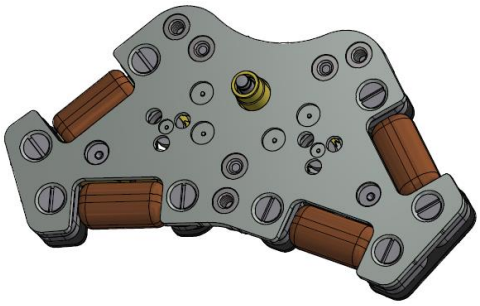
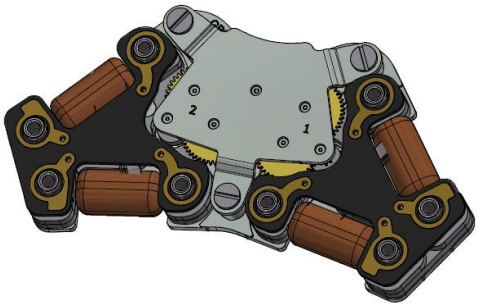
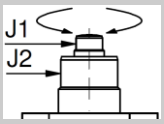
GB22



Bidirectional Gear Box with two independent hands with 1° resolution per hand.

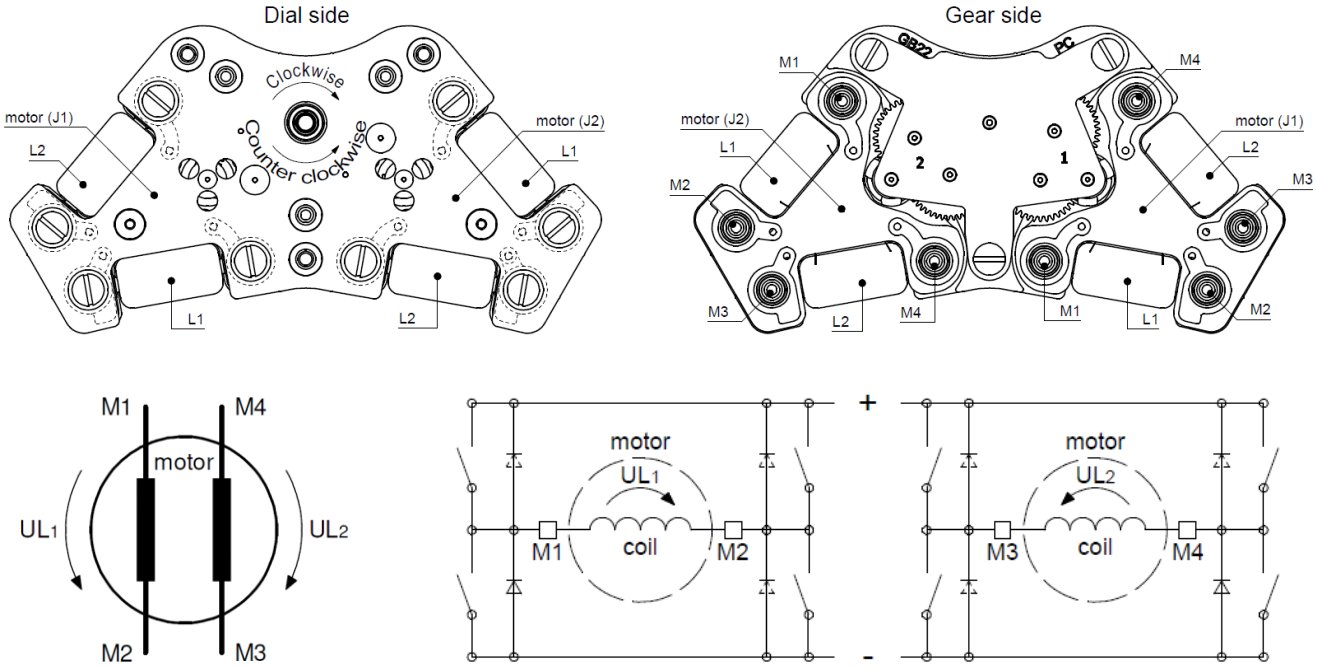


Issued	07.04.2019	dh5221
Modified	11.11.2020	fl5223
Modification No.	40041	
Released	Yes	

Hands		2
Motors		2
Jewels		0
Operating temperature		0…50 °C
Resistance to magnetic fields *		18.8 Oe
Shock resistance *		NIHS 91 - 10
Direction of rotation		bidirectional
Gear reduction	J1, J2	independent
Rotation angle / pulse	J1, J2	1°
Number of pulses for a complete rotation (360°)	J1, J2	360°

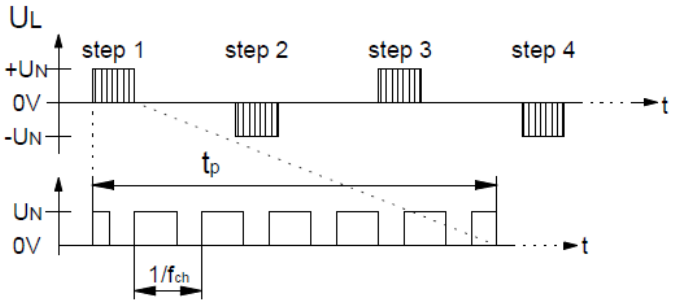
* By using driving methods mentioned on pages 4 and 5.

Principle for the driver electronics



Motor connection no. 1			M1
Motor connection no. 2			M2
Motor connection no. 3			M3
Motor connection no. 4			M4
Coil no. 1			L1
Coil no. 2			L2
Resistance of the coil – typical	Condition	T=20 °C	1‘600 Ohm
Inductance of the coil – typical	Condition	f=1 kHz	1.5 H

Recommended driving method

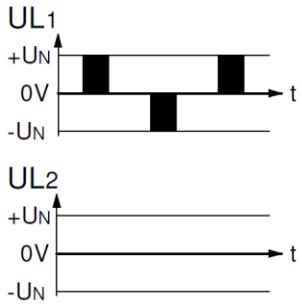
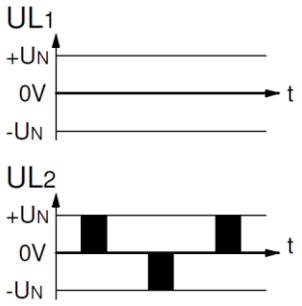


Nominal voltage	U_N	3.0	3.0	3.7	V
Voltage range	U_{min} U_{max}	2.80 3.20	2.20 3.50	2.90 4.50	V V
Duty cycle	PWM	100%	100%	100%	
Pulse width [4]	t_p	3.0	4.0	3.5	ms
Maximal frequency of motor steps [1), 3), 4)]	f_{Step}	60	60	60	$^{steps}/_{s}$
Chopper frequency	f_{ch}	- - -	- - -	- - -	Hz
Current consumption (f_{Step} = 1 step/s) [2), 4)]	I_{mot}	4.0	6.0	6.6	µA
Current consumption (f_{Step} = 60 step/s) [2), 4)]	I_{mot}	240	360	396	µA
Torque [2), 4)]	M	50	50	80	µNm

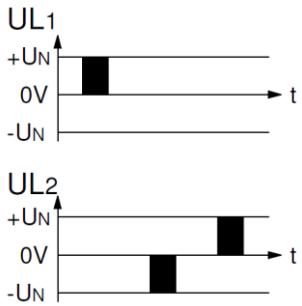
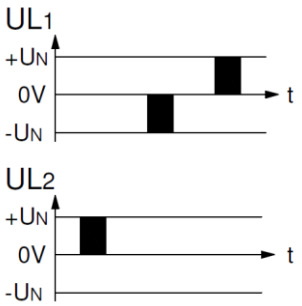
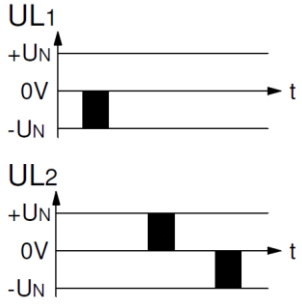
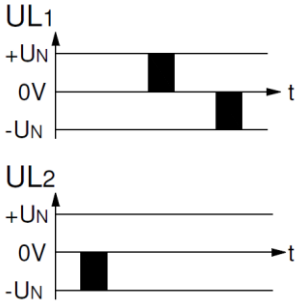
Key:
1) Condition: $U_L = U_N$, T=20 °C
2) typical
3) Tested maximum frequency of motor steps. Higher frequencies may be possible depending on the application.
4) Motor driving with higher frequency: see page 7.

Recommended driving method

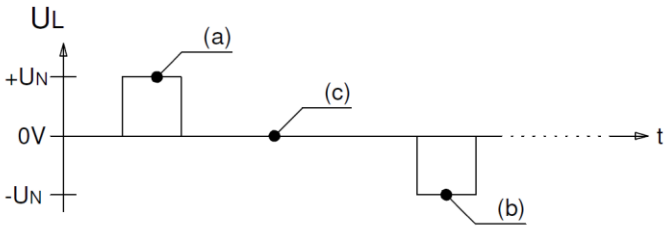
Motor driving in one direction
The following two examples show the motor driving pulses of 3 motor steps to drive the motor in one direction. The motor must be driven by alternating motor pulses.

Direction = clockwise (CW) Sequence of 3 motor steps	**Direction = counter clockwise (CCW)** Sequence of 3 motor steps
	

Change of direction
The following examples show the motor driving pulses for a change of direction

CW → CCW last pulse of a pulse sequence driving the motor CW (ending with a positive voltage pulse) followed by 2 pulses CCW (starting with a negative voltage pulse)	**CCW → CW** last pulse of a pulse sequence driving the motor CCW (ending with a positive voltage pulse) followed by 2 pulses CW (starting with a negative voltage pulse)
	
CW → CCW last pulse of a pulse sequence driving the motor CW (ending with a negative voltage pulse) followed by 2 pulses CCW (starting with a positive voltage pulse)	**CCW → CW** last pulse of a pulse sequence driving the motor CCW (ending with a negative voltage pulse) followed by 2 pulses CW (starting with a positive voltage pulse)
	

Example: recommended driving method



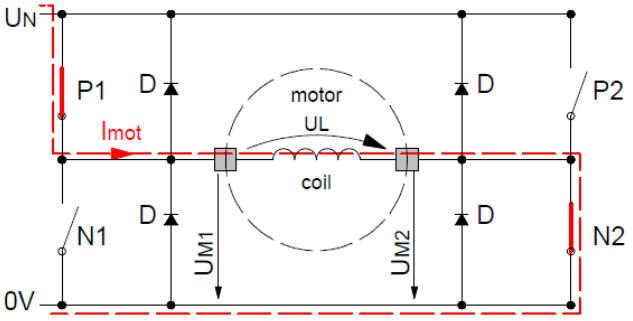
Switching states

(a) positive pulse

$U_L = +U_N$
$U_L = U_{M1} - U_{M2}$

P1, N2 = closed
P2, N1 = open

D = fly back diode

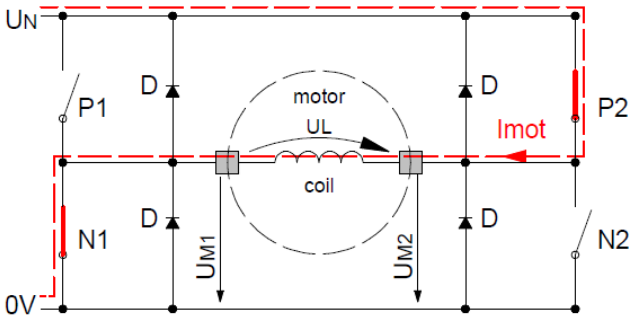


(b) negative pulse

$U_L = -U_N$

P1, N2 = open
P2, N1 = closed

D = fly back diode

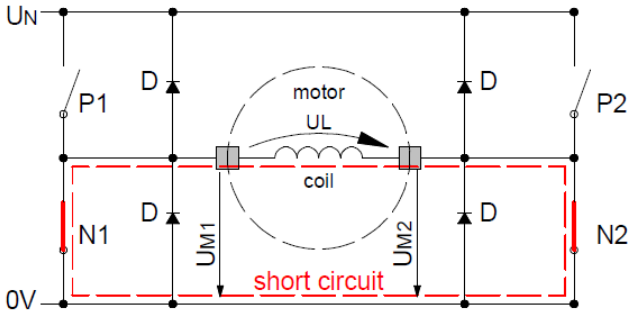


(c) short circuit

$U_L = 0V$

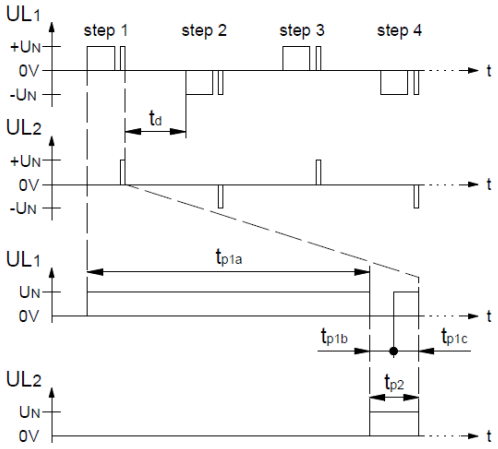
P1, P2 = open
N1, N2 = closed

D = fly back diode

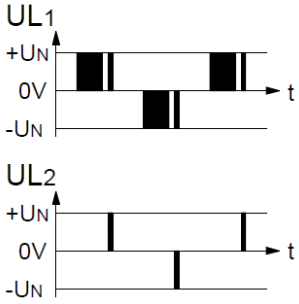
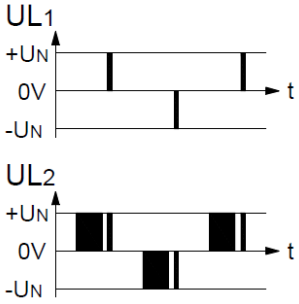


Motor driving method for higher frequency

t_{p1a} = 3.00 ms
t_{p1b} = 0.25 ms
t_{p1c} = 0.25 ms
t_{p2} = t_{p1b} + t_{p1c} = 0.50 ms
t_d ≥ 2.50ms



Motor driving in one direction
The following two examples show the motor driving pulses of 3 motor steps to drive the motor in one direction. The motor must be driven by alternating motor pulses.

Direction = clockwise (CW) Sequence of 3 motor steps	**Direction = counter clockwise (CCW)** Sequence of 3 motor steps
	

Maximal frequency of motor steps [1), 3)]	f_{Step}	167	$^{steps}/_{s}$
Current consumption (fStep = 1 step/s) [2)]	I_{mot}	5.0	µA
Current consumption (fStep = 167 step/s) [2)]	I_{mot}	835	µA
Torque [2)]	M	30	µNm

Key:
1) Condition: $U_L = U_N$, T=20 °C
2) typical
3) Tested maximum frequency of motor steps.