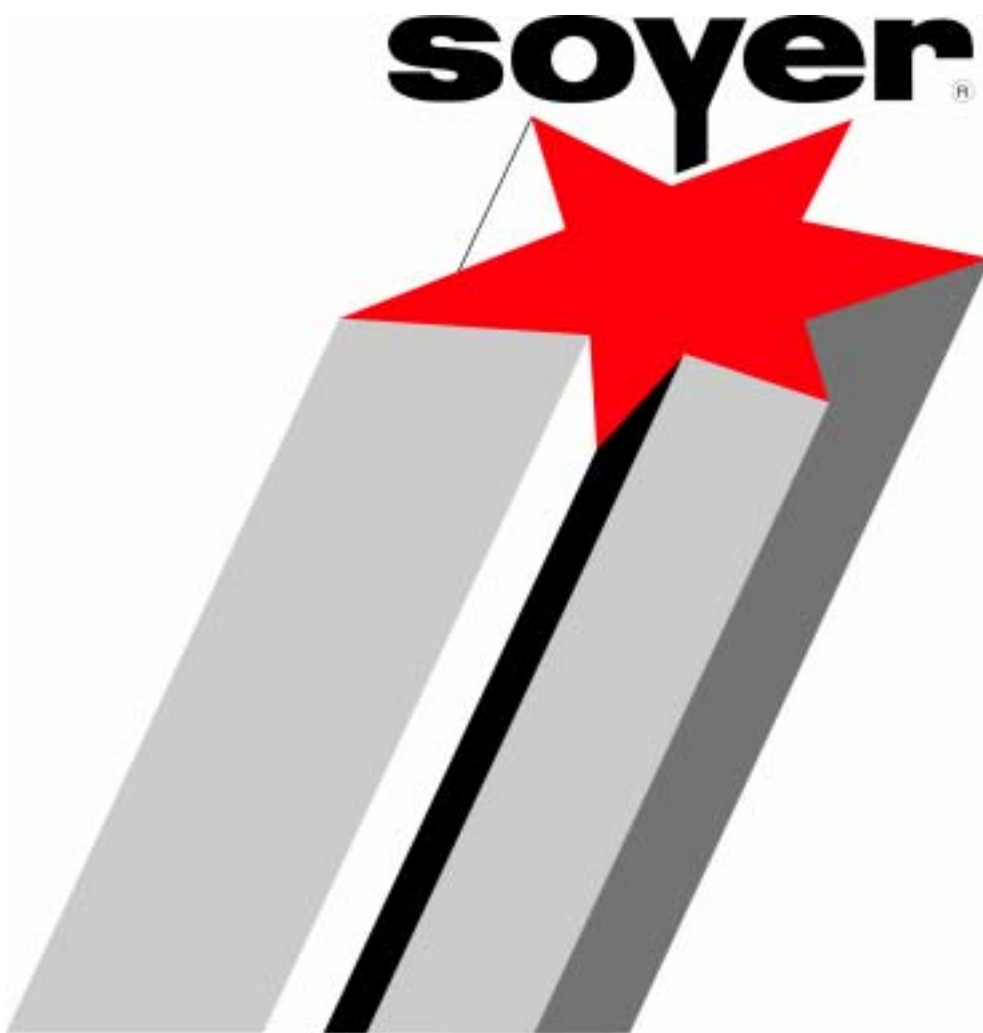


# Operating Instructions

BMK-16 W  
Stud Welder







## Operating Instructions

### BMK-16 W Stud Welder

Serial number\*

BMK-16 W stud welder \_\_\_\_\_

Please enter the serial number here, so that the data are immediately available if you need service support.

Type table for BMK-16 W stud welder

Order no.	Code designation	Note
P01329	BMK-16 W	Standard device (3 x 400 volt power supply)
P01330	BMK-16 W automatic	Standard device (3 x 400 volt power supply) and automatic set for stud reload

Heinz Soyer Bolzenschweißtechnik GmbH  
 Eттerschlag  
 Inninger Straße 14  
 82237 Wörthsee  
 Telephone +49 (0) 8153 - 885 - 0  
 Telefax +49 (0) 8153 - 8030  
 www.soyer.de





---

We congratulate you on purchasing the BMK-16 W SOYER stud welder. You have made an excellent choice. Your BMK-16 W SOYER stud welder was especially developed for high-speed fastening of SOYER welding studs in compliance with **DIN EN ISO 13 918** on metallic workpieces.

SOYER® is a registered trade mark of Heinz Soyer Bolzenschweißtechnik GmbH.

It is prohibited to transmit or reprint this document, as well as to utilize or disclose its contents, unless this has been expressly granted.

Non-compliance with this regulation is liable to compensation. All rights reserved, particularly in the case of a patent grant or a GM registration.

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.

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

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: August 01, 2002

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# 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	First Certification:	02.12.1996
Valid until:	09.19.2005	Düsseldorf:	09.19.2002
Lead Quality Auditor		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-16 W**


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 : June 01, 2002

Producer's signature :  \_\_\_\_\_

Signer's function : Technical Management





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**Appendix A /**

Adjustment of short-cycle drawn arc welding guns

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-16 W 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  $\varnothing$  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-16 W 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.

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  
Ettersschlag  
Inninger Straße 14  
D-82237 Wörthsee  
Telephone +49 (0) 8153-885-0  
Telefax +49 (0) 8153-8030  
[www.soyer.de](http://www.soyer.de)

Product designation BMK-16 W 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-16 W stud welder:

- Operating instructions for BMK-16 W stud welder

**Order no.: P00227**

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-16 W stud welder under normal conditions.

The present operating instructions of the BMK-16 W 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-16 W
- Chapter 10 Troubleshooting
- Chapter 11 Transport and storage
- Chapter 12 Terms of warranty
- Chapter 13 List of standards and guidelines

### 1.5.2 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.



### 1.5.3 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.

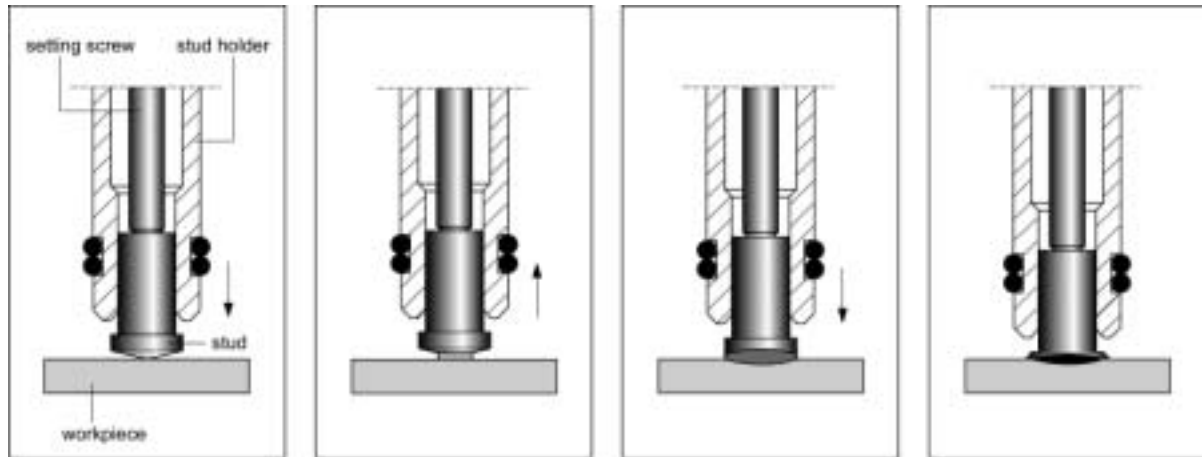
### 1.6 Contacts and service address

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  
Ettersschlag  
Inninger Straße 14  
D-82237 Wörthsee  
Telephone +49 (0) 8153-885-0  
Telefax +49 (0) 8153-8030  
info@soyer.de  
www.soyer.de

## 2 Description of stud welder

### 2.1 Short-cycle drawn arc technology



HZ.0001.E

Illustration 1: Short-cycle drawn arc technology

The BMK-16 W 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-16 W stud welder is suitable for operation with shielding gas and ceramic ferrules. A d.c. power supply 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-16 W 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.

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.

#### 2.1.1 Drawn arc welding with shielding gas

With this method, a gas mixture containing 82% of Argon and 18% of CO<sub>2</sub> (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

#### 2.1.2 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 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.

## 2.2 Stud welder set-up

The modular construction (modular principle) in useful and easy-to-service compact housing, the modern design and progressive technique provide the SOYER stud welder with its unique appearance.

The PH-2L stud welding gun with control cable and shielding gas equipment is the standard gun to be connected to the BMK-16 W 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-16 W 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.

## 2.3 View / Dimensions

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



*Illustration: Front view of BMK-16 W*

**Dimensions of BMK-16 W** 410 X 330 X 600 mm (w x h x d)



## 2.4 Technical data

Designation	BMK-16 W
Welding process	Drawn arc stud welding (DS)
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	Transformer / controlled rectifier bridge
Welding current	300 up to 1000 A
Welding time	10 up to 1000 ms
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 Volt 50/60 Hz (standard type)  3 x 230 Volt 50/60 Hz possible by carrying out reclamping works
E-constant current	2 A / phase
E-constant power	1400 VA
E-peak current	120A / phase with 3 x 400 Volt (short-time operation)
Open-circuit power	78 Volt / DC
System of protection	IP21
Fuse element at front panel	F1 = 0.315 A slow F2 = 2 A slow (with 400V mains supply) F2 = 3.15 A slow (with 230V mains supply)
Interfaces	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	410 x 330 x 600 (w x h x d)
Weight*	68 kg
Colour	RAL 5009 azure
Subject to technical changes	

\*Slight deviations are possible depending on accessories.

## 2.5 Circuit diagram of BMK-16 W

### 2.5.1 Wiring diagram, primary (power circuit, 400 volt standard)

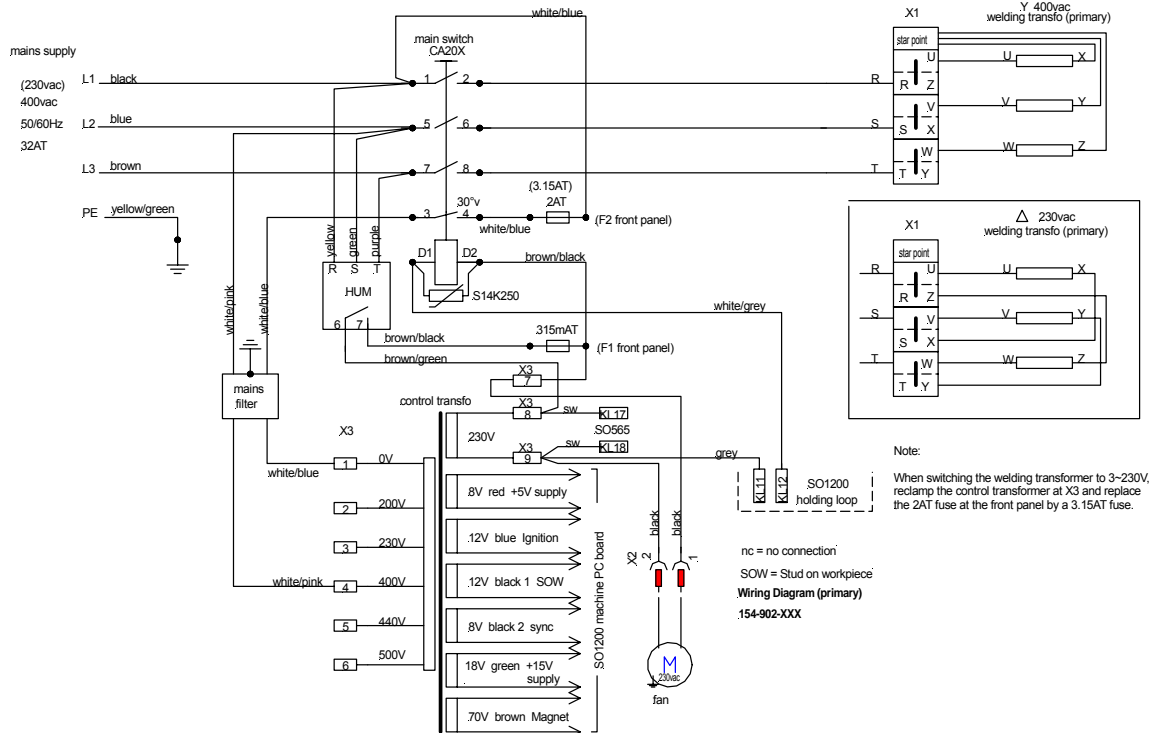


Illustration: Primary wiring diagram, drawing no.: 154-902-XXX

Subject to technical changes

### 2.5.2 Wiring diagram, secondary (welding circuit)

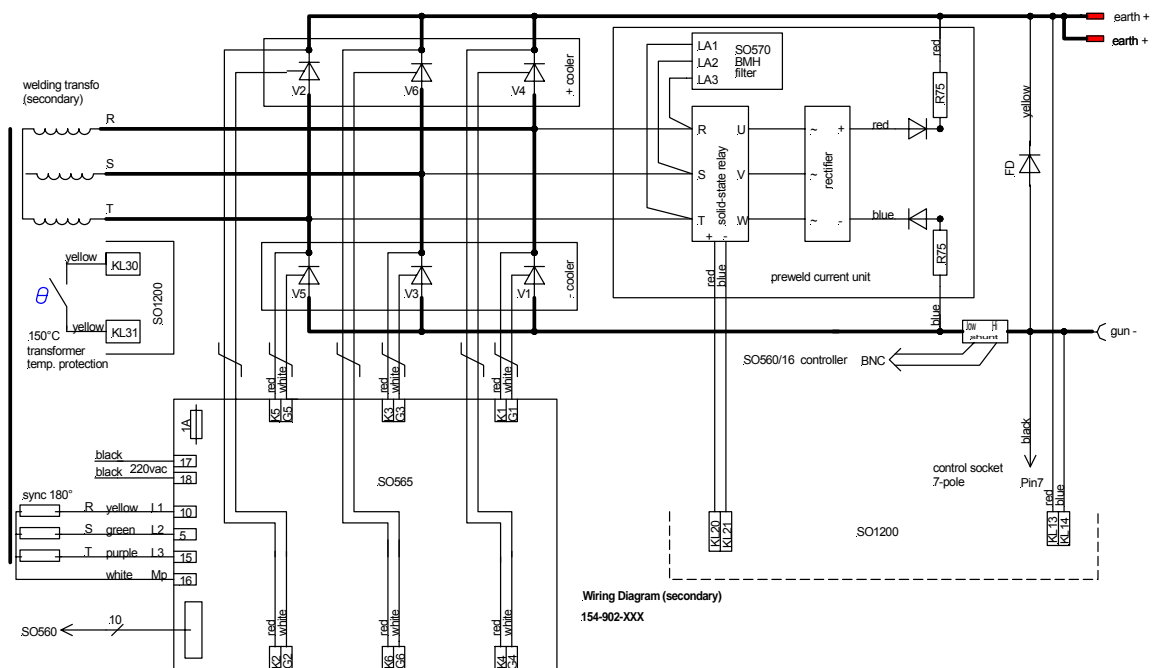


Illustration: Secondary wiring diagram, drawing no.: 154-902-XXX

Subject to technical changes



### 2.5.3 Wiring diagram of modules

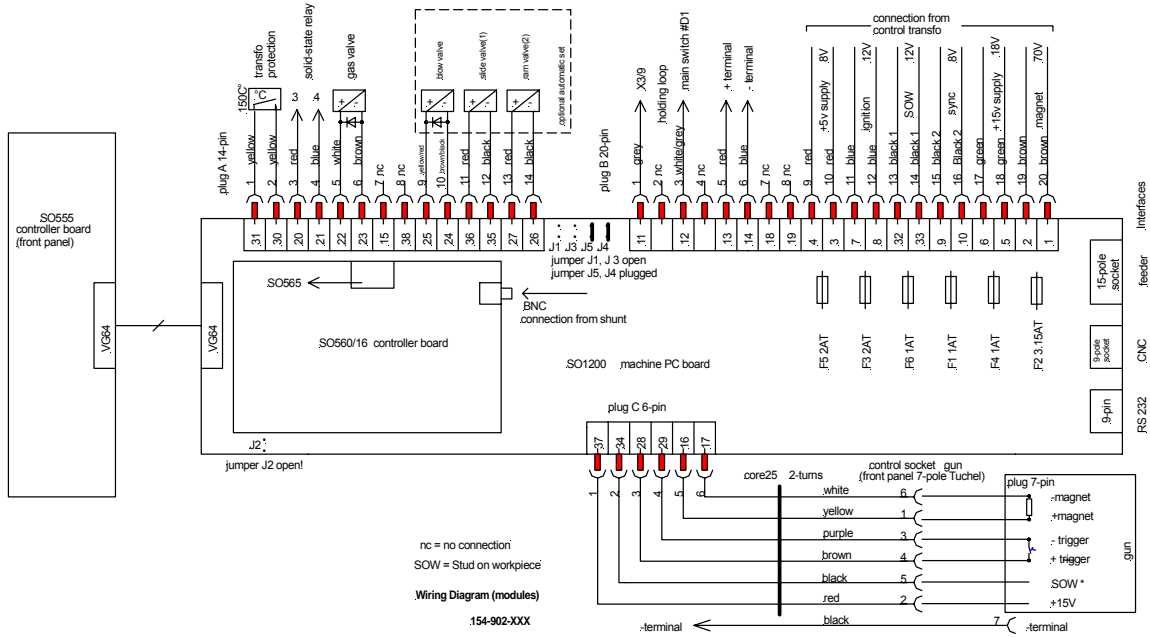
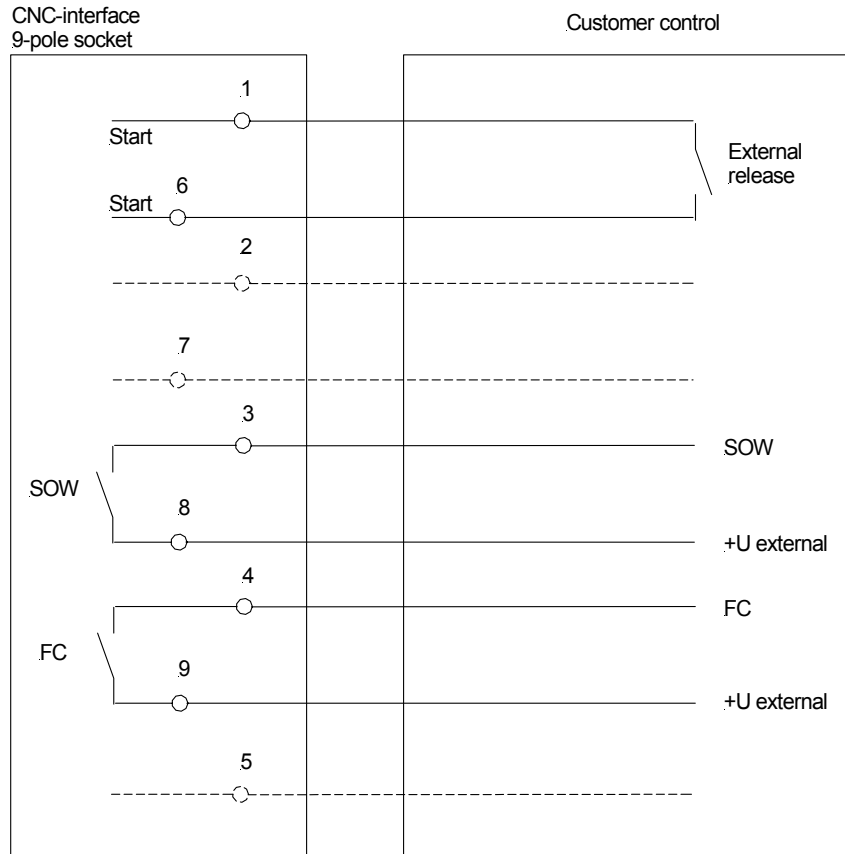


Illustration: Wiring diagram of modules, drawing no.: 154-902-XXX

Subject to technical changes

## 2.6 BMK-16 W interfaces

### 2.6.1 CNC interfaces



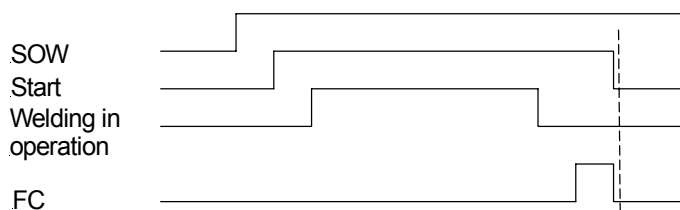
#### Terminology:

**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:





### 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

	<b>Danger!</b>	Immediately imminent danger which may cause heavy physical injuries or death
	<b>Warning!</b>	Possibly dangerous situation which may cause heavy injuries or death
	<b>Caution!</b>	Possibly dangerous situation which may cause minor physical injuries
	<b>Caution!</b>	Warning of damage
	<b>Note!</b>	Possibly detrimental situation which may cause damage to the product or to an object surrounding it.
	<b>Important!</b>	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 has 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.

**DANGER**

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

- Wear gauntlet gloves made of leather.
- Wear neither rings, watches nor electrically conductive jewellery.
- Wear protective goggles with eye-protecting lens number 2 (DIN 58211, part 6) to protect your eyes from welding spatters and flashes of light that are generated during the welding process.
- Wear side-shielded glasses.
- Wear ear protection. Capacitor discharge generates a loud bang.

**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.

**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

*Only carry out maintenance works when the welding equipment has been switched off*

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

*Limit values*

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

- Switch off the main switch (item 2, chapter 5.1) of the stud welder
- 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 20/21, 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



**MORTAL 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 upper side of the BMK-16 W stud welder is equipped with two plastic handles.

The handles are intended for transport by hand only. Never pull ropes through these handles 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 handles 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 "Transformer overheated, please wait" is shown alternately with the current operating mode on the display.

**Transformer overheated, please wait**

KZ 0030 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



The BMK-16 W 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.

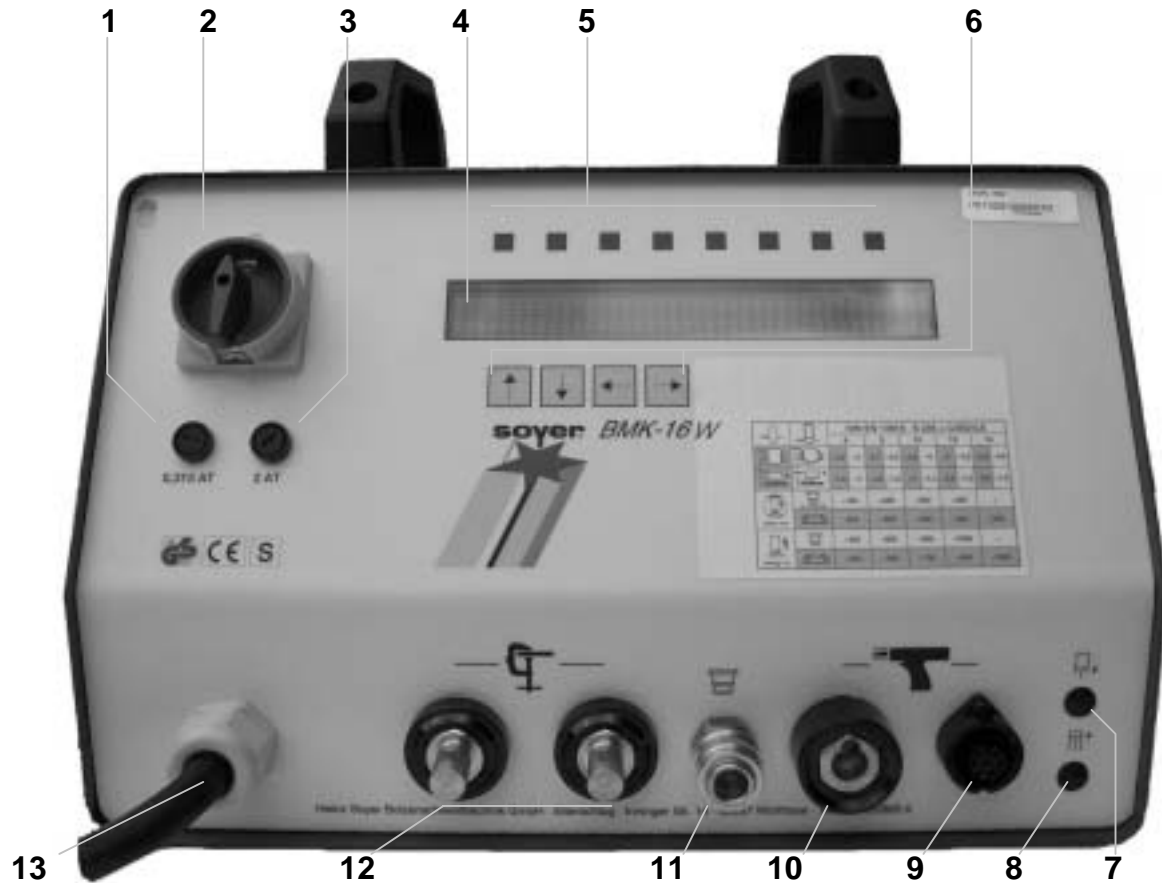


**NOTE**

The housing of BMK-16 W 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.

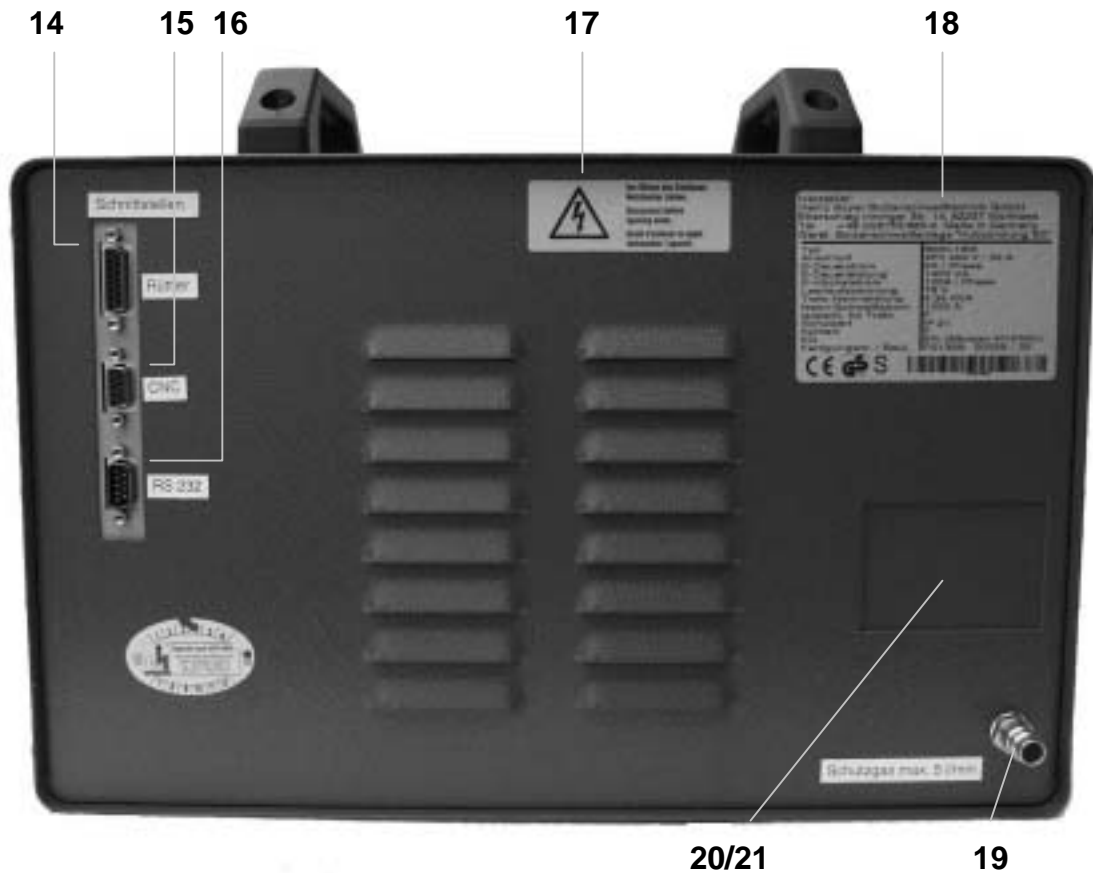
## 5 Start-up

### 5.1 Front and rear view



Front view of BMK-16 W

- |  |                                    |
|--|------------------------------------|
| 1 Fuse element F1                                  | 8 Air function "backward" (option) |
| 2 Main switch                                      | 9 Control cable connection         |
| 3 Fuse element F2                                  | 10 Welding cable socket            |
| 4 LCD display                                      | 11 Gas connection socket           |
| 5 Light-emitting diodes for function control       | 12 Earth cable connectors          |
| 6 Function keys for setting the welding parameters | 13 Mains cable                     |
| 7 Air function "forward" (option)                  |                                    |



#### Rear view of BMK-16 W

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

#### 5.1.1 Operating elements

##### • Main switch (item 2, chapter 5.1)

The main switch is used to switch the stud welder on and off. The main switch does not remain in position "I", when the following faults arise:

- Fuse F1(item 1, chapter 5.1) or F2 (item 3, chapter 5.1) is defective
- Phase of rotary current supply is missing
- Phase sequence of rotary current supply is not positive

• **Function keys for setting the welding parameters (item 6, chapter 5.1)**

The BMK-16 W 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"

KZ.2006.X

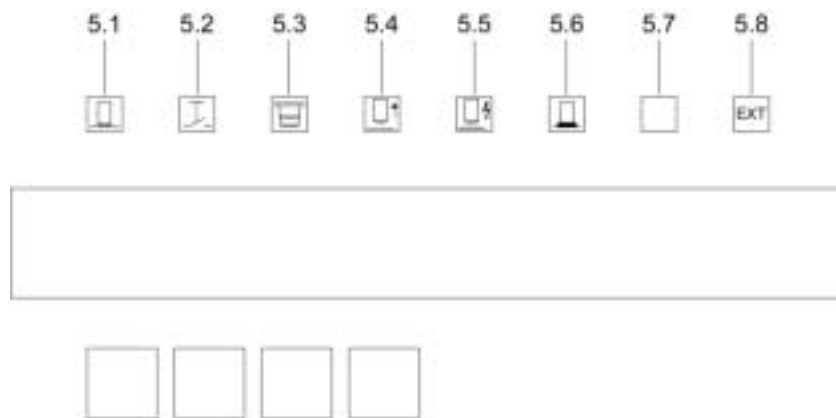
• Function keys "arrow up/down" (items 6.1 and 6.2, chapter 5.1)  
Modification of selected parameters (flashing symbol in display).

• 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)   |

KZ.2012.X



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

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.:

<b>MODE</b>	<b>MC</b>	<b>MCT</b>	<b>PCT</b>	<b>GPT</b>	<b>RLT</b>
<b>OP</b>	<b>300</b>	<b>20</b>	<b>40</b>	<b>0</b>	<b>0</b>

KZ.2027.E

#### Explanation of operating modes / parameters:

##### • 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

Pre-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)

##### • MC

Main current. Value set between 300 and 1000 ampere.

##### • MCT

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

##### • PCT

Pre-current time. Period of time set between 40 and 1000 milliseconds.

##### • GPT

Gas preflow time. Period of time set between 0 and 9900 milliseconds in 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 in 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

- **Mains cable (item 13, 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

- **Earth cable connectors (item 12, chapter 5.1)**

The earth cable connectors serve to connect the earth clamps 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 to the gas connection socket

- **Welding cable socket (item 10, chapter 5.1) and control cable connection (item 9, chapter 5.1)**

The control cable connection and the welding cable socket serve to connect the stud welding gun to the stud welder

- **Air function "backward" (item 8, chapter 5.1, optional equipment)**


















Connection for welding guns or heads with automatic stud feed

- **Air function "forward" (item 7, chapter 5.1, optional equipment)**

Connection for welding guns or heads with automatic stud feed



### 5.1.5 Symbols

Symbol	Designation	Function
	Electrical energy	Main switch for switching 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 "ALTER PARAMETERS"	Upward alteration of the selected parameters (represented blinking in the display).
	Function key "ALTER PARAMETERS"	Downward alteration of the selected parameters (represented blinking in the display).
	Function key "SELECT PARAMETERS"	Selection of parameters to be changed (relocation of blinking symbol to the left).
	Function key "SELECT PARAMETERS"	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.

### 5.1.6 Fuses (items 1 and 3, chapter 5.1)

The BMK-16 W stud welder is protected by the following fuses:

- Fuse F1 0.315 A slow
- Fuse F2 2 A slow (with 400V up to 500V) or 3.15 AT with 230V



#### **CAUTION**

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



#### **WARNING**

Disconnect the mains plug from the mains supply when replacing fuses!

## 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 connector (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.



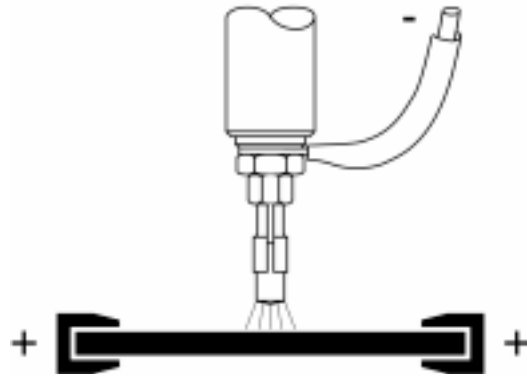
Please ensure that the contact areas of the earth clamps are always kept clean and do not oxidize, otherwise high transition resistances could occur that may result in a considerable reduction of the rated welding current.

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:

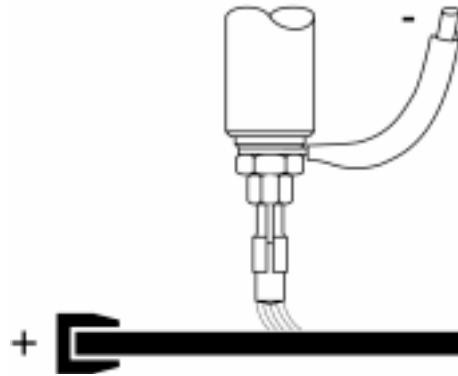
Balanced earth connection

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

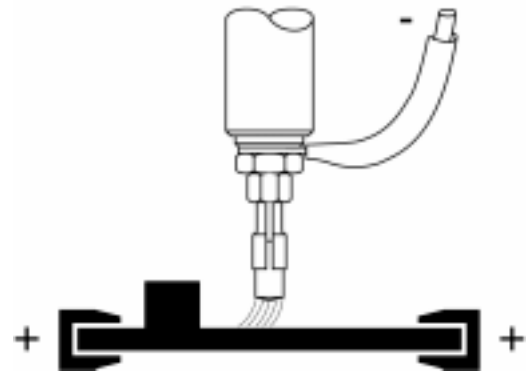


Unbalanced earth connection

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 19, 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 18, chapter 5.1) with the data (supply voltage / fuse protection) of your power supply network.



Always comply with the correct line voltage as indicated on the type plate.  
Never connect the stud welder to a power supply with the wrong line voltage.

Connect mains cable (item 13, chapter 5.1) to power supply using the CEE plug (standard 3 x 400V~, 32A-CEE plug).



### **DANGER**

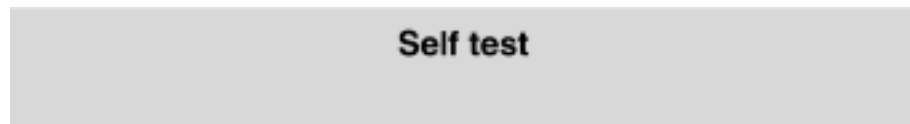
Only connect stud welder to authorized CEE sockets.  
Standard connection = 3 x 400 V + earth conductor, 32A-CEE. If need be, have an expert in electrics check if the socket is earthed.



### 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).



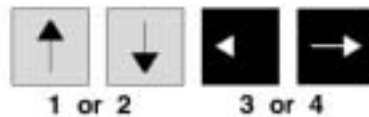
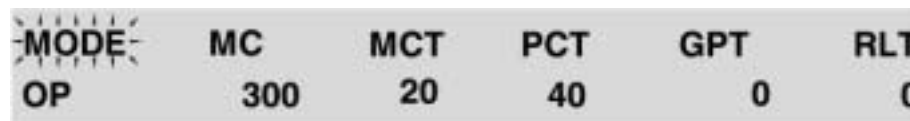
KZ.0033.E

The stud welder is locked during the self test and it is impossible to operate it or to enter data.

After the self tests have 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. Settings can only be carried out by means of the function keys (**1 or 2**) when the display is flashing.



KZ.3028.E

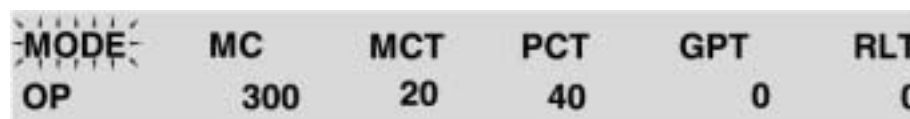
The four different operating modes which may be set are also listed in chapter 5.1.3.

##### 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".



KZ.3035.E

### 5.3.2.2 Operating mode "PRE" (pre-current test)

The adjustment "PRE" (pre-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 pre-current is flowing.

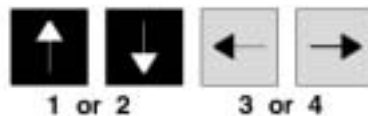


#### CAUTION

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".

<b>MODE</b>	<b>MC</b>	<b>MCT</b>	<b>PCT</b>	<b>GPT</b>	<b>RLT</b>
PRE	300	20	40	0	0



KZ.2029.E

- Position the gun or welding head on the workpiece.
- 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 pre-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".

<b>MODE</b>	<b>Test lift with trigger</b>
LIFT	Drop time: mS




KZ.2008.E

- 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.

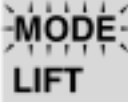
- Position gun or welding head on workpiece. The LED "Stud on workpiece" lights up.



KZ.0024.X

- 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.
- 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.



**MODE**  
**LIFT**

**Test lift with trigger**  
**Drop time: no ground**

KZ.2008.E



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:

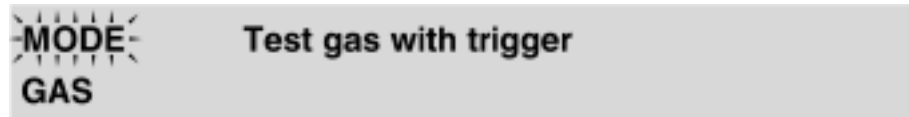
**Lift test carried out too long!**  
**1 minute to cool lifting magnet**

KZ.0026.E

#### 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).



K2.2010.E

- Connect gas supply (see chapter 6.3.1)
- The gas valve may be activated by
  - the trigger of the welding gun or welding head
  - an active start signal at the CNC interface



## 5.4 Special functions

With the stud welder BMK-16 W 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 main 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 stud welder on with main switch.
- Stop pressing "arrow up", "arrow down", "arrow right" and "arrow left" keys.

**Memory cleared**  
**Switch off stud welder**



KZ.2019.E

- Switch off stud welder with main switch and switch on again.

### 5.4.2 Special function " Display of operating counter"

This special function serves to display the operating counter and the equipment number.

- Simultaneously press "arrow up" and "arrow down" keys and keep them pressed.
- Switch stud welder on with main switch.
- Stop pressing "arrow up" and "arrow down" keys.

Operating counter: 1234  
OK: unit off, clear: arrow right



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 stud welder on with main switch.
- Stop pressing "arrow right" and "arrow left" keys.

<b>Plunger</b>	<b>BIAir</b>	<b>Feeder (RUT)</b>
<b>100</b>	<b>100</b>	<b>BMS</b>



KZ.2025.E

Display when setting feeder type "BMS"

<b>Plunger</b>	<b>Ready</b>	<b>Cont</b>	<b>BIAir</b>	<b>Feeder (RUT)</b>
<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>BMK</b>



KZ.2021.E

Display when setting feeder type "BMK"

The parameters "Plunger", "Ready", "Cont." and "BIAir" 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 adjusts 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 adjusts the waiting period of the hexagon barrel being in 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 adjusts 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 adjusts 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.

#### **• BIAir**

This parameter adjusts 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.

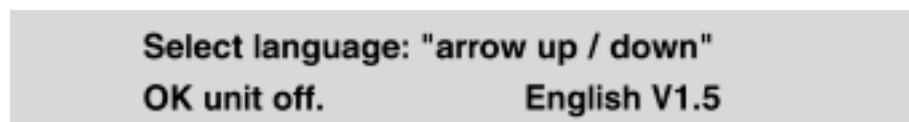
#### **• Feeder (RUT)**

This parameter adjusts 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 stud welder on with main switch.
- 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 stud welder on with main switch.
- Stop pressing function keys.

**Schieber (Slider)**  
**aus (off)**



KZ.2006.E

Display when setting feeder type "BMS"

or:

**Schieber (Slider)**      **Fertig (Ready)**      **Gefuellit (Full)**  
**aus (off)**                      **aus (off)**                      **aus (off)**



KZ.2003.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 possibly existing sensors are displayed as "on" or "off". For further information, please refer to the operating instructions of your universal feeder.



## 6 Operation

### 6.1 Standard operation

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

#### 6.1.1 Setting welding parameters for standard welding operation

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

- Switch the main switch on (item 2, 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.

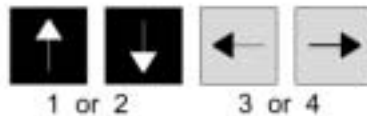
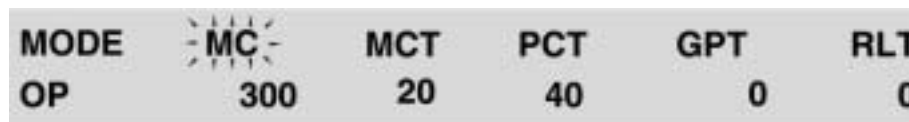


KZ.2027.E

- Set the necessary parameters for your welding task. For doing so, please refer to the standard values indicated in the list "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).



KZ.2030.E

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 function key "arrow up" (1) or "arrow down" (2).

MODE	MC	MCT	PCT	GPT	RLT
OP	300	20	40	0	0



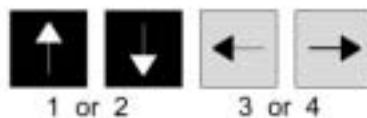
KZ.2031.E

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 (pre-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 pre-current time from 40 - 1000 ms in 20 ms-steps by pressing either function key "arrow up" (1) or "arrow down" (2).

MODE	MC	MCT	PCT	GPT	RLT
OP	300	20	40	0	0



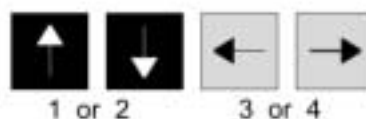
KZ.2032.E

### 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).

MODE	MC	MCT	PCT	GPT	RLT
OP	300	20	40	0	0



KZ.2033.E



### 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).

MODE	MC	MCT	PCT	GPT	RLT
OP	300	20	40	0	0



1 or 2

3 or 4

KZ.2004 E

- If you are not satisfied with the welding results, you may change the set welding parameters at any time according to chapter 5.3.

**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 them 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.

### 6.1.2 Welding parameters for welding operation









#### IMPORTANT INFORMATION

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 influence the welding parameters as well.

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-16 W 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	1/4d, but 1 mm min.
	> 100 ms	3 up to 16 mm	300 up to 3000	SG	1/4d, but 1mm min.
Short-cycle drawn arc stud welding	≤ 100 ms	3 up to 12 mm	up to 1500	NP, SG, CF	1/4d, 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

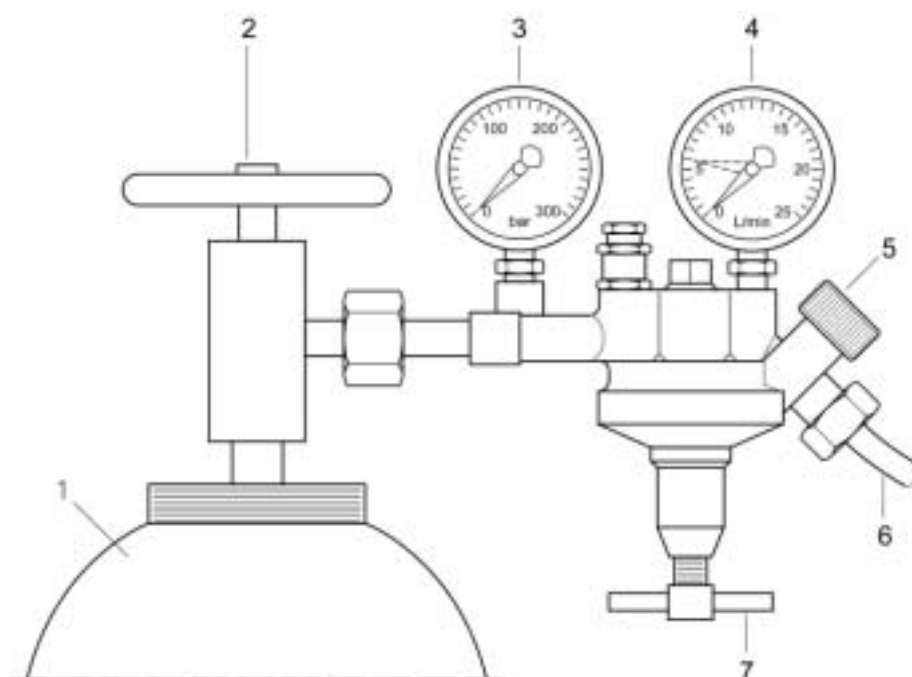
## 6.2 Welding operation with shielding gas

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



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

- 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.

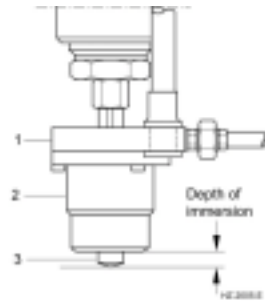
- Open shut-off valve (item 5).

- 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 list in chapter 6.1.2.

- 1 Foot plate
- 2 Gas shroud
- 3 Welding stud



III.

*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.

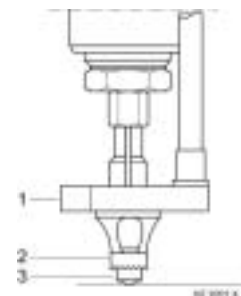
The LED "Gas valve open" (item 5.3, chapter 5.1.2) indicates that the gas valve is open.

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



III. 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 them 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

### 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 0903 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


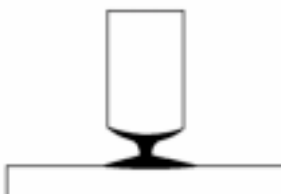
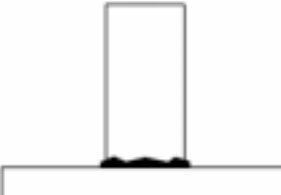

#### 7.3.1 Production of samples

The dimensions of the test piece shall 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.

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

Please also refer to the following standard:

- DIN EN ISO 14555                      Arc welding of metallic materials

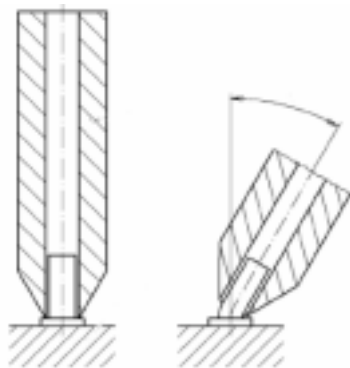
Source of supply: Beuth Verlag GmbH, Berlin    [www.beuth.de](http://www.beuth.de)

### 7.3.3 Bend test

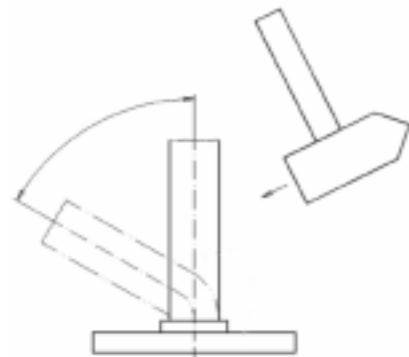
The bend test is a simple work test which serves to roughly check the setting values selected. The welding zone is subjected to undefined tension, pressure and bending. A minimum of 3 studs is welded and bent to an angle of  $30^\circ$  by means of a tube that is slipped over the stud. The test is considered as successful, if no superficial fissure or fracture is detected in the welding zone.



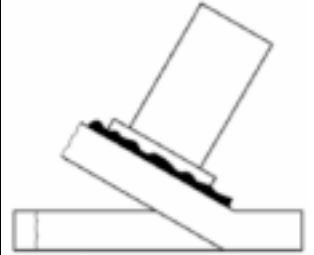

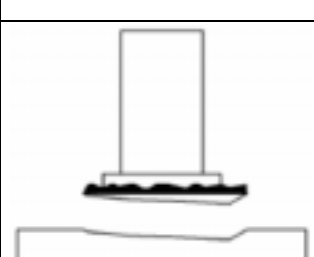
Bend the studs by  $30^\circ$  when welding with capacitor discharge.  
With drawn arc welding using ceramic ferrules or shielding gas and with short-cycle drawn arc welding, bend the studs by  $60^\circ$ .



Bend test with tube placed upon the stud



Bend test with hammer

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



#### 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 our customer service responsible for your area or visit our website at [www.soyer.de](http://www.soyer.de).

## 8 Maintenance

### 8.1 Stud welder

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. Any defects of the system's control unit can be easily eliminated by replacing the printed circuits or the clearly arranged fuses.



**DANGER**

Always disconnect the mains cable from the mains supply before replacing any components. Electric and electronic components may only be replaced by a specialist. Contact the SOYER<sup>®</sup> service department if need be.



**CAUTION**

Before starting any repair work, disconnect the shielding gas supply from the stud welder's connections.

### 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**

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.



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## 9 Spare parts list for BMK-16 W

### 9.1 Spare parts for BMK-16 W

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 connecting plug from the socket before opening the housing of the stud welding equipment. Only trained and appropriately qualified personnel are allowed to carry out works at the electric power supply and welding system.



### **CAUTION**


Only trained and appropriately qualified personnel are allowed to replace components of the stud welding equipment.



### **DANGER**

Before starting any repair work, disconnect the shielding gas supply from the connections located at the front of the stud welder.

## 10.1 Malfunctions

Error	Cause → Elimination
Main switch does not remain in position "1".	One or several phases have failed. → Check mains supply fuses.
	Fuse 1 or F2 are defective. → Replace defective fuse.
	Phase sequence of mains connection socket is not positive. → Have the phases in the mains socket interchanged by appropriately qualified personnel.  Only appropriately qualified personnel are allowed to interchange phases in the connecting socket..
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 working with drawn arc and short-cycle drawn arc operation, the main switch must remain in position "1". 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 cable properly or check for damage. Replace if necessary.
	Connecting plug or socket of stud welder are 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.



	<p>Time for gas flow duration is set to "0" → Set gas flow duration to the desired preflow time.</p> <p>Gas flow rate is set too low. → Set gas flow rate to 4-5 l/min by means of the control cock.</p> <p>Solenoid valve in stud welder is soiled or defective. → Deaerate solenoid valve, clean it and/or have it replaced by SOYER customer service.</p>
Stud does not lift, neither preweld current nor main current arc is generated, even though LED "Stud on workpiece" lights up.	<p>Height of lift is not correctly set. → Set height of lift in accordance with the operating instructions of your stud welding gun.</p> <p>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.</p>
Stud lifts, preweld current is initiated, but main current is not ignited.	<p>Operating mode (chapter 5.3.2.1) is set to position "PRE". → Set operating mode to position "OP".</p> <p>Preweld current arc breaks. → Clean or abrade workpiece surfaces.</p> <p>Lift is too high. → Set lift in accordance with the operating instructions for your welding gun and/or welding head.</p> <p>Gas pressure is too high. → Set gas pressure to the value prescribed in chapter 6.2.</p>
Varying welding results	<p>Welding energy not correctly adjusted. → Adjust welding energy.</p> <p>Cable connections too loose. Transition resistances are generated. → Check all cable connections and earth clamps for tight fit.</p> <p>Stud too loose or not fully inserted into stud holder until stop. → Insert stud into stud holder until stop. Replace stud holder, if necessary.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Welding time and/or gas flow incorrectly set. → Set welding time and/or gas flow in compliance with chapter 6.2.1</p> <p>Parent metal not suitable for welding. → Use suitable material combinations.</p>
Single-fillet bulging at equal points.	<p>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.</p>
flange almost melted away	<p>Time too long. → Readjust time for main current duration according to the list.</p> <p>Welding current too high. → Readjust welding current.</p>



Stud not welded with total flange surface, deficient weld joint strength	Time too short. → Readjust time for main current duration according to the list.
	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.
Main switch returns to position "0".	Stud lift not correctly set. → Set stud lift in accordance with the operating instructions for 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.
	Insufficient mains supply, i.e. supply voltage below value required for welding operation. → Connect stud welder without extension cable to mains supply. If you need to use an extension cable, use one having a higher cable core cross-section.
	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. → Replace defective fuse.
LED "Transformer overheated, pls. wait" 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-16 W stud welder has two handles on its top for easy transport and mobile use within short distances.



### CAUTION

The handles are intended for transport by hand only. Never pull ropes through those handles to lift the stud welder by means of a crane to the installation site. The stud welder may tilt from its original position, the handles come off and the stud welder fall to the ground when using such unstable tightening methods.

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-16 W 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/EWG (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

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