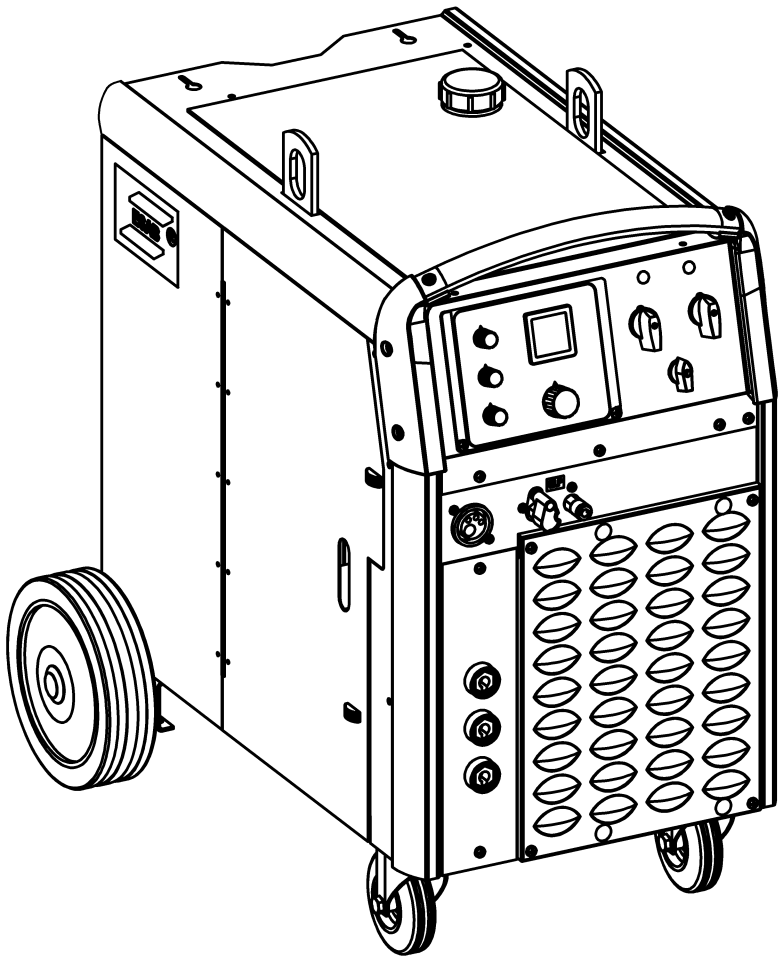
ESABMig C420
ESABMig C420s



Service manual

0349 300 041 030410

Valid for serial no. 237–xxx–xxxx

READ THIS FIRST

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 board is 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 up to and including March 2003.

The ESABMig C420w/C420 and ESABMig C420sw/C420s are designed and tested in accordance with international and European standard IEC/EN 60974–1 and EN 50199. On completion of service or repair work, it is the responsibility of the person(s) etc. performing the work to ensure that the product does not depart from the requirements of the above standard.

WARNING

Many parts of the power unit are at mains voltage.

INTRODUCTION

The ESABMig C420w/C420sw are step–controlled compact welding power units incorporating wire feed mechanism intended for MIG/MAG welding with solid wires of steel, stainless steel or aluminium, and cored wires with or without shielding gas. The ESABMig C420w/420sw are equipped with cooling liquid system for welding torch. The ESABMig C420/420s are not equipped with cooling system and can operate only with appropriate gas cooled torches.

The ESABMig C420w/420 is equipped with standard control unit (manual setting of all welding parameters) and ESABMig C420sw/420s contains additional synergy control facility (preprogrammed welding parameters).
The power units are fan–cooled and equipped with thermal overload protection.
The machines can be fitted with a flow guard (C420sw/C420w).

TECHNICAL DATA

	ESABMig C420/C420w	ESABMig C420s/C420sw
Voltage	400–415V, 3~50/60Hz	400–415V, 3~50/60Hz
Permissible load		
at100 % duty cycle	315 A/30V	315 A/30V
at 60 % duty cycle	400 A/34V	400 A/34V
at 50 % duty cycle	420 A/35V	420 A/35V
Setting range (DC)	50A/16,5V–420A/35V	50A/16,5V–420A/35V
Open circuit voltage	14–47V	14–47V

Open circuit power	520W	520W
with cooling unit	730W	730W
Efficiency at max current	77%	77%
Power factor at max current	0,92	0,92
Control voltage	42V, 50/60Hz	42V, 50/60Hz
Wire feed speed	1,9 – 25,0m/min	1,6 – 25,0m/min
Burnback time	0 – 0,5s	0 – 0,35s
Creep start	OFF / ON	ON
2/4 stroke	2 / 4	2 / 4 /
Welding gun connection	EURO	EURO
Max diameter of wire bobbin	300mm	300mm
Wire dimension range	0,6 – 1,6mm	0,6 – 1,6mm
Dimensions lxwxh	935 x 640 x 800mm	935 x 640 x 800mm
Weight	209kg	209kg
with cooling unit	217kg	217kg
Operating temperature	–10 to +40°C	–10 to +40°C
Enclosure class	IP 23	IP 23
Application classification	S	S

	ESABMig C420/C420w
Voltage	230/400–415/500V 3~50Hz 230/440–460 3~60Hz
Permissible load	
at100 % duty cycle	315 A/30V
at 60 % duty cycle	400 A/34V
at 50 % duty cycle	420 A/35V
Setting range (DC)	50A/16,5V–420A/35V
Open circuit voltage	14–47V
Open circuit power	520W
with cooling unit	730W
Efficiency at max current	77%
Power factor at max current	0,92
Control voltage	42V, 50/60Hz
Wire feed speed	1,9 – 25,0m/min
Burnback time	0 – 0,5s
Creep start	OFF / ON
2/4 stroke	2 / 4
Welding gun connection	EURO
Max diameter of wire bobbin	300mm
Wire dimension range	0,6 – 1,6mm
Dimensions lxwxh	935 x 640 x 800mm
Weight	209kg
with cooling unit	217kg
Operating temperature	–10 to +40°C
Enclosure class	IP 23
Application classification	S

WIRING DIAGRAM

Component description

WARNING !

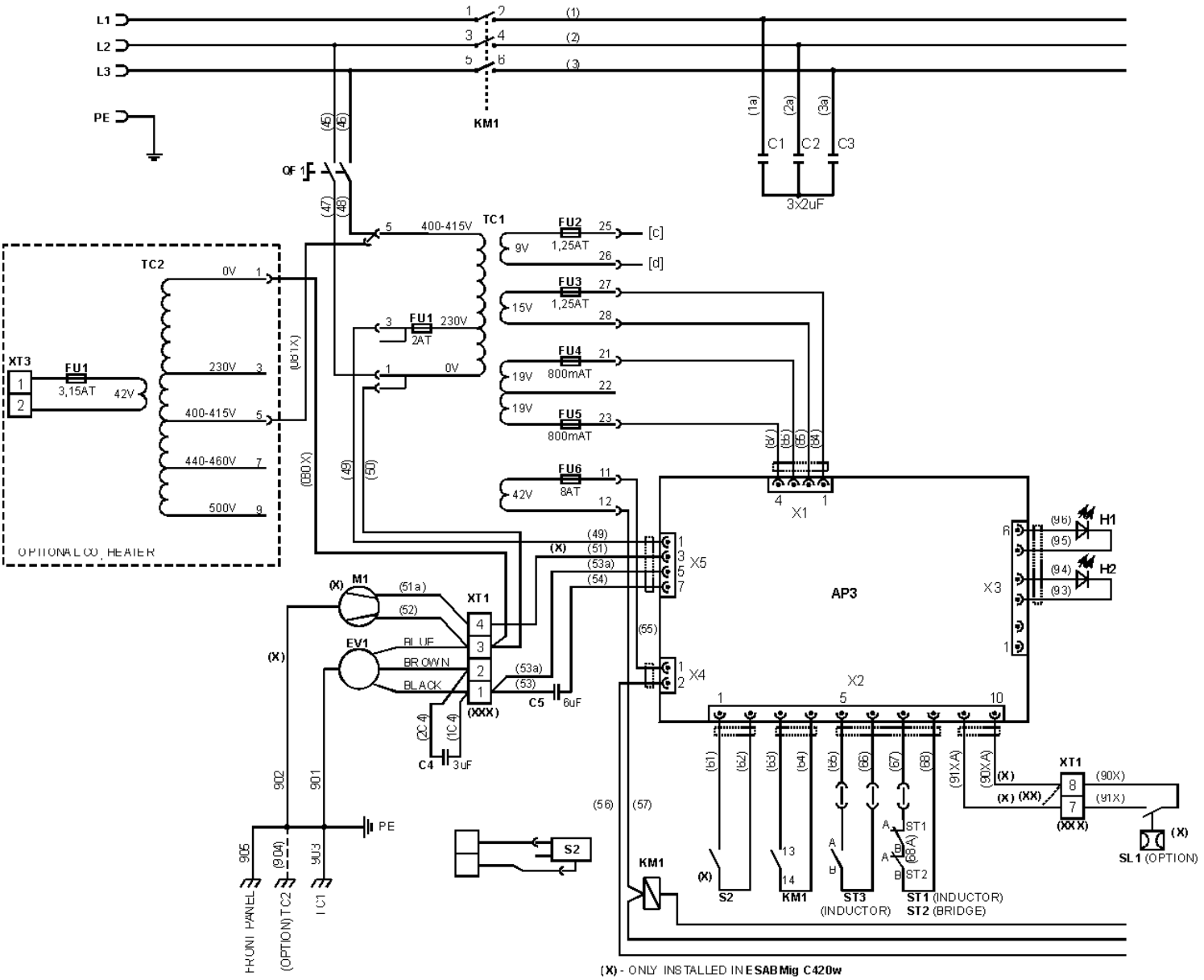
STATIC ELECTRICITY can damage circuit boards and electronic components.

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

AP1	Control circuit board with control electronics (see – page XX and YY).
AP2	Digital instrument (see page XX and YY).
AP3	Control circuit board (see – page XX).
C1 – C3	EMC – capacitors 2 uF 450 V.
C4	Capacitor, 3 uF 400 V. Start and run capacitor for fan motor EV1.
C5	Capacitor, 6 uF 400 V. For speed reduction of the cooling fan.
C6 – C8, CES	Suppression capacitors 0.1 uF 250 V.
EV1	Fan.
G1	Tachogenerator, 660 Hz output at a wire speed of 25m/min. The tachogenerator is incorporated in motor M2 (ESABMig C420w/C420 only).
H1	Indicating lamp, green. Lights when switch QF1 is in the ON position.
H2	Indicating lamp, yellow. Lights when thermal overload (thermal cut–out active). If the machine is equipped with flow guard, the lamp also indicates loss of coolant.
KM1	Contactor 42 V 50 Hz. For energising of the welding circuit.
M1	Pump motor, 230 V 50 Hz 0.2 kW. Only machines with water cooler.
M2	Motor, rated voltage 42 V DC (wire feed unit).
QF1	Main ON/OFF switch.
QF2	Welding voltage selector (coarse setting).
QF3	Welding voltage selector (fine setting).
RS	Shunt, 60 mV / 400 A (optional accessory).

S2	ELP switch – on the cooling water outlet, activates pump M1. Only in machines with water cooler.
SL1	Flow guard (optional accessory; only in machines with water cooler.).
ST1	Thermal switch – overheating protection, in the inductor L1 (NC, 120°C).
ST2	Thermal switch – overheating protection, on the bridge V1 (NC, 120°C).
ST3	Thermal switch – change–over the speed of the fan motor EV1 (NO, 80°C). The switch opens when the machine temperature falls to 60°C.
TC1	Control power supply transformer.
TC2	Transformer for CO2 heater (optional accessory).
TM1	Main transformer.
V1	Diode bridge (3ph.).
V2	Diode bridge (1ph.; ESABMig C420sw/C420s only).
XB1	EURO–Connector, for welding gun connection.
XB2 – XB4	Welding current socket, single—pole (return current wire).
XT1	9 pole/ 3 pole – terminal block (machine with/without water cooler–respectively).
XT2	Auxilary 1 pole connector.
XT3	2 pole terminal block (optional accessory).
XTP	Terminal block for polarity reversing .

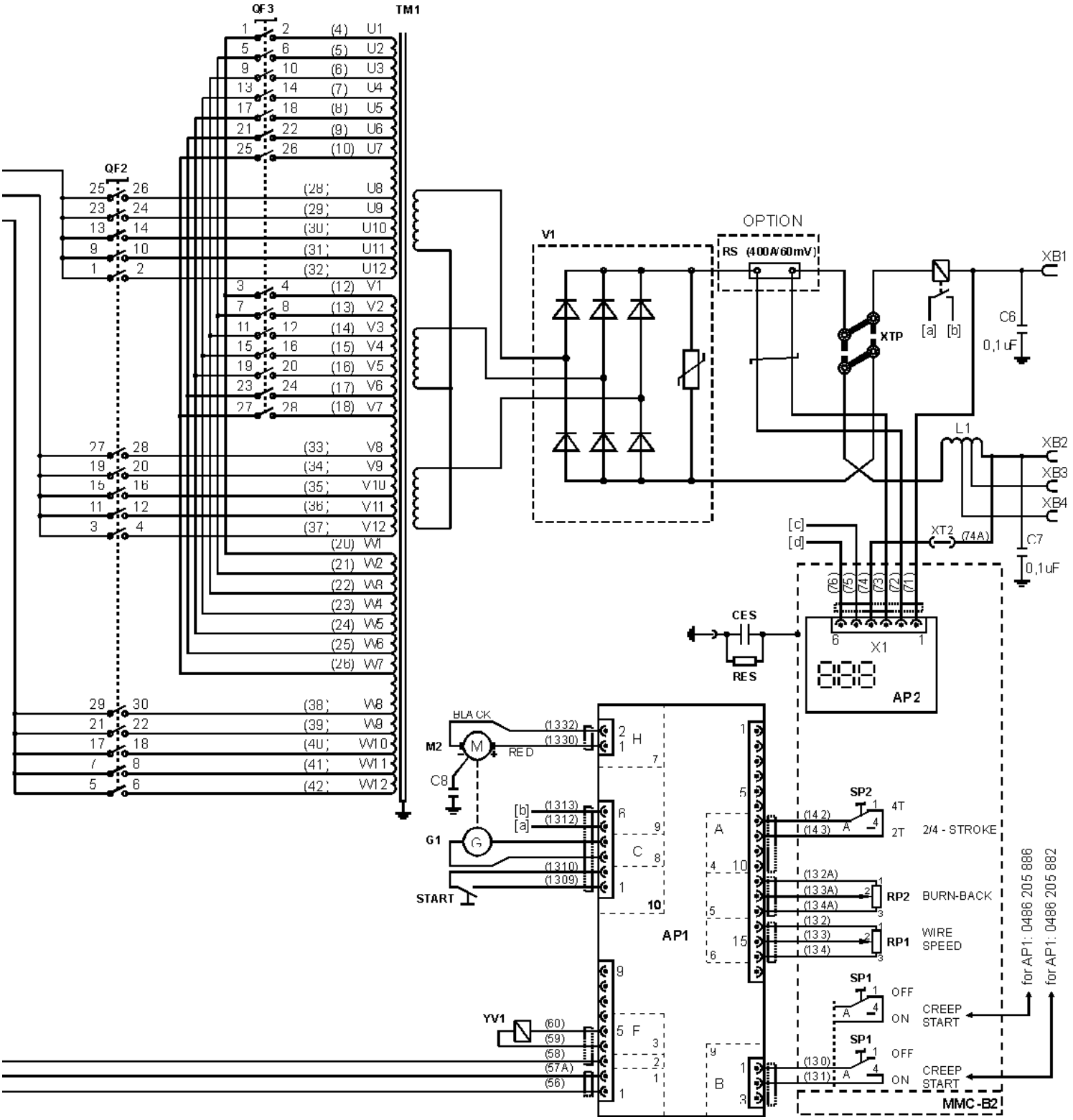
ESABMig C420/C420w



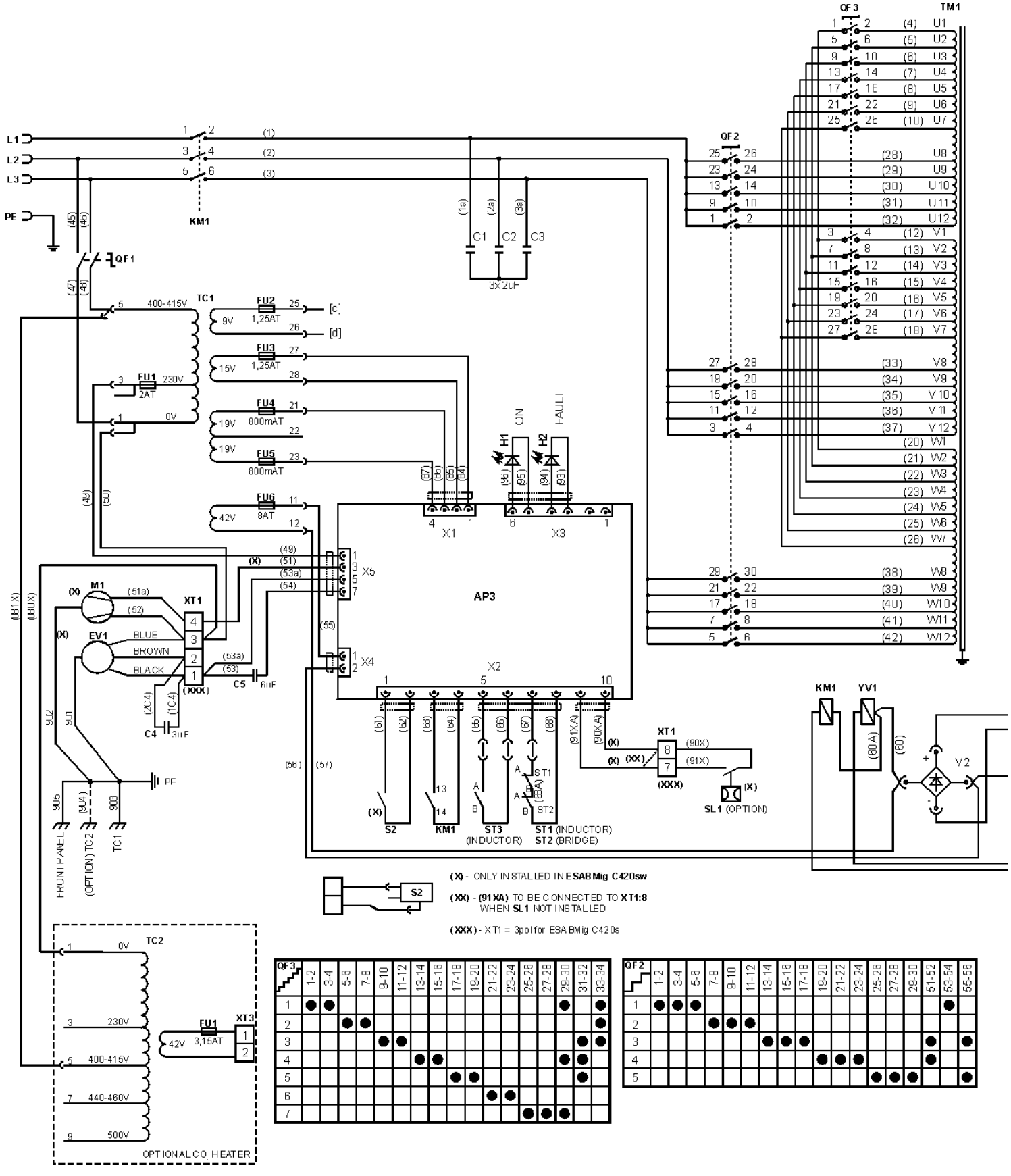
QF3	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28
1	●	●												
2			●	●										
3					●	●								
4							●	●						
5									●	●				
6											●	●		
7													●	●

QF2	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30
1	●	●	●												
2				●	●	●									
3							●	●	●						
4										●	●	●			
5													●	●	●

ESABMig C420/C420w



ESABMig C420s/C420sw



(X) - ONLY INSTALLED IN **ESABMig C420sw**

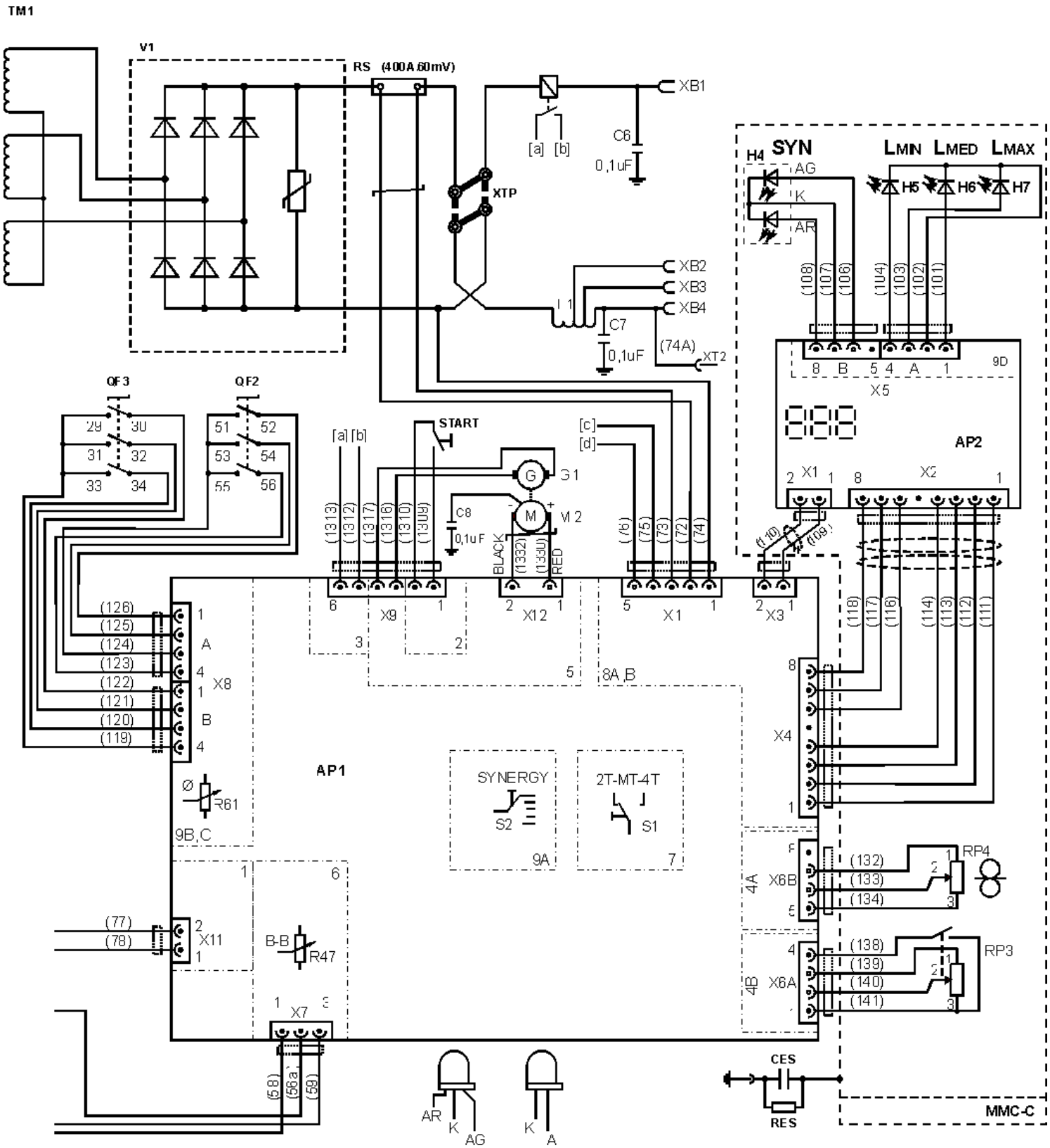
(XX) - **(91XA)** TO BE CONNECTED TO **XT1:8** WHEN **SL1** NOT INSTALLED

(XXX) - XT1 = 3pol for ESABMig C420s

QF3	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34
1	●	●													●		●
2			●	●													●
3					●	●										●	●
4							●	●							●	●	
5									●	●						●	
6											●	●					
7													●	●	●		

QF2	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30	51-52	53-54	55-56
1	●	●	●														●	
2				●	●	●												
3							●	●	●							●		●
4										●	●	●				●		
5													●	●	●			●

ESABMig C420s/C420sw



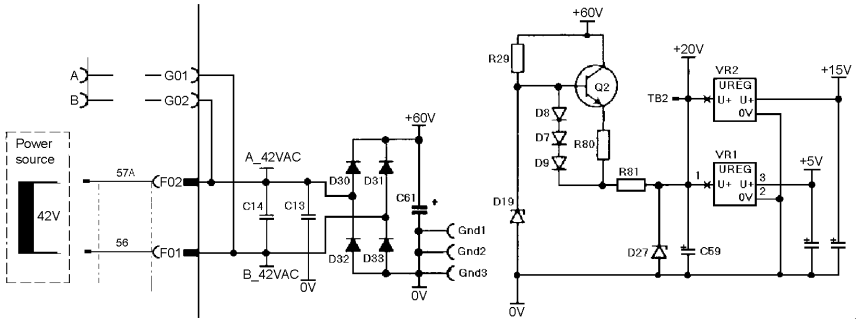
DESCRIPTION OF OPERATION

This description of operation 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.

AP1 Control board (for C420w/C420)

Note: AP1 – 0486 205 882 only for machines manufactured till May 2003
AP1 – 0486 205 886 only for machines manufactured after May 2003

AP1:1 Power supply

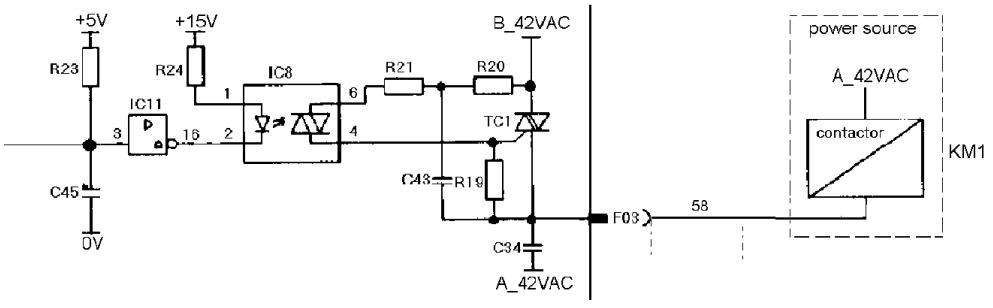


The wire feed unit receives 42 V from the control power supply transformer in the welding power unit via relay contact on AP3.

42 V AC is supplied to the welding gun trigger switch, the gas valve and the contactor.

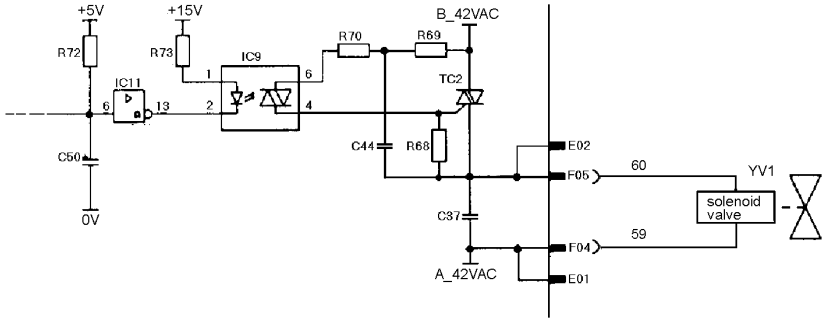
DC power supplies
Diodes D30 – D33 rectify the 42 V supply to 60 V. Capacitor C61 smooths the supply, which is then used to power the wire feeder motor.
Transistor Q2 is a pre–regulator that drops the voltage from 60 V to 20 V. Q2 is current–limited to about 200 mA.
VR1 and VR2 are voltage regulators, producing 5 V and 15 V respectively. The circuit board's microprocessor monitors the voltages. If the 15 V supply falls below 13 V, the wire feed unit is stopped.

AP1:2 Activation, contactor



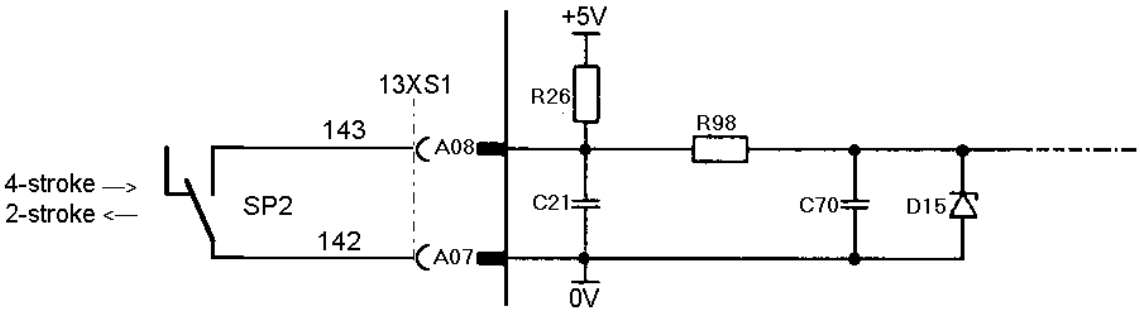
The start signal is connected to contactor KM1.

AP1:3 Activation, gas valve



The gas valve is connected to connectors F04 and F05.

AP1:4 2–stroke / 4–stroke



2–stroke

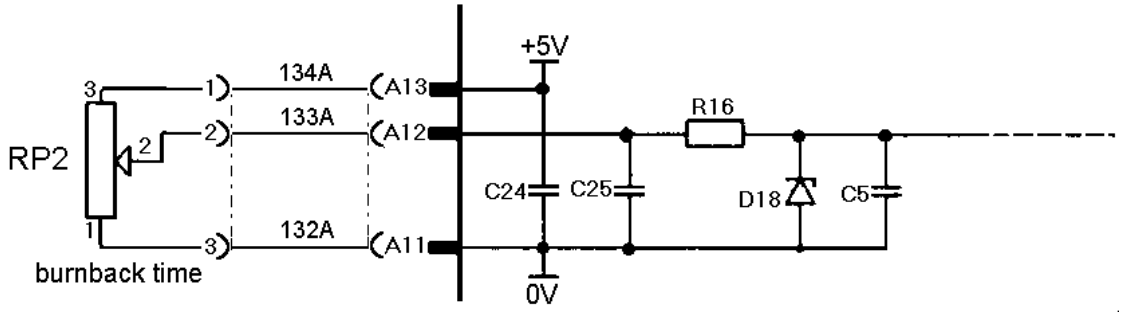
When switch SP2 is open, 2–stroke control mode is selected. This means that closing the welding gun trigger switch starts the wire feed motor, opens the gas valve and closes the power unit contactor.
Releasing the switch stops the motor, releases the contactor and closes the gas valve. If burn–back time is operative, welding ceases after the burn–back time has elapsed.

4–stroke

When switch SP21 is closed, 4–stroke control mode is selected. This means that first closure of the trigger switch operates the gas valve, with the wire feed motor starting, and the power unit contactor operating, when the trigger switch is released.

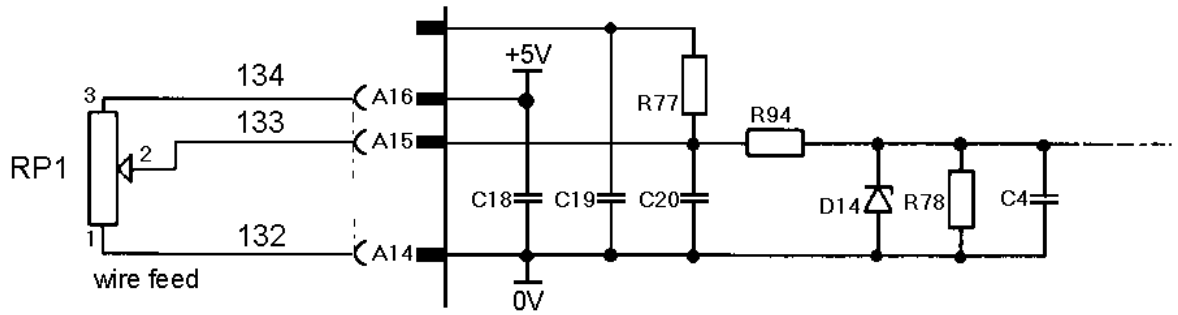
Closing the trigger switch for the second time stops the motor and de–energises the contactor in the power unit. Releasing the switch closes the gas valve. If burn–back time is operative, welding ceases after the burn–back time has elapsed.

AP1:5 Burn–back time



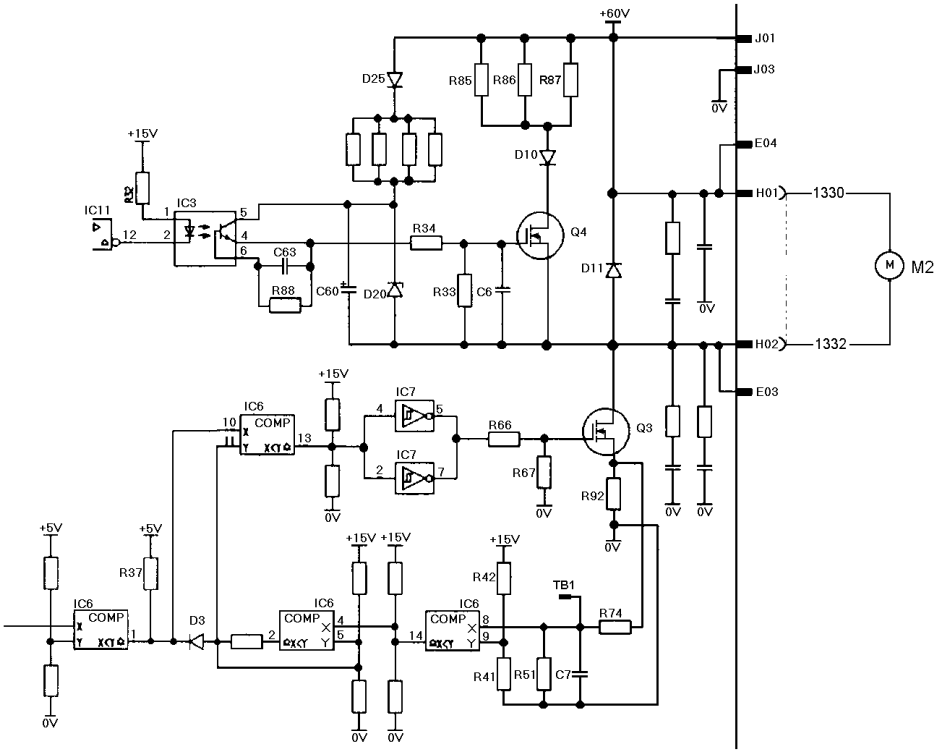
The burn–back time is the time from when motor braking starts until the machine contactor opens. It can be adjusted by potentiometer RP2 between 0 and 0.5 seconds.

AP1:6 Wire feed speed



Potentiometer RP1 controls the wire feed speed over a range from 1.9 to 25 metres/minute.

AP1:7 Motor driving / braking



Driving

The motor is powered by the smoothed +60 V supply. Pulse width modulation, controlled by transistor Q3, is used to vary the motor voltage. The pulse frequency is 12 kHz, and the maximum conducting time of the pulses is 97% of the pulse cycle time. Freewheeling diode D11 maintains motor current during the pulse breaks.

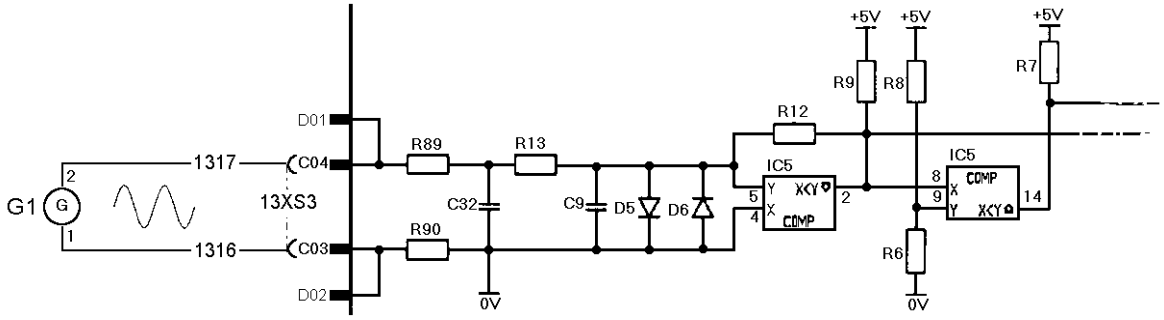
At a drive roller speed of 266 r/min, the wire feed speed is 25 m/min.

The voltage drop across resistor R92 provides a signal that is proportional to the motor current. When the current exceeds 15.4 A, IC6:2 turns off the gate pulse to Q3. When the current drops, Q3 conducts again at the next gate pulse.

Braking

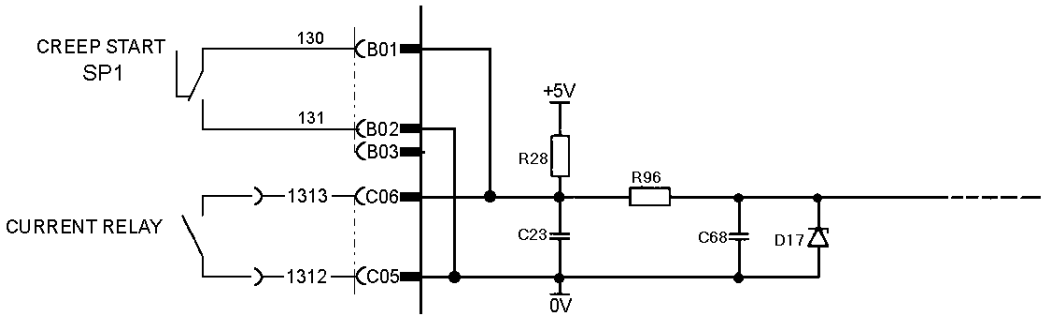
When the motor starts, capacitor C60 charges up to 15 V, with zener diode D20 limiting the voltage across it. Braking is activated by the optocoupler IC3. When the transistor in IC3 is turned on by the LED, 15 V from capacitor C60 is connected to the gate of transistor Q4. Transistor Q4 turns on and short circuits the motor through the resistors R85–R87 (AP1 – 0486 205 886). The resistors limit the braking current to about 20 A.
NB: On AP1 – 0486 205 882 only R86 & R86 are installed.

AP1:8 Tachometer input



The tachometer G1 is fitted inside the motor casing. Comparator IC5;2 converts the sine wave signal from the tachogenerator to a square wave at the same frequency.

AP1:9 Creep start, Current relay



Creep start

The creep start function is activated when switch SP1 is:

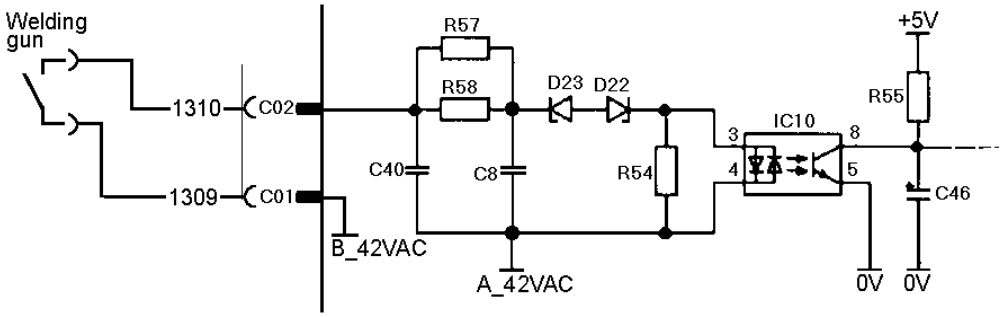
- open (AP1 – 0486 205 886)
- closed (AP1 – 0486 205 882)

Creep start means that the motor runs at a speed of 1.9 m/minute until the current relay is activated. When the relay operates, the speed increases to the set speed. If the current relay has not operated within one second after starting, the motor increases to the set speed.

Current relay

The current relay operates if the welding current exceeds 20 A.

AP1:10 Start / Stop



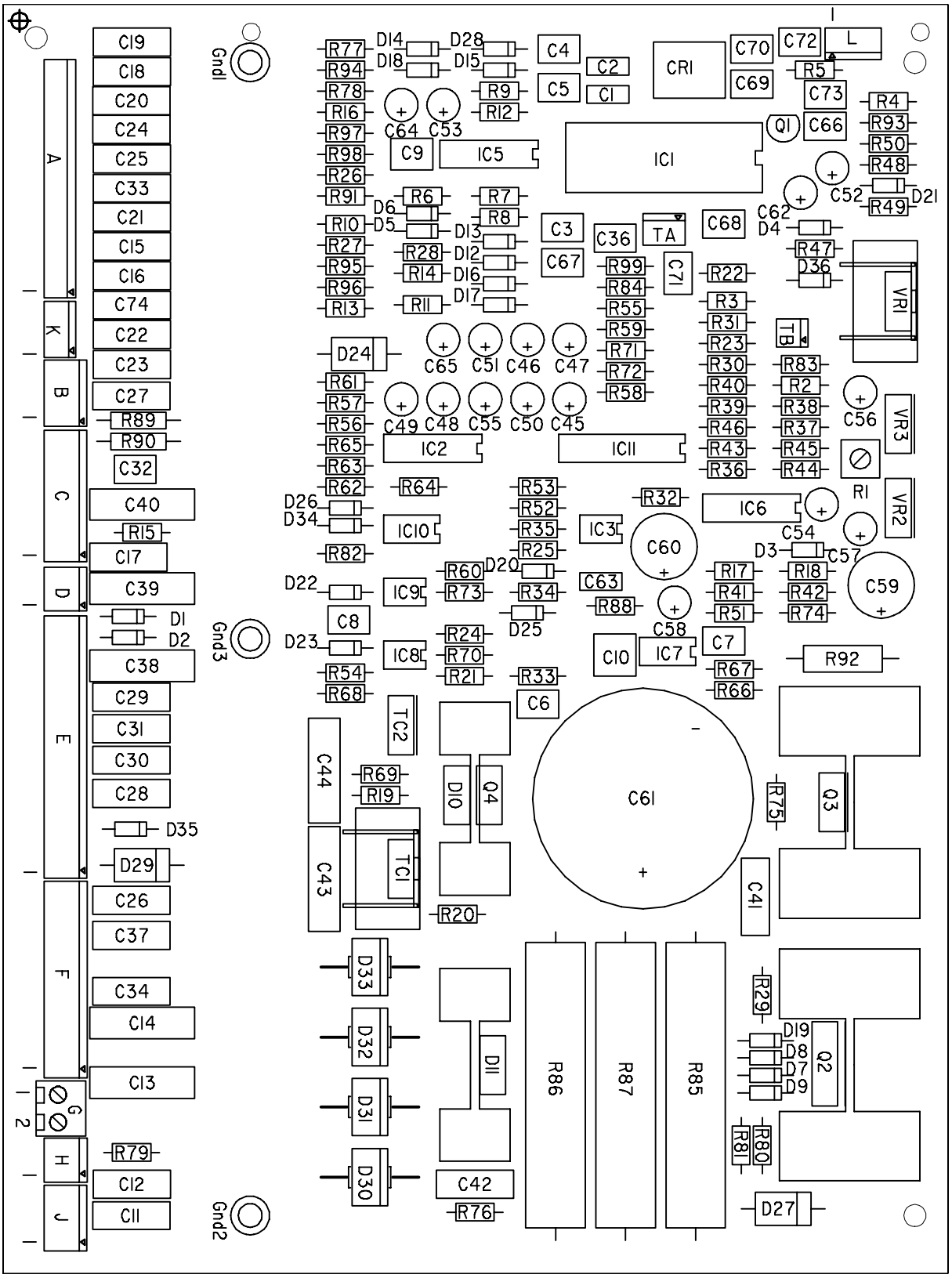
The trigger switch in the welding gun is supplied at 42 V AC. Closing the switch energises optocoupler IC10, pulling down the voltage across C46.

AP1:11 Processor

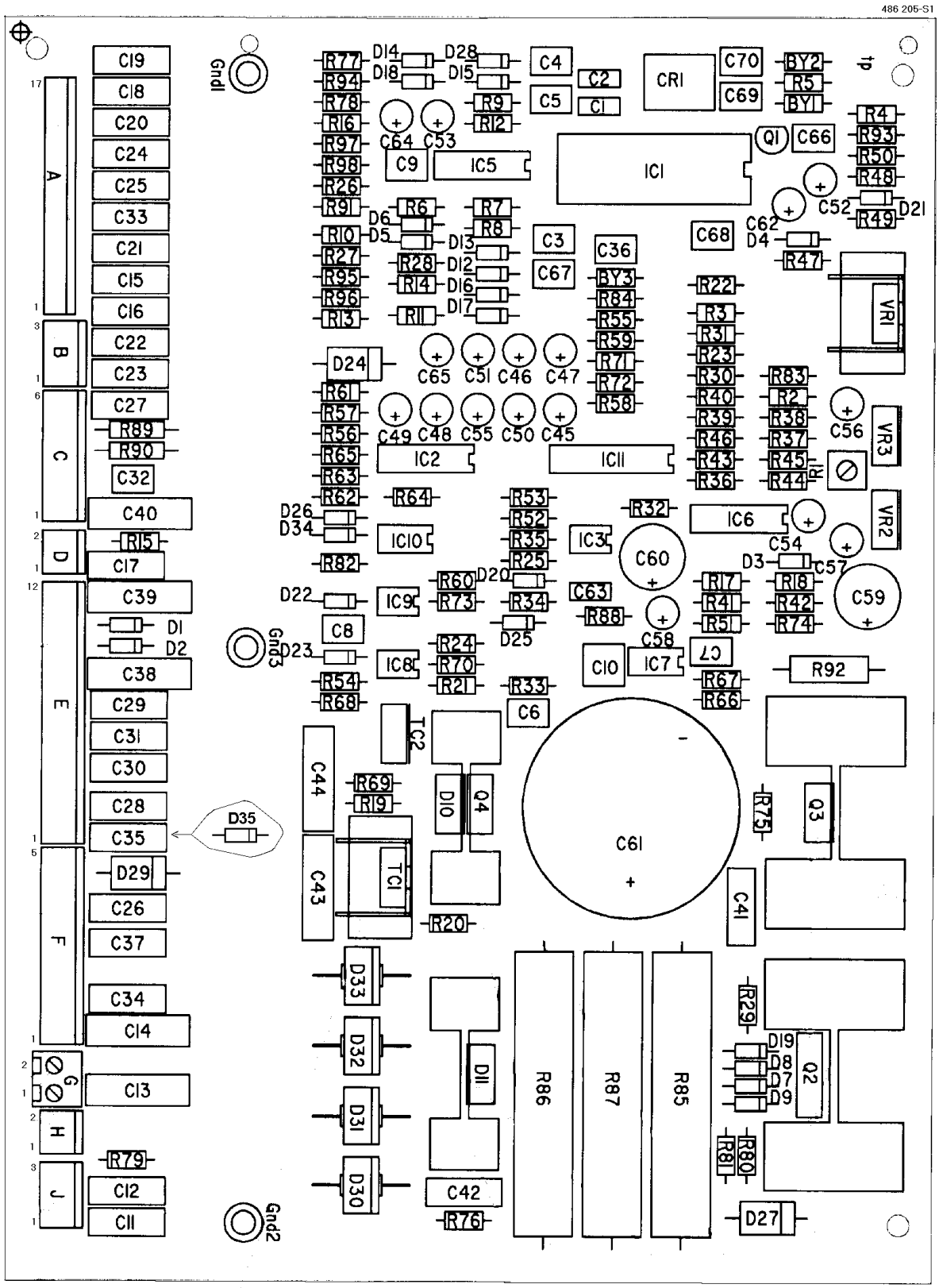
The processor stores the machine program. It monitors the power supply voltages: if the voltages drop to too low a level, wire feed is stopped, as described in section AP1:1 above.

The processor also monitors speed. If the wire speed deviates from the set value by more than 1.5 m/min for more than five seconds, wire feed will be stopped.

AP1 Component positions (0486 205 886)



AP1 Component positions (0486 205 882)



AP2 Digital instrument (option for C420w/C420)

AP2:1 Calibration and voltage correction

The meter has a possibility of the voltage and current calibration, as well as a possibility of the current–dependant voltage correction, to show a voltage approximately equal to the actual arc voltage.

Since all meters are factory calibrated it is recommended to carry out a second calibration only if it's needed. In most applications a zero voltage correction (no correction) is factory adjusted.

For the calibration an accurate reference meter and a resistance load are required. The resistance load should force at least 100A current flow.

For calibration following actions should be done:

1 Switch the machine on and load it. The meter should indicate voltage and current presence.

2 Press simultaneously both pushbuttons placed on the meter PC board. In sequence, symbols of the calibration modes appear: "U" – voltage calibration, "I" – current calibration, "dU" – voltage correction. Release the buttons as the required mode appears.

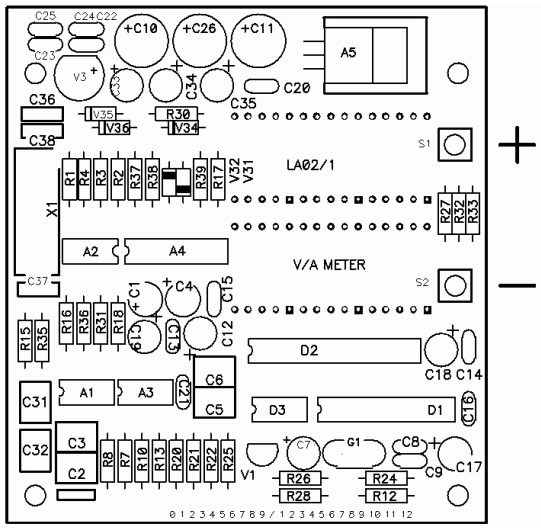
3 Adjust the voltage or the current value equal to the value shown by the reference meter by means of the pushbuttons: S1 – "+", S2 – "–".

Voltage calibration mode

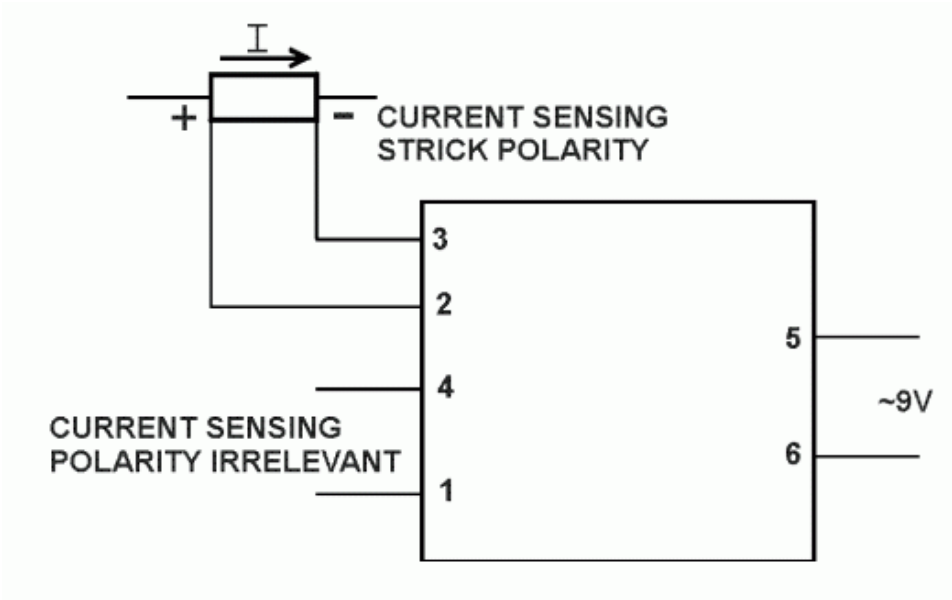
The reference meter should be connected to the same potentials as a calibrated meter. Exclusively in this mode a voltage without correction is shown on display.

Voltage reduction mode

The reference meter should be connected to the end of mass cable and to the torch current tip, which are connected to the external load. In this mode, as well as during the regular work, the meter shows a voltage taking in account voltage drops on cables and welding torch. An adjustment of the voltage correction should be carried out only in assumption of the proper voltage calibration and in the presence of load current above 100A.



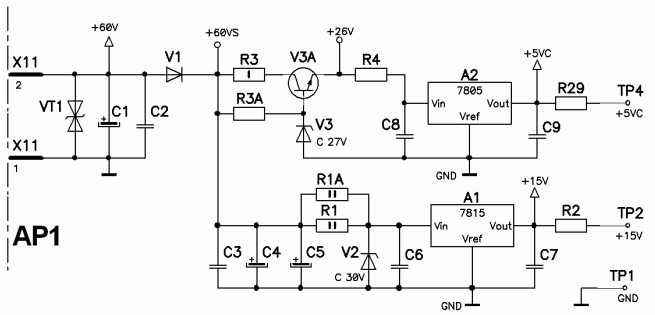
AP2:2 Connections to the digital instrument



AP1 (0349 303 176), AP2 (0349 303 193) control boards (for C420s/C420sw)

AP1:1 Power suply

The circuit board uses one supply voltage: 42VAC (rectified by the bridge V2) for power supply to the motor and control circuitry.



+60VS power supply from diode V1 through R1A, R1 – is regulated to 15V by voltage regulator A1

+60VS from V1 through R3, V3A, R4 is regulated to +5V by voltage regulator A2,

+15V is used for supplying of the motor control electronic

+5V – supplies microprocessor control circuits

+60V/+60VS power supply

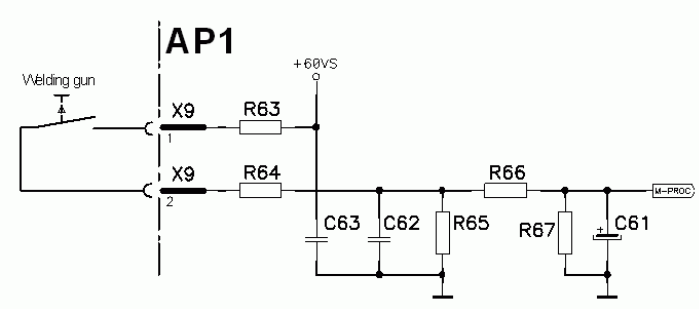
+60V – is used for motor control

+60VS – is used for energizing of some input control circuits (see next sections)

These voltages may vary (with load/mains voltage deviation) – from –15% to +10%.

+26V (intermediate voltage for A2) – also supplies the relays K1 and K2 (on the pcb)

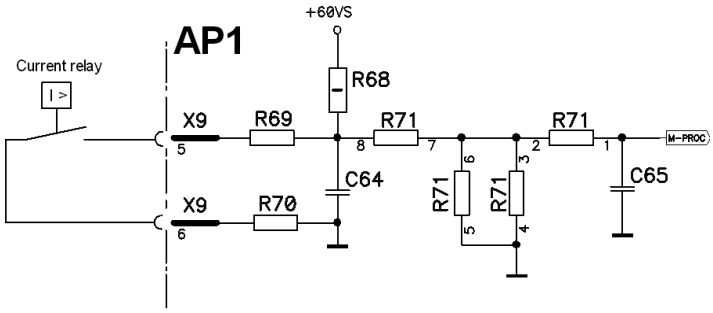
AP1:2 Start / stop



Closing contact on the welding torch starts the welding process – or only motor M2 (motor test/inching/) – depending on control mode selection (see – section 7)

NOTE: When the machine is turned–on while the torch trigger is depressed – operation of the machine is disabled (LED ”17” on the front control panel emits red light).

AP1:3 Welding current detection



Signal from current relay is used for detection of welding current presence – after closing of the torch trigger.

AP1:4 Welding parameter setting

NOTE: 1.In the AP1 diagrams in the next sections – there are shown electronic reference potentials GNDCA and GND (not marked); they are both galvanically connected and accessible at test point TP1.

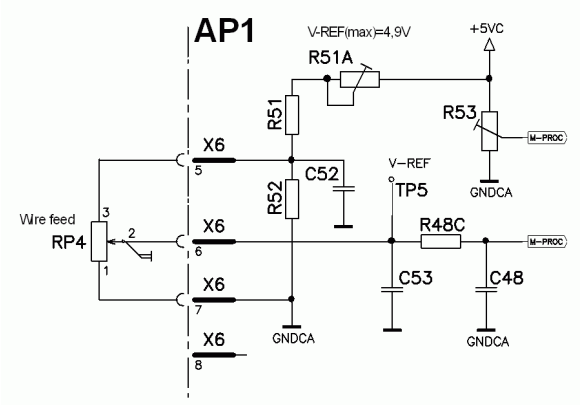
NOTE: Device numbers ”xx” refer to the chapter: ”OPERATION / Connections and control devices”.

A. Wire feed speed / creep start

The wire speed setting range is 1,6 to 25 meter/minute. Speed value is set by the potentiometer RP4 (”12”) in the front control panel (in ”standard control mode”, see sec. 9A) or by the programm stored in the microprocessor (”synergy control mode”).

The upper limit of the speed reference signal may be adjusted by trim–pot. R51A : 4.9V at TP5 (refered to TP1 – when RP4 max – in ”standard mode”) corresponds to 25m/min.
Additional speed reference adjustment is performed by the trim potentiometer R53, it allows to shift upwards the whole speed range within 0 – 0,5m/min – so as to correct especially the minimum speed of wire (Note: this correction is not shown on speed reference display ”14”).

Calibration of the actual motor speed (i.e. matching the speed reference signal) is carried out by the trim potentiometer R7 on the pcb (it may be necessary only when wire feed motor is changed).



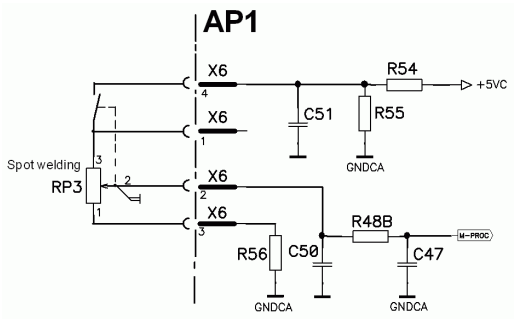
There is built–in ”creep speed” function in the program (ca 60% of work speed, but not less than 1,2m/min), i.e. welding starts with reduced wire speed and when welding current relay picks–up (see, sec.3), the speed rise up to the value pre–set with RP4. Independently of the current relay, after ca 0,77 sec. the speed increases automatically to the work speed.

V–REF voltage is the analog reference signal for motor speed control circuit, the digital reference speed is displayed on the front control panel (display ”14”, lower row with selected ”m/min”).

In ”standard control mode” (Synergy = OFF with switch ”21” in wire feeder compartment) welder may set the wire speed in full range with the potentiometer RP4. When ”synergy control mode” is active (switch ”21” in any position but OFF) signal from RP4 serves only as correcting value within +/–20% of preset in microprocessor program speed value.

Note: That correction is counted from the middle point of RP4.

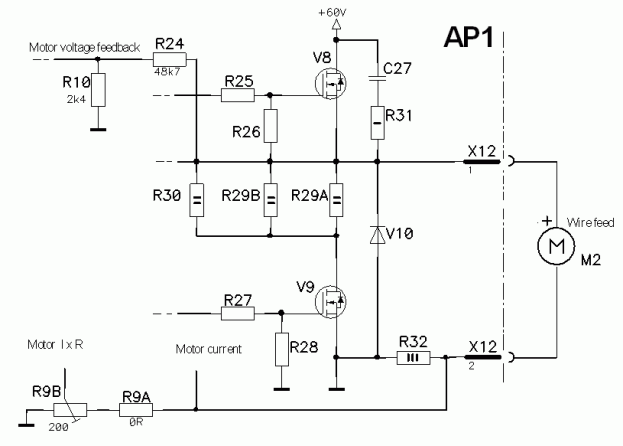
B. Spot welding setting



Turning right the potentiometer with switch RP3 in the front panel (”13”) welder may select the function ”spot welding”, i.e. time controled welding process. RP3 allows to adjust the process duration within 0.5 – 4.5 sec.

Normal welding is selected – when RP3 is set in the utmost left position.

AP1:5 Motor driving / braking



Driving

The motor is powered by the smoothed +60 V supply. Pulse width modulation on transistor V8 controls the motor voltage. The pulse frequency is about 16 kHz, and maximum conduction time of the pulses is about 95% of the pulse cycle time. During the off parts of the pulse cycle, the motor current freewheels through diode V10.

At 42V motor supply voltage, the wire feed roller speed is 258 r/min +/–5%. At a roller speed of 265r/min, the wire feed speed is 25 m/min.

Speed control

The gate pulses for transistor V8 are generated by a PWM circuit, which compares speed reference from microprocessor electronic with signal proportional to the motor voltage (R10, R24).

Current limit

The current limit is set at 13 A. The motor current is measured by resistor R32 which produces a voltage drop proportional to the current (1A = 33mV).

The current limit restricts the conduction time of the gate pulses to transistor V8.

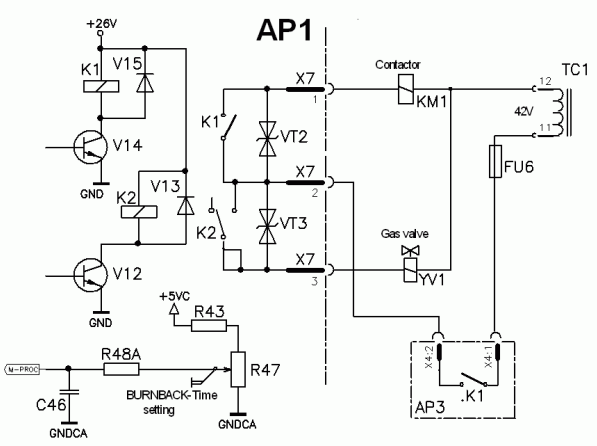
Compensation of motor I x R voltage

Current signal allows to compensate voltage drop on motor armature resistance so as to improve wire transportation at low speed settings (Compensation is adjusted via trim potentiometer R9B, recommended setting is 60 – 80 % of the pot.range).

Braking

Motor braking is activated by the turning on the V9 transistor; braking curent flows thru R29A,R29B,R30, and its maximum value is limited to ca 18A.

AP1:6 Burnback time, contactor, gas valve



Burnback time

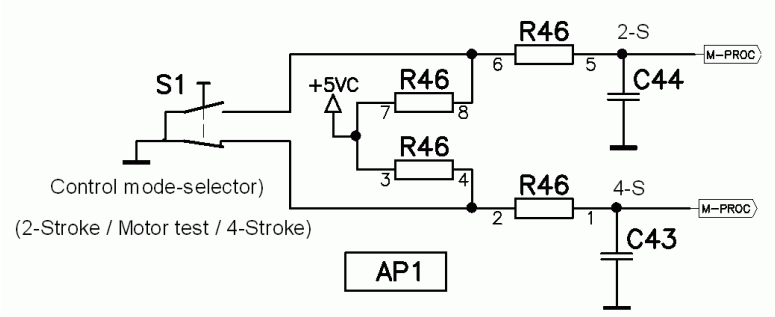
The burnback time is the time from when motor braking starts until the main contactor opens. The burnback time can be adjusted from 0 to 0,35 seconds with potentiometer R47on the pcb (signal to the microprocessor). R47 is located in the auxilary control panel inside wire feed compartment (pos. ”23”).

Activation, contactor and gas valve

Contactor KM1 is switched on by the relay K1, which is controlled by transistor V14.

Gas valve YV1 is controlled by V12 and K2. Valve YV1 opens in advance to the contactor (gas preflow time – 0.27sec) and closes with delay (gas postflow time – 0.4sec)

AP1:7 2–stroke / motor test (inching) / 4–stroke



With switch S1 on AP1 in the motor compartment (item ”24”), welder may select the following control modes:

2–stroke

When the switch on welding gun is pressed, welding process starts (wire feed motor, gas valve and power unit contactor are active). When switch on welding is released, welding process stops (motor is immediately inactive, contactor is inactive when burnback time is elapsed and gas valve is inactive with delay of the postflow time).

Motor test (inching)

When the switch on welding gun is pressed, only wire feed motor starts, gas valve and contactor remain inactive.

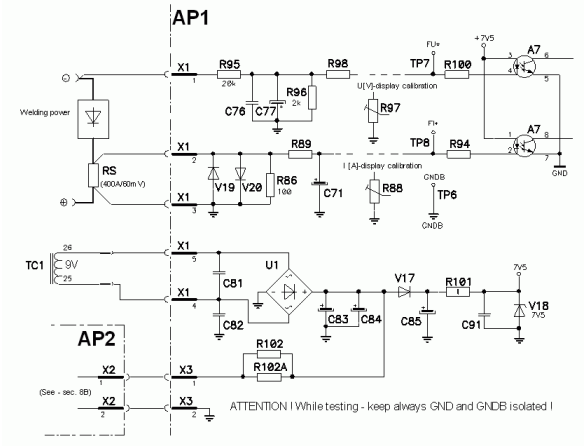
4–stroke

When the switch on welding gun is pressed 1st time, only gas valve is turned on, after releasing the switch welding process starts (motor and contactor are active). Pressing the switch again stops the motor and deactivates the contactor (after burnback time); opening the switch cuts–off the gas flow.

AP1:8, AP2:1 Measuring and displaying of welding parameters

NOTE: All circuits of the U/I measurment part of the AP1 are galvanically isolated from other circuits on AP1, hence the reference potentials: GNDB (test point TP7) connected with welding power circuit, and GND/GNDCA (test point TP1) MUST be kept separated!

U/I measurement inputs

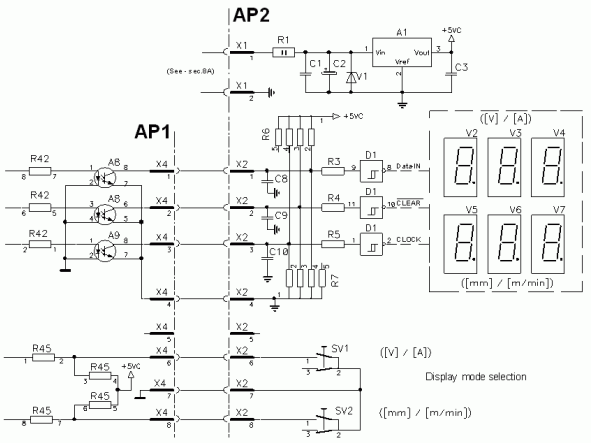


Negative voltage (maximum 60V!) and positive 60mV shunt signal are applied to the AP1. Those signals are converted into pulse–frequency signals (FU* and FI* respectively) that are processed in microprocessor.

- FU* – frequency is 6,4 kHz for – 40V input (adj. by R97)
- FI* – frequency is 6,4 kHz for +60mV / 400A / input (adj. by R88)

NOTE: signals on TP7 and TP8 are referred to TP6!

Parameters displaying and display mode selection



ESABMig C420s/C420sw is equipped with 2–row display, located on AP2, which includes 2 selectors for choosing of displayed parameters (items ”14”,”15”,”16”)

With SV1 (switch ”15”) [V] or [A] display is selected (open contact correspondents to [A]).

With SV2 (switch ”16”) recommended thickness of welded material [mm] or reference wire speed [m/min] is selected for displaying (open contact corresponds to [m/min]).

Display ”14” on AP2 operates in 3 modes:

- Before start of welding (bright indicators), expected values of V or A (only in ”synergy mode”), and recommended material thickness or wire speed reference are displayed.
- During welding (bright indicators), actual values of V or A are displayed.
- After stop of welding (dimmed indicators), memorised values of V and A are displayed (”HOLD”– function)

AP1:9 Synergy control presets and indications

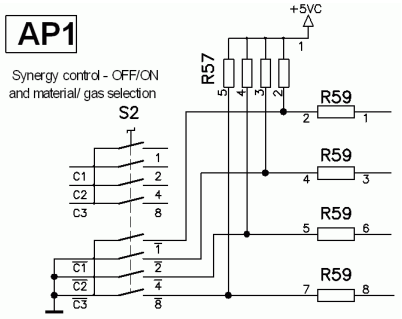
Synergy ON/OFF and material / gas selection

10–position selector S2 on AP1 (item ”21” in wire feeder compartment) serves for selection of control mode:

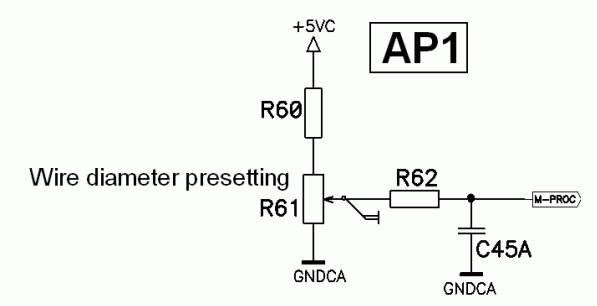
1st position,”STANDARD control mode”, i.e. SYNERGY is OFF”

remaining positions correspond to ”SYNERGY control mode”, for presetting of different sets of electrode material and shield gases

NOTE: S2 output is BCD–coded



Wire diameter presetting



Presetting of wire electrode diameter is performed with the potentiometer R61 on AP1 (item ”22” in feeder compartment).

Welding voltage selection

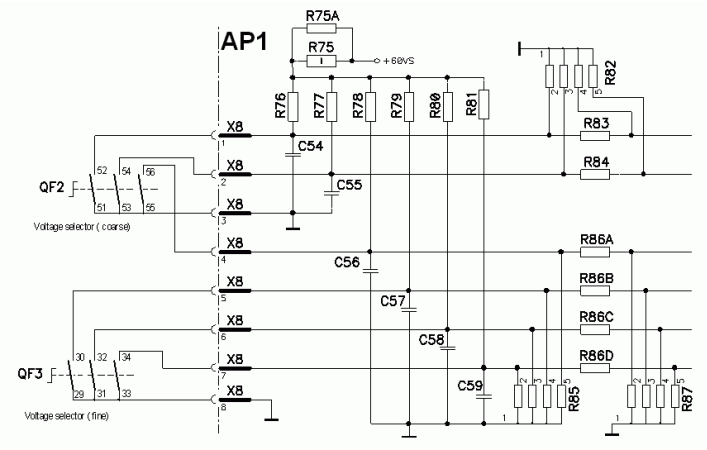
Welder may select required value of welding voltage with switch QF2 (coarse setting) and QF3 (fine setting). Each position of the voltage selectors is identified by microprocessor so as to determine optimum welding parameter.

In ”standard control mode”, there are no restrictions for voltage selection, i.e. it is possible to weld with any selected parameters (see NOTE1 below).

In ”synergy control mode”, depending on the preset wire diameter and material/gas, operation is enabled only for optimum values of voltage (LED ”17” in the front panel lights green and all indications are active, otherwise ”17” is red, other indications are inactive and operation is disabled).

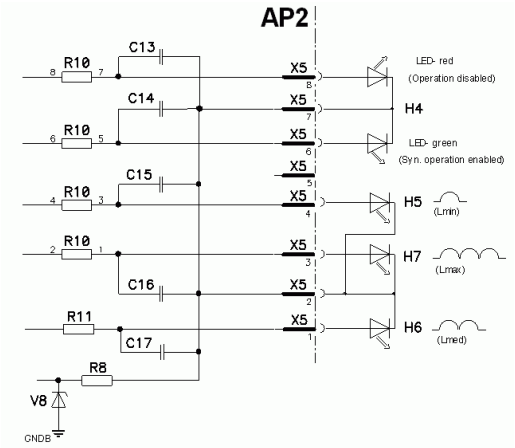
NOTE1: Independently on the selected control mode, operation of the machine is disabled (LED ”17” in red) in following cases:

- any of the selectors QF2, QF3 is operated during welding process
- mains voltage deviation from 400V is more then +/– 15%



NOTE2: In above diagram are shown contacts of the selectors QF2 and QF3 for 400V machine version,for another machine versions, contact designation may differ from those above! (refer to the relevant wiring diagrams in order to identify actual connection).

Indication of synergy control status



Depending on parameter presets made by welder (voltage, material/gas, wire diameter), microprocessor determines and displays necessary data and signals.

When the combination of the presets is incorrect or prohibited, red LED H4 (”17”) warns the operator and all control function are disabled. (See also – NOTE in section 2 and NOTE1 in section 9C)

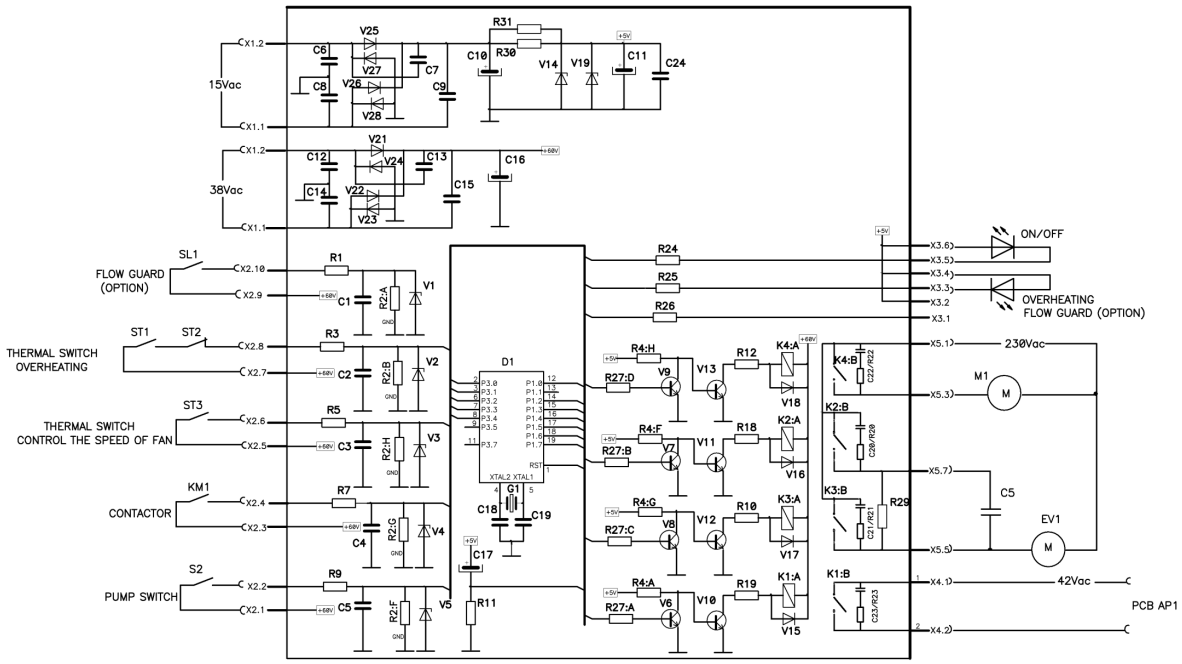
When all presets are optimal (correct), green LED H4 (”17”) informs that welding is enabled.

When welding functions are enabled, there are displayed expected welding parameters (see section 8B) and also relevant green LED H5, H6 or H7 (”18”) indicates recommended inductance output for the return cable (Lmin, Lmed; Lmax).

AP3 Control board

Control board AP3 switches on and off. the fan, pump and supply voltage for AP1.
Signal levels:

- inputs: 60V dc
- ouputs: relays 16A/250V + indicating LED diodes.



AP3:1 Start

When switched on, indicating lamps are tested for 2 seconds. Normally, if the machine is not overheated, it should start to work in idle mode, which is indicated by blinking of the supply–ON lamp. The fan and the coolant pump are stopped.The fan starts from the first start of welding. The coolant pump starts at the same moment, if it is switched on by means of the ELP switch located on the water outlet to the welding gun.

AP3:2 Overheating protection

The power source includes 2–step control of the fan speed and overheating protection. If temperature crosses the threshold point, the fan starts to operate with increased speed. If the internal temperature becomes too high, the supply of the PCB – AP1 is cut–off – disabling operation of the machine. This state is indicated by permanent lighting of the orange indicating lamp on the front of the unit. AP1 supply restores automatically when the temperature falls down. The thermal overload cutout ST1 is fitted in the inductor winding L1, it opens at temperature of 120 ºC. ST2 is located on the heatsink of the V1 rectifier and opens at 120 ºC. NC–contacts of the ST1 and ST2 are connected in series – activating thermal overload alarm. Thermal switch ST3 is also located in the L1 winding, its NO–contact at 80 ºC turns–over the fan speed.

AP3:3 Water connection

The ESABMig C420w has a sensor **ELP, ESAB L**ogic **P**ump, which senses whether the water hoses of the welding gun are connected. When a water–cooled welding gun is connected, the water pump is activated by means of control board AP3.

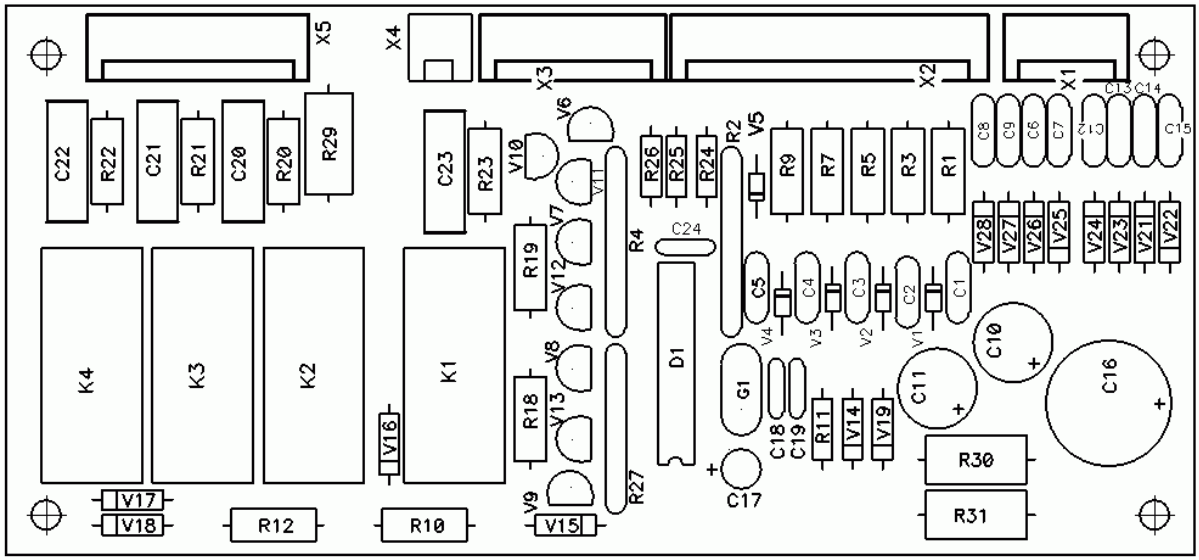
AP3:4 Water flow guard (ESABMig C420w – optionally)

The water flow guard interrupts and disables the welding in the event of loss of coolant. This state is indicated by blinking of the orange indicating lamp on the front of the power source. If there is a lack a coolant flow, after 1 min the pump is switched off and latched in this state. The pump restarts from this state along with starting of welding.

AP3:5 Idle mode

When long inactivity of the machine – the control board AP3 turns the machine to the idle mode. The fun is switched off 5 min after the last welding or after 5 min of work with decreased speed without welding. The pump is switched off 3 min after the last welding. When both fan and pump are switched off the power–supply lamp on the front panel is blinking.

AP3 Component positions



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.

INSTRUCTIONS

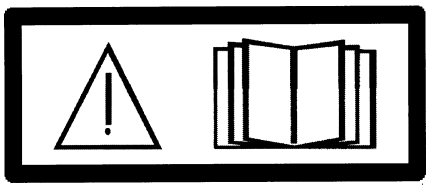
This chapter is an extract from the instructions for ESABMig C420w/C420 and ESABMig C420sw/C420s

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 unauthorised 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 draughts
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 extinquishing 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.

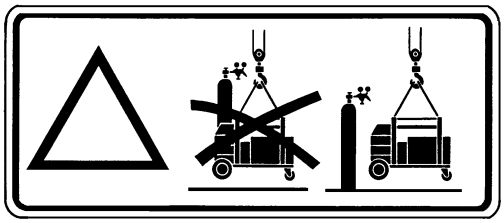
INSTALLATION

WARNING!

This product is intended for industrial use. In a domestic environment this product may cause radio interference. It is the user's responsibility to take adequate precautions.

Lifting instructions

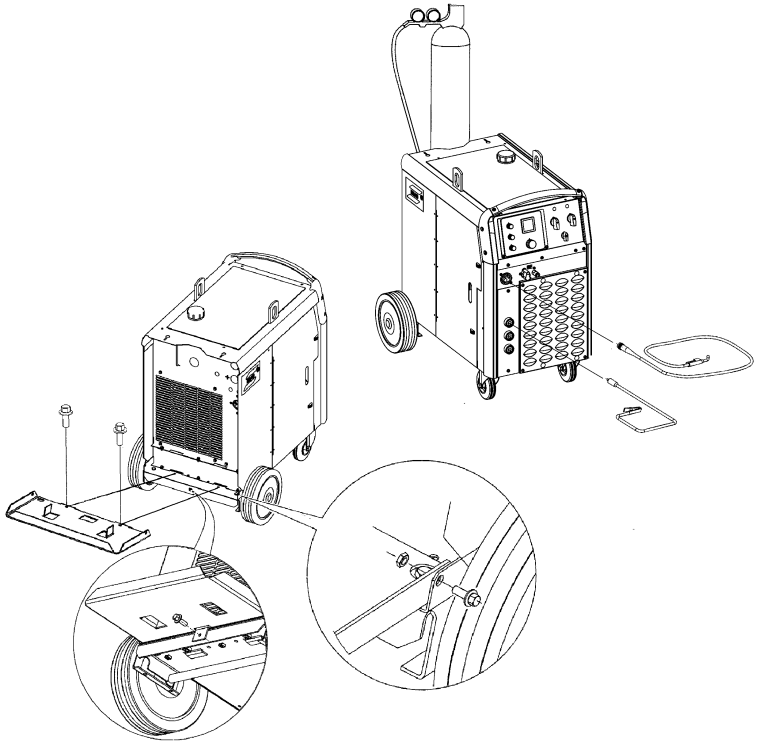
The power supply should be lifted by means of its lifting eye. The handle is only intended for pulling it along the ground.



Placing

Position the welding power source so that its cooling air inlets and outlets are not obstructed.

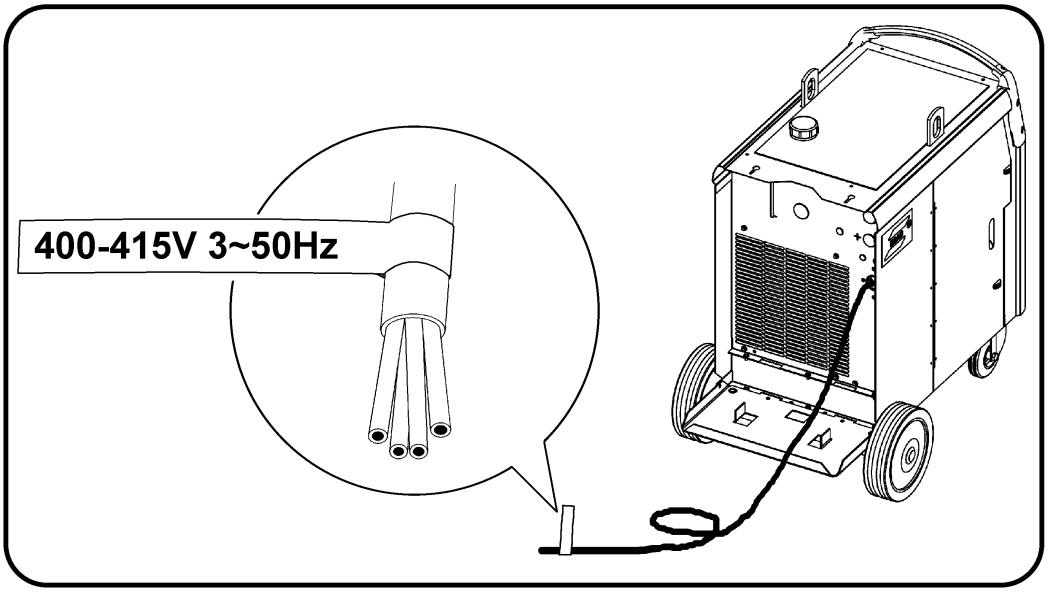
Assembly of components



WARNING!

During transport, the rear wheels of the power source are in their forward position.
Before use, place the wheels in their rear position.

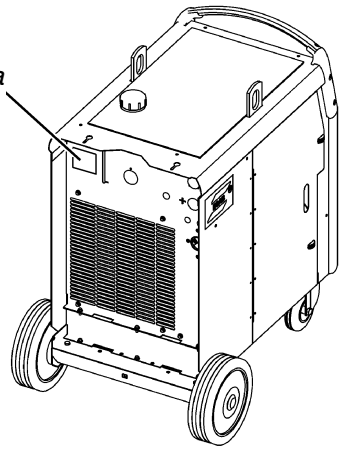
Electrical installation



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 size. A protective earth connection must be made, in accordance with regulations.

Rating plate with supply connection data



ESABMig C420w/C420sw	**3~ 50/60 Hz**
Voltage V	400/415
Current A	
at100% duty cycle	19
at 60% duty cycle	27
at 50% duty cycle	30
Cable area mm^2	4 x 4
Fuse, slow A	25

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.*

OPERATION

General safety regulations for the handling of the equipment can be found on page 33. Read through before you start using the equipment!

WARNING!

Rotating parts can cause injury, take great care.

WARNING – TIPPING RISK!

There is a risk of tipping while transportation and operation, if the welding machine leans more than 10°. In that case appropriate securing has to be provided !

CONNECTIONS AND CONTROL DEVICES

ESABMig C420w/C420

1 Mains supply switch

2 Switch, coarse control

3 Switch, precise control

4 Indicating lamp, power supply ON

5 Orange indicating lamp, overheating and loss of coolant*

6 EURO – connector (for welding gun)

7 Connection for cooling water to the welding gun (Blue – with ELP** switch)

8 Connection for cooling water from the welding gun (Red)

9 Connection for return cable (–), high inductance

10 Connection for return cable (–), medium inductance

11 Connection for return cable (–), low inductance

12 Knob for wire speed setting

13 Knob for selecting 2/4–stroke control mode

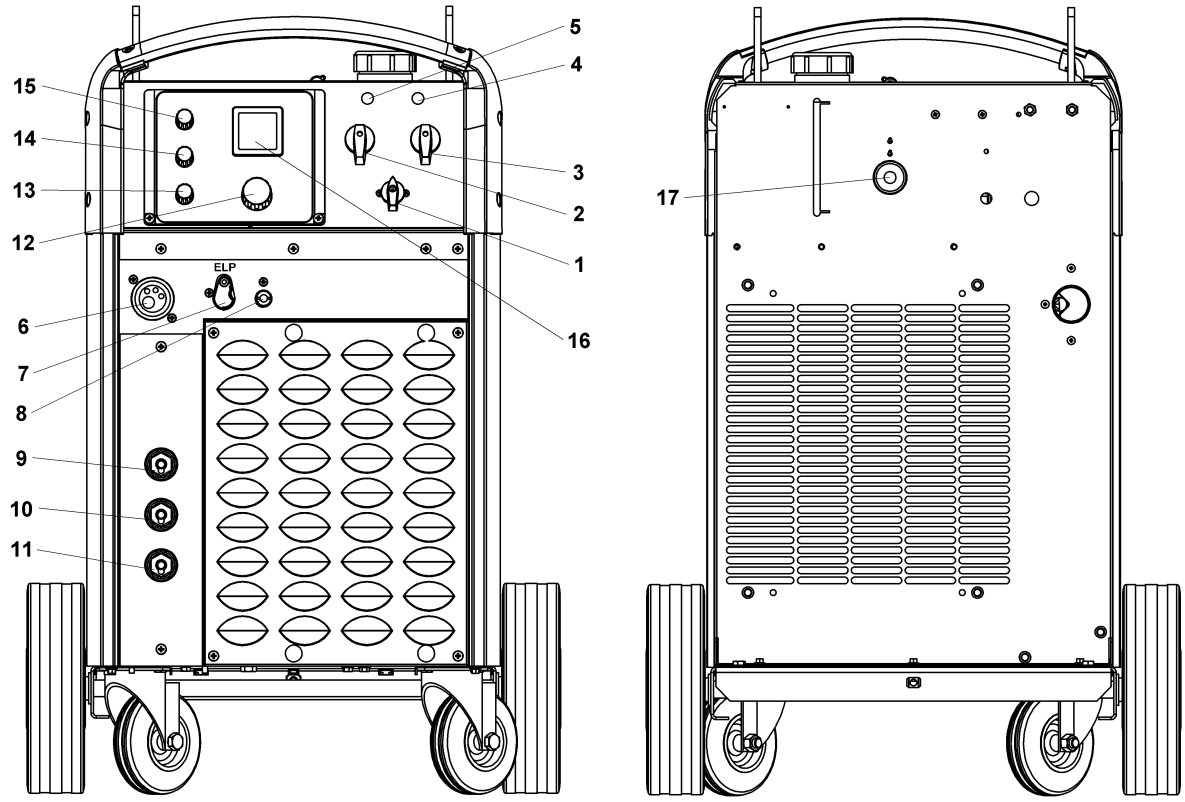
14 Knob for selecting – creep start – ON/OFF

15 Knob for burn–back time setting

16 Digital instrument – V / A

17 Water flow guard

* Indicating loss of coolant, only when water flow guard is used
** ELP = ESAB Logic Pump



ESABMig C420sw/C420s

1 Mains supply switch

2 Switch, coarse control

3 Switch, precise control

4 Indicating lamp, power supply ON

5 Orange indicating lamp, overheating and loss of coolant*

6 EURO – connector (for welding gun)

7 Connection for cooling water to the welding gun (Blue – with ELP** switch)

8 Connection for cooling water from the welding gun (Red)

9 Connection for return cable (–), high inductance

10 Connection for return cable (–), medium inductance

11 Connection for return cable (–), low inductance

12 Knob for wire speed setting / correction

13 Knob for spot welding – ON/OFF and time setting

14 Digital display for welding parameters

15 Switch for display selection – Volt. or Amp

16 Switch for display selection – m/min or mm

17 Lamp indicating status of synergy control

18 Lamps indicating recommended (–) current output – max/med/min inductance

19 Switch for ”Synergy”– ON/OFF and material/gas selection

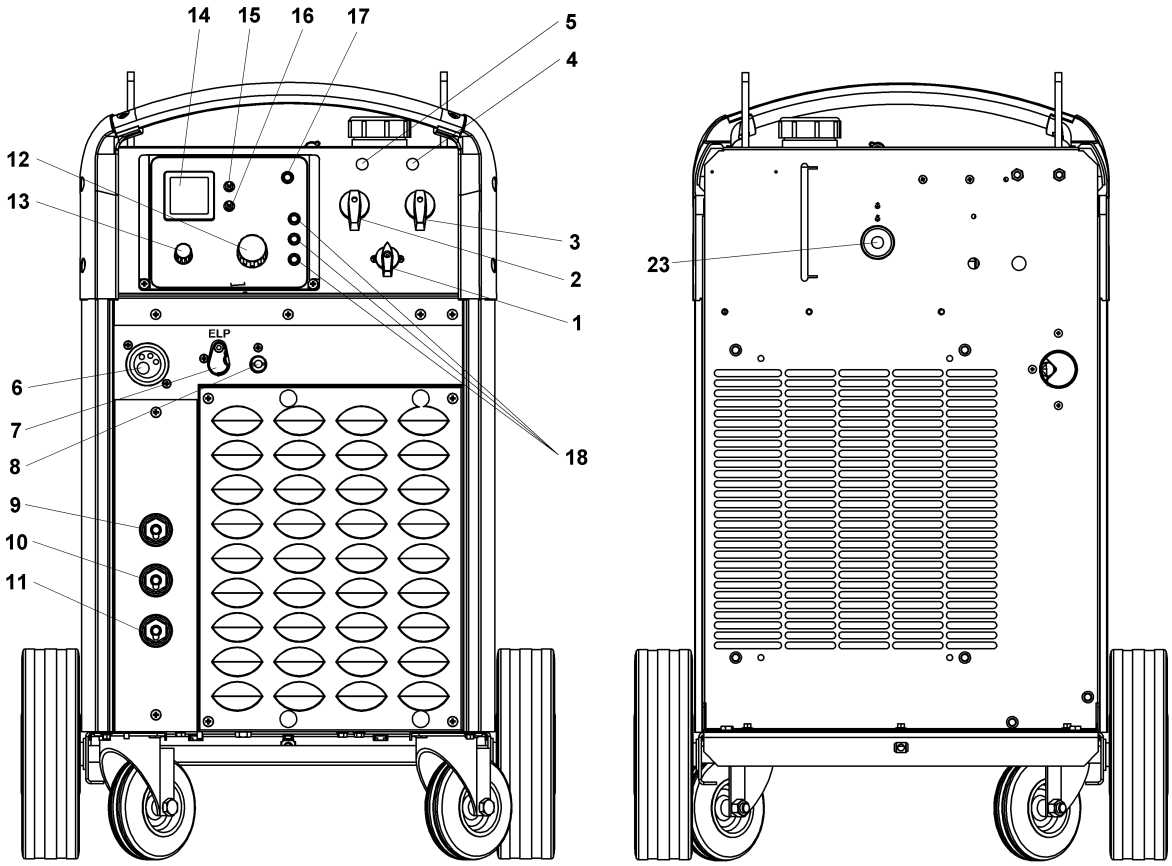
20 Knob for selection of the wire diameter

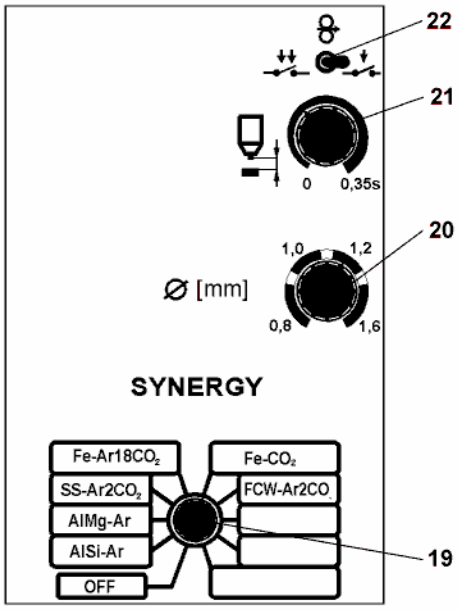
21 Knob for burn–back time setting

22 Mode selector 2–stroke / motor test / 4–stroke

23 Water flow guard

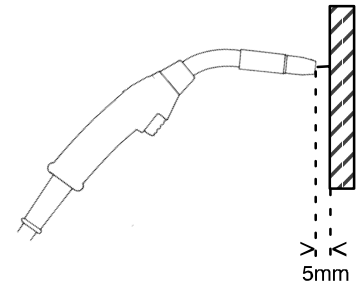
* Indicating loss of coolant, only when water flow guard is used
** ELP = ESAB Logic Pump


14
15
16
17
5
4
12
13
3
2
1
ELP
6
7
8
18
9
10
11
23


22
21
0
0,35s
20
1,0
1,2
Ø [mm]
0,8
1,6
SYNERGY
Fe-Ar18CO2
Fe-CO2
SS-Ar2CO2
FCW-Ar2CO
AlMg-Ar
AlSi-Ar
OFF
19

Setting the wire feed pressure

Start by making sure that the wire moves smoothly through the wire guide. Then set the pressure of the wire feeder's pressure rollers. It is important that the pressure is not too great.



cmek0p10

Fig 1

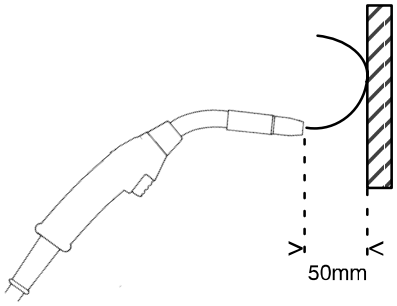


Fig 2

To check that the feed pressure is set correctly, you can feed out the wire against an insulated object, e.g. a piece of wood.

When you hold the welding gun approx. 5 mm from the piece of wood (fig. 1) the feed rollers should slip. If you hold the welding gun approx. 50 mm from the piece of wood, the wire should be fed out and bend (fig. 2).

FUNCTIONS EXPLANATION

Start

When switched on, indicating lamps [4,5] are on for 2 seconds. Normally, if the machine is not overheated, it should start to work in idle mode, which is indicated by blinking of the supply ON lamp. The fan and the coolant pump are stopped. The fan starts at the first start of welding. The coolant pump starts at the same moment, if it is switched on with ELP switch on the water outlet [7].

Overheating protection

The power source has 2–step control of fan speed and overheating protection. If temperature crosses the threshold point, the fan starts to run with increased speed. If the internal temperature becomes too high, the welding is interrupted and disabled. This state is indicated by permanent lighting of the orange indicating lamp on the front of the unit. It resets automatically when the temperature falls down.

Water connection

The ESABMig C420w/C420sw have a sensor ELP, ESAB Logic Pump, which senses whether the water hoses of the welding gun are connected. When a water cooled welding gun is connected, the water pump is active.

It is recommended to switch the power source off by means of the mains switch ON/OFF [1] for connecting the cooling water hoses to/from the ESABMig C420sw/C420w.

Water flow guard

The machines with cooling unit (C420w/C420sw) can be fitted with a water flow guard (option – see page NO TAG).

The water flow guard interrupts and disables the welding in event of loss of coolant. This state is indicated by blinking of the orange indicating lamp on the front of the power source. If there is a lack a coolant flow, after 1 min the pump is switched off and latched in this state. The pump restarts from that state along with start of welding.

Idle mode

The machine has an idle mode. The fan is switched off 5 min after the end of the last welding, or after 5 min of work with decreased speed without welding. The pump is switched off 3 min after the last welding. When both fan and pump are switched off the power supply lamp [4] on the front panel is blinking.

ESABMig C420w/C420

The ESABMig C420w/420 is equipped with standard control unit. Welder can manually select and adjust all welding parameters.

Wire speed (1,9 – 25m/min) is set with knob [12].

The stroke control (2/4 stroke) is selected with switch [13].

Creep start i.e. start with 50% wire speed is toggled ON/OFF with switch [14].

Burn back time is set with knob [15].

The machines C420w/C400 can be fitted with a digital instrument that displays current and voltage. It incorporates a hold function.

ESABMig C420sw/C420s

ESABMig C420sw/420s control unit enables two ways of welding control:

- the standard control (welder can manually select and adjust all welding parameters) – switch “SYNERGY” [19] set to OFF
- the synergy control (partly preprogrammed welding parameters) – switch “SYNERGY” [19] set to any material/gas group

The stroke control (2/4 stroke) or motor inching (only wire feed motor is activated) is selected with switch [22].

Burn back time is adjusted with knob [21].

Spot welding (turning on and time setting 0,5 – 4s) is activated with knob [13].

For machines C420sw/C420s digital instrument is included as standard.

Standard control mode

When standard control mode is selected lamps [17, 18] are off and only a lower row of digital display [14] shows wire speed reference (selector [16] shall be in position ”m/min”).

Operator selects the required voltage [2, 3] and he may set wire speed wthin full range (1,6 – 25m/min) with knob [12].

During welding process the upper row of display shows actual welding voltage or current, depending on selection with switch [15]. When welding process is stopped, displayed values are ”frozen” (dimmed display).

Synergy control mode

In synergy control mode, the operator first has to preselect material/gas [19] and wire diameter [20].

While changing the voltage (with the voltage selectors [2,3]) digital instrument [14] and lamps [17,18] on the front panel show welding parameters.

Synergy status lamp [17] is green (only in synergy mode) when correct welding parameters are set, or red when incorrect or not allowed welding parameters are set (then machine operation is disabled!).

Note: Lamp is also red (in all control modes):

- if during welding (gun trigger pressed) – any voltage selector [2, 3] is operated, then the operation of the machine is disabled immediately until the trigger is released,
- when the gun trigger is pressed while turning on the machine with switch [1].

One of the lamps [18] points at recommended current outlet (–) with appropriate inductance [9,10,11].

Digital display [14] shows values depending on display selectors [15, 16] and machine status.

Before welding start: the upper display shows expected values of welding current [A] or voltage [V] (both only in SYNERGY mode); the lower display shows wire speed reference [m/min] or recommended maximum thickness [mm] of workpiece.

During welding: upper display shows actual welding voltage or current, the lower display – as above.

After welding stop: the upper display shows last memorised (HOLD) values of voltage or current (dimmed display).

Wire speed is set by program (stored in the microprocessor) and the knob [12] shall be set to middle position ”0”. If necessary the operator may correct the preset speed reference with that knob within +/– 20% of the set value.

MAINTENANCE

Regular maintenance is important for safe, reliable operation.

Maintenance must be executed by a professional.
Only those persons who have appropriate electrical knowledge (authorised 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.

Inspection and cleaning

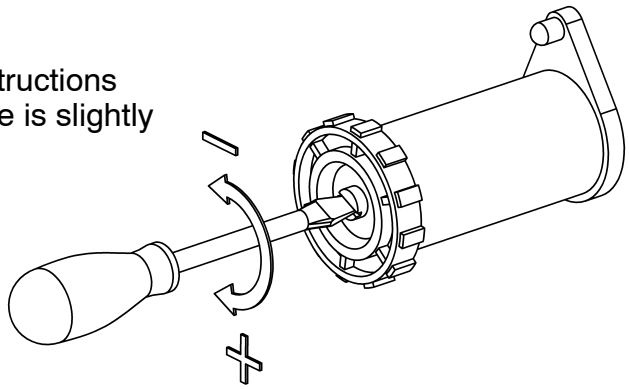
Check regularly that the power source is free from dirt.

The power source should be regularly blown clean using dry compressed air at reduced pressure. More frequently in dirty environments.

Otherwise the air inlet/outlet may become blocked and cause overheating. To avoid this you can use an airfilter.

The brake hub

The hub is adjusted when delivered, if readjustment is required, follow the instructions below. Adjust the brake hub so that wire is slightly slack when wire feed stops.



Welding gun

- Cleaning and replacement of the welding gun's wear parts should take place at regular intervals in order to achieve trouble–free wire feed. Blow the wire guide clean regularly and clean the contact tip.

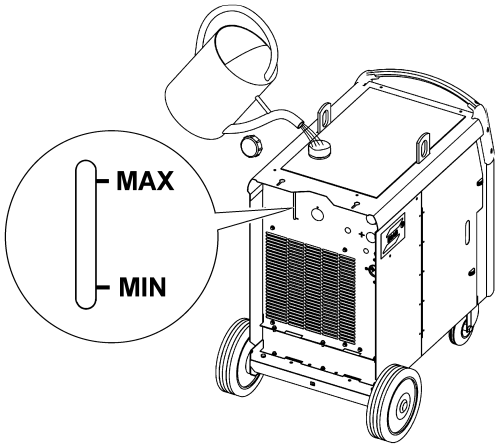
Wire feed unit

Check regularly that the wire feed unit is not clogged with dirt.

- Cleaning and replacement of the wire feed unit mechanism's worn parts should take place at regular intervals in order to achieve trouble–free wire feed. Note that if pre–tensioning is set too hard, this can result in abnormal wear on the pressure roller, feed roller and wire guide.

Topping up the coolant

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



ORDERING OF SPARE PARTS

Spare parts may be ordered through your nearest ESAB dealer, see the last page of this publication.

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