ACTUCON (ACTUCONE_0033)

Index:

Note:  **Notes contain important information.**

Warning:  **Warnings indicate special methods or handling procedures which, if not followed properly, may result in serious injury.**

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1 General

The intelligent control unit ACTUCON is a compact combination of a local control unit and an electronical positioner. It contains a programmable microprocessor control, which can be parameterized, specially to the requirements of open-loop and closed-loop actuators. An optimum communication with the proccess control system is possible, and it controls a frequency inverter in order to achieve the best positioning adjusting behaviour.

The output frequency of the inverter and therefore the positioning velocity is controlled proportionally to the value of the position deviation (set point-actual value deviation).

Maximum and minimum frequency are programmable input values.

While the set point is being approached, a constant delay cares for an optimum positioning precision, and prevents the regulating circuit from running over and from oscillating.

The slope of the acceleration and braking ramps, the desired dead zone as well as more other functions can be selected and modified with parameter inputs.

2 Advantages:

2.1 In operation:

- A softly starting up and braking take care of all the mechanical components
- High regulation precision provides an optimum closed-loop operation
- Fast adaptation of actual value to set point
- High reliability, because there is no wear
- No current and torque peaks during motor starting
- The user improves the operation while modifying the parameters
- Frequency control of the robust three-phase asynchronous motor
- Reproducible and gently valve seating

2.2 Safety functions:

- Single-phase connection without false phase sequence
- Programmable behaviour in case of fault
- Permanent self-monitoring

3 Parameter setting with the software ACTUCON-Manager:

Each parameter setting is possible with Pull-Down menues of the ACTUCON-Manager software. The parameters are divided in the menu **“Parameter” (Parameters)** in following groups.

3.1 “Allgemein” (General):

3.1.1 “Komplementüberprüfung“ (Complementary monitoring):

The function of the switches is supervised, if the complementary monitoring is activated. (A change-over switch has to have either a closed operating contact or a closed inoperating contact.) It comes to a fault signal, if a switch-failure is detected for longer than 500msec.

3.1.2 “Sollwertvorgabe analog“ (Analog set point input):

Must be always set, while using the ACTUCON as a positioner!

3.1.3 “Resolver“:

Not included, must not be set!

3.1.4 “Sollwert steigend für Schließen“ (Increasing set point for closing):

Normally a set point of 20mA means OPENING of the valve. If a closing of valve with 20mA is desired, this parameter has to be set.

3.1.5 “Drehmomentabhängig Öffnen“ (Torque depending opening):

The final position OPEN is reached only if the corresponding travel switch and the torque switch are activated. After the travel switch has been actuated, runs on the actuator with the seating frequency (3.4.12), until the torque switch switches off.

3.1.6 “Drehmomentabhängig Schließen“ (Torque depending closing):

The final position CLOSED is reached only if the corresponding travel switch and the torque switch are activated. A lot of tight closing valves are switched off torque depending in the end position “CLOSED“. After the travel switch has been actuated, runs on the actuator with the seating frequency (3.4.12), until the torque switch switches off.

3.1.7 “Linksschließende Armatur“ (Ccw-closing final control element):

Most of the valves close normally in clockwise(cw)-rotation. In case of valve with ccw-closing rotation this parameter has to be set.

3.1.8 “Großer Positionswert Links“ (Ccw position value for OPEN):

Normally is the adjusting of the position transmitter of the actuator between 4 and 20 mA. 20mA correspond to the end position OPEN in ccw-rotation. If this parameter is set, 20mA correspond the end positon in cw-rotation (ccw-closing control elements). Modify this parameter, if the motor runs in the false direction respectively to the set point, until the end position has been reached (during closed-loop operation of the actuator).

3.1.9 “Überwachung Positionswert“ (Position value supervision):

A wire break supervision of the position value is with this parameter possible. This function has only sense for 4…20mA!

3.1.10 “Überwachung Sollwert“ (Set point supervision):

A wire break supervision of the set point is with this parameter possible. This function has only sense for 4…20mA!

3.1.11 “Überwachung Istwert“ (Actual value supervision):

Not included, must not be set!

3.2 “Fehlerverhalten” (Fault behaviour):

3.2.1 “Reaktion bei Fehler“ (Fault reaction):

Reaction definition in case of detection of a wiring break of the analog values, or if the external commands OPEN and CLOSE are activated at the same time.

- “Stop” (Actuator stops)
- “Schließen” (Close) (Actuator runs to the end position CLOSED)
- “Öffnen” (Open) (Actuator runs to the end position OPEN)
- “Notposition” (Emergency position) (Actuator runs to the emergency position)

3.2.2 “Alternativreaktion“ (Alternative reaction):

Reaction definition in case of detection of a wiring break of the position value (unknown position of the actuator):

- “Stop“ (Actuator stops)
- “Schließen” (Close) (Actuator runs to the end position CLOSED with tight closing frequency (3.4.12))
- “Öffnen” (Open) (Actuator runs to the end position OPEN with tight closing frequency (3.4.12))

3.3 “Frequenzumformer” (Frequency inverter):

3.3.1 “Allgemein“ (General):

- “Frequenzbereich“ (Frequency range): (only read function)
- “Taktfrequenz“ (Pulse frequency): (only read function)
- “TimeOut“: (only read function)
- “Drehzahlregler“ (Speed controller): (only read function)
- “Autostart“: (only read function)
- “Sollwertvorgabe” (Set point input): (only read function)
- “Analogoffset” (Analog offset): This parameter is used for an internal adjustment of the frequency inverter with the analog outputs. For an control value of 0…20mA set this value to 0mA, for 4…20mA set 4mA!

3.3.2 “Relais“ (Relays):

- “FU Relais 1” (FI Relay 1): (only read function)
- “FU Relais 1” (FI Relay 2): (only read function)

3.4 “Motor”:

3.4.1 “Anlaufspannung“ (Starting voltage):

Motor voltage at a frequency equal to zero. Increase this voltage (voltage U_B, Figure 2) in order to increase the starting torque (ATTENTION: Intense heating of the motor).

3.4.2 “Nennspannung“ (Nominal voltage):

Nominal voltage of the motor, maximum voltage (U_N, Figure 2)

3.4.3 “Nennfrequenz“ (Nominal frequency):

Nominal frequency of the motor. Nominal voltage output with this freuqency (f_N, Figure 2).

3.4.4 “Knickspannung“ (Breaking voltage):

Additional support point to define the voltage/frequency. Normally this point is not needed. Set the breaking voltage equal to the starting voltage (3.4.1).

3.4.5 “Knickfrequenz“ (Breaking frequency):

Additional support point to define the voltage/frequency. Normally this point is not needed. Set the breaking frequency equal to 0.

3.4.6 “Totzone beim Sollwert” (Dead zone of set point):

If the deviation of position set point and position actual value is smaller than the dead zone, then no deviation control will be done (Figure 1). A resting of the control loop is caused by this parameter.

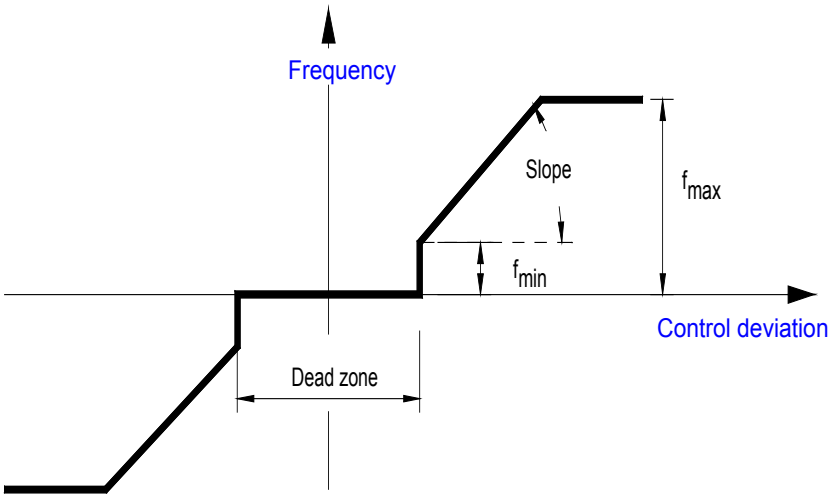


Figure 1: Setting parameters

3.4.7 “Hochlaufzeit“ (Starting time):

Minimum time in seconds for starting of the motor from standstill to maximum frequency (f_{max}, Figure 1, Figure 3).

3.4.8 “Auslaufzeit“ (Run down time):

Minimum time in seconds from the maximum frequency until standstill of the motor, if a disconnecting condition occurs (end position has been reached, disactivating of a positioning command, etc...). This time has to be chosen as short as possible in order to have a fast standstill of the motor. Part of the rotation energy of the motor is absorbed in the intermediate circuit of the frequency inverter. In case of a long delay it comes to an increasement of the intermediate circuit‘s voltage and the frequency inverter switches off shortly (fault signal, temporary disappearing of the ready signal).

3.4.9 “Steigung“ (Slope):

The positioning behaviour near to the set point can be influenced with the slope (Figure 1). The smaller the slope, the sooner will be the reduction of the frequency, and the slower it will be, too, and the exactlier will reach the actuator its set point position. It comes to an overshooting in case of a bigger slope. The slope is indicated in divisions of the maximum frequency (3.4.14) per positioning range.

3.4.10 “Zeitkonstante der Analogwegfilterung“ (Analog values filtering-timing constant):

Timing constant of the filter for an additional software-filter of the analog inputs:

- 160ms
- 80ms
- 40ms
- 20ms
- 0ms

A resting of the control loop is possible by increasing the filter timing constant, in case of high interferences of the analog values due to disturbances. ATTENTION: A long timing constant makes the control loop slower, oscillations may occur.

3.4.11 “Frequenz für Ortsbetrieb“ (Frequency for local operation):

The maximum frequency for local operation will be defined with this parameter. The adjustment has to be done in per cent of the maximum frequency for remote operation (3.4.14).

3.4.12 “Dichtschließfrequenz“ (Seating frequency):

The actuator runs with this frequency to the end positions torque depending CLOSING (3.1.6) and torque depending OPENING (3.1.3) (actuation of torque switch), after the travel switch has been actuated The adjustment has to be done in per cent of the maximum frequency for remote operation (3.4.14).

3.4.13 “Minimale Frequenz für Fernbetrieb“ (Minimum frequency for remote operation):

None frequency will never fall below this setting.

3.4.14 “Maximale Frequenz für Fernbetrieb“ (Maximum frequency for remote operation):

This maximum frequency will be reached in remote operation (f_{max}, Figure 1, Figure 3).

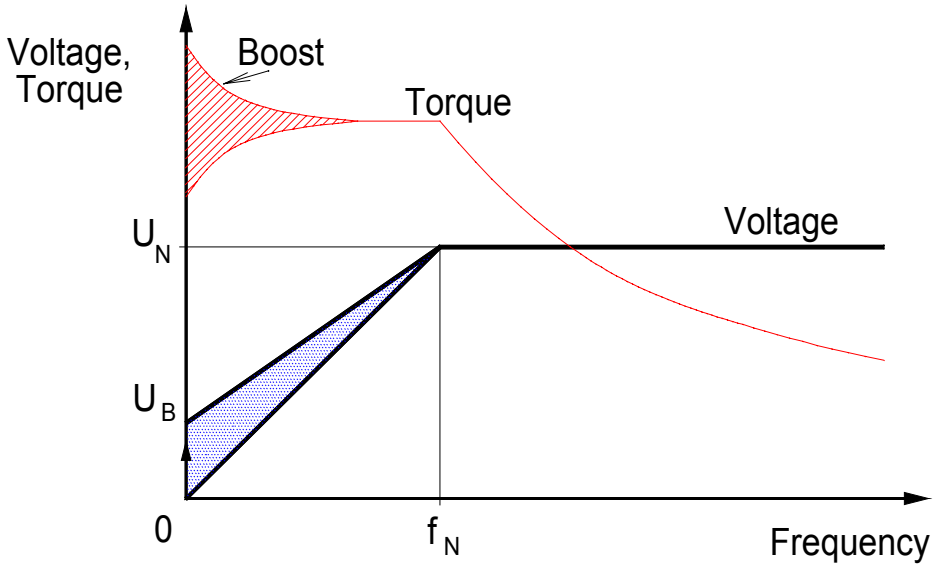


Figure 2: Torque and voltage curves

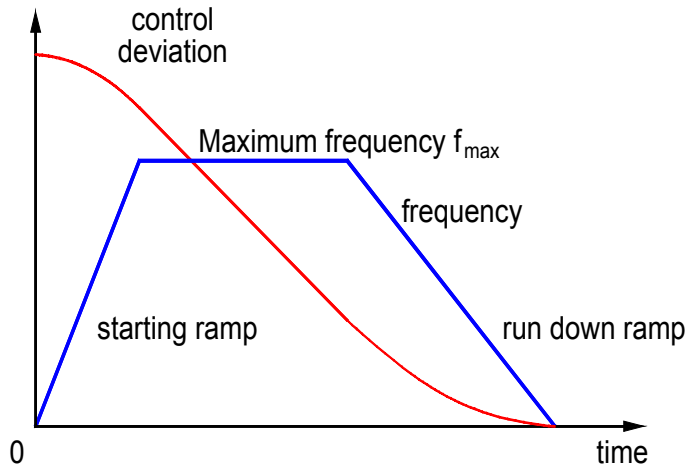


Figure 3: Set point-step response

3.5 “Positionswerte” (Position values):

The position values 3.5.1 to 3.5.6 can be modified. The adjustment of the position values with TEACH IN is certainly easier (4.5 to 4.9). The position values should be programmed in ascending. The maximum frequency can be adjusted between each position values for the respectively distance. This frequency is indicated in per cent of the maximum frequency for remote operation.

3.5.1 “Notposition zwischen Weggeber Schaltern“ (Emergency position between travel switches):

3.5.2 “Frequenz 0-1“ (Frequency 0-1):

3.5.3 “Positionswert 1“ (Position value 1):

3.5.4 “Frequenz 1-2“ (Frequency 1-2):

3.5.5 “Positionswert 2“ (Position value 2):

3.5.6 “Frequenz 2-3“ (Frequency 2-3):

3.5.7 “Positionswert 3“ (Position value 3):

3.5.8 “Frequenz 3-4“ (Frequency 3-4):

3.5.9 “Positionswert 4“ (Position value 4):

3.5.10 “Frequenz 4-5“ (Frequency 4-5):

3.6 “Relais” (Relays):

3.6.1 “Relais 2“ (Relay 2):

Possible events for relay response are:

- “Lauf AUF” (Run OPEN) (actuator runs in OPEN direction)
- “Lauf ZU” (Run CLOSE) (actuator runs in CLOSE direction)
- “Moment AUF” (Torque OPEN) (torque exceeding in OPEN direction)
- “Moment ZU” (Torque CLOSE) (torque exceeding in CLOSE direction)
- “Weggeber AUF” (Travel switch OPEN) (travel end position OPEN has been reached)
- “Weggeber ZU” (Travel switch CLOSE) (travel end position CLOSED has been reached)
- “Bedienung LOKAL” (LOCAL operation) (local operation is active, control switch S31)
- “Bedienung FERN” (REMOTE operation) (remote operation is active, position control, ext. positioning commands)
- “Pos>Pos1” (actual position is greater than position 1)
- “Pos<Pos1” (actual position is smaller than position 1)
- “Pos>Pos2” (actual position is greater than position 2)
- “Pos<Pos2” (actual position is smaller than position 2)
- “Pos>Pos3” (actual position is greater than position 3)
- “Pos<Pos3” (actual position is smaller than position 3)
- “Pos>Pos4” (actual position is greater than position 4)
- “Pos<Pos4” (actual position is smaller than position 4)

If various events are selected, the relay will response for each one of them (i.e. torque exceeding in OPEN or CLOSE direction).

3.6.2 “Relais 3“ (Relay 3):

like Relay 2 (3.6.1)

3.6.3 “Relais 4“ (Relay 4):

like Relay 2 (3.6.1)

3.6.4 “Relais 5“ (Relay 5):

like Relay 2 (3.6.1)

3.6.5 “Relais 6“ (Relay 6):

like Relay 2 (3.6.1)

3.6.6 “Relais 7“ (Relay 7):

like Relay 2 (3.6.1)

3.6.7 “Relais 8“ (Relay 8):

like Relay 2 (3.6.1)

3.7 “Hardwarejustage” (Hardware adjustment):

The adjustment of the actual value output must be done after the position value adjustment (3.8).

3.7.1 “Verstärkung“ (Gain):

Balance range of actual value output

3.7.2 “Offset“:

Offset adjustment of actual value. ATTENTION: The parameter “Frequenzumformer Analogoffset“ (Frequency inverter, analog offset) (3.3.1) must be modified, if the actual value output range 0..20mA or 4...20mA is modified, too.

3.7.3 “Ruhestrom“ (Stand-by current):

Adjustment indication of stand-by current (not calibrated!). Do not change this value! The adjustment of the stand-by current is possible with a particular control command (4.15).

3.7.4 “Resolvernullpunkt“ (Resolver-zero point):

Not included!

3.8 “Positionswert Justage” (Position value adjustment):

Before to the adjustment procedure gain must be set to 1 and offset equal to 0. This parameters have to be transfered to the ACTUCON with “Parameter setzen“ (Set parameters). The adjustment of the set point with the position value suceeds via TEACH IN. Run the actuator first to the end position CLOSED and set the desired set point for the CLOSED position. This will be concluded with “ZU-Position bestätigen“ (Confirm CLOSED-position). Afterwards run the actuator to the OPEN end position and set the desired set point for the OPEN position. It will be concluded with “AUF-Position bestätigen“ (Confirm OPEN-position). The new parameters will be calculated with “Justage neu berechnen“ (New adjustment calculation) and transfered to the ACTUCON with “Parameter setzen“ (Set parameters) .

4 Control commands of the ACTUCON-Manager software:

Additional to the parameters settings the ACTUCON includes control commands for its actually communication with the software.

All the parameters will be saved twice in the ACTUCON, that is in the actual and in a copy-set of parameters. The ACTUCON works with the actual set of parameters, only while booting or switching on of the power supply happens a equality supervision betweeen both parameter sets. The copied parameter set can be used, too, as the last reserve to cancel any programming variation.

4.1 “Parameter setzen” (Set parameters)

The parameters will be transfered from the software to the actual set of parameters of the ACTUCON.

4.2 “Parameter lesen” (Read parameters)

The actual set of parameters will be transfered from the ACTUCON to the software.

4.3 “Parameter wiederherstellen” (Restore parameters)

The copy-set of parameters in the ACTUCON will be taken in the actual set. This function is necessary in case that the original parameters setting has to be restored after any variation of the parameters. ATTENTION: The restoring of the parameters is of course only possible, if the actual (modified) parameters have been not already saved (4.4).

4.4 “Parameter speichern” (Save parameters)

The actual set of parameters will be taken in the copy-set of parameters. This has to occur at the end of a parameter variation, in order to establish an equality between both sets of parameters; otherwise will the ACTUCON signalize a fault in the following boot-process (i.g. power supply failure) because both parameters sets are not equal.

4.5 “Position 1 speichern” (Save position 1)

The actual position will be saved in position 1 (Teach in).

4.6 “Position 2 speichern” (Save position 2)

The actual position will be saved in position 2 (Teach in).

4.7 “Position 3 speichern” (Save position 3)

The actual position will be saved in position 3 (Teach in).

4.8 “Position 4 speichern” (Save position 4)

The actual position will be saved in position 4 (Teach in).

4.9 “Notposition speichern” (Save emergency position)

The actual position will be saved in the emergency position (Teach in).

4.10 “Position messen” (Position measurement)

Continous position measurement (not calibrated!).

4.11 “Istwert messen” (Actual value measurement)

Not included, without function!

4.12 “Sollwert messen” (Set point measurement)

Continous set point measurement (not calibrated!).

4.13 “Resolverposition speichern” (Save resolver position)

Not included, without function!

4.14 “Motorstrom messen” (Motor current measurement)

Continous motor current measurement (not calibrated!).

4.15 “Ruhestrom einstellen” (Adjust stand-by current)

The stand-by current adjustment has to occur by standing still of the (Teach in).

4.16 “Booten” (Boot)

New booting of the ACTUCON (Logical only by variation of the parameters).

4.17 “Fehlerliste” (Failure list)

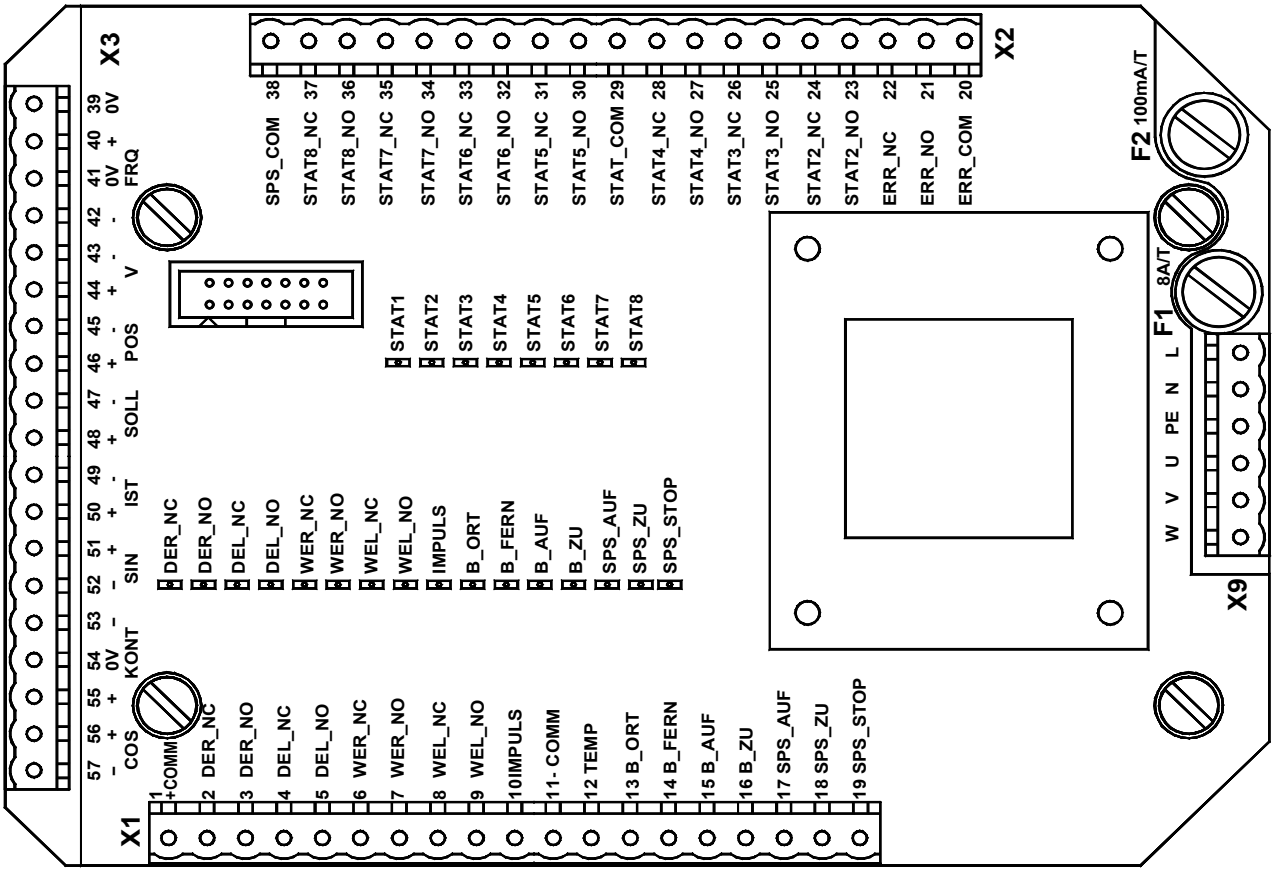
Indication of the last 128 events. The actual fault number is indicated at the beginning of the list. At the line beginning is the current fault number and the event‘s reason, succeeded from the time interval in minutes to the last event in the next line. The number event before the first one is 128 (ring memory).

4.18 “Aktueller Fehler” (Actual fault)

Actual fault indication. The signal “Steuerung gebootet” (Controlling already booted) will be indicated, if the ACTUCON is ready for operation.

5 Connection pins

Figure 4: Connections of the ACTUCON



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Nr.	Connec-tion	Description	Type
	U	Motor connection	Motor output
	V	Motor connection	Motor output
	W	Motor connection	Motor output
	L	Power supply 220V, 50Hz; Phase	Supply input
	N	Power supply 220V, 50Hz; Neutral	Supply input
	PE	Power supply 220V, 50Hz; Protective earth	Supply input
1	+COMM	Potential-free +15V to -COMM for the digital inputs 2...16	Internal digital supply
2	DER_NC	Torque switch cw DER (normally closed)	Digital input
3	DER_NO	Torque switch cw DER (normally open)	Digital input
4	DEL_NC	Torque switch ccw DEL (normally closed)	Digital input
5	DEL_NO	Torque switch ccw DEL (normally open)	Digital input
6	WER_NC	Travel switch cw WER (normally closed)	Digital input
7	WER_NO	Travel switch cw WER (normally open)	Digital input
8	WEL_NC	Travel switch ccw WEL (normally closed)	Digital input
9	WEL_NO	Travel switch ccw WEL (normally open)	Digital input
10	IMPULS	Not applied	Digital input
11	-COMM	Common connection (ground) for the digital inputs 2...16	Internal digital common connection
12	TEMP	Thermal switch F5 (0V=excess temperature)	Digital input
13	B_ORT	Selector switch S30 „LOCAL“	Digital input
14	B_FERN	Selector switch S30 „REMOTE“	Digital input
15	B_AUF	Control switch S31 „OPEN“	Digital input
16	B_ZU	Control switch S31 „CLOSE“	Digital input
17	SPS_AUF	Switch „OPEN“ (normally open) S22 („REMOTE“)	Digital input
18	SPS_ZU	Switch „CLOSE“ (normally open) S21 („REMOTE“)	Digital input
19	SPS_STOP	Switch „STOP“ (normally open) S23 („REMOTE“)	Digital input
20	ERR_COM	Fault signalling relay K1 common (picks up when READY)	Relay output
21	ERR_NO	Fault signalling relay K1 normally open (picks up when READY)	Relay output
22	ERR_NC	Fault signalling relay K1 normally closed (picks up when READY)	Relay output
23	STAT2_NO	Signalling relay K2 normally open	Relay output
24	STAT2_NC	Signalling relay K2 normally closed	Relay output
25	STAT3_NO	Signalling relay K3 normally open	Relay output
26	STAT3_NC	Signalling relay K3 normally closed	Relay output
27	STAT4_NO	Signalling relay K4 normally open	Relay output
28	STAT4_NC	Signalling relay K4 normally closed	Relay output
29	STAT_COM	Common connection relays K2...K8	Relay output
30	STAT5_NO	Signalling relay K5 normally open	Relay output
31	STAT5_NC	Signalling relay K5 normally closed	Relay output
32	STAT6_NO	Signalling relay K6 normally open	Relay output
33	STAT6_NC	Signalling relay K6 normally closed	Relay output
34	STAT7_NO	Signalling relay K7 normally open	Relay output
35	STAT7_NC	Signalling relay K7 normally closed	Relay output

36	STAT8_NO	Signalling relay K8 normally open	Relay output
37	STAT8_NC	Signalling relay K8 normally closed	Relay output
38	SPS_COMM	Common connection (ground) for the external digital inputs 17, 18, 19	External digital ground connection
39	0V	Not applied	
40	+FRQ	Not applied	
41	0V	Not applied	
42	-FRQ	Not applied	
43	-V	Potential-free power supply for ESM (actual value)0V DC	Analog ground connection
44	+V	Potential-free power supply for ESM (actual value) +24V DC	Analog supply
45	-POS	Position transmitter signal (ESM) -; (0)4...20mA	Analog input
46	+POS	Position transmitter signal (ESM) +; (0)4...20mA	Analog input
47	-SOLL	Set point signal -; (0)4...20mA	Analog input
48	+SOLL	Set point signal +; (0)4...20mA	Analog input
49	-IST	Not applied	
50	+IST	Not applied	
51	+SIN	Not applied	
52	-SIN	Not applied	
53	-KONT	Control value (position signal) -; (0)4...20mA	Analog output
54	0V	Not applied	
55	+KONT	Control value (position signal) +; (0)4...20mA	Analog output
56	+COS	Not applied	
57	-COS	Not applied	

6 Technical Data

Power section:

Power supply	230V(±10%), 47...63Hz
Supply line fusing	3,15A time-lag
Motor nominal voltage	3x230V, 50Hz
Short-time power output	1100 VA, max. 0,75kW
Continous power output at 40°C	0,3kW
Output frequency	0...136Hz

Analog inputs:

Set point	(0)4...20mA, 100Ω Internal resistance, floating ±48V to analog ground (accor. to EN 61131-2)

Digital inputs:

3 Digital inputs	OPEN, STOP, CLOSE (Remote op.), Int. resistance100Ω
Input signal	24V DC (accor. to EN 61131-2) with same common or potential-free contacts

Analog output:

Control value	(0)4...20mA to analog ground (accor. to EN 61131-2)
Load	max. 500Ω

Relay outputs:

1 Relay (change-over switch)	Fault signal (picks up when READY)
7 Relays (change-over switch)	free configuration, same common
Max. switching voltage	220VDC, 250VAC
Max. switching current	2A
Switching power	1A, 30VDC, resistive, 500 x 10^3 switching cycles 0,5A, 125VAC, resistive, 200 x 10^3 switching cycles
Mechanical life	10^8 switching cycles

Interface	RS232
Protection	IP65
Ambient temperature	-20...+50°C

System requirements:

Software: WINDOWS 95 or WINDOWS NT 4.0

Hardware: Serial interface with FIFO

7 Dimensions