

isel-servo power output module

UVE 8012



Operating Instruction

970314 BE002
09/2000

About these instructions

In this instructions, you find different symbols marking important information for easy and fast reference.

Danger



Caution



Reference



Example



Supplementary
information



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We welcome any suggestions and remarks on faults.



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Contents

1	Function description4
2	Hardware description8
2.1	Layout plan of the main board8
2.2	Layout plan of the processor board .....	.9
2.3	Jumper settings of the main board .....	.9
2.4	Jumper settings of the processor board .....	.11
2.5	LED status indicator .....	.11
2.6	Serial interface (pin allocation) .....	.13
2.7	Adjustment of analog tacho input .....	.13
2.8	Board connector (pin allocation) .....	.14
2.9	Internal circuitry of in- and output-pins .....	.15
2.10	Examples .....	.20
3	Starting-up of operation .....	.22
3.1	Motor specific parameters .....	.22
3.2	Setting the operation mode .....	.22
3.3	Offset adjustment .....	.22
4	Data transmission .....	.23

1 Function description

Features

- digital four quadrant power output module with 80C196 micro controller
- a power supply voltage (link voltage) from + 40 V to + 80 V
- high degree of efficiency through the use of IGBT output module
- up to 10 A permanent current
- up to 25 A peak current
- output module is short-circuit-proof
- temperature monitoring
- I²t monitoring or I²t cut-off, time can be set digitally as parameter via a serial interface
- monitoring and limitation of the current at standstill
- voltage monitoring with Reset logic
- digital current controller
- digital speed controller (PID controller)
- digital position controller (PD controller)
- serial interface according to RS232
- all controller parameters can be set digitally via the serial interface
- parameter for permanent current and peak current can be set separately and digitally via the serial interface
- EEPROM for storing of all parameters (Motor and controller parameters) and settings (operation mode, etc.)
- Preset desired value through ± 10 V analog voltage, through PWM signal with direction-signal or through the serial interface
- Feedback through evaluation of the encoder signals A and B or through analog tacho voltage (adjustable)
- two 24 V inputs (limit-switches)
- direct monitoring of the limit switches possible
- one relay output
- Polarity reversal protection and overvoltage protection of the inputs
- digital offset adjustment
- LED status indicator
- isolation of all inputs and outputs possible
- Europe card 160 mm x 100 mm, installation width 9 TE
- directly interchangeable with isel servo power card UME 10 Art. No.: 314 000

Application

The digital four quadrant power output module serves for the control of the mechanically commutated (with brushgear) DC servo motors.

The power output module is realized as Europe card with an installation width of 9 TE. It consists of two units, a main board and a plugged-in processor board.

All required operating voltages are provided by the link voltage (+ 40 V to + 80 V) via a DC/DC converter.

Due to the use of a powerful micro controller, various other functions can be realized apart from the actual current and speed controller. You can set and store all parameters digitally. This allows an optimal adjustment of the output module to the motor and the movement progress.

The desired value can be pre-defined either as ± 10 V analog voltage, as PWM signal with directional signal or digitally via the serial interface. The output module works in the current controller and speed controller operation modes.

Current Controller operation mode

In this operation mode, the output module works as current controller, that is, the preset desired value is converted into a corresponding motor current. The maximum desired value corresponds to the set maximum current. The internal resolution is 10 bit, so that for each direction, 511 levels can be distinguished (e. g. maximum current 10 A -> step distance approx. 20 mA).

If the current is not reached, the motor runs up to the maximum speed.

In this setting, the output module does not require any feedback.

Speed Controller operation mode

In this operation mode, the output module works as speed controller, that is, the preset desired value is converted into a corresponding motor speed. The maximum desired value corresponds to the set nominal speed. The internal resolution is 10 bit, so that for each direction, 511 levels can be distinguished (e. g. nominal speed 3 000 r. p. m. -> step distance approx. 6 r. p. m.). The speed control is carried out via a PID control algorithm, the parameters of which can be adjusted digitally. The necessary feedback in the form of the actual speed is facilitated by the evaluation of the encoder signals or by the connection of an external tachometer.

Position Controller operation mode

In this operation mode, the output module works as position controller. In this mode, 10 definable position sets which are stored in the output module (position, speed, acceleration, absolute/relative) can be selected via the desired value. In addition, any position can be set through the serial interface.

The selection or the approaching of the individual positions is executed via a desired value input of the output module (e. g. 0 - 10 V or PWM signal) by setting the desired value to a certain threshold (10 % - pos 0, 20 % - pos 1, ...). In the case of a desired value of 0, the current movement is terminated. If the desired value is set to a different threshold during a movement, the current movement is terminated and the new position is approached. After the switching-on or resetting of the output module, a reference run is carried out before any position is approached. After that, the zero point is retained until the desired value is set to a different threshold.

Presetting of desired value as ± 10 V analog

The desired value is preset as an analog voltage value of ± 10 volt via the respective connections on the plug connector.

The desired value is converted via a 10 bit A/D converter, so that for each direction, up to 511 levels (depending on the zero point offset) are available.

Presetting of desired value as PWM signal

The desired value is preset as PWM signal (TTL level) via the respective connections on the plug connector. The frequency of the signal can be between 100 Hz and 10 kHz.

Presetting of desired value as RS-232

The desired value is preset through the serial interface.

When this operation mode is set, the desired value can be set by sending the appropriate command (see data transfer).

Encoder RS422 feedback

When this operation mode is set, the processor evaluates the encoder signals that have to be input at the respective connections on the plug connector. From these signals, the position and the speed are then ascertained. The signals are transmitted and evaluated according to the RS422 standard (A, /A, B, /B).

Tacho signal feedback

When this operation mode is selected, the tacho signal, which has to be fed to the respective connections of the plug connector, is evaluated by the processor. The speed is then calculated from this information.

The preset nominal speed corresponds to the maximum tacho voltage.

Monitoring of limit switch

It is possible to evaluate two limit switch signals in the output module. For this purpose, the limit switch levels have to be carried to the appropriate inputs on the plug connector as 24 V low-active signals.

If a limit switch is triggered, the respective direction is blocked and the motor can only be moved in one direction (out of the limit switch). A corresponding error signal is indicated by the LEDs (see Error Conditions).

Monitoring of current

The servo motor power card has a wide range of monitoring and protection functions. Apart from the short-circuit protection of the outputs and the temperature control, a I²t monitoring of the motor current has been realized.

If the permissible motor current is exceeded, the I²t monitoring limits the motor current to the nominal current after the time (t) that is calculated according to the following formula.

$$t = \frac{(I_{\max} - I_{\text{nenn}})^2}{(I - I_{\text{nenn}})^2} \cdot t_{\max}$$

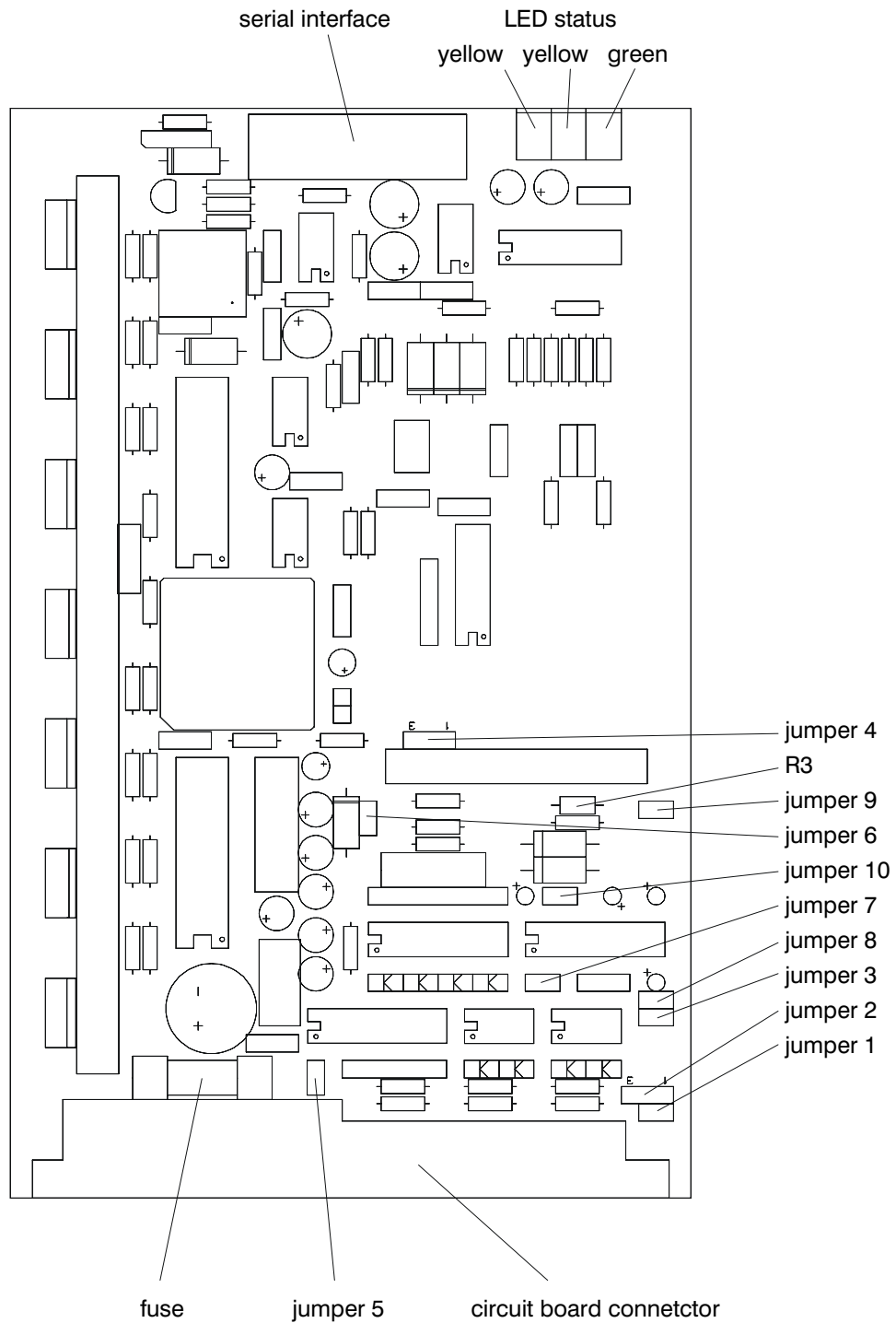
The values for I_{\max} (peak current) and t_{\max} can be set digitally via the serial interface.

Another protection function is the current limitation when the motor is standing still. If the motor current at motor standstill (speed 0) is higher than the nominal current for a period of time (t), which can be set in the range from 1 ms to 60 000 ms, the motor current is limited to the nominal current.

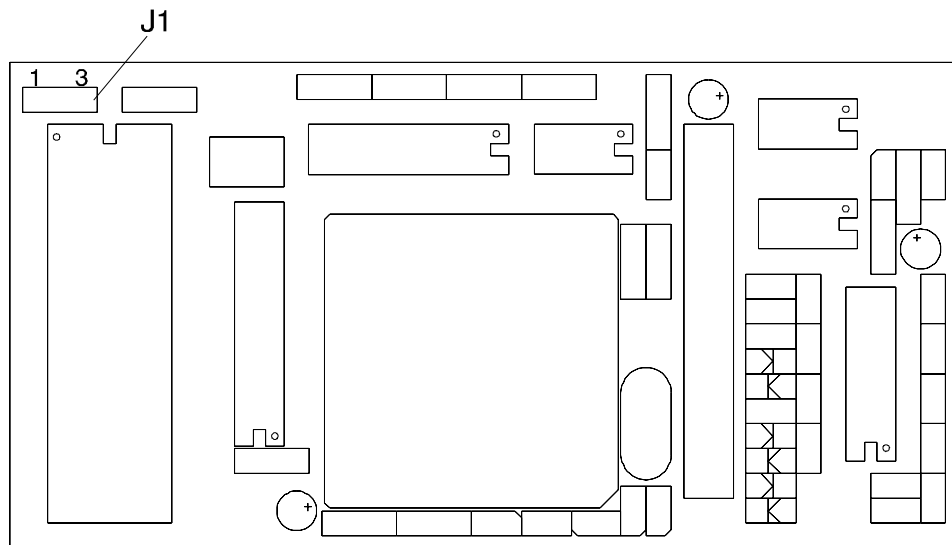
All error conditions are indicated by the status LEDs. The short-circuit, position error and overtemperature errors lead to a permanent switching-off of the motor current. This state can only be de-activated by an external reset or by switching the output module off and then on again. All other error conditions become inactive as soon as the reason of the error has been eliminated.

2 Hardware description

2.1 Layout plan of the main board





2.2 Layout plan of the processor board



2.3 Jumper settings of the main board

The position of the jumper is shown in the layout plan of the main board.

The following positions are possible for the jumpers J2 and J4:

position: 1 - 2		pin 1 is bridged with pin 2
position: 2 - 3		pin 2 is bridged with pin 3

Configuration of the output module enable - jumpers J1, J2 and J3

The active level of the Enable signal is defined by the jumpers J1, J2 and J3.

High-Active	J1 open J2 position 2 - 3 J3 closed
Low-Active	J1 closed J2 position 1 - 2 J3 open

Configuration of motor temperature input - Jumper J7

J7 closed: If no temperature sensor is connected, the motor temperature input is placed on a defined potential (GND).
J7 open: Motor temperature input is active.

Removing the isolation of the inputs - jumper J5, J6, J8 ,J9 and J10

J5 - bridging + 5 V DC/DC converter

J5 closed: + 5 V operating voltage is bridged with isolated voltage + 5 V
J5 open: isolation of the + 5 V voltages prepared

J6 - bridging + 15 V DC/DC converter

J6 closed: operating voltage + 15 V is bridged with isolated voltage + 15 V
J6 open: isolation of the + 15 V voltages prepared

J8 - bridging of analog earth with digital earth

J8 closed: analog earth is bridged with digital earth
J8 open: isolation of digital earth and analog earth prepared

J9 - bridging - 15 V DC/DC converter

J9 closed: operating voltage - 15 V is bridged with isolated voltage - 15 V
J9 open: isolation of the - 15 V voltages prepared

J10 - bridging of isolation amplifier



J10 closed: isolation amplifier is bridged.
J10 open: isolation of the desired value prepared

The isolation of the inputs is only present when every one of the jumpers J5, J6, J8 and J10 is open. If only one of the aforementioned jumpers is closed, the isolation of the inputs is cancelled.

2.4 Jumper settings of the processor board

The position of the jumper is shown in the layout plan of the processor board.

The following positions are possible for Jumper J1:

position: 1 - 2		pin 1 is bridged with pin 2
position: 2 - 3		pin 2 is bridged with pin 3

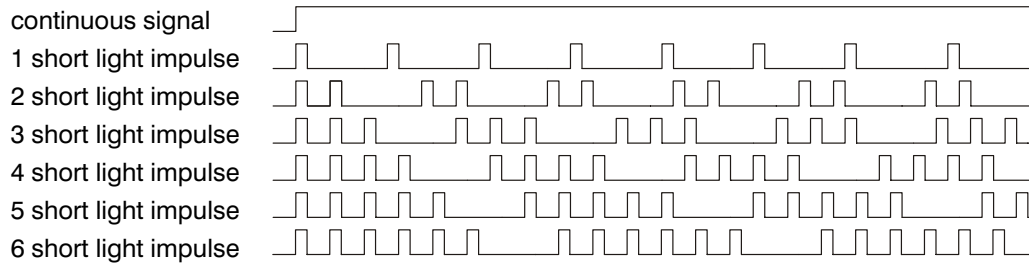
Memory configuration J1

J1 position 1 - 2:	Memory configuration 32 kB EPROM
J1 position 2 - 3:	Memory configuration 64 kB Flash memory

2.5 LED status indicator

The LED status indicator consists of a total of three LEDs, a green LED and two yellow LEDs. The LEDs have the following function:

green LED (LED on the right):	Ready for operation lights up as soon as the operating voltage is switched on and the internal voltages are available
yellow LED (centre LED):	Disable lights up when the output module is disabled
yellow LED (LED on the left):	The LED serves for the indication of error conditions. In order to differentiate between the error conditions that are listed in detail in the following, every error is allocated a certain number of blinking impulses. The possible error signal variants are shown in the following illustration.



continuous signal

overtemperature

Occurs if a certain temperature is exceeded and remains on as long as the over-temperature remains.

1 short light impulse

overcurrent, overtemperature

Occurs if an overcurrent ($> 25 \text{ A}$) is detected as well as when there is an over-temperature.

2 short light impulse

current limitation at 0 speed

Occurs if the set standstill current is exceeded when the motor is at a standstill.

3 short light impulse

I^2t current limitation

If the motor current is higher than the nominal current of the motor, the motor current is limited to the nominal current after a period of time that is calculated according to the I^2t function.

4 short light impulse

limit switch 1

Occurs if the limit switch 1 was activated during a time when the limit switch monitoring was activated.

5 short light impulse

limit switch 2

Occurs if the limit switch 2 was activated during a time when the limit switch monitoring was activated.

6 short light impulse

position error

Occurs if the position error window is exceeded.

2.6 Serial interface (pin allocation)

The servo output module has a serial interface (RS232 port) and is located in the front panel of the slot-in module.

pin allocation 9-pin Sub D plug	
pin No.	signal
1	-
2	RxD
3	TxD
4	Bridge to PIN6
5	GND
6	Bridge to PIN4
7	Bridge to PIN8
8	Bridge to PIN7
9	-

2.7 Adjustment of analog tacho input

The tacho voltage is applied to the tacho inputs (Tacho 1 and Tacho 2) as a differential voltage. Internally, the maximum speed + 10 V or - 10 V is allocated. The external tacho voltage can be adjusted via a voltage divider. For that purpose, the resistor R3 (see layout plan of main board) is to be fitted in accordance with this equation:

$$R_3 = \frac{20 \text{ k}\Omega}{\frac{|U_T|}{10 \text{ V}} - 1}$$

U_T - external tacho voltage

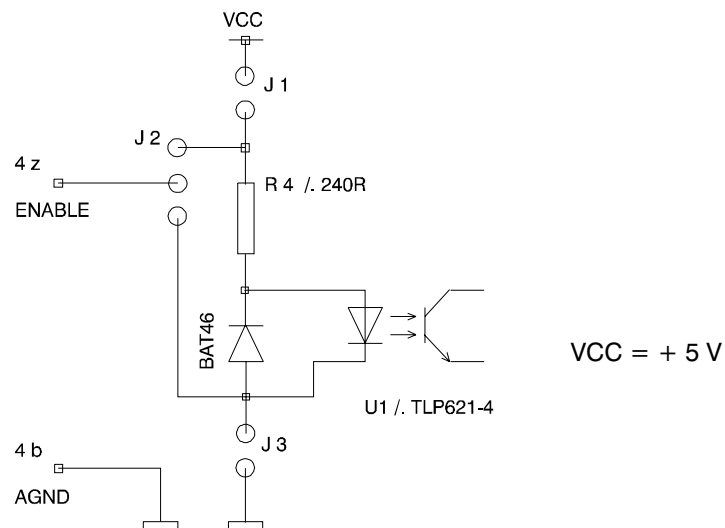
2.8 Board connector (pin allocation)

pin allocation of connector F24H7	
pin No.	signal
2z	set value ± 10 V
2b	AGND
2d	/RESET
4z	ENABLE
4b	AGND
4d	tacho signal
6z	tacho signal
6b	GND (24 V)
6d	set value
	external PWM signal
8z	input 1
8b	input 2
8d	set value
	PWM-direction signal
10z	GND (log.)
10b	+ 5 V (log.)
10d	encoder B
12z	encoder /B
12b	encoder A
12d	encoder /A
14z	encoder Z
14b	encoder /Z
14d	+ 16 V
16z	motor temperature
16b	/fault
16d	relay output
20	+ Vs (+ 40 V to + 80 V)
22	
24	motor output 1
26	motor output 2
28	
30	
32	GND

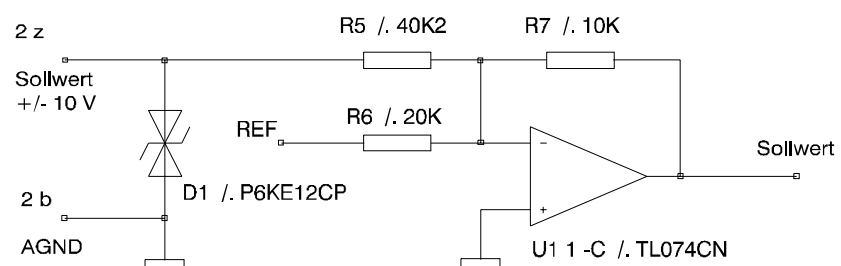
2.9 Internal circuitry of in- and output-pins

Enable input

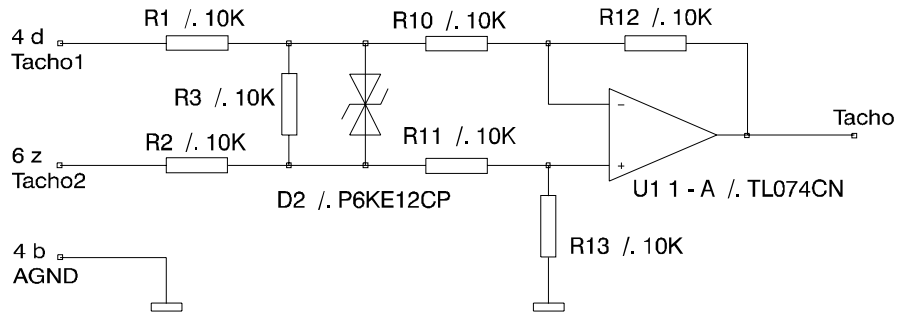
enable/disable of the power transistors.



Input analog set value ± 10 V

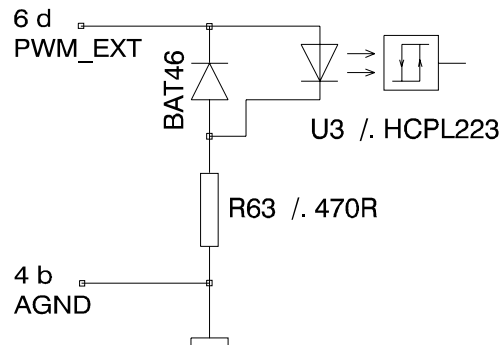


Input tacho signal

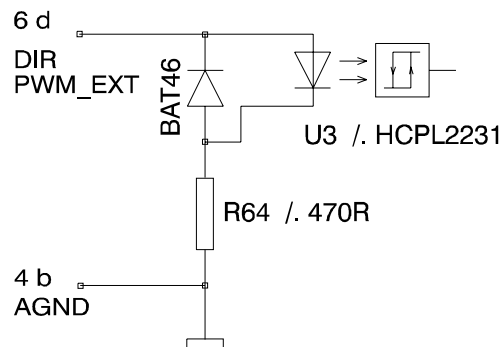


Input PWM set value

PWM-voltage should be 5 V (TTL). The impulse width of high-signal corresponds to set value. The frequency of the PWM-signal has to be in the range 100 Hz to 10 kHz.

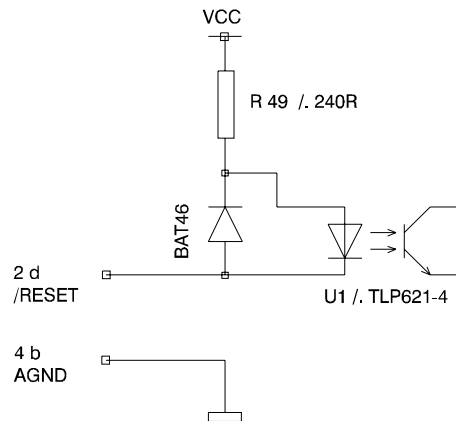


Input PWM set value direction



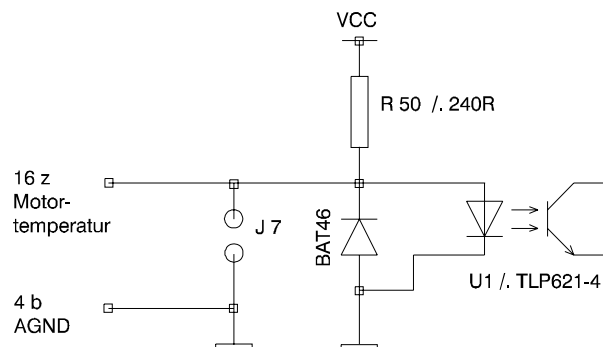
Input Reset

This Low-active (TTL-) signal resets the processor and the power circuit.



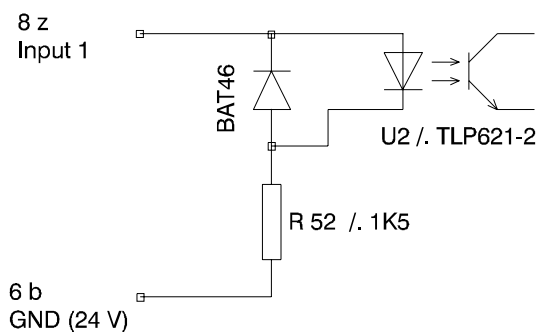
Input motor temperature

A temperature-sensor could be connected to this pin. In normal condition it should have low impedance and in case of exceeding the application specific temperature there has to be high impedance to trigger the temperature error. Jumper 7 is plugged if no temperature-sensor is present.



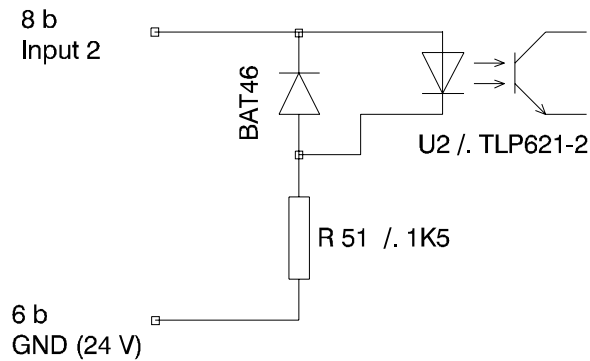
Input Limit-Switch 1

This is a 24 V low-active input for the first limit switch. The related ground is on pin 6b.



Input Limit-Switch 2

This is a 24 V low-active input for the second limit switch. The related ground is on pin 6b.



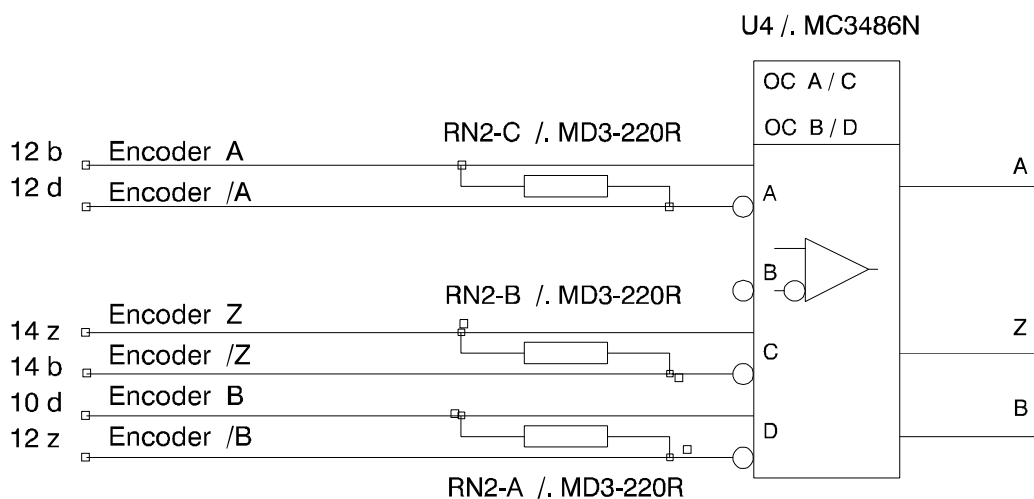
Encodersignal Inputs

The position feedback interface to the motor consists of an incremental encoder with two quadrature signal inputs A and B. The optional index pulse Z is not evaluated by the module.

The transmission of these signals is according to the RS422 specification.

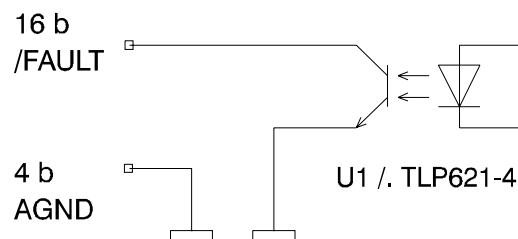


The power supply to the encoder has to be external, e. g. from the Servo control board UPMV 4/12.

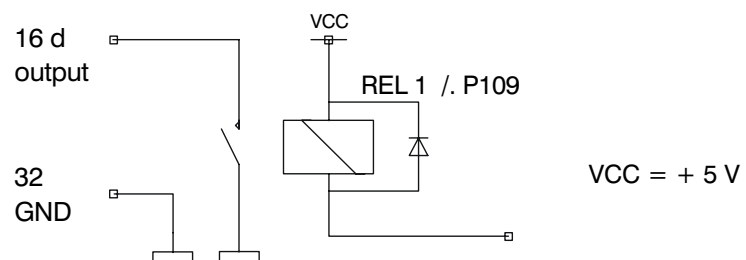


Output Fault-signal

This is a open-collector active-low output. Maximum ratings are 24 V and 50 mA.



Relais-Output



2.10 Examples



Current mode. No encoder feedback. Analog set value (± 10 V).

- inputs
 - pin 2z ± 10 V set value
 - pin 2b GND set value
 - pin 4z ENABLE
 - pin 4b GND
 - pin 16b /fault
 - pin 20 + 40 V to + 80 V
 - pin 32 GND
- outputs
 - pin 24 motor
 - pin 26 motor

Current mode or Velocitymode. Encoder feedback. Analog set value (± 10 V).

- inputs
 - pin 2z ± 10 V set value
 - pin 2b GND set value
 - pin 4z ENABLE
 - pin 4b GND
 - pin 10d encoder signal B
 - pin 12z encoder signal /B
 - pin 12b encoder signal A
 - pin 12d encoder signal /A
 - pin 16b /fault
 - pin 20 + 40 V to + 80 V
 - pin 32 GND
- outputs
 - pin 24 motor
 - pin 26 motor

Positionmode. Encoder feedback. Analog set value (± 10 V).

- inputs
 - pin 2z ± 10 V set value
 - pin 2b GND set value
 - pin 4z ENABLE
 - pin 4b GND
 - pin 6b GND (24 V)
 - pin 8z limit switch 1
 - pin 8b limit switch 2
 - pin 10d encoder signal B
 - pin 12z encoder signal /B
 - pin 12b encoder signal A
 - pin 12d encoder signal /A
 - pin 16b /fault
 - pin 20 + 40 V to + 80 V
 - pin 32 GND
- outputs
 - pin 24 motor
 - pin 26 motor

Velocitymode. Tachosignal feedback. Analog set value (± 10 V).

• inputs	pin 2z	± 10 V set value
	pin 2b	GND set value
	pin 4z	ENABLE
	pin 4b	GND
	pin 4d	tacho signal
	pin 6z	tacho signal
	pin 16b	/fault
	pin 20	+ 40 V to + 80 V
	pin 32	GND
	pin 24	motor
• outputs	pin 26	motor

Velocitymode. Encoder feedback. PWM-set value. Limit switch monitoring

• inputs	pin 4z	ENABLE
	pin 4b	GND
	pin 6b	GND (24 V)
	pin 6d	PWM-signal
	pin 8d	PWM-direction
	pin 8z	limit switch 1
	pin 8b	limit switch 2
	pin 10d	encoder signal B
	pin 12z	encoder signal /B
	pin 12b	encoder signal A
	pin 12d	encoder signal /A
	pin 16b	/fault
	pin 20	+ 40 V to + 80 V
	pin 32	GND
- outputs	pin 24	motor
	pin 26	motor

Option - directly Limit Switch monitoring (for all modes)

• inputs	pin 6b	GND (24 V)
	pin 8z	input 1 (limit switch 1)
	pin 8b	input 2 (limit switch 2)

3 Starting-up of operation

1. Configure the servo output module by setting the jumpers (Chapter 2.3).
2. Set all parameters and the operation mode. For that purpose, connect the servo output module with the PC (COM1, 2, 3 or 3) using a serial cable and switch on the output module (applying of the supply voltage).
3. Start the Windows program setting program for servo output module. A detailed description is given in the on-line help. First, select the appropriate interface in the *Settings* menu under the item *Serial Interface*.

3.1 Motor specific parameters

The motor-specific parameters can be set in the *Settings* menu under the menu item *Motor Parameters*.

Enter the motor-specific value from the motor data sheet into the respective fields. You can also set the time value for the I²t monitoring as well as activate or de-activate and set the parameters for the *current Limitation* monitoring function at standstill. All parameters are stored in the servo output module and can be recalled and/or changed at any time.

3.2 Setting the operation mode

The operation mode can be set in the *Settings* menu under the item *Operation Mode*. You can select the operation mode, the feedback and the desired default value. The operation modes for current controller, speed controller or position controller are distinguished. For the feedback, you can choose between the feedback via encoder signals or analog tachometer voltage. The desired default value can be configured as ± 10 V analog voltage, as pulse-width-modulated signal (PWM signal) with digital directional signal or as digital value via the serial interface.

3.3 Offset adjustment

If the desired value is preset as ± 10 V analog voltage, it is recommended that an offset adjustment be carried out.

You can activate this function in the *Settings* menu under the item *Offset Adjustment*.

You have to set the desired value for the output module to 0. When the offset adjustment is carried out, the analog desired value signal is assigned the value of zero internally.

In this way, external as well as internal zero point displacements are compensated for.

4 Data transmission

Transmission speed

The transmission speed is set at a fixed rate of 19 200 bit/s.

Description of commands



Depending on the set operation mode of the output module, some commands may not always be available.

- Commands for all operation modes start with the starting character #.
- Commands that are only available in one operation mode start with @.
- All commands and feedbacks are finished with a carriage return (CR, ASCII 13).
- In the case of errors or commands that are not available, a corresponding error code is returned. An error code always starts with E (except in the position mode).

Command	Description	Feedback	Notes
#STS	status request	32 bit hexadecimal number as ASCII: bit 0 - 1: Operation mode: 00: current controller 01: Speed controller 10: position controller bit 2 - 3: desired default value: 00: analog 01: PWM 10: RS232 bit 4: set mode bit 5: standstill current limitation bit 6: I ² t current limitation bit 7: position error bit 8: feedback 0: tacho 1: encoder bit 10: switch off speed controlling at zero point bit 11: current monitoring at standstill bit 12: limit switch monitoring bit 13: encoder counting direction: 0: positive 1: negative bit 14: sin ² ramp bit 15: exchange limit switch bit 16: position error bit 17: SP601 error bit 20: overcurrent at standstill bit 21: overcurrent (I ² t monitoring) bit 23: actual rotation direction bit 24: input IN1 bit 25: input IN2 bit 26: input IN3 bit 29: relay output bit 30: overtemperature bit 31: disable signal	
#RST	output module reset	switch-on message: 'DSC'	
#CUR	change operation mode: current controller	actual status	not in set mode

#VEL	change operation mode: speed controller	actual status	not in set mode
#POS	change operation mode: position controller	actual status	not in set mode
#ANA	change operation mode: analog desired value	actual status	not in set mode
#PWM	change operation mode: PWM desired value	actual status	not in set mode
#RSS	change operation mode: desired value via serial interface	actual status	not in set mode
#ENC	change operation mode: feedback: encoder	actual status	not in set mode
#TAC	change operation mode: feedback: tacho signal	actual status	not in set mode
#ENP	change operation mode: encoder counter direction positive	actual status	not in set mode
#ENN	change operation mode: encoder counter direction negative	actual status	not in set mode
#SET	switch on set mode	actual status	
#ESM	switch off set mode	actual status	
#AMP	request for actual current	integer value: 0 .. 255, corresponds to 0 - 25.5 A	
#RPM	request for actual speed	integer value: 0 .. 5 000 (r. p. m.)	
#ACP	request for actual position	long value: - 2 147 483 648 .. 2 147 483 647 (increments)	not for tacho signal feedback
#CAL	adjustment of offset: analog desired value	desired value zero point (Integer value)	only for analog desired value
#CAT	adjustment of offset: tacho signal desired value	tacho signal zero point (Integer value)	only for tacho signal feedback
#RON	switch on relay output	actual status	
#ROF	switch off relay output	actual status	
#IZE	switch on current monitoring at standstill	actual status	
#IZA	switch off current monitoring at standstill	actual status	
#VZN	speed controller switched on at zero point	actual status	
#VZF	speed controller switched off at zero point	actual status	
#ESE	switch on limit switch monitoring	actual status	
#ESA	switch off limit switch monitoring	actual status	
#PEE	position error monitoring on	actual status	
#PEA	position error monitoring off	actual status	
#ESN	exchange limit switches	actual status	
#ESP	not exchange limit switches	actual status	

#DMP	output EEPROM contents	EEPROM addresses and values	
#Zxxx	set desired value xxx = - 511 .. 511	send back desired value	only for RS232 desired value

Commands for the set mode

In the set mode, EEPROM parameters can be set or read.

No desired value is transmitted to the output module.

Command	Description	Feedback	Notes
@L,adr	request for an EEPROM value. (adr = 0 .. 63)	memory contents as 16 bit unsigned value	
@S,adr,wert	storing of a value in the EEPROM. (adr = 0 .. 60 -> value = 0 .. 65535)	received value is sent back	

Commands for the speed mode

Command	Description	Feedback	Notes
@ZVxxx,yyy	set desired value and request f. speed xxx = -511 .. 511, yyy = 0 .. 500. Every 4 ms, the output module sends the current speed as hex value. yyy gives the duration in 4 ms units, after which the request is terminated.	actual speed in r. p. m. is returned every 4 ms as hex number followed by a comma. When the request is finished, the message 'TRM' and a carriage return are sent.	see also @ESV
@ZIxxx,yyy	set desired value and request for motor current. xxx = -511 .. 511, yyy = 0 .. 500. Every 4 ms, the output module sends the current speed as hex value. yyy gives the duration in 4 ms units, after which the request is terminated.	actual value of the motor current in 1/10 A is returned every 4 ms as hex number followed by a comma. When the request is finished, the message 'TRM' and a carriage return are sent.	See also @ESV
@ESV	terminates the request for speed or motor current prematurely.	40 ms after the receipt, the request is terminated and the message 'TRM' and a CR are sent.	see also @ZV..., @ZI....

Commands for the position mode

Command	Description	Feedback	Notes
@Apos,vel	relative movement. Starts a movement to the given target position, pos in incr. with the given speed, vel in 100 incr./s. The position relates to the preceding target position or end position. If no speed is stated, the speed of the last movement is retained.	0 after the successful receipt of the command and (!) after the termination of the movement.	
@Mpos,vel	absolute movement. Starts a movement to the given target position (pos in incr.) with the given speed (vel in 100 incr./s). The position relates to the zero point (or reference point). If no speed is stated, the speed of the last movement is retained.	0 after the successful receipt of the command and (!) after the termination of the movement.	

Command	Description	Feedback	Notes
@h	terminates the movement that is currently being carried out with normal braking ramp.	0 after the successful receipt of the command and (!) after the termination of the movement.	
@H	terminates the movement that is currently being carried out with normal braking ramp and returns to the point at which the command was received.	0 after the successful receipt of the command and (!) after the termination of the movement.	
@R1	carries out a reference run	0 after the successful receipt of the command and (!) after the termination of the movement.	
@Xhex	carries out a relative movement with maximum ramp. The transmitted value (<i>hex</i> , 4-digit hex number in two's complement) is directly added to the current position desired value.	0	
@Dvel	set reference run speed (<i>vel</i> , in 100 incr/s).	0	the transmitted value is stored in the EEPROM.
@DP	set reference run direction (positive direction)	0	the transmitted value is stored in the EEPROM.
@DN	set reference run direction (negative direction)	0	the transmitted value is stored in the EEPROM.
@Uaccel	set acceleration (<i>accel</i> , in 1000 incr/s ²)	0	the transmitted value is stored in the EEPROM.
@Wnr,pos,vel	store position set in the EEPROM. The transmitted values (<i>pos</i> , in incr) and (<i>vel</i> , in 100 incr/s) are stored under the stated pos.no (<i>nr</i> , 0..9) in the EEPROM. The position is an absolute position.	0	
@WRnr,pos,vel	store position set in the EEPROM. The transmitted values (<i>pos</i> , in incr) and (<i>vel</i> , in 100 incr/s) are stored under the stated pos.no (<i>nr</i> , 0..9) in the EEPROM. The position is a relative position.	0	

EEProm-addresses

Adresse	Description	Scope
0	position control parameter kp	0 .. 32 767
1	position control parameter kd	0 .. 32 767
2	set value zero point	0 .. 1 023
3	rated current	100 .. 12 000 [mA]
4	max current	100 .. 25 000 [mA]
5	rated speed	10 .. 5 000 [U/min]
6	I ² t-Cut-off time at I _{max}	depend on I _{max} , 1 .. 500 to maximum 1 .. 60 000 [ms]
7	current at standstill	1 .. 12 000 [mA]
8	standstill-current cut-off time	1 .. 60 000 [ms]
9	number of encoder lines	100 .. 1 000
10	control parameter kp	0 .. 32 767
11	control parameter ki	0 .. 32 767
12	tacho zero pint	0 .. 1 023
13	control parameter kd	0 .. 32 767
14	control parameter il	0 .. 32 767
15	control parameter td	0 .. 255
16 bit 0-14	limitation of control error	10 .. 30 000 [Incr]
16 bit 15	kind of limitation	1: hard limitation 0: soft limitation
17	acceleration	1 .. 15 000 [1 000 Inc/s ²]
18 bit 0-14 18 bit 15	homing speed homing direction	1 .. 10 000 [100 Inc/s] 1: positive 0: negative direction
20 21	position 0 high word low word	- 2 147 483 648 .. 2 147 483 647
22 bit 0-14 22 bit 15	velocity for position 0 relative/absolute flag	1 .. 10 000 [100 Inc/s] 1: relative move 0: absolute move
23	Acceleration for position 0	1 .. 15 000 [1 000 Inc/s ²]
24 25	position 1 high word low word	s.a.
26 bit 0-14 26 bit 15	velocity for position 1 relative/absolute flag	s.a.
27	acceleration for position 1	s.a.
28 29	position 2 high word low word	s.a.
30 bit 0-14 30 bit 15	velocity for position 2 relative/absolute flag	s.a.

Adresse	Description	Scope
31	acceleration for position 2	s.a.
32 33	position 3 high word low word	s.a.
34 bit 0-14 34 bit 15	velocity for position 3 relative/absolute flag	s.a.
35	acceleration for position 3	s.a.
36 37	position 4 high word low word	s.a.
38 bit 0-14 38 bit 15	velocity for position 4 relative/absolute flag	s.a.
39	acceleration for position 4	s.a.
40 41	position 5 high word low word	s.a.
42 bit 0-14 42 bit 15	velocity for position 5 relative/absolute flag	s.a.
43	acceleration for position 5	s.a.
44 45	position 6 high word low word	s.a.
46 bit 0-14 46 bit 15	velocity for position 6 relative/absolute flag	s.a.
47	acceleration for position 6	s.a.
48 49	position 7 high word low word	s.a.
50 bit 0-14 50 bit 15	velocity for position 7 relative/absolute flag	s.a.
51	acceleration for position 7	s.a.
52 53	position 8 high word low word	s.a.
54 bit 0-14 54 bit 15	velocity for position 8 relative/absolute flag	s.a.
55	acceleration for position 8	s.a.
56 57	position 9 high word low word	s.a.
58 bit 0-14 58 bit 15	velocity for position 9 relative/absolute flag	s.a.
59	acceleration for position 9	s.a.
60	free	
61	EEProm internal code	
62	status	
63	EEProm checksum	

error codes

E1	number error	a transmitted value is outside the allowed range
E5	syntax error	the transmitted command code could not be allocated correctly
E10	receive CR	end character (CR) was not received or was received too early
E11	receive buffer full	receiving buffer is full. The last character was ignored
E13	GetChar error	internal error during processing of command
E14	unknown command	the received command is unknown (only for # commands)
E16	command mode	the received command is not available in this operation mode
E101	watchdog error	a reset was triggered due to an internal error

error codes in the position mode

1	number error	a transmitted value is outside the allowed range
5	syntax error	the transmitted command code could not be allocated correctly
9	moving error	the transmitted command cannot be executed because a reference run is being carried out at the moment
E18	position error	position-error-window is exceeded