

DVP-02HC

High-speed Counter Module Instruction Sheet

1 WARNING

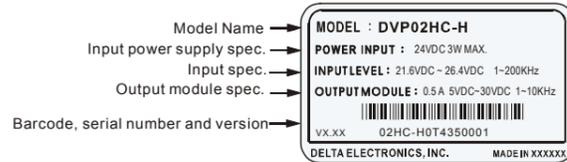
- Please carefully read this instruction thoroughly prior to use the DVP-02HC.
- Make sure that power is OFF before wiring.
- This is an OPEN TYPE PLC. The PLC should be kept in an enclosure away from airborne dust, humidity, electric shock risk and vibration. Also, it is equipped with protective methods such as some special tools or keys to open the enclosure, in order to prevent hazard to users or damage the PLC.
- Do NOT connect the AC main circuit power supply to any of the input/output terminals, or it may damage the PLC. Check all the wiring prior to power up.

2 INTRODUCTION

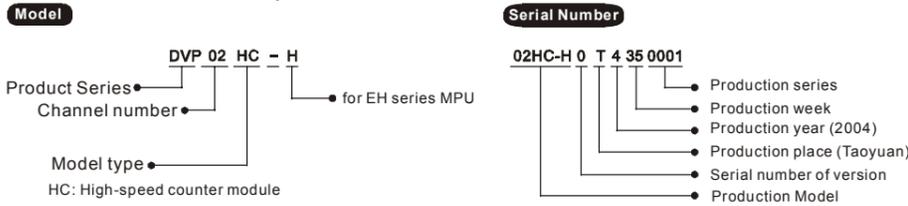
2.1 Model Name Explanation and Peripherals

- Thank you for choosing DELTA's PLC DVP series. DVP-02HC high-speed counter input module could accept 2 sets of 200KHz pulse from external counter. It uses instruction FROM/TO to read/write the data in module via EH MPU. There are 34 Controlled Registers (CR, each register is 16-bit) in each module. 32 bits data consists of two continuous CRs and allow executing itself after setting CR.
- The different counter mode, such as single-phase mode, two phases mode, 16-bit mode or 32-bit mode, can be designated by CR.
- Input signal source could be 1-phase or 2-phase encoder and voltage level could be 24V. Besides, it also provides two terminals, PRESET and DISABLE. When terminal "PRE" is on, current value of counter will be changed to be factory setting. When terminal "DIS" is on, "count" operation is disabled. There are two modes, Sink mode and Source mode, for input wiring.
- There are two outputs, YH0(CH0) and YH1(CH1), in hardware input module of DVP-02HC. When counter value is equal to the setting, the corresponding output will activate. The transistors of outputs are independent and isolated.

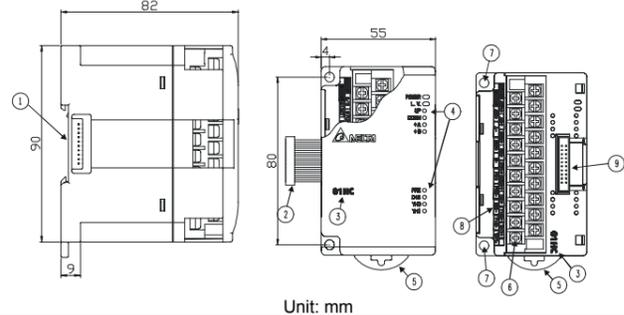
2.2 Nameplate Explanation



2.3 Model and Serial Number Explanation



2.2 Product Profile and Outline



1. DIN rail track (35mm)	6. Terminals
2. Mounting hole for wire to connect extension module/extension unit	7. Mounting hole
3. Model name	8. Terminal layout
4. Indicator status for POWER, ERROR and RUN	9. Mounting port to connect extension unit/extension module
5. DIN rail clip	

LED Display

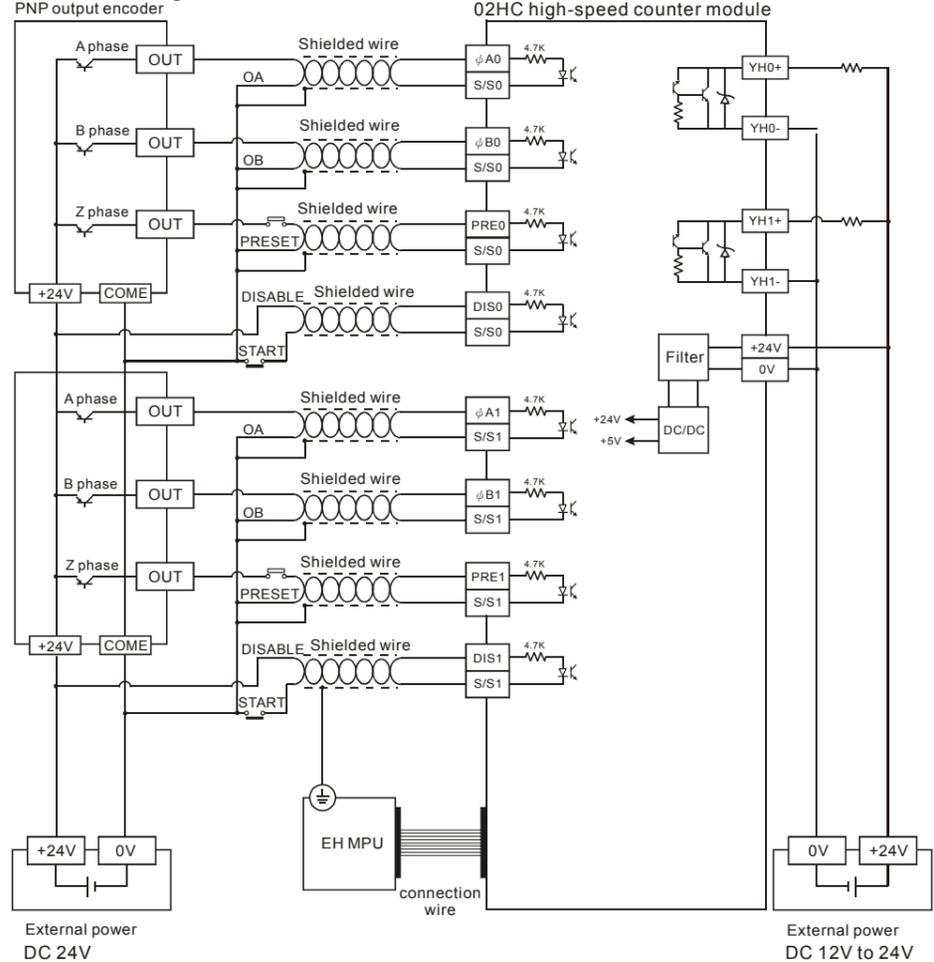
- Power : Power LED. When external +24V power is applied, it will be ON.
- L.V. : Low voltage LED. When external power supply is lower than 19V, it will be ON.
- UP_0 : Count up LED of CH0
- DN_0 : Count down LED of CH0
- A0 : When input A of CH0 is ON, it will light.
- B0 : When input B of CH0 is ON, it will light.

- PRE0 : PRESET LED of CH0. When external terminal PRE0 is ON, it will light.
- DIS0 : DISABLE LED of CH0. When external terminal DIS0 is ON, it will light.
- YH0 : When output YH0 of CH0 is ON, it will light.
- UP_1 : Count up LED of CH1
- DN_1 : Count down LED of CH1
- A1 : When input A of CH1 is ON, it will light.
- B1 : When input B of CH1 is ON, it will light.
- PRE1 : PRESET LED of CH1. When external terminal PRE1 is ON, it will light.
- DIS1 : DISABLE LED of CH1. When external terminal DIS1 is ON, it will light.
- YH1 : When output YH1 of CH1 is ON, it will light.

2.3 Wiring

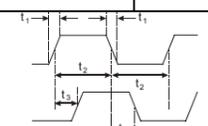
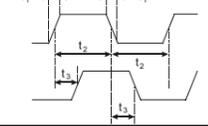
- Please use O-type or Y-type terminals for I/O wiring terminals. The specification for the terminals is as shown on the left. Tighten PLC terminal screws to a torque of 5 to 8 kg-cm (4.3~6.9 in-lbs).
- I/O signal wires or power supply should not run through the same multi-wire cable or conduit.
- Use copper conductor only, 60°C.

External Wiring



- Make sure the positive/negative pole of DVP-02HC input terminal wiring is correct when using NPN encoder.
- Start-up current for DVP-02HC is $I_{PEAK}=0.8A$ and general working current is $I_{MAX}=0.2A$ (input voltage is +24V).

3 SPECIFICATION

Item	1-phase Input		2-phase (A, B) Input		
	1 Input	2 Inputs	Normal Frequency	Double Frequency	Four Times Frequency
Power Supply	DC24V(-15% ~ +20%), Current consumption 140±30mA Power is supplied from PLC or external power supply.				
Max. Number of Connecting Units	8 units; (All I/O points are not occupied. There can be 8 special extension units at most connected to EH series.)				
Input Signal	Voltage Level	Terminals $\Phi A0$, $\Phi B0$, PRE0, DIS0, $\Phi A1$, $\Phi B1$, PRE1 and DIS1: DC24V $\pm 10\%$ Note: ΦA : A Phase, ΦB : B Phase, PRE: Preset and DIS: Disable			
	Max. Count Frequency	200KHz	200KHz	200KHz	100KHz
Waveform					
	t1: rise/fall time $\leq 0.8\mu s$ t2: On/Off pulse width $\geq 2.5\mu s$ t3: phase difference between A phase and B phase $\geq 1\mu s$ PRESET input: input pulse width $\geq 50\mu s$ DISABLE input: input pulse width $\geq 50\mu s$				
Count Specification	There is three count modes: count up/down (2-phase input for AB phase), 1-phase 2 inputs and 1-phase 1 input.				

Item	1-phase Input		2-phase (A, B) Input		
	1 Input	2 Inputs	Normal Frequency	Double Frequency	Four Times Frequency
Range	32-bit mode: -2,147,483,648~+2,147,483,647 16-bit mode: 0~65,536 (upper limit can be set by CH0_CR#4.5 and CH1_CR#6.7)				
Comparison Method	Two comparison values are available. CH0 corresponds to YH0 and CH1 corresponds to YH1. When count value is equal to settings, the output will be ON. It adopts hardware circuit comparison and output settings with real-time handle.				
Output Signal	Output Form		YH0+: output YH0, transistor: Collector YH0-: output YH0, transistor: Emitter YH1+: output YH1, transistor: Collector YH1-: output YH1, transistor: Emitter		
	Output		5V TO 30VDC, 0.5A		
Communication Mode (RS-485)	MODBUS ASCII/RTU Mode. Communication baud rate of 4800 / 9600 / 19200 / 38400 / 57600 / 115200. For ASCII mode, data format is 7Bits, even, 1 stop bit (7 E 1). For RTU mode, data format is 8Bits, even, 1 stop bit (8 E 1). The RS-485 is disabled when the DVP-02HC is connected in series with MPU.				
Connect to DVP-PLC MPU in Series	The module number it connects to MPU from closest to the furthest is from 0 to 7. 8 modules is the max and it won't occupy any digital I/O.				

3.2 Other Specification

Environmental specifications	
Operation/Storage	1. Operation: 0°C~55°C (Temperature), 50~95% (Humidity), pollution degree 2 2. Storage: -25°C~70°C (Temperature), 5~95% (Humidity)
Vibration/Shock immunity	Standard: IEC1131-2, IEC 68-2-6 (TEST Fc) / IEC1131-2 & IEC 68-2-27 (TEST Ea)
Antistatic spec.	All places between terminals and ground comply with the spec.

4 CONTROLLED REGISTER (CR)

DVP-02HC High-speed Counter Module					
HW	LW	CR Number		Content	Setting Range
		Communication Address	Latched Attribute		
#0	H 415E	✓	R	Model type	System used, read only, DVP-02HC model code=H'0220
#1	H 415F	✗	R/W	Count up/down mode setting	1 phase 1 input (Software) count up/down setting, count up:0, count down: 1. Setting CH0: when b0=0, count up. When b0=1, count down. Setting CH1: when b1=0, count up. When b1=1, count down. Factory setting is K0
#2	H 4160	✗	R/W	Instruction	Instruction (Factory setting is K0)

CR#2	'0'(Off)	'1'(On)
b0	Count is disable for CH0	Count is enable for CH0
b1	Preset is disable for CH0	Preset is enable for CH0
b2	Output is disable for YH0	Output is enable for YH0
b3	Reserved	
b4	Count is disable for CH1	Count is enable for CH1
b5	Preset is disable for CH1	Preset is enable for CH1
b6	Output is disable for YH1	Output is enable for YH1
b7	Reserved	
b8	Not used	YH0 output is cleared
b9	Not used	YH0 output setting
b10	Not used	YH1 output is cleared
b11	Not used	YH1 output setting
b12	Not used	Clear error flag
b13-b15	Reserved	

- When b0 is set to 1, disable terminal of CH0 is off. Counter is able to input pulse.
 - When b1 is set to 0, Preset terminal of CH0 is on. Preset function is disabled.
 - When b2 is set to 1, YH0 (hardware comparison output of CH0) output is enabled.
 - When b4 is set to 1, disable terminal of CH1 is off. Counter is able to input pulse.
 - When b5 is set to 0, Preset terminal of CH1 is on. Preset function is disabled.
 - When b6 is set to 1, YH1 (hardware comparison output of CH1) output is enabled.
 - When b8 is set to 1, YH0 output will be set to off.
 - When b9 is set to 1, YH0 output will be set to on.
 - When b10 is set to 1, YH1 output will be set to off.
 - When b11 is set to 1, YH1 output will be set to on.
 - When b12 is set to 1, all error flags (CR#31) will be cleared.
- Setting notes:
- After setting CR#2, b8~b12 will be cleared to 0 automatically.
 - It is necessary to disable count (b0 and b4 should be set to 0 before setting CR#3).

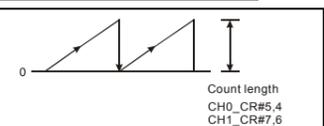
#3	H 4161	✗	R/W	Count mode setting	Count mode K0~K11, factory setting is K0
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Count mode	CH0_CR#3(b3-b0) CH1_CR#3(b7-b4) settings	
	32 bits	16 bits
2-phase 2 inputs	Normal frequency	K0
	Double frequency	K2
	Four times frequency	K4
1-phase 1 input	1-phase 2 inputs	K6
	Count Up/Down is controlled by Hardware (Note 1)	K8
	Count Up/Down is controlled by software (Note 2)	K10
		K9
		K11

Note1: count up/down is controlled by external input.
 Note2: count up/down is controlled by internal control register(CR#1).

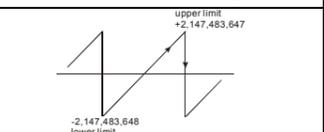
16-bit mode

When it is 16-bit mode, the count values are all positive value and its range is 0~65,536. When overflow event is occurred, count value will be changed from upper limit to 0 or from 0 to upper limit. The upper limit of CH0 is set by CR#4 and CR #5. The upper limit of CH1 is set by CR#7 and CR #6.



32-bit mode

When it is 32-bit mode, the count range is -2,147,483,648 - 2,147,483,647. When overflow event is occurred, count value will be changed from upper limit to lower limit or from lower limit to upper limit. And upper limit is +2,147,483,647 and lower limit is -2,147,483,648.



Setting notices:

- It only can be written when count of CH0 and CH1 are disabled (bit 0 and bit4 of CR#4 are 0).
- After writing, it will initial controlled registers as follows: CR#1=0, CR#4,5=65,536, CR#6,7=65,536, CR#10,11=0, CR#12,13=32,767, CR#14,15: 32,767, CR#16,17=0, CR#18,19=0, CR#20,21=0, CR#22,23=0, CR#24,25=0 and CR#26,27=0.

1-phase 1 input (K8-K11) External input count up/down control (K8-K9)		1-phase 2 inputs (K6-K7) Internal controlled register count up/down control (K10-K11)	
A input: Off (count up) / On (count down) B input: count up / count down count value: 1 2 3 3 2 1 0		A input: pulse of count up / pulse of count down count value: 1 2 3 3 2 1 0	

2-phase 2 inputs (K0-K5) Normal frequency (K0, K1)		Double frequency (K2, K3)		Four times frequency (K4, K5)	
A input: count value 0 1 2 2 1 0 B input: count value 0 1 2 3 4 3 2 1 0		A input: count value 0 1 2 3 4 3 2 1 0 B input: count value 0 1 2 3 4 3 2 1 0		A input: count value 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0 B input: count value 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0	

#5	#4	H 4162	R/W	Ring length of CH0	16-bit mode, factory setting: K65,536
#7	#6	H 4164	R/W	Ring length of CH1	16-bit mode, factory setting: K65,536

Example: M0

Take CH0 as example: Write K200 into first extension module CR#5 and CR#4 (i.e. CR#5 = 0, CR #4 = 200). Setting range: K2 to K65,536.

When ring length is set to K200, the count value will be as shown on the left.
 Count up: when count value reaches 199, the next count value will be 0.
 Count down: when count value reaches 0, the next count value will be 199.

Setting notices:

- It must write with 32-bit.
- It only can be write-in when writing value is greater or equal to current count value.
- It only can be set when counter stops counting and count mode is 16-bit.

#9	#8	H 4166	R/W	CH0 factory setting	Factory setting for CH0 counter (#10: Lower word / #11: Upper word), factory setting: K0 Setting notes: in 16-bit mode, CR#9 will be cleared to 0 when writing factory setting.
#11	#10	H 4168	R/W	CH1 factory setting	Factory setting for CH1 counter (#10: Lower word / #11: Upper word), factory setting: K0 Setting notes: in 16-bit mode, CR#11 will be cleared to 0 when writing factory setting.
#13	#12	H 416A	R/W	YH0 comparison value	YH0 output comparison value (#12: Lower word / #13: Upper word), factory setting: K32,767. Setting notes: in 16-bit mode, CR#13 will be cleared to 0 when writing YH0 comparison value.
#15	#14	H 416C	R/W	YH1 comparison value	YH1 output comparison value (#14: Lower word / #15: Upper word), (factory setting: K32,767). Setting notes: in 16-bit mode, CR#15 will be cleared to 0 when writing YH1 comparison value.

Take CH0 as example: When current value of counter CH0= CH0 comparison value, output YH0 will be ON and hold. User can clear output by using b8 and b10 of CR#2.

If count value of CH0 = comparison value by using PRESET or instruction TO, corresponding output YH0 will be OFF. In other case that count value = comparison value does not use PRESET or instruction TO, corresponding output YH0 will be ON.

#17	#16	H 416E	R/W	Current value of counter for CH0	Current value of counter for CH0 (#16: Lower word / #17: Upper word), factory setting is K0. Setting notices: 1. It must write with 32-bit. 2. In 16-bit mode, value that is written must be less than ring length (CR#4, 5). 3. In 16-bit mode, CR#17 will be cleared to 0 when writing into current value of counter.
#19	#18	H 4170	R/W	Max. count value for CH0	Max. count value for CH0 (#18: Lower word / #19: Upper word), factory setting is K0.
#21	#20	H 4172	R/W	Min. count value for CH0	Min. count value for CH0 (#20: Lower word / #21: Upper word), factory setting is K0.
#23	#22	H 4174	R/W	Current value of counter for CH1	Current value of counter for CH1 (#22: Lower word / #23: Upper word), factory setting is K0. Setting notices: 1. It must write with 32-bit. 2. In 16-bit mode, value that is written must be less than ring length (CR#6, 7). 3. In 16-bit mode, CR#23 will be cleared to 0 when writing into current value of counter.
#25	#24	H 4176	R/W	Max. count value for CH1	Max. count value for CH1 (#24: Lower word / #25: Upper word), factory setting is K0.
#27	#26	H 4178	R/W	Min. count value for CH1	Min. count value for CH1 (#26: Lower word / #27: Upper word), factory setting is K0.
#28	H 417A	R		Comparison result	Comparison result

CR#28		'0'(Off)	'1'(On)	CR#28		'0'(Off)	'1'(On)
YH0	b2	Setting value ≤ current value	Setting value > current value	YH1	b6	Setting value ≤ current value	Setting value > current value
	b1	Setting value ≠ current value	Setting value = current value		b5	Setting value ≠ current value	Setting value = current value

CR#28		'0'(Off)	'1'(On)	CR#28		'0'(Off)	'1'(On)
b0		Setting value ≥ current value	Setting value < current value	b4		Setting value ≥ current value	Setting value < current value

#29	H 417B	R	Action status	The indication of CH0/CH1 count up/down and terminal status(On/Off)			
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CR#29 CH0		'0'(Off)	'1'(On)	CR#29 CH1		'0'(Off)	'1'(On)
b0		-	Count up (Up_0)	b8		-	Count up (Up_1)
b1		-	Count down (Dn_0)	b9		-	Count down (Dn_1)
b2		A0 input is Off	A0 input is On	b10		A1 input is Off	A1 input is On
b3		B0 input is Off	B0 input is On	b11		B1 input is Off	B1 input is On
b4		PRE0 input is Off	PRE0 input is On	b12		PRE1 input is Off	PRE1 input is On
b5		DIS0 input is Off	DIS0 input is On	b13		DIS1 input is Off	DIS1 input is On
b6		YH0 output is Off	YH0 output is On	b14		YH1 output is Off	YH1 output is On
b7		Reserved		b15		Reserved	

#31	H 417D	R	Error Status	Data register that is used to save all error status. Refer to table below.			
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CR#31 Error Status							
b0	Overflow indication of CH0 count up. When count-up value exceeds upper limit(upper limit is CR#4,5 in 16-bit mode and it is K2,147,483,647 in 32-bit mode)						
b1	Overflow indication of CH0. When count-down value is less than lower limit(lower limit is 0 in 16-bit mode and it is K-2,147,483,648 in 32-bit mode)						
b2	Overflow indication of CH1 count up. When count-up value exceeds upper limit(upper limit is CR#6, 7 in 16-bit mode and it is K2,147,483,647 in 32-bit mode)						
b3	Overflow indication of CH1. When count-down value is less than lower limit(lower limit is 0 in 16-bit mode and it is K-2,147,483,648 in 32-bit mode)						
b4-b5	Reserved						
b6	The CR number designated by FROM/TO instruction exceeds range						
b7	RS-485 communication setting (CR#33 and CR#34) error						
b8-b15	Reserved						

#32	H 417E	R	System version	Hexadecimal, display current software version, such as version 1.0A will be displayed as H'010A.			
#33	H 417F	R/W	Communication address setting	Setting RS-485 communication address. Setting range is 01-254. Factory setting is K1.			
#34	H 4180	R/W	Baud Rate Setting	Communication baud rate could be 4800 / 9600 / 19200 / 38400 / 57600 / 115200. For ASCII mode, data format is 7Bits, even, 1 stop bit (7 E 1). For RTU mode, data format is 8Bits, even, 1 stop bit (8 E 1). b0: 4800 bps. b1: 9600 bps. (factory setting) b2: 19200 bps. b3: 38400 bps. b4: 57600 bps. b5-b14: Reserved. b15: ASCII / RTU mode switch.			

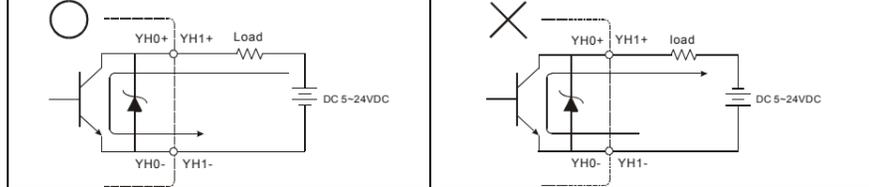
- CR#0-CR#34: The corresponding addresses are H 415E-H 4180 for user to read/write by using RS-485.

 - Baud rate could be 4800, 9600, 19200, 38400 and 57600bps.
 - Communication protocol can be Modbus ASCII mode and RTU mode. For ASCII mode, data format is 7Bits, even, 1 stop bit (7 E 1). For RTU mode, data format is 8Bits, even, 1 stop bit (8 E 1).
 - Function code: 03H: read register data. 06H: write one WORD data into register. 10H: write multiple WORDs into register.

5 TRIAL RUN & TROUBLESHOOTING

- MPU connects to HC extension module

 - Make sure that the power of MPU and extension unit is OFF before wiring.
 - Open extension port of EH MPU and connect to HC extension unit with cable. There is no connection order for EH MPU to connect extension unit, mix connection is allowed.
 - The power supply of HC extension unit must be external +24VDC power supply.
 - Before power up, check if the load circuit of outputs YH0 and YH1 is correct, especially the circuit between YH0+, YH0- and YH1+, YH1-. There is a Zener Diode that is connected between YH0+, YH0- and YH1+, YH1- in HC. If the positive/negative pole is wrong, it may cause unexpected result.



- Before power up, check if A phase or B phase connects to correct voltage level. (there are three voltage level: +24, +12V and +5V) If +24V signal connects to +5V input terminal, it may damage internal circuit.
- After power up MPU, it will start to detect extension module. If no external +24VDC power is applied to HC at this time or power is applied after EH MPU completing detecting extension module, the connection will fail. Therefore, power wiring and power supply timing should be as following.

Power wiring

Power supply timing

Timing analysis

- When power supply for HC is +24V_INT: t5 > t3, power is ON and the connection of HC extension unit is normal.
- When power supply for HC is +24V_EXT: Because start time (t2) of external power supply for HC extension module is unknown, user must make sure that t2+t4 < t1+t5, otherwise HC extension module cannot be detected by MPU.

- After completing above steps, power up MPU and connect to PC with cable WPLACAB215. When using WPLSoft to read peripherals status to make sure that HC connects to MPU.

Open WPLSoft

Click View-Workspace

Workspace display

Double click "EH Series" for communication.

It is communicating.

Complete communicating.

Note: All communication settings, including baud rate, communication port and communication address, should be set before communicating.

It means communication is successful when "02HC" displays in special module.

- The maximum special extension modules number for EH MPU connects is 8 special extension modules. After power is ON, EH will save module codes of connected special modules in D1320-D1327 in order. The module code of 02HC is H'0220. It indicates communication is OK when H'0220 is displayed in the corresponding special D register by using HPP02 or other monitor software.
- Troubleshooting
 - Judge the errors by the indicators on the front panel. When errors occurred on DVP PLC, please check:
 - "POWER" LED: The "POWER" LED at the front of HC extension module will be lit (in green) if the power is on. If the indicator is not on when power up, please remove the wiring on terminals +24V. Once the indicator lights after this, it means that the 24V DC power supply of the PLC is overloaded. Please do not use the DC power supply from the +24V terminals, but use a DC24V power supply instead.
 - "L.V." LED: The "L.V." LED at the front of HC extension module will be lit if input voltage is not enough. The extension module won't active at this time.

6 RELATIVE INSTRUCTIONS AND EXAMPLES

API	FROM	(m1) (m2) (D) (n)	Read Special Module CR Data
78	D	P	

Instruction Explanation: (m1): number of special module (m1=0-7). (m2): CR number of special module that will be read. (D): address for saving reading data. (n): data number for reading once.

Program Example: Writing special module #0 of CR#24 into D0 and special module #0 of CR#25 into D1. only write two data once (n=2).

API	TO	(m1) (m2) (S) (n)	Special Module CR Data Write In
79	D	P	

Instruction Explanation: (m1): number of special module (m1=0-7). (m2): CR number of special module that will be wrote in. (S): data to write in CR. (n): data number to write in once.

Program Example: Using 32-bit instruction DTO to write D11 and D10 into special module#0 of CR#3 and CR#2. only write a data once (n=1).

Application Example:

- Following program is the application example of CH0 for 02HC:
- Setting CR#2 to disable count mode before setting.
 - Setting counter to be 1-phase 1 input (CR#3) of 16-bit mode, ring length of CH0 is 2000 (CR#4, 5) and factory setting is 100 (CR#8). When count value of CH0 reaches 500, YH0 is ON (CR#12).
 - Using X0-X11 to set instructions (CR#2).
 - Reading values, including current value of counter for CH0 (CR#16), max. count value for CH0 (CR#18), min. count value for CH0 (CR#20), comparison result for CH0 (CR#28), terminal status (CR#29) and error status (CR#31).

