NOVOTRON
für Dynamik und Bewegung

NOVODRIVE

ND11 – 615

ND11 – 625

ND11 – 1512

ND11 – 1520

Edition: 2002 – August

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1 TECHNICAL DATA OF CONTROLLERS ND11

	615	625	1512	1520
Rated mains voltage	42VAC	42VAC	106VAC	106VAC
Connected load for rated current	0.75kVA	1.25kVA	1.4kVA	2.5kVA
Fuse	16Amtr	30Amtr	20Amtr	25Amtr
Max. storage temperature	- 25 ˚C to +70 ˚C			
Max. humidity	95 %			
Operating temperature	0 ˚C to 55 ˚C			
Rel. humidity	5 – 85 %			
Altitude over NN	Up to 1000 m over NN power decrease must be expected			
Fuse ballast-switching	2,5 Atr	2,5 Atr	3,15 Atr	5Atr
Intermediate circuit voltage	60 V	60 V	150 V	150 V
Rated output current (at 25˚C)	15 A	25 A	12 A	22 A
Peak output current	30 A	50 A	24 A	40 A
Excess voltage signal	85 V	85 V	185 V	185 V
Low voltage signal	24 V	24 V	24 V	24 V
Trip threshold ballast switching	75 V	75 V	170 v	170 V
Peak voltage ballast switching	1.1 KVA	1.1 KVA	5.8 KVA	5.8 KVA
Continuous power loss ballast switching	51 W	51 W	51 W	51 W
Input 1, to set 0.2..1.0	+/- 10 V			
Input 2, to set 0.2..1.0	+/- 10 V			
Input resistance	20 kOhm			
Max, input drift	15 µV/K			
Form factor of output current	1.01			
Current control circuit band width	1 kHz			
Timing frequency of modulator	10 kHz			
Timing frequency above load	20 kHz			
Auxiliary voltage output	+/- 15V / 50 mA			
Max. service voltage (rated current)	50 V	50 V	120 V	120 V
Power loss controlled switched off	12 W	12 W	12 W	12 W
Power loss at rated current and voltage	50 W	80 W	50 W	95 W
Closed circuit	120 mA			
Ready to operate relay				
- Switching voltage DC/AC	100 V / 100 V			
- Switching power W/ (VA)	20 / (10)			
Weight	0.845 Kg			
Dimensions	220 mm x 100 mm x 12 TE			

2 DESIGNATION OF INSTRUMENT

ND11 - 6 15 V-01

- Instrumentations (such as current etc.)
- Type V = DIN 41612 plug-in connector
  C = Combicon plug
  K = self-contained instrument with Combicon plug
- Rated current
- Voltage 6 = 60 V
  15 = 150 V
- Series ND11

3 CONNECTIONS

Power board ND11-8910-2xx	Model V	DIN 41612-H15 Messer 1
	Models C and K	COMBICON 16-pole Phönix
Controller board ND11-8910-1xx	Model V	DIN 41612-B32ab Messer 1
	Models C and K	COMBICON 16-pole Phönix

4 CONTROLLER BOARD CONNECTIONS

ST2 Feedback board

Terminal n°	VGB32ab	RPST1	RPST2	Function
Types K + C	Type V	Type V	Type V	
	2a	4	-	+ set point input 2
1	2b	1	-	+ set point input 1
	4a	5	-	-- set point input 2
2	4b	2	-	-- set point input 1
	6a	10	-	Current set point input
3	6b	7	-	+ tacho input
	8a	14	-	Nc
4	8b	8	-	- tacho input
	10a	11	-	+15 V
5	10b	3, 6, 9, 12	-	Analogue GND
	12a	13	-	-15 V

6	12b	-	2	BTB NC contact
	14a	-	3	BTB NO contact
7	14b	-	1	BTB common
	16a	15	-	nc
8	16b	-	4	blocking protection (oe)
	18a	-	5	tacho error (oe)
9	18b	-	6	brake (oe)
	20a	-	-	nc
10	20b	-	7	external + UB
	22a	-	-	nc
11	22b	-	10	- limit switch positive
	24a	-	9	+ limit switch positive
12	24b	-	12	- limit switch negative
	26a	-	11	+ limit switch negative
13	26b	-	14	- controller switch-off
	28a	-	-	nc
14	28b	-	13	+ controller switch-off
	30a	-	15	1-1 control
15	30b	-	16	integral ab
	32a	16	-	Ramping switch-off
16	32b	-	8	external -UB

5 CONNECTIONS OF THE OUTPUT STAGE BOARD

Terminal n°	VGH15dz	Function
Types K + C	Type C	220 V for ventilator
15,16		
13,14,15*)	4z / 6d	- intermediate circuit
11,12	8z / 10d	+ intermediate circuit
9, 10	12z / 14d	L1
7, 8	16z / 18d	L2
5, 6	20z / 22d	L3
3, 4	24z / 26d	+ motor connection
1, 2	28z / 30d / 32z	- motor connection

*) If ventilator connection is not required, terminal 15 is bridged downstream the – (minus) intermediate circuit.

6 BRIEF DESCRIPTION

The following components are installed on the plug-in module of two boards:

- three-phase power supply with filter capacitors
- Fuse element in intermediate circuit
- four-quadrant output stage
- d.c.-d.c. transformer to obtain internal service voltages
- Ballast switching with fuse element to limit the intermediate circuit voltages during brake functions
- 2 set point difference inputs
- 1 direct voltage tacho input
- Parity potentiometer or fixed component for all critical settings
- Current set point input (requires opening bridge R3B)
- I x R control (soldered bridge on tacho input)
- Electrically isolated control inputs (5….24V polarity protection)
    - 1 : 1 control
    - integral switch-off
    - controller switch-off
    - limit switch positive
    - limit switch negative
    - ramping switch-off
- Following electrically isolated control outputs (open emitter, 5mA)
    - Brake, delay 15 ms or more (additional capacitor)
    - Blocking protection
    - Tacho error
- Ready for service (relay)
- Limitation of commutation current
- Double I^2t monitoring in function of output stage temperature
- PI (proportional-integral) current and speed controller
- Plug-in board for additional ramping and tacho monitoring functions
- LED's to display
    - LED 1 : high voltage
    - LED 2 : low voltage
    - LED 3 : short circuit error in output stage
    - LED 4 : excess temperature
    - LED 5 : error in service voltage
    - LED 6 : effective current limitation
    - LED 7 : ready for service
    - LED 8 : ballast switching activated
    - LED 1 – 4 : tacho error (if an additional board is mounted)
    - LED 1 – 4 : error in limit switch logic

- LED's in each output stage switch for identification of faulty switches.
- Five monitor test pins

7 PROTECTIVE FUNCTIONS

- Short-circuit resistance against any potential on the motor terminals
- Fuse element protects intermediate circuit voltage
- Fuse element protects ballast switching
- Controller service voltage is monitored.
- Service voltage monitoring in the output stage quadrants
- High current monitoring in each output stage quadrant
- Monitoring the output stage temperature
- Double I^2t monitoring in function of temperature to protect motor and amplifier
- Monitoring the tacho (option)
- Protection against blocking
- Commutation current limitation
- Limit switch logic

8 INSTRUMENT DESIGN

The series ND11 instruments of surface mounted technique (SMT) design are the result of a concept with the objective to install versatile amplifiers of high capacity and low losses in the smallest possible volume.

MODE OF OPERATION OF THE MODULATION

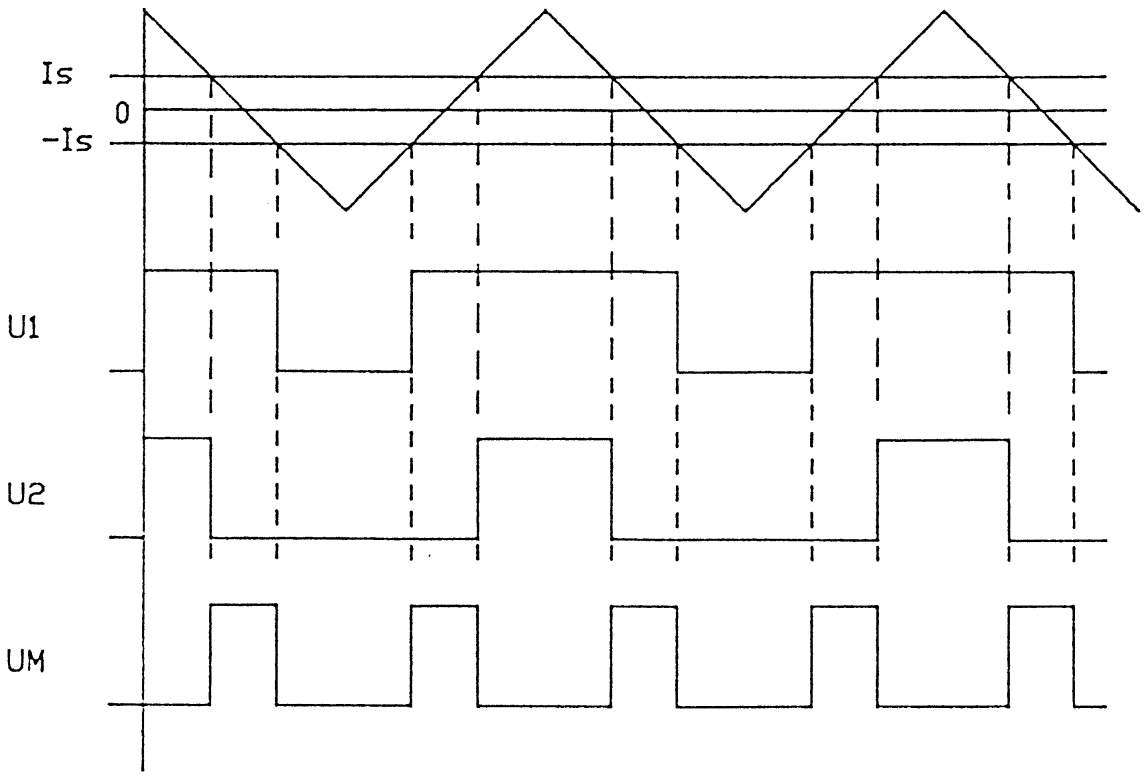


Fig. 1 Timing above the straight branches and load

This objective was realized by using most modern components such as MOS field effect transistors (MOS-FET) in the output stage, a surface mounted technique and, last not least, the perfected switching technique. These amplifiers are suited not only for individual mounting but also for plug-in technique into 3 HE cassettes what allows to connect in parallel to multi-axis systems on the d.c. side by means of bus bar. Both controllers work at 10KHz modulation (parallel timing), which results in the doubling of the timing frequency over the load (see Fig. 1, Fig. 2).

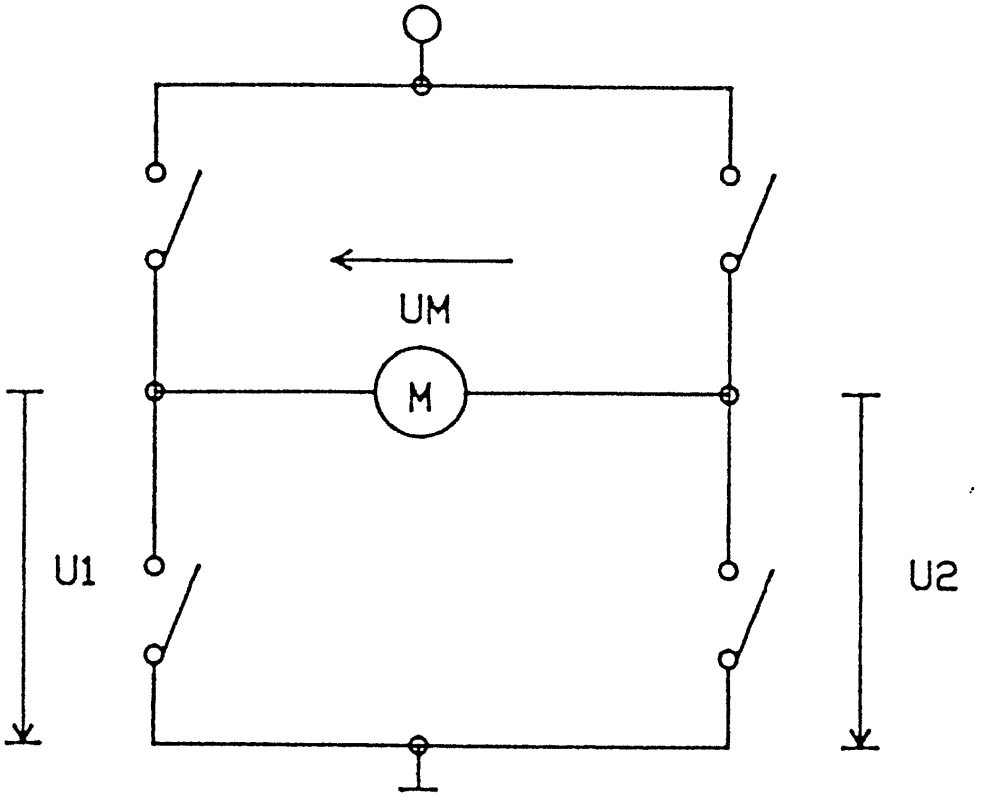


Fig. 2 Switch arrangement

The quick switches in the output stage allow to neglect the switching losses and what is left are only the losses from the current flow resistances in the switches. The amplifiers can, therefore, take the power in function of the temperature. This power is by far higher than that achieved through simple cooling by convection. It can also be observed that the higher power results in a higher I^2t value and, when providing for the appropriate cooling, the power in continuous service can reach that of the peak current. The instruments have their own power supply, the source of which is the intermediate circuit voltage, what makes them independent of external auxiliary voltages (Exception: message signals). Comprehensive monitoring and safety measures inclusive of error displays provide for the safe operation of amplifier and motor. An option in the retrofitting of all controllers with additional electronic component which consists of one tacho monitor and one adjustable ramping generator with downstream located filter. The user can set all modifiable parameters by a potentiometer on the front side of the amplifier or can set them by fixed components. Another feature are 5 standard plug-in connectors to monitor service and adjusting manipulations.

The instruments are connected either by 2 DIN plug-in connectors or 2 Phönix Combicon screw-type-plug-in connectors.

9 CONTROL INPUTS AND OUTPUTS, ADJUSTMENTS

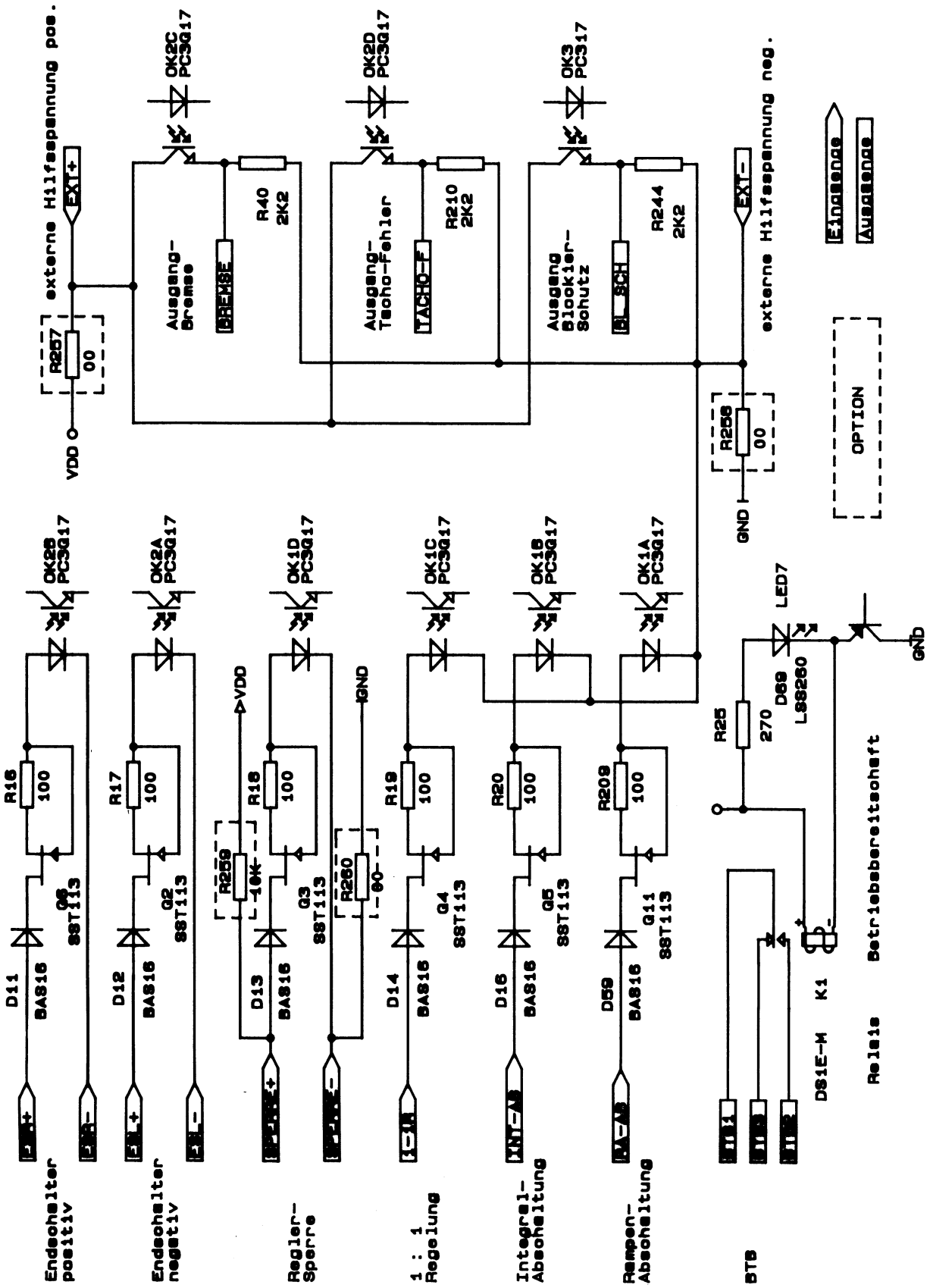


Fig. 3 Control inputs and outputs

10 SET POINT INPUT 1, SET POINT INPUT 2

Both set point inputs are equivalent difference amplifiers not working retroactively. The voltage bias may be +/-10 V and the maximum voltage at the inputs shall not be higher than +/-20 V against ground. The range of the input reducer P2 (P3) amounts to 20%...100% (Fig. 4).

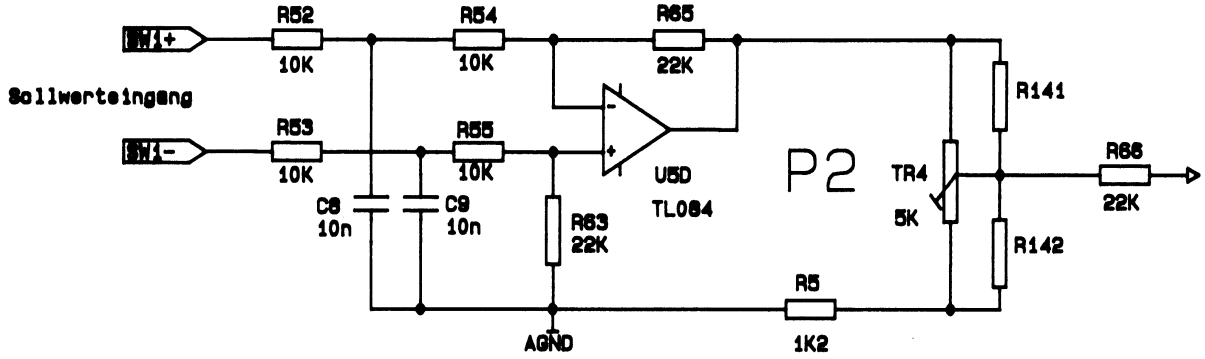


Fig. 4 Difference amplifier

11 OFFSET

Purpose of the offset potentiometer (P4) is to equalize the speed at 0V set point with motor standstill. The setting range is +/-6 mV.

12 TACHO INPUT

Connect the direct voltage tacho at this input. When pre-selecting a 10 V set point and rated speed, the minimum tacho generator voltage should be 12 V and not more than 100 V. Speed adaptation is done with P1. Applications which require the tacho-generator can be realized by using the operational mode of I x R (current x resistance) Control. The voltage through the motor is taken as the actual speed value. At this mode of operation, the tacho input must not be energized and bridge R227 must be closed (Fig. 5).

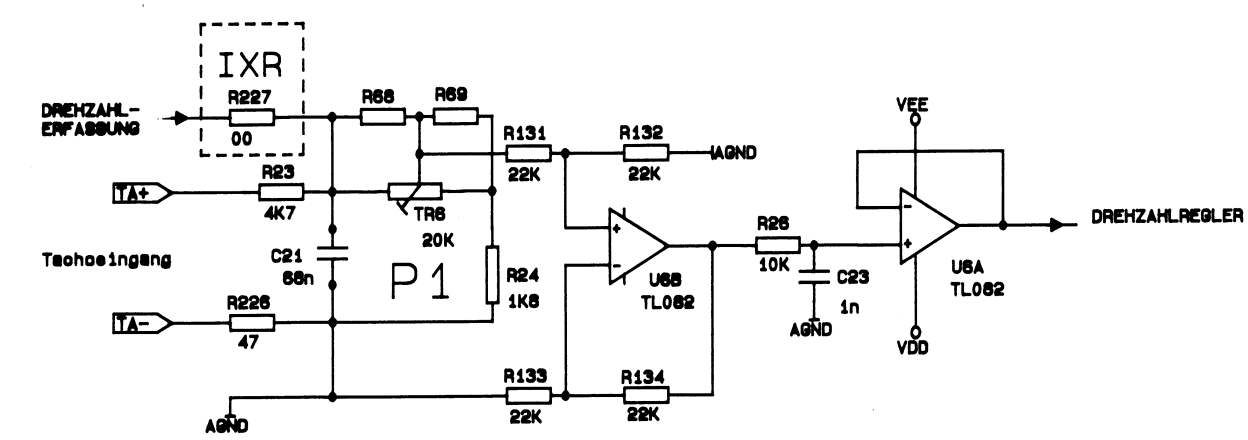


Fig. 5 Tacho input

13 PEAK CURRENT

The peak current setting potentiometer (P5) allows to set the peak current 0 to Imax at h stop. If, however, a lower peak current is required at the stop, it can be obtained by reducing R121. In no case use a value higher than the one built in by the manufacturer, Because such higher peak current eventually brings about the destruction of the output stage (Fig. 6) .

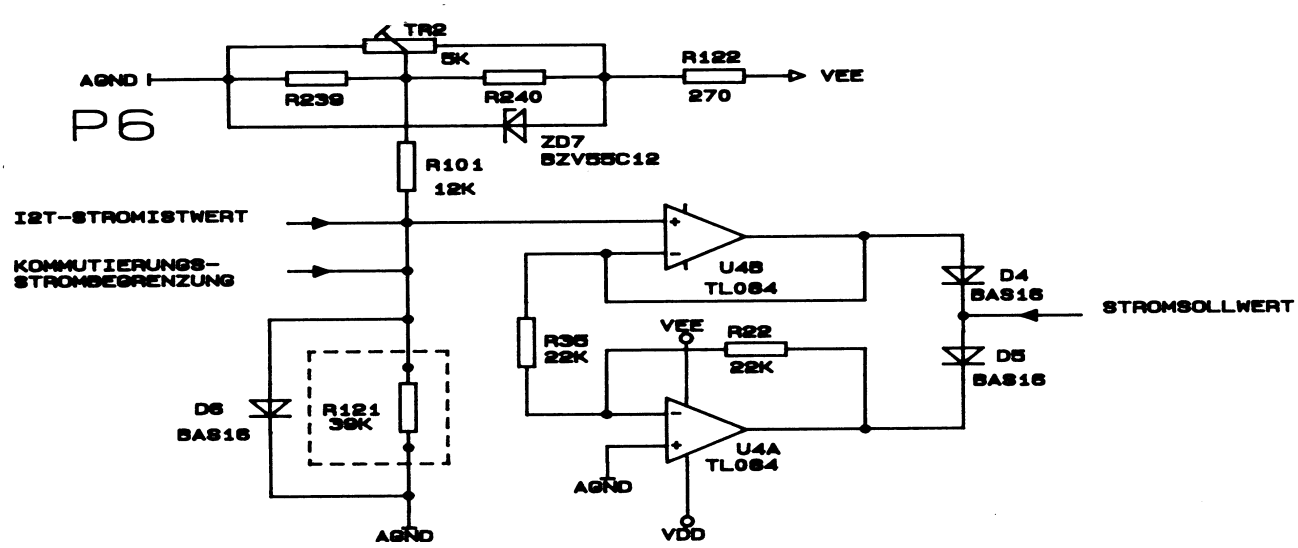


Fig. 6 Peak current limitation

14 AC GAIN, DC GAIN

Purpose of this potentiometer (P6) is to achieve the optimum control by infinitely variably connecting the integral part to the speed control. Its too high setting will be noted by the loud whistling noise of the motor. The current monitor distinctly displays these oscillations. The optimum setting is that point at which the oscillations stop when turning P5 back. If the static rigidity is not sufficient after the motor has come to standstill, a higher holding moment can be obtained by reducing R50 (on soldered supporting pins) (see Fig. 7).

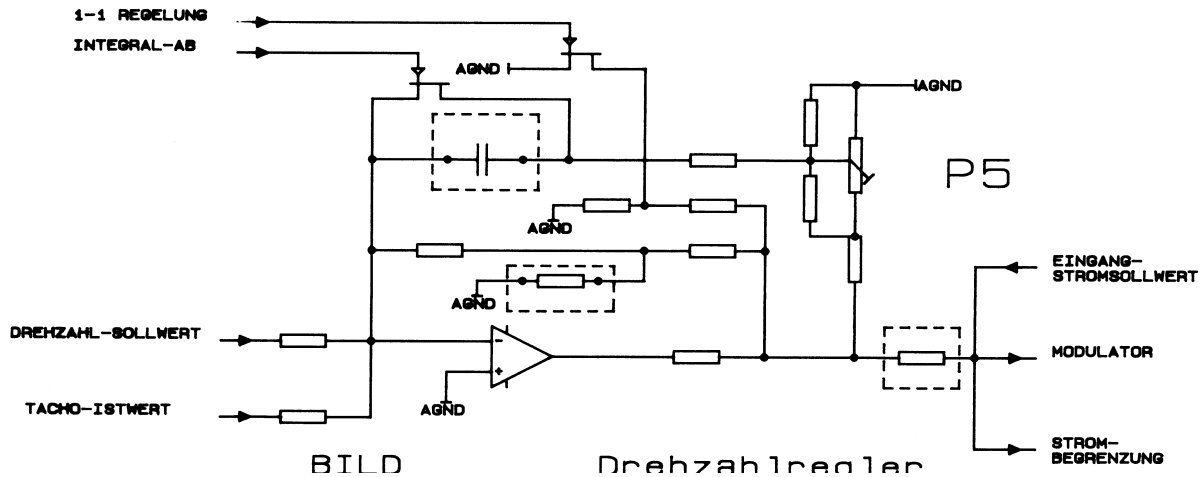


Fig. 7 Speed controller

15 POSITIVE LIMIT SWITCH

This control input is potential-free and can be designated through soldered bridges as "active high" or "active low" (soldered bridges X21 / X20 / X19).

Setting done in manufacturer's workshop is "active high". The input voltage range is 5…24V/4mA, faulty polarity proof. When the limit switch has started at corresponding setting, the motor is stopped in its positive direction and does not react anymore to positive speed signals. Furthermore, the integral part in the speed controller is switched off. Negative speed signals are still feasible (Fig. 7).

16 NEGATIVE LIMIT SWITCH

Has same function as POSITIVE LIMIT SWITCH, but for reverse direction of rotation (soldered bridges X24 / X23 / X21). Should both limit switches operate simultaneously in case of error, it will be recorded and the amplifier is shut off. This error is shown by the four LED's I_{max} (current), U_{min} (voltage), U_{max} and TEMP lighting up simultaneously (Fig. 3)

17 CONTROLLER SWITCH-OFF

This input is potential-free, protected against incorrect polarity and of a wide input voltage range between 5 and 24 V/4mA. It can be connected with the INTERNAL +15V SERVICE VOLTAGE and the GROUND by closing two soldered bridges. When applying a voltage, the output stages and the integral parts of the speed and current controllers are switched off. This does not influence the READY TO OPERATE function. On- and off-switching take place without any delay. Provided the supplementary ramp function board is installed, the ramp function is reset at the same time the controller is switched off (see Fig. 3).

18 INTEGRAL SWITCH-OFF

Provided the operational controllers are superimposed, "overshooting" of the integral part of the speed controller is not welcome when travelling into the zero position. These overshoots can be cut out by means of this control input during the coasting to correspondence. In order to improve, however, the positioning accuracy, the integral part should be connected again during zero positioning. This control input is potential-free in relation to the amplifier. On the other hand, the earthing point is connected with the ground line of the EXTERNAL AUXILIARY VOLTAGE. The input voltage is protected against incorrect polarity and has a range of 5…24V/4mA (see Figs. 3 and 7).

19 I x R CONTROL

This mode of operation allows to operate the amplifier without tacho. The motor voltage in this mode takes care of the speed feedback. Care should be taken not to energize the tacho connections. This mode of operation requires as well the insertion of bride R227. Speed adaptation is done by that reducer (P3) which is used as well in the tacho generator mode of operation (see fig. 5)

20 I²t CURRENT LIMITATION

To protect controllers and motor, the instrument is equipped with a two-step current limitation. The first step limits the maximum peak current in function of the effective current, heat sink temperature and motor voltage. This automatic step protects the controller against any hazards during operation. The second step is dimensioned in function of the motor. This step limits the peak current in such a way that the admissible maximum effective motor current cannot be surpassed over a longer period (see Fig. 8).

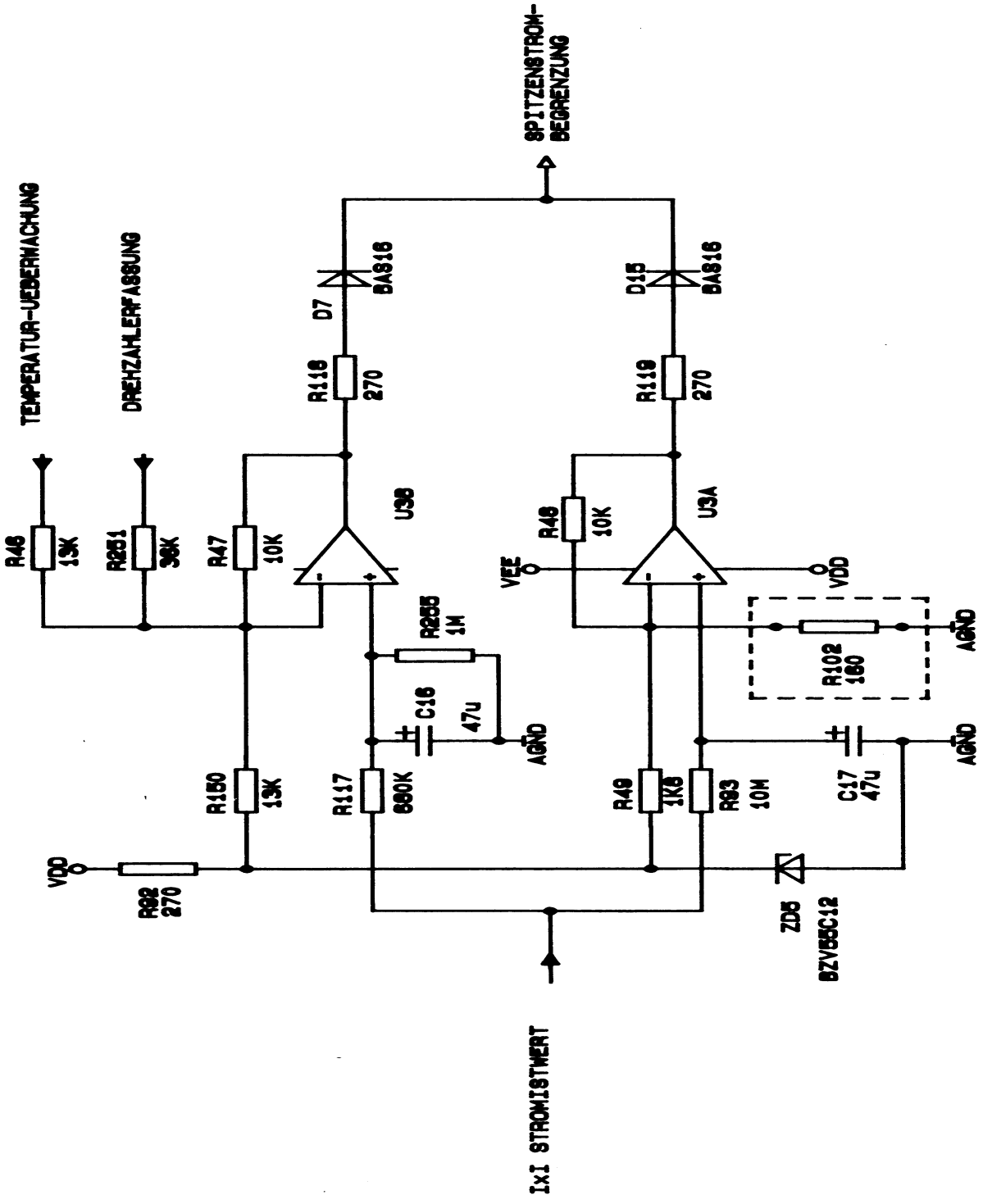


Fig. 8 Effective current limitation

21 PROTECTION AGAINST BLOCKING

As soon as the peak current has been reduced to the admissible maximum effective motor current, the PROTECTION AGAINST BLOCKING signal is given with some 7 seconds delay. It can now be expected that the motor will be blocked or has become defective because of high friction.

22 COMMUTATION CURRENT LIMITATION

The motor brushes can take fire at very high speeds and, consequently, controller and motor are being destroyed. To avoid such hazards, a supplementary electronic element is mounted to the controller. This element allows a reduced current only at very high speeds. The instrumentation is a function of the used motor and will be custom tailored in function of the pertinent motor date (see Fig. 9).

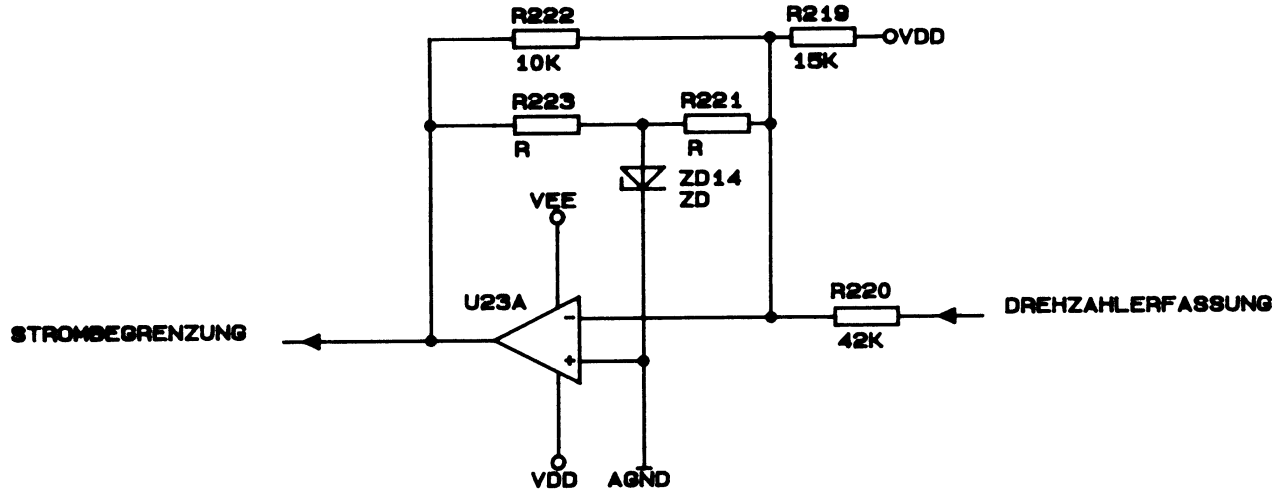


Fig. 9 Commutation current limitation

23 1 : 1 CONTROL

Cutting the potential of this input out is identical with that of the INTEGRAL SWITCH-OFF. By applying a control voltage, the current control switches over. The P (proportional) part of the speed controller is set to “1” and the I (integral) part is shut off. This control input is potential-free in relation to the amplifier. On the other hand, the earthing point is connected with the ground line of the EXTERNAL AUXILIARY VOLTAGE: The input voltage is protected against incorrect polarity and has a range if 5-24V/4mA (see Fig. 3 and 7)

24 CURRENT SET POINT INPUT

When in normal operation, this line is bridged internally through R38 to the speed controller and is equivalent with the current set point monitor. Having removed bride R38, a current set point of +/-10V can be supplied to this input the current limitations still staying operative. This mode of operation shall be set up by parallel conneciton of several amplifiers (see Fig. 10)

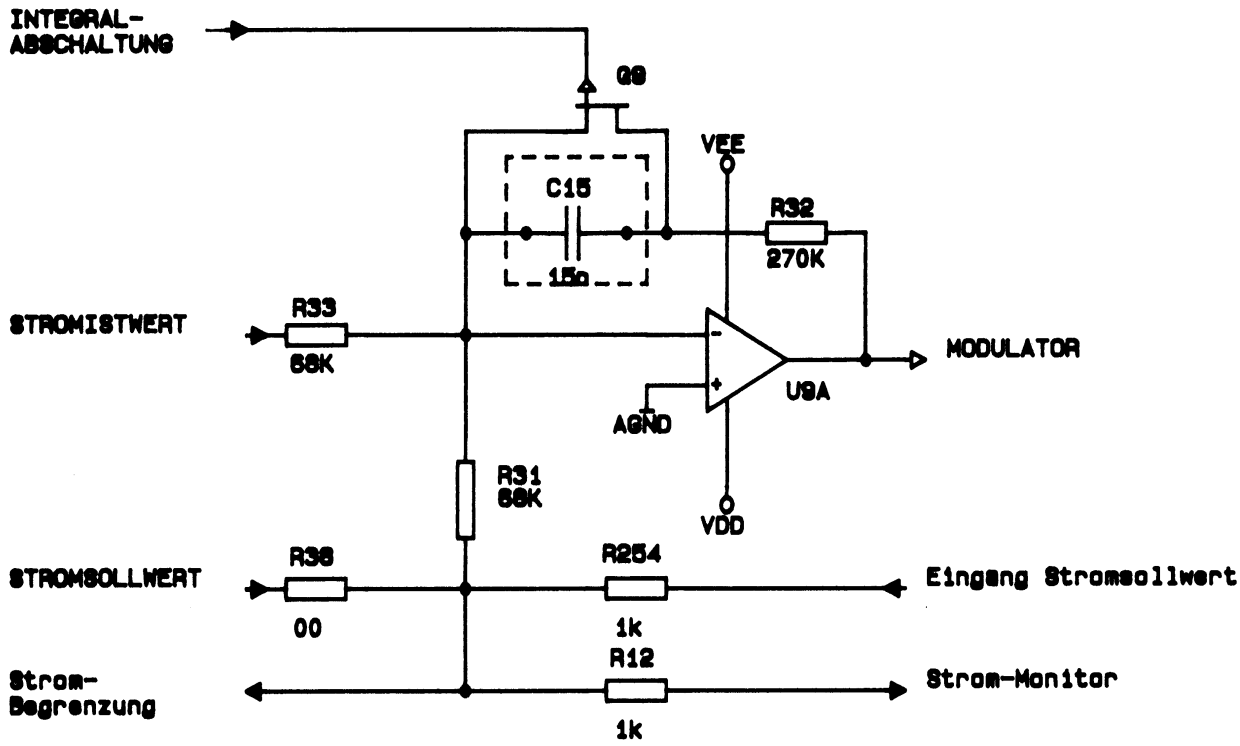


Fig. 10 Current controller

25 RAMPING GENERATOR (OPTION)

Using a supplementary electronic element, a ramp function can be established on the jump function at the set point inputs. The ramp function ascent and descent times can be set individually. One low pass filter is installed downstream the ramping generator in particular when ramps reproduced from numerical controls are concerned and are equivalent to a step-up function because of their cycle periods. The low pass filter provides for considerable reduction of current peaks which provide for an unnecessary current load on amplifier and motor in the event the high frequency shares at the edges of the different steps are not filtered. The filter can be connected downstream the ramping generator through a soldered bridge and as required. The use of the supplementary board requires the removal of R44. This supplementary board is also fitted with a tacho monitor with faulty polarity identification. For further details see the “Technical Description” for this option

26 RAMPING SWITCH OFF

It will be necessary under specific conditions to cancel the integrates set point of the ramping generator. This is done by either the CONTROLLER SWITCH-OFF or the RAMPING SWITCH-OFF control input. The said control input is potential-free in relation to the amplifier. On the other hand, the earthing point is connected with the ground line of the EXTERNAL AUXILIARY VOLTAGE. The input voltage is protected against incorrect polarity and has a range of 5...24V/4mA.

27 TACHO ERROR

If the tacho monitoring identifies a defective tacho connection (break of wire, incorrect polarity), the subject output provides for an electrically isolated signal in function of the magnitude of the EXTERNAL AUXILIARY VOLTAGE.
This signal is generated by an "open emitter" transistor and supplies max. 10 mA. The fault is displayed by making the four LEDs I_{max}, U_{min}, U_{max} and TEMP light up simultaneously.

28 BRAKE

This output trips a signal with 15 ms delay after the function CONTROLLER SWITCH-OFF. The controller can profit of this time to stop the motor prior to the activation of the brake. In the event the time is too short, it can be extended by enlarging C7 (on soldered pin support). Approximately 1nF (1 nanoFarad)) is equal to 1 ms. The switching mode of the signal output is identical with that of TACHO ERROR.

29 RELAY READY TO OPERATE

This relay is being energized when the amplifier is switched on and de-energized if following errors are identified in the amplifier:

Excess current in the
Output stage
Excess temperature
Excess voltage
Low voltage
Tacho error
Error
Limit switch logic

CONTROLLER SWITCH-OFF, I^2t limitation and protection against blocking are of no influence.

30 MONITOR TEST PINS

The user has available for commissioning, service and analysis the 4 most important measuring signals, located on the amplifier front side.
They are:
Actual current value
Current set point
Speed set point
Tacho voltage

The current set point and actual current value signals are laid out for 10V of the standard peak current (see Techn. Date, page 1).

31 LED DISPLAYS

LED 1	Excess voltage	
LED 2	low voltage	Tacho error
LED 3	Short circuit in output stage	Limit switch logic
LED 4	Excess temperature	
LED 5	Service voltage	
LED 6	effective current	
LED 7	ready to operate	

32 AUXILIARY VOLTAGES +/-15 V

This uncontrolled voltage source is available for peripheral message systems or set point transmitters and should not be loaded with more than 50mA.

33 EXTERNAL AUXILIARY VOLTAGE

It should be supplied by user and can be 0…24V. The afore described signals are at user's disposition through this control adaptation:

- brake
- tacho error
- protection against blocking.

If the potential separation is not required at this point, the +/-15V auxiliary voltage can be used as well and connected to the external auxiliary voltage through two soldered bridges. This means that the TACHO ERROR, BRAKE and PROTECTION AGAINST BLOCKING signals as well are no longer separate but on the same potential.

34 INTERMEDIATE CIRCUIT VOLTAGE CONNECTIONS

The intermediate circuit voltage connections have double outputs. This make it possible to connect external, additional intermediate circuit capacitors, ballast switchings or power supplies.

35 MOTOR CONNECTIONS

The external brake switching can be connected to the double output connections of the motor lines.

36 COMMISSIONING

To avoid eventual damages to the motor and amplifier, the potentiometers on the amplifier front side should be adjusted prior to commissioning.

P1 Tacho reducer

Turn P1 to the left up to the stop if tacho voltages of maximum 12V/1000 min $^{-1}$ are concerned. In the event, voltages of maximum 100V/1000 $^{-1}$ are required, turn P1 in clockwise direction in relation to the required voltage.

P2 Set point input 1 Turn in clockwise direction up to the stop

P3 set point input 2 Turn in clockwise direction up to the stop

P4 Offset parity Can be neglected here

P5 a.c. gain Turn in counter-clockwise direction up to stop

P6 Peak current 1/3 off the stop in clockwise direction

37 CORRECT POLARITY

The motor runs without control into indefinite direction if the polarity is incorrect. It is, therefore, necessary to check the polarity prior to starting the instrument in order to avoid its destruction. To carry out the check, switch the amplifier off and apply a positive control signal so that terminal 2a (respectively 2b) (type V) or terminal 1 St 2 (types C and K) is positive in relation to terminal 4a (respectively 4b) (type V) or terminal 2 St 2 (types C and K).

Thereupon, manually turn the motor shaft of the switched-off instrument into that direction which is confirmed to be positive. It must be possible at the same time to measure on terminal 28z (respectively 30d) (type V) or terminal 1 St. 1 (types C and K) a positive voltage in relation to terminal 24z (respectively 26d) (type V) or terminal 3 St 1 (types C and K). The tacho voltage on terminal 6b (type V) or terminal 3 St 2 (types C and K) should be negative in this direction of rotation in relation to terminal 8b (type V) or terminal 4 St 2 (types C and K).

38 FIRST START

When started for the first time (set point preselection 0V), the motor should develop holding moments at little drift only. The motor should follow the set point preselections without jerking. In the event limit switches are connected, check their correct functions by a careful start-up. The function of an eventual short-circuit brake should be checked the same way.

39 SETTING THE CURRENT

At first, set peak current potentiometer (P6) by turning it in counterclockwise direction to its stop. The peak current setting is done best during operation with a rectangular set point (amplitude +/- 1 V, frequency less than 1 cycle). At the same time, alternately switch motor in clockwise an counterclockwise rotations. Turn potentiometer P6 slowly in clockwise direction checking at the same time the standard peak current by the oscilloscope on test pin 5. Ten (10) V are identical with the standardised peak current. Now turn P6 until the required peak current has been obtained. ATTENTION! Quick alternations between clockwise and counterclockwise rotations can damage the machine. To avoid any damages, disconnect, whenever possible, motor and machine when carrying the adjustment out. If the disconnection is impossible, make sure the machine has a sufficiently long travel and also check whether the limit switch functions well (check in advance!). ATTENTION! The too high peak current setting can accelerate machines so much, that they may be damaged.

40 TACHO ADAPTATION

The start being done, preselect a 10% rate of the maximum set point and use tacho potentiometer P1 to adjust the motor speed to 10% of the maximum speed. If tacho voltage constants are low (less than 12V/1000 1/min.), it can happen that the tacho potentiometer P1 setting range is not wide enough with the consequence that a high speed is obtained with the potentiometer at the counterclockwise stop. In such cases , reduce the set point signal by turning the set point potentiometer in counterclockwise direction until the required speed has been obtained (P2 for a set point at set point output 2, P3 for a set point at set point output 1). Check afterwards with the maximum set point

whether the maximum speed can be obtained. If the difference is too big, use tacho potentiometer P1 to make an adjustment. Speed setting requires speed measuring. This is done by measuring the tacho voltage or, with the pulse transmitter built in, by measuring the pulse frequency an, finally by means of a manual speedometer. The resulting adjustment accuracy is a function of the used measuring method. Best results are obtained when using a pulse transmitter or an accurate manual speedometer. A 10% deflection can generally be attributed to tacho voltage measurings, the source f inaccuracy being on the manufacturing stage. Therefore, this way of measuring is suited for preliminary speed settings only. When setting the speed, disconnect the machine from the motor. If the disconnection is impossible, make sure the machine has a sufficiently long travel and check in advance whether the limit switch logic functions correctly.

41 CONTROL FUNCTION OPTIMISATION

Optimisation in most cases is limited to a.c. voltage gain by potentiometer P 5: Slowly open P 5 until you hear a highly pitched whine. Immediately turn P5 back until this high-pitched whine has faded out. The oscillograph on the current monitor makes these oscillations visible. In few cases only can become necessary an additional capacitor to filter the tacho voltage (C21), another integration capacitor (C14) or the modification of the d.c. voltage gain (R50).

DIRECT VOLTAGE GAIN

An accurately defined static rigidity is in particular requested for superimposed operational circuits. The rigidity can be increased by reducing R50. It is furthermore a function of the position of the P2 an P3 input potentiometers, but not of P5.

INTEGRATION CAPACITOR C14

When only the speed is controlled, the shaft should react as rigid as possible with short-time excessive oscillations being accepted. This reaction is achieved by means of the small integration capacitor C14. Another possibility to obtain satisfactory rigidity without excessive oscillation when ramping up is the use of the integral switching-off during positioning.

LOW FREQUENCY OSCILLATION IN THE OPERATIONAL CIRCUIT (SEVERAL HZ)

In several operational circuit arrangements, the encoder for the recording of angles and positions is directly connected with the load and the motor connected through gears, gear belts etc. Naturally, this system has the tendency to oscillate because a phase substitute comes up between motor an encoder. In case oscillations are generated, the only corrective is a more rigid coupling between motor and encoder.

HIGH FREQUENCY OSCILLATIONS (SEVERA 100 HZ)

In the event the motor generates high-pitch whines of several 100 cycles already when starting the motor, in particular when setting high current limit values without set point preselections and all this with the potentiometer P5 in left-hand stop position, the tacho generator is producing torsion resonances. Use capacitor C21 to oppress this resonance frequency by gradually increasing the electric charge until the gain of the resonance frequency becomes less than 1. Parallel connection of a capacitor cascade is the practical

way to eliminate resonances. The oscillation starting point found after each charge increase is then removed by soldering. The optimum capacitor setting point is finally ascertained the moment the hysteresis between oscillation start and stop cannot be reduced anymore.

Table of the I²t current limitation magnitude

ND11

1512	615	1520	625	R49	R102	R237
10 - 11A	12.5 - 13.8A	16.7 - 18.3A	20.8 - 22.8A	3K3	1K	5K1
9 - 10A	11.2 - 12.5A	15.0 - 16.7A	18.7 - 20.8A	3K	680	4K7
8 - 9A	10.0 - 11.3A	13.3 - 15.0A	16.6 - 18.8A	4K7	910	3K6
7 - 8A	8.8 - 10.0A	11.7 - 13.3A	14.6 - 16.6A	3K3	430	3K
6 - 7A	7.5 - 8.8A	10.0 - 11.7A	12.5 - 14.6A	5K6	560	2K
5 - 6A	6.3 - 7.5A	8.3 - 10.0A	10.4 - 12.5A	6K8	430	1K6
4 - 5A	5.0 - 6.3A	6.7 - 8.3A	8.4 - 10.4A	6K2	200	1K
3 - 4A	3.8 - 5.0A	5.0 - 6.7A	6.3 - 8.4A	6K8	120	390

Other modifiable components:

C21	:	68 nF	(tacho input filter)
R121	:	39 K	(maximum peak current)
C14	:	150 nF	(integration capacitor)
R50	:	330 Ohm	(static rigidity)
R227	:	no instrument	(I x R control possible)
C7	:	10 nF	(delay of 'brake against controller release' output)
R44	:	0 Ohm	(must be opened when equipped with RTF1)

42 ERROR DETECTION

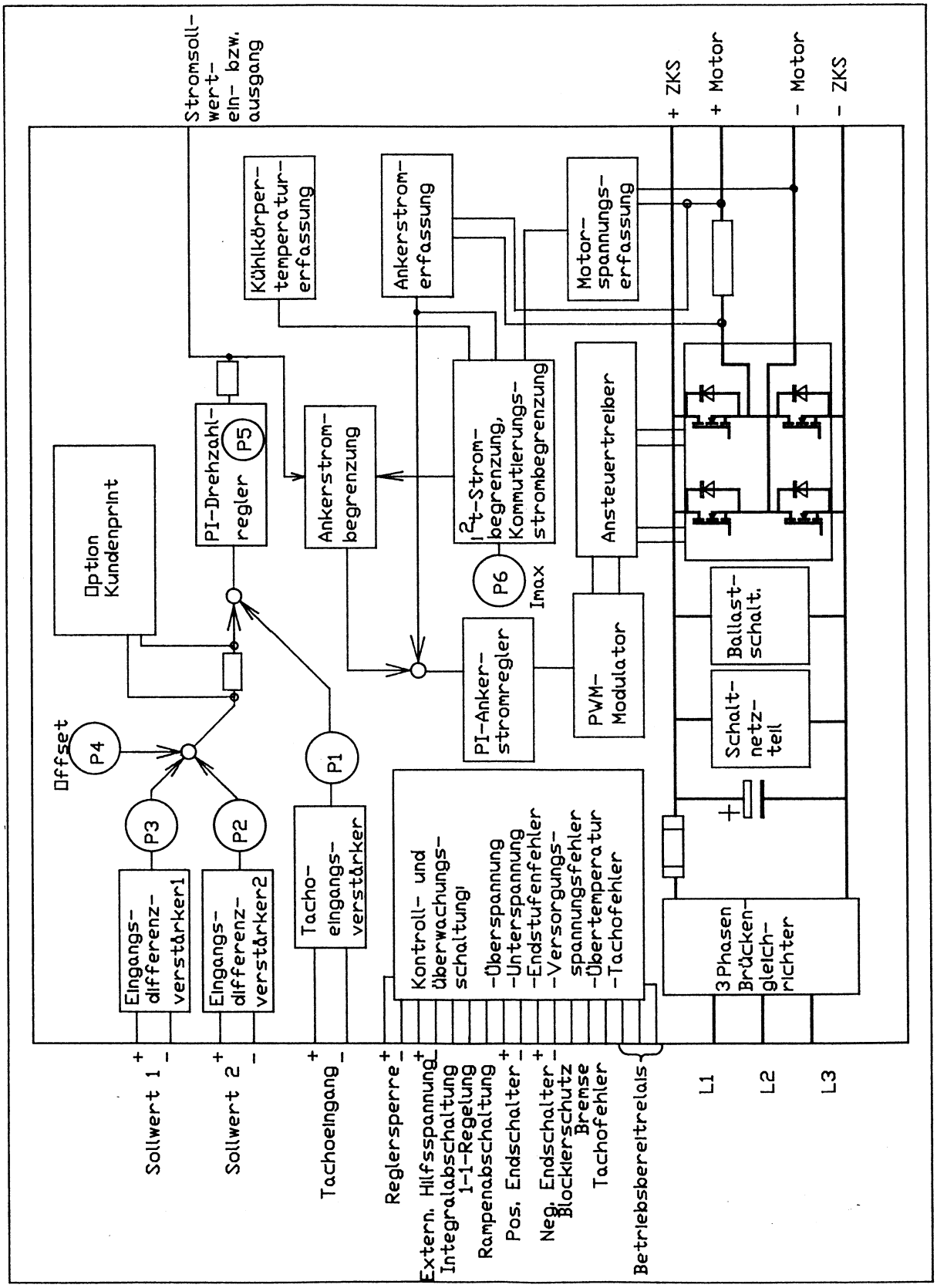
Error	Probable reason
Axis does not travel, motor without holding moment, no error display	Controller switch-off is active No service voltage Break in armature circuit
Axis does not travel, motor without holding moment	Motor shaft blocked if brake exists Set point missing
Motor speed goes up quickly	Tacho voltage missing Incorrect tacho polarity
LED 1 lighted	Service voltage too high (Brake energy too high)
LED 2 lighted	Service voltage too low Transformer power insufficient

LED 3 lighted	Ground short Collector brushfire Error in amplifier Motor line short circuit
LED 4 lighted	Heat sink temperature too high Sensor defective
LED 5 lighted	15 V service voltage too low External or internal short-circuit
LED 6 lighted	I^2t limitation starts working
LED 7 lighted	Controller ready to operate
LED 8 flickers	Ballast switching starts (on power board)
LED 1 to 4 lighted	Tacho monitor has responded Limit switch logic detects error

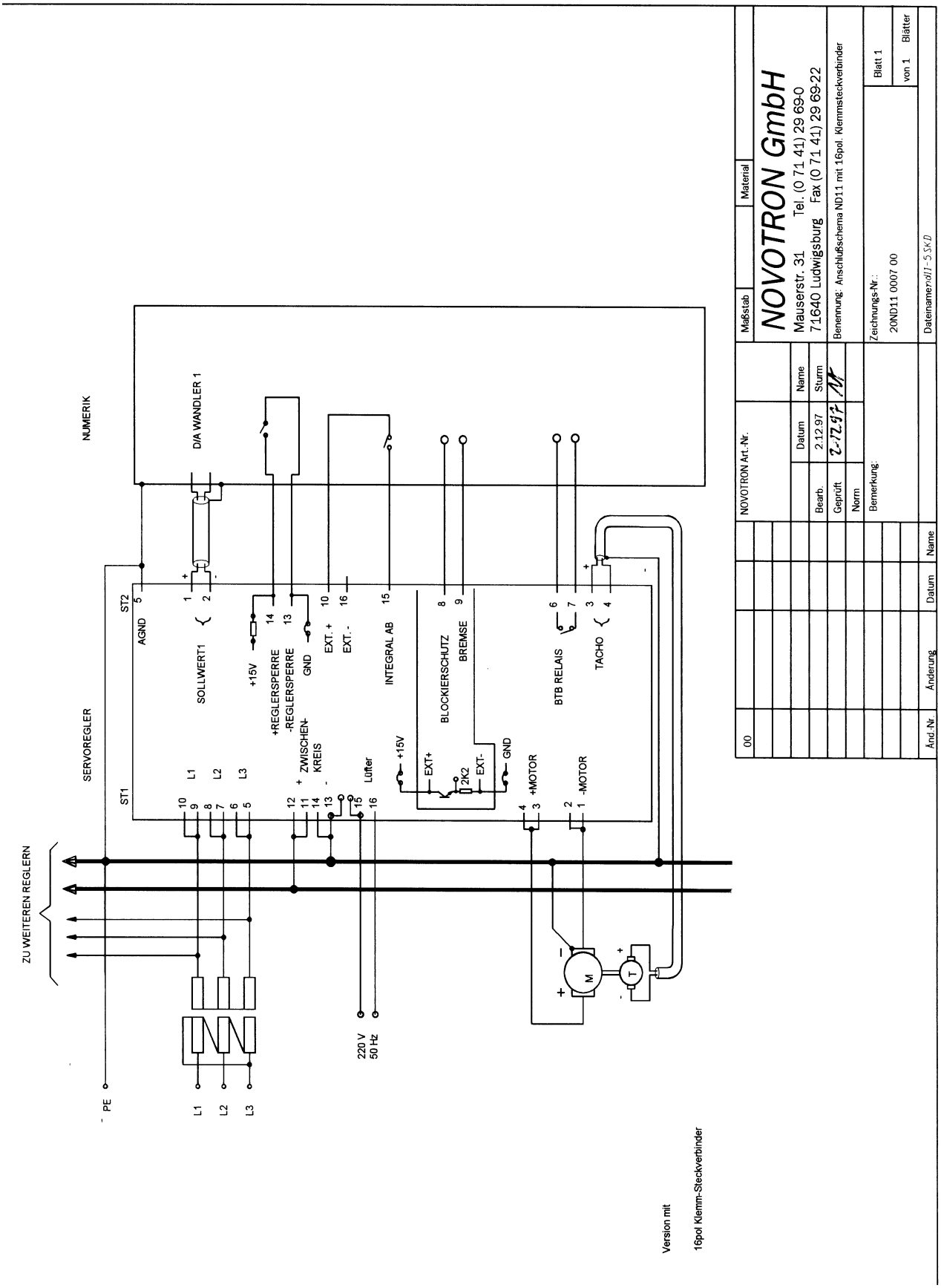
No performance

I^2t display	Friction too high Armature short in motor Field energisation too low Humming on input line
Speed too low	Service voltage too low Input too much reduced Incorrect tacho adaptation
Unbalanced run	Tacho defective Armature short
Unsteady run	Gain too high Tacho fluctuations too high Electromagnetic interferences
Unstable standstill	Incorrect input connection

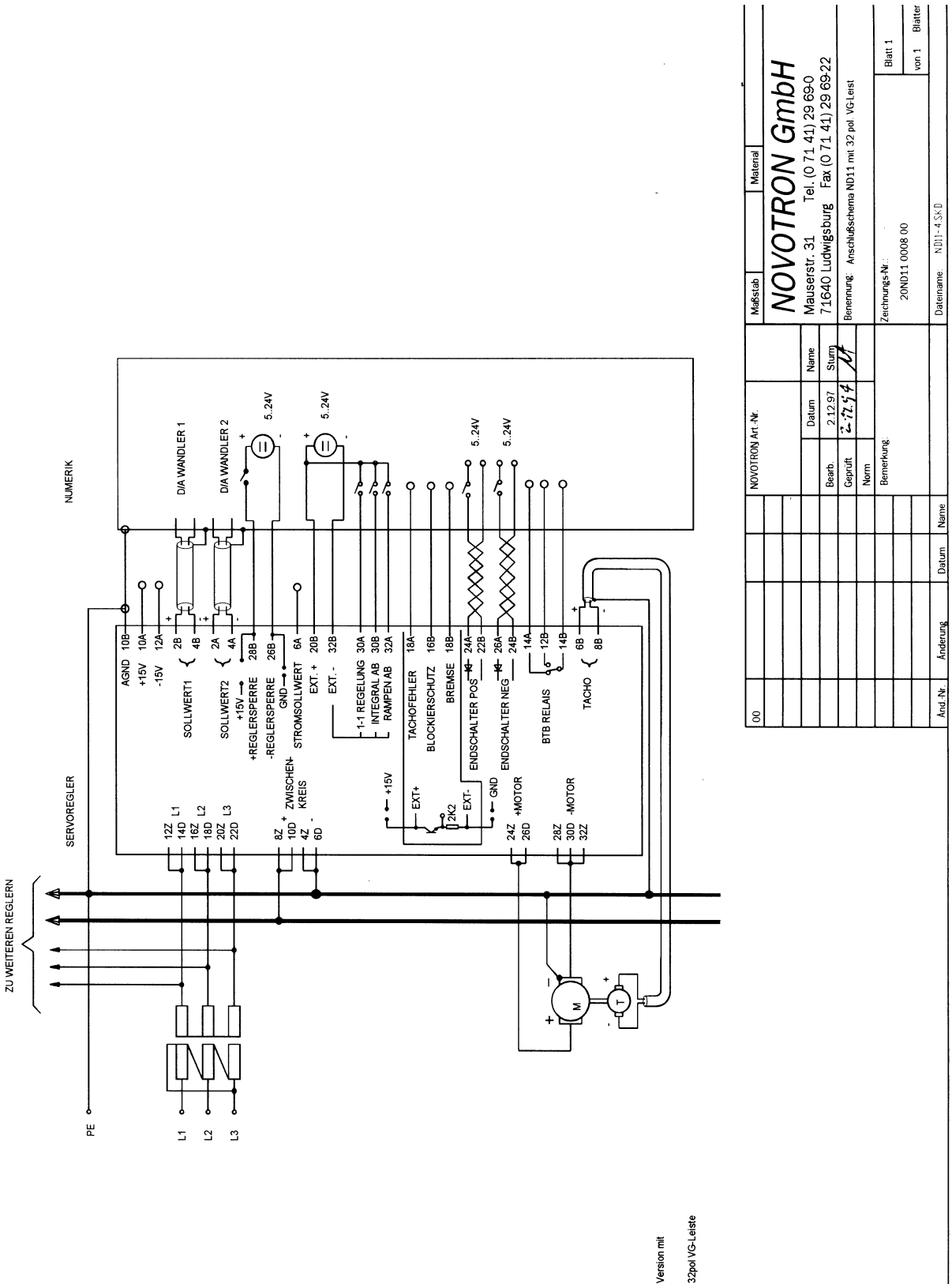
43 PRINCIPLE-CURCUIT DIAGRAM



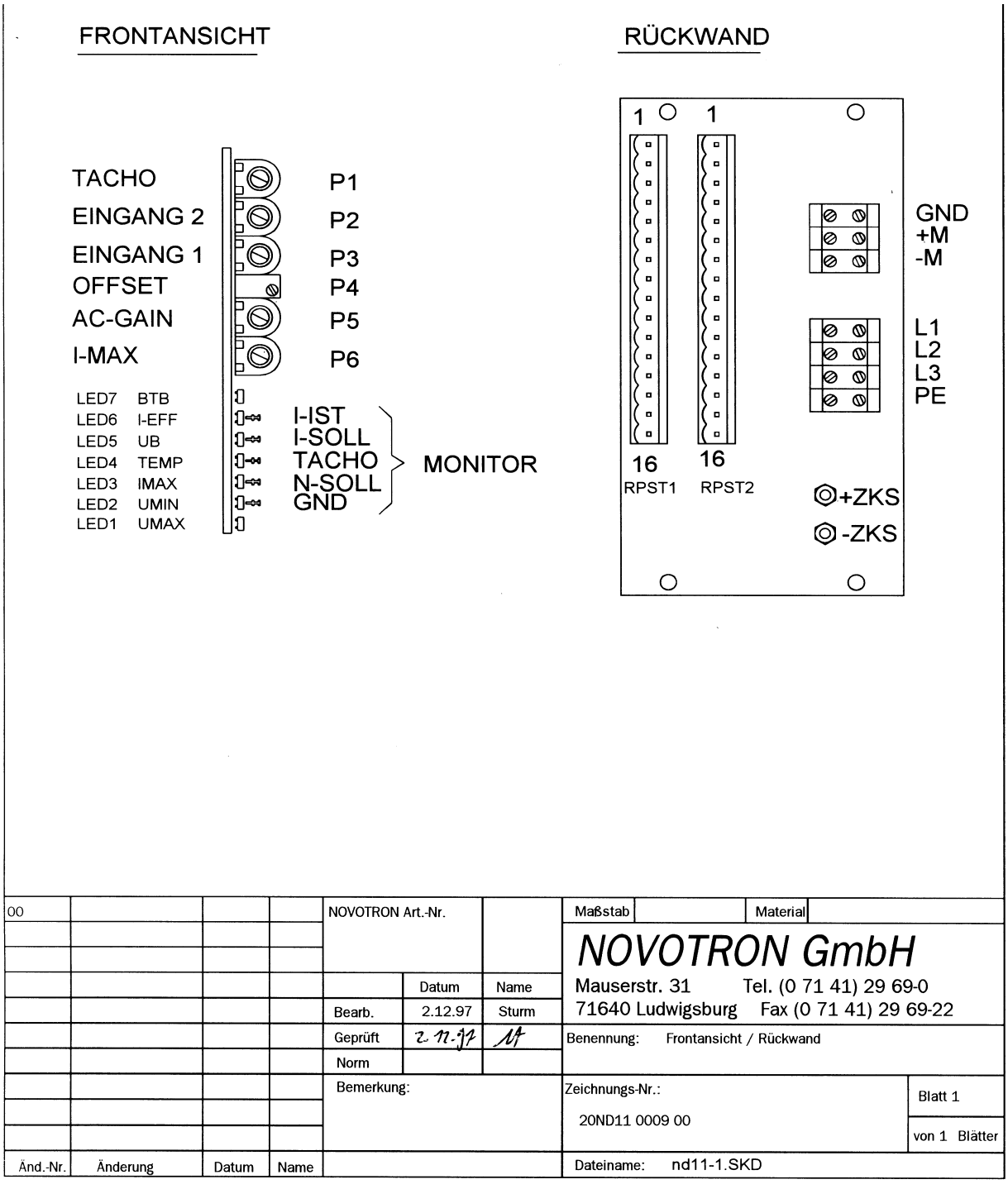
44 CONNECTION-DIAGRAM WITH 16POL JUM-NUT-CONNECTOR



45 CONNECTION-DIAGRAM WITH 32POL VG-STRIP

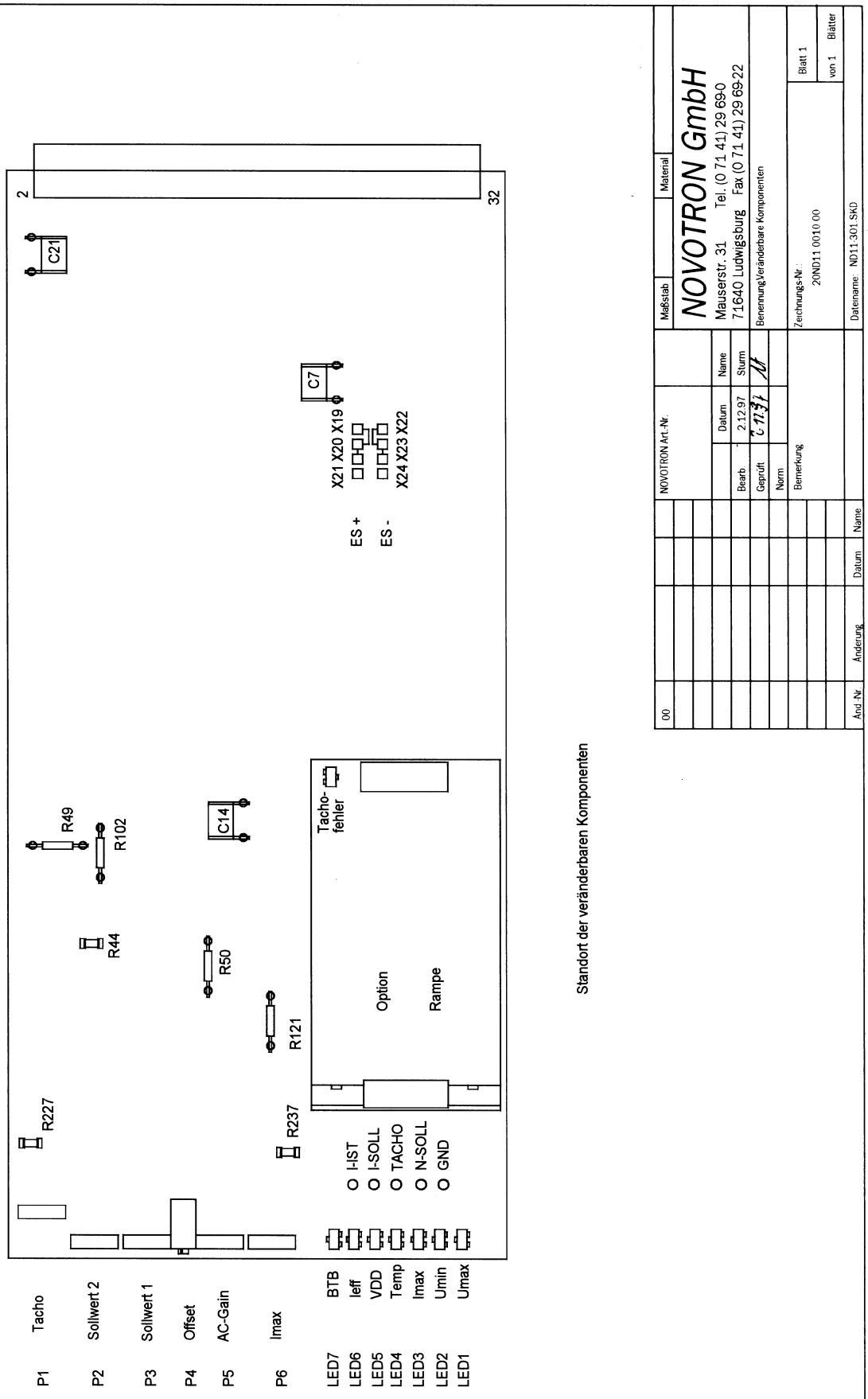


46 FRONT SIGHT / BACK



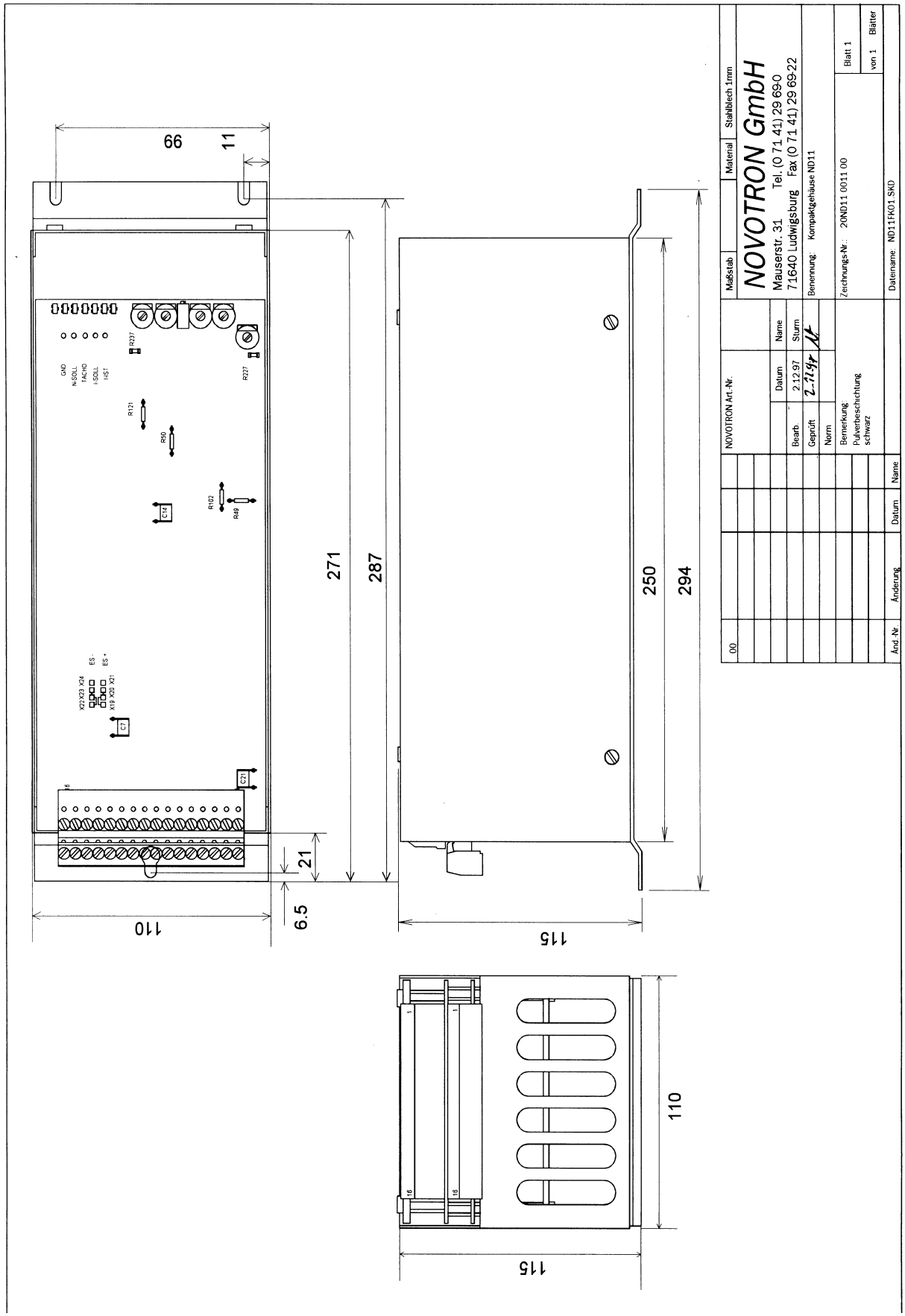
00				NOVOTRON Art.-Nr.			Maßstab	Material
							NOVOTRON GmbH	
					Datum	Name	Mauserstr. 31 Tel. (0 71 41) 29 69-0	
				Bearb.	2.12.97	Sturm	71640 Ludwigsburg Fax (0 71 41) 29 69-22	
				Geprüft	2.12.97		Benennung: Frontansicht / Rückwand	
				Norm				
				Bemerkung:			Zeichnungs-Nr.: 20ND11 0009 00	Blatt 1
								von 1 Blätter
Änd.-Nr.	Änderung	Datum	Name				Dateiname: nd11-1.SKD	

47 DESIGNATION, CHANGEABLE COMPONENTS

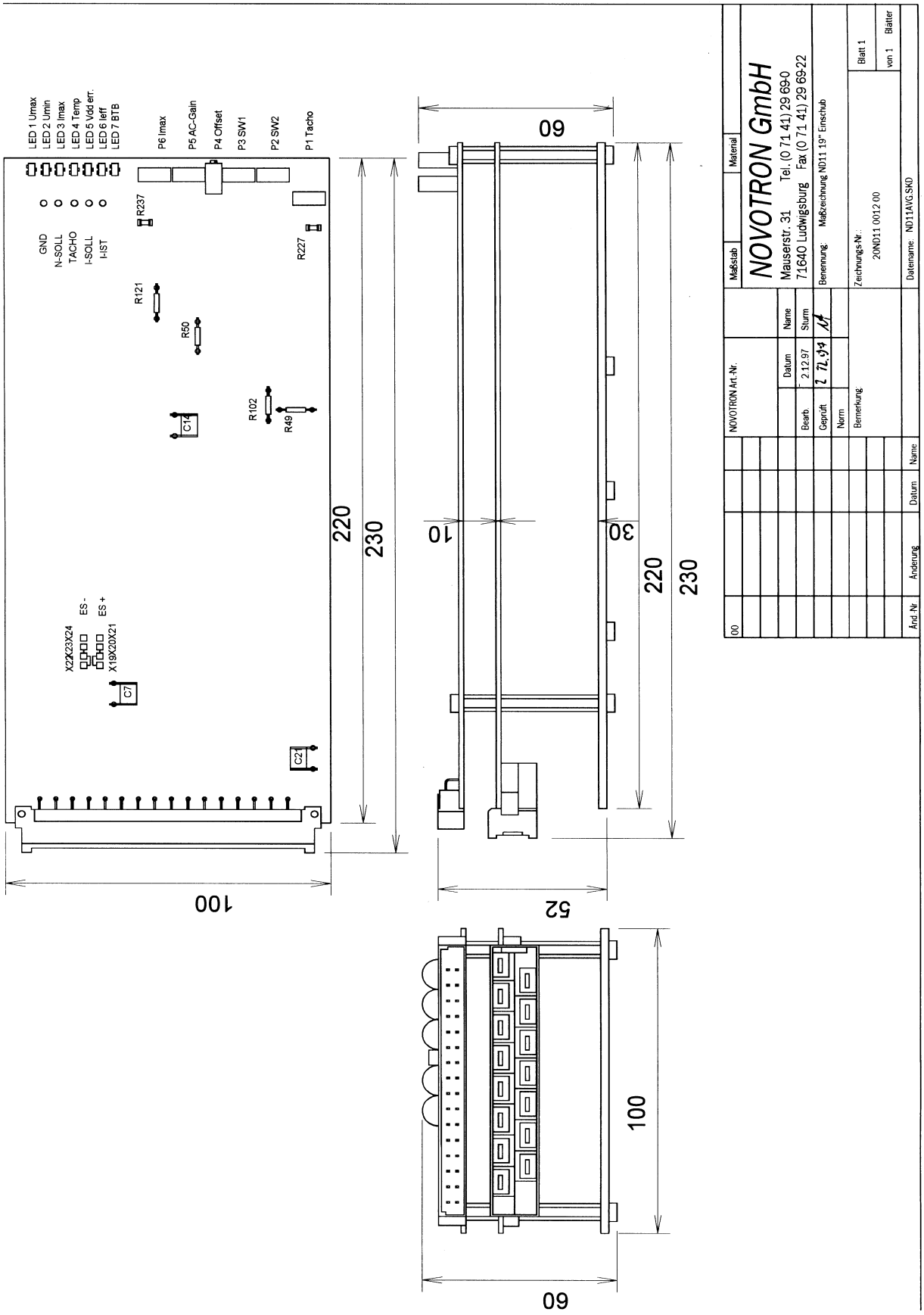


Standort der veränderbaren Komponenten

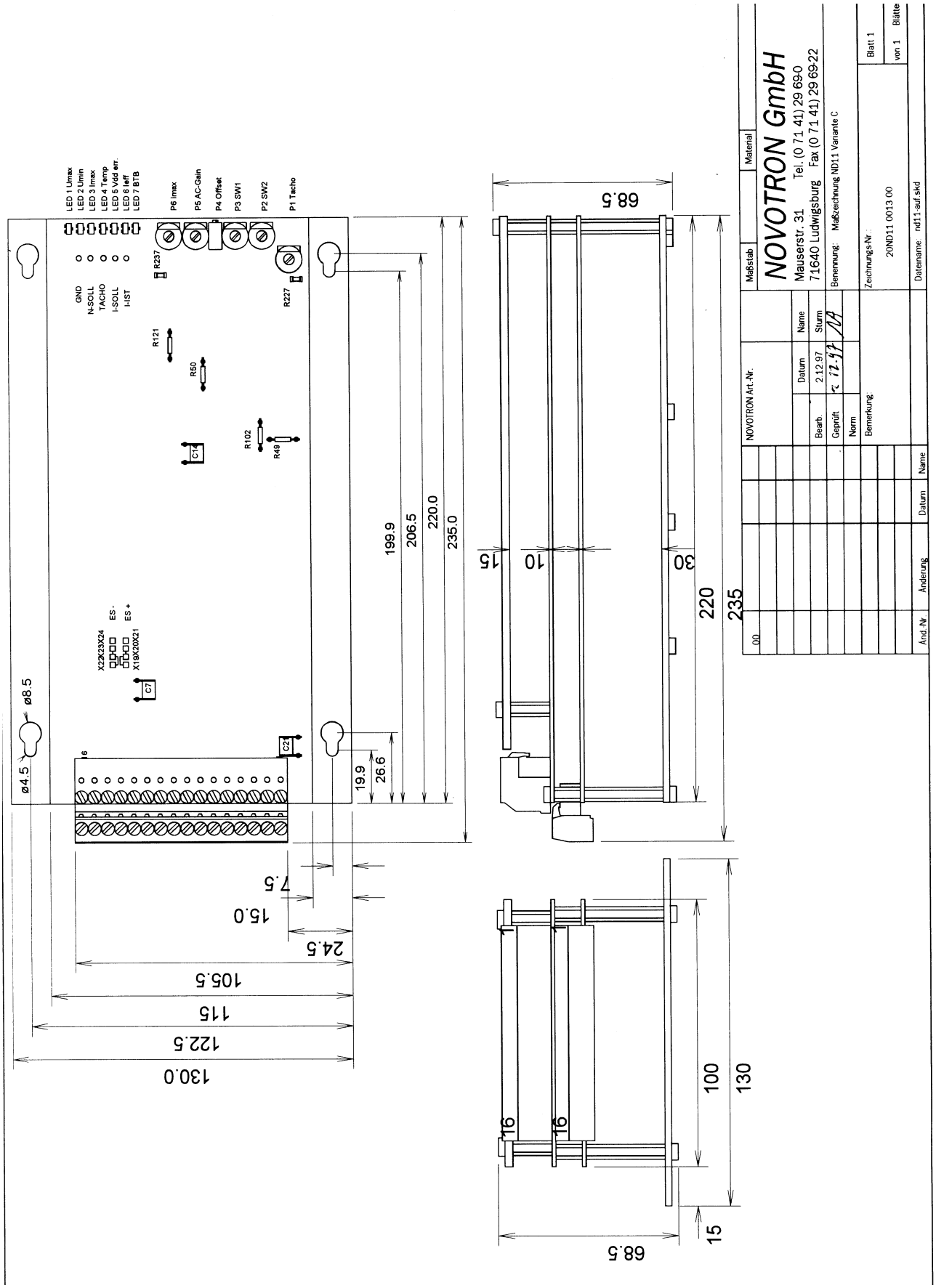
48 COMPACT CASE



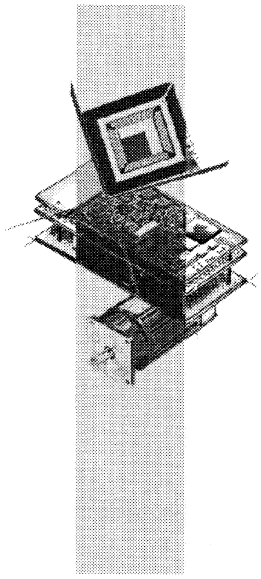
49 MEASURE DRAWING OF 19” INSERT



50 MEASURE DRAWING VARIANT C



NOTES



NOVOTRON
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