

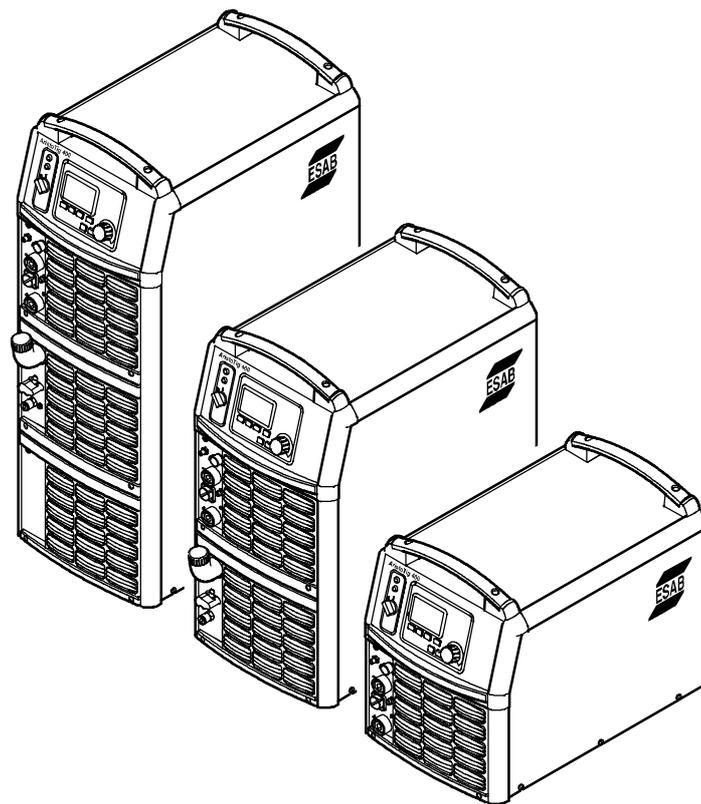


# ***AristoMig U400***

# ***AristoMig 400***

# ***AristoTig 400***

# ***AristoArc 400***



**Service manual**

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## READ THIS FIRST

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Maintenance and repair work should be performed by an experienced person, and electrical work only by a trained electrician. Use only recommended replacement parts.

This service manual is intended for use by technicians with electrical/electronic training for help in connection with fault-tracing and repair.

Use the wiring diagram as a form of index for the description of operation. The circuit boards are divided into numbered blocks, which are described individually in more detail in the description of operation. All component names in the wiring diagram are listed in the component description.

This manual contains details of all design changes that have been made from January 2001 up to and including June 2005.

The manual is valid for AristoMig U400, AristoMig 400, AristoTig 400 and AristoArc 400 with serial no. 105-xxx-xxxx, 322-xxx-xxxx, 334-xxx-xxxx, 347-xxx-xxxx, 445-xxx-xxxx and 524-xxx-xxxx.

**Note:** AristoMig 400, AristoTig 400 and AristoArc 400 with serial number 050-xxx-xxxx differ slightly from the description in this manual. For those machines there are separate service manuals available.

**AristoMig U400, AristoMig 400, AristoTig 400 and AristoArc 400 have been designed and tested in accordance with international and European standards IEC/EN 60974-1 and EN 50199.**

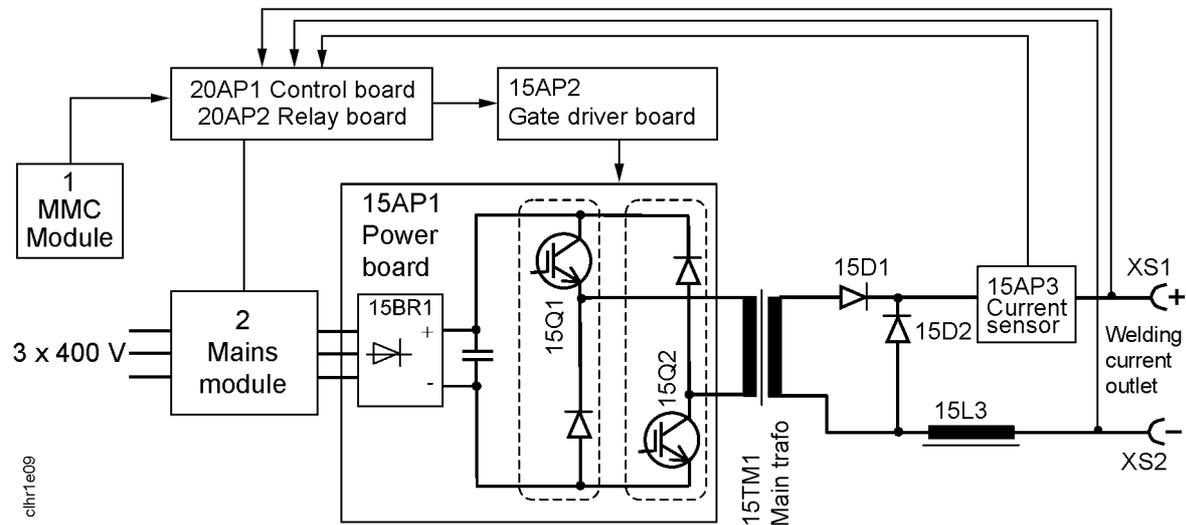
**On completion of service or repair, the service organisation that has performed the work must make sure that the equipment still complies with the above standards.**

## WARNING

**Many parts of the power source are at mains voltage.**

# INTRODUCTION

The power source is transistor-controlled, operating on the inverter principle. It consists of a number of function modules, as shown in the schematic diagram below. Each module has a module number, which is always included as the first part of the name/identification of components in the module.



Schematic diagram of the power source

The modules have the following main functions:

## 1 MMC module

The control panel and welding data unit, which control the machine functions.

## 2 Mains module

Mains interference suppressor, mains switch, control power transformer, contactor.

## 15 Power module

This module is a forward converter inverter, operating at a switching frequency of 27 kHz. IGBT transistors are used as the switching elements. All power semiconductors are built into modules in order to ensure a robust design suitable for use in the demanding welding environment.

## 20 Processor board module (controller module)

This is the controller board, 20AP1, with a microprocessor, that monitors and controls the voltage and current. It is served by relay board 20AP2, which handles input and output signals to/from the controller board.

Further information on the modules can be found in the component and function descriptions.

# TECHNICAL DATA

## AristoMig U400

<b>Mains voltage</b>	400V, $\pm 10\%$ , 3~ 50 Hz
<b>Primary current</b>	
$I_{max}$ MIG/MAG	36 A
$I_{max}$ MMA	38 A
$I_{max}$ TIG	29 A
<b>No-load power</b> demand when in the energy-saving mode, 6.5 min. after welding	60 W
<b>Voltage/current range</b>	
MIG/MAG	8-60 V / 16-400 A
MIG/MAG, M2	8- 42 A
MMA	16- 400 A
TIG	4 - 400 A
<b>Permissible load at MIG/MAG</b>	
35% duty cycle	400 A / 34 V
60 % duty cycle	320 A / 30 V
100% duty cycle	250 A / 27 V
<b>Permissible load at MMA</b>	
35% duty cycle	400 A / 36 V
60 % duty cycle	320 A / 33 V
100% duty cycle	250 A / 30 V
<b>Permissible load at TIG</b>	
35% duty cycle	400 A / 26 V
60 % duty cycle	320 A / 23 V
100% duty cycle	250 A / 20 V
<b>Power factor</b> at maximum current	0.65
<b>Efficiency</b> at maximum current	85 %
<b>Open-circuit voltage</b>	
MIG/MAG	55 - 70 V
MMA	78 - 90 V
TIG	78 - 90 V
<b>Operating temperature</b>	-10 to +40°C
<b>Continual A-weighted sound pressure</b>	<70 db
<b>Dimensions, lxbxh</b>	
with cooling unit	625 x 394 x 496 mm 625 x 394 x 776 mm
<b>Weight</b>	
with cooling unit	61 kg 81 kg
<b>Insulation class</b>	H
<b>Enclosure class</b>	IP 23
<b>Application class</b>	<b>S</b>

## AristoMig 400

	<b>AristoMig 400</b> not reconnectable	<b>AristoMig 400</b> reconnectable
<b>Mains voltage</b>	400V, $\pm 10\%$ , 3~ 50 Hz	208/230/400/460/475/500/ 575 V, $\pm 10\%$ , 3~ 50/60 Hz
<b>Primary current</b>		
$I_{max}$ (MIG/MAG)	36 A	61/54/36/28/28/25/19 A
$I_{max}$ (MMA)	38 A	65/57/38/30/30/26/20 A
<b>No-load power</b> demand when in the energy-saving mode, 6.5 min. after welding	60 W	235 W
<b>Voltage/current range</b>		
(MIG/MAG)	8-60 V / 16-400 A	8-60 V / 16-400 A
(MIG/MAG, M2)	8- 42 A	8- 42 A
(MMA)	16- 400 A	16 - 400 A
<b>Permissible load at (MIG/MAG)</b>		
35% duty cycle	400 A / 34 V	400 A / 34 V
60 % duty cycle	320 A / 30 V	320 A / 30 V
100% duty cycle	250 A / 27 V	250 A / 27 V
<b>Permissible load at (MMA)</b>		
35% duty cycle	400 A / 36 V	400 A / 36 V
60 % duty cycle	320 A / 33 V	320 A / 33 V
100% duty cycle	250 A / 30 V	250 A / 30 V
<b>Power factor</b> at maximum current	0.65	0.65
<b>Efficiency</b> at maximum current	85 %	85 %
<b>Open-circuit voltage</b>		
(MIG/MAG)	55 - 70 V	55 - 70 V
(MMA)	78 - 90 V	78 - 90 V
<b>Operating temperature</b>	-10 till +40°C	-10 till +40°C
<b>Dimensions, lxbxh</b>		
with cooling unit	625 x 394 x 496 mm 625 x 394 x 776 mm	625 x 394 x 776 mm 625 x 394 x 1056 mm
<b>Continual A-weighted sound pressure</b>	<70 db	<70 db
<b>Weight</b>		
with cooling unit	57 kg 77 kg	114 kg 134 kg
<b>Insulation class</b>	H	H
<b>Enclosure class</b>	IP 23	IP 23
<b>Application class</b>	<b>S</b>	<b>S</b>

## AristoTig 400

	<b>AristoTig 400</b> not reconnectable	<b>AristoTig 400</b> reconnectable
<b>Mains voltage</b>	400V, $\pm 10\%$ , 3~ 50 Hz	208/230/400/460/475/500/575 V, $\pm 10\%$ , 3~ 50/60 Hz
<b>Primary current</b>		
$I_{max}$ (TIG)	29 A	50/44/29/23/23/20/15 A
$I_{max}$ (MMA)	38 A	65/57/38/30/30/20/20 A
<b>No-load power</b> in the energy-saving mode, 6.5 min. after welding	60 W	235 W
<b>Voltage/current range</b>		
(TIG)	8-60 V / 4-400 A	8-60 V / 4-400 A
(MMA)	16 - 400 A	16 - 400 A
<b>Permissible load at TIG</b>		
35% duty cycle	400 A / 26 V	400 A / 26 V
60 % duty cycle	320 A / 23 V	320 A / 23 V
100% duty cycle	250 A / 20 V	250 A / 20 V
<b>Permissible load at MMA</b>		
35% duty cycle	400 A / 36 V	400 A / 36 V
60 % duty cycle	320 A / 33 V	320 A / 33 V
100% duty cycle	250 A / 30 V	250 A / 30 V
<b>Power factor</b> at maximum current	0.65	0.65
<b>Efficiency</b> at maximum current	85 %	85 %
<b>Open-circuit voltage</b>	78 - 90 V	78 - 90 V
<b>Operating temperature range</b>	-10 to + 40°C	-10 to + 40°C
<b>Dimensions, lxbxh</b>		
with cooling unit	625 x 394 x 496 625 x 394 x 776	625 x 394 x 776 625 x 394 x 1056
<b>Continual A-weighted sound pressure</b>	< 70 db	< 70 db
<b>Weight</b>		
with cooling unit	59 kg 79 kg	116 kg 136 kg
<b>Insulation class</b>	H	H
<b>Enclosure class</b>	IP 23	IP 23
<b>Application class</b>	S	S

## Cooling unit

Cooling power	2500 W at 40°C temp. difference and flow 1.5l/min
Coolant	50 % water / 50% glycol
Coolant quantity	5.5 l
Maximum water flow	2.0 l/min

## AristoArc 400

<b>Mains voltage</b>	400 V, $\pm 10\%$ , 3~ 50 Hz
<b>Primary current</b> $I_{max}$	38 A
<b>No-load power</b> in energy-saving mode 6.5 min. after welding	50 W
<b>Setting range</b>	16 A - 400 A
<b>Maximum permissible load at</b>	
35% duty cycle	400 A / 36 V
60 % duty cycle	320 A / 33 V
100 % duty cycle	250 A / 30 V
<b>Power factor</b> at maximum current	0.65
<b>Efficiency</b> at maximum current	85%
<b>Open-circuit voltage</b>	78 - 90 V
<b>Temperature range</b>	-10 till + 40 °C
<b>Dimensions, l x b x h</b>	625 x 294 x 492 mm
<b>Continual A-weighted sound pressure</b>	<70 db
<b>Weight</b>	45 kg
<b>Insulation class</b>	H
<b>Enclosure class</b>	IP 23
<b>Application class</b>	<b>S</b>

### Duty cycle

The duty cycle refers to the time as a percentage of a ten-minute period that you can weld at a certain load without overloading.

### Enclosure class

The **IP** code indicates the enclosure class, i. e. the degree of protection against penetration by solid objects or water. Equipment marked **IP23** is designed for indoor and outdoor use.

### Application class

The symbol **S** indicates that the power source is designed for use in areas with increased electrical hazard.

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## WIRING DIAGRAMS

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The power source consists of a number of function modules, which are described in the component descriptions on the following pages. Wire numbers and component names in the wiring diagrams show to which module each component belongs.

**Wires/cables within modules** are marked 100 – 6999.

**Wires/cables between modules** are marked 7000 – 7999.

**Components outside modules** – e.g. capacitors – are named such as C1 – C99, connection (plug/socket) XS1 – XS99 (S = sleeve), XP1 – XP99 (P = pin) etc.

**Circuit boards within each module** have names such as 20AP1 – 20AP99.

20 = module association, 1-69  
AP = circuit board  
1 = individual identification number, 0-99

**Transistors within particular modules** have identification numbers such as 15Q1 – 15Q99.

15 = module association, 1-69  
Q = transistor  
1 = individual identification number, 0-99



### WARNING !

**STATIC ELECTRICITY can damage circuit boards and electronic components.**

- Observe precautions for handling electrostatic-sensitive devices.
- Use proper static-proof bags and boxes.

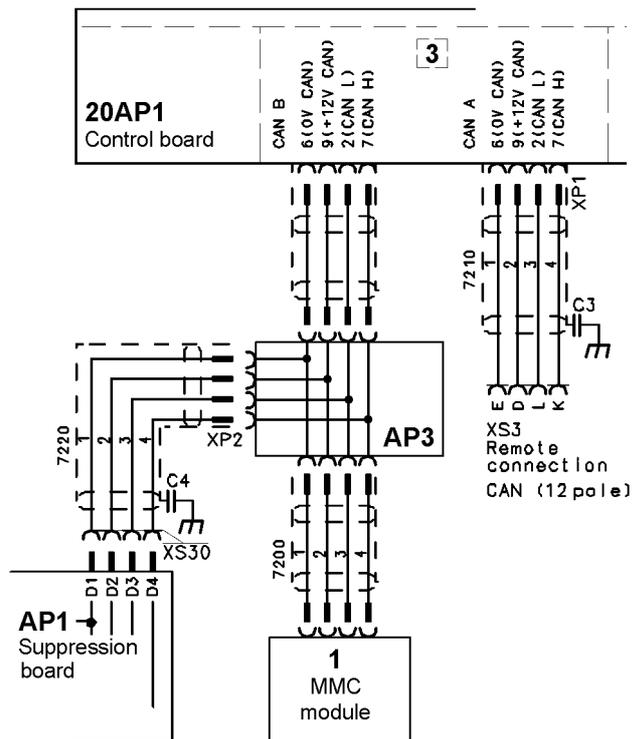
### Component description

Component	Description
AP1	Connection board for communication with the wire feed unit and remote control device.
AP2	Interference suppressor board. See diagram on Page 22.
AP3	CAN bus distribution board. Accessory, included in the MMC kit for AristoMig, see page 13.
C3	Capacitor, 100 nF 250 V.
C4	Capacitor, 100 nF 250 V.
D1	LED, orange, for overtemperature indication.
HL1	Indicating lamp, white. Indicates Power On
XP..	Plug connectors.

<b>Component</b>	<b>Description</b>
<b>XS..</b>	Socket connectors.
<b>XT..</b>	Terminal blocks.
<b>1</b>	<b>MMC module.</b> Wire numbers 100–199. See description on Page 22.
<b>2</b>	<b>Mains module.</b> Wire numbers 200–299.
<b>2AP1</b>	EMC suppressor board. See diagram on Page 23.
<b>2FU1</b>	MCB, 5 A. Replaced by a 4 A slow blow (anti-surge) fuse, from serial no. 347–351–xxxx. See also Page 55.
<b>2FU2</b>	Fuse, 6.3 A, slow blow (anti-surge).
<b>2FU3</b>	Fuse, 3.15 A, slow blow (anti-surge).
<b>2FU4</b>	Fuse, slow blow (anti-surge), different rating depending on machine type. AristoMig U400 and AristoMig 400: 8 A. AristoTig 400: 0.5 A
<b>2FU5</b>	Fuse, 2 A, slow blow (anti-surge).
<b>2KM1</b>	Main contactor. See 20AP2:3 on Page 43.
<b>2QF1</b>	Mains switch. See 20AP2:3 on Page 43.
<b>2TC1</b>	Control power transformer. New winding added from serial no. 524–xxx–xxxx, see page 69.
<b>2TC2</b>	Control power transformer. If the mains voltage exceeds 427 V, the link on terminal 2XT2 must be moved from the 400 V terminal to the 428 V terminal.
<b>3</b>	<b>Primary inductor module.</b> Wire numbers 300–399.
<b>3L1</b>	Primary inductor.
<b>4</b>	<b>Autotransformer module.</b> Wire numbers 400–499. See the diagram and connection notes on Page 23.
<b>4EV1</b>	Fan, 24 V DC. See 20AP1:2 on Page 33.
<b>4TM1</b>	Autotransformer.
<b>5</b>	<b>Water cooling module.</b> Wire numbers 500–599. The wiring diagram for the cooling module is on Page 24. The power supply to the cooling water pump and fan is controlled by the machine software. See the description of the 20AP2:5 on Page 44.
<b>10</b>	TIG module. Wire numbers 1000–1199.
<b>10AP1</b>	HF starting device. See the description of 20AP2:7 on Page 47.
<b>10C1</b>	Interference suppression capacitor, 47 nF 250V.
<b>10TV1</b>	HF transformer.

<b>Component</b>	<b>Description</b>
<b>10YV1</b>	Gas valve. See the description of 20AP2:6 on Page 47.
<b>15</b>	<b>Power module.</b> Wire numbers 1500–1699. See the schematic diagram and description on Page 25.
<b>15AP1</b>	Power board.
<b>15AP2</b>	Driver board.
<b>15AP3</b>	Current sensor. See the description of 20AP1:8 on Page 36.
<b>15BR1</b>	Rectifier bridge. See the description of 15AP1:1 on Page 26 and the assembly instructions on Page 55.
<b>15D1, 15D2</b>	Rectifier and freewheel diode modules. Each module consists of two diodes. 15D1 rectifies the welding current. During the time interval between two voltage pulses from transformer 15TM1, the freewheel diodes 15D2 maintain the welding current from inductor 15L3. See Page 55 for assembly instructions for the diode modules.
<b>15EV1, 15EV2</b>	Fans, 24 V DC. See the description of 20AP1:2 on Page 33.
<b>15L1, 15L2</b>	2 + 2 ferrite rings. Reduce transient voltages produced when the diode modules 15D1 and 15D2 turn off.
<b>15L3</b>	Inductor.
<b>15Q1, 15Q2</b>	IGBT transistors. See the description of 15AP1:2 on Page 27 and the installation instructions on Page 55.
<b>15ST1</b>	Thermal overload cutout, in the winding of main transformer TM1. See the description of 20AP1:4 on Page 35.
<b>15ST2</b>	Thermal overload cutout, mounted on the heat sink for the IGBT modules. See the description of 20AP1:4 on Page 35 and the installation instructions on Page 55.
<b>15TM1</b>	Main transformer.
<b>20AP1</b>	Controller circuit board.
<b>20AP2</b>	Relay board.

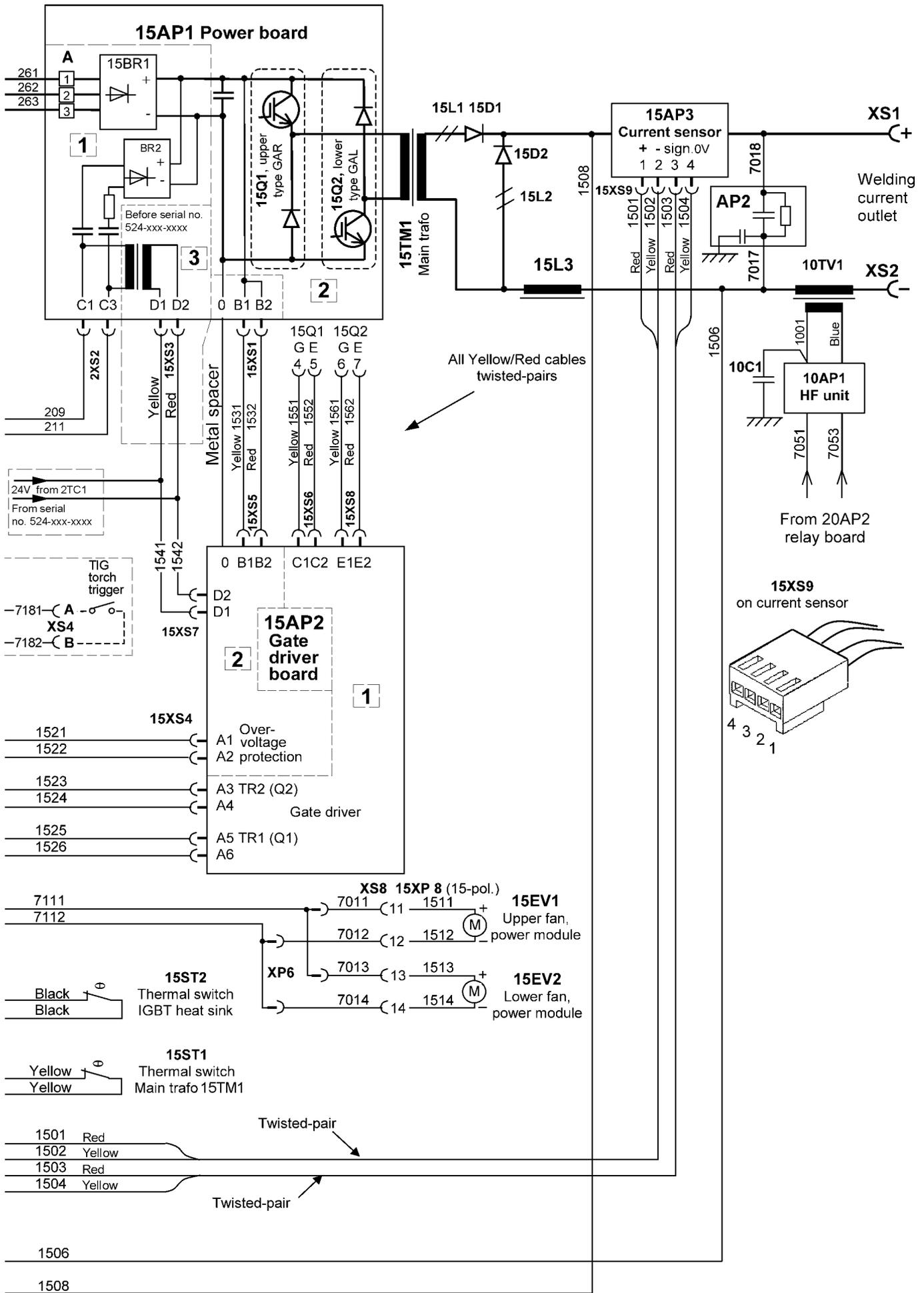
## AristoMig MMC option



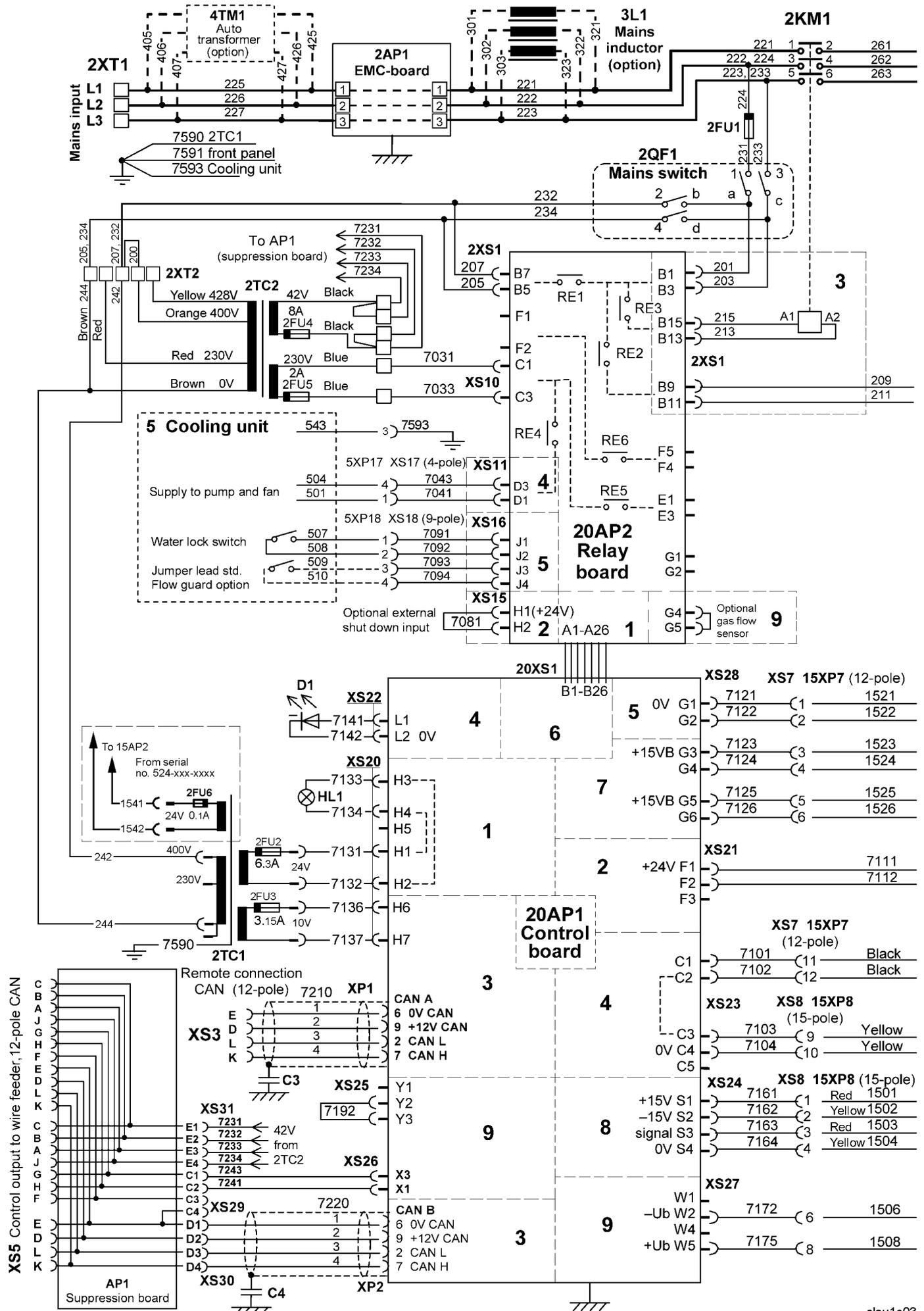
CAN bus distribution board AP3 connected to AristoMig

The AristoMig is normally delivered without MMC module. If the accessory 'MMC kit' is used, the MMC module can be moved from the wire feed unit to the power source.

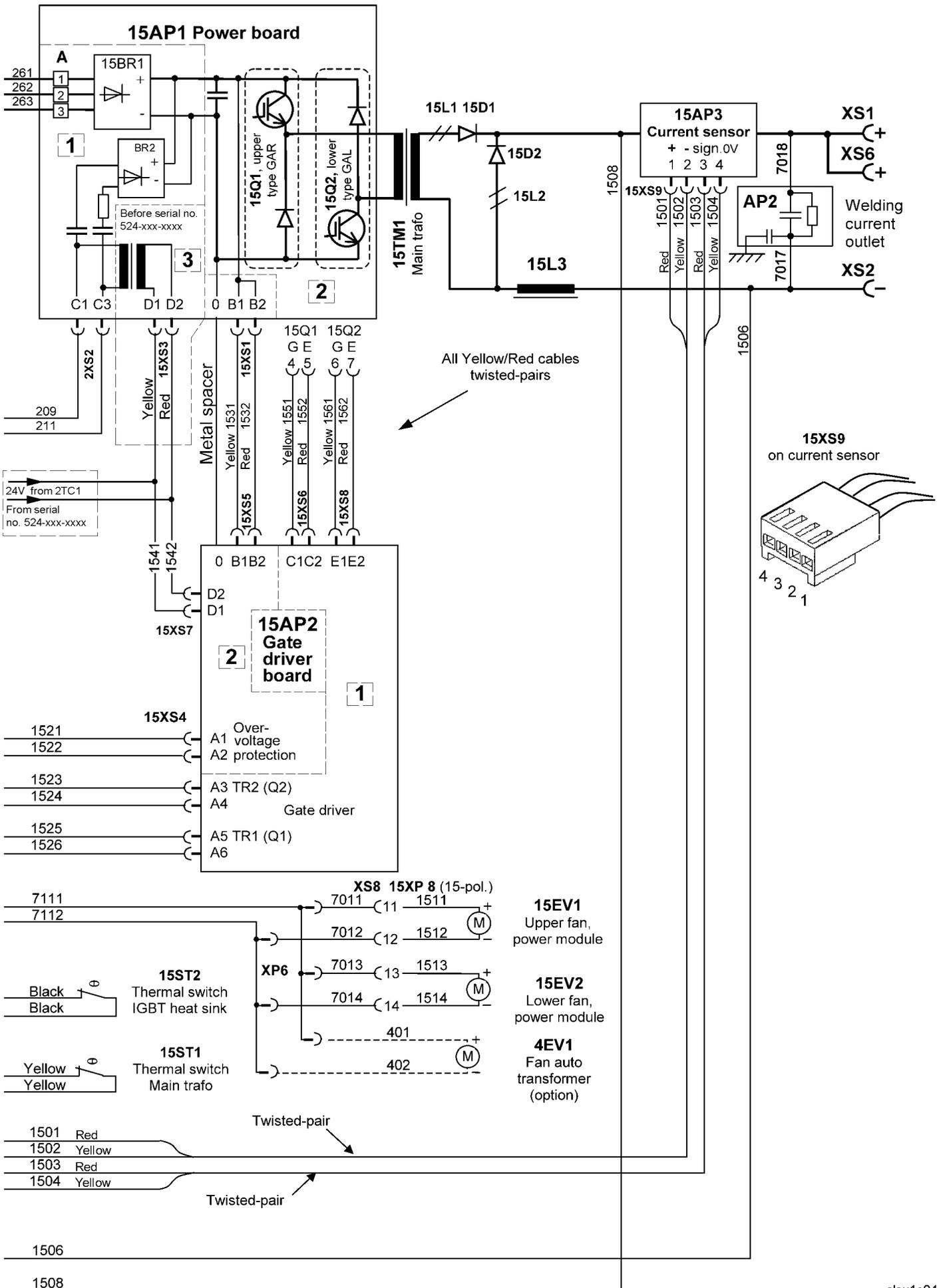




**AristoMig 400** valid for serial number 105-xxx-xxxx to 524-xxx-xxxx

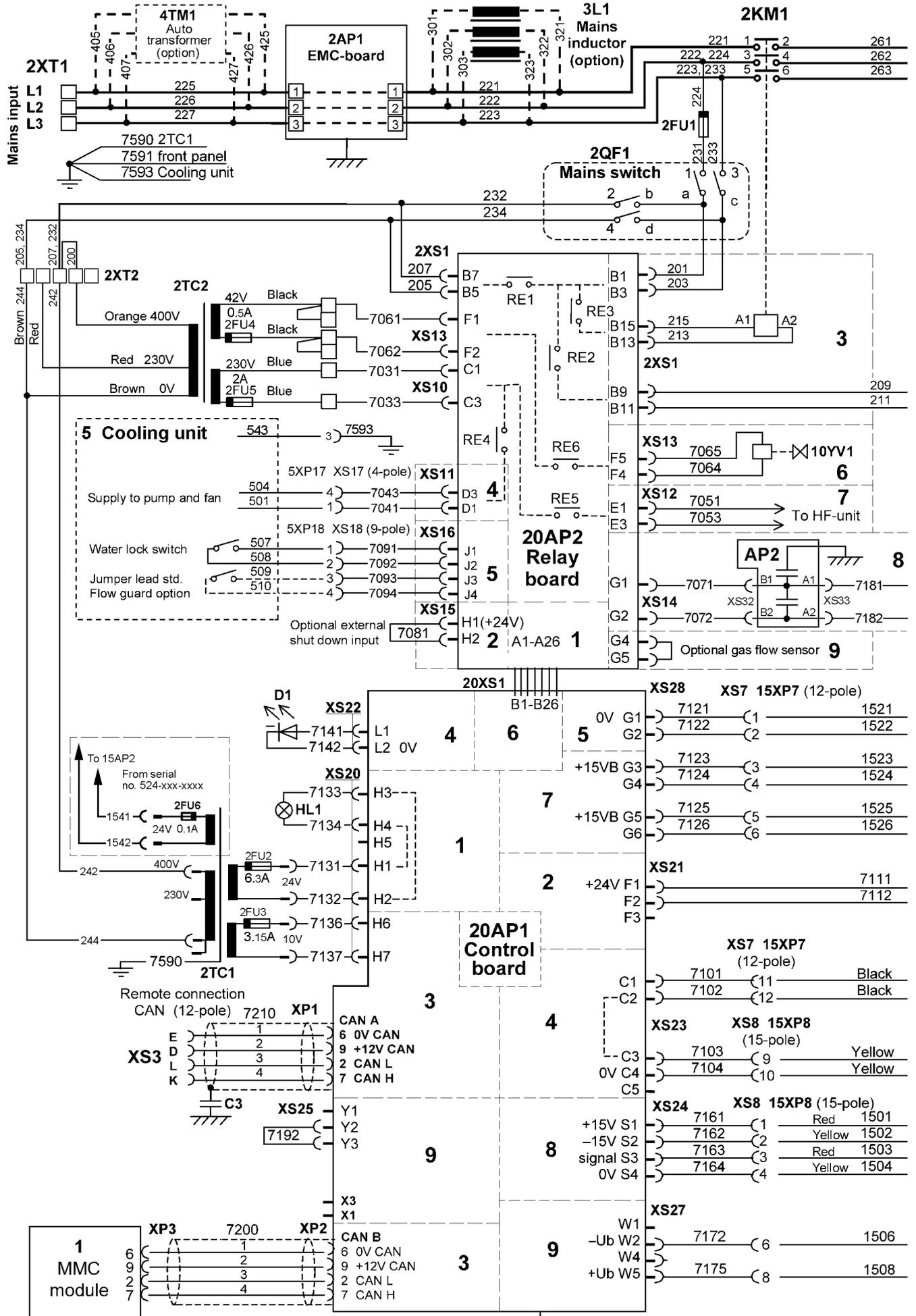


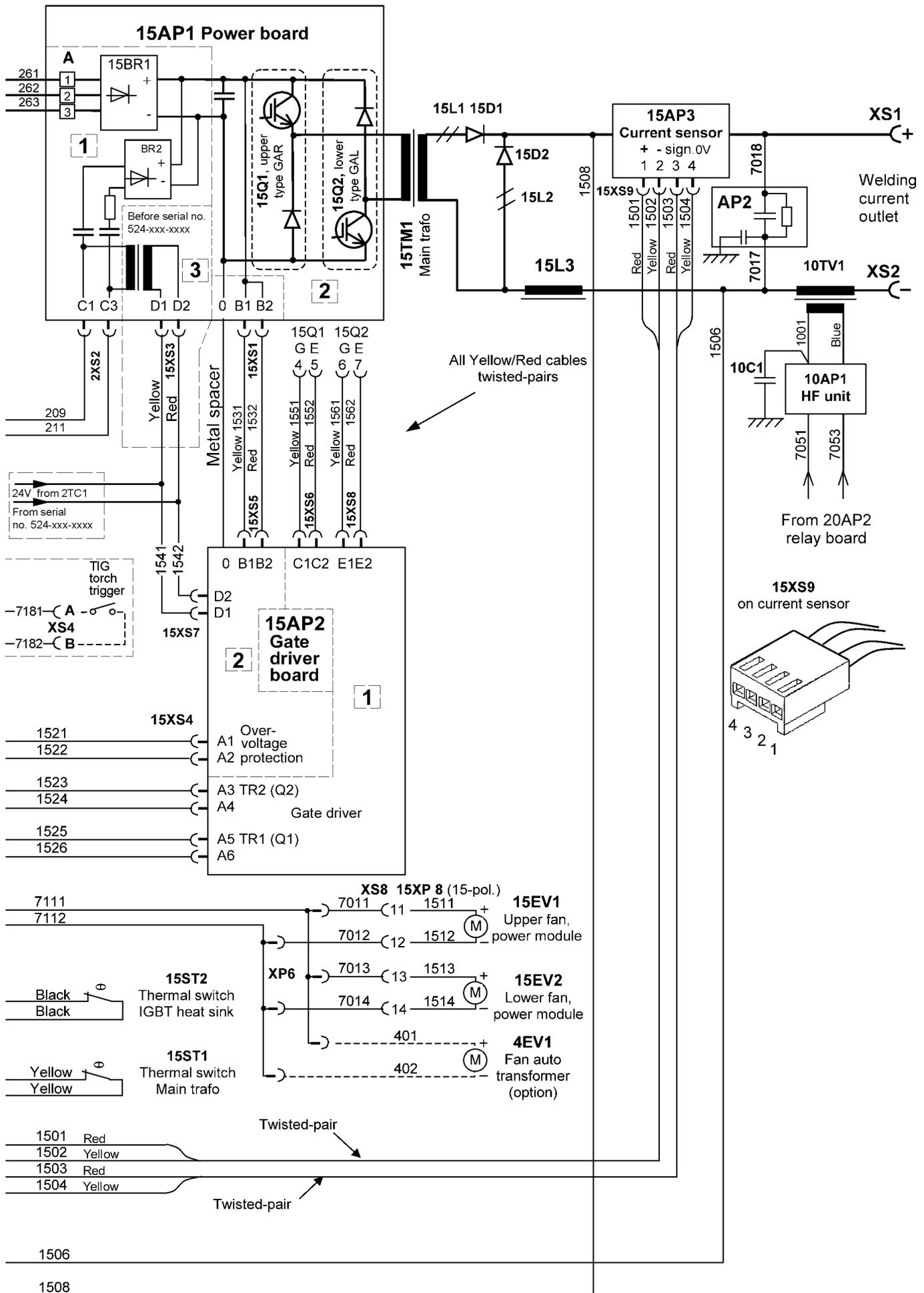
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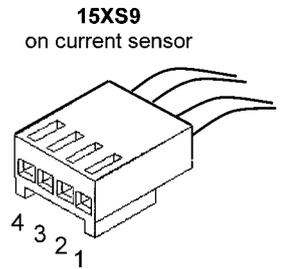
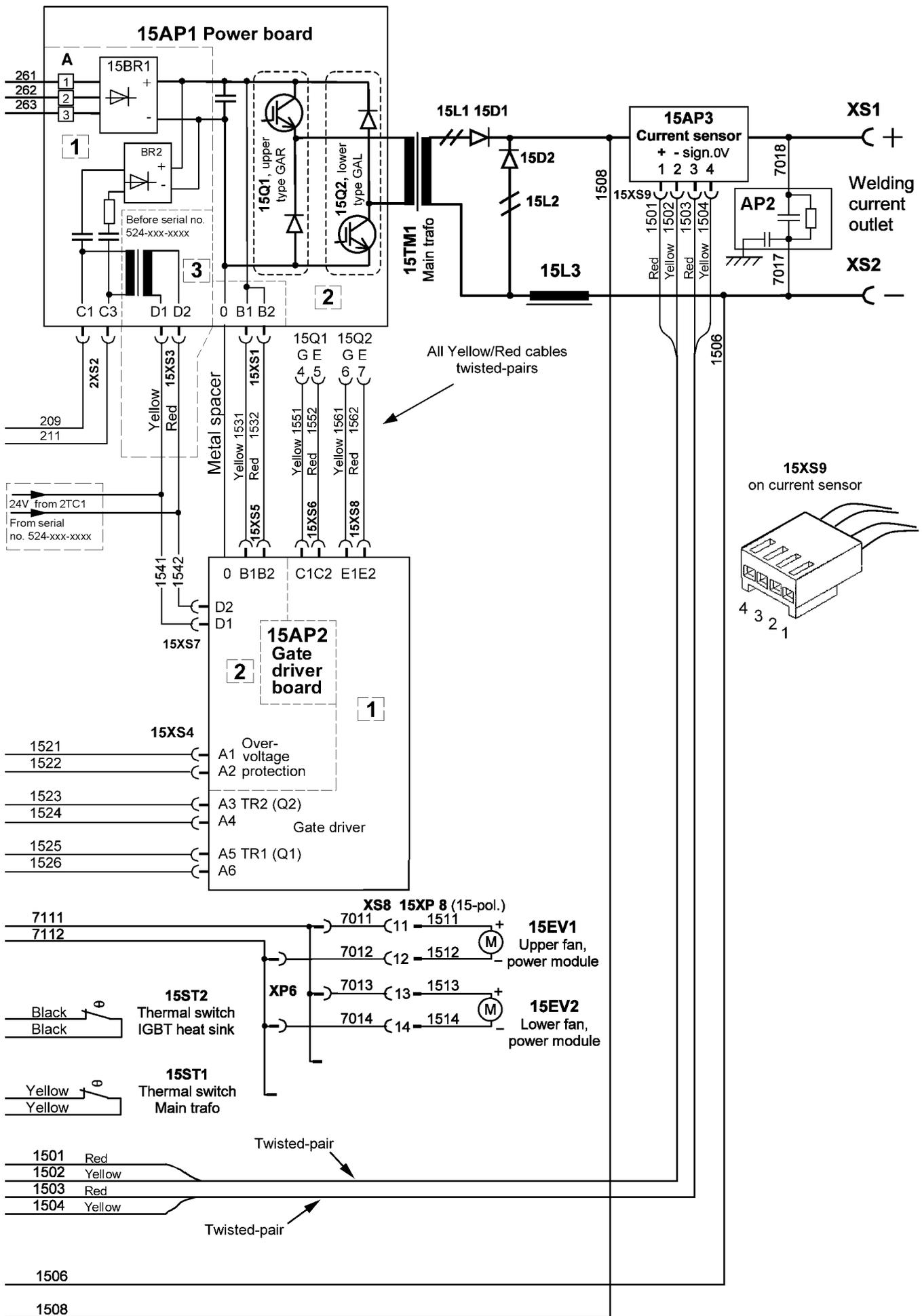
# AristoTig 400 valid for serial number 105-xxx-xxxx to 524-xxx-xxxx





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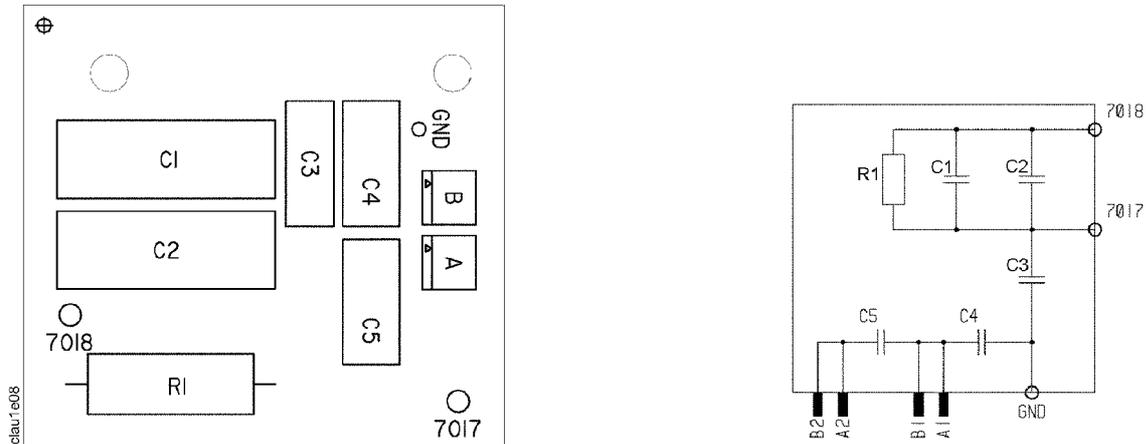
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## DESCRIPTION OF OPERATION

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This function description describes the function of circuit boards and other components in the power unit. It is divided into sections, numbered to correspond to the circuit board numbers and divisions into function blocks.

### AP2 Interference suppressor board



Component positions and circuit diagram for circuit board AP2

The circuit board removes interference signals.

### 1 MMC module

The MMC module consists of an operator's control panel and a welding data board.

The power unit, the wire feed unit and the control panel each have their own microprocessor for control, with the control panel being the central unit in the system. In addition to storing and issuing welding data, it also exercises overall control of the system as a whole.

#### Setting the welding data

Man-machine communication (MMC) is assisted by the modular architecture of the Aristo range. It is possible to choose systems with the emphasis on the simplest possible operation, or those that can provide more optimised settings for the best welding performance.

The MMC modules are described in separate service manuals

#### MMC modules for the AristoMig U400 and AristoMig 400

The MMC module can either be a control panel fitted to the wire feed unit or a control pendant connected to the remote connection of the power unit or the feed unit.

**AristoMig U400:** Control panel U6 and AristoPendant U8.

**AristoMig 400:** Control Panel M2, Control Panel MA4, Control Panel MA6 and AristoPendant U8.

#### MMC modules for the AristoTig 400

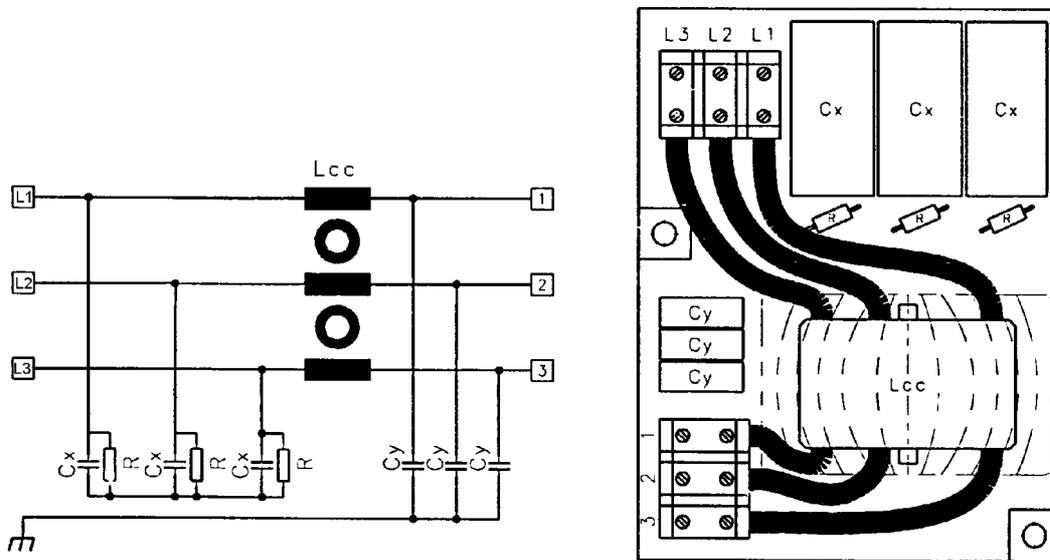
The power unit is supplied with Control Panel T4 or Control Panel T6.

#### MMC modules for the AristoArc 400

The power unit is supplied with Control Panel A2 or Control Panel A4.

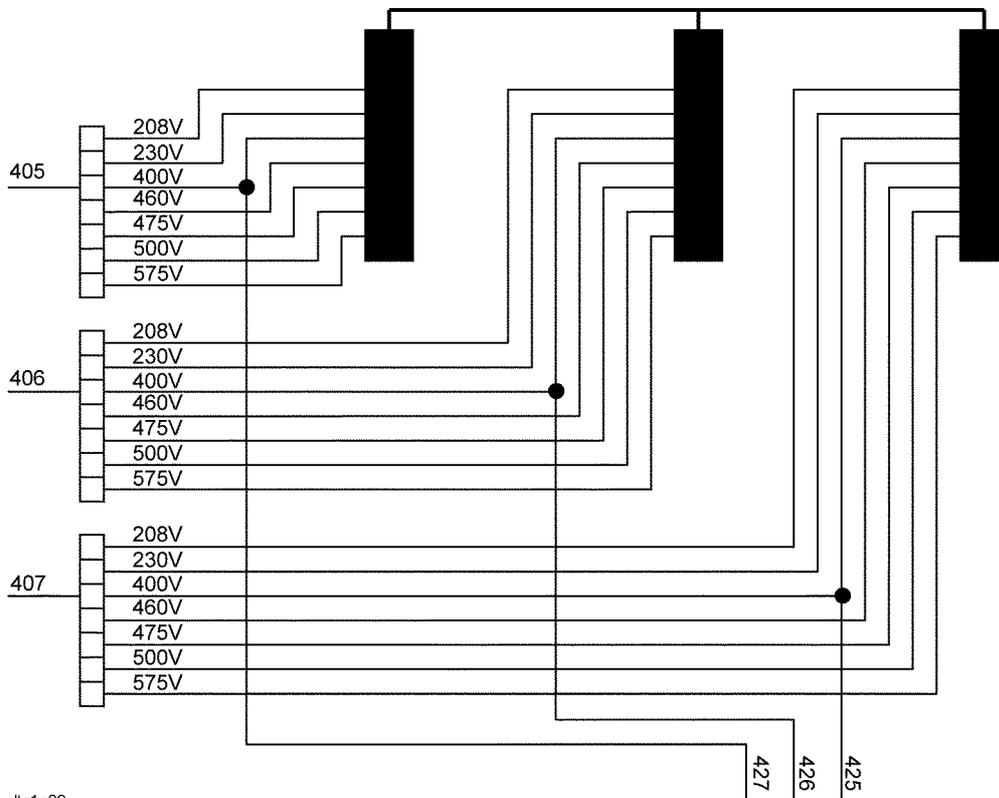
## 2AP1 Interference suppressor board

This circuit board reduces mains-borne interference to/from the power unit.



Circuit diagram and component positions of the 2AP1 interference suppression circuit board

## 4 Autotransformer



cltc1e09

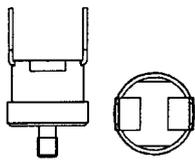
The AristoMig 400 and AristoTig 400 can be delivered with built-in autotransformer. As delivered, the autotransformer is connected for a 400 V supply. See Page 70 for connection instructions.

## 5 Cooling unit

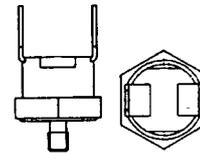
AristoMig U400, AristoMig 400 and AristoTig 400 can be delivered with built-in cooling unit.

### Component description, water cooling unit

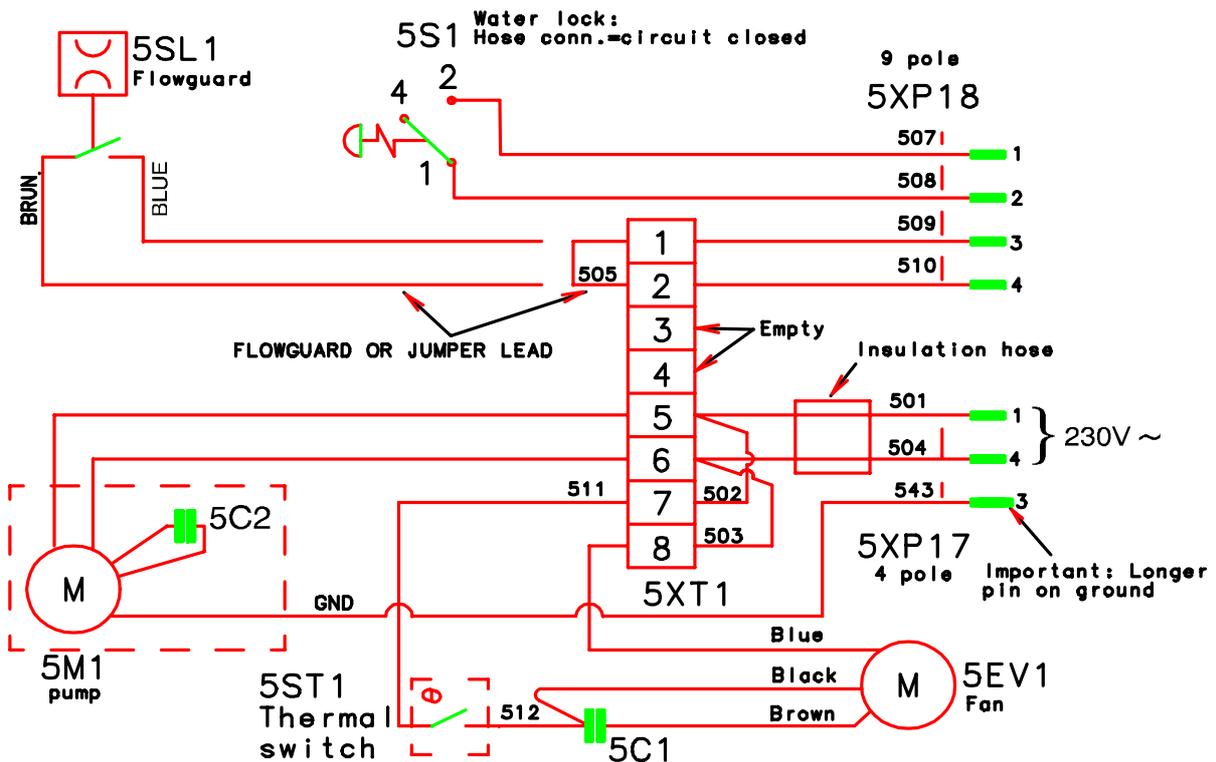
- 5C1** Start and run capacitor for the fan motor, 5  $\mu$ F 450 V AC.
- 5C2** Start and run capacitor for the pump motor, 3  $\mu$ F 400V.
- 5EV1** Fan motor, 230 V AC.
- 5M1** Pump motor, 230 V AC.
- 5S1** Microswitch for the water lock connection.
- 5SL1** Water flow guard. The contact closes for flow rates of 0.7 l/min and over.  
**Note:** this is an accessory.
- 5ST1** Temperature sensor switch. Closes at 45 °C, opens at 35 °C.  
(Before serial no. 105-122-xxxx: Closes at 60 °C, opens at 50 °C.)



Thermal switch 5ST1, 45 °C



Thermal switch 5ST1, 60 °C



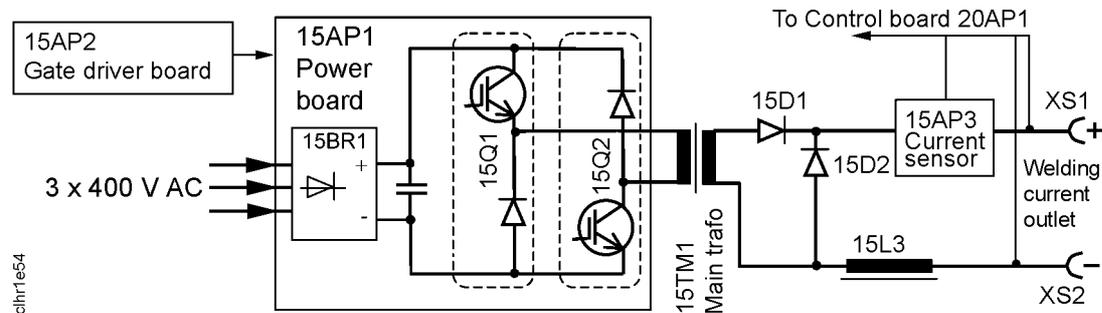
Wiring diagram for the cooling unit

The power supply to cooling water pump 5M1 and fan 5EV1 is controlled by the machine software in the welding data unit. See the description of the 20AP2:5 on Page 44. The fan is energised in parallel with the pump, and is controlled by temperature sensor switch 5ST1.

## 15 The power module

The power module converts 3-phase 400 V to the welding voltage. It consists of a forward converter inverter, operating at a switching frequency of 27 kHz.

The mains rectifier bridge 15BR1, the IGBT transistors 15Q1 and 15Q2 and the diode modules 15D1 and 15D2 are all mounted on a heat sink. Circuit board 15AP1 links them together. It also carries a smaller circuit board, 15AP2, which provides the functions for the gate drivers and overvoltage and undervoltage protection.



*Schematic diagram of the power module*

If the IGBT transistors 15Q1 and 15Q2, or circuit boards 15AP1, 15AP2 or 20AP1, are replaced, the gate pulse waveforms must be checked afterwards and the machine must be soft-started. See Pages 56 and 60.

See the instructions on Page 55 concerning mounting of the components on the heat sink (15Q1, 15Q2, 15BR1, 15D1 and 15D2).

### **WARNING**

**The power module is at mains voltage.**

**0 V in the power module is connected to mains voltage.**

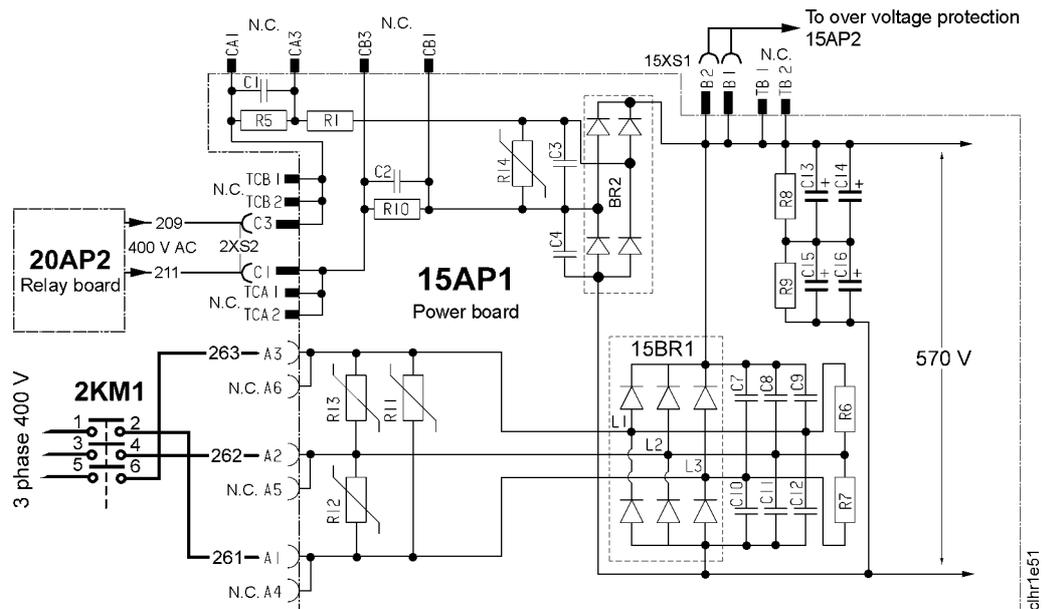
## 15AP1 Power board

The power board carries the mains rectifier, the charging circuit, the switching circuit and a transformer for voltage supply to the overvoltage and undervoltage protection.

Circuit board connectors marked NC are not connected.

If this circuit board is to be replaced in machines with serial number prior to 524-xxx-xxx: See page 69 for instructions.

### 15AP1:1 Mains rectifier bridge and charging circuit

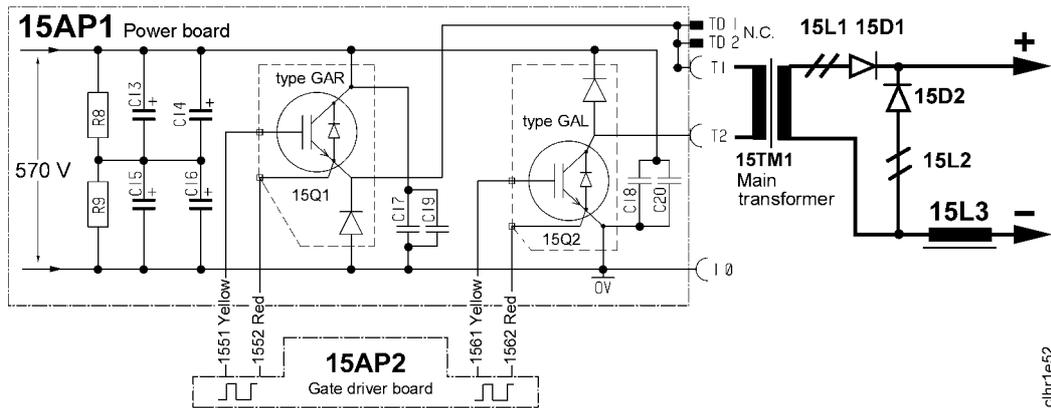


When the mains power supply is turned on, smoothing capacitors C13-C16 charge up via rectifier bridge BR2. Contactor 2KM1 closes after about twelve seconds and connects the mains supply to rectifier bridge 15BR1. See Page 43 for a more detailed description of the starting sequence.

#### Component description:

- BR2 Rectifier for charging current.
- C1, C2 Capacitors, restricting the inrush charging current to rectifier bridge BR2. The current while capacitors C13 - C16 are charging is about 0.7 A.
- C13 - C16 Smoothing capacitors, with a total capacitance of 1000  $\mu$ F.
- R5, R10 Discharge resistors for C1 and C2.
- R1 Series resistor (10  $\Omega$ ) for the charging current to C13 - C16.
- R8, R9 Potential divider and discharge resistors for C13 - C16.
- R11 - R13 Varistors. Clip the voltage peaks exceeding about 1000 V. The varistors do not conduct when the voltage is below 480 V AC RMS, this corresponds to a peak voltage of 680 V.
- 15BR1 Main rectifier for mains voltage.

## 15AP1:2 Switching circuit



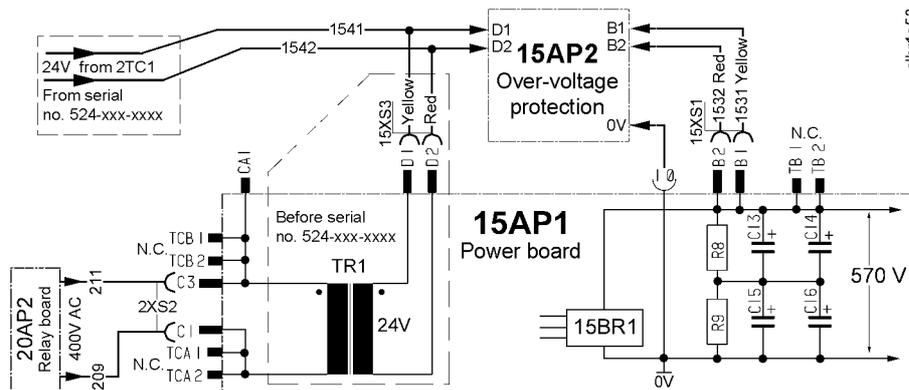
The power module switching components consist of IGBT transistors 15Q1 and 15Q2, operating at a switching frequency of 27 kHz. The transistors must never be energised when the gate connections are removed.

The gate pulse waveforms and duration are vital for correct operation. See also Page 29.

If an IGBT transistor (15Q1, 15Q2) has failed, both transistors must be replaced. Failure of either transistor always subjects rectifier bridge 15BR1 to a high current surge, which substantially reduces its life. We therefore recommend that the rectifier bridge should also be replaced if the transistors have failed. See Page 54 for instructions on checking the IGBT transistors.

Diode modules 15D1 and 15D2 each contain two diodes. Both they and the IGBT transistors must be mounted in accordance with the instructions on Page 55.

## 15AP1:3 Overvoltage and undervoltage protection



The voltage protection function monitors the voltage across smoothing capacitors C13-C16. See Page 29 for a description of operation.

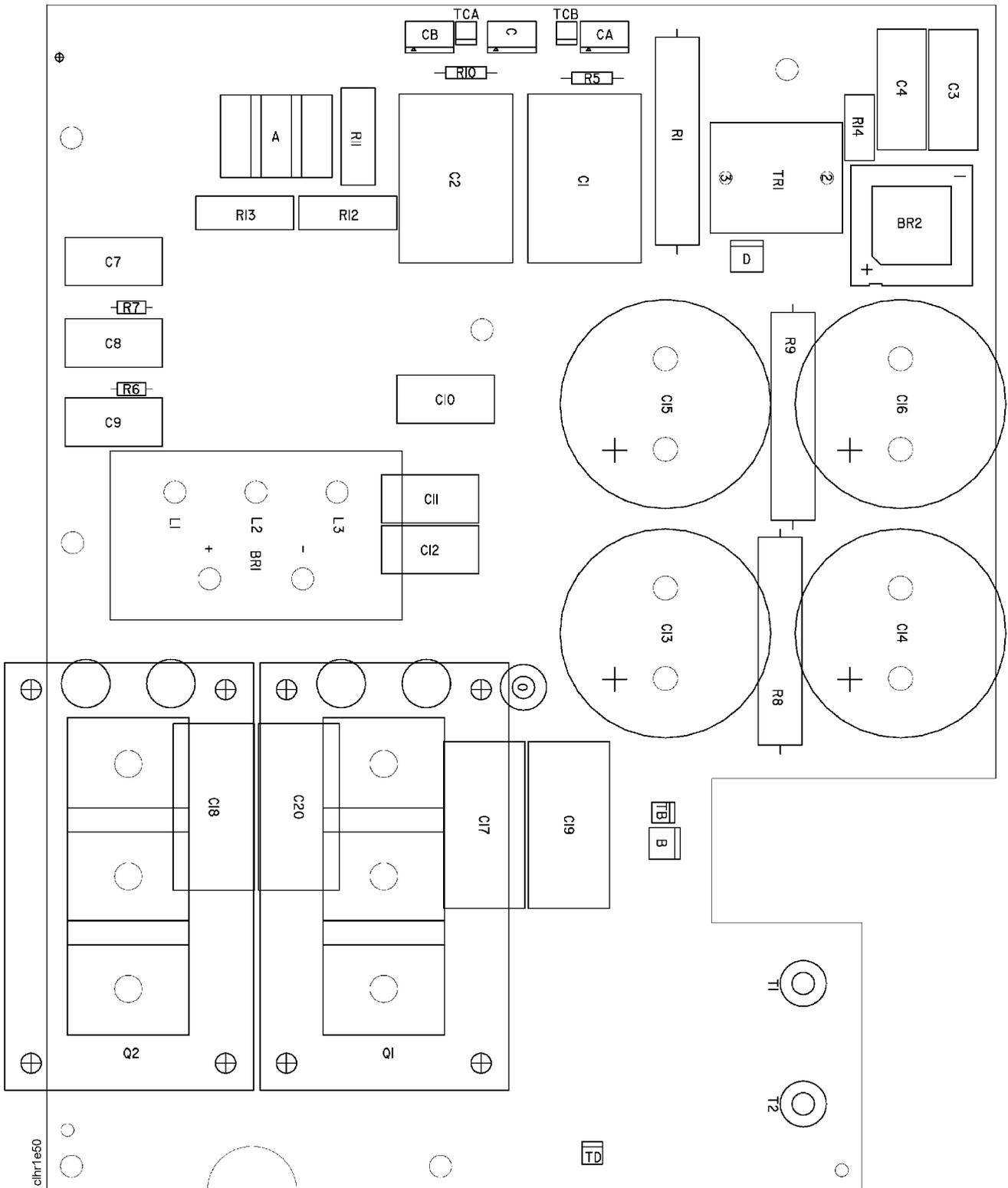
From serial no. 524-xxx-xxx the voltage protection function is powered from transformer 2TC1.

Before serial no. 524-xxx-xxx the voltage protection function was powered from transformer TR1 on power board 15AP1. See page 69 for more information.

### Warning:

Take care not to confuse contacts **B** and **D** on circuit board 15AP2.

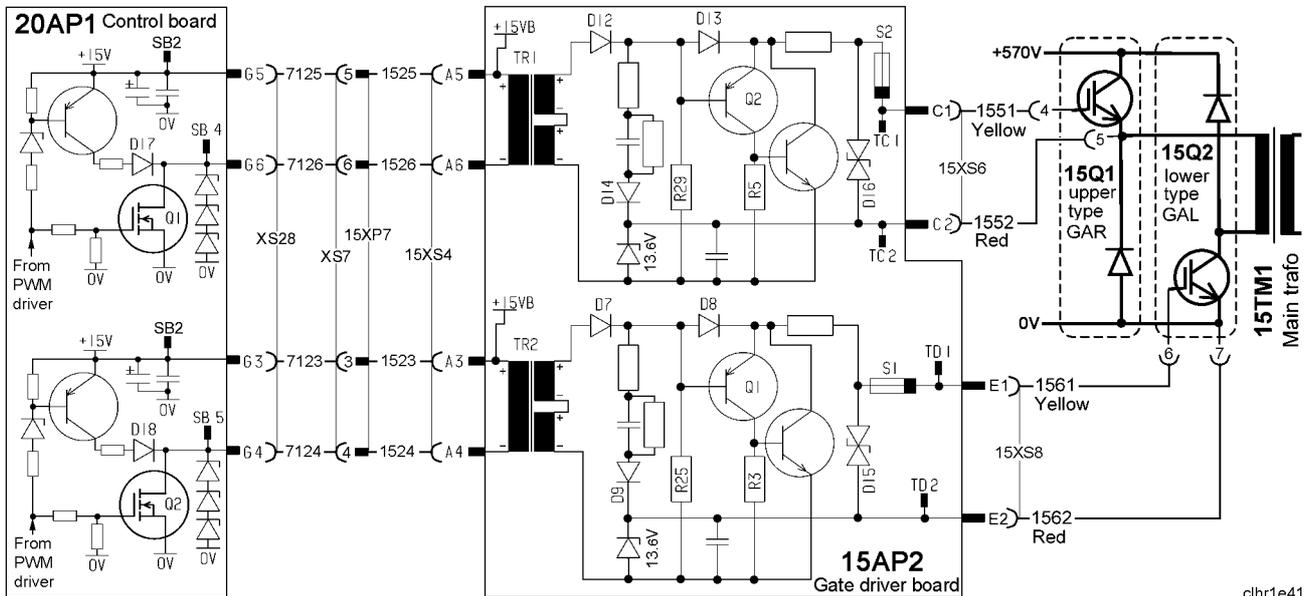
# 15AP1 Component positions



## 15AP2 Gate driver board

The gate driver board carries circuitry for gate driving and overvoltage and undervoltage protection.

### 15AP2:1 Gate driver stages



clhr1e41

**WARNING! Dangerous voltage - mains voltage. Never measure the gate signals when the power unit is connected to the mains supply.**

The pulse frequency is 27 kHz, with a maximum pulse width of 39.0 - 40.8 % of the cycle width. See Page 56 for screen traces of waveforms and measurement instructions.

Transformers TR1 and TR2 are gate driver transformers for galvanic isolation of the drive circuits from controller board 20AP1. Fuses S1 and S2 protect the gate driver circuit if the IGBT transistors fail.

Transistor 15Q1 has a diode connected in series with its emitter: this transistor has the identification 'GAR' on its case. Transistor 15Q2 has a diode in series with its collector, and is identified by 'GAL' on its case.

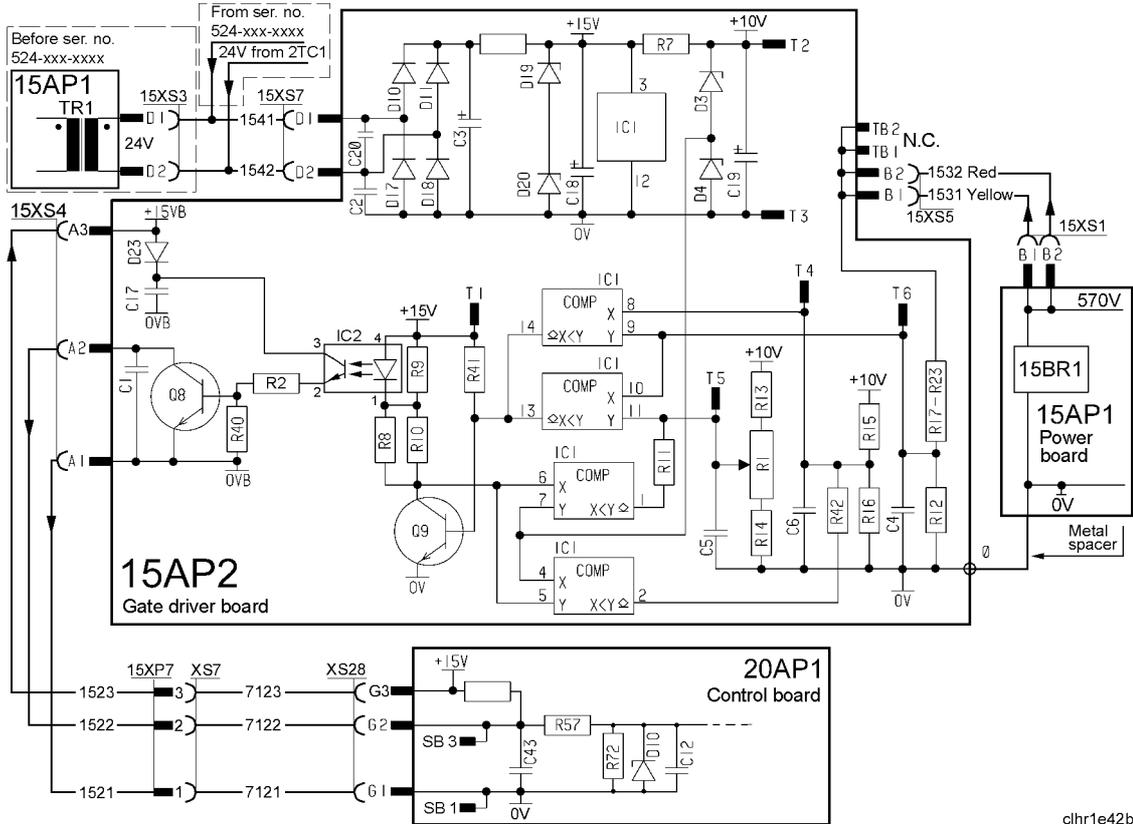
### 15AP2:2 Overvoltage and undervoltage protection

**WARNING! Dangerous voltage. Mains voltage on circuit boards 15AP1 and 15AP2 when connected to the 400 V supply.**

0 V on power board 15AP1 and gate driver board 15AP2 is connected to the mains supply. 0 V on the power board and gate driver board is galvanically isolated from 0 V on controller board 20AP1.

The overvoltage and undervoltage protection generates a fault signal if the output voltage across rectifier bridge 15BR1 falls outside the permitted interval of 330 - 680 V DC, which is equivalent to 235 - 495 V AC input voltage. The lower voltage limit is fixed, while the upper voltage limit can be adjusted by potentiometer R1. The neutrals on the power board and the gate driver board are connected to each other by a spacer screw.

During normal operating conditions, the voltage between pins A1 and A2 on circuit board 15AP2 is about 0.1 V. Optocoupler IC2 is used for galvanic isolation of the voltage monitoring circuit from control board 20AP1.



clhr1e42b

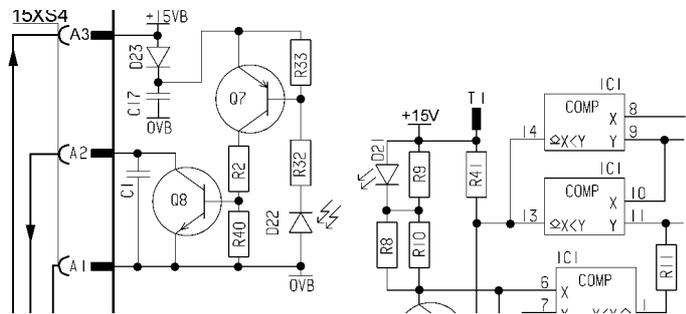
*Circuit diagram of the over and undervoltage protection, version 2*

A break in any of the conductors to/from 15AP2, as shown in the diagram above, will result in a fault state.

In the event of a fault, the charging relay and the contactor open, as described in the description of the starting sequence on Page 43. Machines with a display panel will show fault code 5.

See Page 62 for instructions on check measurements of voltage levels.

There are two versions of the optocoupler function of the circuit board. Version 2 is fitted to the machines from January 2002.

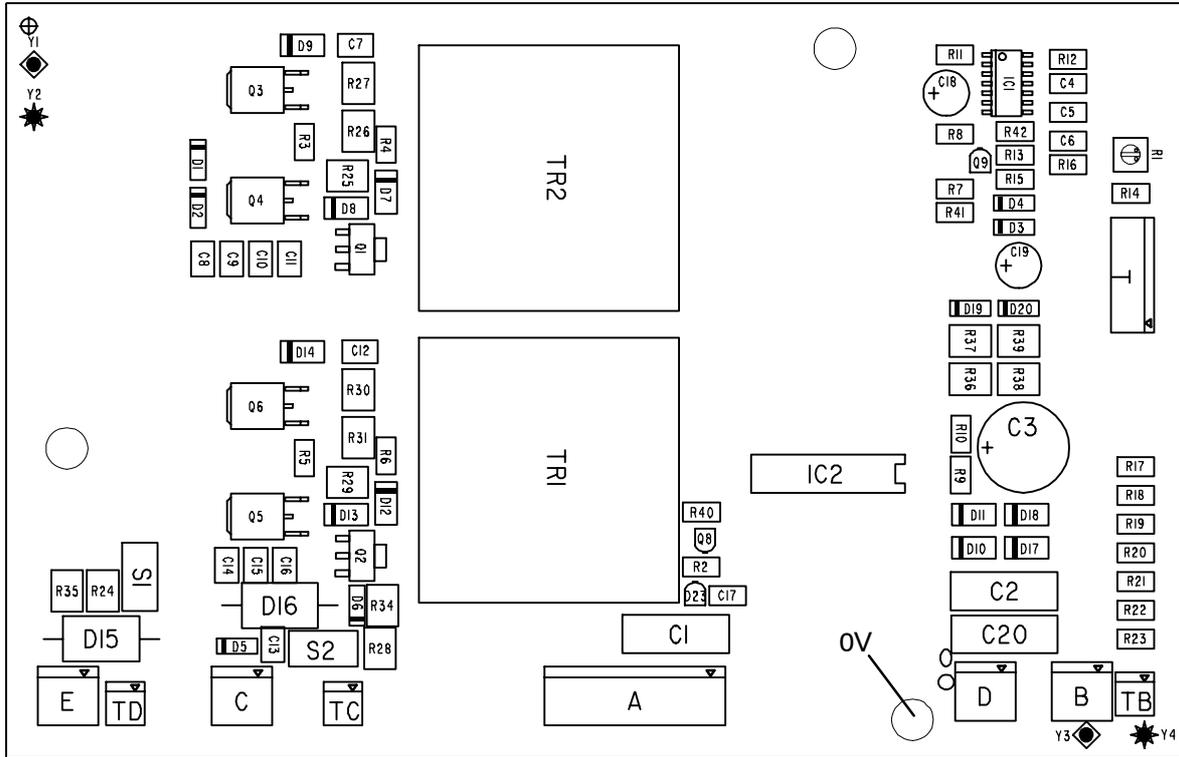


*The optocoupler function of version 1 of the over and undervoltage protection*

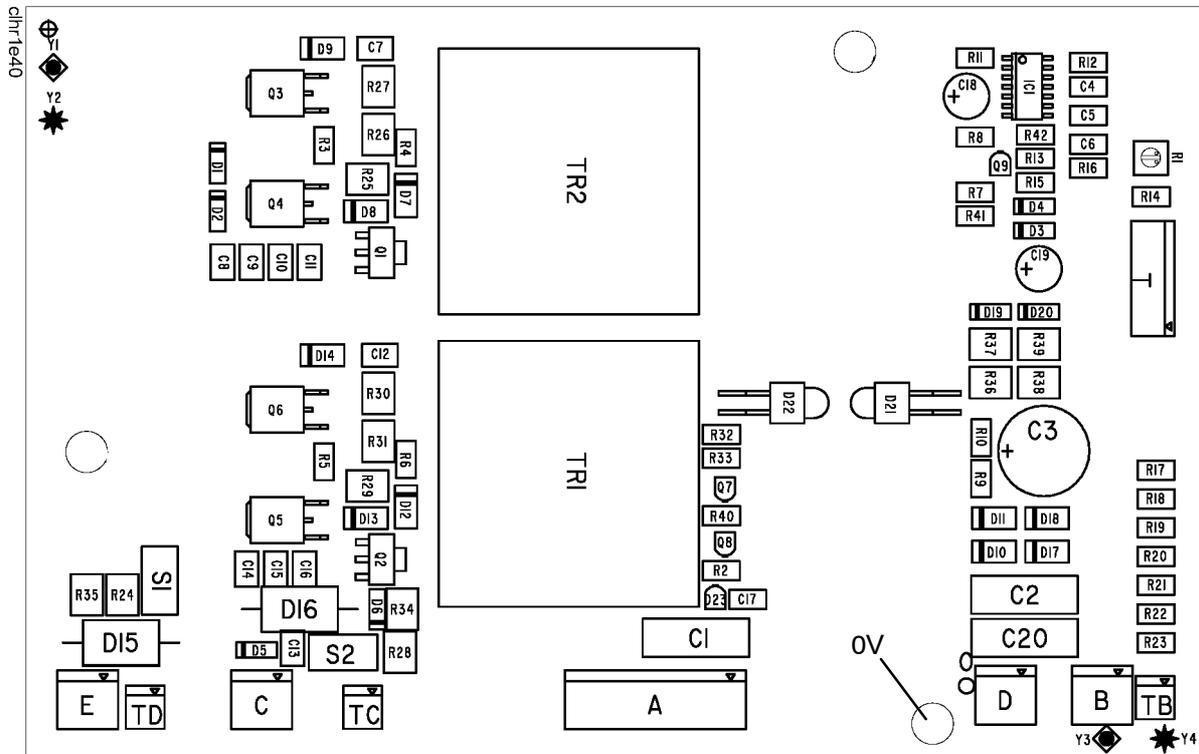
Optocoupler version 1: Transmitter and receiver diodes D21 and D22 form an optocoupler for galvanic isolation of the voltage monitoring circuit from control board 20AP1. Light between the two represents normal operation. Dirt build-up on D21 and/or D22 will result in a fault state.

## 15AP2 Component positions

**Warning:** 0 V on this circuit board is at mains voltage.



Version 2 of circuit board 15AP2



Version 1 of circuit board 15AP2

## 20AP1 Control board

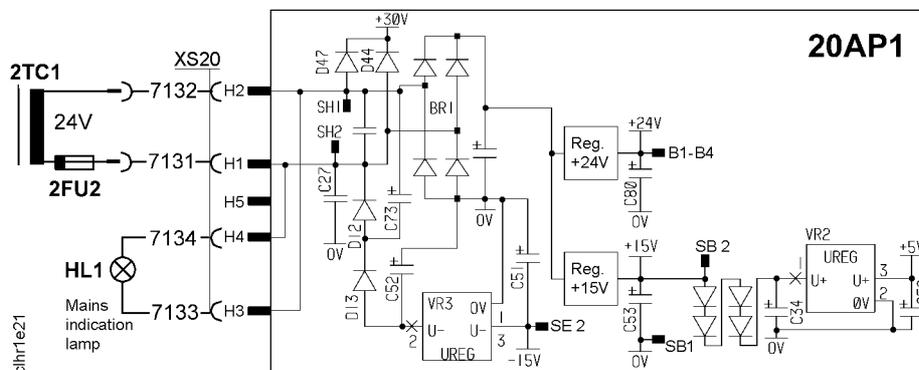
The processor on the control board monitors and controls the various functions of the power unit. It obtains information on welding data and welding processes from the welding data board in the MMC control panel.

From serial no. 347-xxx-xxxx a new version of the control board is fitted to the machines. The control boards are interchangeable up to and including serial no. 105-xxx-xxxx, from serial number 347-xxx-xxxx the new version of the control board must be used.

**WARNING:** This circuit board looks identical to the control board used in the 500 Amp Aristo machines, but there is a difference in both hardware and software. If wrong board is used, it might cause serious damage to the machine. Make sure that the replacement board has correct article number, see the spare parts list.

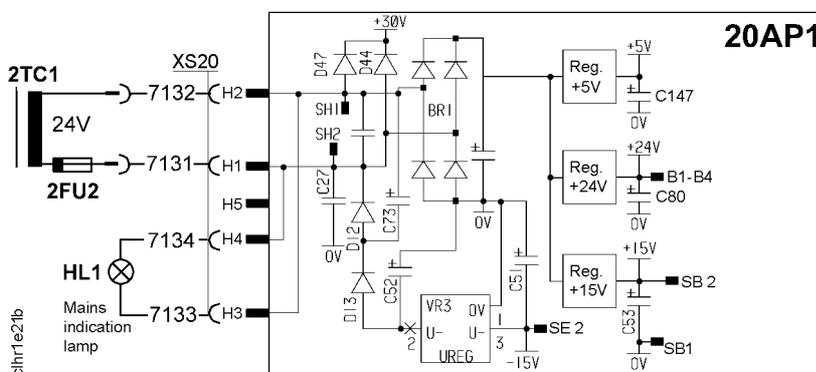
The control board has a software identity, machine ID. When starting up the machine the MMC unit sends a request for the ID, this board has ID 11, which means that it is a 400 Amp machine.

### 20AP1:1 Power supply



Power supply, circuit board version 1

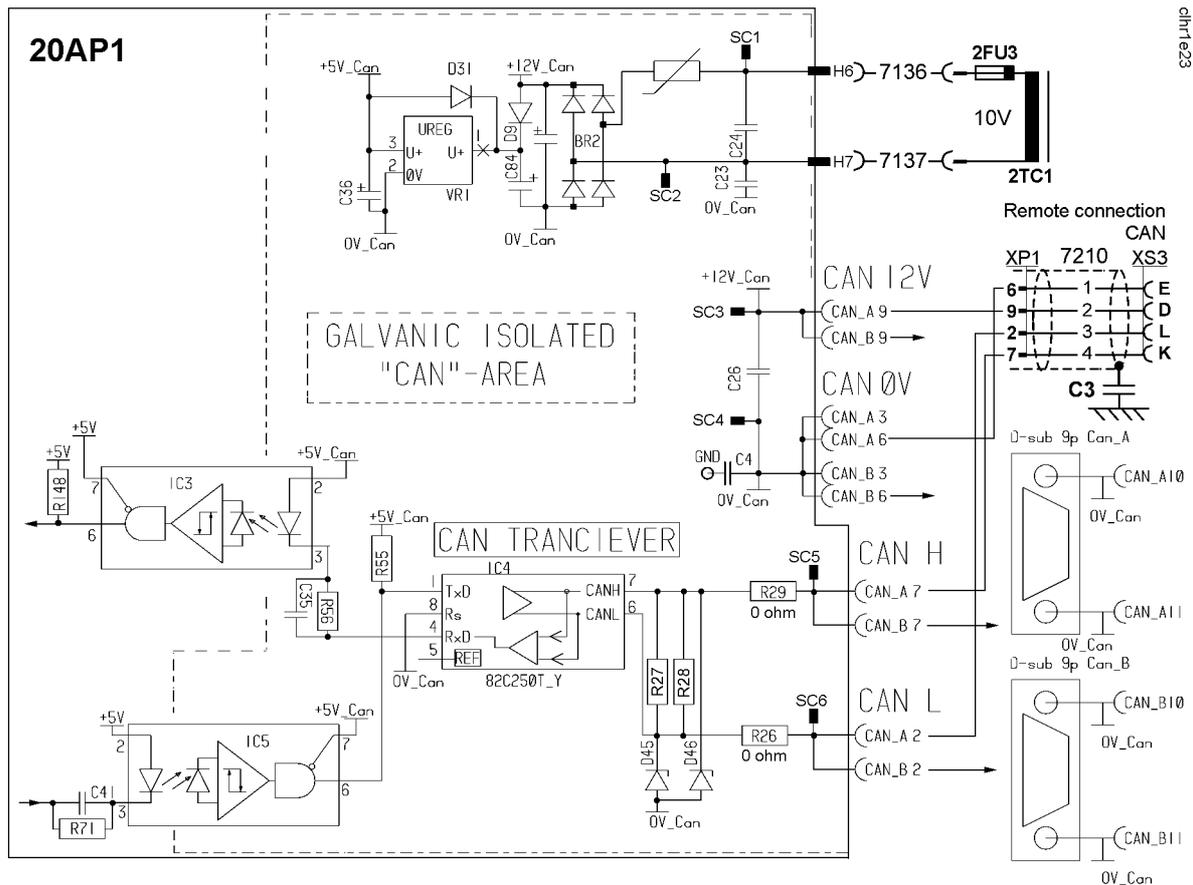
- +24 V Power supply to relay board 20AP2
- +15 V Internal power supply on 20AP1 and power supply to the pulse transformers on 15AP2.
- 15 V Internal power supply on 20AP1.
- +5 V Internal power supply on 20AP1.



Power supply, circuit board version 2

This circuit board has a more powerful +5 V and +15 V supply, which is needed for the processor used on this board.





Bus communication circuits to and from the control board

Check the following points in the event of problems with CAN communications:

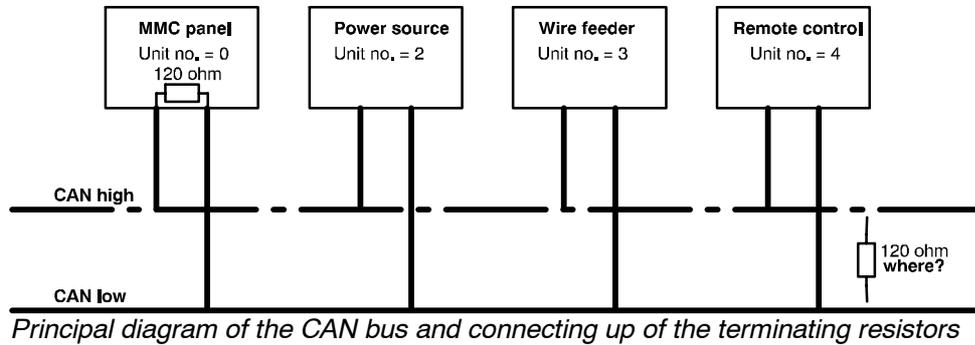
- The terminating resistor. The CAN bus resistance must lie in the range 50 – 130 Ω: the optimum value is 60 Ω. To check the resistance, turn off the power unit and measure the resistance between pins L and K in the remote control connector socket XS3 on the front of the machine.
- The connection cable between units. Check that the correct type of cable is being used. Check that each signal is being carried by the correct core. CAN H and CAN L must be carried by the twinned pair.
- All screen connections must be sound.
- Good contact with the chassis connections from/to the control board, suppressor board and suppressor capacitors. See the main circuit diagram.

### Terminating resistors

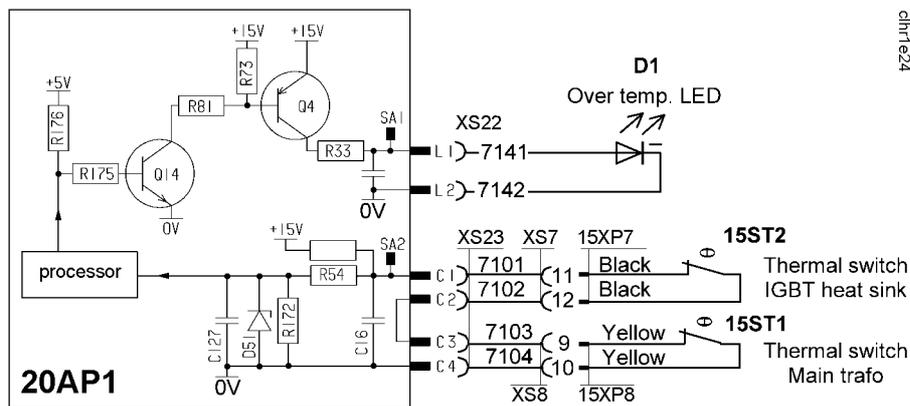
In order to avoid communication interference, the ends of the CAN bus must be terminated by resistive loads.

One end of the CAN bus is at the control panel, which incorporates a terminating resistor. The other end is in the power source and it must be fitted with a terminating resistor. If a CAN remote control with terminating resistor is connected to the power source, the terminating resistor must be removed from the power source.

The CAN remote controls and CAN adapters have a built-in terminating resistor. This resistor can be disconnected or connected by moving a jumper: See the service manual for the CAN based remote controls (filename 0740 800 170).



## 20AP1:4 Temperature monitoring



From serial number 105-138-xxxx: Thermal cutout switch 15ST1 is fitted under the winding of main transformer 15TM1, and opens at a temperature of 130°C. The duty cycle is valid for 40°C.

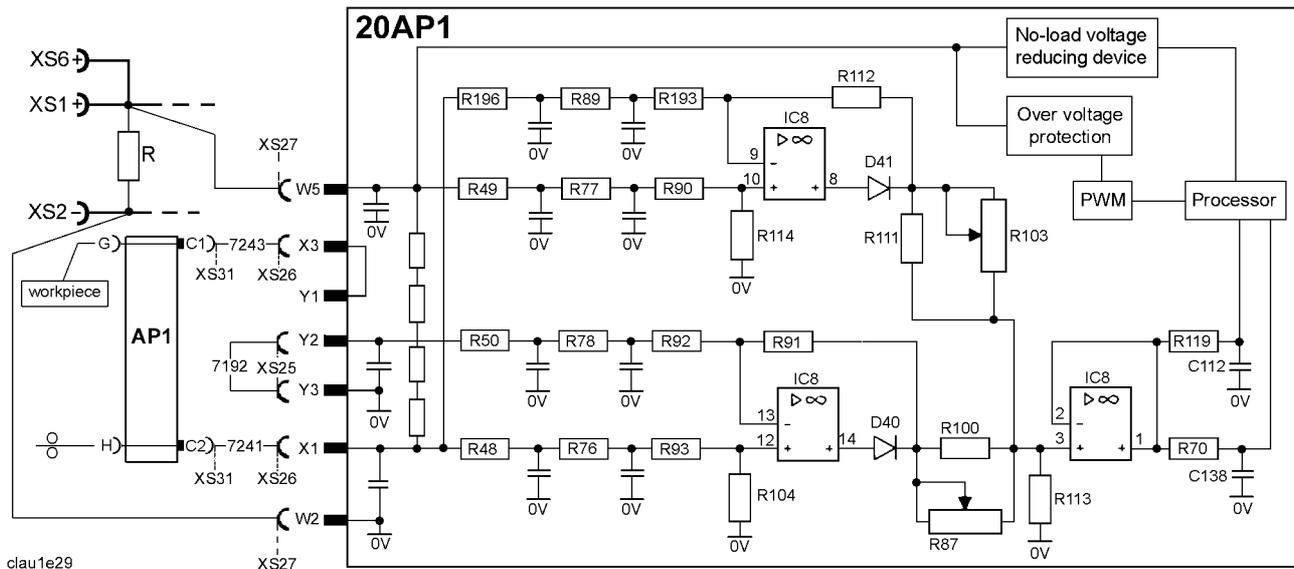
Thermal cutout switch 15ST2 is mounted on the heat sink, beside the IGBT transistors, and opens at a temperature of 80°C. See Page 55 for fitting instructions.

If either of the switches operates, the power unit is stopped and LED D1 on the front panel lights. The power unit cannot be restarted until it has cooled sufficiently for the switch(es) to reclose.

Before serial number 105-138-xxxx: Thermal cutout switch 15ST1 is fitted on the winding of main transformer 15TM1, and opens at a temperature of 110°C. The duty cycle is valid for 25°C.



## 20AP1:9 Arc voltage input for Universal and MIG machines



Circuit diagram of the arc voltage input

The arc voltage input senses the welding voltage regardless of the welding polarity or welding method. If sensing via the welding filler wire is connected, it is this voltage that will be used: if not, the voltage at the power units terminals is used.

The signal from the arc voltage input is used as an input signal to the welding process controller: from it, the controller calculates in real time how much current must flow in the circuit in the next instant. The controller activates/deactivates the no-load voltage reduction function.

The arc voltage signal provides a voltage signal to the power unit's display panel.

See Page 65 for instructions for calibrating the arc voltage signal input.

### No-load voltage reduction

#### MIG

The no-load voltage controller senses the voltage at the welding current terminals and limits it to a level between 55 V and 70 V. This function is inactive during welding, and is activated within 0.5 seconds after conclusion of welding.

#### MMA

The no-load voltage controller senses the voltage at the welding current terminals and limits it to a level between 78 V and 90 V. This function is inactive during welding, and is activated within 0.5 seconds after conclusion of welding.

#### TIG

For TIG welding with HF starting, the power unit produces the unregulated no-load voltage of about 140 V while the starting function is active, which is normally a maximum of 0.5 seconds.

### No-load overvoltage protection

This disables the PWM circuit if the no-load voltage exceeds 113 V for more than one second. The power unit cannot then be restarted until the mains switch has been turned off and then on again. The display shows fault code 16 if this protection operates.

This overvoltage protection function operates independently of the welding process controller.

## Methods of measuring the arc voltage

Various methods of measurement are available by transferring a link between contacts Y1, Y2 and Y3. When delivered, the link is fitted between Y2 and Y3. **The link must be connected between Y2 and Y3 for MMA and TIG welding.**

- **Welding with the filler wire positive: voltage sensing from the wire.**  
This is the commonest arrangement for MIG welding.

Y2 - Y3 must be linked. This method of measurement allows for the voltage drop in the supply conductor (= to the welding gun). The input signal is measured between inputs X1 and W2. Amplifier IC8:14 is active.

- **Welding with the filler wire negative: voltage sensing from the wire**

Y2 - Y3 must be linked. This method of measurement allows for the voltage drop in the supply conductor. The input signal is measured between inputs X1 and W5. Amplifier IC8:8 is active.

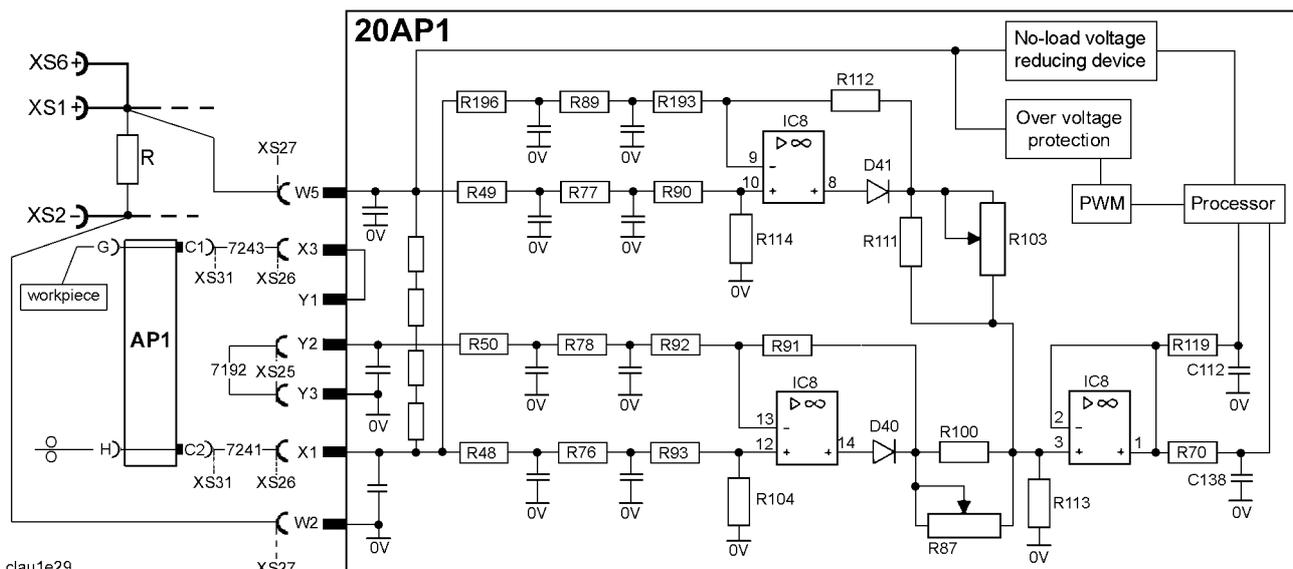
- **Welding with the filler wire positive or negative, without external sensing from the wire or workpiece.**

Y2 - Y3 must be linked. The input signal is measured between inputs W5 and W2 (= the voltage at the power unit terminals), as there is no connection to X1. Amplifier IC8:14 is active.

- **Welding with the filler wire positive: voltage sensing from the wire and workpiece.**

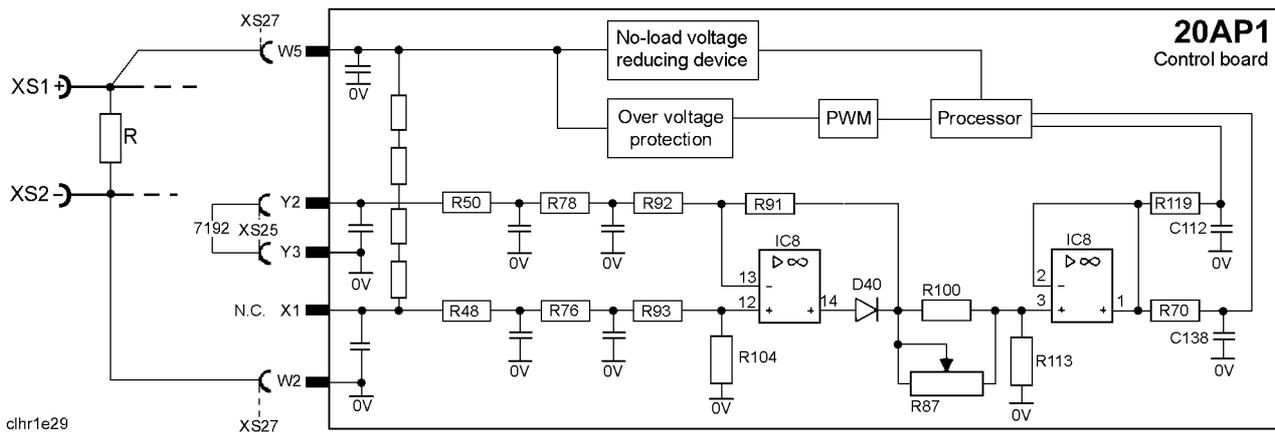
Y1 and Y2 must be linked. This method allows for the voltage drop in both the supply and return conductors. The input signal is measured between X1 and X3. Amplifier IC8:14 is active.

**Note:** If the voltage signal connection to X3 is lost, the power unit loses control of the arc voltage.



Circuit diagram of the arc voltage input

## 20AP1:9 Arc voltage input for TIG and MMA machines



The arc voltage input senses the welding voltage at the power unit's welding current terminals. Contacts Y2 and Y3 must be linked.

The signal from the arc voltage input is used as an input signal to the welding process controller: from it, the controller calculates in real time how much current must flow in the circuit in the next instant. The controller activates/deactivates the no-load voltage reduction function.

The arc voltage signal provides a voltage signal to the power unit's display panel.

See Page 68 for instructions for calibrating the arc voltage signal input.

### No-load voltage reduction

#### MMA

The no-load voltage controller senses the voltage at the welding current terminals and limits it to a level between 78 V and 90 V. This function is inactive during welding, and is activated within 0.5 seconds after conclusion of welding.

#### TIG

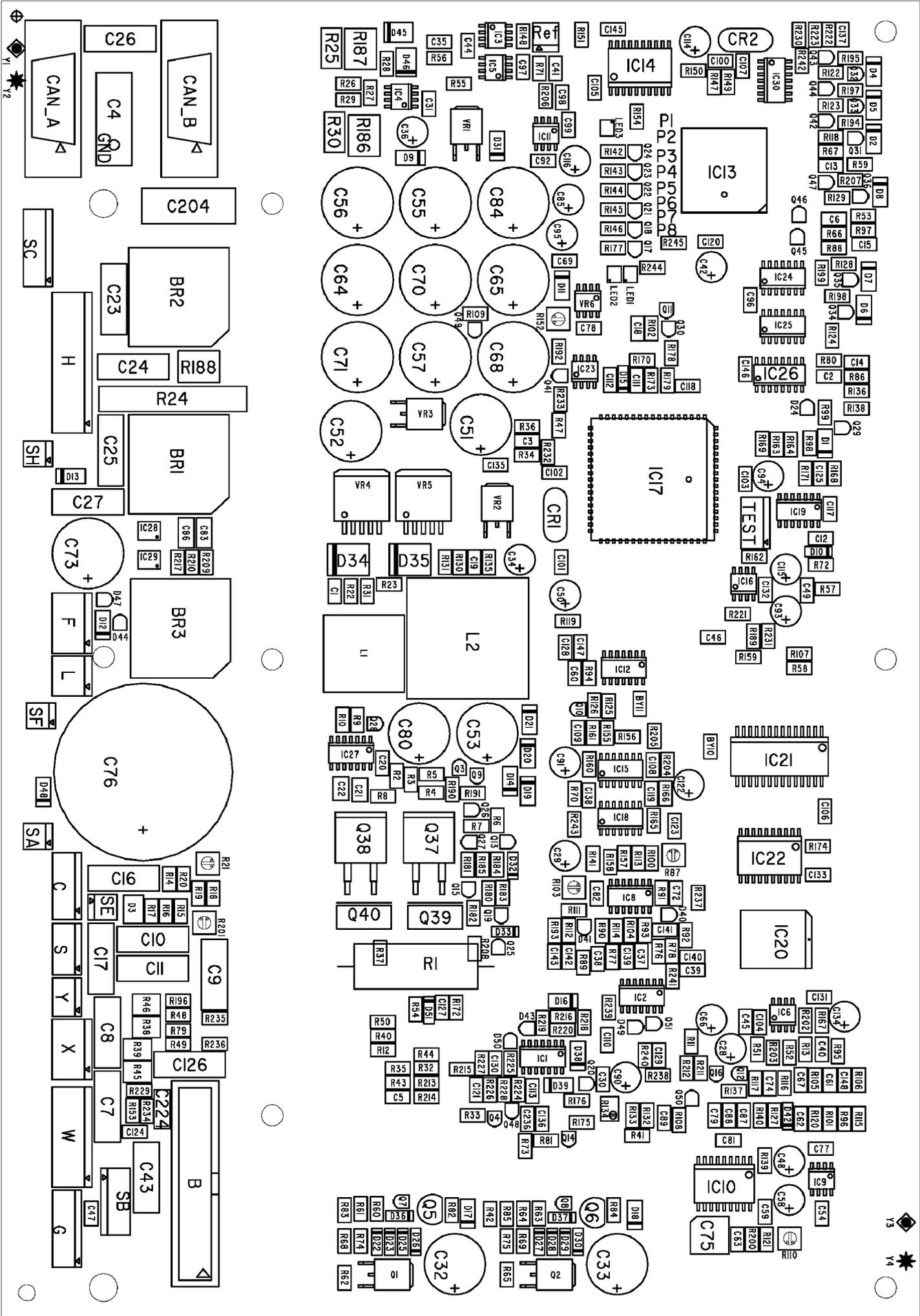
For TIG welding with HF starting, the power unit produces the unregulated no-load voltage of about 140 V while the starting function is active, which is normally a maximum of 0.5 seconds.

### No-load overvoltage protection

This disables the PWM circuit if the no-load voltage exceeds 113 V for more than one second. The power unit cannot then be restarted until the mains switch has been turned off and then on again. The display shows fault code 16 if this protection operates.

This overvoltage protection function operates independently of the welding process controller.



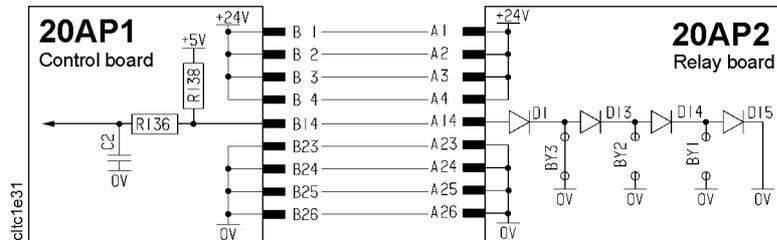


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## 20AP2 Relay board

The relay board handles hardware-connected inputs and outputs to/from control board 20AP2. The relays provide the necessary galvanic insulation. In the event of a relay fault, the entire board must be replaced.

### 20AP2:1 Power supply

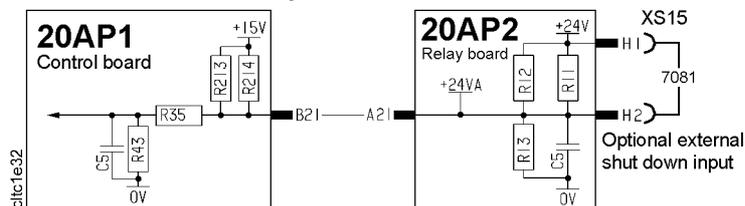


The relay board is supplied at +24 V from controller circuit board 20AP1. Link BY3 tells the processor on the controller board what version of the relay board is in use.

### 20AP2:2 External shutdown

The external shut down function is redesigned. The redesigned boards are delivered as spare parts and fitted to new machines from the end of 2005.

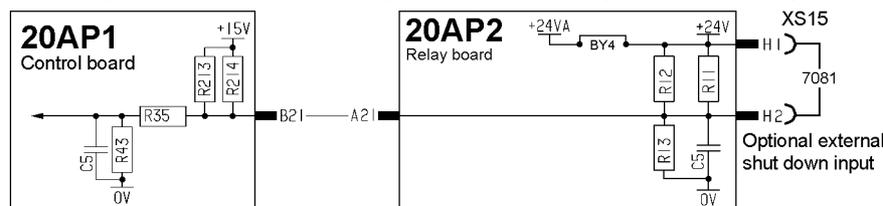
#### First version of relay board 20AP2 (0486 855 xxx)



Contacts H1 and H2 must be linked if the power source is to work. All relay coils are supplied at +24 V. Relay RE1 is supplied directly from 20AP1, while the other relays are supplied indirectly via the +24VA supply. If there is no +24VA supply, the processor and PWM circuit on the control board are disabled.

The H1 - H2 inputs are used in connection with mechanised welding to provide On/Off control of the welding power source.

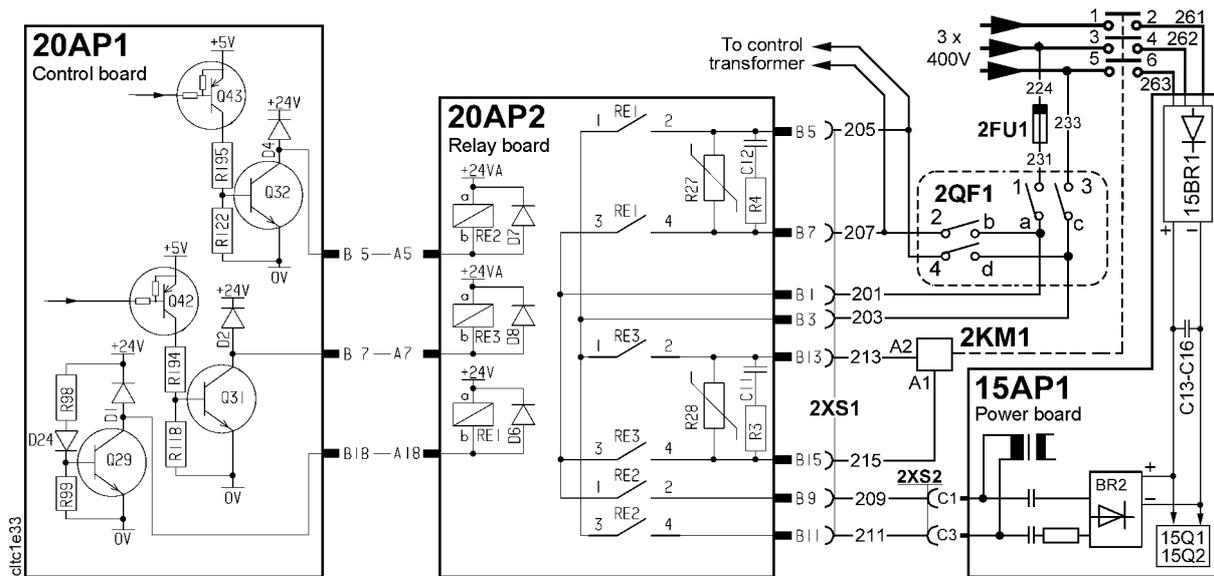
#### Redesigned version of relay board 20AP2 (0486 855 xxx)



Contacts H1 and H2 must be linked if the power source is to work. If there is no link, the processor and PWM circuit on the control board are disabled.

The H1 - H2 inputs are used in connection with mechanised welding to provide On/Off control of the welding power source.

## 20AP2:3 Starting sequence

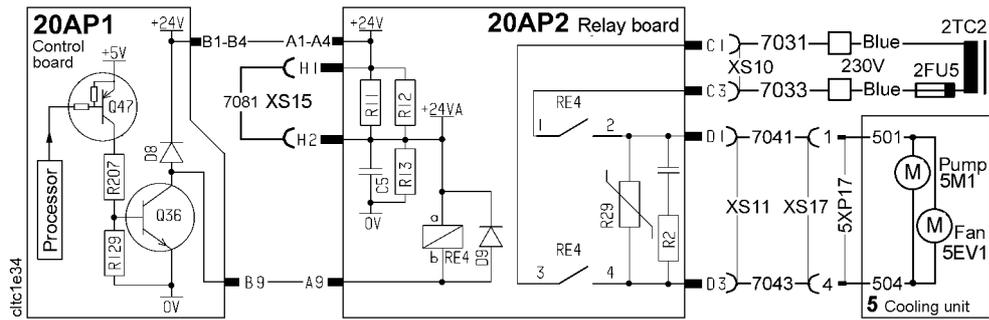


Schematic diagram of the power unit starting circuits

### Starting sequence:

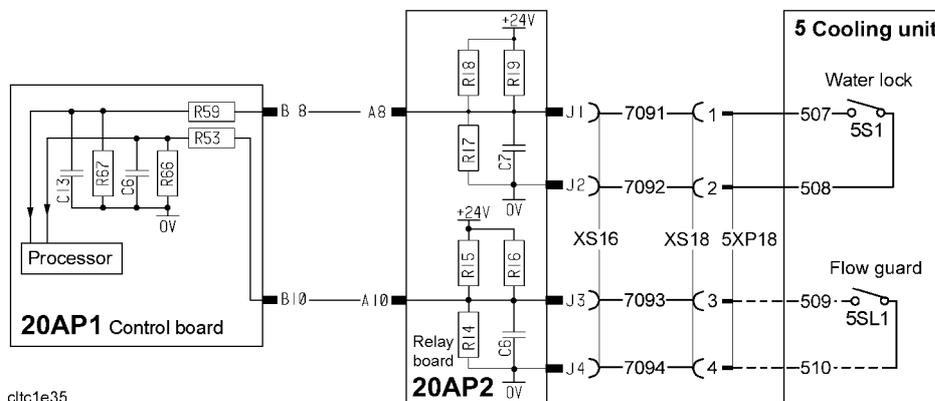
1. Turning main switch 2QF1 from 0 to 1 closes contacts a-1 and c-3, this energises the relay contacts on RE1 - RE3.
  2. Turning 2QF1 to the START position closes contacts 2-b and 4-d.
  3. The controller board is energised from the control current transformer.
  4. Relay RE1 is energised by transistor Q29.
  5. The control power transformer is supplied via contacts 1-2 and 3-4 on relay RE1. The relay is held in via the controller circuit board.
  6. When released from the START position, the main switch returns to Position 1.
  7. The software in the MMC module is initiated for about nine seconds.
  8. Relay RE2 is activated by transistor Q32.
  9. RE2 connects 400 V AC to rectifier bridge BR2 on circuit board 15AP1.
  10. After about three seconds, the voltage across smoothing capacitors C13 - C16 is about 440 V.
  11. The overvoltage and undervoltage protection senses whether the voltage across capacitors C13 - C16 is within the tolerance range of 330 - 680 V.
  12. If the voltage is within the tolerance range, relay RE3 is activated by transistor Q31.
- If the voltage is outside the tolerance range, the starting sequence is interrupted at this point. Contactor 2KM1 does not close, and relay RE2 drops off. Machines having an MMC-panel with display show fault code 5.
13. RE3 energises main contactor 2KM1, which closes and connects 3-phase 400 V to main rectifier 15BR1.

## 20AP2:4 Power supply to the cooling unit



The cooling water pump is controlled by the software in the welding data unit via circuit board 20AP1. The connection diagram for the cooling unit is shown on Page 24.

## 20AP2:5 Cooling water monitoring in MIG welding mode

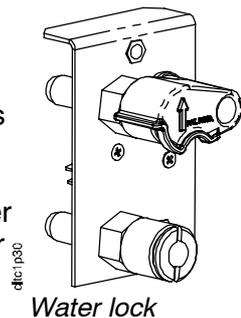


cltc1e35

*Water lock and flow guard in the AristoMig*

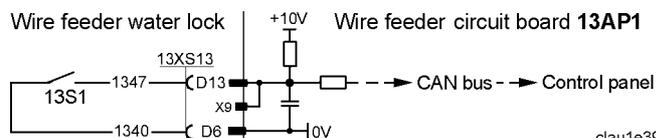
Microswitch 5S1 in the water lock connector closes when a cooling water hose is connected to the blue water connector on the front of the cooling unit. The pump stops if the switch opens.

In MIG welding mode, the cooling water connection on the front of the cooler is not used: instead, the water connections on the back of the unit, which have no water locks, must be connected to the wire feed unit. However, the cooling water connections on the front of the wire feed unit **do** have a water lock, within which microswitch 13S1 senses if a cooling water hose is connected, see the diagram below.



Contact 5SL1 in the flow guard closes when the water flow rate exceeds 0.7 l/minute. **The flow guard is an accessory:** if no flow guard is fitted, connections XS18:3 and XS18:4 are linked.

The following description refers to cooling units with a flow guard: machines without a flow guard behave as if cooling water is always flowing.



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*Water lock in the wire feed unit*

### **Starting the welding equipment**

1. The MMC panel senses whether microswitch 13S1 in the wire feed unit is closed.
2. If 13S1 is closed, the panel generates a command to start the pump. If water flow is not detected within 15 seconds, the pump is stopped.
3. If welding does not start within 6.5 minutes, the pump is stopped.

If the water flow stops when the pump is started, the fault indication lamp on the MMC will flash. Machines with a display panel show fault code 29.

The pump is stopped if microswitch 13S1 opens.

### **Starting to weld**

1. The welder presses the trigger switch on the welding gun.
2. The water pump starts if microswitch 13S1 is closed.
3. If water flow is achieved within three seconds, welding starts.

If water flow is not detected within three seconds, the pump is stopped.

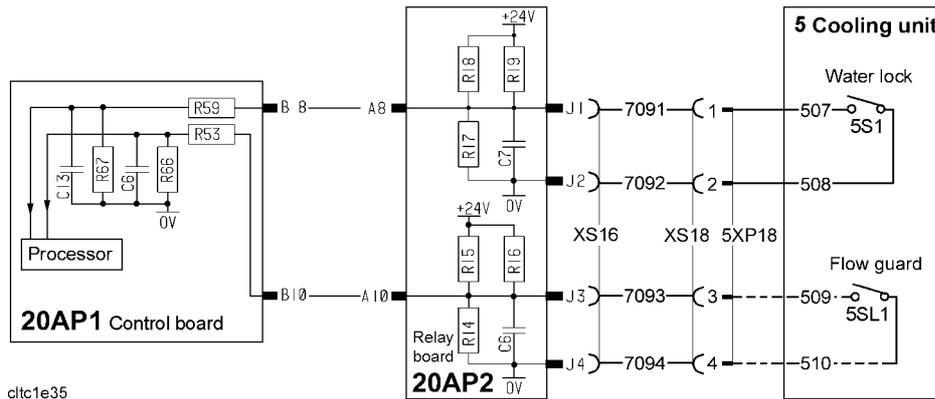
If the water flow stops during welding, welding will be interrupted and the fault indication lamp on the MMC panel will flash. Machines with a display show fault code 29.

### **Stopping welding**

1. The welder releases the welding gun trigger switch.
2. Welding stops.
3. The water pump continues to run for a further 6.5 minutes.

If welding is restarted while the pump is still running, the pump will continue to run as required, i.e. the 6.5 minute shutdown countdown is interrupted.

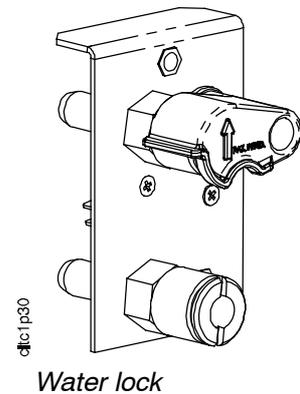
## 20AP2:5 Cooling water monitoring in TIG welding mode



Microswitch 5S1 in the water lock connector closes when a cooling water hose is connected to the blue water connector on the front of the cooling unit. The pump stops if the switch opens.

Contact 5SL1 in the flow guard closes when the water flow rate exceeds 0.7 l/minute. **The flow guard is an accessory:** if no flow guard is fitted, connections XS18:3 and XS18:4 are linked.

The following description refers to cooling units with a flow guard: machines without a flow guard behave as if cooling water is always flowing.



### Starting the welding equipment

1. The MMC panel senses whether microswitch 5S1 is closed.
2. If 5S1 is closed, the panel generates a command to start the pump. If water flow is not detected within 15 seconds, the pump is stopped.
3. If welding does not start within 6.5 minutes, the pump is stopped.

If the water flow stops when the pump is started, the fault indication lamp on the MMC will flash. Machines with a display panel show fault code 29.

The pump is stopped if microswitch 5S1 opens.

### Starting to weld

1. The welder presses the trigger switch on the welding gun.
2. The water pump starts if microswitch 5S1 is closed.
3. If water flow is achieved within three seconds, welding starts.

If water flow is not detected within three seconds, the pump is stopped.

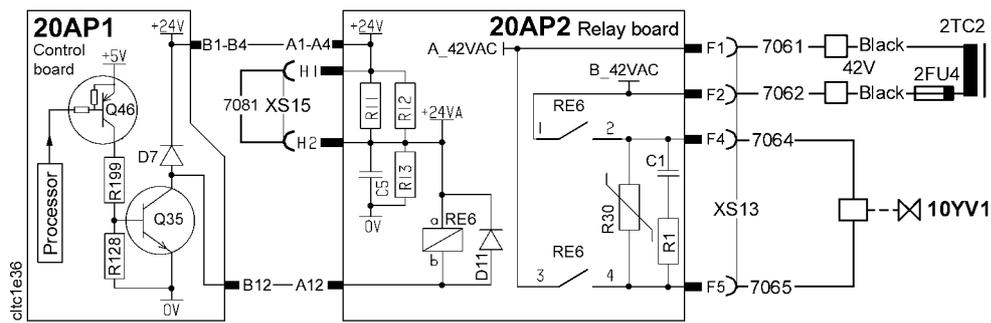
If the water flow stops during welding, welding will be interrupted and the fault indication lamp on the MMC panel will flash. Machines with a display show fault code 29.

### Stopping welding

1. The welder releases the welding gun trigger switch.
2. Welding stops.
3. The water pump continues to run for a further 6.5 minutes.

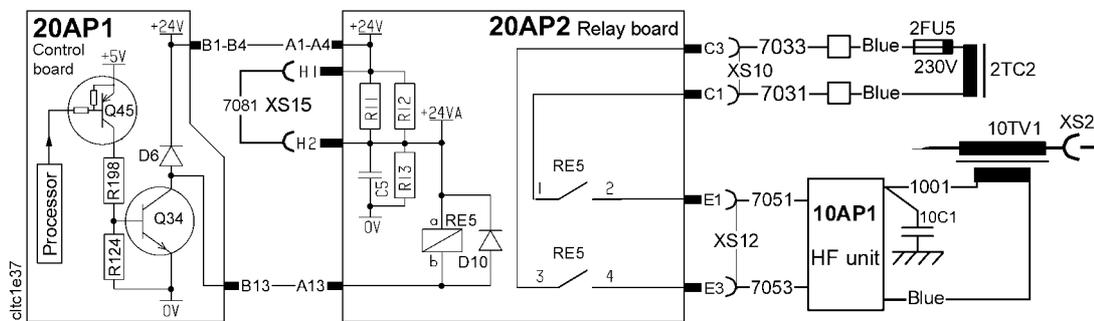
If welding is restarted while the pump is still running, the pump will continue to run as required, i.e. the 6.5 minute shutdown countdown is interrupted.

## 20AP2:6 TIG Gas valve



Gas valve 10YV1 is controlled by the processor on circuit board 20AP1. It can be activated via service function no. 10.

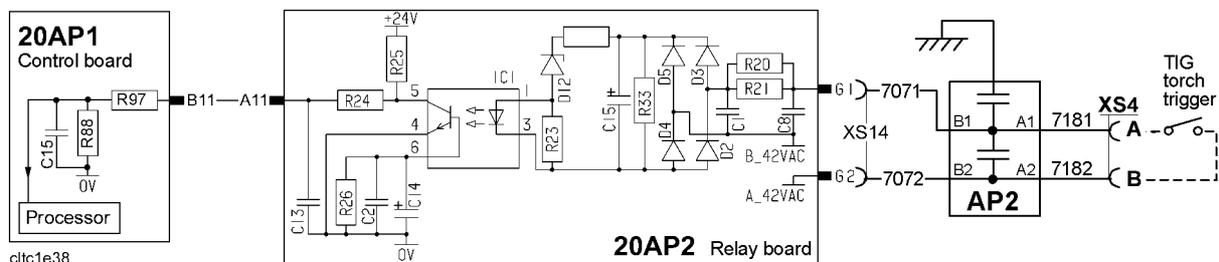
## 20AP2:7 TIG HF starting device



The 10AP1 HF starting device is controlled by the processor on circuit board 20AP1. It is activated during the starting sequence until the arc strikes, or for a maximum of 0.7 seconds. The voltage on the primary side of transformer 10TV1 is about 500 V, producing a secondary voltage of 10 - 12 kV, if a 4 metre long welding torch is connected. If the welding torch is 16 metre the HF spark is about 8 kV.

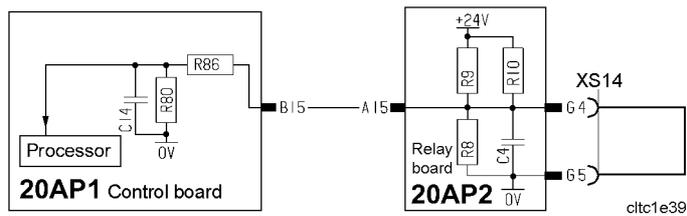
Due to electromagnetic interference regulations the energy in the HF ignition spark is limited. The HF spark weakens with increasing length of the torch. The HF ignition is satisfactory for welding torches up to 16 metres.

## 20AP2:8 TIG Starting



The welding torch trigger switch is supplied at 42 V AC. Closing the contact activates IC1 and supplies a Low signal to 20AP1.

## 20AP2:9 Gas flow monitor



### AristoMig, AristoTig

Terminals G4 and G5 are intended for use with a gas flow monitor. The processor reacts to voltage flanks from the input.

The AristoMig and AristoTig units are not normally fitted with gas flow monitors, which means that this input must be short-circuited by a link. If the link is open the control panel shows fault code 32.

### AristoArc

Terminals G4, G5 and resistors R8 – R10 are not mounted on the board that is delivered with the machine.

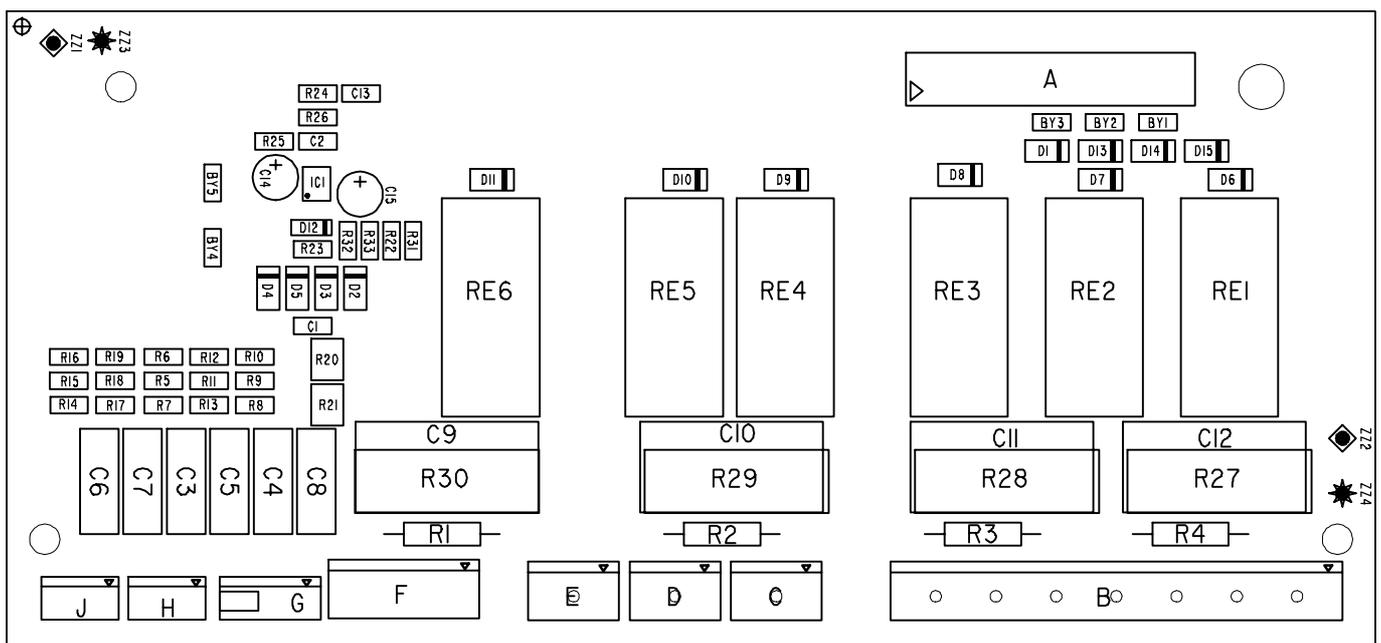
Spare part circuit boards are delivered with all components fitted. Terminals G4 and G5 are intended for use with a gas flow monitor. AristoArc 400 units are not fitted with gas flow monitors, which means that G4 – G5 must be short-circuited by a link. If the link is open the control panel shows fault code 32.

If version no. 1 of control board 20AP1 is used there is no need to use the link.

## 20AP2 Component positions

The circuit diagram and component positions shows all the components with which the board may be fitted: the exact choice of components varies, depending on in which machine the board is used.

Spare part circuit boards are delivered with all components fitted.





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## REMOTE CONTROLS

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A number of remote control units can be connected to the Aristo, these are described in a separate service manual with filename / ordering no. 0740 800 170.

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## FAULT CODES

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All faults that occur when using the welding equipment are documented as error messages in the fault log. The most recent fault message is displayed on the control panel.

For more information on the fault codes, see the service manuals for the control panels.

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## SERVICE INSTRUCTIONS

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### **WARNING !**

**STATIC ELECTRICITY can damage circuit boards and electronic components.**

- Observe precautions for handling electrostatic-sensitive devices.
- Use proper static-proof bags and boxes.

### **What is ESD?**

A sudden transfer or discharge of static electricity from one object to another. ESD stands for Electrostatic Discharge.

#### *How does ESD damage occur?*

ESD can cause damage to sensitive electrical components, but is not dangerous to people. ESD damage occurs when an ungrounded person or object with a static charge comes into contact with a component or assembly that is grounded. A rapid discharge can occur, causing damage. This damage can take the form of immediate failure, but it is more likely that system performance will be affected and the component will fail prematurely.

#### *How do we prevent ESD damage?*

ESD damage can be prevented by awareness. If static electricity is prevented from building up on you or on anything at your work station, then there cannot be any static discharges. Nonconductive materials (e.g. fabrics), or insulators (e.g. plastics) generate and hold static charge, so you should not bring unnecessary nonconductive items into the work area. It is obviously difficult to avoid all such items, so various means are used to drain off any static discharge from persons to prevent the risk of ESD damage. This is done by simple devices: wrist straps, connected to ground, and conductive shoes.

Work surfaces, carts and containers must be conductive and grounded. Use only antistatic packaging materials. Overall, handling of ESD-sensitive devices should be minimized to prevent damage.

## Service aid

We can offer a number of service tools that will simplify the service.

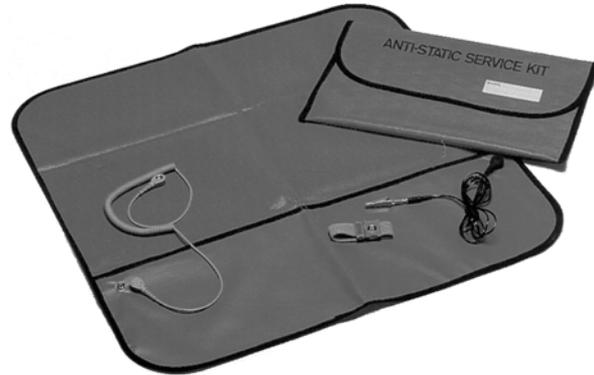
### Antistatic service kit

Ordering no. 0740 511 001

The kit makes it easier to protect sensitive components from electrostatic discharge.

Contents:

- A conductive mat (size 610 x 610 mm)
- A 1.5 metre long ground cable with a crocodile clip
- An adjustable wrist strap and cable with an inbuilt protective resistor



*Antistatic service kit*

### Esat service kit

Ordering no. 0458 847 880

The software update is made from a PC, it has to be managed by a trained serviceman. For this a computer program called Esat, **ESAB Software Administration Tool**, is needed. The PC is connected to the welding equipment by a cable connector and a CAN reader. From the Esat it is possible to update the software in power source, wire feeder and control panel. Esat contains also service functions by which it is possible to control, change or read the different functions in the equipment.

For the installation and use of Esat program you need a computer with operating system Windows 9x, NT4 or 2000.

The Esat service kit contents:

- CAN adapter PPCAN
- Connection Cable between CAN reader and power source
- CAN adapter software and Esat software on CD
- Instruction manual for Esat

### Service set for power source

Ordering no. 0740 601 880

- Dummy load for the gate drive circuits on circuit board 15AP2, see Page 57.
- Connector SB with short circuiting jumper and measuring points for the gate pulses. To be used when measuring the gate pulses and soft starting the machine, see Pages 56 and 60.
- Power supply cable set for soft starting, see Page 60.
- Power supply cable set to the mains voltage monitoring function. To be used when checking the overvoltage and undervoltage threshold values, see Page 62.

## Exchange circuit boards

Exchange circuit boards are repaired and tested circuit boards. We offer those boards to a lower price than new circuit boards. When an exchange circuit board is ordered, **the defect board must be sent back to ESAB. Use only antistatic packaging materials for the circuit board.** If we do not receive the defect board, or if it is not packed in antistatic packaging, the price for the exchange board will be 30 to 50% higher than the normal price.

Some boards must have a machine ID, for this you need the Esat service kit. In order to make the service of the machines easy, we offer the boards with individual ordering numbers, where machine-ID is needed (plug and play). Machine ID is needed for the boards in the control panels (MMC module) and the wire feed units.

There are three price levels for the circuit boards, level 1. is the cheapest:

1. Exchange board without machine ID
2. New circuit board without ID
3. Exchange board with machine ID

During the warranty period we only accept the warranty costs for circuit boards without machine ID.

All circuit boards in the spare parts list are new circuit boards. Below is a list of the exchange boards for the AristoArc 400, AristoTig 400, AristoMig 400 and the control panels.

### Complete exchange control panels with machine ID

Panel	Ordering no.	Panel	Ordering no.	Panel	Ordering no.
A2	E458 535 881	T4	E458 535 883	M2	E458 535 882
A4	E458 535 888	T6	E458 535 885	MA4	E458 535 884
		U6	E458 535 890	MA6	E458 535 886

### Exchange circuit boards for control panels

Panel	ID	Ordering no.	Panel	ID	Ordering no.	Panel	ID	Ordering no.
A2	no	E486 819 887	T4	no	E486 819 880	M2	no	E486 819 887
A2	yes	E486 819 881	T4	yes	E486 819 883	M2	yes	E486 819 882
A4	no	E486 819 880	T6	no	E486 819 880	MA4	no	E486 819 880
A4	yes	E486 819 888	T6	yes	E486 819 885	MA4	yes	E486 819 884
			U6	no	E486 819 880	MA6	no	E486 819 880
			U6	yes	E486 819 890	MA6	yes	E486 819 886

### Exchange circuit boards for power sources

Product	PCB	ID	Ordering no.	Notes
AristoArc/Tig/Mig	15AP1	-	E486 739 880	
AristoArc/Tig/Mig	20AP1*	yes	E458 842 880	*The defect circuit board, 20AP1, must be returned complete with its screening box Use E458 842 882 from ser.no.347-xxx-xxxx
		yes	E458 842 882	
AristoArc/Tig/Mig	20AP2	-	E486 855 880	

## Dismantling

When dismantling the power unit, start as follows:

1. Remove the screws securing the cover and the rear handle.
2. Pull the cover backwards and lift it off.
3. Remove the side plates.

## Service traps

The following are a number of points where it is easy to make a mistake and damage the equipment.

### Main On/Off switch, 2QF1

Don't get the cable cores mixed up. Connect all the cores to the switch in accordance with their numbers and the terminal numbers on the switch, all as shown in the circuit diagram for the power unit. If the cores are mixed up and connected to the wrong terminals, there is a risk of short-circuiting and burning up relay board 20AP2.

### Terminal block, 2XT2

Don't mix up the wires connected to terminal block 2XT2: take care to connect them as shown in the circuit diagram. If the wires are mixed up and connected to the wrong terminals, there is a risk of short-circuiting and burning up relay board 20AP2.

### Overvoltage and undervoltage protection

Don't mix up contacts 15XS7 and 15XS5: if you do, you write off circuit board 15AP2.

Contact 15XS5 is marked **B**, and must be connected to terminal strip B on circuit board 15AP2.

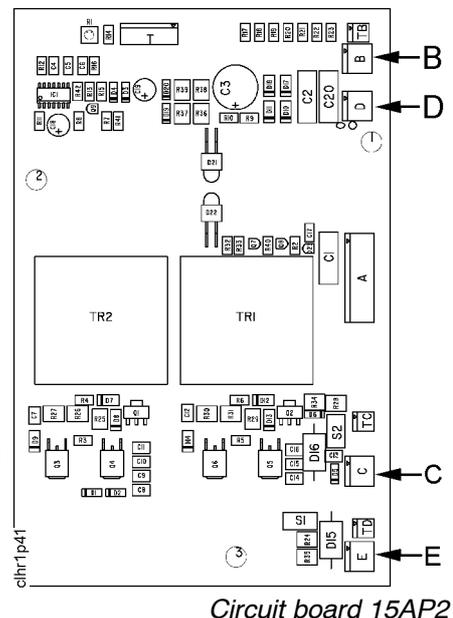
Contact 15XS7 is marked **D**, and must be connected to terminal strip D on circuit board 15AP2.

### The gate contacts

Make sure that gate contacts 15XS6 and 15XS8 are connected to terminal strips C and E on circuit board 15AP2 **before** the power unit is energised.

If the contacts are not connected, the IGBT transistors will fail.

As the signals from contacts C and E are the same, mixing them up will not cause a fault.



### The current sensor

Check that current sensor 15AP3 is connected to control circuit board 20AP1. If it is not, then there will be no current limit protection, and the power unit can fail.

### Power components

Follow the instructions for fitting components to the heat sink. Use thermal contact paste, and tighten all bolts to the correct torque. Incorrectly mounted components can cause breakdowns. See the instructions on Page 55.

## Checking the IGBT transistors

Check the IGBT transistors with the diode test mode of a multimeter.

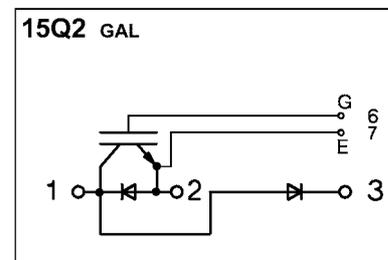
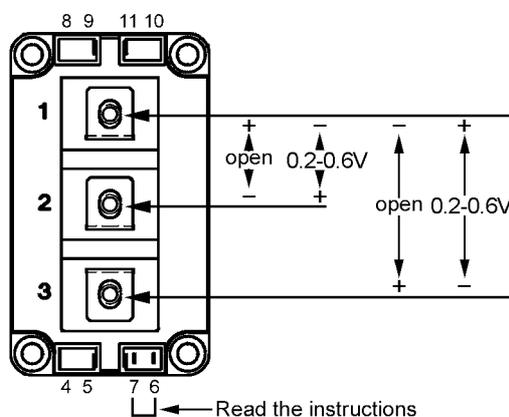
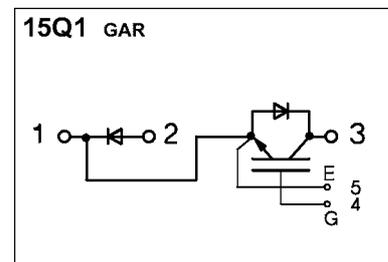
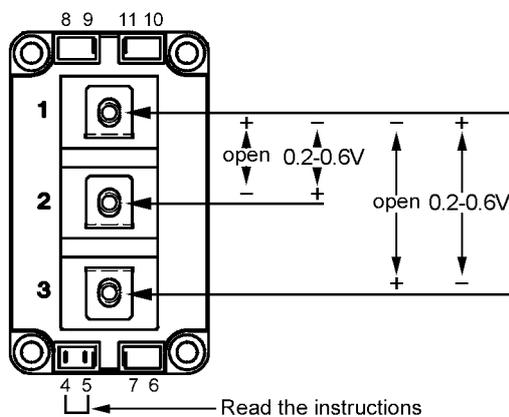
**WARNING:** these components are very sensitive to static electricity (ESD). **Use protective equipment to protect against ESD.** Place the transistors on a conducting and grounded surface. Never touch the gate connections.

Short-circuit the gate and emitter connections (terminals 4 - 5 and 6 - 7 respectively) before making the measurements.

Make sure that you and the short-circuiting link are not statically charged relative to the IGBT transistor. Touch your hand and the short-circuiting link to terminals 1, 2 and 3 on the transistor before fitting the link.

Without the short-circuiting link, the measurements will be incorrect.

Measure the transistor voltages as shown in the diagram below.



clhr1p51

*Voltage measurement for IGBT transistors. **WARNING! BEWARE OF ESD!***

It is also possible to check the IGBT transistors when they are mounted in the machine. Short circuit the gate connections, contact TC1 and TC2 respectively TD1 and TD2 on circuit board 15AP2, see diagram on page 29. Measure on the screws that connect the IGBT transistors to power board 15AP1. The measuring result will be almost the same as above, the voltages are lower: 0.1 - 0.5 V.

If an IGBT transistor has failed, both transistors must be replaced. See also the description on page 27.

## Mounting components on the heat sink

### Thermal paste

Apply thermal conducting paste to the following components before fitting them.

Start by cleaning the heat sink, and then apply a **very thin**, even layer of thermal paste to the contact surfaces of the components. The purpose of the paste is to fill out any hollows in the surfaces of the components and the heat sink. Those parts of the component and the heat sink that are in true metallic contact may have such contact.

Mount the components as described below. See the spare parts list for the order number for thermal paste. Use only the paste recommended by us.

### Fitting instructions

#### 15Q1, 15Q2 IGBT transistors

Clean the heat sink and apply thermal conducting paste as described above. Fit the transistor and tighten the screws alternately to a torque of 2.5 Nm, and then further tighten them to 4.5 Nm. **NB:** The screws must be tightened diagonally.

Tighten the screws that connect the IGBT transistors to circuit board 15AP1 to a torque of 4.5 Nm.

**Warning:** Incorrectly fitted IGBT transistors can cause failure. Do not tighten the screws to more than 4.5 Nm.

#### 15D1, 15D2 Diode modules

Clean the heat sink and apply thermal conducting paste as described above. Fit the module and tighten the screws to a torque of 1 Nm, and then further tighten them to 2.5 Nm.

Tighten the connections to the busbars to 4.5 Nm.

#### 15BR1 Rectifier bridge

Clean the heat sink and apply thermal conducting paste as described above. Fit the bridge and tighten the screws to a torque of 1 Nm, and then further tighten them to 4.5 Nm.

Tighten the screws that connect the bridge to circuit board 15AP1 to 4.5 Nm.

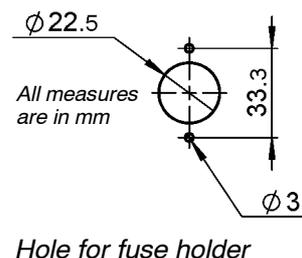
#### 15ST2 Thermal overload cutout

Clean the heat sink and apply thermal conducting paste as described above. Fit the thermal overload cutout.

## Replacing MCB 2FU1

Micro circuit breaker 2FU1 is from serial no. 347-351-xxxx replaced by a 4 A slow blow (anti-surge) tube fuse. The MCB can not be delivered any more, a broken MCB must be replaced by a fuse holder and fuse. For ordering no. see the spare parts list.

To fit the fuse holder in the rear panel of the machine you have to increase the diameter of the hole in the panel and drill two additional holes.



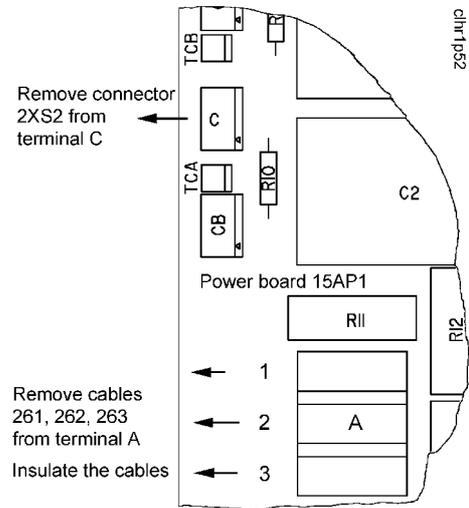
## Checking the gate pulses

**Never** measure the gate pulses when the power unit is connected to the mains. **The gate circuits are at mains voltage.**

Disconnect the power unit from the mains, and follow the instructions below.

### Disconnection from the mains supply

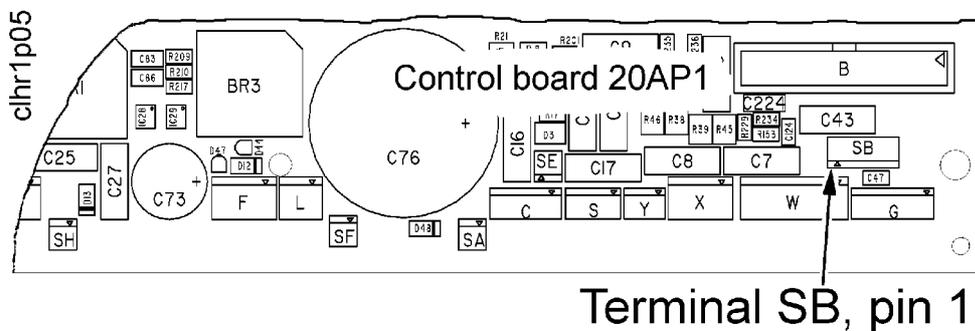
1. Remove wires 261, 262 and 263 from terminal block A on circuit board 15AP1.
2. Unplug contact 2XS2 from 15AP1.
3. **Insulate the wires that have been removed from each other and from all other parts.**



*Disconnection of the 400 V supply to the power board*

### Disconnection of the overvoltage and undervoltage protection

In order to be able to start the power unit, the overvoltage and undervoltage protection must be disabled **before** connecting the unit to the mains. Short-circuit pins 1 and 3 on connector SB on circuit board 20AP1.



*Circuit board 20AP1, connector SB*

### **AristoTig 400 and AristoMig U400:**

Disconnect the HF starting unit by removing fuse 2FU5 from transformer 2TC2: see the connection diagram.

### **AristoMig 400 and AristoMig U400:**

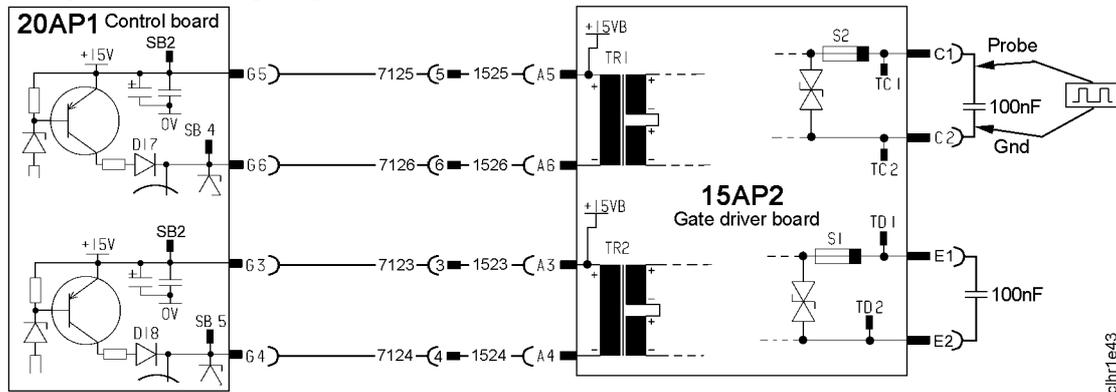
A wire feed unit with control panel or AristoPendant U8 must be connected in order to be able to operate the power unit.

## Pulses from circuit board 15AP2 to transistors 15Q1 and 15Q2

**Warning:** The IGBT transistors are sensitive to ESD. Read and follow the instructions on page 56, before you check the pulses.

1. Remove the gate connections, connector 15XS6 from terminals C1, C2 and connector 15XS8 from terminals E1, E2.
2. Connect a 100 nF capacitor across each gate output, terminals C1, C2 and E1, E2.

### Test points for the gate pulses



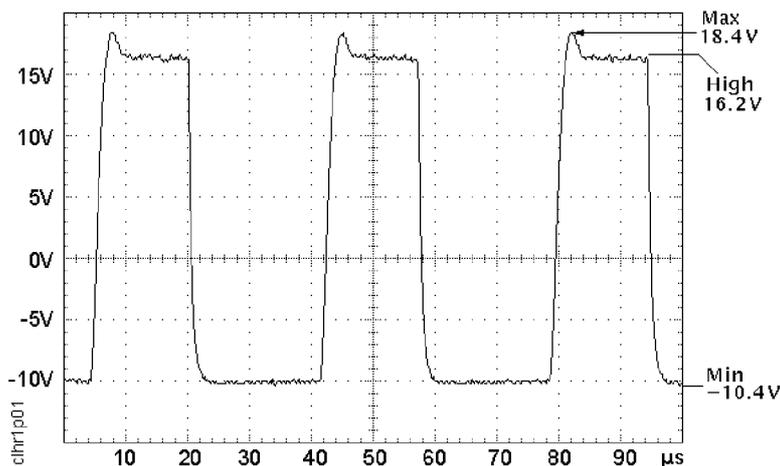
Pulses from 20AP1

Pulses from 15AP2

3. Connect an oscilloscope with the probe to C1 and the screen to C2.
4. Start the power unit and set it to the MMA mode.

If the power unit is an AristoMig 400 and the wire feed unit has an M2 panel: Activate starting by short-circuiting the welding gun switch contacts in the wire feed unit. The power unit will generate pulses for three seconds: after this, the switch contacts input must be opened and reclosed.

5. Compare the waveform of the gate pulses with the diagram below. The waveform shape must be as in the diagram.



Gate pulses from 15AP2 to 15Q1 and 15Q2



Measuring of the gate pulses

6. Measure the pulse frequency, it must be  $27 \text{ kHz} \pm 0.5 \text{ kHz}$ .
7. Measure the pulse duration, it must be 39.0 -40.8 % of the cycle time, measured at a voltage level of +5 V.
8. Measure the maximum pulse voltage, it must be in the range 14 - 17 V (High in the diagram above). The minimum voltage must be in the range from -9 to -12.5 V.
9. Connect the oscilloscope with the probe to E1 and the screen to E2.

10. Repeat the measurements in item 5 to 8 above.

The pulses on outputs C1, C2 and E1, E2 are in phase with each other.

Pulse frequency and duration are controlled by circuit board 20AP2: rise and fall times are controlled by gate driver board 15AP2.

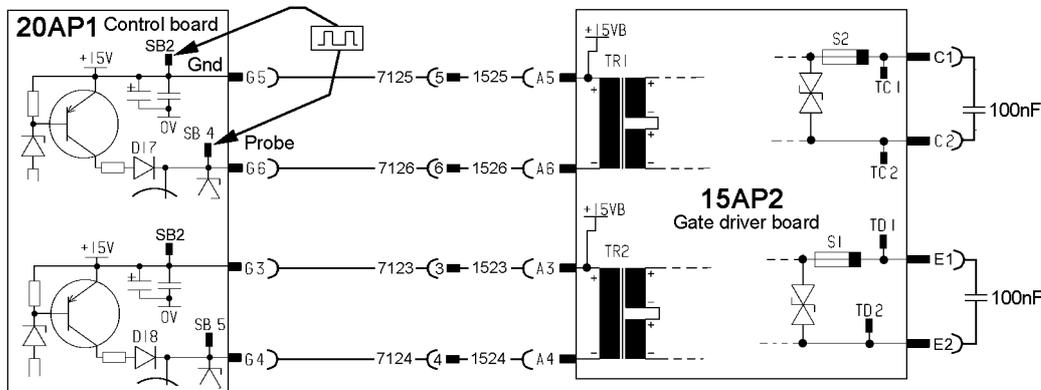
If the waveform shape, pulse duration and frequency are as described above, the results are satisfactory and the measurements can be concluded here.

### Pulses from circuit board 20AP1 to circuit board 15AP2

Read and follow the instructions on page 56, before you check the pulses. Measure the pulses when loaded by the pulse transformers on 15AP2.

1. Connect an oscilloscope with the screen to SB2 and the probe to SB4.

#### Test points for the gate pulses

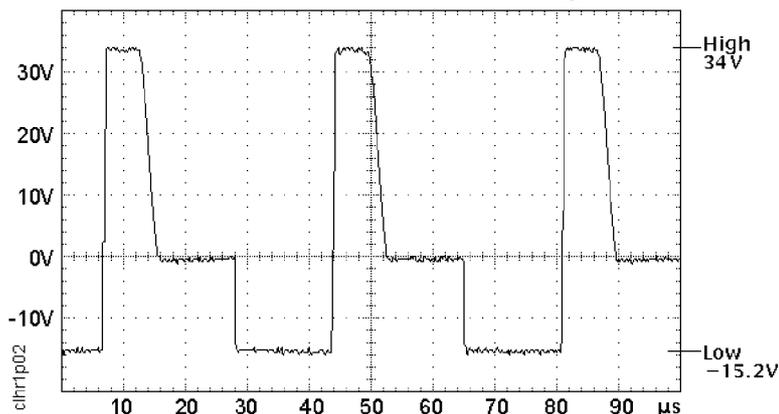


**Pulses from 20AP1**

**Pulses from 15AP2**

clhr1e43

2. Start the power unit and set it to MMA mode.
3. Compare the waveform of the gate pulses with the diagram below. The waveform shape must be as in the diagram.



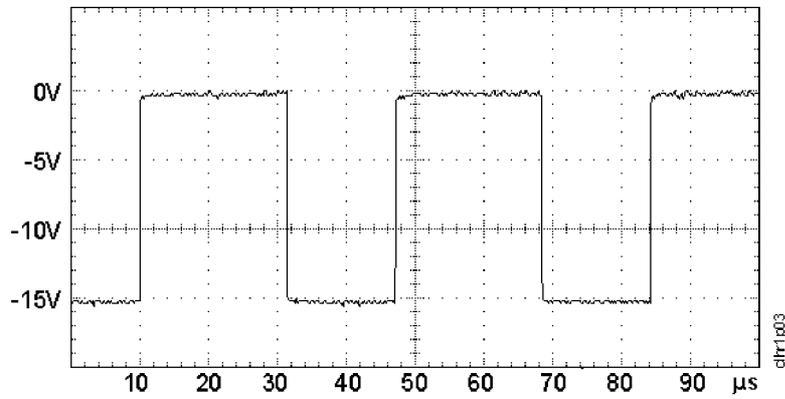
**Pulses from 20AP1 to 15AP2 when the output of 20AP1 is connected to 15AP2.**

4. Measure the pulse frequency, it must be  $27 \text{ kHz} \pm 0.5 \text{ kHz}$ .
5. Measure the pulse duration, it must be 41 - 43 % of the cycle time, measured at -10 V on the negative pulse, as shown in the diagram above.
6. Measure the maximum pulse voltage, it must be in the range 30 - 38 V. The minimum voltage must be in the range from -14 to -16 V.
7. Connect the probe to SB5 and the screen to SB2.

8. Repeat the measurements in item 3 to 6 above.

The pulses on SB4 and SB5 are in phase with each other.

If the pulse transformer on circuit board 15AP2 is not connected, or if there is a break in the transformer primary, the pulses will look as shown in the figure below.



*Pulses from 20AP1 when the output from 20AP1 is **not** connected to 15AP2.*

## Soft starting

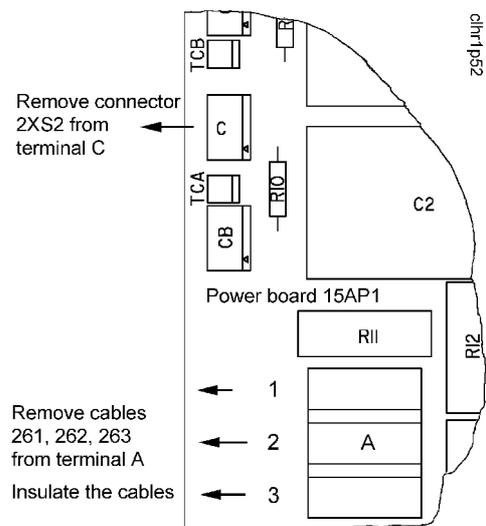
We recommend soft starting of the machine after replacing control circuit board 20AP1, relay board 20AP2 or circuit boards or components in the power module. This supplies the power module with a low AC voltage in order to avoid injury to persons or damage to components.

It is also a good idea to use soft starting when fault tracing in the power module. In addition, certain measurements in the unit should be made only during soft starting.

The following description refers to the use of 24 V AC from control power transformer 2TC1. However, an external 24 V source may also be used.

### Changing wire connections prior to soft starting

1. Disconnect wires 261, 262 and 263 from terminal block A on circuit board 15AP1.
2. Unplug contact 2XS2 from 15AP1.
3. **Insulate the wires that have been removed from each other and from all other parts.**
4. **AristoTig:**  
Disconnect the HF starting unit by removing fuse 2FU5 from transformer 2TC2: see the wiring diagram.



*Disconnections prior to soft starting*

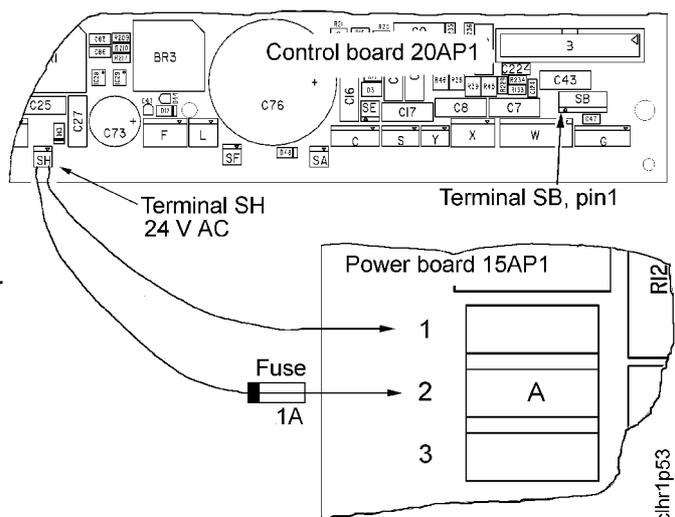
5. Connect 24 V AC from contact SH on circuit board 20AP1 to two of the three connections on terminal block A on circuit board 15AP1.

Connect a fast-acting 1 Amp fuse in series with the power supply.

This protects the foil on circuit board 20AP1 in the event of any short circuit.

6. In order to be able to start the power unit, the undervoltage protection must be disabled **before** connecting the unit to the mains.

Short-circuit pins 1 and 3 in connector SB on circuit board 20AP1.



*Power supply for soft starting*



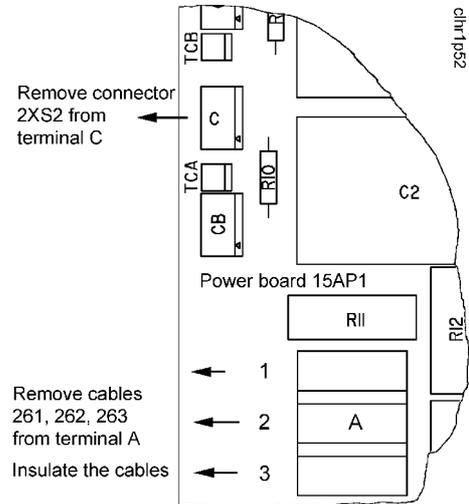
## Checking the overvoltage and undervoltage threshold values

**WARNING - Dangerous voltages. Mains voltage on circuit board 15AP1 and 15AP2 when the power unit is connected to the 400 V supply.**

Disconnect the machine from the mains, and follow the instructions below.

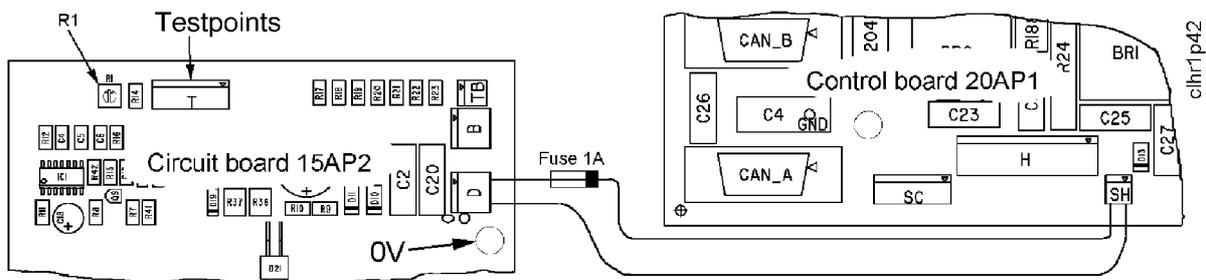
### Disconnection from the mains supply

1. Remove wires 261, 262 and 263 from terminal block A on circuit board 15AP1.
2. Unplug contact 2XS2 from 15AP1.
3. **Insulate the wires that have been removed from each other and from all other parts.**



*Disconnection of the 400 V supply to the power board*

4. Disconnect the power supply to the overvoltage and undervoltage protection function: pull off the plug marked "D" from connector D on circuit board 15AP2.
5. Connect 24 V AC from circuit board 20AP1, contact SH, to contact D on 15AP2. Protect the connection by a 1 A fuse: see the connection diagram below.



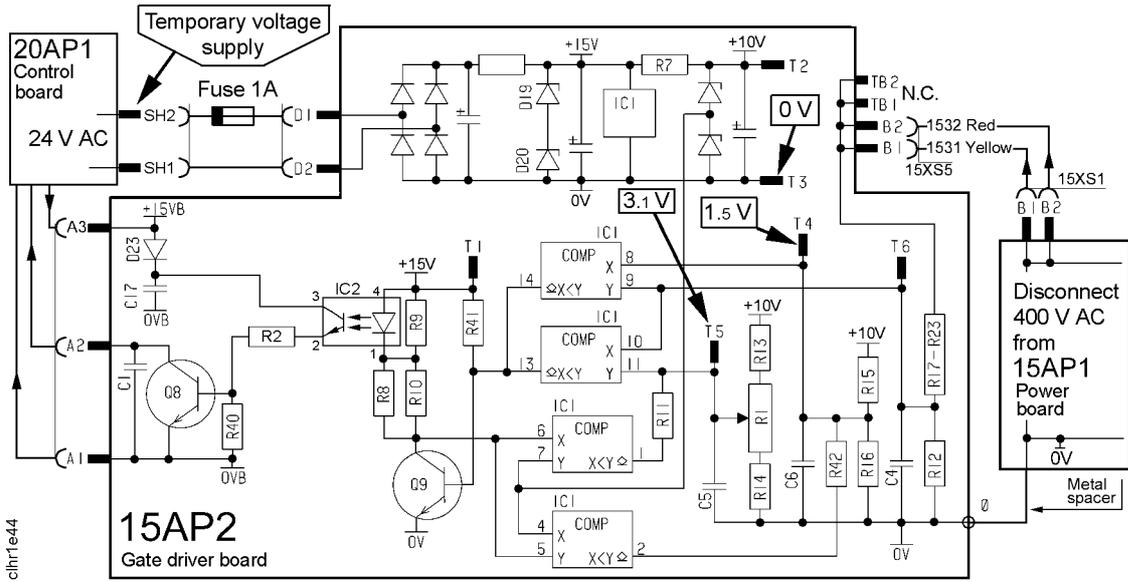
*Temporary power supply connection to the voltage protection function*

6. Energise the power unit and measure the voltage between test point T3 (0 V) and:
  - Test point T4, threshold value for undervoltage. Must be about 1.5 V.
  - Test point T5, threshold value for overvoltage. Must be about 3.1 V.

The circuit board and the test points are varnished. Before measuring, remove the varnish from the test points.

Disconnect the 24 V supply and restore the connections.

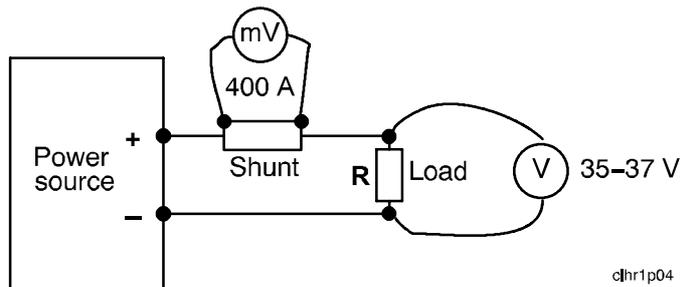
**NB:** Take care not to confuse contacts B and D on circuit board 15AP2.



Test connection for checking the threshold values of overvoltage and undervoltage protection

## Calibrating the current sensor signal

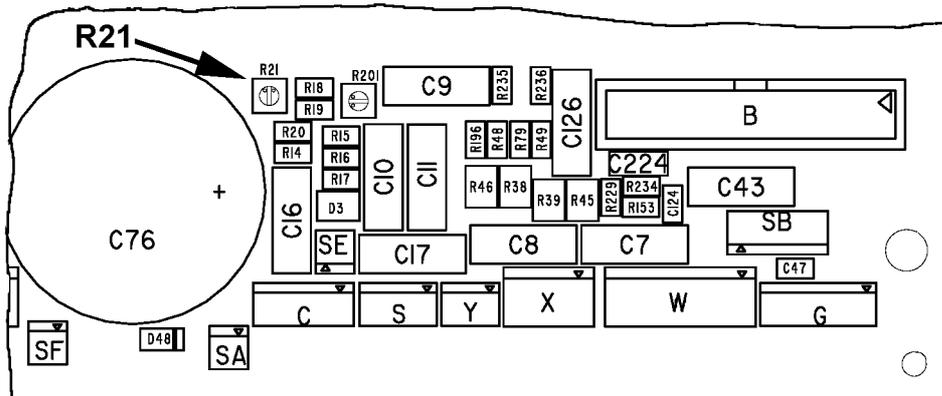
1. If the power unit has a TIG function, **remove fuse 2FU5** from transformer 2TC2. This disconnects the supply to the HF ignition unit (see the connection diagram).
2. Connect the power unit to a resistive load.
3. Connect a **calibrated shunt** in series with the load.
4. Set a welding current of 400 A.
5. Load the power unit so that the voltage across the load is 35 – 37 V.



clhr1p04

*Circuit diagram for current calibration*

6. Measure the shunt voltage using a **calibrated multimeter**.
7. Using potentiometer R21 on circuit board 20AP1, adjust the shunt voltage to correspond to 400 A  $\pm$  4 A.

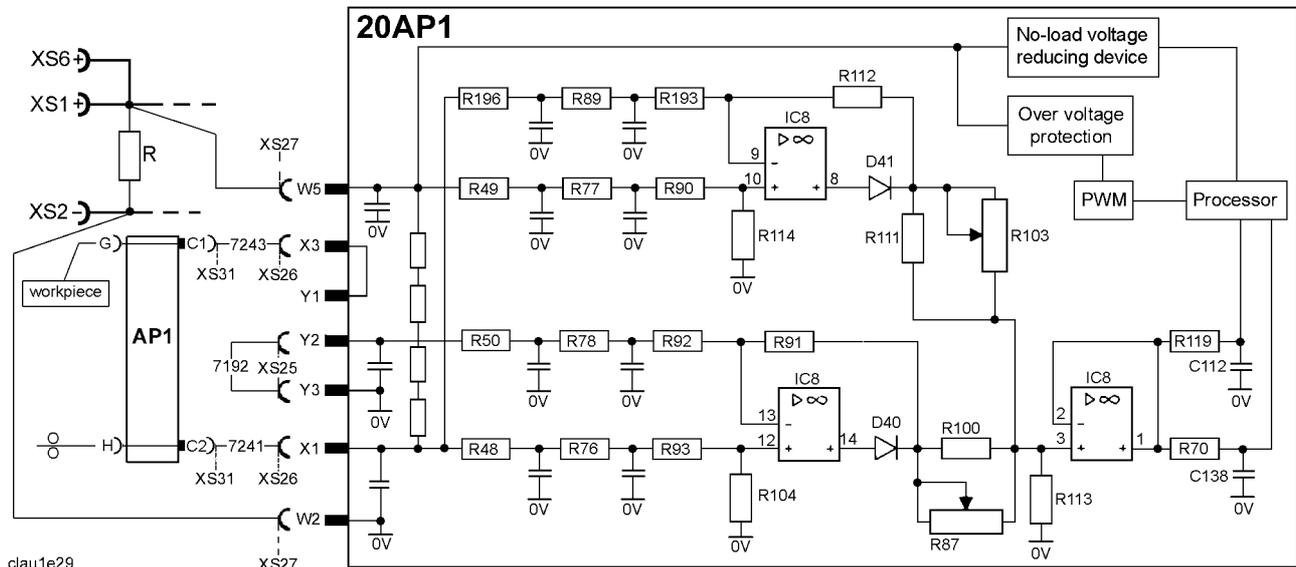


*Position of potentiometer R21 on circuit board 20AP1.*

8. Check the current at low values as well: 16 A at 19 – 22 V, for which the tolerance is  $\pm$  1 A. If the current is outside the tolerance, replace current sensor 15AP3.

## AristoMig, calibration of the arc voltage input

The arc voltage input can be calibrated using trimming potentiometers R87 and R103 on circuit board 20AP1. The board has been calibrated in the factory: further adjustment should not normally be necessary.



*Circuit diagram of the arc voltage input*

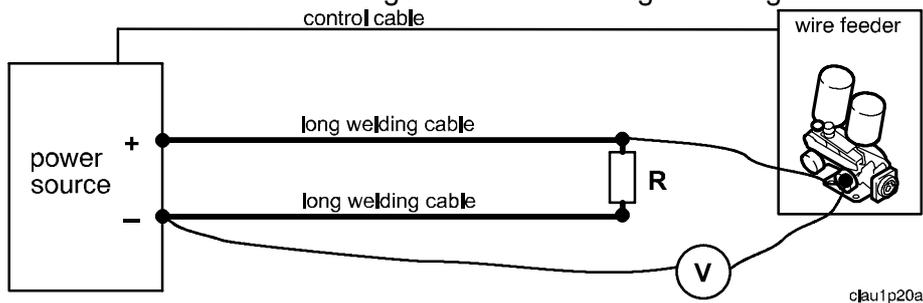
Check that there is a short-circuiting link across connectors Y2 - Y3: see the circuit diagram above. Connect a wire feed unit to the power unit. Connect long welding current cables, to give an appreciable voltage drop in the cables. Connect a wire to the feed rollers, and connect an external voltmeter, as shown in the diagrams on next page. Set the power unit to MIG short arc welding mode, and apply a resistive load to give a current of 100 A at 25 - 30 V.

Start the power unit from the welding gun trigger contact and adjust the current by changing the wire fed speed setting. Adjust the voltage by varying the load resistor.

**Use an accurately calibrated external voltmeter to measure the output voltage of the machine.**

**1. Welding with the filler wire positive: voltage sensing from the wire**

This is the commonest arrangement of arc voltage sensing.

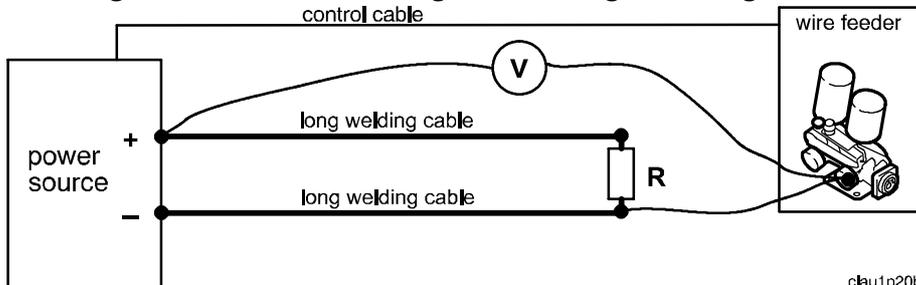


clau1p20a

$V$  = external voltmeter.  $R$  = load resistor.

The control panel must show the same voltage value as shown on the external voltmeter  $\pm 0.6$  V. Adjust the display value by means of potentiometer R87.

**2. Welding with the filler wire negative: voltage sensing from the wire**

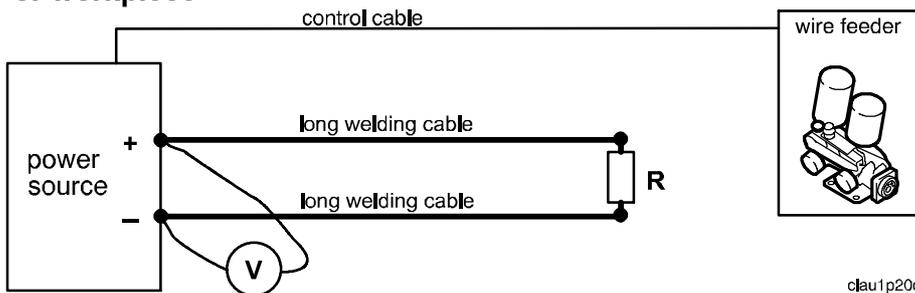


clau1p20b

$V$  = external voltmeter.  $R$  = load resistor.

The control panel must show the same voltage value as shown on the external voltmeter  $\pm 0.6$  V. Adjust the display value by means of potentiometer R103.

**3. Welding with the filler wire positive or negative: no external sensing from the wire or workpiece**



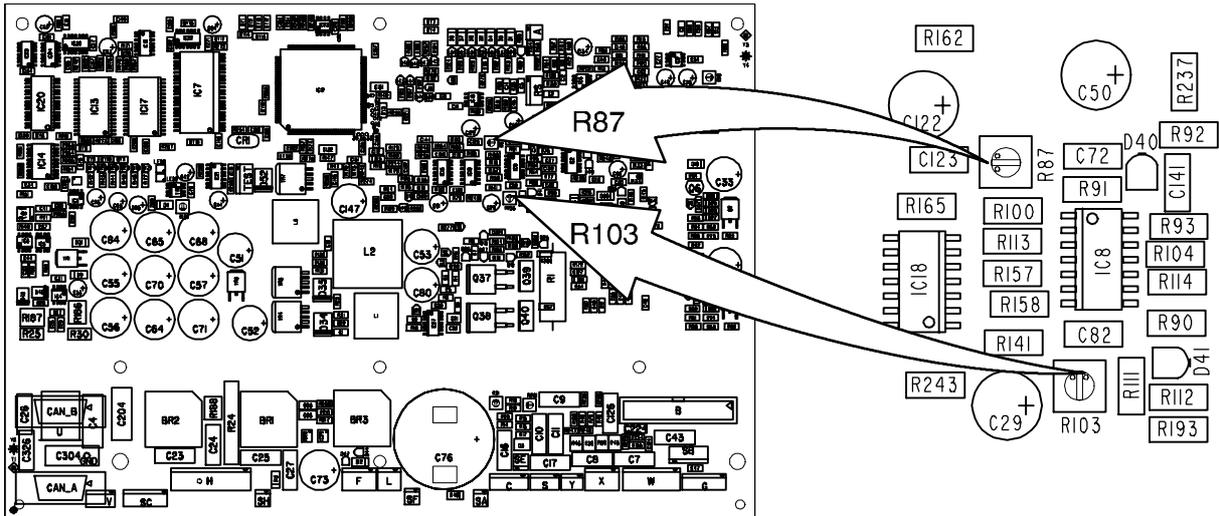
clau1p20c

$V$  = external voltmeter.  $R$  = load resistor.

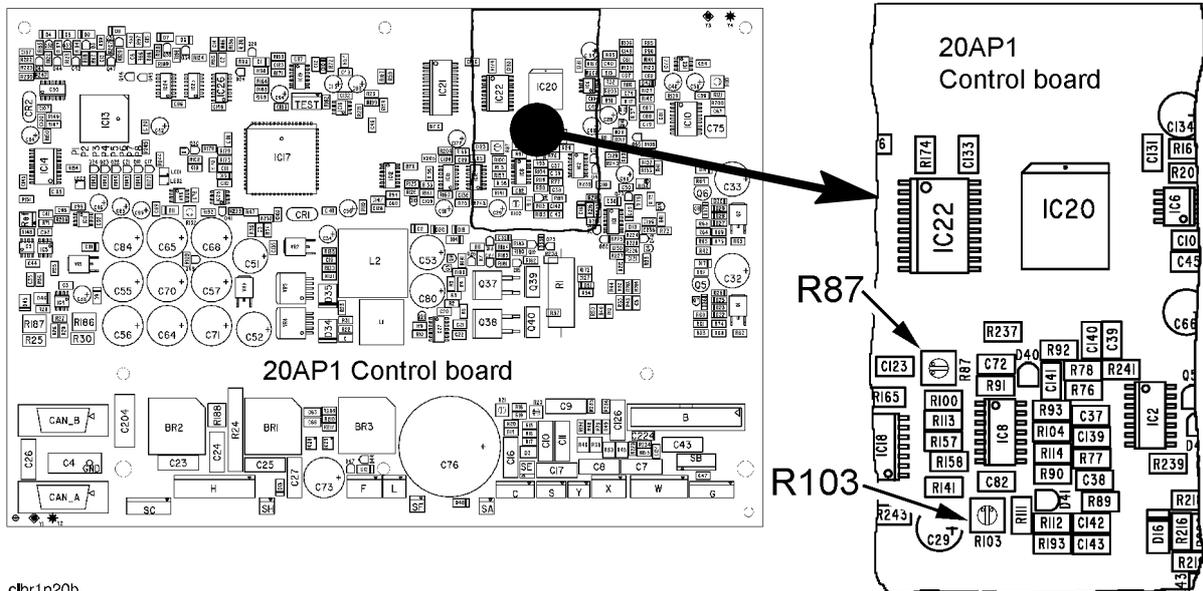
The external voltmeter shows a value 0.2 – 1.6 V higher than the value shown on the control panel. Do not adjust the value shown on the control panel: this is already adjusted from 1) above.

**4. Check measurement of the connection for voltage sensing from the workpiece**

Measure the resistance between connector pin G on AP1 and input X3 on the circuit board. See the circuit diagram on Page 65.



Positions of potentiometers R87 and R103 on circuit board 20AP1 version 2



chr1p20b

Positions of potentiometers R87 and R103 on circuit board 20AP1 version 1



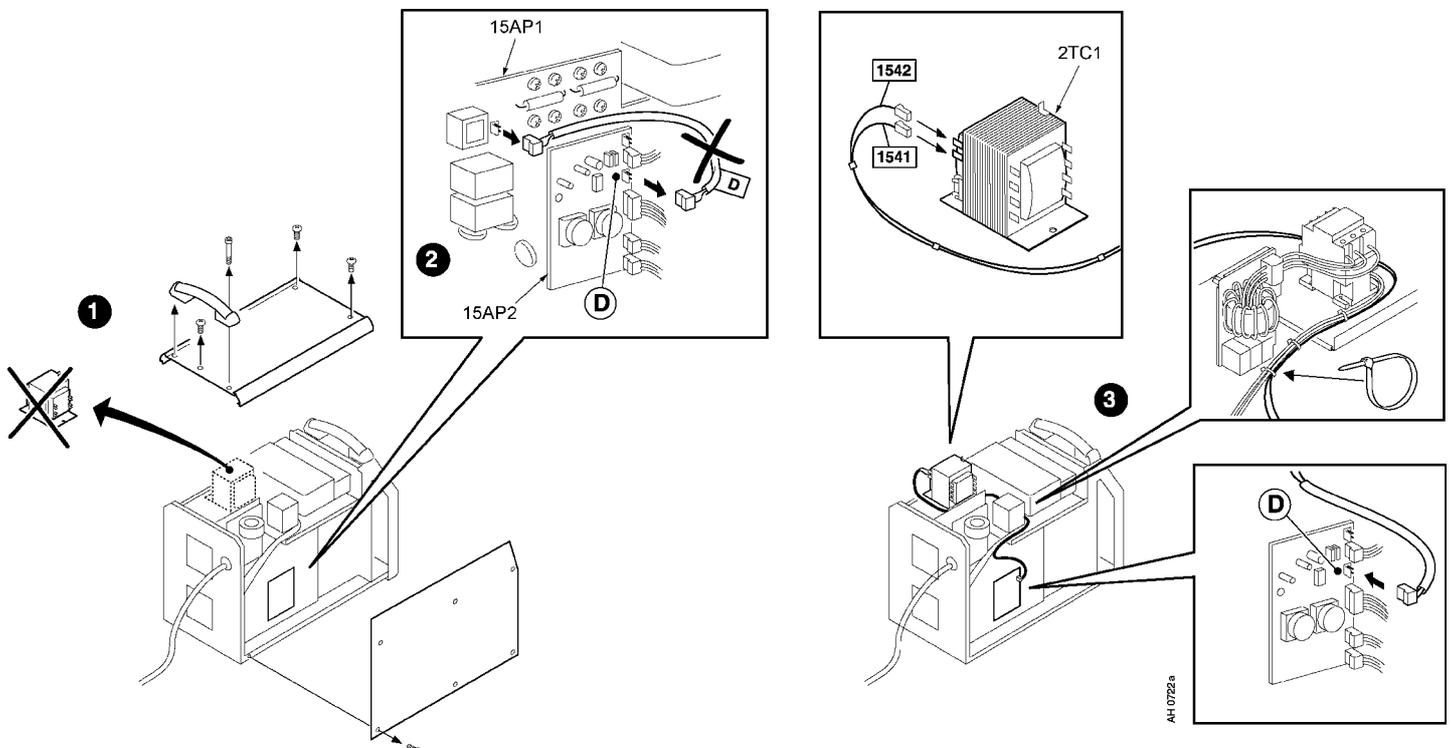
## Replacing TR1 on 15AP1 with new version of 2TC1

This instruction is valid for machines with serial no. prior to 524-xxx-xxxx.

Transformer TR1 is not anymore fitted to circuit board 15AP1, see the diagram on page 27 and the main wiring diagram.

If transformer TR1 is defective, it must be replaced by a new version of transformer 2TC1.

- Disassemble circuit board 15AP1.
- If transformer TR1 is the only defective component on the board, unsolder and remove TR1. If there are additional faults on the board, replace the board.
- Assemble circuit board 15AP1 to the machine.
- Tighten the screws that connect the IGBT transistors and the rectifier bridge to the circuit board to a torque of 4.5 Nm.
- Replace transformer 2TC1 with the new version of the same transformer.
- Replace the cable set: see the picture below.



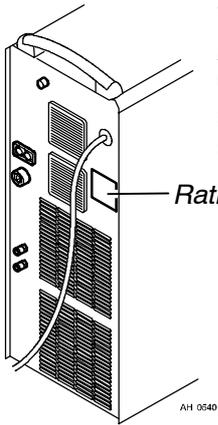
*Location of new cable set and transformer 2TC1*

### Ordering numbers:

0486 739 880 Circuit board 15AP1

0459 837 880 Transformer 2TC1 and cable set 2TC1 ---> 15AP2

## Electrical installation of built-in autotransformer



Rating plate with supply connection data

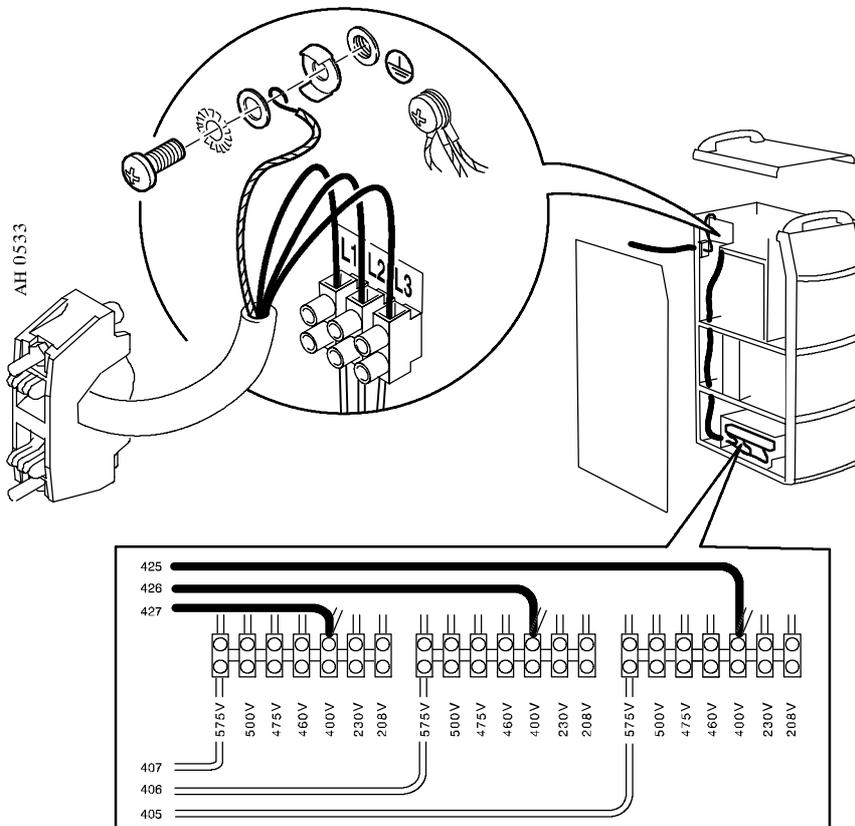
The built-in autotransformer is only available for the AristoMig 400 and AristoTig 400.  
Check that the unit is connected to the correct mains power supply voltage, and that it is protected by the correct fuse size. A protective earth connection must be made, in accordance with regulations.

## Recommended fuse sizes and minimum cable areas

### AristoMig 400, AristoTig 400

Mains voltage	208 V	230 V	400 V	460 V	475 V	500 V	575 V
Mains cable area, mm <sup>2</sup>	4G6	4G6	4G4	4G4	4G4	4G4	4G4
Phase current, I RMS	38 A	33 A	22 A	18 A	18 A	16 A	11 A
<b>Fuse</b>							
Anti-surge	50 A	50 A	25 A	20 A	20 A	16 A	16 A
Type C MCB	50 A	50 A	32 A	-	-	-	-

**NB:** The mains cable areas and fuse sizes as shown above are in accordance with Swedish regulations. They may not be applicable in other countries: make sure that the cable area and fuse sizes comply with the relevant national regulations.



Connection of mains power supply to AristoMig / AristoTig with built-in autotransformer

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# INSTRUCTION MANUAL

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This chapter is an extract from the instruction manuals for the AristoMig U400, AristoMig 400, AristoArc 400 and AristoTig 400.

## SAFETY

Users of ESAB welding equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of welding equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

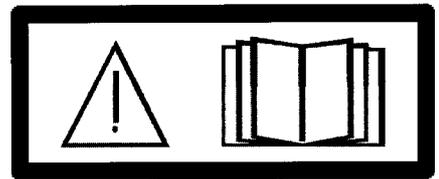
All work must be carried out by trained personnel well-acquainted with the operation of the welding equipment. Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

1. Anyone who uses the welding equipment must be familiar with:
  - its operation
  - location of emergency stops
  - its function
  - relevant safety precautions
  - welding
2. The operator must ensure that:
  - no unauthorized person is stationed within the working area of the equipment when it is started up.
  - no-one is unprotected when the arc is struck
3. The workplace must:
  - be suitable for the purpose
  - be free from drafts
4. Personal safety equipment
  - Always wear recommended personal safety equipment, such as safety glasses, flame-proof clothing, safety gloves.
  - Do not wear loose-fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.
5. General precautions
  - Make sure the return cable is connected securely.
  - Work on high voltage equipment **may only be carried out by a qualified electrician.**
  - Appropriate fire extinguishing equipment must be clearly marked and close at hand.
  - Lubrication and maintenance must **not** be carried out on the equipment during operation.



### WARNING!

Read and understand the instruction manual before installing or operating.



### WARNING!

Do not use the power source for thawing frozen pipes.

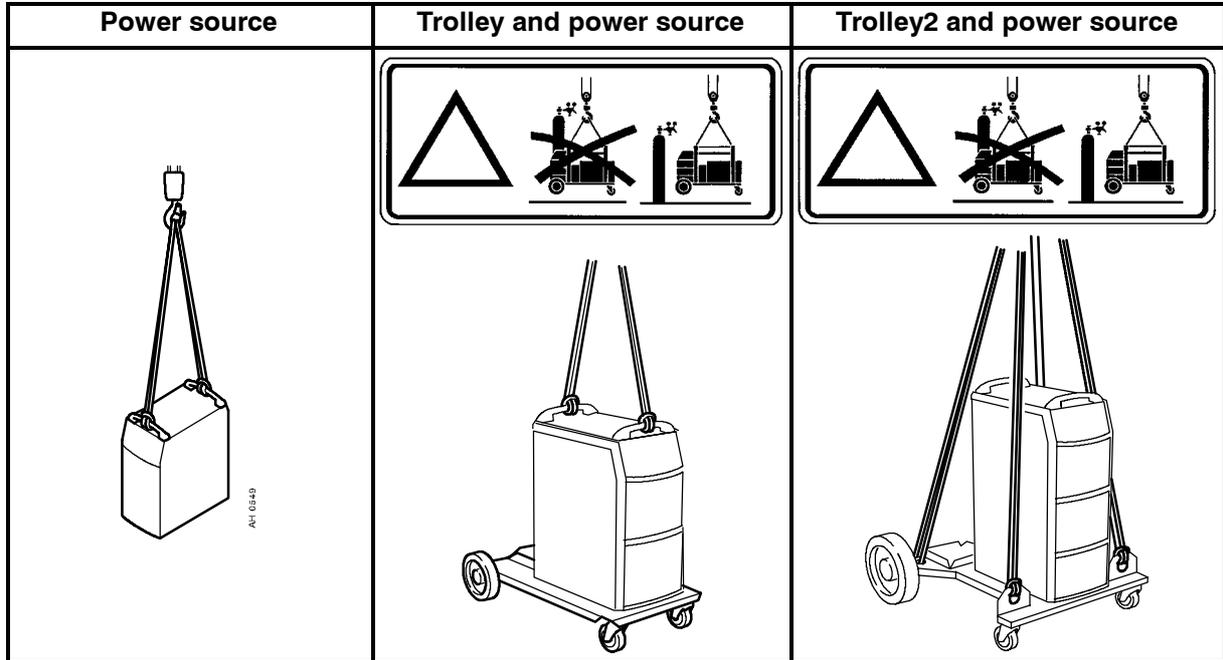


**This product is solely intended for arc welding.**

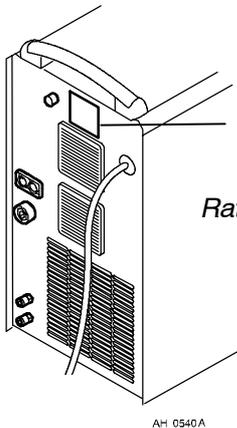
# INSTALLATION

*The installation must be executed by a professional.*

## Lifting instructions



## Mains power supply



Check that the unit is connected to the correct mains power supply voltage, and that it is protected by the correct fuse sizes. A protective earth connection must be made, in accordance with regulations.

*Rating plate with supply connection data*

## Recommended fuse sizes and minimum cable area

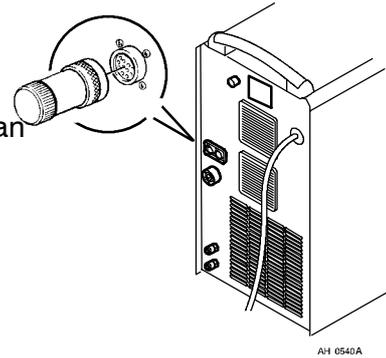
<b>Mains voltage</b>	400 V 3~ 50 Hz
<b>Mains cable area, mm<sup>2</sup></b>	4G4
<b>Phase current, I RMS</b>	22 A
<b>Fuse</b>	
Anti-surge	25 A
Type C MCB	32 A

**NB:** The mains cable areas and fuse sizes as shown above are in accordance with Swedish regulations. They may not be applicable in other countries: make sure that the cable area and fuse sizes comply with the relevant national regulations.

## Terminating resistor, AristoMig

In order to avoid communication interference, the ends of the CAN bus must be fitted with terminating resistors.

One end of the CAN bus is at the control panel, which has an integral terminating resistor. The other end at the power source must be fitted with the terminating resistor, as shown on the right.



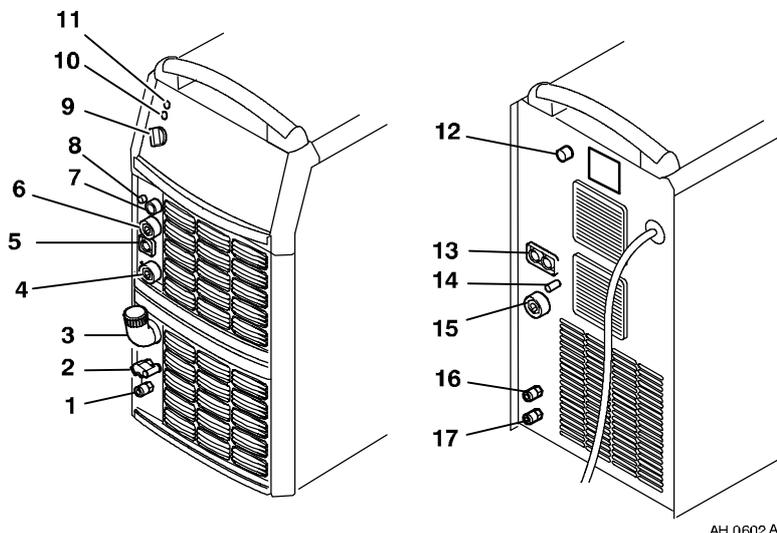
## OPERATION

General safety regulations for the handling of the equipment can be found on page 71. Read through before you start using the equipment!

## Connections and control devices, AristoMig U400

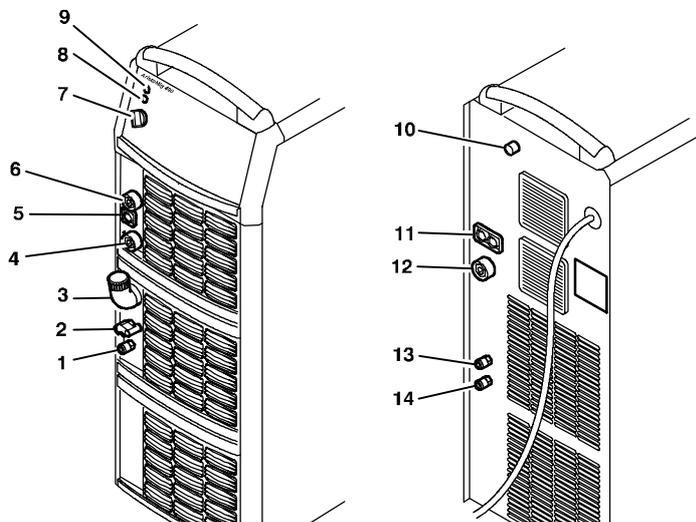
- |   |  |    |   |
|---|--|----|---|
| 1 | Connection for cooling water from the TIG torch - RED                                      | 10 | White indicating lamp - Power supply ON   |
| 2 | Connection with ELP* for cooling water to the TIG torch - BLUE                             | 11 | Orange indicating lamp - Overheating  |
| 3 | Cooling water filler   | 12 | Fuse  |
| 4 | Connection for welding current cable (+) at MMA welding or for return cable at TIG welding | 13 | Connection for control cable to the wire feed unit or to the terminating resistor |
| 5 | Connection for remote control adapter  | 14 | Connection for gas hose   |
| 6 | Connection for return cable (-) or for welding current cable at TIG welding                | 15 | Connection for welding current to the wire feed unit                              |
| 7 | Connection for start signal from the torch.  | 16 | Connection for cooling water to the wire feed unit - BLUE                         |
| 8 | Connection for gas to the TIG torch  | 17 | Connection for cooling water from the wire feed unit - RED                        |
| 9 | Main power supply switch, 0 / 1 / START  |    |   |

\* ELP = ESAB Logic Pump, see **Cooling unit** on page 76.



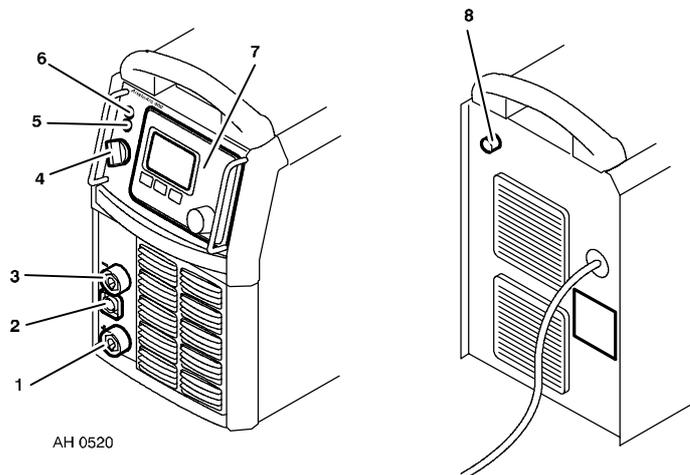
## Connections and control devices, AristoMig 400

- |   |  |    |  |
|---|--|----|--|
| 1 | Connection for cooling water. <i>Not used on this model.</i> | 8  | White indicating lamp - Power supply ON                                    |
| 2 | Connection for cooling water. <i>Not used on this model.</i> | 9  | Orange indicating lamp - Overheating                                       |
| 3 | Cooling water filler   | 10 | MCB  |
| 4 | Connection for welding current cable (+) (MMA welding)       | 11 | Connection for control cable to the wire feed unit or terminating resistor |
| 5 | Connection for remote control adapter                        | 12 | Connection for welding current to the wire feed unit                       |
| 6 | Connection for return cable (-)                              | 13 | Connection for cooling water to the wire feed unit - BLUE                  |
| 7 | Main power supply switch, 0 / 1 / START                      | 14 | Connection for cooling water from the wire feed unit - RED                 |



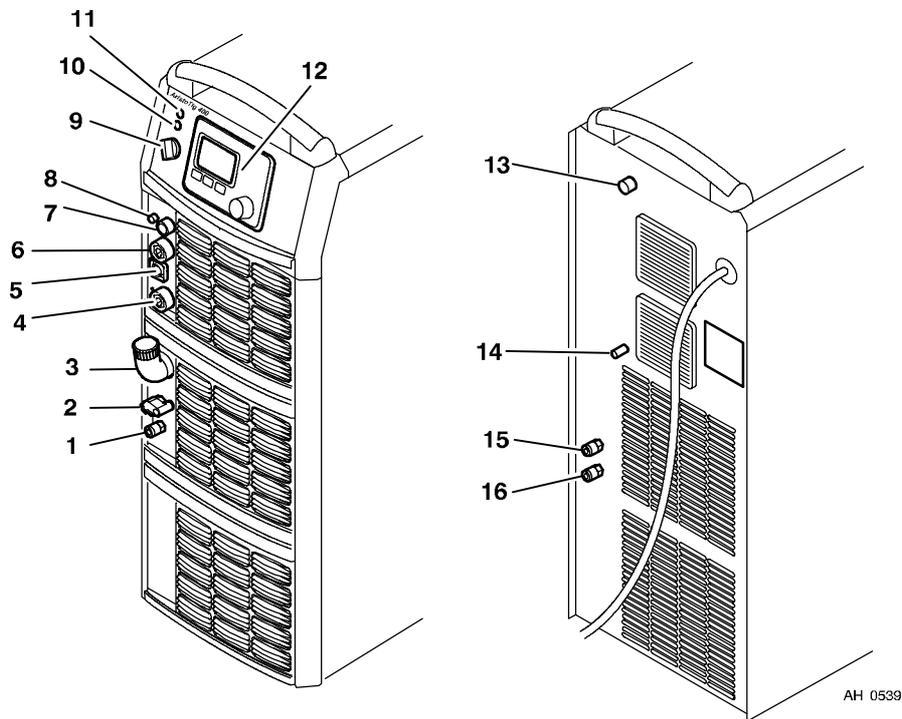
## Connections and control devices, AristoArc 400

- |   |  |   |   |
|---|--|---|---|
| 1 | Welding current cable connector (+)        | 5 | White indicating lamp, mains power supply ON      |
| 2 | Connector for remote control adapter       | 6 | Orange indicating lamp, overheating               |
| 3 | Return welding current cable connector (-) | 7 | Control panel (see respective instruction manual) |
| 4 | Main power supply switch, 0 / 1 / START    | 8 | Miniature circuit-breaker                         |



## Connections and control devices, AristoTig 400

- |   |  |    |  |
|---|--|----|--|
| 1 | Connection for cooling water from the TIG torch - RED                | 9  | Main power supply switch, 0 / 1 / START                      |
| 2 | Connection with water lock for cooling water to the TIG torch - BLUE | 10 | White indicating lamp - Power supply ON                      |
| 3 | Cooling water filler   | 11 | Orange indicating lamp - Overheating                         |
| 4 | Connection for return cable (+)                                      | 12 | Control panel (see the respective instructions)              |
| 5 | Connection for remote control adapter                                | 13 | MCB  |
| 6 | Connection for welding cable (-)                                     | 14 | Connection for gas hose                                      |
| 7 | Connection for start signal from the welding torch                   | 15 | Connection for cooling water. <i>Not used on this model.</i> |
| 8 | Connection for gas to the TIG torch                                  | 16 | Connection for cooling water. <i>Not used on this model.</i> |



### Turning on the power source

Turn on the mains power by turning the main power supply switch to the "START" position. Release the switch, and it will return to the "1" position.

If the mains power supply should be interrupted while welding is in progress, and then be restored, the power source will remain de-energised until the switch is again turned manually to the "START" position.

Turn the unit off by turning the switch to the "0" position.

Whether in the event of a loss of power supply or of turning the power source off in the normal manner, welding data will be stored so that it is available next time the unit is started.

## **Fan control**

The power source fans continue to run for 6.5 minutes after welding has stopped, and the unit switches to energy-saving mode. They start again when welding restarts.

The fans run at reduced speed for welding currents up to 146 A, and at full speed for higher currents.

## **Overheating protection**

The power source has two thermal overload trips which operate if the internal temperature becomes too high, interrupting the welding current and lighting the orange indicating lamp on the front of the unit. They reset automatically when the temperature has fallen.

## **Cooling unit**

### **Water connection (TIG welding)**

The cooling unit is equipped with a detection system **ELP (ESAB Logic Pump)** which checks that the water hoses are connected.

The power source On/Off switch must be in the "0" position (Off) when connecting a water-cooled TIG torch.

If a water-cooled TIG torch is connected, the water pump starts automatically when the main On/Off switch is turned to "START" and/or when welding starts. After welding, the pump continues to run for 6.5 minutes, and then switches to the energy-saving mode.

### **Function when welding**

To start welding, the welder presses the welding gun trigger switch. The power source turns on and starts the wire feed and the cooling water pump.

To stop welding, the welder releases the welding gun trigger switch. Welding ceases, but the cooling water pump continues to run for 6.5 minutes, after which the unit switches to energy-saving mode.

### **Water flow guard**

The water flow guard interrupts the welding current in the event of loss of coolant, and displays an error message on the control panel. The water flow guard is an accessory.

## **Remote control unit**

The remote control unit must be a CAN based remote control unit or it must be connected via a remote control adapter.

The power source and wire feed unit are set to remote control mode and buttons and dials are blocked when the remote control is connected. Functions can only be adjusted via the remote unit.

If the remote control unit is not to be used, the remote control unit must be disconnected from the power source / wire feed unit, as otherwise it will remain in remote control mode.

For more information about the operation of the remote control unit, see the operating instructions for the control panel.

## MAINTENANCE

Regular maintenance is important for safe, reliable operation.

*Maintenance must be executed by a professional.*

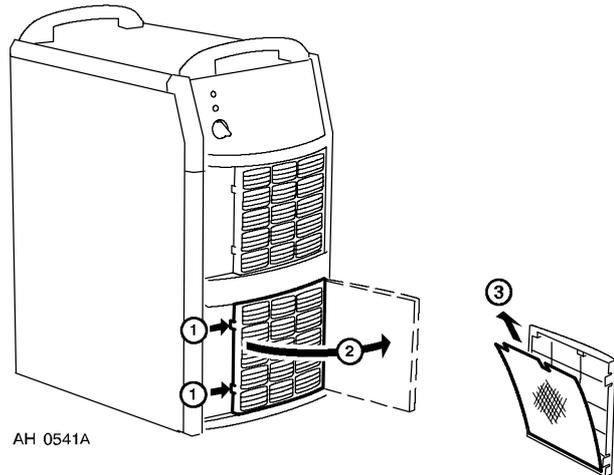
*Only those persons who have appropriate electrical knowledge (authorized personnel) may remove the safety plates.*

### **Note!**

*All guarantee undertakings from the supplier cease to apply if the customer himself attempts any work in the product during the guarantee period in order to rectify any faults.*

### **Cleaning the air filter**

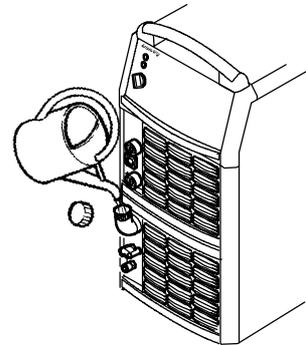
- Release the cover plate with the dust filter (1).
- Swing out the cover plate (2).
- Remove the dust filter (3).
- Blow it clean with compressed air at reduced pressure.
- Replace the filter with the finer mesh on the side against the cover plate (2).
- Replace the cover plate with the filter.



### **Topping up the coolant**

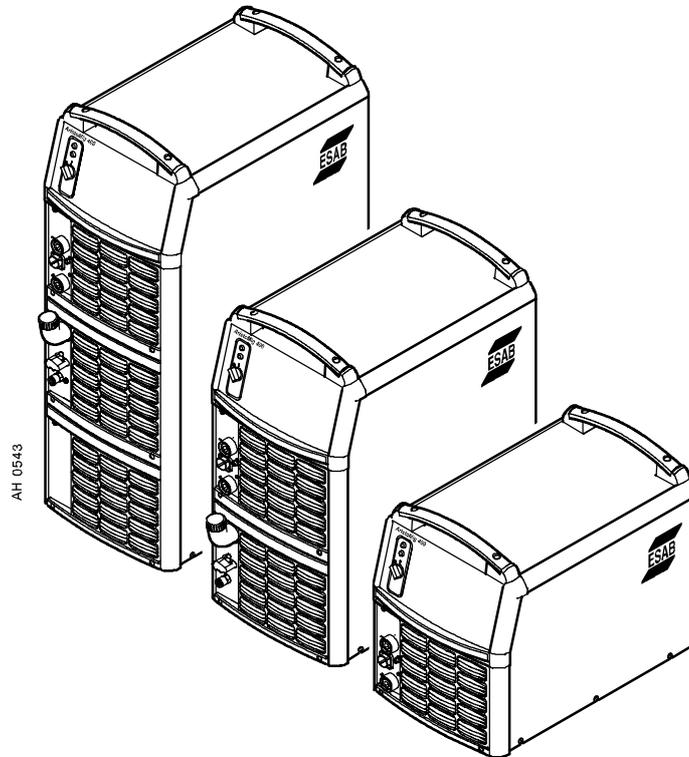
We recommend a 50/50 % mixture of water and ethylene glycol.

Top up with coolant until it is up to the level of the filling hole.





**Spare parts list**



AH 0543

**Valid for serial no. 050-xxx-xxxx, 105-xxx-xxxx, 347-xxx-xxxx, 445-xxx-xxxx, 524-xxx-xxxx**

**Ordering number**

Machines without auto transformer are connected for 400 V mains voltage.

Machines with auto transformer can be connected for other mains voltages.

0458 625 880 AristoMig 400

0458 625 881 AristoMig 400 with cooling unit

0458 625 882 AristoMig 400 with auto transformer

0458 625 883 AristoMig 400 with cooling unit and auto transformer

Spare parts are to be ordered through the nearest ESAB agency. Kindly indicate type of unit, serial number, denominations and ordering numbers according to the spare parts list.

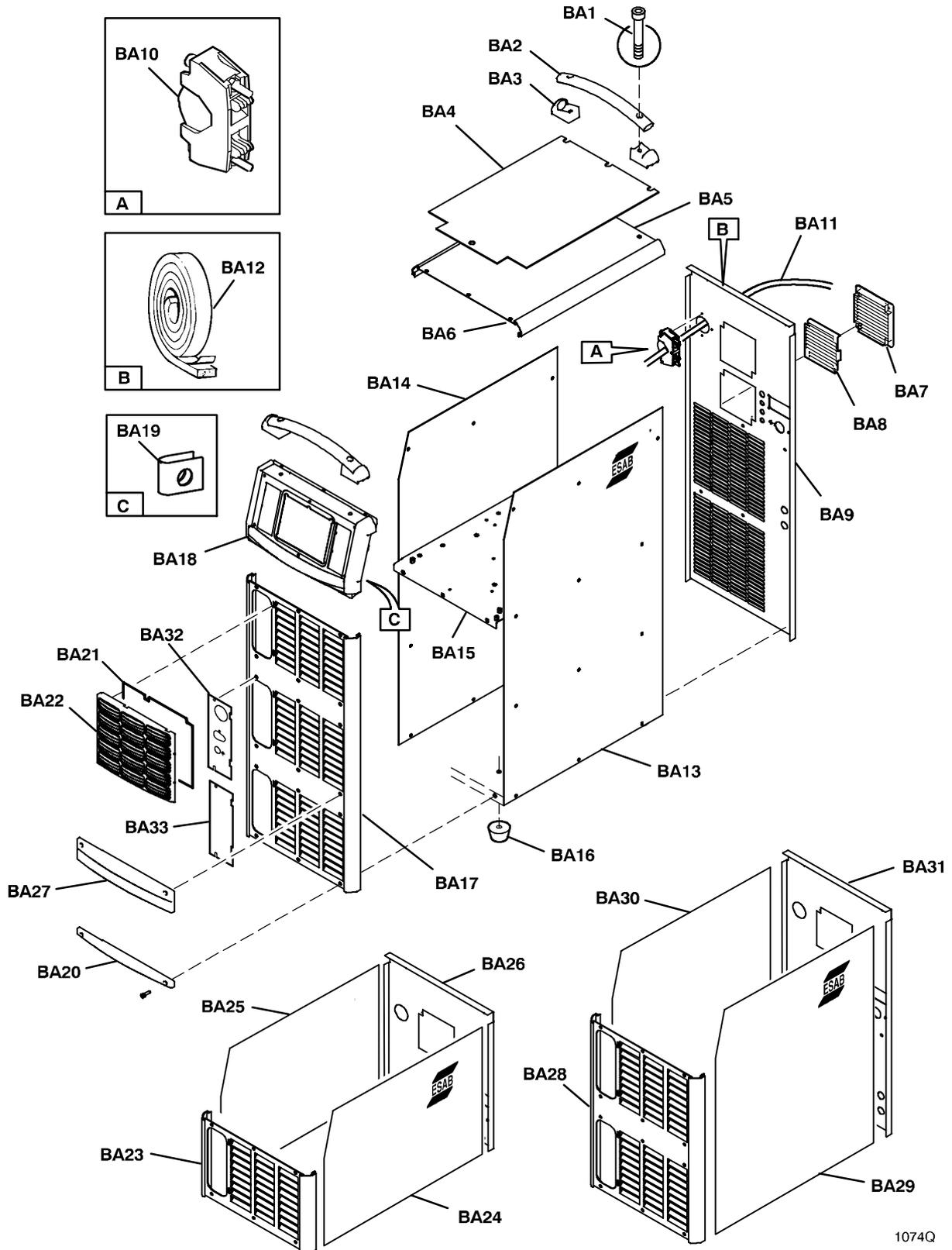
Maintenance and repair work should be performed by an experienced person, and electrical work only by a trained electrician. Use only recommended spare parts.

Rights reserved to alter specifications without notice.

## AristoMig 400

Item	Qty	Ordering no.	Denomination	Notes
BA1	4		Screw	High-tensile steel, included in item BA2
BA2	2	0459 307 881	Handle set	
-	2		Nut	M8, Included in item BA2
BA3	4		Handle corner	Included in item BA2
BA4	1	0458 399 002	Rubber mat	
BA5	1	0458 390 005	Cover	
BA6	4	0458 310 001	Gasket	Seal
BA7	2	0458 533 001	Rear grille	
-	4		Screw	RXS B6x9.5
BA8	1	0458 641 001	Water cover	Grille
-	4		Screw	RXS B6x25
BA9	1	0458 394 003	Rear plate high	Rear panel, long
-			Screw	M6x16
BA10	1	0469 950 880	Cable clamp	
-	3		Screw	RXPT 8-16x20
BA11	1	0468 516 886	Mains cable	
BA12	1	0192 526 002	Sealing strip	To be ordered per metre
BA13	1	0458 387 003	Side cover high	Side panel, long, right, with label
-			Screw	M6x16
BA14	1	0458 388 003	Side cover high	Side panel, long, left, with label
BA15	1	0458 385 001	Bottom plate	
BA16	4	0458 683 001	Foot	
-	4		Screw	M6x19
BA17	1	0458 390 004	Front profile high	Front panel, long
-			Screw	M6x16
-			Washer	Ø 11/6.4x2.1
BA18	1	0458 396 001	Front frame	
BA19	5	0469 381 001	Fast lock nut	
BA20	1	0458 509 001	Lower beam	Bracket
-	2		Screw	M6x20
BA21		0458 398 001	Filter	
BA22		0458 383 001	Front grille	
BA23	1	0458 390 002	Front profile low	Front panel, short
BA24	1	0458 387 001	Side cover low	Side panel, short, right
BA25	1	0458 388 001	Side cover low	Side panel, short, left
BA26	1	0458 394 001	Rear plate low	Rear panel, short
BA27	1	0458 511 001	Middle beam	Bracket
BA28	1	0458 390 003	Front profile middle size	Front panel, medium
BA29	1	0458 387 002	Side cover middle	Side panel, medium, right
BA30	1	0458 388 002	Side cover middle	Side panel, medium, left
BA31	1	0458 394 002	Rear plate middle size	Rear panel, medium
BA32	1	0458 623 004	Connection plate, cooler	
BA33	1	0458 623 005	Connection plate, auto transf.	

# AristoMig 400



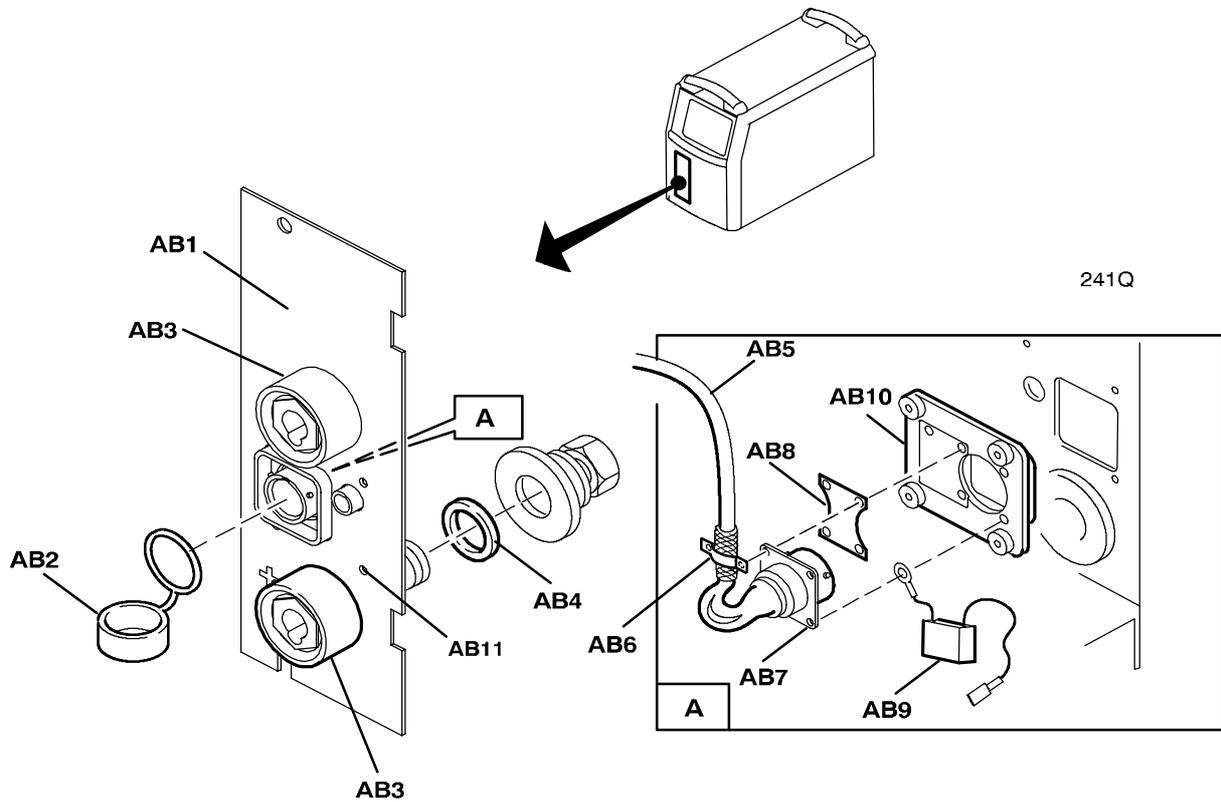
1074Q



# AristoMig 400

C = component designation in the circuit diagram

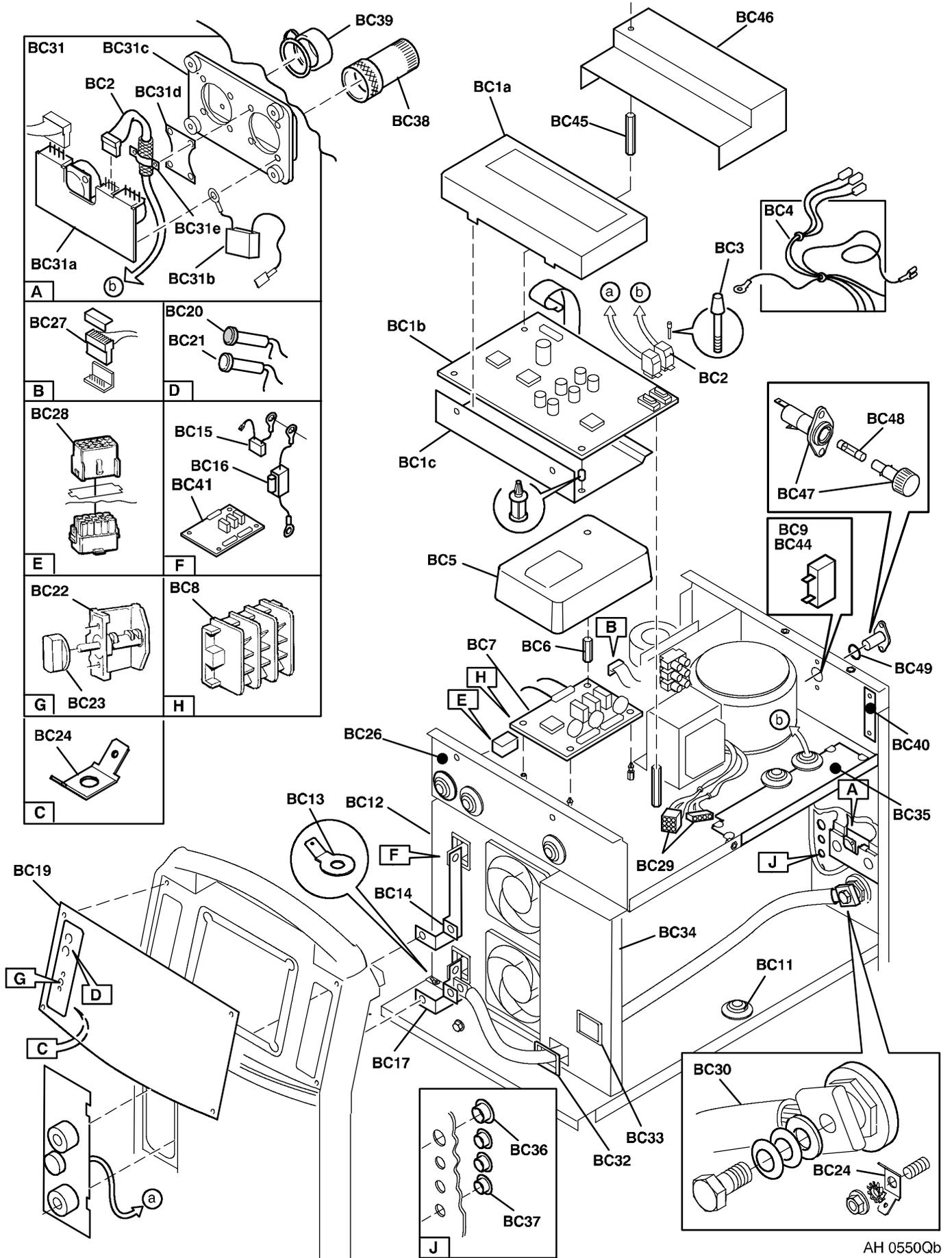
Item	Qty	Ordering no.	Denomination	Notes	C
AB1	1	0458 623 001	Connection plate		
AB2	1	0366 285 001	Cap		
AB3	2	0160 362 881	Cable connector	OKC	XS1, XS2
AB4	2	0466 325 001	Gasket		
AB5	1	0458 681 883	Cable	Connectors included	XP1, XS3
AB6	1	0456 686 880	Clamp		
AB7	1	0368 544 003	Socket	12 pole	XS3
-	3		Screw	RXPT 6-19x8	
AB8	1	457 799 001	Screen plate		
AB9	1	0467 911 883	Capacitor		C3
AB10	1	0458 969 001	Insulation		
-	4		Screw	MRX M4x12	
AB11	4	0194 142 412	Nut	M4 domed, plastic	



**C = component designation in the circuit diagram**

Item	Qty	Ordering no.	Denomination	Notes	C
BC1	1	0458 842 882	PC-board module	From serial no. 347-xxx-xxxx	
	1	E458 842 880	PC-board module	For serial no. 050-xxx-xxxx to 105-xxx-xxxx	
BC1a	1		Top box	Included in item BC1	
BC1b	1		Circuit board	Included in item BC1	20AP1
BC1c	1		Bottom box	Included in item BC1	
BC2	1	0458 681 884	Cable double burndy	Included in item BC31	XP2, XS30
BC3	2	0193 052 980	Screw		
BC4	1	0458 629 884	Cable set common	Connectors included: XP6, XS7, XS8, XS15, XS20, XS21, XS22, XS23, XS24, XS25, XS27, XS28	<-----
BC5	1	0458 314 001	Dust protection		
BC6	1	0394 516 038	Spacer screw	M5x30	
BC7	1	0486 855 880	Printed circuit board	Relay board	20AP2
BC8	1	0466 884 003	Connection		
BC9	1	-	Automatic fuse	MCB; 5 A. Replaced by items BC47, BC48, BC49	2FU1
BC11	3	0194 069 003	Rubber inlet	Grommet	
BC12	1		Power module	See page 10	
BC13	1	0191 548 009	Flat pin connector	Ø 6.3x0.8	
BC14	1	0458 624 002	Connection rail		
BC15	1		Capacitor	For ser.no. 050- use item BC41 as spare part	C2
BC16	1		Capacitor complete	For ser.no. 050- use item BC41 as spare part	C1, R1
BC17	1	0458 624 001	Connection rail		
	2		Washer	Ø 22/10.5x2	
	4	0219 504 307	Spring washer	T=1.1, Ø 20/10.2	
	2		Screw	M10x20	
BC19	1	0458 801 001	Front panel		
	3		Washer	Ø 4.3X8	
	7		Nut	M4	
BC20	1	0369 733 005	Lamp	Orange LED	D1
BC21	1	0369 733 008	Indicating lamp	White 28 V	HL1
BC22	1	0458 601 001	Switch		2QF1
	2		Screw	FXS ST3.5x9.5	
BC23	1	0366 296 003	Knob		
BC24	2	0192 038 102	Flat pin connector	5.3 mm	
BC25	2	0458 777 001	Protection clamp		
BC26	1		Mains module	See page 8	
	6		Screw	M6x16	
BC27	9		Connector	Included in item BC4	
BC28	2		Socket	Included in item BC4	
BC29	1	0458 629 885	Cable set MIG	Connectors included: XS10, XS11, XS16, XS17, XS18, XS26, XS29, XS31	<-----
BC30	1	0458 610 882	Cable set coarse		
BC31	1	0458 679 881	Contact CAN doub.	BC2, BC31a, BC31b, BC31c, BC31d, BC31e included	AP1, C4
BC31a	1	0486 388 880	Circuit board	Connection board	AP1
BC32	1	0458 074 001	Inlet		
BC33	1	0192 230 113	Blind plug	Before ser.no.105-131-xxxx	
	1	0458 074 001	Inlet	From ser.no.105-131-xxxx	
BC34	1	0458 593 001	Bracket		
BC35	1	0458 709 002	Cover 2-hole		
BC36	1	0192 230 107	Blind plug P-625		
BC37	3	0192 230 105	Blind plug		
BC38	1	0456 680 880	Terminal resistor	Termination resistor	
BC39	2	0366 285 001	Dust cap		
BC40	1	0456 806 001	Cover plate		
BC41	1	0486 892 880	Printed circuit board	From serial number 105-xxx-xxxx	AP2
BC44	1	0455 376 001	Protection cap	For item BC9	
BC45	1	0394 516 038	Spacer screw	M5x30 From ser.no.105-152-xxxx	
	1	0394 516 036	Spacer screw	M5x20 From ser.no.105-152-xxxx	
BC46	1	0458 881 001	Protection cap	From ser.no.105-152-xxxx	
BC47	1	0459 284 001	Fuse holder	From ser.no. 347-351-xxxx	
BC48	1	0459 285 001	Fuse 4 A slow	From ser.no. 347-351-xxxx	2FU1
BC49	1	0190 680 218	O-ring	From ser.no. 347-351-xxxx	

# AristoMig 400



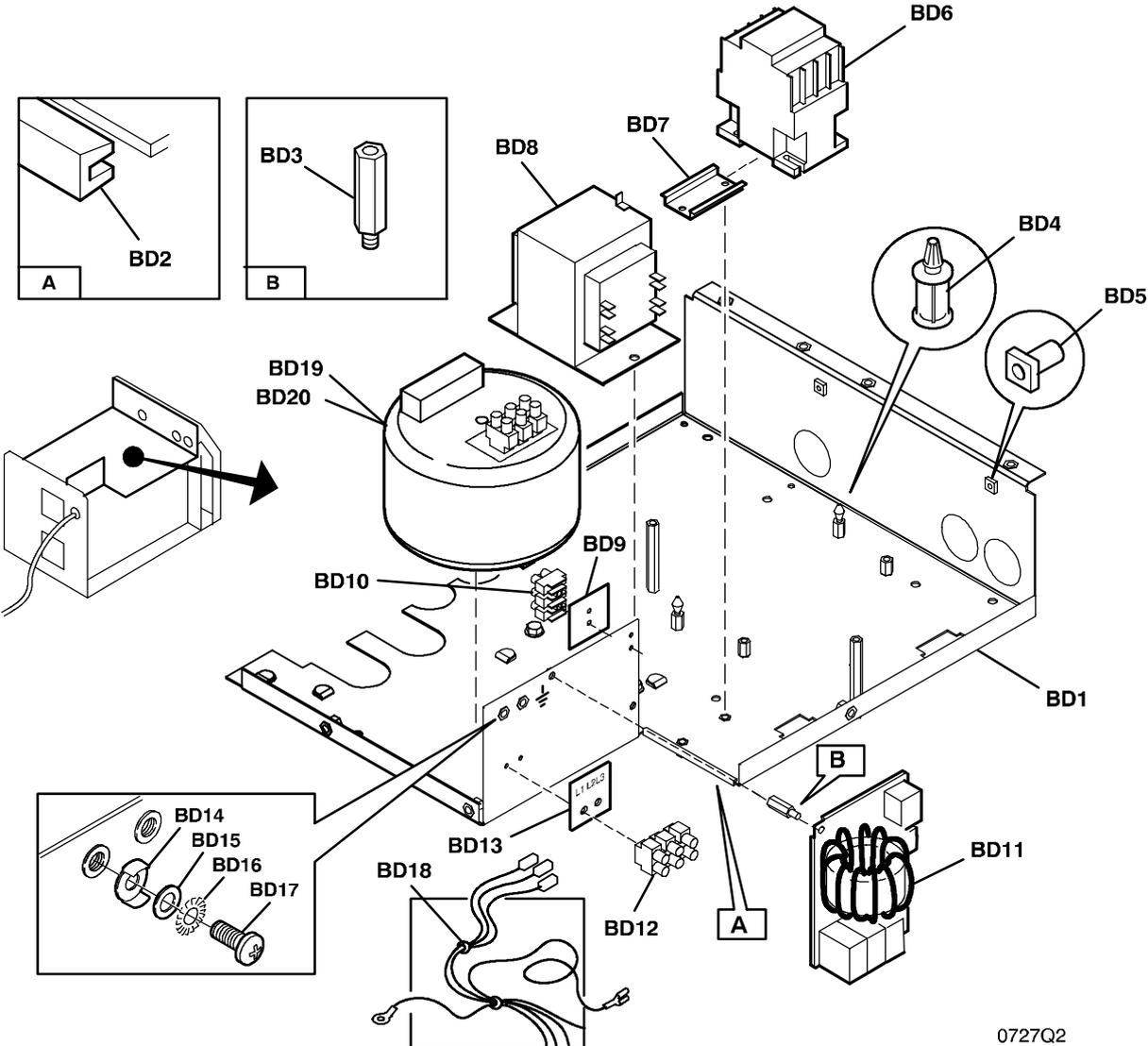
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# AristoMig 400

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
BD1	1	0458 392 001	Circuit board shelf		
BD2	1	0193 350 101	Grommet strip	L = 50 mm. To be ordered per metre	
BD3	2	0394 516 033	Distance screw	Spacer screw M5x12	
-	2	0394 516 036	Distance screw	Spacer screw M5x20	
-	2		Washer	Ø 10/5.3	
-	2		Screw	M5x8	
-	2	0394 516 044	Distance screw	Spacer screw M5x60	
BD4	2	0192 790 104	Spacer	12.7 mm	
BD5	2	0194 019 003	Spacer	3.2	
BD6	1	0193 502 105	Contactactor	400 V	2KM1
BD7	1	0193 298 101	Bar for contactor		
-	2		Screw	M5x8	
BD8	1	0458 607 001	Control transformer	With fuses 2FU2 and 2FU3	2TC1
-	2		Screw	M6x16	
BD9	1	0191 409 019	Insulating washer		
BD10	1	0193 655 012	Terminal block	Delivered as 12 pole, to be cut to 5 pole	2XT2
-	2		Screw	RXS B8x19	
BD11		0455 803 880	Circuit board		2AP1
BD12	1	0320 378 011	Mans select block	Terminal block Delivered as 12 pole, to be cut to 3 pole	2XT1
-	2		Screw	M4x25	
BD13	1	0468 882 004	Sign		
BD14	1	0264 300 404	Washer	KB6.5	
BD15	1		Washer	Ø 16/8.4x1.5	
BD16	2	0219 501 309	Washer lock AZ	Ø 11/6.4x2.1	
BD17	2		Screw	M6x16	
BD18	1	0458 611 881	Cable set mains module	Connectors included	2XS1, 2XS2, 2XT2
BD19	1	0458 608 001	Control transformer MIG	<b>Only for MIG machines</b>	2TC2
-	1	0567 900 151	Fuse 8 A slow		2FU4
-	1	-	Fuse 2 A slow		2FU5
-	1		Screw	M8x110	
-	1		Nut	M8	
BD20	1	0458 613 001	Control transformer TIG	<b>Only for TIG machines</b>	2TC2
-	1	-	Fuse 0.5 A slow		2FU4
-	1	-	Fuse 2 A slow		2FU5
-	1		Screw	M8x90	
-	1		Nut	M8	

**AristoMig 400**



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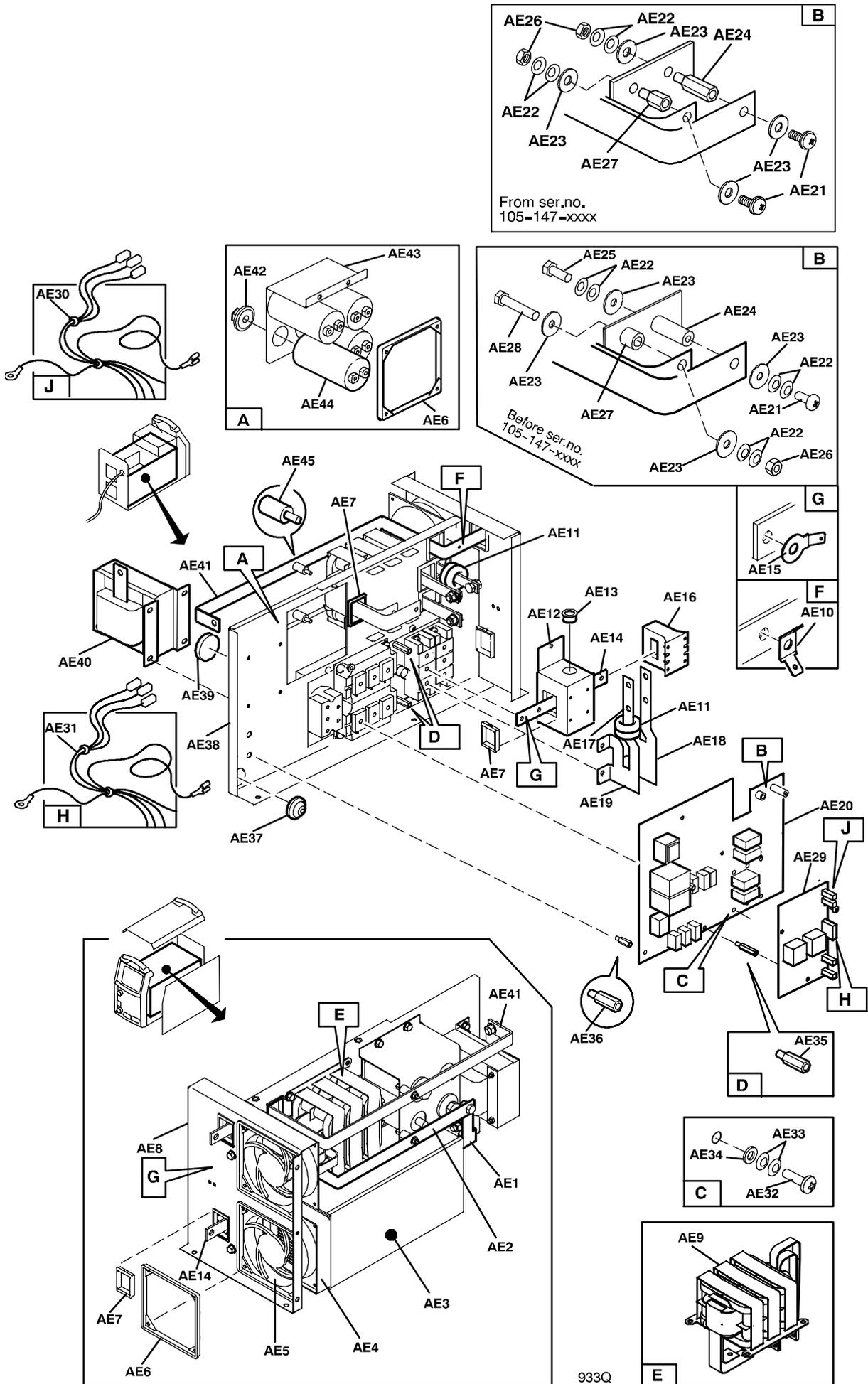
# AristoMig 400

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
AE1	1	0458 308 001	Rail		
AE2	1	0458 072 001	Rail		
AE3	1		Semiconductor module	See page 12	
AE4	1	0458 055 001	Spacer		
AE5	2	0458 065 001	Fan		15EV1, 15EV2
	4		Screw	MRX-TT M4x8	
AE6	3	0458 076 001	Fan attachment		
AE7	8	0458 074 001	Inlet	Grommet	
AE8	1	0458 059 001	Fan plate		
	3		Screw	M6SF-TT M6x19	
AE9	1	0458 075 880	Transformer module		15TM1
	4		Screw	M6SF-TT M6x14	
AE10	1	0192 038 102	Flat pin	Ø 5.3	
AE11	4	0455 569 001	Ferrit ring core		15L1, 15L2
-			Cable tie	Heat resistant	
AE12	1	0458 077 001	Screen plate		
	2		Screw	MRX-TT M4x8	
AE13	1	0192 041 119	Grommet		
AE14	1	0458 067 001	Rail		
AE15	3	0191 548 009	Flat pin	6.3x0.8	
AE16	1	0458 063 001	Current sensor		15AP3
AE17	1	0190 209 120	Hose	Ø 15.9/14, L= 45mm, to be ordered per metre	
AE18	1	0458 068 002	Rail		
AE19	1	0458 068 001	Rail		
	3		Screw	M8x16	
	3		Nut	M8	
AE20	1	0486 739 880	Circuit board		15AP1
AE21	26	0194 143 327	Screw	M5x12 <b>See * below</b>	
AE22		0219 504 302	Spring washer	Ø 10/5.2x0.5	
AE23	4		Washer	Ø 16/5x1	
AE24	1	0457 902 001	Spacer	<b>Before ser.no. 105-147-xxxx</b>	
	1	0458 991 001	Spacer screw	<b>From ser.no. 105-147-xxxx</b>	
AE25	2		Screw	M5X16	
AE26	8		Nut	M5	
AE27	1	0301 064 001	Spacer	<b>Before ser.no. 105-147-xxxx</b>	
	1	0458 991 002	Spacer screw	<b>From ser.no. 105-147-xxxx</b>	
AE28	1		Screw	M5x20	
AE29	1	0486 735 880	Circuit board		15AP2
-	2	0193 767 001	Fuse	Fuses S1 and S2 on circuit board 15AP2	
AE30	1	0458 064 881	Cable set gate	Connectors included: 15XS1, 15XS3, 15XS5, 15XS6, 15XS7, 15XS8	<-----
AE31	1	0458 064 880	Cable set 350/400	Connectors included: 15XP7, 15XP8, 15XS4, 15XS9	<-----
AE32	6	0194 143 368	Screw	M6x16 <b>See * below</b>	
AE33	12	0219 504 303	Spring washer	T=0.7. Ø 12.5/6.2 Included in item AE32	
AE34	6		Washer	Ø 12x6.4x1.5 Included in item AE32	
AE35	5	0394 516 038	Spacer screw	M5x30	
AE36	2	0394 516 035	Spacer screw	M5x18	
AE37	1	0194 069 002	Rubber inlet	Grommet	
AE38	1	0458 054 001	Intermediate plate		
AE39	1	0349 134 001	Rubber distance	Rubber spacer	
AE40	1	0458 066 880	Inductor		15L3
AE41	1	0458 069 001	Rail		
AE42	4	0320 901 003	Insulating nut	M12	
AE43	1	0458 058 001	Support plate		
	2		Screw	M6SF-TT, M6x14	
AE44	4	0192 903 505	Capacitor	1000 µF	
AE45	3	0193 609 105	Insulator		

\* Special screw with inbuilt washer and spring washer function, used from ser.no.105-140-xxxx

# AristoMig 400



## AristoMig 400

C = component designation in the circuit diagram

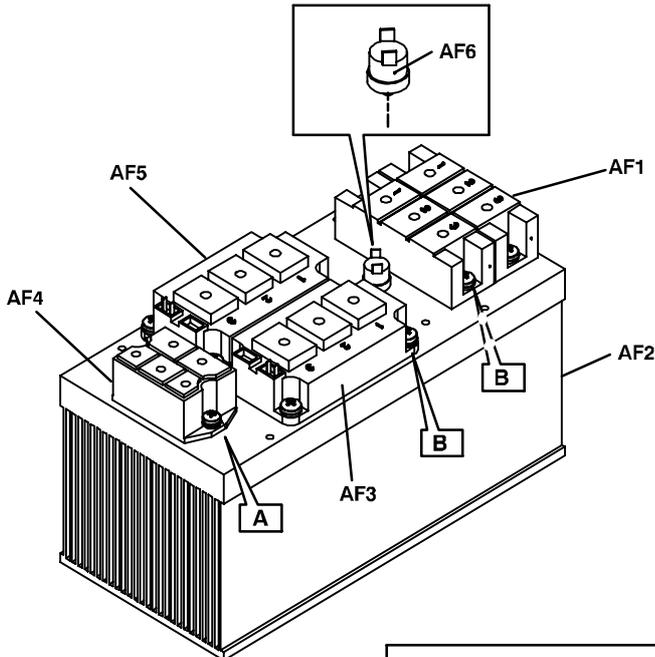
Item	Qty	Ordering no.	Denomination	Notes	C
-	1	0458 073 880	Semiconductor module	Complete. Items AF1 - AF12	
AF1	2		Diode module	See item AF52	15D1, 15D2
AF2	1	0301 011 003	Heat sink		
AF3	1		IGBT module	See item AF50	15Q2
AF4	1		Rectifier bridge	See item AF51	15BR1
AF5	1		IGBT module	See item AF50	15Q1
AF6	1	0456 113 886	Thermal switch		15ST2
AF7	2	0194 143 329	Screw	M5x16 <b>See * below</b>	
AF8	4		Spring washer	Ø 10/5.2x0.5 Included in item AF7	
AF9	2		Washer	Included in item AF7	
AF10	12	0194 143 370	Screw	M6x20 <b>See * below</b>	
AF11	24		Spring washer	T=0.7, Ø 12.5/6.2 Included in item AF10	
AF12	12		Washer	Included in item AF10	
-	1	0192 058 101	Thermal compound	For fitting of items AF1, AF3, AF4, AF5 and AF6	

\* Special screw with inbuilt washer and spring washer function, used from ser.no.105-140-xxxx

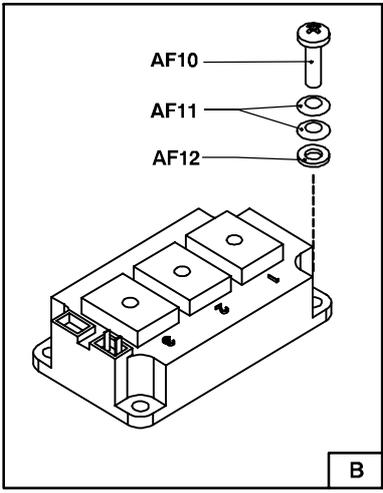
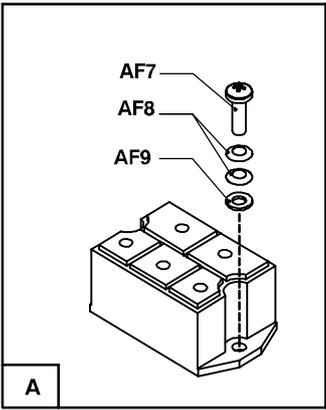
### SPARE PARTS SETS

Item	Ordering no.	Denomination	Notes
AF50	0458 920 880	IGBT modules set	Includes: item AF3 IGBT 15Q2, item AF5 IGBT 15Q1, thermal compound, roller and mounting instruction
AF51	0458 920 881	Rectifier set	Includes: item AF4 rectifier bridge 15BR1, thermal compound, roller and mounting instruction
AF52	0458 920 882	Diode module set	Includes: diode module item AF1, thermal compound, roller and mounting instruction. <b>Note: there is only one diode module in the set.</b>
-	0458 910 002	Roller handle	For the roller in the spare parts sets above

**AristoMig 400**



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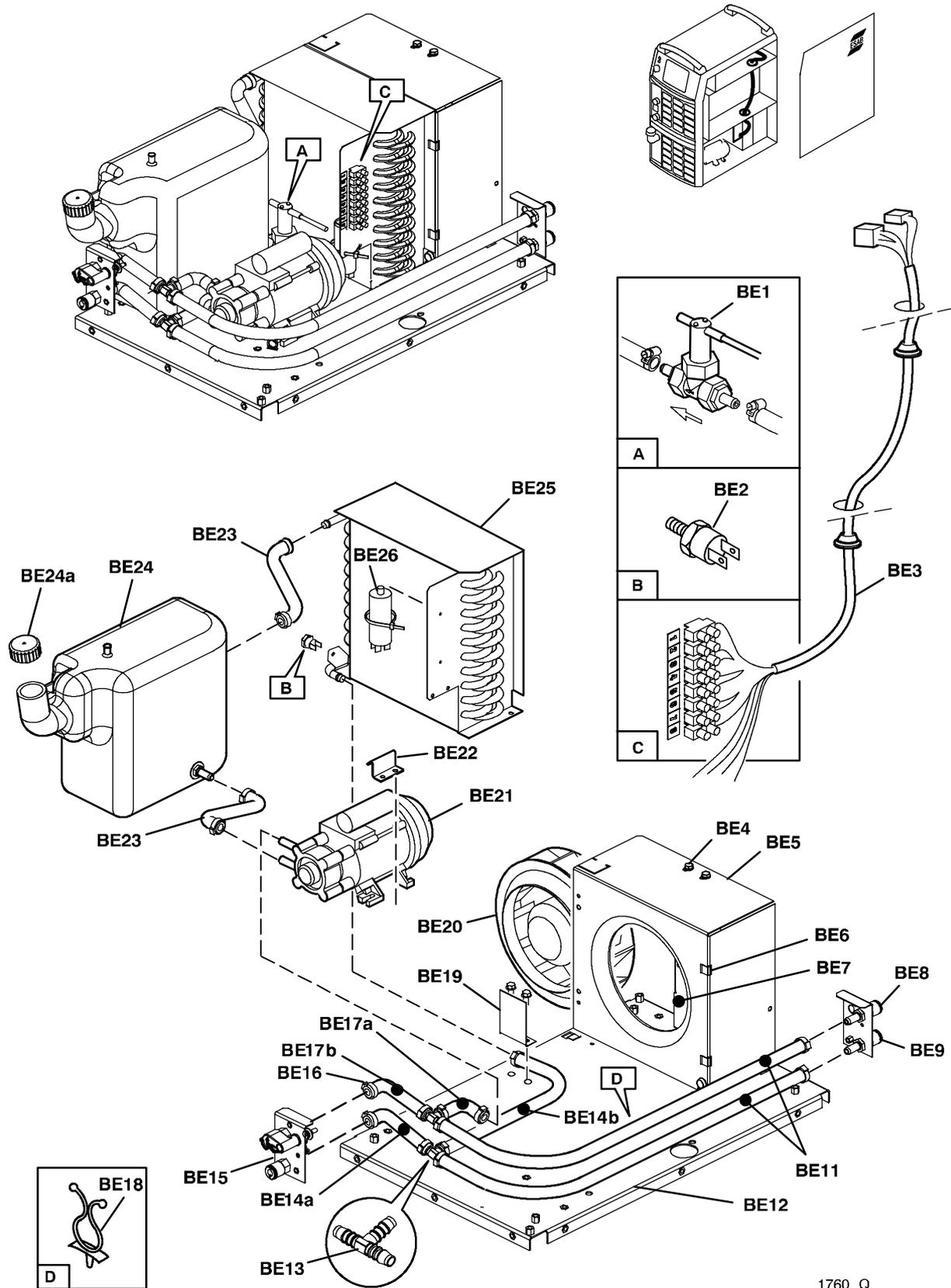


**C = component designation in the circuit diagram**

Item	Qty	Ordering no.	Denomination	Notes	C
BE1	1	0467 118 001	Waterflow switch	Option	5SL1
BE2	1	0467 864 007	Thermal switch	Closes at 45 °C, opens at 35 °C Use thermal compound when mounting	5ST1
BE3	1	0458 745 881	Cable set	Connectors included	5XP17, 5XP18, 5XT1
BE4	4		Screw	M6x16	
BE5	1	0458 556 001	Fan plate		
BE6	4	0457 212 001	Clips		
BE7	1	0458 555 001	Fan holder		
BE8	1	0365 803 012	Quick connector	Female, blue	
BE9	1	0365 803 011	Quick connector	Female, red	
BE11	2	0457 987 001	Water hose	L=0.68m D=17/10mm To be ordered per metre	
BE12	1	0458 385 001	Bottom plate		
BE13	2	0458 558 001	T connection		
BE14a	1	0459 025 001	Hose	From red connector.	
BE14b	1	0457 987 001	Hose	To radiator. L=0.35m D=17/10mm To be ordered per metre	
BE15	1	0458 370 880	Water outlet with lock	Complete, for details see page 16	5S1
BE16	16	0190 484 002	Hose clamp		
BE17a	1	0459 026 001	Hose	From blue connector.	
BE17b	1	0459 025 001	Hose	To pump.	
BE18	3	0455 122 002	Cable saddle	Assemb. hole 4mm	
BE19	1	0458 560 001	Stop plate tank		
BE20	1	0369 827 001	Fan		5EV1
BE21	1	0469 692 002	Pump	Delivered with capacitor. See * below	5M1
-	1		Capacitor	5µF 450V AC	5C2
BE22	1	0458 807 001	Pump clamp	See * below	
BE23	2	0458 554 001	Hose		
BE24	1	0459 044 880	Tank with connections	Water tank	
BE24a	1	0457 245 002	Tank cap	Included in item BE24	
BE25	1	0458 559 001	Radiator		
BE26	1	0191 085 203	Capacitor	3µF 400V	5C1

\* When ordering a pump, item BE21, to a machine with serial number prior to 445-508-xxxx, also item BE22 must be ordered.

# AristoMig 400



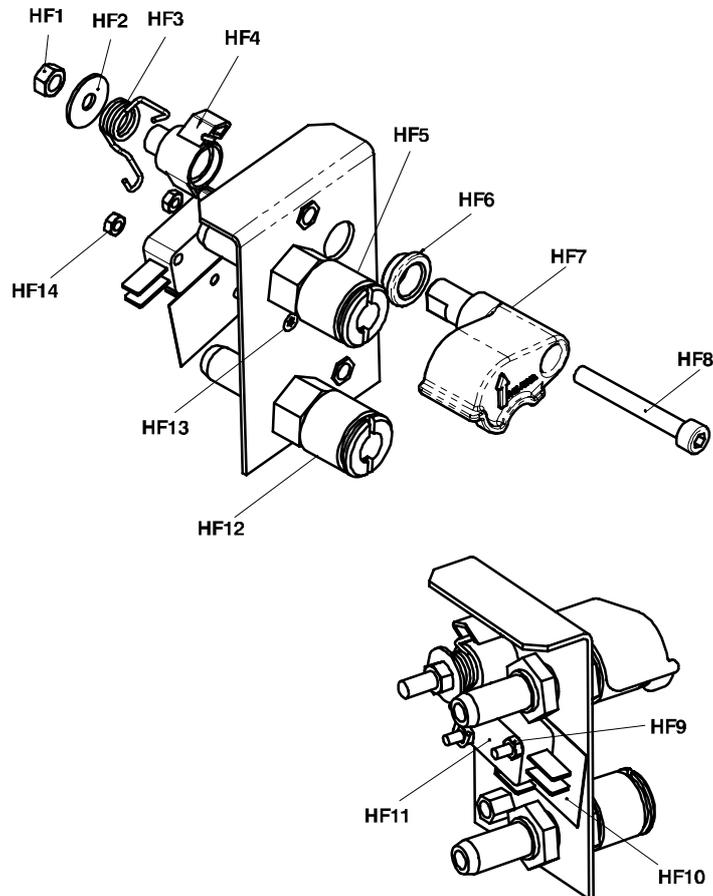
1760 Q

# AristoMig 400

Item	Qty	Ordering no.	Denomination	Notes
HF1	1		Nut	M5
HF2	1		Washer	D16/5x1
HF3	1		Spring	
HF4	1		Water lock cam	
HF5	1	0365 803 015	Quick connector	Female, blue <b>Note: only for wire feed units</b>
	1	0365 803 009	Quick connector	Female, blue <b>Note: only for power source cooling units</b>
HF6	1		Water lock bushing	
HF7	1		Water lock outlet	
HF8	1		Screw	M5x35
HF9	1		Nut	M3
HF10	1	0458 589 001	Insulation plate	
HF11	1	0458 364 001	Micro switch	
HF12	1	0365 803 014	Quick connector	Female, red <b>Note: only for wire feed units</b>
	1	0365 803 008	Quick connector	Female, red <b>Note: only for power source cooling units</b>
HF13	2		Screw	M3x20
HF14	2		Nut	M3

## SPARE PARTS SET

Item	Qty	Ordering no.	Denomination	Notes
HF50	1	0458 370 900	Water connection spare kit	Contains items HF1, HF2, HF3, HF4, HF6, HF7 and HF8

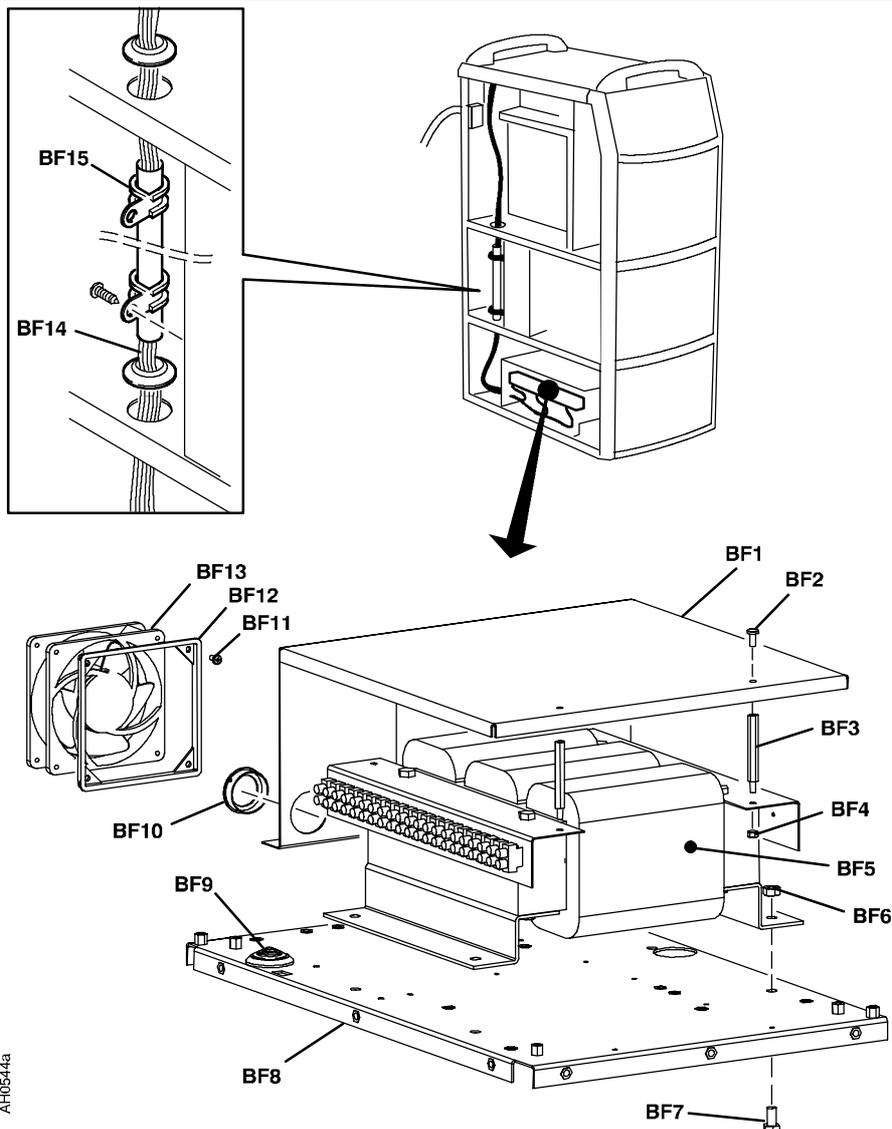


H

# AristoMig 400

C = component designation in the circuit diagram

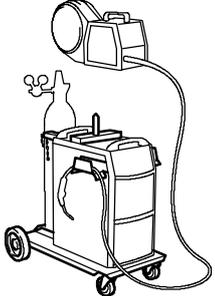
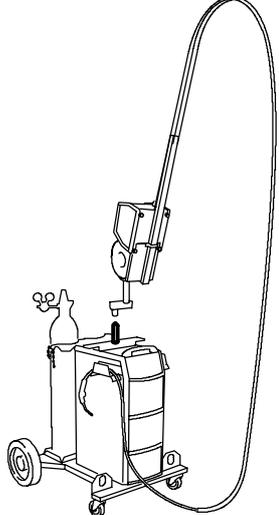
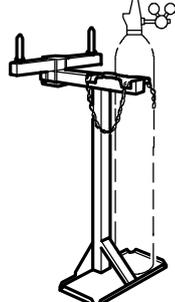
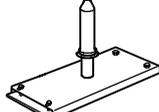
Item	Qty	Ordering no.	Denomination	Notes	C
BF1	1	0458 581 001	Transformer roof	Transformer cover plate	4TM1
-	2		Screw	M6x14	
BF2	2		Screw	M5x10	
BF3	2	0394 516 044	Distance screw	Spacer screw M5x60	
BF4	2		Nut	M5	
BF5	1	0458 582 001	Auto transformer		
BF6	4		Nut	M8	
BF7	4		Screw	M8x16	
BF8	1	0458 385 001	Bottom plate		
BF9	1	0194 069 003	Rubber inlet	Grommet	
BF10	1	0192 041 137	Grommet		
BF11	4		Screw	MRX taptite M4x8	
BF12	1	0458 076 001	Fan attachment		
BF13	1	0458 065 001	Fan		
-	1	0458 610 887	Cable set	For fan	
BF14	1		Cable tree	Included in item BF5	
BF15	2	0417 699 011	Clamp GSK 20/15		

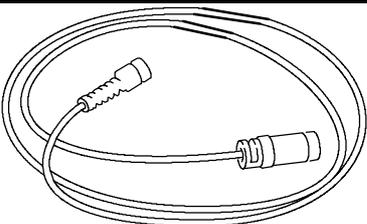
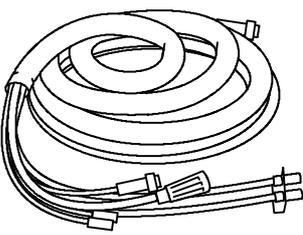
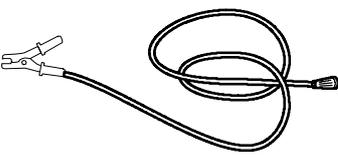


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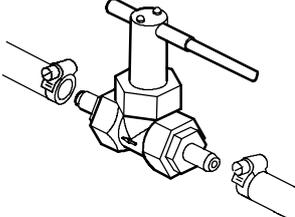
# AristoMig 400

## Accessories

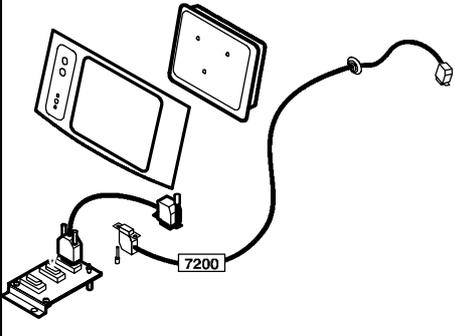
 A line drawing of a trolley with two wheels and a handle. A gas cylinder is mounted on the trolley, and a welding torch is attached to the top. A power cable is connected to the side.	<b>Trolley for AristoMig</b> ..... 0458 530 880
 A line drawing of a trolley with two wheels and a handle. A gas cylinder is mounted on the trolley, and a welding torch is attached to the top. A long, flexible cable is connected to the side.	<b>Trolley 2 for AristoMig</b> (for feeder with counterbalance device and/or 2 gas bottles) . 0458 603 880
 A line drawing of a stand with a vertical post and a horizontal arm. A gas cylinder is mounted on the horizontal arm.	<b>Feeder stand</b> ..... 0458 522 880
 A line drawing of a small, rectangular metal plate with a central hole and four mounting holes at the corners.	<b>Turning piece</b> ..... 0458 703 880
 A photograph of a black, rectangular remote control adapter with a yellow label and a metal bracket.	<b>Remote control adapter RA12</b> 12 pole .... 0459 491 910 For analogue remote controls to CAN based equipment.

	<p><b>Remote control unit MTA1 CAN</b> ..... 0459 491 880</p> <p>For setting of wire feed speed, current and arc force.</p>
	<p><b>Remote control unit M1 10Prog CAN</b> ..... 0459 491 882</p> <p>For setting of voltage and current. Choice of on of 10 programs.</p>
	<p><b>Remote control unit AT1 CAN</b> ..... 0459 491 883</p> <p>For setting of current.</p>
	<p><b>Remote control unit AT1 CF CAN</b> ..... 0459 491 884</p> <p>For rough and fine setting of current.</p>
	<p><b>Remote control cable 12 pole - 4 pole</b></p> <p>5 m ..... 0459 554 880</p> <p>10 m ..... 0459 554 881</p> <p>15 m ..... 0459 554 882</p> <p>25 m ..... 0459 554 883</p> <p>0.25m ..... 0459 554 884</p>
	<p><b>Connection set</b></p> <p>1.7 m ..... 0456 528 880</p> <p>5 m ..... 0456 528 890</p> <p>10 m ..... 0456 528 881</p> <p>16 m ..... 0456 528 882</p> <p>25 m ..... 0456 528 883</p> <p>35 m ..... 0456 528 884</p> <p><b>Connection set, water</b></p> <p>1.7 m ..... 0456 528 885</p> <p>5 m ..... 0456 528 895</p> <p>10 m ..... 0456 528 886</p> <p>16 m ..... 0456 528 887</p> <p>25 m ..... 0456 528 888</p> <p>35 m ..... 0456 528 889</p>
	<p><b>Return cable 5 m 70 mm<sup>2</sup></b> ..... 0156 743 881</p>

**AristoMig 400**



**Water flow guard 0.7 l/min** ..... 0456 855 880



**MMC kit AristoMig** ..... 0459 579 880



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