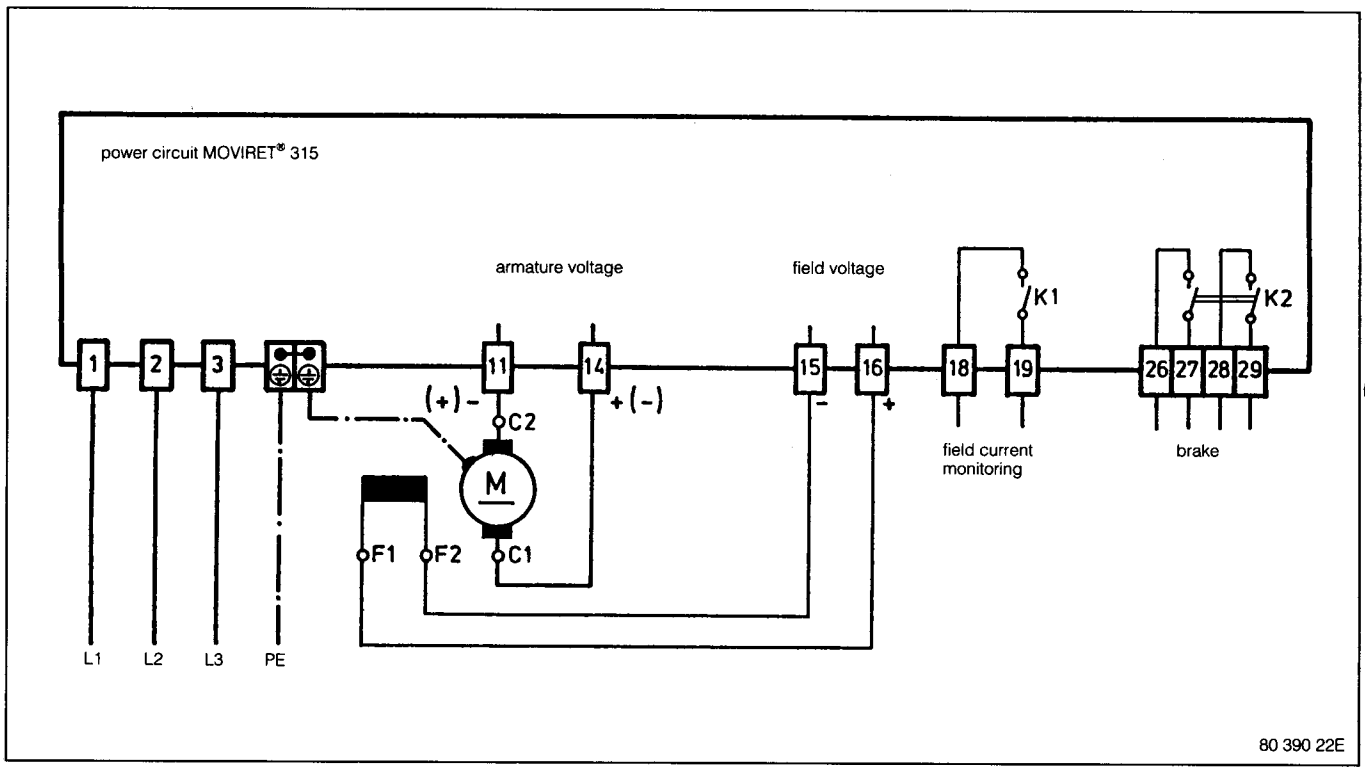
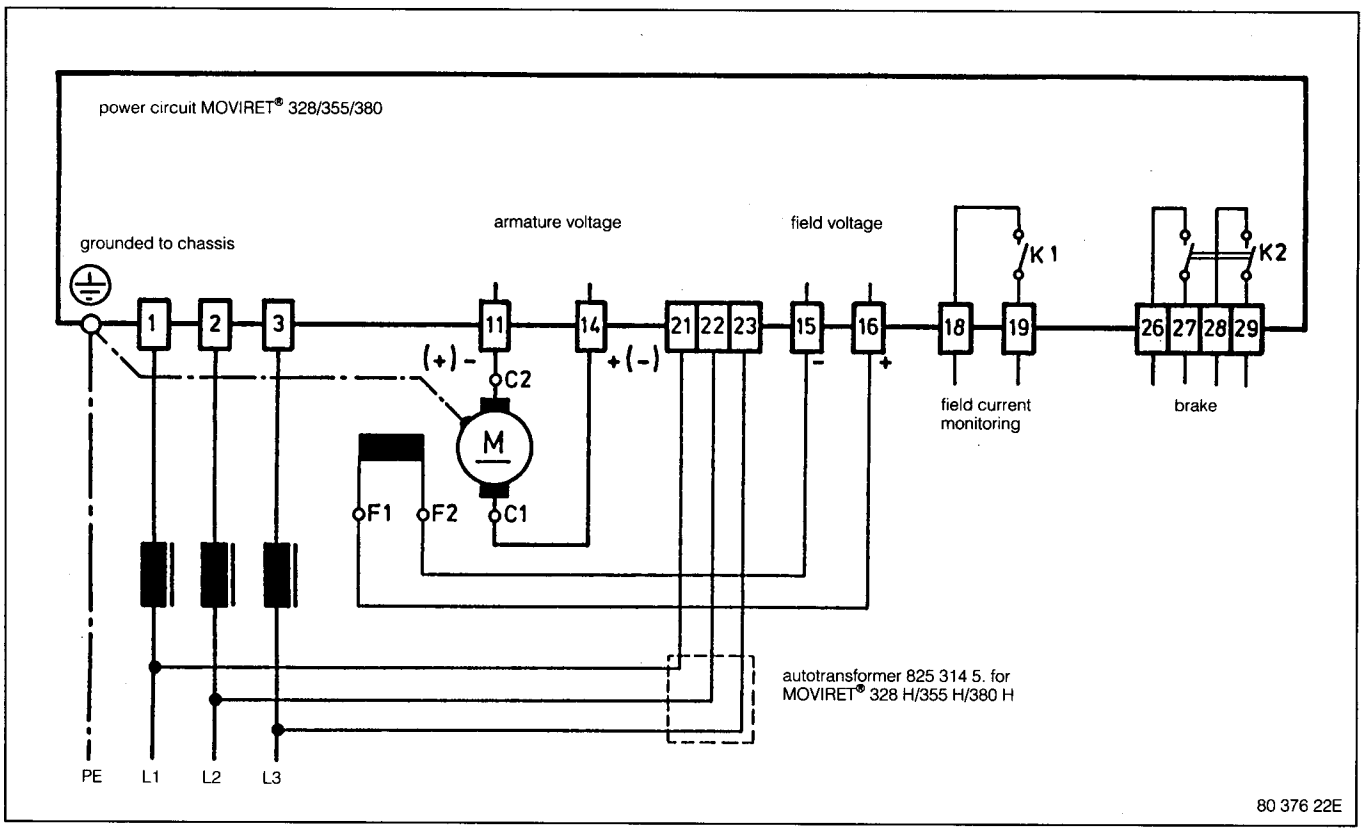
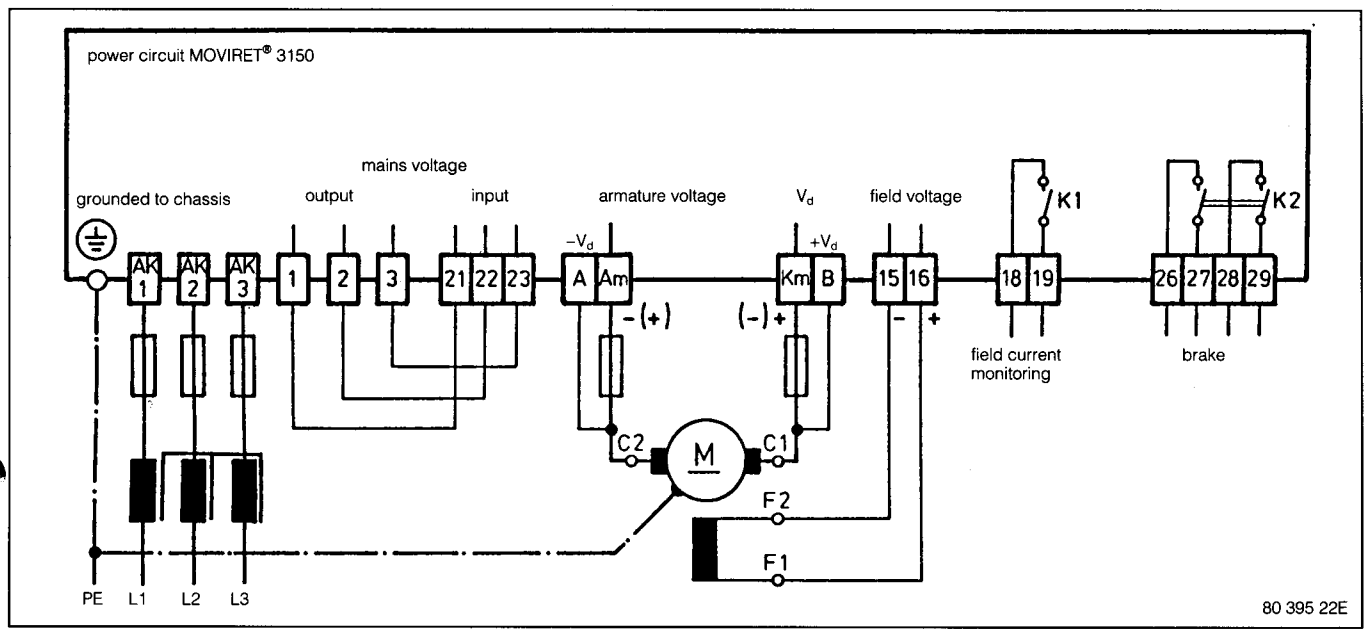
2.4 Connection circuit diagrams

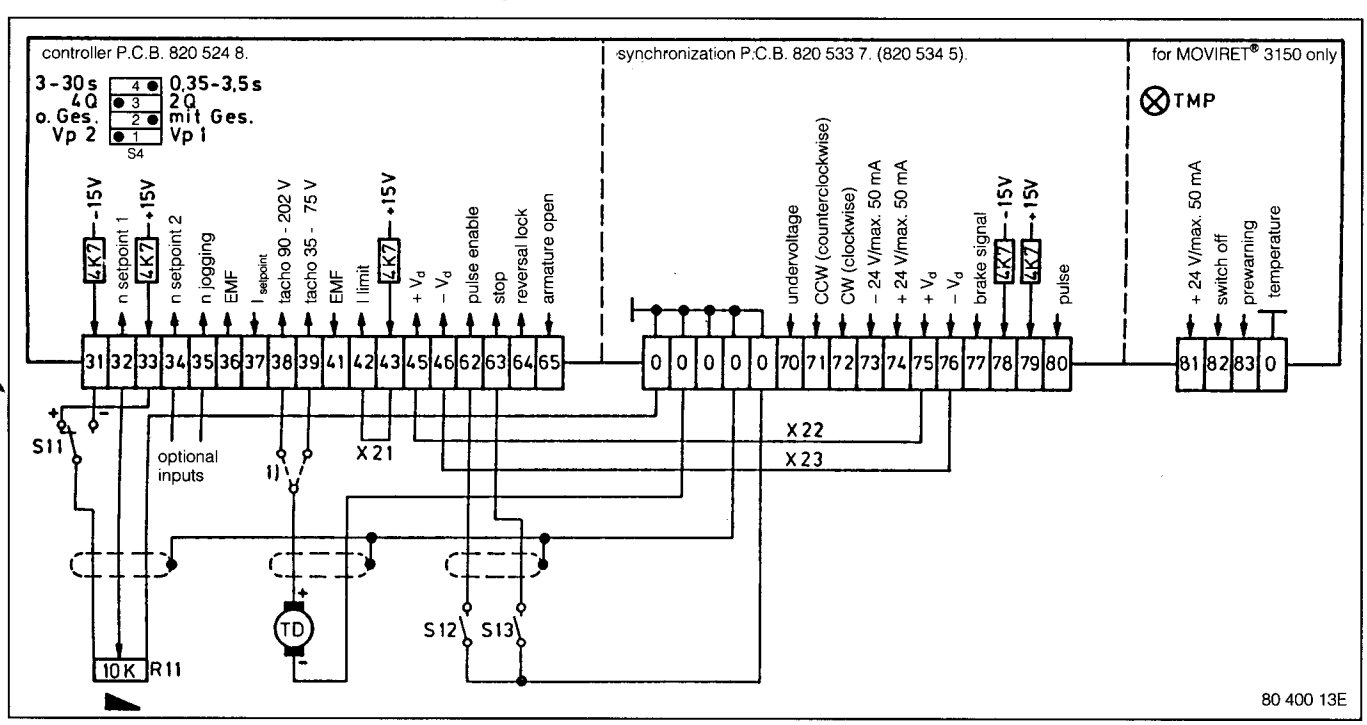
2.4.1 Power circuit - connection circuit diagrams







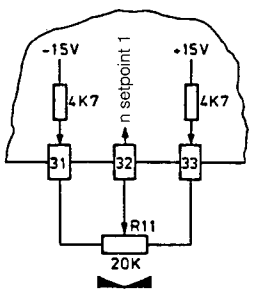
2.4.2 Electronic circuit - connection circuit diagrams



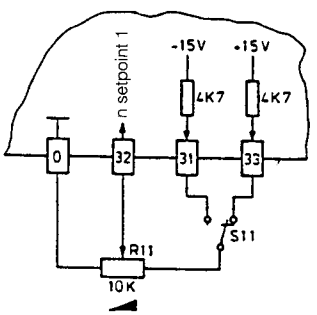
Notes:

- Earth screen ends according to connection circuit diagram in section 2.3
- n control with tachogenerator (TD) as shown in the diagram 1):
  Jumper X20 (terminals 36/41 must be removed)
  Given polarity V_{TD} applies to + n_{setp}
  Depending on value of V_{TD} at rated speed to be connected according to section 2.4.2.2, example 2...5
- Armature voltage control (without tachogenerator): jumper X20 (terminals 36/41 must be connected)
- Switch functions:
  S11 = reversal of rotational direction
  S12 = pulse enable
  S12 = open = pulse disenable (inverter limit)
  S13 = stop function
  S13 = open = stop (rapid stop not with ramp generator but with I_{max})
- Jumper X21 (terminals 42/43) connected = external current limit $I_{max} = 1.5 \cdot I_N$

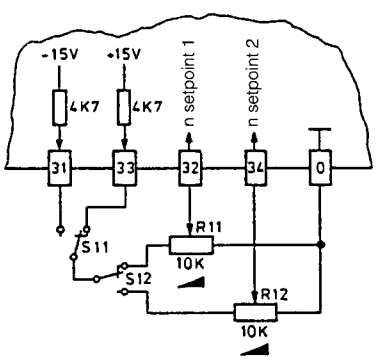
2.4.2.1 Setpoint terminal connection



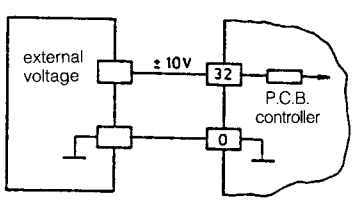
Example 1 Infinitely variable setpoint for both rotational directions
Mid-position setting corresponds to zero speed



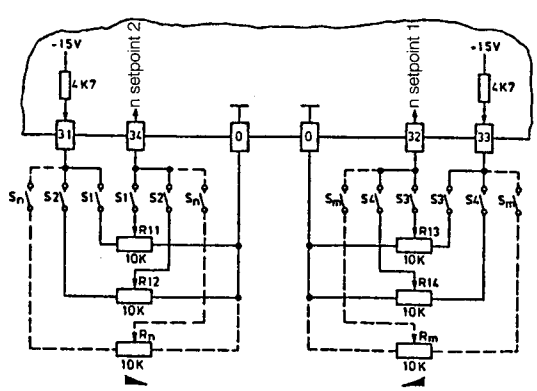
Example 2 Setpoint switchable for both rotational directions



Example 3 2 setpoints, switchable via S14
Both setpoints are valid for both rotational directions



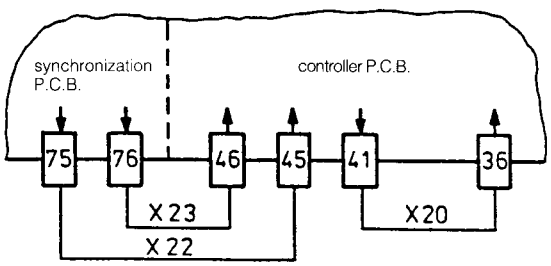
Example 4 Setpoint provided by an external voltage source



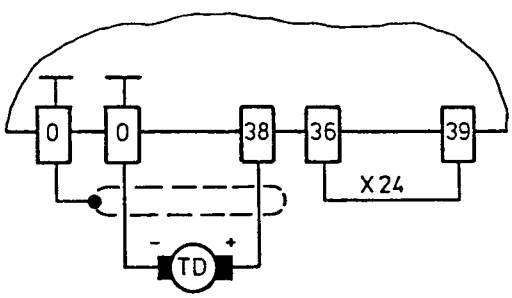
Example 5 Setpoint reversal positive and negative for more than two setpoints

80 347 10E

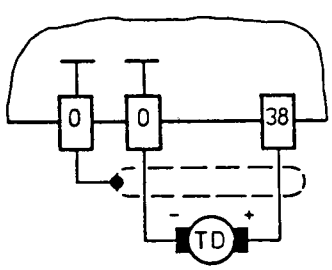
2.4.2.2 Actual value terminal connection



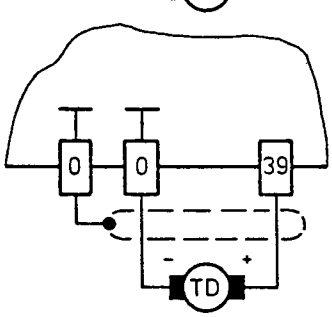
Example 1 $V_{armature\ voltage}$ control with I × R compensation
No tachogenerator connected



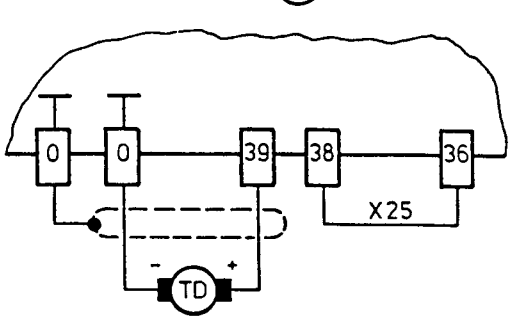
Example 2 Tachogenerator (TD) voltage 25-45 V
no jumper X20



Example 3 Tachogenerator voltage 90-200 V
no jumper X20



Example 4 Tachogenerator voltage 35-75 V
no jumper X20



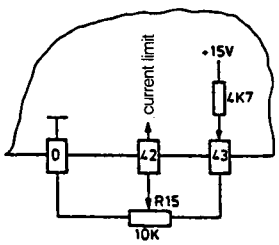
Example 5 Tachogenerator voltage 60-130 V
no jumper X20

Earth screen end in accordance with circuit connection diagram in section 2.3.
The given tachogenerator polarity applies to + $n_{setp.}$

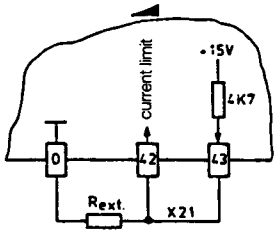
80 361 11E

2.4.2.3 External current limitation

If the external current limit is not used, the jumper X21 (terminals 42/43) installed at the manufacturing plant remains connected (I_{max} = 1.5 × I_N during 15 s), refer to example 3.

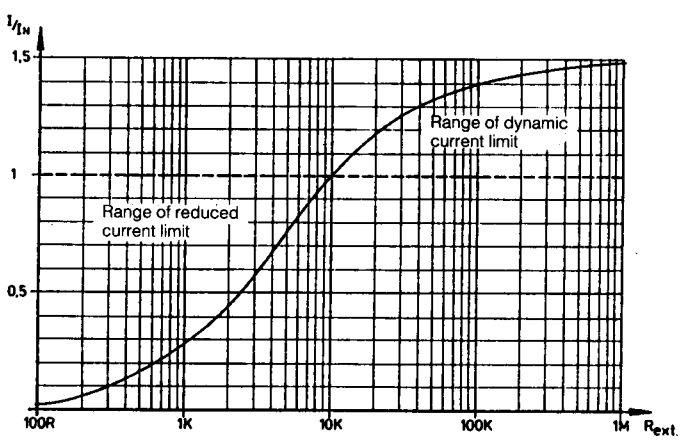


Example 1: Variable current limit adjustable via R15 in the range of 0-100 % I_N of the internally set current limit



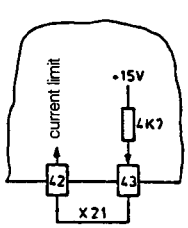
Example 2: Fixed current limit by R_{ext} selection from the diagram below

80 348 10E

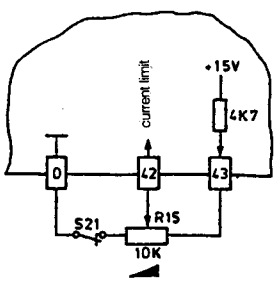


Determination of the resistance R_{ext} as a function of the desired current limit
Resistance values above 10 kΩ result in a dynamic current limit > 100% I_N

80 774 00E



Example 3: Maximum current limit (I_{max} = 1.5 × I_N). The time limit is 15 s (function "Increased current limit" with LED "ESB")

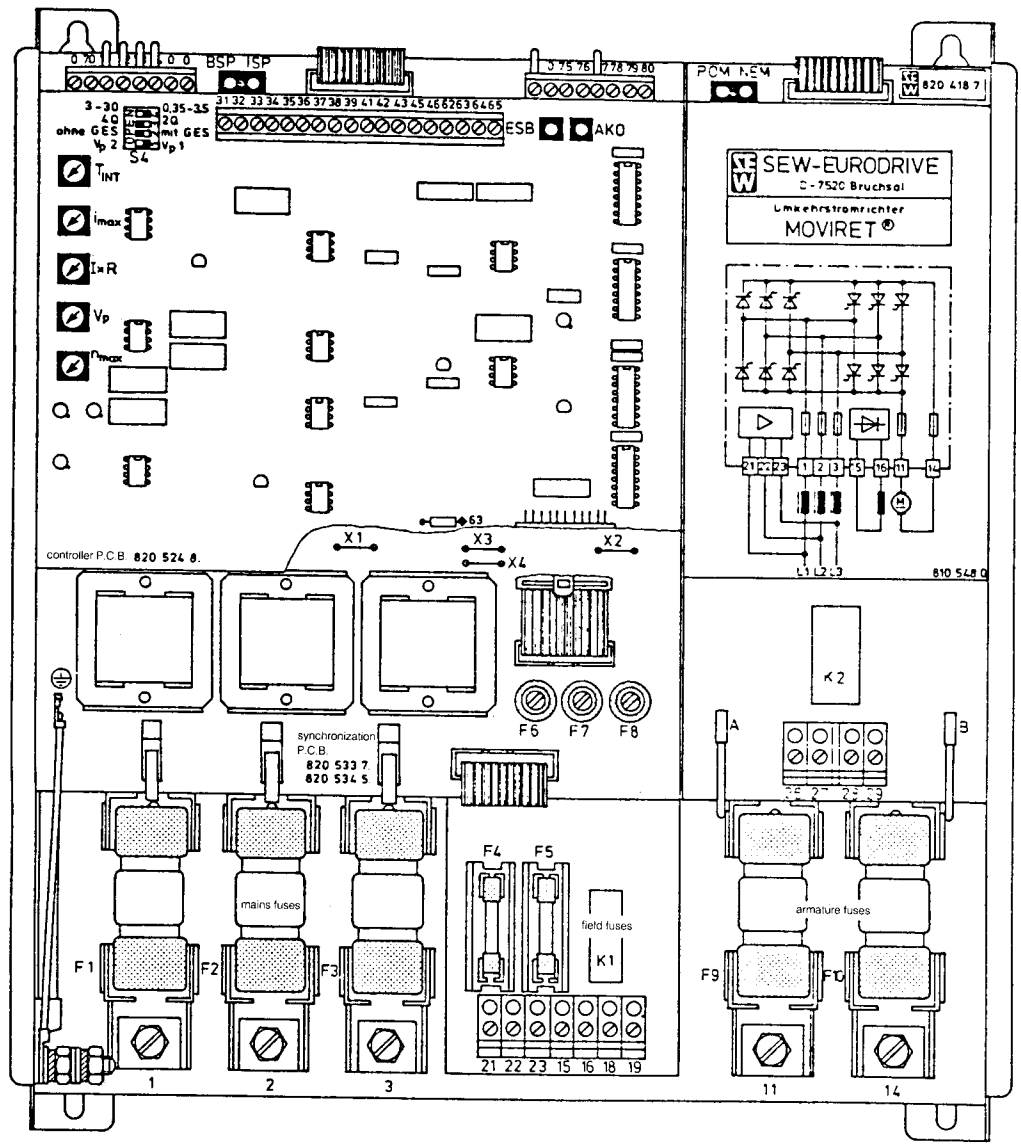


Example 4: Variable current limit (as example 1), however connectable:
S21 open: $I_{max} = 1.5 \cdot I_N$
S21 closed: I_{max} according to R15 setting (example 1)

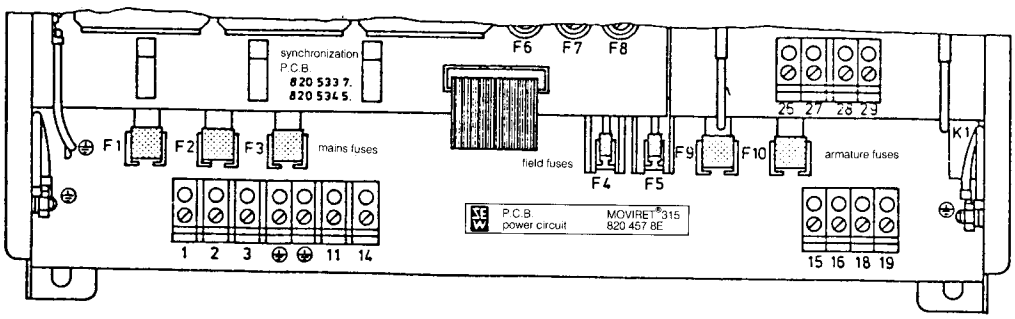
80 348 10E

4. Service information

4.1 Illustration of mechanical arrangement of component parts in the unit



MOVIRET® 328-380
MOVIRET® 3150
correspondingly,
however without
F1/2/3/9/10



MOVIRET® 315

80 265 12E

4.2 LED functions

LED	Colour	Normal status	Display function
BSP	green	ON	Operating voltage o.k.
ESB	green	ON	Increased current limit Dynamic current limit ineffective, i.e. 150 % I_{dN} readiness
POM	green	alternatively	Positive torque (driving)
NEM	green	ON	Negative torque (braking)
ISP	red	OFF	Pulse disenable ineffective, i.e. pulse enable (unit not blocked)
AKO	red	OFF	Armature circuit open = fault If LED AKO = ON (= fault) then LED ISP = ON (result of AKO)
TMP	red	OFF	Applicable only to MOVIRET® 3150: Temperature control of unit heat sink

4.3 Trouble shooting table

Fault situation	LED status						Remedy Section 4.4 Point No.:
	BSP	ESB	POM	NEM	ISP	AKO	
Motor does not start	○	○	○	○	○	○	1
	●	●	● or	●	●	○	2
	●	●	● or	●	○	○	3/4/5/6/7.2
	●	●	● or	●	●	●	7
	●	○	● or	●	○	○	4/5
	○	●	● or	●	●	○	8
With active load (e.g. hoisting operation): Load is lowering	●	●	● or	●	○	○	4.2/5/6
	●	○	● or	●	○	○	4.2/5
Motor does not attain the speed	●	●	● or	●	○	○	6/9
	●	○	● or	●	○	○	5
Sudden drop in motor speed	●	●	● or	●	○	○	5/6/9.3/10/17
	●	○	● or	●	○	○	5
Motor runs at n_{max} (not controllable)	●	●	● or	●	○	○	11
Motor runs too fast, controllable	●	●	● or	●	○	○	12
Motor does not attain speed fast enough	●	●	● or	●	○	○	5/13/14
	●	○	● or	●	○	○	5
Speed is oscillating	●	●	● ⇄	○	◐	○	15/16/17/18
Motor only turns in one direction (only one torque direction available)	●	●	●	○	○	○	19
	●	●	○	●	○	○	20
Motor continues running despite n_{setp} = 0V	●	●	● or	●	○	○	21
Motor continues running despite actuation of Stop function	●	●	● or	●	○	○	22
Motor is turning in the wrong direction	●	●	● or	●	○	○	23

● = LED on
○ = LED off

● ⇄ ○ = LEDs on alternately
◐ = LED blinking

4.4 Fault causes and remedial measures (27 points)

Measurements in the electronic assembly are to be carried out with a permanent-magnet moving-coil instrument (R > 10 kω/Volt). All electronic voltages are to be measured against terminal 0 (= 0V).

1. No supply voltage:

1.1 Check whether mains voltage is applied between terminals 1 and 2, between terminals 1 and 3 and between terminals 2 and 3 according to the technical specifications. With the MOVIRET® units of the 328/355/380 series and the H and N versions, the mains voltage applied between terminals 21 and 22, terminals 21 and 23 and between terminals 22 and 23 must additionally be checked. If any of the designated locations is found to be without mains voltage, there is a fault in the supply system.

1.2 Disconnect the unit from the supply. Remove mains fuses F1/F2/F3, mains fuses F4 and F5 as well as control unit fuses F6/F7/F8 and armature fuses F9/F10 and check for continuity. In case of defective fuses refer to points 24 to 27.

2. The unit is blocked internally:

2.1 Measure voltage at terminal 62 (15 V_{DC} measuring range). If the voltage applied exceeds 1 V, the pulse enable is not effective (S12 open or defective).

2.2 Measure voltage at terminal 63 (15 V_{DC} measuring range). If the voltage applied exceeds 1 V, the stop function has been activated (S13 open or defective).

2.3 Check whether terminal 64 has been connected. Terminal 64 is not to be used by the customer.

3. No speed setpoint available or negative torque direction blocked:

3.1 Measure voltage at terminal 32 resp. terminal 34 (15V_{DC} measuring range). If no voltage is applied, apply speed setpoint. If two setpoints are connected, the sum of both setpoints must not be equal to 0 V (addition true to sign). For setpoint selection please refer to section 2.4.2.1.

3.2 Check position of switch S4/3. The switch must be set to 4Q (or otherwise there is no negative torque direction).

4. Motor is overloaded (LED "ESB" off approx. 15 s after switch-on):

4.1 Check whether the drive is blocked mechanically; the cause could be a built-on brake which has not been released.

4.2 The motor hardly develops any torque if there is no field current. For control purposes the field current monitoring relay is used. Check terminals 18 and 19 for continuity.

5. The unit is at the internally set current limit (LED "ESB" off approx. 15 s after switch-on)

If the internal current limit has not been set to the armature rated current, perform the setting in accordance with section 3.2, point b).

6. The unit is at the externally set current limit:

Measure voltage at terminal 42 (15 V_{DC} measuring range). If less than +10 V are applied, the external current limit prevails and reduces the internally set current limit, cf. section 2.4.2.3.

7. The armature circuit is open (LED "AKO" on):

7.1 Fuses F1/F2/F3 or F9/F10 are defective (refer to point 1.2).

7.2 Isolate unit; remove leads from terminal 11 and terminal 14 and check for continuity. If no continuity is measured, the armature circuit in the incoming line or in the motor is interrupted (carbon brushes).

7.3 The connection of the control electronics (terminals 21/22/23) does not comply with the mains connection - refer to point 25.1.

7.4 LED "AKO" on despite intact fuses F9/F10: potentiometer n_{max} is set to CW limit and $V_{arm\ max}$ is set too high (setting in accordance with section 3.2 point a).

8. The control electronics has identified mains undervoltage or phase failure (LED "BSP" off, "ISP" on):

8.1 Short-time mains undervoltage or short-time phase failure: switch mains voltage off and then on again (= failure reset).

8.2 Cf. point 1.

8.3 Measure voltage at terminals 73 and 74 (30 V_{DC} measuring range). If less than +18 V are applied to terminal 74 resp. less than –18 V to terminal 73, the power supply unit may be subjected to an excessive external load. Remove connections from terminals 73 and 74 and once more measure against 0 V there.

9. The unit has been adjusted incorrectly:

9.1 Measure voltage at terminal 32 resp. 34 (15 V_{DC} measuring range). If the setpoint voltage is smaller than 10 V, increase the setpoint. Only at 10 V the drive reaches its maximum speed (section 2.4.2.1). If two setpoints are connected at the same time, it must be ensured that the two voltages are added true to their sign.

9.2 Turn potentiometer n_{max} in CW direction. If, as a result, the speed increases, set maximum speed in accordance with section 3.2 point a).

9.3 In case of tachogenerator control: check whether jumper X20 (terminals 36/41) has been removed.

9.4 Measure voltage at terminal 36 (10 V_{DC} measuring range). If a voltage of approx. 5 V is measured, the speed setpoint - in case of tachogenerator control - has not been adjusted properly. Connect tachogenerator in accordance with section 2.4.2.2 subject to maximum tachogenerator voltage and reset speed limitation as per section 3.2 point a).

9.5 The field voltage of the motor is too low or its armature voltage too high. Check whether the field voltage and the armature voltage specified on the nameplate of the DC motor correspond to those of the DC converter.

10. In case of V_{arm} control: IxR compensation is not or only insufficiently compensated:

Adjust I x R compensation in accordance with section 3.2 point c).

11. There is no speed actual value feedback or the actual value feedback has the wrong polarity:

11.1 In case of tachogenerator control:
The tachogenerator has been connected with the wrong polarity or the tachogenerator line is interrupted, resp. an AC tachogenerator with built-in rectifier was used. Refer to section 3.1 point a + k...n.

11.2 In case of V_{arm} control:
Check whether jumpers X20, X22, X23 have been installed in accordance with section 2.4.2.2 (example 1).

12. The unit has been adjusted incorrectly:

12.1 Turn potentiometer n_{max} in CCW direction and set maximum speed in accordance with section 3.2, point a).

12.2 In case of tachogenerator control check whether jumper X20 (terminals 36/41) has been removed, cf. section 2.4.2.2.

12.3 Check whether in case of tachogenerator control the tachogenerator has been connected properly according to the tachogenerator voltage at n_{max}.

12.4 The motor data deviate from the data of the DC converter. Refer to point 9.5

13. The setpoint increases too slowly:

13.1 Setpoint ramp generator limits increase:
turn potentiometer T_{INT} in CCW direction and/or at CCW limit position set switch S4/4 to ramp generator time 0.35 to 3.5 s. If the motor speed increases faster then, set the desired acceleration time at potentiometer T_{INT}.

13.2 Increase of externally set setpoint too slow:
check setpoint increase at terminals 32 resp. 34 with a low-set ramp generator time by measuring and comparing with the acceleration time of the motor. If there are any differences between the acceleration time of the motor and the setpoint increase, the drive is accelerating along the current limit. Refer to point 14. If there is no difference, the external setpoint is increasing too slowly.

14. The motor accelerates along the current limit (with large load resp. with high flywheel effect):

14.1 The external current limit reduces the torque
(refer to point 6).

14.2 Measure voltage at terminal 42 (15 V_{DC} measuring range). If less than +14 V are applied, activate the dynamic current limit (section 2.4.2.3 example 3).

15. In case of V_{arm} control: load-dependent drop of the motor speed is overcompensated:

Turn potentiometer I x R back in CCW direction and set in accordance with section 3.2 point c). Overcompensation has to be avoided.

16. Speed controller oscillates:

Optimize speed controller in accordance with section 3.2, point d).

17. The setpoint is not stable:

Turn potentiometer T_{INT} in CW direction and set switch S4/4 to ramp generator time range 3 to 30 s. If the oscillation resp. the falling off in the motor speed becomes smaller, then the speed setpoint already oscillates (check setpoint voltage supply).

18. Periodic load changes:

In case of fast periodic load changes, the speed controller has not enough time to compensate speed drops completely. Up to a load change frequency of approx. 4 Hz, the optimization of the speed controller in accordance with section 3.2, point d) brings an improvement.

In case of periodic load changes in the range between 4 Hz and 10 Hz, it is more favourable to intentionally slow down the speed controller to prevent the oscillation from escalating. In that case the speed controller hardly reacts to the load changes, which are then only compensated by the mass moment of inertia. Set switch S4/1 to V_{p1} and turn potentiometer V_p almost back to the CCW limit position.

19. No negative setpoint or torque direction II in the unit is interlocked:

19.1 Measure voltage at terminal 32 resp. terminals 34 (15 V_{DC} measuring range). In the absence of a negative setpoint, the motor speed cannot be reversed either (section 2.4.2.1). If two setpoints are connected, the sum of both setpoints must be negative (section 2.4.2.1).

19.2 If a negative setpoint is measured, check the position of the switch 4/3 (position "1" = 4 Q).

20. No positive setpoint:

Measure voltage at terminal 32 resp. terminal 34 (15 V_{DC} measuring range). If there is no positive setpoint voltage, apply + setpoint.

21. The unit has not been set to the proper mains frequency or has been adjusted incorrectly:

21.1 Check whether in case of operation off a 50 Hz mains the jumpers X1/X2/X3/X4 have been soldered in on the synchronization P.C.B. With a 60 Hz mains these jumpers must be opened.

21.2 Jogging input terminal (terminal 35) for approx. 7% setpoint is assigned. Check whether voltage is applied to terminal 35. If there is, isolate terminal 35.

21.3 Remove connection leads from terminals 32, 34 and 35 and connect them to 0 V. If the motor is rotating visibly slower now, check the setpoint generator and its earthing/grounding cable.

21.4 If, in spite of setpoint voltage 0 V, the motor rotates at creep speed, refer to point 15 (IxR compensation). If the motor is not supposed to rotate, either S12 (terminal 62) or S13 (terminal 63) needs to be opened.

22. Jogging input terminal (terminal 35) for approx. 7% setpoint is activated:

The stop function S13 (terminals 63) only decelerates down to zero speed if the jogging input terminal has been disconnected. Check whether voltage is applied to terminal 35. If there is, isolate terminal 35.

23. Motor runs in wrong rotational direction:

23.1 In case of V_{arm} control, interchange field connections (terminals 15/16).

23.2 In case of tachogenerator control, interchange field connections (terminals 15/16) and tachogenerator connections (terminals 0 and 38/39).

24. Field fuse F4 resp. F5 blows when the unit is switched on:

24.1 Check whether the field has been connected to terminals 15/16 as shown on the circuit connection diagram and whether the right fuses in accordance with the technical data listed in section 5.1 are installed.

24.2 Check per the technical data of the motor and the DC converter whether the maximum permissible field current of the unit is exceeded.

24.3 Disconnect connections to terminals 15/16 and check leads for short circuit and earth/ground fault.

25. Fuses F1/F2/F3 resp. armature fuses F9/F10 blow in case of pulse enable (S12 = closed).

25.1 With MOVIRET® units 328/355/380/3150 and the N version: Measure voltage (500V measuring range) between terminals 1 and 21, terminals 2 and 22 and terminals 3 and 23. If any voltage is measured, phase coincidence was not attended to (refer to section 3.1, point a). For units of the H version the measured value should be approx. 120 V, if the mains = 500 V_{AC}.

25.2 With a 60 Hz mains: check whether the unit has been switched over to 60 Hz (jumpers X1, X2, X3 and X4 on the synchronization P.C.B. opened).

25.3 Switch off device, remove armature leads from terminals 11/14 and check leads with the motor being connected for short circuit or earth/ground fault.

25.4 Check whether a contactor is installed between the DC converter and the motor. In this case the contactor must definitely be closed before switch S12 is closed (pulse enable). The contactor may only be opened if the device has been disenabled at least 50 ms prior (switch S12 open).

26. Mains fuses F1/F2/F3 resp. armature fuses F9/F10 blow at high speed:

26.1 Check whether at maximum speed the armature voltage exceeds the output rated voltage of the unit. If the armature voltage exceeds the output rated voltage, use potentiometer n_{max} to limit the speed (and thus the armature voltage) to the rated value (cf. section 3.2 point a).

26.2 Check motor (carbon brushes and collector).

26.3 Refer to point 25.3 (short circuit or earth/ground fault).

27. Fuse blows at nondefined times:

27.1 Check whether power cables are run together with control leads (chapter 2.3). If run with contactor control leads, it suffices to provide the contactor coil with an RC circuit. Other devices with magnetic leakage fields need to be removed from the immediate vicinity of the DC converter or be screened.

27.2 Refer to point 25.4 (contactor installed between the motor and the DC converter).

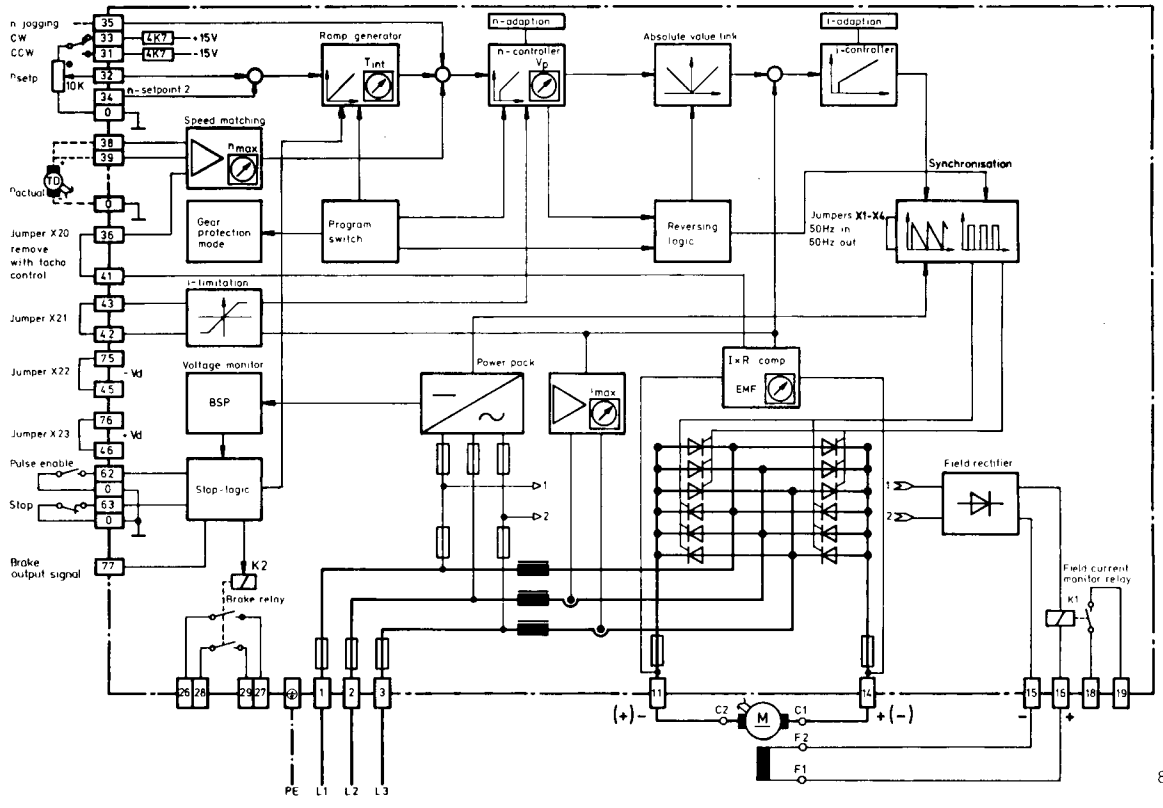
5. Technical data, description of functions

5.1 Technical data

DC converter MOVIRET® Type Part number	315 825 207 6	328 825 186 X	355 825 187 8	380 825 188 6	3150 825 395 1
Mains rated voltage **Permissible range at rated output data** **Permissible range at reduced V_{arm}**	V_{mains} = 3 × 380/415 V_{AC} V_{mains} – 5 % + 10 % V_{mains} – 10 % if $V_{dmax} \leq$ 380 V_{DC}				
Mains frequency	50 Hz, can be changed to 60 Hz (60 Hz = open up jumpers X1/2/3/4)				
Phase input at rated power output	12.5 A_{AC}	23 A_{AC}	46 A_{AC}	61 A_{AC}	115 A_{AC}
Motor armature rated voltage V_{dN}	at V_{mains} 3×380 V_{AC} : V_{dN} = 400 V_{DC} (DIN 40 030) at V_{mains} 3×415 V_{AC} : V_{dN} = 430 V_{DC}				
Unit rated current I_{dN}	15 A_{DC}	28 A_{DC}	55 A_{DC}	80 A_{DC}	150 A_{DC}
Permissible form factor at I_{dN}	$F_f \leq$ 1.25			$F_f \leq$ 1.15	
Dynamic current limitation	150 % I_{dN} during t = 15 s (function "ESB")				
Field voltage/max. field current	340V_{DC}/2A_{DC}	340V_{DC}/3A_{DC}			340V_{DC}/4A_{DC}
Field current monitoring relay K1 closes at	≥ approx 0.18 A_{DC}	≥ approx. 0.35 A_{DC}			
Fuses **Mains F1/2/3** **Armature F9/10** **Field F4/5** **Electronics F6/7/8** **Series fuses F11/12/13**	3 × FF 25 A 2 × FF 25 A 2 × FF 4 A 3 × T0.315 A	3 × FF 40 A 2 × FF 40 A 2 × FF 6.3 A 3 × T0.313 A	3 × FF 80 A 2 × FF 80 A 2 × FF 6.9 A 3 × T0.315 A	3 × FF 100 A 2 × FF 100 A 2 × FF 6.3 A 3 × T0.315 A	3 × FF 200 A 2 × FF 200 A 2 × FF 6.3 A 3 × T0.315 A 3 × FF12.5 A
Mains chokes	installed	3 × ND 231	3 × ND 451	1 × ND 703	1 × ND 1503
Speed setpoints $n_{setp}1$ (terminal 32)	0... + 10 V rotational direction I 0... – 10 V rotational direction II				
$n_{setp}2$ (terminal 34)	0... + 10 V rotational direction I 0... – 10 V rotational direction II				
n_{jog} (terminal 35)	+ 24 V (from terminal 74) = 7 % n_{max} rotational direction II – 24 V (from terminal 73) = 7 % n_{max} rotational direction I The polarity of n_{jog} has the reverse rotational effect and is effective directly (not via the ramp generator)				
Input impedance	for terminals 32/34/35: 100 KΩ each				
Setpoint ramp generator - time ranges	0.35...3.5 s; can be switched over to 3...30 s via S4/4				
Actual value inputs	Terminal 39: V_{TG} = 25... 45 V and 35... 75 V applies to n_{max} Terminal 38: V_{TG} = 60... 130 V and 90... 200 V applies to n_{max} Terminal 36: jumper X20 to terminal 41: internal V_{arm} I × R compensation: 0... 20 % V_{dN} adjustable				
Control range	with tachogenerator coverage: approx. 400 : 1 with V_{arm} +/– I × R coverage: max. 40 : 1				
Output relay **Field current monitoring K1** **Brake K2**	Terminals 18/19 Terminals 26/27 + 28/29 } contact rating 250 V_{AC}/ 1 A_{AC}/AC 1				
Operating ambient temperature	0... + 45° C; > 45° C... 70° C: 2 % reduction from I_{dN} per K				
Power loss P_1 at rated values	100 W	150 W	250 W	330 W	600 W
Data according to Standard Specifications	DIN 40 050 : Enclosure IP 00 DIN 57 558 T1 : Load type M (motor operation) Duty type DB (continuous operation)				
Cooling type DIN 41 751	Convection cooling				Forced cooling

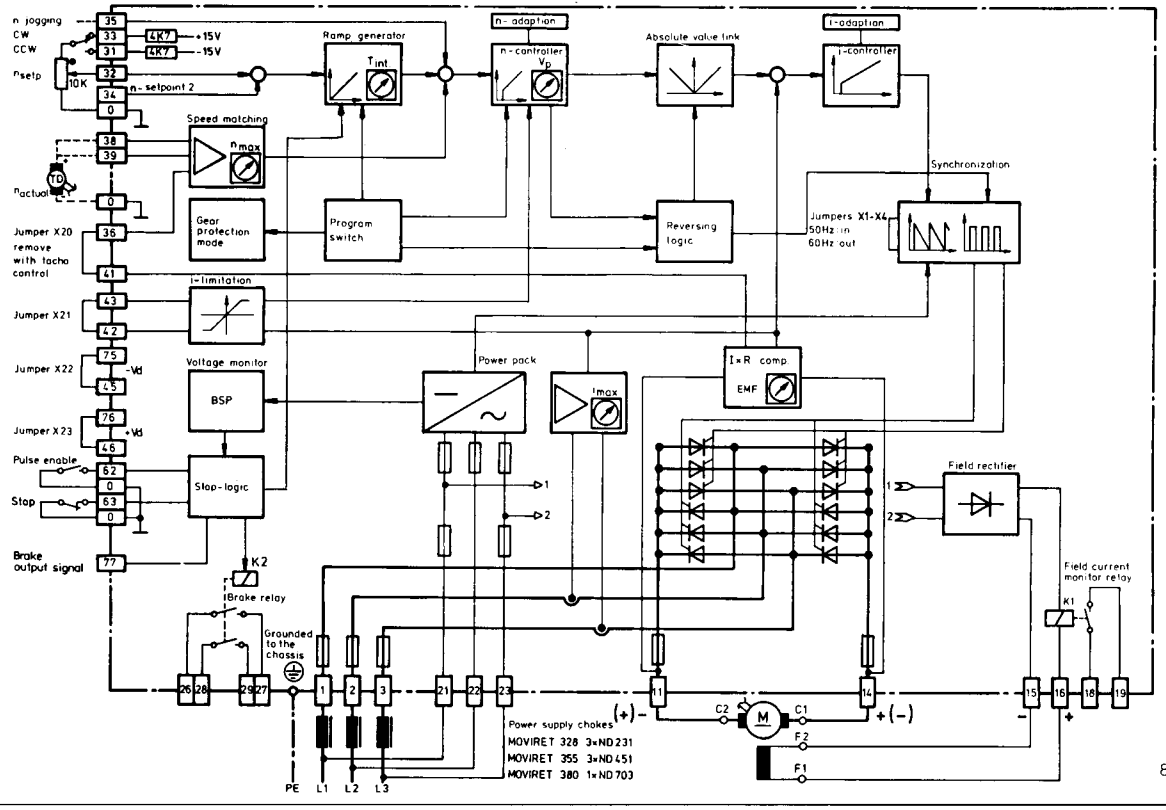
6. Block diagrams

MOVIRET® 315 (N)



80 797 22E

MOVIRET® 328 (N) / 355 (N) / 380 (N)



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