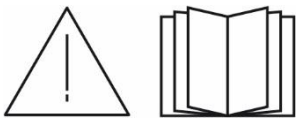
BMK-16i Stud Welder

Operating Instructions

GB: English Version

Read these operating instructions before starting any work!



CE

Doc.ID: **P00229** Date of issue: 12.2013 www.soyer.de

Operating Instructions

BMK-16i Stud Welder

Serial number*

BMK-16i Stud Welder_____

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

Order No.	Code designation	Note
P01340	BMK-16i	Mains voltage 3 x 400 V
P01341	BMK-16i Automatic	Mains voltage 3 x 400 V

Heinz Soyer Bolzenschweißtechnik GmbH
Inninger Straße 14 | 82237 Wörthsee | Tel.: +49 8153 8850 | Fax: +49 8153 8030 | E-mail: info@soyer.de | www.soyer.de

Thank you!

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 weld studs in compliance with **DIN EN ISO 13918** on metallic, weldable workpieces.

Our devices have been tested and proven according to current European and national guidelines on health and safety. Proof of conformity has been established and the manufacturer is in possession of the corresponding documents.

FOR YOUR SAFETY

Read all of these operating instructions prior to start-up. Please follow all safety precautions as well as all chapters of these operating instructions before starting to weld. Non-compliance with the safety precautions can result in serious personal injuries or death.

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 is verified regularly and any necessary corrections incorporated in future impressions. Any suggestions for improvement are appreciated.

Date of issue: November 20, 2013
Rev.: Update Declaration of Conformity: 2021-02

Heinz Soyer Bolzenschweißtechnik GmbH
Inninger Straße 14
82237 Wörthsee

CE Declaration of Conformity

We herewith declare that the machine described in the following and the version available on the market correspond in design and construction to the safety and health requirements of the listed guidelines and standards. Any unauthorised modification to this machine automatically annuls this declaration.

Designation of machine	:	**Stud welding device**
Machine type	:	**BMK-16i**
Machine no.	:	_____
Applicable EU directives	:	RoHS Directive (2011/65/EU) Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU)
Applied harmonised standards, in particular	:	EN 60 974-1:2018 + A1:2019 EN 60 974-10:2016
Applied national standards	:	DGUV directive 1
Date	:	01 February 2021
Producer's signature	:	_____
Signer's function	:	Managing Director

Table of contents

1 Safety instructions

These safety precautions are for your safety.

General safety instructions
Take part in a training programme. Read and follow all safety precautions listed below and all chapters of this manual before starting to weld.
Non-compliance with the safety precautions can result in personal injuries or death.

Only qualified persons are allowed to operate and maintain the equipment.

Children and juveniles under the age of 16 years must be kept away from the equipment.

WARNING
It is prohibited to open the stud welding equipment.
The service personnel are required to meet special qualifications.
Our after-sales service has adequately trained personnel, suitable service equipment and the means to carry out all necessary works.

Warning of electromagnetic fields
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, airbags).

Ensure that the welding equipment is not operated near electronically sensitive life-support equipment, such as in intensive care units in hospitals.

Persons with pacemakers may neither operate the stud welding equipment nor stay in the immediate vicinity while it is running.

Electric shock can cause death
Prevent electric shock by insulating your body from the working area and the ground. Stand on dry insulating material and wear rubber soled shoes.

Inspect all cables including power cord for damage, wear or bare wiring.

Always ensure the correct supply voltage in accordance with the type plate.
Never connect the welding equipment to a power supply network with incorrect supply voltage.

Always disconnect the welding equipment from the mains supply before starting any cleaning works. Only trained and appropriately qualified personnel are allowed to carry out works at the electric mains supply and welding system.

Do not touch live electrical parts with bare hand. Wear dry, hole-free insulating gloves.

Do not wear rings, watches or electrically conductive jewellery.

Keep the work area, studs, guns, cables, energy source as well as your clothes dry.

Fumes and gases can cause damage to your health

Fumes and suspended/floating particles may be generated during welding. Beware of fumes detrimental to health, particularly when using surface treated materials. Please also observe the safety regulations applicable for your country.

Do not inhale fumes and gases. Use adequate ventilation in the work area to remove fumes and gases.

Welding can cause fire and explosions

Welding sparks and heat from flames and arcs can cause fires. Keep a portable fire extinguisher within reach for immediate use. Be sure you are trained to use it.

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

Comply with the fire regulations and do not weld, for instance, in hazardous locations.

Pay attention to flammable objects at the welding place. All flammable materials and liquids, such as oil, fuel, etc. must be removed prior to the start of work.

Electronic equipment (e.g. airbags) and the use of explosive substances for fuel supply require further safety precautions when carrying out welding operations on cars. Appropriate information can be obtained from the trade associations or the car manufacturers.

Skin and eye protection

Arc rays and welding spatters can injure eyes and skin.
Wear safety glasses with side shields and protective goggles with correct shade of filter to protect your eyes from welding spatters and flashes of light that are generated during the welding process.

Wear gauntlet gloves made of leather as well as non-combustible closed working clothes such as heavy long-sleeve shirts, cuffless pants and safety shoes.

Wear a leather apron to protect your clothes from welding spatters.
Keep sleeves and collars buttoned and remove open pockets from the front side of your clothing.

We recommend using ear protection. Some welding and working processes may generate loud noises.

1.1 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 operating 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, prohibitions and regulations are used in this manual:

 Prohibited for persons with pacemakers	 Prohibited (only in combination with an additional safety symbol)	 Do not touch Housing is current-carrying	 Fire extinguisher
 Warning of a danger spot	 Warning of dangerous electric voltage	 Warning of electromagnetic field	 Warning of moving parts
 General prohibition (only in combination with an additional safety symbol)	 Warning of inflammable substances	 Warning of explosive substances	
 Eye protection required	 Protective clothing required	 Ear protection required	 Protective gloves required

 General instructions are marked with the hand symbol.

1.2 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 must be carefully regulated by the user. If your personnel do not have the necessary knowledge, they must 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 have been 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.

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

The non-compliance with safety instructions may not only endanger persons, but also the equipment and its environment. Any non-compliance with safety instructions may result in a complete loss of damage claims.

The following dangers may result if the safety instructions are not complied with:

- Failure of important system functions.
- Failure of prescribed methods for maintenance.
- Danger to persons through electrical, mechanical, thermal and/or acoustic influences.

1.4 Before starting to weld...

- Check the state of all cables and cable connections before starting to weld.
- Immediately replace defective cables and cable connections.

1.5 Working with the stud welding equipment

Comply with all accident prevention regulations applicable to the operation of your welding device.
If an accident happens,

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

1.6 Inadmissible operating methods

Limit values

The working safety of the stud welding equipment is only guaranteed when the system is used in accordance with its purpose. The limit values indicated in the chapter "Technical data" must never be exceeded.

1.7 Stopping the stud welding equipment

- Turn off the mains switch of the stud welding equipment.
- Disconnect the mains plug from the mains socket.
- In case of automatic operation, disconnect the compressed-air supply.
- Disconnect the earth cable from the stud welder.
- Disconnect welding gun or head from the stud welder.
- Roll up the cables without buckling them.
- Prevent the stud welder being operated by unauthorized personnel.
- Check welding cables 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.

2 General

2.1 The following should be principally observed...

With the BMK-16i stud welder you have purchased a product which

- is state-of-the-art technology
- fully complies with the current safety requirements and
- ensures high performance.

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 start-up. Each operator should confirm this per signature.
- Prevent the stud welder being operated by unauthorized personnel.
- Only trained personnel may operate the stud welder.

2.2 Intended use

The BMK-16i SOYER stud welder allows you to weld pins and threaded studs from M3 – M16 or Ø 2 - 13 mm and many other types of weld fasteners manufactured from steel, stainless steel and aluminium.

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

2.3 Marketing and service

If you have any questions regarding the operation of retrofits for special applications or if you require service, please contact your responsible service office or the following address:

Heinz Soyer Bolzenschweißtechnik GmbH
Inninger Straße 14
D-82237 Wörthsee
Tel.: +49 8153 8850
Telefax: +49 8153 8030
www.soyer.de
info@soyer.de

2.4 Information on the documentation

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

• Operating instructions for BMK-16i **Order no.:** P00229

2.4.1 Information on the operating instructions

Legal relationship

We point out that the contents of these operating instructions are neither part of any former or existing arrangement, pledge or legal relationship nor have they been designed to modify the latter. All obligations of Heinz Soyer Bolzenschweißtechnik GmbH result from the respective contract of purchase. This contract also contains the complete and universally 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 welding equipment without specifically knowing the operating instructions or the respective part. Ensure that only qualified and trained personnel familiar with the operating instructions operate the system.

2.4.2 Conduct in the case of malfunctions

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

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

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

This information helps us save time and unnecessary costs, e.g. incurred by delivering the wrong spare parts.

3 Description of stud welder

3.1 Description

The BMK-16i SOYER stud welder is universally applicable for both manual and automatic operation. Control via a serial CNC interface is possible.

The BMK-16i stud welder enables the storage of parameters for various welding tasks as welding programs. These parameters can be recalled at any time. To simplify operation, it is possible to store programs for different stud diameters. This allows a more rapid and simpler interchange of different welding tasks. The integrated quality control (optional) allows the most important parameters of the weld to be monitored and any welding faults to be reported when inadmissible deviations occur.

The stud welder is equipped with four keys, eight light-emitting diodes (LED) and a two-lined text display at the front panel. The stud welder is adjusted via the keys. The operating state during welding is shown by the light-emitting diodes and on the display.

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

- SRM stud welding
- 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

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, PK-0K and PH-3N SRM stud welding guns. These operating instructions only refer to the BMK-16i stud welder.

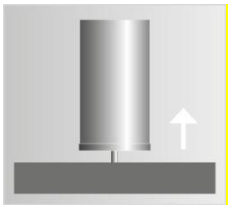
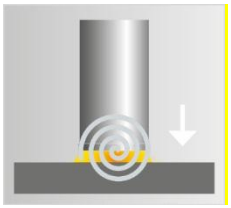
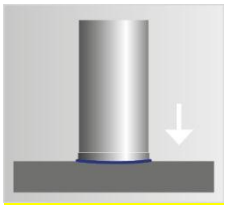
For information regarding the stud welding guns to be used and their settings, please refer to the respective operating instructions.

3.2 Radial-symmetric magnetic field stud welding (SRM Technology)

For operating the BMK-16i stud welder, we recommend using the patented SRM stud welding process (patent no. 10 2004 051 389) in conjunction with the newly developed HZ-1 universal weld stud featuring a plane end face and centring tip (patent no. 10 2006 016 553). This innovative welding technique enables welds at a ratio of 1:10 from the sheet thickness to the stud diameter (previously 1:4). Furthermore there is no need to use ceramic rings during this process. The numerous advantages delivered by the SRM procedure offer completely new potential applications, primarily in the area of automated stud welding plants and large-scale component production (for additional information, please refer to www.hz-1.com).

Further benefits of SRM welding include:

- No disturbing weld bead
- No ceramic ferrule required even in constrained positions (out-of-position welding)
- Reduced penetration in the sheet
- Less energy consumption and shorter welding time
- No weld spatters

		
The stud comes into contact with the workpiece and is raised. The arc is triggered.	The arc is guided through the spiral-shaped magnetic field and completely melts both join parts.	The stud immerses into the very flat penetration zone and is inseparably connected.

The above illustration shows the radial-symmetric magnetic field stud welding process (SRM).

With this welding method, we recommend using shielding gas as weld pool protection (e.g. a gas mixture containing 82% of Argon and 18% of CO_2).

3.2.1 Drawn arc stud welding technology using 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

3.2.2 Drawn arc stud welding technology using 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 welding bead.
- 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 off and replaced by a new one. Usually this method allows you to weld in any position.

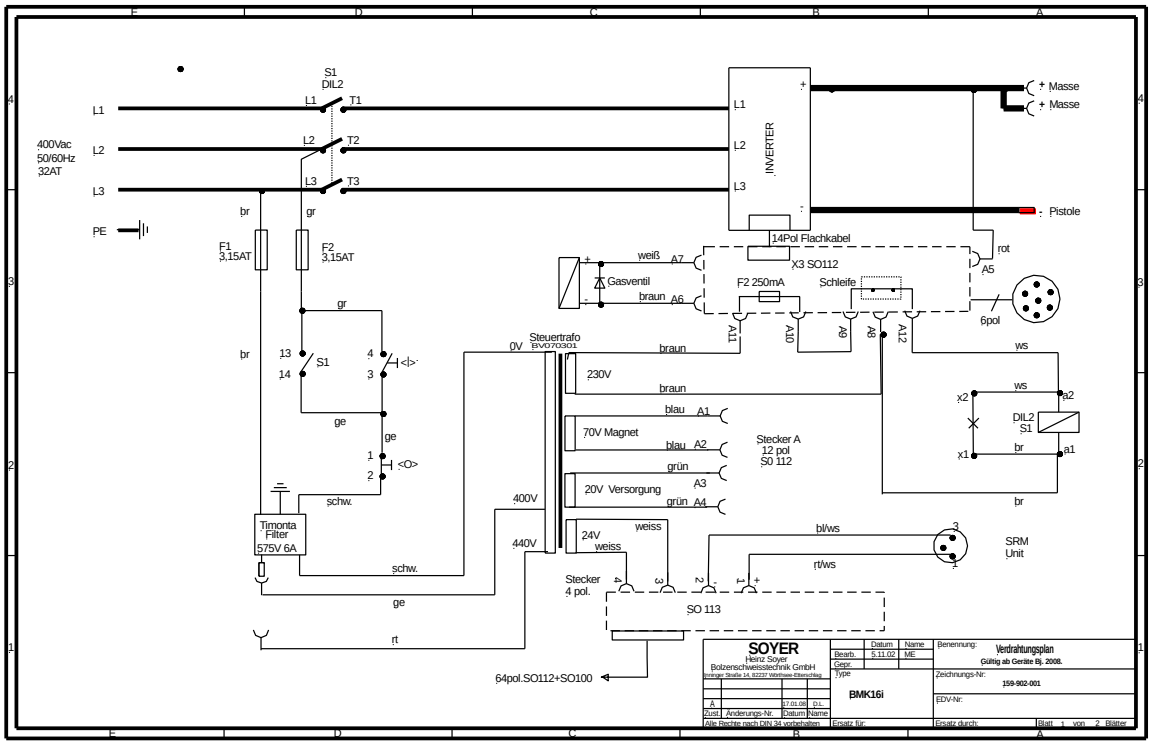
	**IMPORTANT INFORMATION** Ensure ceramic ferrules are absolutely dry.

3.3 Technical data

Designation	BMK-16i
Welding process	Drawn arc stud welding (DA) Electrode welding rectifier
Welding range	SOYER threaded studs, DIN EN ISO 13918 from M3 - M16 RD (MR) or Ø 2 - 13 mm
Material	Steel, stainless steel and heat-resistant steel (aluminium conditionally depending on respective requirements)
Power source	Inverter technology
Welding current	100 up to 1000 A stud welding 40 up to 300 A electrode welding 40 up to 100 A TIG welding
Welding time	3 up to 1000 ms (only with operating mode "stud welding")
Welding sequence	15 - 30 studs/min. with M3 Up to 3 studs/min. M12 (Ø 11 mm)
Standard gun	PH-2L stud welding gun (PH-3N SRM)
Power supply	CEE 32 A (3P + safety earth conductor) 3 x 400 V 50/60 Hz +10% -15%
E-continuous current	1 A / phase
E-continuous power	700 VA
E-peak current	90A / phase with 3 x 400 V (short-time operation)
Open-circuit voltage	80 V / DC (direct voltage)
System of protection	IP21
Interfaces (option)	Feeder interface: 15-pole socket CNC interface : 9-pole socket RS 232 interface: 9-pin plug (with SO-250 option)
Ext. program selection	PG.Select interface : 9-pole socket
Compressed-air supply	max. 6 bar (compressed air only with optional automatic set)
Shielding gas supply	max. 4 – 5 l/min.
Dimensions	335 x 440 x 700 (w x h x d)
Weight*	36.5 kg
Colour	RAL 5009 azure
Technical specifications are subject to change without notice.	

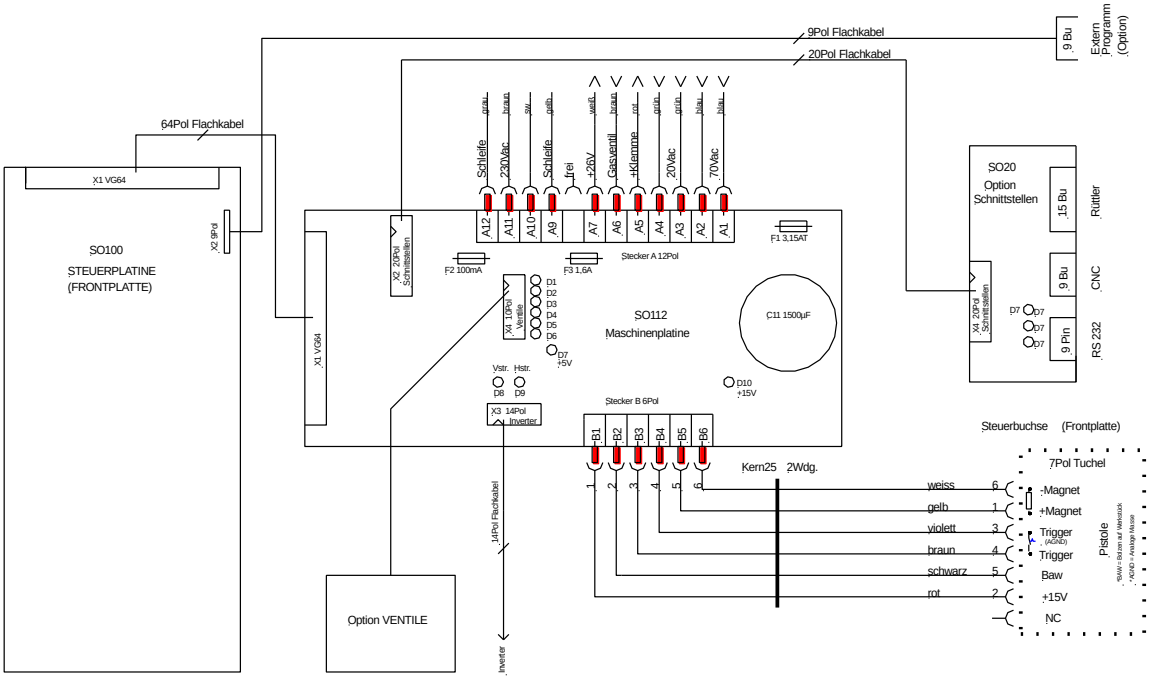
WARNING
The "S" symbol is the symbol for welding current sources permitted for operation with increased electrical danger. The "S" symbol on our stud welders refers exclusively to the welding current circuit and not to the complete stud welding equipment.

3.3.1 Wiring diagram BMK-16i



Technical specifications are subject to change without notice

3.3.2 Wiring diagram - Components



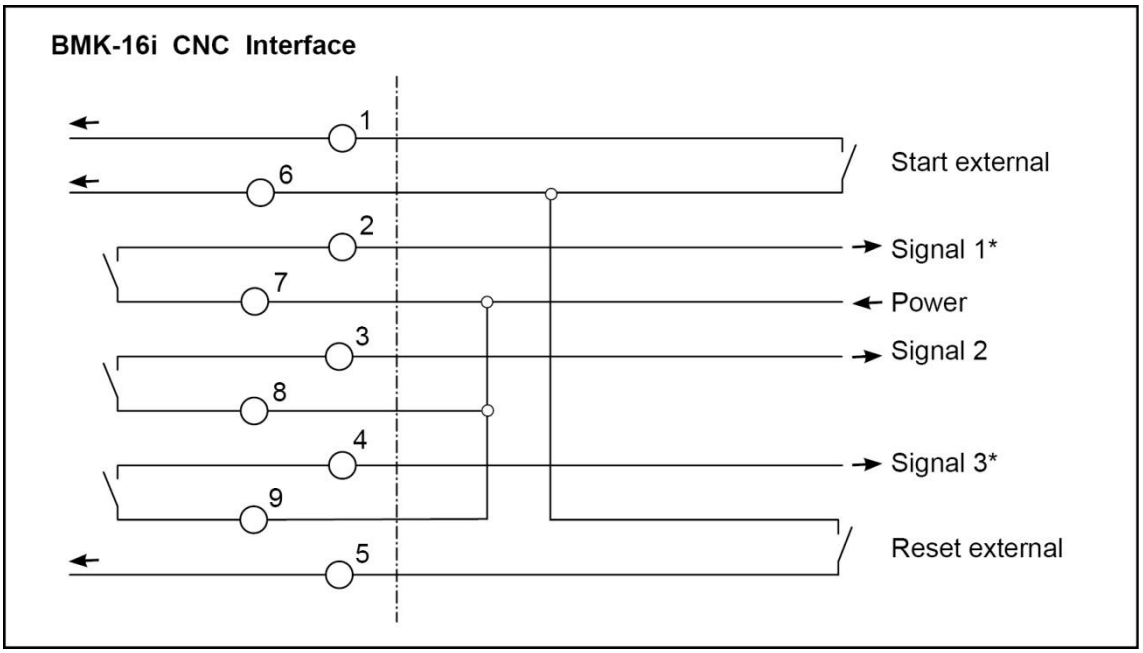
Technical specifications are subject to change without notice

3.4 Interfaces BMK-16i

3.4.1 CNC interface

The CNC interface serves for the control and communication e.g. in conjunction with a CNC stud welding machine.

Circuit diagram of CNC interface



Description of CNC interface

PIN	Identification	Description
1+6	Start external	Contact releases the welding process.
2+7	Signal 1 (**QUAKO option**)	**Weld is OK:** Contact is present during operation. It is interrupted in case of a faulty weld and can be reset with "Reset external".
3+8	Signal 2 (SOW)	**Stud onto workpiece** Contact is made when stud touches the workpiece.
4+9	Signal 3 (**QUAKO option**)	**Final contact:** Contact is reset after welding e.g. in order to prevent an external control from being released/started.
6+5	Reset external	**Error reset, external** Contact resets error messages.

3.4.2 RS 232-interface (SO-250 option)

The RS 232 interface serves as a "printer interface" or as "remote control" e.g. in conjunction with a CNC stud welding machine.
A complete device configuration for the central control via a PC is possible via the interface. Operation via the four function keys is therefore no longer necessary.

3.4.3 Feeder interface

The feeder interface serves as the control and communication of our systems for the external stud feed e.g. by means of an UVR-300 SOYER universal feeder.

3.4.4 PG.Select

Communication interface for the P3-Select/S gun distribution system. This interface serves for the automatic selection of programs (for further information, please refer to the operating instructions of the P3-Select gun distribution system).

4 Installation of stud welding system

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 to the ground.

- Only install the stud welder on an even surface. The pads located on the bottom of the welding equipment 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 for the welding equipment.
- Make sure there is sufficient free space around the air apertures, otherwise the device safety mechanism will respond and interrupt the welding process. This state, represented as "Unit not ready" is shown alternately with the current operating mode on the display.

- Install the stud welder close to the welding location.
- Ensure correct connected loads for electrical connections:

  Socket CEE 32A - 6h; 3 x 400 V~/ 50 Hz / 60Hz.

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

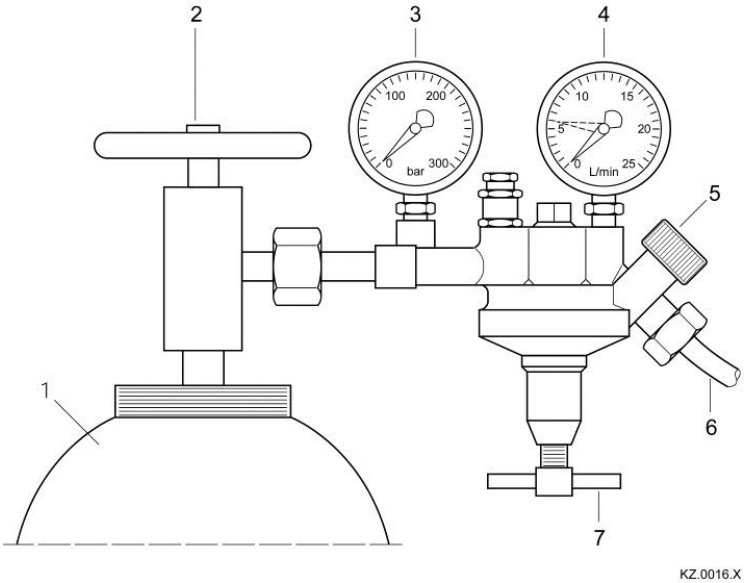
- Please observe that additional extension cables cause a voltage drop, possibly leading to system disturbances.
- When welding with shielding gas, make sure the gas cylinder is installed safely in its approved, accident-proof installation device.

	**NOTE** The housing of BMK-16i stud welder corresponds to safety class IP21. Please observe that this system of protection is not suitable for being operated or transported in the rain.

4.1 Preparation of gas supply

Gas supply must be provided before welding with shielding gas.

The gas connection at the rear side of the stud welder serves to supply the stud welder with gas by means of a pressure reducer (pressure reducing valve not included in delivery). The admissible gas flow value ranges from between 4 to 5 l/min.



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

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

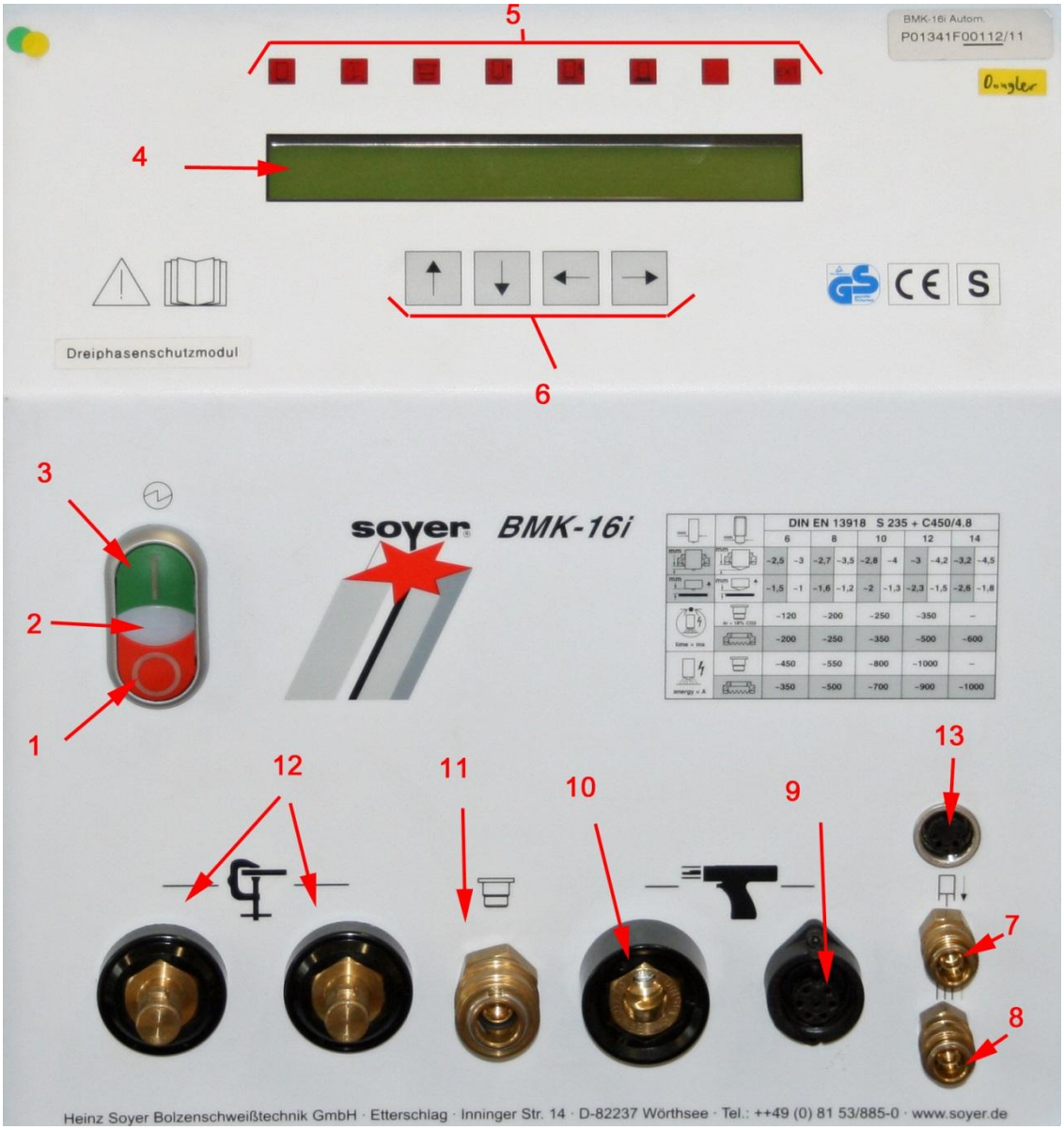
- Connect gas supply hose and gas hose of pressure reducing valve (pressure reducing valve not included in delivery) to the stud welder.
- Open hand wheel (item 2) of gas cylinder.
- Open shut-off valve (item 5).
- Use control cock (item 7) to set shielding gas flow rate to a maximum of 4 - 5 l/min.

	NOTE Make sure the gas cylinder is installed safely in its admissible, accident-proof installation device.

	NOTE As protective gas, we recommend using the following gas mixtures: 80% Argon and 20% CO_2 **82% Argon and 18% CO_2** 85% Argon and 15% CO_2

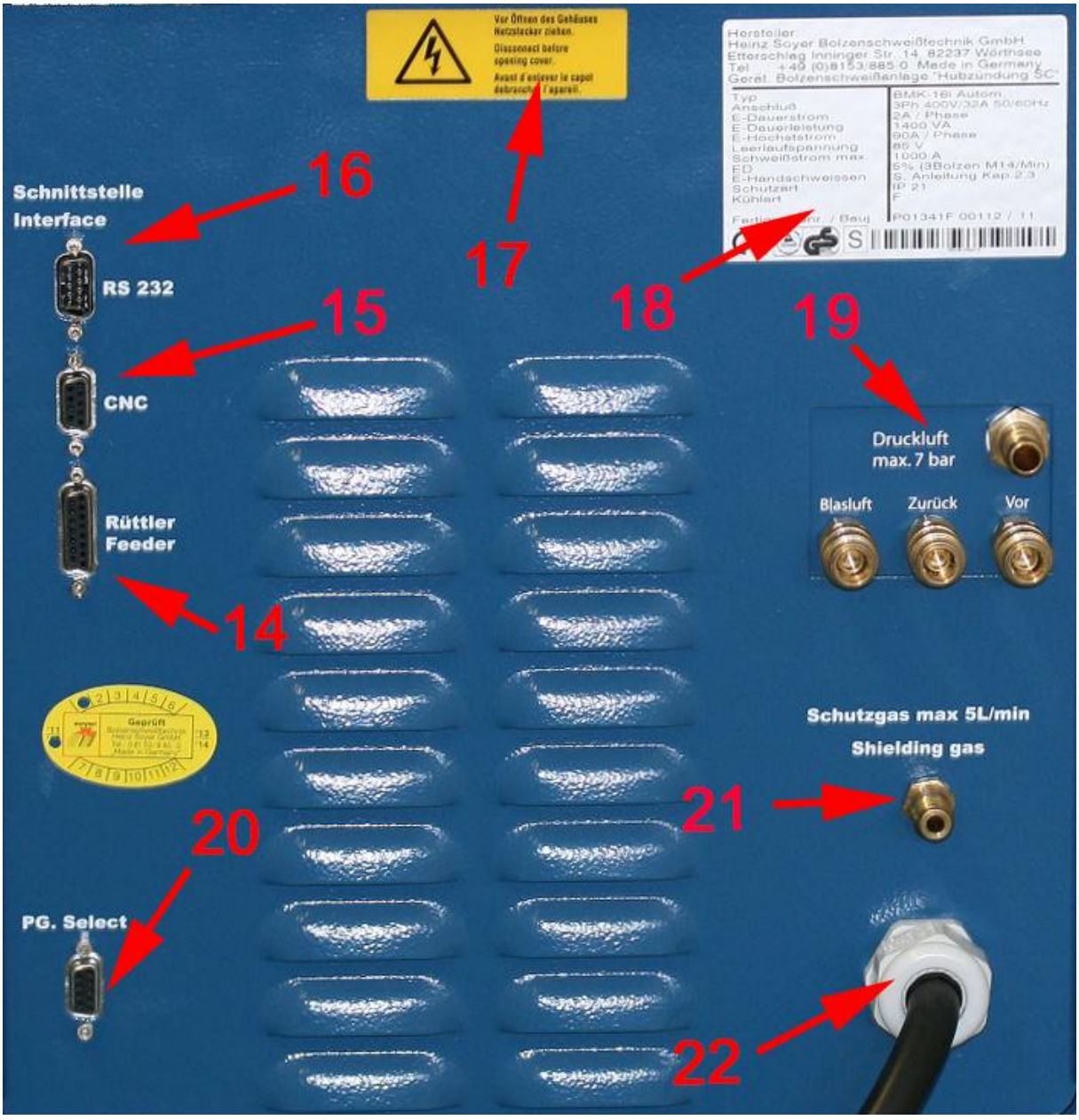
5 Start-up

5.1 Front- and rear view



Front view BMK-16i

1 : OFF switch (to switch stud welder off)
2 : Signal lamp (operating mode display)
3 : ON switch (to switch 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 "back" (option)
9 : Control cable connection
10 : Welding cable socket
11 : Gas connection socket
12 : Earth cable connectors
13 : SRM connecting socket



Rear view BMK-16i

14* : 15-pole connecting socket for controlling the feeder
15* : 9-pole connecting socket for controlling the stud welder via a CNC interface
16* : 9-pin connector, interface RS 232
17 : Danger sign
18 : Type plate
19 : Compressed-air supply connection for feeder control (admissible connection pressure max. 7 bar)
Connecting sockets for compressed-air control of feeder
20 : Connecting socket for P3-Select gun distribution system
21 : Shielding gas connector
22 : Mains cable

**optional automatic set*

5.1.1 Operating elements

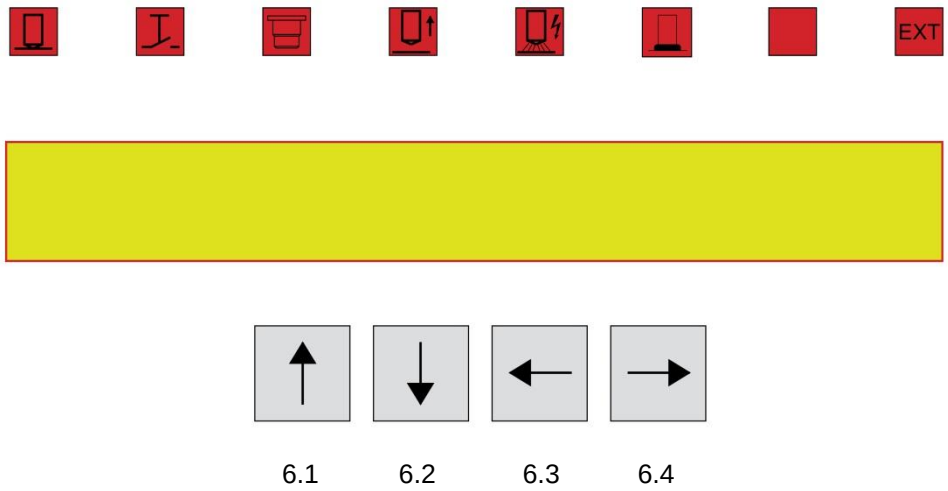
- **ON - OFF switch**

Keep the "ON" switch (item 3, chapter 5.1) pressed to turn the stud welder on. The signal lamp (item 2, chapter 5.1) shows that the stud welder is operative.

Press the "OFF" switch (item 1, chapter 5.1) to turn 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).

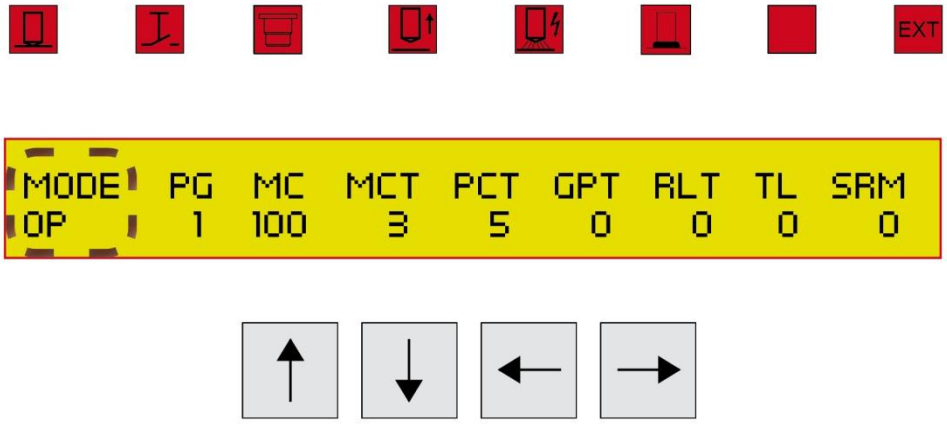
Function keys "Arrow left/right" (items 6.3 and 6.4, chapter 5.1)
Selection of parameters to be modified (shifting of the flashing symbol to the left or right).

5.1.2 Display elements (LED displays)

LED	Description
5.1 LED "SOW"	LED lights up as soon as the stud touches the workpiece provided the workpiece is connected to the earth pole of the stud welder.
5.2 LED "Release"	LED lights up when pressing the trigger switch of the gun or when the start signal at the external interface has been activated.
5.3 LED "Gas valve"	LED lights up when gas valve is open.
5.4 LED "Lift"	LED lights up as soon as the lifting magnet of the gun has been activated.
5.5 LED "Ignition"	LED lights up when main current is supplied.
5.6 LED "FC"	LED lights up after welding.
5.7	NO FUNCTION
5.8 LED "External"	LED lights up with optional key switch.

5.1.3 Description of display

A parameter designation is shown blinking in the display to indicate that its value can be altered using the keyboard.



Description of operating parameters (MODE)

Parameter	Description
OP	Operation. Standard setting for normal welding operation. The parameters of the programs can only be altered in this mode.
PRE	Pre-current test.
LIFT	Lift test. It allows activating the lifting magnet of the gun/head to control the setting **without welding operation**.
GAS	Gas test
MEAS*(option)	The operating mode "MEAS" allows you to determine the desired values for a welding program (pls. refer to the description of the quality control).
Electrode welding	
TIG welding	

Setting options for welding operation (OP)

Parameter	Description	Range
PG	Number of programs available	1-30
MC	Main current	100-1000 A (in increments of 10)
MCT	Main current time	3-1000 ms
PCT	Preweld current time	0-999 ms
GPT	Gas preflow time Period of time during which the shielding gas valve is open before welding. Set to "0" when welding without shielding gas.	0-9900 ms (in increments of 100)
RLT	Reload time Period of time during which the compressed air valve remains open to allow stud transference from the universal feeder to the welding gun/welding head. Set to “0” to switch off the automatic reload.	0-9900 ms (in increments of 100)
TL (option)	Permissible deviation of main parameters in percent.	0-50 %
SRM	Magnetic field current	0-1500 mA (in increments of 15)

<u>Please note</u>:
The programs 1 -30 are available to the user. Depending on the respective welding task, the welding parameters can be determined and stored as user programs in the programs sites 1 – 30.
In addition, there are fixed welding programs for all common welding tasks. With the exception of the tolerance range (TL) and the reload time (RLT), these parameters cannot be changed.

5.1.4 Description of symbols

Symbol	Designation	Function
	Electrical energy	ON/OFF key to turn the stud welder on or 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 button of welding gun or welding head.
	LED "Gas valve open"	LED lights up when shielding gas valve is 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 in the test run and with 'key switch' OPTION.
	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/welding head.

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 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 magnetic blow effect on the arc, i.e. the arc for welding the stud is asymmetrical. This is shown by an irregular course of the welding bead 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 optimally balanced and also good welding results.

Difficult areas are welds on the edge of the workpiece or greater inhomogeneities 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 lead to poor welding results.

Examples for various earth connections and possible effects:

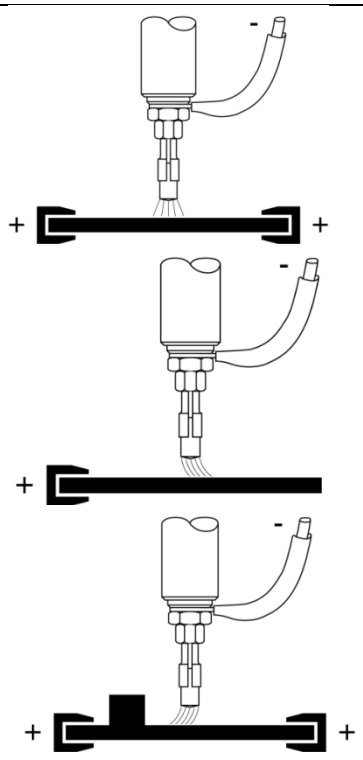
Balanced earth connection

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.

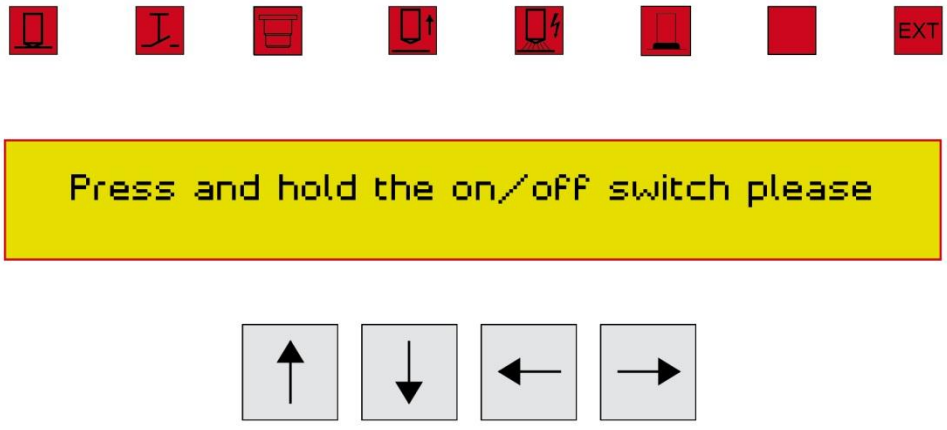
5.2.4 Power supply

Use the mains cable to connect the stud welder to the power supply.

	**MORTAL DANGER** **Ensure correct connected loads for electrical connections as indicated on the type plate.**

5.3 Starting the stud welder

After switching on the stud welder, the 8 LED lamps light up briefly. Depending on the equipment index, the stud welder carries out a self test which is either shown on the display or runs in the background.
Stud welders as from index "F" are equipped with a three-phase protection module. Here the self-test is no longer displayed.



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

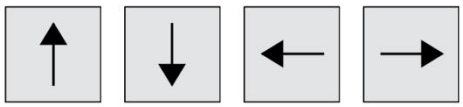
After the self test has been carried out successfully, the stud welder automatically sets the parameters which were last set. When the main switch is kept pressed, an input network check is carried out with those stud welder types equipped with a 3-phase protection module. In case of deviations from the admissible tolerance, the stud welder cannot be switched on. If there is a mains power failure during operation, the stud welder may possibly switch itself off.

5.3.1 Operating mode "OP"

This operating state must be set for normal welding operation. When the optional quality control is switched on, the stud welder locks if welds are outside the tolerance.

5.3.2 Operating mode "PRE" (preweld current test)

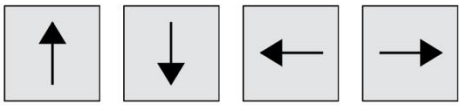
The operating mode "Preweld current test" enables a function test using the set parameters without application of main current and serves to control the gun setting.



Use the function key “Arrow up“ or "Arrow down" to set operating mode **"PRE".**

CAUTION
Protective goggles are required to carry out this test. Please also refer to the safety instructions in chapter 1.

5.3.3 Operating mode "LIFT" (lift test)



This operation mode enables you to adjust and check the lift of the gun or welding head.

- Use the function key “Arrow up" or "Arrow down" to set operation mode "LIFT".
- Insert a stud into the welding gun or welding head.
- Check the immersion depth of the stud and set it according to the operating instructions of the welding gun or welding head.

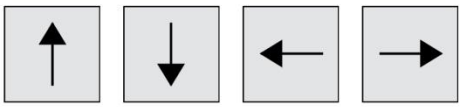
	CAUTION Ensure once again that the operation mode is set to "LIFT" and comply with the safety instructions in chapter 1.

- Position gun or welding head on workpiece. The LED "Stud on workpiece" lights up.
- Press the release button of the gun or the welding head or give a triggering signal via the CNC interface. The weld stud is lifted off the workpiece as long as the triggering signal is there.

If necessary, check and correct the height of lift according to the specified standard values.
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 (ms) on the display.

	NOTE Do not activate the release too often at short intervals. This can cause the thermo safety mechanism protecting the lifting magnet to react and the current supply for the magnet will be interrupted. This condition is shown as error message on the display.

5.3.4 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 there is a triggering signal, shielding gas flows out of the gas shroud on the welding gun or welding head. This enables you to rinse the gas supply lines with shielding gas before starting to weld.

- Select the operating mode "GAS" with the function key "Arrow up" or "Arrow down".
- Connect gas supply (pls. refer to CHAPTER "GAS SUPPLY")
- The gas valve may be activated by

  1. the trigger of the welding gun or welding head.
  2. an active start signal at the CNC interface.

5.3.5 Operating mode "MEAS" (Measuring) OPTION

The operating mode "MEAS" allows you to determine the desired values for a welding program (**see description of quality control**).

The quality control serves to monitor the reproducibility of the welding process and to display inadmissible deviations. This allows changes to be detected which could impair the quality of the welding result (e.g. sluggish guns, poor ground connection etc.).

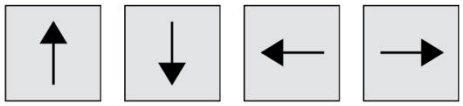
5.3.6 Electrode welding

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" to set operating mode "ELECTRODE WELDING".

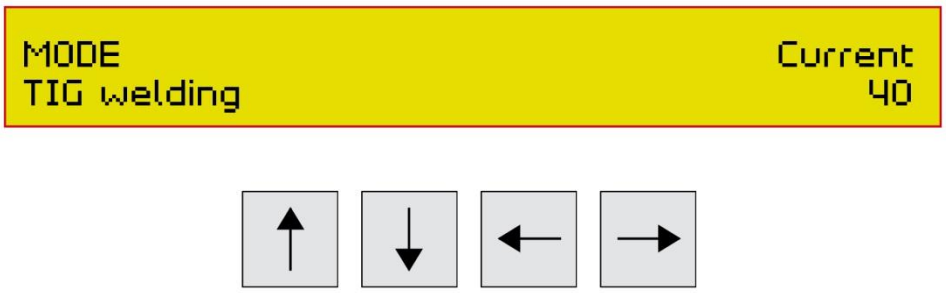
Use the function key "Arrow right" to set the welding current.
Setting range: 40 – 300



5.3.7 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" to set operating mode "TIG WELDING".
Use the function key "Arrow right" to set the welding current
Setting range: 40 -100



5.4 Special functions – Submenus

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

The stud welder must be switched off when calling up special functions. In order to call up the respective special function 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 started again.

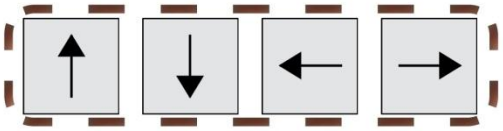
5.4.1 Special function "Deleting the main memory"

This special function serves as a "RESET function" e.g. for eliminating troubles or starting the stud welder the first time. **All settings of the main memory are deleted by using this function.**

	**Please note** Only concern yourself with the special functions when you are familiar with the basic functions of the stud welder.

To delete the main memory, please proceed as follows:

- Simultaneously press "Arrow up", "Arrow down", "Arrow right" and "Arrow left" keys and keep them pressed.
- Switch the stud welder on using the main switch.



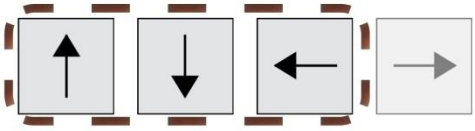
- Switch the stud welder off using the main switch and switch it on again.

5.4.2 Special functions – Extended submenu

This submenu allows various parameters to be adapted.

To call up this special function, the following steps are necessary:

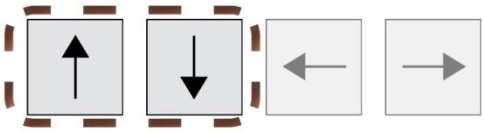
- Simultaneously press the “Down arrow”, “Up arrow” and “Left arrow” function keys and keep them pressed.
-
- Switch on the stud welder by means of the main switch.



Parameter	Description	Range	Default
Post arc c. (Afterglow t.)	The post-arc current serves to extend the short-circuit current at the end of the welding process, this can improve the welding quality.	0-500 ms	0
Aut.load	Here the automatic stud reload can be switched off or on.	on/off	on
Trg. delay	The trigger delay increases the time between pressing the release button and the welding process.	0-1000 ms	0
PCR	Preweld current	80-100 ampere	80

5.4.3 Special function "Display of operating counter"

This special function serves to display the operating counter.



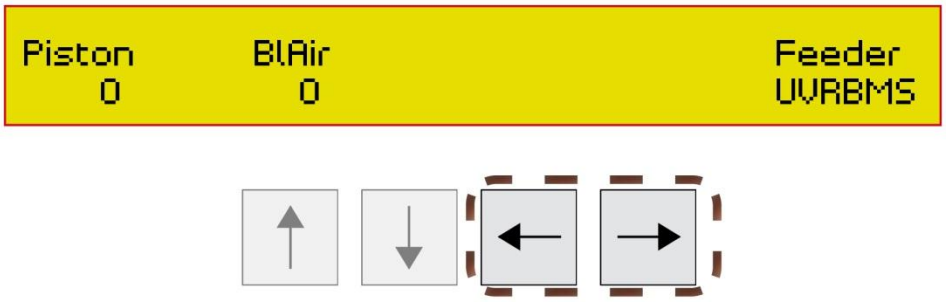
- Simultaneously press "Arrow up" and "Arrow down" keys and keep them pressed.
- Switch stud welder on using the "ON switch".
- The operating counter can be reset to "0" by pressing the function key "Arrow right".

5.4.4 Special function "Setting the type of feeder and its functions"

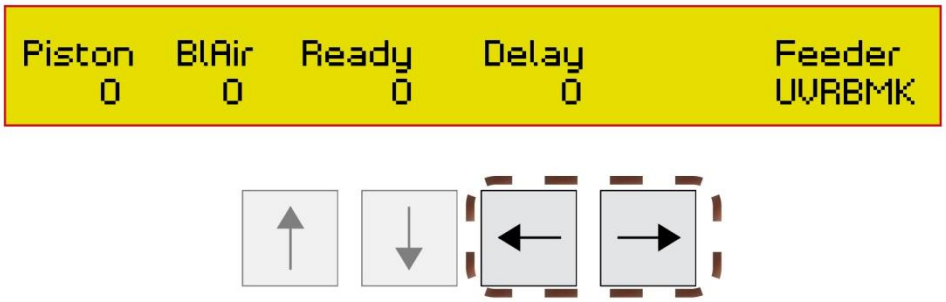
This special function serves to adapt the control to the feeder.

To call up this special function, please proceed as follows:

- Simultaneously press "Arrow right" and "Arrow left" keys and keep them pressed.
- Switch stud welder on using the main switch.



The standard stud welder is set to feeder type "BMS" (CD).
With parameter 5 (Feeder), the stud welder can be set to feeder type "BMK" (short-cycle) by pressing the "Arrow up" key.



The parameters 1 – 4 "Piston", “BlAir”, "Ready", "Delay/After-running period." can be selected in 100-ms increments.
The parameters can be horizontally selected by using the function keys "Arrow left" and "Arrow right".

Explanation of parameters

Parameter	Description	Range	Default value
Piston	This parameter sets the after-running time of the stud feed blow air for the pushing piston in the welding gun/welding head to press the stud out of the stud chuck. A longer time setting is required when welding e.g. above the head to achieve a trouble-free stud reload.	0 – 2000 ms	0
BlAir	This parameter serves to adjust the delay time of the stud feed blow air after the pushing piston in the welding gun/welding head has moved back. After the set delay time, the stud feed blow air is activated. This is necessary e.g. in the case of a short stud feed hose.	0 – 2000 ms	0
Ready	**(only with function UVR BMK)** This parameter serves to adjust the waiting period of the hexagonal barrel in the feeding position. Depending on the type of stud, a basic setting between of 500 ms and 1000 ms is recommended.	0 – 2000 ms	0
Delay/After-running period	**(only with function UVR BMK)** This parameter serves to adjust the after-running period of the feeder to fill the outlet rail when a stud has been brought in blow-off position. Recommendation: 500 – 1000 ms.	0 – 20.000 ms	0
Feeder	This parameter serves to adjust the feeder type connected. UVRBMS and UVRBMK can be set as feeder types.		

5.4.5 Special function "Setting the language"

This special function serves to select different languages for the display texts and to display the software version number. The languages available are shown in the display.

To select this special function, the following procedures are necessary:

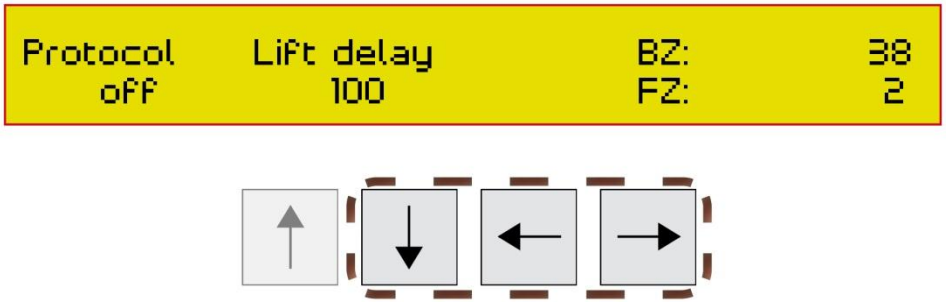
- Simultaneously press function keys "Arrow up" and "Arrow right" and keep them pressed.
- Switch on stud welder with main switch.

Please follow the instructions shown on the display.

5.4.6 Special function "Protocol/Log" (OPTION)

To call up this special function, please proceed as follows:

- Simultaneously press "Arrow up", "Arrow left" and "Arrow right" keys and keep them pressed.
- Switch stud welder on with main switch.



Parameter	Description
Protocol	Serves to switch the measurement data transfer on or off via the RS 232 interface. The measurement data is transferred automatically after every weld. To further process the data, you need an external PC with the necessary Soyer software installed.
Lift delay	Serves to set the delay time between switching on the preweld current and activating the lifting magnet in the gun.
BZ/OC	Operating counter which is increased after each weld.
FC/EC	Error counter which is increased after the stud welder was switched off due to inadmissible mains voltage.

5.5 Welding parameters

	NOTE The set welding parameters substantially influence the reproducibility and quality of the welding results. 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 consistently good welding results (see DVS guideline, Part 1, "Quality assurance of stud welding joints").

The welding parameters were determined with the BMK-16i stud welder and the PH-3N stud welding gun using a lift adjustment of about 2.5 mm. A steel plate with a thickness of 5 mm served as base metal for SOYER weld studs as per DIN EN ISO 13918.

Table for welding parameters

		For weld studs as per DIN EN ISO 13 918									
		6		8		10		12		14	
mm	mm	~2.5	~3	~2.7	~3.5	~2.8	~4	~3	~4.2	~3.2	~4.5
mm	mm	~1.5	~1	~1.6	~1.2	~2	~1.3	~2.3	~1.5	~2.6	~1.8
Time =ms		~ 120		~ 200		~ 250		~ 350		--	
		~ 200		~ 250		~ 350		~ 500		~ 600	
Energy=A		~ 450		~ 550		~ 800		~ 1000		--	
		~ 350		~ 500		~ 700		~ 900		~ 1000	

<u>Please note</u>:
The programs 1 - 30 are available to the user. Depending on the respective welding task, the welding parameters can be determined and stored as user programs in the programs sites 1 – 30.
In addition, there are fixed welding programs for all common welding tasks. With the exception of the tolerance range (TL) and the reload time (RLT), these parameters cannot be changed.

Overview of fixed welding programs

Displayed message	Suitable for
A8 | A10 | A12	Aluminium studs with flange M8, M10 or M12
N 6 | N 8 | N 10 | 12	Welding nuts V2A M6, M8, M10 or M12
H 8 | H10 | H 12	HZ-1 welding studs made of steel 5.8 M8, M10 or M12
R 8 | R 10 | R 12	Welding studs made of steel 4.8 MR 8, MR 10 or MR 12

6 Operation

6.1 Brief description

This section is designed to provide you with a quick start into the welding operation. For detailed information, please refer to **chapter 6.2**.

	**NOTE** The relevant accident prevention and safety regulations must be complied with when operating the stud welder.

	**NOTE** The welding areas must be metallically bright. → If necessary, grind the area to be welded.

- Switch on mains switch.

	After switching the stud welder on, all eight LED lamps light up for a short period. Depending on the respective operating state, further messages are shown via the digital display.

- Set operating mode "Lift test" and check the welding gun's height of lift.

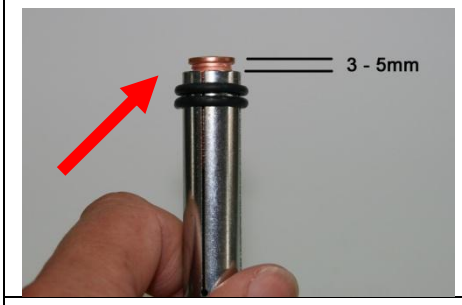
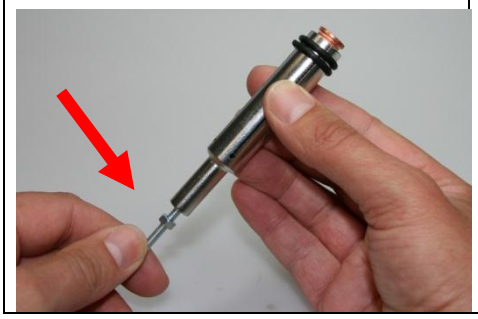
	**NOTE** The height of lift is the distance for which the stud is lifted from the workpiece during the welding process. This distance is required for igniting the arc. **The height of lift should amount to approx. 2 mm.**

- Set desired operating mode "OP" or "MEAS" (OPTION).
- Choose welding parameter depending on stud diameter using the function keys.
- Position welding gun with weld stud on the workpiece. When earth connection is made and the stud in the gun touches the workpiece, the LED "Stud on Workpiece" (SOW) lights up.
- Press the push button. The LED "Release" lights up and the stud welding process is started.

During the welding process, keep the gun steady. After completion of the welding process, remove gun vertically from the welded stud to prevent widening and damaging of the stud chuck. In case of automatic operation, a weld stud will be reloaded.

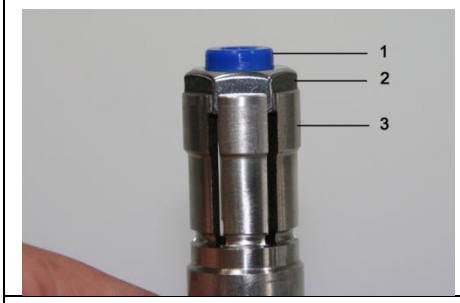
6.2 Basic setting of the SRM stud chuck

SRM stud chucks are available in the following different sizes: M8, Ø 9 mm, M10, Ø 10.8, M12 and M14.

	• The SRM stud chuck has been specifically designed for the PH-3N, PH-3N SRM, PH-9 and PH-9 SRM stud welding guns. • For different stud diameters, different stud chucks are required.
	Insert weld stud into stud chuck.
	The weld stud must make contact with the stop screw. Adjust stop screw in the stud chuck by turning it until the distance between the top edge of the stud flange and the front edge of the stud chuck equals 3 – 5 mm.
	Ensure depth of immersion / stud protrusion is set between 3 mm and 5 mm. After adjustment, check and correct if necessary. Hand-tighten by means of the fixing nut. **With a stud protrusion of more than 5 mm, the necessary transverse magnetic field is deflected laterally which may lead to an uncontrolled SRM welding.**

6.3 Basic setting of the SRM nut holder

The SRM nut holder is available for M6, M8, M10 and M12 nuts.

	The SRM nut holder has been specifically designed for the PH-3N SRM and PH-9 SRM stud welding guns. The SRM nut holder can be installed directly.
	Insert nut into nut holder. SOYER nut holders are already factory-set to SOYER weld nuts. No further adjustment is required.
	1 Centering insert 2 Weld nut 3 Nut holder

Possible material combinations for nut welding with SRM

Weld nut of A2-50 / stainless steel	Sheet metal of stainless steel	well suitable
Weld nut of A2-50 / stainless steel	Sheet metal of steel	well suitable
Weld nut of steel	Sheet metal of steel	not suitable

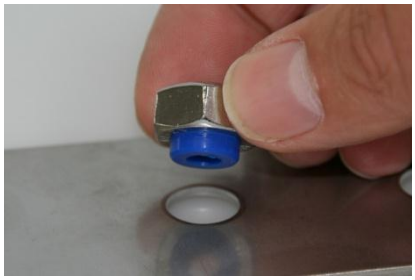
A galvanised sheet metal is generally not recommendable. You can, however, remove the zinc layer from the workpiece according to the diameter of the weld nut by means of cutting or mechanical processing.

Note for nut welding on non-punched sheet metal

Use our weld nuts without centering inserts for non-punched sheet metal.
The PH-3N stud welding gun is positioned onto the workpiece without further aids.
The positioning is completed “manually”, using a template or suitable fixture.

Note for nut welding on punched sheet metal

<table>
<tr>
<td>  </td>
<td>Use our weld nuts with centering inserts for punched sheet metal.
Thanks to our centering insert, the weld nut is welded centrally over a hole.

TIP
When using a template or other equipment, it is not necessary to use the centering insert. Without the centering insert, spatters might, however, stick in the thread.</td>
</tr>
<tr>
<td>  </td>
<td>Weld nut with centering insert.

Important!
The hole diameter must be prepared according to the nut size.</td>
</tr>
<tr>
<td colspan="2">For an optimal welding result, you must comply with the following hole diameters:

M8 weld nut with centering insert — Ø 9.5 mm (punched holes that are free of burrs to the largest possible extent)
M10 weld nut with centering insert — Ø 12 mm (punched holes that are free of burrs to the largest possible extent)
M12 weld nut with centering insert — Ø 14 mm (punched holes that are free of burrs to the largest possible extent)</td>
</tr>
</table>

6.4 Start-up of PH-3N SRM stud welding gun

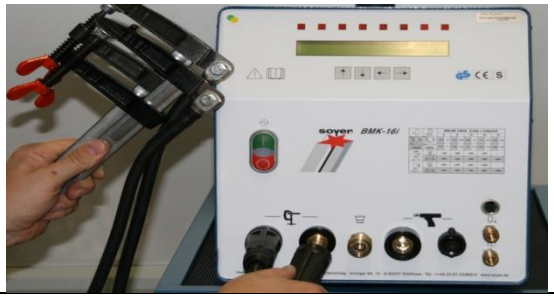
NOTE: The PH-3N SRM welding gun is only suitable for stud sizes M6 - M12 and weld nut sizes M8, M10 and M12!

TIP: The PH-3N SRM welding gun is provided with a standard gas shroud. Use inert gas in order to avoid the formation of pores and to optimise the collar formation.

With this example we would like to explain the necessary work steps in detail. This example applies correspondingly to other stud welding guns.

SRM nut holder

SRM stud chuck



Installation of stud welder:

Connect both ground cables and lock them by turning to the right until stop.

<u>Ensure a tight fit of connection cables!</u>

Connect gas supply

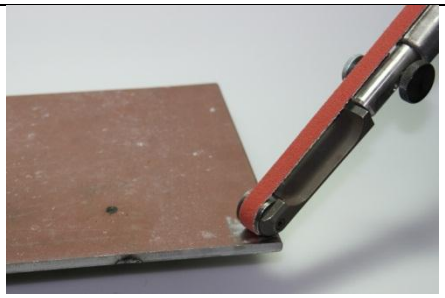
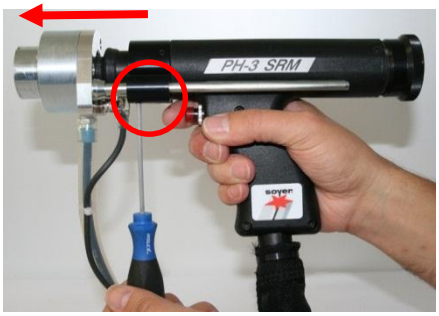
Set gas flow rate to a value between 3 and 5 l/min.

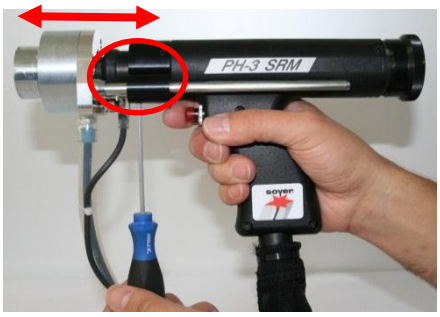
Argon gas mixture containing
82% of Argon and 18% of CO_2

Connect welding cable of welding gun to the welding cable socket and lock it by turning to the right until stop.

Insert control cable of welding gun into control cable connection and lock it by turning to the right until stop.

Connect gas hose.

	**If necessary,** prepare the ground connection (use protective goggles). The contact areas for the ground connection must be metallically bright. TIP: You can improve the transition resistances if both sides of the locking pliers have contact with the ground. 
	**NOTE:** To facilitate the installation of the stud chuck or nut holder, move or dismantle the support together with the gas shroud. To do so, loosen the four Allen screws.
 Support not illustrated	The stud welder must be switched off when installing the stud chuck or nut holder.  Loosen sleeve nut with a SW 17 socket wrench or SW 17 open-end wrench. Insert the chuck into the spring piston and push it firmly until it comes to a stop.
 Support not illustrated	Hand-tighten sleeve nut with a SW 17 socket wrench or SW 17 open-end wrench.



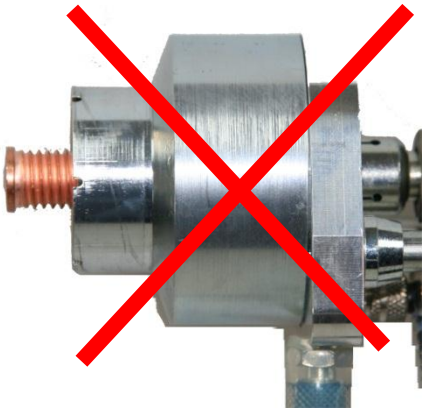
How to correct the stud protrusion

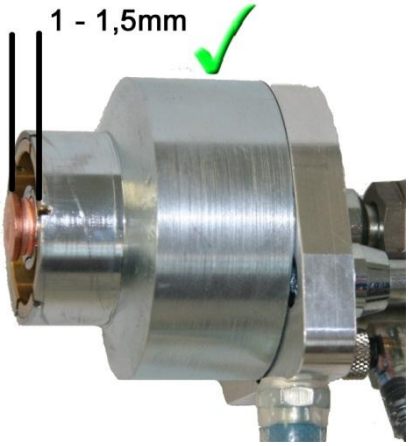
Insert the stud / weld nut into the chuck / nut holder and push it firmly until it comes to a stop.
Use Allen wrench (size 3) to loosen the four Allen screws.
Move support until a stud protrusion of approx. 1 – 1.5 mm is obtained.

Tighten Allen screws.

<u>Ensure stud protrusion is set between 1 mm – 1.5 mm</u>

The stud must protrude for about 1 mm– 1.5 mm from the SRM gas shroud!





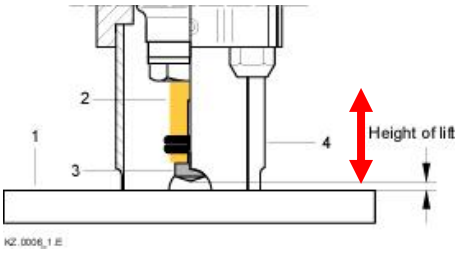
Connect power cable.

Ensure correct connected loads for electrical connections (please refer to the type plate of the stud welder).

Standard design
CEE 32 A (3P + protective earth conductor)
3 x 400 V 50/60 Hz

Important: Slow-blow fuse, no automatic circuit breakers.

<table>
<tr>
<td>  </td>
<td>Switch stud welder on by means of the mains switch.

Please observe the safety instructions!
  </td>
</tr>
<tr>
<td> 
</td>
<td><u>Adjusting and checking the height of lift</u>

The height of lift is the distance by which the stud is lifted from the workpiece during the welding process. This distance is required for igniting the arc.
The height of lift should amount to approx. 1 – 2 mm.

<u>Tip:</u>
With the SRM stud welding method, you often achieve better results with a smaller lifting height.</td>
</tr>
<tr>
<td> 
</td>
<td>To adjust and check the height of lift, please select the operating mode "Lift Test".

• Position welding gun on the workpiece
• Press the trigger. The gun lifts the chuck with weld stud away from the workpiece.

Adjustment of the gun lift is achieved by turning the rear adjustment cap of the welding gun to the left or to the right.

Anti-clockwise rotation increases the gun lift and conversely clockwise rotation reduces the gun lift.</td>
</tr>
<tr>
<td>  </td>
<td>Please ensure that the welding parameters are set in accordance with the respective stud diameter.

Please make sure gas supply has been properly connected.

Check and adjust accordingly if necessary.</td>
</tr>
</table>

Position welding gun vertically on the workpiece (at a 90-degree angle to the workpiece).
Check the selected parameters. Start the welding process by pressing the trigger.

During the welding process, keep the gun steady. After completion of the welding process, remove gun vertically from the welded stud to prevent widening and damaging of the stud chuck.

Please carefully observe all safety instructions!

6.5 Notes on the "Lifting test" operation mode

The lifting test allows for the activation of the gun's lifting magnet thus controlling the setting.

Proceed as follows:

- Provide ground connection to the workpiece, connect welding gun.
- Mount stud chuck to the welding gun and insert weld stud into stud chuck.
- Select operation mode "Lift test".

- Press the trigger. A lifting cycle is carried out using the control parameters of a real weld.

	NOTE The appropriate lifting height can be adjusted by rotating the adjusting cap at the rear side of the welding gun to the left or to the right. **The lifting height should be approximately 2 mm.**

This procedure can be repeated as frequently as required. To avoid overheating the magnetic coil, a waiting time of approx. one second must be observed between two test lifts.

If at the beginning of the lifting cycle **BAW** (**SOW** = stud positioned on workpiece) is recognised, the stud welder will display the drop time of the gun in ms (milliseconds) with a resolution of 0.1 ms. This time measurement starts with the deactivation of the lifting magnet and stops as soon as the stud touches the workpiece.

6.6 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 in chapter 1 have to be complied with when operating the stud welder.

6.7 SRM welding operation

Using this patented welding process (patent no.: 10 2004 051 389), threaded studs, pins, tapped studs etc. can be welded to metallic workpieces of alloyed and non-alloy steel.

You need a stud welding gun or head, equipped with a special fixture for SRM stud welding.
Due to the inert gas shroud with integrated magnetic coil, a magnetic field is generated. Depending on the welding task, the current in mA for the power of the magnetic field can be changed via the SRM parameter.

The setting procedure for further welding parameters such as stud protrusion and lift is similar to that of stud welding without SRM.

MODE	PG	MC	MCT	PCT	GPT	RLT	TL	SRM
OP	1	100	3	5	0	0	0	0

The current intensity (mA) of the radial-magnetic field is altered via the SRM parameters.

SRM = 0 means that SRM is not active
SRM = 300 current for magnetic field 300 mA

Range: 0 – 1500 mA adjustable in 15 mA increments.

6.7.1 Stud welding with shielding gas

- Set the parameters required for your welding task.

1 Foot plate
2 Gas shroud
3 Welding stud

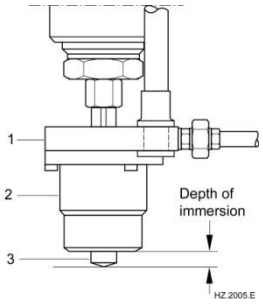


Fig. Stud welding with shielding gas

- 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 chuck 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" indicates that the gas valve is open.
- The LED "Final contact" indicates that the welding process is completed.

6.8 Welding operation with ceramic ferrules

1 Foot plate
2 Ceramic ferrule
3 Weld stud

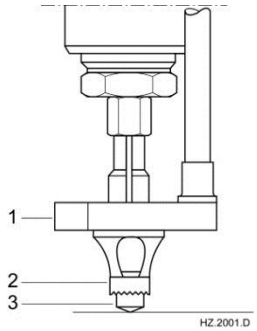


Fig. Stud welding with ceramic ferrule

6.8.1 Stud welding with ceramic ferrules

- Set the parameters required for your welding task.
- 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 weld 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 chuck 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.
- 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 chuck.
- Knock off ceramic ferrule from the welded area.

6.9 Welding operation with quality control "MEAS" (OPTION)

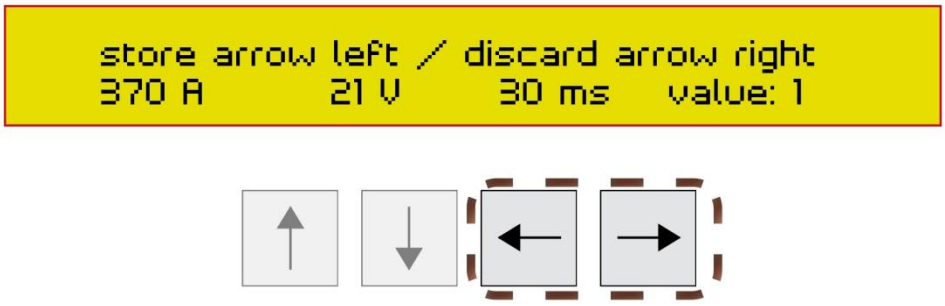
This mode of operation allows you to determine the reference values for a welding program and to use them as a basis for the quality control.

Determination of reference values:

- Set the parameters required for your welding task. The parameters can only be set in the operating mode "OP".
- Insert a weld stud into the gun or welding head and set stud welder to operation mode "MEAS".

> ☞ Carry out a minimum of five test welds. The edge distances and welding positions must be the same as used in later production. Only use original parts.
>
> No warranty is provided when non-Soyer welding studs are used.

Press the trigger of the gun or welding head or give a triggering signal via the CNC interface. The stud is lifted off the workpiece and a test weld is carried out. Carry out a work test. If the test result corresponds to your requirements, the parameters obtained can be saved as reference values by pressing the function key "Arrow left" or deleted by pressing the function key "Arrow right".
Please also pay attention to the query shown on the display.



The sample values shown in above illustration have the following meaning:

370 A =	Welding current
21 V =	Welding voltage
30 mS =	Welding time
Counter	Test welds

The saved results of the five test welds are averaged and transferred as reference values in the set program when exiting the operating mode "MEAS". The acquisition of reference values can be repeated at any time. The existing values are overwritten.

Select the admissible deviation of the quality control

Value TL = Tolerance 0 = Quality control off.
1 = smallest tolerance limit 50 = maximum tolerance limit

In the operating mode "OP", the actual values of each weld are compared with the reference values previously determined. Possible percentage deviations will be displayed. If the reference values correspond to the actual values, they have a 100% match. If the deviation exceeds the permissible tolerance, the corresponding value is represented blinking in the display. Operation of the stud welder is inhibited until reset via the external interface or by pressing any function key.

Switching off the quality control

☞ The quality control can only be switched off in the operation mode "OP".

• Set the tolerance range "TL" by pressing either function key "Arrow left" or "Arrow right".

• Set the tolerance range "TL" to "0" by pressing the "Down arrow" function key.

For more information, please also refer to the respective operating instructions of the welding guns or welding heads. If the results of the test welds meet your requirements, you can save the determined parameters as reference values and switch the quality control on again.

Switching on the quality control

• Set the tolerance range "TL" to a value between "1 and 50" (the admissible tolerance ranges between 1% and 50%).
A tolerance value of approx. 10% is optimal

7 Quality control (stud welding)

7.1 General instructions

Provided the SOYER stud welding system is correctly 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 standards:

DIN EN ISO 14555 *Arc welding of metallic materials*
DVS 0904 *Information on practical application – Arc stud welding*

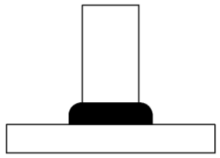
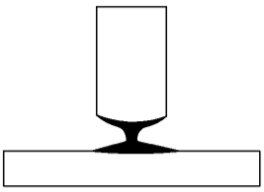
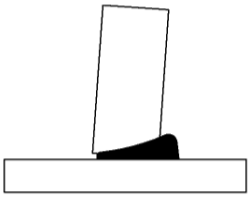
7.2 Test execution

7.2.1 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.

7.2.2 Visual inspection

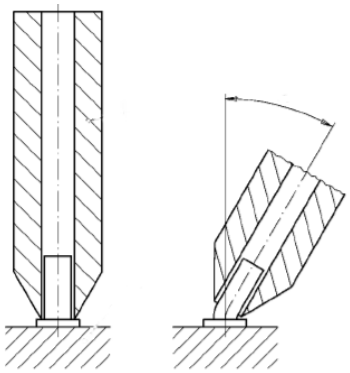
The visual inspection serves as a rough check for major defects. The uniformity of the weld is assessed.

	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.

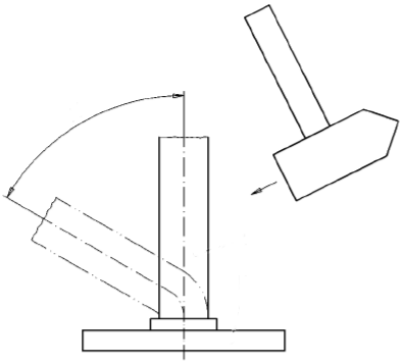
7.2.3 Bend test

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 are welded and bent by means of a tube slipped over the stud. The test is successful when no superficial fissure or fracture is detected in the welding zone.

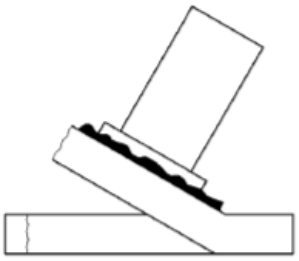
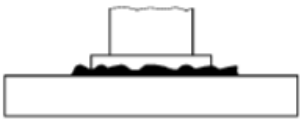
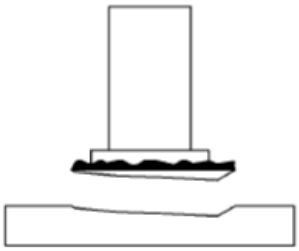
☞	Bend the studs by 30° when welding with capacitor discharge. With drawn arc welding using ceramic ferrules or shielding gas and with short-cycle drawn arc welding, bend the studs by 60°.



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.

8 Maintenance

8.1 Important instructions

The stud welder is constructed so that only a minimum of maintenance is required. It should, however, be cleaned by a specialist at regular intervals and depending on the environmental conditions at the location of use.

	**WARNING** The service personnel are required to meet special requirements. Our after-sales service has adequately trained personnel, suitable service equipment and the means to carry out all necessary works.

8.2 Important instructions for all service works

	**DANGER** Always disconnect the mains cable from the mains supply before starting any repair, maintenance or cleaning work. Always disconnect the connecting plug from the mains supply socket before opening the housing of the stud welding system. Only trained and appropriately qualified personnel are allowed to carry out works at the electric mains supply and welding system.

	**NOTE** Only use original SOYER ® spare parts.

8.3 Cleaning

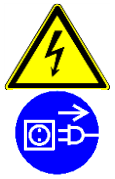
Cleaning works should be carried out occasionally depending on how soiled the stud welder is.

8.3.1 Detergents for cleaning the housing

Almost any 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.

8.4 Replacement of components

Components may only be replaced by trained SOYER personnel. The perfect function of your stud welder can only be guaranteed when original SOYER spare parts are used.

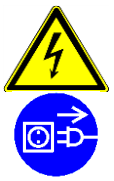
	**CAUTION** Disconnect the mains cable from the mains supply before replacing any components. Electric and electronic components may only be replaced by the SOYER ® customer service or by trained and appropriately qualified personnel.

	**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.

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

9 Troubleshooting

The following list of errors, their causes and remedies is designed to help you eliminate any trouble immediately on the spot. If you cannot eliminate the trouble, please contact the SOYER customer service responsible for your area or Heinz Soyer Bolzenschweißtechnik GmbH.

	**DANGER** Before starting any repair, maintenance or cleaning works, always disconnect the mains cable from the socket.

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

9.1 Malfunctions

Error	Cause → Elimination
Stud welder cannot be switched on.	One or several phases have failed. → Check mains supply fuses.
No arc although welding system is ready for operation.	Stud is too loose in stud chuck. Press stud chuck together or tighten it.
System does not weld. No spark formation.	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 are damaged. → Connect cables and/or gas hose 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 or 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 chuck.
	Control of stud welder or welding gun is defective. → Contact SOYER customer service.
No shielding gas flow during welding process.	Gas cylinder is not or not properly connected to the welding equipment and/or valve or shut-off valve are not open. → Connect gas cylinder and/or open valve or shut-off valve.
	Time for gas flow duration is set to "0" → Set gas flow duration to the desired pre-flow time.
	Gas flow rate is set too low. → Set gas flow rate to 4-5 l/min by means of the regulating valve.
	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, even though LED "Stud on workpiece" lights up.	Height of lift is not correctly set. → Set height of lift in accordance with the operating instructions of your stud welding gun.
	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 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 specified value.
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 chuck until stop. → Insert stud into stud chuck until stop. Replace stud chuck, 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. → Readjust welding time and/or gas flow.
	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	Main current 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	Main current 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 chuck incorrectly set. → Set distance between stud chuck 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 the welding gun off 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 specified 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 ready" 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 while testing the lift. →Wait until the coil in the welding gun has cooled down.
Stud thread scorched.	Stud chuck worn → Replace stud chuck.

10 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 for easy transport and mobile use over short distances.

	**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.

	**NOTE** 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.

11 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 welding system and the quality of welded joints when non-Soyer welding studs are used.

12 List of standards and guidelines

• 2014/35/EU	Directive on Low Voltage
• 2014/30/EU	Directive on Electromagnetic Compatibility
• EN 60974–1	Arc welding equipment - welding current sources
• EN 60974–10	Arc welding equipment - EMC requirements
• DVS Information Sheet 0901	Arc stud welding of metallic materials
• 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
• EN 14555	Arc welding of metallic materials
• EN 13918	Studs and ceramic ferrules for arc welding
• DGUV Regulation 1	Principles of prevention
• 2006/42/EC	Machinery Directive
• EN 12100–1	Safety of machinery – Basic terminology, systems engineering
• EN 12100–2	Safety of machinery – Technical principles and specifications
• EN 60204–1	Electric equipment of machinery, general requirements

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