Operating Instructions

BMK-16i
Stud Welder

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BMK-16i
Stud Welder

Serial number*

BMK-16i stud welder _____

Please enter the serial number here to have it immediately available if you need service support.

Type table for BMK-16i stud welder

Order No.	Code designation	Note
P01340	BMK-16i	Standard device (3 x 400 volt power supply)
P01341	BMK-16i automatic	Standard device (3 x 400 volt power supply) with automatic set for stud reload

Heinz Soyer Bolzenschweißtechnik GmbH
Etterschlag
Inninger Straße 14
82237 Wörthsee
Tel.: +49 (0) 8153 - 885 - 0
Fax: +49 (0) 8153 – 8030
www.soyer.de

Congratulations on purchasing the BMK-16i SOYER stud welder.
You have made an excellent choice. Your BMK-16i SOYER stud welder was specially developed for the high-speed fastening of SOYER welding studs in compliance with **DIN EN ISO 13 918** on metallic, weldable workpieces.

We have verified that the contents of this pamphlet correspond to the hard- and software described. Deviations, however, cannot be excluded so that we cannot warrant for absolute compliance.

The illustrations contained in this instruction manual can vary in some details from your product. This, however, has no influence on the handling of the machine.

The data in this documentation, however, have been verified regularly and necessary corrections will be incorporated in future impressions. We appreciate any suggestions for improvement.

Date of issue: December 01, 2002
Xxxxxxxx 03-06-03

Printed in the Federal Republic of Germany

CERTIFICATE

DVS ZERT® e.V.
Aachener Str. 172, D - 40223 Düsseldorf

This is to certify that the company

Heinz Soyer
Bolzenschweißtechnik GmbH
Inninger Straße 14
D - 82237 Wörthsee-Etterschlag

has implemented a quality system in the following areas of application.

Development, Production and Sales of Stud Welding Equipment
Production of Welding Studs

By way of a quality audit it was proved that this quality system has been put into service and fulfils the requirements of the Standard

DIN EN ISO 9001:2000

Registration No.: DE-1996-001-2
Valid until: 09.19.2005
Lead Quality Auditor

First Certification: 02.12.1996
Düsseldorf: 09.19.2002
Certification Body

Ing. W. Pupp

Dipl.-Ing. M. Lehmann

Heinz Soyer Bolzenschweißtechnik GmbH
Inninger Straße 14
82237 Wörthsee

EC Conformity Declaration
in compliance with EC Directive on Machinery 89/392/EEC, appendix II A

We herewith declare that the machine described in the following and the version available on the market correspond in its design and construction to the fundamental safety and health requirements stipulated by EC Directive on Machinery. Any modification of this machine without confirmation shall automatically annul this declaration.

Designation of machine	:	**Stud Welder**
Machine type	:	**BMK-16i**
Machine no.	:	_____
Applicable EC directives	:	EC Directive on Machinery (89/392/EEC) in the version 91/368/EEC EC Directive on Low Voltage (73/23/EEC) EC Directive on Electromagnetic Compatibility (89/336/EEC)
Applied harmonised standards, in particular	:	EN 292 - 1 and EN 292 - 2, EN 60 204 - 1 EN 60 974 - 1
Applied national standards and technical specifications, in particular	:	VBG 1, VBG 4, VBG 5, VDE 0544
Date	:	August 01, 2002
Producer's signature	:	_____
Signer's function	:	Technical Management

Table of contents

Appendix A /

1 General

1.1 The following should be principally observed...

With this stud welder you have purchased a product which

• is state-of-the-art technology
• fully complies with the current safety requirements and
• enables successful working.

Before installing the stud welder, please observe the following:

• Store the operating instructions in a place accessible to every operator

• Ensure that the respective operator has read and understood the operating instructions prior to installation. Each operator should confirm this per signature.

• Prevent the stud welder being operated by unauthorized personnel

• Only trained personnel may operate the stud welder

DANGER
Persons with pacemakers must not operate the stud welding equipment and must not stay near it while it is running. Ensure that the stud welding equipment is not operated near electronically sensitive life-supporting equipment, such as in intensive care units in hospitals.

CAUTION
Keep sufficient distance from electronic devices. When stud welding, highly intensive electromagnetic fields are created which may permanently damage these devices (e.g. television sets).

• Moreover, please observe the safety instructions in chapter 3.

• Call a doctor in case of an accident.

1.2 Application

The BMK-16i SOYER stud welder for short-cycle drawn arc welding allows SOYER threaded studs as per **DIN EN ISO 13918** and ranging from M3 – M16 RD (MR) or Ø 2 – 13mm (studs, shear connectors, concrete anchors) made of plain, stainless and heat-resistant steel to be welded on different workpieces (sheets, tubes, steel girders etc.).
Usually round pins with or without thread are welded. You may also weld fasteners with different cross-sectional shapes. For this purpose, however, special stud holders and ceramic ferrules or gas shrouds are required.

With the BMK-16i SOYER stud welder it is also possible to weld studs of other metallic materials than steel. It is, however, necessary to first carry out experimental welds and to inspect them.

Manual electric welding (electrode welding) and TIG welding is also possible to a limited extent.

If you need consultation or assistance in solving problems, please contact either our parent company or our field engineers.

1.3 Information on the product

Manufacturer Heinz Soyer Bolzenschweißtechnik GmbH
Etterschlag
Inninger Straße 14
D-82237 Wörthsee
Tel.: +49 (0) 8153-885-0
Fax: +49 (0) 8153-8030
www.soyer.de

Product designation	BMK-16i Stud Welder
Country of origin	Germany

1.4 Type plate

The type plate is located on the rear side of the stud welder. It contains the following information:
- Manufacturer's name
- Address of manufacturer or agency
- Country of origin
- Product designation
- Mains connection values
- Performance data
- Production number / year of construction

1.5 Information on the documentation

The following operating instructions are supplied with the BMK-16i stud welder:

- Operating instructions for BMK-16i stud welder

Order no.: P00229

For repeat-orders please contact your responsible service office or our parent company. Please refer to chapter 1.6.

1.5.1 Chapters of operating instructions

The operating instructions describe the start-up and operation of the BMK-16i stud welder under normal conditions.
The present operating instructions of the BMK-16i stud welder comprise the following chapters in detail:

- Chapter 1 General
- Chapter 2 Description of stud welder
- Chapter 3 Safety instructions
- Chapter 4 Installation of stud welder
- Chapter 5 Start-up
- Chapter 6 Operation
- Chapter 7 Quality control
- Chapter 8 Maintenance
- Chapter 9 Spare parts list for BMK-16i
- Chapter 10 Troubleshooting
- Chapter 11 Transport and storage
- Chapter 12 Terms of warranty
- Chapter 13 List of standards and guidelines

1.5.1 Information on operating instructions

Legal relationship

We draw your attention to the fact that the contents of these operating instructions are neither part of any former or existing arrangement, pledge or legal relationship nor are designed for modifying the latter. All obligations of Heinz Soyer Bolzenschweißtechnik GmbH result from the respective contract of purchase which also comprises the complete and generally valid warranties. These contractual warranty terms are neither extended nor restricted by the implementation of these operating instructions.

CAUTION
Do not carry out any actions on the stud welder without specifically knowing the operating instructions or the respective part. Ensure that only qualified personnel familiar with the operating instructions and the necessary technical activities (training!) operate the system.

1.5.2 Conduct in the case of malfunctions

If malfunctions occur, first try to detect and eliminate the causes according to the list in chapter 10 "Troubleshooting" of the operating instructions. In all other cases, please contact our service department.

If you require our service, please make sure that you supply us with the following information:

- Customer number
- Product designation
- Serial number
- Year of construction
- Options
- Material of stud and workpiece
- Stud dimensions

This information will help us both to save time and unnecessary costs, e.g. caused by delivering the wrong spare parts.

1.6 Contacts and service address

If you have any questions regarding the operation of the stud welding system, retrofits or if you require service, please contact your responsible service office or the following address:

Heinz Soyer Bolzenschweißtechnik GmbH
Etterschlag
Inninger Straße 14
D-82237 Wörthsee
Tel.: +49 (0) 8153-885-0
Fax: +49 (0) 8153-8030
info@soyer.de
www.soyer.de

2 Description of stud welder

2.1 Short-cycle drawn arc technology

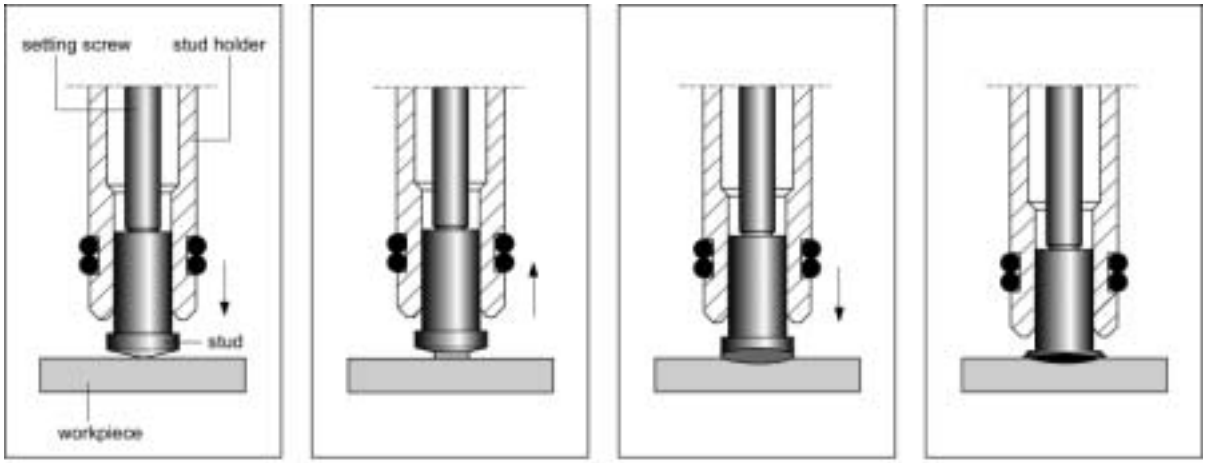


Illustration 1: Short-cycle drawn arc technology

The BMK-16i SOYER stud welder runs according to the principle of short-cycle drawn arc stud welding. For detailed information, please refer to the following regulations:
• DIN EN ISO 14555, "Arc welding of metallic materials“
• DVS Information Sheet 0902, "Drawn arc welding“

When welding, the stud is positioned on the workpiece. The preweld current is ignited and the stud is lifted off the workpiece. The subsequent ignition of the main current creates a molten pool between stud and workpiece. The stud immerses in the liquid molten pool and the material solidifies.

This method allows manual, semi-automatic and fully automatic inseparable welding of threaded stud fasteners, pins, balls, T-bolts, tapped studs, insulating pins, special studs and many other fasteners made of steel, CrNi steel, heat-and acid-resisting steel with the workpieces. Conditionally it is also possible to weld nickel and titanium depending on the respective requirements. Standard studs for drawn arc and capacitor discharge welding in compliance with DIN EN ISO 13918 can be welded without requiring any auxiliary aids. The application of shielding gas or ceramic ferrules is recommended for studs with a diameter of more than 6 mm to prevent pore formation and to optimise the formation of bulges.

The standard BMK-16i stud welder is suitable for operation with shielding gas and ceramic ferrules. A D.C. power supply with inverter technology provides the welding current. The weld duration and welding current can be selected. Owing to the low penetration depth of about 0.4 mm, the short-cycle drawn arc method can be applied from a sheet thickness of 0.6 mm on. It guarantees particularly safe, uniform and reproducible stud welded joints without high requirements to setting accuracy and stud tip quality. Application is especially recommended for workpieces with difficult surface characteristics, e.g. oil, grease, zinc and other galvanic treatments as well as rolling scale, filling materials, forging scale, oxide films, etc. The ratio of minimum sheet thickness and stud diameter amounts to 1:8.

IMPORTANT INFORMATION
Ensure that the surface is electroconductive.
Abrase hot galvanized parts.

The following welding methods are possible when using the BMK-16i SOYER short-cycle drawn arc stud welder:

- Short-cycle drawn arc stud welding without shielding gas and ceramic ferrules.
- Drawn arc stud welding using ceramic ferrules as auxiliary aid.
- Drawn arc stud welding using shielding gas as auxiliary aid.
- Manual electric welding (electrode welding)
- TIG welding

Preferably use shielding gas as auxiliary aid. The use of ceramic ferrules as auxiliary aid, however, is necessary when carrying out particularly critical welding works as e.g. welding works during which the gun has to be held in a horizontal position or above the head.

2.2 Stud welding

The PH-2L stud welding gun with control cable and shielding gas equipment is the standard gun to be connected to the BMK-16i stud welder. Optionally you may also connect the PH-3N, PH-3L and PK-0K stud welding guns. These operating instructions only refer to the BMK-16i stud welder.

For information regarding the stud welding guns or welding heads to be used and their setting, please refer to the respective operating instructions.

2.2.1 Drawn arc welding with shielding gas

With this method, a gas mixture containing 82% of Argon and 18% of CO 2 (e.g. Corgon®18*) is used as auxiliary aid.
This shielding gas protects the welding point from the atmosphere and simultaneously supports the weld pool. Moreover, it ensures a concave fillet weld upset formation with a blank metallic surface, thus reducing the risk of corrosion and obtaining an improved dynamic behaviour of the welded joint.

An accurate bulging, to scale or in a calibrated or reproducible type, is not possible when welding with shielding gas without using any auxiliary aid. Stud welding with shielding gas can be carried out at much shorter intervals as no ceramic ferrules have to be fitted and removed in each welding process.

*) Corgon®18 is a gas mixture of Linde AG in D-82049 Höllriegelskreuth

2.2.2 Drawn arc welding with ceramic ferrules

The ceramic ferrule fulfils the following functions:

- It centres the electric arc.
- It protects the welding point from the atmosphere.
- It ensures the exact formation of the weld upset.
- It prevents too rapid cooling of the weld pool.
- It partially protects against spraying sparks.

To ensure a perfect and accurate weld upset, each stud requires a ceramic ferrule matching its diameter and shape. After every welding process, the ceramic ferrule must be knocked down and replaced by a new one.
Usually this method allows you to weld in any position.

IMPORTANT INFORMATION
Ensure ceramic ferrules are absolutely dry.

2.3 Manual electric welding / TIG welding

Instructions on application

These operating instructions only describe the function "stud welding".

Instructions on manual electric welding / TIG welding can be obtained from the respective manufacturers of the necessary accessories.

Table for electrical characteristic values as per DIN EN 60974-1

6) 	8) ⎓	10) 40 A / 21.6 V up to 300 A / 32 V		
		11) X	11b) 60 %	11c) 100 %
7) S	9) U_0 = 85 V	12) I_2	12b) 300 A	12c) 200 A
		13) U_2	13b) 32 V	13) 28 V

Field 6	Graphical symbol for welding process “Covered-Electrode Manual Arc Welding"
Field 7	Symbol for welding current sources which are suitable for welding in an environment of increased electrical danger.
Field 8	Symbol for direct current.
Field 9	Dimensioning value of open-circuit voltage in volt.
Field 10	Lowest and highest power range.
Field 11	Symbol for operating time.
Field 12	Symbol for dimensioning value of welding current.
Field 13	Symbol for standardized operating voltage.
Field 11b,c	Value of operating time in %.
Field 12b,c	Dimensioning value of welding current in ampere.
Field 13b,c	Value of standardized operating voltage in volt.

2.3.1 Manual electric welding (electrode welding)

"Electrode welding" allows simple welding works with covered electrodes (electrode holders are not included in delivery)

Please pay attention to the following:

- Stud welding technology necessitates that the electrode holder is connected to the negative pole. Polarity may, however, be inverted by changing the plug-in connection of the earth and welding cables. Two adapter cables are necessary for doing so (special accessories).
- Welding current is adjustable from 40A up to 300A in 10A steps.

The welding current has to be set depending on the electrode diameter and the welding task.
Approx. 40A for each mm diameter of the electrode may serve as a standard value for the current adjustment.

CAUTION
During electrode welding, the connecting socket "welding cable" and the connecting plug "earth cable" are always live.
The open-circuit voltage has always a direct voltage of approx. 80 V!

2.3.2 TIG welding

TIG welding allows simple welding works using a TIG welding torch (welding torch is not included in delivery).

Please pay attention to the following:

- Stud welding technology necessitates that the electrode holder is connected to the negative pole. Polarity may, however, be inverted by changing the plug-in connection of the earth and welding cables. Two adapter cables are necessary for doing so (special accessories).
- Only direct voltage (DC operation) is available as welding current. It is not possible to change over to alternating voltage.
- The current may be adjusted between 30A and 100A in 10A steps.

Gas and welding current are switched on by pressing the switch of the torch. Keep pressing the switch during the welding process. Gas and current are switched off when you stop pressing the switch.

NOTE
Do not press the switch of the torch too long. There is no optional torch cooling available.

2.4 View / Dimensions

The BMK-16i stud welder has a handy, compact and robust design. The carrying handle on the top of the housing allows easy transport so that the stud welder can be used at different work places.

Illustration: Front view of BMK-16i

Dimensions of BMK-16i 335 X 440 X 700 mm (w x h x d)

2.5 Technical data

Designation	BMK-16i
Welding process	Drawn arc stud welding (DS) Electrode welding rectifier
Welding range	SOYER threaded studs, DIN EN ISO 13918 from M3 – M16 RD (MR) or Ø 2 – 13mm
Material	Steel, stainless steel and heat-resistant steel (aluminium conditionally depending on respective requirements)
Source of current	Inverter technology
Welding current	300 up to 1000 A (stud welding) 40 up to 300 A (electrode welding) 30 up to 100 A (TIG welding)
Welding time	10 up to 1000 ms (only with operating mode "stud welding")
Welding sequence	15 – 30 studs/min. with M3 up to 3 studs/min. with M12 (Ø 11mm)
Standard gun	PH-2L stud welding gun
Power supply	CEE 32 A (3P + safety earth conductor) 3 x 400 V 50/60 Hz +10% -15%
E-constant current	1 A / phase
E-constant power	700 VA
E-peak current	95A / phase with 3 x 400 V (short-time operation)
Open-circuit power	80 V / DC (direct voltage)
System of protection	IP21
Interfaces (optional automatic set)	Feeder interface: 15-pole socket CNC interface: 9-pole socket RS 232 interface: 9-pin plug (no function)
Compressed air supply	max. 6 bar (compressed air only with optional automatic set)
Shielding gas supply	max. 4 – 5 l/min.
Dimensions	335 x 440x 700 (w x h x d)
Weight*	36.5 kg
Colour	RAL 5009 azure
Subject to technical changes	

**Slight deviations are possible depending on accessories.*

2.6 Circuit diagram of BMK-16i

2.6.1 Wiring diagram

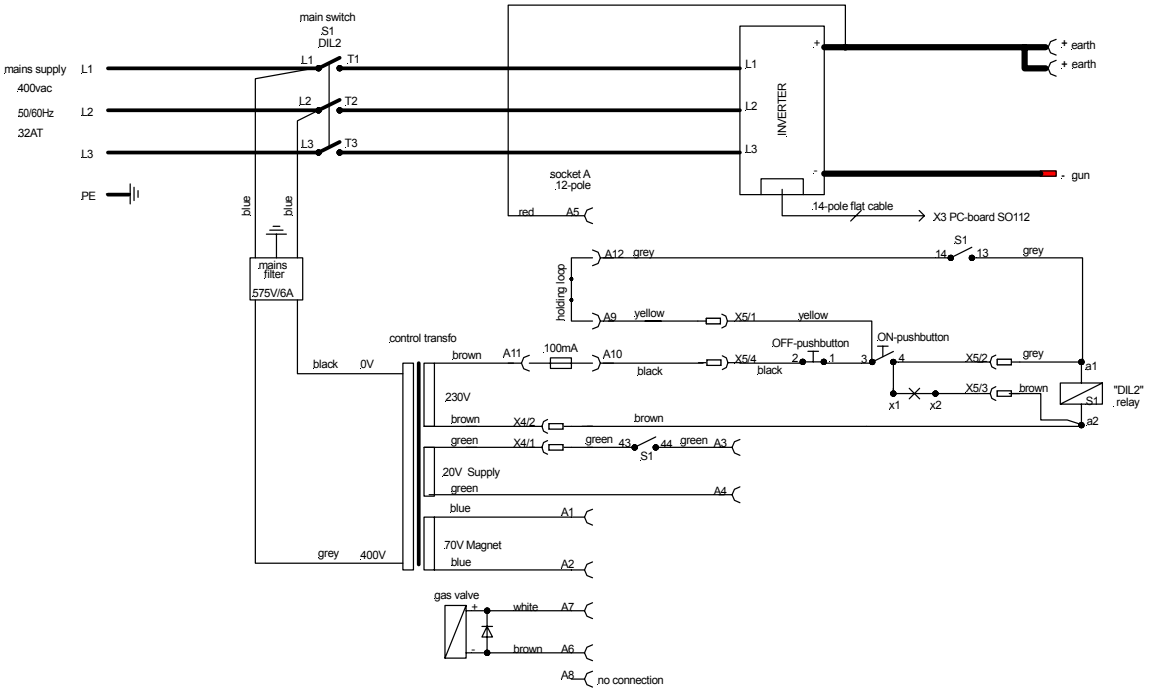


Illustration: Wiring diagram, drawing no.: xxx.xxx.xxx *Subject to technical changes.*

2.6.2 Wiring diagram of modules

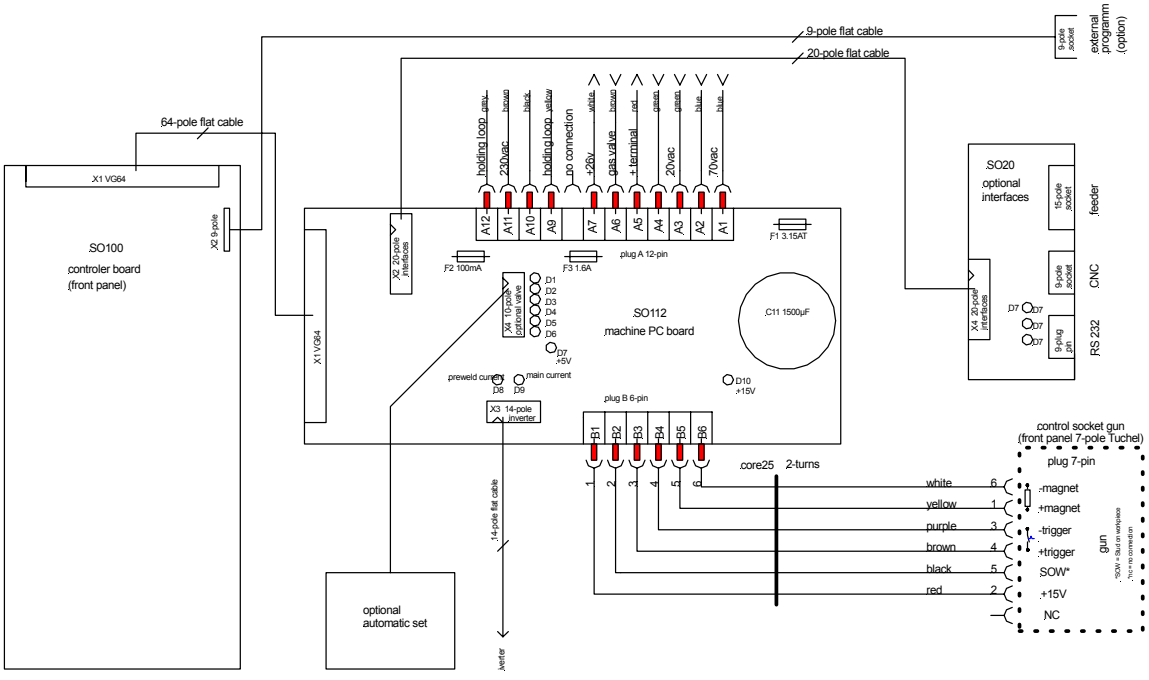
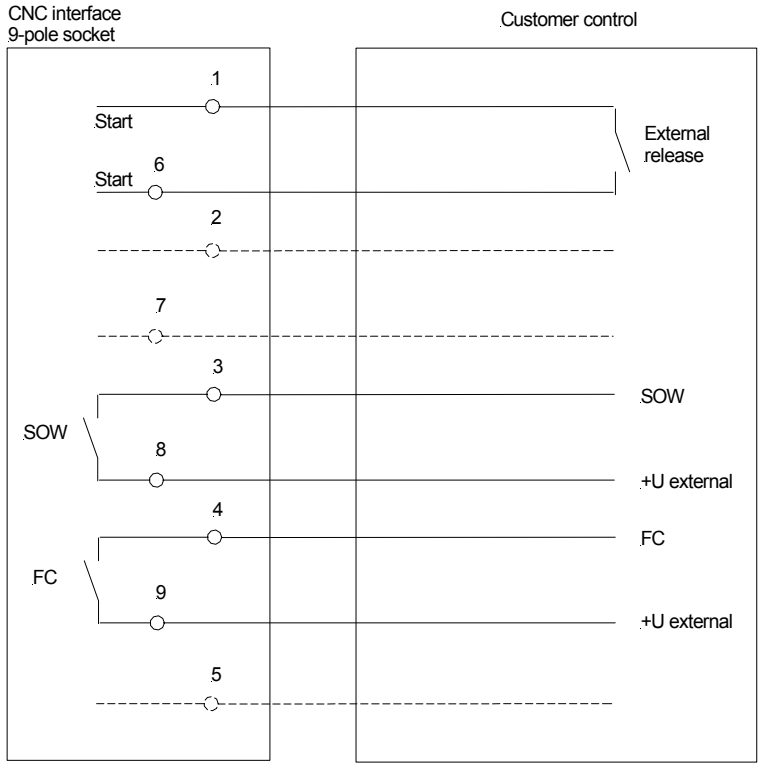


Illustration: Wiring diagram of modules, drawing no.: xxx-xxx-xxx *Subject to technical changes.*

2.7 BMK-16i interfaces

2.7.1 CNC interface



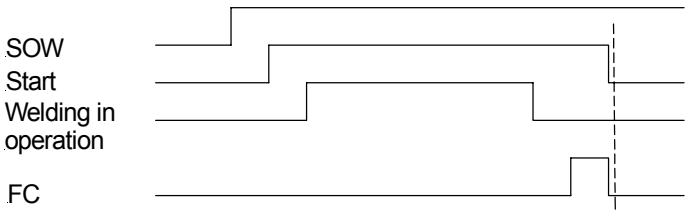
Terminology:

SOW Stud on workpiece
Is only required when stud welder is operated via an external control.

Start Contact releases the welding process.

FC Final contact
Contact is closed after welding. Release of external control must then be reset to original position.

Time sequence (stud welding):



Note:
Interfaces are only available when you have a stud welder with an optional automatic set.

3 Safety instructions

These operating instructions contain basic instructions which have to be complied with during installation and/or operation. It is therefore absolutely necessary that these operating instructions are read by the operator and responsible specialist staff prior to assembly and start-up. The operating instructions must always be available at the installation site.

Not only the general “safety instructions” listed under this main item, but also the special safety instructions e.g. for high temperatures, voltage etc. listed under the other main items have to be complied with.

3.1 Description of reference signs in the operating instructions

The non-observance of safety instructions such as pictographs and warning words can cause damage to persons. The safety instructions of this manual describe the following:

Safety instructions

Danger!	Immediate hazards which could result in serious personal injuries or loss of life.
Warning!	Potential hazards which could result in serious personal injuries or loss of life.

Caution!	Potential hazards which could result in minor personal injuries.
Caution!	Warning of damage

Note!	Potential detrimental situation which may cause damage to the product or to an object surrounding it.
Important!	Instructions for application and other useful information facilitating the proper use of the product

Safety symbols

The following pictographs for warnings, bans and decrees are used in this manual:

		
Ban for persons with pacemakers	Ban (only in combination with an additional safety symbol!)	Warning of electromagnetic field
		
Warning of dangerous electric voltage	Warning of hand injuries	Warning of a danger spot

General instructions are marked with the hand symbol.

3.2 Staff qualification and training

The staff responsible for operation, maintenance, inspection and assembly must have the respective qualification for carrying out these works. Field of responsibility, competence and the supervision of staff have to be exactly regulated by the user. If your personnel do not have the necessary knowledge, they have to be trained and instructed. If necessary, this can be done by the manufacturer/supplier on behalf of the user. Furthermore, the user must ensure that the contents of the operating instructions are fully understood by the staff.
The society of welding institutes (GSI: Gesellschaft der Schweißtechnischen Institute mbH) offers the appropriate training courses for your personnel.
For information on branches, please refer to website http://www.dvs-ev.de.

3.3 Dangers in the case of non-compliance with safety instructions

The non-compliance with safety instructions may not only endanger persons, but also the welding equipment and its environment. Any non-compliance with safety instructions may result in a complete loss of damage claims.
Non-compliance with safety instructions may have the following consequences:
• Failure of important system functions
• Failure of prescribed methods for maintenance
• Danger of persons through electric, mechanic, thermal and acoustic influences

3.4 Safety-conscious working

The safety instructions listed in this manual, existing national accident prevention regulations and possible international working, operating and safety regulations of the user must be complied with.

3.5 Safety instructions for the operator/user

When stud welding, danger may result from

• electric current
• optical radiation
• harmful substances (smoke)
• acoustic shock (does not apply to drawn arc welding)
• spraying sparks

You are therefore obliged to restrict dangers to an inevitable degree and to point these dangers out to the operator and other persons involved.

DANGER
Persons with pacemakers must neither operate the stud welder nor stay near it.

3.6 The following should be observed before starting the system…

Before starting up the system, pay attention to the following information:

- Juveniles under the age of 16 years must not operate the stud welding system.
- Read all of the operating instructions before starting the system.
- Only qualified personnel are allowed to operate the system.
- Prevent unauthorized use of the system by children or unqualified personnel.
- .Wear non-combustible closed working clothes.
- Wear a leather apron to protect your clothes from welding spatters that are generated during the welding process.
- Wear a head protection when carrying out welding works above your head.

WARNING
When welding, do not wear clothes soiled with easily combustible substances such as oil, grease and paraffin oil etc.

NOTE
Welding spatters and flashes of light are generated during the welding process.
- Wear gauntlet gloves made of leather.
- Wear protective goggles with eye-protecting lens number 2 (DIN 58211, part 6).
- Wear side-shielded glasses.

- Wear neither rings, watches nor electrically conductive jewellery.

3.7 Before starting to weld...

- Check the state of all cables and cable connections before starting to weld.
- Immediately replace defective cables and cable connections.
- Ensure that the air apertures of the housing are not covered. Heat accumulation may damage the stud welding device.

3.8 Safety precautions at installation site

- When placing the stud welder on tables or similar workshop furniture, ensure that the system stands firmly and that the table can bear its weight.
- Make sure mains socket and stud welding system are properly earthed.
- Comply with fire prevention regulations and do not weld in hazardous locations.
- Make sure there are no combustible objects at the weld place. Before starting to weld, remove all combustible materials and liquids.
- Make sure room is well ventilated or extract welding fumes, if necessary, or use e.g. a breathing mask.

CAUTION
When welding, fumes and suspended matters may be generated. Beware of fumes detrimental to health, particularly when using surface-treated materials. If possible, only weld in rooms which are higher than 3 m. As per VBG 15 special regulations apply to narrow rooms.

3.9 Working with the stud welding equipment

• Comply with all accident prevention regulations which apply to the operation of your stud welding device.

☞	One of the accident prevention regulations applicable to stud welders is VGB15 “Welding, cutting and similar working methods”. For more information, please contact the Employer’s Liability Insurance Association

	**DANGER** Persons with pacemakers must neither operate the stud welder nor stay near it.

If an accident happens,

• switch off the welding device and disconnect it from the mains supply
• call a doctor.

3.10 Safety instructions for maintenance, inspection and assembly

The user must ensure that all maintenance, inspection and assembly works are only carried out by authorized and qualified technical personnel.

Generally, only work at the system when it has been switched off and after having disconnected it from the mains supply. The safety instructions described in the operating instructions have to be complied with.

Immediately after having completed your work, re-install and activate all safety and protective devices.

3.11 Unauthorized retrofit and spare parts production

The system may only be retrofitted and modified after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee safety. The use of other parts may result in the cancellation of warranty for any consequences thus caused.

3.12 Inadmissible operating methods

Working safety of the stud welding system supplied can only be guaranteed when the system is used in accordance with its purpose. The limit values indicated in the chapter “Technical data” must never be exceeded.

3.13 Stopping the stud welder

• Press the red OFF button "0" (item 1, chapter 5.1)
• Disconnect the mains plug from the socket.
• Disconnect
- the control cable (item 9, chapter 5.1)
- the welding cable (item 10, chapter 5.1)
- the earth cables (item 12, chapter 5.1)
- gas supply (items 11+19, chapter 5.1) and compressed-air supply (items 7/8/18/19, chapter 5.1)

from the stud welder.

• Roll up the cables without buckling them.

☞	Our GW-1 SOYER tool and gear wagon (optional equipment) is the optimum solution for properly storing SOYER stud welders as well as welding guns, cables, studs, retrofit kits etc.

• Make sure stud welder can not be used by unauthorized persons.
• Check welding cable and connections of the stud welder for damage such as burn-off, mechanical wear etc. and have damaged parts replaced by the SOYER customer service.

3.14 The “S” symbol

DANGER
The “S” symbol is the symbol for welding current sources permitted for operation with increased electrical danger. The “S” symbol on our stud welders refers exclusively to the welding current circuit and not to the complete stud welder.

4 Installation of stud welder

The top of the BMK-16i stud welder is equipped with a carrying handle.

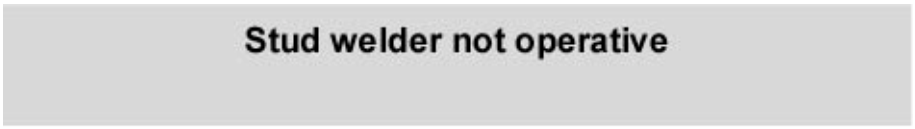
CAUTION
The carrying handle is intended for transport by hand only. Never pull ropes through this handle to lift the stud welder by means of a crane to the installation site. The welding unit would become instable and might tilt from its original position. As a result the handle could rip and the system would fall on the ground.

• Only install the stud welder on an even surface. The anti-vibration pads located on the bottom of the welding system guarantee its anti-skid position and serve as vibration dampers.

• Although the stud welder is resistant to environmental influences, it should be protected against dampness and dust.

• Please pay particular attention to the bearing strength of the workshop furniture and ensure a safe and stable position of the welding system.

• Make sure there is sufficient free space around the air apertures, otherwise the excess temperature safety mechanism will respond and interrupt the welding process. This state, represented as "Stud welder not operative" is shown alternately with the current operating mode on the display.



KZ.2038.E

Only when this information is no longer shown on the display, is it possible to continue the welding operation.

• Install the stud welder close to the welding location.

• Ensure correct connected loads for electrical connections:
Socket CEE 32 - 6 hrs; 3 x 400 V~/50 Hz/60Hz

BMK-16i stud welder has a four-core connecting cable: 3P + safety earth conductor

• Please observe that additional extension cables cause a voltage drop, possibly leading to system disturbances.

• When welding with shielding gas, make sure the gas cylinder is installed safely in its admissible, accident-proof installation device.

CAUTION
The gas cylinder must be protected against tilting when installing it vertically. A horizontal position of the gas cylinder is not allowed since the gas cylinder connection and/or manometer could be easily damaged by doing so.

• Ensure sufficient ventilation of the working room when operating the welding system.

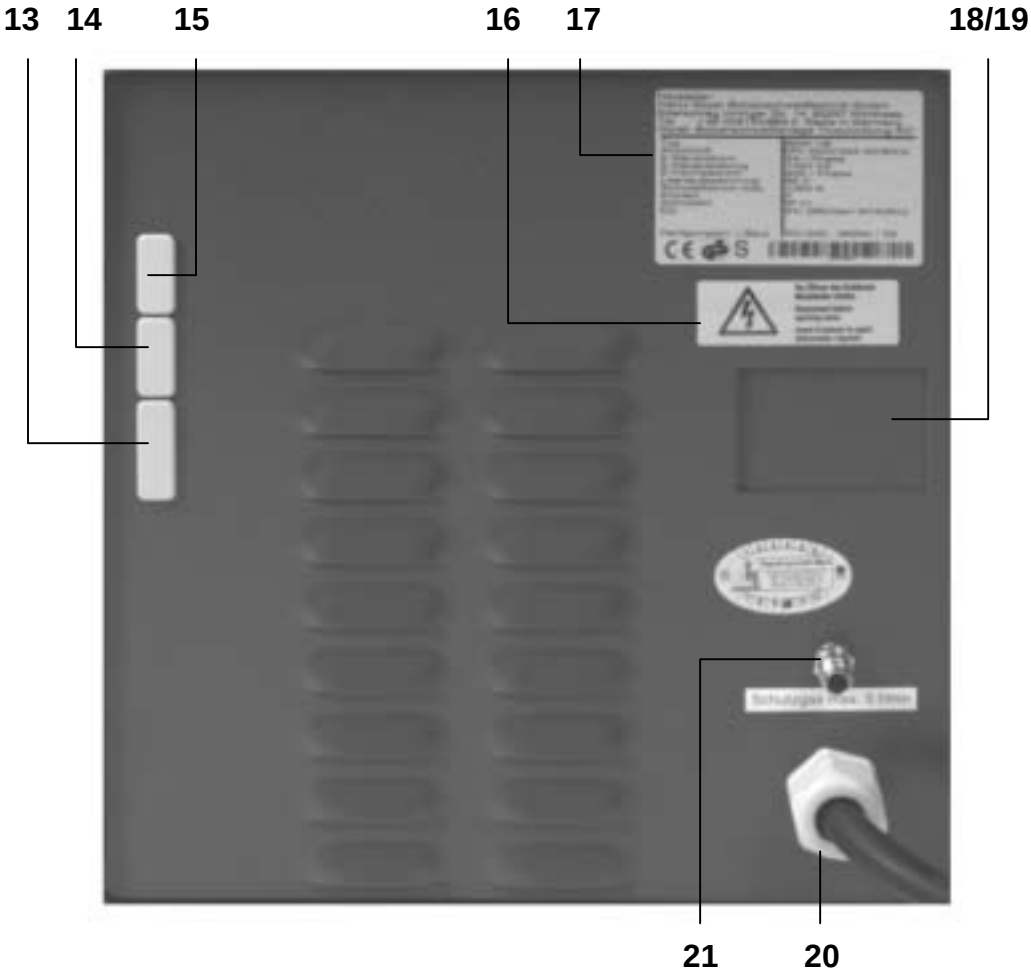
NOTE
The housing of BMK-16i stud welder corresponds to safety class IP 21. Please observe that this system of protection is not suitable for being operated or transported in the rain.

5 Start-up

5.1 Front and rear view

Front view of BMK-16i

1 OFF switch to switch the stud welder off
2 Equipment-on indicator lamp
3 ON switch to switch the stud welder on
4 LCD display
5 LED display for function control
6 Function keys for setting the welding parameters
7 Air function "forward" (option)
8 Air function "backward" (option)
9 Control cable connection
10 Welding cable socket
11 Gas connection socket
12 Earth cable connectors



Rear view of BMK-16i

13 15-pole connecting socket for controlling the feeder (BMK-16i automatic).
14 9-pole connecting socket for controlling the stud welder via a CNC interface or SPS control system (BMK-16i automatic)
15 9-pin connector, interface RS 232 (no function)
16 Danger sign
17 Type plate
18 Compressed-air supply connection for feeder control (BMK-16i automatic)
19 Connecting sockets for compressed-air control of feeder (BMK-16i automatic)
20 Mains cable
21 Shielding gas connector

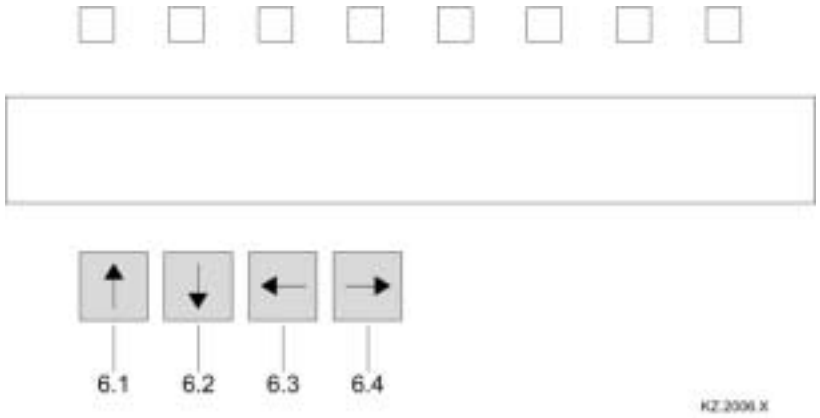
5.1.1 Operating elements

• **ON/OFF switch**

Switch ON/OFF switch to position "I" (item 3, chapter 5.1) to switch the stud welder on. The signal lamp (item 2, chapter 5.1) shows that the stud welder is operative.

Switch ON/OFF switch to position "0" (item 1, chapter 5.1) to switch the stud welder off.

• **Function keys for setting the welding parameters (item 6, chapter 5.1)**
The BMK-16i stud welder has four function keys on the front panel for setting the welding parameters:



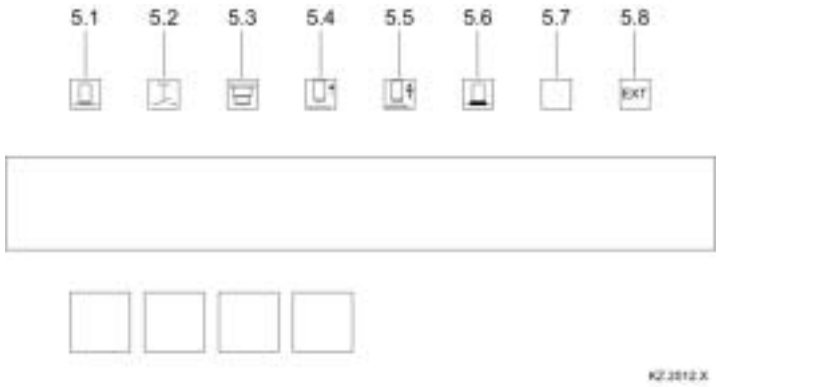
6.1 Function key “arrow up”
6.2 Function key “arrow down”
6.3 Function key “arrow left”
6.4 Function key “arrow right”

• Function keys "arrow up/down” (items 6.1 and 6.2, chapter 5.1)
Modification of selected parameters (flashing symbol in display).

• Function keys "arrow left/right" (items 6.3 and 6.4, chapter 5.1)
Selection of parameters to be modified (shifting of the flashing symbol to the left or right).

5.1.2 Display elements

• **LED displays (item 5, chapter 5.1)**
The LEDs show the respective operating states.



5.1	LED “Stud on Workpiece”	5.5	LED “Main Current”
5.2	LED “Release”	5.6	LED “Final Contact”
5.3	LED “Gas Valve Open”	5.7	LED (no function)
5.4	LED “Lift”	5.8	LED (no function)

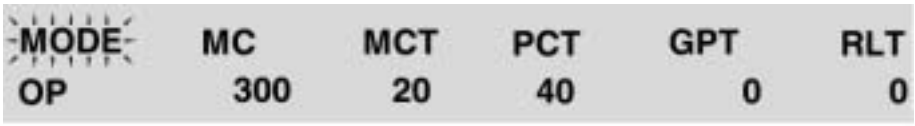
When switching the equipment on, the 8 LEDs light up for a short period to check proper operation.

> ☞ If not all LEDs light up when starting the system, please contact your service partner.

5.1.3 LED display (item 4, chapter 5.1)

The first line of the display shows the designation of the parameters to be set. The second line shows the set value. When the parameter designation is flashing, you may change its value by using the keyboard.

After switching the stud welder on, the following may appear on the display, e.g.:



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Explanation of displayed operating modes:

• MODE
Operating mode set. It is possible to set four different operating modes:

1- OP
Operational state which must be set for normal welding operation.

2- PRE
Preweld current test (see chapter 5.3.2.2)

3- LIFT
Lift test (see chapter 5.3.2.3)

4- GAS
Gas test (see chapter 5.3.2.4)

5- ELECTRODE WELDING
Electrode welding (pls. refer to chapter 5.3.2.5)

6- TIG WELDING
TIG welding (pls. refer to 5.3.2.6)

Explanation of displayed parameters:

• MC
Main current. Value set between 300 and 1000 ampere (operating mode “Stud Welding”).

• MCT
Main current time. Period of time set between 10 and 1000 milliseconds.

• PCT
Preweld current time. Period of time set between 40 and 1000 milliseconds.

• GPT
Gas preflow time. Period of time set between 0 and 9900 milliseconds during which the shielding gas valve is open before welding and remains open after welding. Set "0" when welding without shielding gas.

• RLT
Reload time. Period of time set between 0 and 9900 milliseconds during which the blast air valve remains open to allow stud transference from the universal feeder to the welding gun/welding head. Set “0” to switch off the automatic reload.

5.1.4 Connecting elements

• **Air function "forward" (item 7, chapter 5.1, option BMK-16i automatic)**
Connection for welding guns or heads with automatic stud feed.

• **Air function "backward" (item 8, chapter 5.1, option BMK-16i automatic)**
Connection for welding guns or heads with automatic stud feed.

• **Control cable connection (item 9, chapter 5.1**) and **welding cable socket (item 10, chapter 5.1)**
The control cable connection and the welding cable socket serve to connect the stud welding guns or heads to the stud welder.

• **Gas connection socket (item 11, chapter 5.1)**
Before welding with shielding gas, connect the gas hose of the welding gun or head to the gas connection socket.

• **Earth cable connectors (item 12, chapter 5.1)**
The earth cable connectors serve to connect the earth clamps to the stud welder.

• **Feeder interface (option BMK-16i automatic) (item 13, chapter 5.1)**
The feeder interface serves to connect the feeder control to the stud welding device.

• **CNC interface (option BMK-16i automatic) (item 14, chapter 5.1)**
The CNC interface serves to be connected with an external control system for controlling the stud welding process.

• **Compressed-air connection (option BMK-16i automatic) (item 18, chapter 5.1)**
This connection serves to supply the stud welder with compressed air. The admissible supply pressure amounts to a maximum of 7bar.

• **Feeder connection sockets (option BMK-16i automatic) (item 19, chapter 5.1)**
These connection sockets serve to connect the compressed-air hoses of the feeder control to the stud welder.

• **Mains cable (item 20, chapter 5.1)**
The mains cable is a four-core (3P + PE), highly flexible connecting cable for connecting the stud welder to the mains supply with a 32 A-CEE-plug

• **Gas connector (item 21, chapter 5.1)**
This connection serves to supply the stud welder with gas by means of a pressure regulator. The admissible gas flow value ranges between a max. of 4 and 5 l/min.

5.1.5 Symbols

Symbol	Designation	Function
	Electrical energy	ON/OFF switch for switching the stud welder on and off.
	LED "Stud on Workpiece"	LED lights up when earth terminal of stud welder is connected and stud touches the workpiece.
	LED “Release"	LED lights up when pressing release switch of welding gun or welding head.
	LED "Gas valve open"	LED lights up with shielding gas valve being open.
	LED "Lift"	LED lights up with lifting magnet of welding gun being activated.
	LED "Main current"	LED lights up when main current is started.
	LED "Final contact"	LED lights up after welding, with release switch being pressed.
	LED "External“	LED lights up when stud welder is operated by remote control via the serial interface (RS232) (not yet in use).
	Function key "Arrow up"	Upward alteration of the operating mode and the parameters selected (represented blinking in the display)
	Function key "Arrow down"	Downward alteration of the operating mode and the parameters selected (represented blinking in the display)
	Function key "Arrow left"	Selection of parameters to be changed (relocation of blinking symbol to the left)
	Function key "Arrow right"	Selection of parameters to be changed (relocation of blinking symbol to the right)
	Air function "forward"	Air supply for stud welding gun/welding head with automatic operation (optional equipment).
	Air function "backward"	Air supply for stud welding gun/welding head with automatic operation (optional equipment).
	Gas supply	Gas supply for welding gun/welding head, coupler socket KD - 1/4.
	Earth	Marks earth cable connector to be connected with earth cable.
	Gun	Marks control and welding cable sockets to be connected with welding gun.

5.2 Preparation for start-up

Connect the stud welding gun and earth cables to the stud welder prior to start-up.

5.2.1 Earth connection

• Attach earth cable to earth cable connectors (item 12, chapter 5.1) and lock by turning to the right until stop.

• Attach earth clamps to workpiece.

☞	Ensure optimum contact with workpiece. Owing to the high welding current, an unbalanced current distribution may cause a magnet blow effect on the arc, i.e. the arc for welding the stud is asymmetrical. This is shown by an irregular course of the weld upset on the side of the stud. The welding results are unsatisfactory and not reproducible.

For this reason, you should attach the earth clamps to the workpiece in such a manner that the welding gun is positioned as close as possible to the centre of the connecting route of both earth clamps. This guarantees a current distribution around the stud that is balanced to the largest possible extent and satisfactory welding results.

Difficult areas are welds on the edge of the workpiece or greater nonhomogeneities in material thickness, i.e. the material thickness varies by a few millimetres or additional material is welded or riveted to the metal. This also includes stud welding on profile sections.

To ensure good welding results, carry out several test welds under different conditions. For example, simply change the position of the earth clamps or turn the welding gun.

You may determine the symmetry and quality of the arc during the preweld current test and then optimise them by means of adequate combinations of the earth connection and the gun position.

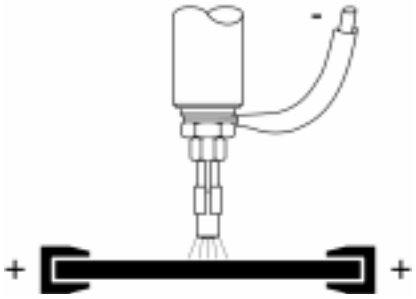
☞	Please ensure that the contact areas of the earth clamps are always kept clean and do not oxidize, otherwise high transition resistances could occur that may result in a considerable reduction of the rated welding current.

In addition, make sure that the earth clamps are clamped securely to the workpiece and the earth cables as well as the gun cable are securely connected to the stud welder. This prevents high transition resistances and arc losses on the clamps or plug-in connections which in turn would result in poor welding results.

Examples for various earth connections and possible effects:

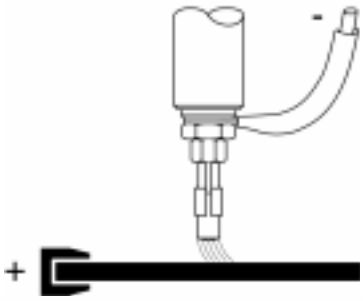
Balanced earth connection

Ideal condition: The stud is located in the centre of both earth connections.

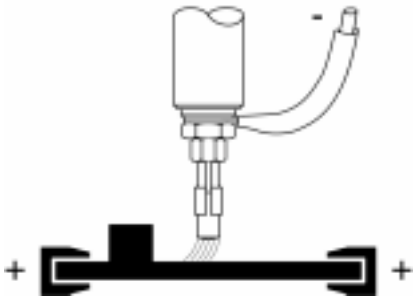


Unbalanced earth connection

Arc is deflected to the side where there is less current density.



Additional masses disturb arc symmetry.



5.2.2 Connection of stud welding gun

• Connect welding cable of welding gun to the relevant socket (item 10, chapter 5.1) and lock it by turning to the right until stop.

• Insert control cable into control cable connection (item 9, chapter 5.1) and tighten with sleeve nut.

• Please refer to the information given in the operating instructions for the welding guns.

5.2.3 Gas supply

When welding with shielding gas, provide the following connections:

• Insert gas supply hose's coupler plug of the welding gun into the gas supply socket (item 11, chapter 5.1) of the stud welder.

• Connect the gas hose of the pressure reducing valve (pressure reducing valve not included in delivery) to the shielding gas connector (item 21, chapter 5.1) at the rear side of the stud welder.

5.2.4 Power supply

• Compare the power data (supply voltage / current consumption) on the type plate (item 17, chapter 5.1) with the data (supply voltage / fuse protection) of your power supply network.

☞	Always ensure the correct supply voltage in accordance with the data plate. Never connect the stud welding device to a power supply network with incorrect supply voltage.

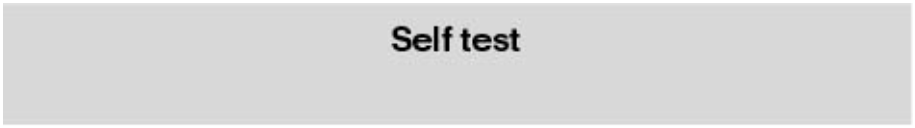
• Connect mains cable (item 20, chapter 5.1) to power supply using the CEE plug (standard 3 x 400V~, 32A-CEE plug).

⚠	**DANGER** Only connect stud welder to authorized CEE sockets. Standard connection = 3 x 400 V + earth conductor, 32A-CEE. If need be, have an expert in electrics check if the socket is earthed.

5.3 Adjustment of operating modes

5.3.1 Starting the stud welder

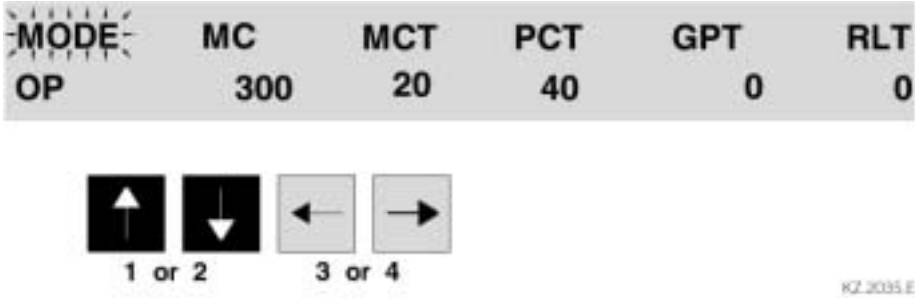
After switching the stud welder on, the 8 LED lamps (items 5.1 - 5.8, chapter 5.1.2) light up for a short period. The stud welder carries out a self test (self check) which is shown on the LED display (item 4, chapter 5.1).



The stud welder is locked during the self test and it is impossible to operate it or to enter data.
After the self test has been carried out successfully, the stud welder automatically sets the parameters which were last set.

5.3.2 Operating modes / parameters

Press the function key "arrow right" or “arrow left" **(3 or 4)** to select the parameters. Only the parameter designation which is flashing on the display can be set by means of the function keys **(1 or 2)**.

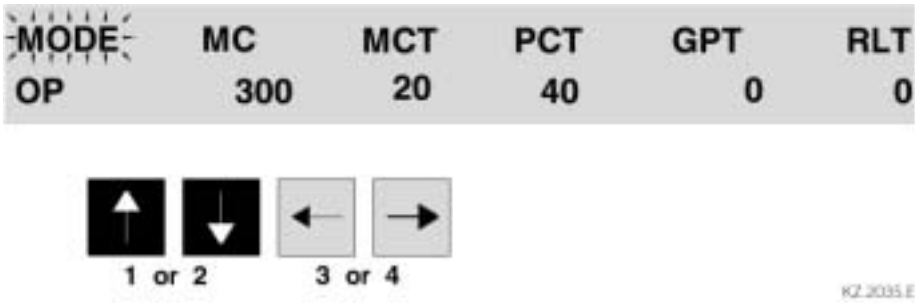


The six different operating modes possible have already been briefly described in chapter 5.1.3.

5.3.2.1 Operating mode "OP" (operational state)

The operating mode "OP" allows normal welding operation with the welding parameters set.
In the case of an excessive welding sequence, the welding operation is temporarily interrupted to avoid overheating of the stud welder.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operating mode "OP".

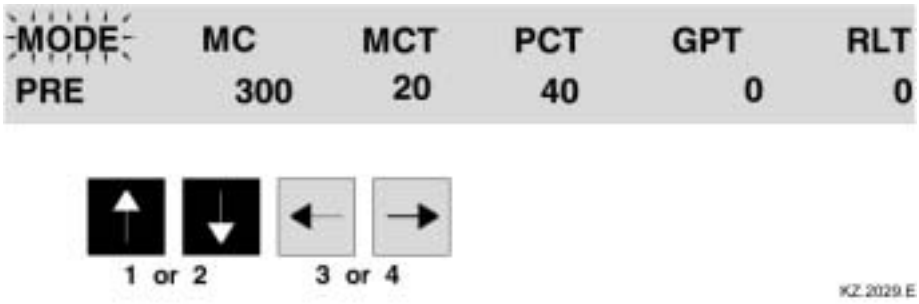


5.3.2.2 Operating mode "PRE" (preweld current test)

The adjustment "PRE" (preweld current test) enables carrying out welds by means of the set parameters without application of main current and serves to control the gun or head adjustment and to test performance. During this operating mode, an arc is generated with low current when the gun or welding head is positioned on the complete circuit (workpiece connected with earth) and the gun switch is pressed (or when a signal is given via the interface). This is helpful to check the symmetry of the arc or whether preweld current is flowing.

CAUTION
Protective goggles are required to carry out this test. Please also refer to the safety instructions in chapter 3.

• Use the function key “arrow up“ or "arrow down" **(1 or 2)** to set operating mode "PRE".



• Position the gun or welding head on the workpiece.

• Insert a stud into the gun or welding head.

• Check the immersion depth of the stud and/or set it according to the operating instructions of the welding gun or welding head.

• Check the lift setting of the stud welding gun and/or set the lift as described in the operating instructions of the welding gun or welding head.

CAUTION
Ensure once again that operating mode is set to "PRE" and observe the safety instructions in chapter 3.

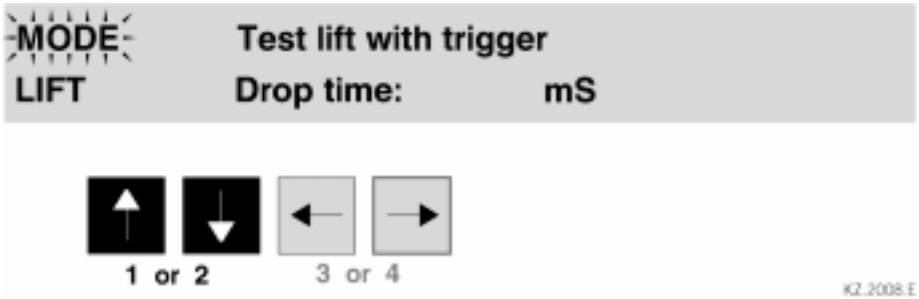
• Position gun or welding head on workpiece. The LED "Stud on workpiece" lights up.

• Activate trigger switch on the gun, welding head or activate the release via the CNC interface. After the preset period of gas flow has expired, the stud will be lifted off the workpiece. A small arc is generated the duration of which corresponds to the selected preweld current and main current period.

5.3.2.3 Operating mode "LIFT" (lift test)

This operating mode enables you to adjust and check the lift of the gun or welding head. For further information, please refer to the operating instructions of the welding gun or welding head.

• Use the function key “arrow up“ or "arrow down" **(1 or 2)** to set operating mode "LIFT".



• Insert a stud into the gun or welding head.

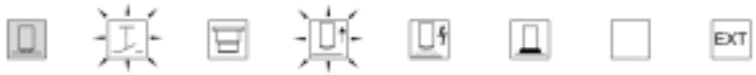
• Check the immersion depth of the stud and/or set it according to the operating instructions of the welding gun or welding head.

CAUTION
Ensure once again that operating mode is set to "LIFT" and observe the safety instructions in chapter 3.

• Position gun or welding head on workpiece. The LED "Stud on workpiece" lights up.

• Activate the trigger switch on the gun or the welding head or give a triggering signal via the CNC interface. The stud is lifted off the workpiece as long as the triggering

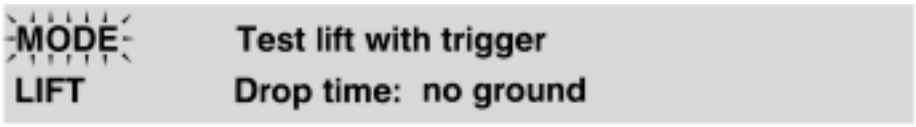
signal is there. After a maximum of 4 sec, however, the lift test will be interrupted to protect the magnet. There is no welding current during this period of time.



KZ.2043.X

• If necessary, check and correct the height of lift according to the prescribed standard values (see table for welding parameters in chapter 6.1.2) for the welding gun or welding head.

If the lift test is carried out on a workpiece which is connected to the earth connection of the stud welder, the drop time will be shown in milliseconds on the display. If the workpiece is not connected to the earth connection, "no ground" appears on the display.



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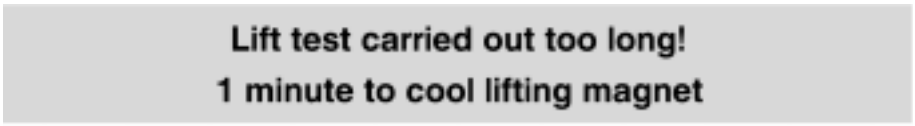
☞	Do not activate the release too often in short intervals, as this would cause the thermo safety mechanism protecting the lifting magnet to react and the current supply for the magnet to be interrupted. This condition is displayed as follows:



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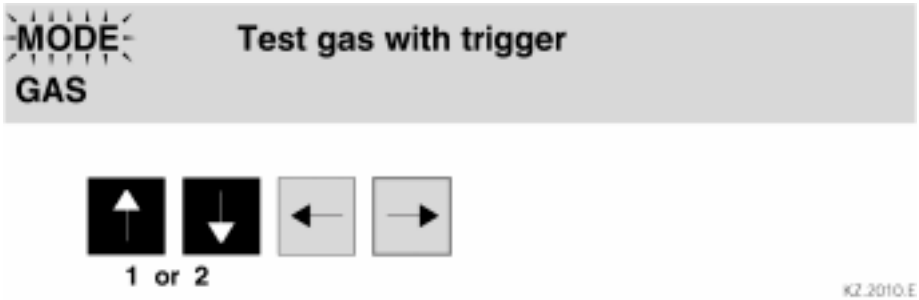
5.3.2.4 Operating mode "GAS" (gas test)

This operating mode checks whether the shielding gas flows through the gas shroud of the welding gun or welding head. As long as a triggering signal is there, shielding gas flows out of the gas shroud on the welding gun or welding head. This enables you to rinse the gas lines with shielding gas before starting to weld.

• Select the operating mode "GAS" with the function key "arrow up" or "arrow down" **(1 or 2)**.



KZ.2010.E

• Connect gas supply (see chapter 6.2.1)

• The gas valve may be activated by

- the trigger of the welding gun or welding head
- an active start signal at the CNC interface

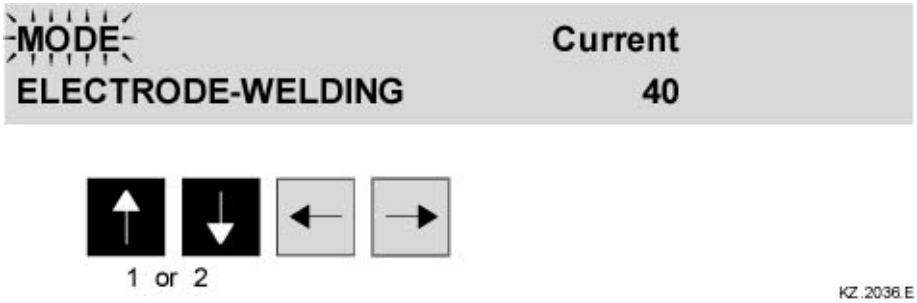
KZ.2044.X

5.3.2.5 Operating mode "Electrode welding"

In the operating mode "Electrode welding" the stud welder works like a welding rectifier.

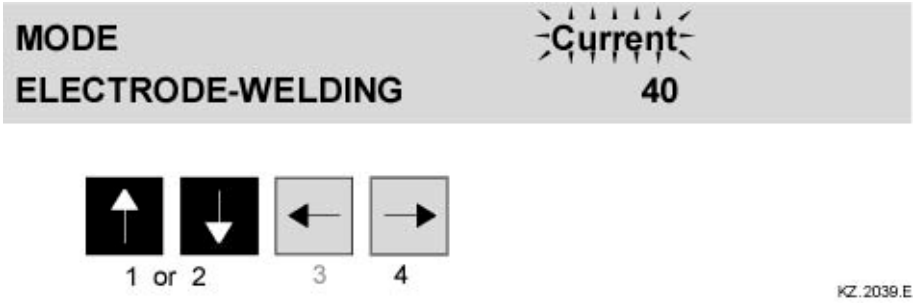
CAUTION
Please observe that there is permanently an open-circuit voltage of about 80V direct current on the terminals in the operating mode “Electrode welding”!

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operating mode "ELECTRODE WELDING".



KZ.2036.E

Use the function key "arrow right" **(4)** to set the welding current.



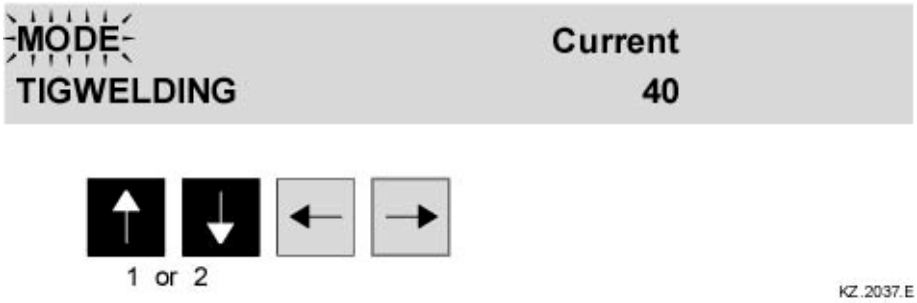
KZ.2039.E

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set the desired intensity of current.

5.3.2.6 Operating mode "TIG WELDING"

In this operating mode the stud welder works as a TIG welding device.
Gas and welding current flow when pressing the key on the burner.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operating mode "TIG WELDING".



Use the function key "arrow right" **(4)** to set the welding current.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set the desired intensity of current.

5.4 Special functions

With the stud welder BMK-16i you can call additional special functions:

> Start dealing with the special functions when you are familiar with the basic functions of the stud welder.

The stud welder must be switched off when calling special functions. In order to call the respective special functions you have to press certain function key combinations and keep them pressed when starting the stud welder. Switch off the stud welder by means of the OFF switch to terminate the special functions.

After this, the stud welder can be restarted as described in chapter 6.

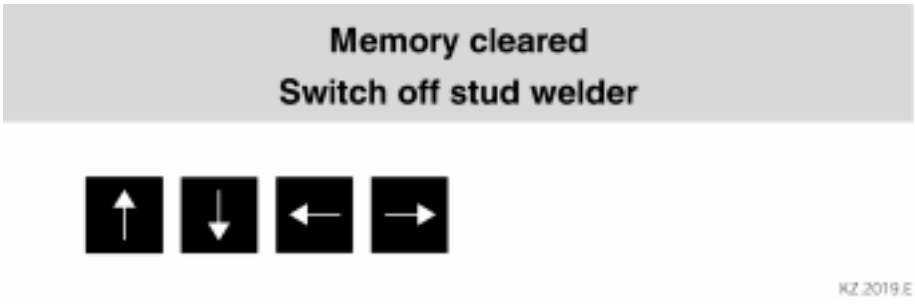
5.4.1 Special function "Erasing the working storage"

This special function serves as "RESET function" e.g. for eliminating troubles or starting the stud welder the first time. All settings of the working storage are erased by using this function.
To erase the working storage, please proceed as follows:

• Simultaneously press "arrow up", "arrow down", "arrow right" and "arrow left" keys and keep them pressed.

• Switch ON/OFF switch to position “I” to switch stud welder on.

• Stop pressing "arrow up", "arrow down", "arrow right" and "arrow left" keys.



• Switch ON/OFF switch to position “0” to switch the stud welder off and to position “I” to switch the stud welder on again.

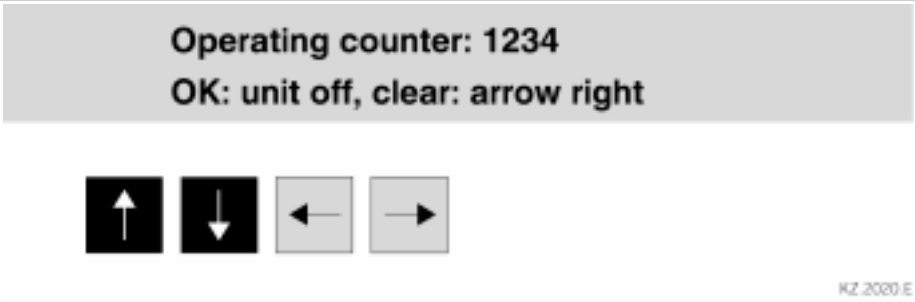
5.4.2 Special function "Display of operating counter"

This special function serves to display the operating counter.

• Simultaneously press "arrow up" and "arrow down" keys and keep them pressed.

• Switch ON/OFF switch to position “I” to switch stud welder on.

• Stop pressing "arrow up" and "arrow down" keys.



KZ.2020.E

The operating counter can be reset to "0" by pressing the function key "arrow right".

5.4.3 Special function "Setting the type of feeder and its functions".

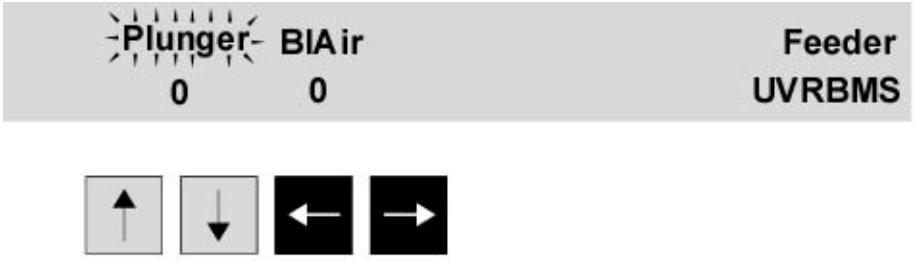
With automatic operation, this special function serves to adapt the control to the feeder (parameter 1-4, only with BMK feeder). The type of feeder connected can be set by means of parameter 5.

To call this special function, please proceed as follows:

• Simultaneously press "arrow right" and "arrow left" keys and keep them pressed.

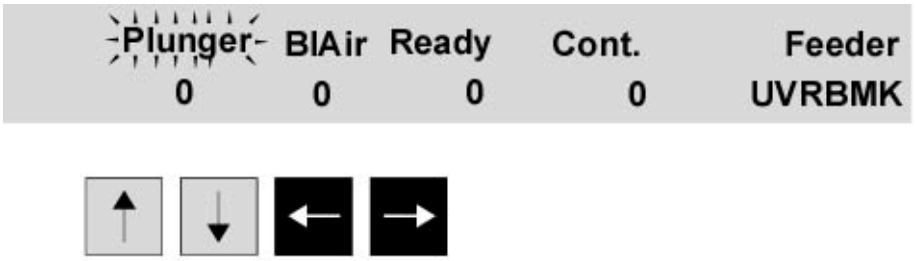
• Switch ON/OFF switch to position “I” to switch stud welder on.

• Stop pressing "arrow right" and "arrow left" keys.



KZ.2025_1.E

Display when setting feeder type “BMS“



KZ.2021_1.E

Display when setting feeder type “BMK“
The parameters "Plunger", "Ready", "Cont." and "BlAir" may be selected in 100 ms-steps.
The parameters may be horizontally selected by using the function keys "arrow left" and "arrow right".

Explanation of parameters

• Plunger

This parameter serves to adjust the after-blowing time of the stud feed blast air beyond the standard measure when the injection piston in the welding gun/welding head has moved forward to press the stud out of the stud holder. A longer time setting is required when welding e.g. above the head to achieve a trouble-free stud reload. The after-blowing time can be set between 100ms and 2000 ms.

• Ready (only possible with "Feeder BMK" function in conjunction with a BMK feeder)

- With UVR-300 feeder: This parameter serves to adjust the waiting period of the hexagonal barrel in the feeding position with simultaneous after-vibration of studs. Depending on the feeder type, a basic setting between 500ms and 1000ms is recommended.
- With UVR-250 feeder: This parameter serves to adjust the after-running period of the feeder when the light barrier has detected a stud in the stud escapement.

• Cont. (only possible with "Feeder BMK" function in conjunction with a BMK feeder)

This parameter serves to adjust the after-vibration period of the feeder to fill the outlet rail when a stud has been brought in blowing-off position. The after-vibration period can be set between 100ms and 2000ms.

• BlAir

This parameter serves to adjust the delay time of the stud feed blast air after the injection piston in the welding gun/welding head has moved back. After the set delay time, the stud feed blast air is activated. This is necessary e.g. in the case of a short stud feed hose. The delay time can be set between 100ms and 2000ms.

• Feeder (RUT)

This parameter serves to adjust the feeder type connected. UVRBMS and UVRBMK can be set as feeder types.

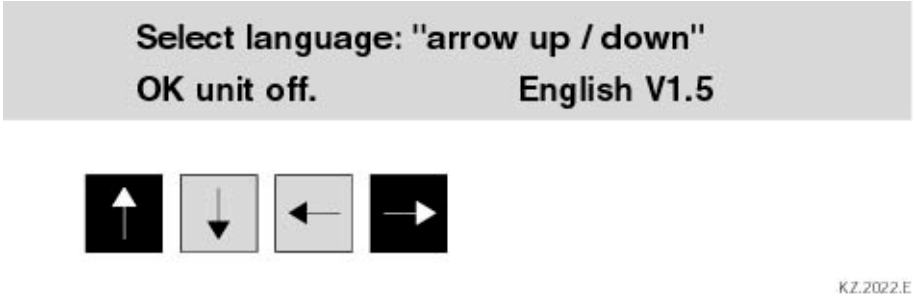
5.4.4 Special function "Selection of language. Display of software version number".

This special function serves to select different languages and to display the version number of the software. The languages available are indicated on the display.
For calling this function, please proceed as follows:

• Simultaneously press the "arrow up" and "arrow right" keys and keep them pressed.

• Switch ON/OFF switch to position "I" to switch stud welder on.

• Stop pressing the function keys.



• Follow the instructions on the display.

5.4.5 Special function "Setting the feeder operation"

This special function serves as a help for setting the feeder operation when the stud welder is equipped with an optional automatic set.

For calling this special function, please proceed as follows:

• Simultaneously press "arrow down" and "arrow left" keys and keep them pressed.

• Switch ON/OFF switch to position “I” to switch stud welder on.

• Stop pressing function keys.

KZ 2026.E

Display when setting feeder type “BMS“

or:

KZ 2023.E

Display when setting feeder type “BMK“

By using the function keys "arrow left" or "arrow right" you can move the slider in the feeder’s stud escapement to the left or right end position and thereby check the setting. During this process, the operational states of possible existing sensors are displayed as "on" or "off". For further information, please refer to the operating instructions of your universal feeder.

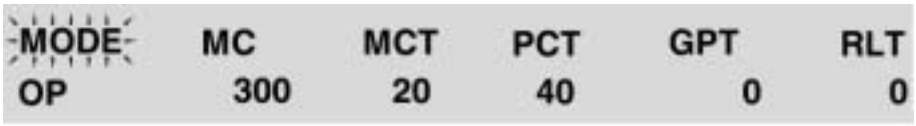
6 Operation

NOTE
The applicable accident prevention and safety regulations in chapter 3 have to be complied with when operating the stud welder.

6.1.1 Setting welding parameters for standard welding operation

• Switch ON/OFF switch to position “I” (item 3, chapter 5.1)

The stud welder carries out a self test. After the self test has been carried out successfully, the display shows the setting last used.

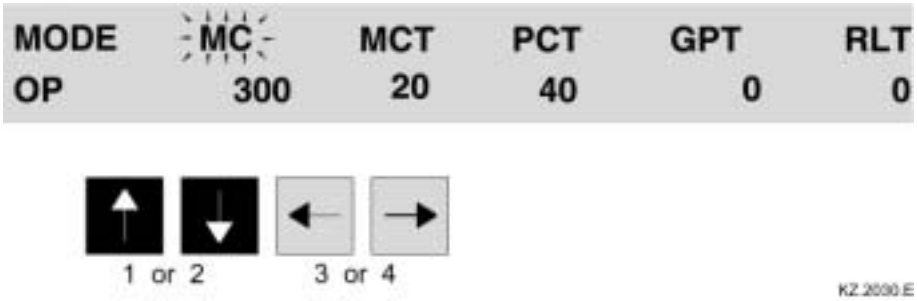


• Set the necessary parameters for your welding task. For doing so, please refer to the standard values indicated in the table “Welding parameters”.

6.1.1.1 MC (main current in ampere)

• Select function "MC" by pressing function key "arrow left" **(3)** or "arrow right" **(4)**

• Select the corresponding value for the main current from 300 to 1000 ampere in 10 A-steps by pressing function key "arrow up" **(1)** or "arrow down" **(2)**.

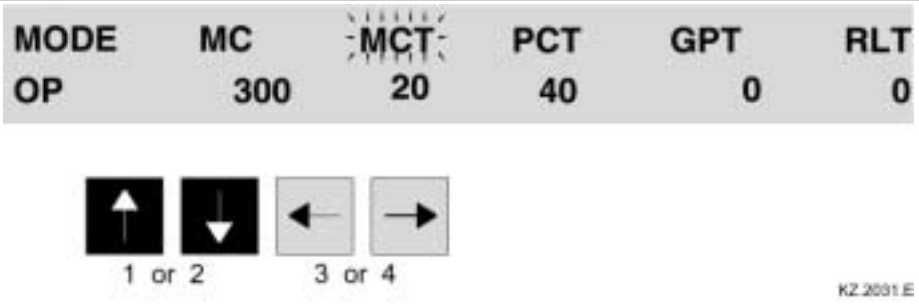


The setting values for the most important stud dimensions are represented in tabular form in chapter 6.1.2 "Welding parameters for welding operation“.

6.1.1.2 MCT (main current time in milliseconds)

• Select function "MCT" by pressing either function key "arrow left **(3)** or "arrow right" **(4)**.

• Select the corresponding value for the main current time from 1 - 1000 ms in 1 ms-steps by pressing the function key "arrow up" **(1)** or "arrow down" **(2)**.

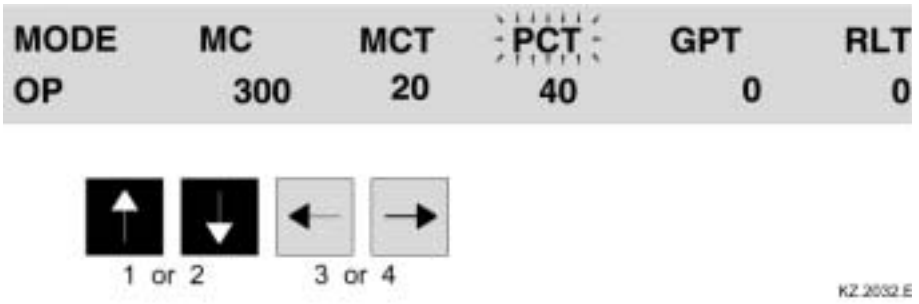


The main current times for the most important stud dimensions are represented in tabular form in chapter 6.1.2 "Welding parameters for welding operation“.

6.1.1.3 PCT (preweld current time in milliseconds)

• Select function "PCT" by pressing either function key "arrow left" **(3)** or "arrow right" **(4)**.

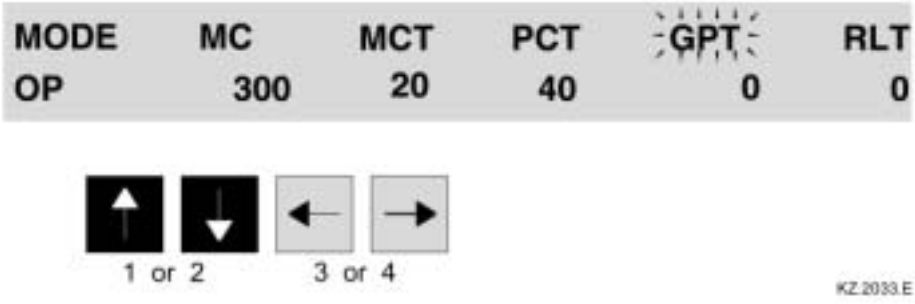
• Select the corresponding value for the preweld current time from 40 - 1000 ms in 20 ms-steps by pressing either the function key "arrow up" **(1)** or "arrow down" **(2)**.



6.1.1.4 GPT (Gas preflow time in milliseconds)

The gas preflow time is the period of time, during which the shielding gas valve is open before starting the welding process and remains open after the welding process has been completed. Set value "0" when welding without shielding gas.

• Select function "GPT" by pressing either function key "arrow left” **(3)** or "arrow right" **(4)**.
• Select the corresponding value for the gas preflow time from 0 - 9900 ms in 100 ms-steps by pressing function key "arrow up" **(1)** or "arrow down" **(2)**.

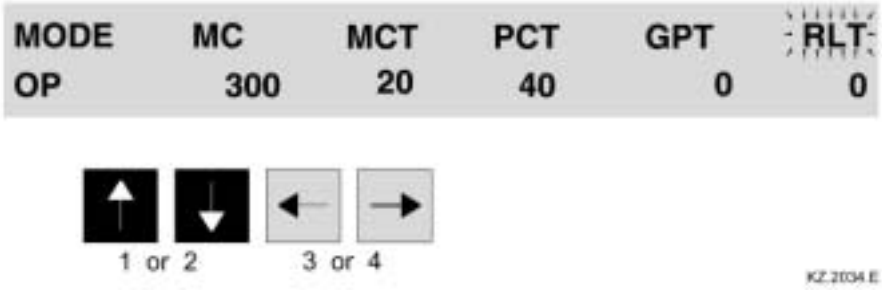


6.1.1.5 RLT (reload time in milliseconds)

The reload time is the period of time the blast air valve requires for transporting the stud from the universal feeder to the welding gun or welding head. The longer the blast air hose is, the higher you have to set the reload time correspondingly. If automatic reload is not required, set value "0". The reload time can only be used in connection with optional "automatic operation" (feeder connection).

• Select function "RLT" by pressing either function key "arrow left" **(3)** or "arrow right" **(4)**.

• Select the corresponding value for the reload time from 0 - 9900 ms in 100 ms-steps by either pressing function key "arrow up" **(1)** or "arrow down" **(2)**.

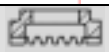
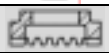


6.1.2 Welding parameters for welding operation

IMPORTANT
The set welding parameters influence the reproducibility and quality of the welding results to a large extent. The parameters depend on the size of the studs and the material properties. The values indicated in the tables are standard values which are exclusively valid for studs supplied by SOYER. They may vary depending on the type of workpiece, the workpiece thickness, the surface condition of the workpiece and on environmental conditions (e.g. low outdoor temperatures). The settings of the welding gun or welding head also influence the welding parameters.

Random samples should be taken during any production process to ensure constantly good welding results (see DIN EN ISO 14 555, "Arc welding of metallic materials").

The welding parameters were determined with the BMK-16i stud welder and the PH-3N stud welding gun having a lift setting of about 2.5 mm.
A steel plate with a thickness of 5 mm was used as base material for welding SOYER welding studs as per DIN EN ISO 13 918.

		For studs as per DIN EN ISO 13 918									
		6		8		10		12		14	
		~2.5	~3	~2.7	~3.5	~2.8	~4	~3	~4.2	~3.2	~4.5
		~1.5	~1	~1.6	~1.2	~2	~1.3	~2.3	~1.5	~2.6	~1.8
 Time=ms		~ 150		~ 250		~ 350		~ 450		--	
		~ 200		~ 250		~ 350		~ 500		~ 600	
 Energy=A		~ 450		~ 600		~ 800		~ 1000		--	
		~ 350		~ 500		~ 700		~ 900		~ 1000	

When using stud diameters exceeding 6 mm, we recommend the application of shielding gas or ceramic ferrules in order to prevent pore formation and to optimise bulging.

6.1.3 Minimum sheet thickness when welding with drawn arc operation

Observance of the minimum sheet thickness prevents the plate from being burnt through during the welding process.

Method	Weld time	Stud dia.	Welding current in ampere	Weld pool protection	Minimum sheet thickness
Drawn arc stud welding with ceramic ferrule or shielding gas	> 100 ms	3 up to 25 mm	300 up to 3000	CF	¼d, but 1 mm min.
	> 100 ms	3 up to 16 mm	300 up to 3000	SG	⅛d, but 1 mm min.
Short-cycle drawn arc stud welding	≤ 100 ms	3 up to 12 mm	up to 1500	NP, SG, CF	⅛d, but 0.6 mm min.
Capacitor discharge drawn arc stud welding	< 10 ms	3 up to 10 mm	up to 3000	NP, SG	1/10d, but 0.5 mm min.

CF = ceramic ferrule, SG = shielding gas, NP = no weld pool protection

Important information for standard welding operation (stud welding)

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

NOTE
The applicable accident prevention and safety regulations indicated in chapter 3 must be complied with when operating the stud welder.

DANGER
Persons with pacemakers must not operate the stud welding equipment and must not stay near it while it is running.

DANGER
Never touch stud or stud holder during the welding process. These components are current-carrying!

• Position the welding gun or welding head on the workpiece and press the trigger switch. The welding process will be started with the parameters set. The LED "Final contact" (item 5.6, chapter 5.1.2) indicates the end of the welding process.

• Hold the welding gun or welding head still during the welding process and wait until the welding process has been completed before removing the welding gun or head vertically from the welded stud. For further information, please also refer to the operating instructions of your welding gun or welding head.

• After the welding process, please keep the welding gun or welding head on the weld for about 5 seconds before removing to prevent the stud loosening out of the still fluid weld metal.

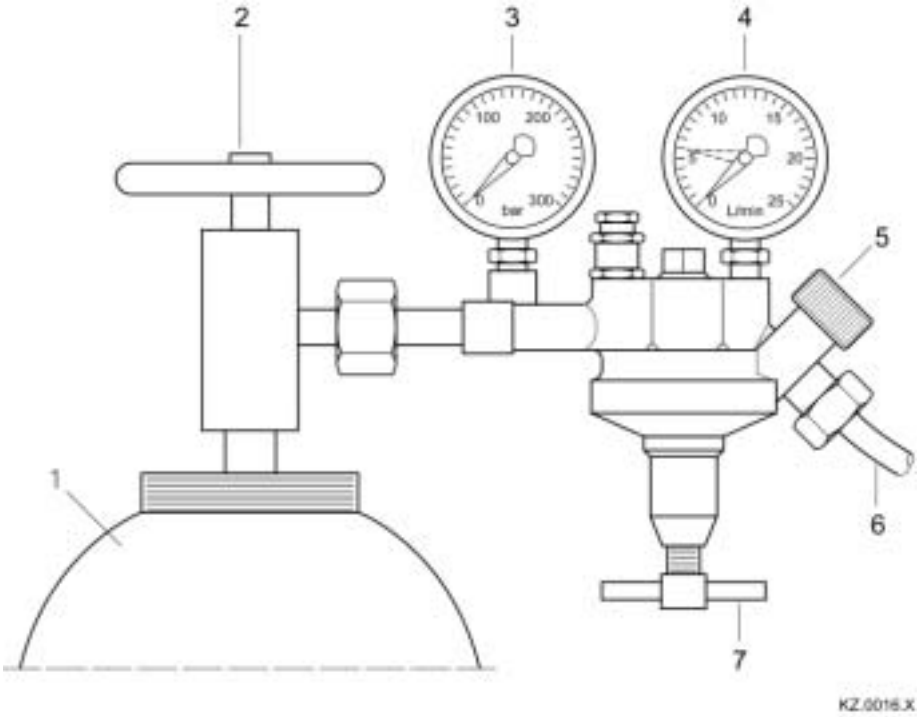
If the temperature in the stud welder exceeds the admissible operating value, the welding operation will be interrupted. The welding operation can be continued as soon as the transformer has cooled down.

6.2 Welding operation with shielding gas

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

NOTE
The applicable accident prevention and safety regulations indicated in chapter 3 must be complied with when operating the stud welder.

6.2.1 Preparation of gas supply



Example for gas supply. Deviations are possible depending on the manufacturer

1 Gas cylinder
(shielding gas as per chapter 2.1.1)
2 Hand wheel
(left = open, right = closed)
3 Manometer for indicating the gas cylinder's pressure
4 Flow meter
5 Shut-off valve
6 Gas supply hose
7 Control cock for gas flow rate
Screwing in increases the flow
Screwing out decreases the flow

• Connect gas supply hose and gas hose of pressure reducing valve (pressure reducing valve not included in delivery) to the stud welder (chapter 5.2.3, "Gas supply").

• Open hand wheel (item 2) of gas cylinder.

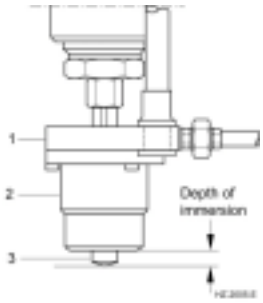
• Open shut-off valve (item 5).

• Use control cock (item 7) to set shielding gas flow rate to a maximum of 4 - 5 l/min.

6.2.2 Instructions for welding with shielding gas

• Set the parameters required for your welding task according to the table in chapter 6.1.2.

1 Foot plate
2 Gas shroud
3 Welding stud



Ill. Stud welding with shielding gas

Set gas flow rate to a value between 4 and 5 l/min. If the value is too high, the arc is extinguished, if the value is too low, the protective function of the gas is reduced. Welding results are poor in both cases.

• Insert a stud into the welding gun or welding head.

DANGER
Never touch stud or stud holder during the welding process. These components are current-carrying!

• Position welding gun or welding head vertically on the workpiece when welding.

• Press trigger switch.

When welding with shielding gas, the welding point is rinsed during the welding process as well as before and after welding for the period adjusted.

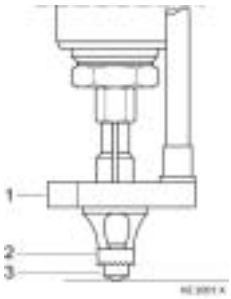
The LED "Gas valve open" (item 5.3, chapter 5.1.2) indicates that the gas valve is open.

The LED "Final contact" (item 5.6, chapter 5.1.2) indicates that the welding process is completed.

6.3 Welding operation with ceramic ferrules

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

1 Foot plate
2 Ceramic ferrule
3 Welding stud



Ill. Stud welding with ceramic ferrule

Welding operation with ceramic ferrules is only possible when using SOYER drawn arc welding studs, types PD, MD, RD, UD and SD, similar to DIN EN ISO 13 918.

6.3.1 Instructions for welding with ceramic ferrules

• Start the stud welder as described in chapter 5.

• Only use ceramic ferrules which are absolutely dry and do not show any flaws.

• Only use ceramic ferrules which match the type and size of the studs.

• Start by carrying out test welds in order to achieve optimum welding results. If necessary, modify the prescribed welding parameters.

• Insert stud into stud holder until stop.

• Make sure stud is centred in the ceramic ferrule holder.

• Place ceramic ferrule on ceramic ferrule holder.

• Position the welding gun in such a way that the centre of the stud points exactly toward the marked welding point.

• Make sure that the gun does not tilt, i.e. that the ceramic ferrule is positioned evenly on the workpiece.

• Start welding process. The LED "Final contact" lights up after completion (item 5.6, chapter 5.1.2).

• After the welding process, please keep the welding gun or welding head on the weld for about 5 seconds before removing to prevent the stud loosening out of the still fluid weld metal.

• Remove gun vertically to prevent widening and damaging of the stud holder.

• Knock off ceramic ferrule from the welded area.

6.4 Stopping the stud welder

Please refer to chapter 3.13 of the present operating instructions.

7 Quality control (stud welding)

7.1 General

Provided that the SOYER stud welding system is properly used and the materials are appropriately selected, the strength of the welding joint (welding zone) will always be stronger than that of the stud or base material. The following tests are carried out in general practice:

•Visual inspection

•Bend test

Please also refer to the following DVS information sheets

•DVS 0902 Drawn arc stud welding

•DVS 0904 Practical information – Arc stud welding

or standards

•DIN EN ISO 14555 Arc welding of metallic materials
•DIN EN ISO 13918 Studs and ceramic ferrules for arc welding

Heinz Soyer Bolzenschweißtechnik GmbH is a member of the German Welding Society (DVS = Deutscher Verband für Schweißtechnik e.V), Munich.

7.2 Demands on the company

The company must employ a technical supervisor responsible for welding matters, as well as qualified operating personnel for stud welding.

7.3 Test execution

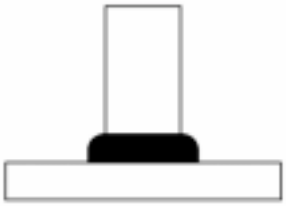
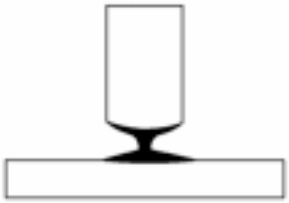
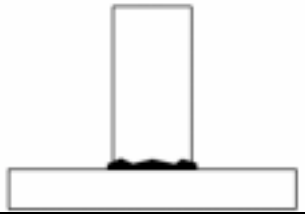
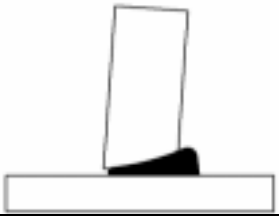
7.3.1 Production of samples

The dimensions of the test piece must be sufficient to carry out all tests. The thickness of the test piece must be the same as used in later production. Use the same welding positions and edge distances as on the component to be welded later. If it is possible and sensible from an economical point of view, use parts that are identical to those used in later production.

☞ Comply with the minimum sheet thickness (see chapter 6.1.3) as per DIN EN ISO 14 555

7.3.2 Visual inspection

The visual inspection serves as a rough check for major defects. The uniformity of the weld is assessed.

	Good welded joint. Optimum setting. Regular, bright and complete weld upset.
	Poor-quality welded joint e.g. caused by excessive welding energy or insufficient plunge or lift. Stud is constricted at the welded joint. Stud is not completely welded all over the surface.
	Poor-quality welded joint e.g. caused by insufficient welding energy or humid ceramic ferrules. Reduced and irregular weld upset.
	Poor-quality welded joint, e.g. caused by arc blow, tilted or unsteady welding position of welding gun. Stud flange is not completely welded and shows visual defects. Weld undercuts are visible.

Please also refer to the following standard:

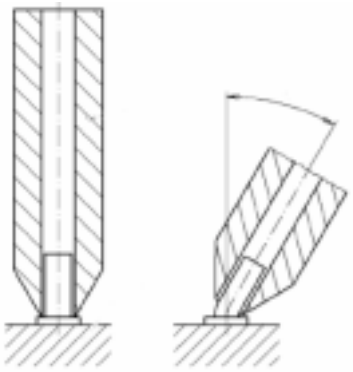
• DIN EN ISO 14555 Arc welding of metallic materials

Source of supply: Beuth Verlag GmbH, Berlin www.beuth.de

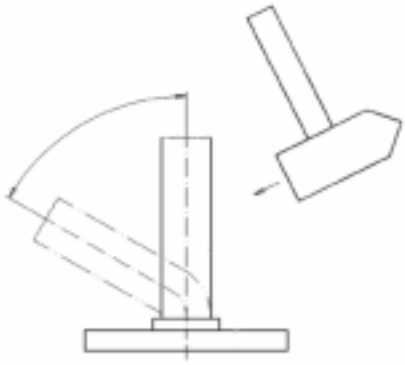
7.3.3 Bend test

The bend test is a simple work test which serves to roughly check the setting values selected. The welding zone is subjected to undefined tension, pressure and bending. A minimum of 3 studs is welded and bent by means of a tube that is slipped over the stud. The test is successful when no superficial fissure or fracture is detected in the welding zone.

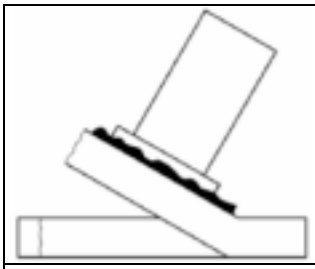
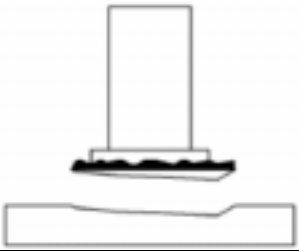
☞	Bend the studs by 30° when welding with capacitor discharge. With drawn arc welding using ceramic ferrules or shielding gas and with short-cycle drawn arc welding, bend the studs by 60°.



Bend test with tube placed upon the stud



Bend test with hammer

	Good welded joint. Optimum setting Tearing of parent metal.
	Good welded joint. Optimum setting Fracture above stud flange.
	Poor-quality welded joint Fracture in the heat-affected zone.

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7.3.4 Tensile test

The tensile test serves to test the metallic bond of the stud with the base metal. At least 3 studs are welded and then axially loaded by means of an appropriate tension device until they break. If the customer demands that a certain percentage of the welded studs should be tested with a specific test load in production, a tension device with load indicator should be used.
If the stud breaks outside the welding zone, the test is regarded as successful.
If it breaks within the welding zone, an examination of the fractured surface helps to find out the appropriate changes of the welding conditions. The setting values must be modified and the test repeated.

Note

Numerous special accessories are available for perfectly testing stud welded joints.

BP-1 SOYER Bend Testing Device for non-destructive stud testing to support quality assurance procedures

DMS-1 SOYER Torque Wrench for non-destructive stud testing to support quality assurance procedures

ZPV-1 SOYER Tensile Testing Device for non-destructive stud testing to support quality assurance procedures

For further information, please contact our parent company or the customer service responsible for your area or visit our website at www.soyer.de.

8 Maintenance

8.1 Important instructions

The stud welder is constructed in such a way that only a minimum of maintenance is required. The interior of the stud welder should, however, be cleaned at regular intervals depending on the environmental conditions at the location of use.

	**CAUTION** Special demands are imposed upon the service personnel due to the INVERTER technology. Our customer service has adequately trained personnel, suitable service equipment and the means to carry out all necessary works.

	**DANGER** Always disconnect the mains cable from the socket and the shielding gas and compressed-air supplies from the connections of the stud welder before starting any repair, maintenance or cleaning works.

	Please note Only use original SOYER ® spare parts.

8.2 Cleaning

Cleaning should be carried out once a week depending on how soiled the stud welder is.
Please pay particular attention to foreign substances in and around the air apertures in the housing.

Blow through the interior of the stud welder with clean, dry and filtered compressed air with a pressure of about 2 bar. If no compressed air is available, a vacuum cleaner may be used instead. Ensure, however, that no components are damaged by the nozzle.

8.2.1 Detergents

Almost every detergent without corrosive or acidic substances is suitable for cleaning purposes. However, please observe the manufacturer's specifications on the detergent you intend to use.

8.3 Replacement of components

Defective components may only be replaced by trained SOYER servicemen. Perfect function of your stud welder can only be guaranteed when original SOYER spare parts are used.

CAUTION
Disconnect the mains cable from the mains supply and detach the shielding gas and compressed-air supplies before replacing any components. Electric and electronic components may only be replaced by the SOYER ® customer service or by trained specialist staff.

CAUTION
Should it become necessary to replace fuses, only use fuses with the prescribed electrical values. Oversized fuses could either cause defects on the electrical system or a fire.

DANGER
Disconnect the mains plug from the mains supply when replacing fuses.

9 Spare parts list for BMK-16i

9.1 Spare parts for BMK-16i

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In preparation

Item No.	Quantity	Designation	Order No.

10 Troubleshooting

The following list of errors, their causes and remedies is designed to help you eliminate any trouble immediately on the spot. If it is difficult or impossible to eliminate the trouble, please contact the SOYER customer service responsible for your area or Heinz Soyer Bolzenschweißtechnik GmbH.
For address and telecommunication data, please refer to chapter 1.6 (contacts and service address).

	**DANGER** Always disconnect the mains cable from the socket and the shielding gas and compressed-air supplies from the connections of the stud welder before starting any repair, maintenance or cleaning works.

	**CAUTION** Electric and electronic components may only be replaced by the SOYER ® customer service or by trained and appropriately qualified personnel.

10.1 Malfunctions

Error	Cause → Elimination
Stud welder cannot be switched on.	One or several phases have failed. → Check mains supply fuses.
There is no arc even though system is ready for operation.	Stud is too loose in stud holder. → Press stud holder together or tighten it.
System does not weld, no or only poor sparking.	System is not switched on or not connected to mains supply. → Connect system to mains supply and switch on. When switching on the system, the LEDs light up shortly.
	Operating mode is set to PRE, LIFT, GAS → Set operating mode to "OP".
	Welding cable, control cable or gas hose are not connected properly or damaged. → Connect cables properly or check for damage. Replace if necessary.
	Connecting plug or socket of stud welder is burnt down. → Have plug or socket replaced by SOYER customer service.
	Both earth cables are not properly connected or not connected at all, or earth clamps are not attached to the workpiece. → Connect earth cables; attach earth clamps to the workpiece.
	Welding points and/or earth connection points at the workpiece are not blank. → Prepare workpiece and studs accordingly.
	Height of lift and/or depth of immersion are not adjusted correctly. →Refer to the operating instructions of the welding gun to set the height of lift and depth of immersion correctly.
	Gas flow rate is set too high, i.e. higher than 5 l/min (arc is extinguished). Set gas flow rate to the maximum value of 4-5 l/min.
	Stud is tilted in ceramic ferrule and does not lift. → Ensure gun is vertically positioned on workpiece. Centre ceramic ferrule and stud holder.
	Control of stud welder or welding gun is defective. → Contact SOYER customer service.
Stud thread scorched.	Stud holder worn → Replace stud holder.
No shielding gas flow during welding process.	Gas cylinder is not or not properly connected to the system and/or valve or shut-off valve are not open. → Connect gas cylinder according to chapter 5.2.3 and/or open valve or shut-off valve.
	Time for gas flow duration is set to "0" → Set gas flow duration to the desired preflow time.
	Gas flow rate is set too low. → Set gas flow rate to 4-5 l/min by means of the control cock.
	Solenoid valve in stud welder is soiled or defective. → Deaerate solenoid valve, clean it and/or have it replaced by SOYER customer service.
Stud does not lift, neither preweld current nor main current arc is generated,	Height of lift is not correctly set. → Set height of lift in accordance with the operating instructions of your stud welding gun.

even though LED "Stud on workpiece" lights up.	Control of stud welder or welding gun is defective. (Stud does not lift, even though height of lift is correctly set). → Contact SOYER customer service.
Stud lifts, preweld current is initiated, but main current is not ignited.	Operating mode (chapter 5.3.2.1) is set to position "PRE". → Set operating mode to position "OP".
	Preweld current arc breaks. → Clean or abrase workpiece surfaces.
	Lift is too high. → Set lift in accordance with the operating instructions for your welding gun and/or welding head.
	Gas pressure is too high. → Set gas pressure to the value prescribed in chapter 6.2.
Varying welding results	Welding energy not correctly adjusted. → Adjust welding energy.
	Cable connections too loose. Transition resistances are generated. → Check all cable connections and earth clamps for tight fit.
	Stud too loose or not fully inserted into stud holder until stop. → Insert stud into stud holder until stop. Replace stud holder, if necessary.
	Magnetic blowing action. Arc is forced into a certain direction. → Alter fixture of earth clamps, place iron parts on the edges and/or rotate welding gun.
	Height of lift and/or depth of immersion are incorrectly set. → Refer to the operating instructions of your welding gun to set the height of lift or depth of immersion correctly.
	You have used low-quality studs with inaccurate dimensions or poor surface finish. Only use SOYER® welding studs as per DIN EN ISO 13 918.
	Welding time and/or gas flow incorrectly set. → Set welding time and/or gas flow in compliance with chapter 6.2.1
	Parent metal not suitable for welding. → Use suitable material combinations.
Single-fillet bulging at equal points.	Bulging is caused by magnetic blow effect. The arc is forced into a certain direction. → Alter fixture of earth clamps, place iron parts on the edges and/or rotate welding gun.
Intensive sparking, stud flange almost melted away	Time too long. → Readjust time for main current duration according to the table.
	Welding current too high. → Readjust welding current.
Stud not welded with total flange surface, deficient weld joint strength	Time too short. → Readjust time for main current duration according to the table.
	Poor earth connection → Check earth cables and earth clamps for tight fit, tighten if necessary.
	Workpiece surface too soiled. → Clean workpiece surface.
	Stud face deformed. → Use new welding studs.
	Stud projection over stud holder incorrectly set. → Set distance between stud holder and stud face to 2-3 mm.

	Welding gun in tilted position. → Ensure that all three gun legs are simultaneously and evenly positioned on the workpiece.
	Lift not correctly set. → Set lift correctly.
Stud welder switches off.	Stud lift not correctly set. → Set stud lift in accordance with the operating instructions of the welding gun. Switch stud welder on.
	You have pulled off the welding gun from the workpiece while main current has been flowing. → Switch stud welder on again.
	Arc breaks as gas pressure is too high. → Set gas pressure to the prescribed value.
	Workpiece surface is poorly electroconductive - arc breaks. → Abrase surface.
	Mains supply is defective. → Check fuses of mains supply.
	Fuse of stud welder is defective. → Contact customer service.
LED "Stud welder not operative" lights up.	There is not enough free space around the stud welder. → Make space available to eliminate heat accumulation.
	Excessive welding sequence. → Please observe the admissible welding sequence.
LED "Lift test carried out too long" lights up.	You have activated the lifting magnet too long or too often when testing the lift. →Wait until the coil in the welding gun has cooled down.

11 Transport and storage

The stud welder is robustly designed and has a two-piece metal housing with front and rear panel. Owing to electronic components it should be ensured, however, that transport is free from vibrations.

The BMK-16i stud welder has a carrying handle on its top for easy transport and mobile use within short distances.

CAUTION
The carrying handle is intended for transport by hand only. Never pull ropes through this handle to lift the stud welder by means of a crane to the installation site. The welding unit would become instable and might tilt from its original position. As a result the handle could rip and the system would fall on the ground.

The GW-1 SOYER tool and gear wagon is the optimum solution for properly storing welding guns, cables, studs and conversion kits (optional equipment).

NOTE
Prevent unauthorized use of the stud welding system by children and unqualified personnel.
After long system standstill, we recommend having the stud welding system checked by SOYER® customer servicemen prior to start-up.

The housing of the BMK-16i stud welder corresponds to safety class IP 21. Please observe that this system of protection is not suitable for being operated or transported in the rain.

12 Terms of warranty

We warrant for this equipment for a period of 12 months in the case of commercial, professional or equivalent use. When repairs are necessary, we guarantee to undertake them in our factory in Etterschlag. Parts subject to wear and tear are excluded.

Any claim to a warranty will be forfeited if damage is caused by improper operation, or if repairs or interferences have been made by unauthorized personnel, or whenever accessories and spare parts have been used which do not match our equipment.

We cannot guarantee the perfect function of the stud welder and the quality of welded joints if welding studs acquired from another company are used.

13 List of standards and guidelines

• 91/368/EEC (formerly 89/392 EEC)	EC Directive on Machinery
• 73/23/EEC	EC Directive on Low-Voltage
89/336/EEC	EC Directive on Electromagnetic Compatibility
• DIN EN 292 – 1	Safety of machinery; basic terms, general principles of construction; Part 1: basic terminology, systems engineering
•DIN EN 292 – 2	Safety of machinery; basic terms, general principles of construction; Part 2: technical principles,specifications
• EN 60204 –1 (formerly VDE 0113)	Electric equipment of machinery, general requirements
• EN 60974 – 1 (DIN VDE 0544-1)	Safety requirements for arc welding equipment, part 1 welding current sources
• VBG 1	General instructions (instructions for accident prevention)
• VBG 5	Power-operated substances (instructions for accident prevention)
• DIN 4100	Welded steel structures with predominantly dead load
• DIN 267, Part 5	Screws, nuts and the like, technical terms of delivery, testing and acceptance
• DIN EN ISO 14555	Arc welding of metallic materials
• DIN EN ISO 13918	Studs and ceramic ferrules for arc welding
• DIN 50049	Certificate on material tests
• DIN 50125	Testing of metallic materials, tensile tests, guidelines for production
• DVS Information Sheet 0902	Drawn arc stud welding
• DVS Information Sheet 0903	Capacitor discharge stud welding with tip ignition
• DVS Information Sheet 0904	Practical information – Arc stud welding

Date of issue:

Appendix A / Short-cycle drawn arc stud welding

1 General

This appendix describes the operation of the PH-2L, PH-4L and PH-5L stud welding guns.

Some details of the illustrations shown in these operating instructions may be different from your product depending on the gun type. This, however, does not have any influence on the operation of the welding equipment.

Gun types, overview

Order No.	Code designation	Note
P02225	PH-2L	Control cable connector, 7-pin Welding cable connector SK 50/70 mm²
P02250	PH-4L	Control cable connector, 7-pin Welding cable connector SK 50/70 mm²
P02260	PH-5L	Control cable connector, 7-pin Welding cable connector SK 95/120 mm²

The stud welding guns were equipped with different welding cable connectors depending on the welding range. Adapter cables (not included in delivery) enable you to operate the stud welding guns with SOYER stud welders having different welding cable connections.

Order list for adapter cables / connectors

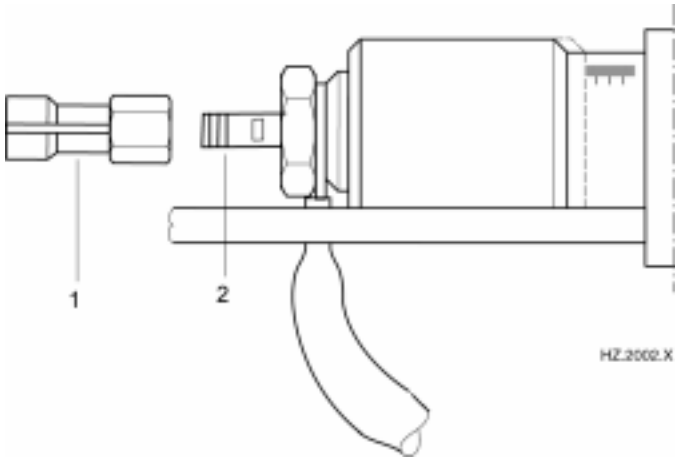
Welding cable connection to stud welder	PH-2L	PH-4L	PH-5L
SK-25 e.g. BMK- 8, BMK-10, BMK-12 W	BK-50/70►SKM-25 Order no.: F03718/FA	BK-50/70►SKM-25 Order no.: F03718/FA	BK-95/120►SK-50/70 Order no.: F04061/FA and BK-50/70►SKM-25 Order no.: F03718/FA
SK-50/50 e.g. BMK-16i, LC, W	No adapter required	No adapter required	BK-95/120►SK-50/70 Order no.: F04061/FA
SK-95/120 e.g. BMH-22SV	BK-50/70►SK-95/120 Order no.: F04062/FA	BK-50/70►SK-95/120 Order no.: F04062/FA	No adapter required

2 Adjustment of stud welding gun

2.1 Stud holder for drawn arc operation

The PH-2L, PH-4L and PH-5L stud welding guns can be equipped with a stud holder for drawn arc operation when studs with a diameter of more than 6 mm are to be welded.

The stud holder is directly screwed on the locking screw.



The stud holder (1) must be tightly screwed on the locking screw (2). When the screwed connection is not tight enough, these parts could be damaged by scorching during the welding process.

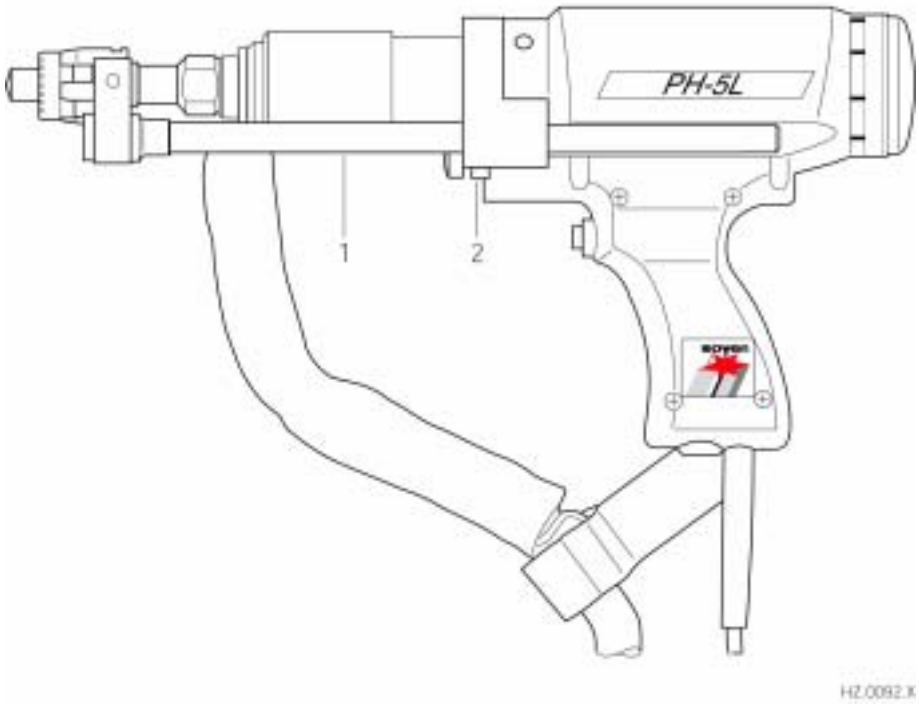
☞	Ensure a minimum stud length when welding with ceramic ferrules. Minimum stud length = Height of ceramic ferrule + 15 mm. e.g. ceramic ferrule for MR10 studs =10 mm high + 15 mm = minimum stud length of 25 mm

	NOTE Check after installation that the stud holder is tightly screwed. There is a risk of scorching during the welding process when the stud holder is screwed to loosely.

2.2 Installation of stud holder into stud welding gun

DANGER
Switch off the welding equipment before adjusting it (mains switch must be in "OFF“ position).

The stud holder suitable for the corresponding stud diameter is installed as follows:



Ill. PH-5L stud welding gun

1 Support leg 2 Allen screws

• Loosen both Allen screws (2).
• Shift support legs (1) to the front till there is enough space available to install the stud holder.
• If necessary, unscrew existing stud holder.
• Screw on and tighten appropriate stud holder.

NOTE
Check after installation that the stud holder is tightly screwed. There is a risk of scorching during the welding process when the stud holder is screwed to loosely.

2.3 Adjusting the depth of immersion

DANGER
Switch off stud welder to adjust the depth of immersion.

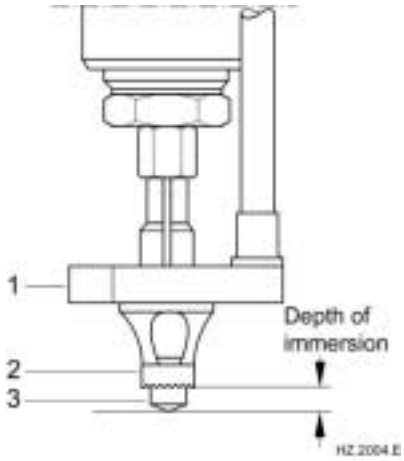
The stud must be firmly inserted into the stud holder till it stops.

The depth of immersion is the distance the stud projects over the end of the ceramic ferrule, the gas shroud or the support tube. When placing the welding gun on the workpiece, the stud is pushed back this distance. During welding, the stud will immerse up to this length into the liquid weld pool on the workpiece. The process of adjusting the depth of immersion is the same for both welding with shielding gas and ceramic ferrules. The depth of immersion always depends on the stud diameter.

The following illustrations show the depth of immersion when welding with ceramic ferrules and shielding gas.

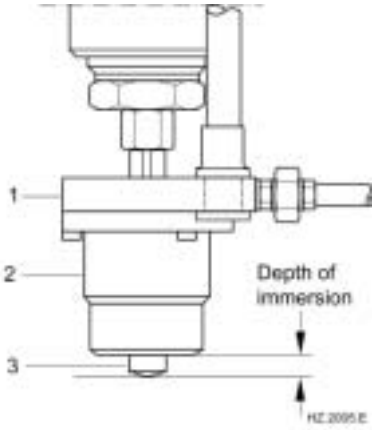
Stud welding with ceramic ferrule

1 Foot plate
2 Ceramic ferrule
3 Stud



Stud welding with shielding gas

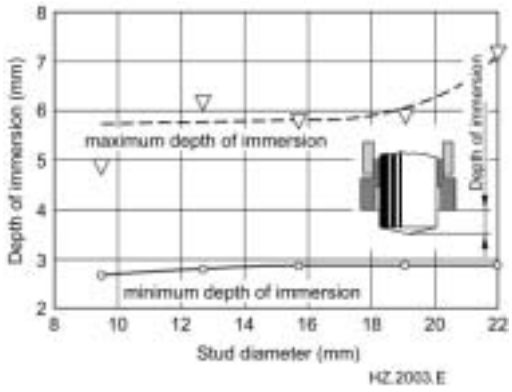
1 Foot plate
2 Gas shroud
3 Stud



How to adjust the depth of immersion:

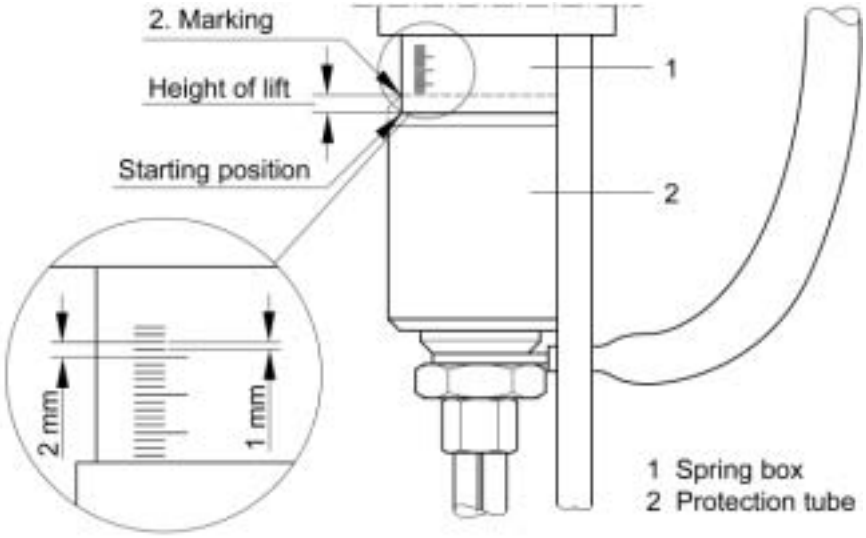
• Insert the relevant stud (3) into stud holder until stop
• Loosen both Allen screws (item 2, chapter 2.2)
• Move support legs (item 1, chapter 2.2) until the required depth of immersion is obtained
• Tighten Allen screws (item 2, chapter 2.2)

The bores used for mounting the support legs to the foot plate are long holes which allow you to guide the gas supply hose through when welding with shielding gas.



2.4 Height of lift

The height of lift is the distance the stud is lifted from the workpiece during the welding process. This distance is required for igniting the arc. Determination and adjustment of the lift is the same for welding with both support tube and ceramic ferrules. The height of lift always depends on the stud diameter.



		DIN EN ISO 13918 S 235 + C450/4.8															
		6		8		3/8" - 10		12 - 1/2"		14		5/8" - 16		19 - 3/4"		20		22 - 7/8"	
		-1,5	-1	-1,6	-1,2	-2	-1,3	-2,3	-1,5	-2,6	-1,8	-3	-2	-3,5	-2,3	-3,7	-2,6	-4	-3

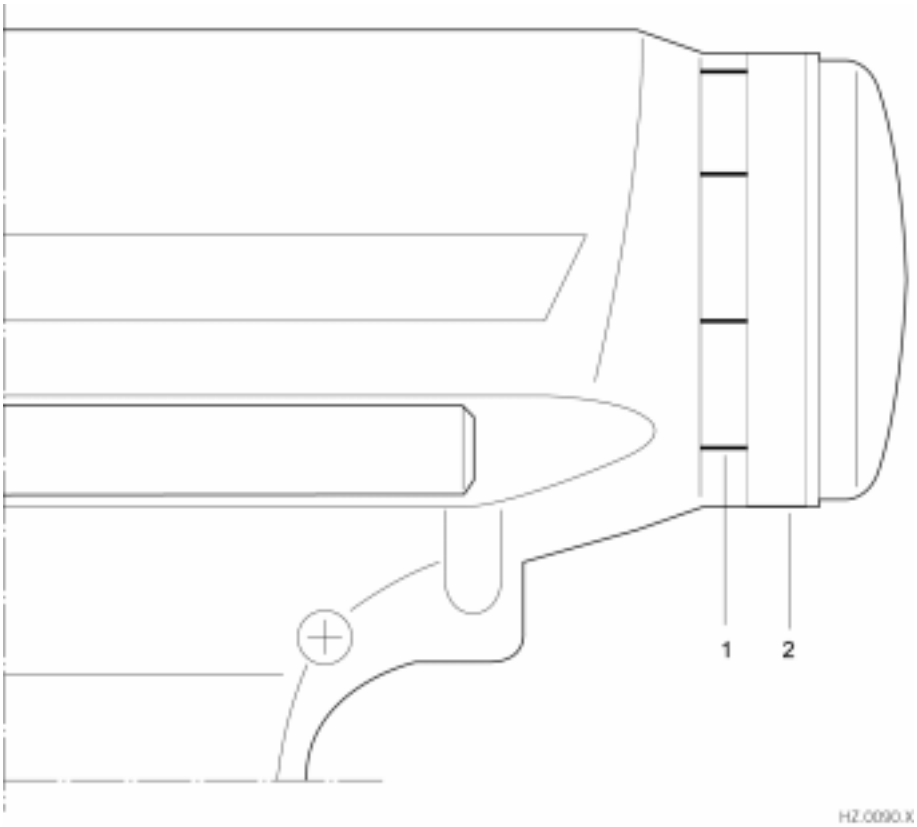
HZ.0087.E

2.4.1 Determining the height of lift

- Set function "lift test" at the stud welder
- Position welding gun on the workpiece

- Pay attention to the starting position of the protection tube (item 2)
- Press trigger switch. The entire welding process takes place without the welding current flowing.
- Read the highest position of the protection tube (item 2) on the scale. The number of graduation marks indicated corresponds to the height of lift.

2.4.2 Adjusting the height of lift



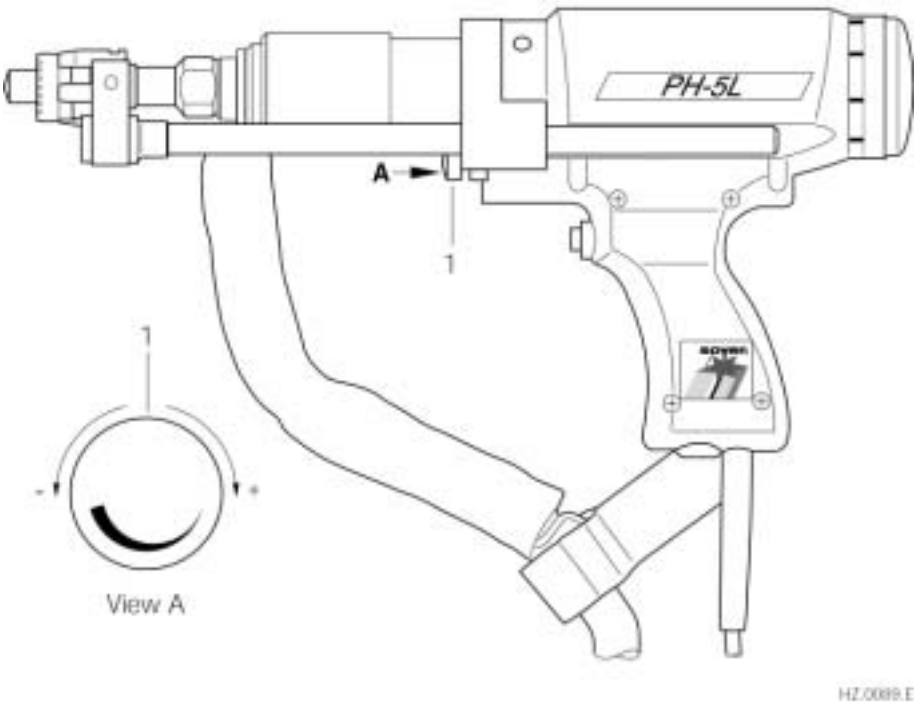
The height of lift can be adjusted by turning the adjusting cap (2) at the stud welder's back to the left or to the right.

Turning the adjusting cap (2) to the left increases the height of lift, turning to the right decreases the height of lift. Setting the adjusting cap (2) by one graduation mark corresponds to a height adjustment of approx. 0.5 mm.

After setting, check the height of lift and correct if necessary.

2.5 Immersion speed

2.5.1 Adjusting the speed of immersion for PH-4L and PH-5L



The immersion speed or its damping depends on the stud diameter.

Studs with a diameter up to 10 mm do not require any damping (turn adjusting screw (1) to the left till it stops).
The larger the diameter of the stud, the more the immersion speed has to be dampened (turn adjusting screw (1) to the right till it stops).

☞	Damping can only be adjusted when the welding gun is not positioned on the workpiece (spring box is in starting position)

Good results can be achieved with dampened immersion speeds of approx. 70 - 100 mm/s. The stud should be rapidly immersed in the weld pool, this, however, in a reduced and non-hammer-type method to prevent excessive spatter formation.

Immersion speeds which are too low result in pore formation and irregular bulging. The surface of the molten pool would solidify before the stud touches the workpiece.

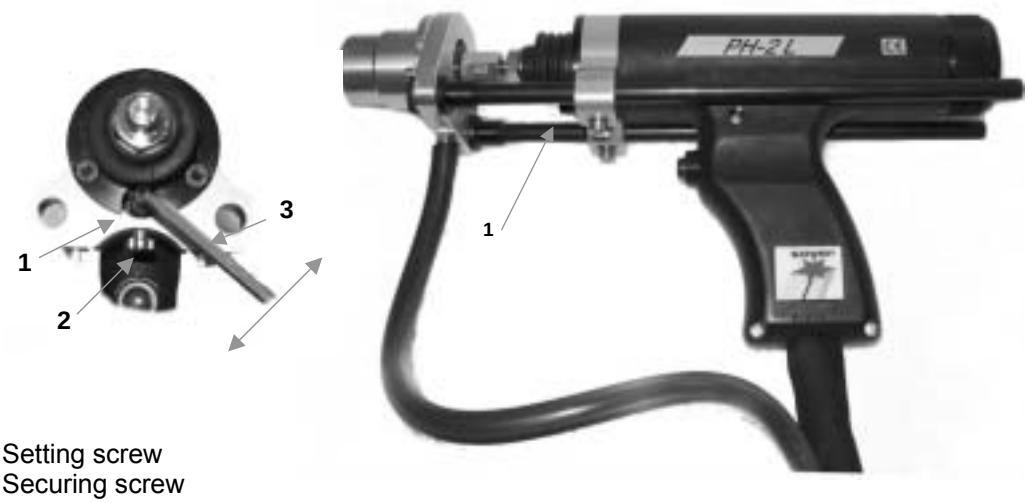
Determine the setting values and enter them in the table below:

Stud diameter (mm)	Rotations of adjusting screw
12	
14	
16	
20	
22	

2.5.2 Adjusting the speed of immersion (damping) for PH-2L

The PH-2L stud welding gun can only be set to “Damping ON” or “Damping OFF”.

An infinite adjustment of the immersion speed is not possible.



1 Setting screw
2 Securing screw
3 Hexagon screwdriver 4mm

Damping "ON"

- Loosen the securing screw (2) by turning to the left.
- Manually turn the setting screw (1) to the right till stop. Use a hexagon screwdriver of 4mm to loosen tight setting screws.
- Secure the setting by turning the securing screw (2) to the right.

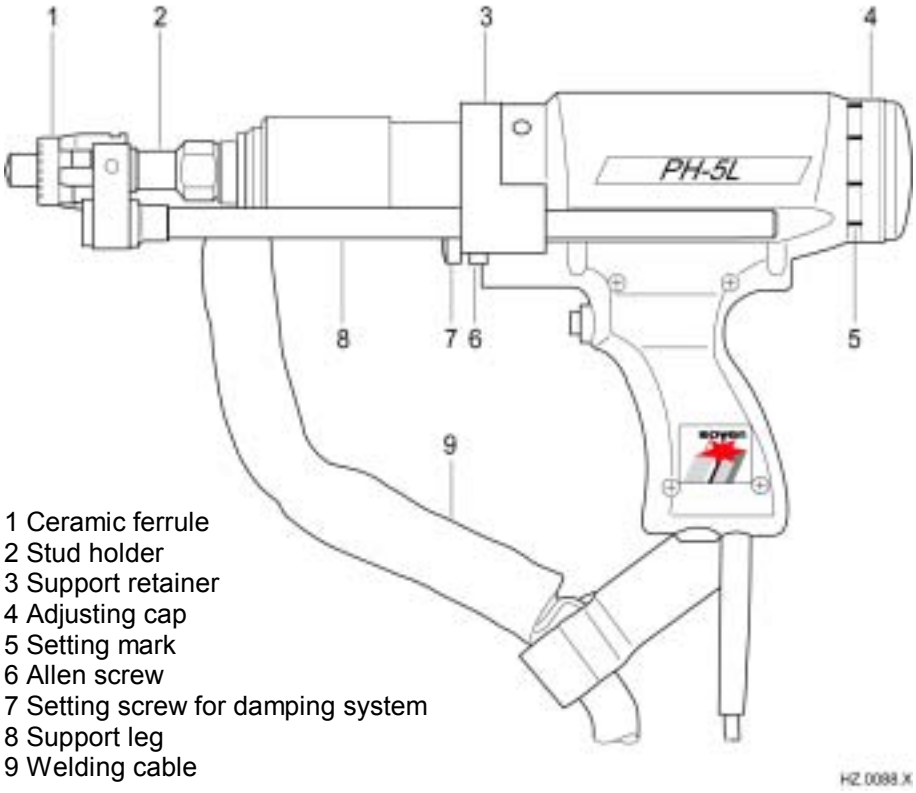
Damping "OFF"

- Loosen the securing screw (2) by turning to the left.
- Manually turn the setting screw (1) approx. four rotations to the left. Use a hexagon screwdriver of 4mm to loosen tight setting screws.
- Secure the setting by turning the securing screw (2) to the right.

3 Start-up

3.1 Total view

The illustration below shows the standard stud welding gun for drawn arc operation. A large range of equipment is available.



1 Ceramic ferrule
2 Stud holder
3 Support retainer
4 Adjusting cap
5 Setting mark
6 Allen screw
7 Setting screw for damping system
8 Support leg
9 Welding cable

3.2 Connecting stud welding gun to stud welder

Use the gun cable and control cable to connect the stud welding gun to the stud welder.

• Insert connector of stud welding gun’s welding cable into the welding cable socket of the stud welder.
• Insert connector of welding gun's control cable into the control cable socket of the stud welder.
• Insert gas supply connector of stud welding gun into the appropriate socket of the stud welder (only when using "Gas" option).

3.3 Operation

- Connect stud welder to earth.
- Adjust stud welding gun as described in Appendix A, chapter 1.
- Connect stud welder to mains supply.
- Adjust parameters at stud welder according to welding studs to be used.
- For standard operation, insert welding studs into stud holder.
- Position stud welding gun on workpiece and press trigger switch.

For further instructions regarding connection and operation, please refer to the operating instructions of your stud welder.

Before welding, carry out some test welds and check them to determine optimum setting values.

Random samples have to be taken during production to ensure optimum welding results.

3.4 Welding parameters

For welding parameters, please refer to the operating instructions of your stud welder.

4 Spare parts / Wear parts

4.1 Spare parts list for PH-2L, 4L, 5L stud holders and accessories

View	Description	Dimensions / Type	Order No.
	Drawn arc and short-cycle drawn arc stud holder suitable for all stud welding guns with M10 locking screw	M6	F01190
		M8	F01191
		M10	F01192
		M12	F01193
		M14	F01194
		M16	F01195
		M20	F01196
		M22	F01197
		M24	F01198
	SGL-1 gas shroud made of aluminium or brass L = 45mm Ø = 30mm Outside diameter	aluminium	F01631
		brass	F02476
	SGL-2 gas shroud made of aluminium or brass L = 45mm Ø = 34mm Outside diameter	aluminium	F01633
		brass	F02477
	Foot plate for gas shroud	SGL-1	F01636
		SGL-2	F01637
	Shielding gas valve for foot plate	SGL-1/2	M01443
	Foot plate for ceramic ferrule holder	FP-1 for 3/8“ - ½”	F01640
		FP-2 for 5/8”–7/8”	F01641
		FP-1 for 6-10mm	F01642
		FP-2 for 12-22mm	F01643

View	Description	Dimensions / Type	Order No.
	Flat-head screw Two pieces are required for mounting the foot plate to the support legs	M6 x 25	M01439
	Conical socket Two pieces are required for mounting the foot plate to the support legs	M8 Ø = 9.6mm	M01440
	Ceramic ferrule holder, flexible Depending on the type of ceramic ferrule, it may be necessary to rebend the holder	KR 6 KR 8-10 KR 12 KR 16-20	F03768 F03769 F03770 F03771
	Adapter / Extension piece	M10 / M10	F01357
	Stud holder for shear connectors suitable for all stud welding guns with M10 locking screw	3/8 inch ½ inch 5/8 inch 7/8 inch	F01353 F01354 F01355 F01356
	Ceramic ferrule holder for shear connectors	3/8 inch ½ inch 5/8 inch ¾ inch 7/8 inch	F01653 F01654 F01655 F01657 F01658

View	Description	Dimensions / Type	Order No.
	Earth cable with clamp for BMK-16i, LC, W and BMH-16 SV	50mm²	F01666/FA
	Earth cable with clamp for BMH22 SV	95mm²	F01662/FA
	C-clamp, large		M01457
	Screw clamp, large		M01459
	Earth socket 50mm²	BK-50-70	E01959
not illustrated	Earth socket 95mm²	BK-95-120	E01962
not illustrated	Welding cable plug 50mm²	SK-35/50	E01965
not illustrated	Welding cable plug 95mm²	SK-70/95	E01968

5 Spare parts for PH-2L

5.1 Spare parts list for PH-2L stud welding gun

in preparation

6 Spare parts for PH-4L and PH-5L

6.1 Spare parts list for PH-4L and PH-5L stud welding guns

Item No.	Qty.	Designation	Order No. PH-4L	Order No. PH-5L
X	X	PH-5L stud welding gun, complete	P02250	P02260
1	1	M10 tightening nut for cable bracket		F04153
2	1	Cable bracket		E02354
3	1	Distance washer		F04154
4	2	Cheese head screw M4 x 10		M01595
5	1	Straight pin Ø 3 x 16		M03623
6	1	Spring cover		F04155
7	1	Locking screw		F04156
8	1	Pressure spring		F04157
9	1	Insulating stopper		F04158
10	1	Piston, part 1		F04159
11	1	Bearing bush		F04161
12	1	Linear ball bearing		F04162
13	1	Bearing housing		F04163
14	1	Support retainer		F04164
15	2	Insulating bush		F04165
16	1	Straight pin Ø 6 x 45		M03624
17	2	Cheese head screw M5 x 20		M01172
18	3	Grub screw M4 x 4		M03625
19	2	Clamping sleeve for support		F04166
20	1	Grub screw M4 x 6		M03626
21	1	Knurled disk for damper		F04167
22	1	Damper		M03627
23	1	Fastening screw M4 x 12		F04205
24	1	Holding device for damper		F04168
25	1	Cheese head screw M4 x 6		M03628
26	1	Piston, part 2		F04160
27	2	Flat-head screw M4 x 8		M01563
28	1	Housing		F04169
29	1	Gun label, company address		M03617
30	1	PH-5L gun label		M03614
31	1	Clamping cone		F04170
32	7	Steel ball		M03629
33	1	Ball bearer		F04171
34	1	Pressure spring		F04172
35	2	Flat-head screw M3 x 8		M03630
36	1	Slotted disk		F04173
37	1	Spring dowel sleeve Ø 3 x 20		M03631
38	1	Armature		F04174
39	1	Pressure spring		F04175
40	1	Magnet (complete)		F04176/FA
41	1	Magnetic head		F04177
42	1	Magnet coil		E03742
43	2	Grub screw M4 x 6		M03626
44	1	Magnet core		F04178
44.1	1	Spring dowel sleeve Ø3 x 16		M03640
45	1	Grub screw M4 x 13		F04179

Item No.	Qty.	Designation	Order No. PH-4L	Order No. PH-5L
46	1	Magnet cover		F04180
47	1	Coupling piece		F04181
48	1	Sealing nut		F04182
49	2	Pressure piece		M03632
50	1	Adjusting cap		F04183
51	1	Flat-head screw M4 x 8		M01563
52	1	Bubble level		M01602
53	1	Locking ring 12 x 1		M03633
54	4	Flat-head screw M4 x 16		M03635
55	4	Flat-head screw M4 x 12		M03634
56	1	Gun handle, left side		F04184
57	1	Gun handle, right side		F04185
58	1	Strain relief, part 2		F04186
59	2	Gun label, Soyer logo		M03615
60	1	Bush for press button		F04187
61	1	Cover disk for press button		F04188
62	1	Press button, 1-pole		E02103
63	1	Cap (red) for press button		E02104
64	1	Cover for damper		F04189
65	2	Flat-head screw M4 x 12		M03634
66	0.29 m	Fabric tube 26 x 1.5, black		M01390
67	1	Strain relief, part 1		F04190
68	1	SIOV varistor		E01341
69	1	Double-ended pipe clip		M03636
70	1	Anti-kink sleeve, small		E02093
71	1	Cheese head screw M5 x 25		M01174
72	2	Cheese head screw M5 x 25		M01174
73	13	Cable strap 185/46, black		E02077
74	5.7 m	Control cable 5-pole		E02889
75	1	Cable plug, 7-pin		E01948
76	5 m	Earth cable 95 mm		E02385
77	1	Earth plug 95-120		E01968
78	0.45 m	Stranded conductor, brown		E02033
79	1	Coupler plug KS1/4 PK-4 optional shielding gas equipment (not illustrated)	M01304	M01304
80	6m	Pneumatic hose PU-4 black optional shielding gas equipment (not illustrated)	M01049	M01049

6.2 Exploded view of PH-5L stud welding gun