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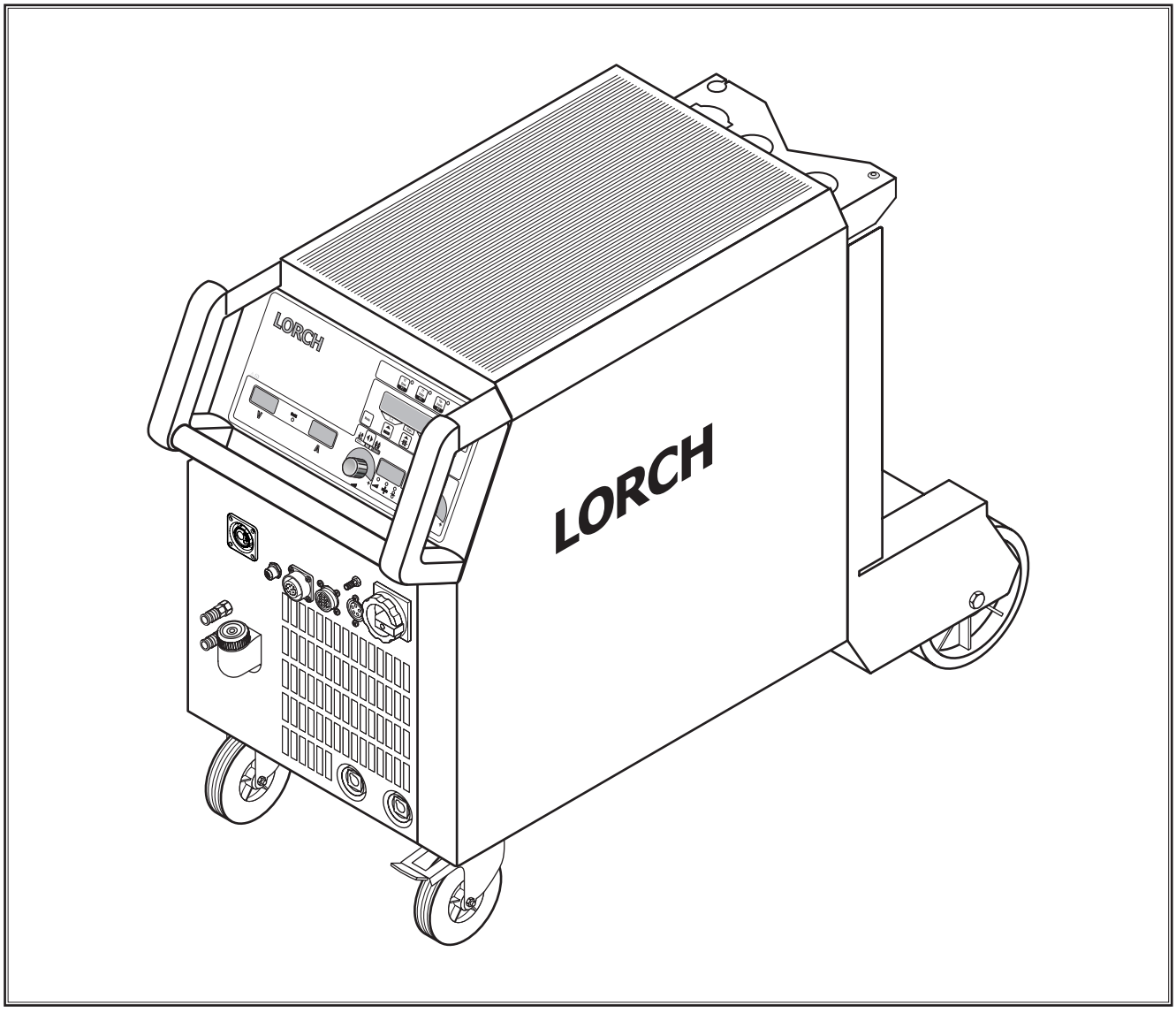
# Service manual
# S-Pulse/S-SpeedPulse XT
# P-Basic/-Synergic XT




909.2710.1-06

**Publisher** LORCH Schweisstechnik GmbH

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**Document number** 909.2710.1-06

**Issue date** 07/29/2020



**Technical changes** Our machines are in a constant state of development, and the right is reserved to make technical changes without notice.

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# 1 Machine elements

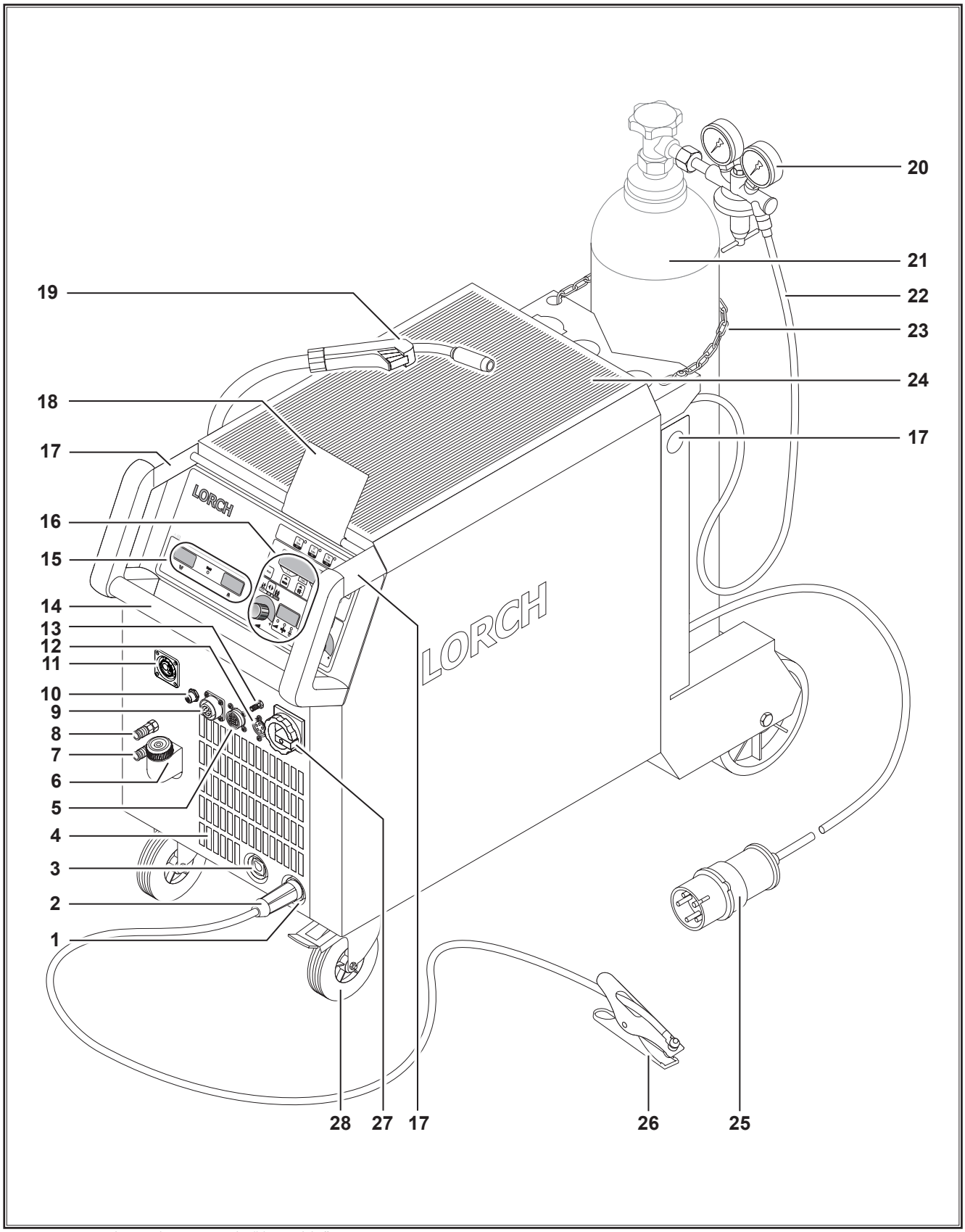



Fig. 1: Machine elements S/P "driveable"

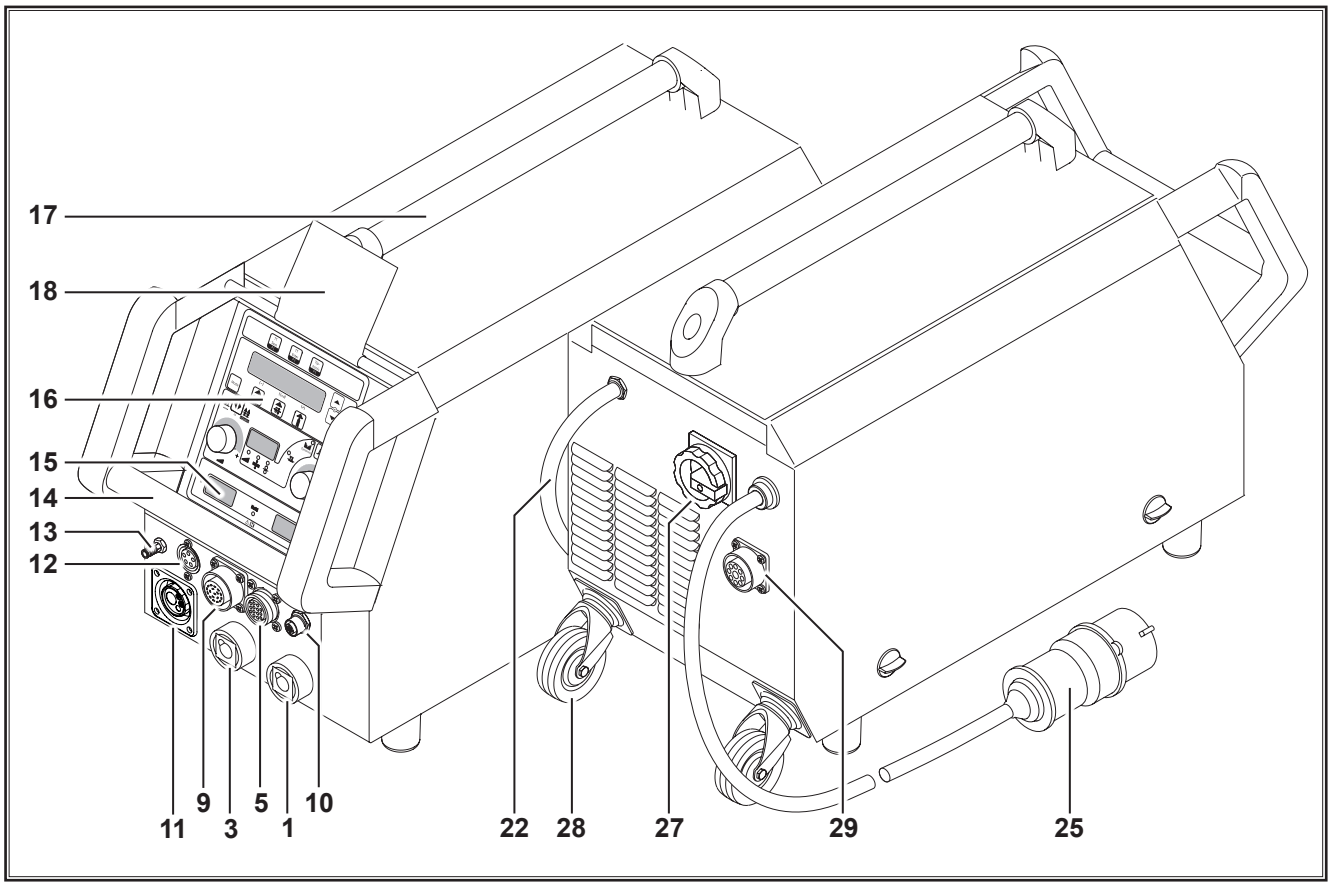



Fig. 2: Machine element S/P mobile

**1** Connection socket ground cable
**2** Ground cable
**3** Connection socket electrode holder
**4** Air intake
**5** Socket remote control (optional)
**6** Coolant filling nozzle (optional)
**7** Coolant return (optional)
**8** Coolant flow (optional)
**9** Torch socket/digital push pull (optional)
**10** LorchNet socket
**11** Central socket
**12** TIG torch socket control line (optional)
**13** TIG torch gas connection (optional)
**14** Hand grip
**15** Display welding current/voltage indicator
**16** Control panel
**17** Hoisting points
**18** Protective cover, operating console (optional)
**19** Torch
**20** Pressure reducer
**21** Gas bottle [1)]

[1)] Accessories

**22** Gas hose
**23** Chain
**24** Tray area
**25** Mains plug
**26** Ground clamp
**27** Main switch
**28** Transport rollers
**29** Socket for WUK 5 cooling system

Some depicted or described accessories are not included in the scope of delivery. Subject to change.

# 2 Safety precautions

## 2.1 Requirement

Use and maintenance of welding and cutting machines can be dangerous. Please draw user´s attention to follow the safety precautions to avoid injuries. Welding and cutting machines must be used appropriately and only by qualified/trained staff. Please follow safetyregulations and use safety precautions in order to prevent accident when working with these machines.

Only qualified workers who are knowledgeabel and have been trained to work safely with test instruments and equipment on energized circuits shall be permitted to perform testing work on electrical circuits or equipment were there is danger of injury from accidental contact with energized parts or improper use of the test instruments and equipment.

Use only original spare parts

Replace any components that are not in perfect condition immediately.

Carry out the safety inspection after every repair or hardware change of the machine.

### Norms

IEC 60974-4 In-service inspection and testing

## 2.2 Testing Lorch machines according to IEC 60974-4

- it is not necessary to disconnect any components of the power unit for the test
- it is recommended to disconnect the torch at water cooled machines
- the machine has to be cleaned properly before the test
- switch to MMA mode (stick electrode) if possible
- the test of the protective earth monitoring circuit is not demanded by the norm, because all safety related elements of the machine are fully covered by the necessary normative measurements

# 3 Inverter Principle

A welding inverter is a electronically controlled welding power source. At conventional transformer based machines, the mains voltage with 50/60 Hz is directly switched to the welding transformer. At a welding inverter the mains voltage is rectified first and with electronic power switches (MOSFETs or IGBTs) chopped into a frequency of 80 kHz. This allows a very small construction of the welding transformer, because it's driven at this high frequency.

The basic structure of a welding inverter is always the same at Lorch power sources:

- mains filter
- power-up circuit
- mains rectifier
- primary inverter
- transformer
- secondary rectifier

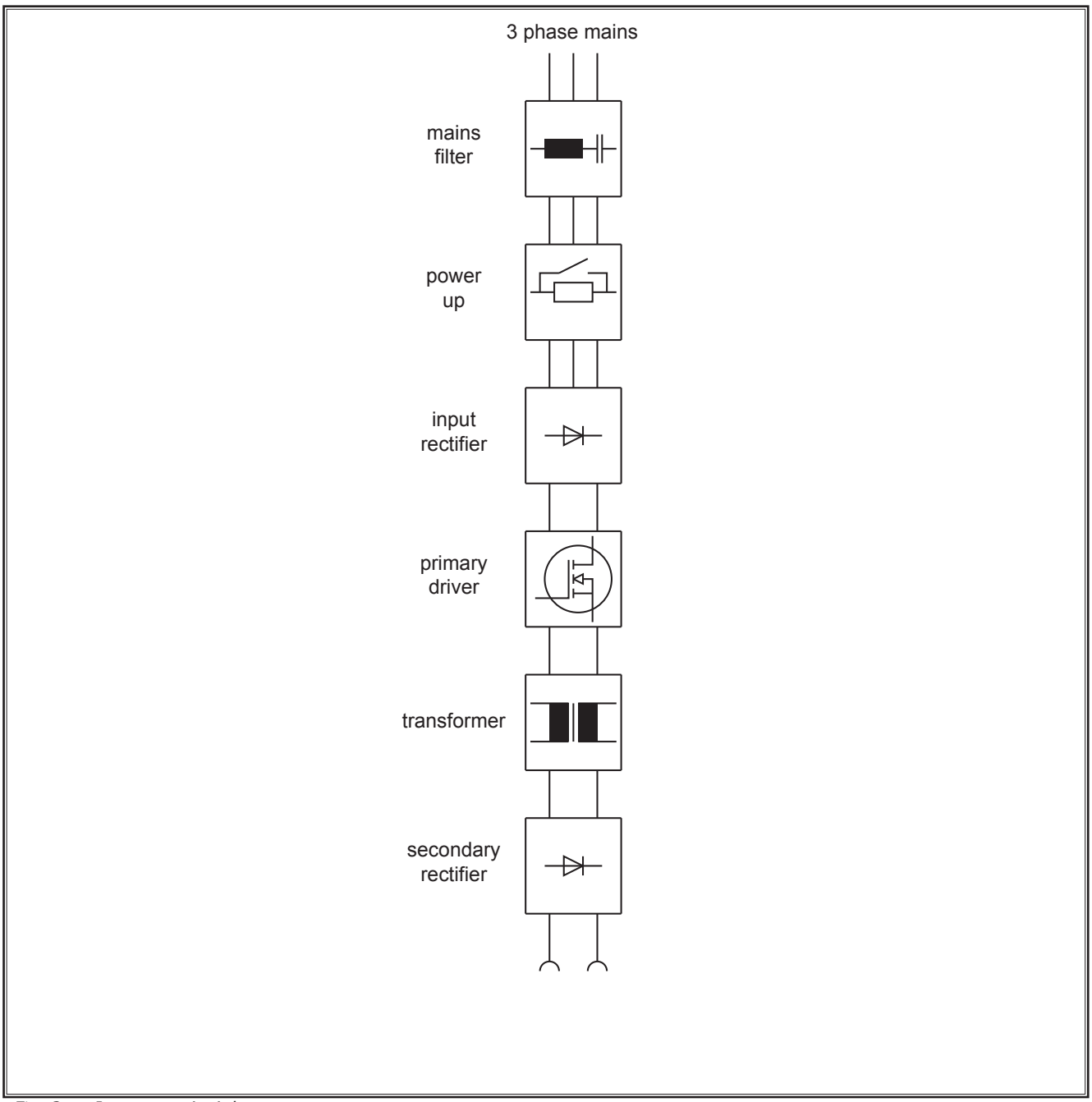
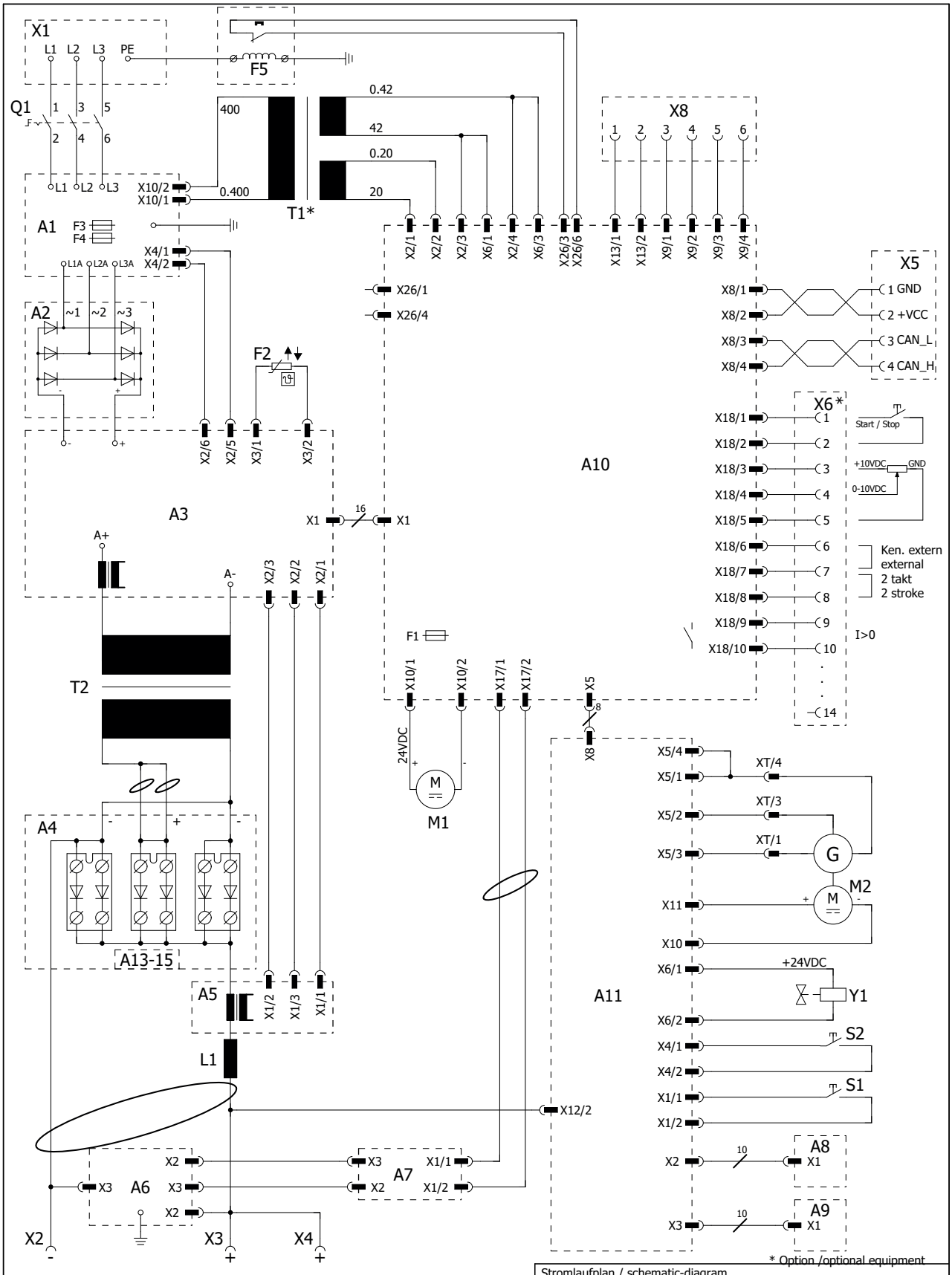
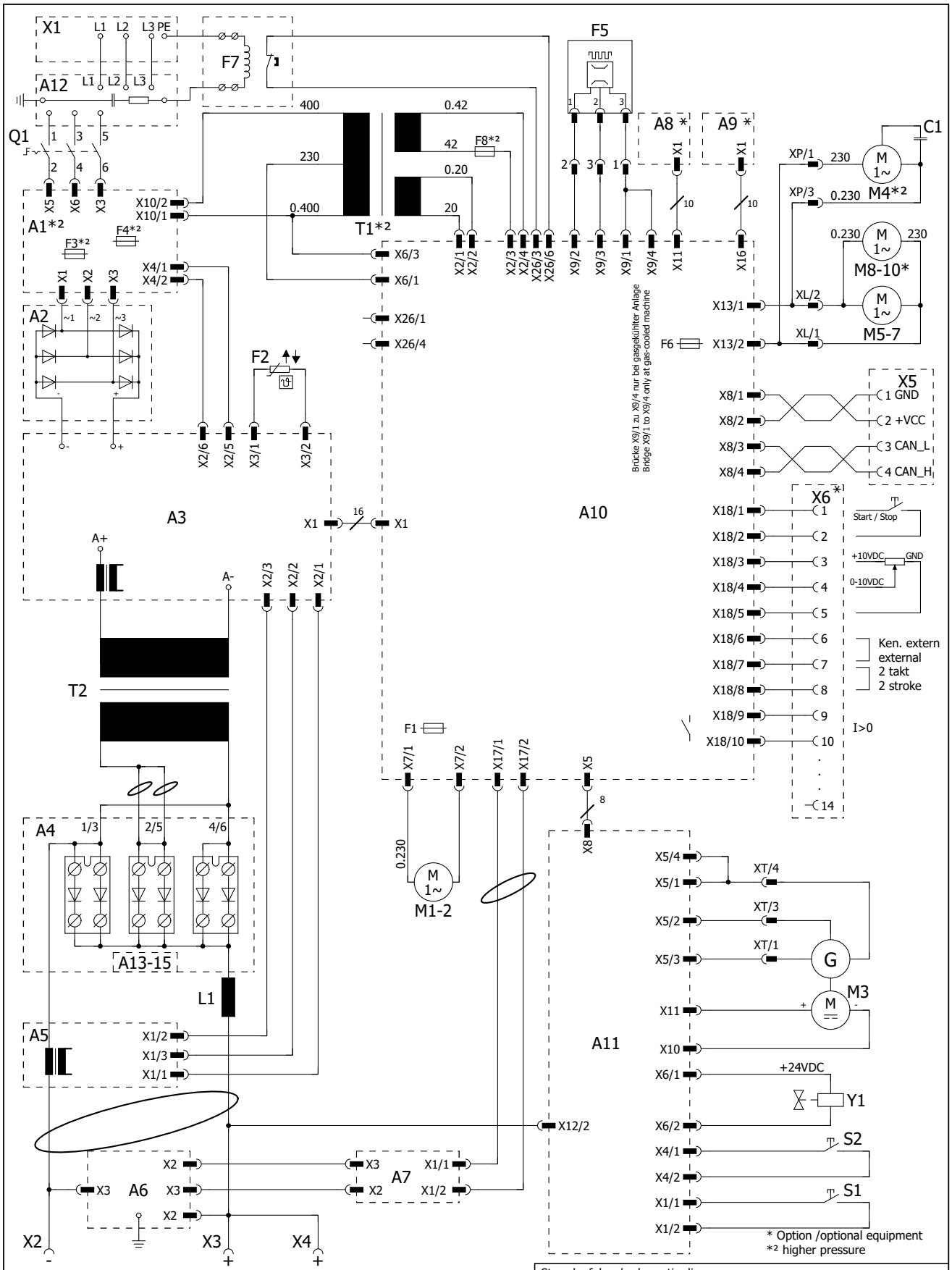



Fig. 3: Inverter principle

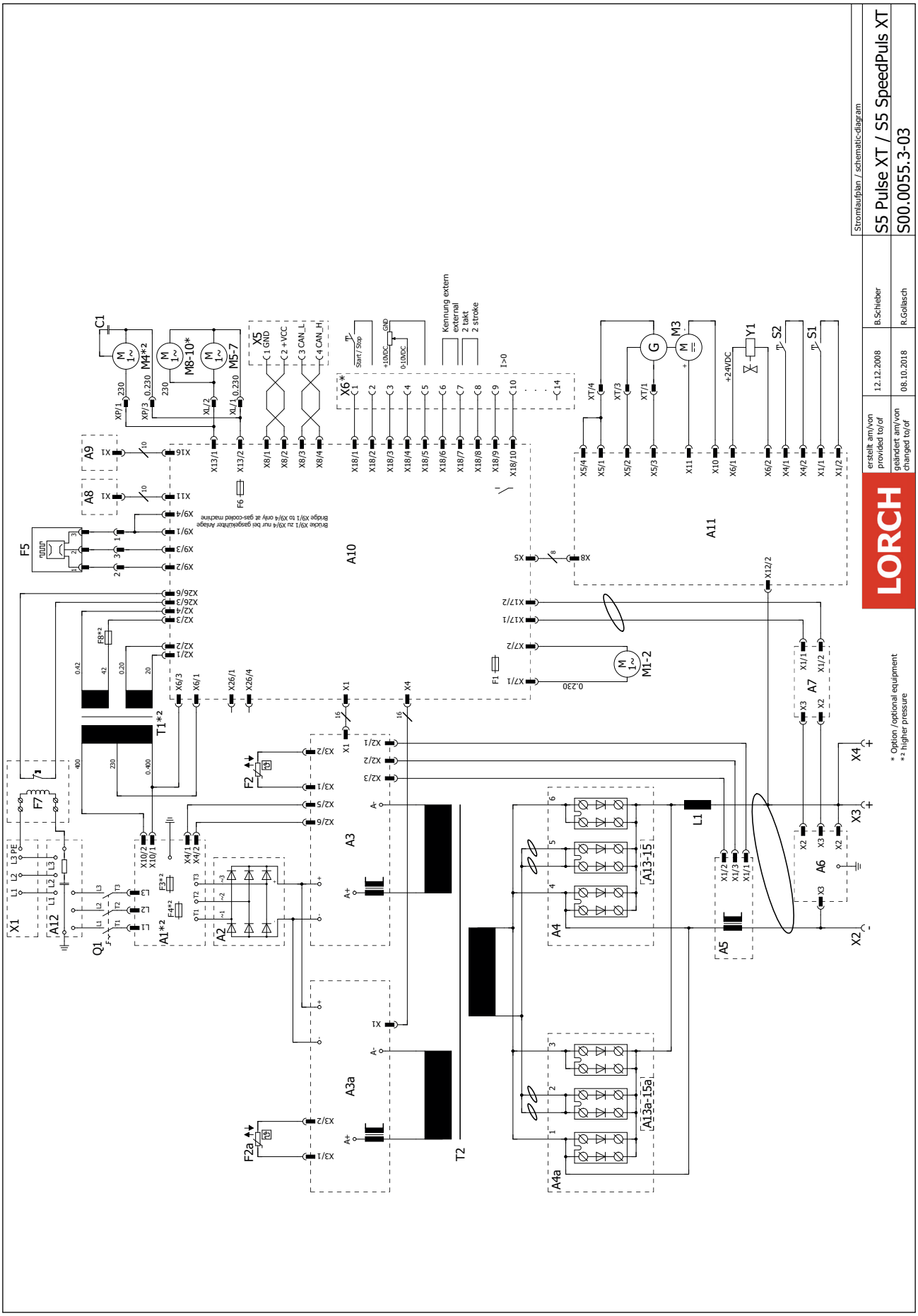
# 4 Machine Wiring Diagrams




| | | | | |
|---|---|---|---|---|
| LORCH | erstellt am/von provided to/of | 11.12.2008 | B.Schieber | Stromlaufplan / schematic-diagram<br>S3 mobil XT / SpeedPulse XT |
| | geändert am/von changed to/of | 17.12.2015 | B.Schieber | S00.0055.0-02 |




| | | | | |
|---|---|---|---|---|
| LORCH | erstellt am/von provided to/of | 11.12.2008 | B.Schieber | Stromlaufplan / schematic-diagram<br>S3 Pulse XT / S3 SpeedPulse XT |
| | geändert am/von changed to/of | 08.10.2018 | R.Gollasch | S00.0055.1-03 |


Stromlaufplan / schematic-diagram
S5 Pulse XT / S5 SpeedPuls XT
S00.0055.3-03
B.Schieber
R.Gollasch
12.12.2008
08.10.2018
erstellt am/von provided to/of
geändert am/von changed to/of
LORCH
* Option /optional equipment
*2 higher pressure
Brücke X9/1 zu X9/4 nur bei gasgekühlter Anlage
bridge X9/1 to X9/4 only at gas-cooled machine
Kennung extern
external
2 takt
2 stroke
Start / Stop
+10VDC
0-10VDC
+24VDC
A1*2
A2
A3
A3a
A4
A4a
A5
A6
A7
A8
A9
A10
A11
A12
A13-15
A13a-15a
T1*2
T2
M1-2
M3
M4*2
M5-7
M8-10*
Y1
S1
S2
F1
F2
F2a
F3*2
F4*2
F5
F6
F7
F8*2
Q1
C1
G
X1
X2
X3
X4
X5
X6
X10/1
X10/2
X11
X12/2
X13/1
X13/2
X16
XP/1
XP/3
XL/1
XL/2
XT/1
XT/3
XT/4
XZ/1
XZ/2
XZ/3
XZ/4
XZ/5
XZ/6
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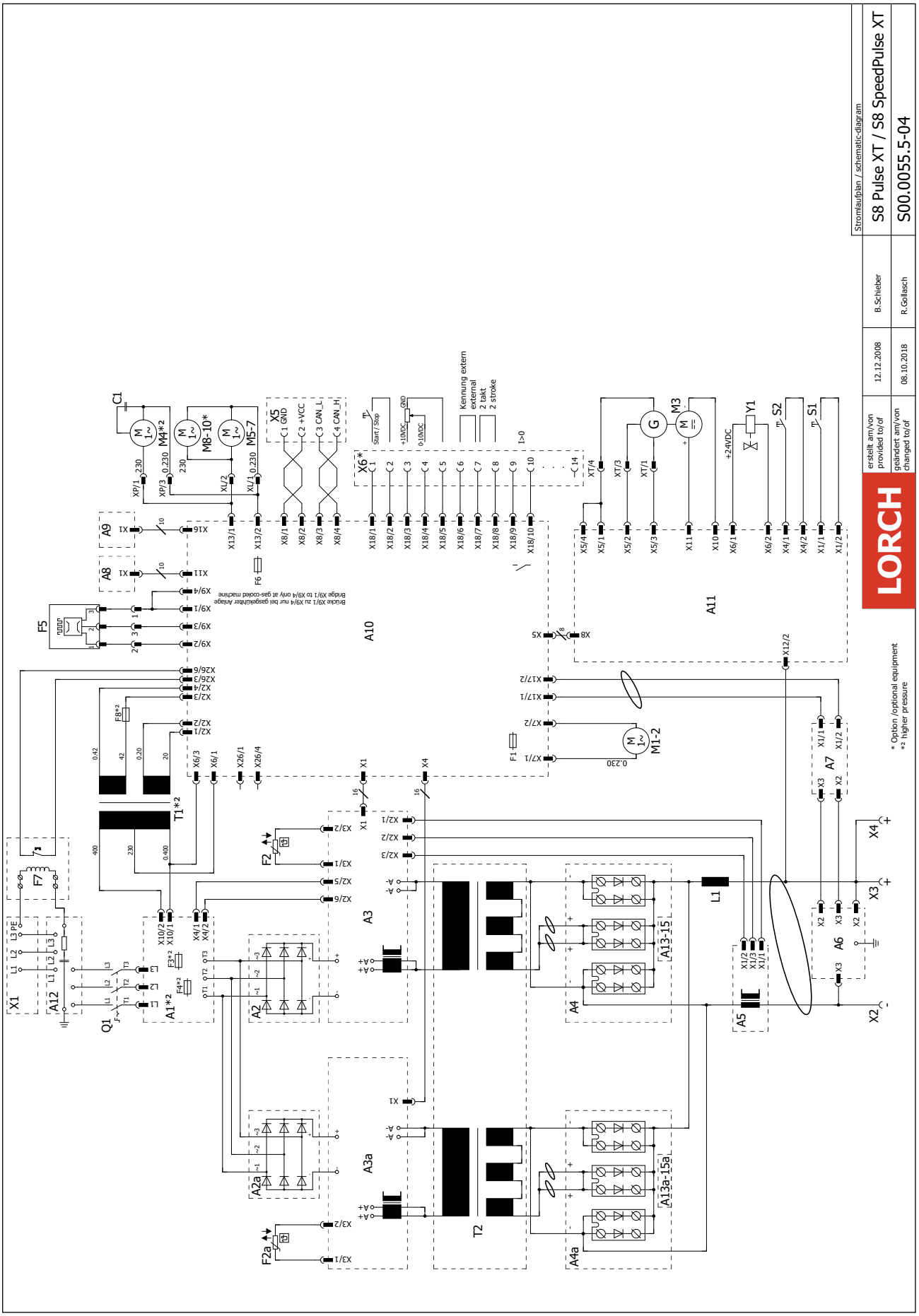
X9/4
X17/1
X17/2
X18/1
X18/2
X18/3
X18/4
X18/5
X18/6
X18/7
X18/8
X18/9
X18/10
X26/1
X26/4
L1
L2
L3
PE
I>0
1 GND
2 +VCC
3 CAN_L
4 CAN_H


Stromlaufplan / schematic-diagram
S8 Pulse XT / S8 SpeedPulse XT
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*2 higher pressure
Kennung extern
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2 takt
2 stroke
Start / Stop
+10VDC
0-10VDC
GND
+24VDC
Brücke X9/1 zu X9/4 nur bei gasgekühlter Anlage
bridge X9/1 to X9/4 only at gas-cooled machine
A1*2
A2
A2a
A3
A3a
A4
A4a
A5
A6
A7
A8
A9
A10
A11
A12
A13-15
A13a-15a
T1*2
T2
Q1
F2
F2a
F5
F6
F7
F8*2
F3*2
F4*2
M1-2
M4*2
M5-7
M8-10*
C1
Y1
S1
S2
G
M3
X1
X2
X3
X4
X5
X6*
L1
L2
L3
PE

# 5 Common Logic Functions

| component | function | event |
|---|---|---|
| fan (power unit) | on | power module temperature > 40°C |
| | off | power module temperature < 40°C |
| fan (cooling system) waterpump | on | after detection “arc established” |
| | off | after welding two minutes post cooling-time |

Tab. 1: Common logic functions

# 6 Front panels

## 6.1 Front panel P-Synergic / S-Pulse / S-SpeedPulse 3.0

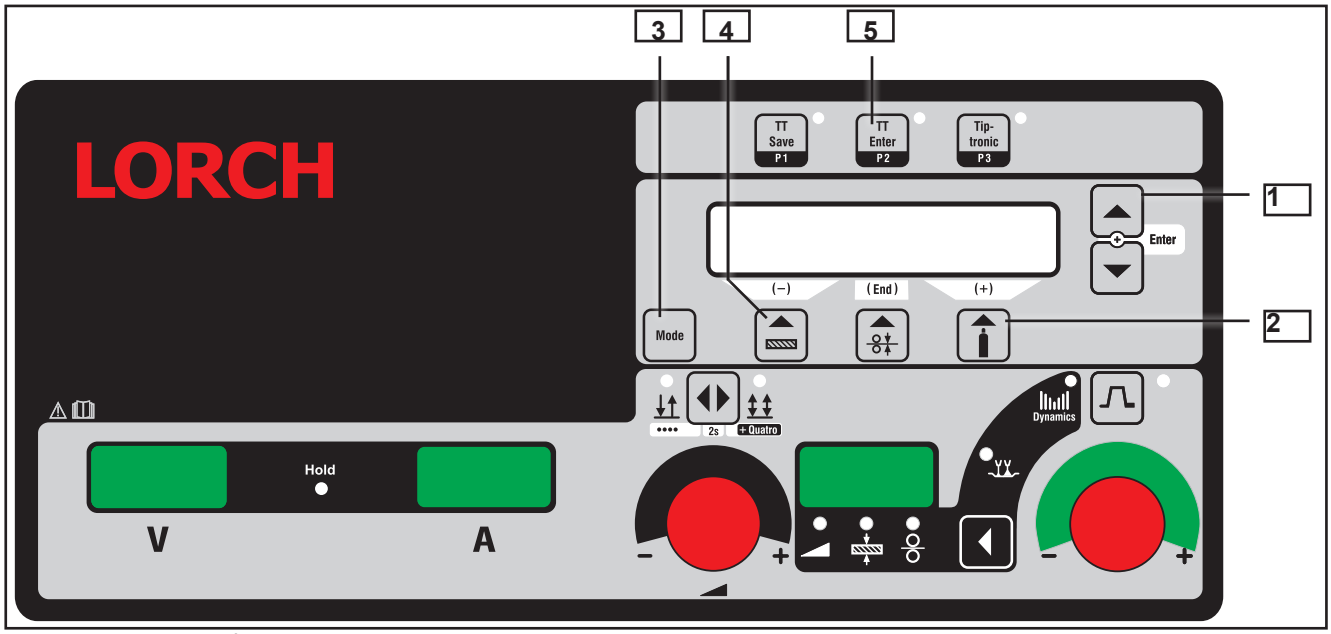



Fig. 4: Front panel S 3.0

## 6.2 Front panel functions S/P

### Gas test

- press the buttons “arrow up” [**1**] and “gas type“ (+) [**2**] at the same time
- the gas valve is activated for 30 sec.
- a countdown is shown in the display
- press button “gas type“ (+) [**2**] again to end the test manually

### Pump / fan test

- press the buttons “arrow up” [**1**] and “material type“ (-) [**4**] at the same time
- the cooling pump and the fans of the power unit are activated for one minute
- press button “material type“ (-) [**4**] again to end the test manually

### Reset

- press the buttons “arrow up” [**1**] and “TT Enter” [**5**] at the same time
- all secondary parameters are reset to their default values
- if Tiptronic is active, the settings of the current job are reset to their programmed values
- all adjustments of the Extras menu remain unchanged

## Master Reset

- press the buttons “arrow up” [**1**] and “Mode” [**3**] together for about five sec.
- the display shows “Master Reset“
- the machine is reset completely to factory settings

**!!! CAUTION !!!**

**all** Tiptronic jobs are deleted after a Master Reset!

Before a Master reset is done, it is important to check if Tiptronic jobs are present on the machine. If necessary make a safety copy of the jobs using the PC software “JobTool”.

## Menu Extras

- press both buttons “arrow up” and “arrow down” [**1**] at the same time
- use the buttons “material type” (-) [**4**] and “gas type” (+) [**2**] to switch between the menu items forth and back
- press both buttons “up” and “down” [**1**] again to go into the selected menu item
- press the middle button “wire diameter” (End) to go back to the previeous menu level

## Menu Customizing

- press the buttons “arrow up” [**1**] and “wire diameter” (End) together for about five sec.
- use the buttons “up” and “down” [**1**] to switch between the menu items forth and back
- use the buttons “material type” (-) [**4**] and “gas type” (+) [**2**] to change the setting

## 6.3 Front panel P-basic

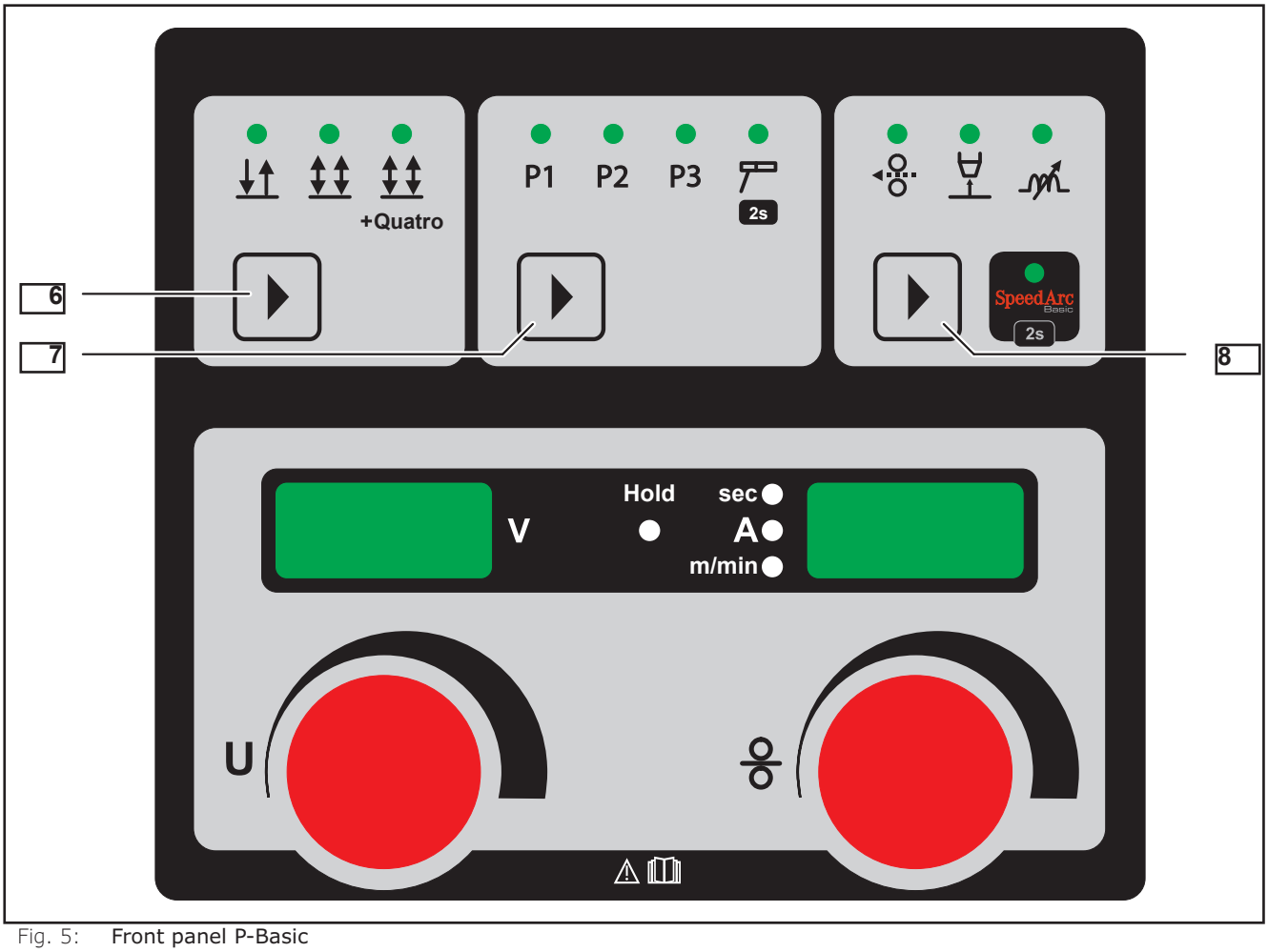



Fig. 5: Front panel P-Basic

### Gas test

- keep the torch trigger pressed
- switch on the machine with the pressed trigger switch
- the gas valve is switched on for 30 sec.

### Pump test

- press the button “operating mode” [6] and “program selection” [7] together at the same time
- the water pump is switched on for one minute
- press both buttons again to switch off the pump manually

### Reset

- keep the buttons “program selection” [7] and the button “main parameter” [8] pressed for about five sec.
- all parameters are reset to factory settings

# 7 Pc-Boards

## 7.1 Pc-board MAPRO05

The pc-board MAPRO05 is responsible for the welding sequence and is managing the process control of the S- and P-series. (MAPRO = MAster-PROcess)

### Functions

- Logicfunctions of the welding process
- generating and monitoring supply voltages
- driving powerup-relais
- driving power unit/units
- monitoring control and operating elements (DS20BF, remote control, torch buttons)
- driving fans
- driving coolingpump
- monitoring flowmeter
- monitoring mains- and output voltage
- generating signal „welding current on“ (arc established)
- managing communications between PC and machine
- managing and storage of all welding parameters
- LorchNet communication (CAN-bus)

### LEDs

| LED | state | meaning |
|---|---|---|
| 1 (green) | blinking | CPLD in function |
| | off | CPLD not working |
| 2 (red) | off | **D**igital **S**ignal **P**rocessor (DSP = “Process”) ok |
| | on | DSP detected a malfunction |
| 3 (green) | on | supply voltage 3.3V ok |
| | off | supply voltage 3.3V missing |
| 4 (red) | off | Microcontroller (Master) in function |
| | on | Master detected a malfunction |
| 5 (green) | blinking | DSP (Process) in function |
| | off | DSP not working |
| 6 (green) | blinking | Microcontroller (Master) in function |
| | off | Master not working |

Tab. 2: LEDs MAPRO05

### Overview fuses on MAPRO05

| fuse | type | safeguarding |
|---|---|---|
| Si6 | 1A (slow) | fans (power unit) |
| Si7 | 4A (slow) | cooling unit |

Tab. 3: Fuses MAPRO05

## Picture pc-board MAPRO05

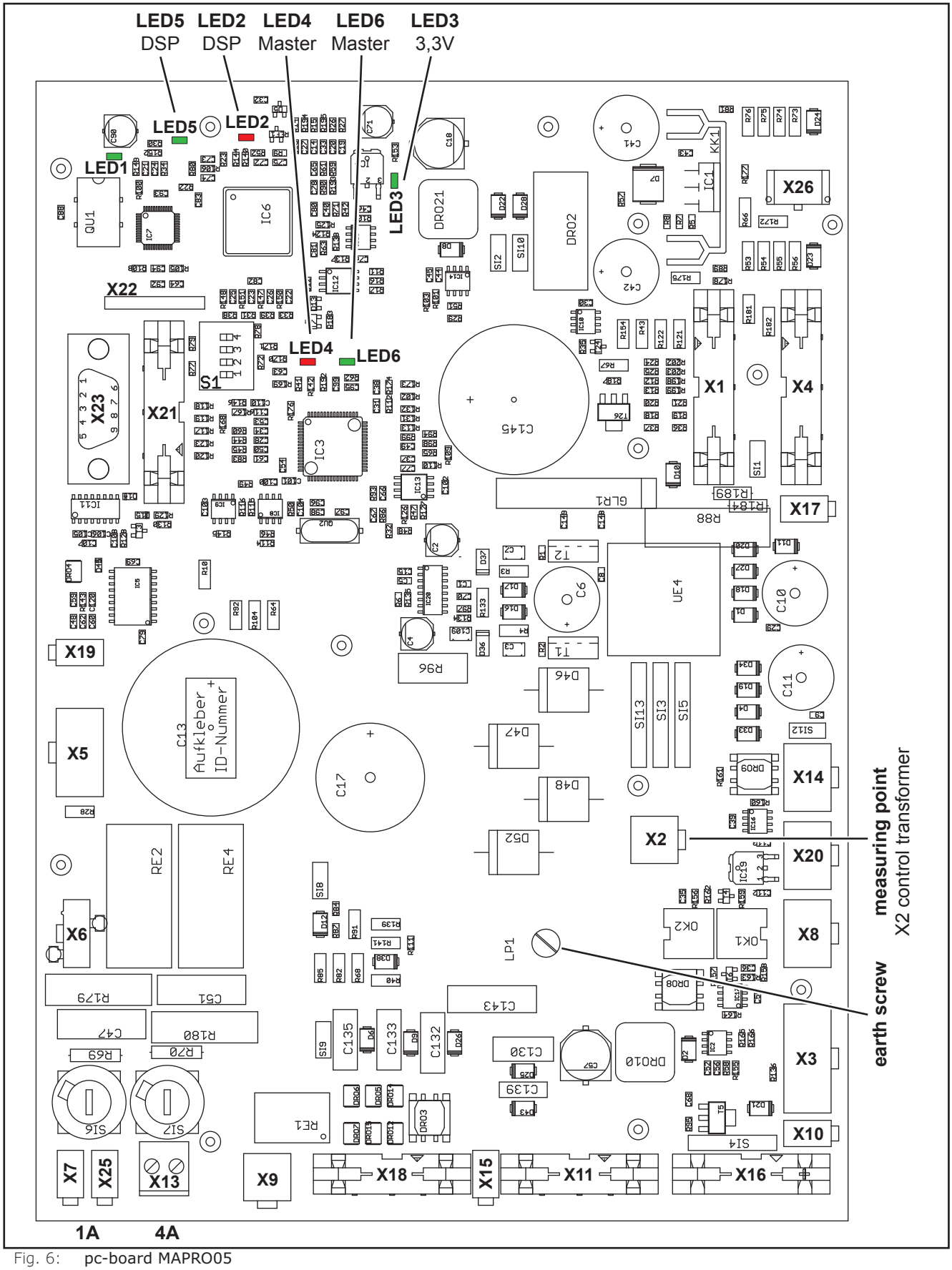



Fig. 6: pc-board MAPRO05

## DIP switch

It is possible to program the DSP (Process) via a serial port (RS232 at connector X23). To set the processor into programming mode, the DIP switches 1, 2 and 3 must be set to “ON”. All details about the serial programming is given in the operating manual “LorchInstall” (909.0410.1).

The DIP switch 4 is used to set the configuration of the water cooling unit. It is set due to the type of the unit (external or internal watercooling).

| DIP switch | setting “ON” | setting “OFF” |
|---|---|---|
| 1, 2, 3 | DSP programming mode active | normal mode |
| 4 | configuration external cooling unit (WUK)<br>for S3 mobile / P3000 mobile | configuration internal cooling unit<br>for S3, S5, S8 / P3500, P4500, P5500 |

Tab. 4: Settings DIP switches

## Measuringpoints

| designation | measuring point | | result |
|---|---|---|---|
| supply voltage from control transformer (primary) | X6-1<br>X6-3 | ~<br>~ | 230V AC (driveable housing)<br>42V AC (S mobile/ P mobile) |
| supply voltage fans group 1 | X7-1<br>X7-2 | ~<br>~ | 230V AC |
| supply voltage fans group 2 | X25-1<br>X25-2 | ~<br>~ | 230V AC |
| supply voltage cooling unit | X13-1<br>X13-2 | ~<br>~ | 230V AC |
| supply voltage from control transformer (secondary) | X2-1<br>X2-2 | ~<br>~ | 18V AC |
| | X2-3<br>X2-4 | ~<br>~ | 42V AC |
| supply voltage flow meter | X9-1<br>X9-3 | +<br>gnd | +15V DC |
| supply voltage LorchNet<br>(CAN bus) | X8-1<br>X8-2 | gnd<br>+ | +15V DC |
| | X14-1<br>X14-2 | gnd<br>+ | +15V DC |
| | X20-1<br>X20-2 | gnd<br>+ | +15V DC |

Tab. 5: Measuringpoints MAPRO05

## Counting pins for Minifit and Microfit connectors

The way of reading the pin numbers on the Minifit- and Microfit-connectors is done always in the same way: when looking from the top onto the connector, pin no.1 is alway on the far left, opposite to the clip

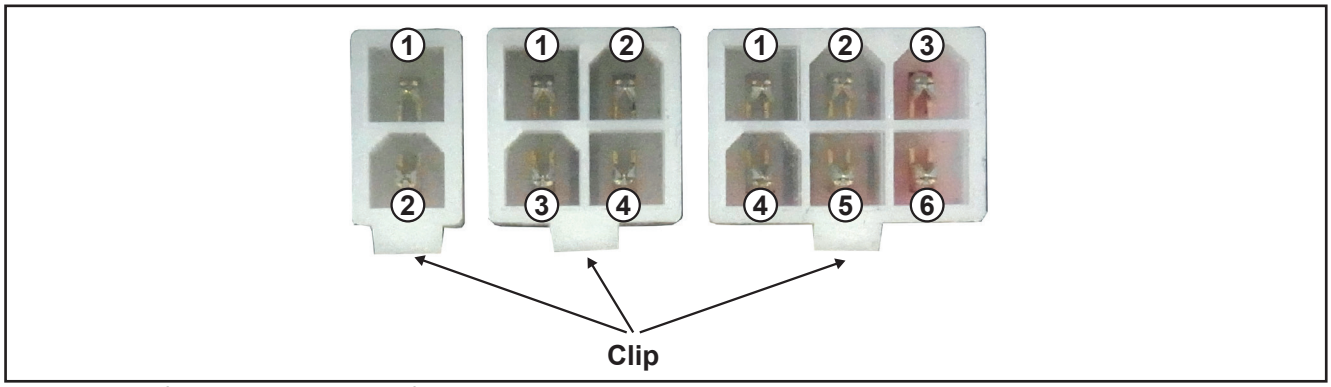



Fig. 7: Reading connector pin numbers

## Overview connectors MAPRO05

| Connector | designation |
|---|---|
| X1 | connector to power uint 1 |
| X2 | connector control transformer (supply of pc-board) |
| X3 | connector to pc-baord DS-ERW (only used at machines with two wire feed units) |
| X4 | connector to power uint 2 |
| X5 | connector to Interpass hose package |
| X6 | 230V supply fans/cooling unit (from control transformer) |
| X7 | connector fan group 1 (230V AC) |
| X8 | LorchNet connector (CAN bus) |
| X9 | connector flow meter |
| X10 | connector gas valve (only used when TIG option is installed) |
| X11 | connector front panel |
| X13 | connector cooling unit |
| X14 | LorchNet connector (CAN bus) |
| X15 | connector TIG torch button |
| X16 | connector volt/amp display |
| X17 | connector output voltage (to pc-board DP-UFI-BO) |
| X18 | connector remote control |
| X19 | connector gas test button |
| X20 | LorchNet connector (CAN bus) |
| X21 | connector JTAG interface (internal programming port) |
| X22 | connector JTAG interface (internal programming port) |
| X23 | connector serial Interface (RS232: internal programming port) |
| X25 | connector fan group 2 (230V AC) |
| X26 | connector PE and gas monitoring |

Tab. 6: connectors MAPRO05

## 7.2 Pc-board DMR

The pc-board DMR is the wire feed motor control of the machine.

### Functions

- control and monitoring wire feed motor
- driving solenoid valve
- control and monitoring of operating elements (DS20BF, PowerMaster, torch button)
- monitoring wire inching button
- supply pc-board PP90R (Push-Pull)

### LEDs

| LED | state | meaning |
|---|---|---|
| 1 (red) | blinking | normal operation |
| | lit weak | microprocessor not programmed |
| 2 (green) | on | internal supply voltage 5V DC ok |
| | off | internal supply voltage 5V missing |

Tab. 7: LEDs DMR

### Picture pc-board DMR

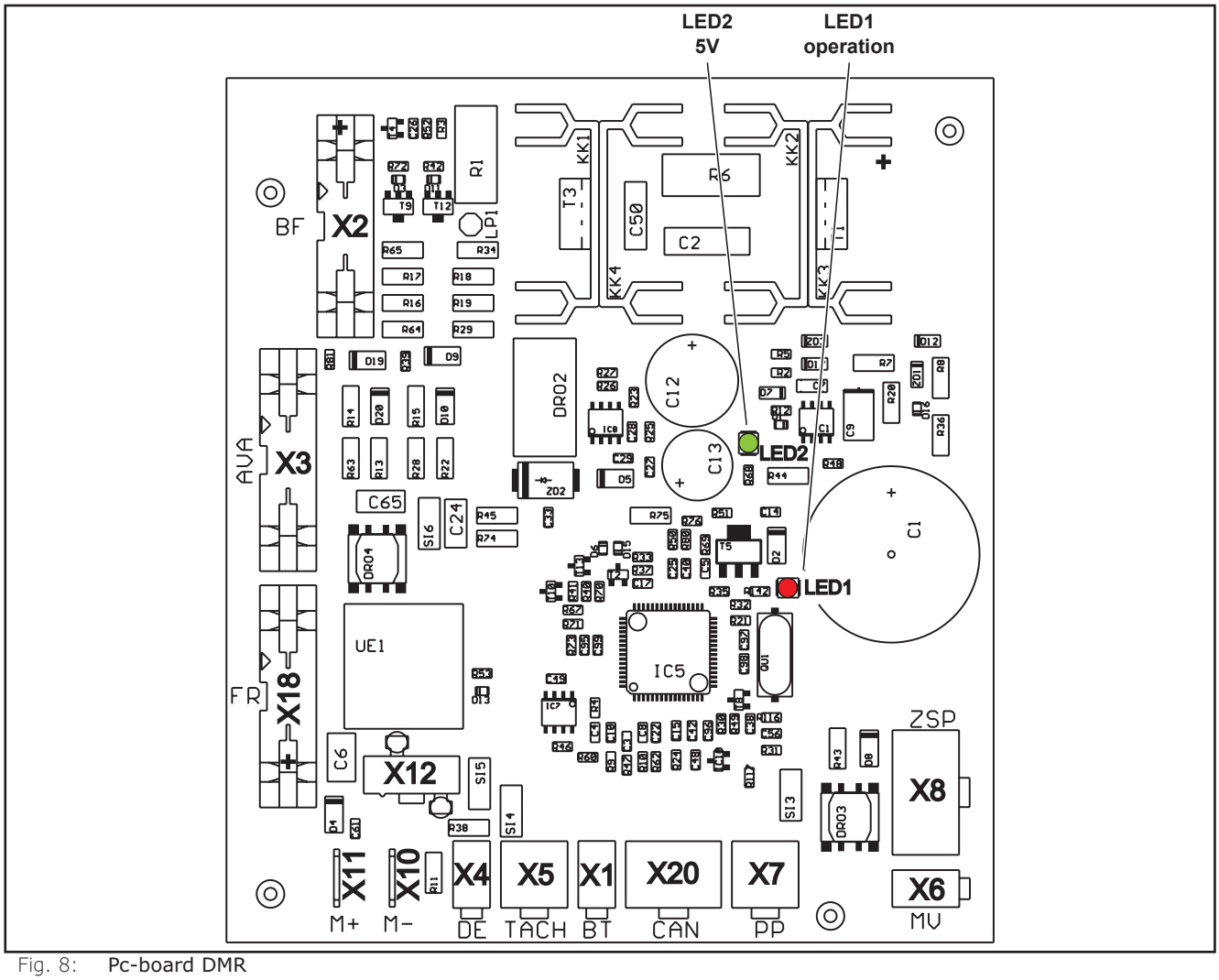



Fig. 8: Pc-board DMR

## Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| 5V internal supply voltage | X5-1<br>X5-3 | +<br>gnd | +5V DC |
| 24V internal supply voltage | X8-8<br>X8-1 | +<br>gnd | +24V DC |
| 60V Motor supply voltage | X8-5<br>X8-6 | +<br>gnd | +60V DC |

Tab. 8: Measuring points DMR

## Overview connectors DMR

| connector | designation |
|---|---|
| X1 | torch trigger switch |
| X2 | front panel |
| X3 | volt/amp display |
| X4 | wire insert button |
| X5 | tacho |
| X6 | gas valve |
| X7 | pc-board PP90R (Push-Pull option) |
| X8 | Interpass hose package |
| X10 | wire feed motor “-“ (minus) |
| X11 | wire feed motor “+“ (plus) |
| X12 | welding potential |
| X18 | remote control interface<br>**!!! CAUTION !!!** only the start contact (pins 1 and 2) is available. There is no analog input or a digital output (welding current on : I>0) |
| X20 | LorchNet (CAN bus) |

Tab. 9: Connectors DMR

## 7.3 Pc-board PP90R

The pc-board PP90R is an analog control PCB for a PushPull torch. It is optional and can be retrofitted into existing, compact machines and wire feeders. It is connected to the pc-board DMR.

### Functions

– supply for PushPull motor

### Meauring points

| designation | measuring point | | result |
|---|---|---|---|
| supply voltage | X1-2<br>X1-5 | ~<br>~ | 42V AC |
| motor supply | X1-1<br>X1-4 | +<br>- | +60V DC |
| relay voltage | X1-6<br>X1-7 | +<br>- | +24V DC |

Tab. 10: Measuring points PP90R

### Picture pc-board PP90R

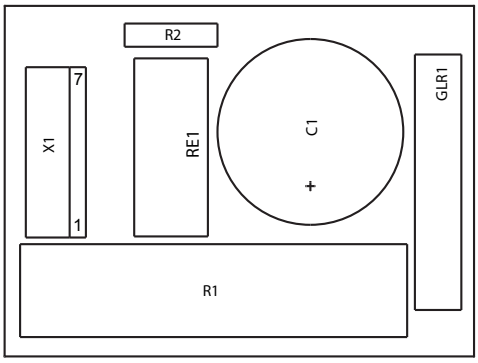



Fig. 9: Pc-board PP90R

### Schematic

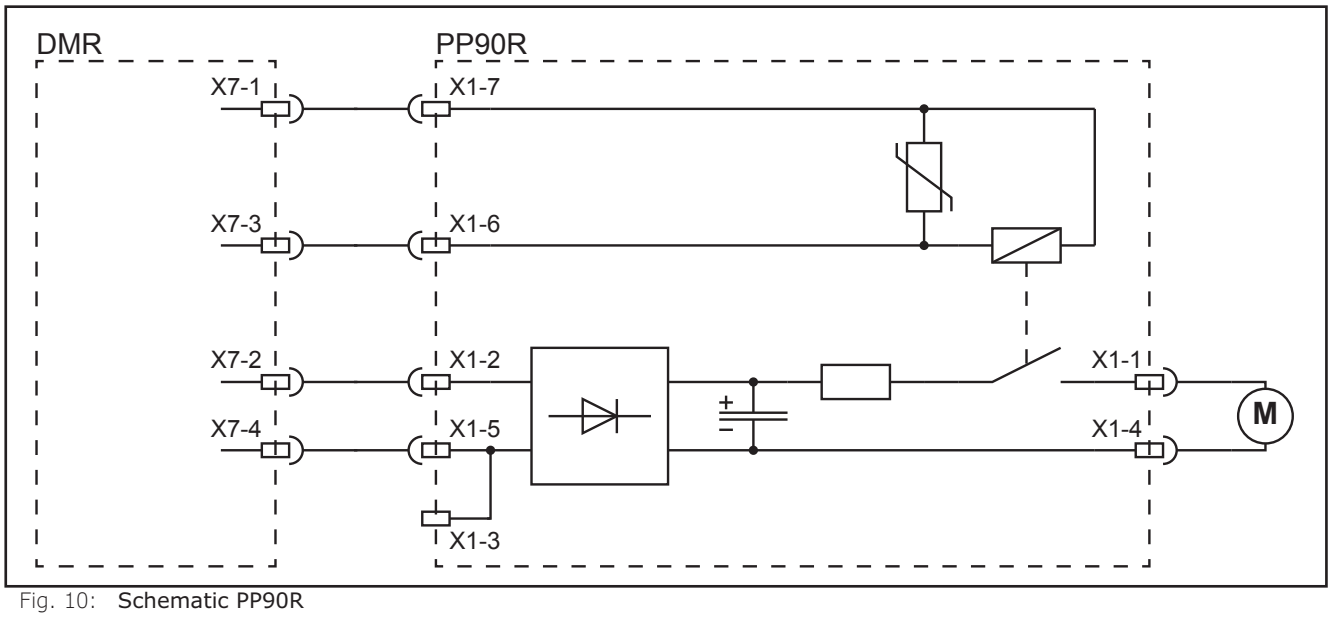



Fig. 10: Schematic PP90R

## 7.4 Pc-board DMRPP04

The pc-board DMRPP04 is the (digital) control board to use a Lorch Push-Pull torch (optional).

It is also necessary for the use of an intermediate feeder or for the NanoFeeder.

If a digital PushPull shall be retrofitted into an existing machine, the pc-board DMR is replaced by the DMRPP04.

The pc-board DMRPP04 consists of two single boards which are connected via flat ribboncables with each other:

- pc-board DMRPP-P: power driver circuit for motor
- pc-board DMRPP-C04: control logic

### Functions

- drive level and monitoring wire feed motor / PushPull motor / intermediate feed motor
- driving gas valve
- control and monitoring operating elements (front panel, remote control, torch button, PowerMaster)

### LEDs

| LED | state | meaning |
|---|---|---|
| 1 (red) | off | DSP ok |
| | on (brigth) | pc-board is in programming (flash) mode: DIP switch1 = ON |
| | on (weak) | DSP is not programmed |
| 2 (green) | on | 5V internal supply voltage ok |
| | off | 5V supply voltage is missing |
| 3 (green) | blinking | DSP in function |
| | on | no intermediate feeder present (if DIP switch2 = ON) |

Tab. 11: LEDs DMRPP04

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| 5V internal supply voltage | X5-1<br>X5-3 | +<br>gnd | +5V DC |
| 24V internal supply voltage | X8-8<br>X8-1 | +<br>gnd | +24V DC |
| 60V motor supply | X8-5<br>X8-6 | +<br>gnd | +60V DC |

Tab. 12: Measuring points DMRPP04

### DIP switches

| DIP switch | setting | function |
|---|---|---|
| 1 | ON | programing mode active |
| | OFF | normal operation |
| 2 | ON | configuration Intermediate Feeder |
| | OFF | configuration PushPull/NanoFeeder |

Tab. 13: DIP switches DMRPP04

## Picture pc-board DMRPP04

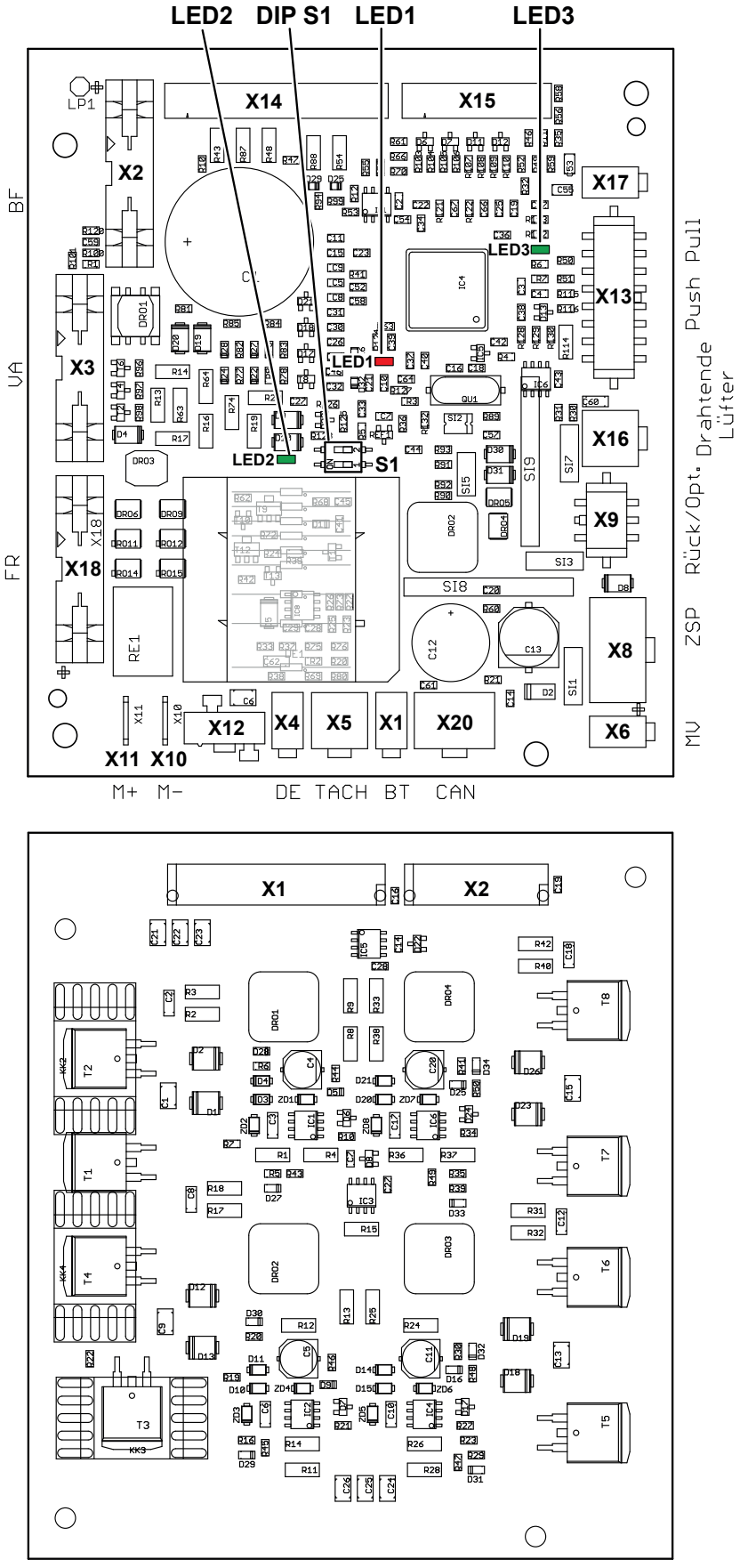



Fig. 11: Pc-board DMRPP04

## Overview connectors DMRPP04

| connector | designation |
|---|---|
| X1 | torch trigger switch |
| X2 | front panel |
| X3 | volt/amp display |
| X4 | wire inch button |
| X5 | tacho wire feed motor |
| X6 | solenoid valve |
| X8 | control cable (Interpass hose package) |
| X9 | wire inch and retract button |
| X10 | wire feed motor “-” (minus) |
| X11 | wire feed motor “+” (plus) |
| X12 | welding potential (PowerMaster signal compensation) |
| X13 | control cable PushPull |
| X14 | flat ribbon connector motor wires |
| X15 | flat ribbon connector PWM control |
| X16 | wire-end sensor |
| X17 | PushPull motor |
| X18 | remote control interface |
| X20 | LorchNet (CAN bus) |

Tab. 14: Connectors DMRPP04

## Overview PushPull, Intermediate Feeder, NanoFeeder

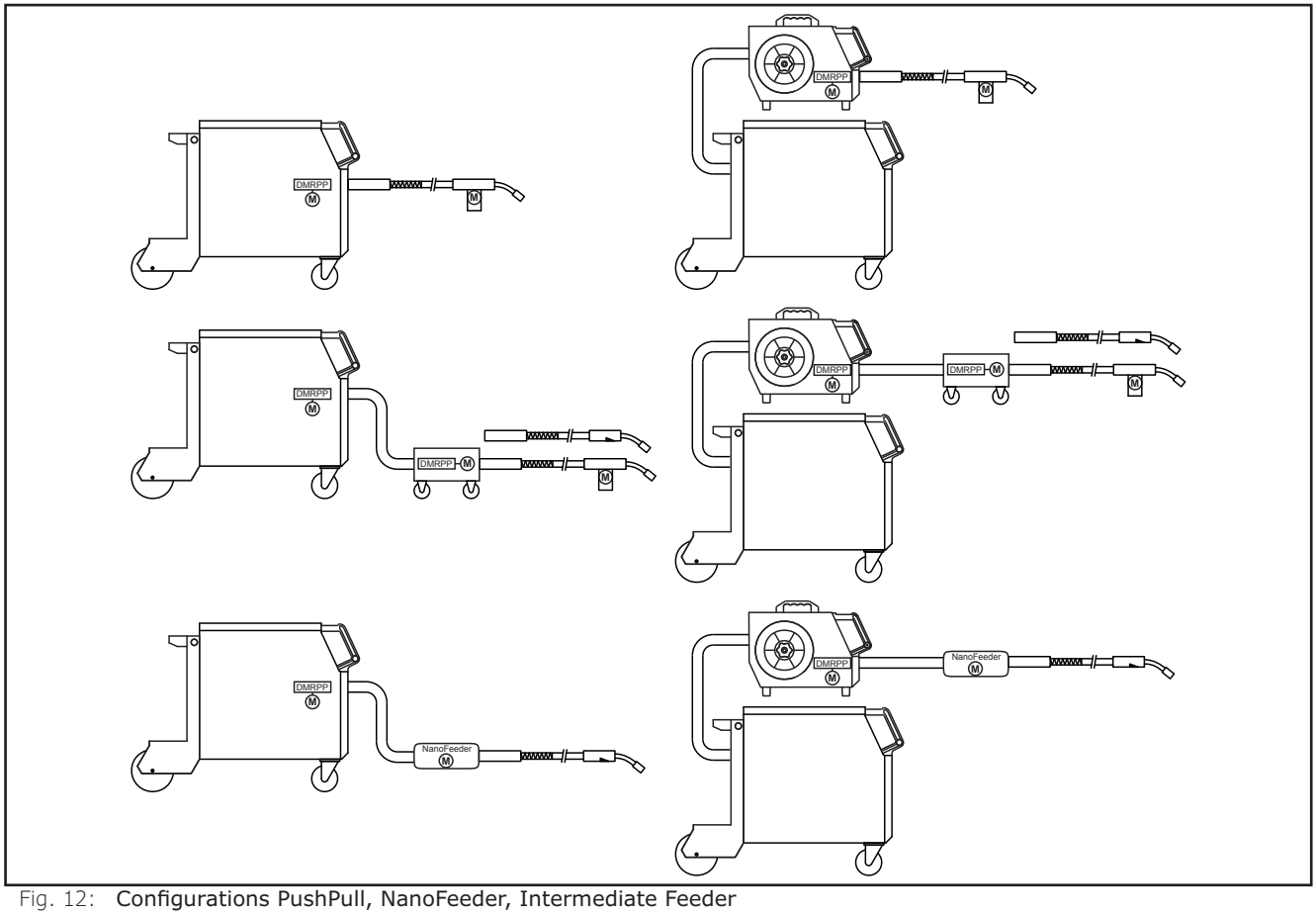



Fig. 12: Configurations PushPull, NanoFeeder, Intermediate Feeder

### Configuration Intermediate Feeder

When using an intermediate feeder, a stronger control transformer (655.8031.0) is used in the power source to provide enough power for the intermediate unit. This is done via an additional pc-board ZVP.

Detailed information is given in the mounting instruction “Digital PushPull with auxiliary drive“ (E00.0320.1).

**Please note!:** the first (“rear”) DMRPP04 pc-board requires special software (special firmware), the DMRPP04 pc-board in the intermediate feeder (“front”) has the standard PushPull firmware.

Since the push-pull software version 1.24 from 14.03.2019 the special software is no longer required.

## 7.5 Pc-board ZVP

The pc-board ZVP is the additional power supply for the motor inside the intermediate feeder.

### Picture pc-board ZVP

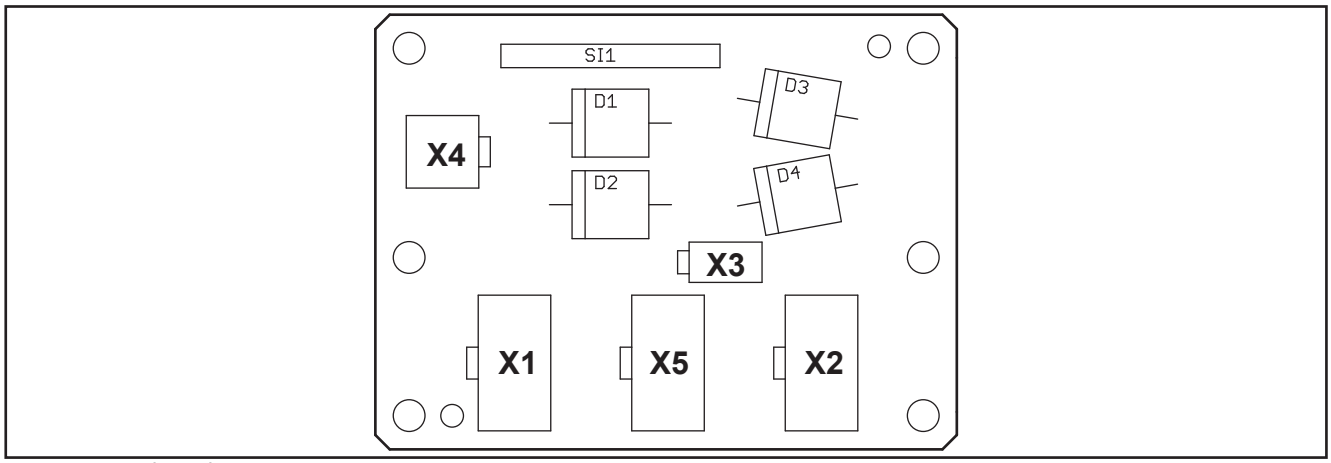



Fig. 13: pc-baord ZVP

## Schematic

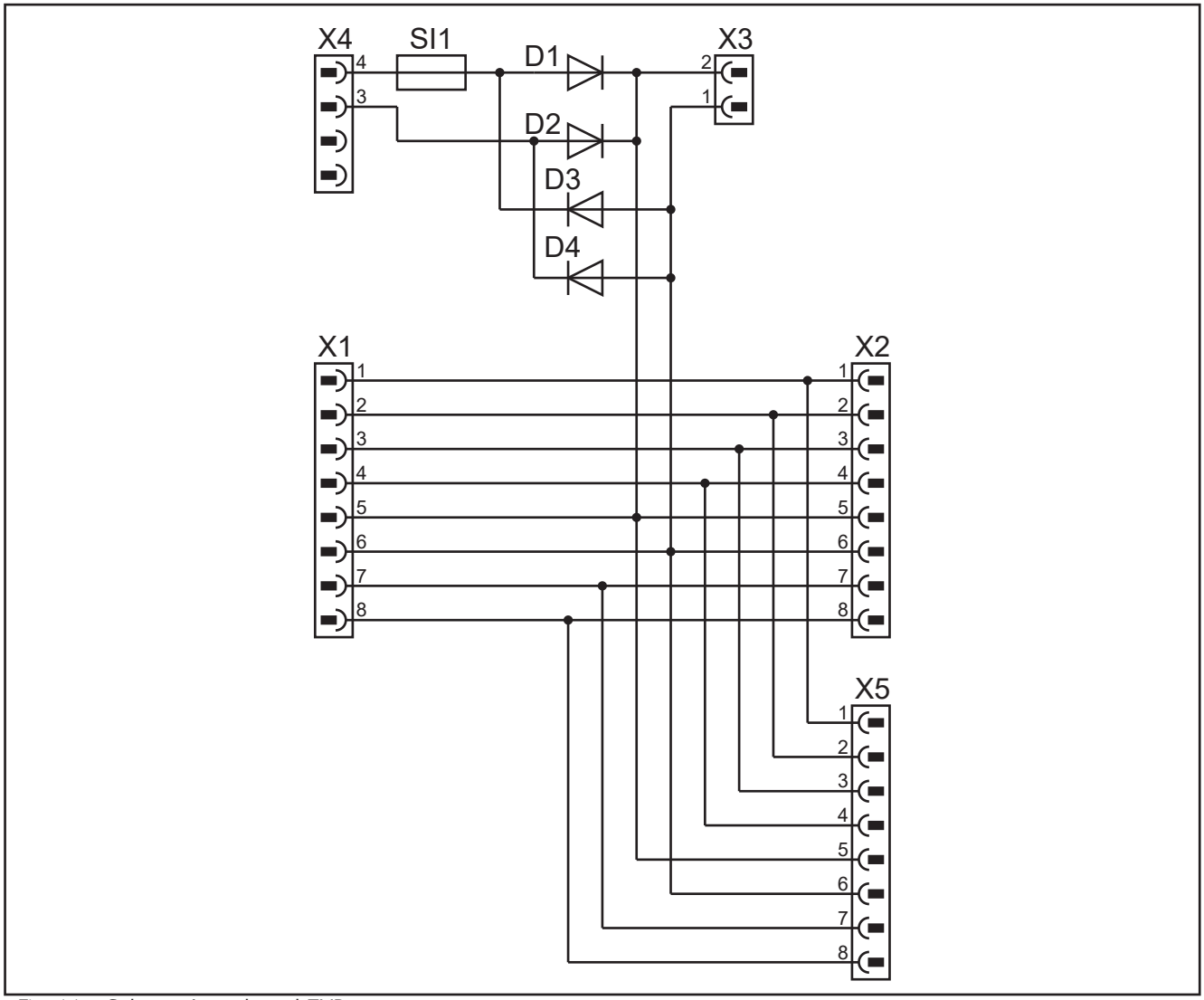



Fig. 14: Schematic pc-board ZVP

| connector | designation |
|---|---|
| X1 | control cable to MAPRO (X5) |
| X2 | control cable to DMRPP |
| X3 | +60V DC |
| X4 | connection (input) 42V AC control transformer |
| X5 | parallel connection to DMRPP |

Tab. 15: connections pc-board ZVP

## 7.6 Pc-board DS20BF

The pc-board DS20BF is the front panel with all buttons, rotary impulse encoder and all displays.

### Functions

- operating/setup the machine
- display of parameters and malfunction codes

### Picture pc-board DS20BF

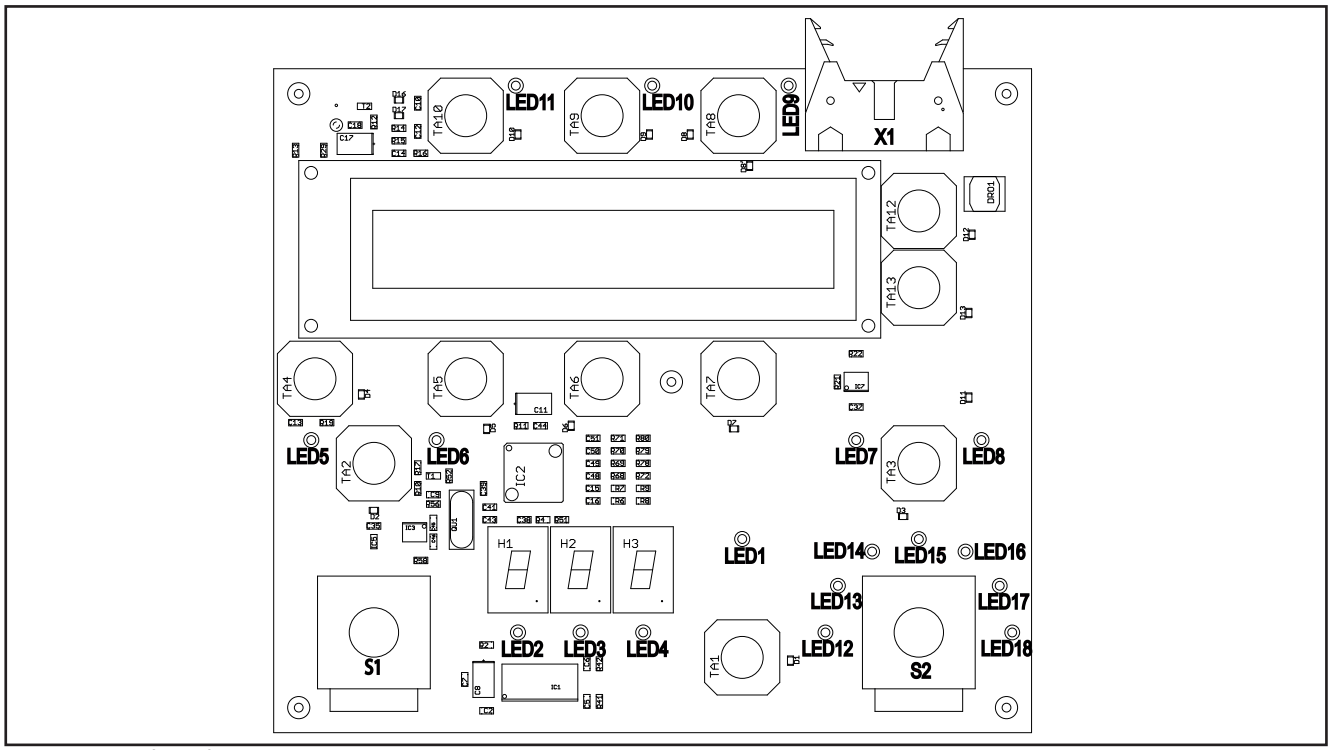



Fig. 15: Pc-board DS20BF

### Display test

The display board has an internal test function.

To execute the test press the buttons “arrow down“ ▼ (TA13) and “mode“ Mode (TA4) at the same time. At a machine with seperated front panels, the test can also be executed at the DS21BF with the buttons “2-stroke/4-stroke“ ↓↑ ◆ ↕ (TA2) and “slope“ ◿ (TA3).

Now the LCD-Display shows „Display Test“ and the version number of the operating system. Press any button to start the first test, where all LEDs and the LCD-Display are turned on and off alternately. The LCD-Display shows „LEDs on, Backlight off“.

Press any button to go to the next test. In this test all buttons are checked, by pressing all 12 buttons one after another. The button which is to be pressed, is indicated by a lit LED. After that the rotary impulse encoders are checked. The LCD-Display shows a cursor which can be moved by the rotary impulse encoders. At first the cursor has to be moved to the left with the left rotary impulse encoder then to the right. After that the cursor has to be moved to the left and right with the right rotary impulse encoder.

Then the test is completed and the LCD-Display shows „End of Tests“ and the machine goes back into normal mode, which was displayed before the display test was executed.

At a machine with separated front panels, the pc-boards DS21BF and DS22BF are used.

## 7.7 Pc-board DS21BF

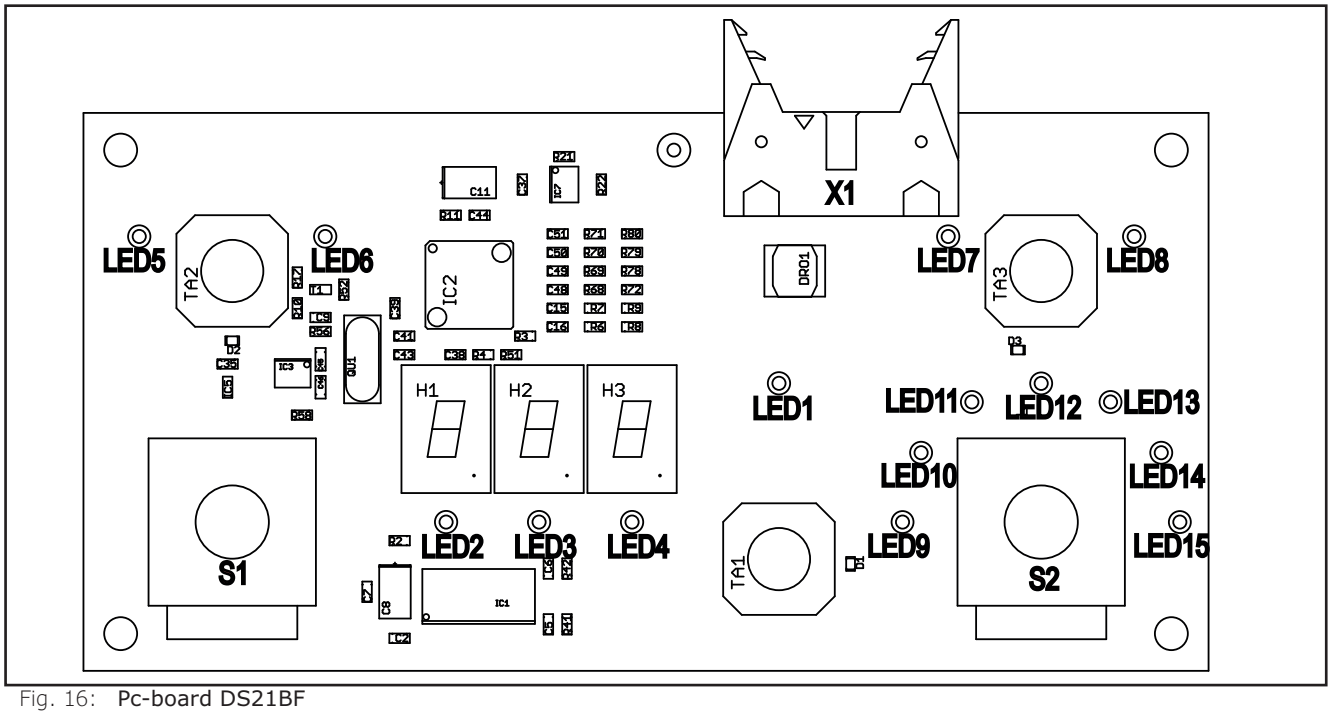



Fig. 16: Pc-board DS21BF

## 7.8 Pc-board DS22BF

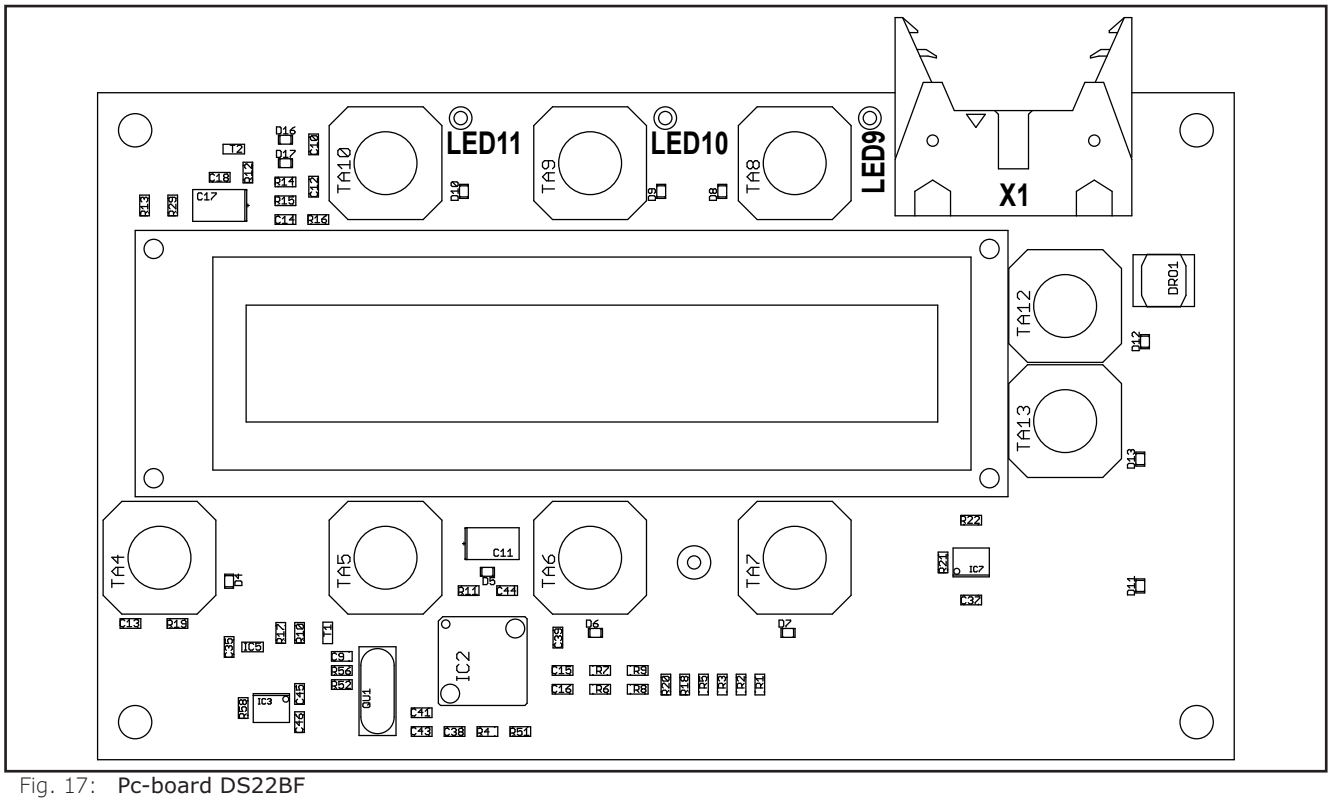



Fig. 17: Pc-board DS22BF

## 7.9 Pc-board MAT-BF

The pc-board MAT-BF is the front panel of the P-Basic machines.

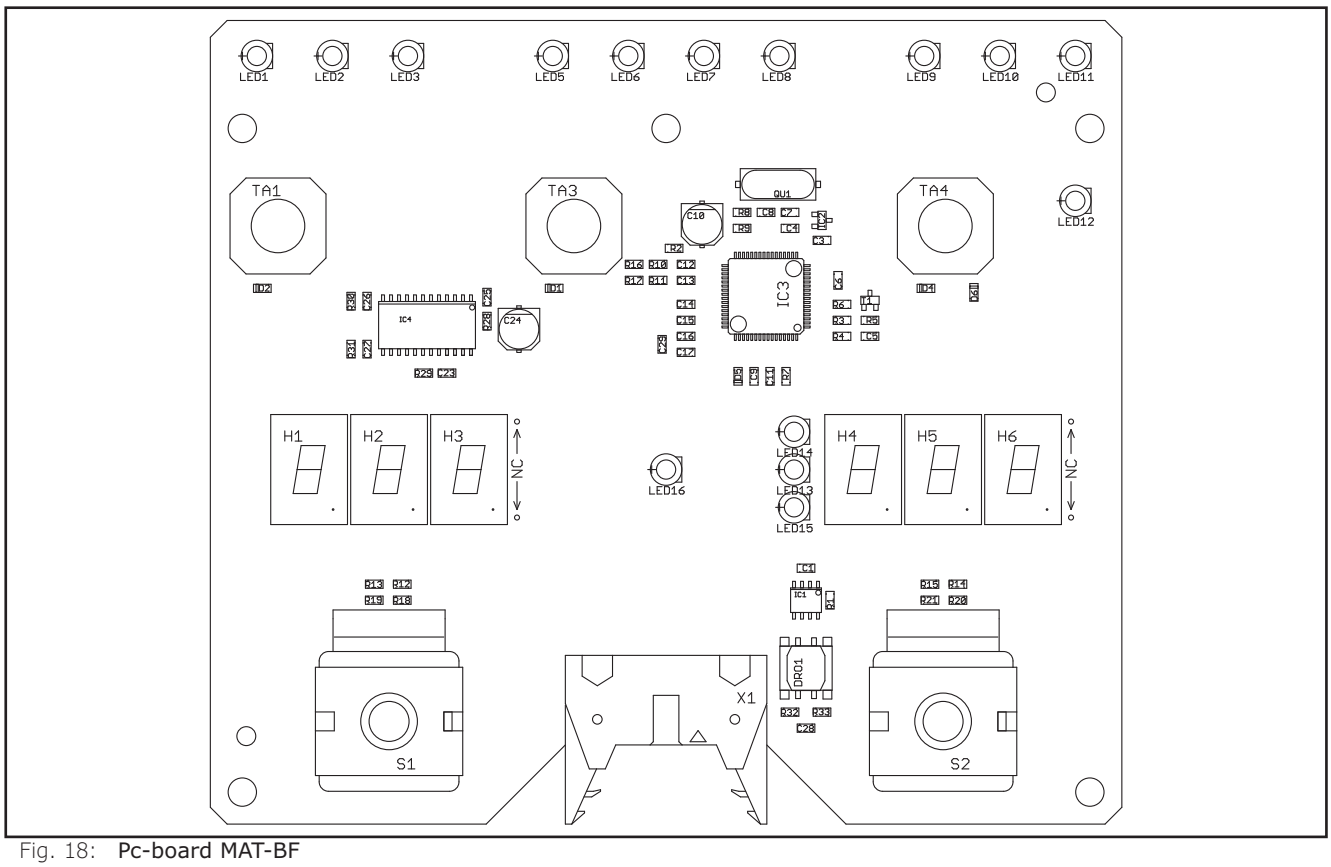



Fig. 18: Pc-board MAT-BF

### Front panel test function

The display test at the P-Basic machines is activated by pressing the two outer buttons (mode TA1 and main parameter TA4).

## 7.10 Pc-board DS-VA

The pc-board DS-VA is the digital volt and ampere display of the machine.

### Functions

- display nominal and actual values of welding voltage and welding current
- hold-function of the last welding values
- displaying malfunction codes

### Picture pc-board DS-VA

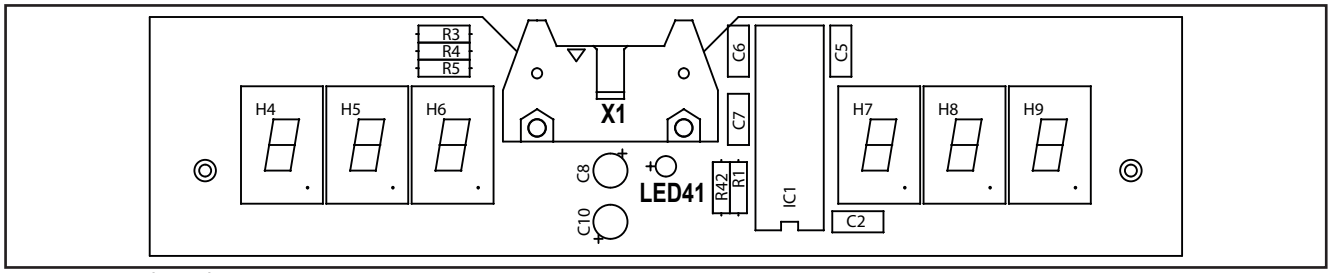



Fig. 19: Pc-board DS-VA

### Display test DS-VA

There is an internal display test for the pc-board DS-VA. To carry out the test a PowerMaster torch or RC20 is necessary. Pressing the “mode” button and the rocker switch “left” at the same time and keep them pressed, all segments and LEDs of the pc-board DS-VA are lit cyclically.

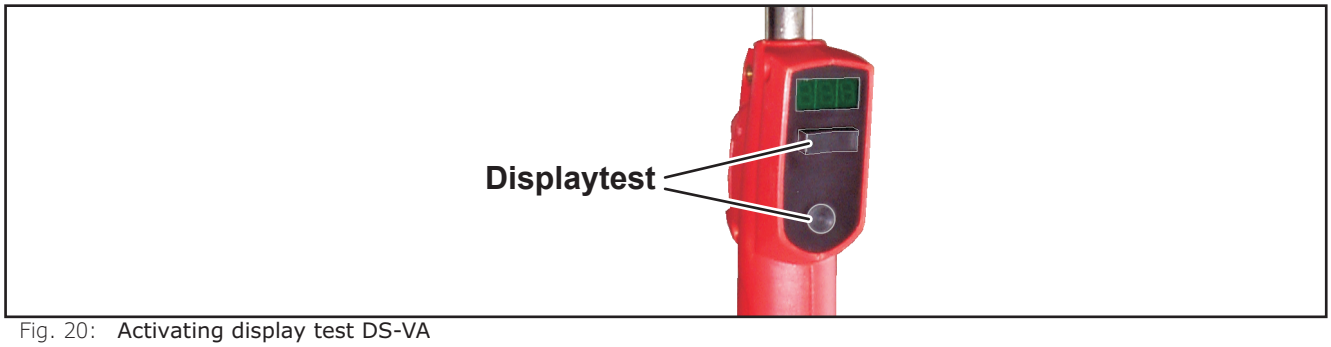



Fig. 20: Activating display test DS-VA

## 7.11 Pc-board DCDR21 / DCDR23

The pc-board DCDR21 is the primary driver board of the S5 and S8 / P4500 and P5500.
The pc-board DCDR23 is the primary driver board of the S3 and P3x0 mobile.

### Functions

- encoding power unit
- connection temperature sensor of heat sink
- supply current sensor
- monitoring bus voltage
- safety shut-down of power unit
- passthrough signal for power-up relays
- passthrough signal from current sensor

### Encoding power unit

The DIP switch is used to set the type of the power unit.

| DIP1 | DIP2 | setting | type |
|---|---|---|---|
| OFF | OFF | 240A | S5 / P4500 |
| OFF | ON | 350A | S3 / P3x00 |
| ON | OFF | 300A | S8 / P5500 |
| ON | ON | reserved | |

Tab. 16: DIP switch DCDR

### LEDs

| LED | state | meaning |
|---|---|---|
| 1 (red) | off | normal operation |
| | on | input current too high, power unit is blocked |
| 2 (green) | off | no supply for driver circuit low-side |
| | on | supply for driver circuit low-side is ok |
| 4 (green) | off | bus voltage too high |
| | on | bus voltage ok |
| 5 (green) | off | no supply for driver circuit high-side |
| | on | supply for driver circuit high-side is ok |
| 6 (green) | off | bus voltage too low |
| | on | bus voltage ok |

Tab. 17: LEDs pc-board DCDR

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| supply voltage current sensor | X2-1<br>X2-6 | +<br>gnd | +15V DC |
| | X2-3<br>X2-6 | -<br>gnd | -15V DC |
| temperature sensor | X3-1<br>X3-2 | gnd<br>+ | 10kΩ at 25°C |

Tab. 18: Measuring points DCDR

## Picture pc-board DCDR2x

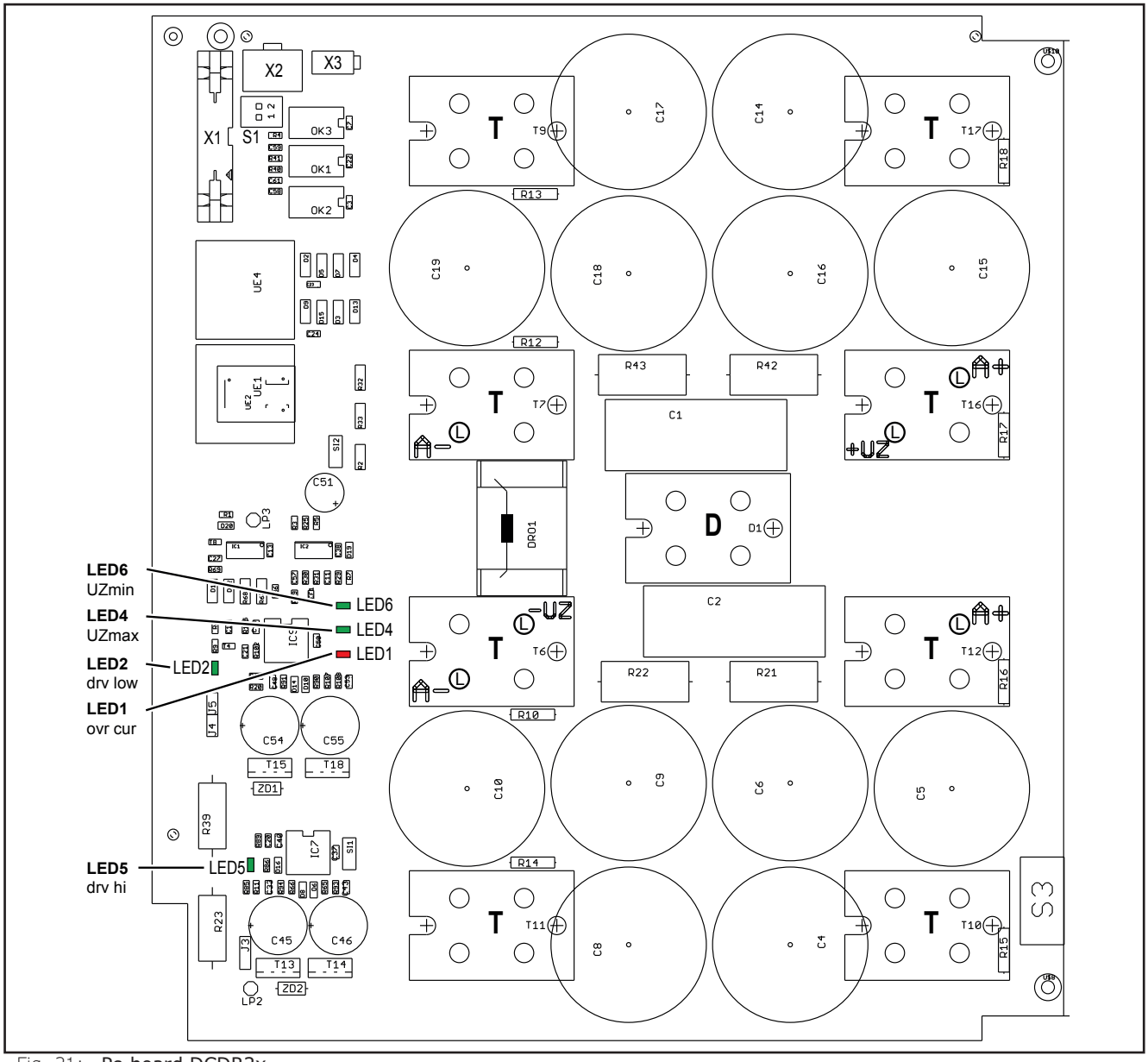



Fig. 21: Pc-board DCDR2x

T=MOSFET (power transistor)

D=diode

**!!! CAUTION !!!**

at all positions where cables are attached, the longer screws are used (A+ A- +UZ -UZ).

The rest of the ISOTOP screws are the short ones. All screws need to be tightened with a torque of **2.2Nm**.

If a MOSFET should fail, all MOSFETs have to be replaced including the DCDR. This is necessary because all MOSFETs must have the same switching times (all MOSFETs out of one production batch). In the case of a defective MOSFET, it is very likely that the drive circuit on the DCDR module is also damaged or pre-damaged. Therefore, in this case also the pc-board DCDR has to be exchanged.

## Overview connectors pc-board DCDR

| connector | designation |
|---|---|
| X1 | flat ribbon cable to pc-board MAPRO05 |
| X2 | connection to current sensor and pc-board PWRUP |
| X3 | connection temperature sensor |

Tab. 19: Connectors DCDR

## PWM-Driver

The pc-baord DCDR is the primary driver board for the transformer. It is a classical half bridge design. The supply is provided via pins 1, 2 and 3 of the flat ribbon cable and the PWM signals (PWM = Pulse Width Modulation) for driving the MOSFETs are at pin 5 (low side) and pin 6 (high side).

## Monitoring primary current

The “A+” wire of the transformer (primary coil) is going through a current sensor. As soon as the primary input current gets too high, the driver circuits are locked and via pin 8 of the flat ribbon cable the DCDR signals to the MAPRO that an “overcurrent” has occured (see details on page 59).

## Monitoring bus voltage

The bus voltage is monitored by the DCDR board. As soon as the bus voltage gets too high or too low, the DCDR signals to the MAPRO via pins 9 (overvoltage) and 10 (undervoltage) that the bus voltage is out of limits (see details on page 60).

## Schematic

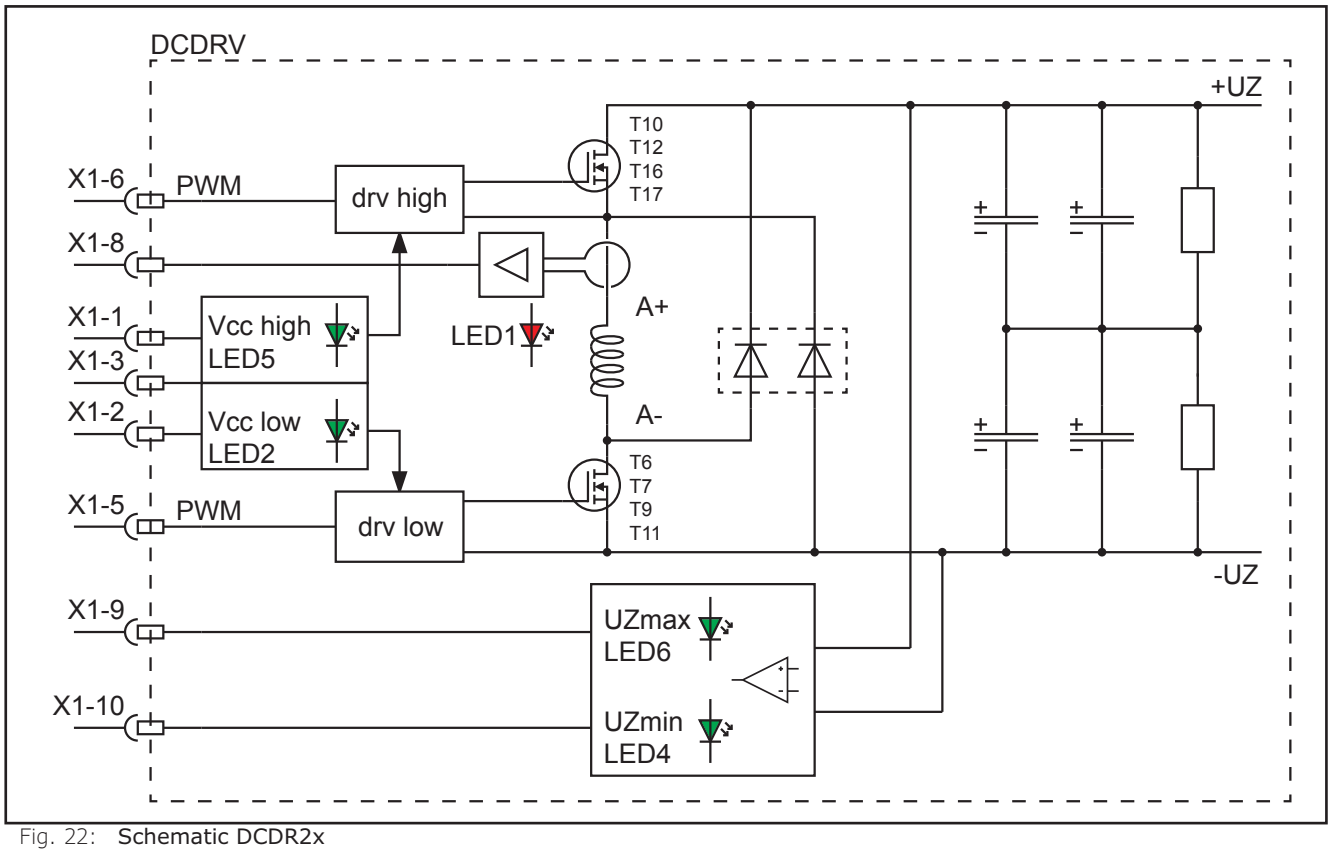



Fig. 22: Schematic DCDR2x

## 7.12 Pc-board DK-PWRUP / DK-PWRUP02

The pc-board DK-PWRUP is the charge-up control of the S3 and P3500. Depending on the type of the water pump or the application, the DK-PWRUP or the DK-PWRUP02 is used.

| cooling unit | DK-PWRUP | DK-PWRUP02 |
|---|---|---|
| water pump | standard | “high pressure” |
| application | standard | intermediate feeder |
| fuses | 2 x 4A / 500V (slow) | 2 x 6.3A / 500V (slow) |

Tab. 20: Useage pc-boards DK-PWRUP

### Functions

- limitation of inrush-current when charging up the capacitors on pc-board DCDR
- supply for control transformer

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| mains input L1 | X5 | ~ | 400V AC |
| mains input L2 | X6 | ~ | |
| mains input L3 | X7 | ~ | |
| mains output L1 | X1 | ~ | 400V AC |
| mains output L2 | X2 | ~ | |
| mains output L3 | X3 | ~ | |
| supply voltage control transformer | X10-1<br>X10-2 | ~<br>~ | 400V AC |
| relay voltage | X4-1 + -3<br>X4-2 + -4 | +<br>- | +24V DC |

Tab. 21: Measuring points PWRUP

### Picture pc-board DK-PWRUP

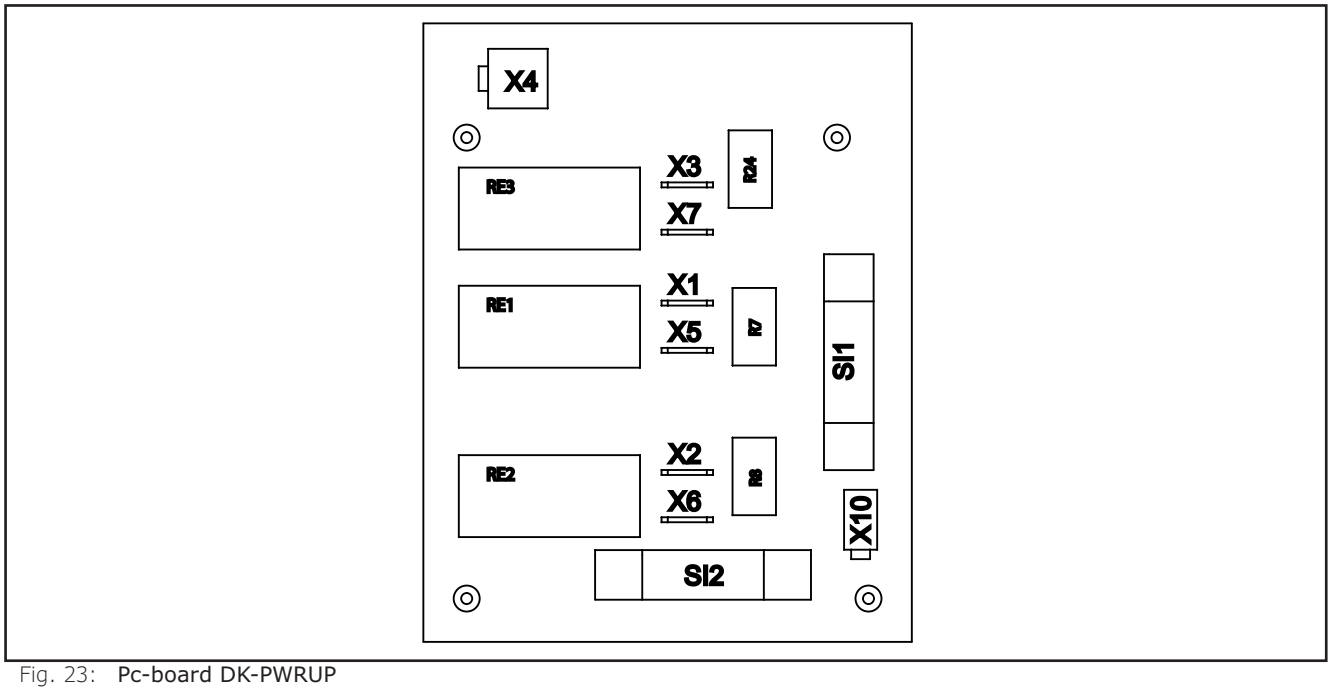



Fig. 23: Pc-board DK-PWRUP

## 7.13 Pc-board DK-PWRUP04DKL / DK-PWRUP05-DKL

The pc-board DK-PWRUP is the charge-up control of the S5, S8 and P4500, P5500. Depending on the type of the water pump or the application, the DK-PWRUP04 or the DK-PWRUP05 is used.

| cooling unit | DK-PWRUP04DKL | DK-PWRUP05-DKL |
|---|---|---|
| water pump | standard | “high pressure” |
| application | standard | intermediate feeder / Cobot |
| fuses | 2 x 4A / 500V (slow) | 2 x 6.3A / 500V (slow) |

Tab. 22: Pc-boards DK-PWRUP

### Functions

- limitation of inrush-current when charging up the capacitors on pc-board DCDR
- supply for control transformer

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| mains input L1 | X1 | ~ | 400V AC |
| mains input L2 | X2 | ~ | |
| mains input L3 | X3 | ~ | |
| mains output L1 | X11 | ~ | 400V AC |
| mains output L2 | X12 | ~ | |
| mains output L3 | X13 | ~ | |
| supply voltage control transformer | X10-1<br>X10-2 | ~<br>~ | 400V AC |
| relay voltage | X4-1 + -3<br>X4-2 + -4 | +<br>- | +24V DC |

Tab. 23: Measuring points PWRUP04/-05

### Picture pc-board DK-PWRUP04/-05DKL

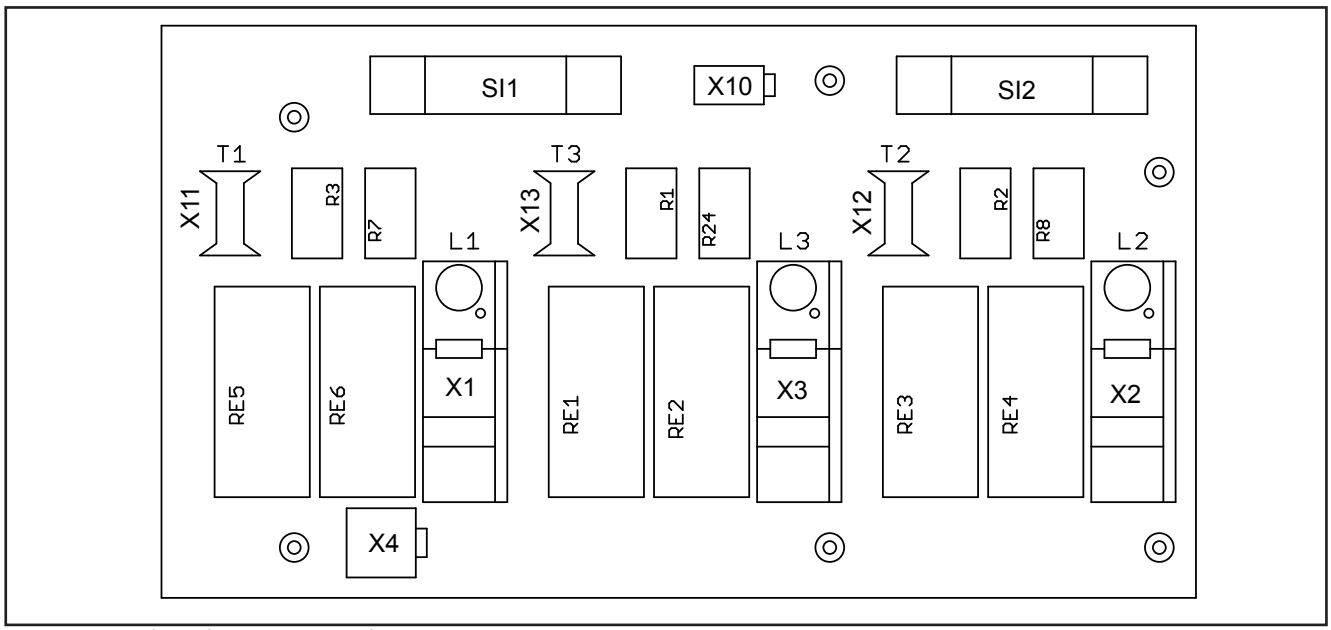



Fig. 24: Pc-board DK-PWRUP04/-05DKL

## 7.14 Pc-board DP-S3NEFI

The pc-board S3NEFI is the mains filter board and power-up of the S3 mobile and P3000 mobile.

### Functions

- mains filter
- limitation of inrush-current when charging up the capacitors on pc-board DCDR
- supply for control transformer

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| mains input L1 | LP1 | ~ | 400V AC |
| mains input L2 | LP2 | ~ | |
| mains input L3 | LP3 | ~ | |
| mains output L1 | LP4 | ~ | 400V AC |
| mains output L2 | LP5 | ~ | |
| mains output L3 | LP6 | ~ | |
| supply voltage control transformer | X10-1<br>X10-2 | ~<br>~ | 400V AC |
| relay voltage | X4-1 + -3<br>X4-2 + -4 | +<br>- | +24V DC |

Tab. 24: Measuring points S3NEFI

### Picture pc-board S3NEFI

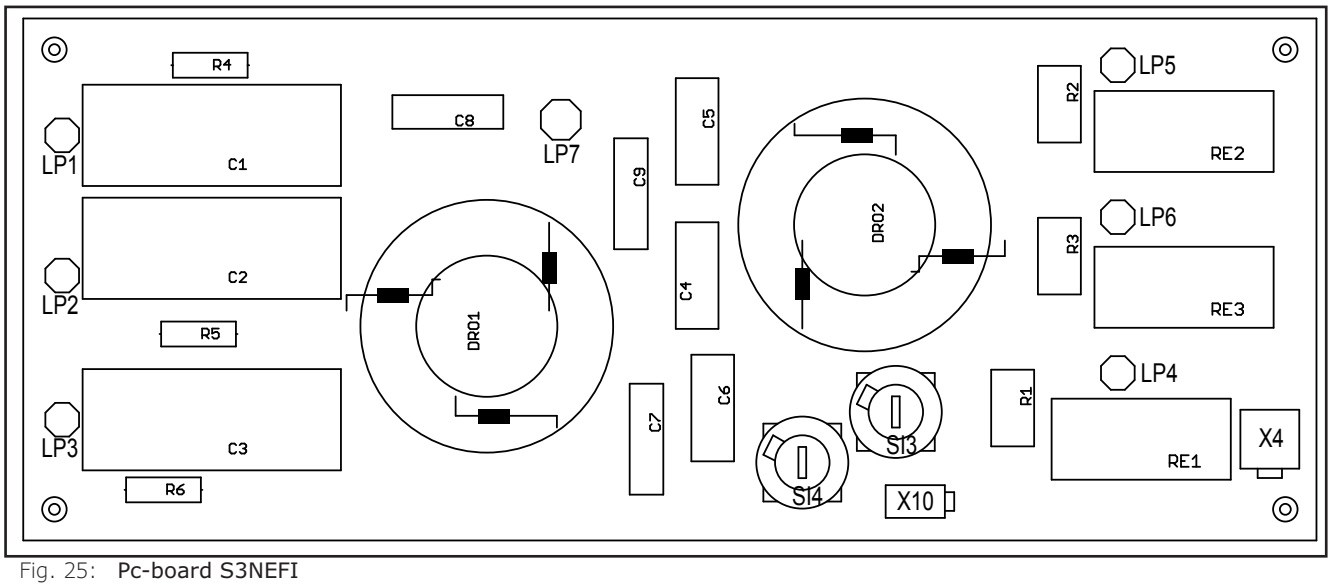



Fig. 25: Pc-board S3NEFI

## Power-up cycle

After switching on the machine with the mains switch, the capacitors on the DCDR pcb are charged up first.

These capacitors are buffering the bus voltage (rectified mains voltage). The input current during charge up can be very high and must be limited to prevent the mains fuses to break. The current limitation is made by the PWRUP pcb, where each phase is conducted via resistors to the mains rectifier. After a charge up time for about two seconds, the resistors on the PWRUP pcb are shorted with the relays, so the the full mains input is present and the bus voltage is at maximum (560V DC to 580V DC).

The bus voltage is monitored by the DSP (Process) and the relays on the PWRUP board are switched by the microcontroller (Master).

## Schematic

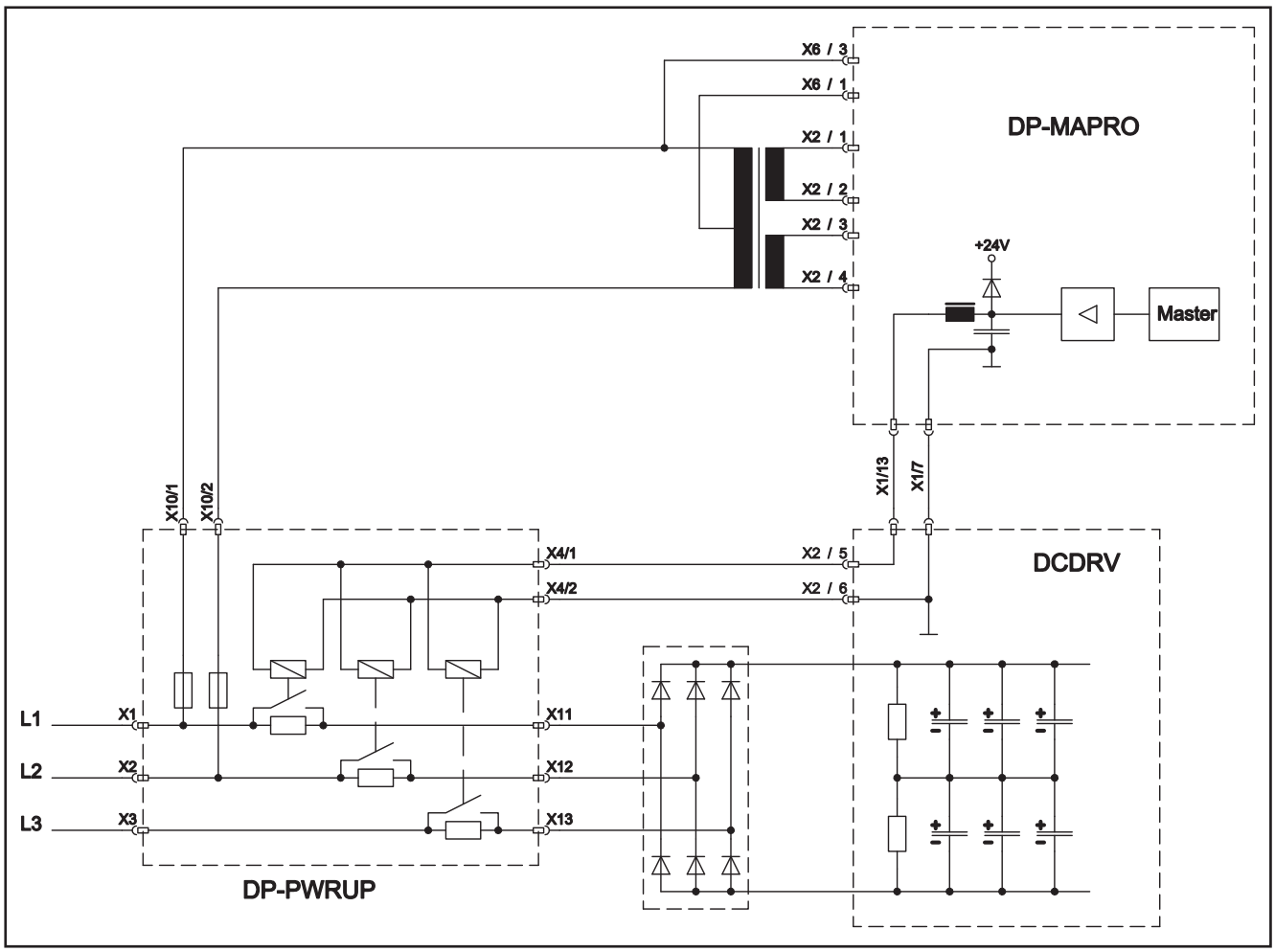



Fig. 26: Power-up circuit

## 7.15 Pc-board DK-GLCL3

The pc-board DK-GLCL3 is for connecting/wiring the secondary rectifier diodes.

### Functions

- connecting diodes
- impulse smoothng
- diode protection

### Picture pc-board DK-GLCL3

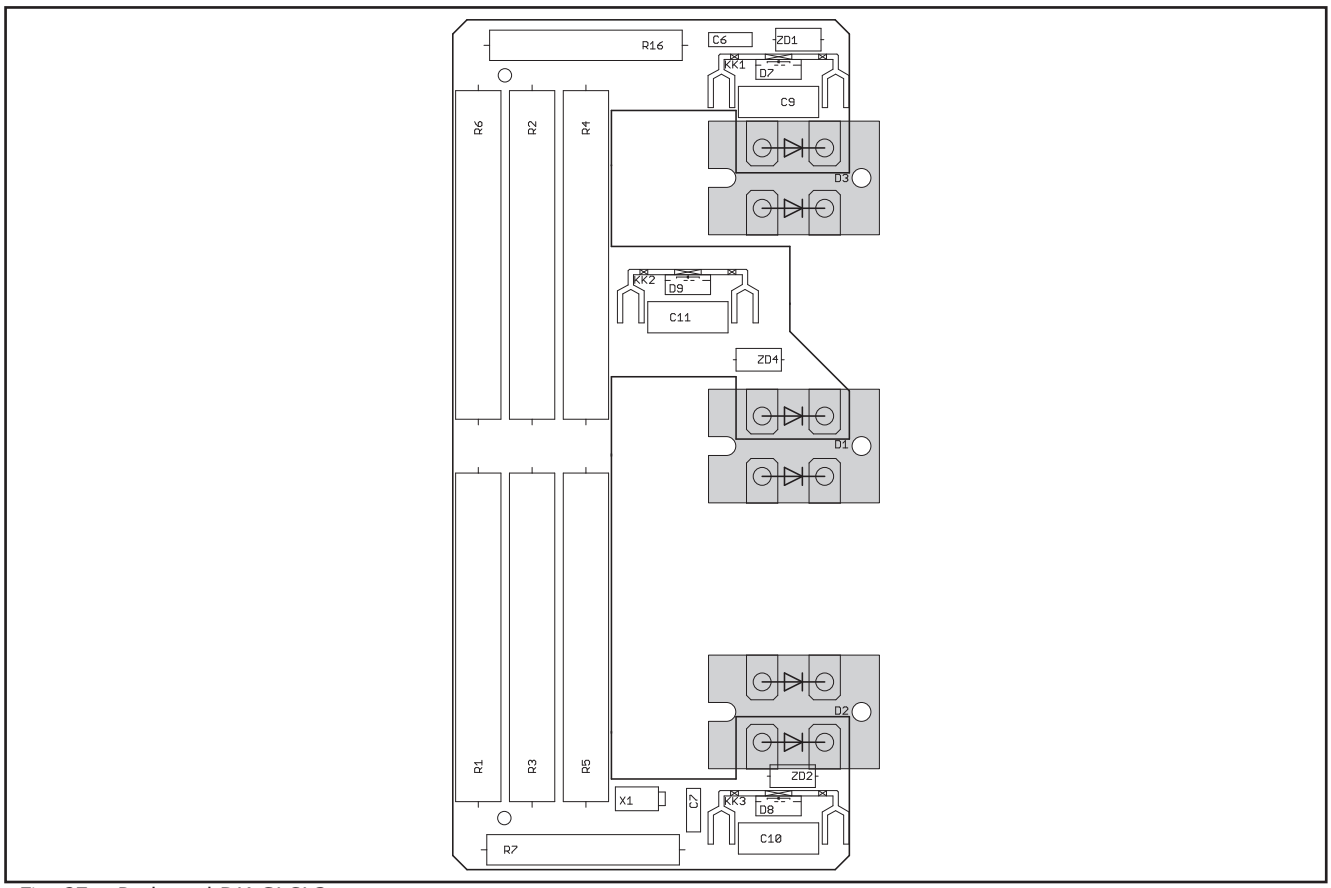



Fig. 27: Pc-board DK-GLCL3

### Schematic

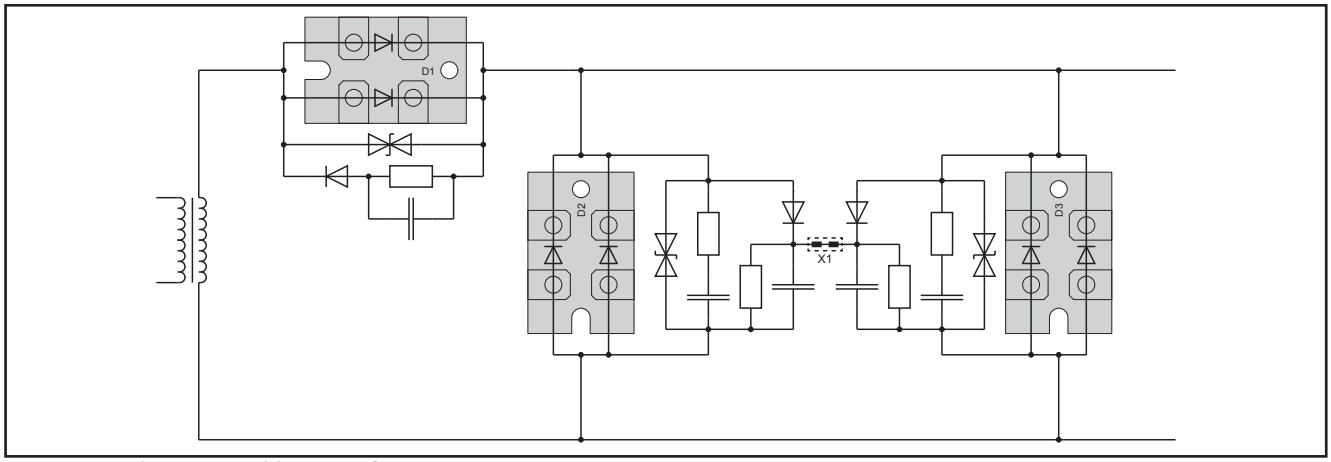



Fig. 28: schematic welding rectifier

## 7.16 Pc-board DP-UFI-BO

The pc-board DP-UFI-BO is a filter circuit for meassuring the output voltage.

### Functions

– low-pass filter for measuring output voltage

### Picture pc-board DP-UFI-BO

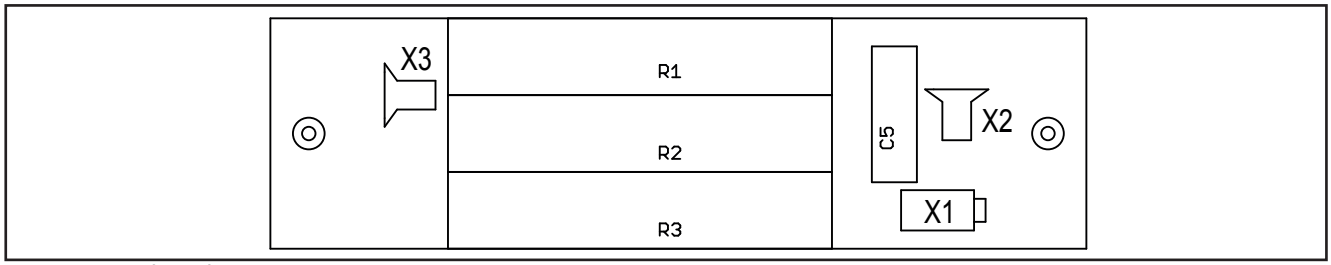



Fig. 29: Pc-board DP-UFI-BO

## 7.17 Pc-board DP-EMV

The pc-board DP-EMV is a emc-filter circuit for the compliance with emc regulations.

### Functions

– emc filter

### Picture pc-board DP-EMV

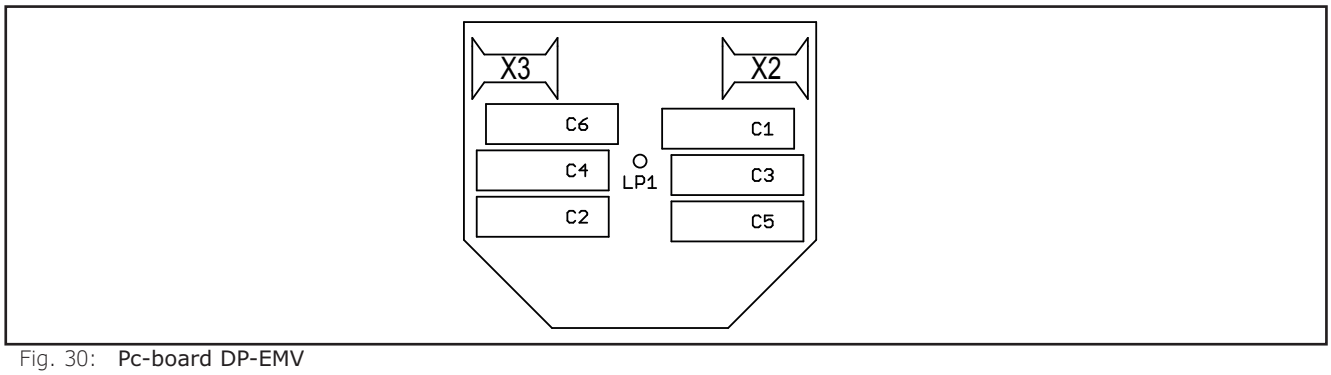



Fig. 30: Pc-board DP-EMV

### Schematic

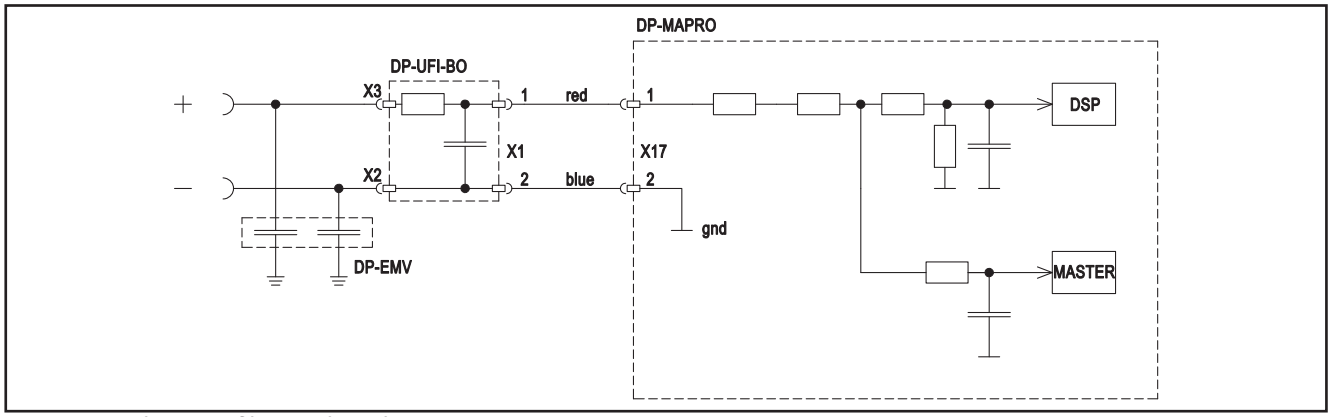



Fig. 31: Schematic filter pc-boards

## 7.18 Pc-board DS-ERW

The pc-board DS-ERW is an extension board for machines with additional wire feeder (AB or BB version).

### Functions

- switching between wire feeder 1 / wire feeder 2
- driving solenoid valve
- driving water valves

### LEDs

| LED | state | meaning |
|---|---|---|
| 1 (green) | off | wire feed unit 1 is active |
| | on | wire feed unit 2 is active |

Tab. 25: LEDs DS-ERW

### Picture pc-board DS-ERW

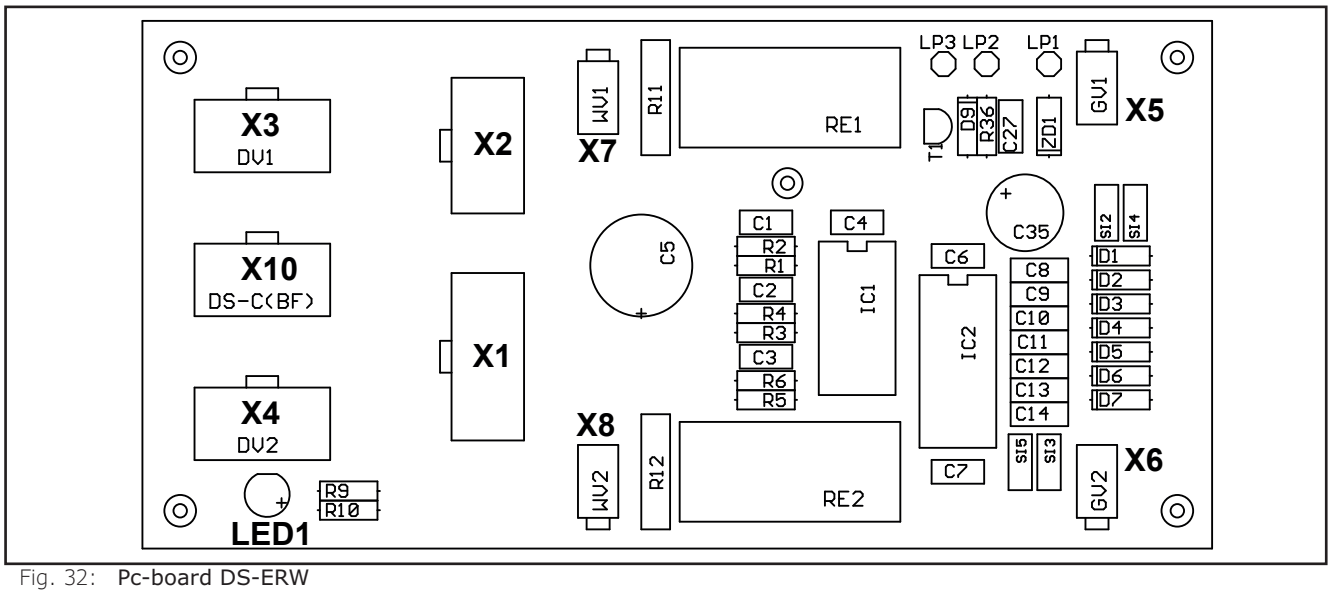


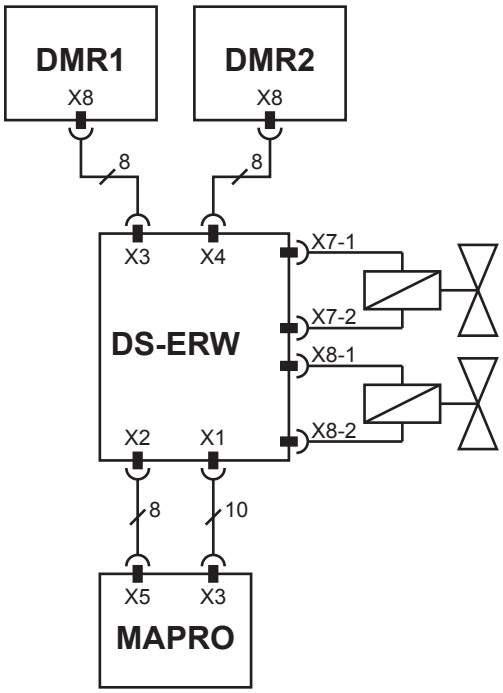

Fig. 32: Pc-board DS-ERW

### Overview connectors pc-board DS-ERW

| connector | designation |
|---|---|
| X1 | connector to pc-board MAPRO05 |
| X2 | connector to pc-board MAPRO05 (interpass hose) |
| X3 | connector to pc-board DMR 1 (first wire feed unit) |
| X4 | connector to pc-board DMR 2 (second wire feed unit) |
| X5 | connector gas valve 1 |
| X6 | connector gas valve 2 |
| X7 | connector water valve 1 |
| X8 | connector water valve 2 |

Tab. 26: Connectors DS-ERW

## Schematic




In addition to the two DMR boards, the water valves are also connected the DS-ERW. Depending on the active torch (feed one or two), the water cooling circuit is also switched over.

## 7.19 Pc-board TC21

The pc-board TC21 is the control board used inside the PowerMaster torches and in the hand remote control RC20.

It is used to set welding parameters.

The communication is done via the torch trigger wires (PowerMaster torch) in the central connector (bi-directional, single-wire communication), or via the start-contact wires of the remote control socket (RC20).

### Functions

- display and change of welding parameter and Tiptronic jobs
- torch button (start/stop)

### Picture pc-board TC21

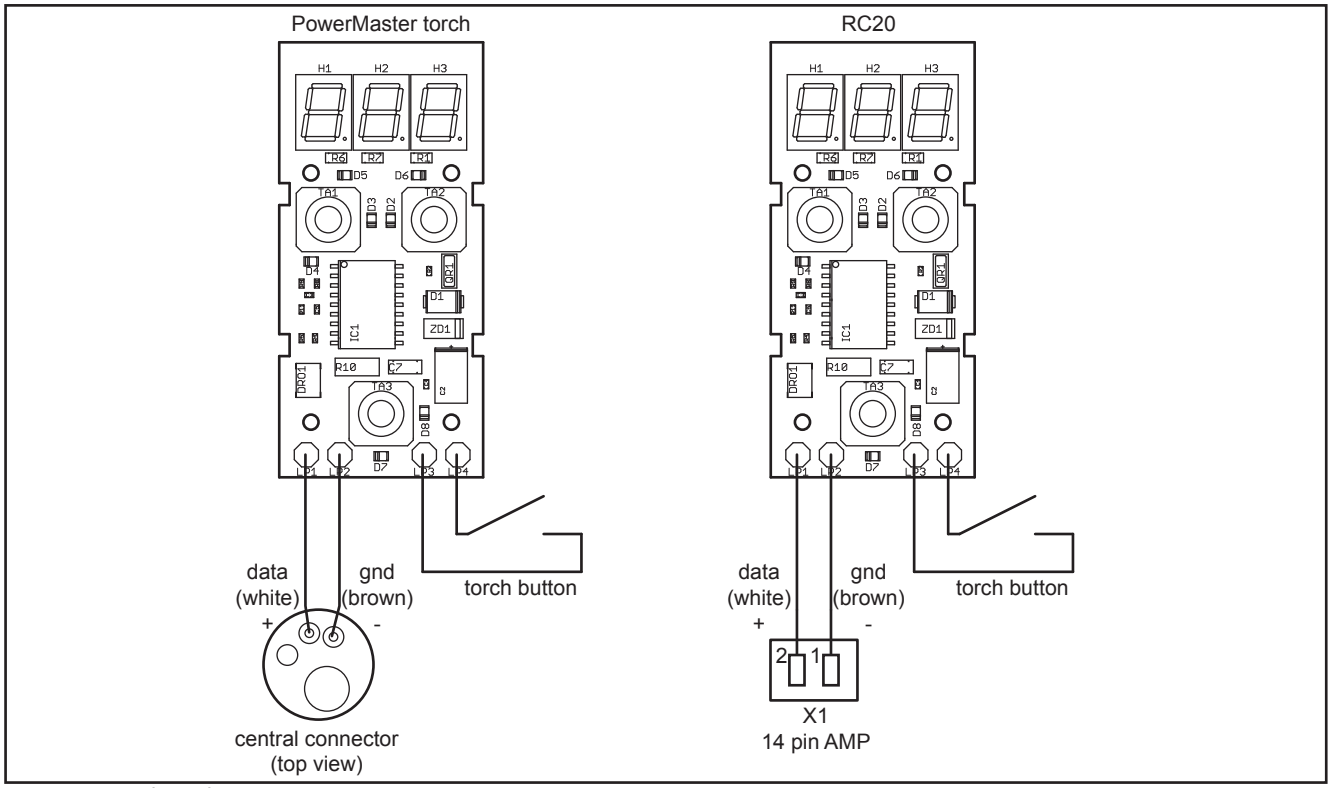



Fig. 33: Pc-board TC21

### Schematic

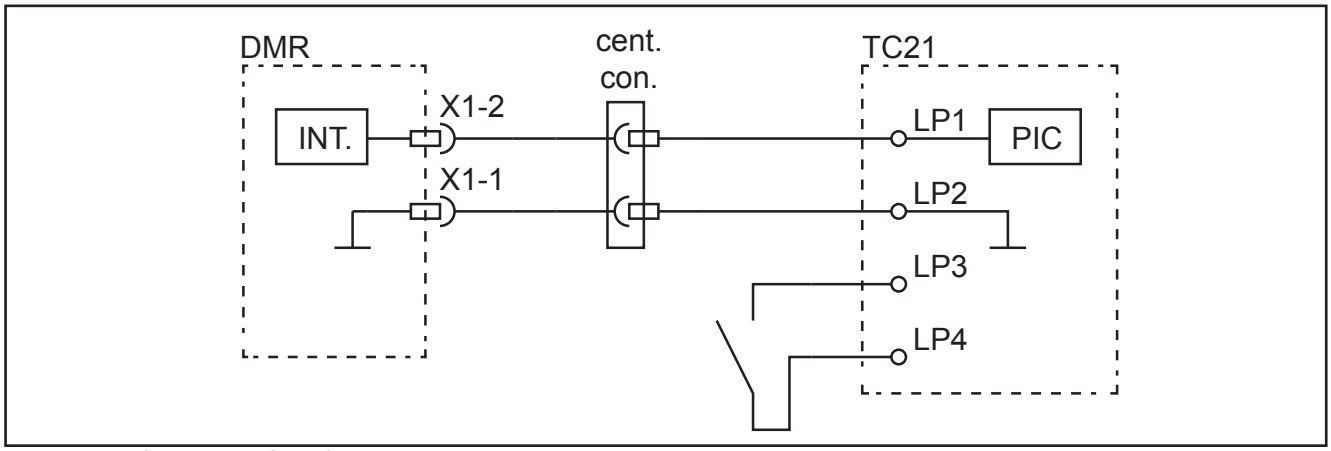



Fig. 34: Schematic pc-board TC21 PowerMaster

# 8 Electrical Components

## 8.1 Current Sensor VAC

The current sensor is used to measure the weldng current.

### Measuring points

| designation | measuring point | | result |
|---|---|---|---|
| supply voltage | X1-1<br>X1-2<br>X1-4 | +<br>- | +15V DC<br>-15V DC |
| sensor output | X1-3 | | output current signal 1:2000) |

Tab. 27: Measuring point current sensor VAC

### Picture current sensor VAC

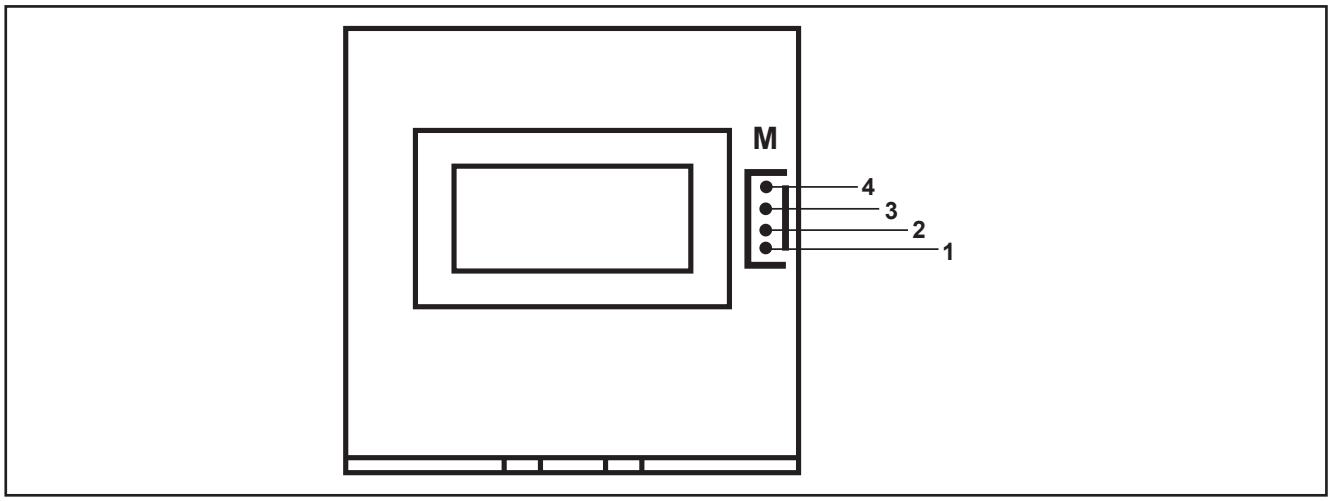


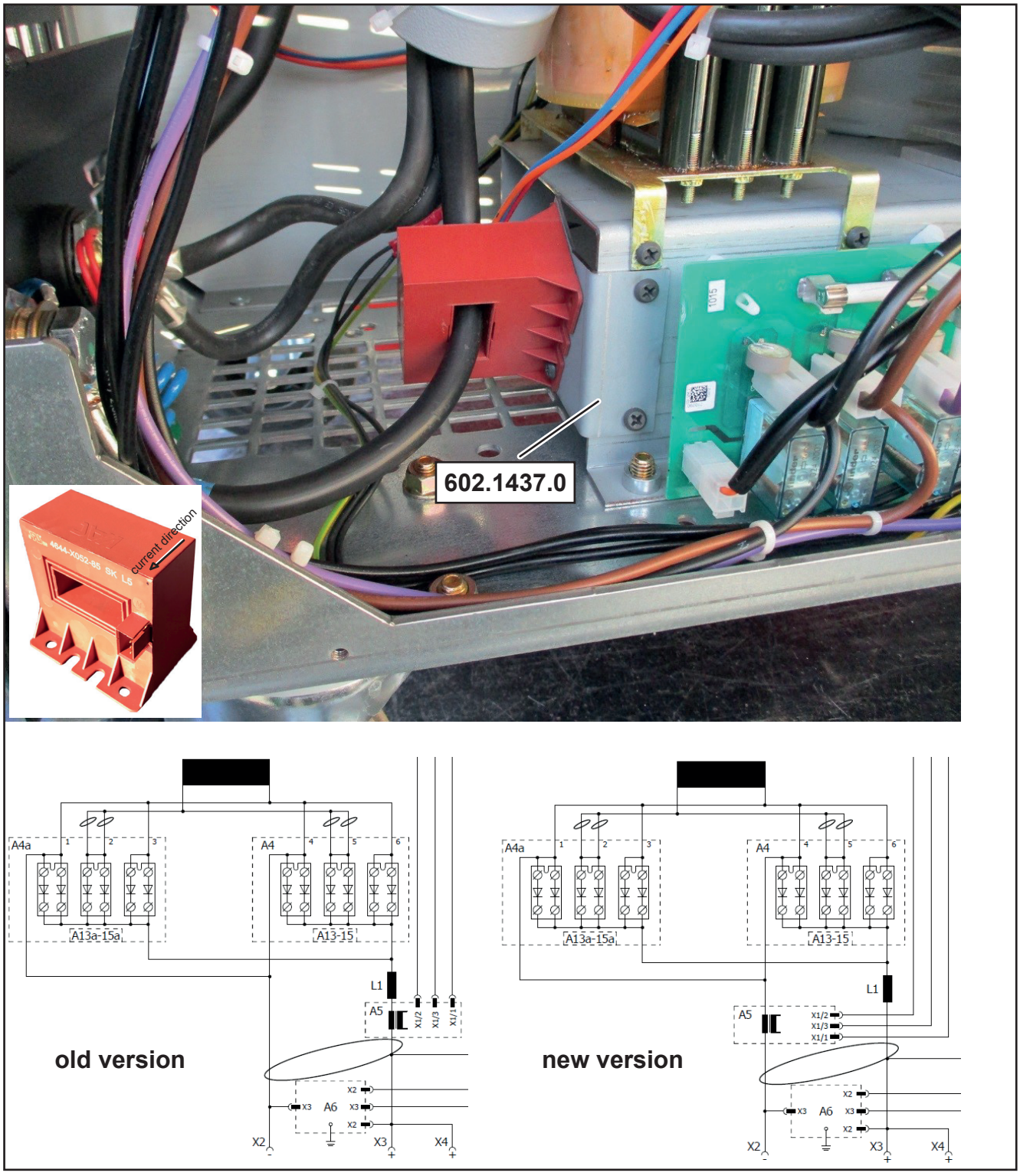

Fig. 35: Current sensor VAC

## New VAC position

With the release of the software version 3.05 on 29.03.2018 the ignition behaviour of some welding characteristics has been improved. As a result, the magnetic field of the welding inductor also increases. This stronger magnetic field also affected the current sensor VAC, which was mounted relatively close to the welding choke, and sporadically there were false measurings. In these cases, the power source responded with error messages E16 or E24 (overcurrent).

Since 17.09.2018, the VAC is mounted with a retaining plate (602.1437.0) in a new position to ensure a greater distance to the inductor.

While the current sensor was in the positive line with the previous wiring, it is now in the minus line. When retrofitting, the correct current direction of the VAC must be ensured.



## 8.2 Control transformer

Depending on the machine configuration, different control transformers are used.

| control transformer | useage |
|---|---|
| 655.8021.0 | S3, S5, S8 / P3500, P4500, P5500 with standard water pump |
| 655.8023.0 | S3 mobile / P3000 mobile |
| 655.8031.0 | S3, S5, S8 / P3500, P4500, P5500 with intermediate feeder |
| 655.8037.0 | S3, S5, S8 / P3500, P4500, P5500 with water pump “high pressure” |

Tab. 28: Conrol transformers

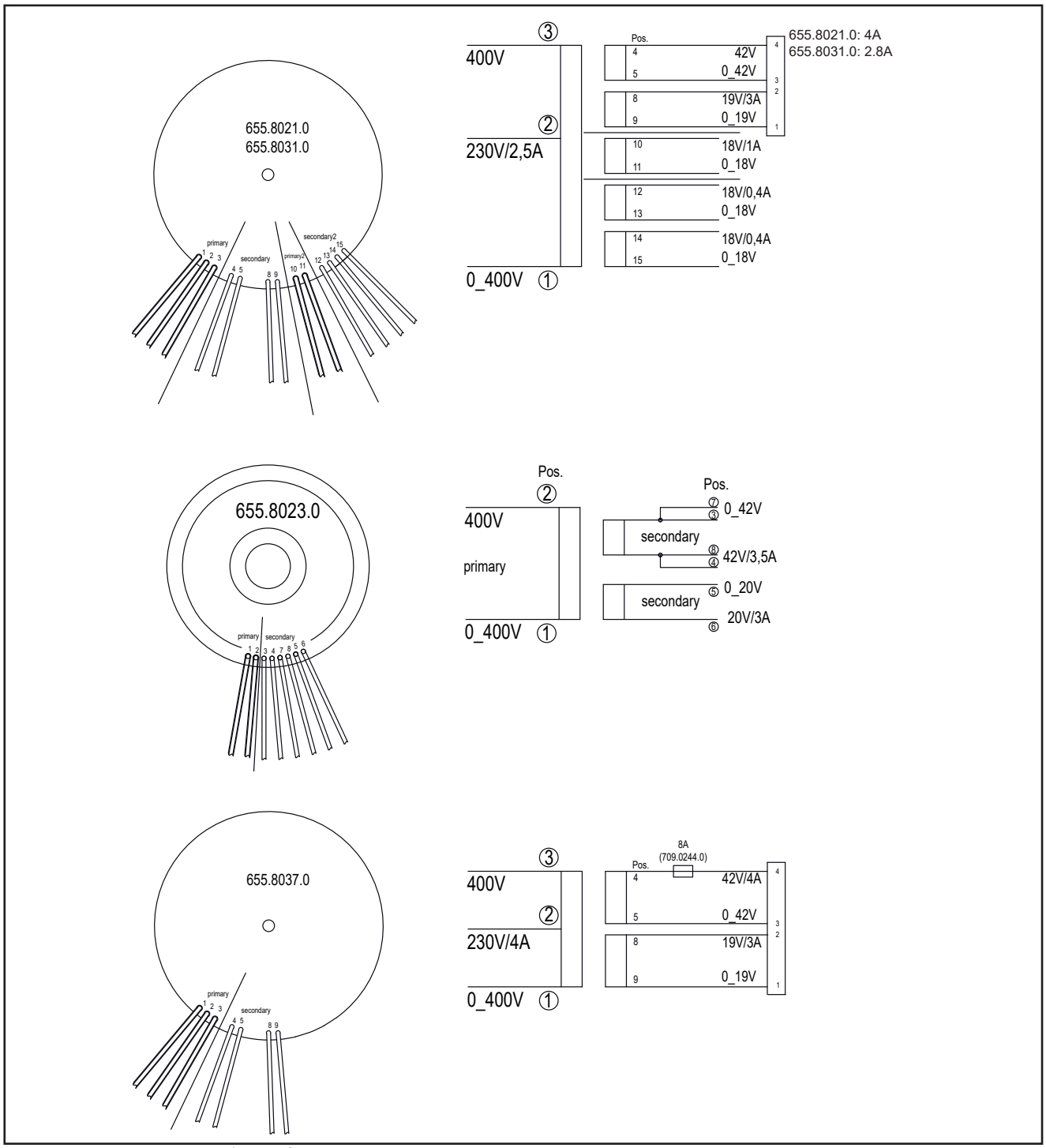



Fig. 36: Overview control transformers

## 8.3 TIG Option

The TIG mode can be retrofit into all S- and P- machines. The retrofit kit contains all necessary parts like a additional solenoid valve and a TIG control socket. The TIG function must be activated first, before the mode can be selected via the mode button at the front panel (see also “9.14 Service Codes” on page 63).

| retrofit kit | part number |
|---|---|
| power source “driveable” | 570.8035.0 |
| power source “mobile” | 570.8036.0 |

Tab. 29: Overview retrofit kits TIG option

### Schematic

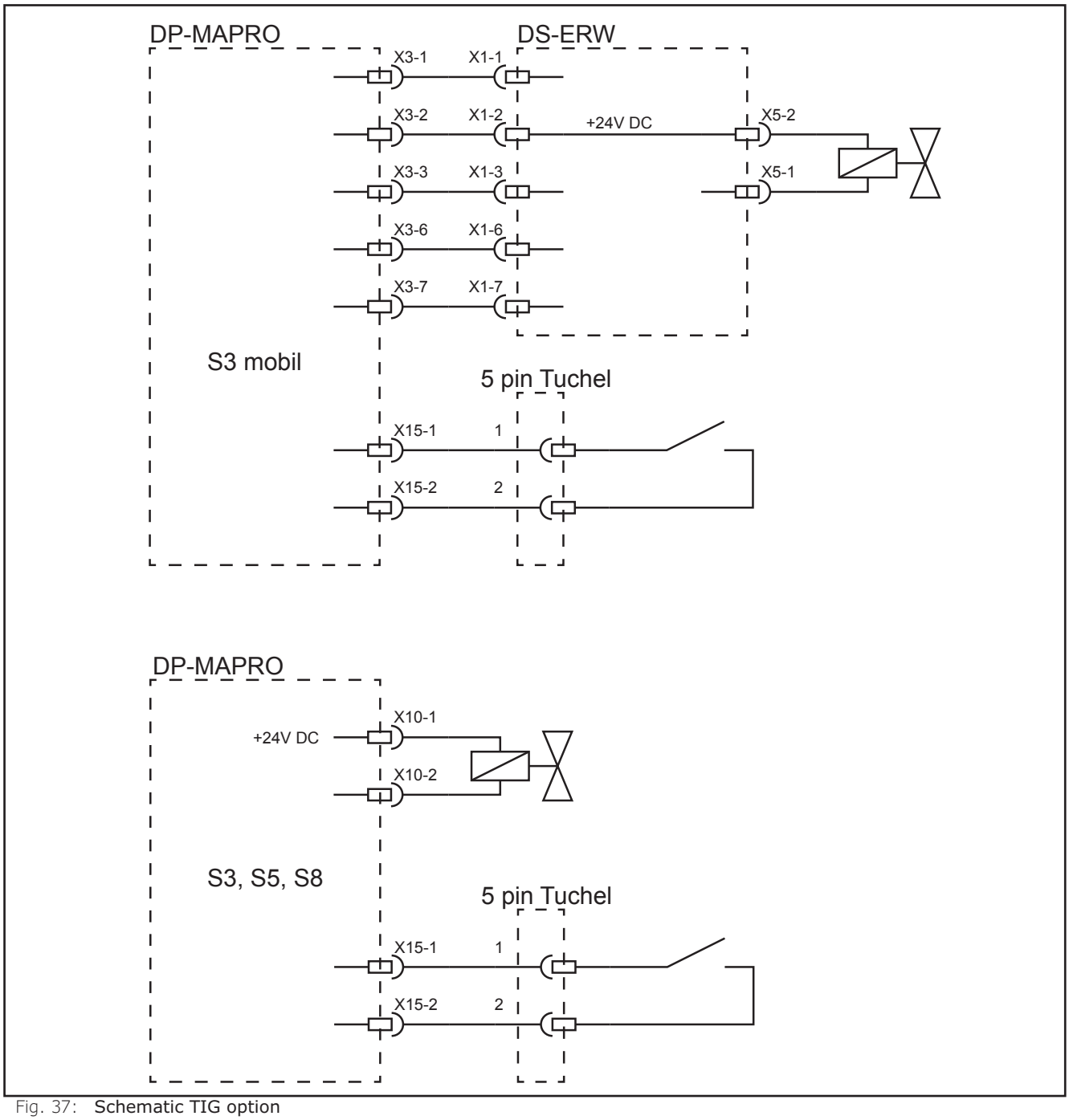



Fig. 37: Schematic TIG option

# 9 Troubleshooting

## 9.1 Monitoring temperature

The temperature of the heat sink is constantly monitored via a temperaure sensor. This sensor is a temperature dependent resistor (NTC = negative temperature coefficient). The higher the temperature, the lower the resistance value of the sensor.

### Schematic

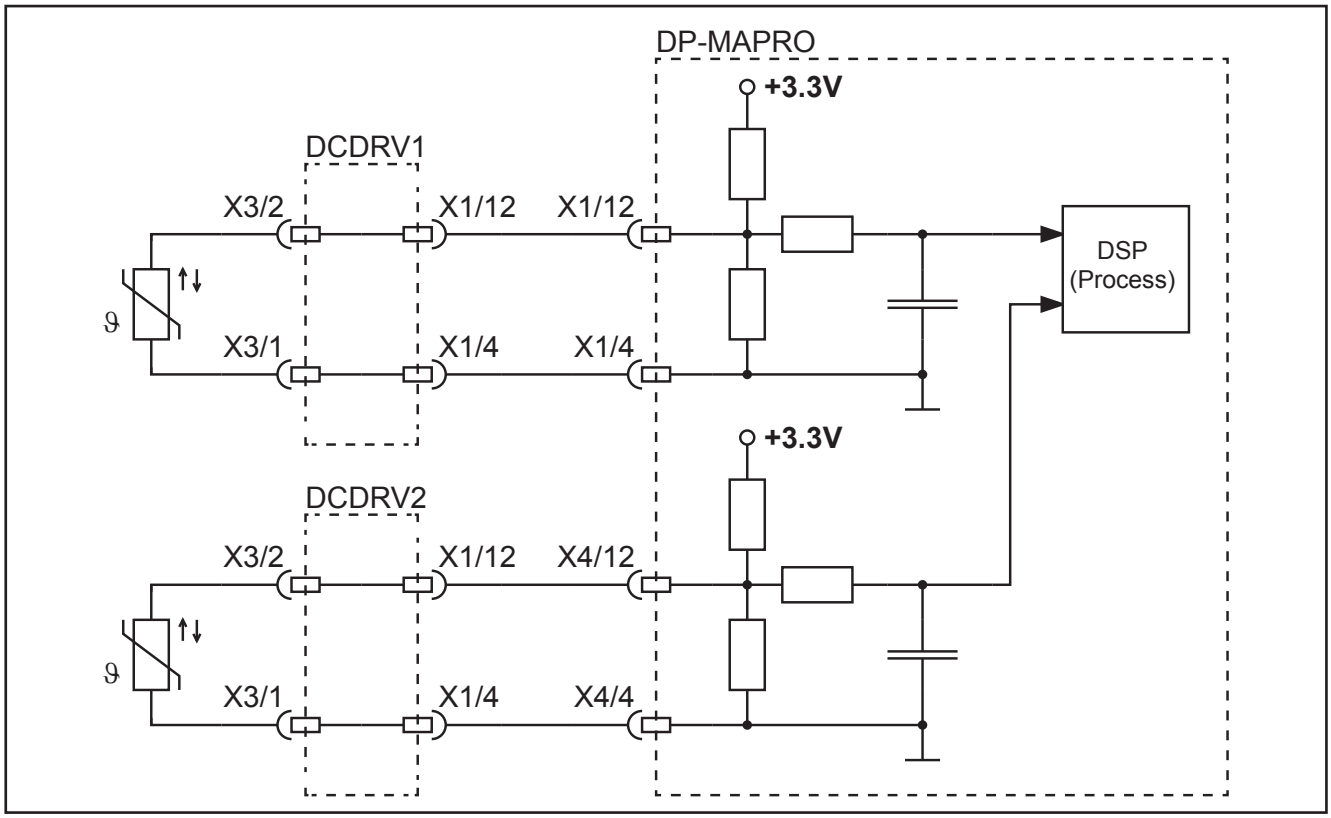



Fig. 38: Temperature monitoring

The DSP is monitoring the temperature of the heatsink and as soon as the temperature reaches the programmed maximum value, the machine will stop and displays **E01** (thermal overload).

The actual value of the temperature can be displayed at the front panel in menu Extras, Diagnosis, Module Temperatures.

| Machine type | max. Temperature |
|---|---|
| S3, S3 mobile, P3000 mobile, P3500 | 77°C |
| S5, P4500 | 80°C |
| S8, P5500 | 75°C |

Tab. 30: Maximum temperatures

If the connection of the sensors to the MAPRO is interrupted (loose contact at any of the connectors), the machine will stop after some time and displays **E13**, because a rise of the temperature can not be detected.

There is a special overload program active in the DSP, which calculates and monitors the inside temperature of the semiconductors (MOSFET power transistors). Before the inside temperature reaches a critical limit, the machine will stop and displays **E18** (Overload protection).

## 9.2 Supply voltages

All internal supply voltages are generated and monitored on the pc-board MAPRO05. The basic supply is coming from the control transformer.

### Schematic

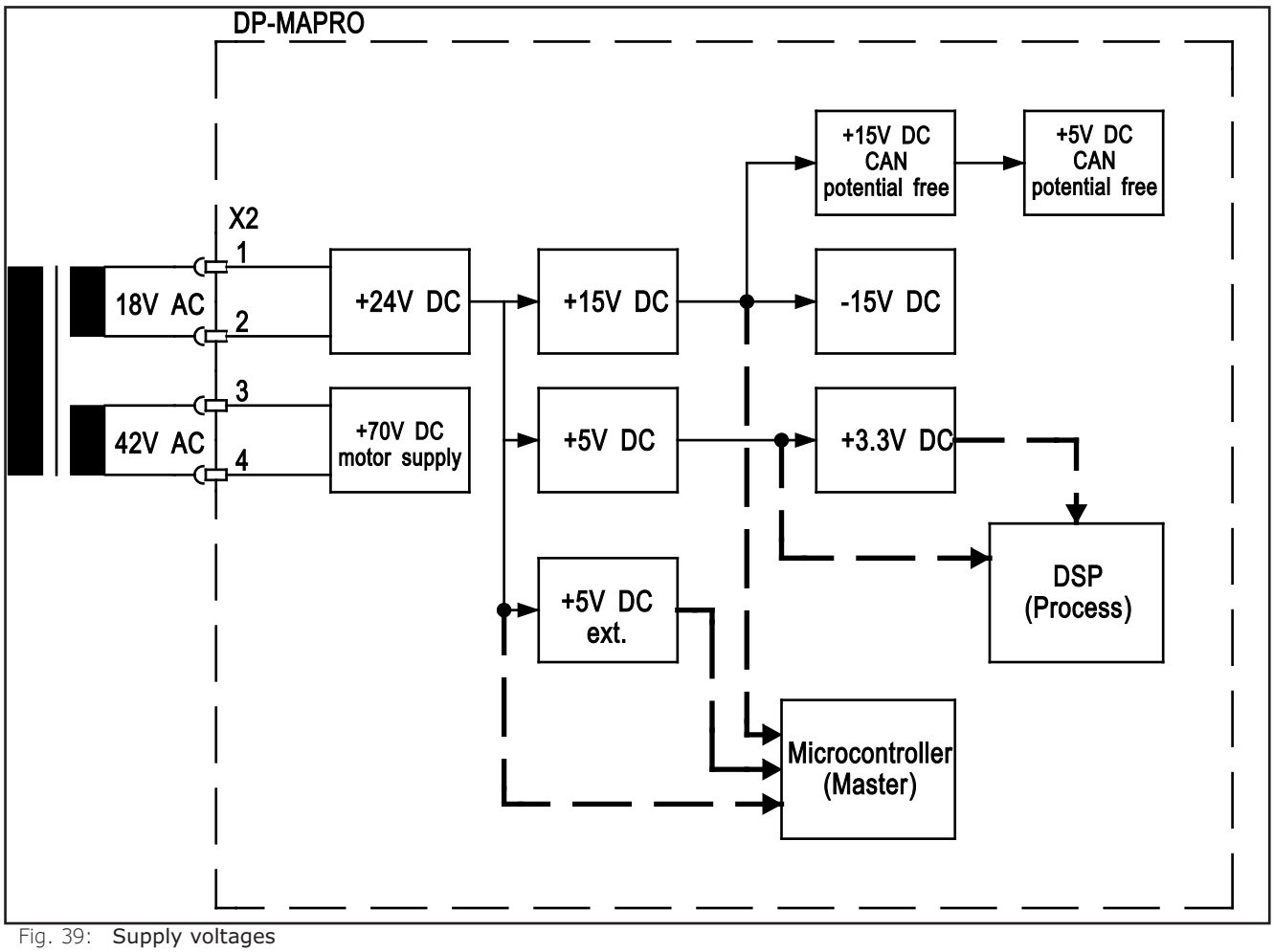



Fig. 39: Supply voltages

Different supply voltages are monitored by the Microcontroller (Master) and the DSP (Process).
If the 24V drops below 17V the machine will stop and displays **E14** (Op. voltages error).
If the 24V are higher than 36V the machine will stop and displays **E02** (mains overvoltage).

| voltage | limit | reaction |
|---|---|---|
| +24V DC | <17V DC | Shutdown with E14 |
| +24V DC | >36V DC | Shutdown with E02 |

Tab. 31: Voltage limits

The actual values of the 24V and 15V can be checked via the front panel in menu Extras, Diagnosis, Op. Voltages.

## 9.3 Monitoring welding current

The welding current is measured via a separate current sensor (VAC). The current is monitored by the Microcontroller (Master) and the DSP (Process) independantly from each other.

### Schematic

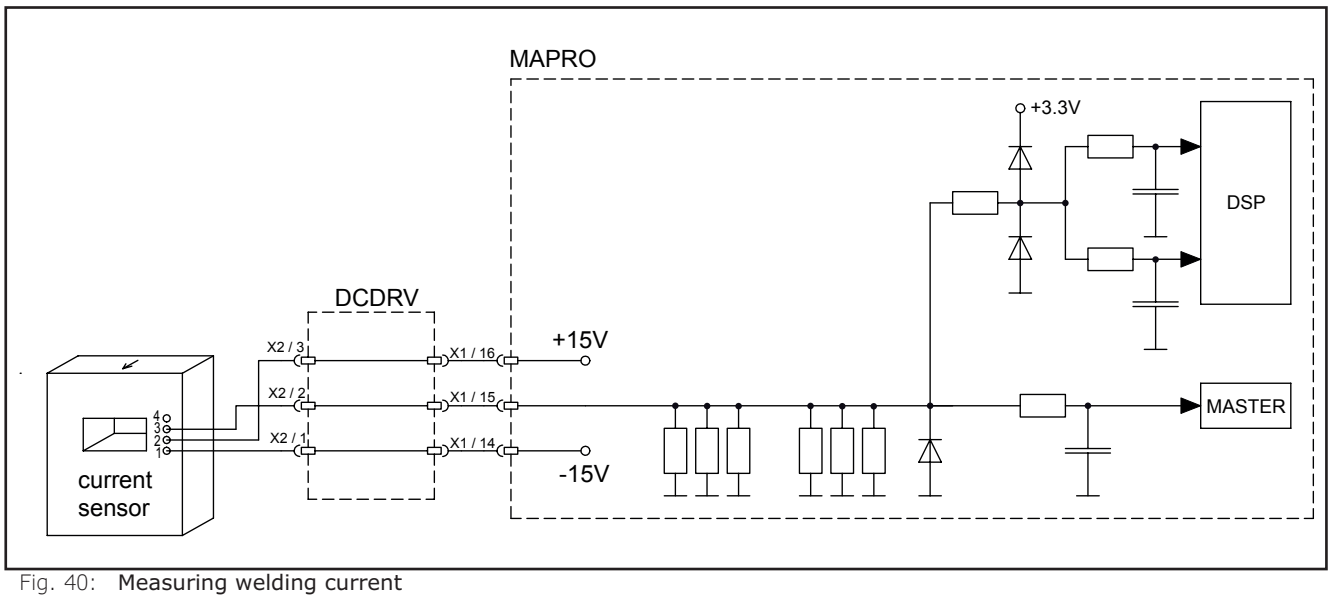



Fig. 40: Measuring welding current

The output of the current sensor is a current with a ratio of 1:2000, meaning at a welding current of 300A the sensor output is 150mA. The output current is measured via an internal shunt resistor by the Master and Process (independant measurings).

If the Master measures a current >120% of the maximum value, the machine will stop and displays **E03** (secondary overcurrent). For example the maximum welding current of a Saprom S5 is 400A, if the Master measures a welding current > 480A, it stops with **E03**.

If the Master measures a voltage >3.5V at the shunt resistor (that would mean a welding current >988A), the machine will stop and displays **E09** (error v/a measuring).

If the Process is measuring a welding current >20A although the machine is not welding (standby), the machine will stop and displays **E21** (Output voltage/current).

## 9.4 PE-protection / gas pressure switch

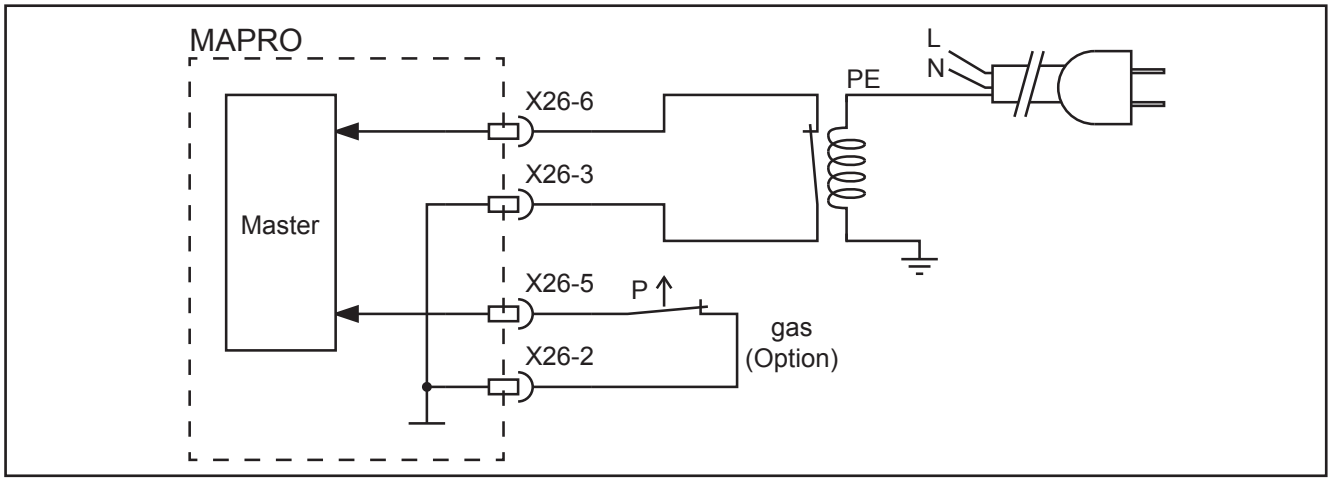
All machines of the S- and P-Relaunch series have a build-in PE protection by standard. As soon as a current >15A is flowing via the PE (protective earth) wire of the mains cable, the Reed-contact opens and the machine stops with the code **E04-01** (Stop/peripherals error).

### Gas monitoring (optional)

An additional optional feature is a gas monitoring function using a gas pressure switch. The opening contact of the pressure switch is directly connected to the MAPRO05 board.

As soon as the gas pressure switch opens (gas bottle is empty), the machine would stop with **E04-02** (Stop/peripherals error). The message is only shown if the switch opens during the time the gas valve is active (during welding, gas post flow time or gas test).

### Schematic




Both monitoring functions (PE and gas) are self-activating functions, that means as soon as the Master detects a closed contact at the input X26-6 or X26-5, the respective monitoring function becomes permanently active. From that time on the Master is expecting always a closed contact.

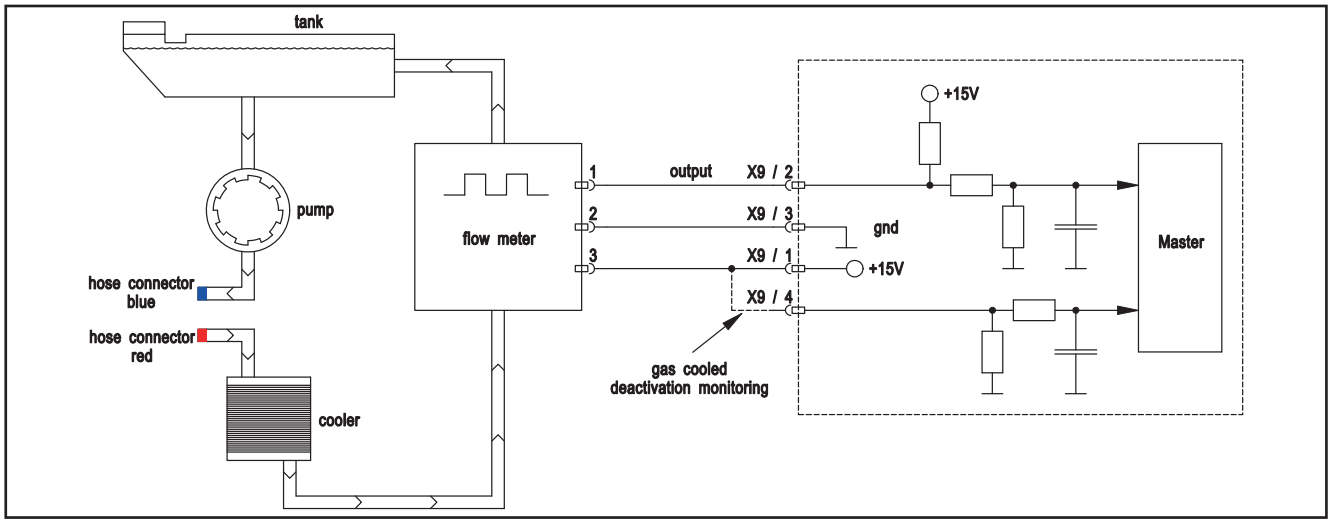
The monitoring functions can be deactivated using the Service codes 663 and 665 (see also “9.14 Service Codes” on page 63).

## 9.5 Cooling unit

At watercooled machines, the flowrate of the coolant is measured in the return flow. The flowmeter output is a digital signal where it's frequency is proportional to the flowrate. The higher the flowrate, the higher the frequency.

If the flowrate is below 0.3 liter per minute, the machines will stop and dislays **E05** (cooling system error).

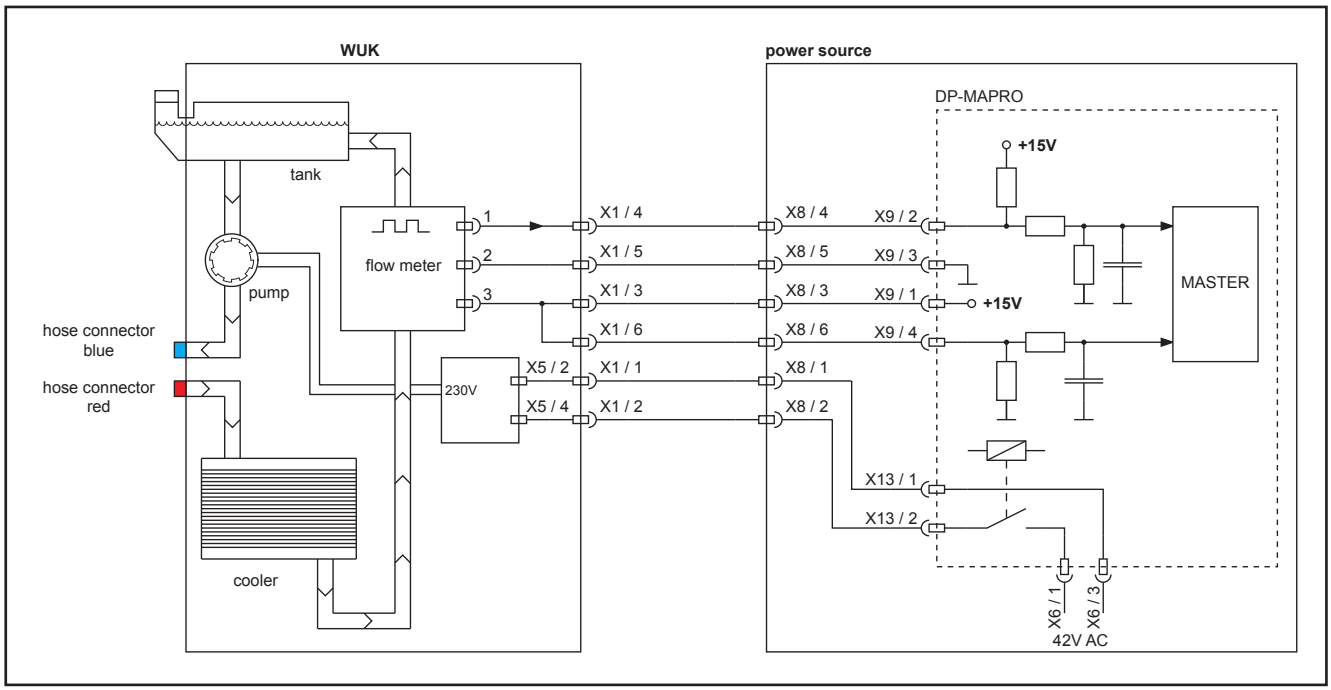
### Schematic internal cooling unit




The actual flowrate can be monitored via the front panel in menu Extras, Diagnosis, Flowrate Cool.System.

At gas cooled machines instead of the flowmeter, there is a small cable bridge between pin 1 and 4 at connector X9. This cable bridge is deactivating the monitoring of the flowmeter.

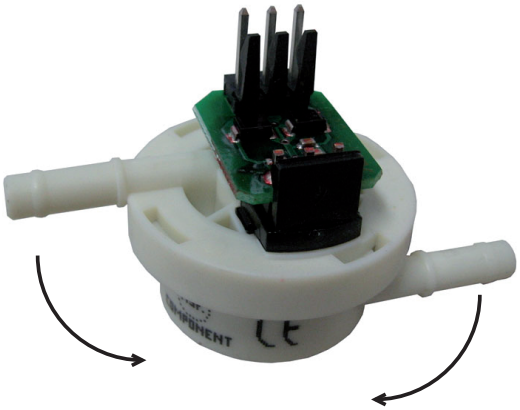
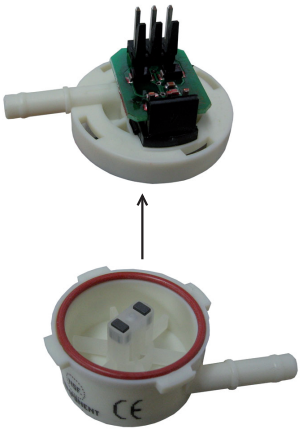
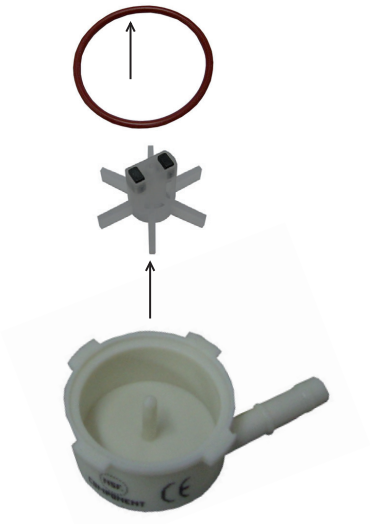
### Schematic external cooling unit




At "mobile" machines the bridge between pin 1 and 4 is used to detect if an external cooling unit (WUK) is attached or not. Therefore the DIP switch 4 on pc-board MAPRO must be set: ON = mobile OFF = "driveable" (see also "DIP switch" on page 17).

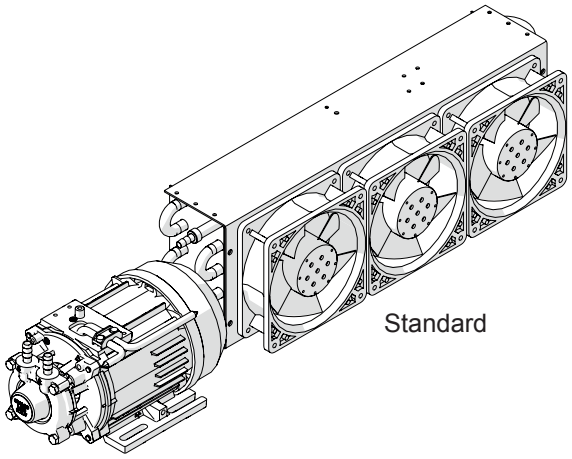
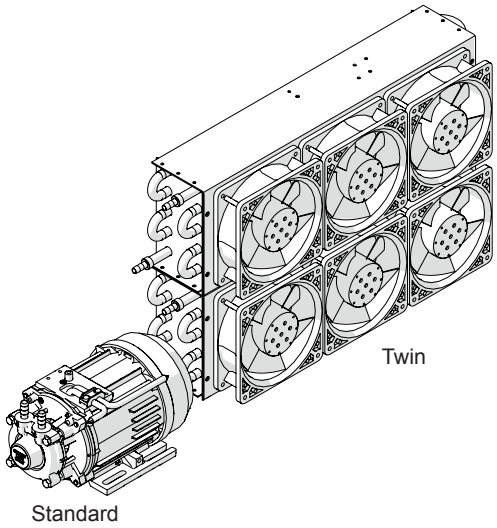
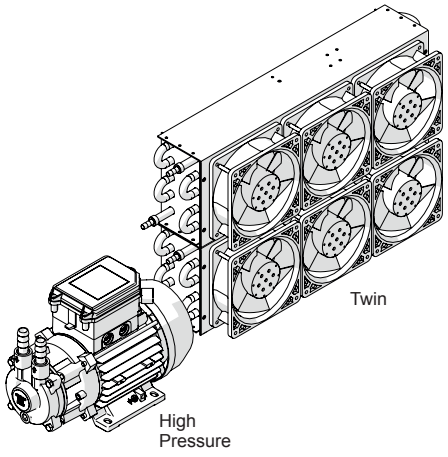
## Flow meter

The most common cause of a cooling water fault “E05” is a dirty flow meter. Regular cleaning of the complete cooling circuit (torch, intermediate hose package, internal hoses, cooler) is recommended. Depending on the degree of pollution, the coolant tank should be completely washed out, as dirt can accumulate at the bottom of the tank over time.

| | |
|---|---|
| to open the flow meter, turn the housing halves against each other (bayonet assembly) |  |
| take off the top halve |  |
| take out sealing ring and the turbine<br><br>**!!! CAUTION !!!**<br>mind the right flow direction, do not reverse in- and output when mounting the flow meter back into the machine |  |

## Cooling unit versions

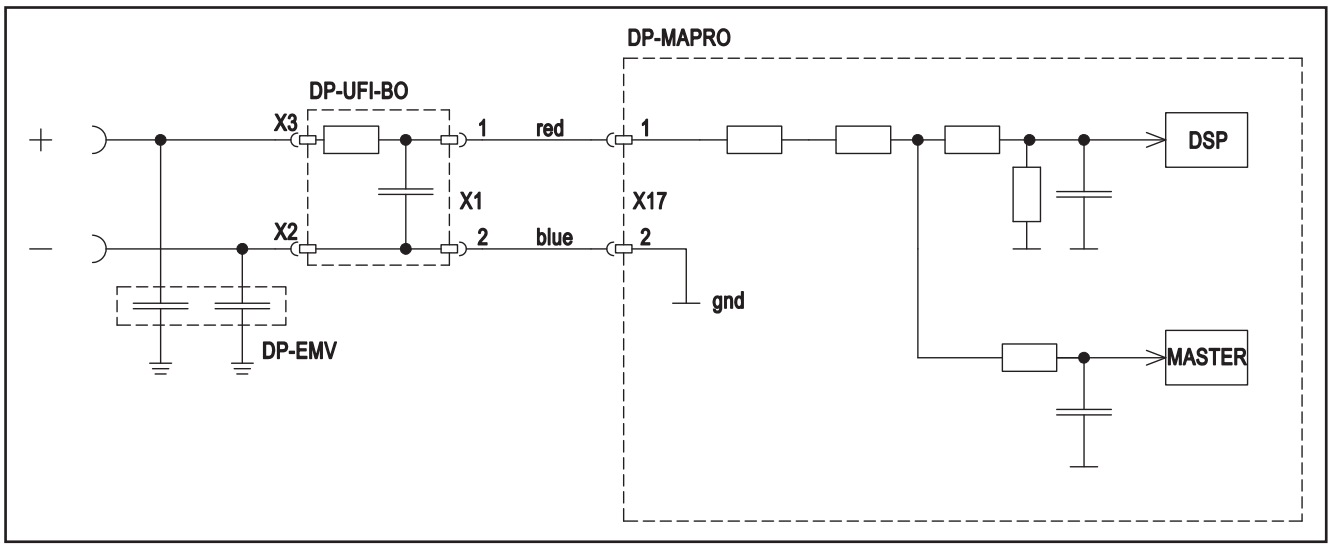
The machines of the S- and P-Relaunch series can be ordered with different cooling units. Depending on the customers needs, he can choose between three versions:

| version | pump | control transformer | fuse PWRUP | |
|---|---|---|---|---|
| standard | standard 665.5571.0 | standard 655.8021.0 | 2 x 4A slow |  |
| double cooling “Twin”<br><br>!! only possible at B- or BB-machines !! | standard 665.5571.0 | standard 655.8021.0 | 2 x 4A slow |  |
| “High Pressure” (only together with double cooler “Twin”)<br><br>!! only possible at B- or BB-machines !! | High-Pressure 665.5573.0 | “stronger” 655.8037.0 | 2 x 6.3A slow |  |

## 9.6 Monitoring output voltage

The output voltage is conducted via a low pass filter (pc-board DP-UFI-BO) to the MAPRO pcb. The voltage is measured by the Master as well as the Process.

### Schematic




If the Master is measuring a voltage >100V, the machine will stop and displays **E06** (secondary overvoltage). If the Process should detect a voltage higher that 100V, the machine will stop and displays **E20** (Overvoltage secondary).

If no voltage can be measured at all, then machine will stop and displays also **E20**.

Possible reasons could be:

- disconnected measuring wires (red and blue)
- loose connection of the connectors
- interchanged wires (red with blue)

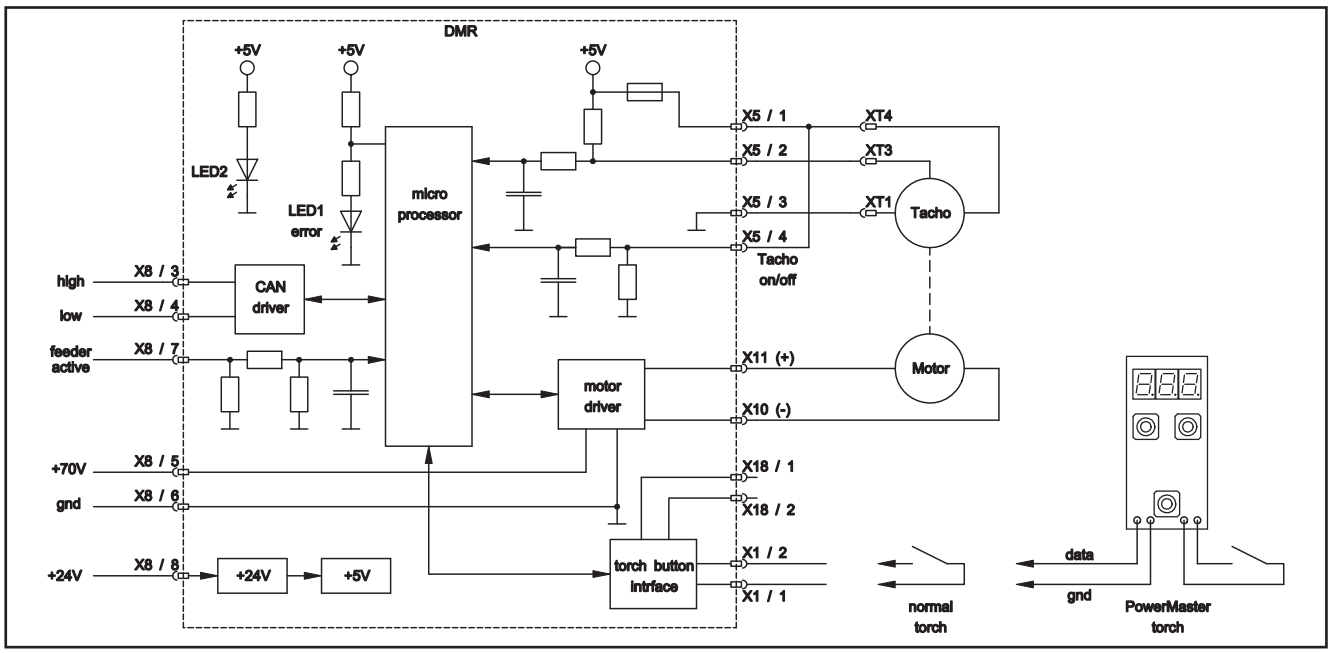
If the Master is measuring another voltage than the DSP, the machine will stop and displays **E09** (V/A measuring error).

If the Process is measuring an output voltage >60V when the machine is not welding (standby), the machine displays the error message **E21** (Output voltage/current).

## 9.7 Monitoring wire feed motor

The pc-board DMR has it's own microcontroller which is responsible for driving, controlling and monitoring the wire feed motor.

### Schematic

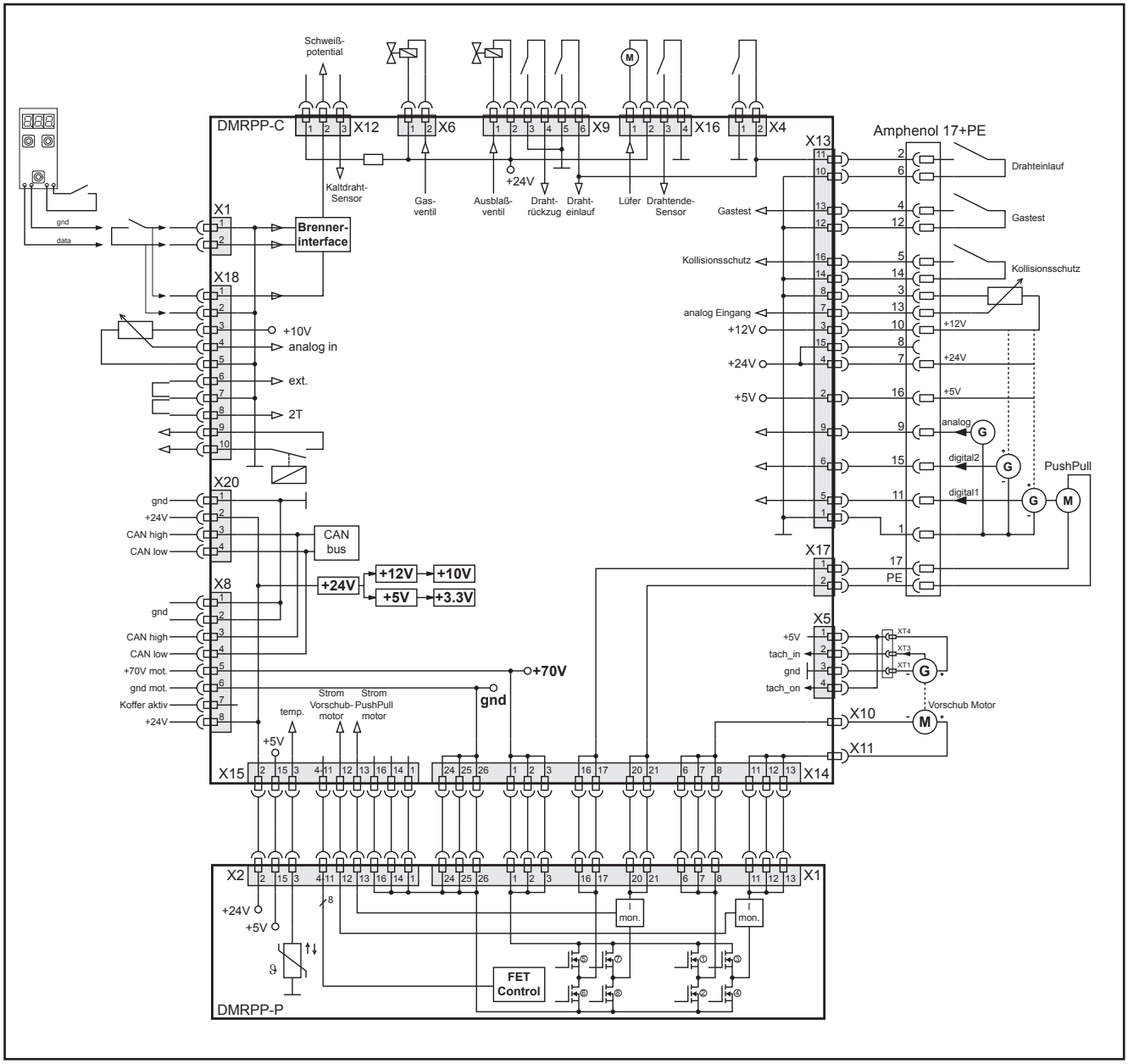



The current consumption and the tacho signal of the motor are monitored by the microcontroller. If the current consumption of the motor is too high (e.g. if wire feed unit is blocked mechanically) or if the tacho is not connected, the machine will stop and displays **E08** (wire feed / tacho).

The DMR and the MAPRO are communicating via the CAN bus with the Master. If the communication is interfered or jammed, the machine will stop and displays also **E08**.

Is one of the CAN bus wires is disconnected (loose connection) between MAPRO and DMR, the display (connected to the DMR) is only showing a "**?**".

## Schematic DMRPP04



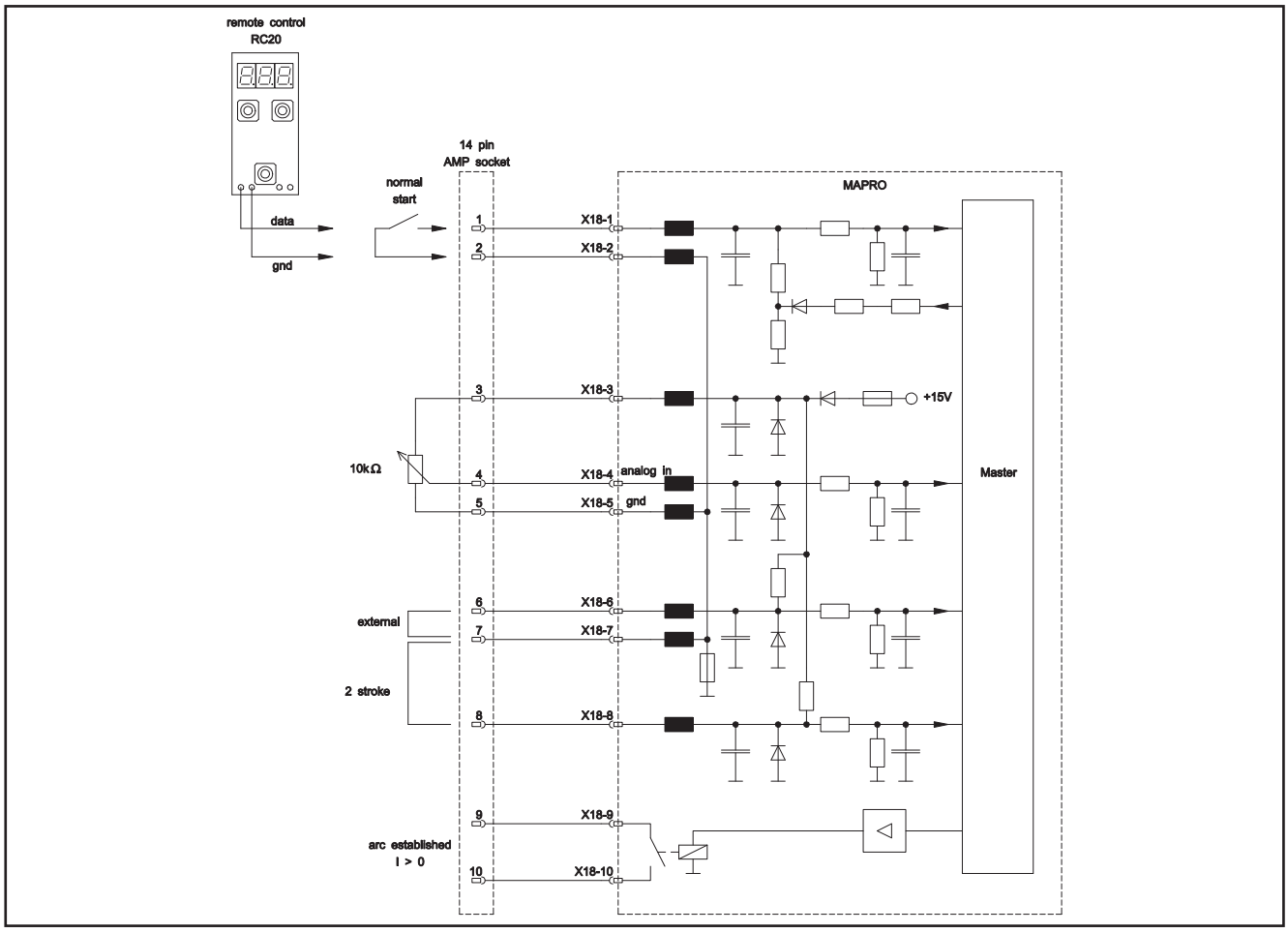

In case of a DMRPP04, at a detection of a malfunction not only the E08 code is shown, but also an additional sub-code is displayed. For example E08-03. (see also “9.15 Malfunction Codes” on page 64)

## 9.8 Remote control

The remote control interface is for connecting a hand or foot remote control. It is also possible to use the interface for a small automation application.

In case of “inpermissible“ short circuits between the connector pins of the interface, the machine will stop and displays **E11** (remote control conn.). Also if the start contact is closed during switching on the machine, the machine shows **E11** in the display.

### Schematic




| signal | pin | designation |
|---|---|---|
| weld start | 1 and 2 | as soon as pin 1 and 2 are connected, the machine starts (same function as pressing the torch trigger switch) |
| weld energy | 4 | analog input for setting the weld energy (e.g. with an potentiometer)<br>0V = minimum setting of the actual welding program<br>15V = maximum setting of the actual welding program<br>**! CAUTION !** this analog input is only valid if the identification “external“ on pin 6 and 7 is active |
| identification “external“ | 6 | as soon as pin 6 is connected to pin 7 (gnd), the analog input (pin 4) is valid and the decimal point in the lower rigth corner of the ampere display is lit. |
| ground | 7 | gnd for the identification signals on pins 6 and 8 |
| identification “2 stroke“ | 8 | as soon as pin 8 is connected to pin 7 (gnd), the machine operates in 2-stroke mode at “weld start“ |
| arc established | 9 and 10 | as soon as welding current is flowing, this relay contact is closing pin 9 to 10<br>maximum contact load: 1A |

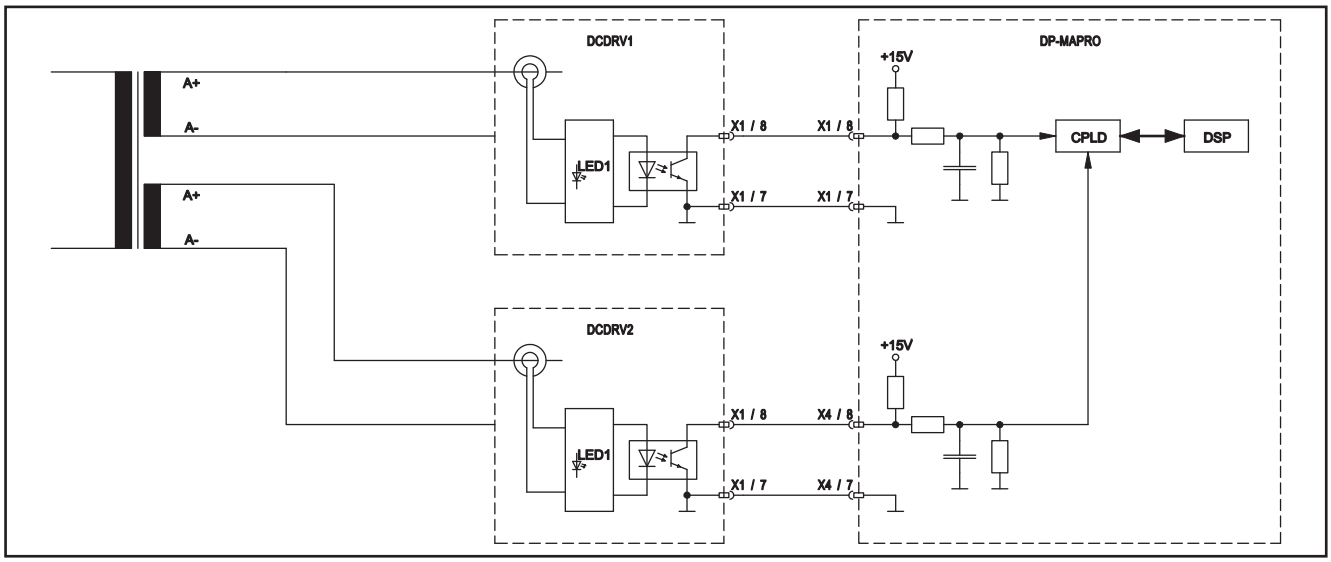
Tab. 32: Signal overview

## 9.9 Monitoring primary input current

The input current of the power units is monitored at the DCDR pcb. The current that is flowing through the primary coils of the welding transformer is measured with an internal current sensor. As soon as the current is exceeding the maximum value, the CPLD (= Complex Programmable Logic Device) on the MAPRO shuts down the power unit immediately.

The S5 and S8 / P4500 and P5500, the weld energy is generated with two power units at the same time. The S3 and S3 mobile / P3500 and P3000 mobile only have one power unit.

### Schematic




If power unit 1 draws too much current, the machine will stop and displays **E16** (primary overcurrent protection1) : red LED on DCDR unit1 is on.

If power unit 2 draws too much current, the machine will stop and displays **E24** (primary overcurrent protection2) : red LED on DCDR unit2 is on.

For example: E16 (primary overcurrent protection1)

possible reasons could be:

- power unit 1 is faulty (like short circuit at MOSFET)
- power unit 2 is not active (if driver signals for the second power unit are missing or the DCDR pcb of power unit 2 is malfunctioning) In this case power unit 1 has to generate all the weld energy by itself. Which is possible to a certain amount of power (200A to 250A) but beyond that, the unit will stop with E16
- malfunction at DCDR pcb of power unit 1 (e.g. optocoupler output malfunction)
- bad flat ribbon cables between MAPRO pcb and power units
- short circuit at output diodes

There is a simple way to find out if the power unit itself is bad or not (only possible at S5 or S8): exchange the flat ribbon cables at the MAPRO pcb against each other (connectors X1 and X4) so that power unit 1 becomes power unit 2 and vice versa. If the machine now shuts down with E24 (Overcurrent protection 2) instead of E16, the power unit itself is faulty.

If the E16 should still remain, it is very likely that the MAPRO pcb is faulty.

Another reason for a primary overcurrent is a short circuit at the output (secondary side). If for example one of the output diodes has a short circuit, no output voltage (open circuit voltage) can be created. In this case the machine reacts with E16 (at S3, S3 mobile / P3500, P3000 mobile) or with E24 (at S5, S8 / P4500, P5500).

Similarly, E16 / E24 can be triggered if the VAC current sensor is still mounted in the “old” position, but the software is already version 3.05 or newer (see “New VAC position” on page 45).

## 9.10 Monitoring bus voltage

The bus voltage is monitored by the DSP (Process) directly. As soon as the bus voltage is too low or too high, the machine will stop and displays the corresponding error message:

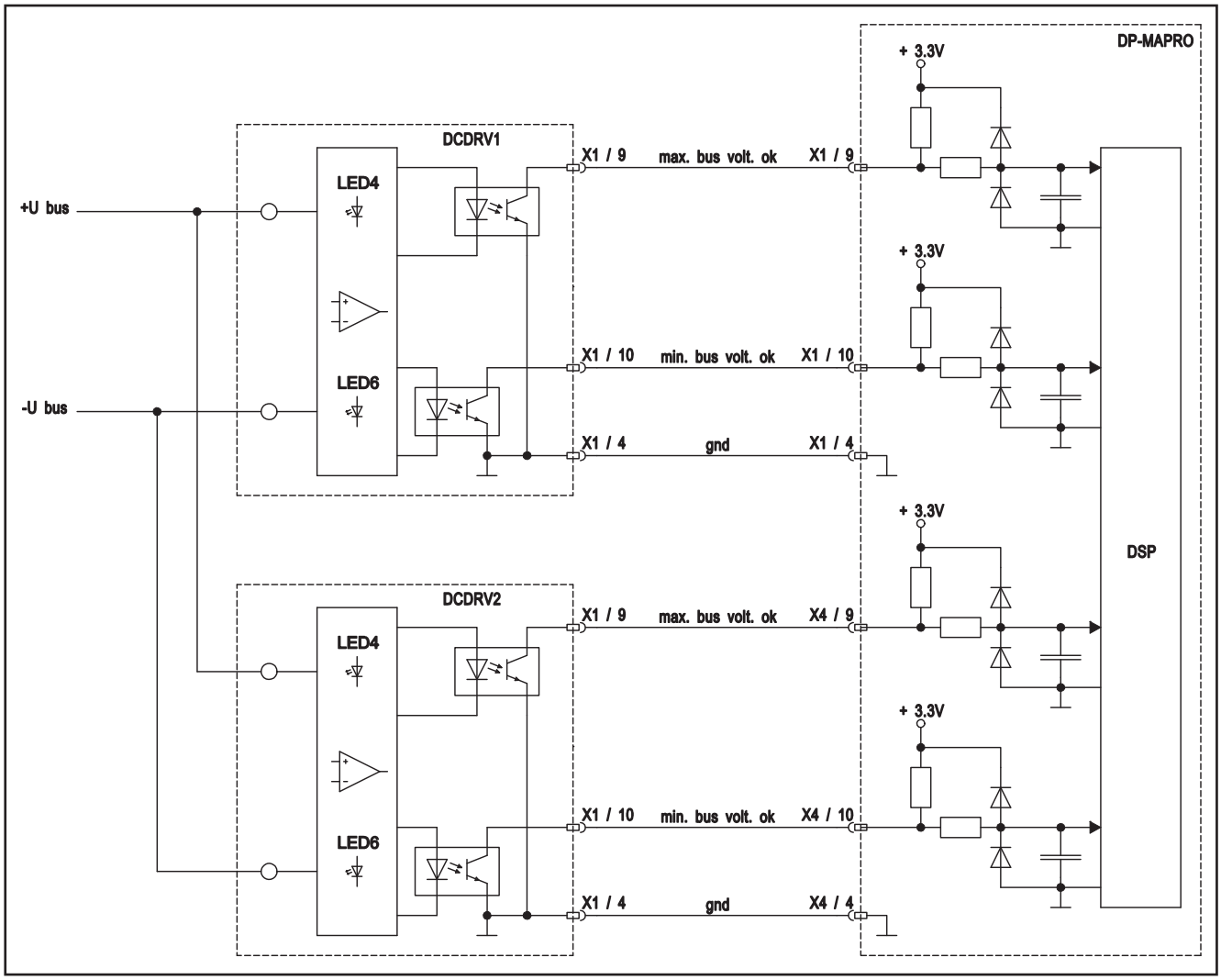
**E22** : Mains undervoltage 1

**E23** : Mains overvoltage

**E30** : Mains undervoltage 2

Should the mains voltage be too low at both power units (at S5 or S8 / P4500 or P5500), only the error message with the highest number is displayed (E30).

### Schematic



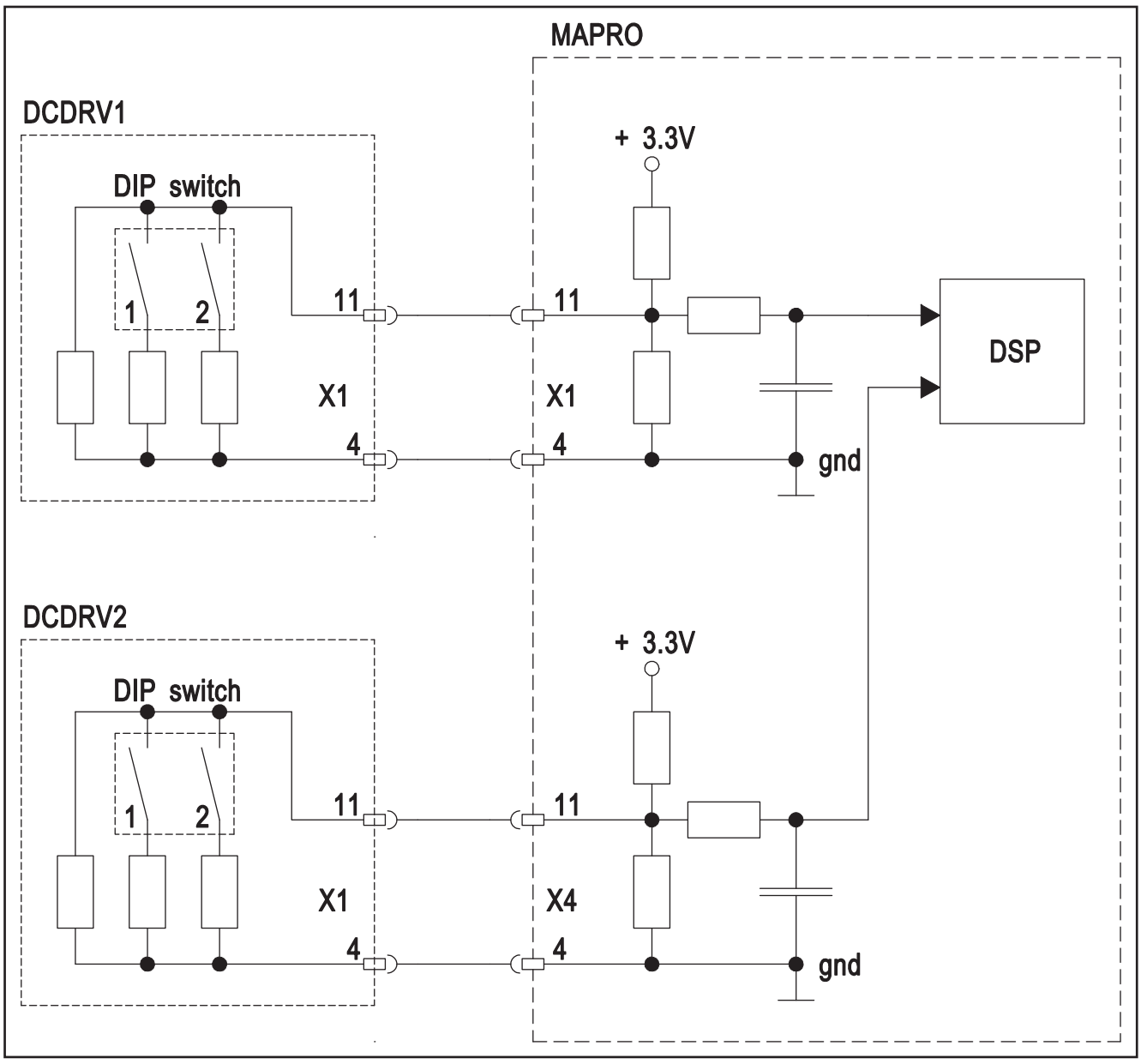

| bus voltage | LED4 | LED6 | optocoupler min. bus volt (pin 10) | optocoupler max. bus volt (pin 9) | error message |
|---|---|---|---|---|---|
| 0-250V | on | off | high | low | E22 / E30 |
| 255V - 700V | on | on | low | low | - |
| 705V - ∞ | off | on | low | high | E23 |

Tab. 33: Voltage limits

## 9.11 Encoding power units

During the initialisation of the machine (switching on), the MAPRO pcb is detecting what power units are connected. The identification of the power units is made by a DIP switch at the DCDR pcbs. Should the MAPRO detect that the configuration is not valid, it will stop and displays **E25** (Power module detection).

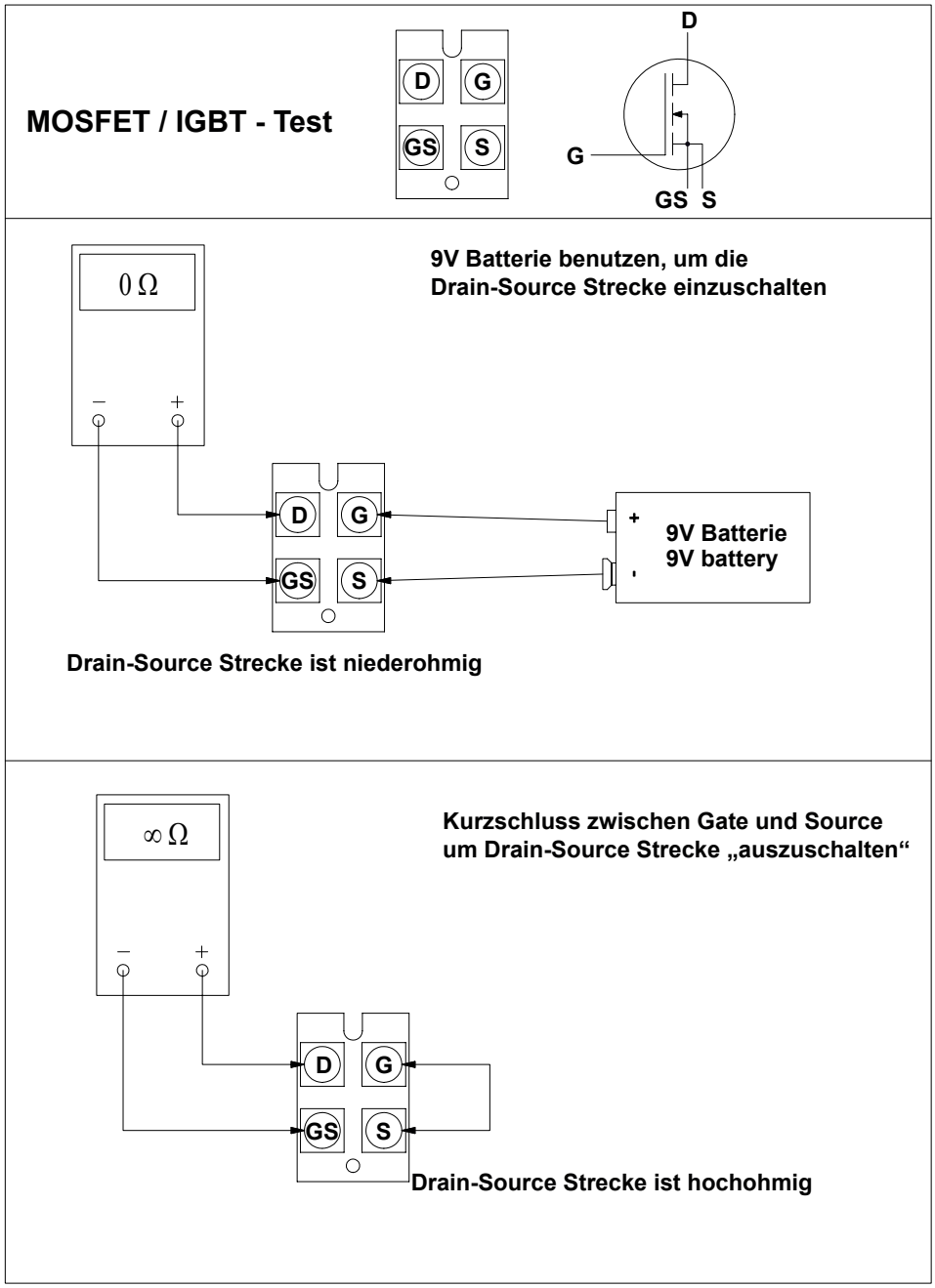
### Schematic



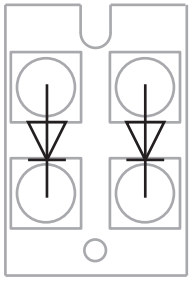

| DIP1 | DIP2 | setting | type |
|---|---|---|---|
| OFF | OFF | 240A | S5 / P4500 |
| OFF | ON | 350A | S3 / P3x00 |
| ON | OFF | 300A | S8 / P5500 |
| ON | ON | reserved | |

Tab. 34: Power unit configuration

## 9.12 Testing MOSFETs




## 9.13 Inside diagram diodes



## 9.14 Service Codes

Via menu Extras, Lock function special Service codes can be entered to enanble or disable different functions.

| code | function | displayed message |
|---|---|---|
| 644 | reset the three-digit code of the lock function to “000” | Code = 0 |
| 660 | activate TIG mode selection | TIG mode On |
| 661 | deactivate TIG mode selection | TIG mode Off |
| 663 | deactivate PE protection | PEC control Off |
| 664 | activate PowerMaster buttons | Powermaster On |
| 665 | deactivate gas pressure switch monitoring | Gas monitor. Off |
| 666 | deactivate PowerMaster buttons | Powermaster Off |
| 668 | activate +/- 10% correction at Tiptronic with lock level 2 or 3 | PlusMinus10% On |
| 669 | deactivate +/- 10% correction at Tiptronic with lock level 2 or 3 | PlusMinus10% Off |
| 670 | activate US units | US units On |
| 671 | deactivate US units | US units Off |

### Entering the Codes

- enter menu Extras, Lockfunction
- press button material (minus) or button gas (plus)
- acknowledge the question „Change Parameter?“ with button “arrow up”
- press button minus or plus
- enter the code number with the encoder of the front panel
- acknowledge with button “arrow down”

## 9.15 Malfunction Codes

| code | designation | reason | removal |
|---|---|---|---|
| E 01 | Thermal overload | thermal sensor of power unit measures a too high temperature | let machine cool down in standby (*1)<br>see page 48 for details |
| E 02 | Mains overvoltage | mains voltage too high<br>internal 24V supply > 36V | check mains voltage and control transformer (*2)<br>see page 49 for details |
| E 03 | Secondary overcurrent | welding current is too high (>120%) | check current sensor and its wiring<br>see page 50 for details |
| E 04 | Stop/ Peripherals error sub code **-01** | PE protection has detected a current >15A flowing via the protective earth wire of the mains cable | – check if the welding wire has contact to metal parts of the housing or parts with PE potential (wire spool installation)<br>– check X26 on MAPRO board<br>– switch the machine off and on again to reset the error message<br>see page 51 for details |
| | Stop/ Peripherals error sub code **-02** | the gas pressure switch (optional feature) has opened: not enough gas pressure left | – check / replace the gas bottle<br>– check X26 on MAPRO board<br>– switch the machine off and on again to reset the error message<br>see page 51 for details |
| | Stop/ Peripherals error sub code **-03** | the gas flow rate is too low (only possible with installed flow sensor) | – check gas supply<br>– check min.gas flow setting in customize menu |
| E 05 | Cooling system error | flowrate of the cooling liquid is too low (< 0.3 l/min) | – pump is not working<br>– check level of cooling liquid and flowrate (*3)<br>– check connectors of flow-meter<br>– check fuse SI7 (4A) on MAPRO<br>– check all hoses incl. torch and interpass hose<br>see page 52 for details |
| E 06 | Secondary overvoltage | Master detects output voltage is too high (>100V) | check wiring of power unit<br>see page 55 for details |
| E 07 | EEProm checksum error | no welding program stored or error during reading from memory | switch the machine off and on again, if necessary transfer the welding programs to machine again |
| E 08 | Wire feed / tacho | – power consumption of wire feed motor too high<br>– tacho not connected to DMR X5<br>– CAN-Bus connection between MAPRO and DMR is interfered/ blocked | – blow out torch package with compressed air<br>– check wire feed unit<br>– check motor current (*4)<br>– check wiring of wire feed motor and pc-board DMR<br>– check interpass hose package<br>see page 56 for details |
| | **M01** Motor overvoltage (only at DMRPP) | supply voltage for motor driver is too high (70V DC > 130V DC) | – check control transformer<br>– check motor supply |
| | **M02** Motor op. voltages (only at DMRPP) | supply voltage for motor driver is too low (70V DC < 30V DC) | – check control transformer<br>– check motor supply |
| | **M03** Motor 1 overcurrent (only at DMRPP) | wire feed motor draws too much current | – check wire feed unit and motor<br>– check motor current (*4) |

| code | designation | reason | removal |
|---|---|---|---|
| E 08 | **M04** Motor 2 overcurrent (only at DMRPP) | PushPull-motor draws too much current | – check PushPull-torch and -motor<br>– check motor current (*4) |
| | **M05** Tachometer motor 1 (only at DMRPP) | – tacho signal of wire feed motor is missing or bad<br>– wire feed motor is not running | – check wiring of the tacho<br>– check wiring of the motor, exchange motor if necessary |
| | **M06** Tachometer motor 2 (only at DMRPP) | – tacho signal of PushPull motor is missing or bad<br>– PushPull motor is not running<br>– wrong PushPull torch type selected | – wrong PushPull torch type selected<br>– check PushPull torch and wiring of the PushPull |
| | **M07** EEProm access (only at DMRPP) | no access to EEProm memory (hardware) | switch the machine off and on again, exchange pc-board DMRPP if necessary |
| | **M08** EEProm checksum (only at DMRPP) | data in EEProm memory wrong/corrupted (software) | – switch the machine off and on again<br>– re-program the DMRPP<br>– exchange pc-board DMRPP if necessary |
| | **M09** Remote-control conn. (only at DMRPP) | start contact (remote control interface DMRPP) was closed during switching on the machine | check remote control and the wiring of the remote control socket/interface |
| | **M10** Torch connection (only at DMRPP) | – start button (torch trigger switch) was pressed during switching on the machine<br>– too high voltage on the torch button wires (short circuit between torch button wires to welding potential or motor wires.) | check torch and torch control wires |
| | **M12** Calibration error (only at DMRPP) | calibration of the PushPull torch was unsuccessful | – check torch and torch control wires<br>– check pressure lever of wire feed unit and of PushPull torch<br>– insert the wire |
| | **M13** Machine ID unknown (only at DMRPP) | the internal power source id couldn't be recognized<br>(unknown power source) | – switch the machine off and on again<br>– reprogram (flash) the DMRPP or exchange it if necessary |
| | **M14** Thermal overload (only at DMRPP) | the temperature of the lower pc-board DMRPP-P is too high | let the pc-board cool down when the machine is switched off |
| | **M15** Wire end detection (only at DMRPP) | wire-end sensor has detected no wire (wire spool empty) | !!! this error message is not active/ implemented !!! |
| | at all sub messages Mxx of the DMRPP: see also hardware details on page 56 | | |
| E 09 | Error v/a measuring | – too high output signal from current sensor VAC<br>– voltage measuring difference between Master and Process | – check current sensor VAC and its wiring<br>– check pc-board DP-UFI-BO and its wiring<br>see page 50 and page 55 for details |
| E 11 | Remote-control conn. | – start contact was closed during switching on the machine<br>– short circuit between remote control cables | check remote control and wiring of remote control socket<br>see page 58 for details |
| E 12 | Communication Process | Process is not responding to Master | switch the machine off and on again, exchange pc-board MAPRO if necessary |

| code | designation | reason | removal |
|---|---|---|---|
| E 13 | Temp. sensor error | no increase of the temperature was detected after some welding time: Temp. sensor is faulty or has a loose contact | – check sensor resistor value and wiring of the sensor<br>– check temperature (*1)<br>see page 48 for details |
| E 14 | Op. voltages error | internal MAPRO supply voltage is too low (24V supply < 17V) | check mains voltage and control transformer (*2)<br>see page 49 for details |
| E 15 | Error configuration<br>sub code **#1 - #5** | wrong or faulty pc-board, wrong software | – check connecor X26 on pc-board MAPRO<br>– switch the machine off and on again<br>– contact Lorch Service if necessary |
| | sub code **#10** | setting of DIP switch 4 does not match to serial number of the machine (only at P3000 mobile) | check DIP switch 4 on MAPRO |
| | sub code **#14** | operating system version of the Process does not match to the version of the Master | reprogram the MAPRO with the correct operating system versions |
| | sub code **#15** | the software version does not match to the serial number of the machine | install the correct software version |
| E 16 | Overcurrent protection1 | power consumption of power unti 1 is too high | – check MOSFETs and pc-board DCDR<br>– check output diodes<br>see page 59 for details |
| E 18 | Overload protection | safety shutdown to protect electrical components | – let machine cool down in standby<br>– check temp. sensor<br>see page 48 for details |
| E 20 | Overvoltage sec. | Process reports a too high output voltage (>100V) or no voltage | check wiring of power unit, especially wiring from output sockets to pc-baord MAPRO<br>see page 55 for details |
| E 21 | Output voltage/current | external current or voltage | – check wiring of current sensor VAC and pc-board DP-UFI-BO<br>– check VAC, replace VAC sensor if necessary<br>see page 50 and page 55 for details |
| E 22 | Mains undervoltage 1 | power unit 1 detected a too low bus voltage | check mains voltage, mains rectifier, pc-board PWRUP and DCDR<br>see page 60 for details |
| E 23 | Mains overvoltage | power units detected a too high bus voltage | check mains voltage, mains rectifier and pc-board DCDR<br>see page 60 for details |
| E 24 | Overcurrent protection2 | power consumption of power unit 2 is too high | – check MOSFETs and pc-board DCDR<br>– check output diodes<br>see page 59 for details |
| E 25 | Power module detection | wrong DIP switch setting on pc-board DCDR | – check machine configuration (*5)<br>– check DIP switch on pc-board DCDR<br>see page 61 for details |
| E 27 | no program (DSP) | no welding data (welding characteristics) are present: the torch trigger switch was pressed with an invalid material-wire-gas combination (nop) | – select valid material-wire-gas combination or<br>– transfer welding programs to machine again |
| E 28 | Error EEPROM | access to EEPROM memory not possible (hardware) | switch the machine off and on again, exchange the MAPRO if necessary |

| code | designation | reason | removal |
|---|---|---|---|
| E 29 | EEProm checksum error | data in EEPROM memory faulty/corrupt | switch the machine off and on again, exchange the MAPRO if necessary |
| E 30 | Mains undervoltage 2 | power unit 2 detected a too low bus voltage | check mains voltage, mains rectifier, pc-board PWRUP and DCDR<br>see page 60 for details |
| E 31 | Communication error | Master is not responding to Process | switch the machine off and on again, exchange pc-board MAPRO if necessary |
| "?" | the display only shows "?" | the display doesn't get any data from the MAPRO<br>mains phase is missing | – no CAN bus connection between pc-board DMR and pc-board MAPRO<br>– check flat ribbon cable betwenn MAPRO and DMR or control cable of interpass hose package<br>– check all phases from mains supply<br>see page 56 for details |
| "nop" | no program | no welding parameters available for selected material-wire-gas combination (no reasonable combination) | select other material-wire-gas combination |
| CFG ERR | "CFG ERR" is shown in volt/amps display | wrong front panel connected (only at P Basic) | connect the correct front panel (pc-board MAT-BF) |
| | blinking volt/amps display | Overload, the power unit was electrically overloaded, the machine is limiting the max. power output | indication goes away together with the hold LED |

(*1) display the module temperatures in menu Extras > Diagnosis > Module temperatures
(*2) display the supply voltages in menu Extras > Diagnosis > Operating voltages
(*3) display the flow rate in menu Extras > Diagnosis > Flow rate cooling system
(*4) display the motor current in menu Extras > Diagnosis > W.Feeder motor current
(*5) display the configuration in menu Extras > Machine data > Configuration