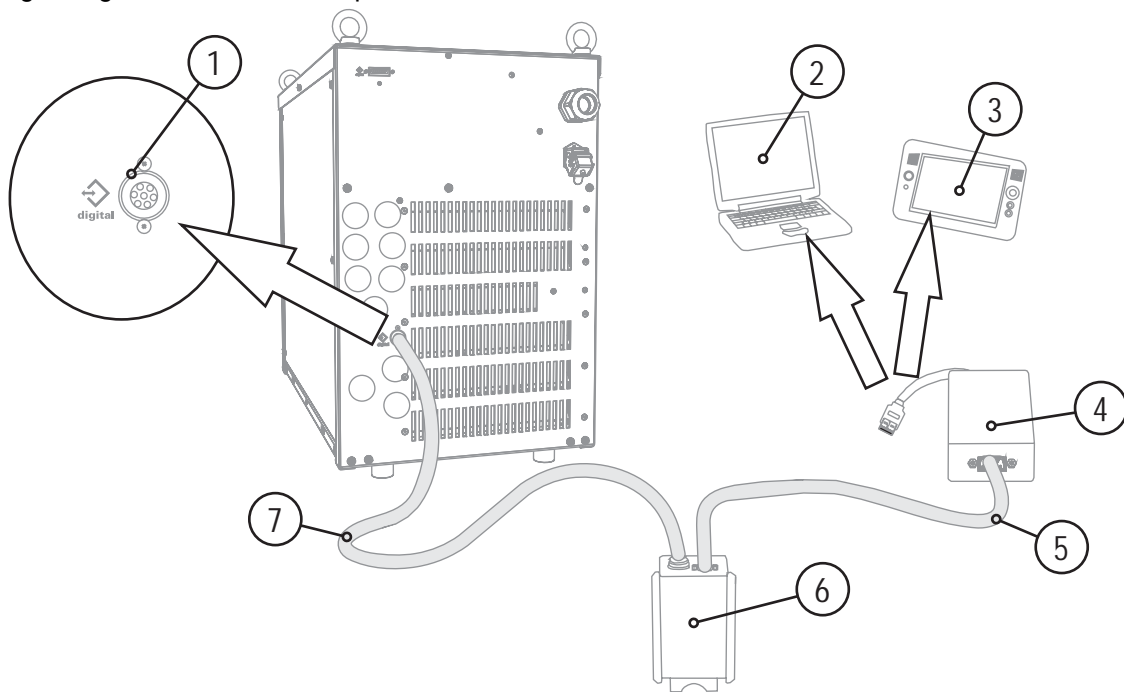
Figure 5-10

Item	Symbol	Description
1	⬦	**7-pole connection socket (digital)** For connecting digital accessory components
2		**Windows PC**
3		**RC300 tablet PC**
4		**SECINT X10 USB**
5		**Connection cable, 9-pole, serial**
6		**PCINT X10**
7		**Connection cable, 7-pole** Connection between switching cabinet and power source

---

⚠ CAUTION

Equipment damage or faults may occur if the PC is connected incorrectly!

Not using the SECINT X10USB interface results in equipment damage or faults in signal transmission. The PC may be destroyed due to high frequency ignition pulses.

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

5.13.4 Connecting the WELDQAS welding data monitoring and documentation system

Network-compatible welding data monitoring and documentation system for digital power sources.
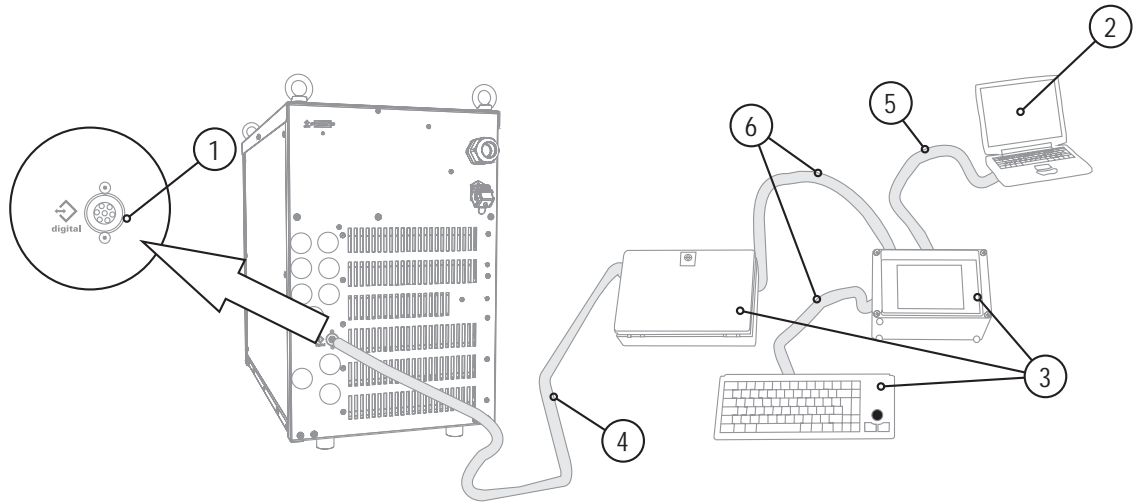
Figure 5-11

Item	Symbol	Description
1		**7-pole connection socket (digital)** For connecting digital accessory components
2		**Windows PC**
3		**WELDQAS welding data monitoring and documentation system**
4		**Connection cable, 7-pole** Connection between switching cabinet and power source
5		**Integration option of WELDQAS into existing network systems via network cables**
6		**Connection cable included as standard with WELDQAS**

5.13.5 Automation interface

The welding power sources feature a very high safety standard.

This safety standard is also maintained when peripheral equipment is connected for mechanised welding, if this peripheral equipment meets the same criteria, particularly with regard to isolation from the mains supply.

This is guaranteed by the use of transformers conforming to VDE 0551.

The welding machines are equipped for mechanised operation as standard.

For the simplest possible mechanised applications, control inputs and galvanically isolated relay contacts are available on the interface for mechanised welding.

⚠	**CAUTION**
	Equipment damage due to unshielded control leads!
	Unshielded control leads can cause damage to the power source and accessory components.
	• Use shielded control leads only.
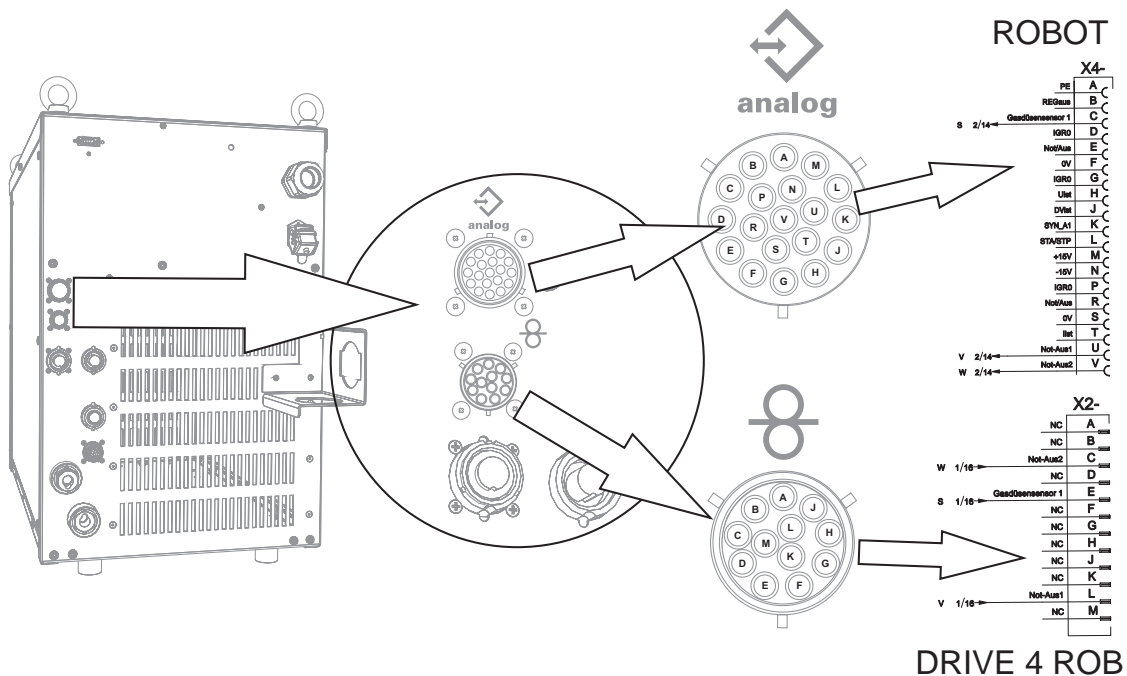
Figure 5-12

⚠	**WARNING**
	No function of the external shut-down devices (emergency stop switch)!
	If the emergency stop circuit has been realised using an external shut-down device via the interface for mechanised welding, the device must be set for this setup. If this is not observed, the power source will ignore the external shut-down devices and will not shut down!
	• Disconnect jumper 1 on PCB T320/1 (Tetrix) or M320/1 (Phoenix / alpha Q)!

19-pole connection assignment for mechanised welding interface (X4):

Pin	Input/output	Designation	Note
A	Output	PE Cable screen connection	
B	Output	REGaus	
C	Input	Gasdüsensensor 1	
D	Output	IGR0 Current flowing signal (I>0) 0 V = welding current 15 V = no welding current	Maximum load 100 mA Not isolated!
E/R	Input	Not/Aus Open = welding current switched off	Make sure that jumper 1 on PCB M320/1 of the welding machine is open! Connection with potential-free contact!
F	Output	0V	
G/P	Output	IGR0 Power relay contact, I>0 to the user	Potential-free, +-15 V/100 mA
H	Output	Uist $+U_{act}$	10 V = 100 V welding voltage
J	Output	DVist	
K	Output	SYN_A1	Seam tracking synchronising signal
L	Input	STA/STP Start/stop	Contact at M Switch to potential-free
M	Output	+15V Power supply	+15 V, max. 75 mA
N	Output	-15V Power supply	-15 V, max. 25 mA
S	Output	0V	
T	Output	Iist $+I_{act}$	10 V = 1000 A welding current
U	Output	Not-Aus 1 e.g. emergency stop for shutdown box, collision switch	
V	Output	Not-Aus 2 e.g. emergency stop for shutdown box, collision switch	

12-pole connection assignments for mechanised welding interface (X2):

Pin	Signalshape	Circuit diagram signal name	Function
A		NC	
B		NC	
C/L	Input	NOT-AUS	Emergency stop for higher level shut-down of the power source. To use this function, jumper 1 must be unplugged on PCB M320/1 in the welding machine. Contact open = welding current switched off
D		NC	
E		Gasdüsensensor 1	
F		NC	
G		NC	
H		NC	
J		NC	
K		NC	
M		NC	

5.13.6 Sensor Voltage

The sensor voltage is transmitted via PIN F of the mechanised welding torch connection socket (X22). Outside the welding process, there is a voltage of approx. 12 V on the welding torch electrode. If the electrode comes into contact with the workpiece or the molten pool, the short-circuit produced means that when using the relevant interface (BUSINT X11/RINT X12), the resultant signal can be used for various functions (e.g. workpiece search). The output signal can be used to connect the cold wire component in order to enable fusing detection at the end of the process.

5.14 Protecting welding parameters from unauthorised access

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

In key switch position 1 all functions and parameters can be set without restriction.

In key switch position 0 the following functions and parameters cannot be changed:

- Job switching function, welding task selection
  (block job mode possible with Power-control torch)
- Job Manager mode
- Program Steps mode
- Program A mode
- Job Info mode
- Super pulse function

5.15 Welding data display

To the left and right of the LCD display on the control there are 2 "arrow keys" on each side for selecting the welding parameter to be displayed. The ▲ button is used to scroll through the parameters from the bottom upwards and the ▼ button is used to scroll downwards from the top.

As soon as changes have been made to the settings after welding (display on hold values), the display switches back to the nominal values.

Figure 5-13

Parameter	Before welding	During welding		After welding	
	Nominal value	Actual value	Nominal value	Hold value	Nominal value
Welding current	☑	☑	☐	☑	☐
Material thickness	☑	☐	☑	☐	☑
Wire speed	☑	☑	☐	☑	☐
Welding voltage	☑	☑	☐	☑	☐
Motor current	☐	☑	☐	☑	☐
JOB no.	☑	☐	☐	☐	☐
Operating time	☐	☑	☐	☐	☐

5.16   Definition of MIG/MAG welding tasks

The user defines the welding tasks using job numbers.

Each job number stores all the parameters relating to the welding task.

For the most commonly used applications, 128 pre-programmed JOBs (welding tasks) are stored in the machine control with the relevant parameters.

On the control panel, the user can either load an existing job, load an existing job and change it, or define a completely new job.

The welding task or job is defined using the following parameters:

Basic parameters

The job number is defined using four basic welding parameters:

Welding process, material type, wire diameter and gas type.

According to the pre-programmed jobs, the typical or frequently used gas types and wire diameters for the material are suggested automatically depending on the material type selected. It is impossible to select inappropriate combinations for welding.

Program sequence

Other welding parameters, such as parameters for the start program, secondary program or end program and the gas pre-flow time, wire creep, slope times, wire burn-back (and many more) are preset for a variety of applications, but can be modified where required. On the control panel, the most important welding parameters are displayed directly and can be modified where required.

Program or control voltage (operating point)

The operating point can either be set using up to 15 (PROG 1 to PROG 15) freely definable programs or using control voltages (PROG 0) via the robot interface (RINTX12 / BUSINTX11).

* The wire speed, voltage correction and dynamics are stored in each program. These program parameters can be specified on the control panel. The program number is selected by the robot control.

* In control voltage mode, there is a control voltage (0 V to 10 V) available on the robot interface for each parameter (wire speed, voltage correction and dynamics).

The digital system calculates the required process parameters, such as the welding current, welding voltage and pulse current according to the operating point specified.

NOTE
☞   **The parameters and functions described here can also be programmed using a PC or laptop and the PHOENIX PCM 300 welding parameter software.**

Operating mode

Non-latched or non-latched special (start current, main current and end program)

Welding type

Pulse or standard welding

5.17 Welding task selection

5.17.1 Selecting or defining a new job

Option 1: Select job from existing job reference list

To do this, the job overview (see Appendix 2) is used as a reference for determining the welding task.

It is also possible to use the "Job list" menu option on the M3.40 power source control to determine the relevant job number according to the basic parameters (see Appendix 1: "Job organisation function sequence").

Defining a new job

Operating element	Action	Result	Display (example)
Job info ● ⟐ new ● ⤳ copy ● ⟫ list ● ⟫⟫ ▼	X x ☞	**Select "Job new"** The signal light displays the selection.	Verf. : MIG
Enter	1 x ☞	**Select "Welding process"**	Verf. : MIG
⊙	↻☞	**Select "Welding process"**	Verf. : MIG
Enter	1 x ☞	**Select "Material type"**	Material: xxxxx
⊙	↻☞	**Select "Material type"**	Material: xxxxx
Enter	1 x ☞	**Select "Wire diameter"**	Draht : xxxxxx
⊙	↻☞	**Select "Wire diameter"**	Draht : xxxxxx
Enter	1 x ☞	**Select "Gas type"**	Gas-Art : xxxxxx
⊙	↻☞	**Select "Gas type"**	Gas-Art : xxxxxx
Enter	1 x ☞	**Select "Job number"**	Job-Nr. : xxx
⊙	↻☞	**Select "Job number"** Search for job number for selected welding task: Jobs 129 to 256 (free memory space)	Job-Nr. : xxx
Enter	1 x ☞	**Save job number** Save selected job number in the free memory	Wait

---

NOTE

☞ **The job number is selected and changed by the robot control via robot interface RINTX11 or BUSINTX12.**

5.17.2 forceArc

The forceArc process is welding in the spray arc range with a considerably shortened arc. Disadvantages of short-circuit phases are compensated by the fast control inverter technology.

Benefits of forceArc welding:
- Good fusion penetration
- Directionally stable arc
- No undercuts
- Higher welding speed
- Small heat-affected zone

You can make use of these properties after selecting the forceArc process (see the "Selecting a MIG/MAG welding task" chapter).

As with pulse arc welding, it is important to make sure of a good welding current connection.
- Keep welding current cables as short as possible and ensure that cable cross-sections are adequate!
- Fully unroll welding current cables, torche tube packages and, if applicable, intermediate tube packages. Avoid loops!
- Use welding torches, preferably water-cooled, that are suitable for the higher power range.
- Use welding wire with adequate copper coating when welding steel. The wire spool should have layer spooling.

NOTE
☞ **Unstable arc!**   **Welding current cables that are not fully unrolled can cause faults in the arc (flickering).**   • Fully unroll welding current cables, torch tube packages and, if applicable, intermediate tube packages. Avoid loops!

5.17.3 Operating mode

This parameter setting is specified by the robot control via the RINTX12 or BUSINTX11 robot interface (see documentation in the relevant interface description).

The selected parameter is displayed on the status displays on the control panel.

5.17.4 Welding type

This parameter setting is specified by the robot control via the RINTX12 or BUSINTX11 robot interface (see documentation in the relevant interface description).

The selected parameter is displayed on the status displays on the control panel.

NOTE
☞ **This parameter can be changed over during the welding process.**

5.17.5 Program or control voltage mode

NOTE
☞ **The operating point can either be specified using up to 15 freely definable programs (PROG 1 to PROG 15) or an operating point can be set using control voltages (PROG 0) via the robot interface (RINTX11 / BUSINTX10).**

Program operation

Different welding tasks or positions on a workpiece demand various welding outputs (operating points) or welding programs.

For each program, the

• Wire speed
• Correction of the arc length and the
• Dynamics / choke effect

can be set separately.

15 different programs (PROG 1 to PROG 15) can be defined. It is possible to switch between these programs during the welding process.

The parameters for the relevant program are selected on the control panel.

Operating element	Action	Result	Display
PROG 0 ... PROG 15	X x 👆	**Select "Program number"** The signal light displays the selection. PROG 1 to PROG 15 are available.	P1 DV2 : 2.0m/m
m/min / DYN / V	1 x 👆	**Select "Wire speed"** The signal light displays the selection (m/min).	P1 DV2 : x.x m/m
(knob)	🔄👆	**Select "Wire speed"** Setting from 0.1 to 40.0 m/min.	P1 DV2 : x.x m/m
m/min / DYN / V	1 x 👆	**Select "Voltage correction"** The signal light displays the selection (V).	P1 U2 : + x.x V
(knob)	🔄👆	**Select "Voltage correction"** Setting from -9.9 V to +9.9 V.	P1 U2 : + x.x V
m/min / DYN / V	1 x 👆	**Press "Dynamics"** The signal light (DYN) flashes.	
(knob)	🔄👆	**Select "Dynamics"** Setting from -40 to +40.	

Control voltage operation

This parameter setting is specified by the robot control via the RINTX12 or BUSINTX11 robot interface (see documentation in the relevant interface description).

Signal light "PROG 0" lights up on control panel.

5.17.6 Program sequence

Certain materials, such as aluminium, require special functions in order to be able to weld them safely and at high quality. The non-latched special operating mode is used here with the following programs:
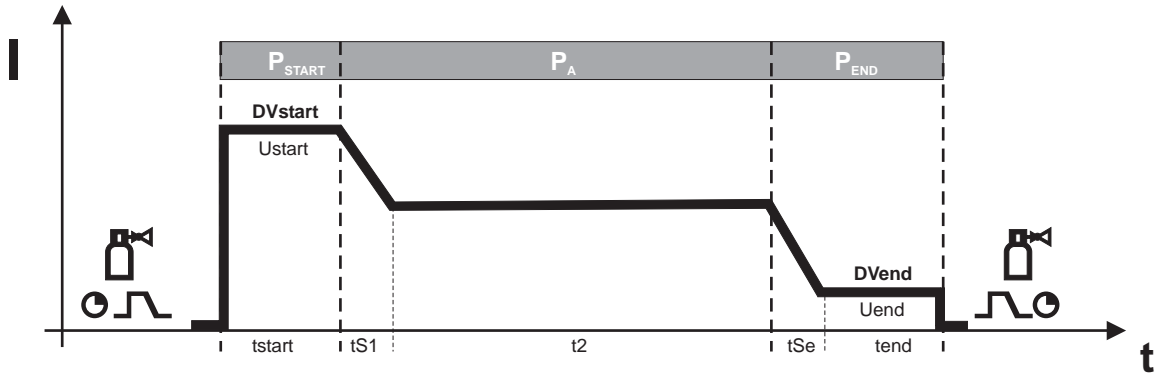
Figure 5-14

The following parameters can be selected and changed on the control panel:

Graphic	Symbol	Parameter	Value
	⏱ 🔧	Gas pre-flows	0.0 to 20.0 sec
	P start	Ignition program • Wire speed • Voltage correction	WFstart 0 % to 200 % or Ustart -9.9 V to +9.9 V Change with button
	t start	Start time	0.0 to 20.0 sec
	P0...15	Program number	P0 to P15
	P end	End program • Wire speed • Voltage correction	WFend 0 % to 200 % or Uend -9.9 V to +9.9 V Change with button
	t end	End time	0.0 to 20.0 sec
	▲ 🔧	Wire burn-back	2 to 500
	⏱ 🔧	Gas post-flow time	0.0 to 20.0 sec

Parameter changes are made either using the "Welding parameter ⊙" rotary dial or the buttons.

The program P_A corresponds to one of the up to 15 freely definable programs. The times for parameters tS1 and tSe (soft wire transfer) are factory-set.

The complete list of parameters can be found in chapter:
MIG/MAG program sequence ("Program steps" mode).

The signal lights display the current progress in the function sequence throughout the welding process.

5.17.7 Superpulses
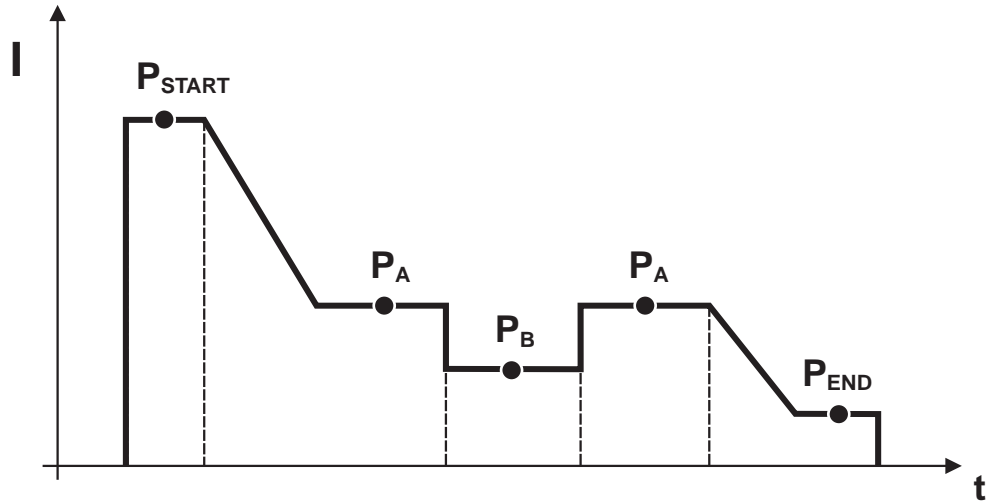
Figure 5-15

With superpulses, there is a changeover between the main program (P_A) and reduced main program (P_B).

This function is used in the very thin metal sheet range, for example, to reduce the heat input in a targeted way.

Selection on the operating panel:

Operating element	Action	Result	Display
Enter	**2 s**	**Switch superpulses on or off** The "SP" signal light displays the selection.	No change

For setting the program parameters, see "MIG/MAG program sequence" ("Program steps" mode) chapter.

5.18 MIG/MAG functional sequences / operating modes

NOTE
☞ **There are optimum pre-sets for welding parameters such as gas pre-flow and free-burn, etc. for numerous applications (although these can also be changed if required).**

5.18.1 Explanation of signs and functions

Symbol	Meaning
	Start of welding
	End of welding
	Shielding gas flowing
I	Welding output
	Wire electrode is being conveyed
	Wire creep
	Wire burn-back
	Gas pre-flows
	Gas post-flows
	Non-latched
	Non-latched special
t	Time
PSTART	Start program
Flat	Main program
PEND	End program

Non-latched mode
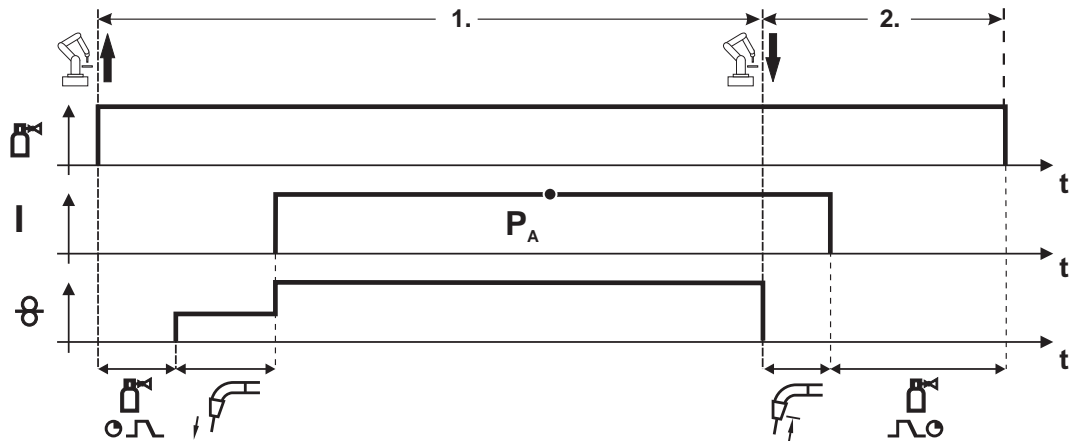
Figure 5-16

Step 1

- Robot issues the start signal to the power source.
- Shielding gas is expelled (gas pre-flows).
- Wire feed motor runs at "creep speed".
- Arc ignites after the wire electrode makes contact with the workpiece; welding current flows.
- Changeover to pre-selected wire speed (main program P_A).

Step 2

- Robot issues the stop signal to the power source.
- WF motor stops.
- Arc is extinguished after the pre-selected wire burn-back time elapses.
- Gas post-flow time elapses.

Non-latched operation with superpulse

NOTE
☞ **Pulse arc welding machines only.**
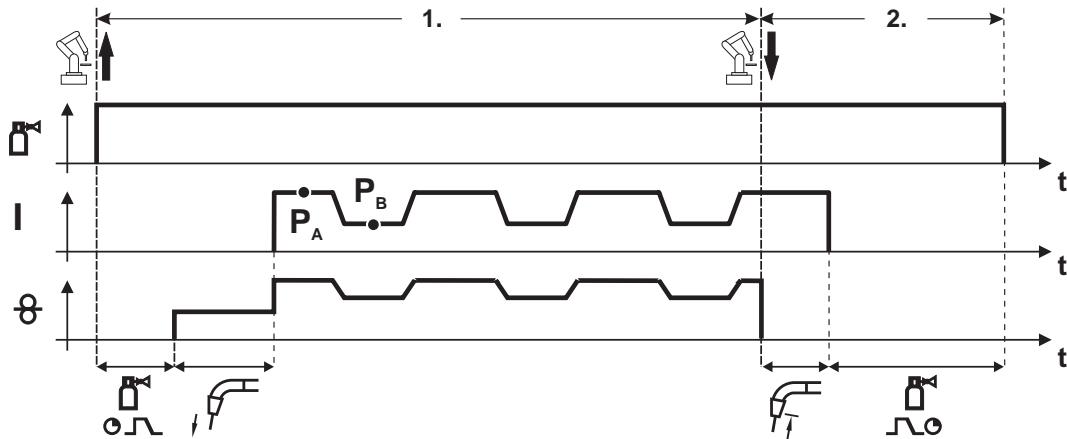
Figure 5-17

Step 1

- Robot issues the start signal to the power source.
- Shielding gas is expelled (gas pre-flows).
- Wire feed motor runs at "creep speed".
- Arc ignites after the wire electrode makes contact with the workpiece; welding current flows.
- Start the super pulse function beginning with main program P_A:
  The welding parameters switch between main program P_A and the reduced main program P_B at the specified times.

Step 2

- Robot issues the stop signal to the power source.
- Super pulse function is ended.
- WF motor stops.
- Arc is extinguished after the pre-selected wire burn-back time elapses.
- Gas post-flow time elapses.

Special, non-latched
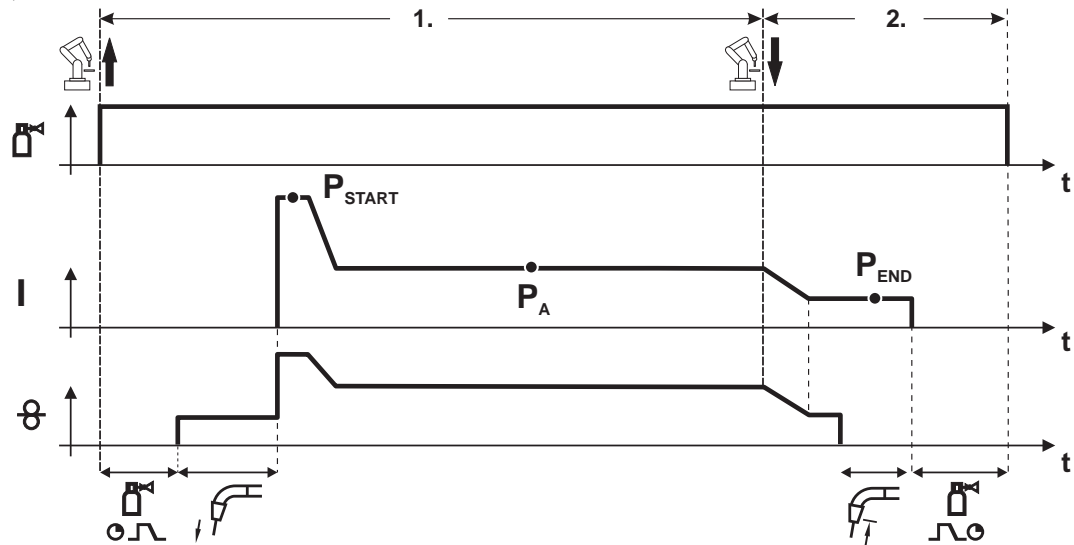
Figure 5-18

Step 1

- Robot issues the start signal to the power source.
- Shielding gas is expelled (gas pre-flows)
- Wire feed motor runs at "creep speed".
- Arc ignites after the wire electrode makes contact with the workpiece, welding current is flowing (start program P_{START} for the time t_{start}).
- Slope to main program P_A.

Step 2

- Robot issues the stop signal to the power source.
- Slope to end program P_{END} for the time t_{end}.
- WF motor stops.
- Arc is extinguished after the pre-selected wire burn-back time elapses.
- Gas post-flow time elapses.

Special, non-latched with superpulse

NOTE
☞   **Pulse arc welding machines only.**
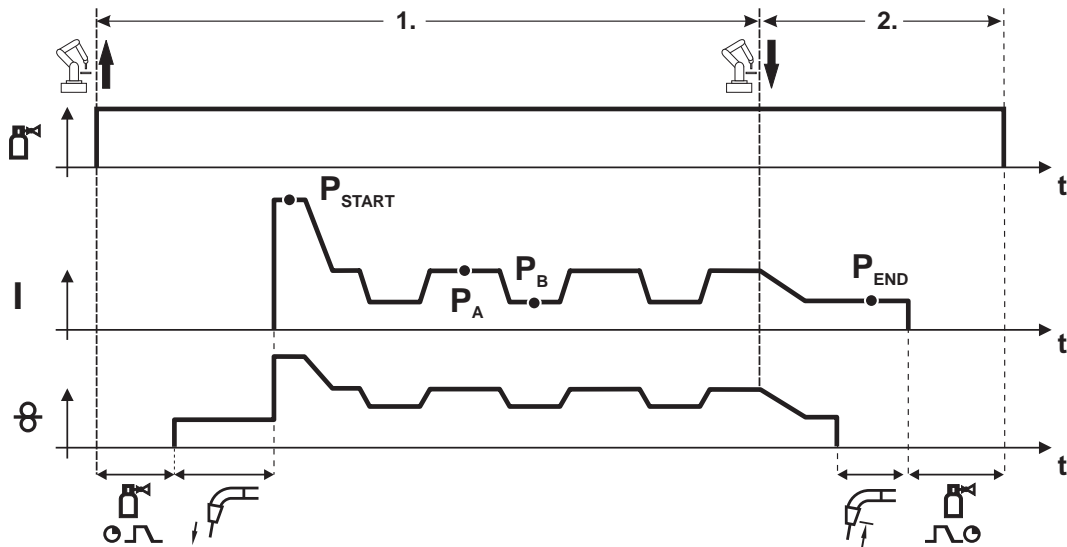
Figure 5-19

Step 1

• Robot issues the start signal to the power source.

• Shielding gas is expelled (gas pre-flows)

• Wire feed motor runs at "creep speed".

• Arc ignites after the wire electrode makes contact with the workpiece, welding current is flowing (start program P_{START} for the time t_{start}).

• Slope on main program P_A.

• Start the super pulse function beginning with main program P_A:
The welding parameters switch between main program P_A and the reduced main program P_B at the specified times.

Step 2

• Robot issues the stop signal to the power source.

• Super pulse function is ended.

• Slope to end program P_{END} for the time t_{end}.

• WF motor stops.

• Arc is extinguished after the pre-selected wire burn-back time elapses.

• Gas post-flow time elapses.

5.19 MIG/MAG program sequence ("Program steps" mode)

Certain materials, such as aluminium, require special functions in order to be able to weld them safely and at high quality. The non-latched special operating mode is used here with the following programs:

- Start program P_{START} (reduction of cool points at the start of the seam)
- Main program P_A (continuous welding)
- Reduced main program P_B (targeted heat reduction)
- End program P_{END} (minimisation of end craters via targeted heat reduction)

5.19.1 Selection

Operating element	Action	Result	Display
(button icon)	1 x	Select program sequence mode	Program steps
(buttons icon) A	n x	Select the parameters using the buttons ▲ "Up" and ▼ "Down" (left)	
(buttons icon) V Job Nr Hold	n x	Adjust the selected parameter using the buttons ▲ "Up" and ▼ "Down" (right)	
(button icon)	3 x	Machine returns to display mode	

5.19.2 MIG/MAG overview of parameters for M3.1x
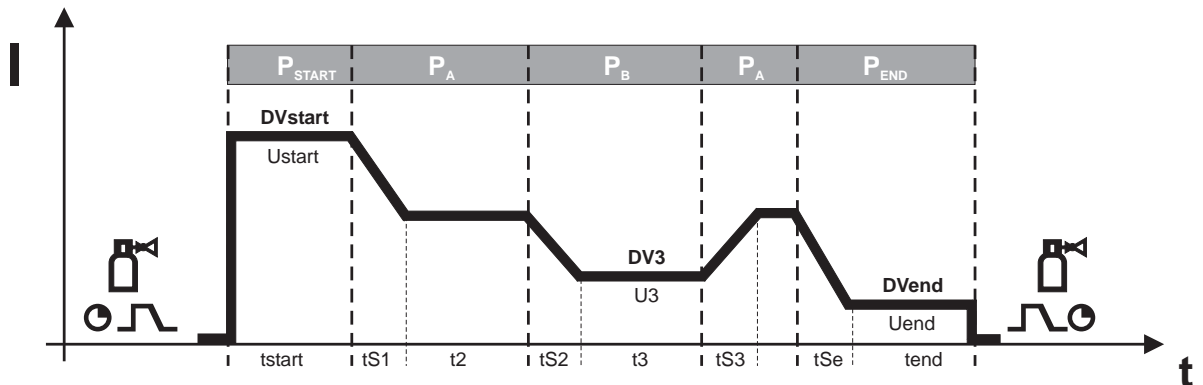
Figure 5-20

Basic parameters

Display	Meaning / explanation	Setting range
GASstr	Gas pre-flow time	0.0s to 0.9s
RUECK	Wire burn-back length	2 to 500
GASend:	Gas post-flow time	0.0s to 20s
Proc.Sp.	Process speed to determine the a-measurement	10cm to 200cm

"P_{START}" start program

DVstart	Wire speed	1% to 200%
Ustart	Arc length correction	-9.9V to +9.9V
tstart	Duration	0.0s to 20.0s

"P_A" main program

| tS1	Slope duration from P_{START} to P_A	0.0s to 20.0s
t2	Duration (spot time and superpulse)	0.01s to 20.0s
tS2	Slope duration from P_A to P_B	0.00s to 20.0s

"P_B" reduced main program

DV3	Wire speed	1% to 200%
U3	Arc length correction	-9.9V to +9.9V
t3	Duration	0.01s to 20.0s
tS3	Slope duration from P_B to P_A	0.00s to 20.0s

"P_{END}" end program

tSe	Slope duration from P_A to P_{END}	0.0s to 20s
DVend	Wire speed	1% to 200%
Uend	Arc length correction	-9.9V to +9.9V
tend	Duration (superpulse)	0.0s to 20s

P_{START}, P_B, and P_{END} are "relative programs", i.e. they relate to percentages of the WF value from main program P_A. The wire feed values of the relative programs can also be set as absolute values if required, regardless of the main program (see chapter "Special Mode" mode).

Various functional sequences can be set up according to the operating mode. Selecting and setting other parameters, functions and modes.

5.20   Main program A mode

5.20.1   Selection

Operating element	Action	Result	Display
(icon)	2 x (icon)	Select main program A mode	Program A
(icons)	n x (icon)	Select the welding parameters using the buttons (▲) "Up" and (▼) "Down" (left)	
(icons)	n x (icon)	Change values for the selected welding parameter using the buttons (▲) "Up" and (▼) "Down" (right)	
(icon)	2 x (icon)	Machine returns to Display mode	

5.20.2 MIG/MAG overview of parameters for M3.1x

Different welding tasks or positions on a workpiece demand various welding outputs (operating points) or welding programs.

For each program, the

- Wire speed
- Correction of the arc length and the
- Dynamics / choke effect

can be set separately.

Up to 15 programs (P1 to P15) can be defined, and the user can switch between these programs during the welding process.

Display	Meaning/explanation	Setting range
curr.prg.: X	Active main program A	**0 to 15**
P0 U2 :+0.0V	Arc length correction (offset WF unit)	**-9.9V to +9.9V**
P1 15 UK :+2.0V	Limitation of the setting range for the voltage correction in program mode	**0.0V to +9.9V**
P1 15 DK : 20%	Restriction of the wire correction range (for more details, see operating instructions for the wire feed unit)	**0% to 30%**
P1 DV2 :+2.0m/m	Wire speed	**0.1m/min. to 20.0m/min.**
P1 U2 :+0.0V	Arc length correction	**-9.9V to +9.9V**
P1 DYN2: + 0	Dynamics/choke effect	**-40% to +40%**
P2 to P14	P2 to P14	**P2 to P14**
P15 DV2 :+2.0m/m	Wire speed	**0.1m/min. to 20.0m/min.**
P15 U2 :+0.0 V	Arc length correction	**-9.9V to +9.9V**
P15 DYN2: + 0	Dynamics/choke effect	**-40% to +40%**
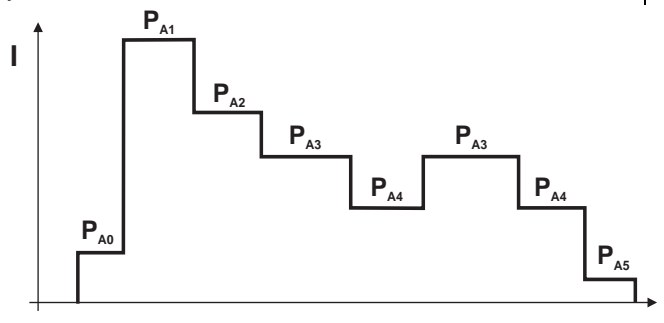
Figure 5-21

5.21 "Special Mode" mode

5.21.1 Selection

NOTE
☞ The key combination shown must be selected without pauses!

Operating element	Action	Result	Display
	1 x	Select Special Mode	Program Steps
Job info / new / copy / list ▼	1 x		
PROG 0 / PROG 1 / PROG 2 / PROG 3 / PROG 4 / PROG 5 / PROG 6 / PROG 7 ▼	2 x		
PROG 8 / PROG 9 / PROG 10 / PROG 11 / PROG 12 / PROG 13 / PROG 14 / PROG 15 ▼	1 x		Special Mode

5.21.2 Switching the Hold function on and off

NOTE
☞ **There is the option of switching the Hold function on and off for welding parameters.**

Operating element	Action	Result	Display
▲● A ●⊹ ▼● 8 ●⊙	👆	Select the Hold function using the buttons ▲ "Up" and ▼ "Down" (left)	Hold-Fct 1
V ●▲ ⓜA ● Job Nr ●▼ Hold ●	👆	Use the buttons ▲ "Up" and ▼ "Down" (right) to switch the Hold function on or off. 1 = Hold function on 0= Hold function off	Hold-Fct 1 Hold-Fct 0

5.21.3 WF speed switching (absolute / relative)

The following wire feed speeds are "relative programs" in the factory settings: DVStart (start program); DV3 (reduced main program); DVEnd (end program). This means that they represent a percentage of the wire feed speed DV2 (main program A) that has been set.

All wire feed speeds can also be specified as absolute values (independent of other values).

To do this, the absolute function (Abs-Fct = 1) must be configured as follows:

Operating element	Action	Result	Display
▲● A ●⊹ ▼● 8 ●⊙	👆	Select function using the buttons ▲ "Up" und ▼ "Down" (left)	Abs-Fct 0
V ●▲ ⓜA ● Job Nr ●▼ Hold ●	👆	Switch the function on and off using the ▲ "Up" und ▼ "Down" (right) buttons 1= Absolute wire feed speeds activated 0= Relative wire feed speeds activated	Abs-Fct 0 Abs-Fct 1

5.21.4 Resetting JOBs to status on delivery (Reset ALL)

Operating element	Action	Result	Display
▲● A ●⊹ ▼● 8 ●⊙	👆	Select Res. All using the buttons ▲ "Up" and ▼ "Down" (left).	Res. All 1

5.21.5 Exiting "Special Mode" after making changes

Operating element	Action	Result	Display
Enter	1 x 👆	Saves the change	No change
|◉	1 x 👆	Exits Special Mode	Last selected parameters are displayed

5.22 "Job Info" mode

NOTE
☞ **Information on the current JOB is displayed in this mode.** In JOBs 127 and 128 (TIG & MMA), it is not possible to select the mode as it would not be relevant.

Selection:

Operating element	Action	Result	Display
	n x ✍	Select "JOB Info mode"	JOB Info
	✍	Parameter selection	See "JOB Info" parameter list table

JOB Info parameter list:

Parameter (display)	Explanation
Uist	Voltage
System	System status
Job-Typ	Pre-defined or user-defined Job
Job-Nr.	JOB number
akt. Prg.	Program number
Mode	Operating mode
Schweiss	Welding type
Job-Text	Text information relating to the JOB (can be edited using PC 300.Net software)
Wire	Wire diameter
Material	Material type
Gas-Typ	Gas type
Verf.	Welding process

5.23 Operating time counter

The operating time is displayed in the format hhhh:mm:'h'. Four digits for the hours, two digits for the minute, and a final 'h' symbol.

On the welding machine control

Operating element	Action	Result	Display
	n x ✍	Press until signal light ⏱ comes on	Operating time display

The operating time is counted when current is flowing, and is written to non-volatile memory once per minute.

5.24 Organising welding tasks (Mode "JOB Manager")

NOTE
☞ **The Job Manager can be used to load, copy or save JOBs.** **The JOB is the welding task defined by the 4 main welding parameters; welding process, material type, wire diameter and gas type.** **One program sequence can be defined in each JOB.** **Up to 15 operating points (P1 to P15) can be set in each program sequence.** **The user has a total of 256 jobs available. 128 of these JOBs are pre-programmed. A further 128 JOBs can be freely defined.** **To ensure that all the changes are active, the welding machine should be switched off after at least 5 seconds have elapsed.**

A distinction is made between two memory sectors:

- 128 factory-set, pre-programmed, fixed jobs (jobs 1 to 128).
  Each welding task is assigned a JOB number (1 to 128).
- 128 freely definable JOBs (JOBs 129 to 256).

Each job can also be loaded directly (see chapter Loading an existing job).

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

NOTE
☞ **It is normally possible to adjust all 256 JOBs individually. However, it is useful to assign a separate JOB number to special welding tasks.**

Define the welding task which most closely matches the required application.

Copy the preset welding task (JOB 1-128) to the free memory sector (JOB 129-256):

Operating element	Action	Result	Display
	3 x	Select JOB Manager mode	JOB Manager
	x x	Select the JOB copy function using the buttons ▲ "Up" and ▼ "Down" (left)	Copy to: xxx
	x x	Select the target JOB number (JOB 129-256) using the buttons ▲ "Up" and ▼ "Down" (right)	Copy to: xxx
Enter	1 x	JOB has been copied	Copy to: xxx
	1 x	Machine returns to Display mode	

5.24.2   Loading an existing job

NOTE
☞   This function is used, for example, if the welding task (JOB) has been selected from the JOB reference list (see Appendix).

Operating element	Action	Result	Display
	3 x	Select JOB Manager mode	JOB Manager
	x x	Select JOB load function using the buttons ▲ "Up" and ▼ "Down" (left)	Load JOB: xxx
	x x	Select the JOB to be loaded using the buttons ▲ "Up" and ▼ "Down" (right)	Load JOB: xxx
Enter	1 x	JOB has been loaded	Load JOB: xxx
	3 x	Machine returns to Display mode	

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

NOTE
☞   If a pre-programmed JOB (JOB 1 to 128) has been changed accidentally, it can be reset to the factory settings.

Operating element	Action	Result	Display
	3 x	Select JOB Manager mode	JOB Manager
	x x	Select the JOB reset function using the buttons ▲ "Up" and ▼ "Down" (left)	Res. JOB: xxx
	x x	Select the JOB (JOB 1-128) to be reset to the factory settings using the buttons ▲ "Up" and ▼ "Down" (right)	Res. JOB: xxx
Enter	1 x	JOB has been reset	Res. JOB: xxx
	1 x	Machine returns to Display mode	

5.25 Expert parameters
5.25.1 Selecting expert model parameters

Operating element	Action	Result
⊙	1 x ✍	
Job info ●↕ new ●⇄ copy ●⨠ list ●⨠ ▼	1 x ✍	
☉ ⌂ ● P start ● t start ● P0…15 ● P end ● t end ● ▲⌐ ● ☉⌂ ● ▼	1 x ✍	Select expert model parameters
Job info ●↕ new ●⇄ copy ●⨠ list ●⨠ ▼	2 x ✍	

5.25.2 Selecting variables (5 model points)

Operating element	Action	Result
⊙	1 x ✍	Select model points 1 to 5

5.25.3 Setting parameters

Operating element	Action	Result
V ●▲ A ● Job Nr ●▼ Hold ●	✍	Select parameter
▲● A ●✂ ▼● ⌛	✍	Adjust parameter

6 Maintenance, care and disposal

> ⚠️ **DANGER**
>
> **Risk of injury from electric shock!**
> **Cleaning machines that are not disconnected from the mains can lead to serious injuries!**
> • Disconnect the machine completely from the mains.
> • Remove the mains plug!
> • Wait for 4 minutes until the capacitors have discharged!

6.1 General

When used in the specified environmental conditions and under normal operating conditions, this machine is largely maintenance-free and requires a minimum of care.

There are some points, which should be observed, to guarantee fault-free operation of your welding machine. Among these are regular cleaning and checking as described below, depending on the pollution level of the environment and the length of time the unit is in use.

6.2 Maintenance work, intervals

6.2.1 Daily maintenance tasks

• Mains supply lead and its strain relief
• Welding current cables (check that they are fitted correctly and secured)
• Gas tubes and their switching equipment (solenoid valve)
• Gas cylinder securing elements
• Operating, message, safety and adjustment devices (Functional test)
• Other, general condition

6.2.2 Monthly maintenance tasks

• Casing damage (front, rear and side walls)
• Transport rollers and their securing elements
• Transport elements (strap, lifting lugs, handle)
• Selector switches, command devices, emergency stop devices, voltage reducing devices, message and control lamps
• Check coolant tubes and their connections for impurities
• Check that the wire guide elements (inlet nipple, wire guide tube) are fitted securely.

6.2.3 Annual test (inspection and testing during operation)

> *NOTE*
>
> ☞ **The welding machine may only be tested by competent, capable personsl.**
> **A capable person is one who, because of his training, knowledge and experience, is able to recognise the dangers that can occur while testing welding power sources as well as possible subsequent damage and who is able to implement the required safety procedures.**
>
> ☞ **For further information, please see the accompanying supplementary sheets "Machine and Company Data, Maintenance and Testing, Warranty"!**

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

6.3 Repair Work

> **⚠ DANGER**
>
> **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)!

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

6.4 Disposing of equipment

> *NOTE*
>
> **Proper disposal!**
> **The machine contains valuable raw materials, which should be recycled, and electronic components, which must be disposed of.**
> • Do not dispose of in household waste!
> • Observe the local regulations regarding disposal!

6.4.1 Manufacturer's declaration to the end user

- According to European provisions (guideline 2002/96/EG of the European Parliament and the Council of January, 27th 2003), used electric and electronic equipment may no longer be placed in unsorted municipal waste. It must be collected separately. The symbol depicting a waste container on wheels indicates that the equipment must be collected separately.
  This machine is to be placed for disposal or recycling in the waste separation systems provided for this purpose.
- According to German law (law governing the distribution, taking back and environmentally correct disposal of electric and electronic equipment (ElektroG) from 16.03.2005), used machines are to be placed in a collection system separate from unsorted municipal waste. The public waste management utilities (communities) have created collection points at which used equipment from private households can be disposed of free of charge.
- Information about giving back used equipment or about collections can be obtained from the respective municipal administration office.
- EWM participates in an approved waste disposal and recycling system and is registered in the Used Electrical Equipment Register (EAR) under number WEEE DE 57686922.
- In addition to this, returns are also possible throughout Europe via EWM sales partners.

6.5 Meeting the requirements of RoHS

We, EWM HIGHTEC Welding GmbH Mündersbach, hereby confirm that all products supplied by us which are affected by the RoHS Directive, meet the requirements of the RoHS (Directive 2002/95/EC).

7 Rectifying faults

7.1 Customer checklist

Legend

⚡: Fault/Cause

✖: Remedy

NOTE

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

Functional errors

⚡ Machine control without displaying the signal lights after switching on

✖   Phase failure > check mains connection (fuses)

⚡ No welding performance

✖   Phase failure > check mains connection (fuses)

⚡ Various parameters cannot be set

✖   Entry level is blocked, disable access lock (see chapter entitled "Lock welding parameters against unauthorised access")

⚡ Connection problems

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

⚡ Insufficient coolant flow

✖   Check coolant level and refill if necessary

Wire feed problems

⚡ Unsuitable or worn welding torch equipment

✖   Adjust contact tip to wire diameter and -material and replace if necessary

✖   Adjust wire guide to material in use, blow through and replace if necessary

⚡ Contact nozzle blocked

✖   Clean, spray with separating agent and replace if necessary

⚡ Setting the spool brake (see "Setting the spool brake" chapter)

✖   Check settings and correct if necessary

⚡ Setting pressure units (see "Inching wire electrodes" chapter)

✖   Check settings and correct if necessary

⚡ Worn wire rolls

✖   Check and replace if necessary

⚡ Wire feed motor without supply voltage (automatic cutout triggered by overloading)

✖   Reset triggered fuse (rear of the power source) by pressing the key button

⚡ Kinked hose packages

✖   Extend and lay out the torch hose package

⚡ Incompatible parameter settings

✖   Check settings and correct if necessary

⚡ Arc between gas nozzle and workpiece (metal vapour on the gas nozzle)

✖   Replace gas nozzle

Welding torch overheated
- Insufficient coolant flow
    - Check coolant level and refill if necessary
    - Eliminate kinks in conduit system (hose packages)
- Loose welding current connections
    - Tighten power connections on the torch and/or on the workpiece
    - Tighten contact tip/collet correctly
- Overload
    - Check and correct welding current setting
    - Use a more powerful welding torch

Unstable arc
- Unsuitable or worn welding torch equipment
    - Adjust contact tip to wire diameter and -material and replace if necessary
    - Adjust wire guide to material in use, blow through and replace if necessary
- Material inclusions in the tungsten electrode due to contact with filler material or workpiece
    - Regrind or replace the tungsten electrode
- Incompatible parameter settings
    - Check settings and correct if necessary

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

7.2 Error messages (power source)

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.

> ### NOTE
>
> ☞ **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.**

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

Error	Category a)	b)	c)	Possible cause	Remedy
Error 1 (Ov.Vol)	-	-	x	Mains – excess voltage	Check the mains voltages and compare with the welding machine connection (see Technical data, chapter 1)
Error 2 (Un.Vol)	-	-	x	Mains – undervoltage	
Error 3 (Temp)	x	-	-	Welding machine - excess temperature	Allow the machine to cool down (main switch to "1")
Error 4 (Water)	-	-	x	Coolant level low	Top up the coolant Leak in the coolant circuit > rectify the leak and top up the coolant Coolant pump is not working > check excess current release on air cooling unit
Error 5 (Wi.Spe)	x	-	-	Error in WF case, tachometer error	Check the wire feed unit Tachometer generator not issuing a signal, M3.00 defective > information service dept.
Error 7 (Se.Vol)	-	-	x	Secondary excess voltage	Inverter error > inform Service
Error 8 (no PE)	-	-	x	Earth fault between welding wire and earth line (Phoenix 300 only)	Separate the connection between the welding wire and case or an earthed object
Error 9 (fast stop)	x	-	-	Fast shut-down triggered by BUSINT X11 or RINT X11	Rectify error on robot
Error 10 (no arc)	-	x	-	Arc interruption Fast shut-down triggered by BUSINT X11 or RINT X11	Check wire feed
Error 11 (no ign)	-	x	-	Ignition error after 5 seconds Triggered by BUSINT X11 or RINT X11	Check wire feed

7.3 General operating problems

7.3.1 Interface for mechanised welding

> ### ⚠ WARNING
>
> ⚠ **No function of the external shut-down devices (emergency stop switch)!**
> **If the emergency stop circuit has been realised using an external shut-down device via the interface for mechanised welding, the device must be set for this setup. If this is not observed, the power source will ignore the external shut-down devices and will not shut down!**
> - Disconnect jumper 1 on PCB T320/1 (Tetrix) or M320/1 (Phoenix / alpha Q)!

7.4 Display machine control software version

NOTE

☞ **The query of the software versions only serves to inform the authorised service staff!**
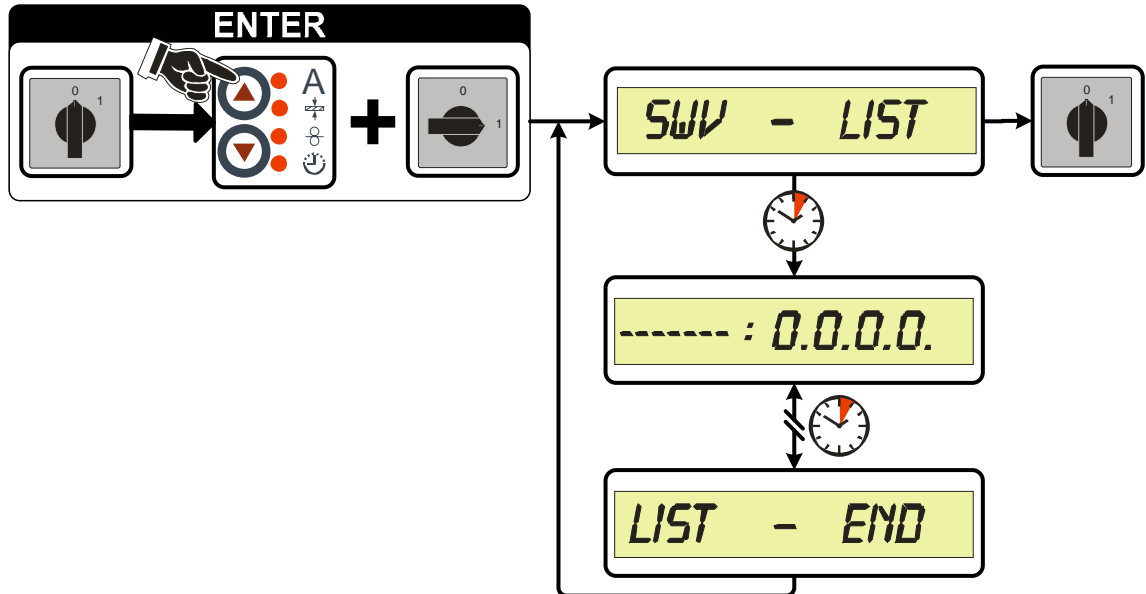
Figure 7-1

Display	Setting/selection
SWV - LISTE	**List of the software** Start of the automated process
------- : 0.0.0.0.	**Software versions display** ------- = System bus ID/printed circuit board 0.0.0.0.= Version number System bus ID/printed circuit board and version number are separated by a colon.
LISTEN - ENDE	**List of the software** End of the list of software versions

---
NOTE

☞ **The printed circuit boards and software versions shown are displayed in an automated process and vary according to the components that are connected and the versions.**

7.4.1 Resetting JOBs to status on delivery (Reset ALL)

Operating element	Action	Result	Display
▲ ▼	☞	Select Res. All using the buttons ▲ "Up" and ▼ "Down" (left).	Res. All 1

8 Technical data

8.1 Phoenix 352, 452, 552 RC Puls forceArc

	352	452	552
Welding current setting range	5 A - 350 A	5 A - 450 A	5 A - 550 A
Welding voltage setting range	14,3 V - 31,5 V	14,3 V - 36,5 V	14,3 V - 41,5 V
Duty cycle 25 °C			
60 %	-	-	550 A
80 %	-	-	520 A
100 %	350 A	450 A	450 A
Duty cycle 40 °C			
60 %	-	-	550 A
80 %	-	450 A	-
100 %	350 A	420 A	420 A
Load alternation	10 min (60 % DC ≙ 6 min welding, 4 min break)		
Open circuit voltage	79 V		
Mains voltage (tolerance)	3 x 400 V (-25 % bis +20 %)		
Frequency	50/60 Hz		
Mains fuse (safety fuse, slow-blow)	3 x 25 A	3 x 35 A	
Mains connection lead	H07RN-F4G6		
Max. connected power	13,9 kVA	20,7 kVA	28,8 kVA
Recommended generator rating	20,3 kVA	29,1 kVA	39,4 kVA
Cosφ	0,99		
Insulation class	H		
Protection classification	IP 23		
Ambient temperature	-20 °C bis +40 °C		
Machine cooling	fan		
Workpiece lead	70 mm^2	70 mm2 > 5 m 95 mm2	95 mm^2
Dimensions L/W/H [mm]	780 x 375 x 625		
Weight	78,5 kg		
Constructed to standards	IEC 60974 -1, -10 Ⓢ / C E		

8.2 Phoenix RC1

Connection lead	2 m / 5 m / 10 m
Protection classification	IP 23
Ambient temperature	-20 °C to +40 °C
Dimensions L/W/D [mm]	285 x 315 x 115
Weight	2.5 Kg
Constructed to standards	IEC 60974 / EN 60974 / VDE 0544 EN 50199 / VDE 0544 Part 206 Ⓢ / C E

9 Accessories, options

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

9.1 Connection cables, connection sockets

Type	Designation	Item no.
RA5 19POL 1x 5M	Connection cable, 19-pole, 5 m	092-001569-00005
RA10 19POL 1x 10M	Connection cable, 19-pole, 10 m	092-001569-00010
FRV5-L 7POL	Extension/connecting cable	092-000201-00003

9.2 General accessories

Type	Designation	Item no.
DM1 32L/MIN	Manometer pressure reducer	094-000009-00000

9.3 Options

Type	Designation	Item no.
BGA364X51X47	Panel for stacking machines	094-012294-00001
ON ZWIPA-CONNECTION	Retrofit option for third party INTPA strain relief	094-007890-00000

9.4 Transportsysteme

Type	Designation	Item no.
PALETTE ROB XX2	Transport pallet for use with robots	090-008275-00000

9.5 Computer communication

Type	Designation	Item no.
RC 300	EWM tablet PC incl. software, adapter and interface	090-008238-00000
PC300.NET	PC300.Net welding parameter software set incl. cable and SECINT X10 USB interface	090-008265-00000
WELDQAS1 Station	Stationary welding data monitoring and docu set for one welding machine	090-008215-00000
PC INTX10 SET	Q-DOC 9000 documentation interface	090-008093-00000

9.6 Wire feed units

Type	Designation	Item no.
M Drive 4 Rob 2 WE	MIG WF unit	090-004999-00502
M Drive 4 Rob 2 WI	MIG WF unit	090-004999-00503
M Drive 4 Rob 2 ZT	Robot intermediate drive	090-005137-00502
M Drive 4 Rob 2 MF	MIG WF unit	090-005000-00502
M Drive 4 Rob 3 RE EZA/F	MIG WF unit	090-005110-00502
M Drive 4 Rob 3 LI EZA/F	MIG WF unit	090-005111-00502

9.7 Cooling units

Type	Designation	Item no.
Cool 82 U44	Cooling module for robot welding machines	090-008268-00502
Cool 82 U45	Cooling module for robot welding machines	090-008280-00502
Cool 82 U45 2Rob	Cooling module for ASM robot welding machines, second wire feed	090-008280-13502

10 Circuit diagrams

10.1 Phoenix 352, 452, 552 RC Puls forceArc

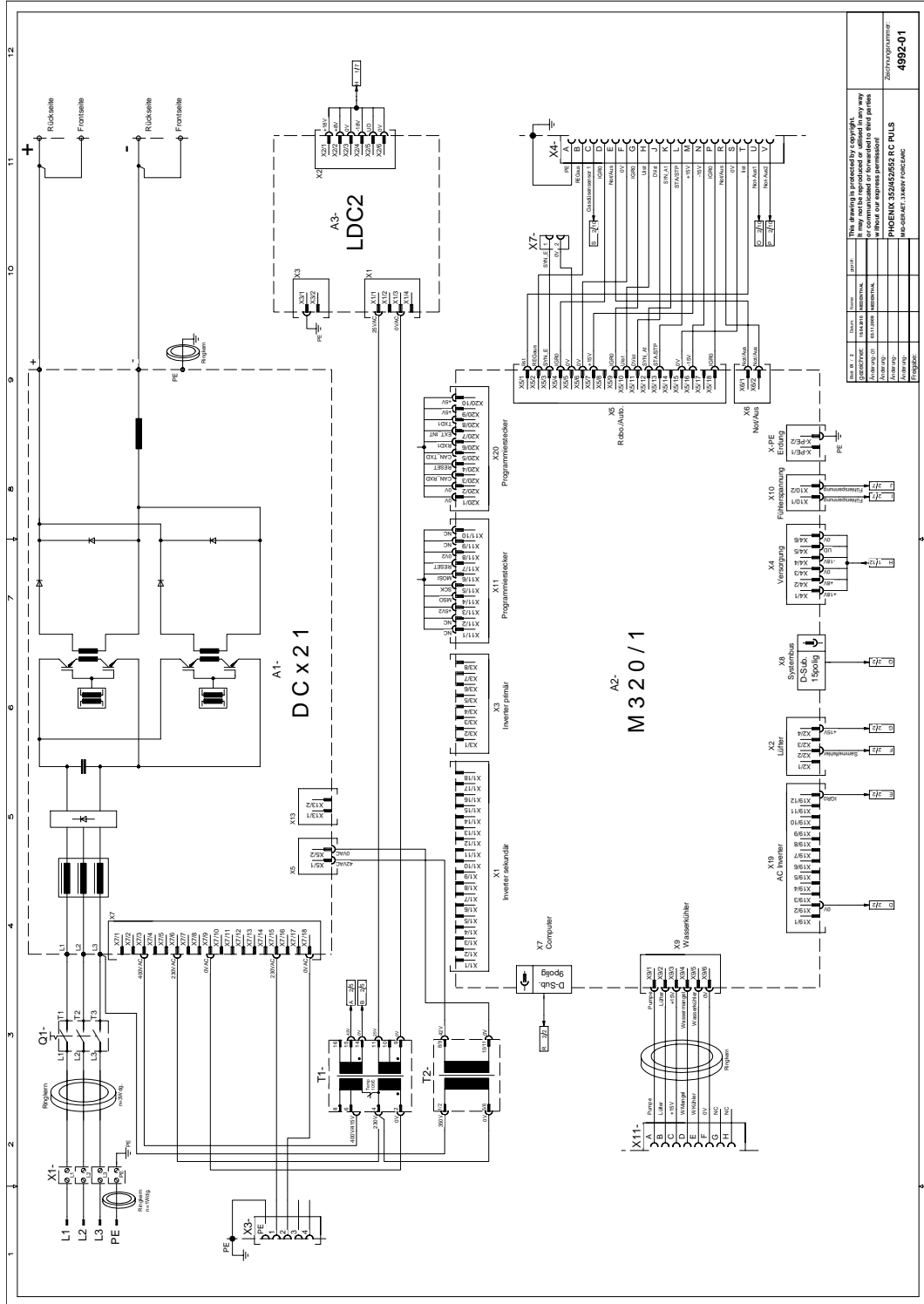| *NOTE* |
|---|
| ☞ **Original format circuit diagrams are located inside the machine.** |

Figure 10-1

Figure 10-2

11 Appendix A

11.1 Job organisation functional sequence

Figure 11-1

11.2 JOB-List

All MIG/MAG process. The four process groups across the table are *Auftragsschweißen / GMA-Surfacing*, *Metall-Fülldraht / Metal-Flux-Cored Wire*, *Rutil-Füldraht / Rutil-Flux-Cored Wire*, and *Basisch-Füldraht / Basic-Flux-Cored Wire*. Each group lists Material, Gas and Wire diameter (mm).

Job-Nr / Job-no.	GMA-Surfacing: Process	Material	Gas	Ø (mm)	Metal-FCW: Process	Material	Gas	Ø (mm)	Rutil-FCW: Process	Material	Gas	Ø (mm)	Basic-FCW: Process	Material	Gas	Ø (mm)
1	MIG/MAG	SG2/3	CO₂	0,8	Metall-Fülldraht	SG2/3	CO₂	0,8	Rutil-Fülldraht	SG2/3	CO₂	0,8	Basisch-Fülldraht	SG2/3	CO₂	0,8
2	MIG/MAG	SG2/3	CO₂	0,9	Metall-Fülldraht	SG2/3	CO₂	0,9	Rutil-Fülldraht	SG2/3	CO₂	0,9	Basisch-Fülldraht	SG2/3	CO₂	0,9
3	MIG/MAG	SG2/3	CO₂	1,0	Metall-Fülldraht	SG2/3	CO₂	1,0	Rutil-Fülldraht	SG2/3	CO₂	1,0	Basisch-Fülldraht	SG2/3	CO₂	1,0
4	MIG/MAG	SG2/3	CO₂	1,2	Metall-Fülldraht	SG2/3	CO₂	1,2	Rutil-Fülldraht	SG2/3	CO₂	1,2	Basisch-Fülldraht	SG2/3	CO₂	1,2
5	MIG/MAG	SG2/3	CO₂	1,6	Metall-Fülldraht	SG2/3	CO₂	1,6	Rutil-Fülldraht	SG2/3	CO₂	1,6	Basisch-Fülldraht	SG2/3	CO₂	1,6
6	MIG/MAG	SG2/3	80-90% Ar	0,8												
7	MIG/MAG	SG2/3	80-90% Ar	0,9												
8	MIG/MAG	SG2/3	80-90% Ar	1,0												
9	MIG/MAG	SG2/3	80-90% Ar	1,2												
10	MIG/MAG	SG2/3	80-90% Ar	1,6												
11	MIG/MAG	SG2/3	91-99% Ar	0,8	Metall-Fülldraht	SG2/3	91-99% Ar	0,8	Rutil-Fülldraht	SG2/3	91-99% Ar	0,8	Basisch-Fülldraht	SG2/3	91-99% Ar	0,8
12	MIG/MAG	SG2/3	91-99% Ar	0,9	Metall-Fülldraht	SG2/3	91-99% Ar	0,9	Rutil-Fülldraht	SG2/3	91-99% Ar	0,9	Basisch-Fülldraht	SG2/3	91-99% Ar	0,9
13	MIG/MAG	SG2/3	91-99% Ar	1,0	Metall-Fülldraht	SG2/3	91-99% Ar	1,0	Rutil-Fülldraht	SG2/3	91-99% Ar	1,0	Basisch-Fülldraht	SG2/3	91-99% Ar	1,0
14	MIG/MAG	SG2/3	91-99% Ar	1,2	Metall-Fülldraht	SG2/3	91-99% Ar	1,2	Rutil-Fülldraht	SG2/3	91-99% Ar	1,2	Basisch-Fülldraht	SG2/3	91-99% Ar	1,2
15	MIG/MAG	SG2/3	91-99% Ar	1,6	Metall-Fülldraht	SG2/3	91-99% Ar	1,6	Rutil-Fülldraht	SG2/3	91-99% Ar	1,6	Basisch-Fülldraht	SG2/3	91-99% Ar	1,6
16																
17																
18																
19																
20																
21	MIG/MAG	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8	Metall-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8	Rutil-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8	Basisch-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8
22	MIG/MAG	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,9	Metall-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,9	Rutil-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,9	Basisch-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,9
23	MIG/MAG	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0	Metall-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0	Rutil-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0	Basisch-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0
24	MIG/MAG	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2	Metall-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2	Rutil-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2	Basisch-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2
25	MIG/MAG	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6	Metall-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6	Rutil-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6	Basisch-Fülldraht	SG2/3	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6
26																
27																

Job-no	MIG/MAG - Verfahren / Material / Gas / Wire-Ø (mm)				Auftragsschweißen / GMA-Surfacing - Material / Gas / Wire-Ø				Metal – Fülldraht / Metal - Flux-Cored Wire - Material / Gas / Wire-Ø				Rutil- Fülldraht / Rutil - Flux-Cored Wire - Material / Gas / Wire-Ø				Basisch -Fülldraht / Basic - Flux-Cored Wire - Material / Gas / Wire-Ø				MIG/MAG - Material / Gas / Wire-Ø			
28																								
29																								
30	MIG/MAG	CrNi	80-90% Ar	0,8	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8		CrNi	80-90% Ar	0,8		CrNi	80-90% Ar	0,8					
31	MIG/MAG	CrNi	80-90%	1,0	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0		CrNi	80-90% Ar	1,0		CrNi	80-90% Ar	1,0		CrNi	80-90% Ar	1,0					
32	MIG/MAG	CrNi	80-90%	1,2	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2		CrNi	80-90% Ar	1,2		CrNi	80-90% Ar	1,2		CrNi	80-90% Ar	1,2					
33	MIG/MAG	CrNi	80-90% Ar	1,6	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6		CrNi	80-90% Ar	1,6		CrNi	80-90% Ar	1,6		CrNi	80-90% Ar	1,6					
34	MIG/MAG	CrNi	91-99% Ar	0,8																				
35	MIG/MAG	CrNi	91-99% Ar	1,0																				
36	MIG/MAG	CrNi	91-99% Ar	1,2																				
37	MIG/MAG	CrNi	91-99% Ar	1,6																				
38																								
39																								
40																								
41																								
42	MIG/MAG	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	0,8					
43	MIG/MAG	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,0					
44	MIG/MAG	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,2					
45	MIG/MAG	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6	CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6		CrNi	Ar/He/O₂, Ar/He/CO₂, 15-30% He	1,6					
46	MIG/MAG	CrNi	1-5% H₂	0,8	CrNi	1-5% H₂	0,8		CrNi	1-5% H₂	0,8		CrNi	1-5% H₂	0,8		CrNi	1-5% H₂	0,8	MIG/MAG	CrNi	0-2% N₂	0,8
47	MIG/MAG	CrNi	1-5% H₂	1,0	CrNi	1-5% H₂	1,0		CrNi	1-5% H₂	1,0		CrNi	1-5% H₂	1,0		CrNi	1-5% H₂	1,0	MIG/MAG	CrNi	0-2% N₂	1,0
48	MIG/MAG	CrNi	1-5% H₂	1,2	CrNi	1-5% H₂	1,2		CrNi	1-5% H₂	1,2		CrNi	1-5% H₂	1,2		CrNi	1-5% H₂	1,2	MIG/MAG	CrNi	0-2% N₂	1,2
49	MIG/MAG	CrNi	1-5% H₂	1,6	CrNi	1-5% H₂	1,6		CrNi	1-5% H₂	1,6		CrNi	1-5% H₂	1,6		CrNi	1-5% H₂	1,6	MIG/MAG	CrNi	0-2% N₂	1,6
50	coldArc	CrNi	91-99% Ar	0,8																				
51	coldArc	CrNi	91-99% Ar	1,0																				
52	coldArc	CrNi	91-99% Ar	1,2																				
53	coldArc	CrNi	91-99% Ar	1,6																				
54	coldArc	AlMg	100% Ar	0,8																				

Verfahren / process	Material / material	Gas / gas	Draht-durch-messer / wire dia-meter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer / wire dia-meter (mm)	Job-Nr / job-no.
coldArc	AlMg	100% Ar	1,0					55
coldArc	AlMg	100% Ar	1,2					56
coldArc	AlMg	100% Ar	1,6					57
coldArc	AlSi	100% Ar	0,8					58
coldArc	AlSi	100% Ar	1,0					59
coldArc	AlSi	100% Ar	1,2					60
coldArc	AlSi	100% Ar	1,6					61
coldArc	Al99	100% Ar	0,8					62
coldArc	Al99	100% Ar	1,0					63
coldArc	Al99	100% Ar	1,2					64
coldArc	Al99	100% Ar	1,6					65
coldArc Löten	CuSi	100% Ar	0,8					66
coldArc Löten	CuSi	100% Ar	1,0					67
coldArc Löten	CuSi	100% Ar	1,2					68
coldArc Löten	CuSi	100% Ar	1,6					69
coldArc Löten	CuAl	100% Ar	0,8					70
coldArc Löten	CuAl	100% Ar	1,0					71
coldArc Löten	CuAl	100% Ar	1,2					72
coldArc Löten	CuAl	100% Ar	1,6					73
MIG/MAG / MIG/MAG	AlMg	100% Ar	0,8	MIG/MAG / MIG/MAG	AlMg	Ar/N₂ Ar/He/N₂ 0-2% N2	0,8	74
MIG/MAG / MIG/MAG	AlMg	100% Ar	1,0	MIG/MAG / MIG/MAG	AlMg	Ar/N₂ Ar/He/N₂ 0-2% N2	1,0	75
MIG/MAG / MIG/MAG	AlMg	100% Ar	1,2	MIG/MAG / MIG/MAG	AlMg	Ar/N₂ Ar/He/N₂ 0-2% N2	1,2	76
MIG/MAG / MIG/MAG	AlMg	100% Ar	1,6	MIG/MAG / MIG/MAG	AlMg	Ar/N₂ Ar/He/N₂ 0-2% N2	1,6	77
MIG/MAG / MIG/MAG	AlMg	Ar/He 15-70% He	0,8					78
MIG/MAG / MIG/MAG	AlMg	Ar/He 15-70% He	1,0					79
MIG/MAG / MIG/MAG	AlMg	Ar/He 15-70% He	1,2					80
MIG/MAG / MIG/MAG	AlMg	Ar/He 15-70% He	1,6					81

Job-no.	Process	Material	Gas	Wire dia. (mm)	Process	Material	Gas	Wire dia. (mm)	Process	Material	Gas	Wire dia. (mm)	Process	Material	Gas	Wire dia. (mm)
82	MIG/MAG	AlSi	100% Ar	0,8	MIG/MAG	AlSi	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	0,8								
83	MIG/MAG	AlSi	100% Ar	1,0	MIG/MAG	AlSi	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,0								
84	MIG/MAG	AlSi	100% Ar	1,2	MIG/MAG	AlSi	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,2								
85	MIG/MAG	AlSi	100% Ar	1,6	MIG/MAG	AlSi	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,6								
86	MIG/MAG	AlSi	Ar/He 15-70% He	0,8												
87	MIG/MAG	AlSi	Ar/He 15-70% He	1,0												
88	MIG/MAG	AlSi	Ar/He 15-70% He	1,2												
89	MIG/MAG	AlSi	Ar/He 15-70% He	1,6												
90	MIG/MAG	Al99	100% Ar	0,8	MIG/MAG	Al99	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	0,8								
91	MIG/MAG	Al99	100% Ar	1,0	MIG/MAG	Al99	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,0								
92	MIG/MAG	Al99	100% Ar	1,2	MIG/MAG	Al99	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,2								
93	MIG/MAG	Al99	100% Ar	1,6	MIG/MAG	Al99	Ar/N$_2$, Ar/He/N$_2$ 0-2% N2	1,6								
94	MIG/MAG	Al99	Ar/He 15-70% He	0,8												
95	MIG/MAG	Al99	Ar/He 15-70% He	1,0												
96	MIG/MAG	Al99	Ar/He 15-70% He	1,2												
97	MIG/MAG	Al99	Ar/He 15-70% He	1,6												
98	MIG/MAG	CuSi	100% Ar	0,8	Auftragsschweißen / GMA-Surfacing	CuSi	100% Ar	0,8	MIG/MAG	CuSi	Ar/He 15-70% He	0,8	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He 15-70% He	0,8
99	MIG/MAG	CuSi	100% Ar	1,0	Auftragsschweißen / GMA-Surfacing	CuSi	100% Ar	1,0	MIG/MAG	CuSi	Ar/He 15-70% He	1,0	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He 15-70% He	1,0
100	MIG/MAG	CuSi	100% Ar	1,2	Auftragsschweißen / GMA-Surfacing	CuSi	100% Ar	1,2	MIG/MAG	CuSi	Ar/He 15-70% He	1,2	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He 15-70% He	1,2
101	MIG/MAG	CuSi	100% Ar	1,6	Auftragsschweißen / GMA-Surfacing	CuSi	100% Ar	1,6	MIG/MAG	CuSi	Ar/He 15-70% He	1,6	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He 15-70% He	1,6
102	MIG/MAG	CuSi	91-99% Ar	0,8	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He/O$_2$, Ar/He/CO$_2$ 15-30% He	0,8								
103	MIG/MAG	CuSi	91-99% Ar	1,0	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He/O$_2$, Ar/He/CO$_2$ 15-30% He	1,0								
104	MIG/MAG	CuSi	91-99% Ar	1,2	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He/O$_2$, Ar/He/CO$_2$ 15-30% He	1,2								
105	MIG/MAG	CuSi	91-99% Ar	1,6	Auftragsschweißen / GMA-Surfacing	CuSi	Ar/He/O$_2$, Ar/He/CO$_2$ 15-30% He	1,6								

Column header labels (German / English):
Verfahren / process, Material / material, Gas / gas, Draht-durch-messer / wire diameter (mm)

Job-Nr. / Job-no.	Verfahren / process	Material / material	Gas / gas	Draht-durchmesser / Wire diameter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durchmesser / Wire diameter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durchmesser / Wire diameter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durchmesser / Wire diameter (mm)
106	MIG/MAG / MIG/MAG	CuAl	100% Ar	0,8	Auftragsschweißen / GMA-Surfacing	CuAl	100% Ar	0,8	MIG/MAG / MIG/MAG	CuAl	Ar/He 15-70% He	0,8	Auftragsschweißen / GMA-Surfacing	CuAl	Ar/He 15-70% He	0,8
107	MIG/MAG / MIG/MAG	CuAl	100% Ar	1,0	Auftragsschweißen / GMA-Surfacing	CuAl	100% Ar	1,0	MIG/MAG / MIG/MAG	CuAl	Ar/He 15-70% He	1,0	Auftragsschweißen / GMA-Surfacing	CuAl	Ar/He 15-70% He	1,0
108	MIG/MAG / MIG/MAG	CuAl	100% Ar	1,2	Auftragsschweißen / GMA-Surfacing	CuAl	100% Ar	1,2	MIG/MAG / MIG/MAG	CuAl	Ar/He 15-70% He	1,2	Auftragsschweißen / GMA-Surfacing	CuAl	Ar/He 15-70% He	1,2
109	MIG/MAG / MIG/MAG	CuAl	100% Ar	1,6	Auftragsschweißen / GMA-Surfacing	CuAl	100% Ar	1,6	MIG/MAG / MIG/MAG	CuAl	Ar/He 15-70% He	1,6	Auftragsschweißen / GMA-Surfacing	CuAl	Ar/He 15-70% He	1,6
114	MIG-Löten / MIG-Brazing	CuSi	100% Ar	0,8	MIG-Löten / MIG-Brazing	CuSi	Ar/He 15-70% He	0,8								
115	MIG-Löten / MIG-Brazing	CuSi	100% Ar	1,0	MIG-Löten / MIG-Brazing	CuSi	Ar/He 15-70% He	1,0								
116	MIG-Löten / MIG-Brazing	CuSi	100% Ar	1,2	MIG-Löten / MIG-Brazing	CuSi	Ar/He 15-70% He	1,2								
117	MIG-Löten / MIG-Brazing	CuSi	100% Ar	1,6	MIG-Löten / MIG-Brazing	CuSi	Ar/He 15-70% He	1,6								
118	MIG-Löten / MIG-Brazing	CuAl	91-99% Ar	0,8	MIG-Löten / MIG-Brazing	CuAl	Ar/He/O₂, Ar/He/CO₂ 15-30% He	0,8								
119	MIG-Löten / MIG-Brazing	CuAl	91-99% Ar	1,0	MIG-Löten / MIG-Brazing	CuAl	Ar/He/CO₂, Ar/He/CO₂ 15-30% He	1,0								
120	MIG-Löten / MIG-Brazing	CuAl	91-99% Ar	1,2	MIG-Löten / MIG-Brazing	CuAl	Ar/He/O₂, Ar/He/CO₂ 15-30% He	1,2								
121	MIG-Löten / MIG-Brazing	CuAl	91-99% Ar	1,6	MIG-Löten / MIG-Brazing	CuAl	Ar/He/O₂, Ar/He/CO₂ 15-30% He	1,6								
122	MIG-Löten / MIG-Brazing	CuAl	100% Ar	0,8	MIG-Löten / MIG-Brazing	CuAl	Ar/He 15-70% He	0,8								
123	MIG-Löten / MIG-Brazing	CuAl	100% Ar	1,0	MIG-Löten / MIG-Brazing	CuAl	Ar/He 15-70% He	1,0								
124	MIG-Löten / MIG-Brazing	CuAl	100% Ar	1,2	MIG-Löten / MIG-Brazing	CuAl	Ar/He 15-70% He	1,2								
125	MIG-Löten / MIG-Brazing	CuAl	100% Ar	1,6	MIG-Löten / MIG-Brazing	CuAl	Ar/He 15-70% He	1,6								
126	Fugenhobeln															
127	WIG / TIG															
128	E-Hand / MMA															
129	Spezial-Job1															
130	Spezial-Job2															
131	Spezial-Job 3															
132																
133																
134																
135																
136																

Job-Nr./ Job-no.	Verfahren / process	Material/ material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material/ material	Gas / gas:	Draht-durch-messer /wire dia-meter (mm):
137																				
138																				
139																				
140	Block 1/ Job1																			
141	Block 1/ Job2																			
142	Block 1/ Job3																			
143	Block 1/ Job4																			
144	Block 1/ Job5																			
145	Block 1/ Job6																			
146	Block 1/ Job7																			
147	Block 1/ Job8																			
148	Block 1/ Job9																			
149	Block 1/ Job10																			
150	Block 2/ Job1																			
151	Block 2/ Job2																			
152	Block 2/ Job3																			
153	Block 2/ Job4																			
154	Block 2/ Job5																			
155	Block 2/ Job6																			
156	Block 2/ Job7																			
157	Block 2/ Job8																			
158	Block 2/ Job9																			
159	Block 2/ Job10																			
160	Block 3/ Job1																			
161	Block 3/ Job2																			
162	Block 3/ Job3																			
163	Block 3/ Job4																			
164	Block 3/ Job5																			
165	Block 3/ Job6																			

Job-Nr / Job-no.	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer / Wire dia-meter (mm)
166	Block 3/ Job7			
167	Block 3/ Job8			
168	Block3/ Job9			
169	Block3/ Job10			
170				
171	coldArc Pipe	SG2/3	CO_2	1,0
172	coldArc Pipe	SG2/3	CO_2	1,2
173	coldArc Pipe	SG2/3	80-90% Ar	1,0
174	coldArc Pipe	SG2/3	80-90% Ar	1,2
175	coldArc	SG2/3	80-90% Ar	0,6
176	coldArc	SG2/3	80-90% Ar	0,6
177	HighSpeed	SG2/3	91-99% Ar	1,0
178	HighSpeed	SG2/3	91-99% Ar	1,2
179	forceArc	SG2/3	80-90% Ar	1,0
180	forceArc	SG2/3	80-90% Ar	1,2
181	forceArc	SG2/3	80-90% Ar	1,6
182	coldArc	SG2/3	CO_2	0,8
183	coldArc	SG2/3	CO_2	0,9
184	coldArc	SG2/3	CO_2	1,0
185	coldArc	SG2/3	CO_2	1,2
186	coldArc	SG2/3	CO_2	1,6
187	MIG/MAG / MIG/MAG	SG2/3	80-89%	Manuell > 8m/s
188	MIG/MAG / MIG/MAG	SG2/3	80-89%	Manuell < 8m/s
189	forceArc	SG2/3	80-90% Ar	0,8
190	forceArc	SG2/3	91-99% Ar	0,8
191	coldArc	SG2/3	80-90% Ar	0,8
192	coldArc	SG2/3	80-90% Ar	0,9
193	coldArc	SG2/3	80-90% Ar	1,0
194	coldArc	SG2/3	80-90% Ar	1,2

Job-Nr./ job-no.	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)	Verfahren / process	Material / material	Gas: / gas	Draht-durch-messer /wire dia-meter (mm):	Verfahren / process:	Material / material:	Gas: / gas:	Draht-durch-messer /wire dia-meter (mm):
195	coldArc	SG2/3	80-90% Ar	1,6												
196	coldArc Löten	AlSi	100% Ar	0,8												
197	coldArc Löten	AlSi	100% Ar	1,0												
198	coldArc Löten	AlSi	100% Ar	1,2												
199	coldArc Löten	AlSi	100% Ar	1,6												
200	coldArc Löten	Zn	100% Ar	0,8												
201	coldArc Löten	Zn	100% Ar	1,0												
202	coldArc Löten	Zn	100% Ar	1,2												
203	coldArc Löten	Zn	100% Ar	1,6												
204	rootArc	SG2/3	CO_2	1,0												
205	rootArc	SG2/3	CO_2	1,2												
206	rootArc	SG2/3	80-90% Ar	1,0												
207	rootArc	SG2/3	80-90% Ar	1,2												
208	coldArc	CrNiMn	91-99% Ar	1,2												
209	coldArc	CrNiMn	91-99% Ar	1,6												
210	Auftragsschweißen	CrNi	91-99% Ar	0,8												
211	Auftragsschweißen	CrNi	91-99% Ar	1,0												
212	Auftragsschweißen	CrNi	91-99% Ar	1,2												
213	Auftragsschweißen	CrNi	91-99% Ar	1,6												
214	Auftragsschweißen	SG2/3	80-90% Ar	0,8												
215	Auftragsschweißen	SG2/3	80-90% Ar	0,9												
216	Auftragsschweißen	SG2/3	80-90% Ar	1,0												
217	Auftragsschweißen	SG2/3	80-90% Ar	1,2												
218	Auftragsschweißen	SG2/3	80-90% Ar	1,6												
219	coldArc Misch.	Zn	100% Ar	0,8												
220	coldArc Misch.	Zn	100% Ar	1,0												
221	coldArc Misch.	Zn	100% Ar	1,2												
222	coldArc Misch.	Zn	100% Ar	1,6												
223	coldArc Misch.	AlSi	100% Ar	0,8												

Job-Nr / job-no.	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)
224	coldArc Misch.	AlSi	100% Ar	1,0
225	coldArc Misch.	AlSi	100% Ar	1,2
226	coldArc Misch.	AlSi	100% Ar	1,6
227	Metall-Fülldraht	CrNi	91-99% Ar	0,8
228	Metall-Fülldraht	CrNi	91-99% Ar	1,0
229	Metall-Fülldraht	CrNi	91-99% Ar	1,2
230	Metall-Fülldraht	CrNi	91-99% Ar	1,6
231	Rutil/Basic-Fülldraht	CrNi	91-99% Ar	0,8
232	Rutil/Basic-Fülldraht	CrNi	91-99% Ar	1,0
233	Rutil/Basic-Fülldraht	CrNi	91-99% Ar	1,2
234	Rutil/Basic-Fülldraht	CrNi	91-99% Ar	1,6
235	Metall-Fülldraht	SG2/3	80-90% Ar	0,8
236	Metall-Fülldraht	SG2/3	80-90% Ar	0,9
237	Metall-Fülldraht	SG2/3	80-90% Ar	1,0
238	Metall-Fülldraht	SG2/3	80-90% Ar	1,2
239	Metall-Fülldraht	SG2/3	80-90% Ar	1,6
240	Rutil/Basic-Fülldraht	SG2/3	80-90% Ar	0,8
241	Rutil/Basic-Fülldraht	SG2/3	80-90% Ar	0,9
242	Rutil/Basic-Fülldraht	SG2/3	80-90% Ar	1,0
243	Rutil/Basic-Fülldraht	SG2/3	80-90% Ar	1,2
244	Rutil/Basic-Fülldraht	SG2/3	80-90% Ar	1,6
245	forceArc	Al99	100% Ar	1,2
246	forceArc	Al99	100% Ar	1,6
247	forceArc	AlMg	100% Ar	1,2
248	forceArc	AlMg	100% Ar	1,6
249	forceArc	AlSi	100% Ar	1,2
250	forceArc	AlSi	100% Ar	1,6
251	forceArc	CrNi	91-99% Ar	1,0
252	forceArc	CrNi	91-99% Ar	1,2

Job-Nr./ Job-no.	Verfahren / process	Material / material	Gas / gas	Draht-durch-messer /wire dia-meter (mm)
253	forceArc	CrNi	91-99% Ar	1,6
254	forceArc	SG2/3	91-99% Ar	1,0
255	forceArc	SG2/3	91-99% Ar	1,2
256	forceArc	SG2/3	91-99% Ar	1,6

12 Appendix B

12.1 Overview of EWM branches

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