



Documentation (V.1.6 EN)

SERIE SM 807 DC

DC Servoamplifier

Directory	2
Safety notes	3
Types, electrical data	6
Assemblies plan	7
Wiring	8
Control signals SM 807 DC	9
DISABLE messages	10
Controller Board RP 202	11
Getting started, Installation	12
Locks, emergency shutdown	14
Customers Print RP100 Layout, wiring diagram (Standard)	16
Customers Print RP150 Layout, wiring diagram (Standard)	18
Setup, description and adjustment of the customer Print	20
Current limits	24
Troubleshooting	26
Mech. Dimensions, mounting of SM 807 DC	28

General Notes

Automation engineering can only be performed safe and technically successful by qualified personnel with appropriate experience in the field of measuring and control technology. For safe installation, setup, normal operation and maintenance it is required to observe (and reliably react to) warnings and safety notes contained in the equipment documentation and attached to the equipment.

Only professional personnel or if necessary, trained persons as defined in DIN 31000/VDE 0100 (Section 3.6 "User") are capable of interpreting correctly the safety notes and warnings issued generally in the documentation and attached to devices, and act appropriately in a concrete individual situation.

For obvious reasons documentation cannot neither take into account every detail of all variation of the described devices nor every conceivable case of project work, operation or maintenance.

H&R will answer to all safety-related and application-specific questions, and will take notice of your suggestions for the improvement of devices and the documentation.

Documentation is not any part of a "facts of the case". The obligations of H&R are exclusively a result of the general business and delivery terms of the HELDT & ROSSI Servoelektronik GmbH.

Qualified Personnel

Qualified personnel is synonymous with

- persons that are familiar with project work and with the safety concepts of electrical engineering and automation technology
- persons that are trained for the work with and in the operation of automation technology, and who understand the documentation contents related to the operation
- persons assigned with commissioning and servicing, who have the according education/experience, and are thus qualified to set power circuits and devices/systems into operation, to ground and to mark them according to the safety standards.

Risk information

The thorough consideration of the key terms described further down is inalienable for the physical safety of application and maintenance personnel, and to prevent damage to the described product and/or to devices attached to it.



Danger

means that physical or fatal injury will be inflicted or damage to property may occur if corresponding precautions are not taken.



Warning

means that death, physical injury or damage to property can occur if corresponding precautions are not taken.

>Caution<

means that physical injury or damage to property can occur if corresponding precautions are not taken.

-Attention-

means that attention is drawn to safety relevant facts according to the definition of "Note" or "Caution".

Note

is an essential, selective help information for the product or the corresponding part of a documentation.

Intended Purpose Use

Every H&R device/system must only be used for the intended purpose that it was designed for and that is specified in the technical documentation. Connections to external devices and components must be coordinated with H&R during the project phase for safety reasons and to maintain the warranty. H&R products are designed, manufactured, tested and documented according to the relevant safety standards. When the regulations and safety-related notes issued for the intended use and maintenance are observed the products will not present under normal conditions a hazard to health or of damage to property. Further requirements for perfect and safe operation of a device are: Appropriate transport, storage, installation and assembly as well as careful operation and maintenance.

Installation and Initial Operation

Every automation device is part of a larger system or installation.
The following notes serve to support the safe integration of a device into its environment.

Warning

By removing the housing respectively protective cover, or by opening the system cabinet parts of these devices /systems could be touched that may conduct dangerous voltages. Only qualified personnel are eligible to manually access these devices /systems.

This personnel must be experienced in all hazards and maintenance procedures in accordance with the relevant device documentation.

In addition it is expected to have a field-oriented problem and safety awareness.

Note

Even if by design a maximum of functional safety is obtained it is imperative to follow the instructions contained in the documentation because wrong measures can defeat the purpose of arrangements for preventing dangerous faults, or can even create additional hazards.

Warning

The current safety and accident prevention regulations must be observed in the respective application case. Devices designed for installation in a housing or electrical cabinet must only be operated when they are installed. Devices with perforated housing (Ventilation) must be installed after all wiring work has been finished, otherwise it must be protected adequately against intrusion by foreign objects.

Installations with local connection (stationary devices/systems) that are not equipped with a safe power disconnect switch and/or fuse must be fitted with a safe power disconnect switch or fuse; the installation must be grounded. A freely accessible grounded power outlet must be located in close vicinity to devices/systems that have a fixed, non-detachable connection line and are without a safe power disconnect switch.

Before starting line power supplied devices they must be checked if their voltage range setting matches with the local line voltage.

Line voltage fluctuation must stay within the specified tolerance limits of the connected device. Failure to observe this may result in faulty operation and dangerous conditions of the electrical modules.

Procedures must be arranged for a controlled restart of a program that is interrupted by a voltage brownout or blackout. Such an event must not lead to a hazardous condition at any time. If necessary an Emergency-Stop must be triggered.

Emergency-Stop facilities according to EN 60204-1/IEC 204-1 (VDE 0113) must remain serviceable under all operating modes of the automation installation. The reset of an Emergency-Stop facility must not lead to uncontrolled restart. 24 V power supplies must have safe electrically isolation.

>Attention<

The installation of connecting and signal lines must be as to prevent as much as possible inductive and capacitive interference and must not cause disturbance of automation functions or reduction of the control characteristics. Instructions given by H&R for the type of cable to be used for certain production areas are constituent part of the specification for the device/system. Operating elements and sensors must be installed as to sufficiently prevent unintentional operation.

Appropriate hardware and software measures must be planned that will prevent undefined conditions in the automation system in case of interrupted signal leads on I/O interfaces.

Active and Passive Faults of an Automation System

Both, active and passive faults can be hazardous in electronic automation systems: in a drive control it is generally the active fault that is dangerous because it leads to an unauthorized motion of the machine. A passive fault could prevent a signal function from issuing a warning message about a hazardous operating condition. Categorizing possible faults into hazardous and non-hazardous types is of utmost importance for any risk assessment.

Warning

Additional arrangements e.g. independent limit switches, mechanical stop bolts, safe retardation areas etc. must be added, or facilities must be created that warrant respectively force a safe operation of automation systems that will inflict injury or cause great damage to property if dangerous faults occur.

Service and Maintenance Procedures

Required measurements or tests on an active device must only be made at the test points clearly marked by H&R. The measuring instruments must be of state of the art technology regarding electric isolation, burden on the test point and general handling safety. A suitable electric tool must be used.

Warning

Unauthorized accessing and inexperienced repairs may lead to serious or fatal injury as well as considerable damage to property. Repair to a H&R automation system must only be performed through service providers that are authorized by H&R. Only spare parts must be used that meet all specifications of the parts list issued by H&R for that device. A blown power fuse is a reaction only to a defect in the H&R device, but not to an overload. Replacing the fuse without prior rectification of the fault leads to considerable consequential damage and forfeits all warranty claims.

- Before opening the device always disconnect power by unplugging the power connector or by switching off the disconnecting switch.
- Fuses must be replaced with the same type as specified in the technical data of the device.
- Do not dispose of batteries in fire and do not solder to the cell housing, explosion hazard! (maximum temperature is 100 °C). Batteries containing Lithium or Mercury must not be opened and must not be recharged, use same type replacement only!
- Batteries or accumulators must be disposed of like special waste.

H&R documentation is reviewed periodically to keep it updated. It can be modified at any time without prior notice. All H&R literature contains information protected by copyright.

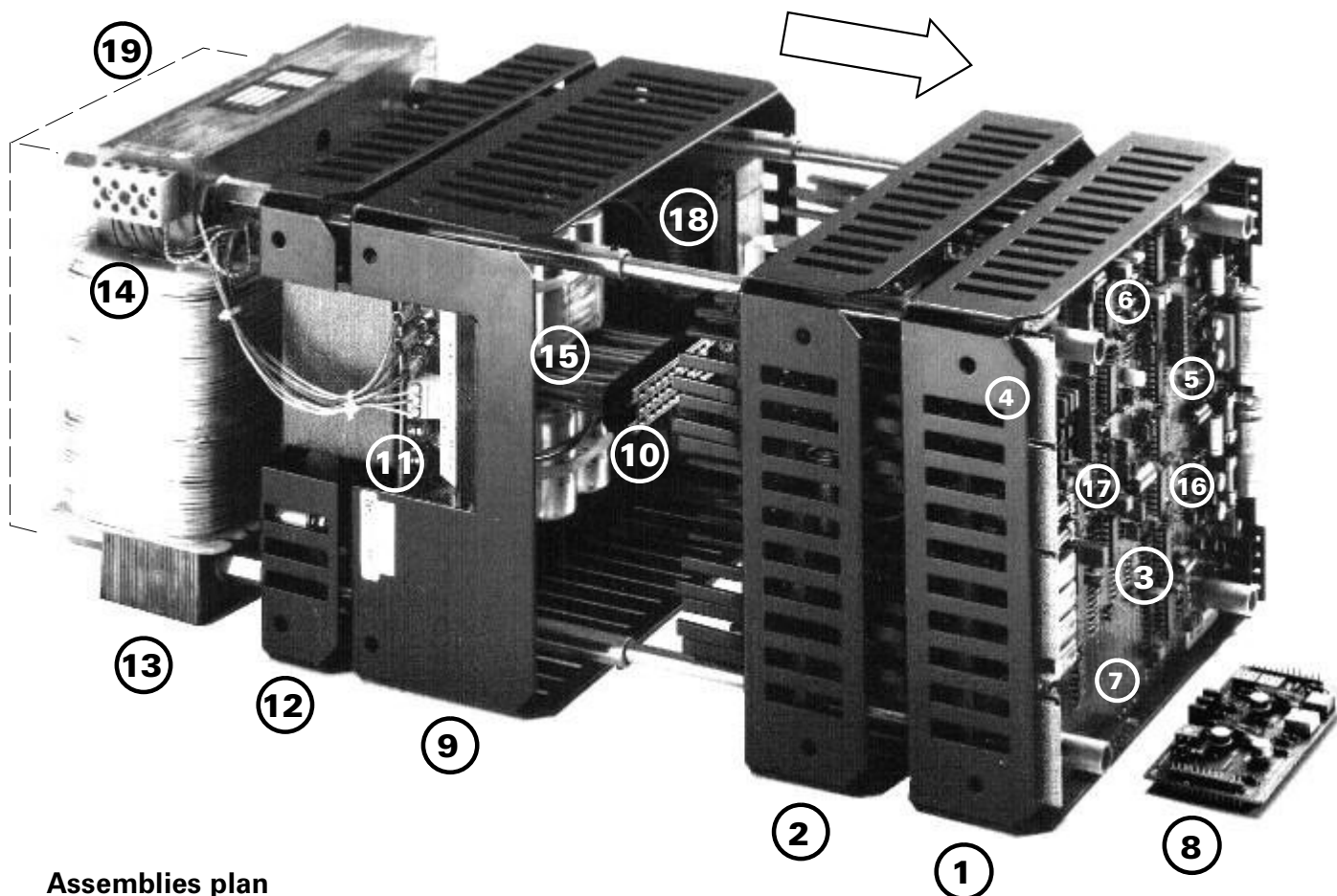
Reproduction of any type or translation into other languages without prior written approval of H&R is prohibited.

Type-List, electrical data of SERIE SM 807 (/2) DC

Servovamplifier Type	max. Output- voltage	max. Output-current		
		static	dynamic	
			807	807/2
250 / 30	± 30 V	±10 A	± 30 A	± 20 A
250 / 60	± 60 V	± 5 A	± 15 A	± 10 A
500 / 75	± 75 V	±7,5 A	± 22 A	± 15 A
750 / 75	± 75 V	±10 A	± 30 A	± 20 A
750 / 100	±100 V	±7A	± 21 A	
750 / 120	±120 V	±6 A	± 18 A	± 12 A
750 / 150	±150 V	±5 A	± 15 A	± 10 A
750 / 175	±175 V	4,5 A	± 13 A	± 9 A
1000 / 75	± 75 V	±15 A	± 30 A	
1000 / 120	±120 V	±12 A	± 25 A	
1250 / 75	± 75 V	±17 A	± 50 A	
1250 / 90	± 90 V	±15 A	± 45 A	± 30 A
1250 / 120	±120 V	±10 A	± 30 A	± 20 A
1250 / 150	±150 V	±8,5 A	± 25 A	± 17 A
1250 / 175	± 75 V	±7 A	± 21 A	± 14 A
1750 / 75	± 75 V	±24 A	± 75 A	± 50 A
1750 / 90	± 90 V	±22 A	± 65 A	± 45 A
1750 / 120	±120 V	±15 A	± 45 A	± 30 A
1750 / 150	±150 V	±12 A	± 35 A	± 25 A
1750 / 175	±175 V	±10 A	± 30 A	± 20 A
2500 / 100	±100 V	± 25 A	± 75A	± 50 A
2500 / 150	±150 V	± 17 A	± 50 A	± 35 A
2500 / 175	±175 V	± 15 A	± 45 A	± 30 A
2500 / 225	±225 V	± 11 A	± 33 A	± 22 A
3500 / 90	± 90 V	± 40 A	± 80 A	
3500 / 120	±120 V	± 30 A	± 60 A	
3500 / 150	±150 V	± 25 A	± 75 A	± 50 A
3500 / 175	±175 V	± 20 A	± 60 A	± 40 A
3500 / 225	±225 V	± 15 A	± 45 A	± 30 A
5000 / 150	±150 V	± 40 A	±120 A	± 80 A
5000 / 175	±175 V	± 30 A	± 90 A	± 60 A
5000 / 225	±225 V	± 23 A	± 70 A	± 45 A
7500 / 120	± 120 V	± 60 A	±120 A	
7500 / 150	± 150 V	± 50 A	±100A	
7500 / 175	± 175 V	± 45 A	± 90 A	
10 000 / 200S	± 200 V	±125 A		
10 000 / 225	± 225 V	± 45 A	± 90 A	

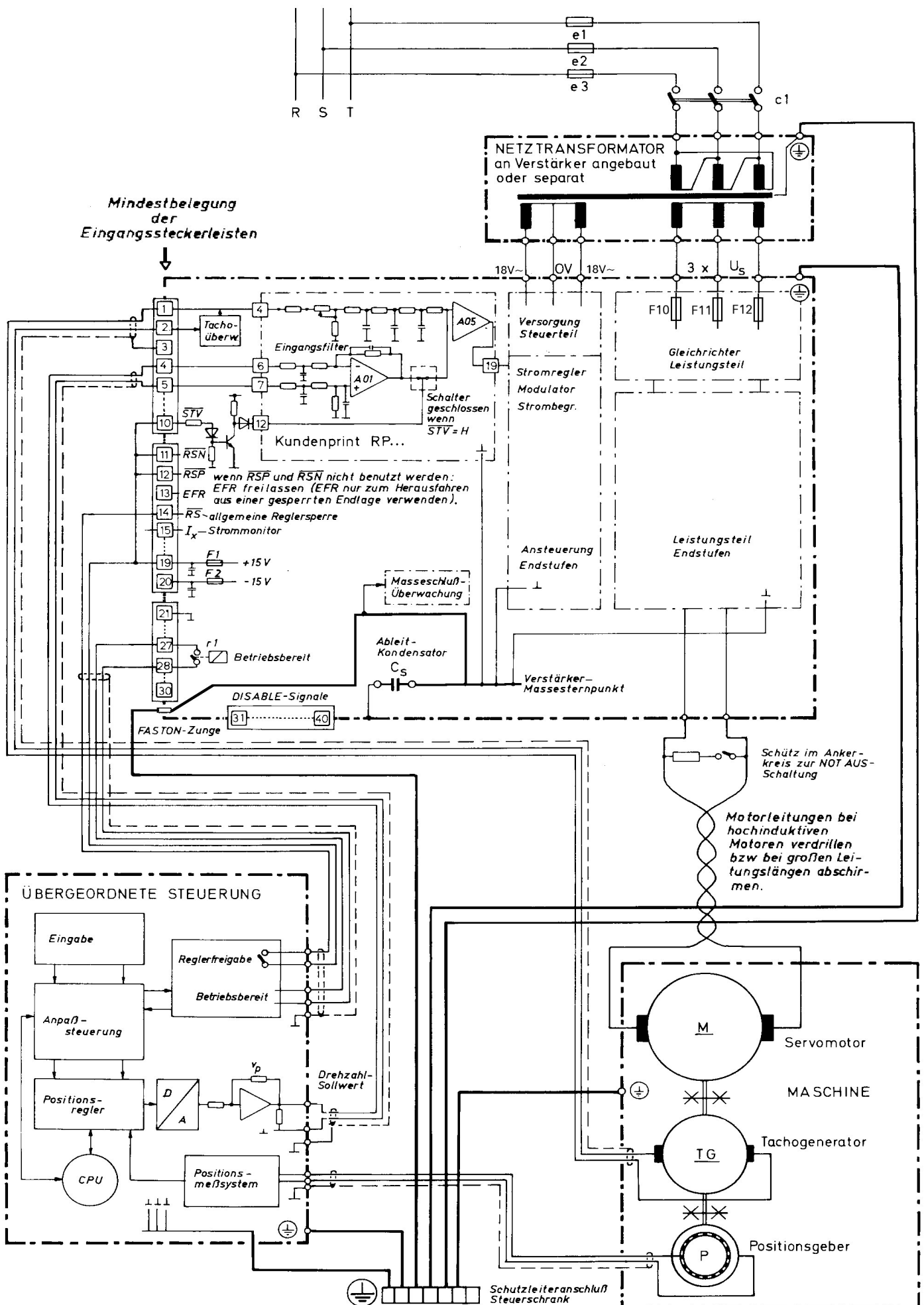
Warning

Do not replace Amp-fuses until gear and installation have been checked carefully.
Power-Fuses actuate only in case of hardware-malfunction, not under "Overload".



Assemblies plan

1. Powerstage modul UG
2. Powerstage modul OG
3. Controlboard RP 202 with Type identification and Serialnumber
4. Input Connectors
5. Low Voltage Powersupply.
6. Plug-in place for Customers Print RP.... with application-specific adjustments
7. Assembly place for Print GT 202 (optional galv. separation of DISABLE exits).
8. Customers Print RP....
9. Power Supply
10. DIN high current plug
11. Power Terminalboard
12. Power resistors (break load)
13. Mains-Transformer
14. Terminal strip for primary connection of mains-transformer
15. Input fuses F10, F11, F12 of Power Supply.
-ATTENTION- These fuses trigger only at severe hardware malfunction, not at "Overload"!
 Replacement of fuses only after Hardware-Repair!
16. Input fuses F3, F4 of low voltage supply (2 A slow, DIN 41662)
17. Output fuses F1, F2 for external use of the internal +/-15 V (100 mA fast, DIN 41662)
18. Output chokes
19. Mounting facilities (bolts with internal thread M8)



Input Connector

1	Tacho +	Tachogenerator-Input
2	Tacho -	Input-values depend on Tacho and Customers P.C.B.
3	Shield	
4	NW 1 +	SW+ Diff. Input for requ. value 1
5	NW 1 -	
6	NW 2 +	SW+ Diff. Input for requ. value 2 (Input-values depend on Customers P.C.B.)
7	NW 2 -	
8, 9, 18, 21	Masse	internally connected to earthing connector (6,3 mm Faston)
10	STV	Zero Speed Command Low = internally forced zero-speed value
11	RSN	RN Lock negativ Low = ccw motor-rotation locked
12	RSP	RP Lock positiv Low = cw motor-rotation locked
13	EFR	EF Endposition release To return from an locked endposition
14	RS	RS General Lock Low = amplifier locked, motor idling
15	IX	Motor-Current Monitor Istat = 3,3V, Idyn = 10 V
16	ID	Current-programm input for dyn. current, 10V: max. dyn. current of device
17	IS	Current-programm input for stat. current, 3,3V: max. stat. current of device
19	+15 V	+/-15 V - auxiliary voltage, overF1 und F2 (0,1 A fast)
20	-15 V	R _{Sich.} = ca. 20 Ohm
22	 r1	Relay r1: stat. current-limit reached (Contact closes)
23		
24	 r3	N0 Relay r3: speed <0,5% of nominal speed (Contact opens)
25	 r2	NW Relay r2: speed-regulation-fault > ca. 3% (Contact opens)
26		
27	 r4	Relay r4: ready (Contact opens in case of malfunktion)
28		
29	ÜT	Overtemperature-warning. Appears at a heatsink temperature of appr. 85° C
30	free	

6,3 mm FASTON Earth connection of Electronic-Ground.

31		DUS	DISABLE Undervoltage Controller
		DUL	DISABLE Undervoltage Powerstage
32		DB	DISABLE Breakload
33		DN	DISABLE Mains overvoltage
34		DT	DISABLE Tacho monitoring
35		DM	DISABLE Groundfault monitoring
36		TW	Warning high temperature
36		DH	DISABLE Overtemperature
37..40		free	

DISABLE-Signale are referred to ground.
Fault message: -12 V

Occupation of OPTION GT 202: (galv. separ. DISABLE-messages)

31	D0	1. Databit of DISABLE-message
32	D1	2. Databit of DISABLE-message
33	D2	3. Databit of DISABLE-message
34	D3	Identification-Bit
35..38	free	
39	Us	+24 V ext. supply for galv. separ. outputsignals
40		0V of ext. 24V

Signal level: High- Signal +13 V bis + 33 V
Low - Signal -30 V bis + 3 V.

Contakts: AMP-Modu-I-System
Crimp-pliers: AMP-NR. 674 655

Monitoring messages at XC5/ 1-6 (Disable signals)

-ATTENTION- The amplifier is disabled when a monitoring facility responds.

The control board possesses a stored display of the fault signals that triggered DISABLE. These signals lead to connector XC5 for external evaluation and have to be processed by the higher-priority controller and the safety facility for **real-time monitoring** of the drive system. Supply voltage to the amplifier must be switched on continuously in order to process the DISABLE fault signals. This is permitted because the amplifier must not be disconnected from its power supply in the event of a fault. Due to the DISABLE signal the powerstage is de-energised. Thus, there is no voltage at the motor terminals.

A contactor controlled by the DISABLE signal can be used to isolate the motor circuit if the safety regulations require that the motor is separated from the amplifier in the event of a fault. In that case this contactor should also be utilised to switch the motor to a braking resistor R_{AK} . See " Wiring DC-Systems ".

Monitored signals:	Trigger criterion:
Line voltage	DN > +20 % in reference to Uref DU < -20 % in reference to Uref
Earth	DM Fault current > 1 A
Tacho connection	DT Tacho defective, - broken lead, - short-circuited, - shorted to ground
Braking energy	DB to high for the installed braking resistor
Powerstage temperatur	DH > 85 °C

The disabled amplifier is reset by switching the device off and then on again:

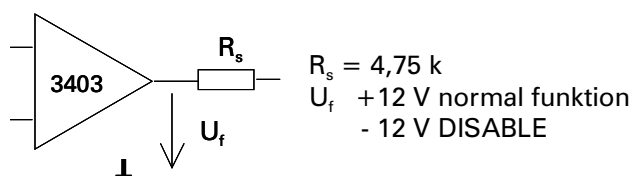
Connector pin-out of disable signals (Standard version):

XC5/	1	DU
	/ 2	DB
	/ 3	DN
	/ 4	DT
	/ 5	DM
	/ 6	DH
	/ 7	reserved
	/ 8	
	/ 9	Supply for option GT 202
	/ 10	(galvanically isolated signal output)

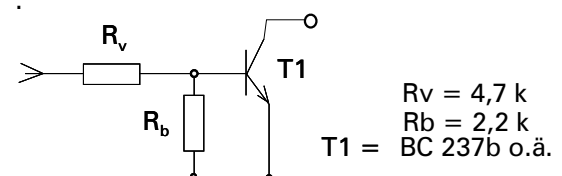
The output signals are in reference to ground.

During error message: approximately -12 V, 1 A max. = 0.5 mA.

DISABLE-Outputsignals:



Recommended evaluation circuit
:



Observe the technical information enclosed with the device.

The latest technical changes, notes and suggestions are found only in the added documentation.

Complete the wiring first before installing the devices in the electrical cabinet! Cover up the amplifier during any wiring work or work on the electrical cabinet to prevent intrusion of wiring bits, metal chips or fluids into the devices.

Mains connection:

Connect the main transformer via the recommended main fuses. Line voltage must be within the specified tolerance (see transformer type label). Phase sequence is insignificant. Ground the cable connection to the accordingly marked terminal.

Power connection on the amplifier:

The connection panel is located on the front side of the device. Every unit is supplied by the electrically isolated secondary windings of a 3-phase main transformer. The secondary fuses are located on this connection panel. The secondary fuses only trip in case of a defective device, not by "overload"! Defective fuses must only be replaced after repair of the device. Careless fuse replacement can lead to considerable consequential damages!

Motor connection:

The motor terminals are marked. The amplifier output is **not in reference to ground**. Shorts to ground or to earth must be avoided! Check the completed wiring of the motor circuit for safe isolation against earth/ground, with the motors connected, **prior to connecting** the motor to the amplifier: Electric isolation min. 500 V DC or the test voltage specified by the motor manufacturer.

The amplifiers of the type DX 808 series contain an earth fault monitor that disables the amplifier (DISABLE signal) as soon as a ground/earth leakage current exceeds approximately 1 Amp.

Note Install additional melting fuses in the motor current circuit to protect the output circuit of the amplifier if high motor speeds and great moment of inertia occur. In the event that a motor is shorted to ground the idle diodes of the amplifier are in danger if the feedback energy is high.

-Attention- During generative (braking) operation the motor must not run in excess of the maximum drive speed.

⚠ Danger ⚠ Only trained professionals must make measurements on the motor circuit, using isolated measuring instruments (high voltages and currents).

Simple and safe measurement of the motor current against ground is possible on the current monitor (contact 15 of the input terminal panels). 10 Volts output corresponds to the dynamic current limit value of the according device.

Grounding connection:

The amplifier housing must be grounded to the marked terminal of the motor terminal board. According to current regulations it is required that the electronic equipment of processing and production machines must be grounded! The grounding cable that leads to the earthed-neutral ground of the electrical cabinet should be as low-resistive and low-inductive as possible. The electronic circuit of the higher-priority controller must be grounded to the same terminal. The earth cable input of the mains connection is the earthed-neutral ground of the electrical cabinet. The grounding terminal is not connected with the amplifier earth. The electronics earth is grounded via the 6.3 mm Fast-on flat tongue.

Control signal connections:

Tacho generator:

⚠ Danger ⚠ Wrong tacho polarity causes uncontrolled acceleration of the motor!

Incorporate the "Speed control error" signal into the machine control! The tacho cables must not be disconnected and must not touch with parts of the cabinet or the machine (short to earth). In multiple-axes configurations the cable shielding of each tacho must be installed isolated from the others. By plug connections

Reference speed signal connection:

Lead the reference speed signal by a separate, shielded 2-wire cable.

Only separated leads can prevent cross-induction between reference speed and other signals.

Controller interlock:

The general controller interlock RS (contact 14), the direction-oriented controller interlock RSP (contact 11) and RSN (contact 12) must be cancelled with at least +12 V. For instance with the +15 V auxiliary voltage (contact 19).

Standstill default:

For positioning the standstill default signal STV (contact 10) must be at least +12 V. If contact 10 is without potential the motor is in the controlled standstill.

-Attention- An electronic standstill control does not replace a mechanical grip. Over longer standstill periods a drift fault can build up caused by temperature influence or electrical noise.

End position enable:

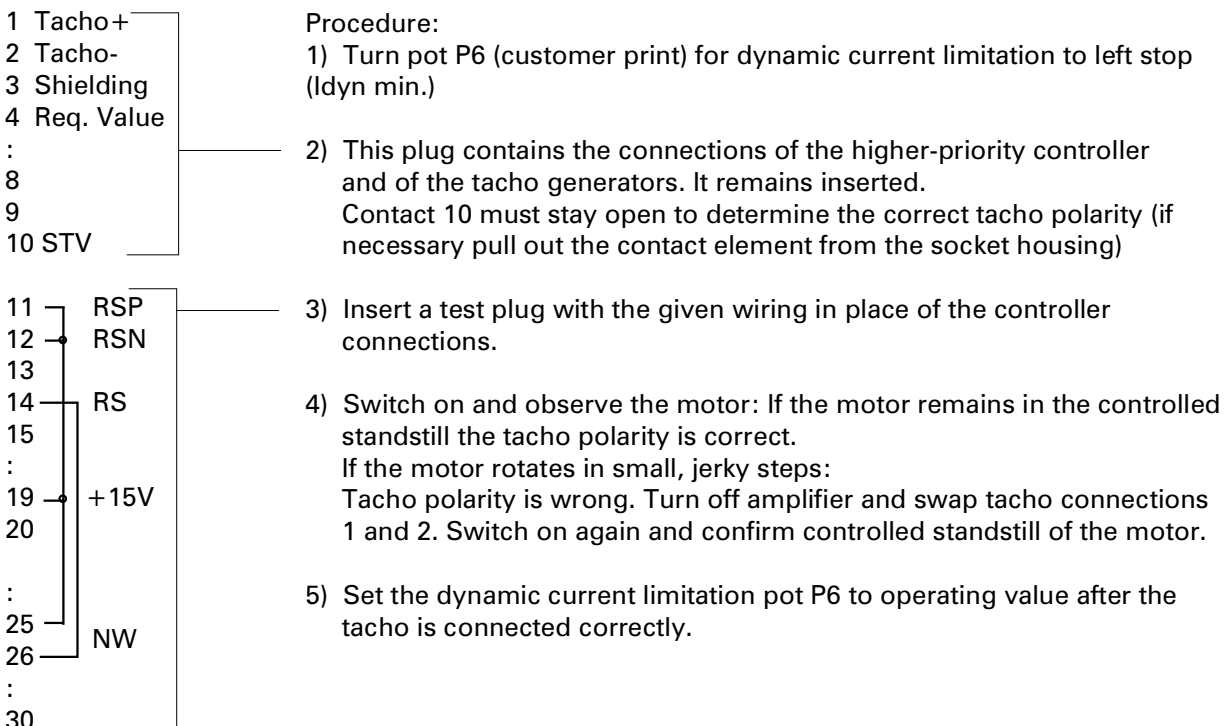
The end position clearance signal EFR (contact 13) must only be activated for moving out of a locked end position. If the end position interlock logic contained in the amplifier is not used leave contact 13 open.

Note When both the amplifier and the controller is grounded there must be no other grounding connection between the two units. An auxiliary voltage (for example 24 V) must also be grounded to the earthed-neutral ground. Shielding must be connected in accordance with the "DC device wiring diagram".

-Attention- Determining the correct tacho generator polarity:

The correct tacho generator polarity can be determined by using the control/feedback signals the DX 808 range devices provide in conjunction with a test plug, without hazard to the connected machine.

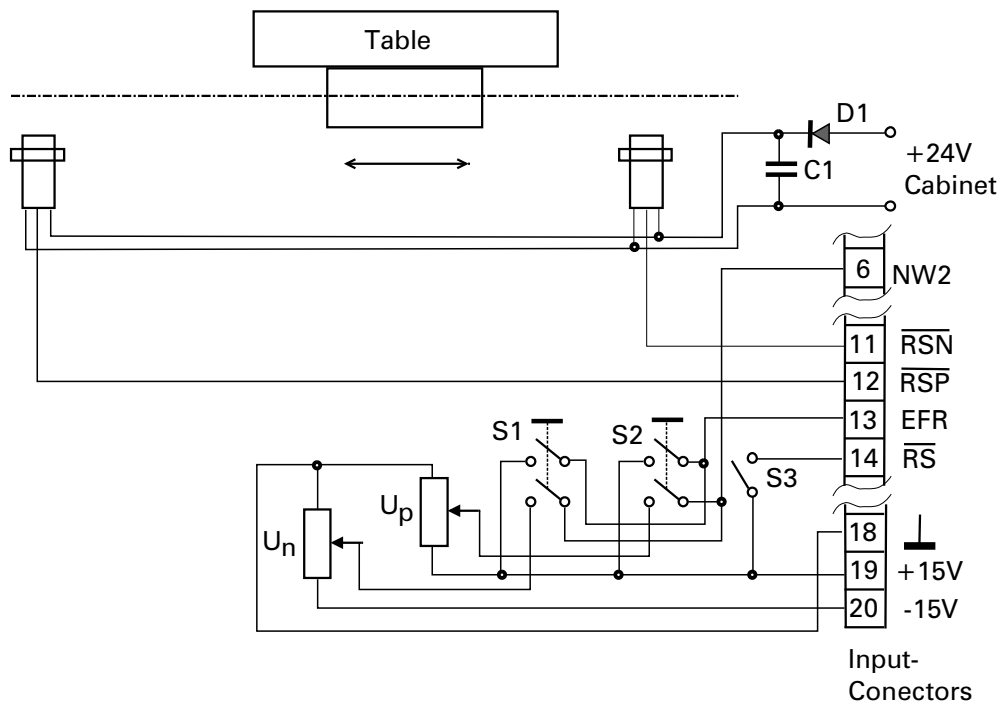
Function of the test plug: If the motor starts up despite standstill default (contact 10 open), due to wrong tacho polarity, then the relay "Speed attained" connected to the contacts 25 and 26 opens. That disables the amplifier through the "general controller interlock" signal (contact 14).



Set signal RS (general controller interlock) to Low to disable the controller in both current directions, and the attached motor is free of torque.

The 8xx range controllers feature two additional direction-oriented controller interlocks that can disable the output current for positive or negative direction individually.

If the controller interlock signals cannot be generated by a higher-priority controller it is easy to construct the end position limiter shown in the diagram below.



- S1 Switch for moving out of the positive end position
S2 Switch for moving out of the negative end position
S3 Switch for general controller interlock (open = disabled)

Function:

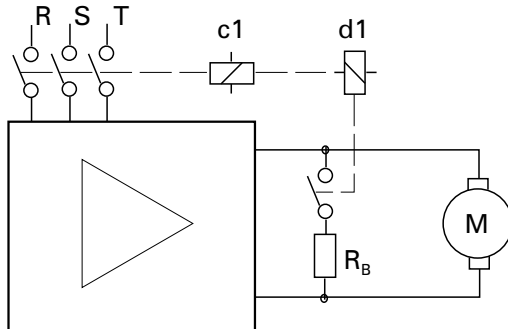
The speed control device is disabled in the movement direction by activating the end position switch. At the same time this sets the reference speed signal internally to 0 V, i.e. the drive brakes with maximum brake current to standstill. At this time the automatic reference voltage must be set to 0 V. The end position clearance signal EFR releases the speed reference signal, that allows the drive to move out of the end position again, in the released direction, in single-quadrant operation. After the end position switch has been cleared, internally unrestricted 4-quadrant operation is selected again.

Note The limit switches are normally powered by the 24 V control voltage of the electrical cabinet. If this voltage is contaminated with electrical noise it is advisable to buffer the supply of the proximity switches, for example with diode D1 and capacitor C1, as shown in the wiring diagram.

Emergency-Stop Circuit

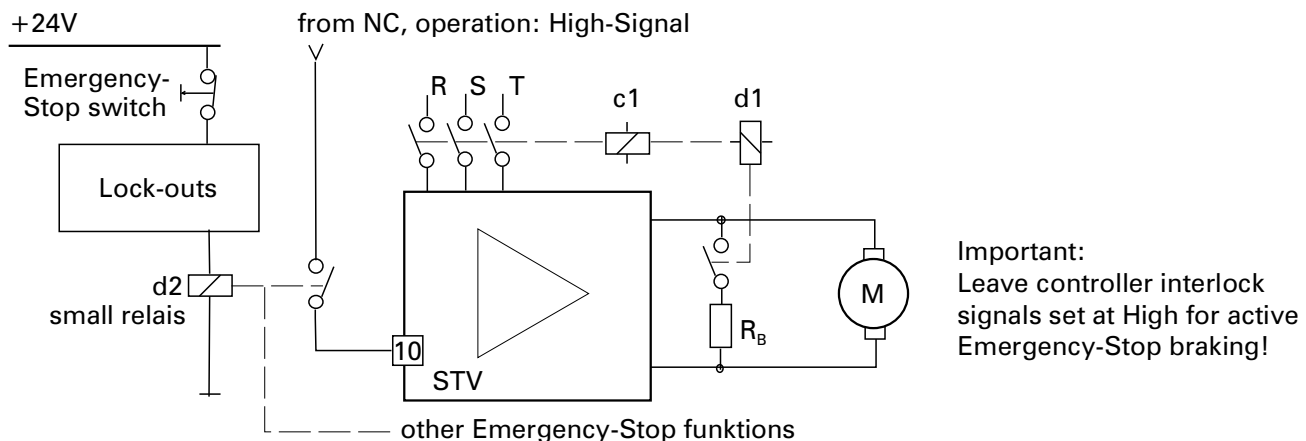
On many processing machines the drive must be stopped as fast as possible when the Emergency-Stop switch is pressed. This can be achieved by installing a contactor in the armature circuit that short-circuits the motor with a defined resistor R_B , when the power supply of the amplifier switches off.

Contactor relay in the armature circuit:



R_B must be dimensioned for obtaining current of approximately $5 \times I_n$ at maximum motor speed (max. E.M.F.). The maximum motor current at which the motor magnets could be de-magnetised is usually significantly higher (observe manufacturer specifications). The resistor must be capable of taking up the kinetic energy stored in the motor. Suitable structural shape: helical, glazed, wire-wound resistor on ceramic substrate. The reaction of the contactor relay $d1$ has a certain time lag. For this reason it is recommended that in critical applications the Emergency-Stop acts directly on the amplifier as control (standstill) signal:

Fast-acting Emergency-Stop Circuit:

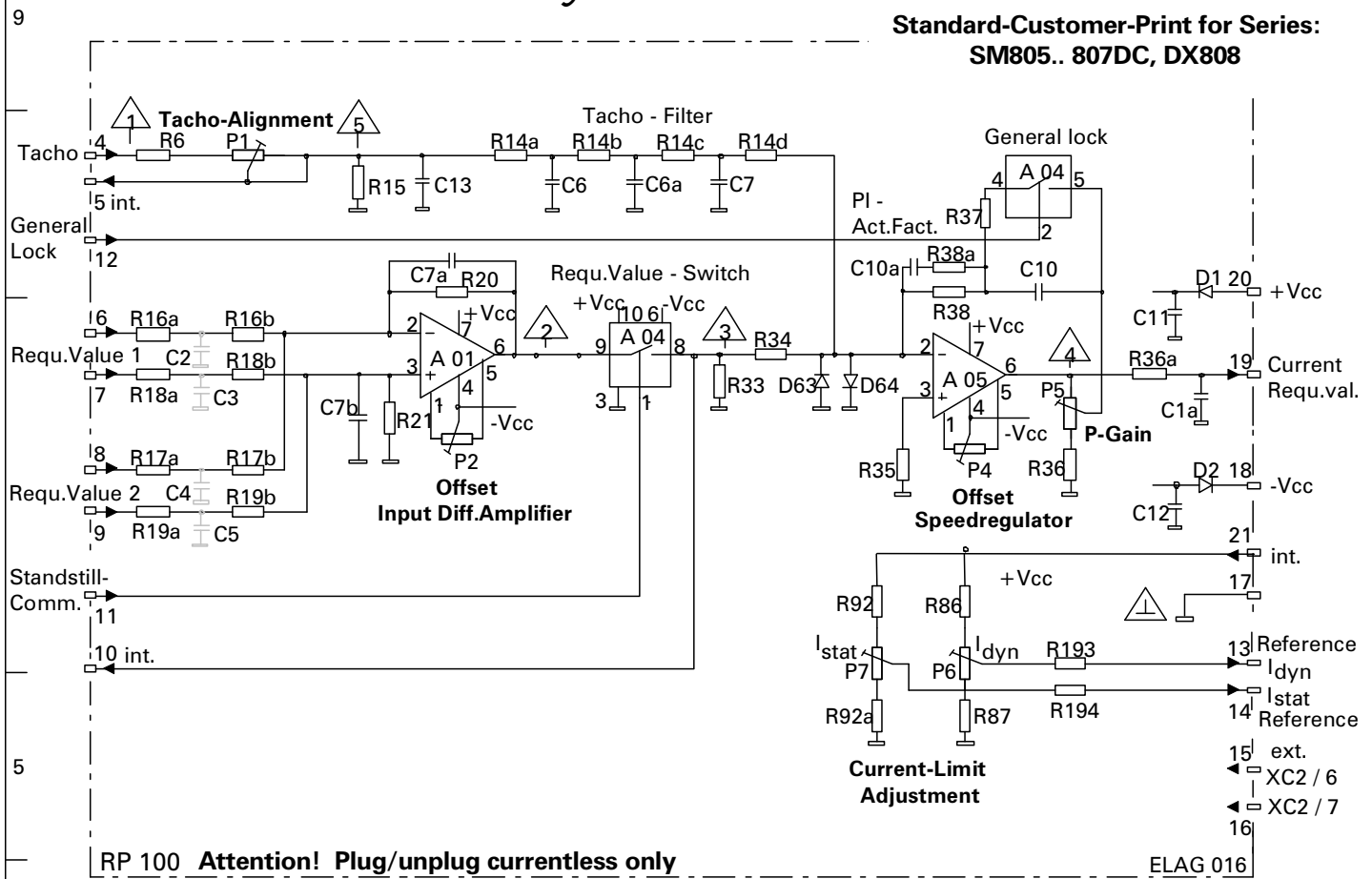


Since the removal of the STV signal almost instantly (less than $10 \mu s$) activates the braking process of the motor the time to standstill of the motor is additionally reduced.

-Attention- This active braking is only effective on a functional controller. Do not dimension run-out distances, that may possibly be necessary, for this braking condition!

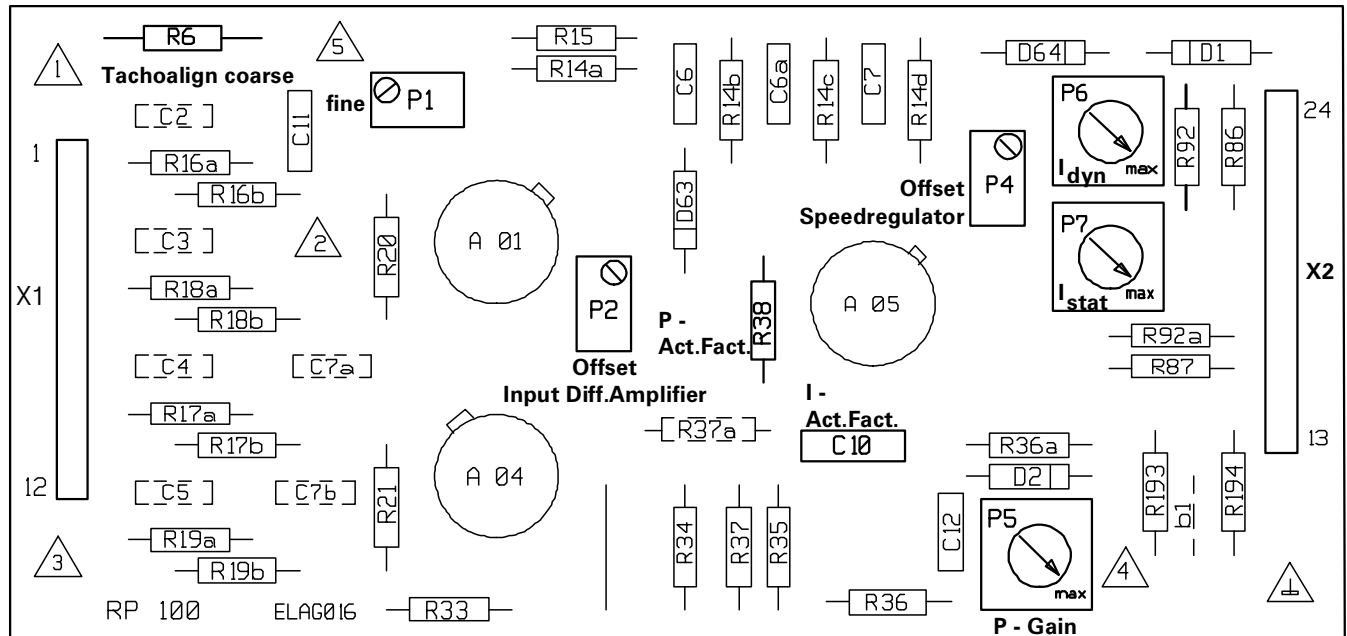
Note In critical applications, when uncontrolled behaviour of the speed controller must be detected as fast as possible the "Zero speed" and "at set speed" signals should be included in the safety circuit for function control.

Sample!



Notes

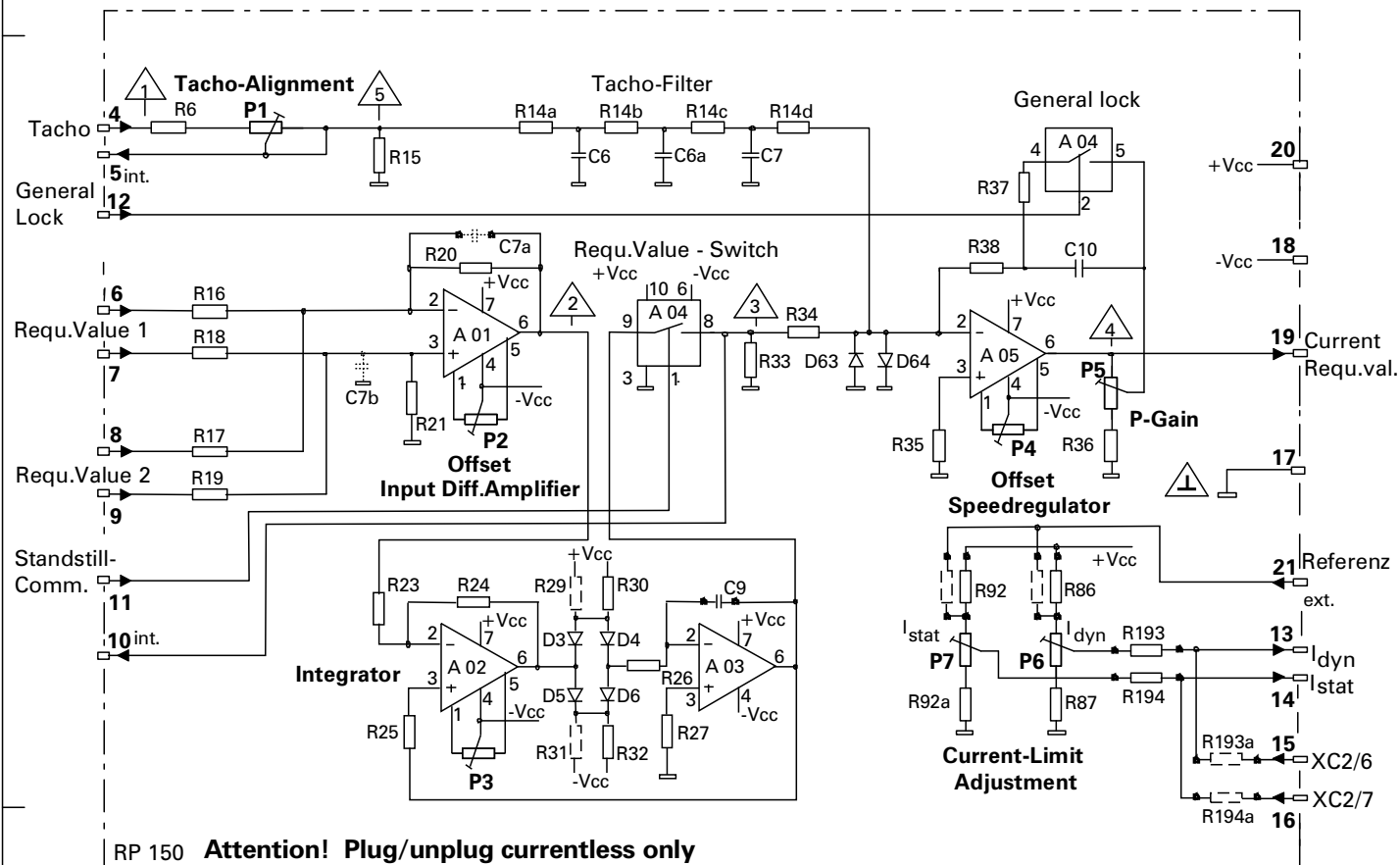
Sample!

Attention! Plug/unplug currentless only

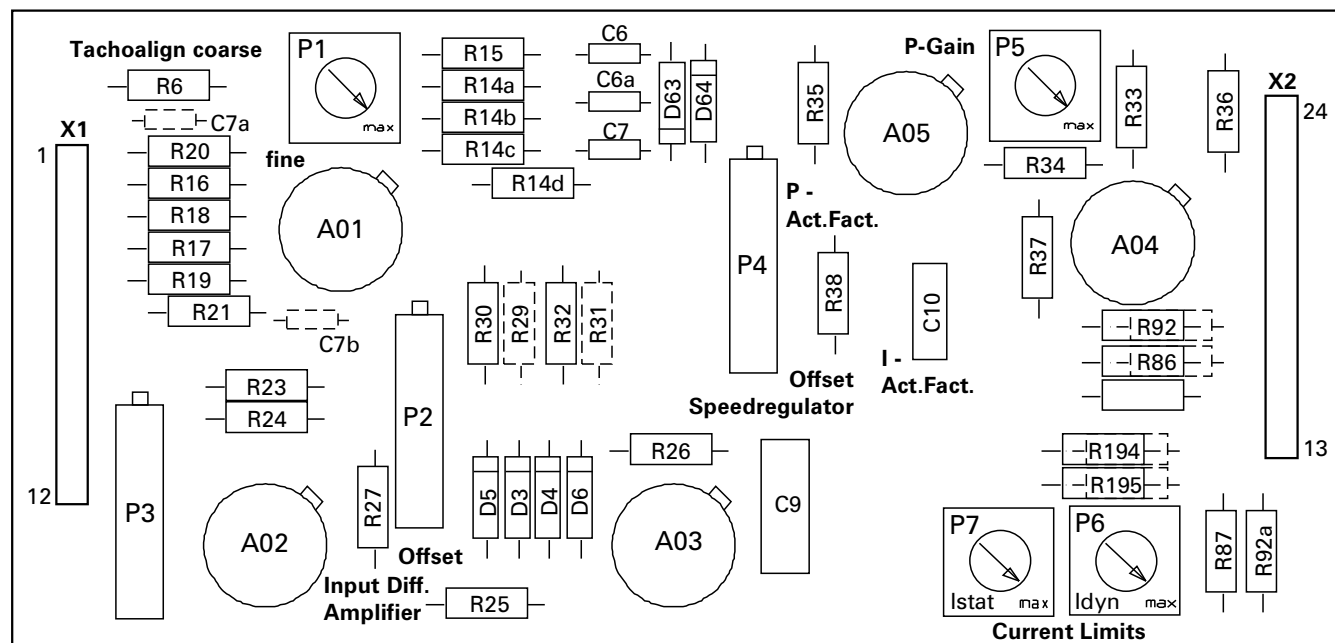
A 01	μ A 741 sel.	R 6	Bridge	R 92	2K21
A 04	DG 200 BA	R 14a	10k	R 92a	68R1
A 05	μ A 741 sel	R 14b	10k	R 193	953R
D 1	1N4148	R 14c	10k	R 194	1k1
D 2	1N4148	R 14d	9k09		
D 63	1N4148	R 15	18k2		
D 64	1N4148	R 16a	4k99		
C 2	no	R 16b	4k99		
C 3	no	R 17a	4k99		
C 4	no	R 17b	4k99		
C 5	no	R 18a	4k99		
C 6	33 nF	R 18b	4k99		
C 6a	33 nF	R 19a	4k99		
C 7	no	R 20	10k		
C 7a	no	R 21	10k		
C 7b	no	R 33	2k21		
C 10	100nF	R 34	39k2		
C 11	47nF	R 35	27k4		
C 12	47nF	R 36	100R		
P 1	10k	R 36a	100R		
P 2	10k	R 37	1k		
P 4	10k	R 37a	no		
P 5	10k	R 38	82k5		
P 6	1k	R 86	681R		
P 7	1k	R 87	332R		

Notes

Sample!

**Notes**

Sample!

Attention! Plug/unplug currentless only

A 01	μ A 741 sel.	R 6	2k21	R 37	1k
A 02	μ A 741	R 14a	10k	R 38	221k
A 03	μ A 741	R 14b	10k	R 86	681R
A 04	DG 200 BA	R 14c	10k	R 87	332R
A 05	μ A 741 sel	R 14d	9k09	R 92	2K21
		R 15	18k2	R 92a	68R1
D 3	1N4148	R 16	10k	R 193	953R
bis		R 17	10k	R 194	1k1
D 64	1N4148	R 18	10k		
		R 19	10k		
C 6	33 nF	R 20	10k		
C 6a	33 nF	R 21	10k		
C 7	33 nF	R 23	4k75		
C 9	typ. 1 μ F	R 24	1M		
C 10	220nF	R 25	4k75		
		R 26	22k1		
P 1	10k	R 27	22k1		
P 2	10k	R 30	1M		
P 3	10k	R 32	1M		
P 4	10k	R 33	2k21		
P 5	10k	R 34	39k2		
P 6	1k	R 35	27k4		
P 7	1k	R 36	332R		

Description and Adjustment of the Customer Print

Standard prints RP100 / RP150

Concerning interfaces, connector pin-outs, control signals, customer prints and electrical values the DX 808 series is compatible to the SM 801.....807 DC family. The setup operation and calibration routines are principally the same in all of H&R product lines.

-Attention- Insert or unplug the customer print only with current off. Otherwise the FET switch and op amp may be damaged. Use electrically isolated soldering devices only. Carefully observe proper fit when inserting the print because it has no mechanical guide!

In the standard version RP100 the customer print contains the

- tacho adjustment
- differential input amplifier A01 with filter wiring features
- speed control A05 with circuitry
- FET switch A04 /1u.2 for standstill default and by-pass of the speed control I-share
- potentiometer for adjustment of the offset, tacho calibration, P amplification and current limits.

The version RP150 the customer print additionally contains a reference voltage integrator that consists of the op amps A02 and A03. See the wiring diagrams " Customer print RP100 and RP150 " for this.

1. Tacho adjustment

The tacho voltage is adjusted by resistor R6 (on soldering rivets) and potentiometer P1. R6 is calculated as follows:

$$R6 = (VT - 10) \text{ kOhm} \quad (VT = \text{tacho E.M.F. at reference motor speed in Volt})$$

Example: Tacho generator with 20 V at 1000 rpm, reference speed 1500 rpm:

$$R6 = (20 \times 1.5 - 10) \text{ kOhm} = 20 \text{ kOhm}$$

Recommended value for R6 = 18 kOhm because the adjustment range can be increased with potentiometer P1 by 10 kOhm. A metal film resistor should be used for R6, if high speed constancy is required.

As a standard R6 has 2.2 kOhm. This value is suitable for the calibration of tacho generators with an E.M.F. of 4...7 V / 1000 rpm at a reference speed of 3000 rpm.

The tacho voltage at maximum operating speed should be at least 10 V. In this case replace resistor R6 with a short-circuit jumper and set P1 to minimum.

The tacho filter is 3-stage with 500 Hz cut-off frequency. This eliminates high frequency static on the tacho voltage as well as the tacho monitoring frequency, at negligible phase shift.

2. Input filter and differential amplifier A01

To assure linear operation of the op amp, high frequency electrical noise that may be induced on the reference voltage line must be suppressed. For this the reference voltage inputs can be wired with filter capacitors.

Observe, that the drain capacitors on both input lines must be the same, when using the differential inputs. Cut-off frequencies of the input filter (RP100-2, RP150-3) to the inputs 6 and 7 of the customer print (2-stage)

$$R16a, R16b, R16c, R18a, R18b, R18c = 3.32 \text{ kOhm}$$

C4a, C4b, C5a, C5b	Cut-off frequency fo	Phase shift at fo
1 nF	48.0 kHz	5 μ s 90 ° el
10 nF	4.8 kHz	52 μ s "
22 nF	2.1 kHz	114 μ s "
47 nF	1.0 kHz	245 μ s "
100 nF	480 Hz	520 μ s "

Standard equipped with 10 nF on customer print RP 100-3 /150-3.

Filter at the inputs 8 and 9 of the customer print (single stage)

R17a, R17b, R19a, R19c

C3a, C3b	Cut-off frequency fo	Phase shift at fo
1 nF	31.8 kHz	4 μ s 45 ° el
10 nF	3.2 kHz	40 μ s"
22 nF	1.5 kHz	86 μ s"
47 nF	678 Hz	185 μ s"
100 nF	318 Hz	400 μ s"

Standard equipped with 10 nF on customer print RP 100-3 / 150-3.

Input filter for the suppression superimposed AC voltages (e.g. for NC's with low-frequency positioning control)

C7a, C7b	Cut-off frequency fo	Phase shift at fo
1.0 nF	15.9 kHz	8 μ s 45 ° el
2.2 nF	7.2 kHz	18 μ s"
3.3 nF	5.0 kHz	23 μ s"
4.7 nF	3.4 kHz	30 μ s"
10.0 nF	1.6 kHz	78 μ s"

As a standard C7a and C7b are not installed.

Note The effective phase shift is significantly more decisive for the stability of positioning control loops than the amplitude attenuation. Therefore the filter capacitors cannot be selected in any desirable large size. Frequencies above 1 kHz are additionally muffled by a current reference voltage filter with 24 dB/octave, that is placed between speed controller output and current controller input.

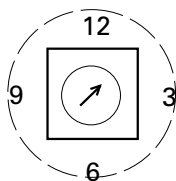
3. Speed control A05 with wiring

The speed control can be wired as P, PI, PID or PD control. It comes standard-wired as PI control. The proportional sensitivity can set with potentiometer P5 from 5.6...176.

Standard: R34 = 39,2 k R36 = 330k R38 = 220 k P5 = 10 k

The set proportional sensitivity can be read on potentiometer P5.

Drawn position: Minimum left stop	Position	Amplification
	min.	5.6
	3	7
	6	12
	7	15
	8	22
	9	33
	10	70
	max.	176



The standard integration capacitor C10 has a value of 0,22 μ F. With the feed-back resistor R38 = 221 k this results in an integration time constant of $T = R38 \times C10 = 50$ ms. This small time constant is adapted to modern, highly dynamic servo motors. On drives with low friction and large flywheel mass the integration capacitors can be increased to approximately 0.68 μ F.

4. FET switch A04/1,2 for controller interlock and standstill default

The FET switch A04/1 separates the speed control A05 from the input differential amplifier A01 on standstill default STV, controller interlock positive RSP, controller interlock negative RSN and general controller interlock RS. The speed controller input is then grounded via R33 (2.2 k) to earth. Therefore, with STV signal = Low defaults to a controlled standstill, regardless of a possibly applied reference value.

During general controller interlock RS both output stage bridge diagonals are disabled. A04/1 together with A04/2 (bypasses the I-share of the speed controller) sets the speed controller output to zero, with the motor (and tacho) at standstill.

During direction-oriented controller interlock RSN/RSP the FET switch A04/2 bypasses the I-share of the speed controller after approximately 0.2 sec. to avoid integration of the speed controller. Upon activation of RSP or RSN the amplifier generates braking current until standstill of the motor.

During end position clearance signal EFR the FET switch A04/1 is closed in priority to the STV, RSP, RSN and RS signals. This enables to drive out of the end position that was reported before by the direction-oriented controller interlock signal.

5. Offset calibration of input differential amplifier and speed controller

Potential differences between higher-priority controller and amplifier, as well as the offset voltage of the controller output (Position control output) can be compensated with the input differential amplifier A01. Observe however, that a very large offset disimproves the characteristic temperature line of the differential amplifier. Therefore, the analogue output of the higher-priority controller should be calibrated as close to 0 as possible.

The device must have operating temperature for the offset calibration.
Perform the calibration as described below:

- a) Disable the amplifier with controller interlock RS (contact 14 open)
- b) Set default in the higher-priority controller to "0". For instance reset or "digital control deviation = zero" can be pre-selected. In numeric controllers with automatic reset the standardised status zero is generated after switching on. In this case switch the numeric controller off and then on again. Important: Check if the standardised status "Zero" is attained (switch display table to contouring error display if possible).
- c) Use an oscilloscope or isolated millivoltmeter for calibrating the output voltage of the op amp with potentiometer P2 to 0 mV. Connect the negative pole to ground of customer print (e.g. lower end R33), and positive pole of the instrument to the lower end of R20. See layout diagram "Customer print".

Note If the amplifier is disabled by RS then the condition for the calibration of the speed controller A05 is automatically fulfilled: The input is grounded to earth, the integration capacitor is bypassed.

- d) Connect an oscilloscope or isolated millivoltmeter to contact 19 of the customer print (as in c) and adjust potentiometer P4 to 0 mV. This calibration should be performed at high amplification of the speed controller (turn P5 clockwise).

An AC voltage with 3.5 kHz (285 μ s period) can be detected on the speed controller. These are residuals of the tacho monitoring voltage and have no influence on the speed control characteristics.

Electronic multimeters can be deceived by this AC voltage and display wrong values. If necessary, ground the tacho monitoring transmitter during the offset calibration at measuring point 1 (see layout diagram of control PCB RP203).

Offset calibration on customer print with reference voltage integrator (RP150):

For customer print with reference voltage integrator first perform steps a) to c) described above. Then calibrate the reference voltage integrator as described below:

- e) Controller interlock remains active (contact 14 open)
Connect an oscilloscope or isolated millivoltmeter to output A03.6 (corresponds to integration capacitor). Connect ground of the measuring instrument as described in c). Adjust the output voltage of the integrator A03 with potentiometer P3 to 0 mV.
- f) Calibration of the speed controller according to section d) above.

6. Optimisation of the speed control circuit

For optimal adjustment of the speed control circuit to the controlled system reference pre-select voltage steps on the speed control circuit and observe the behaviour of the tacho voltage. The voltage steps can be generated by a low-frequency square-wave generator. The amplitude should be set as to avoid that the amplifier is driven into current limit during control operations.

Reference voltage step generation without square-wave generator:

Connect a potentiometer (approximately 5...10 k) to +15 V ext. and earth (contacts 19/20 of the input terminal panels). Connect the sliding contact of the potentiometers to contact 4. Connect the standstill default signal STV via a n/o contact to +15 V.

When the n/o contact is operated the FET switch enables the speed controller input and switches to the speed reference voltage that is pre-selected by the potentiometer.

Note A monitoring voltage of 3.5 kHz is superimposed on the tacho voltage. It should therefore be measured in the tacho filter e.g. at R14a or R14b. A reduction of the tacho voltage in relation to the drop resistors R6, P1 and R14a must be taken into account.

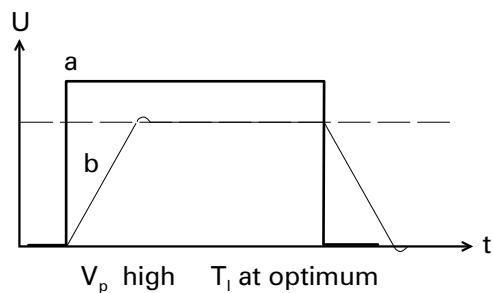
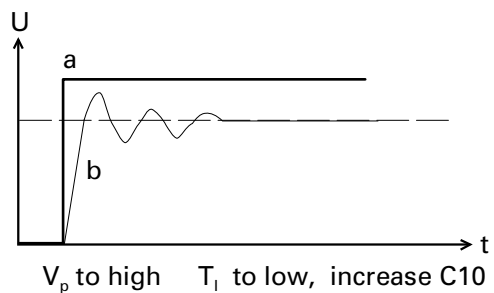
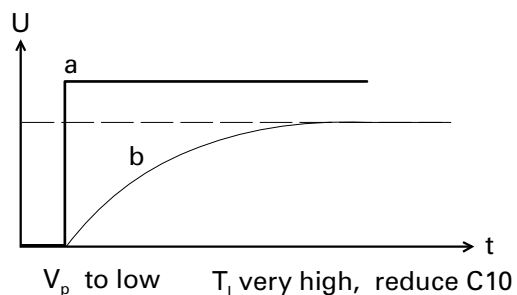
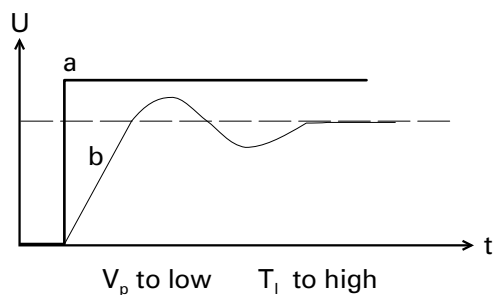
Frequently, a suitable adjustment of the proportional amplification with potentiometer P5 is sufficient for optimising the speed control circuit. If a satisfactory result cannot be obtained then the integration capacitor C10 must be adapted. The integration constant is

$$T_{IN} = R34 \times C10 = 39.2k \times C10$$

Step reaction from the speed control circuit at various adjustments:

a = reference voltage step measured at R33

b = tacho feedback measured at R14a



7. Adjustments on the reference voltage integrator (RP150-8)

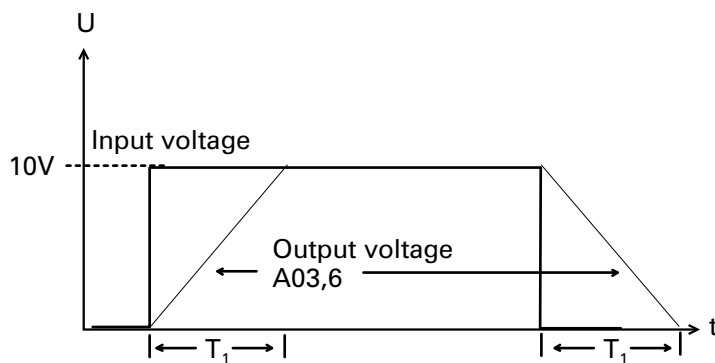
Adjustment of the ramp increase:

See also wiring diagram RP150. The time constant of the reference voltage integrator is

$$T = 0.75 \times C9 \times RS$$

whereby RS corresponds to the parallel circuit R29 and R30 respectively R31 and R32.

Standard component: $C9 = 1 \mu F$
 $R29 = R31 = 1 \text{ MOhm}$
 $R30 \text{ and } R32 \text{ not installed}$
 $T1 = 0.75 \text{ s}$



Time constants with unchanged integration capacitor ($C9 = 1 \mu F$):

T1	R30 = R32
0,75 s	open
0,5 s	2,2 M
0,2 s	390 k
0,1 s	150 k
50 ms	68 k

Capacitor values with unchanged resistors ($R29 = R31 = 1 \text{ MOhm}$, R30 and R32 not installed):

T1	C9
0,75 s	1 μF
0,5 s	0,68 μF
0,165 s	0,22 μF
75 ms	0,1 μF

Installing R30 and R32 with different values result in differences increases of the positive and negative ramp. By this the ramp increase for start-up in positive rotation and braking out of negative rotation corresponds with the ramp increase for start-up in negative rotation and braking out of positive rotation.

8. Adjustment of the current limits

The current limits are pre-defined by reference voltages. These are compared with the current reference value, and depending on the result, the effective value measurement of the motor current must be limited to the set dynamic or static value, if necessary. Since these reference voltages are applied static, and they are related in a constant and defined ration to the maximum output currents, the current limits can be set directly, without manipulation in the motor current circuit.

The reference output currents are adjusted, when potentiometer 6 and 7 are turned clockwise to stop. Thus, all values that can be adjusted are limited to the maximum reference values of the output current that is characteristic for the device.

Adjustment of the static current limit:

The static current limit can be set with pot P7 to 10...100% I_N . At reference current contact 14 of the customer print leads 3 V, when the over-current ration I_{dyn} to I_{stat} is 3:1 (standard for SERIE 805/807/808). At an over-current ration of 2:1 (for special OEM series) contact 14 leads 4.5 V at reference current. The set static current limit corresponds to the effective value of the output current.

Adjustment of the dynamic current limit:

The dynamic current limit can be set with pot P6 to 60...300% I_N . With triple reference current the voltage on contact 13 of the customer print is 9 V.

Note Many motor manufacturers require a current reduction of up to 60% I_N for the stopped/blocked motor. A current reduction can simply be realised through the external current programming, for example in conjunction with the standard "0 speed" detection. In addition customised prints are available for special requirements.

Current limit signal:

If the static current limitation is activated the "Current limit" signal is displayed and relay r4 opens (contact 22-23 input terminal panels). Diode D47a must be installed if additionally the reaction of the dynamic current limit is to be displayed.

9. External current programming

For external current programming the resistors R193 and R194 on the customer print must be moved by one segment on the grid (to the position marked by the dashed outlines). By this the current programming inputs 16 and 17 of the input terminal panels are connected with the customer print outputs (contact 13 and 14). as seen on the wiring diagram of the customer print. The current limiting potentiometer P6 and P7 are then disabled. Due to the protection resistors R193 and R194 the current-limit control voltage on the contacts of the input terminal panels is 10 % higher as compared to the customer print output rates.

Scale

for current programming inputs
of the input terminal panels

10 V = I_{dyn} (contact 16 of the input terminal panels)

for outputs of the customer print

9 V = I_{dyn} (contact 13 of the customer print)

As a result have amplifiers with an over-current a ration of I_{dyn} to I_{stat} = 3:1

3.3 V = I_{stat} (contact 17 of the input terminal panels)

3.0 V = I_{stat} (contact 14 of the customer print)

On amplifiers with an over-current ration of 2:1 (special OEM series) the reference voltage for the static current limit accordingly to 5 respectively 4.5 V.

Troubleshooting

Below problems are listed that can occur, especially during initial operation.

1. After powering up the LED do not illuminate (LED panel in the lower area of the control PCB):
No power supply to the device, device input fuses or internal voltage converter defective.
2. After switching on the LEDs light up but the amplifier does not operate:
Amplifier is not enabled. Check control enable signals from higher-priority controller and plug/cable. The contacts 10, 11, 12 and 14 must have at least 12 V. The according LEDs for controller enable must illuminate.
3. Enable LEDs illuminate. However, amplifier does not react to reference value:
 - a) "Standstill default STV" signal at contact 10 of the input terminal panels is not cancelled.
 - b) Missing customer print. If customer print is plugged correctly (!): Check reference voltage for the dynamic current limit on pin 13 of the customer print. The reference voltage at maximum dynamic current limit value is 9 V, ± 0.4 V, relative to ground.

-Attention- Improperly inserted customer print and shorts generated when measuring on the print can cause serious damage!

5. Amplifier operates, motor runs at low reference values correctly. However, the contouring error monitor of the higher-priority controller reacts at high reference values:
 - a) Motor drives into current limit. Attach an oscilloscope to contact 15 of the input terminal panels and watch the current monitor. If a constant voltage of approximately 3.3 V is seen (amplifiers with a current relation of 3:1 dynamic current/static current) or approximately 4.5 V (amplifiers with a current relation of 2 :1) the amplifier is in static current limiting mode.
Remedy: Check drive system for sluggishness, control lubrication etc.
 - b) Tacho calibration wrong on P positioning controls.
6. Amplifier operates; motor is running. However, a contouring error of a few increments remains during positioning:
Offset- and/or noise voltage problem.
Offset calibration: Although it is factory-calibrated, check the offset voltage of the op amps and re-calibrated it if necessary.

Proceed as follows: Pull off contact 14 (general controller interlock RS) on the input terminal panels. Switch controller off and on again to ensure that the output is 0 mV. Measure the output voltage of the higher-priority controller, and if necessary calibrate to 0 mV.

By pulling off the contact 14 the controller is disabled and, thus, automatically fulfills the calibration condition for the speed control A 05 on the customer print.

The input of the speed controller A 05 has a low-resistive connection to ground, and its integration section is bypassed through the controller interlock. Thus, the offset voltage at the according measuring point (see Customer print wiring diagram) can be adjusted to 0 mV with potentiometer P4. Likewise the input differential amplifier A 01 must be set to 0 mV with potentiometer P2.

If it is not possible to eliminate the offset of the controller it can be compensated with P2 in the range of a few mV.

Note Extreme maladjustment of the offset disimproves the temperature characteristic of the op amp.

During these adjustments make certain that the disabling signals on contacts 10, 11 and 12 are High and that the end position clearance signal EFR, contact 13 is open or has Low signal.

Op-amps on customer prints with reference voltage integrator must also be calibrated. You can measure for example on RP150 at C9 (lower connection) and perform the calibration with potentiometer P3.

Noise voltage problems:

Due to the high positioning resolution of modern processing machines the positioning control of the higher-priority controller outputs only a few mV req.value voltage, while positioning in the vicinity of the target increments. The amplifier must react to this small voltage with a large current-if necessary- to drive the connected motor exactly to the target increment. The perfect, undisturbed transmission of small voltages between the controller and amplifier requires, that the cable for the reference/actual value is suitably constructed, and connected correctly.

-Attention- Reference voltage and tacho voltage must led via separate, shielded cables. Other (DC) signals such as controller interlock etc. must not be transmitted by these cables.

Must be checked:

Perfect connection of the tacho generator cables with the amplifier to the designated contacts 1...3 of the input terminal panels (Exception: Devices with axes selection, where tacho 1 is attached to contacts 31...33 etc., see special connection diagram). The shielding of the tacho cable is connected to contact 3 of the input terminal panels (not to the tacho generator!).

Perfect connection of the reference voltage cable to the amplifier. The shielding of the reference voltage cable is connected to the earth of the controller (not to the servo amplifier!).

Do not install motor leads parallel with control lines. Use shielded motor cable on highly inductive motors. Connect the shielding to the motor/machine foundation (not to the servo amplifier!).

Grounding connection of the amplifier electronics.

Ground the amplifier electronics via XC4 (6.3 mm FASTON contact next to contact 30 of the input terminal panel). Every amplifier in multiple-axes installations must be grounded separately. Amplifier, higher-priority controller and machine must be grounded according to the " DC-Device wiring diagram ". The earthed-neutral ground is the earth cable connection (PE bar) of the electrical cabinet.

Grounding via short, directly led cables with at least 2.5 mm²! Loops in the ground wiring often create very indistinct drive problems and fault messages.



Danger

Safety of the installation and function of the earth fault monitor is only warranted when the electronic circuits are grounded!

Note about the contacts of the input terminal panels:

The crimp contacts used by H&R are very robust and have a very high operating reliability when treated professionally.

Interlock:

The contacts have on one slim side a small, outward bent locking spring.

The contacts can be inserted with two different positions into the housing:

- a) If the locking spring points towards the control PCB the contact latches after it is inserted. It can be unlatched, for example with a flattened wire end of approximately 0.8 mm width (e.g. wire of a resistor) that is inserted between contact and housing from the plug-in side. This presses the locking spring out of its chamber and releases the contact.
- b) If the locking spring points outward, then the contact is not latched and can be pulled from the housing **(only for initial operation!)**.

Mech. Dimensions , Mounting SERIE SM 806, 807, 807/2 DC

Type:	Width	height	depth without Trafo	Trafo mounted
250-...	240	200	185	225 mm
750-...	240	200	185	225 mm
1250-...	240	200	295	375 mm
1750-...	240	200	325	435 mm
2500-...	240	200	325	440 mm
3500-...	290	240	385	Trafo separat
5000-...	440	240	390	Trafo separat
7500-...	440	240	390	Trafo separat
10000-...	440	480	345	Trafo separat

The controller board RP 202 must stand vertically, or else no sufficient konvektion cooling of the final stages.

Position of the fastening bolts on the equipment back:

(length 20 mm, internal thread M8)

