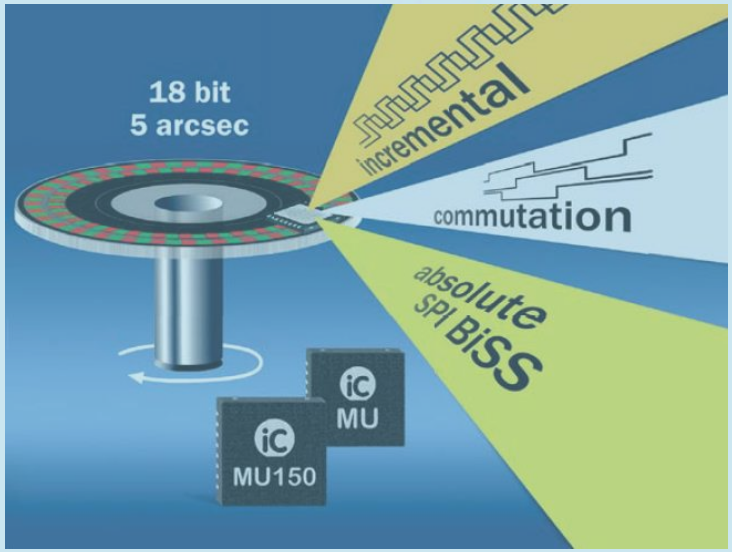
Commutation Signal 생성

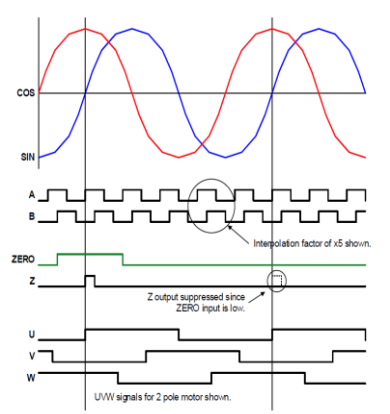
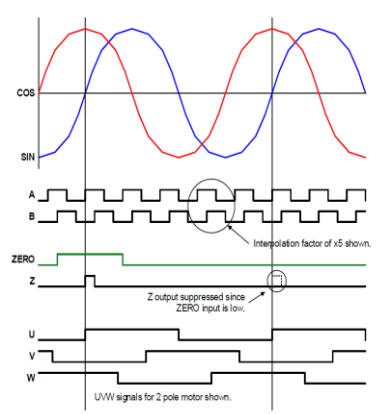
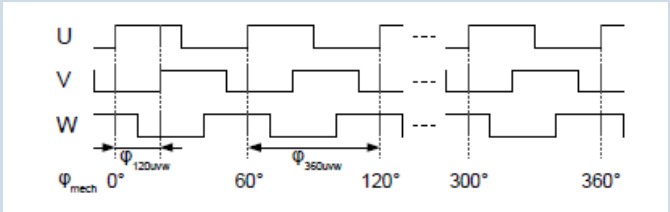
2018.8.27

주식회사 트론



EXACT TRON

BLDC 모터용 Commutation Signal

	1개 Sine & Cosine 파 이용	절대 위치 이용
생성 원리	 Figure 8: iC-TW28 Functional Overview ..... 반복  Figure 8: iC-TW28 Functional Overview	Figure 8: Linear position measurement system 0도 360도 
적용 IC	인터폴레이터 : iC-TW28(~32), iC-TW2(1), iC-PI(~8) 인크리멘탈 자기식 엔코더 : iC-MH8(~4), iC-MH16(~16), iC-MHL200	절대치 자기식 엔코더 iC-MU(~16), iCMU150(~16)
특이 사항	적용 IC의 Sine파 한 주기에 대하여 설정된 자극수로 출력후 사인파 개수만큼 반복하여 출력됨	360도 기계각에 맞추어 설정된 자극수로 출력됨
사용 방법	1. 1회전에 1개 사인파가 출력되는 iC-MH8, MH16을 사용 2. 엔코더 자석 극수를 적용하고자 하는 모터 자석 극수와 동일하거나 ½, ¼ 등으로 선정함 3. 실질적으로 중공형 자기식 엔코더, 광학식 엔코더 적용이 어려움	1. 절대 위치에 대한 시리얼 통신을 수행하는 경우 필요 없음 2. 절대 위치 엔코더를 이용하여 인크리멘탈로 사용하는 경우에 필요함

BLDC 모터용 Commutation Signal

❖ 적용 IC 카타로그 예

iC-PI PROGRAMMABLE 12-BIT Sin/Cos INTERPOLATION IC WITH RS422 DRIVER — preliminary — iC-Haus

Rev B1, Page 35/48

COMMUTATION SIGNALS

Selecting *UVW Mode*, commutation signals become available at pins NA, NB and NZ. The pins PA, PB, and PZ still present the incremental quadrature signals.

The setting of the parameter DUAL is relevant for generating the commutation signals.
For **DUAL = 0**, the commutation signals are derived from the sine input period and are repeated after 1 to 8 fractions of the sine period.
For **DUAL = 1**, the commutation signals are derived from 2 sine input periods and are unique together with the digital word at the input of channel 0. The commutation signals are repeated after 1 to 8 fractions of two sine periods.

POLES	Addr. 0x25, bit 6:4	
Code	Motor Pole Count	UVW Output
0x0	2 poles	1 cpr*, length 360°
0x1	4 poles	2 cpr, length 180°
0x2	6 poles	3 cpr, length 120°
0x3	8 poles	4 cpr, length 90°
0x4	10 poles	5 cpr, length 72°
0x5	12 poles	6 cpr, length 60°
0x6	14 poles	7 cpr, length 51.43°
0x7	16 poles	8 cpr, length 45°
Notes	*) Cycles per revolution with input of 1 sin/cos period per mechanical revolution using DUAL = 0. The setting of POLES is only relevant in *UVW Mode* (MODE = 0x0E).	

Table 52: Pole Count for Commutation Signals

Figure 19 shows the commutation sequence for a motor with 6 pole pairs. Here, a commutation sequence spanning an angle of φ_{360UVW} repeats itself 6 times within one mechanical revolution of the motor's rotor. The phase shift between the commutation signals is 120° related to one signal cycle (360°).

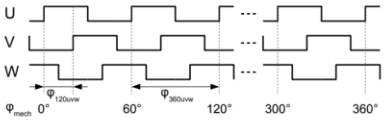


Figure 19: Example of UVW commutation signals.

iC-MU MAGNETIC OFF-AXIS POSITION ENCODER - POLE WIDTH 1.28MM — iC-Haus

Rev D1, Page 48/66

UVW COMMUTATION SIGNALS

MODEB	
Code	Description
0x1	UVW

Table 82: MODEB: UVW

iC-MU can generate commutation signals for BLDC motors from 1 up to 16 pole pairs. The hysteresis is set fixed to 0.0879° referenced to a mechanical revolution.

Figure 45 shows the commutation sequence for a motor with 6 pole pairs. Here, a commutation sequence spanning an angle of φ_{360UVW} repeats itself 6 times within one mechanical revolution of the motor. The phase shift between the commutation signals is 120°.

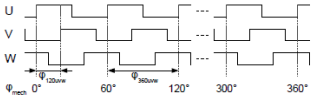


Figure 45: commutation signals UVW

Using parameter PPUVW the number of commutation sequences per mechanical revolution can be set.

PPUVW(5:0)	Addr. 0x17; bit 5:0		
Code	number of pole pairs	Code	number of pole pairs
0x02	1 pole pair	0x1A	9 pole pairs
0x05	2 pole pairs	0x1D	10 pole pairs
0x08	3 pole pairs	0x20	11 pole pairs
0x0B	4 pole pairs	0x23	12 pole pairs
0x0E	5 pole pairs	0x26	13 pole pairs
0x11	6 pole pairs	0x29	14 pole pairs
0x14	7 pole pairs	0x2C	15 pole pairs
0x17	8 pole pairs	0x2F	16 pole pairs

Table 83: Number of commutation signal pole pairs

The sequence of the commutation signals can be selected by φ_{120UVW} as in Figure 45 or with a distance of 60° between two neighboring rising edges referenced to one UVW cycle using parameter PP60UVW.

PP60UVW	Addr. 0x16; bit 3
Code	Phase UVW signals
0	120° phase shift
1	60° phase shift

Table 84: Commutation signal phase length

Register OFF_UVW is used to set the start angle and compensate for the offset between the winding of the BLDC and the Hall sensor signals. This angle can be set with 12 bits.

Note:
After startup or the commands SOFT_RESET and ABS_RESET the OFF_UVW values are amended to include the nonius data, with a configured multiturn updated with the multiturn data, and stored as OFF_COM in the internal RAM.

OFF_UVW(3:0)	Addr. 0x28; bit 7:4
OFF_UVW(11:4)	Addr. 0x29; bit 7:0
OFF_UVW(3:0)	Addr. SER:0x4B; bit 7:4
OFF_UVW(11:4)	Addr. SER:0x4C; bit 7:0
Code	Offset UVW signals
0x000	0.00° mech
0x001	0.09° mech
...	$\frac{360.0° \text{ mech}}{4096} \cdot OFF_UVW$
0xFFF	359.9° mech

Table 85: Commutation signal start angle

OFF_COM(3:0)	Addr. SER:0x23; bit 7:4	R
OFF_COM(11:4)	Addr. SER:0x24; bit 7:0	R
Code	Description	
0x000 ... 0xFFF	start angle commutation signal (automatically computed)	

Table 86: Commutation signal start angle amended by the nonius/MT

The direction of rotation can be inverted with parameter ROT. The parameter affects the output of the data word through the serial interface in MODE_ST=0x0 and 0x1, the ABZ-interface and the UVW-interface.

ROT	Addr. 0x15; bit 7
Code	Description
0	no inversion of direction of rotation
1	inversion of rotation

Table 87: Inverted direction of rotation