Using PLC to send pulse output in order to drive IM motor via C2000 with PG card
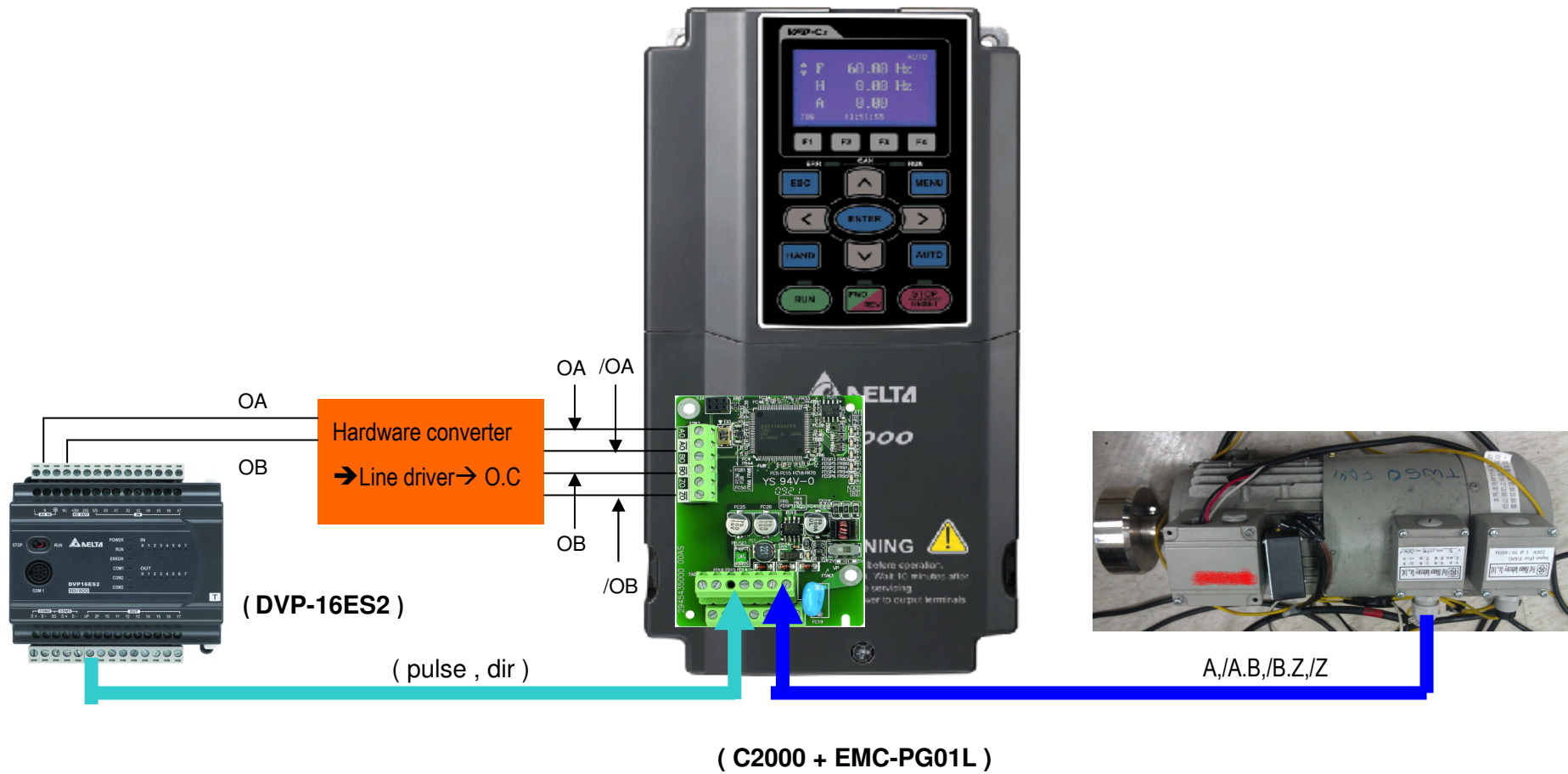
Robert LO 2011/08/22

Outline

1. Configuration

2. Hardware wiring

3. The information about IM Motor and EMC-PG01L

4. The VFD-C2000 parameter setup for auto-tuning

5. The VFD-C2000 parameter setup for connecting PG card

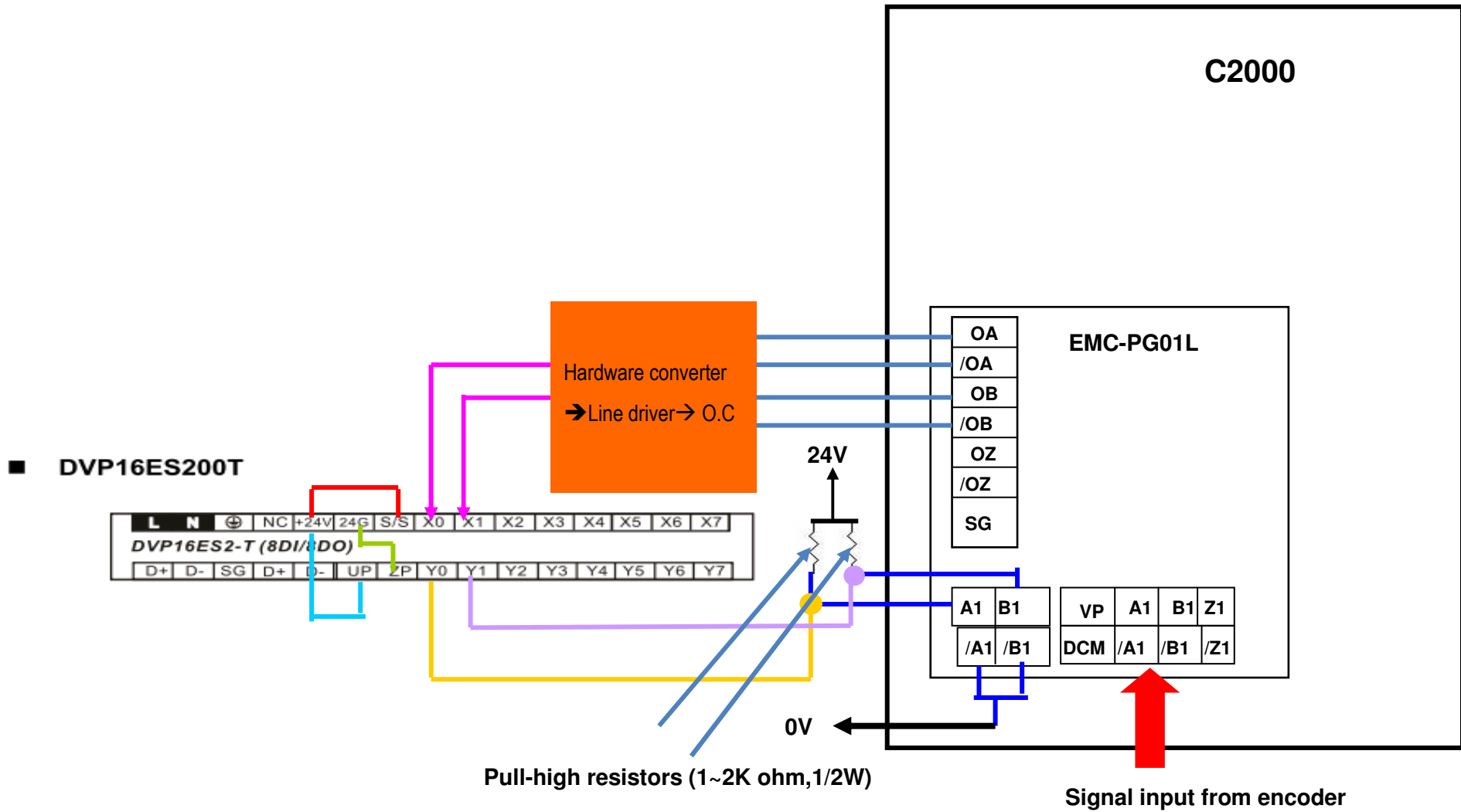6. Pulse output sending via DDRVI instruction and high speed counter of C251/C243
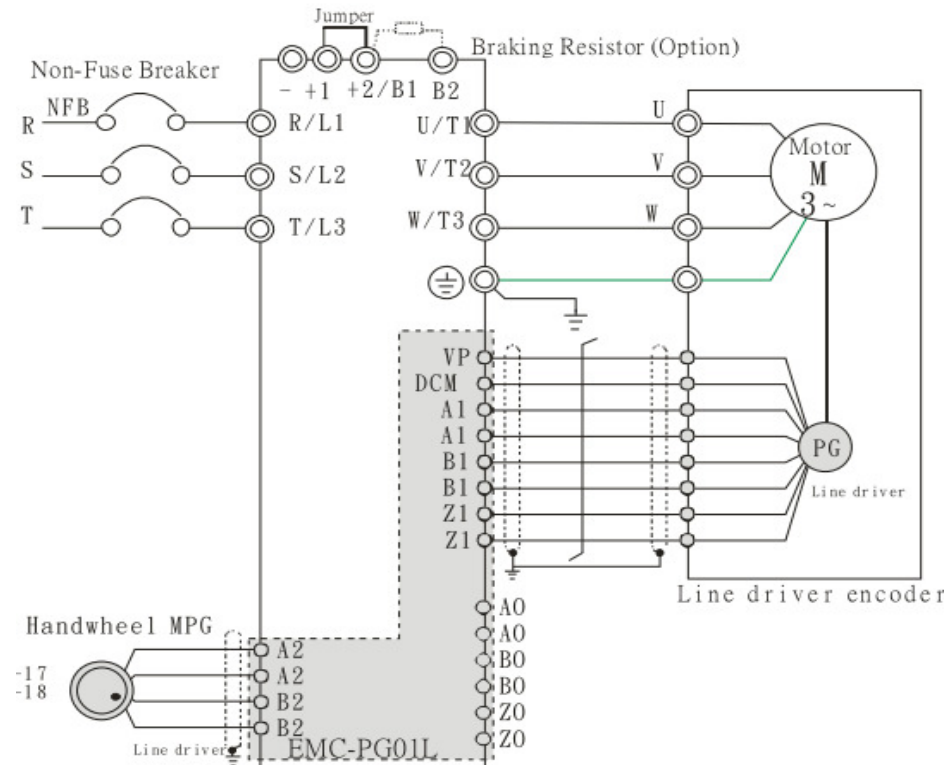
1.Configuration:

OA

Hardware converter
→ Line driver → O.C

OB

OA /OA

OB

/OB

(DVP-16ES2)

(pulse , dir)

A,/A.B,/B.Z,/Z

(C2000 + EMC-PG01L)

2.Hardware wiring:

C2000

EMC-PG01L

| OA |
| /OA |
| OB |
| /OB |
| OZ |
| /OZ |
| SG |

Hardware converter
→ Line driver→ O.C

24V

DVP16ES200T

| L | N | ⏚ | NC | +24V | 24G | S/S | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |

DVP16ES2-T (8DI/8DO)

| D+ | D- | SG | D+ | D- | UP | ZP | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |

| A1 | B1 |
| /A1 | /B1 |

| VP | A1 | B1 | Z1 |
| DCM | /A1 | /B1 | /Z1 |

0V

Pull-high resistors (1~2K ohm,1/2W)

Signal input from encoder

3.The information about IM Motor and EMC-PG01L:

➢ IM motor:
1. Max operation frequency ➔ 50Hz
2. Number of pole ➔ 4
3. Rate power of induction motor ➔ 0.75 KW (1HP)
4. Rate input current ➔ 3.2A
5. Rate Speed ➔ 1395 rpm
6. Encoder resolution of IM➔ 1024

➢ EMC-PG01L:

4.The VFD-C2000 parameter setup for auto-tuning :

➢ Filling in the following parameters: 05-01,05-02,05-03,05-04, before activate the function of

Auto-tuning

01-00	Max. Operation Frequency	50.00~600.00Hz	60.00/ 50.00	→ **50**

Parameter	Explanation	Settings	Factory Setting	
05-00	Motor Auto Tuning	0: No function 1: Measure induction motor in dynamic status (motor spinning) (Rs, Rr, Lm, Lx, no-load current) 2: Measure induction motor in static status (motor not spinning) 3: No function 4: Measure PM motor magnetic pole and PG origin in static status (motor not spinning) 5: Measure PM motor parameter in dynamic status (motor spinning) 6: Measure IM motor flux curve in dynamic status 12: FOC Sensorless inertia estimation	0	→ **1**
05-01	Full-load Current of Induction Motor 1(A)	10~120% of drive's rated current	#.##	→ **3.2**
05-02	Rated Power of Induction Motor 1(kW)	0~655.35kW	#.##	→ **0.75**
05-03	Rated Speed of Induction Motor 1 (rpm)	0~65535 1710(60Hz 4poles) ; 1410(50Hz 4 poles)	1710	→ **1395**
05-04	Pole Number of Induction Motor 1	2~20	4	→ **4**

5.The VFD-C2000 parameter setup for connecting PG card(1) :

00-20	Source of Master Frequency Command（AUTO）	0: Digital keypad 1: RS-485 serial communication 2: External analog input (Pr.03-00) 3: External UP/DOWN terminal 4: Pulse input without direction command (Pr.10-16 without direction) 5: Pulse input with direction command (Pr.10-16) 6: CANopen communication card 7: Reserved 8: Communication card (no CANopen card)	0	→ **5**
00-21	Source of the Operation Command （AUTO）	0: Digital keypad 1: External terminals. Keypad STOP disabled. 2: RS-485 serial communication. Keypad STOP disabled. 3: CANopen communication card 4: Reserved 5: Communication card (no CANopen card)	0	→ **0**
10-00	Encoder Type Selection	0: Disable 1: ABZ 2: ABZ (Delta Encoder for PM motor) 3: Resolver (Standard encoder for PM motor) 4: ABZ/UVW (Standard encoder for PM motor)	0	→ **1**
10-01	Encoder Pulse	1~20000	600	→ **1024**
10-02	Encoder Input Type Setting	0: Disable 1: Phase A leads in a forward run command and phase B leads in a reverse run command 2: Phase B leads in a forward run command and phase A leads in a reverse run command 3: Phase A is a pulse input and phase B is a direction input. (low input=reverse direction, high input=forward direction) 4: Phase A is a pulse input and phase B is a direction input. (low input=forward direction, high input=reverse direction) 5: Single-phase input	0	→ **2**
10-16	Pulse Input Type Setting	0: Disable 1: Phase A leads in a forward run command and phase B leads in a reverse run command 2: Phase B leads in a forward run command and phase A leads in a reverse run command 3: Phase A is a pulse input and phase B is a direction input. (L=reverse direction, H=forward direction). 4: Phase A is a pulse input and phase B is a direction input. (L=forward direction, H=reverse direction). 5: Single-phase input	0	→ **3**

5.1. The VFD-C2000 parameter setup for connecting PG card(2) :

00-11	Control of Speed Mode	0: VF (IM V/f control) 1: VFPG (IM V/f control+ Encoder) 2: SVC(IM Sensorless vector control) 3: FOCPG (IM FOC vector control+ encoder) 4: FOCPG（PM FOC vector control + Encoder） 5: FOC Sensorless (IM field oriented sensorless vector control)	0

02-01	Multi-function Input Command 1 (MI1)
02-02	Multi-function Input Command 2 (MI2)
02-03	Multi-function Input Command 3 (MI3)
02-04	Multi-function Input Command 4 (MI4)
02-05	Multi-function Input Command 5 (MI5)
02-06	Multi-function Input Command 6 (MI6)
02-07	Multi-function Input Command 7 (MI7)
02-08	Multi-function Input Command 8 (MI8)

37: Full position control pulse command input enable

6.Pulse output sending via DDRVI instruction and high speed counter of C251/C243:

API	Mnemonic		Operands				Function		Controllers			
158	D	DRVI	S_1	S_2	D_1	D_2	Relative Position Control		ES2/EX2	SS2	SA2	SX2

Type OP	Bit Devices				Word devices											Program Steps
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F	DDRVI: 17 steps
S_1					*	*	*	*	*	*	*	*	*	*	*	
S_2					*	*	*	*	*	*	*	*	*	*	*	
D_1		*														
D_2		*	*	*												

PULSE				16-bit				32-bit			
ES2/EX2	SS2	SA2	SX2	ES2/EX2	SS2	SA2	SX2	ES2/EX2	SS2	SA2	SX2

Operands:

S_1: Number of pulses (relative positioning) S_2: Pulse output frequency D_1: Pulse output device

D_2: Direction signal output

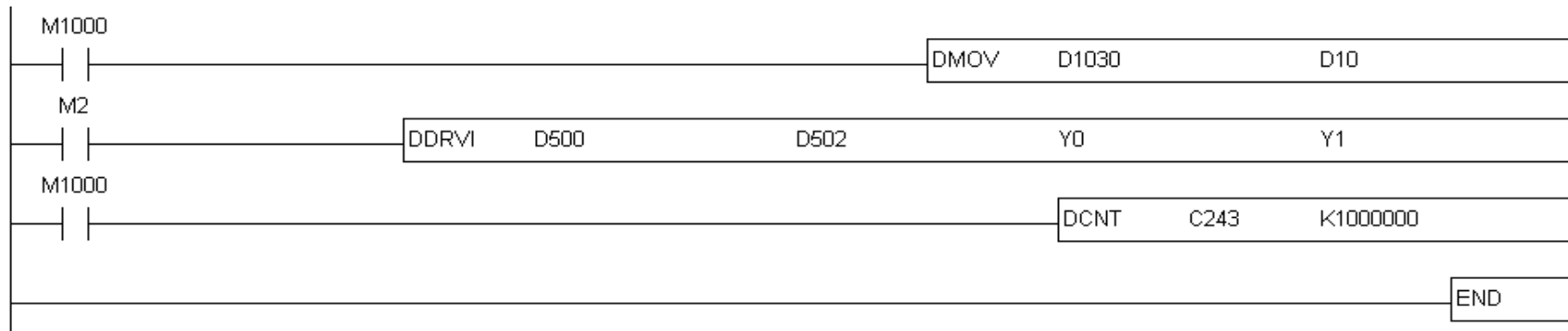| C X	1-phase input		1-phase 2-input						2-phase 2-input			
	C243	C244	C245	C246	C247	C248	C249	C250	C251	C252	C253	C254
X0	U		U/D	U/D	U	U			A	A		
X1	R		Dir	Dir	D	D			B	B		
X2		U					U/D	U/D			A	A
X3		R					Dir	Dir			B	B
X4				R		R				R		
X5								R				R

The max frequency of the 2-phase 2-input counter (X0, X1)(C251, C252) is 5kHz on ES2/EX2

The max frequency of the 2-phase 2-input counter (X2, X3)(C253, C254) is 5kHz on ES2/EX2/SA2 model, 10 kHz on SS2/SX2 model and 50kHz on 32ES211T.

6.1.PLC Ladder program:

```
  M1000
───┤├──────────────────────────────────────[DMOV    D1030            D10    ]
  M2
───┤├─────────────[DDRVI   D500            D502         Y0              Y1    ]
  M1000
───┤├───────────────────────────────────────[DCNT    C243       K1000000   ]

─────────────────────────────────────────────────────────────────[END    ]
```

~ END~

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