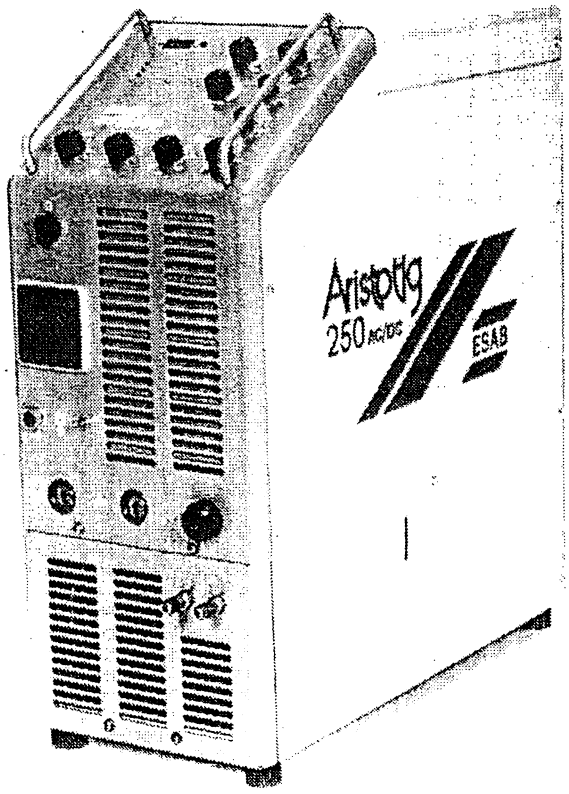
DTM250
Aristotig 250

Welding power source



Service manual

740 800-013 9103

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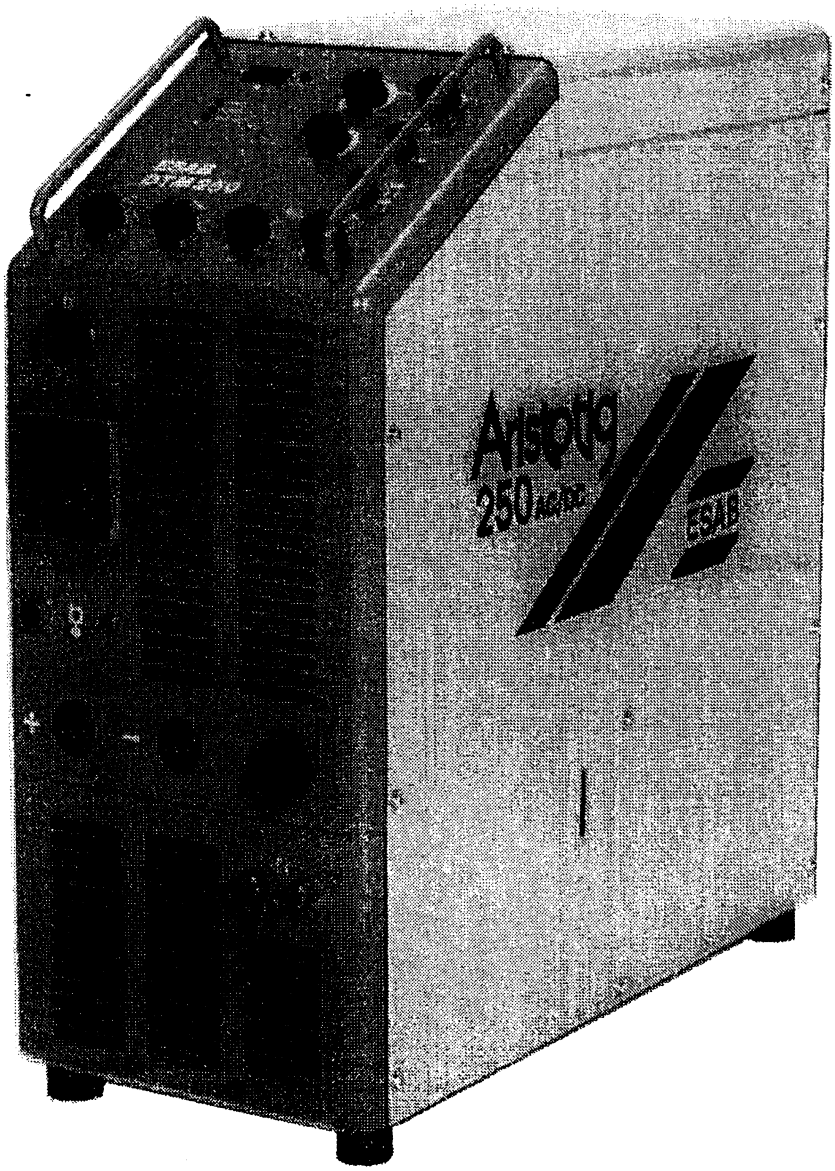
DTM 250

INTRODUCTION

This service manual is intended to be used together with the instructions. The spare parts list can be found in the instructions.

The instructions can be found in the service manual after the service diagrams. Note that page numbering in the instructions starts again from 1, and that several page numbers are omitted. This is because only the English part of the instructions has been included.



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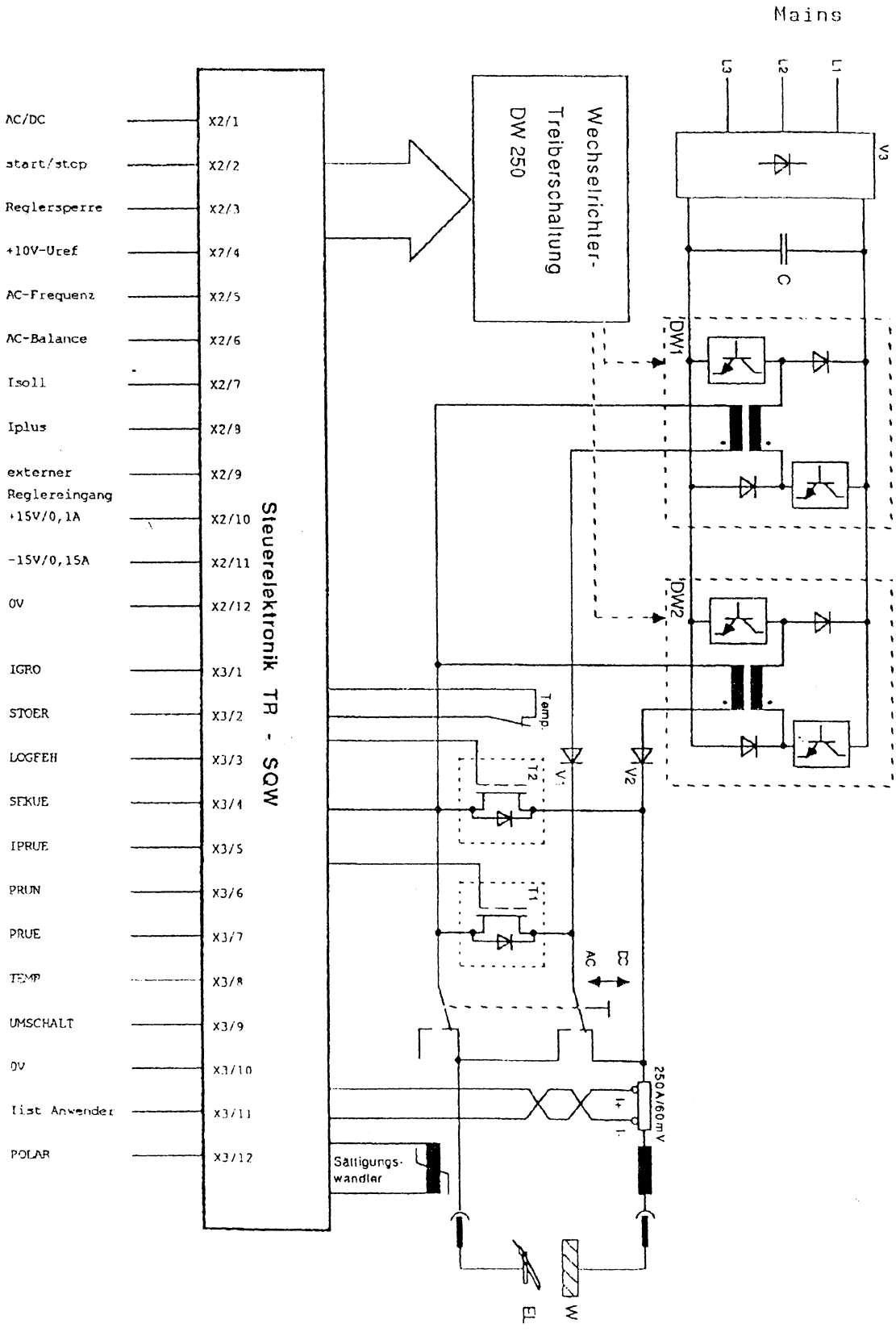
GENERAL DESCRIPTION

The figure is a schematic diagram of the inverter in the DTM250.



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The supply voltage is rectified in rectifier V3 and supplied to the intermediate-voltage circuit at capacitor C via a charging circuit which restricts the current surge to capacitor C when power is turned on.

The DC voltage in the intermediate circuit is inverted to 20 kHz by transistor inverters DW1 and DW2. The inverted voltage is then supplied to the two transformers.

The drive stages for the inverter power transistors are mounted on circuit board DW-250, which also carries the capacitors of the intermediate-voltage circuit and the primary current limit monitoring circuit.

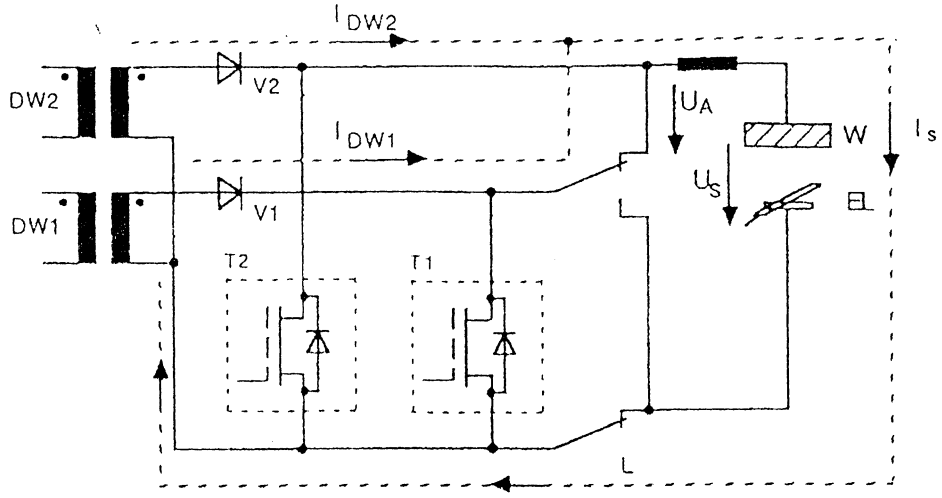
The potential-free driving current power supply to the power transistors is obtained from circuit board SPW-1, which is switched on the primary side at 60 kHz.

All functions on the DW-250, together with secondary switches T1 and T2, are monitored by the central control electronics on the TR-SQW circuit board.

Sections 1 and 2 (below) describe operation of the inverter for DC and AC welding.

DC welding

The figure is a schematic diagram of the arrangement for DC welding.



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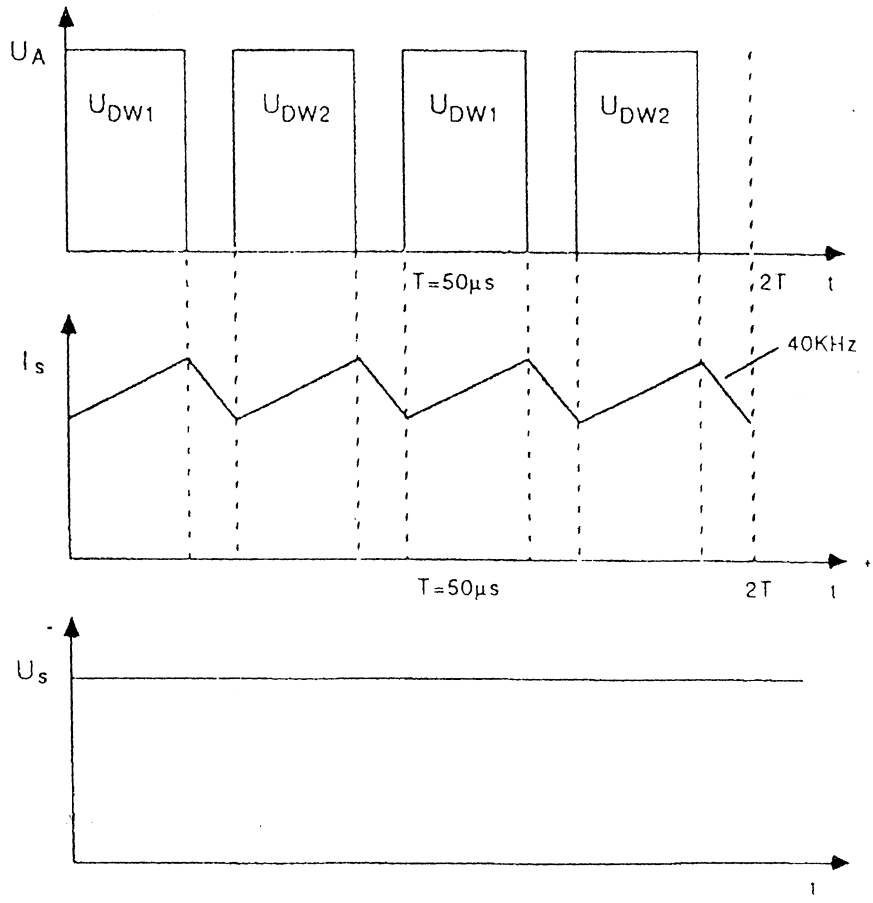
The AC/DC changeover switch on the front panel is in the DC position (symbol =).

The inverters are connected in parallel on the secondary sides of the transformers via the AC/DC changeover switch and the two rectifier diodes, V1 and V2. Transistor switches T1 and T2 are open, with the reverse-connected diodes across the switches operating as freewheel diodes for the welding current.



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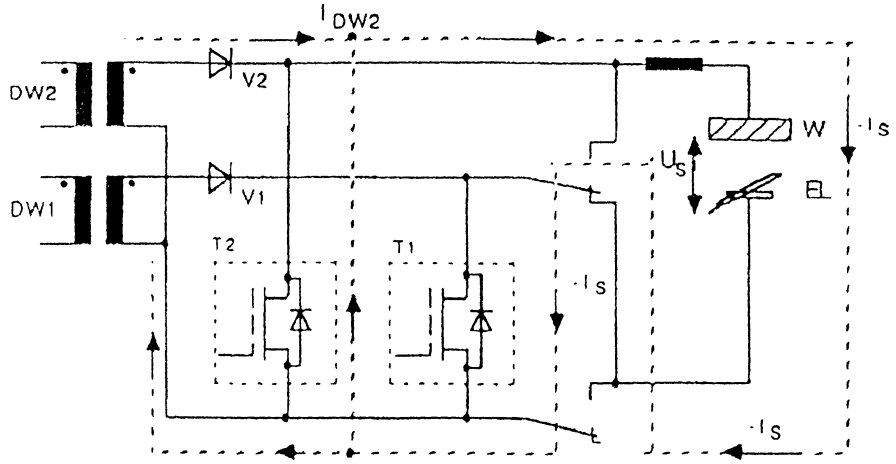
The two inverters, DW1 and DW2, operate at 20 kHz. When one is conducting, the other is inactive, with the result that the final welding current frequency is 40 kHz.

AC welding

The figures are a schematic diagram of AC welding.

The AC/DC changeover switch in the AC position (symbol ~).



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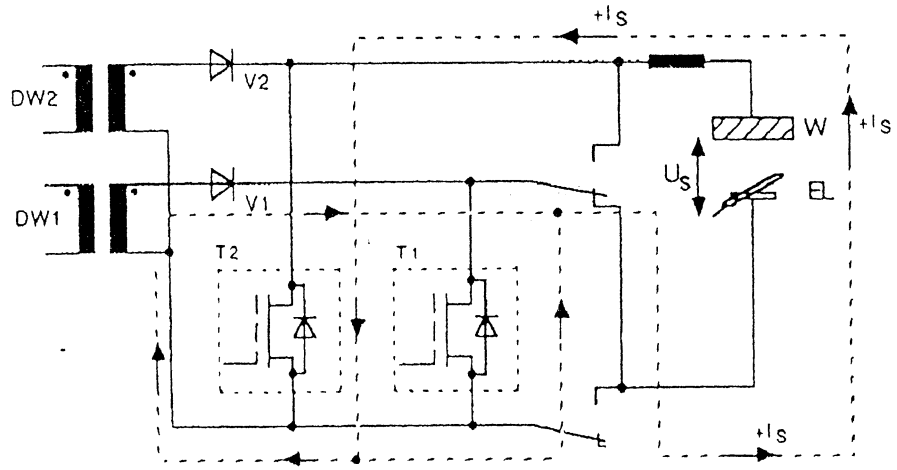
During the **negative half cycle** of the welding current (i.e. with the electrode negative relative to the workpiece), transformer DW2 conducts, while DW1 is inactive. Transistor switch T1 conducts and switch T2 is off.

The welding current flows in the negative direction through rectifier diode V2, the choke and the weld. The reverse-connected diode in T2 acts as a freewheel diode for the welding current.



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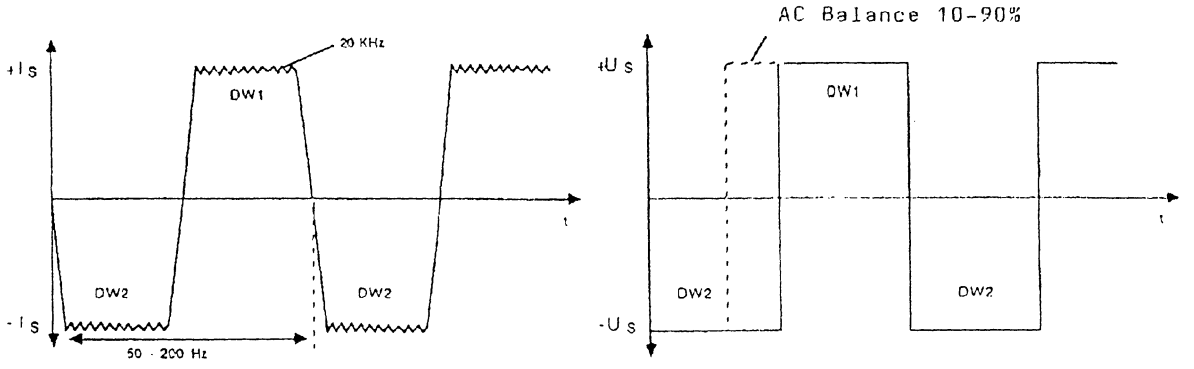
During the **positive half cycle** (i.e. with the electrode positive relative to the workpiece), transformer DW1 conducts, while DW2 is inactive. Transistor switch T2 conducts, and T1 is off.
The welding current flows in the positive direction through rectifier diode V1 and the arc, with the reverse-connected diode in T1 acting as a freewheel diode for the welding current.

The arc is always ignited by DC, with the electrode positive relative to the workpiece. Not until ignition has been successfully completed does the equipment change over to AC. If the arc is extinguished, the power unit changes to DC for re-ignition within 0.2 seconds.



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Note: AC welding in the MMA mode is not possible!

Electronics - control signals

The control electronics in the TR-SQW unit contain all necessary control and supervisory features for the inverter. Other logic functions, such as 2-stroke/4-stroke, slope up, slope down, gas relay, HF relay etc., are provided in the logic control.

The signals between the TR-SQW unit and the logic control are described below.

Start/Stop Contact X2/2

Start - power unit	High level	U > 12 V
Stop - power unit	Low level	U < 1 V

+10 V UREF Contact X2/4

Reference voltage to the logic control.

AC - Frequency Contact X2/5

This set value signal allows the frequency to be varied between 50 Hz and 200 Hz.

AC frequency	50 Hz	equivalent to 0 V
AC frequency	200 Hz	equivalent to +10 V

This signal is inoperative during DC welding.

AC - Balance Contact X2/6

Positive half cycle 20%, negative half cycle 80%, equivalent to 0 V.
Positive half cycle 50%, negative half cycle 50%, equivalent to +5 V.
Positive half cycle 80%, negative half cycle 20%, equivalent to +10 V.
During DC welding, this signal is inoperative.

ISOLL Contact X2/7

Set value for welding current.
Maximum and minimum values can be adjusted on the TR-SQW circuit board.
When delivered from the factory, the power unit is calibrated as follows:

AC operation		Potentiometer
7 A welding current is equivalent to	0 V set value	P7
250 A welding current is equivalent to	+10 V set value	P8
DC operation		
5 A welding current is equivalent to	0 V set value	P5
250 A welding current is equivalent to	+10 V set value	P6

IPLUS Contact X2/8
Whether for AC welding or DC welding, the arc is always ignited by DC. Only when the arc is properly established does the power unit change to AC.

The IPLUS signal allows the logic control to determine the duration of the DC voltage used for arc ignition. As long as the IPLUS signal is held low after ignition, DC will flow in the arc. This DC current quickly heats the tungsten electrode, ensuring reliable ignition even when using thick filler wires and low welding currents.

When the IPLUS signal changes from a low to a high level, the welding current changes to AC.

The ignition time setting is adjustable between 2 and 20 ms on the front panel of the welding power source. For further information please see 'LOGIC CONTROL' on page 13

Positive DC voltage on ignition	Low level	U < 5 V
AC welding after ignition	High level	U > 12 V

During DC welding, this signal is inoperative.

+15 V, 100 mA	**Contact X2/10**
-15 V, 150 mA	**Contact X2/11**
0 V	**Contact X2/12**

The above connections provide power supplies to the high-level control system.

IGRO Contact X3/1

Welding current	Low level	U < 1 V
No welding current	High level	U > 13 V

STOER Contact X3/2
Common alarm.

This signal indicates that a fault has occurred, and is present always with another alarm signal. The second signal, indicating the type of fault, can be found on circuit board TR-SQW.

Alarm	Low level	U < 1 V
No alarm	High level	U > 13 V

for explanation of other alarm signals, see the list of alarm signals provided by'Fault/alarm messages on the TR-SQW LED display' on page 31. Alarm/non-alarm levels are the same as shown above.

SEKUE	**Contact X3/4**
IPRUE	**Contact X3/5**
PRUN	**Contact X3/6**
PRUE	**Contact X3/7**
TEMP	**Contact X3/8**

UMSCHALT **Contact X3/9**
0 V **Contact X3/10**

A changeover contact in the AC/DC changeover switch is connected between these two contact points. They are connected in such a way that they are linked to each other during both AC welding and DC welding.

This signal prevents a changeover being made between AC welding and DC welding while the inverter is operating.

If the link between X3/9 and X3/10 is interrupted while the inverter is operating, the inverter is immediately stopped for about 0.7 s, after which time it is again ready for operation.

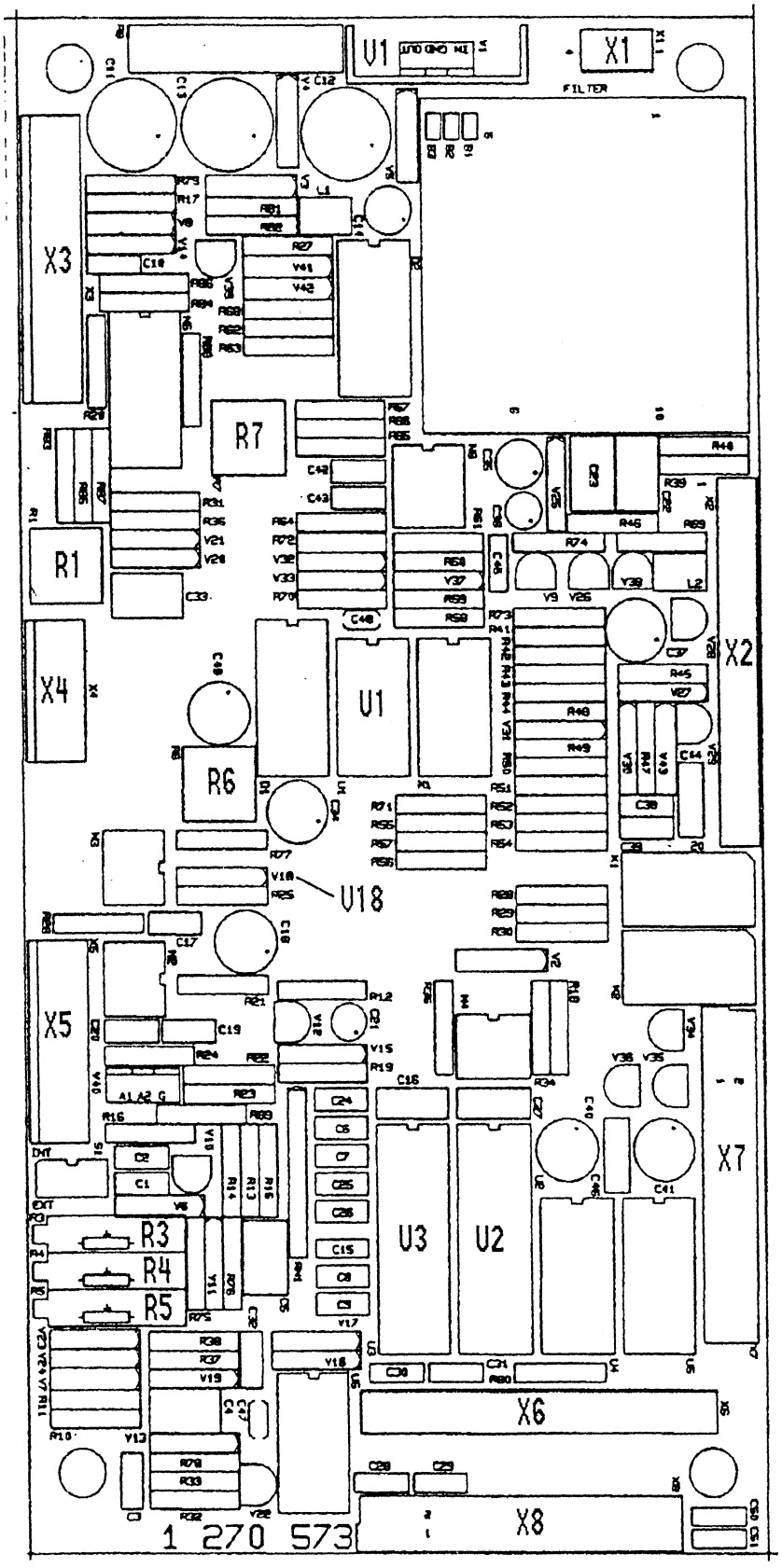
IIST - Anwender **Contact X3/11**

This terminal carries a standardised current reference signal from the inverter to the logic control.

0 A	is equivalent to	0 V
250 A	is equivalent to	+5 V

DESCRIPTION OF THE CIRCUIT BOARDS

Logic control PC-board layout 1 270 573



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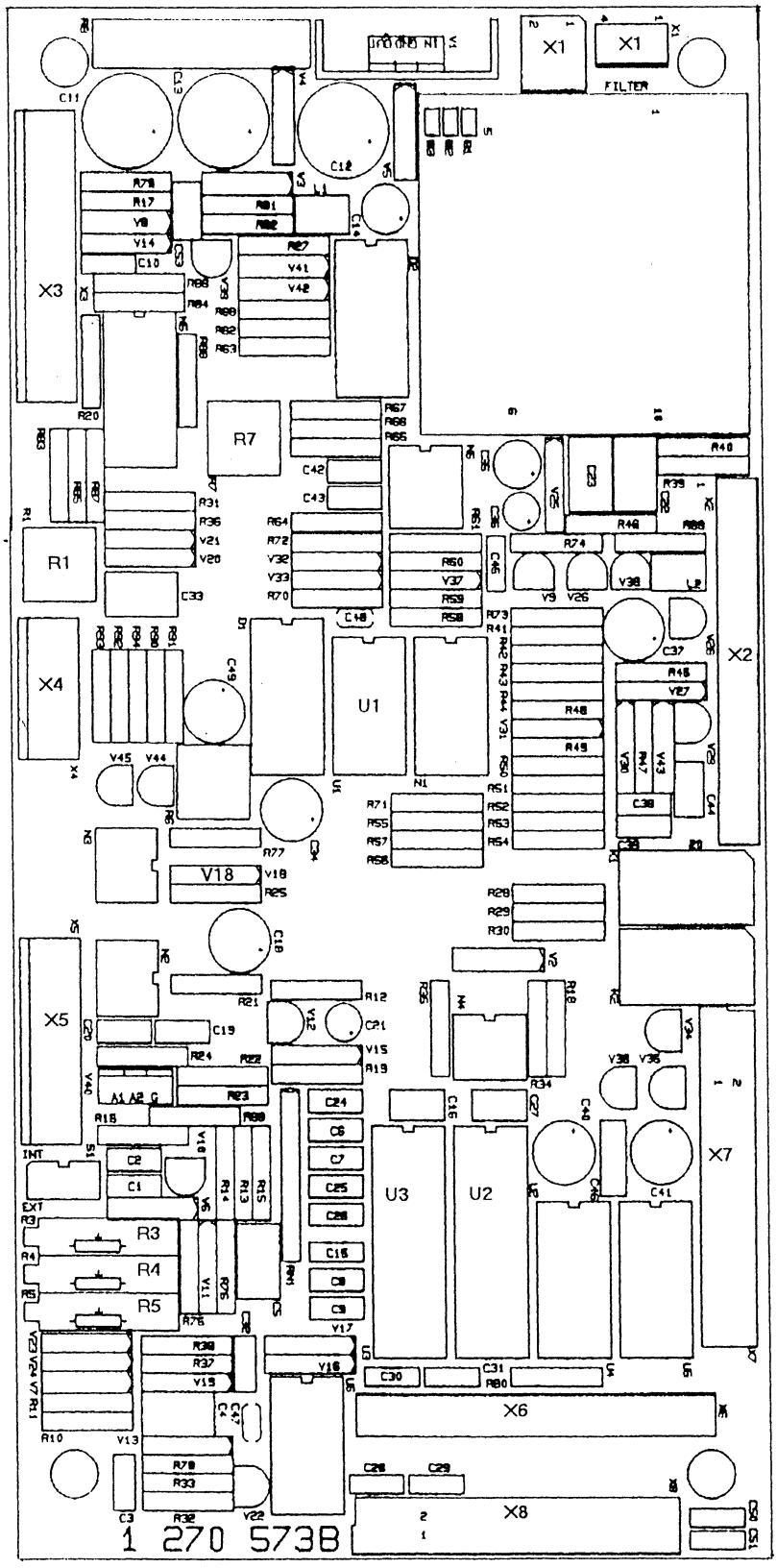
Logic control PC-board layout 1 270 573B



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From machine no. 172 489, this modyfied board is built in to the machines.
PCB 1 270 573 can be replaced by this board.

LOGIC CONTROL

Description of the High level control system (HLCS).

The following changes have been made to the PC-board:

- A second connecting block for X1 (start/stop).
- Remote/local setpoint changeover at the PCB see the diagram on page 17
- C17 and R26 are deleted.
- N3 pin 4 and 6, more distance to other components as these connections are carrying the sync. signal to the HF-oscillator.

Connections with other parts in the welding power source is shown in the 'SERVICE DIAGRAM' on page 34

General description

The supply voltage
+15V contact X3.2 -15V contact X3.3 0V contact X3.1
is taken from the TR-SQW in the inverter block. The +15V is also used as a source for a regulated +5V supply (V1).
The main part of the analog functions are realised with operational amplifiers. The processing of logical functions are realised with programmable array logics (PAL; U2/3).

Description of electronic signals

1. **Waterflow contact X5.6**

   - Release for operation: low level
     Connection is made from 0V pin 5 to pin 6 at the water cooler connector by:
     - a jumper
     - K1 is deenergized (the TIG torch is not connected, MMA welding)
     - flow switch is activated
   - Stop operation: high level
     The connection between pin 5 and 6 at the water cooler connector is open. The switch transistor V10 at PCB activates the fault indication LED at the front panel through contact X7.7.

2. **Inverter block disturbed contact X3.7**

   - Release for operation: high level
   - Stop operation: low level, signal STOER from TR-SQW

3. **Forced switch off**

   - This signal can be measured at the cathode of diode V18.
   - Release for operation: high level
   - If the torch switch is depressed, but welding not started within 2 - 7 s (time base R6, C18),
   - Stop operation is activated: low level
   - The signal is transferred to the TR-SQW via **contact X3.4**, see no.10 below.

4. **Selection MMA contact X2.2**
   Active: low level
   This signal increases, apart from logical functions, the start time (2 - 20 ms) by factor 10 (2 - 200 ms)

5. **Start/Stop contact X1.1 and X1.2**
   Start active: low level
   For protection of the PCB a combination of snubber diodes and LC- filter is applied. The signal is galvanic separated from the torch with the start PCB which is located behind the central connector.

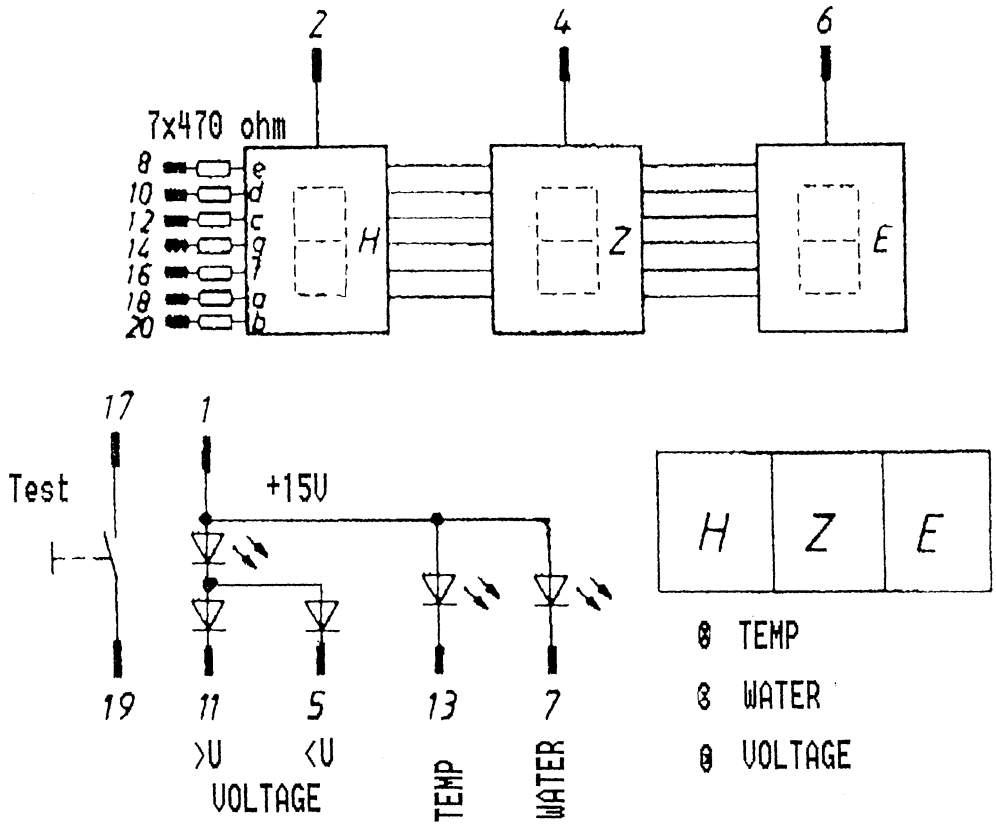
6. **Up- and Down- slope contact X2.8 / X6.16**

   - During constant load operation, X2.8 is 10V (adjusted with trim potentiometer R7) and source to the current reference potentiometer.
   - During the slope up time the reference voltage on contact X2.8 slopes up to 10V.
   - When slope down time is active, the reference voltage slopes down from 10V.

7. **Current reference contact X6.15**
   Range: 0 - 10 V corresponding to 5 - 250 A DC

   - **Display** on front panel, three 8 segment LEDs
     contact X7.2, 4, 6,.....20

The display printed circuit board



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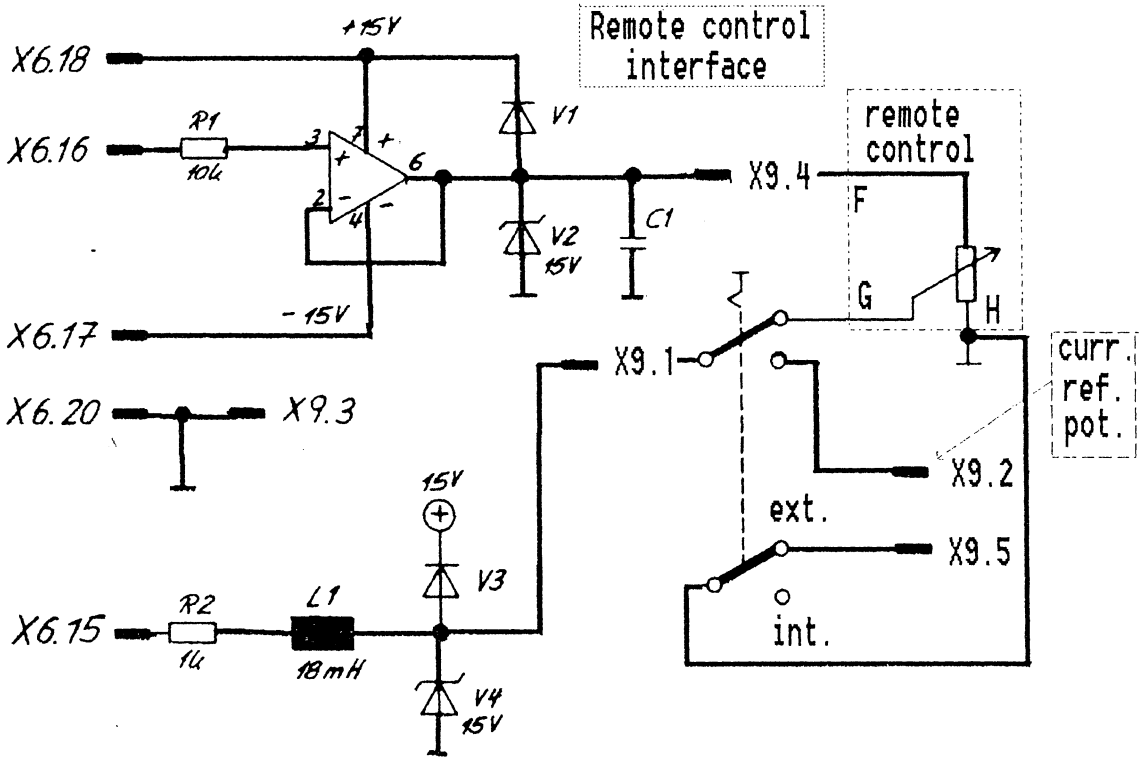
- **Test**, preselect
  Setpoint indication before welding **contact X7.19**
  Active: low level
  By pressing the button, upslope is simulated and the analog value, adjusted by the current reference potientiometer is indicated at the front panel.
- **Remote control** **contact X9.4**
  The remote control interface is placed on an additional PC-board connected to connector X6. Connector X9 is on the remote control interface PCB.



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The 10V source **contact X6.16** is connected through an operational amplifier to the remote control contact F.
The remote connection H has contact to 0V through X9.3.
The Ext/Int selector switch connects in position "Int" the front panel potentiometer with contact X9.1 and X6.15 on the PCB.
In position "Ext" the remote control contact G is connected to the PCB.
From machine no. 172 489 the current reference potentiometer is connected to X2.9, see the diagram on page 17

- **Setpoint to TR-SQW contact X4.1**
  I ref is the output current setpoint to the TR-SQW

  If MMA welding is selected the current setpoint is doubled (max 250A) for the time adjusted at the start time potentiometer (2 - 200 ms).

  If TIG welding is selected the current setpoint is 130A for the time adjusted at the start time potentiometer (2 - 20 ms).

  For the welding after the starttime, the reference level set by the current reference potentiometer is selected.

- 2-stroke down slope
  As long as the welding current setpoint at down slope is greater than 25A, the current may be increased again by pressing the torch switch. If the threshold of 25A is reached the current shuts off.

8. **Gas valve contact X5.3 / X5.4**
   42V AC is switched to the gas valve by a optocoupler triac combination.
   Gas preflow can be adjusted between 0 and 5 seconds at R1 on the PCB.
   Gas post flow can be adjusted between 2 and 20 seconds at the front panel of the welding power source.

9. **AC release contact X3.6**
   Signal name: IPLUS
   For the start of AC welding the arc plus polarity is kept for the time adjusted at the start time potentiometer. After the start time the voltage level at X3.6 switches to +15V and AC welding starts. See also "Setpoint to TR-SQW" on page 15 and IPLUS in chapter "General description".

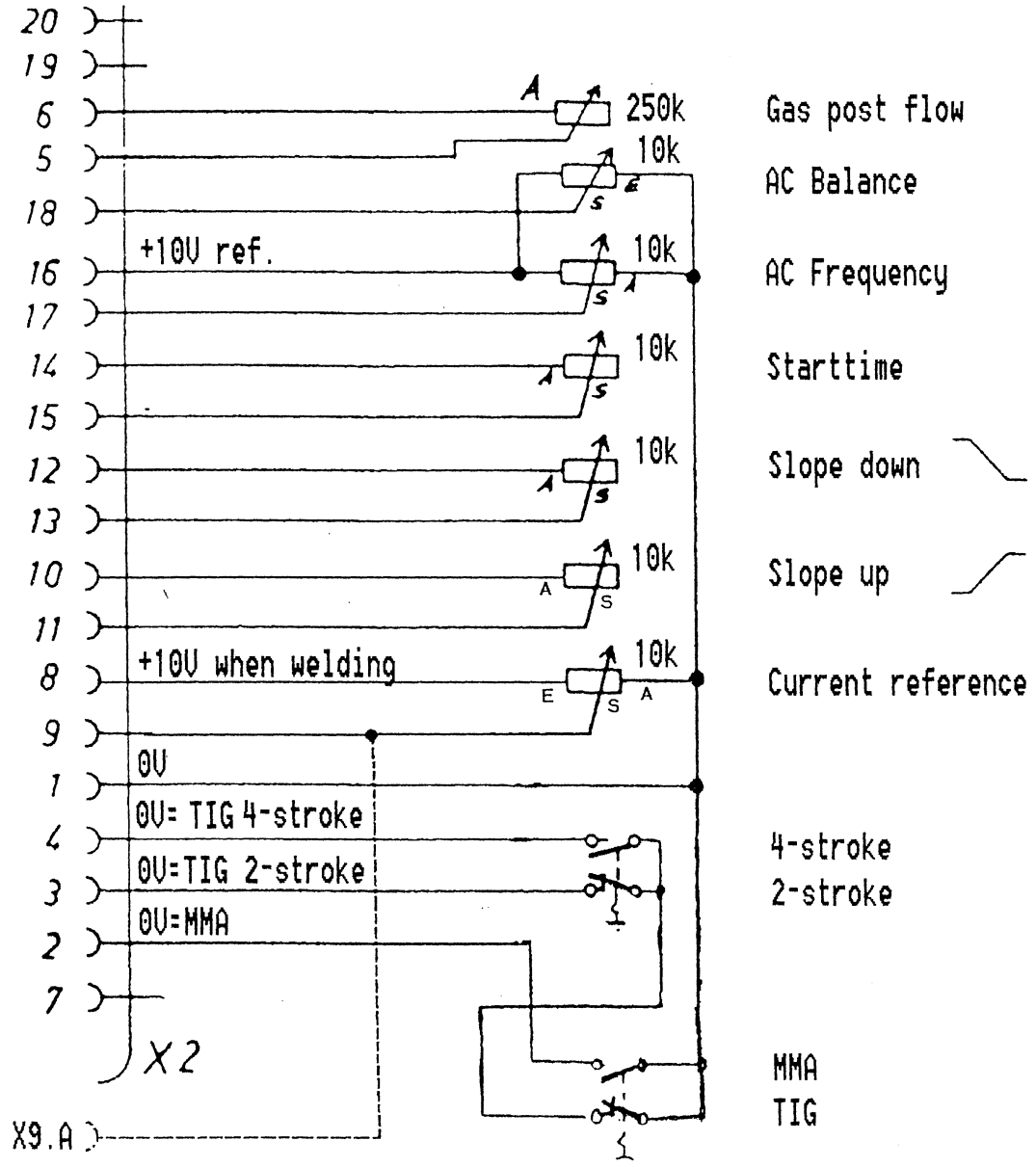
10. **Start/Stop Inverter contact X3.4**
    An optocoupler is activated and is switching +15V to X3.4, the inverter starts.

11. **Start HF ignition unit contact X5.1 / X5.2**
    An opto triac is activated, the triac is closing the syncronizing circuit to the HF unit.

Adjustments on the PCB

- R1 Gas preflow (0 - 5 s)
- R3 "0" LED display, calibrate to 0A. To be calibrated in no load condition.
- R4 Adjustment of the LED display to 250A. When calibrating the test push-button must be depressed and the current reference potentiometer has to be in its maximum position, the calibration must be done in no load condition. **NOTE**, before R4 is adjusted the adjustment of R7 has to be checked.
- R5 Offset 5A for LED display. To be calibrated when the power source is loaded with minimum load (5A).
- R6 Time delay for forced shut down (2 - 7 s), calibrated to 7 sec.
- R7 10V at X2.8 / X6.16 at constant operation.
- All potentiometers are calibrated at factory.

Circuit diagram, potentiometers and switches on the front panel



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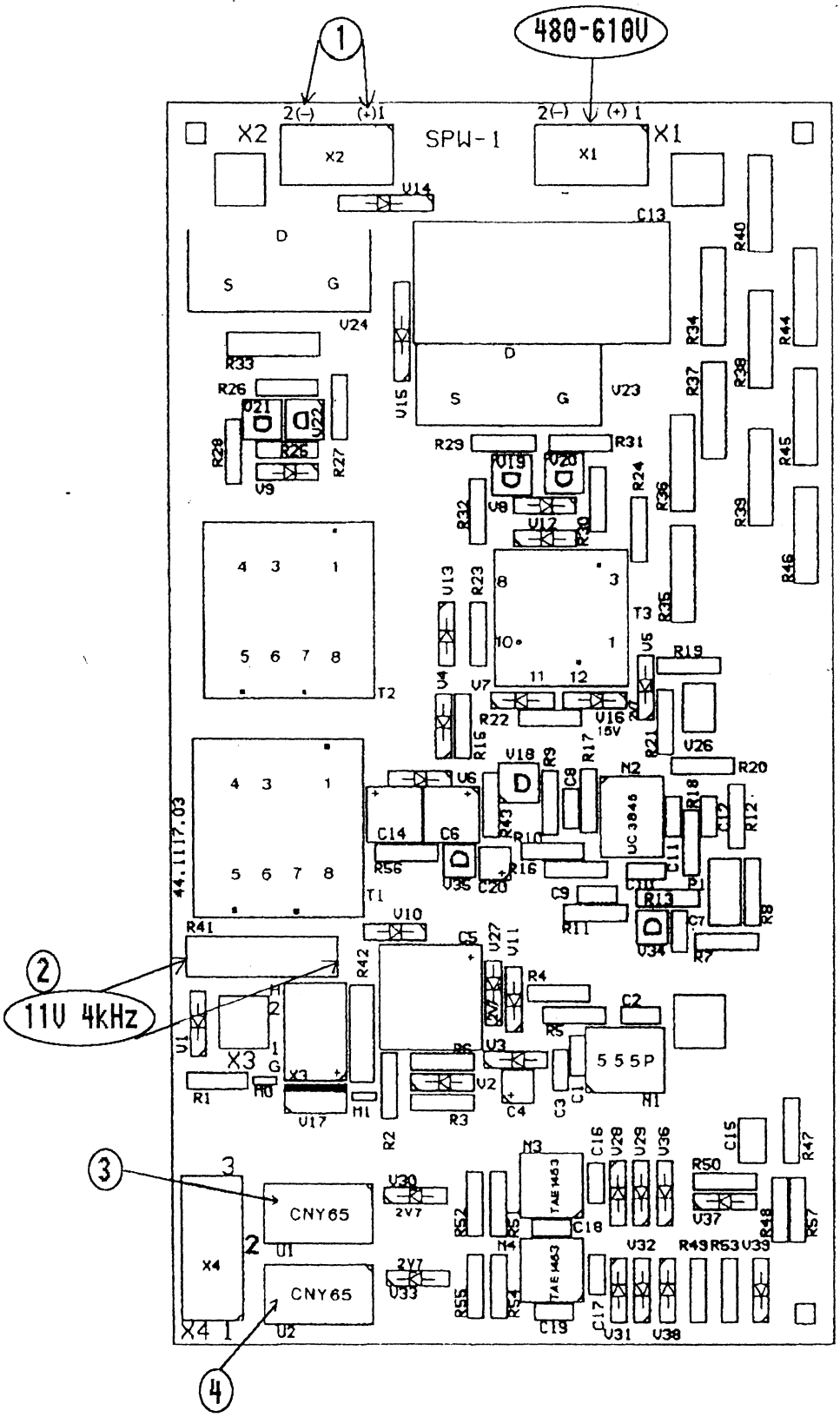
From machine no. 172 489 connection X9.A is deleted. "S" of the current reference potentiometer is connected to X2.9.

SPW-1 Sperrwandler



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PC-board component layout

cnj1ade2 910322

Power is supplied to SPW-1 from the buffer voltage level via contacts X1/1 and X1/2.

SPW-1 has the following functions:

1. Providing the drive stage for the primary switching transistors with a floating power supply via contacts X2/1 and X2/2, from transformers T2, T3, T4 and T5 on DW-250.

   Operating frequency is 53-57 kHz.

2. Turning on the thyristor in the buffer voltage circuit after the delay provided by charging of the smoothing capacitors on power-up. Contacts are X3/1 and X3/2. Trigger pulses for the thyristor will be generated when Ud has risen to about 440 V, providing a delay of about 700 ms.

   The trigger pulse width is 25 µs, amplitude about 11 V, frequency 4 kHz (= 250 µs), as measured across R41.

   - In the event of failure of the thyristor to conduct, current will continue to flow via the PTC resistor. Its temperature will rise and its resistance increase, with the result that Ud falls and the inverter is turned off by the undervoltage protection.

   - If the thyristor should fail to the short-circuit state, the capacitors in the buffer voltage circuit will be charged to a higher than normal value when initially charging up. Again, the inverter will be shut down: this time by its overvoltage protection circuitry.

   - Open-circuit failure of a capacitor will have no effect, as there are several capacitors. A short-circuit failure, on the other hand, will result in loss of Ud, generating an undervoltage fault alarm.

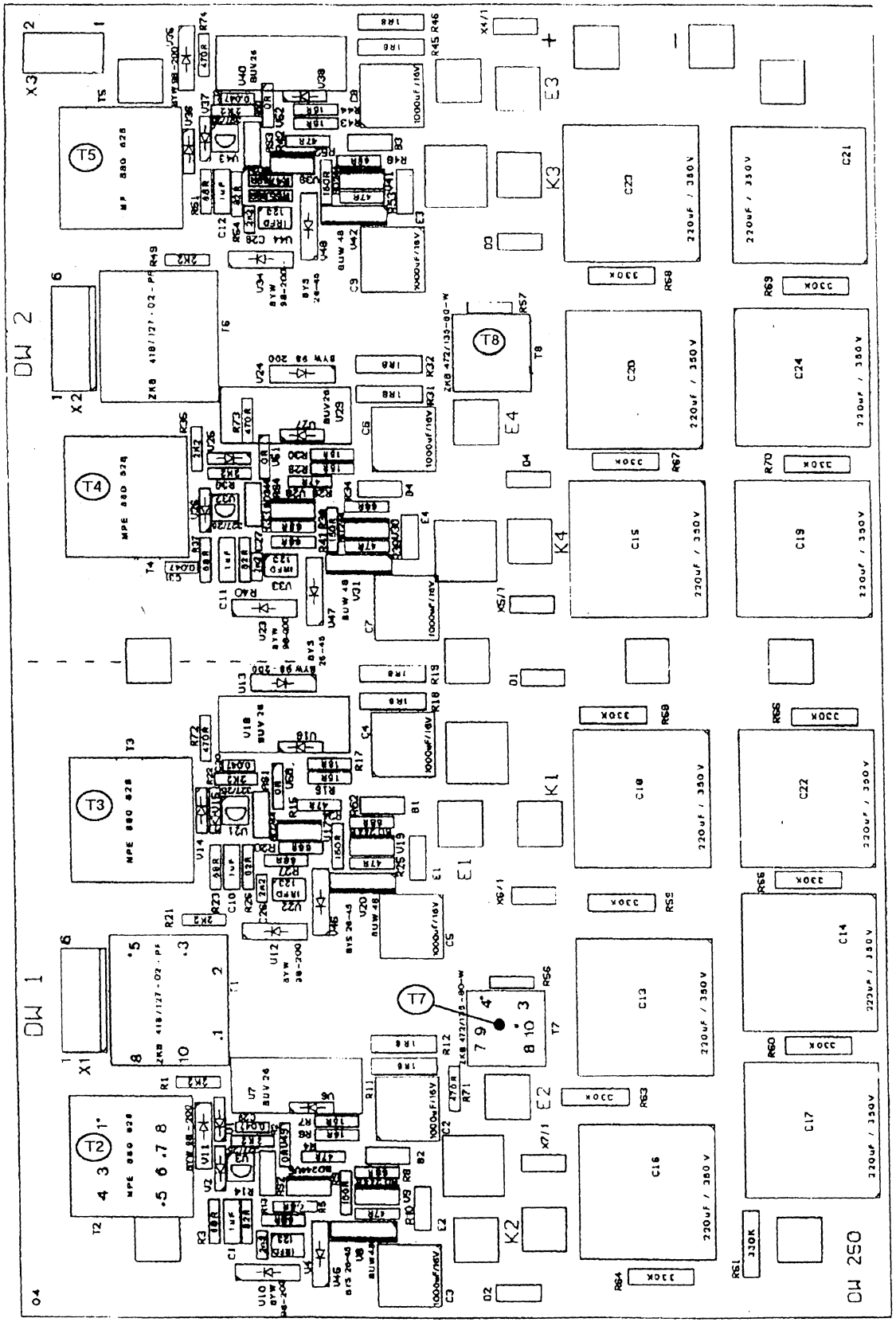
3. Generating an alarm to TR-SQW in the event of primary undervoltage (UPRUN), as measured on contact X4/2. The alarm will be generated if the buffer voltage is 435 ±5 V or lower. The signal is passed via optocoupler U1 to contact X4/2. The optocoupler conducts, i.e. X4/2 is at 0 V relative to X4/3 when the voltage is correct: the output goes high (+15 V) to indicate incorrect voltage.

   Note that the switching level incorporates hysteresis: the alarm signal from U1 will not be cancelled until the voltage has risen to about 450 ±5 V.

4. Generating an alarm to TR-SQW in the event of primary overvoltage (UPRUE), as measured on contact X4/1. The alarm will be generated if the buffer voltage is 620 ±5 V or higher. The signal is passed via optocoupler U2 to contact X4/1. The optocoupler conducts, i.e. X4/1 is at 0 V relative to X4/3 when the voltage is correct: the output goes high (+15 V) to indicate incorrect voltage.

   Note that the switching level incorporates hysteresis: the alarm signal from U2 will not be cancelled until the voltage has fallen to about 605 ±5 V.

DW-250 PC-board layout



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DW-250

The DW-250 contains four separately-supplied drive stages for the bipolar primary switching transistors.

A floating power supply is obtained from SPW-1 via transformers T2-T5. After rectification on the DW-250 circuit board, the positive voltage is +9.3 V and the negative voltage is -7.5 V.

Transformers T1 and T6 receive 20 kHz synchronising pulses from TR-SQW via contacts X2/1, X2/2, X1/1 and X1/2 respectively. Pulse level on the primary sides of the transformers is about 12 V. The frequency is constant, and inverter current is controlled by varying the pulse width.

The drive current to the switching transistors is carried by connections B1-B4.

The primary current in DW1 and DW2 passes through transformers T7 and T8, providing a voltage signal proportional to the current, which is supplied to TR-SQW via contacts X1/3, X1/4, X2/3 and X2/4 respectively.

The smoothing capacitors in the buffer voltage stage are fitted on the DW-250 circuit board.

The cooling fins of the primary switches are at earth potential, insulated from the PTM modules by aluminium oxide.

STM-14 secondary transistor module

This module operates only during AC welding: during other modes, current flows only through the reverse-connected diode in the MOSFET transistors, which acts as a freewheel diode.

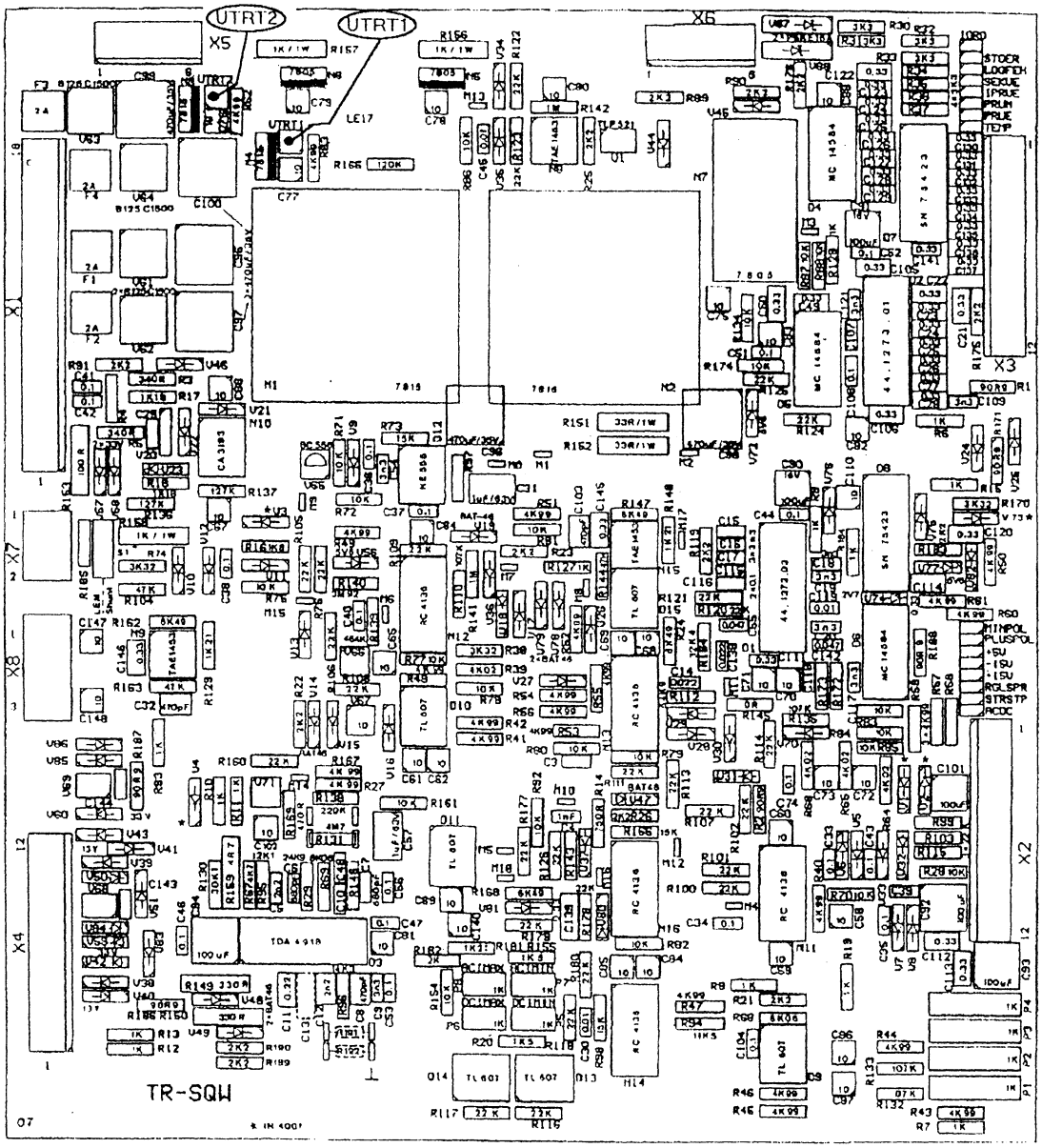
Contacts X1/6 and X1/5 are connected to a thermal cutout fitted in the module, which opens at a temperature of 70 °C.

Contacts X1/4 and X1/5 are connected to an optocoupler, which receives control signals to the module from TR-SQW. A voltage of +12 V on X1/4 will cause the STM-14 module to conduct.

The STM-14 module is supplied by a floating power supply from TR-SQW via X1/3 (+10 V), X1/2 (-5 V) and X1/1 (0 V).

Contact X2/1 carries a signal for voltage clipping of the welding voltage signal to TR-SQW.

TR-SQW PC-board layout



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TR-SQW

Most of the input and output signals to and from this board are described in the sections dealing with the boards with which the TR-SQW communicates.

The signal on contact X2/1 indicates if the switch Q2 is in AC or DC operation.

AC operation	High level	U > 12 V
DC operation	Low level	U < 1 V

"Sättigungswandler", which consists of a ring core on which a coil is wound, is used as a current relay. The welding current is carried by a conductor passing through the centre of the core. Contacts X1/3 and X1/4 on the TR-SQW supply a high-frequency signal to the "Sättigungswandler". When welding current is flowing, the core is saturated, and TR-SQW senses a change in impedance. The core

saturates at a current of about 2.5 A, above which value the change in impedance signals to TR-SQW that current is flowing.

The signal on contact X1/14 indicates the welding voltage. This is monitored by TR-SQW, which generates an alarm if the voltage rises above 90 V.

Contacts X1/7 and X1/8 are connected to a thermal cutout in the interior of the inverter, which opens at a temperature of 80 °C.

Contacts X1/5 and X1/6 carry the signal from the current shunt: this is 60 mV at a welding current of 250 A.

Contacts X1/11 and X1/12 carry a 1 A 18 VAC supply from the transformer. This is rectified and regulated to produce a +15 V supply for internal and external use. A second regulator produces a +5 V supply from this for internal use. LED 12 indicates the +15 V supply, and LED 14 indicates the +5 V supply. Contact X2/10 carries the +15 V supply for external use, with the 0 V connection on contact X2/12.

Contacts X1/9 and X1/10 carry a 1 A 18 VAC supply from the transformer. This is rectified and regulated to produce a -15 V supply for internal and external use. LED 13 indicates the -15 V supply. Contact X2/11 carries the -15 V supply for external use, with the 0 V connection on contact X2/12.

Contacts X1/17 and X1/18 carry a 0.25 A 18 VAC supply from the transformer. This is rectified and regulated to produce +10 V and -5 V floating supplies for T2 on the STM-14 circuit board. Contact X6/3 carries the +10 V supply, contact X6/2 carries the -5 V supply and contact X6/1 carries the 0 V connection. Indication is provided by LED UTRT2.

Contacts X1/15 and X1/16 carry a 0.25 A 18 VAC supply from the transformer. This is rectified and regulated to produce +10 V and -5 V floating supplies for T1 on the STM-14 circuit board. Contact X5/3 carries the +10 V supply, contact X5/2 carries the -5 V supply and contact X5/1 carries the 0 V connection. Indication is provided by LED UTRT1.

HF-OSCILLATOR

The HF oscillator unit provides an ignition voltage of 5,8 kV with a pulse width of 0,6 - 0,8 µs.

The pulse frequency is 50 Hz on no-load. This is controlled by DW pulsing the no-load voltage.

The ignition frequency adjusts itself to the AC frequency when the unit is in the AC welding mode.

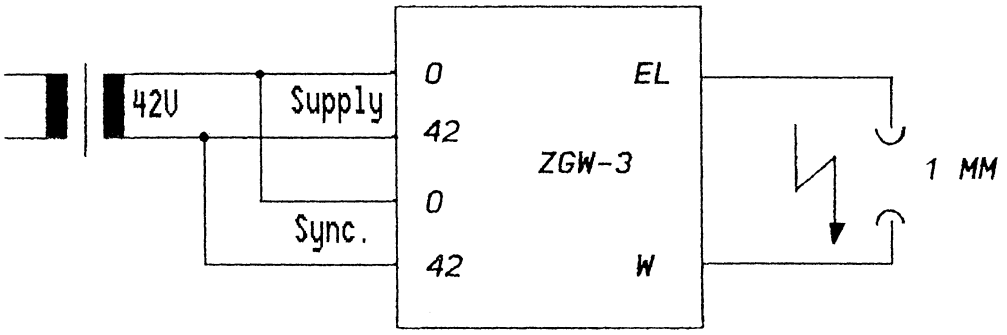
When AC welding, ignition pulses are always applied during the positive half cycles. They are also applied, if necessary, during negative half cycles, i.e. if the arc goes out. Normally, the arc will strike spontaneously during the negative half cycle.

Ignition is initiated from the logic control circuit board, which closes the synchronising circuit to the HF oscillator unit through a triac. The HF unit fires when the synchronising signal exceeds 70 V. As the no-load voltage from the inverter is used as the synchronising signal, an HF spark can occur only when the arc is not established. Positive no-load voltage generates a positive ignition spark, and negative no-load voltage generates a negative spark.

During DC welding, the spark is always negative. During AC welding, it is always positive when starting, after which its polarity tracks the polarity of the welding voltage.

HF-oscillator test

To make a separate test of the oscillator unit. Feed the unit with 42V AC and syncronize it with 42V AC. **NOTE**, power sources with serial number lower than 170 213 may be equipped with a HF-oscillator fed with 230V AC.

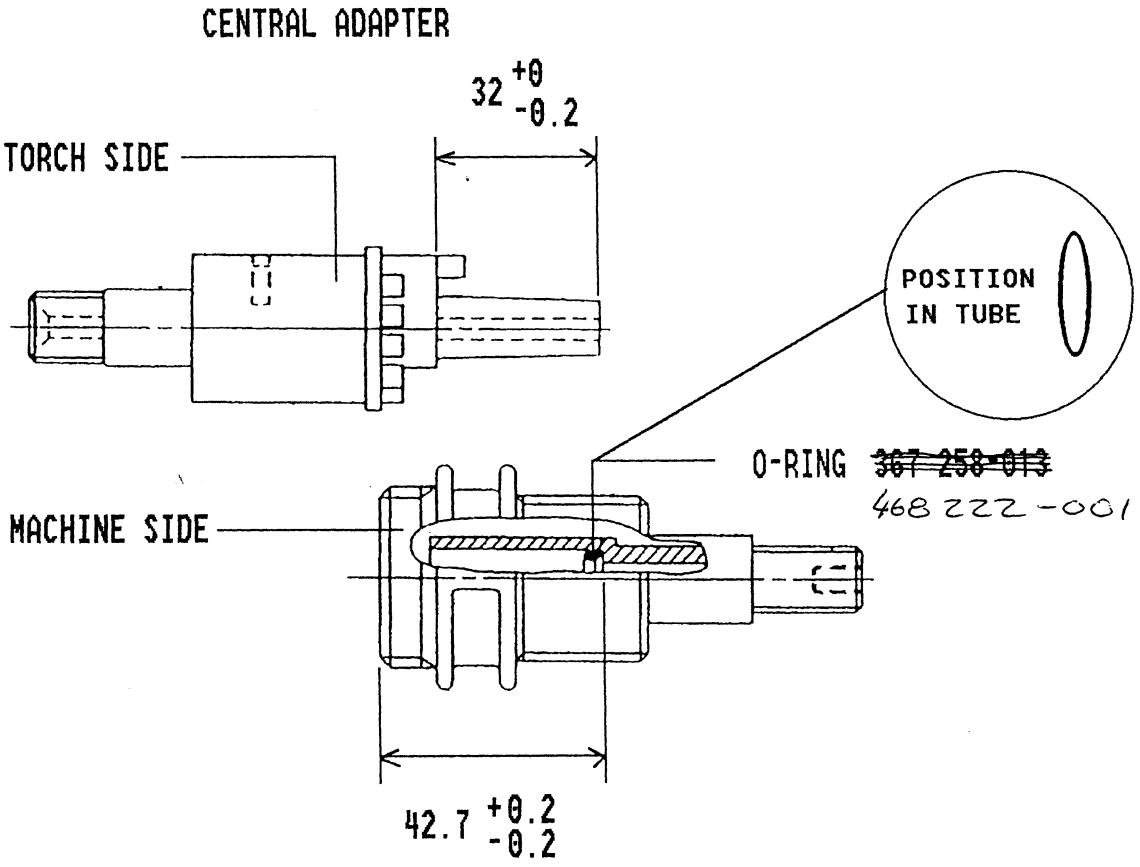


cnj1ap09

The trigger level for the sync signal is approximately 36 - 41 V RMS.
When testing, connect the EL and W connections to a spark plug.

CENTRAL ADAPTER TIG TORCHES

Problems with HF-flash over in the central adapter?
It might depend on on a gasleakage in the adapter. Check the following measurements:



cnjxxp01

If you find any of these measurements wrong, change the faulty parts. Never put in two O-rings in the adapter it will only increase the problems in the long run.

FAULTFINDING

W A R N I N G

H I G H V O L T A G E

D A N G E R

Repairs to, or modifications of, the power unit may be carried out only by trained personnel. The mains supply must always be disconnected when working on the unit. After isolation of the unit from the mains, wait at least three minutes to allow the voltage across the inverter capacitor to fall to a safe level.

Symptom	Cause	Remedy
No function	Defect mains cable	Check the mains cable
	Blown mains fuse	Replace the fuse
	Defect mains plug or mains socket	Repair the defective part
	Faulty main switch	Replace the main switch
	Blown fuse in the inverter block	Replace the fuses (2 x 1 A medium slow 5x30mm) mounted at the backside of the inverter block
	The logic control is faulty	Replace the logic control
		Check the TR-SQW LED display, please look further at 'Fault/alarm messages on the TR-SQW LED display' on page 33
The overtemperature LED at the front panel is on	The duty cycle of the equipment has been exceeded, the power unit is overloaded.	Let the welding power source be switched on for cooling until the overtemperature LED is switched off. Then reset the power source by turning the power supply switch off and then on again.
	Fan fault in the inverter block.	Check the fans and replace the faulty fan.
	Dirt on the cooling fins in the inverter output stage.	Clean the cooling fins with pressurised air. This must be very carefully done and with an airpressure not exceeding 2 bar.

Symptom	Cause	Remedy
The voltage indicating LED at the front panel is on	The mains voltage is too high or too low.	Check the mains voltage.
		Check the mains connection.
	A blown mains supply fuse.	Check the mains fuses and replace blown fuse.
		Check mains supply cable, power supply plug and socket.
	The inverter block is faulty.	Replace the entire inverter block.
		Check the TR-SQW LED display, for further information please see 'Fault/alarm messages on the TR-SQW LED display' on page 33
No welding current when the torch switch is depressed, at TIG 2-stroke mode.	The torch switch is defect, or an interrupt in the connector to the torch switch.	Replace or repair the torch.
	Bad connection in the central connector.	Check the central connector, if necesarry clean the connector.
The LED "STRSTP" on TR-SQW is not on when the torch switch is depressed.	The logic control is defect.	Replace the logic control.
	The start PCB is defect or has a lose connector.	Check the PCB and fasten the connectors.
	Connector X3 or X4 on the logic control board or connector X2 on the TR-SQW PC board is lose or bad connected.	Check and fasten the connectors.
The LED "STRSTP" on TR-SQW is on when the torch switch is depressed.	The inverter control board is TR-SQW defect.	Replace TR-SQW.

Symptom	Cause	Remedy
	The welding return cable is bad or not connected.	Check the connection of the welding return cable.
	Interruption in the welding cable to the torch.	Replace the welding torch.
No gas.	The gas bottle is empty.	Replace the gas bottle.
	The work pressure or bottle pressure gauge is defect.	Replace the defect pressure gauge.
	The gas hose is defect.	Replace or repair the gas hose.
	The welding torch is defect.	Replace the welding torch.
	The gas valve Y1 is defect.	Replace the gas valve.
	The logic control is defect.	Replace the logic control.
No gas post flow; The tungsten electrode is changing coulor after ended welding.	The gas post flow time is too short.	Increase the gas post flow time.
	The logic control is defect.	Replace the logic control.
No HF.	The HF-unit is defekt.	Replace the HF-unit.
	The logic control is defect.	Replace the logic control.
The HF is too weak.	No or not enough gas.	Please see fault cause: No gas.
	Gas leakage in the central connector.	Tighten the central connector, see central adapter tig torches on page 25 .
The welding torch is too hot.	The duty cycle has been exceeded.	Let the welding torch cool.
	The cooling water connections has been mixed up.	Connect the water hoses to the right connections.
	Too little or no cooling water.	Refill cooling water and frost protection liquid.
	The welding torch waterhose is blocked.	Replace the welding torch.

Symptom	Cause	Remedy
	The water hose in the power source is blocked.	Clean the hose with pressurised air, max 2 bar.
	The fan and pump motor M1 is defect.	Replace the defect part.
The waterpump is not running in the Tig-mode. The LED "Water" is on.	The pump M1 is defect.	Replace the pump.
	Bad connection in contact 4 or 6 in the central connector.	Check the central connector.
	Contactor K1 is not energised.	Check contactor K1.
Not possible to adjust the welding current.	The welding current potentiometer is defect.	Replace the potentiometer.
	The logic control is defect.	Replace the logic control.
Only the positive or the negative halfwave is appearing at AC welding.	The AC balance is wrong adjusted.	Adjust the balance potentiometer to its centre position.
	The inverter control TR-SQW is defect.	Replace TR-SQW.
	The inverter block is defect.	Replace the entire inverter block.
The SLOPE UP or the SLOPE DOWN function is defect.	The SLOPE UP or the SLOPE DOWN potentiometer is defect.	Replace the potentiometer.
	The logic control is defect.	Replace the logic control.
It is not possible to adjust the welding frequency.	The AC-frequency potentiometer is defect.	Replace the potentiometer.
	The inverter control TR-SQW is defect.	Replace TR-SQW.

Symptom	Cause	Remedy
2-stroke, 4-stroke, or MMA does not operate.	The welding mode selector switch is defect.	Replace the switch.
	The logic control is defect.	Replace the logic control.

TEST MEASUREMENTS

1. Insulation test with an ohmmeter

- Primary input circuit to housing
  L1, L2, L3 to housing >2.5 MΩ
- Secondary output circuit to housing
  DW-, DW1+, DW2+, EL-OUT, EL-IN to housing >2.5 MΩ
- Primary circuit to secondary circuit
  L1, L2, L3 to DW-, DW1+, DW2+, EL-OUT, EL-IN >5 MΩ

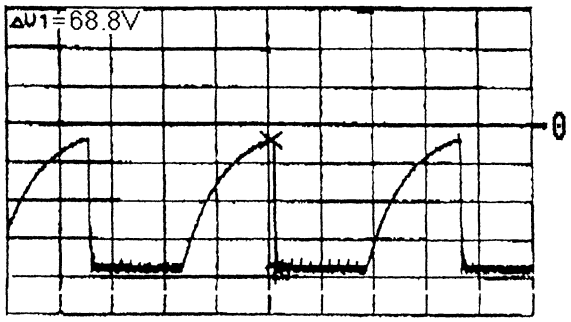
2. Test of Power On Reset

Connect an ohmmeter across connector X3 pin 9 and pin 10 at TR-SQW.
As well in position AC as in position DC continuity must be obtained. Only in the moment of changeover the connection is open.

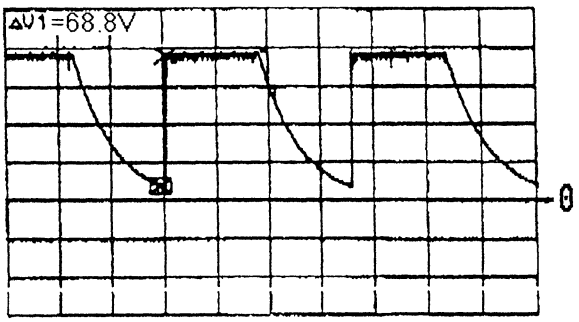
3. No load output voltage

Supply and oscilloscope from an isolation transformer.
Connect the oscilloscope probe to the output of the DTM power source, oscilloscope ground at the negative outlet (-) and the probe at the positive outlet (+).

The oscilloscope is to be in the DC mode. Select MMA-mode and start the machine, the pictures below should appear.



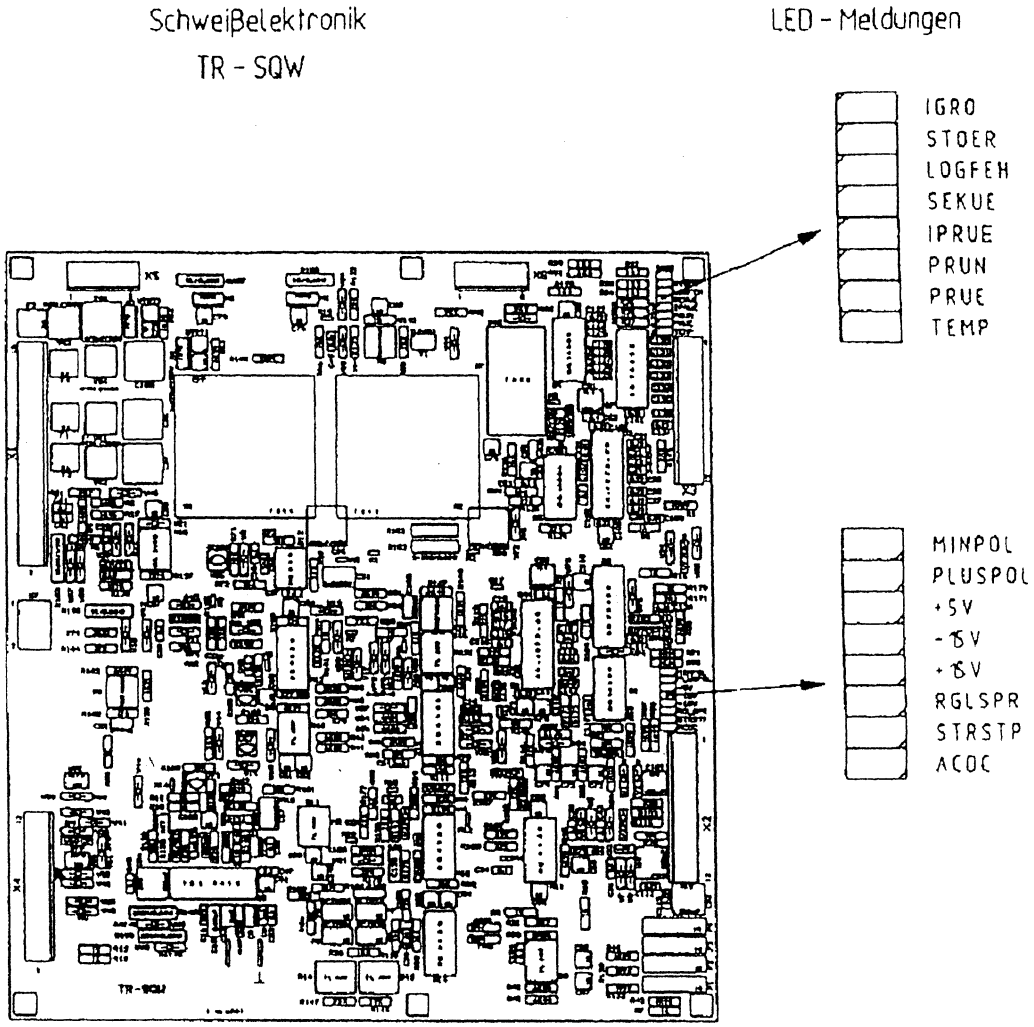
AC-Mode 50Hz 20V/cm, 2ms/cm



DC-Mode 20V/cm, 2ms/cm

cnj1ap13

Fault/alarm messages on the TR-SQW LED display



cnj1ap08

STOER
General alarm message.
This LED always lights, together with one of the individual alarm messages.
Reset the LED by turning the power supply switch off and then on again.

LOGFEH
Logic fault
Defective logic processing in the TR-SQW control unit.
Necessary to replace the TR-SQW circuit board.

SEKUE
Secondary overvoltage.
This alarm indicates excessive inductance in the welding current circuit, e.g. too long a welding cable/hose connection or coiled-up return conductor. Correct the fault and reset the alarm by turning the mains power supply switch off and then on again.

IPRUE
Primary overcurrent.
If this alarm lights, start by attempting to reset it by turning the mains power supply switch off and then on again. If the alarm persists after doing this, or after pressing the pushbutton on the welding torch, it will be necessary to replace the entire inverter unit.

PRUN
Primary - low voltage.
This alarm is generated by too low a mains voltage or loss of one or more phases. Reasons for it may be:

- a blown mains supply fuse
- damaged mains supply cable
- a faulty connector in a power supply plug
- incorrectly connected power supply plug/socket or mains cable
- connection of the unit to too low a supply voltage (e.g. 3 x 230 V).

Once the reason for the alarm has been found and corrected, the alarm signal can be reset by turning the mains power supply off and then on again.

PRUE
Primary overvoltage.
This alarm is generated by too high a mains voltage. The reason for this may be that the equipment has been connected to too high a supply voltage (e.g. 3 x 440 V or 3 x 500 V). Correct the fault and reset the alarm.

PRUE, PRUN
If these two LEDs light together, the complete inverter unit must be replaced.

TEMP
High temperature.
This LED lights to indicate excessive temperature in the power output stage of the inverter. This can be caused by:

- exceeding the duty cycle of the equipment (250 A, 60% with 10-minute intervals).
- blocked cooling air inlet
- blocked cooling air outlet
- dirt on the cooling fins in the inverter output stage
- fan fault

When the inverter output stage has cooled, this alarm will be extinguished, after which the STOER group alarm can be reset as described above.

Operating messages on the TR-SQW LED operating display

MINPOL, PLUSPOL
Both LEDs must be alight during operation.
When performing AC welding, only the PLUSPOL LED lights during the ignition half wave of the arc (the 'I PLUS' X2/8 signal).
If only one of the LEDs is continuously lit, or if neither of them is alight, remove contact X2 on the TR-SQW control board. If the two LEDs still do not light, replace the board.

If the two LEDs light when contact X2 is removed, replace the high-level logic control.

+5 V, -15 V, +15 V
All three LEDs must be alight during normal operation: if any of them is extinguished, the TR-SQW circuit board must be replaced.
If any of the LEDs remain(s) extinguished after replacing the TR-SQW board, check the fuses on the back of the inverter (2 x 1 A medium slow 5x30mm). If they are intact, it indicates a fault elsewhere in the inverter, which must be replaced in its entirety.

RGLSPR
This LED lights only when control is isolated from the high-level control system.

It must be extinguished during welding: if it lights when the pushbutton on the welding torch is depressed, the high-level control system must be replaced.

STRSTP
This LED lights when MMA-welding has been selected, it also lights when the torch switch has been depressed at TIG-welding. If a slope down time is chosen the LED is on during the slope time. If the LED isn't on under the above mentioned circumstanses, the logic control or the start PCB must be replaced.

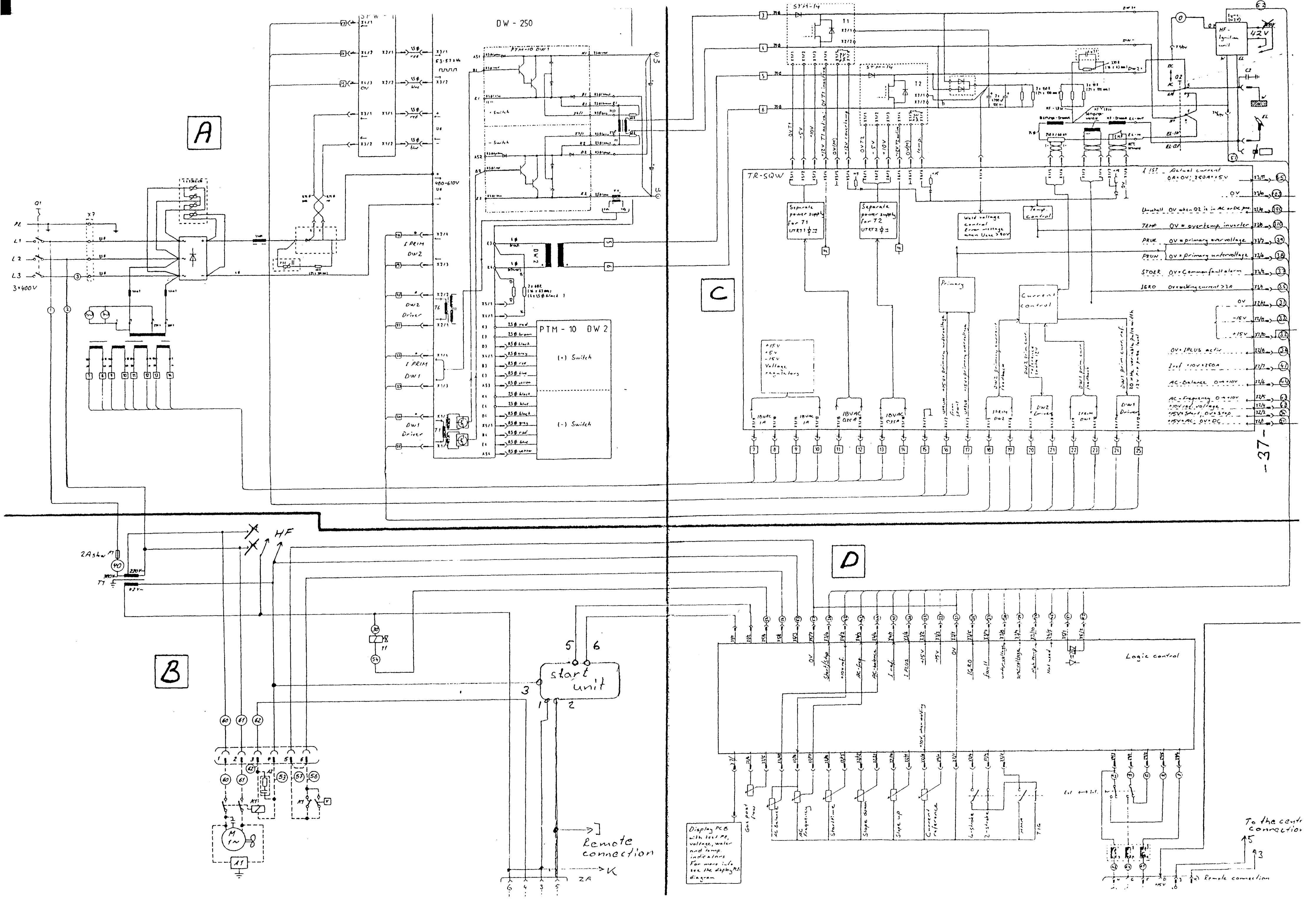
ACDC
This LED lights when AC welding has been selected. It must be extinguished during DC welding.

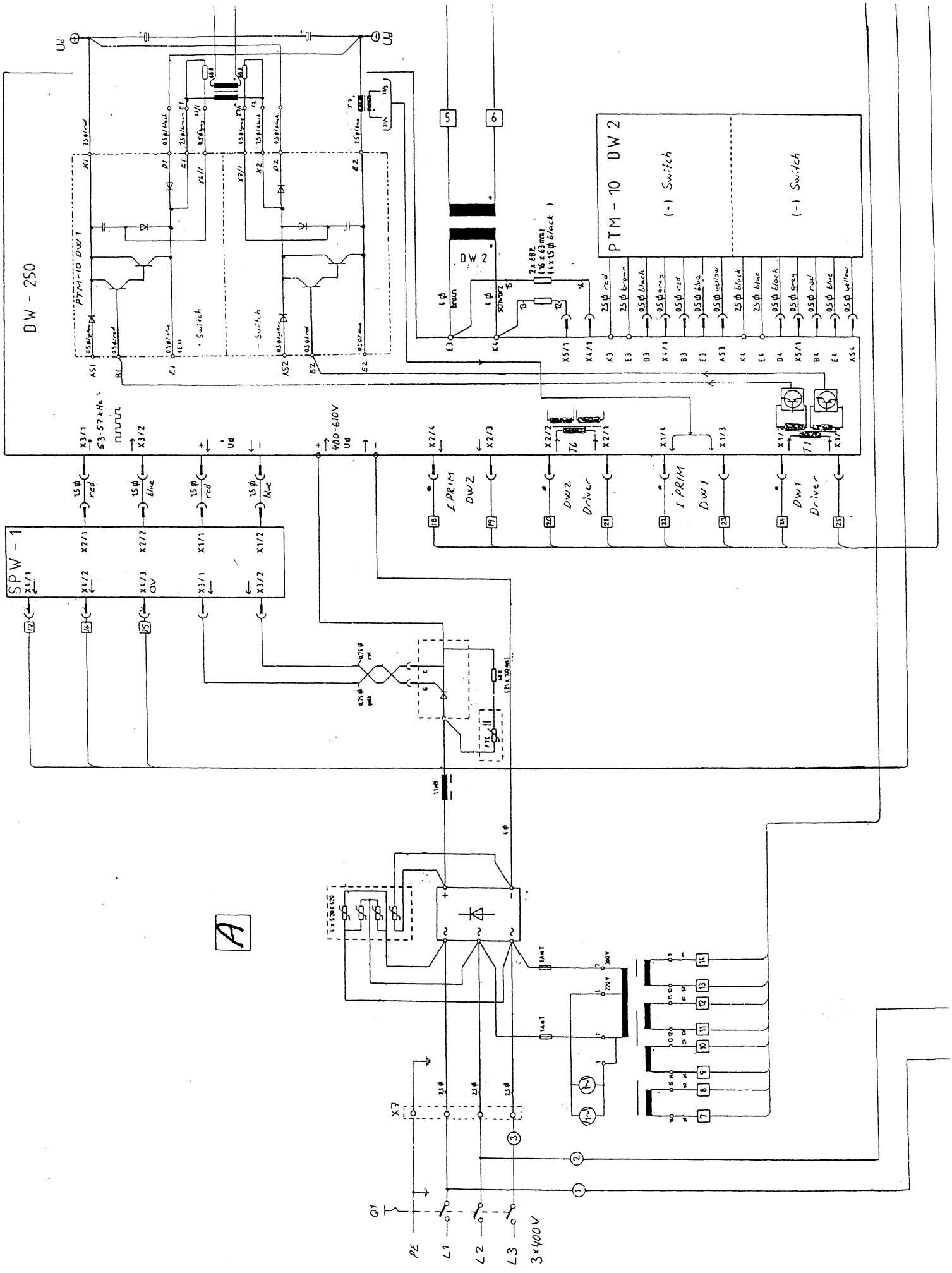
In the event of a fault, replace the high-level control system or check the AC/DC welding changeover switch.

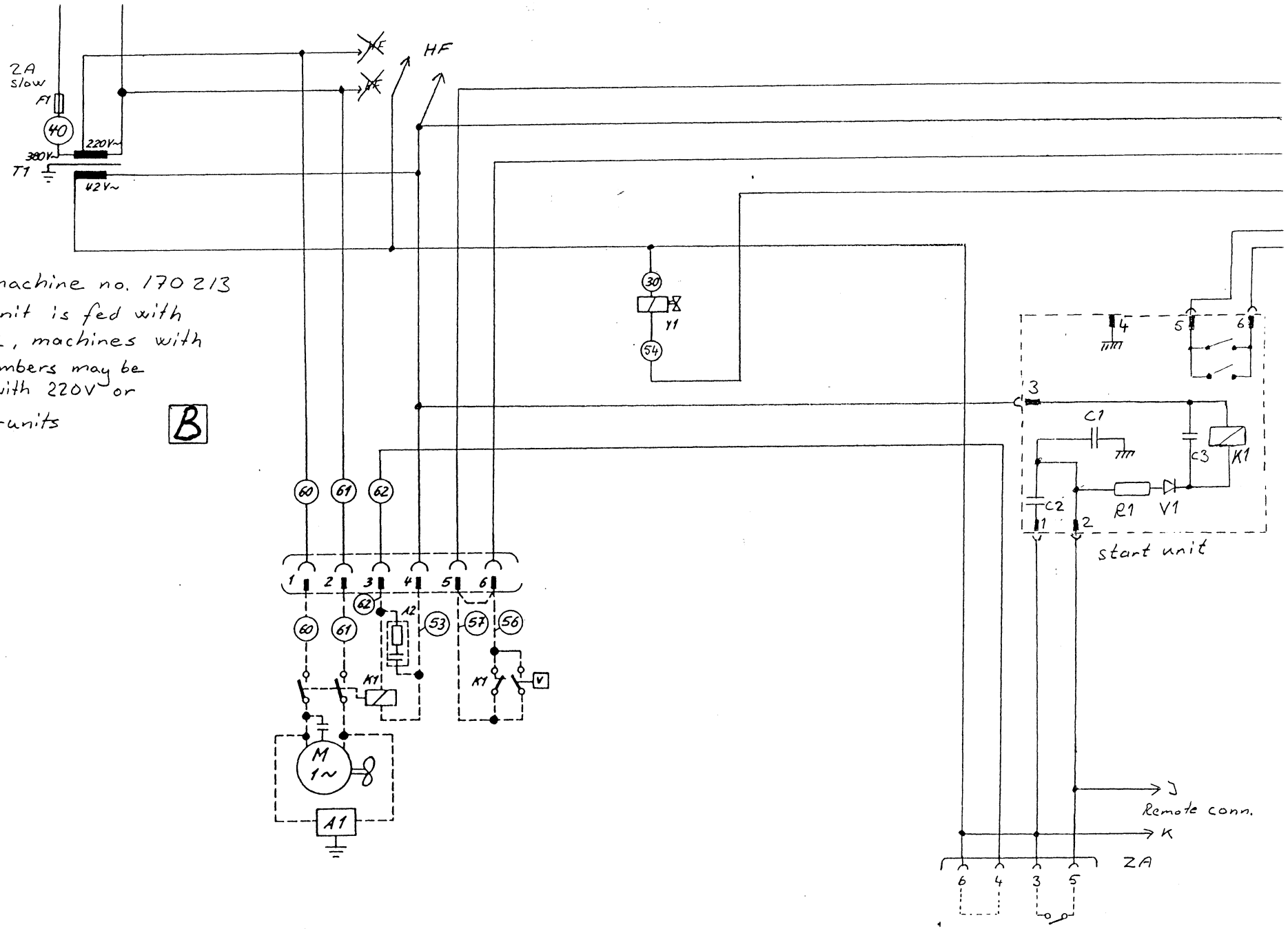
SERVICE DIAGRAM

The first diagram presents the complete service diagram and the dividing of the diagram into four parts A - D. The four parts will follow on the next pages.

The HF ignition unit is connected to 42V AC as a supply voltage, this is valid from serial number 170 213. Machines with lower serial numbers may have a HF-unit supplied with 230V AC.
Note, the HF-unit sparepart number in the users manual is for the 42V unit. When replacing a HF-unit supplied with 230V, replace it with the 42V unit and change the voltage supply to the unit according to the service diagram.

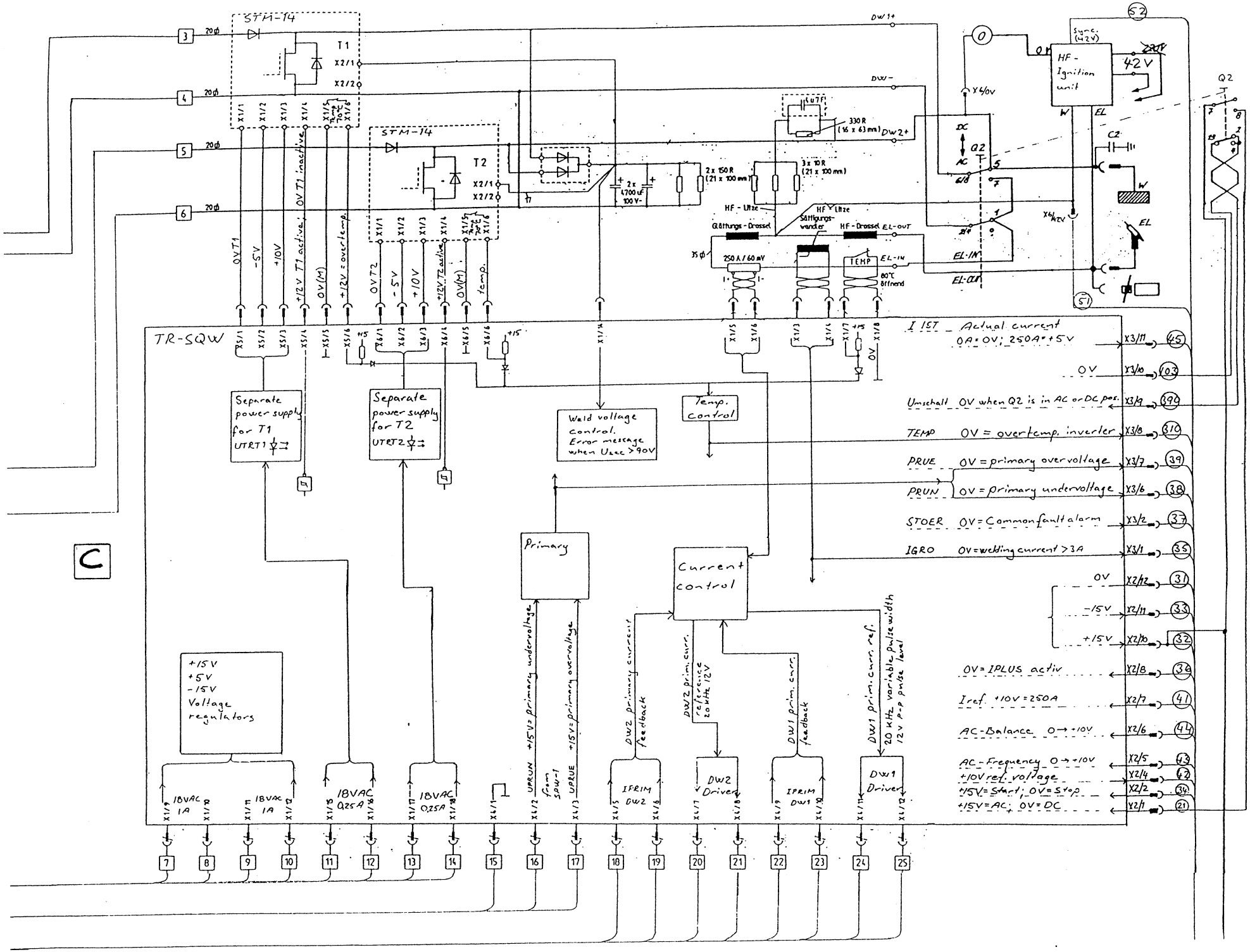

A
B
C
D
DW - 250
PTM - 10 DW 2
TR-SQW
start unit
Logic control
Remote connection
To the central connection

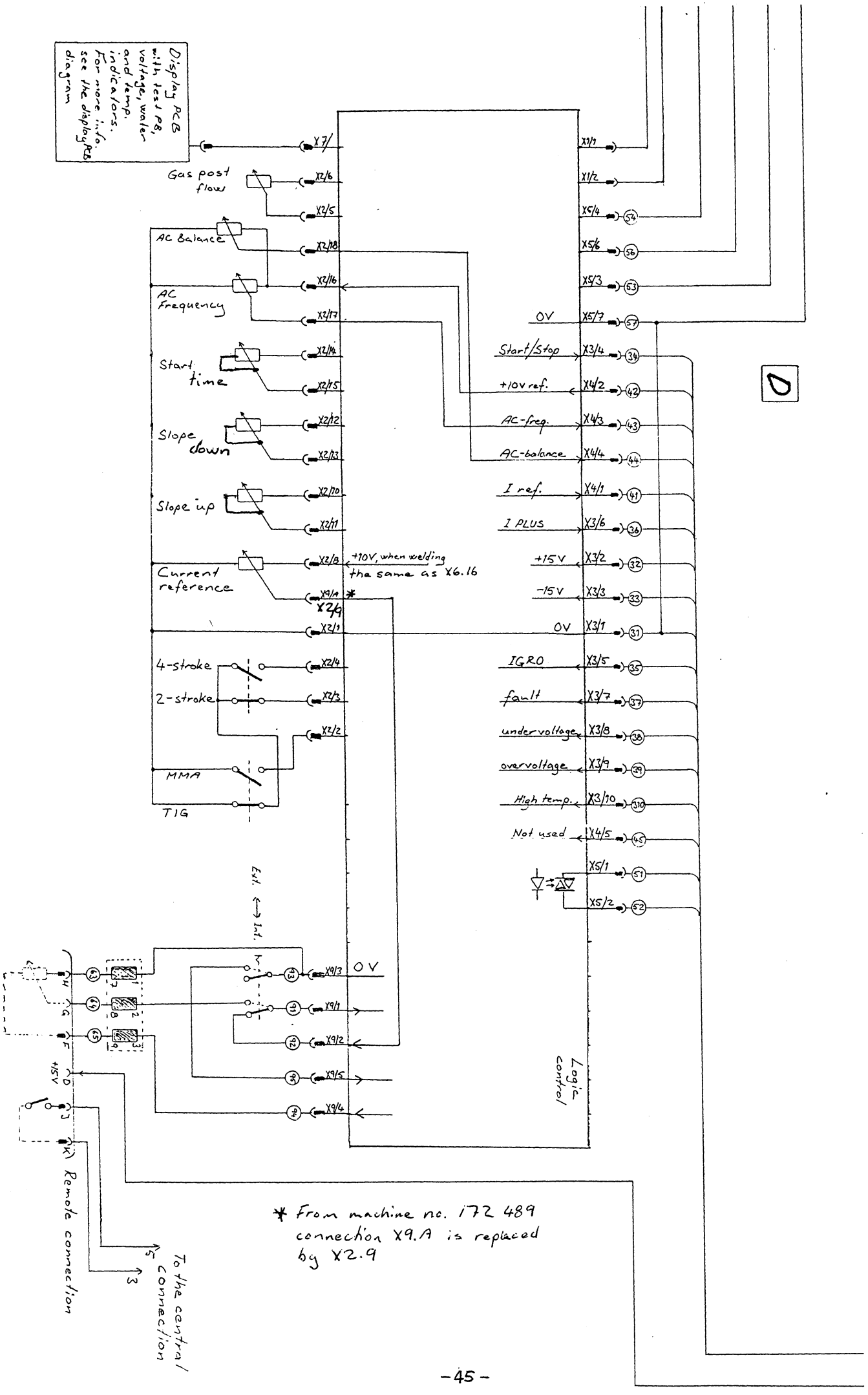

DW - 250
PTM-10 DW 1
PTM - 10 DW 2
(+) Switch
(-) Switch
DW 2
SPW - 1
53-57 kHz
400-610V
Ud
I PRIM DW2
DW2 Driver
I PRIM DW1
DW1 Driver
PE
L1
L2
L3
3x400V
Q1
X7
A



From machine no. 170213 the HF-unit is fed with 42 V AC, machines with lower numbers may be equipped with 220V or 42 V HF-units

B


STM-14
T1
T2
TR-SQW
HF - Ignition unit
42 V
Q2
Separate power supply for T1 UTRT1
Separate power supply for T2 UTRT2
Weld voltage control. Error message when Uacc > 90V
Temp. control
Primary
Current control
+15 V +5 V -15 V Voltage regulators
I IST _ Actual current 0A = 0V; 250A = +5V
0V
Umschalt 0V when Q2 is in AC or DC pos.
TEMP 0V = overtemp. inverter
PRUE 0V = primary overvoltage
PRUN 0V = Primary undervoltage
STOER 0V = Common fault alarm
IGRO 0V = welding current > 3A
-15V
+15V
0V = IPLUS activ
Iref. +10V = 250A
AC-Balance 0 → +10V
AC-Frequency 0 → +10V
+10V ref. voltage
+5V = Start; 0V = Stop
+5V = AC; 0V = DC
HF - Litze
Glättungs-Drossel
Sättigungs-wandler
HF-Drossel
EL-OUT
EL-IN
TEMP
250 A / 60 mV
330 R (16 x 63 mm)
2 x 150 R (21 x 100 mm)
3 x 10 R (21 x 100 mm)
2 x 4700 uF 100 V-


Display PCB with test PB, voltage, water and temp. indicators. For more info. see the display PCB diagram
X7/
Gas post flow
X2/6
X2/5
AC Balance
X2/18
AC Frequency
X2/16
X2/17
Start time
X2/14
X2/15
Slope down
X2/12
X2/13
Slope up
X2/10
X2/11
Current reference
X2/8
+10V, when welding the same as X6.16
X9/1 *
X2/9
X2/1
4-stroke
2-stroke
MMA
TIG
X2/4
X2/3
X2/2
X1/1
X1/2
X5/4
X5/6
X5/3
0V
X5/7
Start/Stop
X3/4
+10V ref.
X4/2
AC-freq.
X4/3
AC-balance
X4/4
I ref.
X4/1
I PLUS
X3/6
+15V
X3/2
-15V
X3/3
0V
X3/1
IGRO
X3/5
fault
X3/7
undervoltage
X3/8
overvoltage
X3/9
High temp.
X3/10
Not used
X4/5
X5/1
X5/2
Ext. ⟷ Int.
0V
X9/3
X9/1
X9/2
X9/5
X9/4
+15V
Logic control
Remote connection
To the central connection
* From machine no. 172 489 connection X9.A is replaced by X2.9

INSTRUCTION MANUAL AND SPARE PARTS LIST

ESAB

ARISTOTIG 250 AC/DC

Svetsutrustning
Welding equipment
Schweissausrüstung
Equipement de soudage

Bruksanvisning och reservdelsförteckning
Instruction manual and spare parts list
Betriebsanweisung und Ersatzteilverzeichnis
Manuel d'instructions et liste de pièces détachées

3 310 145 (320 865-096) 9103

LIST OF CONTENTS Page

WARNING

WARNING

ARC WELDING AND CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER"S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS"HAZARD DATA.

ELECTRIC SHOCK - Can kill

- Install and earth the welding unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from earth and the workpiece.
- Ensure your working stance is safe.

FUMES AND GASES - Can be dangerous to health

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin.

- Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD

- Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby.

MALFUNCTION

- Call for expert assistance in the event of malfunction.

READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

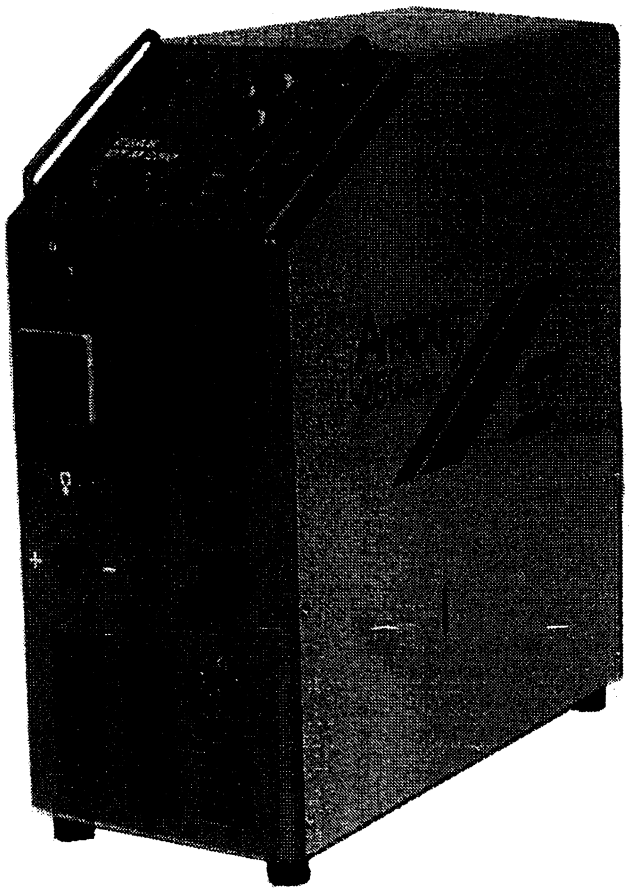
PROTECT YOURSELF AND OTHERS!

INTRODUCTION

ARISTOTIG 250 AC/DC is the name of ESAB's new transistorised inverter power source DTM 250, for TIG and metal arc welding. The machine is constructed with very advanced electronics which amongst other things gives a very quick current control and a low power consumption. It also has extremely good welding characteristics for both TIG and MMA welding processes.

The rating plate with the serial number and the connection data is located on the back of the machine.

DTM 250 is supplied with a digital amperemeter, a central connector for the TIG torch, OKC coupling and 5 m of return cable.



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TECHNICAL DESCRIPTION

ARISTOTIG 250 AC/DC is a double current inverter which gives a clean square wave at the output with AC welding and a very clean direct current with DC welding.

The transistorised power pack operates with a frequency of 20 kHz which allows the weight and size of the power source to be reduced to a minimum and gives a low load on the mains supply.

The power source is constructed in modules with the power pack as a separate unit. This allows the possibility of a module unit comprising of a complete cooling unit to be connected. There is also the possibility to fit an auto-transformer for 230/415/500 V 50/60 HZ.

The cooling unit is automatically connected when a water cooled ESAB torch is fitted to the central connection. DO NOT FORGET TO CHECK THAT THE CORRECT MIXTURE AND AMOUNT OF COOLANT IS IN THE COOLING UNIT. A large number of carriages are available for the power source enabling all the different requirements to be met.

TECHNICAL DATA

Permissable load	250 A
60%	250 A
100%	200 A
Setting range	5-250 A
Slope up	0.1-10 sec.
Slope down	0.1-10 sec.
Post gas flow	0.1-20 sec.
Open circuit voltage	75 V
Power factor	0.85
Max current, primary	25 A
Fuse, slow blow	25 A
Mains power	400 V
Frequency	50/60 Hz
Weight	65 kg.
Dimensions (LxWxH)	700x325x750
Temperature class	F
Enclosure type	IP 23
Standards	VDE 0544, ISO 700, IEC 9741

INSTALLATION

DTM 250 is supplied as standard connected for 400 V 50/60 Hz, it can also be fitted with an auto-transformer allowing the following voltages to be connected: 230/415/500 V 50/60 Hz.

1. Check that the welding power source is connected to the correct mains voltage.

2. The power cable connected to the machine is dimensioned for a 400 V mains supply or higher. Should the machine be connected to 230 V then a heavier cable must be fitted.

3. The welding cable for MMA welding and the return cable for TIG/MMA welding should have a cable cross section of at least 35 mm. To reduce the voltage field when an extra longer cable is connected it might be necessary to select a heavier cable cross section. Check that all cables and connections are correctly fitted.

OPERATION

All controls on the DTM 250 are located with easy access on the front of the machine thereby simplifying the setting of the parameters.

1. Mains supply switch (1): To switch the mains supply on or off. In position "1" the fan is started.

2. Potentiometer (2): To set the welding current 5-250 amp.

3. Push button (3): When the button is pushed in then the current can be preset using potentiometer 2 and the preset value can be read on the ammeter.

4. Potentiometer (4): To set the slope up time from 0.1-10 seconds. This means that the current slowly increases from the minimum value to the set value during the time set. This reduces the risk of contamination on the tungsten electrode.

5. Potentiometer (5): To set the slope down time from 0.1-10 seconds. This means that the current is slowly reduced from the set value to the minimum value during the time set.

6. Potentiometer (6): To set the post gas flow time from 0.1-20 seconds. The long post gas flow time makes the power source fully equipped for the welding of materials susceptible to oxidization e.g. titanium.

7. Potentiometer (7): To set the balance when welding in the AC mode. The square wave can be set to a more positive or more negative half cycle to achieve oxide break up or increased material penetration. The balance is adjustable between 20%- 80% of the cycle.

   20% = max. material penetration. 80% = max. oxide break-up.

8. Potentiometer (8): To set the welding frequency between 50-200 Hz in the AC position. The welding frequency is used to reduce the heat transference to the material and to increase the welding speed. The adjustable welding frequency also allows materials which are difficult to weld, such as anodized aluminium, to be welded.

9. Switch (9): To set the switch to either the 2 or 4 action setting when TIG welding. 2 action setting means that the arc is ignited when the torch switch is pressed in and extinguished when the torch switch is released. 4 action setting means that the torch switch does not need to be held in while welding. Pressing the switch and then releasing it ignites the arc and by pressing and releasing once again the arc is extinguished.

10. Switch (10): For TIG and MMA welding. The power source is constructed in such a manner that it gives exceptionally good welding results with TIG and MMA welding.

11. Switch (11): To switch between AC and DC mode. Never switch between the two current modes while welding.

12. Switch (12): To switch the remote output on or off. Allows remote control of the welding current with e.g. PHA 5.

    Position  :Means that the value set on the machine is operational.

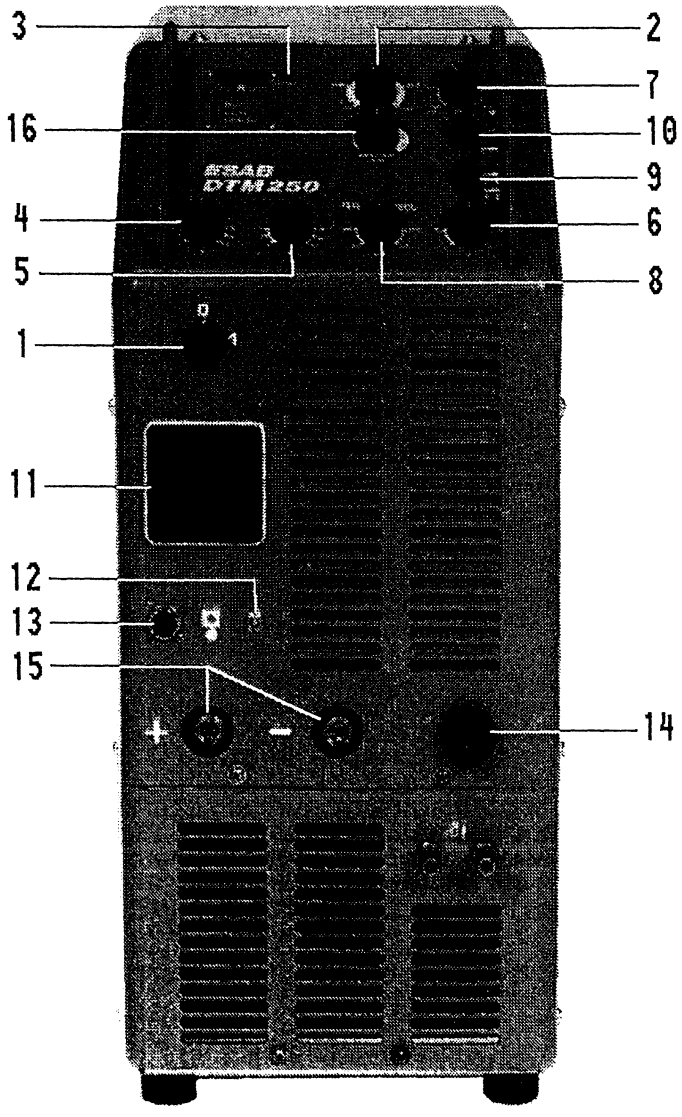
    Position  :Means that the value set on the remote control is operational.

13. Remote socket (13): For connection of the remote unit.

14. Central connector (14): Quick connector for current, gas and the control cable.

15. OKC connectors (15): For the connection of the return cable and the electrode holder for MMA welding.

16. Hot Start - TIG (16). Adjustable hotstart time between 5-20 ms. TIG-welding - At the moment of starting the tungsten electrode is positive during max 20 ms. then it switch over automatically to negative polarity.



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WELDING

- Check that the TIG torch and the return cable are connected correctly.
- Check that the correct thoriated tungsten or lanthanum electrodes are used with DC welding and tungsten and lanthanum with AC welding. The electrodes must also be correctly ground for DC welding.
- Set the correct gas flow, 5-10 lit/min. (Argon 99.95).
- Set the mains switch to position "1" and check that there is a free air flow through the machine.
- Select either machine or remote control.
- Set the different welding parameters e.g. current, slope up etc.
- The machine is now ready to weld. If any further questions arise please refer to ESAB's tutorial video for TIG welding or the nearest retail dealer.

ACCESSORIES

Spare parts are ordered through the nearest ESAB representative. See the last page of this publication. When ordering please quote the type of machine, machine number and the designation and the spare parts number as set out in the spare parts list.

This both simplifies and assures the correct delivery when dispatching.

	ORDER No.
DTM 250 Water cooled 400 V 50/60 Hz.	0467 370-880
DTM 250 Air cooled 400 V 50/60 Hz.	0467 370-881
TIG Torch BTD 253W 4 M	0368 350-884
Pulse unit PHA 5	0367 970-880
Connecting cable 10 m For PHA 5	0367 144-882
Foot pedal FS 002 incl. cable	0349 090-886
Carriage kit chassis	0369 580-880
Carriage 5-20 L. Gas bottle	0466 600-880
Carriage, model semi, 50 l. gas bottle	0369 580-880

MAINTENANCE

IMPORTANT

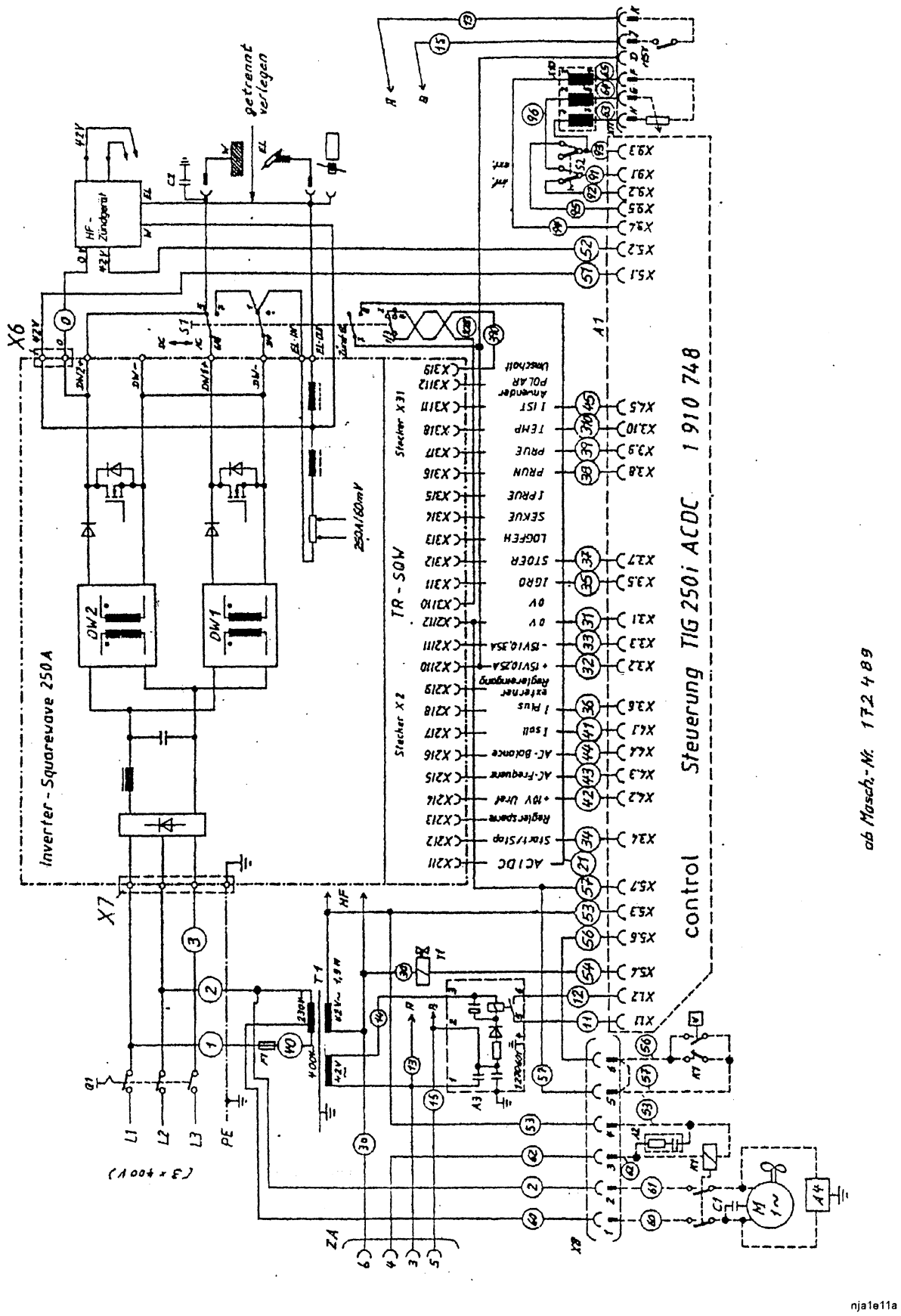
This welding equipment has been designed, manufactured and tested to the highest quality standards to ensure long and trouble free life. However, regular maintenance is an essential part of keeping the machine operating in a reliable and safe manner and your attention is drawn to any maintenance instructions that are contained in this manual.

In general, all welding equipment should be thoroughly inspected, tested and serviced at least annually. More frequent checking will be required when the equipment is heavily used.

Wear and tear, particularly in electro-mechanical and moving components, are gradual processes. Caught in time, repair costs are small and the benefits in performance, reliability and safety are significant. Left alone, they can put the equipment, and you at risk.

Have this equipment regularly inspected and maintained by an approved service centre.

Schema - Diagram - Schaltplan - Schéma



Reservdelsförteckning

Reservdelar beställs genom narmaste ESAB-representant, se sista sidan. Vid beställning v v uppge typ och tillverkningsnummer samt benämningar och beställningsnummer enl reservdelsförteckningen

Spare parts list

Spare parts are to be ordered through the nearest ESAB agency as per the list on the back of the cover. Kindly indicate type of unit serial number, denominations and ordering numbers acc to the spare parts list

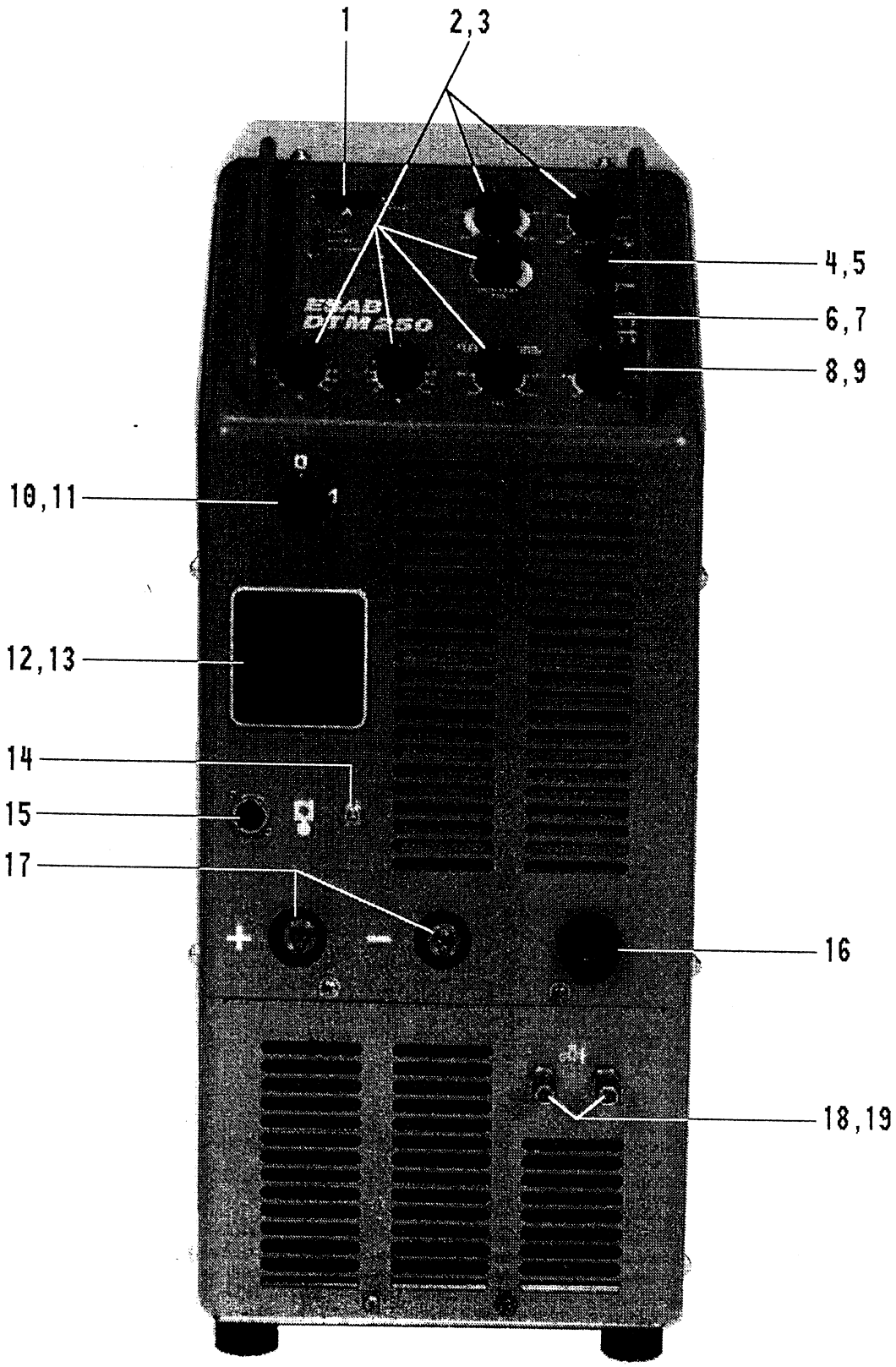
Ersatzteilverzeichnis

Die Ersatzteile können bei der nachsten ESAB-Verftretung bestellt werden, siehe letzte Seite. Bitte geben Sie Typenbezeichnung und Herstellnummer sowie Bezeichnungen und Bestellnummern lt Ersatzteilverzeichnis an.

Liste de pièces détachées

Au dos de la brochure, vous trouverez l'adresse du representant ESAB le plus proche. Priere du lui adresser votre commande, après avoir pris le soin de mentionner le type et le numero de série de l'unité ainsi que le numéro de commande et la désignation conformement à la liste de pièces détachées

Pos nr Item no. Pos. Nr. No. de réf.	Ant Qty Anz Qté	Best nr Ordering no. Bestellnr. No. de commande	Benämning	Denomination	Bezeichnung	Désignation	Anm Remarks Anm. Remarque
		467 370-880	**Strömkälla, vattenkyld**	**Power source, water cooled**	**Schweißgerät, wassergekühlt**	**Source de courant, refroidi par eau**	
		467 370-881	**Strömkälla, luftkyld**	**Power source, air cooled**	**Schweißgerät, luftgekühlt**	**Source de courant, refroidi par air**	
01	1	467 852-001	Digital instrument kompl.	Digital meter	Digital Instrument	Instrument digital	
02	6	467 837-001	Potentiometer	Potentiometer	Potentiometer	Potentiomètre	
03	6	467 841-001	Ratt	Knob	Drehknopf	Bouton	
04	1	467 839-001	Omkopplare	Switch	Schalter	Interrupteur	
05	1	467 840-001	Ratt	Knob	Drehknopf	Bouton	
06	1	467 839-001	Omkopplare	Switch	Schalter	Interrupteur	
07	1	467 840-001	Ratt	Knob	Drehknopf	Bouton	
08	1	467 838-001	Potentiometer	Potentiometer	Potentiometer	Potentiomètre	
09	1	467 841-001	Ratt	Knob	Drehknopf	Bouton	
10	1	467 835-001	Strömställare	Switch	Schalter	Interrupteur	Q 1
11	1	467 854-001	Ratt	Knob	Drehknopf	Bouton	
12	1	467 773-001	Polaritetsomkopplare	Polarity switch	Schalter	Interrupteur	S 1
13	1	467 853-001	Ratt	Knob	Drehknopf	Bouton	
14	1	147 866-001	Omkopplare	Switch	Schalter	Interrupteur	S 2
15	1	323 941-003	Fjärruttag	Socket	Steckdose	Réglage à distance	X 11
16	1	367 258-880	TIG-Centralanslutning	TIG-Central-connection	Zentral anschluß,WIG	Connecteur TIG central	
17	2	160 362-881	Maskinkontakt	Current terminal	Stromanschluß	Prise machine	
18	2	467 855-001	Snabbkoppling Blå	Quick-coupling blue	Schnellkupplung blau	Raccord rapide bleu	
19	2	467 856-001	Snabbkoppling Röd	Quick-coupling red	Schnellkupplung rot	Raccord rapide rouge	



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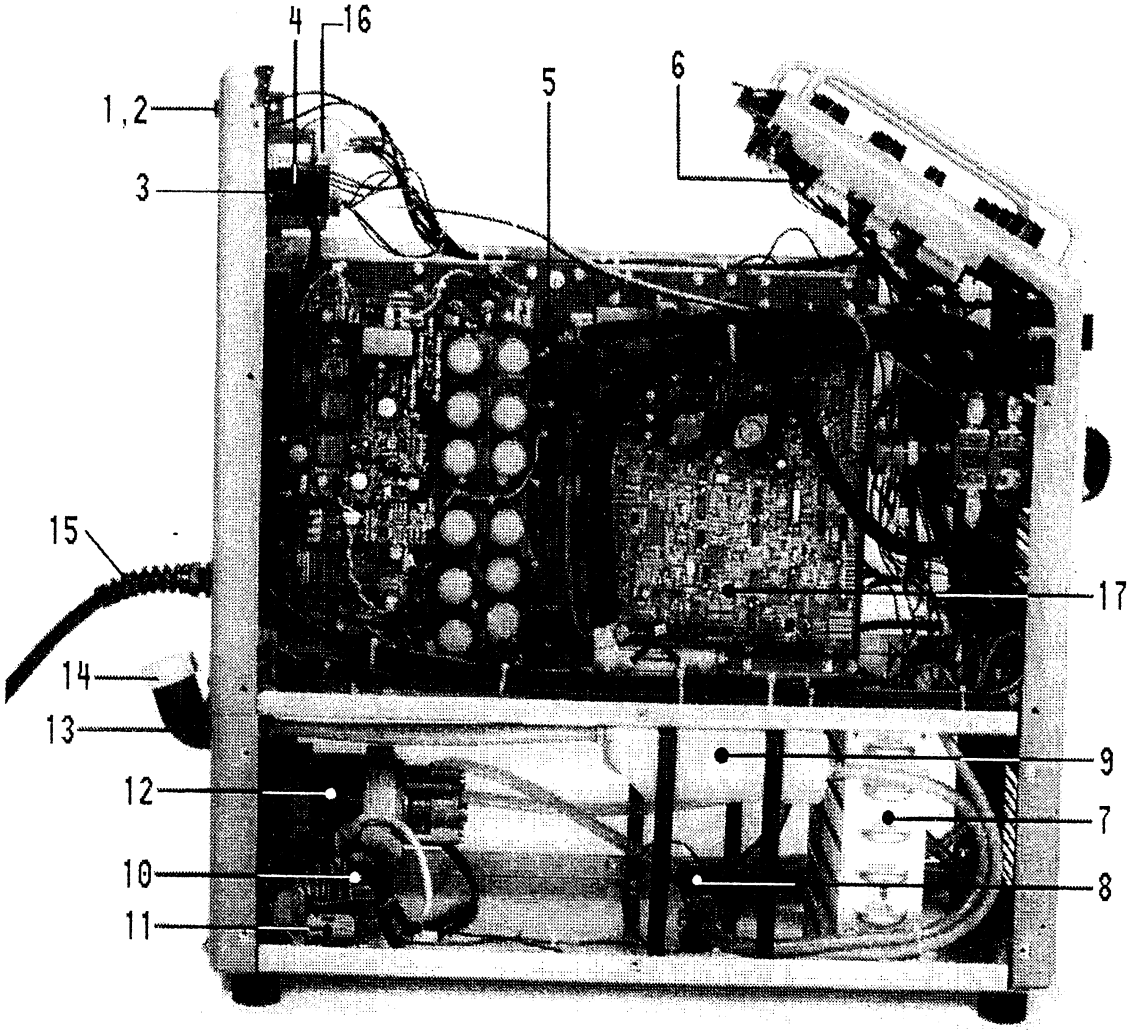
Pos nr Item no. Pos. Nr. No. de réf.	Ant Qty Anz Qté	Best nr Ordering no. Bestellnr. No. de commande	Benämning	Denomination	Bezeichnung	Désignation	Anm Remarks Anm. Remarque
1	1	157 028-002	Säkringshållare	Fuse holder	Sicherungs-halter	Porte-fusible	F1
2	1	5679 001-11	Säkring	Fuse	Sicherung	Fusible	
3	1	193 054-002	Magnetventil	Solenoid valve	Magnetventil	Elektrovanne	Y1
4	1	467 767-001	Transformator	Transformer	Transformator	Transformateur	T1
5	1	467 834-001	Kraftpaket	Power module	Kraft Paket	Moduie de puissance	
6	1	467 772-001	Komplett kontrollenhet	Control module, complete	Steuerung komplett	Circuit imprimé compl.	A1
	1	468 244-001	Kretskort	Control PCB	Steuerung Platine	Circuit imprimé	
	1	468 245-001	Tillsatskretskort	Add on control PCB	Zusatzplatine	Circuit imprimé	
7	1	467 770-001	Kylare	Cooling element	Kühlelement	Elément réfrigérant	
8	1	467 771-001	Flödesvakt	Flow guard	Durchfluss-wächter	Capteur de débit	V
9	1	369 232-001	Vattentank	Coolant reservoir	Wassertank	Réservoir d'eau	
10	1	467 768-001	Kondensator	Capacitor	Kondensator	Condensateur	
11	1	467 766-001	Relä	Relay	Relais	Relais	K1
12	1	467 769-001	Pump	Pump	Pumpe	Pompe	M1
13	1	368 568-001	Vattenintag	Water inlet	Wasseranschluß	Tube de remplissage d'eau	
14	1	369 241-001	Lock	Cover	Deckel	Couvercle	
15	1	193 307-103	Kabel-förskruvning	Cable clamp	Klamme	Equilibreur du Câble	
16	1	468 240-001	HF-don	HF-unit	HF-Gerät	Dispositif HF	42V
17	1	467 836-001	Kretskort	PC-board	Platine	Circuit imprimé	TR-SQW
18	1	468 243-001	Kretskort	Start PCB	Start Platine	Circuit imprimé	A3
19	2	468 246-001	Säkring	Fuse	Sicherung	Fusible	1A 5x30mm



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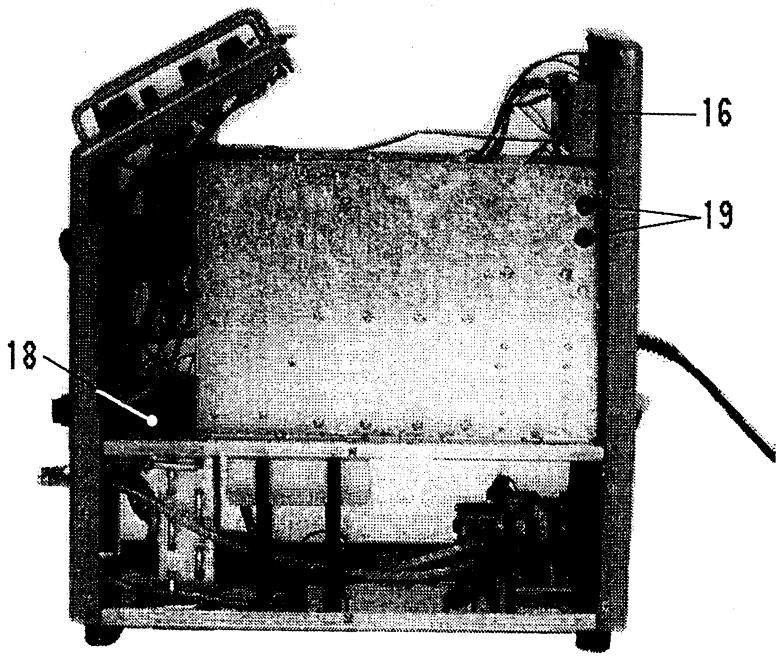

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