Spirit of Innovation

MIYACHI PECO

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Operating Instructions

ISQ20 K
ISQ20 MFC

Miyachi Europe GmbH
Lindberghstraße 1
D-82178 Puchheim

Versions : 2.19.03 and 3.19.03

Order number _____

Serial number _____

2.19 = ISQ20K 3.19 = ISQ-MFC	Versions	
Version	**Date**	**Basis of Revision**
x.16	2002-09	new
x.17	2003-03	Software upgrade
x.18	2003-09	Software upgrade
x.18a	2005-04	Miyachi-Peco
x19.01	2005-09	Low pass / EU format without safety device
X19.02	2006-01	Analogic connections amended
X19.03	2006-04	Declaration by the manufacturer

Table of Contents

1 General Information

 **Information**	**These operating instructions contain device specifications relating to the operation of the units produced by our company.** **Together with the supplementary instructions *"Resistance welding: Safety regulations and general references"*, they constitute unified documentation and form part of the scope of delivery.**

1.1 Declaration by the Manufacturer

Manufacturer	Miyachi Europe GmbH Lindberghstraße 1 82178 Puchheim Deutschland		
Description of the unit	Inverter unit ISQ20K-3	Inverter unit ISQ20K-6	Inverter unit ISQ20-MFC
	Hereby we declare that the designated units or components are intended to be assembled with other machines or units to constitute a machinery. It must not be put into service until the ready machinery or plant in which these parts were installed complies with the following relevant provisions. This confirmation becomes invalid if modifications are made to the units which have not been agreed upon with the manufacturer.		
Harmonized standards and technical specifications applied	European Machinery Directive 98/37/EC EN ISO 12100-1 EN IEC 60204-1		
Puchheim, 2006-04-12	 Roland Regler Quality mandatory		

1.2 Contact Addresses

Address

Miyachi Europe GmbH
Lindberghstraße 1
82178 Puchheim
Germany

Phone	: +49 (0) 89 / 83 94 03 0
Fax	: +49 (0) 89 / 83 94 03 10
Email	: info@miyachi-peco.de
Internet	: http://www.miyachi-peco.de

Inquiries

We require the following unit data for inquiries and spare part orders (see type designation plate):

- Type : ISQ20K or ISQ20 MFC
- Serial number : see type designation plate

Technical Service

Phone	: +49 (0) 89 / 83 94 03 41
Fax	: +49 (0) 89 / 83 94 03 68
E-Mail	: info@miyachi-peco.de

Spare Parts Service

Please state the following when ordering spare parts:

- Quantity
- Part number

Exact information facilitates spare part ordering easier and prevents wrong deliveries.

1.3 Device-Specific Indications for Operation

These **device-specific operating instructions** should help you familiarize yourself with the unit and take advantage of its application possibilities when used as directed.

The Operating Instructions contain important notes to help operate the unit safely, properly, and economically.

Observing the notes will help avoid risks, decrease repair costs and down times, and enhance reliability and the service life of the unit.

1.4 Definition of Symbols

The following designations or symbols are used for especially important information in the operating instructions:

 **Danger**	This symbol indicates an **imminent danger**. Failure to heed these instructions will lead to irreversible or even life-threatening injuries, grave adverse effects on health or considerable material damage.
 **Warning**	This symbol indicates a **potentially imminent** danger. Failure to heed these instructions can lead to irreversible or even life-threatening injuries, grave adverse effects on health or considerable material damage.
 **Warning**	This symbol **warns of hazards emanating from electrical voltage**. Failure to heed these instructions can lead to grave, irreversible or even life-threatening injuries caused by electric shocks.
 **Caution**	This symbol indicates a **potentially harmful** situation. Failure to heed these instructions can lead to product damage or damage to objects in its near vicinity.
 **Information**	This symbol indicates **operator tips** and other useful information for optimum utilization of the machine.

2 Technical Description

2.1 Design and Function

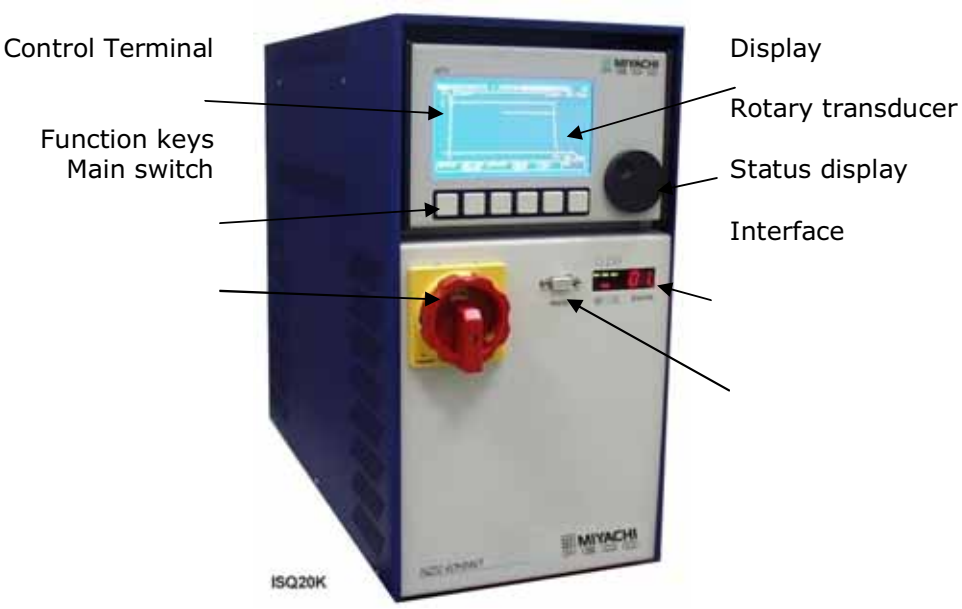


Fig. 1: Front view ISQ20K

The **ISQ20-Kompakt** and **ISQ20-MFC** inverter power sources are distinguished by their MFT operator terminal with the large graphic display (240x128 pixel), a rotary transducer and only six function keys.

A few important functions should be mentioned at this stage.

- APC (Active Part Conditioner)
- Pre-weld check
- Setting of pre-warning and limit values
- Error control as well as process monitoring

The logical menu facilitates setting of all functions which ensure that welding results of the highest level of quality are achieved.

The control mode for each welding pulse can be pre-selected in each of the 99 programs of the ISQ20 inverter power source.

The ISQ20 series is distinguished by extremely rapid control response. Its multiple connection options and external actuation make this inverter series ideal for automation.

2.2 Unit Versions

The welding power sources are supplied in two version.

ISQ20-Kompakt as a compact unit in a housing:
ISQ20-3K for 3 kA
ISQ20-6K for 6 kA

The compact unit is a complete weld control, who contains the infeed, the power and control electronics, along with the transformer rectifier block, the removable control terminal MFT1 and the signal interfaces to the primary system.

ISQ20-MFC as a 19"-plug-in unit.

The 19"unit is only used to actuate an external inverter main stage with rectifier welding transformers.
Operation is the same as with the ISQ20-Kompakt.
The MFT2 operation terminal is located in a separate housing.
Connection and performance data are governed by the operating manual for the connected main stage.

2.3 Technical Data

2.3.1 ISQ20 Kompakt

	400 VAC	Option: 230 VAC
Mains connection:	3x 400 VAC, ±10%, PE	3x 230 VAC,±10%, PE
Mains frequency:	50...60Hz	
Connecting cable:	3x 2,5 mm² + PE	3x 4 mm² + PE
Connected load:	11 kVA	
Fuse protection:	3x 16A, time-lag	3x 32A, time-lag
Dimensions: (LxWxH):	480 x 215 x 420 mm 550 x 215 x 420 mm^3 (including projections)	
Protection type:	IP 30	
Moisture:	40 – 70 %, not condensed	
Ambient temperature:	0..40°C	
Cooling:	Forced ventilation, temperature-regulated	
Secondary connections:	Cu-rails, 2 x M8 holes Negative connection connected to the PE	
Current measurement:	integrated toroidal coil (Rogowski coil)	
Voltage acquisition:	Potential-free, external connection (X9)	
Operation:	Removable terminal, illuminated, 240 x 128 Pixel, 6 keys + I-potentiometer	

2.3.1.1 ISQ20-3K

Rated output current:	2 kA	at	11% ED		measured for Tu = 20°C
Max. output current:	3 kA	at	5% ED		
Min. terminal voltage:	4 V	at	3 kA		with 400 V rated mains voltage at the unit input
Max. idling voltage:	10 V				
Max. output power:	12 kW				
Switching frequency	20 kHz				
Output frequency:	40 kHz				
Weight:	approx. 33kg				

2.3.1.2 ISQ20-6K

Rated output current:	3 kA	at	20% ED		measured for Tu = 20°C
Max. output current:	6 kA	at	5% ED		
Min. terminal voltage:	4 V	at	6 kA		with 400 V rated mains voltage at the unit input
Max. idling voltage:	10 V				
Max. output power:	24 kW				
Switching frequency	14 kHz				
Output frequency:	28 kHz				
Weight	approx. 43kg				

2.3.2 ISQ20 MFC

Mains connection:	230 VAC +PE (L_1 + N +PE)
Mains frequency:	50...60Hz
Connecting:	Non-heating 3 pole connector
Connected load:	Depending on output level
Fuse protection:	Depending on output level
Dimensions (LxWxH):	482 x 174 x 315 (L x H x D; 4HE 19“)
Protection type:	Depending on housing
Moisture:	40 – 70 %, not condensed
Ambient temperature:	0..40°C
Current measurement:	Rogowski coil
Voltage acquisition:	Potential-free, external connection (X9)
Operation:	Terminal, illuminated, 240 x 128 Pixel, 6 keys + I-Potentiometer

2.4 Miscellaneous

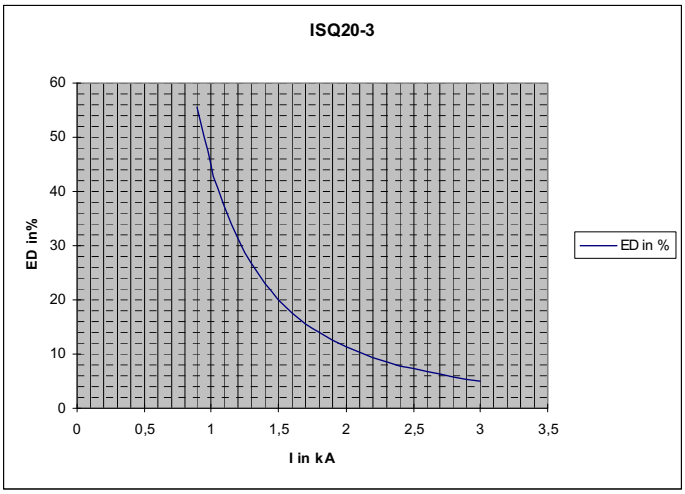
The equivalent continuous noise level of this plant evaluated as **A** lies below **70 dB**.

For lack of clearness, especially in case of missing detailed information regarding the welding product, the necessary clarification should be brought to a competent representative of our factory. In this case, specify the type of unit, serial number and order number.

2.5 Maximum Possible Activation Duration

2.5.1 ISQ20K

Duty ratio (d.r.) relative to the set welding current:



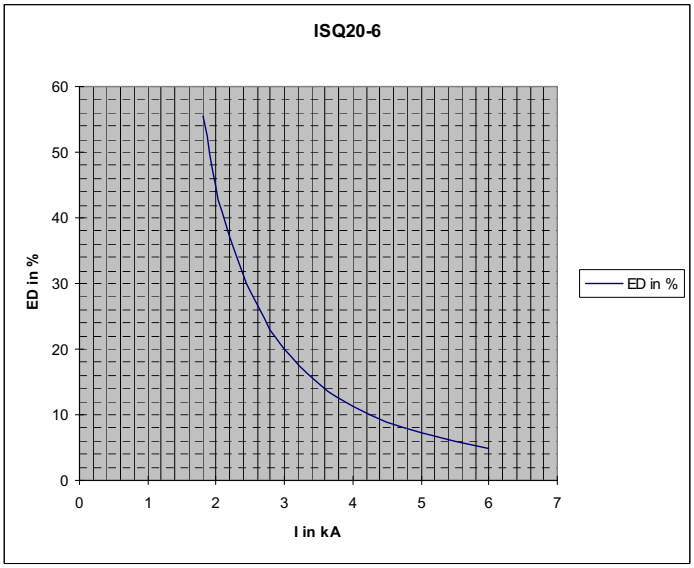


Fig. 2: Maximum duty ratio

2.5.2 ISQ20 MFC

See operating instructions for connected electrical power source

2.6 Overview of all Setting Options

This is an overview of all unit setting options described in these operating instructions.

Name	Sort	Addition
Closed-loop control modes:	• Current closed-loop control • Voltage closed-loop control • Power closed-loop control	
Monitoring:	• Curve display • Measuring modes • Out of Limits • APC • Pre-Weld Check • Weld Limit • Weld to Limit	 Current, voltage, power, energy Upper and lower limit values Active part control Conductivity prior to welding Welding limit Welding to limit value
Actual value monitor:	• Display on terminal	
Control mode for pneumatically-operated welding heads (with air):	• Closing stroke • Closing stroke with lower stroke cylinder • Closing stroke with welding pincers • Closing stroke with compacting unit • Proportional valve • Proportional valve with lower stroke cylinder • Proportional valve with welding pincers • Proportional valve with compacting unit • Adjustment cylinder • Adjustment cylinder with lower stroke cylinder • Adjustment cylinder with welding pincers • Adjustment cylinder with compacting unit • Adjustment cylinder with proportional valve • Adjustment cylinder with proportional valve with lower stroke cylinder • Adjustment cylinder with proportional valve with welding pincers • Adjustment cylinder with proportional valve with compacting unit without air	
Control modes:	• Single and twin head mode Changeover	Current and program changeover
Error diagnosis:	• Error message • Status code display on unit	Frequently additionally plain text on display
Closed-loop control sett.:	• I-, U- and P-closed-loop control	Kp and Ti can be set desperately
Data and program backup:	• pro PC-interface (X21: D-Sub-9 socket)	Uncrossed connection cable to PC [1:1]; adjustable Baud rate
Welding programs:	• internal 99 (1..99) external 99 (1..99)	BCD and binary
Closing time:	• 1 .. 9999 ms	Closing time + squeeze time are also **Adjustment time**
Squeeze time:	• 1 .. 9999 ms	
Adjustable up-slope:	• 0,3 ..309,9 ms	Total pulse duration 310 ms = **Current pulse 1**
Flat-Top current time:	• 0,1 .. 309,7 ms	
Down-slope:	• 0,1 .. 309,7 ms	
Off-time:	• 1 .. 9999 ms	
Current pulse 2:	• Setting options as for current pulse 1	

Name	Sort	Addition
Repeat time:	• 0 .. 9999 ms	Only for 3rd current pulse
Current pulse 3:	• as for current pulse 2	
Hold time:	• 1 .. 9999 ms	
Rest time:	• 1 .. 9999 ms	
Proportional valve:	• Closing pressure • welding pressure • Welding pressure with support cylinder	with pressure deviation control for adjustable pneumatic springs
Counter:	• Welding counter • Global welding counter • Action counter	1 .. 60000 Program sequences

3 Specifications for Operation Site

3.1 Operating Instructions

It is generally forbidden for persons with pacemakers to operate resistance welding machines.

A **strong magnetic field** is generated by the welding current pulse within the secondary circuit of the welding unit.

This causes magnetizable materials, placed close to the field, to be heated by the induced circulating current and loose parts to be attracted magnetically. Parallel running conductors are attracted by the equal flowing current and repelled by opposing current flow (e.g. lead and return circuit). This electrodynamic force is proportional the value $\mathbf{I^2}$ and inversely proportional to the distance **d** to the conductor.

Therefore, you should

- not use any magnetizable materials in the secondary area
- bundle the secondary conductors (e.g. with cable ties) and insulate them
- fix magnetizable workpieces within or close to the welding station by clamping or hold-down units
- take off your wristwatch

The **electrical losses** in the secondary circuit increase considerably in relation to these geometric variables (cable length x cable distance = secondary window).

Therefore, you should

- place the welding transformer as close as possible to the welding head
- bundle the welding cables (e.g. with cable ties) and insulate them

Shunt current outside of the welding zone (e.g. via the workpiece, the unit, or the work piece feeder) will reduce the effective welding current, may cause overheating or burning marks on the workpiece and may result in fluctuations in the weld quality.

Therefore,you should

- insulate the work piece fixture, welding tools, and work piece feeders from each other and from the weld head
- avoid possible shunt currents flowing over the protective ground for electrical machine parts and back over the ground for the welding equipment

The **welding station** must be safe in regard to electrical, mechanical, and other unhealthy dangers for the operator.

Therefore, you should

- shield moving machine parts with protective covers
- adjust the opening between the electrodes to the shortest possible distance (< 6 mm or closing speed < 30 mm/s)
- cover the welding zone, e.g. with a plexi-glass shield against weld splashing
- remove weld vapors by suction devices

The **workpieces** must be **positioned exactly** between the electrodes and fixed during the welding process.

Therefore, you should

- ensure that the highest degree of positioning accuracy is maintained so as to achieve reproducible results
- avoid displacement of the workpieces caused by transverse force components (inclined contact areas on the workpiece, oblique electrodes) by clamping the workpieces
- fix workpieces which tend to stick to the electrodes (coated metals, heating conductors, sinter metals and others), by fixing holding-down devices or strippers.

4 Putting Equipment into Operation

4.1 Electric Connection

The electrical connection must be done by a **qualified electrician**.

The connection must be done according the **connection diagram** as shown in the instruction manual (see chapter 14).

 **Warning**	**Note mains voltage!** First compare the existing **connection voltage** to the voltage stated on the type label of the equipment.

The **connection cable** is to be provided with the stated cross section. In case of long distance to the mains transformer, the cross section will eventually have to be increased to avoid a considerable drop of the mains voltage. As an approximate value, you can evaluate that at maximum short circuit current, the voltage drop on the whole voltage line should not be higher than 5 %.

In order to compensate for **mains feedback**, welding systems must be operated at the main transformer using their own power supplies. Sensitive units nearby should be protected using mains input filters.

Ensure that the units are adequately earthed. The unit housing should be included in safety measures. Use the earthing connection on the rear of the ISQ20-Kompakt for this purpose.

The mains voltage should also be compared with the nominal voltage on the type label when connected auxiliary voltage.

Connection cables on the circuit diagram should be studied carefully and traced before connecting cables for a **separate control system**. Terminal-phase connections of connection cables from the same mains should be given particular attention.

 **Warning**	Potentially **lethal high voltage** is present in the inverter during operation. The housing may only be opened after disconnecting the unit from the mains power supply and following a waiting period to allow the storage capacitors to discharge (approx. 3 min.). Only trained and instructed personnel may be entrusted with service work. **Any unauthorized modifications are prohibited.** The welding current source may only be used for its intended purpose.

Information	An intermediate power circuit of approx. 560V is created from the 3-phase 230/400 VAC / 50/60 Hz mains power supply in the inverter. The operating voltage is then generated via the full-bridge series-connected power electronics for the connected TGB. The operating voltage for the connected TGB is then generated via the series-connected power electronics in a full-bridge circuit. The TGB has midpoint power tapping which is then rectified. The creates double the switching frequency.

The unit is delivered without a mains plug, due to the varying requirements in different countries in which the unit is used. A suitable plug should be fitted or the unit should be connected to a terminal box.

Warning	The mains connection should be established via the main switch if the unit is part of a system. The red/yellow main switch on the unit should then be replaced with a black switch. Please contact our service department for further information.

Insulation test

We use power supply filters in our units to meet European EMC regulations. These filters have a discharge resistance to earth in each phase which is illustrated below. The resistance value is 1 MΩ in each case. This results in an effective resistance of 333 kΩ for a cumulative insulation resistance measurement (L1-L2-L3 to earth).

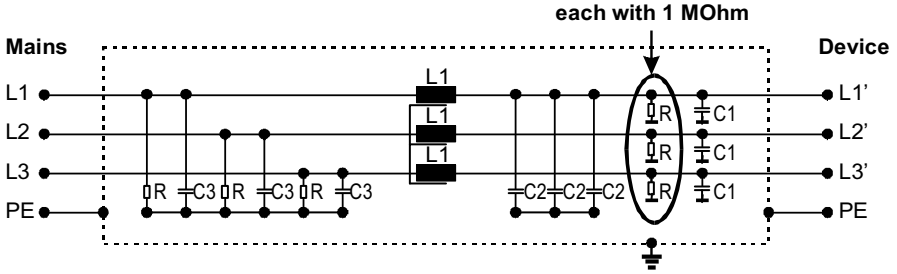


Fig. 3: Circuit structure for mains filters

We recommend disconnecting the "ISQ20-Kompakt" unit for measuring insulation resistances of a system, as this will enable an insulation test under even this technical restriction.

4.2 Preconditions for the Commissioning

- Individual units should be firmly and securely mounted on a table or a stand.
- Installation units should be firmly and securely mounted in a switch cabinet or on a table stand.
- Welding heads should be firmly and securely mounted on a table or a stand.
- Instructions on commissioning should be heeded.
- Ensure that all connections are correctly established.

4.2.1 Closure Processes

 **Warning**	The cylinders move to their home positions when the compressed air is switched on for the first time. Crushing hazard! Ensure that a safe distance is maintained to the welding head. Plant set-up should only be carried out by qualified personnel and **with extreme care**. We recommend that the key be **withdrawn** from the key switch after set-up and kept separately to ensure that processes are controlled or to prevent accessing by unauthorized persons (e.g. during serial production or shift operation). Bypassing of safety functions on systems (e.g. two-handed start or a light barrier) is mainly achieved in setup mode / two-handed mode by actuating the key switch (option). Internal control safety circuits are unaffected by this. Basic control functions can be protected with a code number determined by the installation technician.

4.3 Establishing the Secondary Cable Connection

Use secondary cable with 95-mm² cross-section and a length of at least 500 mm. Use M8 x 16 mm fixing screws.

- Connect a secondary cable to the (+) pole of the ISQ20 and the active electrode at the connection intended for this purpose behind the current band on the welding head
- Connect a secondary cable to the (-) pole of the ISQ20 and the lower electrode holder at the connection intended for this purpose

Fig. 4: ISQ20-K
Secondary cable connection

Caution	Please ensure the following to maintain as low a current resistance in the secondary circuit as possible: • The cable lugs should make contact with the mounted component over as great a surface area as possible • Secondary cables should be laid as closely as possible and bound with cable binders to maintain a limited secondary window • Secondary cables should not be contacted to other parts conducting current and should not form shunt circuits • Contact surfaces should be clean • Contact surfaces should not be corroded • Screw connections should not loosen during operation
Information	The attachment of a second (third) secondary cable to each pole increases the cable cross section, thus reducing the current resistance. The shorter the secondary cable, the lower the conducting loss. A considerable loss should be expected where cables longer than 1.5 m are used. Reversed pole connection can be advantageous, depending on the application involved. Voltage is created by the Peltier effect when welding materials which are widely disparate in the electrical voltage sequence. This voltage is added to the voltage of the welding power control (recommended) or acts against it, depending on the secondary cable pole configuration. A secondary cable pole configuration which suits your particular application should therefore always be selected.

4.4 Front Connections

4.4.1 Connector X21 Serial Connection RS232

The RS232 connector is located on the front of the ISQ20-Kompakt and the rear of the ISQ-MFC. It is used for transmitting data between the ISQ20 and a PC.
A **1:1 serial cable** with a Sub D9 socket and SUB D9 connector is required for transmitting data from the PC to the ISQ20k. See also section 8.5.

The cable can be obtained from us (no. **770.66 028**).

Data Transfer

Measuring results are output from the ISQ20 via the RS232 interface on completion of a welding cycle.

X21	*ISQ20 (socket on unit) – PC (connector on unit)*
	Function
2	TX
3	RX
5	GND

Caution	**Note the baud rate during transmission!**

Adjustable baud rates (bit/s)	2400 Bd, 38400 Bd,	9600 Bd, 115200 Bd
Data bits	8	
Start bits	1	
Stop bits	1	
Parity	none	

Software-Update

The program software can be loaded via an RS232 interface onto the ISQ20 using a PC (see also section 11).

4.4.2 Control Terminal Connection (X20)

All ISQ20 enable connection and disconnection of the MFT1 (at front) or MFT2 control terminal (at rear) at the X20 connection. Control terminals have a 2.5 m cable. Program changes can only be realized if the terminal is connected.

4.5 Rear Panel Connections

The signals described below are transmitted via the connectors at the rear

All inputs have a protected circuit conforming with **VDI 12880**.

Information	Only configurations available in the respective program version are described

Rear Panel of ISQ20-K

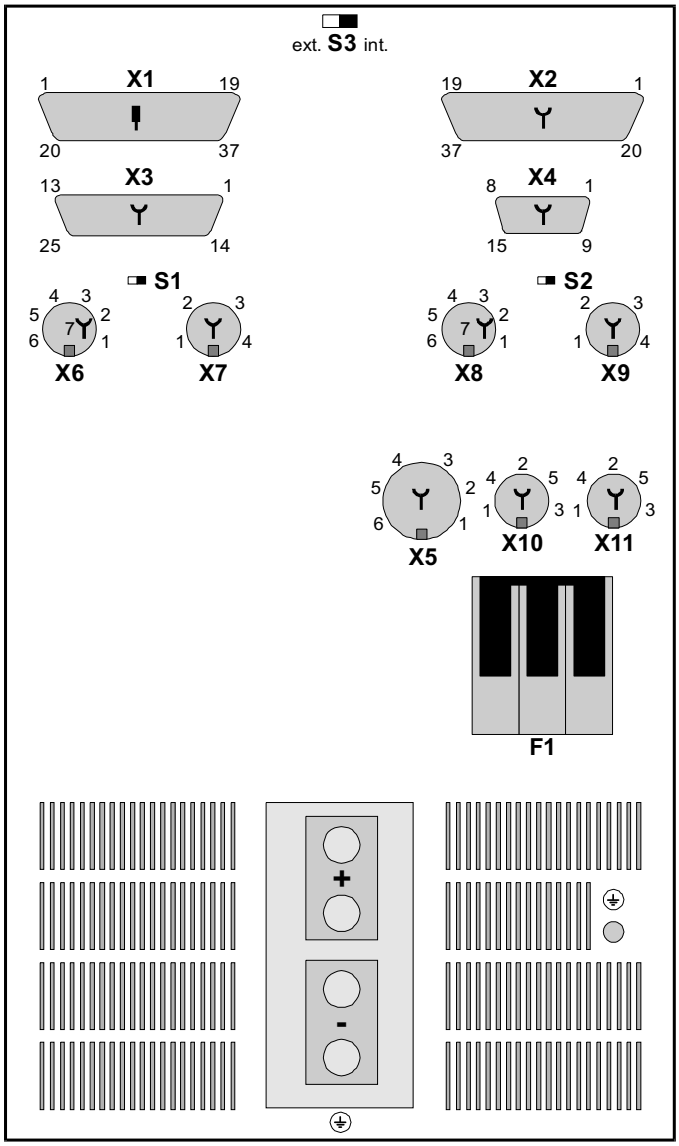


Fig. 5: Connections rear panel of ISQ20-K

Rear panel of ISQ20-MFC

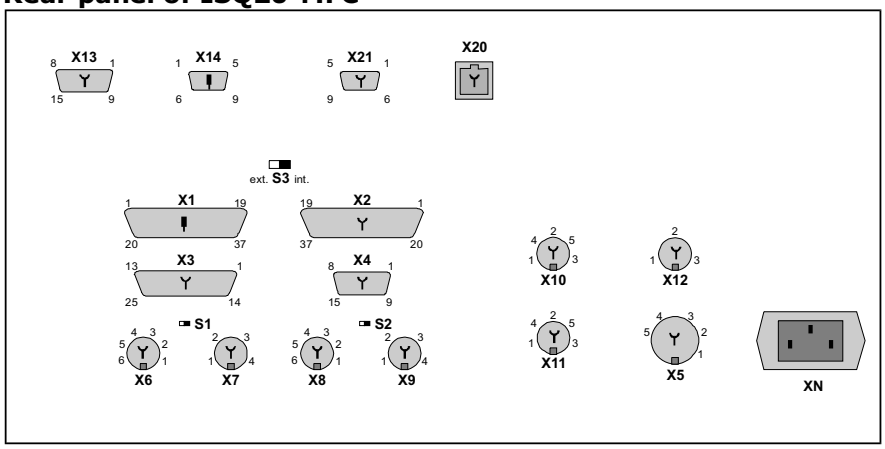


Fig. 6: Connections rear panel of ISQ20-MFC

4.5.1 Toggles S1, S2, S3

S1	Proportional valve changeover (see X6-X7 connectors)
S2	Proportional valve changeover (see X8-X9 connectors)
S3	**Internal**: all outputs are supplied internally with 24V DC (only for welding heads without PLC) **External**: outputs are supplied from a power supply (e.g. PLC).

4.5.2 Fuse F1 (ISQ20-K only)

The ISQ20-Kompakt is equipped with three safety fuses.

Version with **400 V** mains power supply:
3x 16AT 500V Dimensions: Ø 10 x 38 mm

Version with **230 V** mains power supply:
3x 32AT 400V Dimensions: Ø 10 x 38 mm

4.5.3 Connector X1

Binary inputs sequence control *D-Sub 37-pole pin*

The X1 and X2 connectors are provided for communication with other units (e.g. PLC, measuring units, etc.).

X1

Pin	Name		Description / Function		
1	**Without current**		Run without current(setup)		
2	**Counter Reset**		For all counters, with the exception of the action counter		
3	**Reset Out of Limits**		The Out of Limits error is deleted when the inputs are set.		
4	**Current break**		Breakdown of current-program if input is set The current program is interrupted if this input is set and a jump occurs to hold time and/or the end of the current program. Suitable for realizing variable pulse duration (e.g. depending on the penetration depth in the deposit).		
5	**Reset unit error**		Reset occurs at an open Start until the unit is ready after about 30 sec.		
6	**-**				
	The number of the desired welding program can be entered with pins 7 to 14. This includes **BCD 1** (pin 7) of **LSB** and **BCD 80** (pin 14) of **MSB**.				
	In			BCD-coded	Binary-coded
7	**BCD 1**	**BCD or Binary In max. 99 programs**	External program selection	Single digit 1	1
8	**BCD 2**		External program selection	Single digit 2	2
9	**BCD 4**		External program selection	Single digit 4	4
10	**BCD 8**		External program selection	Single digit 8	8
11	**BCD 10**		External program selection	Ten digits 1	16
12	**BCD 20**		External program selection	Ten digits 2	32
13	**BCD 40**		External program selection	Ten digits 4	64
14	**BCD 80**		External program selection	Ten digits 8	(128)
15	**Start 1**		The unit should be "**ready**" prior to setting the Start (i.e. the Quick Stop is set and the unit is in a menu in which welding is possible). A program must be selected in the case of **external** program selection (not program "0"). The cylinder sensors should be in the initial position for **sequential programs** (e. g. lower stroke cylinder, etc.). This input is used for automatic sequential run in **twin-head** mode (parallel with current changeover or consecutive sequence): Head 1 – [rest time after 0] – head 2) FK – end. See section 7.2.1. Setting this input starts the welding. See also connector X5.		
16	Start 2		Start signal for head 1 in twin head mode. See also connector X5.		
17	Start 3		Start signal for head 1 in twin head mode. See also connector X5.		

X1	Pin	Name	Description / Function
	18	**Ini 1** **Head 1 back (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with lower stroke cylinder or pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not back. See also connector X3.1.
	19	**Ini 2** **Head 2 back (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with two stroke cylinders or two pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not back. See also connector X3.4.
	20	**Ini 3** **Stroke cylinder 1 ahead (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with lower stroke cylinder. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not ahead. See also connector X3.7.
	21	**Ini 4** **Stroke cylinder 2 ahead (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with two lower stroke cylinders. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not ahead. See also connector X3.10.
	22	**Ini 5** **Stroke cylinder 1 back (bottom) or pincers 1 locked**	Initiator signal input. If the welding head is situated in initial position or the locking cylinder with welding pincers is in position, the pincers is locked, 24 V is present. Is always used with lower stroke cylinders or pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder (or with pincers)" or "Proportional valve with lower stroke cylinder (or with pincers)" the welding head is not back, if this input is not set at Start or after the rest time of the completed welding. See also connector X3.13.
	23	**Ini 6** **Stroke cylinder 2 back (bottom) or pincers 2 locked**	Initiator signal input. If the welding head is situated in initial position or the locking cylinder with welding pincers is in position, the pincers is locked, 24 V is present. Is always used with two lower stroke cylinders or two pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder (or with pincers)" or "Proportional valve with lower stroke cylinder (or with pincers)" the welding head is not back, if this input is not set at Start or after the rest time of the completed welding. See also connector X3.16.

X1 Pin	Name	Description / Function
24	**Pressure switch 1**	Initiator signal input or similar for welding head 1. If a pressure switch is connected it will signal that welding pressure has been achieved. An input inquiry occurs before the current time starts. If it is not set at this time, a rest time occurs until this is set. This function can be deactivated in basic settings menu if no pressure switch is provided or if this function is not required (see section 8.4.4). The unit immediately indicates "error" if the input changes during the welding time to "low" (error 61). See also connector X3.19.
25	**Pressure switch 2**	Initiator signal input or similar for welding head 2. If a 2nd pressure switch is connected it will signal that welding pressure in welding head 2 has been achieved. An input inquiry occurs before the current time starts. If it is not set at this time, a rest time occurs until this is set. This function can be deactivated in basic settings menu if no pressure switch is provided or if this function is not required (see section 8.4.4). The unit immediately indicates "error" if the input changes during the welding time to "low" (error 61). See also connector X3.22.
26	**Part detection ok head 1**	Limits for distance measurement ok, displacement measuring unit MG.., must be connected.
27	**Part detection ok head 2**	Limits for distance measurement ok, displacement measuring unit MG.. must be connected.
28	**External thermal switch**	Error 73: Activates in case of overtemperature
28	**Mains pressure air / water**	Error 74: The mains pressure monitor must output 24 V if there is a drop in pressure ("Low" active)
30	**Quick stop**	A welding program can only run if this input is set. The welding program is interrupted immediately by 0V ("Low" active Stop input, no STOP category 0 (i.e. only the valves are currentless)). The input is active in all operating modes.
31	**Actions counter reset**	The action counter is reset to the initial program of this sequence.
32	**-**	
33	**24V DC**	Output power supply, max. load: 1.5A, depending on switch position of S3 (see section 4.5.1).
34	**24V DC**	Output power supply, max. load: 1.5A, depending on switch position of S3 (see section 4.5.1).
35	**0V**	Reference ground binary inputs
36	**0V**	Reference ground binary inputs
37	**PE**	Protective earth

4.5.4 Connector X2

Binary outputs welding control *D-Sub 37-pole pin*

The X1 and X2 connectors are provided for communication with other units (e.g. PLC, measuring units, etc.).

X2 Pin	Name	Description / Function
1	**Ready**	Signals the unit's readiness for starting a welding. The return light (green) tells the operator if a welding operation can be started. The unit should be "ready" prior to setting the Start, i.e. the QUICK STOP is not released and the unit is in a menu in which welding is possible). A program must be selected in the case of external program selection (not program "0"). The cylinder proximity switch should be in the initial position for sequential programs (e. g. lower stroke cylinder, etc.). The cylinder sensors should be in the initial position for sequential programs (e. g. lower stroke cylinder, etc.).
2	**Locking 1 (only active with air program)**	Active during on-time and hold-time. This output is set during the welding program. The output is reset again after the current program and hold time end
3	**Stepping contact 1 (FK)**	Active after the end of hold time. In the case of the lower stroke cylinder or pincers when the head and the lower stroke cylinder and/or the pincers are in the initial position. The FK 10 ms remains active if the Start is broken (open) before the stepping contact (FK) actuates. If the Start input is still set, this output is only reset again in the case of a declining slope at the Start input. If the stepping contact (FK) is set at "forwards" during actual evaluation, the FK remains set until the deviation (out of limits) is evaluated (see section 8.4.5).
4	**Welding counter 1**	Welding counter terminated. This output is set after a welding operation if the specified number of welding operations is reached with this welding operation. This output is reset again at the start of the next welding operation and the internal counter begins to count upwards again to the specified number. See also section 11.4.3.2.
5	**Out of Limits Head 1**	The actual value is monitored for a deviation from the rated value. The actual welding value (depending on the current closed-loop control mode current /voltage / power) is checked for deviations from the rated value. This output is set if the deviation is greater than that specified by the maximum and minimum value (Limits and curves). See also section 11.3.1.
6	**Error messages**	For all unit errors #10 - #59
	Outputs for controlling the selected program or selection of another unit (e.g. motor head, weld sentry, changeover stage, etc.). **BCD 1** (pin 7) is the **LSB** here, and **BCD 80** (pin 14) the **MSB**.	

X2

Pin	Name		Description / Function		
	Out			BCD-coded	Binary-coded
7	**BCD 1**	**BCD or Binary Out max. 99 programs**	Program number	Single digit 1	1
8	**BCD 2**		Program number	Single digit 2	2
9	**BCD 4**		Program number	Single digit 4	4
10	**BCD 8**		Program number	Single digit 8	8
11	**BCD 10**		Program number	Ten digits 1	16
12	**BCD 20**		Program number	Ten digits 2	32
13	**BCD 40**		Program number	Ten digits 4	64
14	**BCD 80**		Program number	Ten digits 8	(128)
	Valve outputs 1 – 5 are actuated differently, depending on the control mode selected. The table in Chapter 5.6 illustrates the output function and the initiator for the respective sequence.				
15	**Valve 1**		+24V DC switched See also connector X4.1. Function depends on closed loop control mode, see section 4.6 and 7.2.		
16	**Valve 2**		+24V DC switched See also connector X4.4 Function depends on closed loop control mode, see section 4.6 and 7.2.		
17	**Valve 3**		+24V DC switched See also connector X4.7. Function depends on closed loop control mode, see section 4.6 and 7.2.		
18	**Valve 4**		+24V DC switched See also connector X4.10. Function depends on closed loop control mode, see section 4.6 and 7.2.		
19	**Valve 5**		+24V DC switched See also connector X4.13 Function depends on closed loop control mode, see section 4.6 and 7.2.		
20	**Welding time error pulse 1**		First welding pulse outside the set pulse time (see section 11.3.2).		
21	**Welding time error pulse 2**		Second welding pulse outside the set pulse time (see section 11.3.2).		
22	**Part detection evaluation distance 1**		Output before beginning of squeeze time until the end of the hold time For closed loop control mode with adjustment cylinder 50 ms before current 1st head.		
23	**Part detection evaluation distance 2**		Output before beginning of squeeze time until the end of the hold time For closed loop control mode with adjustment cylinder 50 ms before current 2nd head.		
24	**Penetration 1**		Signal for entire duration of current time 1st head		
25	**Penetration 2**		Signal for entire duration of current time 2nd head		
26	**Welding counter pre-warning value**		A signal occurs if the set figure is reached. See section 11.4.3.1.		
27	**Action counter end**		Reset to initial program (abort sequence). See section 11.4.3.4.		
28	**Out of Limits Head 2**		The actual value is monitored for a deviation from the rated value. The actual welding value (depending on the current closed-loop control mode current /voltage / power) is checked for deviations from the rated value. This output is set if the deviation is greater than that specified by the maximum and minimum value (Limits and curves). Contrary to X2.5, the output is only available as long as the stepping contact is active. It must be read out prior to breaking (opening) the Start. See also section 11.3.1.		

X2	Pin	Name	Description / Function
	29	**Out of Limits 1. pulse**	The actual value of the 1st welding pulse (depending on the current closed-loop control mode current / voltage / power) is checked for deviations from the rated value. This output is set if the deviation is greater than that specified by the maximum and minimum value.
	30	**Out of Limits 2. pulse**	The actual value of the 2nd welding pulse (depending on the current closed-loop control mode current / voltage / power) is checked for deviations from the rated value. This output is set if the deviation is greater than that specified by the maximum and minimum value.
	31	**24V internal**	Output power supply; depending on switch position of S3 (see section 4.5.1).
	32	**24V internal**	Output power supply; depending on switch position of S3 (see section 4.5.1).
	33	**24V external**	Input for external power supply;: switch position of S3 at ext. (see section 4.5.1).
	34	**24V external**	Input for external power supply; switch position of S3 at ext. (see section 4.5.1).
	35	**0V**	Reference ground
	36	**0V**	Reference ground
	37	**PE**	Protective earth

4.5.5 Connector X3

Binary inputs for initiators *D-Sub 25-pole pin*

The initiators (if needed) should be connected here.

X3	Pin	Name	Description / Function
	1	**Ini 1 Head 1 back (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with lower stroke cylinder or pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not back.
	2	**24V**	
	3	**0V**	
	4	**Ini 2 Head 2 back (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with two stroke cylinders or two pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not back.
	5	**24V**	
	6	**0V**	
	7	**Ini 3 Stroke cylinder 1 ahead (top)**	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with lower stroke cylinder. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not ahead.

X3	Pin	Name	Description / Function
	8	24V	
	9	0V	
	10	Ini 4 Stroke cylinder 2 ahead (top)	Initiator signal input. If the welding head is situated in initial position, 24 V is present. Is always used with two lower stroke cylinders. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder" or "Proportional valve with lower stroke cylinder" the welding head is not ahead.
	11	24V	
	12	0V	
	13	Ini 5 Stroke cylinder 1 back (bottom) or pincers 1 locked	Initiator signal input. If the welding head is situated in initial position or the locking cylinder with welding pincers is in position, the pincers is locked, 24 V is present. Is always used with two lower stroke cylinders or two pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder (or with pincers)" or "Proportional valve with lower stroke cylinder (or with pincers)" the welding head is not back, if this input is not set at Start or after the rest time of the completed welding. See also connector X3.16.
	14	24V	
	15	0V	
	16	Ini 6 Stroke cylinder 2 back (bottom) or pincers 2 locked	Initiator signal input. If the welding head is situated in initial position or the locking cylinder with welding pincers is in position, the pincers is locked, 24 V is present. Is always used with two lower stroke cylinders or two pincers. Error message: Using the welding programs with open loop control mode „ Closing stroke with lower stroke cylinder (or with pincers)" or "Proportional valve with lower stroke cylinder (or with pincers)" the welding head is not back, if this input is not set at Start or after the rest time of the completed welding. See also connector X3.16.
	17	24V	
	18	0V	
	19	Pressure switch 1	Initiator signal input or similar for welding head 1. If a pressure switch is connected it will signal that welding pressure has been achieved. An input inquiry occurs before the current time starts. If it is not set at this time, a rest time occurs until this is set. This function can be deactivated in basic settings menu if no pressure switch is provided or if this function is not required (see section 8.4.4). The unit immediately indicates "error" if the input changes during the welding time to "low" (error 61).
	20	24 V	
	21	0V	

X3	Pin	Name	Description / Function
	22	**Pressure switch 2**	Initiator signal input or similar for welding head 2. If a 2nd pressure switch is connected it will signal that welding pressure in welding head 2 has been achieved. An input inquiry occurs before the current time starts. If it is not set at this time, a rest time occurs until this is set. This function can be deactivated in basic settings menu if no pressure switch is provided or if this function is not required (see section 8.4.4). The unit immediately indicates "error" if the input changes during the welding Time to "low" (error 61).
	23	**24 V**	
	24	**0V**	
	25	**PE**	Protective earth

4.5.6 Connector X4

Binary outputs for solenoid valve *D-Sub 15-pole pin*

The pneumatic valves (if needed) should be connected here.

Valve outputs 1 – 5 are actuated differently, depending on the control mode selected. The table in Chapter 6.6 illustrates the output function and the initiator for the respective sequence.

X4	Pin	Name	Description / Function
	1	**Valve 1**	+24V DC switched See also connector X4.1. Function depends on closed loop control mode, see section 4.6 and 7.2.
	2	**0V**	
	3	**PE**	
	4	**Valve 2**	+24V DC switched See also connector X4.7. Function depends on closed loop control mode, see section 4.6 and 7.2.
	5	**0V**	
	6	**PE**	
	7	**Valve 3**	+24V DC switched See also connector X4.10. Function depends on closed loop control mode, see section 4.6 and 7.2.
	8	**0V**	
	9	**PE**	
	10	**Valve 4**	+24V DC switched See also connector X4.10. Function depends on closed loop control mode, see section 4.6 and 7.2.
	11	**0V**	
	12	**PE**	
	13	**Valve 5**	+24V switched The valve output can be chronologically programmed. See section 11.2.2. The valve comes after the first current pulse during current changeover and remains until the end of the hold time.
	14	**0V**	
	15	**PE**	

4.5.7 Connector X5

Binary inputs for the releasing — *Machine round connector 6 + PE socket*

The pedal switch, two-handed start (and other options) are connected here.

X5 Pin	Name	Description / Function
1	+24V	
2	Start 1	The unit should be "ready" prior to setting the Start (i.e. the Quick Stop is set and the unit is in a menu in which welding is possible). A program must be selected in the case of external program selection (not program "0"). The cylinder sensors should be in the home position for sequential programs (e. g. lower stroke cylinder, etc.). This input is used for automatic sequential run in 2 head mode (parallel with current changeover or consecutive sequence): Head 1 – [rest time after 0] – head 2) FK – end. See section 7.2.1. Setting this input starts the welding.
3	Start 2	Start signal for head 1 in twin head mode.
4	Start 3	Start signal for head 1 in twin head mode.
5	0V	
6	-	

4.5.8 Connector X6

Proportional Valve 1 — *Miniature circular socket 7 pole*

X6 Pin	Name	Description / Function
1	Actual value	From the pressure sensor on the welding head ("actual value") (0..10V) or from the proportional valve "actual value" (no pressure sensor). A bridge from X6.1 to X6.4 should be activated (rated value is linked to actual value) if this pin is not connected here or to X7.3. The little red slide switch (S19 between X6 and X7 must point in the direction of X6 if this input is used.
2	-	
3	0V Rated value	
4	0-10 V Rated value	Control voltage for proportional valve ("rated value") (0..10V) ≡ (0-10 bar)
5	0V	
6	+24V	Supply (24V / 1A) for proportional valve and pressure sensor
7	PE	

4.5.9 Connector X7

Pressure sensor for Proportional Valve 1 *Miniature circular socket 4 pole*

X7 Pin	Name	Description / Function
1	+24V	
2	0V	
3	Actual value 1	From the pressure sensor on the welding head ("actual value") (0..10V) or from the proportional valve "actual value" (no pressure sensor). A bridge from X6.1 to X6.4 should be activated (rated value is linked to actual value) if this pin is not connected here or to X6.1. The little red slide switch (S1) between X6 and X7 must point in the direction of X7 if this input is used.
4	PE	

4.5.10 Connector X8

Pressure sensor for Proportional Valve 2 *Miniature circular socket 7 pole*

X8 Pin	Name	Description / Function
1	Actual value 2	From the pressure sensor on the welding head ("actual value") (0..10V) or from the proportional valve "actual value" (no pressure sensor). A bridge from X8.1 to X8.4 should be activated (rated value is linked to actual value) if this pin is not connected here or to X9.3. The little red slide switch (S1) between X6 and X7 must point in the direction of X6 if this input is used.
2	-	
3	0V Rated value 2	
4	0-10 V Rated value 2	Control voltage for proportional valve ("rated value") (0..10V) ≡ (0-10 bar)
5	0V	
6	+24V	Supply (24V / 1A) for proportional valve and pressure sensor
7	PE	

4.5.11 Connector X9

Pressure sensor Proportional valve 2 *Miniature circular socket 4-pole*

X9 Pin	Name	Description / Function
1	+24V	
2	0V	
3	Actual value 2	From the pressure sensor on the welding head ("actual value") (0..10V) or from the proportional valve "actual value" (no pressure sensor). A bridge from X8.1 to X8.4 should be activated (rated value is linked to actual value) if this pin is not connected here or to X8.1. The little red slide switch (S1) between X6 and X7 must point in the direction of X7 if this input is used.
4	PE	

4.5.12 Connector X10, Connector X11

X 10 Voltage acquisition for head 1
X11 Voltage acquisition for head 2

Round connector 5 pole socket

X10 / X11

Pin	Name	Description / Function
1	free	The voltage monitor for head 1 should be connected to X10 and for a second welding head (head 2) to X11. The voltage **must** be recorded at the electrodes **near the weld** for operation of the inverter in "Voltage control" and "Output control" operating modes.
2	Uload 1 / 2 -	
3	free	
4	Uload 1 / 2 +	
5	free	

Fig. 7: (+) Connection (example)

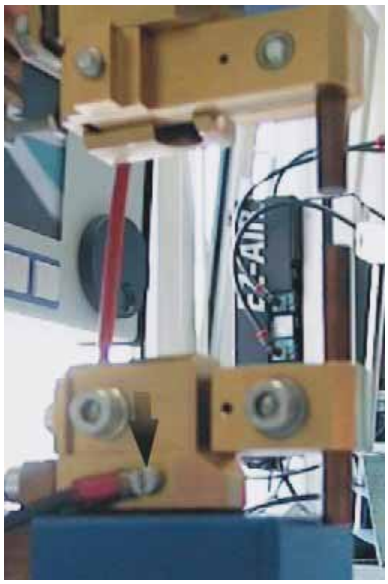


Fig. 8: (-) Connection (example)

Screw the red cable (+) to the electrode holder, which is connected with the (+) pole of the welding control (Fig. 7).

Screw the red cable (+) to the electrode holder, which is connected with the (+) pole of the welding control ().

Insert the 5-pole plug in the socket X10 or X11.

Information	Threaded holes can be drilled if none are provided on the electrode holder for fixing the voltage measuring cable. Ensure that the holes are drilled as close as possible to the electrodes without adversely affecting their stability! Not cooling ducts in the case of water-cooled electrode holders.

4.5.13 Connector X12 (ISQ20 MFC only)

Toroid Coil (Rogowski – Coil) *Miniature circular socket 3 pole*

A current measuring coil must be integrated in the secondary circuit for all inverters with external main stages
(Standard: Toroid ring coil ø 70 mm, no. 770.60 152).

X12

Pin	Name	Description / Function
1	+	
2	-	Shield
3		

Fig. 9:
Flap toroid coil (example) with (+) side marking

Fig. 10:
Ring toroid coil (example) with (+) side marking

Information

The direction of current and, consequently, the coil installation direction are important if the measured current is to be indicated correctly.

Ensure that the (+) side of the coil points in the direction of the (+) current source connection

Ensure that all secondary cables of **one** pole are surrounded (see Fig. 11).

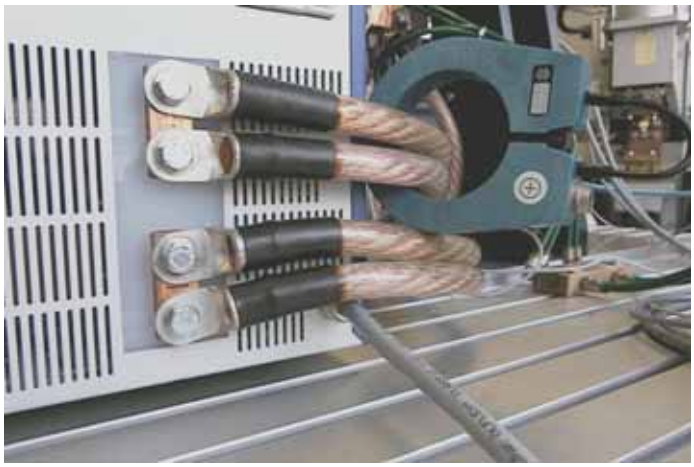


Fig. 11: Application example with an installed toroidal folding coil

- Install the flap toroidal folding coil or ring toroidal coil on the (+) line of the current source (Fig. 11). Ensure that the (+) side of the coil points in the direction of the (+) current source connection. Ensure that all secondary cable **one** poles are surrounded (Fig. 11).
- Connect the cable of current measurement to the coil.
- Insert the 3-pole plug in the socket on your power control or measuring instrument intended for this purpose.

4.5.14 Connector X13 (ISQ20 MFC only)

to the main stages *D-SUB 15 pole socket.*
(e. g. ISQ20 with TGB 4)

X13	Pin	Name	Description / Function
	1-6	-	
	7	Reset	
	8	-	
	9	Enable controller	
	10	0D ISQ20	0V
	11	24V PTC	
	12	0V	
	13	Ready	
	14	+PWMsoll	
	15	-PWMsoll	

4.5.15 Connector X14 (ISQ20 MFC only)

to the main stages (e.g. ISQ20 with TGB 4) — *D-SUB 9 pole socket*

X14 Pin	Name	Description / Function
1	RXD	
2	RXD	
3	TXD	
4	TXD	
5	0D	
6	0D	
7		
8		
9		

4.5.16 Connector XN (ISQ20 MFC only)

Power supply, inlet connector 3-pole

230 VAC (L_1 + N + PE)

4.6 Connection Possibilities Heads / Valves etc.

The most common connection types for different welding tasks are contained in the following tables.

Legend (alphabetical) of abbreviations in the following tables:	
0	Option, can be connected
KV ZU	Compacting unit closed
PV	Proportional valve
SLD	Closing pressure
SLH	Closing stroke
SWD	Welding pressure
SWZ	Welding pincers
SWZ ENT	Welding pincers, unlocked
SV	Safety valve
UHZ	Lower stroke cylinder
USV	Reversing valve
X	Always connect
ZSZ	Adjustment cylinder

The control modes which suit the connection configuration should be set in the program editor.

4.6.1 Connection with One Head and Start 1

Connection possibilities (Selection) with one head	Start 1 X5.2, X1.15	Start 2 X5.3, X1.16	Start 3 X5.4, X1.16	Valve 1 X2.15 X4.1	Valve 2 X2.16 X4.4	valve 3 X2.17 X4.7	Valve 4 X2.18 X4.10	Valve 5 X2.19 X4.13	Proportional-valve 1 X6 X7	Proportional-valve 2 X8 X9	Initiators: Head 1	Stroke 1 back	Stroke 1 ahead	Head 2	Stroke 2 back	Stroke 2 ahead	Pressure switch 1	Pressure switch 2	Stepping contact
Closing stroke	x			SLD	SWD		0	0											x
Closing stroke with lower stroke cylinder	x			SLD	SWD	UHZ	0	0			x	x	x						x
Closing stroke with welding pincers	x			SLD	SWD	SWZ ENT	0	0			x	x							x
Closing stroke with compacting device	x			SLD	SWD	KV ZU	0	0			x	x	x						x
																			x
																			x
Proportional valve	x			SV	0		0	0	SLD / SWD										x
Proportional valve with lower stroke cylinder	x			SV	0	UHZ	0	0	SLD / SWD		x	x	x						x
Proportional valve with welding pincers	x			SV	0	SWZ ENT	0	0	SLD / SWD		x	x							x
Proportional valve with compacting device	x			SV	0	KV ZU	0	0	SLD / SWD		x	x	x						x
																			x
																			x
Adjustment cylinder	x			ZSZ	0		0	0									x	0	x
Adjustment cylinder with lower stroke cylinder	x			ZSZ	0	UHZ	0	0			x	x	x				x	0	x
Adjustment cylinder with welding pincers	x			ZSZ	0	SWZ ENT	0	0			x	x					x	0	x
Adjustment cylinder with compacting device	x			ZSZ	0	KV ZU	0	0			x	x	x				x	0	x
																			x
																			x
Adjustment cylinder with Proportional valve	x			ZSZ	0		0	0	SWD								x	0	x
Adjustment cylinder with Prop. valve and lower stroke cyl.	x			ZSZ	0	UHZ	0	0	SWD		x	x	x				x	0	x
Adjustment cylinder with Prop. valve and welding pincers	x			ZSZ	0	SWZ ENT	0	0	SWD		x	x					x	0	x
Adjustment cylinder with Prop. valve and compacting device	x			ZSZ	0	KV ZU	0	0	SWD		x	x	x				x	0	x

4.6.2 Connection with Two Heads and Start 1, 2 or 3

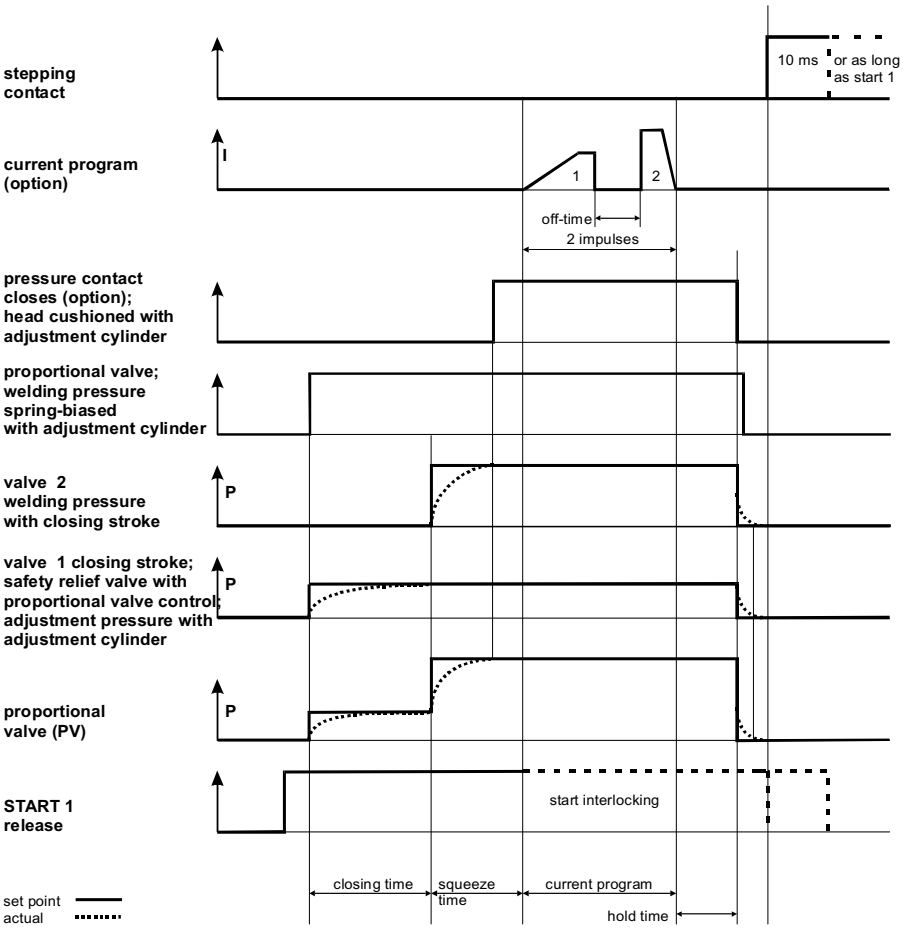
Connection possibilities (Selection) with two similar heads	Start 1 X5.2, X1.15	Start 2 X5.3, X1.16	Start 3 X5.4, X1.16	Valve 1 X2.15 X4.1	Valve 2 X2.16 X4.4	Valve 3 X2.17 X4.7	Valve 4 X2.18 X4.10	Valve 5 X2.19 X4.13	Proportional-valve 1 X6 X7	Proportional-valve 2 X8 X9	Initiators								
											Head 1	Stroke 1 back	Stroke 1 ahead	Head 2	Stroke 2 back	Stroke 2 ahead	Pressure switch 1	Pressure switch 2	Stepping contact
Closing stroke	x			SLD 1	SWD 1	SLD 2	SWD 2	(USV)											x
Closing stroke		x		SLD 1	SWD 1														x
Closing stroke			x			SLD 2	SWD 2	(USV)											x
Proportional valve	x			SV 1	0	SV 2		(USV)	SLD 1 / SWD 1	SLD 2 / SWD 2									x
Proportional valve		x		SV 1	0				SLD 1 / SWD 1										x
Proportional valve			x			SV 2		(USV)		SLD 2 / SWD 2									x
Adjustment cylinder	x			ZSZ 1	0	SZS 2		(USV)									x	x	x
Adjustment cylinder		x		ZSZ 1	0												x		x
Adjustment cylinder			x			SZS 2		(USV)										x	x
Adjustment cylinder with proportional valve	x			ZSZ 1	ZSZ 2			(USV)	SWD 1	SWD 2							x	x	x
Adjustment cylinder with proportional valve		x		ZSZ 1					SWD 1								x		x
Adjustment cylinder with proportional valve			x		ZSZ 2			(USV)		SWD 2								x	x
Proportional valve with lower stroke cylinder	x			SV 1	SV 2	UHZ 1	UHZ 2	(USV)	SLD 1 / SWD 1	SLD 2 / SWD 2	x	x	x	x	x	x			x
Proportional valve with lower stroke cylinder		x		SV 1		UHZ 1			SLD 1 / SWD 1		x	x	x						x
Proportional valve with lower stroke cylinder			x		SV 2		UHZ 2	(USV)		SLD 2 / SWD 2				x	x	x			x
Adjustment cylinder with lower stroke cylinder	x			ZSZ 1	ZSZ 2	UHZ 1	UHZ 2	(USV)			x	x	x	x	x	x			x
Adjustment cylinder with lower stroke cylinder		x		ZSZ 1		UHZ 1					x	x	x						x
Adjustment cylinder with lower stroke cylinder			x		ZSZ 2		UHZ 2	(USV)						x	x	x			x
Adjustment cylinder with prop. valve and lower stroke cyl.	x			ZSZ 1	ZSZ 2	UHZ 1	UHZ 2	(USV)	SWD 1	SWD 2	x	x	x	x	x	x			x
Adjustment cylinder with prop. valve and lower stroke cyl.		x		ZSZ 1		UHZ 1			SWD 1		x	x	x						x
Adjustment cylinder with prop. valve and lower stroke cyl.			x		ZSZ 2		UHZ 2	(USV)		SWD 2				x	x	x			x
Proportionalventil with welding pincers	x			SV 1	SV 2	SWZ 1 ENT	SWZ 2 ENT	(USV)	SLD 1 / SWD 1	SLD 2 / SWD 2	x	x		x	x				x
Proportionalventil with welding pincers		x		SV 1		SWZ 1 ENT			SLD 1 / SWD 1		x	x							x
Proportionalventil with welding pincers			x		SV 2		SWZ 2 ENT	(USV)		SLD 2 / SWD 2				x	x				x
Adjustment cylinder with welding pincers	x			ZSZ 1	ZSZ 2	SWZ 1 ENT	SWZ 2 ENT	(USV)			x	x		x	x				x
Adjustment cylinder with welding pincers		x		ZSZ 1	ZSZ 2	SWZ 1 ENT					x	x							x
Adjustment cylinder with welding pincers			x				SWZ 2 ENT	(USV)						x	x				x
Adjustment cylinder with prop. valve and welding pincers	x			ZSZ 1	ZSZ 2	SWZ 1 ENT	SWZ 2 ENT	(USV)	SWD 1	SWD 2	x	x		x	x				x
Adjustment cylinder with prop. valve and welding pincers		x		ZSZ 1	ZSZ 2	SWZ 1 ENT			SWD 1		x	x							x
Adjustment cylinder with prop. valve and welding pincers			x				SWZ 2 ENT	(USV)		SWD 2				x	x				x

4.7 Flow Diagrams

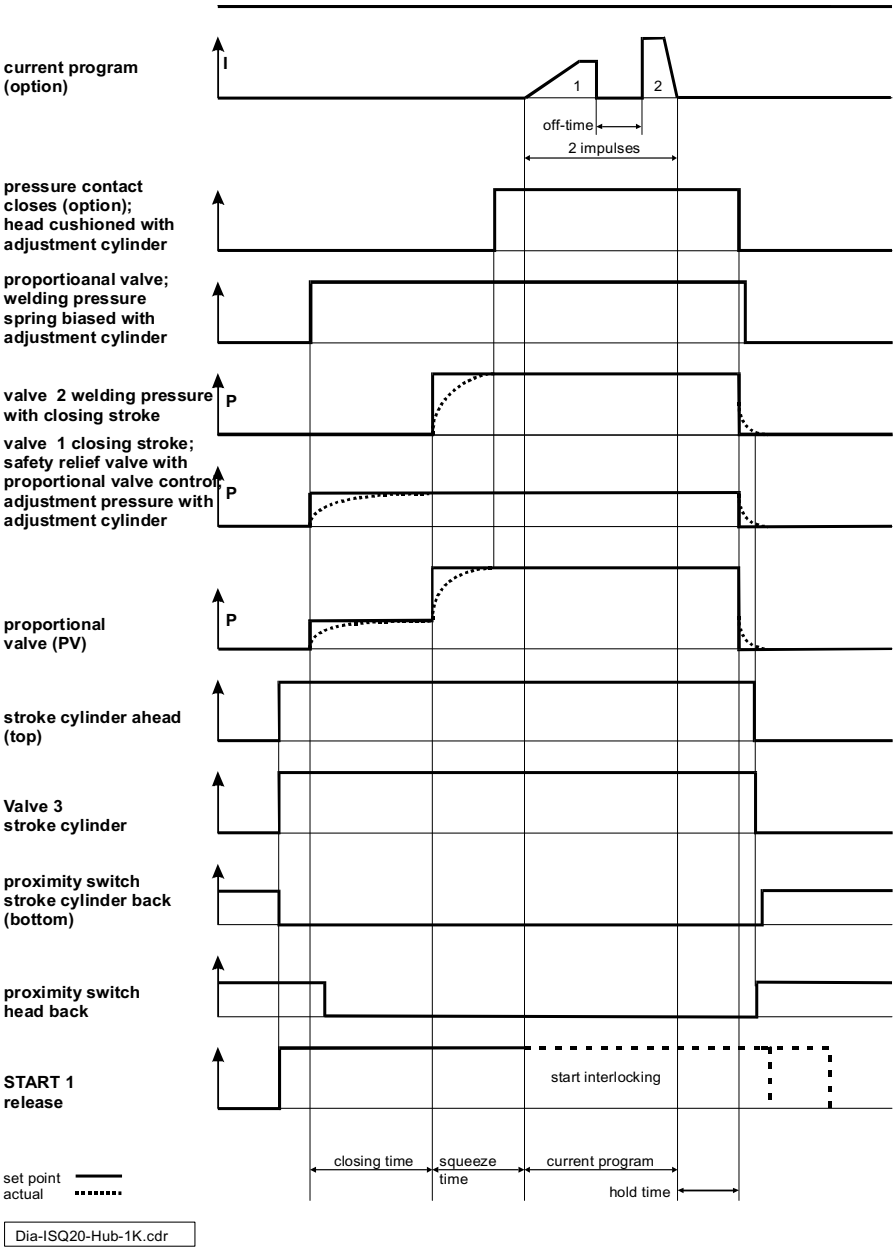
The chronological sequence of signals and functions is illustrated in the diagrams. The following diagrams are examples and cover a broad application range.

4.7.1 Diagrams for One Head

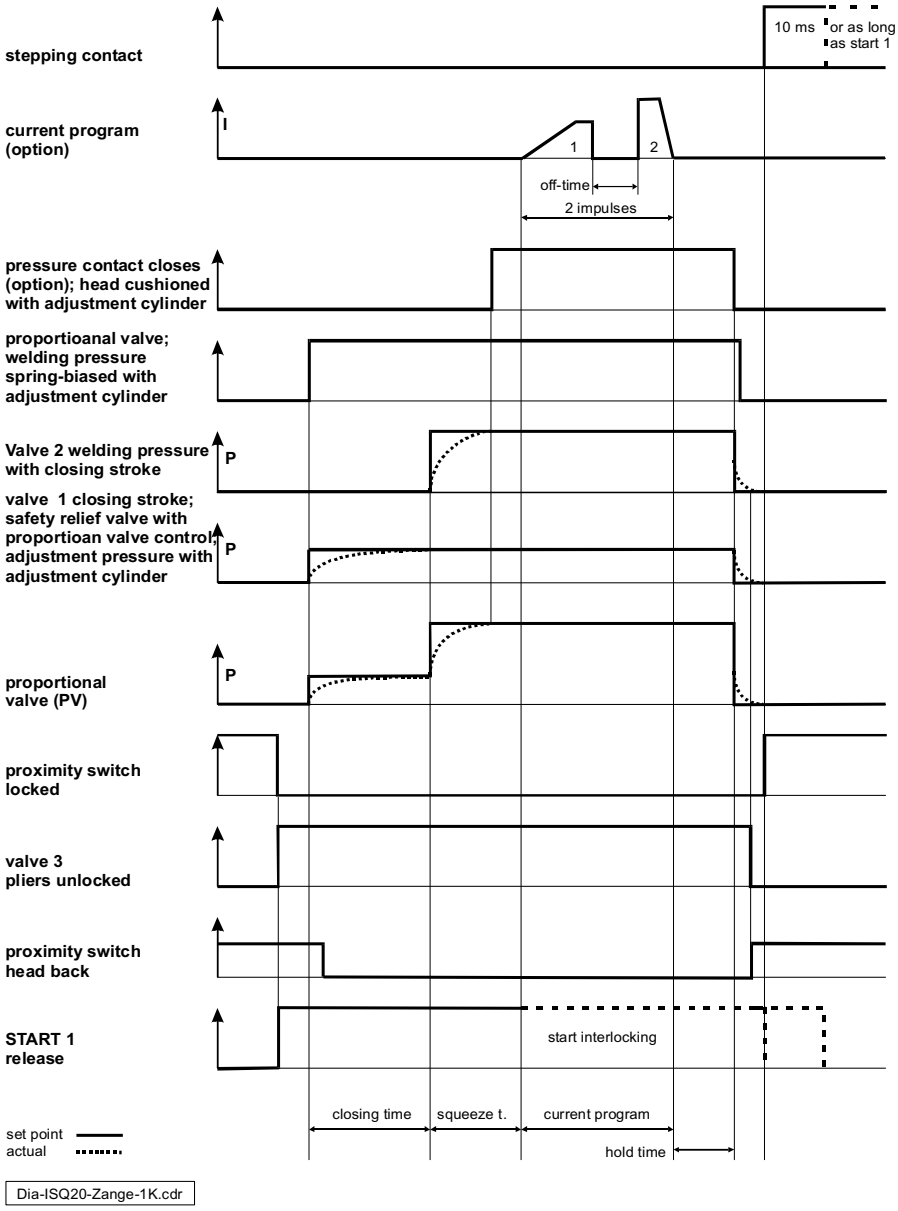
4.7.1.1 Standard Diagram with One Head



4.7.1.2 Diagram for One Head with Stroke Cylinder



4.7.1.3 Diagram for Pincers



4.7.2 Diagrams for Two Heads

On demand

5 Operation

5.1 Activation

For activation turn the main switch from „0" to „1".
The **converter** is first activated after switching on the unit.
The compact inverter is then in the initial state.
Status display 01 indicates that the unit is "Ready".

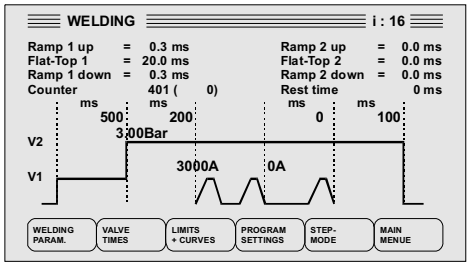
Information	The language requested by the customer is usually set on the display. The language can be changed in the basic settings.

The **Welding** menu first appears on the display with all important parameters of the currently-active program.

The number of the currently-active welding program appears in the upper right of the display (0..99).

Thereby stands

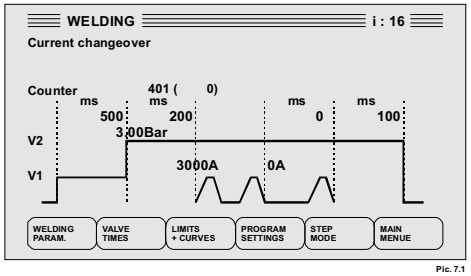
- **i**
  for internal program selection
  (e.g. i:16 = internal no. 16).
- **e**
  for external Program selection



Pic. 13.0

The six keys are used to access the respective sub-menus to enable rapid parameter adaptation in normal welding mode.

A slightly altered connection diagram appears; limited to the internal/external program numbers and the counter, if the program or current changeover is set (see section 7.2.4).



Pic. 7.1

5.2 Control Terminal MFT

The **control terminal**
MFT1 at ISQ20-K resp.
MFT2 at ISQ20-MFC
is used for entering varied welding parameters and setting the welding control.

ISQ20-K:
The control terminal can be loosened from its anchoring by raising it slightly.

It has a 2.5 m long cable which is connected from the front inside the housing recess (X20).

The terminal can remain in this position in the ISQ housing or positioned comfortably in the workplace.

The control terminal can be connected or disconnected when the supply voltage is activated. However, please note the following in this respect:

Caution	The compact inverter should be in the main or welding menu when plugging in or unplugging a control terminal!

No screen image will appear if a control terminal is reconnected which has accidentally **not** been disconnected in the main or welding menu. However, it is possible to return to the main menu again with the "ESC" key and then disconnect and reconnect the terminal again. A complete screen image then appears again.

5.2.1 Function Keys

The six keys below the display are always assigned the functions faded in above. The sub-menus can be accessed with these.

A key occupied with "**ESC**" (Escape) in many of the sub-menus. This can be used to exit the sub-menu.

The altered input is acknowledged with "**ENTER**".

5.2.2 Rotary Encoder

The rotary transducer is used for editing values or moving within a graphic display.

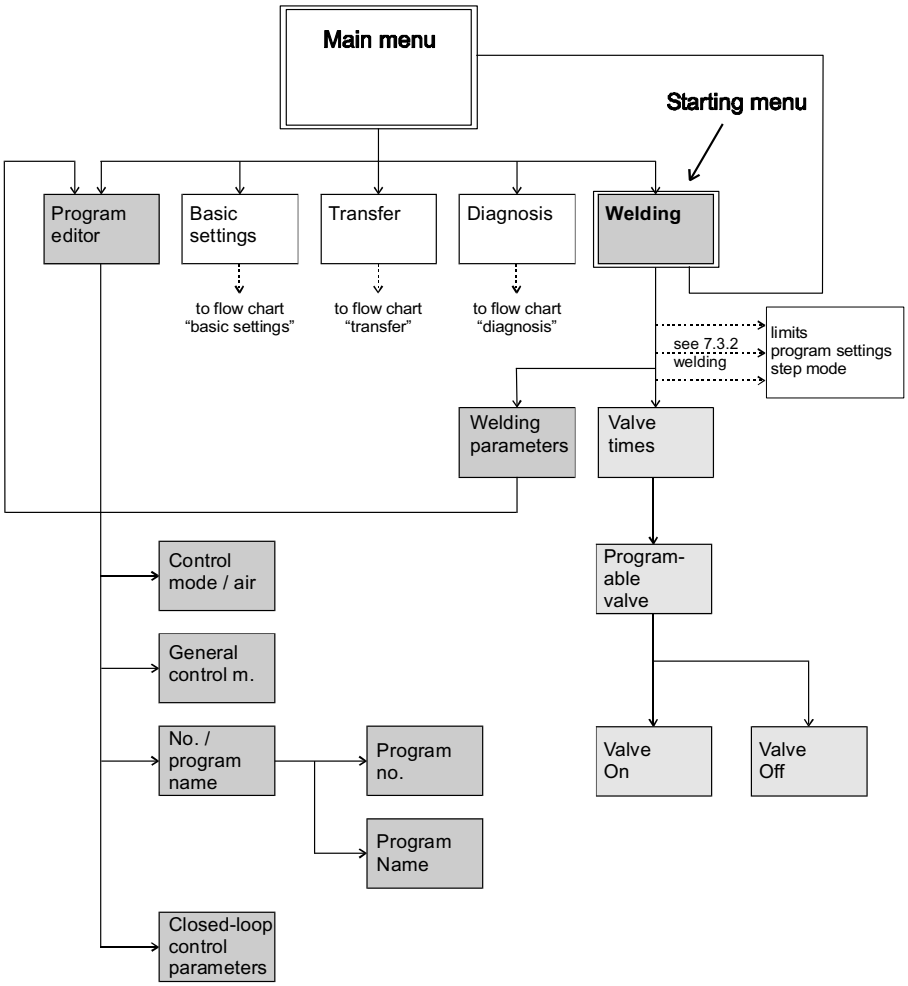
Individual parameters are seelcted with the [←] / [→] keys, and the desired value by turning the rotary transducer. The value underlined with white can always be edited. An explanation of the value underlined with white appears in plain text in the lowermost line.

5.3 Overview Menu Structure

On the following flow diagrams the menu structure is depicted. A table can be seen at the end of the menu with which one can rapidly access individual sub-menus from the "Welding" start menu using the **short-cut selection**.

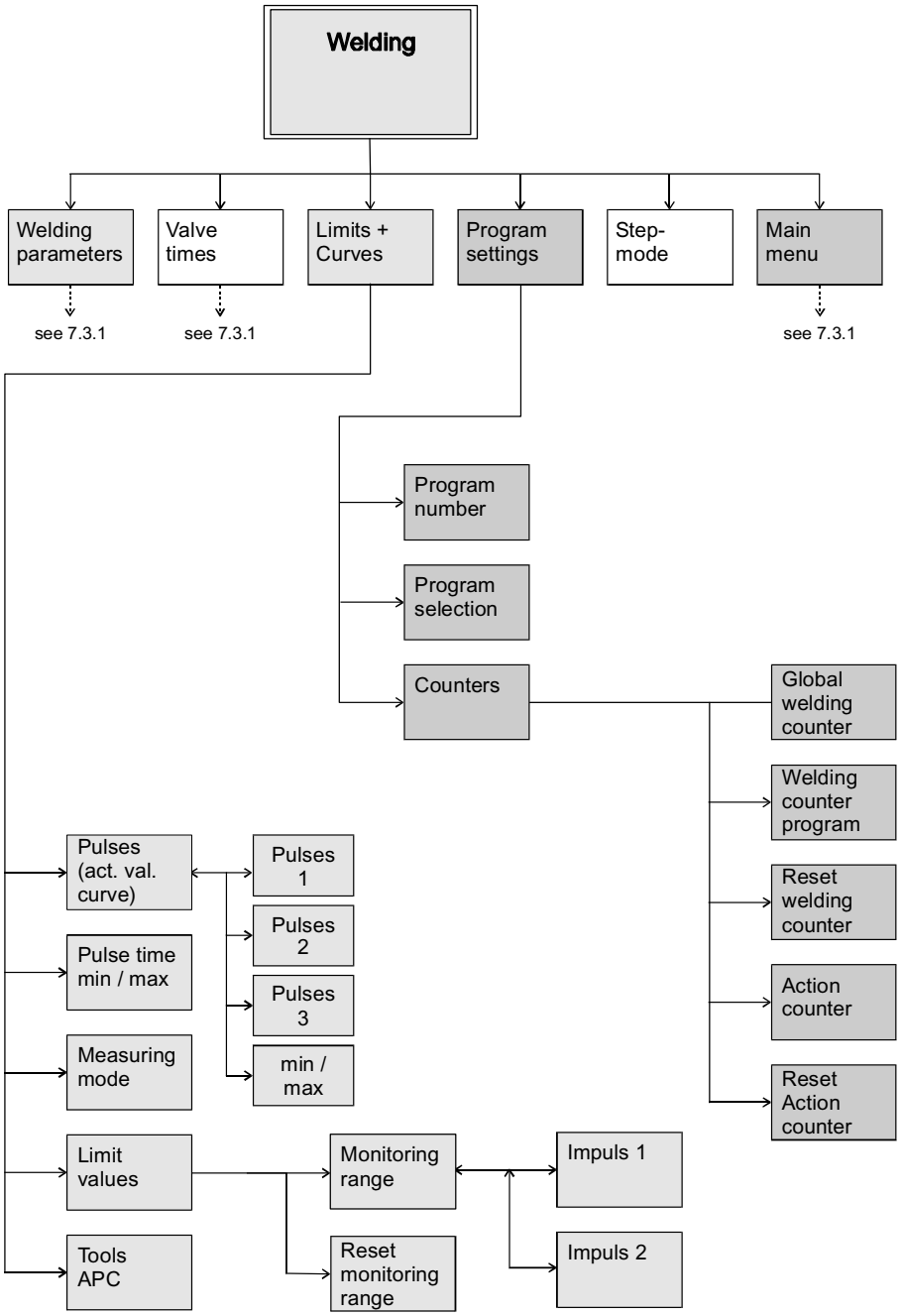
A list of all menus and connector configurations are contained in the Chapter **Index** in alphabetical order at the end of the operating instructions**.**

5.3.1 Welding Parameters Procedure



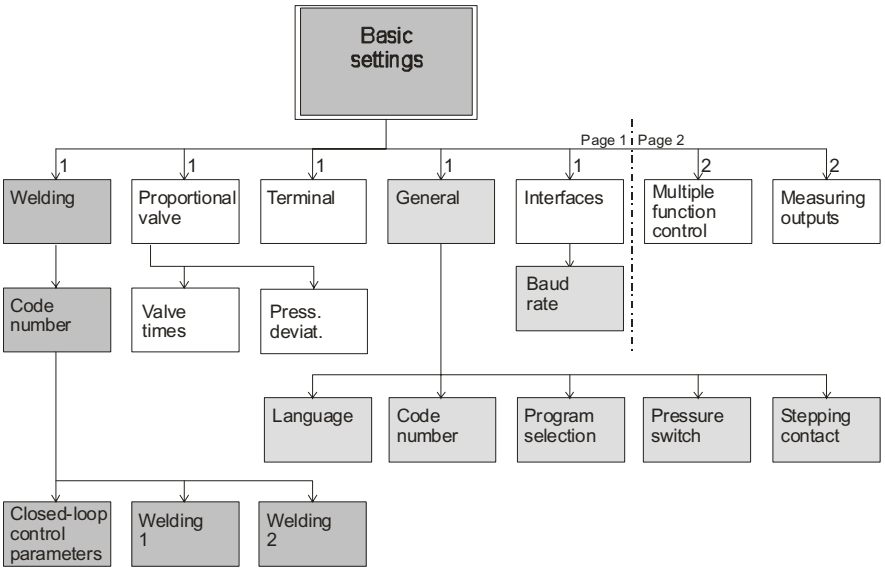
5.3.2 Welding Procedure

This is the Starting Menu which appears after closure.
Description see **chapter 11**.



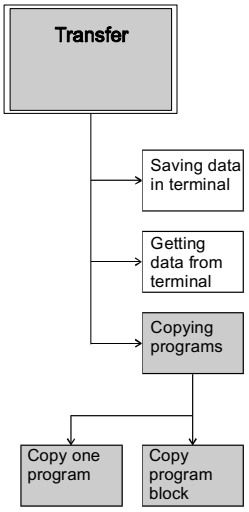
5.3.3 Basic Settings Procedure

Description see **chapter 8**.



5.3.4 Transfer Procedure

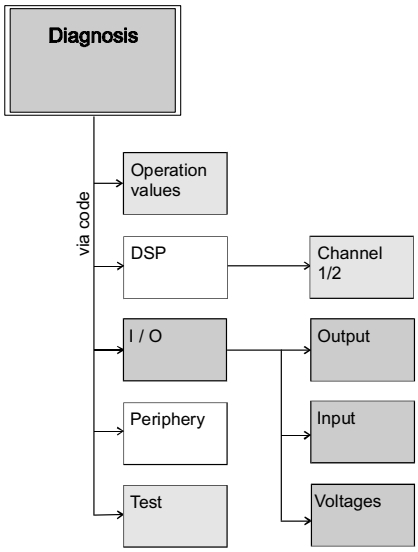
Description see **chapter 9**.



5.3.5 Diagnosis Procedure

Description see **chapter 10**.

Danger	**Relevant safety procedures** are **deactivated** in this menu! Changes should only be undertaken by **qualified personnel**!



5.4 Key Expressions

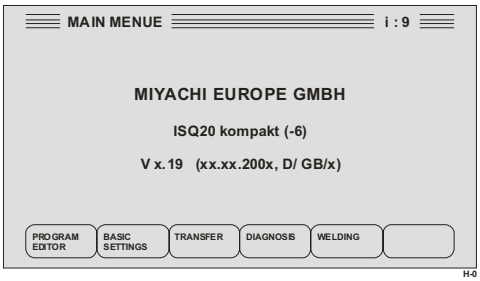
Rapid short-cut selection from the **Welding** start menu using the functions keys:

Key expression	Shortcut
Action counter	4-3-4
Action counter program runs	1-3-2-3
APC (Active part conditioner)	3-5-1
Basic settings	6-2
Baud rate	6-2-5
Change closed-loop control (program-independent)	6-2-1-1
Closed-loop control mode / Air valves	1-3-1
Closed-loop control mode / Air valves	1-3-1
Closed-loop control parameter (program-dependent)	1-3-4
Code number	6-2-4-2
Control mode	1-3-2
Control mode general	1-3-2
Copy one program	6-3-3-1
Copying a program block	6-3-3-2
Copying programs	6-6-3
Counter	4-3
Current changeover	1-3-2
Data saving	6-3
Data saving in terminal	6-3-1
Diagnosis	6-4
DSP (Digital-Signal-Processor)	6-4-2
General basic settings	6-2-4
Get data from terminal	6-3-2
Global welding counter	4-3-1
I/O	6-4-3
I/O input	6-4-3-2
I/O output	6-4-3-1
I/O voltages	6-4-3-3
Initial welding operations	6-5-1
Interface RS232	6-2-5
Language	6-2-4-1
Limit values	3-4
Limits + curves	3
Main menu	6
Measuring mode	3-3
Measuring outputs	6-2→3
Monitoring limits	3-4-3
Monitoring limits pulse 1/2	3-4-3-1/2
Multiple Function Control MFC	6-2→2

Key expression	Shortcut
Operating hours	6-4-1
Operating values	6-4-1
Peripheral units	6-4-4
Pressure deviation	6-2-2-2
Pressure switch	6-2-4-4
Program changeover	1-3-2
Program editor	1-3; 6-1
Program selection (program-independent)	6-2-4-3
Program selection int/ext. BCD/Bin.	4-2
Program name	1-3-3-2
Program number (Program editor)	1-3-3-1
Program number and name	1-3-3
Program settings	4
Programmable valve output	2-3
Programmable valve output OFF	2-3-2
Programmable valve output ON	2-3-1
Program number (welding)	4-1
Proportional valve	6-2-2
Pulse 1-3 / min/max	3-1-(1-4)
Pulse time min / max	3-2
Pulse time min / max Imp. 1-3 min/max	3-2-(1-4)
Pulses (actual value curve)	3-1
Reset action counter	4-3-5
Reset monitoring range	3-4-4
Reset welding counter program	4-3-3
Set welding parameters	1
Setting valve times	2
Step mode	5
Stepping contact	6-2-4-5
Terminal	6-2-3
Test	6-4-5
Tools	3-5
Transfer	6-3
Valve times (program-dependent)	6-2-2-1
Welding (program-dependent)	---
Welding 1 / Welding 2	6-2-1-2/3
Welding basic settings	6-2-1
Welding counter program	4-3-2

6 Main Menu

From starting menu „welding" you can enter the main menu with the right key.



The **main menu** indicates:

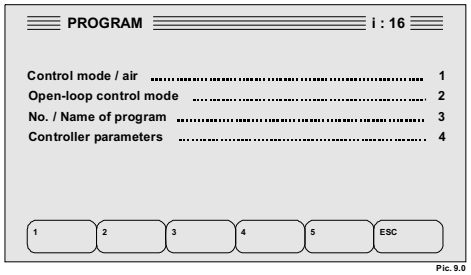
- type, e.g. ISQ20 kompakt (-6) with maximum 6 kA
- the Version number of the Software, e.g. V2.18
- the current **welding program**, e.g. i:9 (Internal Program No. 9)
- the **version date**, e.g. 10.09.2003
- the **languages** available in this version, e.g. **D** = German; **GB** = English; **x** stands for a third language option

All five sub-menus available in this version can be accessed from here (see also overview menu structure, section 5.3, described in the following chapters.

7 Program Editor

The program parameters for each program are set in the program editor (**program-dependent** data).

This sub-menu can be accessed from the main menu by pressing the [Program Editor] key. You can then access the sub-menus by pressing the keys [1] to [4].

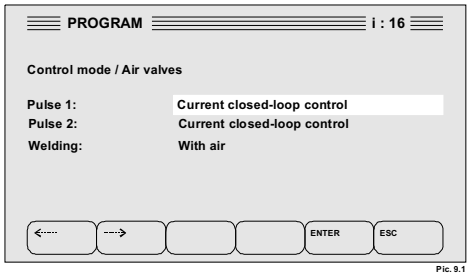


Pic. 9.0

7.1 Control Mode / Air Valves

This sub-menu can be accessed from the program editor under "Control mode / Air" by pressing the key [1] in this sub-menu.

You can also reach this menu if you select "Welding parameter" – "Control mode" from the "Welding" start menu.



Pic. 9.1

Pulse 1 / Pulse 2

Relates to the program displayed (i:16 here).

The closed-loop control for each current pulse can be set to

- Current closed-loop control [A]
- Voltage closed-loop control [V] (Voltage measuring lines necessary)
- Power closed-loop control [W] (Voltage measuring lines necessary)

The inverter tries to maintain the set values at a constant level.

Welding

- **With air**

Set "With air" if you are using pneumatically-actuated welding heads.

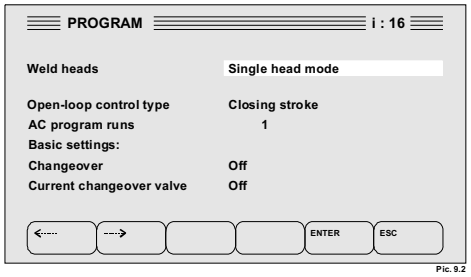
- **Without air**

The option "without air**"** is set for units where the welding head motion is to be set by an **external** unit
(see also "External electrode adjustment", section 12.3).

7.2 General Control Mode

This sub-menu can be accessed from the program editor under "Control mode" by pressing the key [2].

This menu can only be accessed by entering the **Code number**. (see section 8.4.2).



Pic. 9.2

7.2.1 Heads

Single head mode

Only the valves of one welding head can be actuated. The selected program or programs selected by the action counter are run.

Twin head mode (2 stations)

Closing of both stations: Consecutively or simultaneously;
head 1 and head 2 also weld consecutively or simultaneously.
Changeover for the 1st station to **Program increase x+50** occurs automatically if **no** action counter is activated.

Dual weld head

Both welding heads close simultaneously, an inquiry for both pressure switches (X3.19 and X3.22) is generated, and welding occurs subsequently.

7.2.2 Open-Loop Control Mode

Select **one** of the 16 combination options which suit your welding equipment.

- **Closing stroke** (for welding heads with closing and welding pressure, e.g. with air control VL40)
- **Closing stroke** with lower stroke cylinder
- **Closing stroke** with welding pincers
- **Closing stroke** with compacting unit
- **Proportional valve** (e.g. for welding heads FP190 with proportional valve control VL/PV)
- **Proportional valve** with lower stroke cylinder
- **Proportional valve** with welding pincers
- **Proportional valve** with compacting unit
- **Adjustment cylinder** (e.g. for welding heads F120 / F160 with scale housing)
- **Adjustment cylinder** with lower stroke cylinder
- **Adjustment cylinder** with welding pincers
- **Adjustment cylinder** with compacting unit
- **Adjustment cylinder with proportional valve** (z. B. for welding heads F120 / F160 with support cylinder)
- **Adjustment cylinder with proportional valve** with lower stroke cylinder
- **Adjustment cylinder with proportional valve** with welding pincers
- **Adjustment cylinder with proportional valve** with compacting unit

"**Without air**" is displayed if this is selected under "Control mode / Air valves" In item "Welding".

7.2.3 Action Counter (AZ) Program Runs

Setting of **Number of program runs** of the active program before changeover to the next program.

This setting depends on the program and should be defined here for each program.

The action counter itself is activated and set in the "**Welding"** – "**Program selection" – "Counter" – "Action counter"** menu (see section 11.4.3.4.).

7.2.4 Basic Setting Changeover

The program number is automatically increased by 50 **(x+50)** after the current of the first welding operation of the set program has ended when no action counter has been set. Valve 5 now applies the current circuit to the second head and welds after the specified time.

These apply to both the **program** and **current changeover**.

***Example**: set program 16 + 50 = 66 (i.e. the second welding operation is realized with program 66).

The display in the welding menu is limited to the counter.

7.2.4.1 Off

No automatic changeover takes place.

7.2.4.2 Program Changeover

Single head mode:

Any number of welding operations can be actuated consecutively. However, these must **always** run in the same sequence! Settings are realized in the action counter.

Twin head mode:

- **Procedure with Start 1:**
  Station 1 closes– Current 1 welds – Hold Time – Station 1 opens – Changeover of Program number -
  Station 2 closes – Current 2 welds – Hold Time – Station 2 opens – Stepping contact.
- **Welding with Start 2:**
  The 1st station is always triggered by the starting program
- **Welding with Start 3:**
  The 2nd station is always triggered by the starting program.

Information	Changeover occurs initially to the other head if the program number changes if a higher number of program sequences is set in the action counter.

- **Welding with Action counter:**
  as described above, except the action counter settings are undertaken in the program editor. All programs selected with the action counter are processed consecutively.
- **External program selection**:
  The selected program must be part of a program sequence. The Start occurs with the selected program number and not at the start of the sequence.

7.2.4.3 Current Changeover

Both stations close **simultaneously** or are already closed. Current is applied consecutively to the individual head. Current is applied consecutively to the individual heads with the aid of an external secondary changeover stage (e.g. 4GU, SSU6.1). The secondary current is thus transferred to station 2 after welding on station 1 is completed.

Single head mode:

e. g. triode welding (see ID welding), see section 14.2). The system switches to welding mode after the 1st welding operation (burning off insulation material). This can be realized mechanically or electronically.

Twin head mode:

- **Procedure with Start 1:**
  Stations 1 and 2 close - Station 1 welds – Changeover (Program and Station) – Station 2 closes – Stations 1 and 2 open – Stepping contact.
- **Welding with action counter:**
  as described above, except the action counter settings are undertaken in the program editor. The program changeover valve should be at ON during mechanical changeover.
- **Welding with Start 2**:
  The 1st station is always triggered by the starting program.
- **Welding with Start 3:**
  The 2nd station is always triggered by the starting program

Both valves can be changed to connection valve 1 to close welding heads simultaneously.

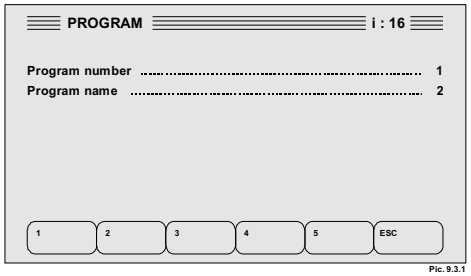
7.2.5 Basic Settings Current Changeover Valve

OFF and **mechanical 150 ms**

- An additional fixed programmed changeover time of 150 ms is specified when setting to "Mechanic 150 ms". This should always be activated if a mechanical secondary changeover is used.
- The secondary current circuit is transferred by the current changeover cylinder and valve 5. Valve 4 can also be utilized if the current changeover occurs between the 1st and 2nd pulse.

7.3 Program Number and Name

This sub-menu can be accessed from the program editor under "No. / Program name" by pressing the key [3].

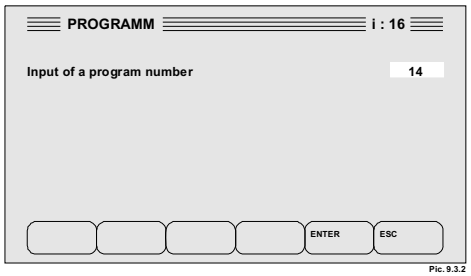


Pic. 9.3.1

Select [1].

The program number is set with the rotary transducer.

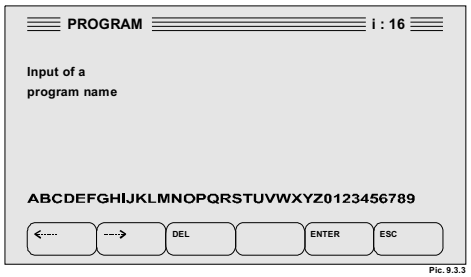
Press the [ENTER] key to transfer to the program.



Pic. 9.3.2

Select [2] to give the program a name.

The program name can have a maximum length of 9 characters and consist of a combination of letters and numbers.



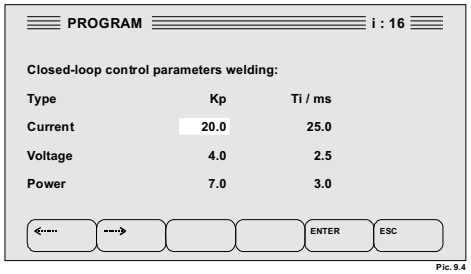
Pic. 9.3.3

Information	The program name is only displayed in the "Welding parameter curve". Names are easier to remember, even in combination with numbers. (e.g. part number, article code or Charge number).

7.4 Closed-Loop Control Parameters

This sub-menu can be accessed from the program editor under "Control parameter" by pressing the key [4].

This program is protected by a code number (see section 8.4.2).



Pic. 9.4

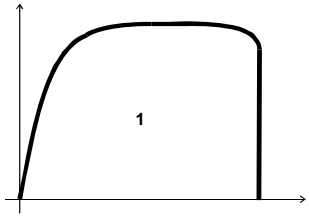
The closed-loop control parameters K_p and T_i for **Current**, **Voltage** and **Power** can here be changed.

The welding curve closed-loop control is a simple P-I controller. The associated **coupling factor Cp** (0,0...50.0) and the **integration site constants Ti** (0.1...100.0ms) can be set separately for the three different closed-loop controls. The closed-loop control must be protected against vibration.

These values depend on the length of the cable, the size of cable loops (window) and the resistance of the welding head and weld material. They can be optimized by conducting test welding operations.

Trimming instructions:

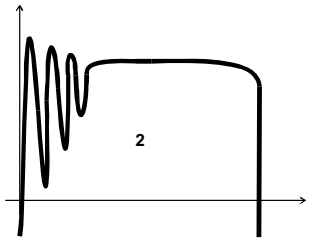
Set the closed-loop control Cp very low and the Ti very high (1)



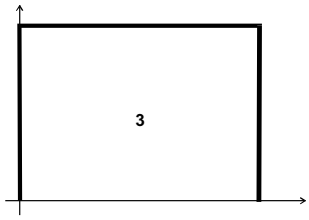
Now enlarge Cp until the curve overshoots at the start (2)

Turn back briefly until the curve smoothens

Reduce the Ti continually until the curve becomes uneven



Now turn back lightly again until it is smooth (3)



Examples:

Information	Typical setting values which are intended as guide values. Compare the inverter on the basis of the secondary circuit and insert utilized through trial welding operations.

For welding operations with an 3 kA inverter and an 6 kA inverter in the lower range:		
Type	Kp	Ti / ms
Current	10	5
Voltage	3	2
Power	5	3

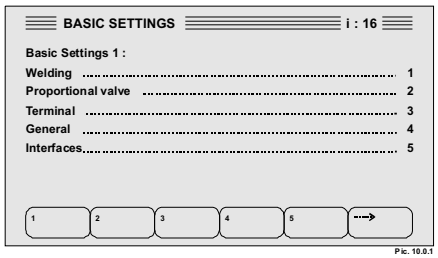
For welding operations with an 6 kA in the upper range:		
Type	Kp	Ti / ms
Current	20	20
Voltage	4	5
Power	7	3

8 Basic Settings

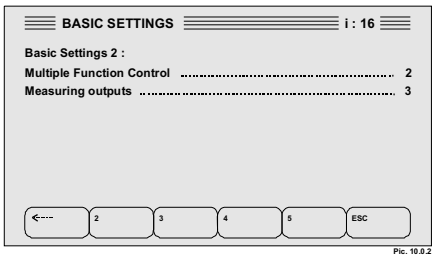
The „Basic settings" menu can be accessed from the main menu.

All **program-independent** parameters are stored in the "Basic setting" menu. These apply to all 99 welding programs and need only be adapted when adjusting the compact inverter to suit a new system.

The menu covers two pages. You can transfer from one to the other with [→] and [←].



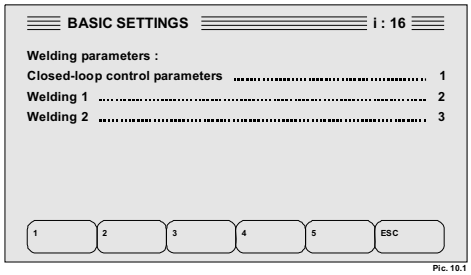
Pic. 10.0.1



Pic. 10.0.2

8.1 Setting of Welding Parameters

This sub-menu can be accessed from the basic settings under "Welding" by pressing the key [1].



Pic. 10.1

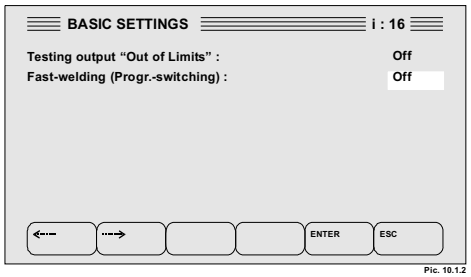
8.1.1 Changing Closed-Loop Control Parameters

This menu is protected by a code number (see section 8.4.2). Parameters can be edited after entering.

This menu is the same as that described in "Program editor" – "Closed-loop control parameters" and is described detailed in section 7.4.

8.1.2 Welding 1

Testpulse output „Out of Limits“:
If the test pulse is activated, **Out of Limits** (closed-loop control deviation beyond limit range) is set (**poor**) prior to each welding operation. The output is deleted if the subsequent weld is o.k. (**good**).



Pic. 10.1.2

Fast welding :
Activating the “Fast welding” function can help when welding quicker than the inverter needs to generate an image and for serial transmission (e.g. during program changeover with two welding heads in quick succession).

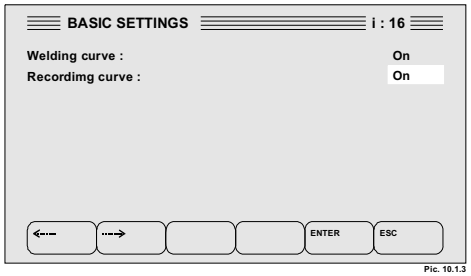
8.1.3 Welding 2

Welding curve OFF:

For quicker repetitive accuracy when welding, as serial transmission of the curve to the display is dispensed with.

Welding curve ON:
(Standard)

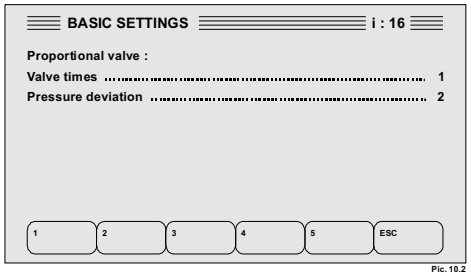
Before each welding a curve is recorded and is shown on the display for “limit values + curves”.



Pic. 10.1.3

8.2 Proportional Valve

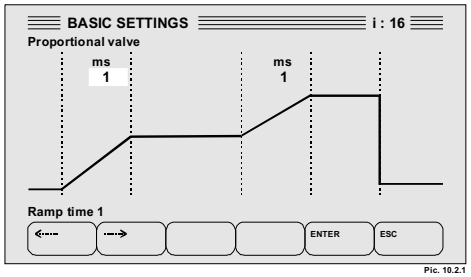
This sub-menu can be accessed from the basic settings under "Proportional valve" by pressing the key [2].



Pic. 10.2

8.2.1 Ramp Times

Ramp times 1 and 2 for a connected proportional valve can be entered here (1….1000ms).



Pic. 10.2.1

The speed or steepness with which the proportional valve delays its nominal value can be set here. One should always work with 1 ms in normal operating mode.

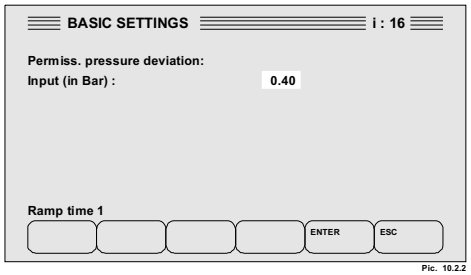
These program-independent times apply equally to all welding programs.

This function can be used to achieve a particular welding pressure at a particular time.

8.2.2 Pressure Deviation

Welding is not initiated or is interrupted if a pressure deviation occurs prior and during the welding operation which is greater than the specified value. The difference should **never** be set at **less than 0.4** if welding pressure > 1.
Reason: During resetting there is always an air influx relative to the surface of the piston.

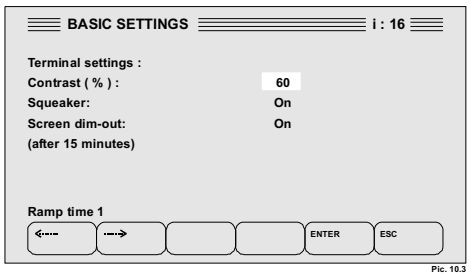
Even the rapid aeration valve can be under a constant pressure of up to 0.2 bar.



Pic. 10.2.2

8.3 Terminal

This sub-menu can be accessed from the basic settings under "Terminal" by pressing the key [3].



Pic. 10.3

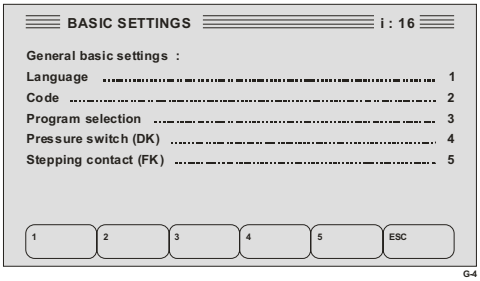
Contrast:
The contrast can be adapted by the operator to suit the prevailing lighting conditions.

Squeaker:
This signal activates as a warning if an incorrect or non-functioning key is pressed.

Screen dim-out:
The display lighting is switched off after 15 minutes and reactivates when a key is pressed again.

8.4 General Settings

This sub-menu can be accessed from the basic settings under "General" by pressing the key [4].



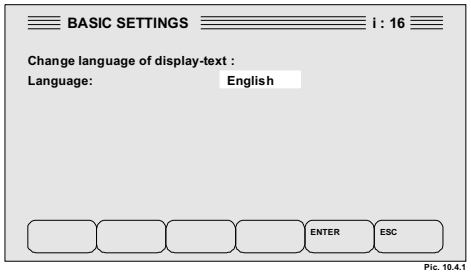
G-4

8.4.1 Language

Three different languages can be chosen on the display.

- German
- English
- *[Third language]*

Further languages on demand.



Pic. 10.4.1

8.4.2 Code Number

The input in the menus "diagnosis", "closed-loop controller parameters", „Open loop control mode general", „action counter" and "code number" itself is protected with a code number. This must be set with the rotary transducer and acknowledged with the [ENTER] key.

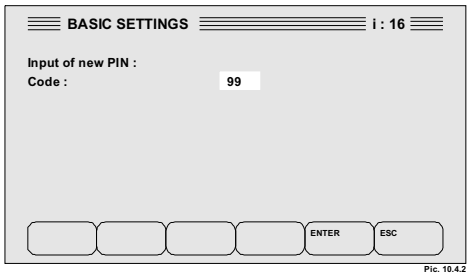
This occurs to protect the standard system adjustments. No changes are necessary in these menu items during active operation. This enables separation of the set-up and normal operating modes.

Information	The pre-set **code number** is **0**.

Code no. can be edited after entering.

The code number can be set in the range 0…99.

Confirm the change with [ENTER].

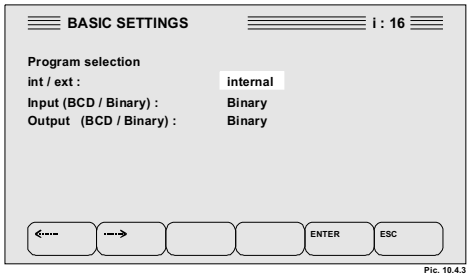


Pic. 10.4.2

8.4.3 Program Selection

You can choose between **internal** or **external** program selection. You can also access this menu via „Welding" – „Program settings" – „Program selection", see section 11.4.2.

- The welding program set in the program editor is active when the **internal** program selection is used. This is also output at the connectors X1 and X2:pin7..14



Pic. 10.4.3

- with **external** program selection the binary inputs on plug X1 (Pin 7..14) are read in and the program number is generated from these (BCD-coded).

The number of the welding program appears in the upper right-hand corner of the display (1..99). **I** stands for the internal program selection (e.g. i:16 = internal no. 16) and **e** for the external program selection.

Difference between BCD and binary coding

The lower (right) four bits (LSB) govern the unit position and the upper (left) four bits (MSB) the decimal position in BCD coding.

Example for different methods of writing the number 17:

BCD-Code: 2 x 4 bit

2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0
80	*40*	*20*	*10*	*8*	*4*	*2*	*1*
0	**0**	**0**	**1**	**0**	**1**	**1**	**1**
Ten digits				Single digits			

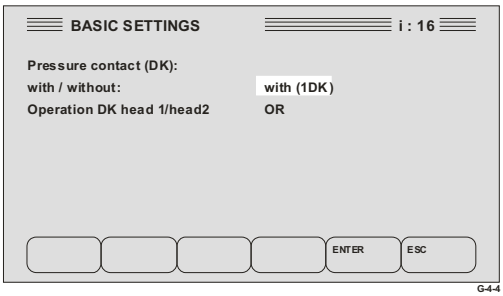
Binary-Code: 1 x 8 bit

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	*64*	*32*	*16*	*8*	*4*	*2*	*1*
0	**0**	**0**	**1**	**0**	**0**	**0**	**1**

8.4.4 Pressure Switch

You can set whether a pressure switch input inquiry should occur here (X3.19, X3.22).

- **without:**
  without DK inquiry
  (possible in the case of heads with external feed motion or a motor head, but not typical!)



Information

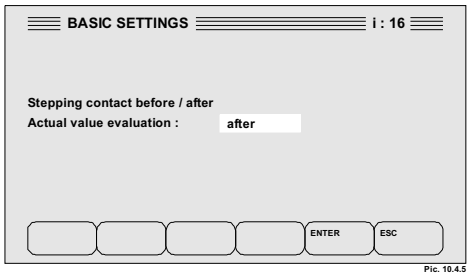
The current program cannot be started using the setting **with** the pressure switch (DK) unless **24V** is applied to the input.

- **with (1DK):** Standard (X3.19)
- **with (2DK):** Both pressure switches must be actuated or depressed to trigger the current if two welding heads move simultaneously towards the weld material (e.g. during gap welding) (X1.24 or X1.25).

Logic operation, pressure switch Head 1 / Head 2

- **AND** If a component is being welded with a double welding head and a pressure switch is not actuated, the program sequence is interrupted. No part is welded and an error message appears.
- **OR** If two separate components (separate stations) are being welded in two-head operation and a pressure switch is not actuated, the welding program continues to run but no welding current flows for the part concerned (only one part is welded). An error message appears.

8.4.5 Stepping Contact (FK)



Pic. 10.4.5

Set FK <u>after</u> actual value evaluation:
The signal "Stepping contact" is always output at the end of a completed welding sequence (i.e. after the hold time and evaluation has occurred).

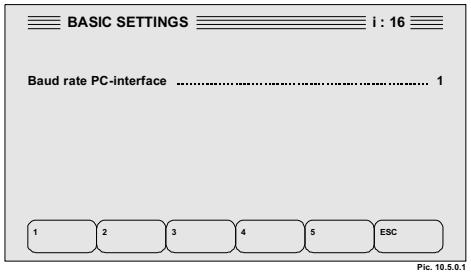
The stepping contact comes first in the case of **pincers**, lower **lifting cylinder** and the **compacting units** if all electrodes are in the original position again.

The output **Out of Limits** is already correctly set in the case of **pneumatic heads**.

Set FK <u>before</u> actual value evaluation:
The **before** output should be selected for motor heads, i.e. stepping contact occurs immediately after the hold time and remains active until the **Out of limits** output is correctly set and an inquiry is possible.

8.5 Interface RS232 (X21)

The serial interface is used for PC data transmission ⇔ ISQ. The description is at **connector X21,** see section 6.4.1).

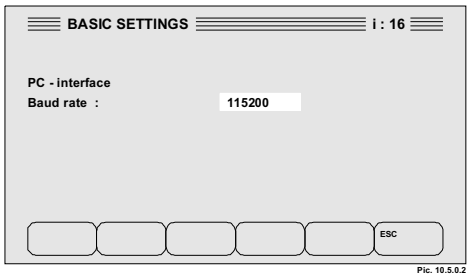


Pic. 10.5.0.1

Transmission speed depends on the receiving appliances employed.

Selection options:

- 2400 Bd
- 9600 Bd
- 38400 Bd
- 115200 Bd



Pic. 10.5.0.2

8.5.1 Transmission Protocol RS232

The **headline** appears after the unit is switched on and when parameter is edited or approx. every 40. lines in ASCI:

Prg	Is1_kA	Us1_V	Ps1_kW	Sz1_ms	Is2_kA	Us2_V	Ps2_kW	Sz2_ms	Count	G+ G-	+-
001	01.756	00.000	00.000	034.10	00.000	00.000	00.456	025.60	00003		*

Information

The headlines can be filtered out, as the string always remains the same

A star **only** appears under "+" if **GOOD** appears.

Character string:

Prg	=	Program number	3 digits
Space			
Is1_kA	=	Current flow in kA from 1 pulse	6 digits
Space			
Us1_V	=	Voltage flow in V from 1 pulse	6 digits
Space			
Ps1_Kw	=	Power flow in kV from 1 pulse	6 digits
Space			
Sz1-ms	=	Duration of current from 1 pulse	6 digits
Space			
Is2_kA	=	Current flow in kA from 2 pulse	6 digits
Space			
Us2_V	=	Voltage flow in V from 2 pulse	6 digits
Space			
Ps2_kW	=	Power flow in kW from 2 pulse	6 digits
Space			
Sz2_ms	=	Duration of current from 2 pulse	6 digits
Space			
Count	=	Global welding counter	5 digits
Space			
Space			
G+	=	Limit value (**Out of Limits** set point deviation) (upwards)	*(Asterix) (Multiplication)
G-	=	Limit value (**Out of Limits** set point deviation) (downwards)	*(Asterix) (Multiplication)
Space			
Space			
+	=	No **Out of Limits** "**good**" set point deviation	*(Asterix) (Multiplication)
-	=	An **Out of Limits** "**poor**" set point deviation	*(Asterix) (Multiplication)

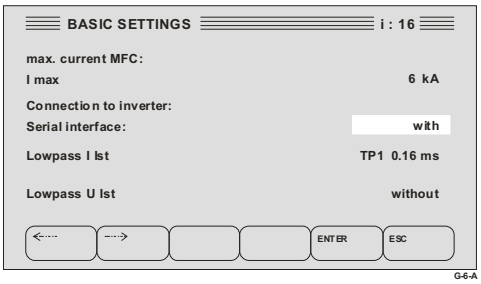
We provide additional software for evaluation, see section 15.1.

8.6 Multiple Function Control (MFC)

This sub-menu can be accessed from the "Basic settings 2" under "Multiple function control" by pressing the key [1].

Adaptations should be realized here for ISQ20-MFC operation with external inverter main stages.

Selection options for the maximum inverter current:



G-6-A

- 6 kA
- 20 kA
- 50 kA
- 100 kA
- 200 kA

The **next highest** value depending on the power stage must be set!

Determine whether the external inverter main stage can also be actuated via the serial interface (connector X14).

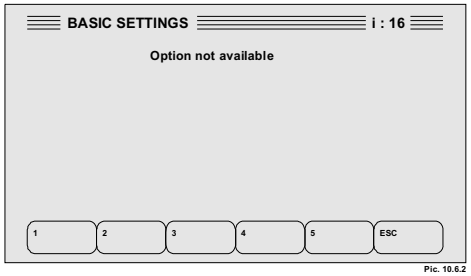
Serial interface:
with: for inverter ISQ20 TGB
without: for inverter series ISQ1-xx

A filter for current and voltage smoothing can be set to smooth the curves:

- without
- TP1 0.16 ms
- TP2 2.5 ms

These settings are not available in the compact inverter ISQ20K. They are only apparent with an inverter ISQ20-MFC.

View compact inverter ISQ20-K



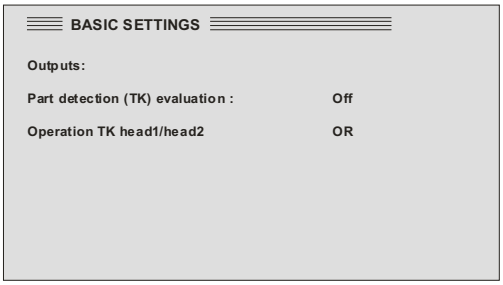
Pic. 10.6.2

8.7 Measuring Outputs

In conjunction with a displacement measuring unit (e. g. MG3Digital) a part detection can be evaluated.

Part detection evaluation:

- **Off**
- **On**



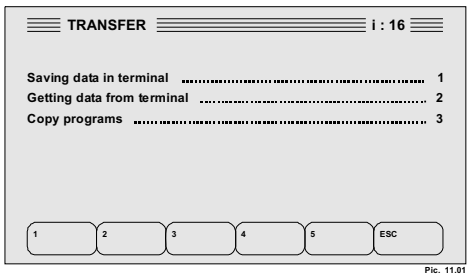
The measuring unit is requested to start the part detection with "On". A signal is sent from output X2.22 to channel 1 or X2.23 to channel 2 and a signal expected at input X1.26 or X1.27. The current time only begins then. Error #71/72 is otherwise output.

Logic operation, part detection Head 1 / Head 2

- **AND** if welding is performed with a double welding head on a component and there is no signal "Part detection OK", the program sequence is interrupted. No part is welded and an error message appears.
- **OR** If two separate components (separate stations) are being welded in two-head operation and a signal "Part detection OK" is not issued, the welding program continues to run but no welding current flows for the part concerned (only one part is welded). An error message appears.

9 Transfer

This sub-menu can be accessed from the main menu by pressing the [Transfer] key. You then gain access to the sub-menus by pressing the keys [1] to [3].



Pic. 11.01

The ISQ control terminal contains an EPROM memory module which can store all ISQ parameters in an intermediate memory. This capacity can be utilized as follows:

Parameter transfer to units of similar construction

It is possible to transfer from on system to the other with the MFT control terminal data where several equivalent systems are used.

Caution	Please note that the inverter controls have similar software versions. ISQ20-Kompakt data should not be transferred to the ISQ20-MFC! Compatibility does not exist.

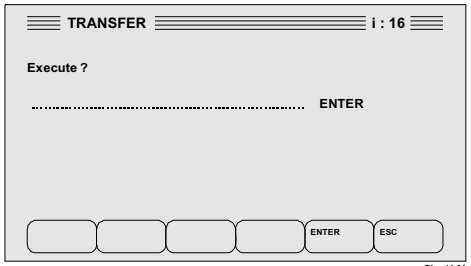
Parameter back-up during software update

The intermediate saving of parameters on the control terminal is also a useful function when updating the ISQ20 program software (see also section 4.4.1).

9.1 Data Saving in Terminal

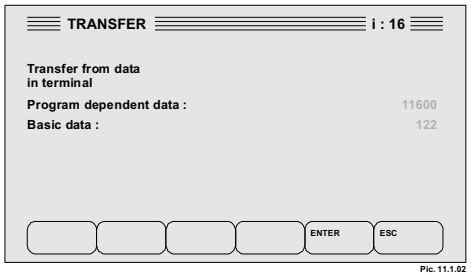
The following image appears after [1] is selected.

The display changes and the command is executed **immediately** if [**ENTER**] is pressed!



Pic. 11.01

Parameters can be temporarily saved to the control unit memory.



Pic. 11.1.02

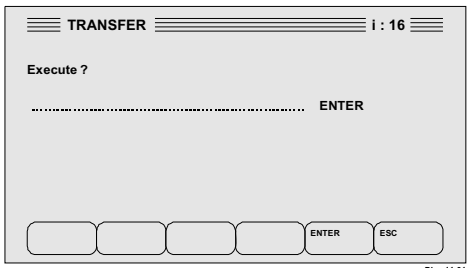
Warning

The terminal should only be unplugged when the main menu is active! (see section 5.2)!

9.2 Getting Data from Terminal

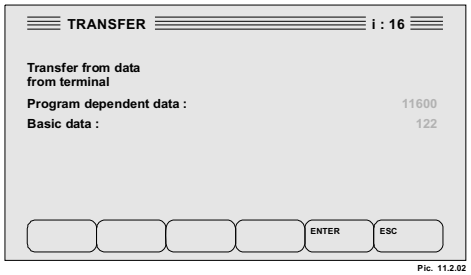
The following image appears after [2] is selected.

The display changes and the command is executed **immediately** if [**ENTER**] is pressed!



Pic. 11.01

The temporarily-saved data is exported to the welding control in this menu.

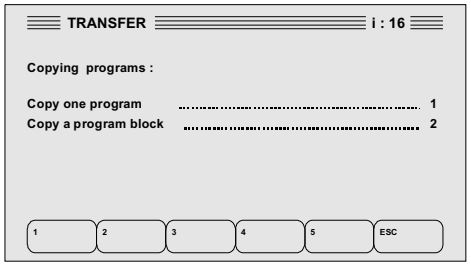


Pic. 11.2.02

9.3 Copying Programs

This sub-menu can be accessed from the "Transfer" menu by pressing the key [3].

All program-dependent data is transferred during copying.

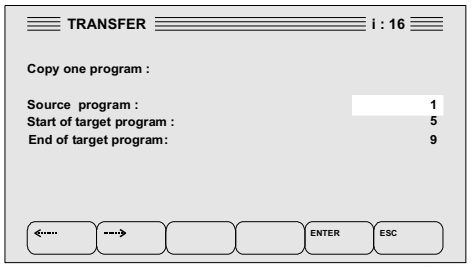


Pic. 11.3

9.3.1 Copy One Program

The desired source program can be copied to **one or more** target programs.

Example: Program 1 is copied in program 5, 6, 7, 8 and 9.

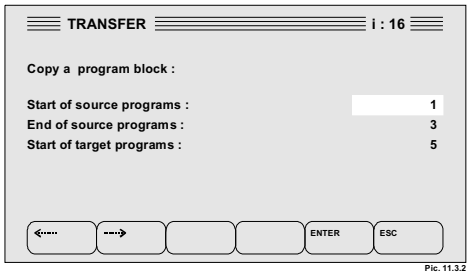


Pic. 11.3.1

9.3.2 Copy a Program Block

A **related** block of programs can be copied.

Example: Programs 1 to 3 (3 programs) are copied. The first target program is 5, so the programs are copied to the program sections 5-7.



Pic. 11.3.2

Caution

Data can be lost where programs overlap!

Avoid copying a program block to a program within as program block.

10 Diagnosis (only for specialized stuff)

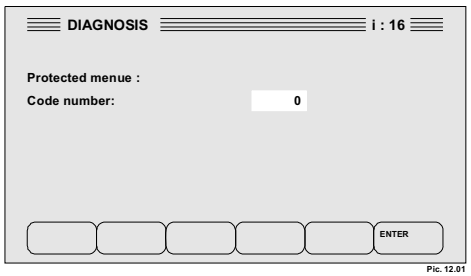
The diagnosis menu is primarily intended for **on-site setup**.

Danger	**Relevant safety procedures are deactivated in this menu!** **Changes should only be carried from indoctrinated specialized stuff!**

The diagnosis menu is used by the operator to diagnose faults which occur, and the manufacturer for commissioning the unit.

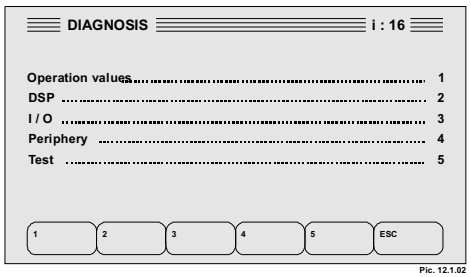
This sub-menu can be accessed from the main menu by pressing the [Diagnosis].

The menu is protected by a **code number** (see section 8.4.2).



Pic. 12.01

The sub-menus can be accessed by pressing the keys [1] to [5].



Pic. 12.1.02

10.1 Operating Values

Unit operating values are stored under this item. Changes qre not possible.

Operating hours

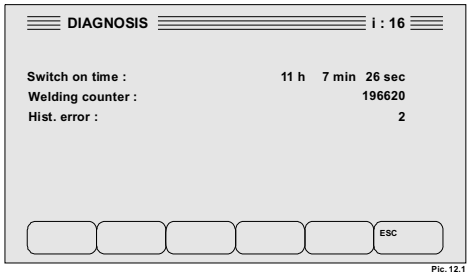
The operating hours show the respective data which has been generated since the unit's date of manufacture.

Welding counter

The welding counter counts the number of Start procedures upwards.

Historic error

The error number of the last error which occurred can be viewed under "Hist. error".



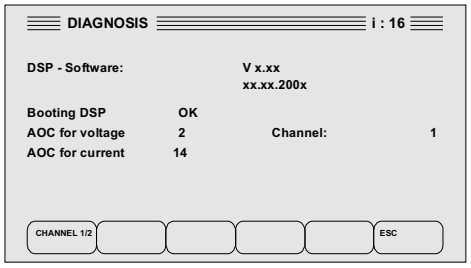
Pic. 12.1

10.2 DSP (Digital Signal Processor)

The signal processor software used in the unit is displayed with the version number and the date of origin.

In addition, there is also a display showing whether a error occurred when the processor was booted up and which voltage and current values are read in.

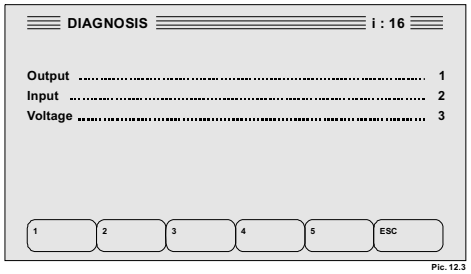
AOC = **A**ctive **O**utput **C**onnection



Pic. 12.2

10.3 I/O In and Outputs

The input / output menu is divided into three sub-menus.

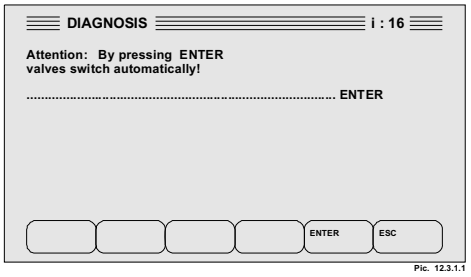


Pic. 12.3

10.3.1 I/O Output

Danger	The outputs should not be connected to a welding head for this case if accidents are to be prevented! Valve outputs are automatically connected consecutively with [ENTER]!

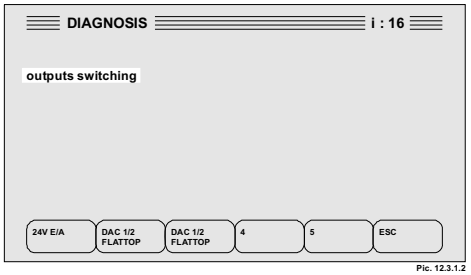
This function should only be used by instructed personnel for testing the inverter.



Pic. 12.3.1.1

The outputs are connected one after another for approx. 1 – 2 seconds.

Warning: these outputs are also under 24V if 24V is active.



Pic. 12.3.1.2

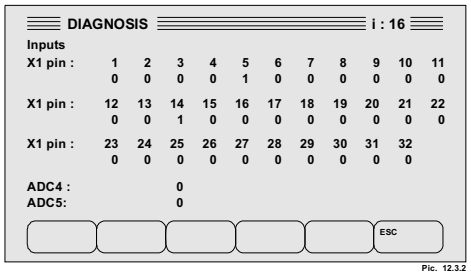
10.3.2 I/O Input

The binary inputs of the connector X1 are shown in this sub-menu. This enables an expert to check whether an applied 24 V signal is also actually present.

1 = On;

0 = Off

ADC4 and 5 are internal signals.



Pic. 12.3.2

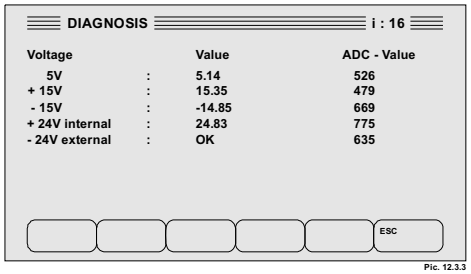
10.3.3 I/O Voltage

All unit operating voltages are listed in this sub-menu.

Voltage - Rated value

Value - Actual value

ADC-Value - Converter value



Pic. 12.3.3

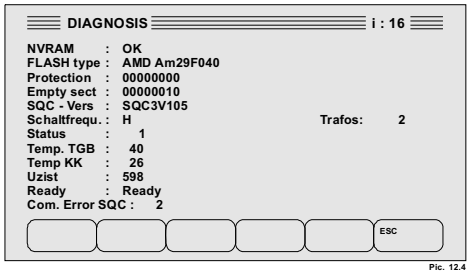
10.4 Periphery

The connected peripheral modules are listed under this point, along with other operating data such as the switching frequency, temperature values, intermediate circuit voltage etc.

Specific unit display, the number of transformers installed in the relevant unit version is also displayed, e.g.

4 transformers:
6000A version,

2 transformers:
3000A version.



Pic. 12.4

10.5 Test

This item is merely intended for commissioning the unit. It is possible to start a fixed pulse duration modulation (PWM).

PWM signal: amplitude and pulse duration can be specified.

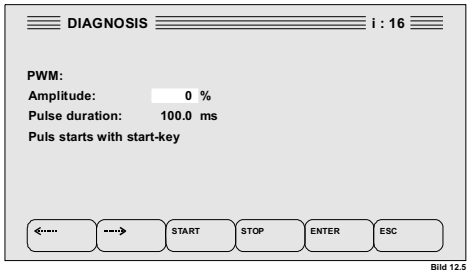


Bild 12.5

Danger	**Operation only by courtesy of specialized stuff!** **Welding current flows when Start is activated!**

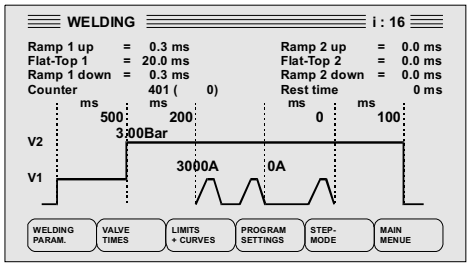
11 Welding

After closure the "Welding**"** menu appears on the display with all important parameters of the active welding program.

If the control is **ready**(X2.2), a welding operation can be started

The number of the currently-active welding program appears in the upper right of the display (1..99).

For program changing see section 11.4.1.



Pic. 13.0

The six function keys are assigned the most important sub-menus to enable rapid parameter adaptation in normal welding mode.

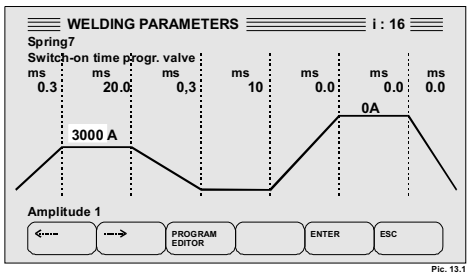
These are described in the following sections.

Only the counters are updated if the function "Fast welding" is activated in the "Basic settings" – "Welding" – "Welding 1" (see sections 5.1 and 8.1.2).

11.1 Adapting Welding Parameters

The menu in which the curve course and the welding current level can be set may be accessed from the "Welding" menu by pressing the [Welding parameters] key.

The program name (if entered) is in the first position (here: Spring7. See section 7.3).



Pic. 13.1

The adjustable welding curve parameters are:

Rated value ramp 1	0,1 – ca. 309,4 ms
Rated value time 1	0,3 – ca. 309,6 ms
Falling ramp 1	0,3 – ca. 300,2 ms
Rated value off time	1 – 9999 ms
Rated value ramp 2	0,3 - 309,1 ms
Rated value time 2	0,1 - 309,7 ms
Falling ramp 2	0 – ca. 310 ms
Amplitude 1 **Closed-loop control mode 1**	The value is based on the closed-loop control mode and inverter size A V W
Amplitude 2 **Closed-loop control mode 2**	The value is based on the closed-loop control mode and inverter size A V W (The setted values for the 2nd pulse also apply to the 3rd pulse if it is activated as a repeated pulse (see valve times, section 11.2)

Warning

Each welding pulse (1, 2 or 3) can only be allocated a **single** overall current time of **310 ms**! See also 2.6.

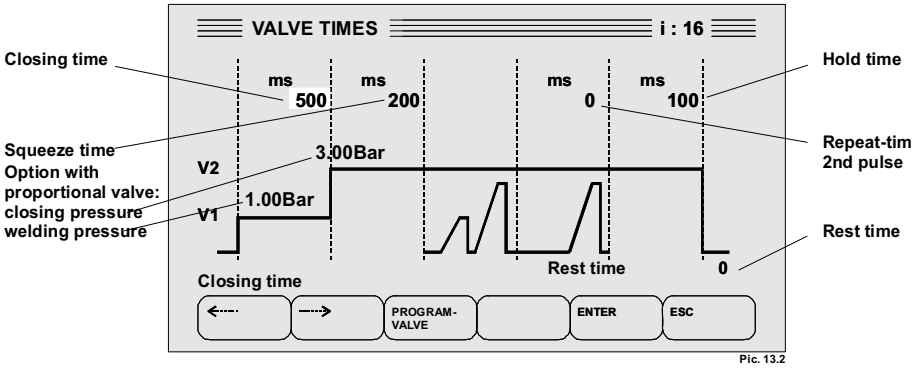
The rated value refers to the **current**, **voltage** or **power**, depending on the set closed-loop control mode. The amplitude ranges which can be set differ for the three closed-loop control modes:

		3 kA	**6 kA**	MFC
A :	**Current closed-loop control**	**0...3000 A**	**0...6000 A**	6...200 kA
V :	**Voltage closed-loop control**	**0...4,0 V**	0...4,0 V (in 0,01V-steps)	**4...20 V**
W :	**Power closed-loop control**	**0...12000 W**	**0...24000 W**	**0...400 kW**

11.2 Setting Valve Times

The menu in which the times are specified that control the sequence of pneumatic valves for actuating the welding heads can be accessed from the "Welding" menu by pressing the [Valve times] key.

The "With air" option must be selected in "Program editor" under "Control mode / Air" for this purpose.



Pic. 13.2

Closing time

From 1...9999ms for heads with welding pressure cylinder (e.g. FP190).
The head is closed under lower pressure within the closing time (typical: 500 ms).

Squeeze time

From 1...9999ms for heads with welding pressure cylinder (e.g. FP190).
The squeeze time should be selected long enough until the welding pressure has built up and the system is settled (typical: 500 ms).

Adjusting time = Closing time + Squeeze time

From 1...9999ms for heads with a feed motion cylinder (e.g. F120) (typical: 500 ms).

Repeat time 2nd pulse

Welding is realized without a third current pulse if **2nd pulse = 0 ms** is set for the **repeat time**. The second pulse is repeated after this time expires if a time (1...9999ms) is set.

Rest time

The rest time begins at the end of the current time. The electrodes remain closed during the rest time (1...9999ms). This enables rapid cooling of weld positions via the electrodes. This generally leads to a more stable connection.

Rest time

Warning	Avoid using rest time for all non-automated systems. Set the rest time to **0 ms** to deactive it.

The rest time (0...9999ms) is used in an automated sequence where one is working with only one Start actuation. The welding material can be changed during the rest time and the welding cycle then commences from the beginning, provided the Start is made (closed).

Not until after all parameter values have been set are they acknowledged with [ENTER]. The previous values are then overwritten. This menu can be exited at any time with [ESC] without any settings being accepted.

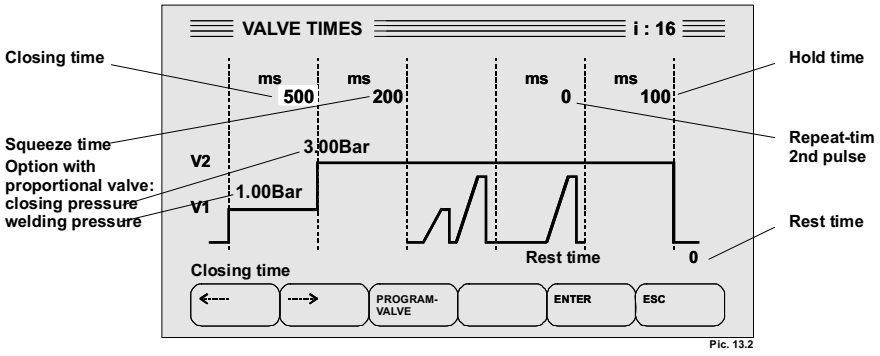
11.2.1 Welding Pressure

The closing pressure level and welding pressure level should be entered in the "Valve times" menu when a proportional valve is used.

The pressure values in "bar" are always blended in if an option with proportional valve is selected in the "control mode" menu item.

Specification 1

A proportional valve controls the closing and welding pressure (e.g. FP190 with VL/PV).



The closing and welding pressure values can be specified comfortably here with the ISQ inverter.

The closing time is assigned to the closing pressure in the sequence control. The closing pressure (typical: 0.8 bar) governs the electrode.

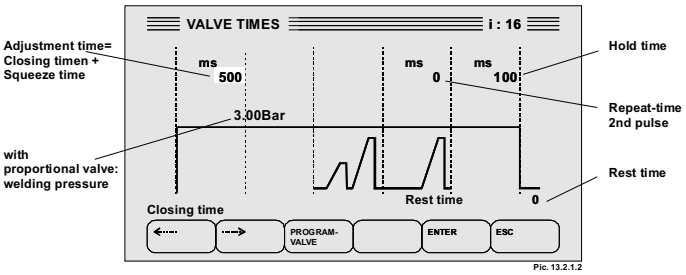
The changeover to the welding pressure and squeeze time occurs when the closing time has expired. The welding pressure is maintained until the end of the welding cycle.

The correct welding pressure level depends on the weld material and should be determined trough trial runs. See also section 19.

The adjustable value range lies between 0.01...10.00 bar, the maximum permissible welding pressure lying mainly at 6 bar.

Specification 2

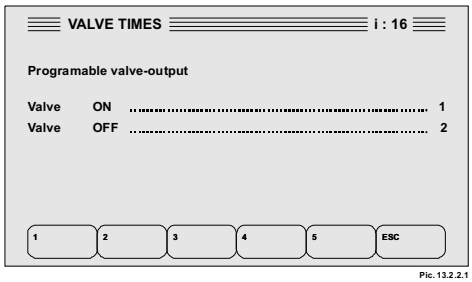
A valve controls the feed motion of the welding head and a proportional valve generates the welding pressure with a force adjustment cylinder (e.g. F120 / F160 with force adjustment cylinder).



The active electrode is moved towards the weld material within the adjustment time. A welding pressure spring is tensioned with the force adjustment cylinder via the proportional valve, the cylinder generating the welding pressure.

11.2.2 Programmable Valve Output

The "programmable valve output" menu can be accessed with the [Program valve] key.



The switch-on and switch-off time for valve output 5 can be specified with this menu.

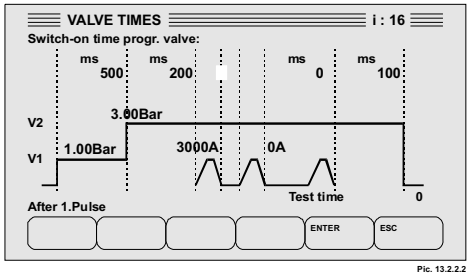
(Valve output 4 is also actuated for compatibility reasons relating to older ISQ20 controls.)

Valve outputs 1 to 4 are usually occupied and the output for valve 5 is used for changeover if the ISQ is utilized for actuating two welding heads.

Press key [1] to determine the switch-on time.

The switch-on time is fixed by turning the rotary transducer. It can be set:

- Before closing time 1
- Before squeeze time 1
- Before 1st pulse
- After 1st pulse
- Before 2nd pulse
- Before repeat time of 2nd pulse
- Before hold time

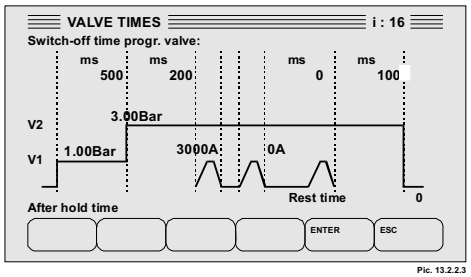


Pic. 13.2.2.2

Press key [2] to determine the switch-off time.

The switch-off time is fixed by turning the rotary transducer. It can be set. The switch-off time can only be set after the switch-on time. It can be set:

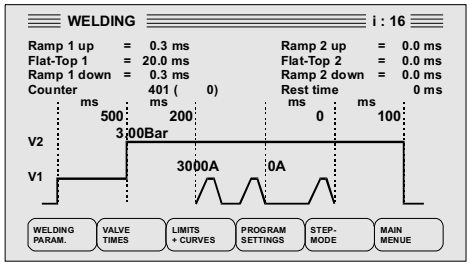
- Before squeeze time 1
- Before 1st pulse
- After 1st pulse
- Before 2nd pulse
- Before repeat time of 2nd pulse
- Before hold time
- After hold time



Pic. 13.2.2.3

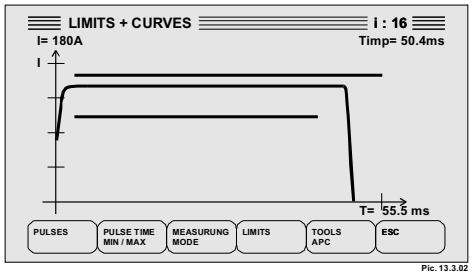
11.3 Limits and Curves

Press the [LIMITS + CURVES] key in the "Welding" menu



Pic. 13.0

The **upper** line indicates the maximum pulse limit entered, the **lower** the minimum pulse limit entered [ms/A]. The **length** of these two lines represents the respective monitoring duration.

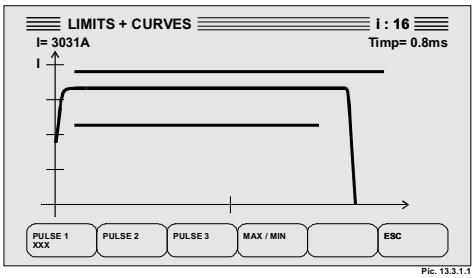


Pic. 13.3.02

11.3.1 Pulses (Actual Value Curve)

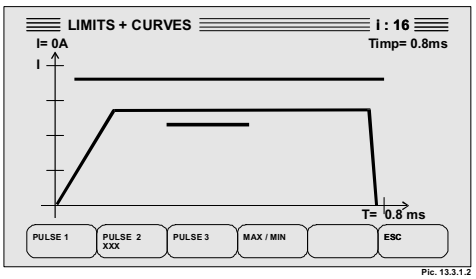
You can gain an overview of the curve course (actual value) of the last welding pulse in the [Pulse] menu item.

The two horizontal lines indicate the upper and lower limit values entered (pulse time and strength). The three crosses **XXX** represent the currently-active display (here: pulse 1)



Pic. 13.3.1.1

Display for pulse 2 and 3 (analog).

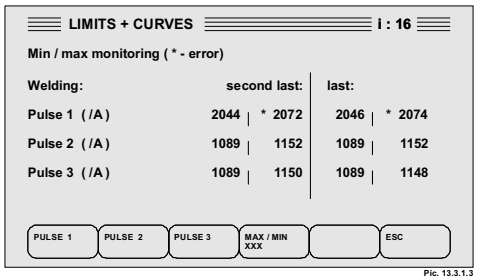


Pic. 13.3.1.2

The key [MIN / MAX] takes you to the menu "Min / Max Monitoring (*-error)".

The last two welding operations are always displayed. The specified values are the lower (left) and upper (rights) limit value.

Measurements which lie beyond the defined limit values are marked with a "*". The output X2.5 – "Out of Limits Kopf 1" is then set.

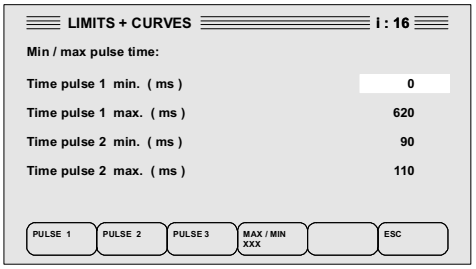


Pic. 13.3.1.3

11.3.2 Min. / Max. Pulse Time

You can leave the [LIMITS + CURVES] and access the sub-menu by pressing the [MIN/MAX PULSE TIME] key.

You can determine a range here within which the 1st or 2nd pulse should lie.



Pic. 13.3.2

A signal output occurs at X2.20 or X2.21 if the measured pulse times are shorter or longer than specified by the range.

No monitoring for:

- Pulse time 1 min. = 0 ms
- Pulse time 1 max. = 620 ms

The 620 ms represents the end of the complete pulse.

Example for monitoring of the length of the 2nd pulse which should be 100 ms:

- Pulse time 2 min. = 90 ms
- Pulse time 2 max. = 110 ms

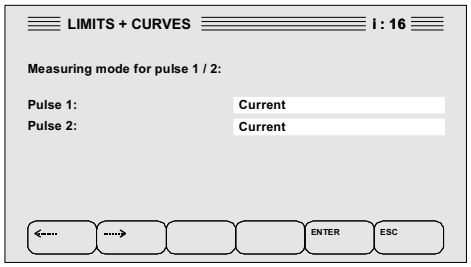
This function is usually utilized additionally when the current is deactivated via the lowering distance.

11.3.3 Measuring Mode

The measuring mode can, but must not be, identical to the closed-loop control mode. Determine which measuring variable you wish to monitor here.

Options:

- Current (I) [A]
- Voltage (V) [V]
- Power (P) [W]
- Energy (W) [Ws]



Pic. 13.3.3

The selected measuring mode is displayed in the "limit value + curves" as Y-axis.

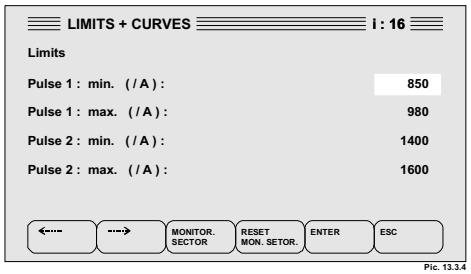
11.3.4 Limit Values

The level of the upper and lower limit value for pulses 1 and 2 are specified in the "Limit values" menu item.

Out of Limits is displayed if the current curve lies outside the limit lines.

The LED for the control deviation display illuminates and the signal output is actuated.

The display in the upper range occurs in **kA** on the **ISQ20 MFC** inverter.



Pic. 13.3.4

A value of ± 20 % with corresponding measuring and control mode is set by the control as a preliminary setting for the limit values.

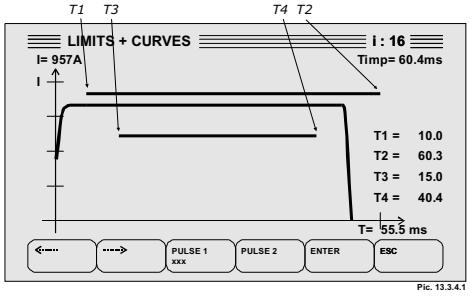
11.3.4.1 Monitoring Range

The monitoring time period is specified for the limit values in the [Limits] sub-menu.

The upper line indicates the maximum pulse limit entered, the lower the minimum pulse limit entered [A]. The length of these two lines represents the respective monitoring duration.

Select the values T1 to T4 with the arrow keys and specify the time in ms.

The three crosses xxx represent the pulse which is active



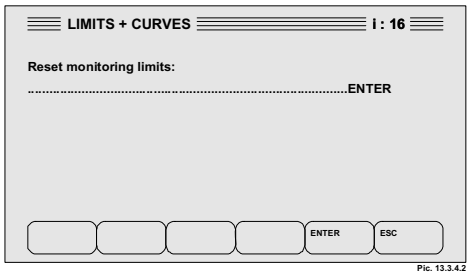
Pic. 13.3.4.1

- T1: Start of monitoring upper limit in ms
- T2: End of monitoring upper limit in ms
- T3: Start of monitoring upper limit in ms
- T4: End of monitoring upper limit in ms

An error message is generated if the upper or lower line is cut by the current curve (error case: Out of Limits). The lower value should only encompass the **critical** sector of the welding. The monitoring time period for the lower limit value should be briefer than the current pulse.

11.3.4.2 Reset Monitoring Limits

The limit value level is set to ± 20% again during realization of "Reset monitoring limit" with [ENTER].



Pic. 13.3.4.2

An error signal is output if the amplitude in the 2nd half of the pulses drops below 20%. This function is deleted if the monitoring range limit values are reset.

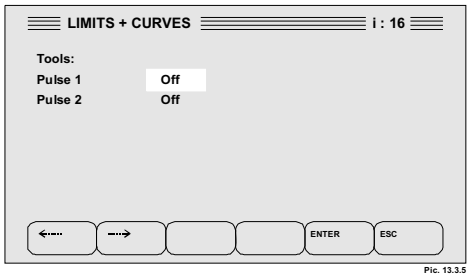
Information	The values are only reset to ± 20% if the control and measuring mode are both set to the same measuring variable (e.g. "A" ampere). Only the monitoring range pages are automatically adapted if this is not the case. All other limit values remain unchanged.

11.3.5 Tools APC

(**A**ctive **P**art **C**onditioner)

The TOOLS APC menu is a sub-menu for Limit values.

One of the following options for pulse 1 and 2 can be selected here.



Pic. 13.3.5

- **OFF**
- APC
  (Active Part Conditioner)
- **Pre-Weld Check**
- **Weld Limit**
- **Weld to Limit**

The selection is imported if one presses [ENTER]. This also applies for pulse 2 (which can be reached with the arrow keys).

11.3.5.1 APC (Active Part Conditioner)

The **APC** is used for welding contaminated and oxidized surfaces.

APC uses the closed-loop control of this double-pulse inverter DC control and parameter monitoring. The surfaces are prepared (conditioned) with the first pulse and the conductivity checked. The second pulse carries out the actual welding operation.

Setting:

The first pulse is set to **power** [W] or **voltage** [V] in the **welding parameters**. An amplitude which is high enough and a time long enough are selected to achieve penetration of the oxide with a high voltage.

Monitoring is realized by the first current pulse (i.e. the measuring mode involved must be set to current [A]. The first pulse welding current begins flowing and increases. The limit value for the current to be monitored is set at a value which will at the most lead to a tacking weld or adhesion of the components. Each time the first pulse reaches this current limit value it is interrupted. A specific current path is created as a result in the components.

Varying contamination / oxidation levels then lead to pulses of differing lengths and are therefore balanced out. Contamination / oxidation which is so severe that the desired current value is not reached within the set 1st pulse time causes the control in **APC** mode to emit a signal.

Components prepared in this way are welded with the second pulse after the rest time. A welding pulse (current and time) strong enough for welding the to all intents and purposes cleared surfaces should be selected for this.

11.3.5.2 Pre-Weld Check

Testing the conductivity prior to welding.

This option checks the **conductivity** of the future weld. It is welded with current [A] and monitored by the voltage [V]. The following values should be adhered to:

- **Current** approx. 1/10 of the welding current
- A brief **weld time** (i.e. 5 – 10 ms)
- The voltage of the first pulse rises if the weld material **resistance** is too great. The first pulse is activated as soon as the upper voltage limit is reached and an error message is output. The welding process continues if the measurements lie within the first pulse limit values (2^{nd} pulse, rest time, etc.).

11.3.5.3 Weld Limit

Welding is only permitted within the **upper** set limits. Exceeding the limits not only causes an error signal to be output, but welding is also interrupted.

The **Energy** [Ws] setting can also be used here, i.e. the contents of the sector below the curve are added to the limit value.

11.3.5.4 Weld to Limit

The first and second pulses can be set separately in the welding parameters, measuring mode is normally energy, otherwise a ramp should be entered. The unit is deactivated when the ramp reaches the upper limit.

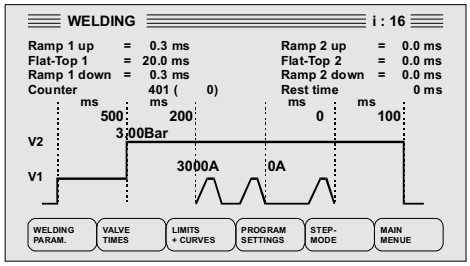
The **Energy** [Ws] setting can also be used here, i.e. the content of the sector below the curve is added to the limit value.

The pulse is deactivated as soon as the upper limit value (energy) is reached and the program jumps to the next pulse (if one is available). **No error signal is generated!**

An error message occurs if deactivation does not occur at the upper limit within the current time and there is no failure to reach the lower limit.

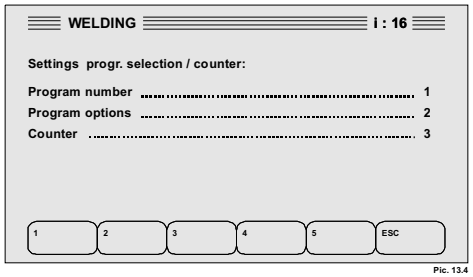
11.4 Program Settings

Press the [PROGRAM SETTINGS] key in the "Welding" menu



Pic. 13.0

The lower selection keys are used to access the sub-menus to select **specific program** settings.



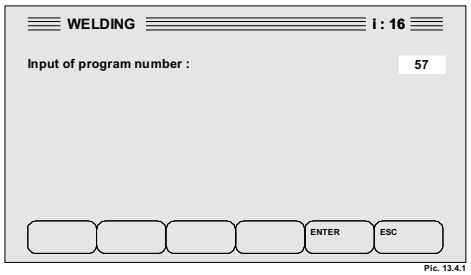
Pic. 13.4

11.4.1 Program Number (internal)

Determine a program number from **1** to **99** for your application during internal program selection. Then adapt the parameters for this program.

The currently-valid program number is displayed at the top.

The newly-set value should be acknowledged with [ENTER].

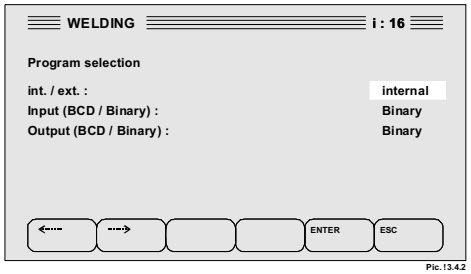


Pic. 13.4.1

11.4.2 Program Settings

Define here whether the program number is to be selected internally or externally and specify the interface coding (BDC / Binary).

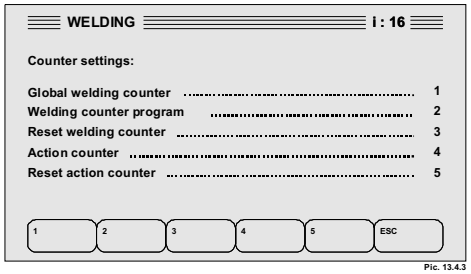
You can also access this menu from the "Main menu" via "Basic settings 1" – "General" – "Select program", and it is described in detail in section 8.4.3.



Pic. 13.4.2

11.4.3 Counters

All counter data are centralized in the sub-menu „Counters".



Pic. 13.4.3

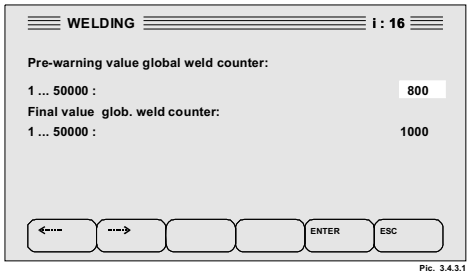
11.4.3.1 Global Welding Counter

The global welding counter operates **across all programs**. It counts every welding operation realized.

The current counter status is displayed in the "Welding" menu under "Counter".

If welding reaches the set number a signal is emitted at the output for:

- **Pre-warning value** (see conductor X2.26) resp.
- **Final value** (see conductor X2.4)



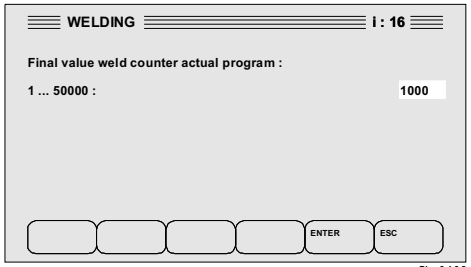
Pic. 3.4.3.1

11.4.3.2 Welding Counter Program

This is a **program-dependent** counter.

The current counter status is displayed in the "Welding" menu under "Counter" and is the number in brackets.

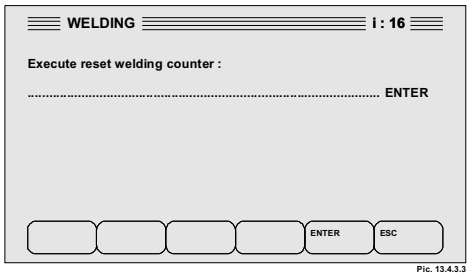
Final value: the output signal occurs at X2.4 when the set number of welding operations is reached**.**



Pic. 3.4.3.2

11.4.3.3 Reset Welding Counter

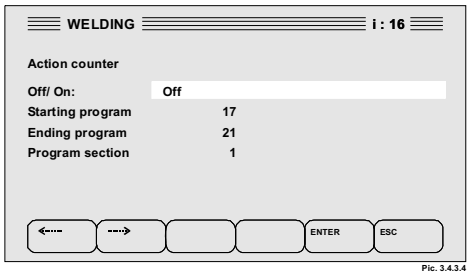
Both counters are reset to zero in the "Welding" menu when reset is realized.



Pic. 13.4.3.3

11.4.3.4 Action Counter

Access to this menu is protected by code number (see section 8.4.2).



Pic. 3.4.3.4

Action Counter On / Off

The action counter can be activated to automatically switch to the next program after a certain number of welding operations. Only consecutive programs can be processed here (from program 17 – 21 in this case). The number of program sequences is specified in "Program editor" under "Control mode – AZ program sequences". Determine here how often (to give an example) program 17 should be repeated before program 18 is changed over (see section 7.2.3).

Starting- / Ending program

Enter Starting and Ending program of a sequence.

Program section

Start and end program define a program section (sequence). These programs used here should not overlap the next program section.

A maximum of 49 program sections can be defined with a maximum total of 99 programs.

Information

Only consecutive programs can be processed.
Program sections should not overlap.

Example:
Adjusting the action counter for a sequence of 4 consecutive programs with end program 8 (program sequence):

Program selection – Program number: enter 1st program	***5*** – ENTER
Counter – Action counter – Code no.	*(e.g. 0)*
Action counter Off/On:	**EIN**
Define Program sequence	**e.g. *1***
Enter Starting program	***5***
Enter Ending program	***8*** – ENTER

The action counter is now activated for program ***5 – 8***.

The procedure of each program (5-6-7-8) can now be set in Program editor – Control mode.

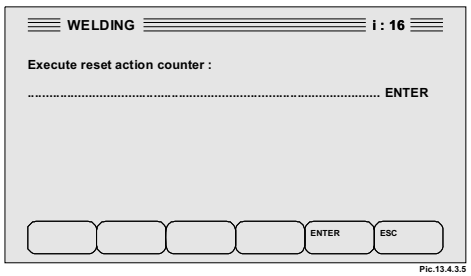
A return to the original program or the externally selected program occurs after the program sequence (**5-8**) set with the AZ program sequences expires. A reset can be initiated to interrupt the sequence if the sequence is to be interrupted, either

internally via Program selection – Counter – Reset action counter or **externally** via a signal to X1.31.

X2.27 (Action counter end) is activated for both the termination and interruption of the sequence

11.4.3.5 Reset Action Counter

The action counter is reset to the starting program of this sequence.



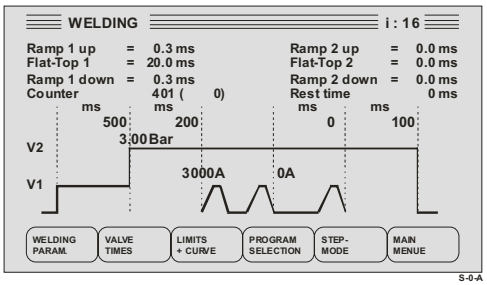
Pic.13.4.3.5

11.5 Step–Mode

Warning	The step mode is only intended for pneumatically-actuated welding heads.

Press the [STEP-MODUS] key in the "Welding" menu.

Use the step mode to set up the sequence.

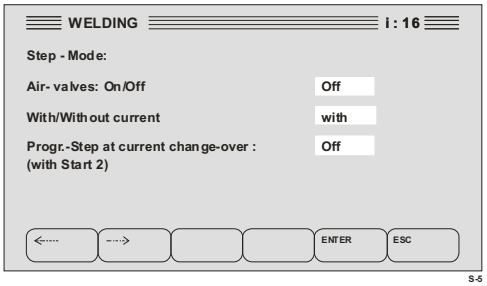


The closing pressure valve is activated and the electrodes close after Start is triggered when the step mode is switched on.
The [Next] key now appears in the function line.
The welding pressure valve is activated by pressing the key.
Repeated pressing of the key triggers the current program.

Step mode:

Air valves

- **On** = Step mode
- **Off**



With / Without current

- **With**
  Operation with welding current
- **Without**
  Operation without welding current. The sequence can be simulated with the "Without current" function for setting up the electrode on the workpiece or trial runs
- **External "H"**
  The with/without switch is actuated externally (X1.1). Binary input „without current" is „high-activ" (14 V - without current)
- **External "L"**
  The with/without switch is actuated externally (X1.1). Binary input „without current" is „low-activ" (24 V - without current)

Program-Step during current changeover: On / Off

Switch on the program-step if you are operating two welding heads. Valve output 5 is also activated during a sequence wit current changeover (see section 7.2.4).

12 Settings for Special Functions

The path is described to the additional functions required for each of the special functions

12.1 Distance Measurement

Distance measurement with part detection
(in relation to adjustment cylinders):

Input sequence:

- Basic settings 1 → basic settings 2
- measurement outputs
- Part detection evaluation: **ON**
  (The X2.22 signal waits 60 ms for the OK signal from part detection X1.26 and X1.27)

12.2 Triode Welding (Insulated Wire Welding)

Specially shaped electrodes are required for insulated wire welding

Welding procedure:

- An electrode is heated on the weld material and melts the insulation
- The program then changes. The current is now conveyed through the weld material.
  See Welding with current changeover.

12.3 External Electrode Adjustment

Applications such as motor head controls, mechanical actuation with cam plates etc.

The unit is operated **without air** and serves purely as a current control, but it can be used with or without a pressure switch.

Input sequence **air valve**:

- program editor – closed-loop control mode / air valves – welding: **without air**

Input sequence **pressure switch**

- basic setting 1 – general (4) – pressure switch (4)

12.4 Changeover Stage or Valve Changeover

(Electronic with Thyristor or with mechanical valve changeover).

The following changes should be made after the unit has been switched on:

1. Program selection		
•	Set an **uneven** figure as the program number, acknowledge with **ENTER**	
•	Counter (3)	
•	Action counter (4): Enter code number (or 0, if not existing) and ENTER	
•	Action counter ON	Consecutive programs are processed. The action counter should be at ON for electronic changeover
	Action counter **OFF**	Programs (x+50) are processed
	Start program	The program number should be uneven
	End program	The program number should be even
•	ENTER – ESC – ESC	

2. Welding menu		
•	Main menu	
•	Program editor	
•	Air control mode (1)	
•	Pulse 1 / Pulse 2	Enter as required (input in current curve is also possible)
•	Welding **with air**	For heads with air cylinder actuated by the control unit
•	Welding **without air**	By motor head, eccentric welding or actuation of heads by a PLC
•	ENTER	

3. Control mode (2)		
• Enter the code number and ENTER		
• Heads	Single head mode	Not for changeover stage
	Twin head mode	- with 2 consecutive heads or - if these contact simultaneously - for stripped insulation welding
• Control mode	Select	
• AZ program procedures	Determine number	Not applicable if action counter is at OFF. It must be entered for electronic changeover. Input is normally 1 for twin head mode As many procedures as are set are run before changing to the next program number.
• Basic setting		
Changeover	OFF	Only for single head mode
	Current changeover	For electronic changeover or valve changeover
	Program changeover	For 2 heads welding consecutively and where the electrode of each head is open
Current valve changeover	OFF	For electronic changeover
	ON	For valve changeover (150 ms waiting period until the switch is closed securely)
ENTER - ESC		

4. Main menu			
•	Basic setting		
•	Welding (1)		
	Welding 1 (2)		
	Test pulse output	Out of Limits OFF	
		Out of Limits ON	
•	Rapid welding	OFF	Normal procedure
		ON	e. g. for current changeover
	ENTER		
•	Welding 2 (3)		
	Generate curve	ON	For slow welding
		OFF	For fast welding
	ENTER		
•	General (4)		
	Pressure switch (4)	with / without	
	ENTER – ESC → Basic settings 2 – ESC – Welding		

5. Enter welding parameters - ENTER			
•	Valve times (2)	Input	
	ENTER –		
•	Program selection (4)		
	Program number	Enter next program number (increase by 1)	
	ENTER –		

Now return to point 2 and repeat points 2, 3 and 5.

12.5 Secret Menue (only for specialized stuff

Warning

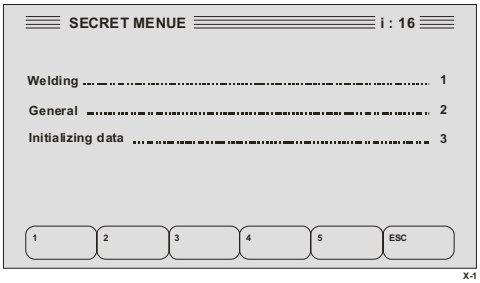
Changes should only be carried from indoctrinated specialized stuff! They affect the customer-specific settings.

12.5.1 Secret Menue 1

This menu can be reached via the key combination

1-3-5

in the main menu.



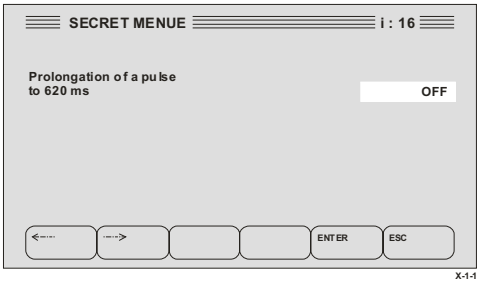
X-1

12.5.1.1 Secret Menue Welding

Here it is possible to extend the welding pulse to max. 620 ms (also see 11.1)

OFF: 310 ms (Standard)
ON: 620 ms

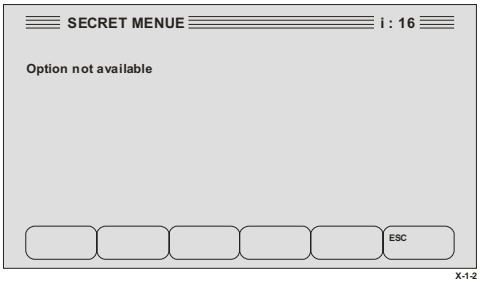
This can be appropriate for enameled copper wire welding or hard soldering.



X-1-1

12.5.1.2 Secret Menue General

This option is not currently available.



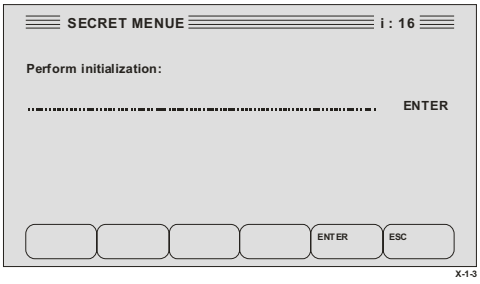
X-1-2

12.5.1.3 Secret Menue Initialize Data Records

Caution

ENTER deletes all customer-specific settings and resets to the factory settings!

The data records are initialized with **ENTER**.



12.5.2 Secret Menue 2 Lock Code

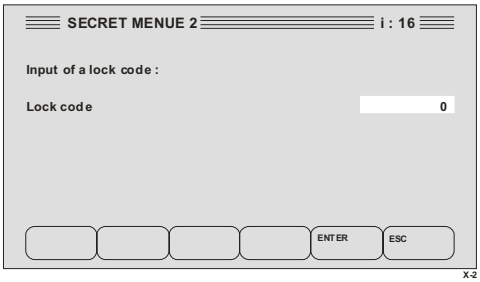
This menu can be reached via the key combination **2-4-6** in the main menu.

The preset value is

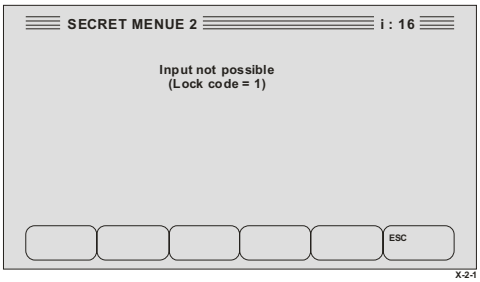
0 = Access to all menu points.

Change in

1 = Lock code 1.
The entry is not possible, only the program selection is released.
Limit values and curves can be seen

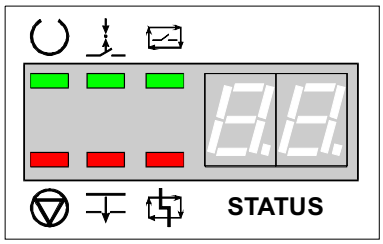


The following display appears



13 Status and Error Messages

Status display on the front plate:



The symbols and bars have the following meaning:

Upper row	○	LED green	Ready	
		LED green	Pressure switch	(DK)
		LED green	Stepping contact	(FK)
Lower row		LED red	Quick stop	
		LED red	Out of Limits	
		LED red	Flow error	

13.1 Status Messages

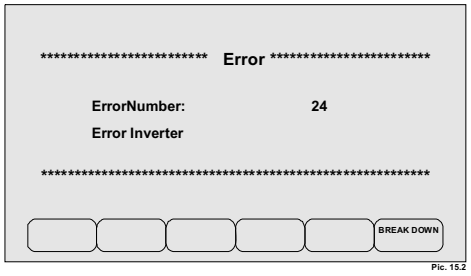
On the right of the display beside the symbols:

00	Ready	Operating voltage is present, system is OK, intermediate circuit is not charged
01	Converter ON	Intermediate circuit successfully charged.
02	Closed-loop controller free	
03	Welding program running	

13.2 Error messages

Each error is displayed twice:

As digits in the 2-position Status display and additionally on the control unit display with number and plain text.



Pic. 15.2

Error messages:

1. Unit error (#10 – #59)

No.	Message	Cause
10	SQC3: EMERGENCY STOP active	
11	SQC3: Undervoltage intermediate circuit	UZK < 450V ; Undervoltage, mains or fuses defective
12	SQC3: Overvoltage intermediate circuit	UZK > 650V ; Mains overvoltage
13	SQC3: Charging contactor defective	Mains undervoltage or fuses defective
14	SQC3: Main contactor defective	
15	SQC3: Overtemperature cooling element	Overtemperature at the cooler (power section) caused by defective fan or excessive ambient temperature
16	SQC3: Overtemperature TGB	Overtemperature on the transformer block due to a lack of air cooling or overload
17	SQC3: Overcurrent	The overcurrent monitoring has responded due to a "hard" short at the output or due to critical closed-loop controller settings
18	SQC3: Error, branch U	Activation of defective or critical closed-loop controller settings
19	SQC3: Error, branch V	Activation of defective or critical closed-loop controller settings
20	SQC3: I^2t too large	i^2t limit reached: excessive current and current duration too long
21	SQC3: Wire breakage NTC-KK	
22	SQC3: Pulse rest time too short	Current rest time too short
23	SQC3: Pulse duration too long	
24	Error Inverter	Erroneous link to inverter (MFC only)
25		
26		
27		
28		
29		

No.	Message	Cause
30	Wrong answer from SQC3	
31	No communication with SQC3	
32	Error when deleting flash	
33	Error, describe flash, Sector 1	
34	Error, describe flash, Sector 2	
35	Error during transfer to terminal	
36	Current too high! (> maximum current)	
37	Current too low! (< minimum current)	
38	Error during DSP booting	
39	Error LCA (SPI)	
40	Error LCA (SGC)	
41	No communication to terminal	
42		
43		
44		
45		
46		
47		
48		
49		
50	Undervoltage 15V	
51	Overvoltage 15V	
52	Undervoltage –15V	
53	Overvoltage -15V	
54	Undervoltage 24V	
55	Overvoltage 24V	
56	Failure 24V external	
57	Undervoltage 5V	
58	Overvoltage 5V	
59		

2. Sequence error (#60 – #90)

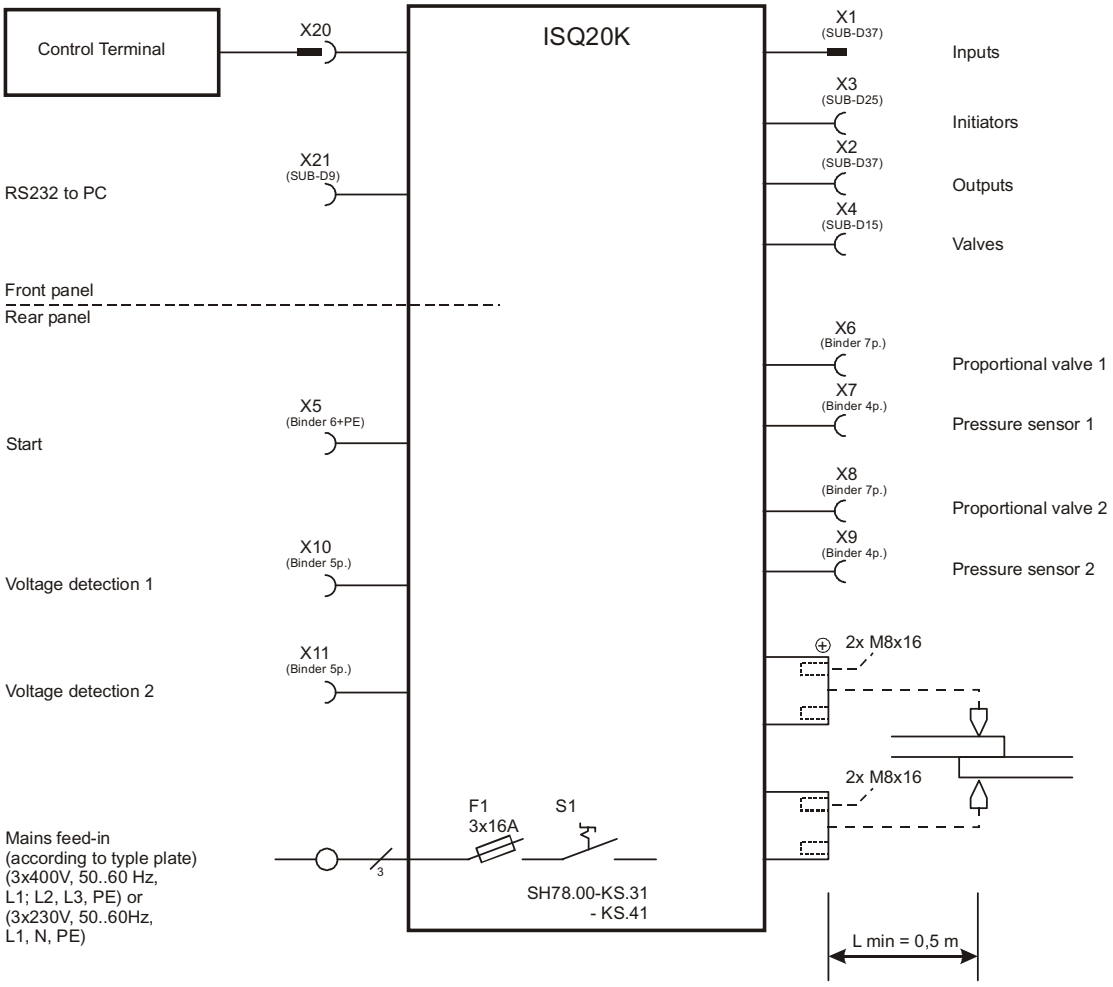
No.	Messages	Cause
60	Contact cylinder 1 not ahead (X3.7)	
61	Error pressure switch 1	
62	Head not back (X3.1)	
63	Contact cylinder 1 not back (X3.13)	
64	Current greater than maximum current	
65	Start set when switching on	
66	Pressure deviation 1 too big	

No.	Messages	Cause
67	Stroke cylinder 1 not in initial position	
68	Head 1 not down (X3.1)	
69	Progr. No. for changeover position incorrect	
70	No external program selected	
71	Part detection input 1 missing	
72	Part detection input 2 missing	
73	Error thermal switch	
74	Mains compressed air error	
75	Quick stop error	
76	Error pressure switch 2	
77	Contact cylinder 2 not ahead (X3.7)	
78	Head 2 not up	
79	Contact cylinder 2 not back (X3.13)	
80	Pressure deviation 2 too big	
81	Stroke cylinder 2 not in initial position	
82	Head 2 not down	
83	No program section AZ chosen	AZ = action counter
84	Contact cylinder 1 back (X3.13)	
85	Contact cylinder 2 back (X3.16)	
86	Contact cylinder 1 ahead (X3.7)	
87	Contact cylinder 2 ahead (X3.10)	
88	Inputs DK1 and DK2 are missing	
89	Inputs DK1 and TK2 are missing	
90	Inputs TK1 and TK2 are missing	
91	Inputs TK1 and TK2 are missing	

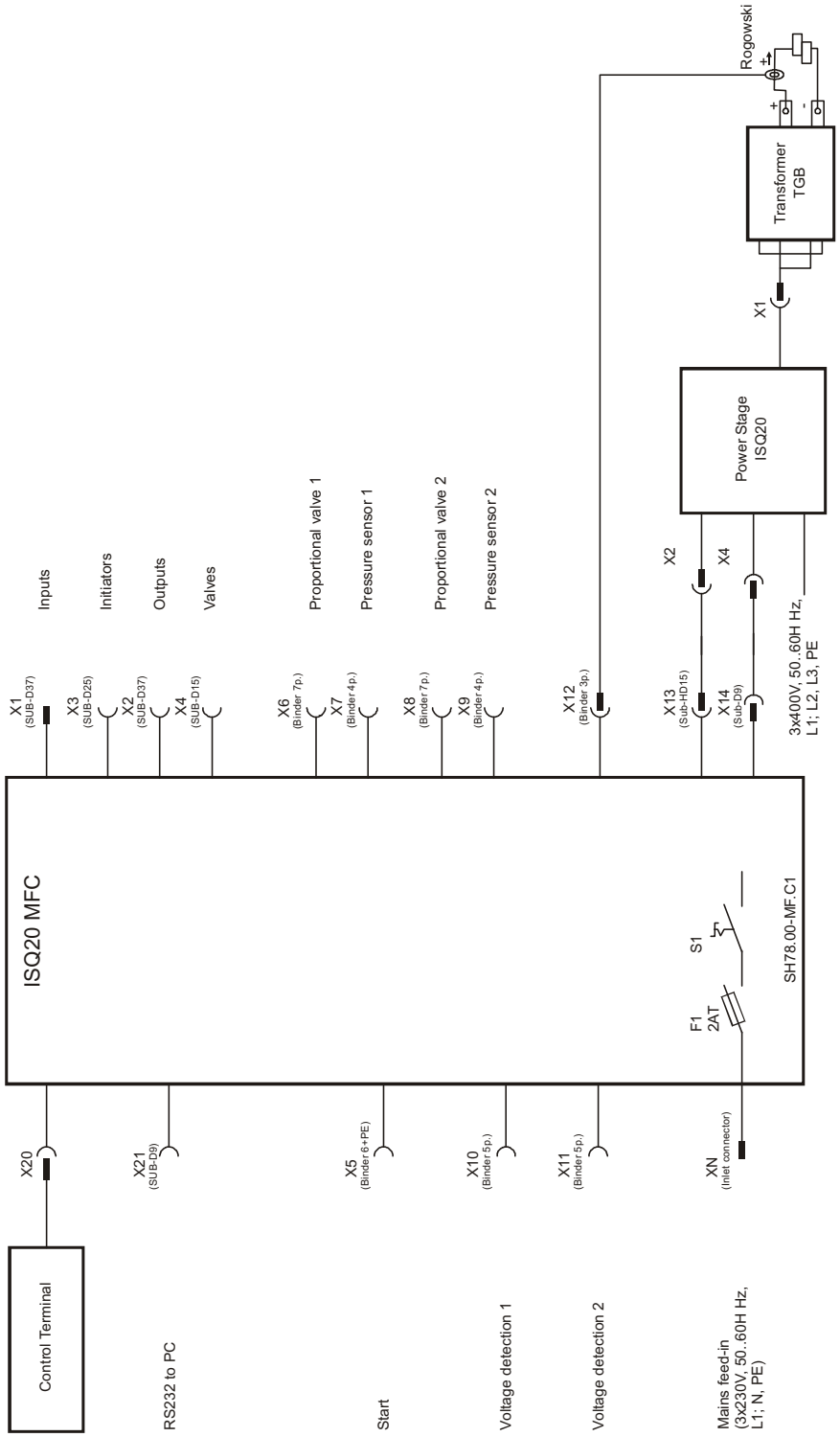
14 Connection Schemes

14.1 External Connections Compact Unit ISQ20K

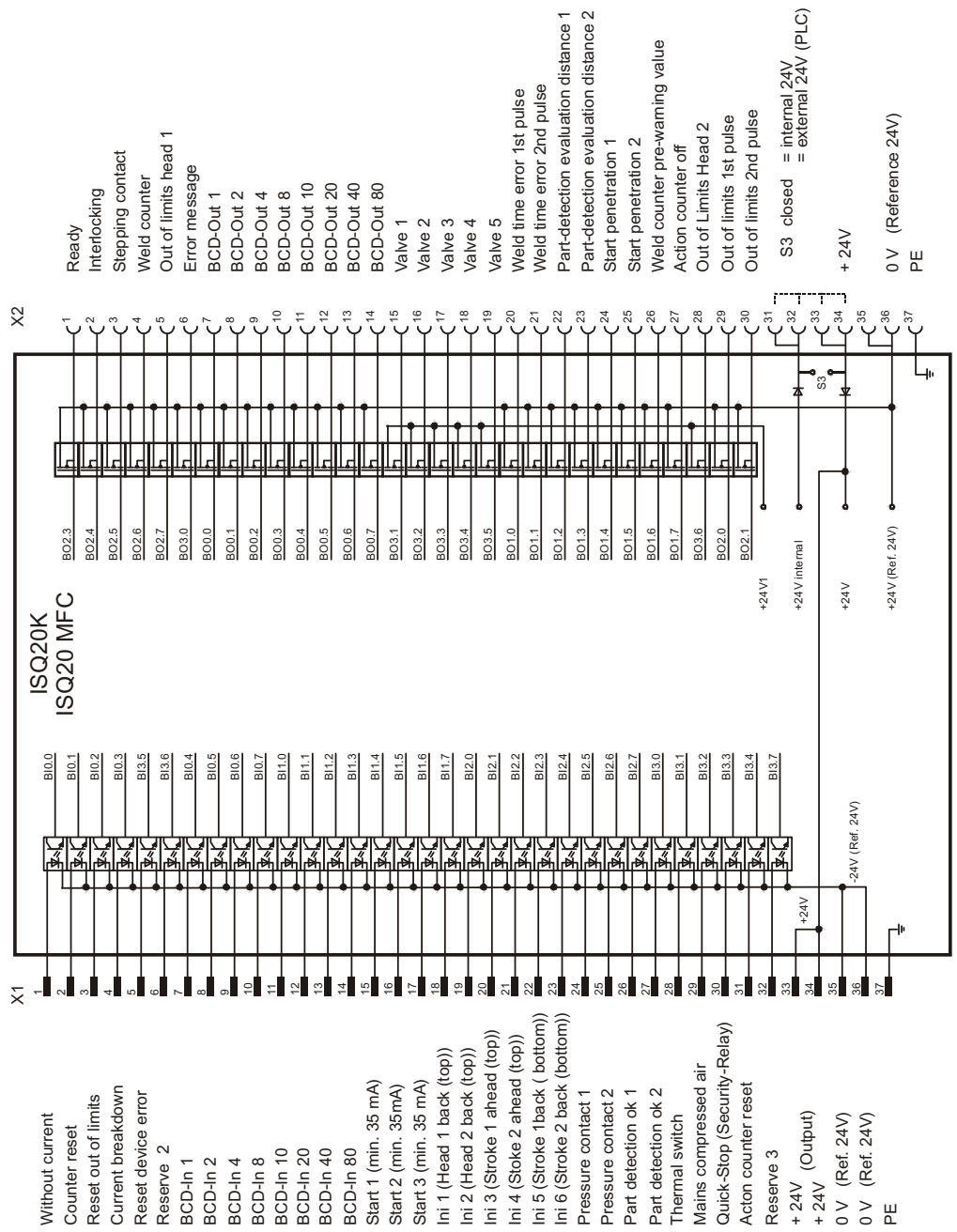
Connection of secondary links is established with M8x16 screws.



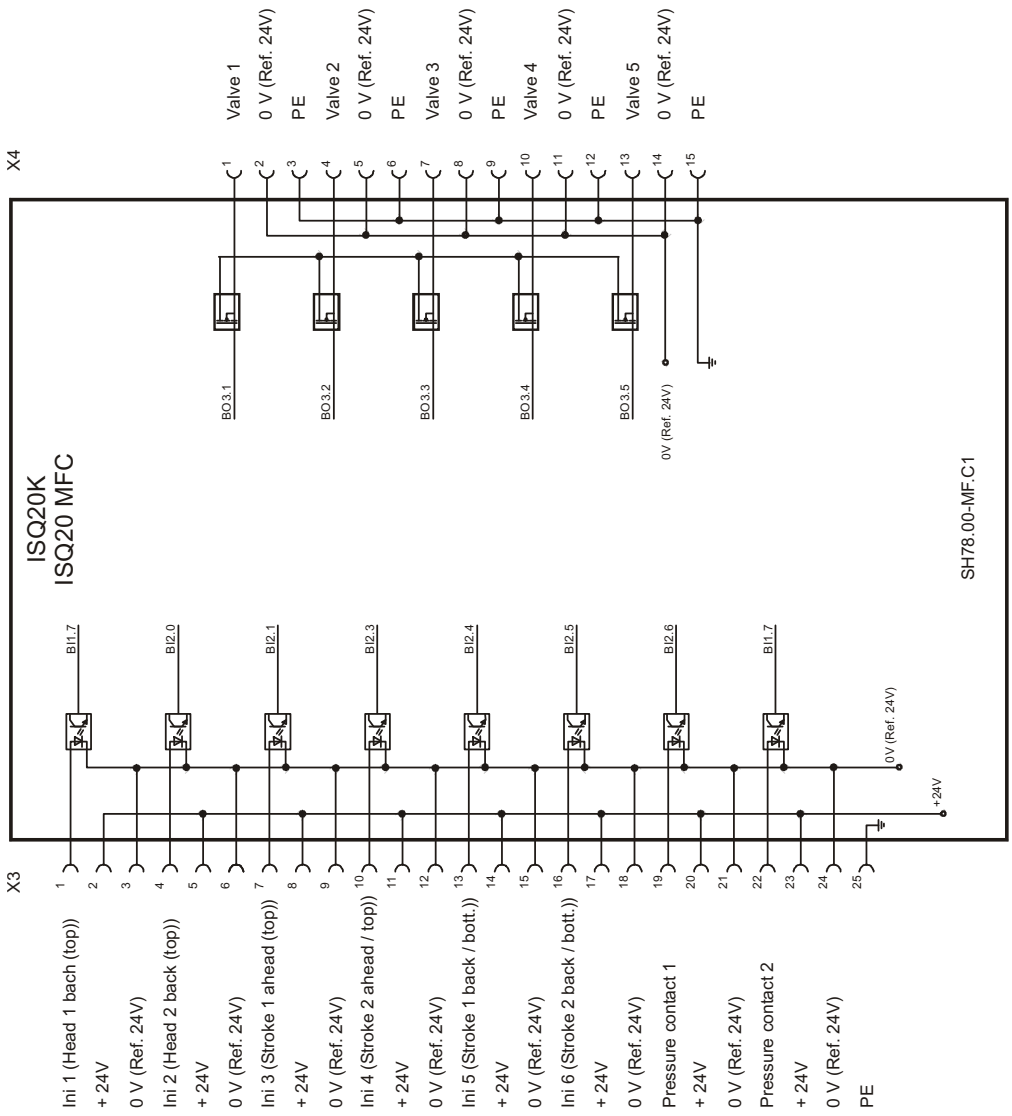
14.2 External Connections – 19“ Unit ISK20-MFC with Main Stage ISQ20



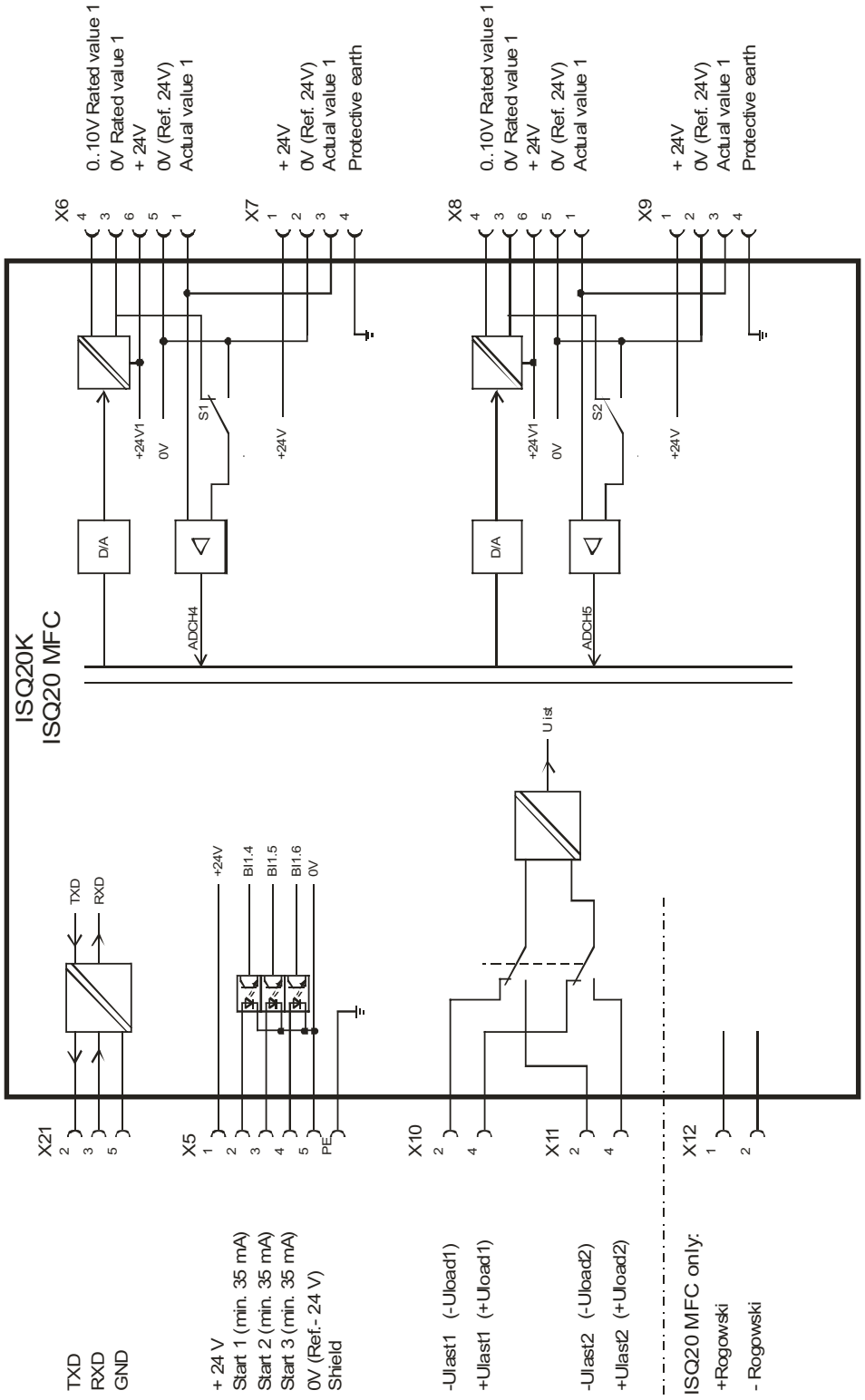
14.3 Binary Connections 1



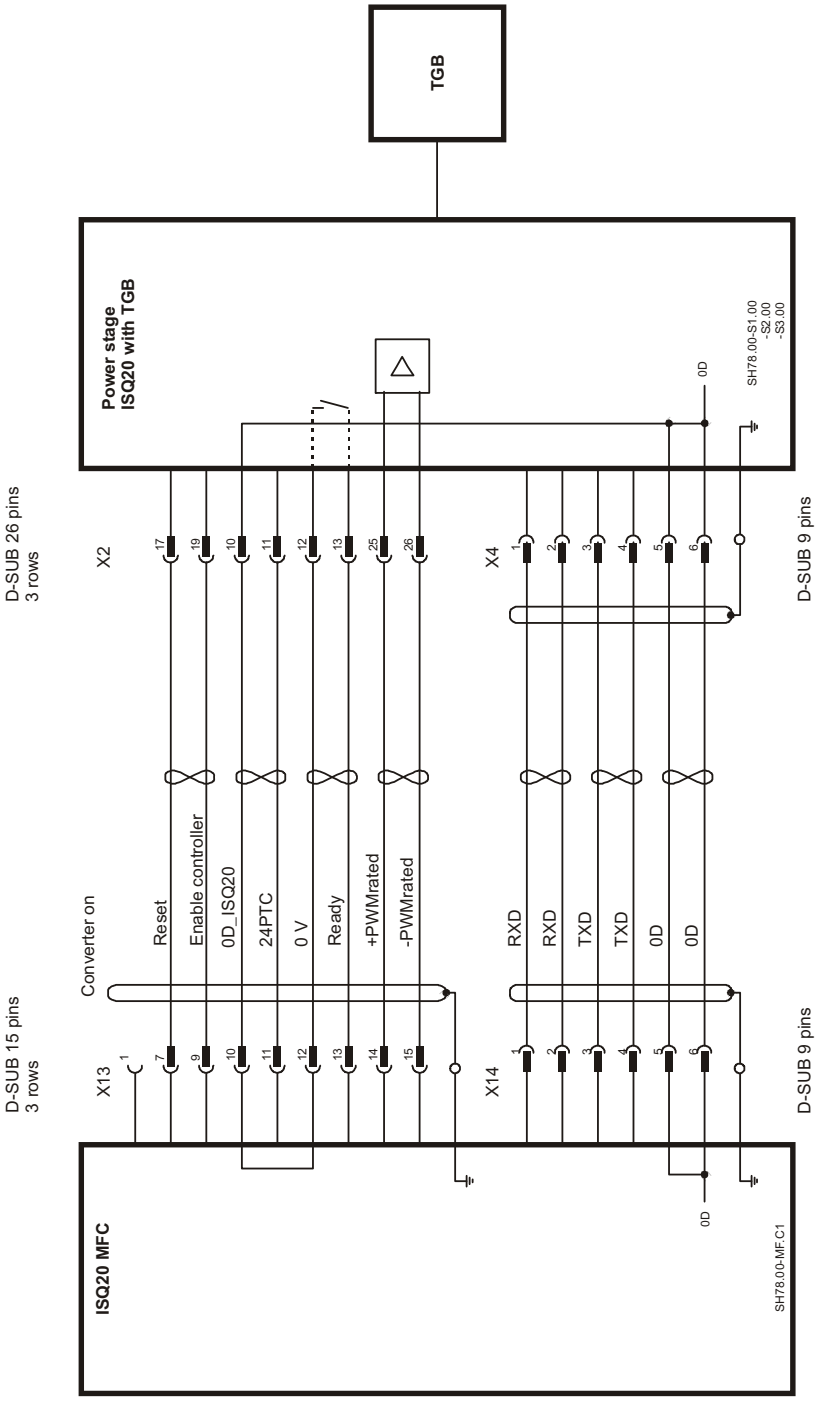
14.4 Binary Connections 2



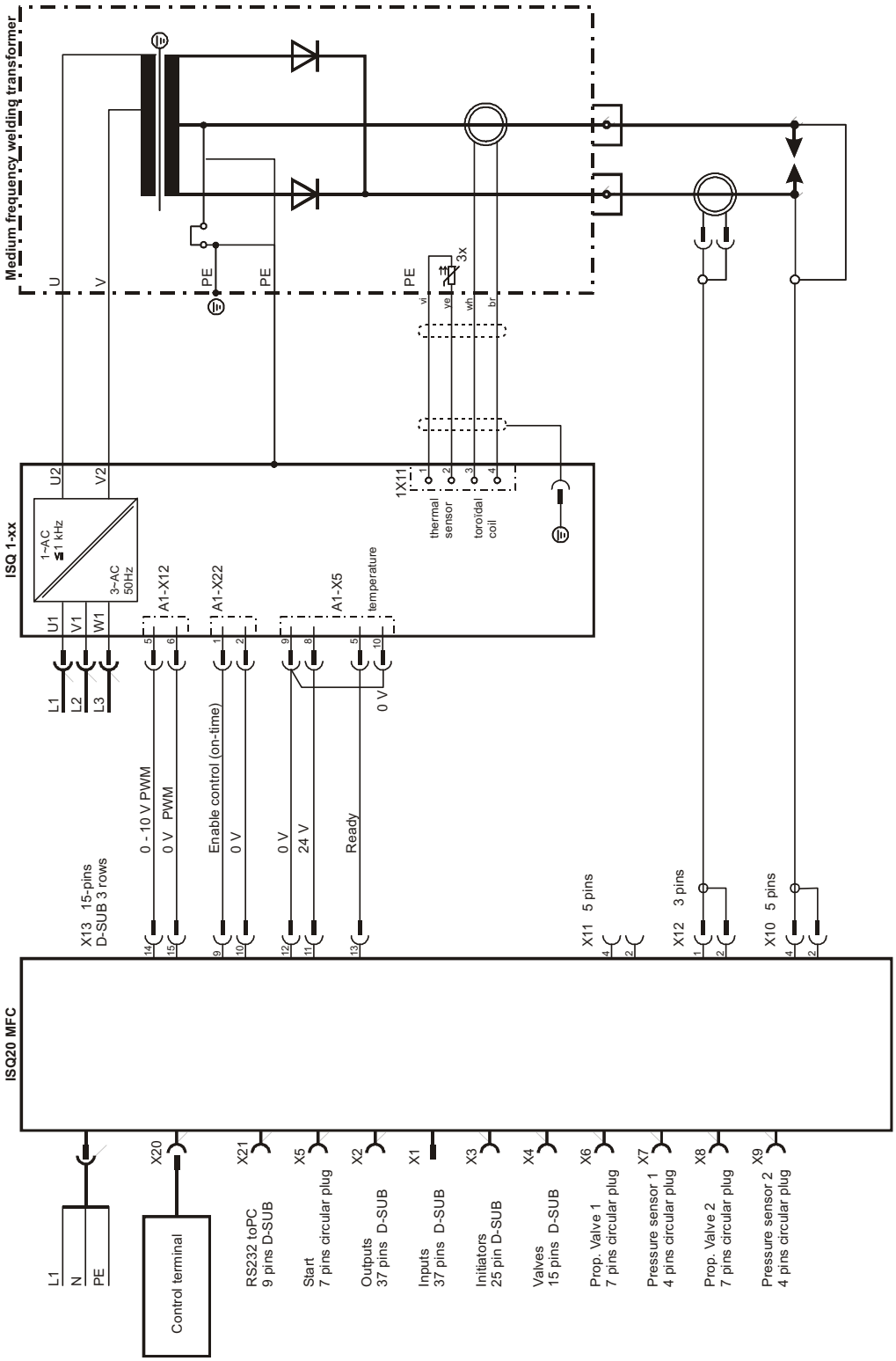
14.5 Analogic Connections and Others



14.6 Control Cable between ISQ20-MFC and Inverter Main Stage ISQ20-TGB

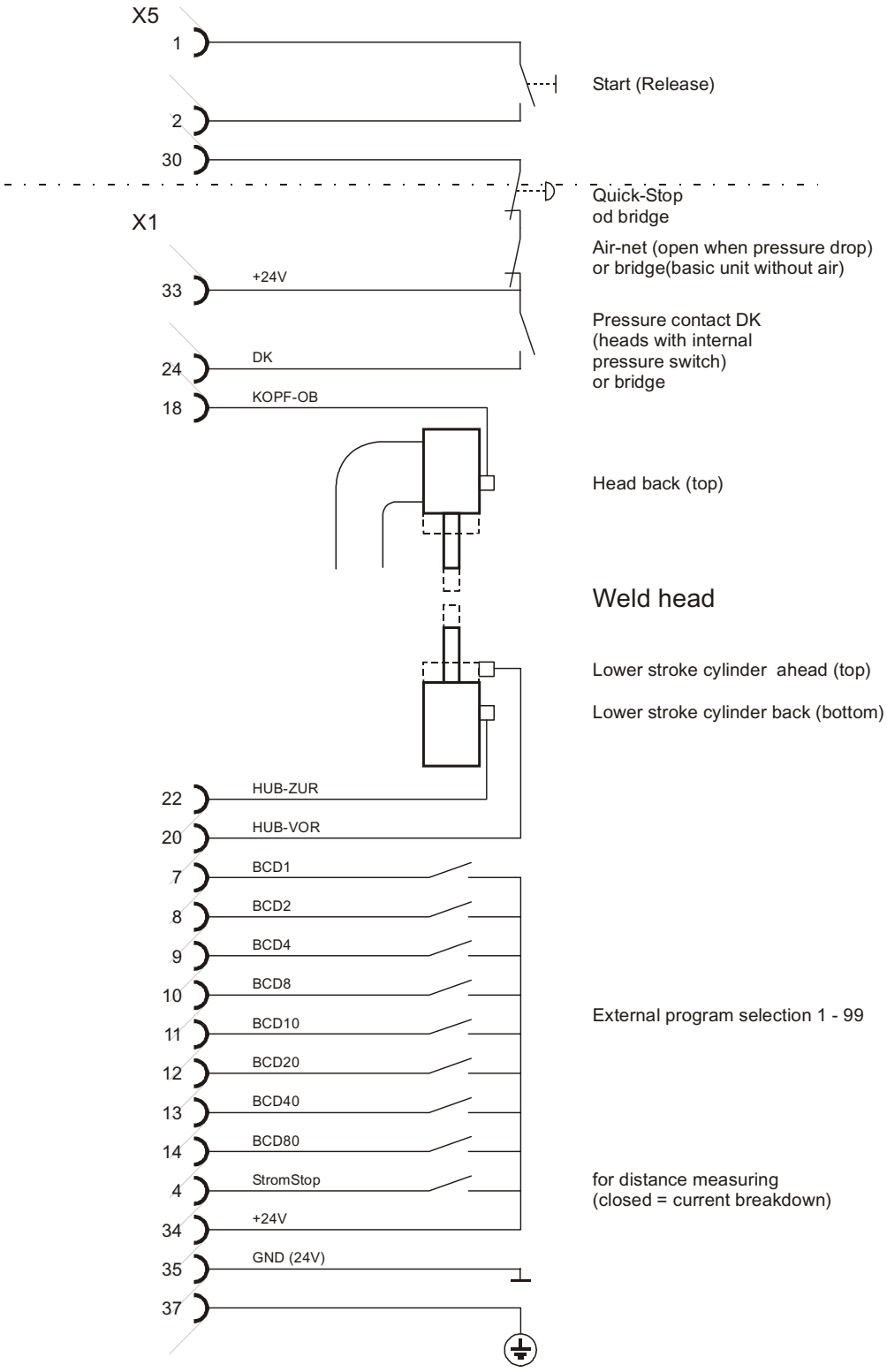


14.7 Control Cable between ISQ20-MFC and Inverter Main Stage ISQ1-xx



14.8 Scheme Inputs - Start

(simplified scheme)



15 Appendix

15.1 Additional Software

Two other programs are available for saving current welding data:

WinMinit S		**766.09 159**
	• Documentation of program numbers • 1st, 2nd, and 3rd amplitude pulse • Respective current times • Counter status • Set point deviation (Out of Limits) from rated value	
or the comfortable		
WinWeld		**766.09 166**
	• As above, but with the additional features: • Statistics • Analysis • 3D-Graphic	

Please contact our sales department for further information.

16 Index

16.1 Figures

16.2 Headword