Smarter. Greener. Together.

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DVP-PLC **Application Manual Special Modules (S/H2 Series)**

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(S/H2 Series)

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DVP-PLC Application Manual

Special Modules (S/H2 Series)

Contents

Chapter 1 Analog Input Module DVP04AD/DVP06AD

Chapter 2 Analog Output Module DVP02DA/DVP04DA

Chapter 3 Mixed Analog Input/Output Module DVP06XA

Chapter 4 Temperature Measurement Module DVP04PT

Chapter 5 Temperature Measurement Module DVP04TC

Chapter 6 PU Position Control Module

Chapter 12 DeviceNet Slave Communication Module DNA02

Chapter 13 CANopen Slave Communication Module COA02

1.1 The A/D Conversion

In industrial automation, many measuring units are transmitted by analog signals. The most frequently adopted range for the signals are voltage -10 ~ 10V and current -20 ~ 20mA. To use the analog signals as the parameters for PLC operations, you have to convert them into digital values first.

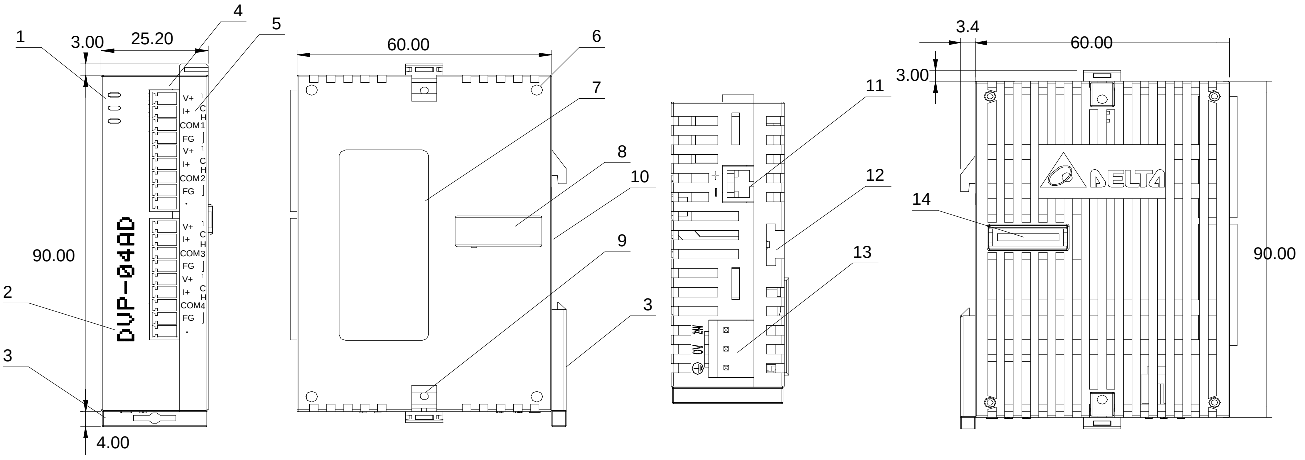
For example, the voltage -10 ~ 10V is first converted into values -8,000 ~ +8,000 by an A/D module, and the PLC will read/write the control registers (CR) in the AD module by FROM/TO instructions. The signals sent back to the PLC for operations will be digital K-8,000 ~ K8,000.

1.2 Introduction

DVP04AD (or DVP06AD) analog signal input module receives external 4 (or 6) points of analog input signals (voltage or current) and converts them into 14-bit digital signals. The MPU can read/write the data in the module by using FROM/TO instructions in the program. There are 49 16-bit control registers in the module. You can select voltage input or current input by the wiring. Range for voltage input: ±10V (±8,000, resolution: 1.25mV). Range for current input: ±20mA (±4,000, resolution: 5μA).

1.3 Product Profile and Outline

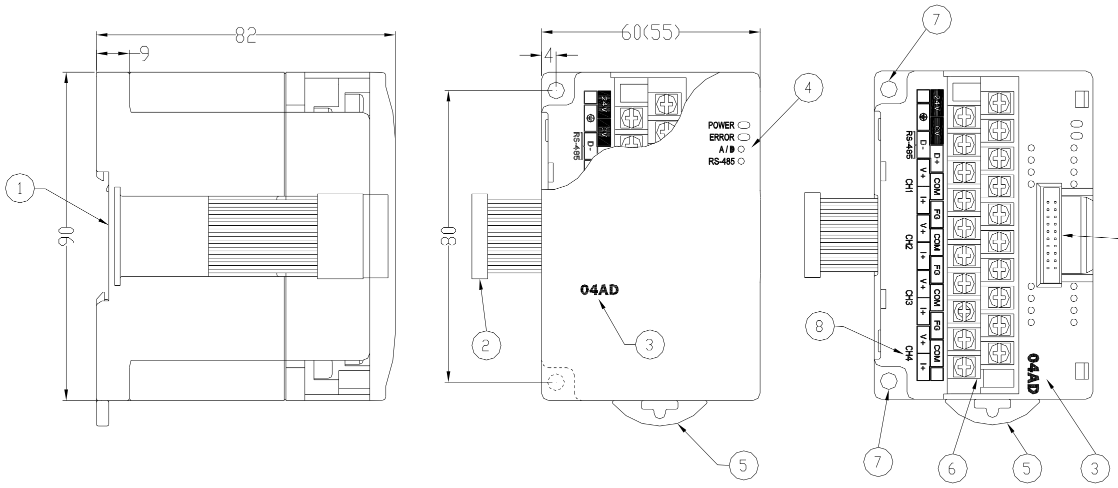
1.3.1 04AD-S



Unit: mm

1. Power, ERROR, A/D indicators	10. DIN rail (35mm)	5. I/O terminals	V+	V+
2. Model name	11. RS-485 communication port		I+	I+
3. DIN rail clip	12. Mounting rail for extension unit/module		COM1	COM3
4. Terminals	13. Power input		FG	FG
5. I/O terminals	14. Connection port for extension unit/module		V+	V+
6. Fixing hole for extension unit/module			I+	I+
7. Nameplate			COM2	COM4
8. Connection port for extension unit/module			FG	FG
9. Fixing clip for extension unit/module			-	-

1.3.2 04AD-H2 (04AD-H)



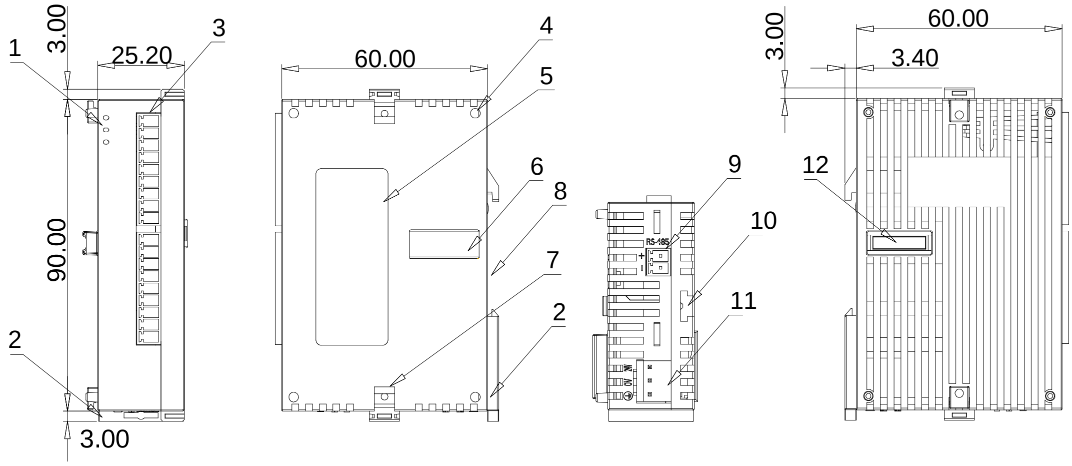
Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals (see below)
4. POWER, ERROR, A/D indicators	9. Mounting port for extension unit/module
5. DIN rail clip	

I/O Terminals:

24V	0V	D+	COM	FG	COM	FG	COM	FG	COM	
	⏚	D-	V+	I+	V+	I+	V+	I+	V+	I+
			CH1		CH2		CH3		CH4	

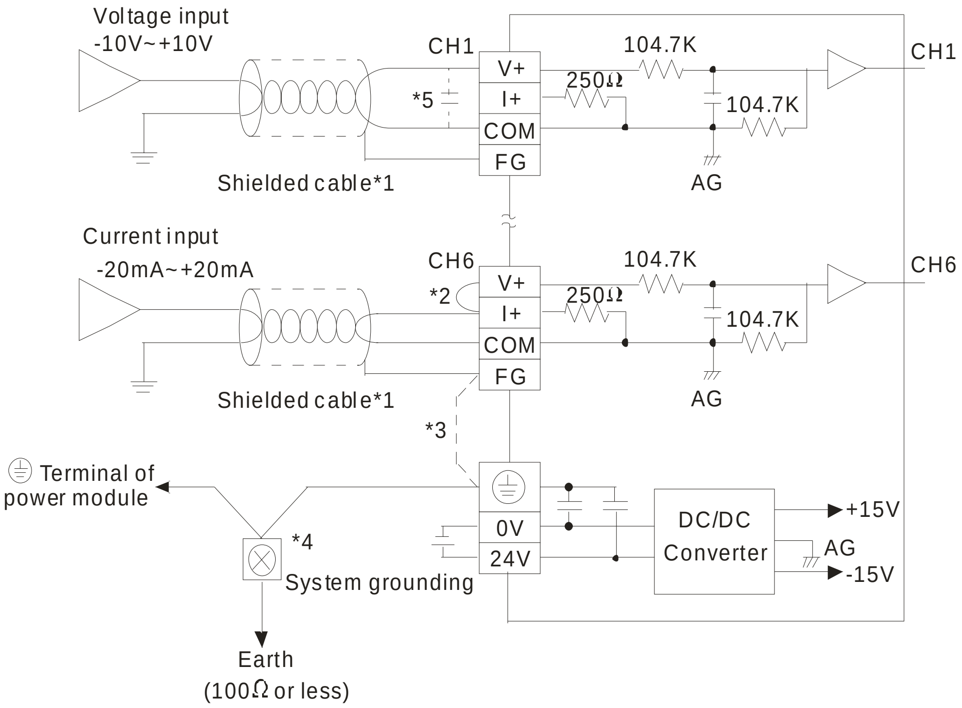
1.3.3 06AD-S



Unit: mm

1. POWER, ERROR, A/D indicator	10. Mounting rail for extension unit/module	5. I/O terminals	V+	V+
2. DIN rail clip	11. Power input		I+	I+
3. Terminals	12. Connection port for extension unit/module		COM1	COM3
4. I/O terminals			FG	FG
5. Nameplate			V+	V+
6. Mounting hole for extension unit/module			I+	I+
7. Extension unit/module fixing clip			COM2	COM4
8. DIN rail (35mm)			FG	FG
9. RS-485 communication port			-	-

1.4 External Wiring



*1: When performing analog input, please isolate other power wirings.

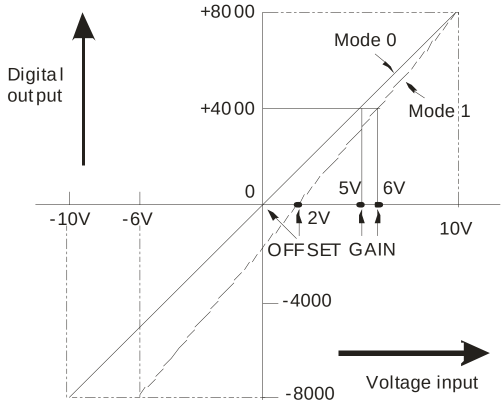
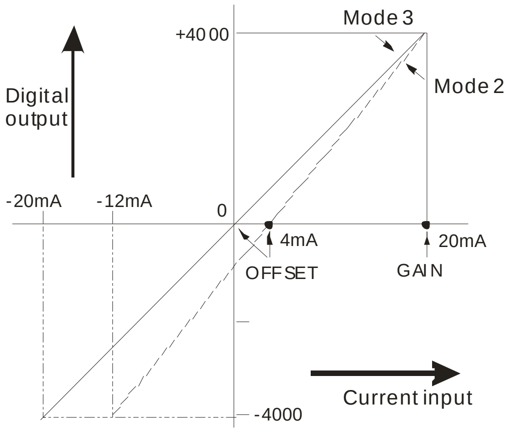
*2: When the A/D module is connected to current signals, make sure you short-circuit “V+” and “I+” terminals.

*3: If the noise is too significant, please connect FG to the grounding terminal.

*4: Please connect the ⏚ terminal on both the power module and A/D module to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

*5: If the ripples at the loaded input terminal are too significant that causes noise interference on the wiring, connect the wiring to 0.1 ~ 0.47μF 25V capacitor.

1.5 Specifications

Analog/Digital module (04AD/06AD)	Voltage input	Current input
Power supply voltage	24 VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)	
Analog input channel	4 channels or 6 channels/module	
Range of analog input	±10V	±20mA
Range of digital conversion	±8,000	±4,000
Resolution	14 bits(1_{LSB} = 1.25mV)	13 bits (1_{LSB} = 5μA)
Input impedance	> 200 KΩ	250Ω
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range of 0 ~ 55°C (32 ~ 131°F)	
Response time	3 ms × the number of channels	
Isolation	Isolation between digital area and analog area. No isolation among analog channels.	
Range of absolute input	±15V	±32mA
Digital data format	13 significant bits out of 16 bits are available; in 2's complement	
Average function	Yes. Available for setting up in CR#2 ~ CR#5. Range for 04AD-S: K1 ~ K4,096, for 04AD-H/06AD-S: K1 ~ K20.	
Self-diagnosis	Upper and lower bound detection/channels	
Communication mode (RS-485)	ASCII/RTU mode Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. Max. 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	
A/D conversion curve (Default: mode 0)	Mode 0: (-10V ~ +10V), Mode 1: (-6V ~ +10V)  Mode 2: (-12 mA ~ +20 mA), Mode 3: (-20mA ~ +20mA)  	

<table>
<tr><td>Operation/storage</td><td>1. Operation: 0°C ~ 55°C (temperature), 50 ~ 95% (humidity), pollution degree 2
2. Storage: -25°C ~ 70°C (temperature), 5 ~ 95% (humidity)</td></tr>
<tr><td>Vibration/shock immunity</td><td>International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)</td></tr>
<tr><td colspan="2">Power supply</td></tr>
<tr><td>Max. rated power consumption</td><td>24VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%), (-S)2W, (-H)2.5W, supplied by external power</td></tr>
</table>

1.6 CR (Control Register)

1.6.1 CR in DVP04AD

<table>
<tr><th colspan="5">DVP04AD</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4000</td><td>O</td><td>R</td><td>Model name</td><td colspan="16">Set up by the system:
DVP04AD-S model code = H’0088
DVP04AD-H model code = H’0400
DVP04AD-H2 model code = H’6400</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’4001</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Input mode setting</td><td colspan="4">Reserved</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Input mode: Default = H’0000. Take CH1 for example:
Mode 0 (b0 ~ b2 = 000): Voltage input (-10V ~ +10V).
Mode 1 (b0 ~ b2 = 001): Voltage input (-6V ~ +10V).
Mode 2 (b0 ~ b2 = 010): Current input (-12mA ~ +20mA).
Mode 3 (b0 ~ b2 = 011): Current input (-20mA ~ +20mA).</td></tr>
<tr><td>#2</td><td>H’4002</td><td>O</td><td>R/W</td><td>CH1 average time</td><td colspan="16" rowspan="4">Range of settings in CH1 ~ CH4:
DVP04AD-S = K1 ~ K4,096
DVP04AD-H = K1 ~ K20
Default = K10</td></tr>
<tr><td>#3</td><td>H’4003</td><td>O</td><td>R/W</td><td>CH2 average time</td></tr>
<tr><td>#4</td><td>H’4004</td><td>O</td><td>R/W</td><td>CH3 average time</td></tr>
<tr><td>#5</td><td>H’4005</td><td>O</td><td>R/W</td><td>CH4 average time</td></tr>
<tr><td>#6</td><td>H’4006</td><td>X</td><td>R</td><td>CH1 input average</td><td colspan="16" rowspan="4">Average of input signals at CH1 ~ CH4</td></tr>
<tr><td>#7</td><td>H’4007</td><td>X</td><td>R</td><td>CH2 input average</td></tr>
<tr><td>#8</td><td>H’4008</td><td>X</td><td>R</td><td>CH3 input average</td></tr>
<tr><td>#9</td><td>H’4009</td><td>X</td><td>R</td><td>CH4 input average</td></tr>
<tr><td colspan="2">#10 ~ #11</td><td colspan="19">Reserved</td></tr>
<tr><td>#12</td><td>H’400C</td><td>X</td><td>R</td><td>CH1 input present value</td><td colspan="16" rowspan="4">Present value of input signals at CH1 ~ CH4</td></tr>
<tr><td>#13</td><td>H’400D</td><td>X</td><td>R</td><td>CH2 input present value</td></tr>
<tr><td>#14</td><td>H’400E</td><td>X</td><td>R</td><td>CH3 input present value</td></tr>
<tr><td>#15</td><td>H’400F</td><td>X</td><td>R</td><td>CH4 input present value</td></tr>
<tr><td colspan="2">#16 ~ #17</td><td colspan="19">Reserved</td></tr>
<tr><td>#18</td><td>H’4012</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH1</td><td colspan="16" rowspan="4">OFFSET settings at CH1 ~ CH4 signal. Default = K0; Unit: LSB.
When voltage input, range: K-4,000 ~ K4,000.
When current input, range: K-4,000 ~ K4,000.</td></tr>
<tr><td>#19</td><td>H’4013</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH2</td></tr>
<tr><td>#20</td><td>H’4014</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H’4015</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH4</td></tr>
<tr><td colspan="2">#22 ~ #23</td><td colspan="19">Reserved</td></tr>
<tr><td>#24</td><td>H’4018</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH1</td><td colspan="16">GAIN settings at CH1 ~ CH4. Default =K4,000; Unit: LSB.</td></tr>
</table>

<table>
<tr><th colspan="5">DVP04AD</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#25</td><td>H’4019</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH2</td><td colspan="16" rowspan="3">When voltage input, range: K-3,200 ~ K16,000.
When current input, range: K-3,200 ~ K10,400.</td></tr>
<tr><td>#26</td><td>H’401A</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH3</td></tr>
<tr><td>#27</td><td>H’401B</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH4</td></tr>
<tr><td colspan="2">#28 ~ #29</td><td colspan="19">Reserved</td></tr>
<tr><td>#30</td><td>H’401E</td><td>X</td><td>R</td><td>Error status</td><td colspan="16">Register for storing all error status. See the table of error status for more information.</td></tr>
<tr><td>#31</td><td>H’401F</td><td>O</td><td>R/W</td><td>Communication address setting</td><td colspan="16">For setting RS-485 communication address: Range: 01 ~ 255.
Default = K1</td></tr>
<tr><td>#32</td><td>H’4020</td><td>O</td><td>R/W</td><td>Communication speed (baud rate) setting</td><td colspan="16">4,800/9,600/19,200/38,400/57,600/115,200bps are available.
ASCII data format: 7-bit, Even, 1 stop bit (7,E,1).
RTU data format: 8-bit, Even, 1 stop bit (8,E,1).
Default = H’0002
b0: 4,800 bps
b1: 9,600 bps (Default)
b2: 19,200 bps
b3: 38,400 bps
b4: 57,600 bps
b5: 115,200 bps
b6 ~ b13: reserved
b14: High/low bit exchange of CRC checksum (only valid in RTU)
b15: Switch between ASCII/RTU mode, 0 = ASCII mode(default)</td></tr>
<tr><td rowspan="3">#33</td><td rowspan="3">H’4021</td><td rowspan="3">O</td><td rowspan="3">R/W</td><td rowspan="3">Returning to default setting; OFFSET/GAIN tuning authorization</td><td>b15</td><td>b14</td><td>b13</td><td>b12</td><td>b11</td><td>b10</td><td>b9</td><td>b8</td><td>b7</td><td>b6</td><td>b5</td><td>b4</td><td>b3</td><td>b2</td><td>b1</td><td>b0</td></tr>
<tr><td colspan="4">Reserved</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Default = H’0000. Take the setting of CH1 for example:
1. When b0 = 0, the user is allowed to tune CR#18 and CR#24 of CH1. When b0 = 1, the user is not allowed to tune CR#18 and CR#24 of CH1.
2. b1 represents whether the OFFSET/GAIN tuning register is latched. b1 = 0 (OFFSET/GAIN tuning register latched). b1 = 1 (OFFSET/GAIN tuning register non-latched). This function is only valid when in RS-485 communication.
3. When b2 = 1, all settings will return to default values (except CR#31 and CR#32)</td></tr>
<tr><td>#34</td><td>H’4022</td><td>O</td><td>R</td><td>Firmware version</td><td colspan="16">Displaying the current firmware version in hex.</td></tr>
<tr><td colspan="2">#35 ~ #48</td><td colspan="19">For system use</td></tr>
<tr><td colspan="21">Symbols:
O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485
LSB (Least Significant Bit): For voltage input: 1_{LSB} = 10V/8,000 = 1.25mV; for current input: 1_{LSB} = 20mA/4,000 = 5μA.</td></tr>
</table>

1.6.2 CR in DVP06AD

<table>
<tr><th colspan="5">DVP06AD</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4000</td><td>O</td><td>R</td><td>Model name</td><td colspan="16">Set up by the system. DVP06AD-S model code = H’00C8</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’4001</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Input mode setting</td><td colspan="4">Reserved</td><td colspan="2">CH6</td><td colspan="2">CH5</td><td colspan="2">CH4</td><td colspan="2">CH3</td><td colspan="2">CH2</td><td colspan="2">CH1</td></tr>
<tr><td colspan="16">Input mode: default = H’0000. Take CH1 for example:
Mode 0 (b0 ~ b1 = 00): Voltage input (-10V ~ +10V).
Mode 1 (b0 ~ b1 = 01): Voltage input (-6V ~ +10V).
Mode 2 (b0 ~ b1 = 10): Current input (-12mA ~ +20mA).
Mode 3 (b0 ~ b1 = 11): Current input (-20mA ~ +20mA).</td></tr>
<tr><td>#2</td><td>H’4002</td><td>O</td><td>R/W</td><td>Average time</td><td colspan="8">CH2</td><td colspan="8">CH1</td></tr>
<tr><td>#3</td><td>H’4003</td><td>O</td><td>R/W</td><td>Average time</td><td colspan="8">CH4</td><td colspan="8">CH3</td></tr>
<tr><td>#4</td><td>H’4004</td><td>O</td><td>R/W</td><td>Average time</td><td colspan="8">CH6</td><td colspan="8">CH5</td></tr>
<tr><td colspan="21">Range of setting in CH1 ~ CH6: K1 ~ K20. Default = K10. Default settings of CR#2 ~ #4 are all H’0A0A</td></tr>
<tr><td colspan="2">#5</td><td colspan="19">Reserved</td></tr>
<tr><td>#6</td><td>H’4006</td><td>X</td><td>R</td><td>CH1 input average</td><td colspan="16" rowspan="6">Average of input signals at CH1 ~ CH6.</td></tr>
<tr><td>#7</td><td>H’4007</td><td>X</td><td>R</td><td>CH2 input average</td></tr>
<tr><td>#8</td><td>H’4008</td><td>X</td><td>R</td><td>CH3 input average</td></tr>
<tr><td>#9</td><td>H’4009</td><td>X</td><td>R</td><td>CH4 input average</td></tr>
<tr><td>#10</td><td>H’400A</td><td>X</td><td>R</td><td>CH5 input average</td></tr>
<tr><td>#11</td><td>H’400B</td><td>X</td><td>R</td><td>CH6 input average</td></tr>
<tr><td>#12</td><td>H’400C</td><td>X</td><td>R</td><td>CH1 input present value</td><td colspan="16" rowspan="6">Present value of input signals at CH1 ~ CH6.</td></tr>
<tr><td>#13</td><td>H’400D</td><td>X</td><td>R</td><td>CH2 input present value</td></tr>
<tr><td>#14</td><td>H’400E</td><td>X</td><td>R</td><td>CH3 input present value</td></tr>
<tr><td>#15</td><td>H’400F</td><td>X</td><td>R</td><td>CH4 input present value</td></tr>
<tr><td>#16</td><td>H’4010</td><td>X</td><td>R</td><td>CH5 input present value</td></tr>
<tr><td>#17</td><td>H’4011</td><td>X</td><td>R</td><td>CH6 input present value</td></tr>
<tr><td>#18</td><td>H’4012</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH1</td><td colspan="16" rowspan="6">OFFSET settings at CH1 ~ CH6. Default = K0; unit: LSB.
When voltage input, range: K-4,000 ~ K4,000.
When current input, range: K-4,000 ~ K4,000.</td></tr>
<tr><td>#19</td><td>H’4013</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH2</td></tr>
<tr><td>#20</td><td>H’4014</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H’4015</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH4</td></tr>
<tr><td>#22</td><td>H’4016</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH5</td></tr>
<tr><td>#23</td><td>H’4017</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH6</td></tr>
<tr><td>#24</td><td>H’4018</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH1</td><td colspan="16" rowspan="6">GAIN settings at CH1 ~ CH6. Default = K4,000; Unit: LSB.
When voltage input, range: K-3,200 ~ K16,000.
When current input, range: K-3,200 ~ K10,400.</td></tr>
<tr><td>#25</td><td>H’4019</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH2</td></tr>
<tr><td>#26</td><td>H’401A</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH3</td></tr>
<tr><td>#27</td><td>H’401B</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH4</td></tr>
<tr><td>#28</td><td>H’401C</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH5</td></tr>
<tr><td>#29</td><td>H’401D</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH6</td></tr>
</table>

<table>
<tr><th colspan="5">DVP06AD</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#30</td><td>H’401E</td><td>X</td><td>R</td><td>Error status</td><td colspan="16">Register for storing all error status. See the table of error status for detail.</td></tr>
<tr><td>#31</td><td>H’401F</td><td>O</td><td>R/W</td><td>Communication address setting</td><td colspan="16">For setting up RS-485 communication address. Range: 01 ~ 255.
Default = K1</td></tr>
<tr><td>#32</td><td>H’4020</td><td>O</td><td>R/W</td><td>Communication baud rate setting</td><td colspan="16">4,800/9,600/19,200/38,400/57,600/115,200bps are available.
ASCII data format: 7-bit, Even, 1 stop bit (7,E,1).
RTU data format: 8-bit, Even, 1 stop bit (8,E,1).
Default = H’0002
b0: 4,800 bps
b1: 9,600 bps (Default)
b2: 19,200 bps
b3: 38,400 bps
b4: 57,600 bps
b5: 115,200 bps
b6 ~ b13: reserved
b14: High/low bit exchange of CRC checksum (only valid in RTU)
b15: Switch between ASCII/RTU mode, 0 = ASCII mode(default)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>b15</td><td>b14</td><td>b13</td><td>b12</td><td>b11</td><td>b10</td><td>b9</td><td>b8</td><td>b7</td><td>b6</td><td>b5</td><td>b4</td><td>b3</td><td>b2</td><td>b1</td><td>b0</td></tr>
<tr><td rowspan="2">#33</td><td rowspan="2">H’4021</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Returning to default setting; OFFSET/GAIN tuning authorization</td><td colspan="4">Return to default setting</td><td colspan="2">CH6</td><td colspan="2">CH5</td><td colspan="2">CH4</td><td colspan="2">CH3</td><td colspan="2">CH2</td><td colspan="2">CH1</td></tr>
<tr><td colspan="16">Default = H’0FFF. Take the setting of CH1 for example:
1. b0: switch for upper/lower bound alarm on the input value for the channel. 0 = disabled; 1 = enabled (default)
2. b1: OFFSET/GAIN tuning. 0 = forbidden; 1 = allowed (default)
3. When b12 ~ b15 = 1, all values in CH1 ~ CH6 will return to default settings (except CR#31, CR#32). b12 ~ b15 will return to 0 automatically after the setting is completed.</td></tr>
<tr><td>#34</td><td>H’4022</td><td>O</td><td>R</td><td>Firmware version</td><td colspan="16">Displaying the current firmware version in hex.</td></tr>
<tr><td colspan="2">#35 ~ #48</td><td colspan="19">System used</td></tr>
<tr><td colspan="21">Symbols:
O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485
LSB (Least Significant Bit): For voltage input: 1_{LSB} = 10V/8,000 = 1.25mV; for current input: 1_{LSB} = 20mA/4,000 = 5μA.

The corresponding parameters address H’4000 ~ H’4022 of CR#0 ~ CR#34 are provided for user to read/write data by RS-485 communication.
1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII / RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).</td></tr>
</table>

1.6.3 Explanation on CR

CR#0: Model name

[Explanation]

1. DVP04AD-S model code = H’0088
2. DVP04AD-H model code = H’0400
3. DVP04AD-H2 model code = H’6400
4. DVP06AD-S model code = H’00C8
5. You can read the model name in the program to see if the extension module exists.

CR#1: Input mode setting

[Explanation]

The working mode of the channels in the analog input module. There are 4 modes for each channel which can be set up separately. The default setting = H’000

For 04AD:

When you set CH1 as mode 0 (b2 ~ b0 = 000), CH2 as mode 1 (b5 ~ b3 = 001), CH3 as mode 2 (b8 ~ b6 = 010), and CH4 as mode 3 (b11 ~ b9 = 011), CR#1 has to be set as H’0688. The higher bits (b12 ~ b15) will be reserved.

For 06AD:

When you set CH1 as mode 0 (b1 ~ b0 = 00), CH2 as mode 1 (b3 ~ b2 = 01), CH3 as mode 2 (b5 ~ b4 = 10), CH4 as mode 3 (b7 ~ b6 = 11), CH5 as mode 0 (b9 ~ b8 = 00), and CH6 as mode 0 (b11 ~ b10 = 00), CR#1 has to be set as H’00E4. The higher bits (b12 ~ b15) will be reserved.

CR#2, 3, 4, 5: Channel average time

[Explanation]

The settings of average times of the signals at CH1 ~ CH4. Please note that the average time settings at CR#2 ~ CR#5 only need to be written in once.

For 04AD:

1. The setup range for 04AD-S: K1 ~ K4,096. Default = K10.
2. The setup range for 04AD-H: K1 ~ K20. Default = K10.

For 06AD:

1. The setup range for 06AD-S: K1 ~ K20. Default = K10.
2. The default setting for CR#2 ~ #4: H’0A0A
3. CR#2 (b7 ~ b0) is for the average time at CH1. CR#2 (b15 ~ b8) is for the average time at CH2.
4. CR#3 (b7 ~ b0) is for the average time at CH3. CR#3 (b15 ~ b8) is for the average time at CH4.
5. CR#4 (b7 ~ b0) is for the average time at CH5. CR#4 (b15 ~ b8) is for the average time at CH6.

CR#6, 7, 8, 9, 10, 11: Input average values at CH1 ~ CH6

[Explanation]

The average of the signals at CH1 ~ CH6 obtained from the settings in CR#2 ~ CR#5. For example, if the settings in CR#2 ~ CR#5 is 10, the content in CR#6 ~ CR#11 will be the average of the most recent 10 signals at CH1 ~ CH6.

CR#12, 13, 14, 15, 16, 17: Input present value at CH1 ~ CH6

[Explanation]

The present value of input signals at CH1 ~ CH6.

CR#18, 19, 20, 21, 22, 23: Adjusted OFFSET value of CH1 ~ CH6

[Explanation]

1. The adjusted OFFSET value of CH1 ~ CH6, representing the analog input voltage or current when the analog signal is converted into digital value 0.

   The adjustable range of voltage: -5V ~ +5V ($-4,000_{LSB}$ ~ $+4,000_{LSB}$)

   The adjustable range of current: - 20mA ~ +20mA ($-4,000_{LSB}$ ~ $+4,000_{LSB}$)
2. Default setting = K0; unit: LSB.

CR#24, 25, 26, 27, 28, 29: Adjusted GAIN value of CH1 ~ CH6

[Explanation]

1. The adjusted GAIN value of CH1 ~ CH6, representing the analog input voltage or current when the analog signal is converted into digital value 4,000.

   The adjustable range of voltage: -4V ~ +20V ($-3,200_{LSB}$ ~ $+16,000_{LSB}$)

   The adjustable range of current: -16mA ~ +52mA ($-3,200_{LSB}$ ~ $+10,400_{LSB}$)
2. Please note that: GAIN value – OFFSET value = $+800_{LSB}$ ~ $+12,000_{LSB}$ (voltage) or $+800_{LSB}$ ~ $+6,400_{LSB}$ (current). When GAIN – OFFSET is small (steep oblique), the resolution of input signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of input signal will be rougher and variation on the digital value will be smaller.
3. Default setting = K0; unit: LSB.

CR#30: Data register for storing all errors

[Explanation]

CR#30: error status value. See the table below:

Error	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H'1)	Reserved	0	0	0	0	0	0	0	1
Incorrect mode setting	K4 (H'4)		0	0	0	0	0	1	0	0
OFFSET/GAIN error	K8 (H'8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H'10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32 (H'20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64 (H'40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H'80)		1	0	0	0	0	0	0	0

✎ ***Note:*** *Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error*

Example: "Abnormal digital range" (K32) will occur when in voltage mode, the digital conversion is lower than -8,000 or higher than 8,000, or in current mode, the digital conversion is lower than -4,000 or higher than 4,000.

CR#31: RS-485 communication address setting

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1. This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#32: Communication speed (baud rate) setting

[Explanation]

The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200bps (bps stands for bits per second). Default = H’0002.

b0 = 1:	4,800 bps
b1 = 1:	9,600 bps (default)
b2 = 1:	19,200 bps
b3 = 1:	38,400 bps
b4 = 1:	57,600 bps
b5 = 1:	115,200 bps
b6 ~ b13:	Reserved
b14:	High/low bit exchange of CRC checksum (only valid in RTU mode)
b15:	Switch between ASCII/RTU mode. 0: ASCII (default); 1: RTU. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1); RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#33: Returning to default setting; OFFSET/GAIN tuning authorization

[Explanation]

For authorization on some internal functions, e.g. OFFSET/GAIN tuning. The latched function will store the output setting in the internal memory before the power is cut off.

For 04AD:

Default setting = H’0000. Take the setting of CH1 for example:

1. When b0 = 0, the user is allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1.
2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0: OFFSET/GAIN tuning registers are latched; b1 = 1: OFFSET/GAIN tuning registers are non-latched. This function is only valid when in RS-485 communication.
3. When b2 = 1, all settings will return to default value except for CR#31 and CR#32.

For 06AD:

Default setting = H’0FFF. Take the setting of CH1 for example:

1. b0: switch of upper/lower bound alarm for input value. 0 = disabled; 1 = enabled (default)
2. b1: OFFSET/GAIN tuning authorization. 0 = forbidden; 1 = allowed (default)
3. When b12 ~ b15 = 1, all settings at CH1 ~ CH6 will return to default value except for CR#31 and CR#32. b12 ~ b15 will automatically return to 0 when the setup is completed.

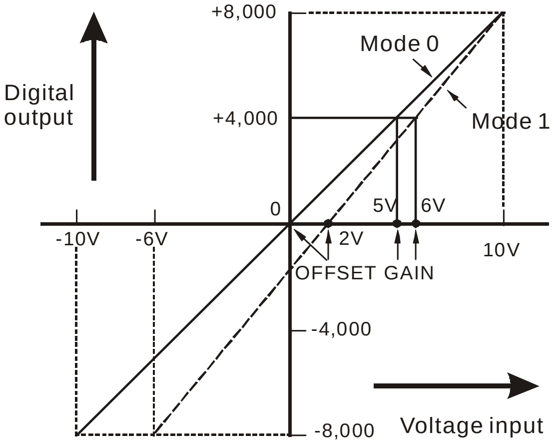
CR#34: Firmware version

[Explanation]

Displaying the current firmware version in hex, e.g. version V1.00 is indicated as H’0100.

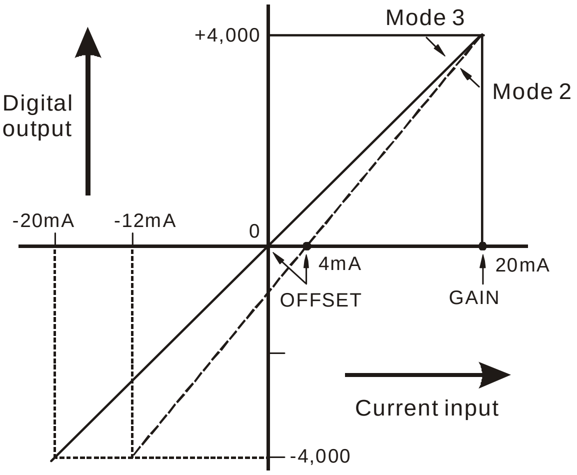
1.7 A/D Conversion Curve

1.7.1 Voltage Input Mode



Mode 0 of CR#1	-10V ~ +10V, GAIN = 5V (4,000$_{LSB}$), OFFSET = 0V (0$_{LSB}$).
Mode 1 of CR#1	-6V ~ +10V, GAIN = 6V (4,800$_{LSB}$), OFFSET = 2V (1,600$_{LSB}$).
GAIN	The voltage input value when the digital output value = 4,000. Range: -4V ~ +20V (-3,200$_{LSB}$ ~ 16,000$_{LSB}$).
OFFSET	The voltage input value when the digital output value = 0. Range: -5V ~ +5V (-4,000$_{LSB}$ ~ +4,000$_{LSB}$).
GAIN - OFFSET	Range: +1V ~ +15V (+800$_{LSB}$ ~ +12,000$_{LSB}$).

1.7.2 Current Input Mode:



Mode 2 of CR#1	-12mA ~ +20mA, GAIN = 20mA (4,000$_{LSB}$), OFFSET = 4mA (800$_{LSB}$).
Mode 3 of CR#1	-20mA ~ +20mA, GAIN = 20mA (4,000$_{LSB}$), OFFSET = 0mA (0$_{LSB}$).
GAIN	The current input value when the digital output value = +4,000. Range: -16mA ~ +52mA (-3,200$_{LSB}$ ~ +10,400$_{LSB}$).
OFFSET	The current input value when digital output value is 0. Range: -20mA ~ +20mA (-4,000$_{LSB}$ ~ +4,000$_{LSB}$).
GAIN - OFFSET	Range: +4mA ~ +32mA (800$_{LSB}$ ~ +6,400$_{LSB}$).

The user can adjust the conversion curves according to the actual needs by changing the OFFSET value (CR#18 ~ CR#21) and GAIN value (CR#24 ~ CR#27).

1.7.3 Adjusting A/D Conversion Curve in Voltage Input Mode

1. Description

- Take 04AD for example. When CR#1 is set as voltage input mode (mode 0), the OFFSET value will be set as 0V (K0) and GAIN value as 5V (K4,000), i.e. input voltage -10V ~ +10V will correspond to values -8,000 ~ +8,000.
- When CR#1 is set as voltage input mode (mode 1), the OFFSET value will be set as 2V (K1,600) and GAIN value as 6V (K4,800), i.e. input voltage -6V ~ +10V will correspond to values -8,000 ~ +8,000.
- If you cannot use the default voltage input mode (mode 0 and mode 1), you can make adjustments on the A/D conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 0V (K0) and GAIN as 2.5V (K2,000).
- You only need to set up the A/D conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.

2. Devices

- X0 = On: Set the input mode of the signals at CH1 ~ CH4 as mode 1.
- X1 = On: Set OFFSET value of CH1 ~ CH4 as 0V (K0) and GAIN value as 2.5V (K2,000).
- M0 = On: Disable adjustment on A/D conversion curve.

3. Program explanation

- When X0 = On, set CR#1 as K585 (H'249, i.e. 0000 0010 0100 1001 in binary) and the signal input mode at CH1 ~ CH4 as mode 1 (voltage input mode).
- When X1 = On, write K0 (OFFSET value of CH1 ~ CH4) into CR#18 ~ 21 and K2,000 (GAIN value of CH1 ~ CH4) into CR#24 ~ 27.
- When X1 goes from On to Off, set M0 = On to disable the adjustment on A/D conversion curve. Write K585 (H'249, i.e. 0000 0010 0100 1001 in binary) into CR#33 to disable the adjustment on A/D conversion curve in CH1 ~ CH4.

4. Program example

Ladder diagram:

Explanation:

Set CH1 ~ CH4 as mode 1 (voltage input mode)

Set the OFFSET value of CH1 ~ CH4

Set the GAIN value of CH1 ~ CH4

Disable adjustment on A/D conversion curve

1.7.4 Adjusting A/D Conversion Curve in Current Input Mode

1. Description
   - Take 04AD for example. When CR#1 is set as current input mode (mode 2), the OFFSET value will be set as 4mA (K800) and GAIN value as 20mA (K4,000), i.e. input current -12mA ~ +12mA will correspond to values -4,000 ~ +4,000.
   - When CR#1 is set as current input mode (mode 3), the OFFSET value will be set as 0mA (K10) and GAIN value as 20mA (K4,000), i.e. input current -20mA ~ +20mA will correspond to values -4,000 ~ +4,000.
   - If you cannot use the default current input mode (mode 2 and mode 3), you can make adjustments on the A/D conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 5mA (K1,000) and GAIN as 20mA (K4,000).
   - You only need to set up the A/D conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.
2. Devices
   - X0 = On: Set the input mode of the signals at CH1 ~ CH4 as mode 3.
   - X1 = On: Set OFFSET value of CH1 ~ CH4 as 5mA (K1,000) and GAIN value as 20mA (K4,000).
   - M0 = On: Disable adjustment on A/D conversion curve.
3. Program explanation
   - When X0 = On, set CR#1 as K1755 (H'6DB, i.e. 0000 <u>0110 1101 1011</u> in binary) and the signal input mode at CH1 ~ CH4 as mode 3 (current input mode).
   - When X1 = On, write K1,000 (OFFSET value of CH1 ~ CH4) into CR#18 ~ 21 and K4,000 (GAIN value of CH1 ~ CH4) into CR#24 ~ 27.
   - When X1 goes from On to Off, set M0 = On to disable the adjustment on A/D conversion curve. Write K585 (H'249, i.e. 0000 <u>0010 0100 1001</u> in binary) into CR#33 to disable the adjustment on A/D conversion curve in CH1 ~ CH4.
4. Program example

Ladder Diagram:

Explanation:

Set CH1 ~ CH4 as mode 3 (current input mode)

Set the OFFSET value of CH1 ~ CH4

Set the GAIN value of CH1 ~ CH4

Disable adjustment on A/D conversion curve

1.8 The Applications

1.8.1 Measuring Current

1. Description

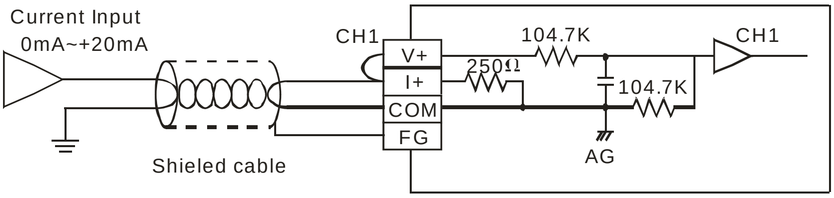
- Assume there is an equipment that has to convert the external current 0mA ~ 20mA supplied into values and display the value in register D0 for monitoring the current.
- Set the input signals of the A/D module as mode 3, i.e. the current input mode (-20mA ~ +20mA).

2. Devices

- D40: average value of the input signals
- D50: present value of input signal
- D0: actual value of the present measured current

3. Wiring

- Connect the current signal to be measured to CH1 of DVP04AD and short-circuit V+ and I+ (as shown below).



4. Program explanation

- When PLC goes from STOP to RUN, set CH1 as current input mode (mode 3), and together set the average time of the input signals at CH1 as 10.
- Save the average value of the input signals measured into D40 and the present value of the input signal measured into D50.
- In the current mode of DVP04AD, The value range for 0 ~ 20mA is K0 ~ K4,000. D50 is 200 times of the actual current value (i.e. 4,000/20 = 200). Divide the value in D50 by 200 and store the value obtained into D0 which will be the actual value of the present measured current.

5. Program example

Ladder diagram:

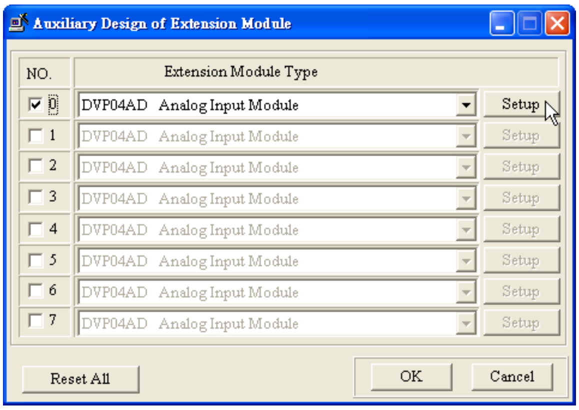
Explanation:

M1002	TO	K0	K1	H3	K1	Set CH1 as mode 3 (current input mode)
	TO	K0	K2	K10	K1	Set the average time of CH1 signals as 10
M1000	FROM	K0	K6	D40	K1	Store the average value of CH1 input signals into D40
	FROM	K0	K12	D50	K1	Store the present value of CH1 input signal into D50
	DIV	D50	K200	D0		D0 is the actual value of the present measured current at CH1

1.8.2 How to Set the Module Wizard in WPLSoft

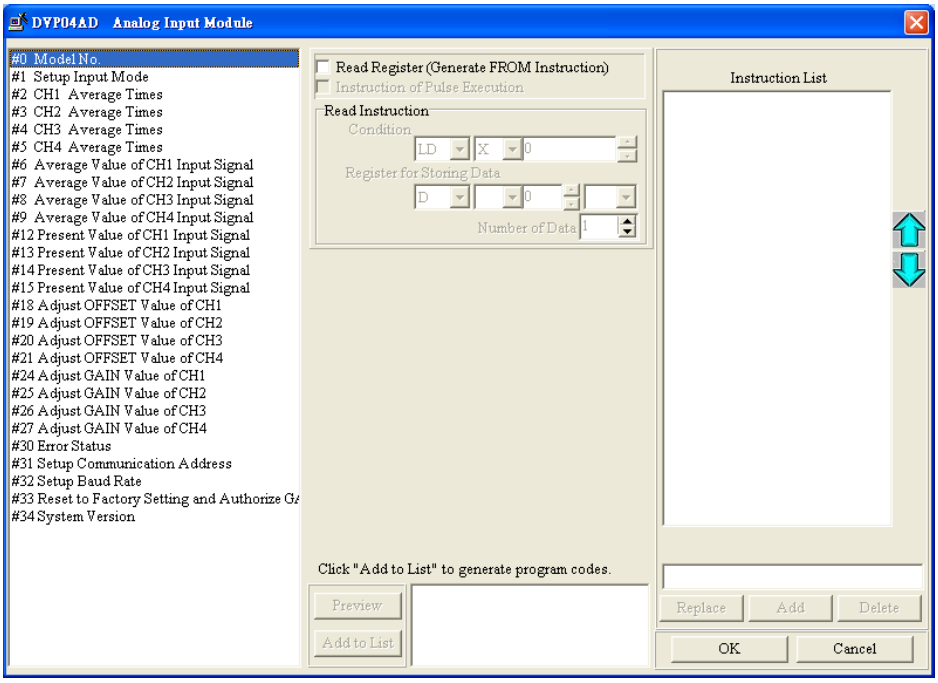
1. Open WPLSoft and click on .

2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP04AD Analog Input Module”. Click on “Setup” button next.



NO.	Extension Module Type	
☑ 0	DVP04AD Analog Input Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.



Click "Add to List" to generate program codes.

4. Next, let’s take <u>1.8.1 Measuring current</u> as example.

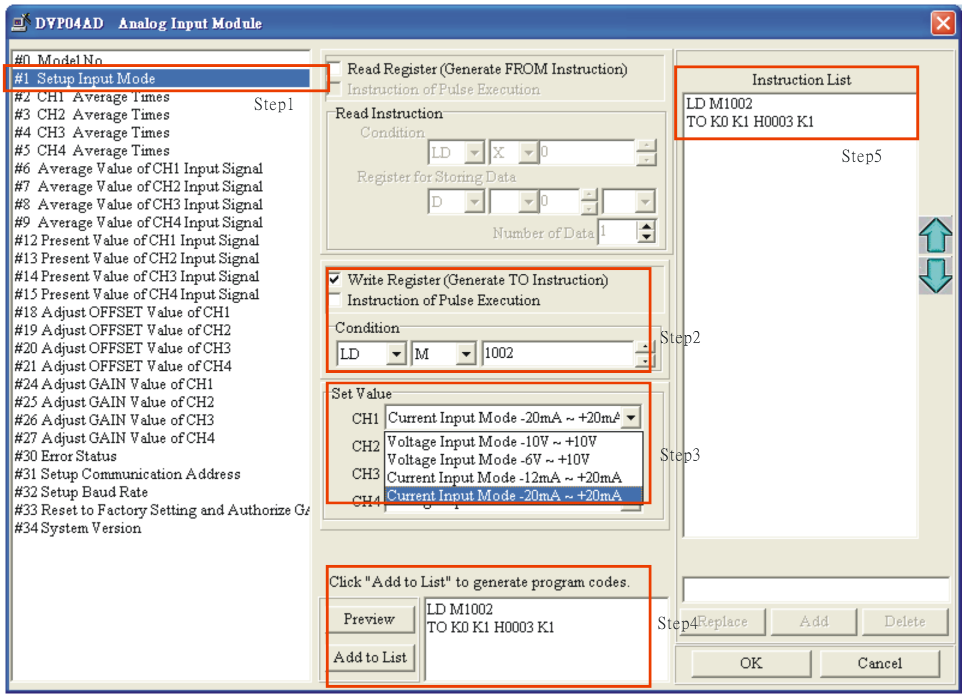
Step 1: Select “#1 Set Up Input Mode”.

Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”.

Step 3: Set CH1 as “Current Input Module -20mA ~ +20mA”.

Step 4: Click “Preview” to check if the generated program codes are correct.

Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#1 is completed.



#0 Model No.
#1 Setup Input Mode
#2 CH1 Average Times
#3 CH2 Average Times
#4 CH3 Average Times
#5 CH4 Average Times
#6 Average Value of CH1 Input Signal
#7 Average Value of CH2 Input Signal
#8 Average Value of CH3 Input Signal
#9 Average Value of CH4 Input Signal
#12 Present Value of CH1 Input Signal
#13 Present Value of CH2 Input Signal
#14 Present Value of CH3 Input Signal
#15 Present Value of CH4 Input Signal
#18 Adjust OFFSET Value of CH1
#19 Adjust OFFSET Value of CH2
#20 Adjust OFFSET Value of CH3
#21 Adjust OFFSET Value of CH4
#24 Adjust GAIN Value of CH1
#25 Adjust GAIN Value of CH2
#26 Adjust GAIN Value of CH3
#27 Adjust GAIN Value of CH4
#30 Error Status
#31 Setup Communication Address
#32 Setup Baud Rate
#33 Reset to Factory Setting and Authorize G/
#34 System Version

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value
CH1 Current Input Mode -20mA ~ +20mA
CH2 Voltage Input Mode -10V ~ +10V
Voltage Input Mode -6V ~ +10V
CH3 Current Input Mode -12mA ~ +20mA
CH4 Current Input Mode -20mA ~ +20mA

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K1 H0003 K1
```

Instruction List

```
LD M1002
TO K0 K1 H0003 K1
```

5. Setting up CR#2 is similar to the setup of CR#1.

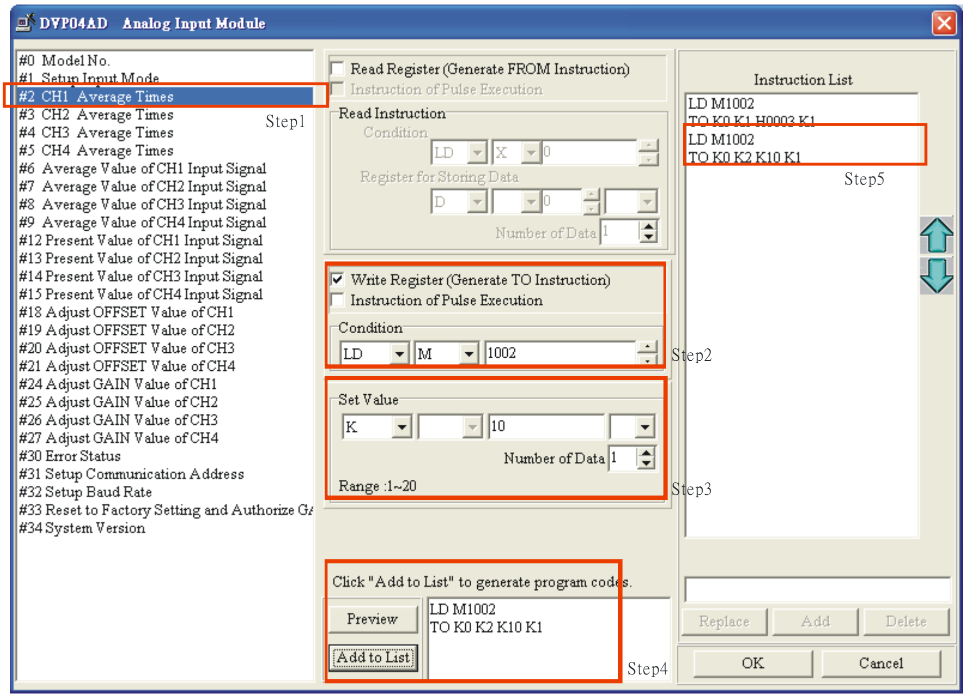
Step 1: Select "#2 CH1 Average Times"

Step 2: Check "Write Register" to generate TO instruction. Set the condition as "LD M1002".

Step 3: Set the set value as "K10" and number of data as "1".

Step 4: Click "Preview" to check if the generated program codes are correct.

Step 5: Click "Add to List" to display the instruction codes in "Instruction List". The setup of CR#2 is completed.



#2 CH1 Average Times (selected)

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value: K 10
Number of Data: 1
Range :1~20

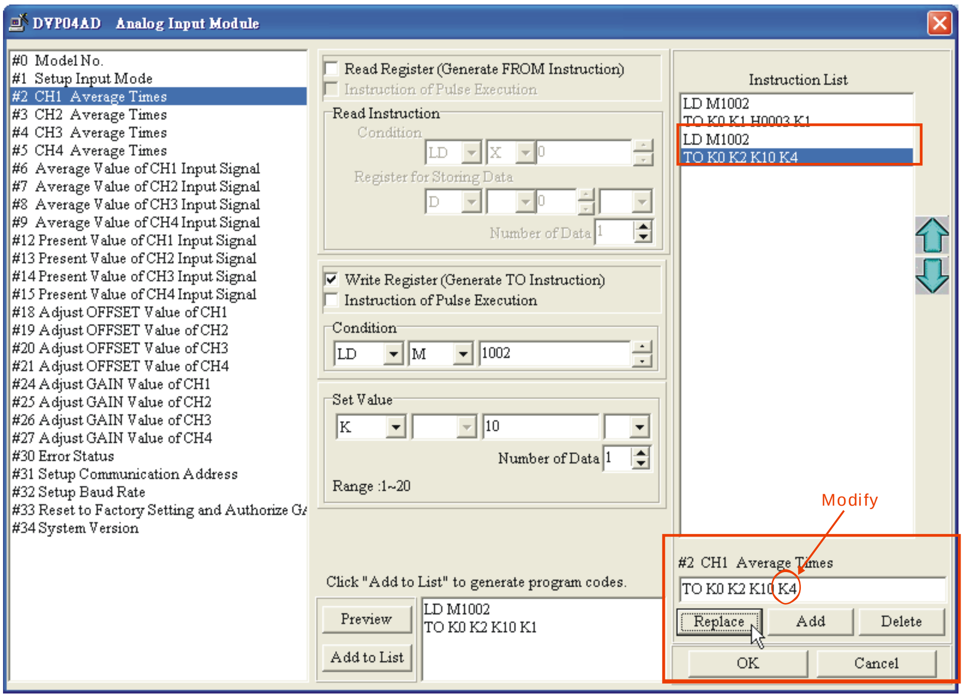
Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K2 K10 K1
```

Instruction List

```
LD M1002
TO K0 K1 H0003 K1
LD M1002
TO K0 K2 K10 K1
```

6. If there is the need, you can modify or add new instruction codes in the "Instruction List". For example, if you want to modify the average time in CR#2, click on the item to be modified in the instruction list and modify K1 into K4. Click on "Replace" to save the modification.



☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Condition: LD X 0
Register for Storing Data: D 0
Number of Data 1

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002
Set Value: K 10
Number of Data 1
Range :1~20

Click "Add to List" to generate program codes.

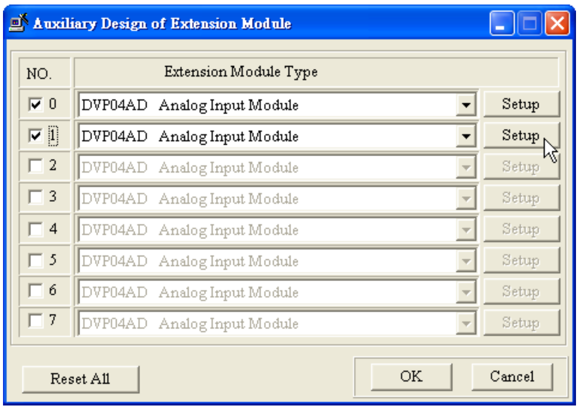
```
LD M1002
TO K0 K2 K10 K1
```

Instruction List:

```
LD M1002
TO K0 K1 H0003 K1
LD M1002
TO K0 K2 K10 K4
```

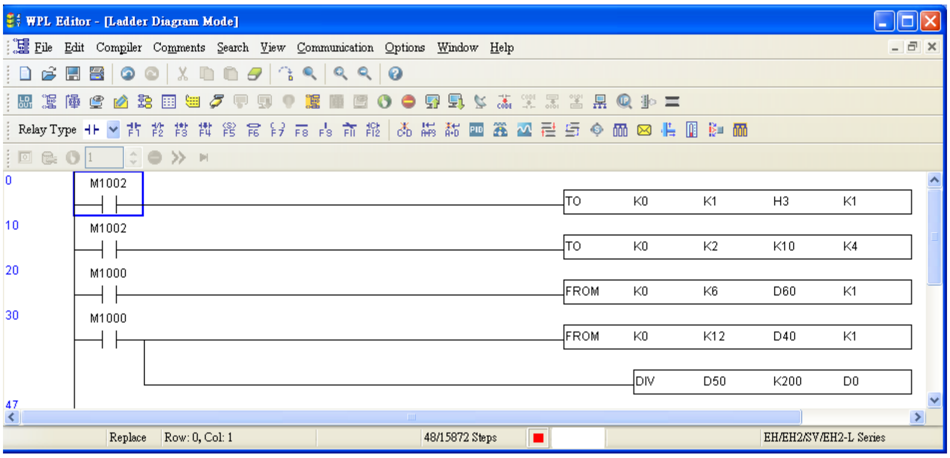
#2 CH1 Average Times
TO K0 K2 K10 K4

7. The setups of other CR parameters can follow the steps illustrated above.
8. After you complete all the setups, click on “OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



NO.	Extension Module Type
☑ 0	DVP04AD Analog Input Module
☑ 1	DVP04AD Analog Input Module
☐ 2	DVP04AD Analog Input Module
☐ 3	DVP04AD Analog Input Module
☐ 4	DVP04AD Analog Input Module
☐ 5	DVP04AD Analog Input Module
☐ 6	DVP04AD Analog Input Module
☐ 7	DVP04AD Analog Input Module

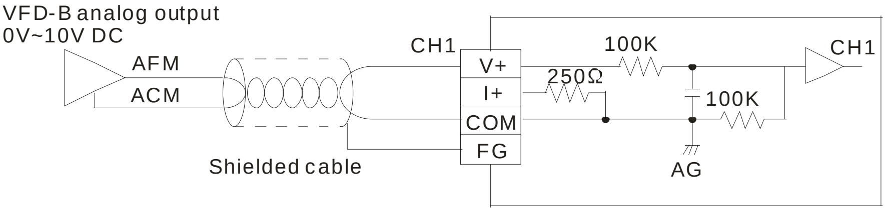
9. After you complete the setups of all the modules, click on “OK” to generate the program below.



10. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.

1.8.3 Measuring the Speed of AC Motor Drive

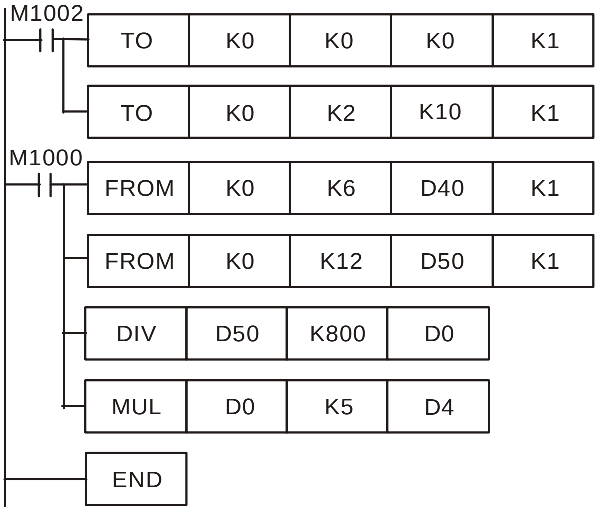
1. Description
    - Assume we set the output frequency of VFD-B as 0 ~ 50.0Hz, which corresponds to the analog 0 ~ 10V DC output supplied by VFD-B, and send it to DVP04AD to be convert into values. The voltage value will be displayed in register D0.
    - After an operation, the voltage value in D0 will become the actual frequency value of VFD-B and the frequency will be stored in register D4.
    - Set the input signals of A/D module as mode 0, i.e. the voltage input mode (-10V ~ +10V).
2. Devices
    - D40: average value of input signals
    - D50: present value of input signal
    - D0: actual value of the present measured voltage
    - D4: actual frequency of VFD-B.
3. Wiring
    - Connect the analog voltage output 0 ~ 10V DC offered by VFD-B to CH1 of DVP04AD (as shown below).



4. Program explanation
    - When PLC goes from STOP to RUN, the analog output voltage VFD-B offers is 0 ~ 10V DC. Therefore, set the input mode of DVP04AD as mode 0, i.e. voltage input mode (-10V ~ +10V).
    - Save the present value of the input signal measured into D50.
    - In the voltage mode of DVP04AD, The value range for 0 ~ 10V DC is K0 ~ K8,000. D50 is 800 times of the actual voltage value (i.e. 8000/10V = 800). Divide the value in D50 by 800 and store the value obtained into D0 which will be the actual value of the measured voltage.
    - The value obtained in D0 is 5 times of the actual voltage value (0 ~ 50.0Hz correspond to 0 ~ 10V). Therefore, multiply the value in D0 by 6 and store the value obtained in register D4 for obtaining the actual output frequency of VFD-B.

5. Program example

Ladder diagram:



Explanation:

Set as mode 0 (voltage input mode)

Set the average time as 10.

Storing the measured average value of input signal to D40.

Store the average value of the input signals measured into D40.

Store the present value of the input signal measured into D50. D50/800 = the actual voltage measured.

D0*5 = D4 (the output frequency)

2.1 The D/A Conversion

In industrial automation, many control signals are analog signals. The most frequently adopted range for the signals are voltage 0 ~ 10V and current 0 ~ 20mA. Therefore, the data in the PLC have to be converted into analog signals for controlling the peripheral devices.

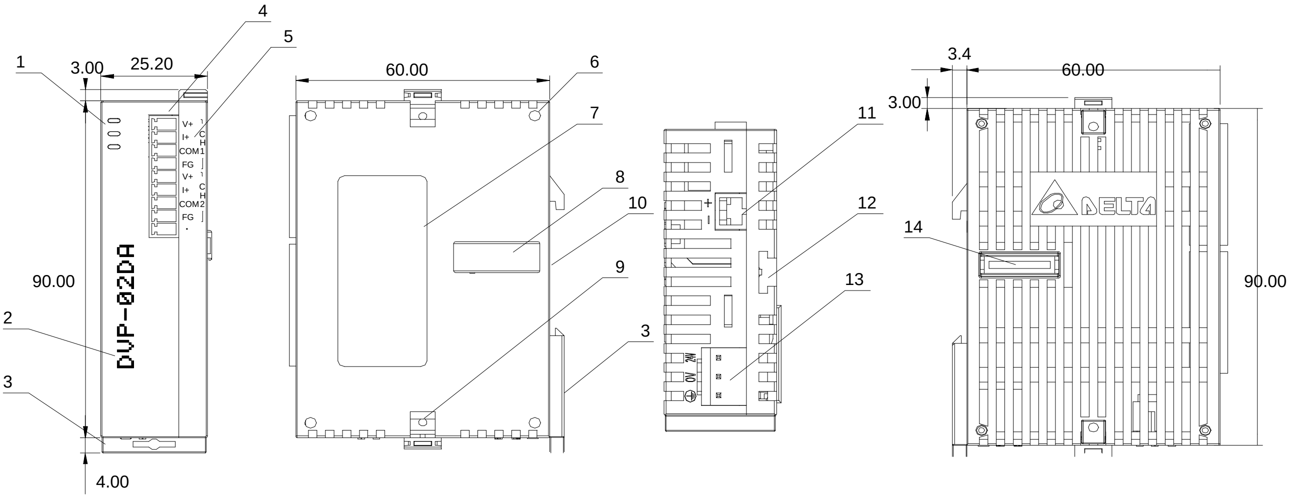
For example, data 0 ~ 4,000 in the PLC are converted into voltage 0 ~ 10V by a D/A module. The output voltage can therefore be used for controlling the peripheral analog devices.

2.2 Introduction

The data in DVP02DA (DVP04DA) analog signal output module can be read/written by using FROM/TO instructions in the program of DVP-PLC MPU. There are 49 16-bit control registers in the module. The module receives 2 (4) groups of 12-bit digital data coming from the PLC MPU and converts the digital data into 2 (4) points of analog output signals (voltage or current). You can select voltage output or current output by the wiring. Range for voltage output: 0 ~ 10V (0 ~ 4,000, resolution: 2.5mV). Range for current output: 0 ~ 20mA (0 ~ 4,000, resolution: 5μA).

2.3 Product Profile and Outline

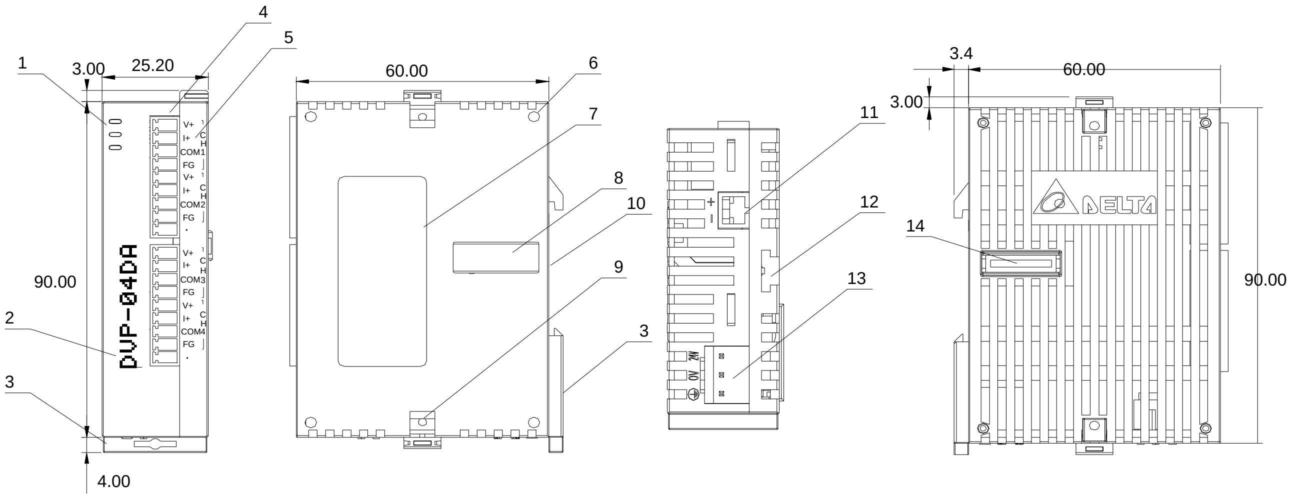
2.3.1 02DA-S



Unit: mm

1. POWER, RUN and ERROR indicator	10. DIN rail (35mm)	I/O terminals	V+
2. Model name	11. RS-485 communication port		I+
3. DIN rail clip	12. Mounting rail for extension unit/module		COM1
4. Terminals	13. Power input		FG
5. I/O terminals	14. Connection port for extension unit/module		V+
6. Fixing hole for extension unit/module			I+
7. Nameplate			COM2
8. Connection port for extension unit/module			FG
9. Fixing clip for extension unit/module			-

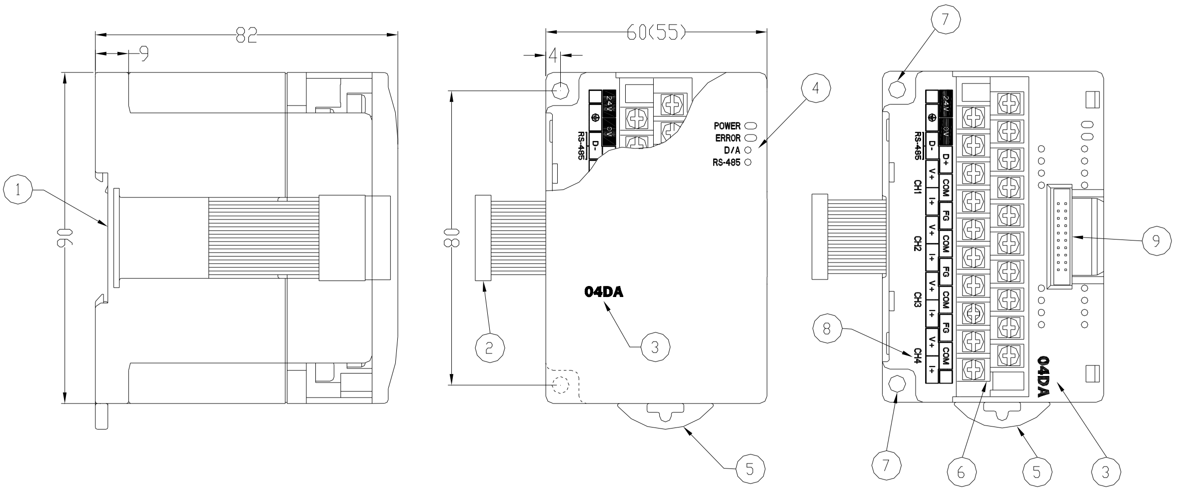
2.3.2 04DA-S



Unit: mm

1. POWER, RUN and ERROR indicator	10. DIN rail (35mm)	I/O terminals	V+	V+
2. Model name	11. RS-485 communication port		I+	I+
3. DIN rail clip	12. Mounting rail for extension unit/module		COM1	COM3
4. Terminals	13. Power input		FG	FG
5. I/O terminals	14. Connection port for extension unit/module		V+	V+
6. Mounting hole			I+	I+
7. Nameplate			COM2	COM4
8. Connection port for extension unit/module			FG	FG
9. Fixing clip for extension unit/module			-	-

2.3.3 04DA-H2 (04DA-H)



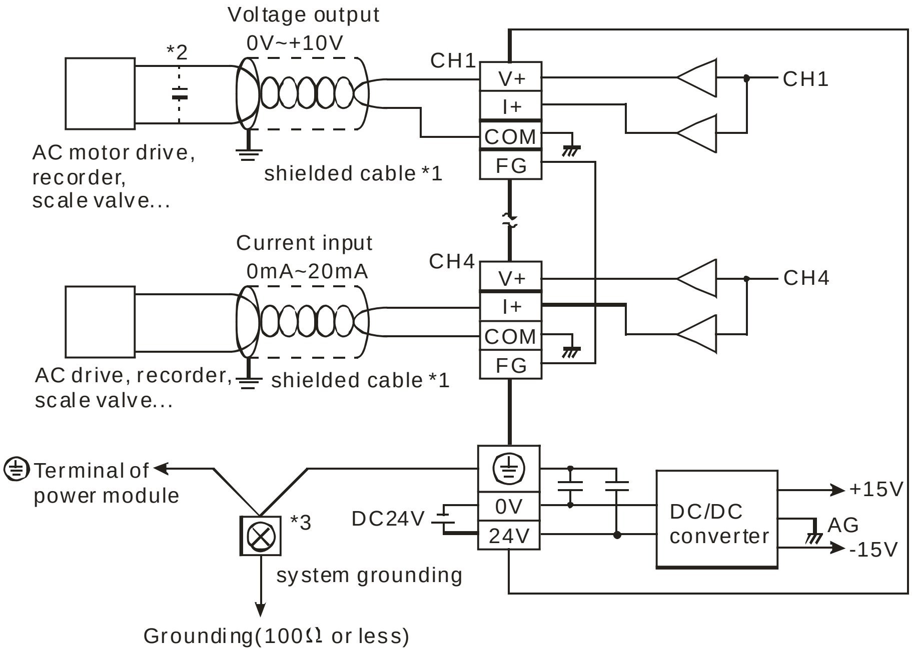
Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. POWER, RUN and ERROR, indicator	9. Connection port for extension unit/module
5. DIN rail clip	

I/O Terminals:

24V	0V	D+	COM	FG	COM	FG	COM	FG	COM	
	⏚	D-	V+	I+	V+	I+	V+	I+	V+	I+
			CH1		CH2		CH3		CH4	

2.4 External Wiring



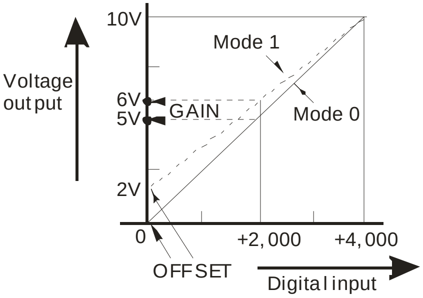
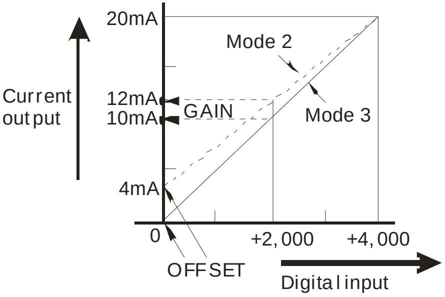
*1: When performing analog output, please isolate other power wirings.

*2: If the ripples at the loaded input terminal are too significant that causes noise interference on the wiring, connect the wiring to 0.1 ~ 0.47μF 25V capacitor.

*3: Please connect the ⏚ terminal on both the power modules and DA to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

Note: *DO NOT wire empty terminals*●.

2.5 Specifications

Digital/Analog module (02DA/04DA)	Voltage output	Current output
Power supply voltage	24 V DC (20.4 ~ 28.8V DC) (-15% ~ +20%)	
Analog output channel	2 channels or 4 channels/module	
Range of analog output	0 ~ 10V	0 ~ 20mA
Range of digital data	0 ~ 4,000	0 ~ 4,000
Resolution	12 bits (1_{LSB} = 2.5mV)	12 bits (1_{LSB} = 5μA)
Output impedance	0.5Ω or lower	
Overall accuracy	±0.5% when in full scale (25°C, 77°F); ±1% when in full scale within the range of (0 ~ 55°C, 32 ~ 131°F)	
Response time	3 ms × the number of channels	
Max. output current	20mA (1KΩ ~ 2MΩ)	-
Tolerance load impedance	-	0 ~ 500Ω
Digital data format	11 significant bits out of 16 bits are available; in 2's complement	
Isolation	Internal circuit and analog output terminals are isolated by optical coupler. No isolation among analog channels.	
Protection	Voltage output is protected by short circuit. Short circuit lasting for too long may cause damage on internal circuits. Current output can be open circuit.	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1), RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No.0 is the closest to MPU and No.7 is the furthest. Maximum 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	
D/A conversion curve (Default: mode 0)	Mode 0: (0V ~ +10V), Mode 1: (2V ~ +10V) 	
	Mode 2: (4mA ~ +20 mA), Mode 3: (0mA ~ +20mA) 	
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	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc) / IEC61131-2 & IEC 68-2-27 (TEST Ea)	
Power Supply		
Max. rated power consumption	24V DC (20.4 ~ 28.8V DC) (-15% ~ +20%), (-S)2W, (-H)2.5W, supplied by external power	

2.6 CR (Control Register)

2.6.1 CR in DVP02DA

DVP02DA					Description
CR#	RS-485 parameters address	Latched		Register content	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
#0	H’4032	O	R	Model name	System by the system. DVP02DA-S model code = H’0049
#1	H’4033	O	R/W	Output mode setting	Reserved | CH2 | CH1 Output mode: Default = H’0000. Take CH1 for example: Mode 0 (b0 ~ b2 = 000): Voltage output (0V ~ 10V). Mode 1 (b0 ~ b2 = 001): Voltage output (2V ~ 10V). Mode 2 (b0 ~ b2 = 010): Current output (4mA ~ 20mA). Mode 3 (b0 ~ b2 = 011): Current output (0mA ~ 20mA).
#2 ~ #9		Reserved			
#10	H’403C	O	R/W	CH1output value	Range of output value at CH1 ~ CH2: K0 ~ K4,000 Default = K0 (unit: LSB)
#11	H’403D	O	R/W	CH2 output value	
#12 ~ #21		Reserved			
#22	H’4048	O	R/W	Adjusted OFFSET value of CH1	Range of OFFSET at CH1 ~ CH2: K-2,000 ~ K2,000 Default = K0 (unit: LSB)
#23	H’4049	O	R/W	Adjusted OFFSET value of CH2	
#24 ~ #27		Reserved			
#28	H’404E	O	R/W	Adjusted GAIN value of CH1	Range of GAIN at CH1 ~ CH2: K0 ~ K4,000 Default = K2,000 (unit: LSB)
#29	H’404F	O	R/W	Adjusted GAIN value of CH2	
#30	H’4050	X	R	Error status	Register for storing all error status. See the table of error status for more information.
#31	H’4051	O	R/W	Communication address setting	For setting up RS-485 communication address. Range: 01 ~ 255. Default = K1
#32	H’4052	O	R/W	Communication speed (baud rate) setting	4,800/9,600/19,200/38,400/57,600/115,200bps are available. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) Default = H’0002. b0: 4,800 bps b1: 9,600 bps (Default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5: 115,200 bps b6 ~ b13: reserved b14: High/low bit exchange of CRC checksum (only valid in RTU mode) b15: Switch between ASCII/RTU mode. 0 = ASCII (default)
#33	H’4053	O	R/W	Return to default setting; OFFSET/GAIN tuning authorization	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 Reserved | CH2 | CH1 Default = H’0000. Take the setting of CH1 for example: 1. When b0=0, the user is allowed to tune CR#18 (OFFSET) and CR#22 (GAIN) of CH1. When b1=1, the user is not allowed to tune CR#18 (OFFSET) and CR#22 (GAIN) of CH1. 2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0 (OFFSET/GAIN tuning register latched); b1 = 1 (OFFSET/GAIN tuning register non-latched). This function is only valid when in RS-485 communication. 3. When b2 = 1, all settings will return to default values.
#34	H’4054	O	R	Firmware version	Displaying the current firmware version in hex.
#35 ~ #48		For system use			

Symbols:
O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485
LSB (Least Significant Bit): For voltage input: 1_{LSB} = 10V/4,000 = 2.5mV; for current input: 1_{LSB} = 20mA/4,000 = 5μA.

2.6.2 CR in DVP04DA

<table>
<tr><th colspan="5">DVP04DA</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameters address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4032</td><td>O</td><td>R</td><td>Model name</td><td colspan="16">Set up by the system.
DVP04DA-S model code = H’0089
DVP04DA-H model code = H’0401
DVP04DA-H2 model code = H’6401</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’4033</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Output mode setting</td><td colspan="4">Reserved</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Output mode: Default = H’0000. Take CH1 for example:
Mode 0 (b0 ~ b2 = 000): Voltage output (0V ~ 10V).
Mode 1 (b0 ~ b2 = 001): Voltage output (2V ~ 10V).
Mode 2 (b0 ~ b2 = 010): Current output (4mA ~ 20mA).
Mode 3 (b0 ~ b2 = 011): Current output (0mA ~ 20mA).</td></tr>
<tr><td colspan="2">#2 ~ #5</td><td colspan="19">Reserved</td></tr>
<tr><td>#6</td><td>H’4038</td><td>O</td><td>R/W</td><td>CH1 output value</td><td colspan="16" rowspan="4">Range of output value at CH1 ~ CH4: K0 ~ K4,000.
Default = K0 (unit: LSB).</td></tr>
<tr><td>#7</td><td>H’4039</td><td>O</td><td>R/W</td><td>CH2 output value</td></tr>
<tr><td>#8</td><td>H’403A</td><td>O</td><td>R/W</td><td>CH3 output value</td></tr>
<tr><td>#9</td><td>H’403B</td><td>O</td><td>R/W</td><td>CH4 output value</td></tr>
<tr><td colspan="2">#10 ~ #17</td><td colspan="19">Reserved</td></tr>
<tr><td>#18</td><td>H’4044</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH1</td><td colspan="16" rowspan="4">Range of OFFSET at CH1 ~ CH4: K-2,000 ~ K2,000.
Default = K0 (unit: LSB).</td></tr>
<tr><td>#19</td><td>H’4045</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH2</td></tr>
<tr><td>#20</td><td>H’4046</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H’4047</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH4</td></tr>
<tr><td colspan="2">#22 ~ #23</td><td colspan="19">Reserved</td></tr>
<tr><td>#24</td><td>H’404A</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH1</td><td colspan="16" rowspan="4">Range of GAIN at CH1 ~ CH4: K0 ~ K4,000
Default = K2,000 (unit: LSB)</td></tr>
<tr><td>#25</td><td>H’404B</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH2</td></tr>
<tr><td>#26</td><td>H’404C</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH3</td></tr>
<tr><td>#27</td><td>H’404D</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH4</td></tr>
<tr><td colspan="2">#28 ~ #29</td><td colspan="19">Reserved</td></tr>
<tr><td>#30</td><td>H’4050</td><td>X</td><td>R</td><td>Error status</td><td colspan="16">Register for storing all error status. See the table of error status for more information.</td></tr>
<tr><td>#31</td><td>H’4051</td><td>O</td><td>R/W</td><td>Communication address setting</td><td colspan="16">For setting up RS-485 communication address.
Range: 01 ~ 255. Default = K1</td></tr>
</table>

DVP04DA					Description															
CR#	RS-485 parameters address	Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#32	H’4052	O	R/W	Communication speed (baud rate) setting	Default = H’ 0002. For setting up communication speed: 4,800/ 9,600/19,200/38,400/57,600/115,200bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1). RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) b0: 4,800 bps b1: 9,600 bps (Default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5: 115,200 bps b6 ~ b13: reserved b14: High/low bit exchange of CRC checksum (only valid in RTU mode) b15: Switch between ASCII/RTU modes. 0 = ASCII mode (default).															
#33	H’4053	O	R/W	Return to default setting; OFFSET/GAIN tuning authorization	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
					Reserved				CH4			CH3			CH2			CH1		
					Default = H’0000. Take the setting of CH1 for example: 1. When b0 = 0, the user is allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. 2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0 (OFFSET/GAIN tuning register latched); b1 = 1 (OFFSET/GAIN tuning register non-latched). This function is only valid when in RS-485 communication. 3. When b2 = 1, all settings will return to default values. (except for CR#31, CR#32)															
#34	H’4054	O	R	Firmware version	Displaying the current firmware version In hex;															
#35 ~ #48		For system use																		

Symbols:

O: latched

X: non-latched (available when using RS-485 communication, not available when connected to MPU)

R: Able to read data by FROM instruction or RS-485 communication

W: Able to write data by using TO instructions or RS-485

LSB (Least Significant Bit): For voltage input: 1_{LSB} = 10V/4,000 = 2.5mV; for current input: 1_{LSB} = 20mA/4,000 = 5μA.

The corresponding parameters address H’4032 ~ H’4054 of CR#0 ~ CR#48 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

2.6.3 Explanation on CR

CR#0: Model name

[Explanation]

1. DVP02DA-S model code = H’0049
2. DVP04DA-S model code = H’0089
3. DVP04DA-H model code = H’0401
4. DVP04DA-H2 model code = H’6401
5. You can read the model name in the program to see if the extension module exists.

CR#1: Output mode setting

[Explanation]

The working mode of the channels in the analog output module. There are 4 modes for each channel which can be set up separately.

For 02DA:

When you set CH1 as mode 2 (b2 ~ b0 = 010) and CH2 as mode 1 (b5 ~ b3 = 001), CR#1 has to be set as H'000A. The higher bits (b6 ~ b15) have to be reserved.

For 04DA:

When you setting CH1 as mode 0 (b2 ~ b0 = 000), CH2 as mode 1 (b5 ~ b3 = 001), CH3 as mode 2 (b8 ~ b6 = 010) and CH4 as mode 3 (b11 ~ b9 = 011), CR#1 has to be set as H'0688. The higher bits (b12 ~ b15) have to be reserved. The default setting = H'0000. Take CH1 as example:

Mode 0 (b0 ~ b2 = 000): Voltage output (0V ~ 10V).
Mode 1 (b0 ~ b2 = 001): Voltage output (2V ~ 10V).
Mode 2 (b0 ~ b2 = 010): Current output (4mA ~ 20mA).
Mode 3 (b0 ~ b2 = 011): Current output (0mA ~ 20mA).

CR#6, 7, 8, 9: The output values at CH1 ~ CH4 in 04DA

[Explanation]

Range of output value at CH1 ~ CH4 in 04DA: K0 ~ K4,000. Default = K0. Unit: LSB.

CR#10, 11: The output values at CH1 ~ CH2 in 02DA

[Explanation]

Range of output value at CH1 ~ CH2 in 02DA: K0 ~ K4,000. Default = K0. Unit: LSB.

CR#18, 19, 20, 21: Adjusted OFFSET value of CH1 ~ CH4 in 04DA

[Explanation]

1. The adjusted OFFSEST value of CH1 ~ CH4 in 04DA, representing the analog output voltage or current when the digital output value is 0 after calculation. Default = K0. Unit: LSB. Range: -2,000 ~ +2,000.
2. The adjustable range of voltage: -5V ~ +5V ($-2,000_{LSB}$ ~ $+2,000_{LSB}$).
3. The adjustable range of current: -10mA ~ +10mA ($-2,000_{LSB}$ ~ $+2,000_{LSB}$).

CR#22, 23: Adjusted OFFSET value of CH1 ~ CH2 in 02DA

[Explanation]

1. The adjusted OFFSEST value of CH1 ~ CH2 in 02DA, representing the analog output voltage or current when the digital output value is 0 after calculation. Default = K0. Unit: LSB. Range: -2,000 ~

+2,000.

2. The adjustable range of voltage: -5V ~ +5V (-2,000$_{LSB}$ ~ +2,000$_{LSB}$).
3. The adjustable range of current: -10mA ~ +10mA (-2,000$_{LSB}$ ~ +2,000$_{LSB}$).

CR#24, 25, 26, 27: Adjusted GAIN value of CH1 ~ CH4 in 04DA

[Explanation]

1. The adjusted GAIN value of CH1 ~ CH4 in 04DA, representing the analog output voltage or current when the digital output value is 2,000 after calculation. Default = K2,000. Unit: LSB.
2. The adjustable range of voltage: -4V ~ +20V (0$_{LSB}$ ~ +4,000$_{LSB}$).
3. The adjustable range of current: -8mA ~ +40mA (0$_{LSB}$ ~ +4,000$_{LSB}$).

Please note that: GAIN value – OFFSET value = +400$_{LSB}$ ~ +6,000$_{LSB}$ (voltage or current). When GAIN – OFFSET is small (steep oblique), the resolution of output signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of output signal will be rougher and variation on the digital value will be smaller.

CR#28, 29: Adjusted GAIN value of CH1 ~ CH2 in 02DA

[Explanation]

1. The adjusted GAIN value of CH1 ~ CH2 in 02DA, representing the analog output voltage or current when the digital output value is 2,000 after calculation. Default = K2,000. Unit: LSB.
2. The adjustable range of voltage: -4V ~ +20V (0$_{LSB}$ ~ +4,000$_{LSB}$).
3. The adjustable range of current: -8mA ~ +40mA (0$_{LSB}$ ~ +4,000$_{LSB}$).

Please note that: GAIN value – OFFSET value = +400$_{LSB}$ ~ +6,000$_{LSB}$ (voltage or current). When GAIN – OFFSET is small (steep oblique), the resolution of output signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of output signal will be rougher and variation on the digital value will be smaller.

CR#30: Data register for storing all errors

[Explanation]

CR#30: error status value. See the table below:

Error	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H’1)	Reserved	0	0	0	0	0	0	0	1
Incorrect analog input value	K2 (H’2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4 (H’4)		0	0	0	0	0	1	0	0
OFFSET/GAIN error	K8 (H’8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H’10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32 (H’20)		0	0	1	0	0	0	0	0
Reserved	K64 (H’40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		1	0	0	0	0	0	0	0

Note: *Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error*

CR#31: RS-485 communication address setting

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1. This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#32: Communication speed (baud rate) setting

[Explanation]

The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200bps (bps stands for bits per second). Default = H’0002.

b0 = 1:	4,800 bps
b1 = 1:	9,600 bps (default)
b2 = 1:	19,200 bps
b3 = 1:	38,400 bps
b4 = 1:	57,600 bps
b5 = 1:	115,200 bps
b6 ~ b13:	Reserved
b14:	High/low bit exchange of CRC checksum (only valid in RTU mode)
b15:	Switch between ASCII/RTU mode. 0: ASCII (default); 1: RTU. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1); RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#33: Returning to default setting; OFFSET/GAIN tuning authorization

[Explanation]

For authorization on some internal functions, e.g. OFFSET/GAIN tuning. The latched function will store the output setting in the internal memory before the power is cut off. Default setting = H’0000. Take the setting of CH1 in 02DA (04DA) for example:

1. When b0 = 0, the user is allowed to tune CR#22 (CR#18) (OFFSET) and CR#28 (CR#24) (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#22 (CR#18) (OFFSET) and CR#28 (CR#24) (GAIN) of CH1.
2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0: OFFSET/GAIN tuning registers are latched; b1 = 1: OFFSET/GAIN tuning registers are non-latched. This function is only valid when in RS-485 communication.
3. When b2 = 1, all settings will return to default value except for CR#31 and CR#32.

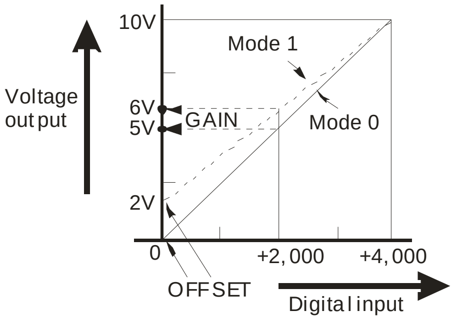
CR#34: Firmware version

[Explanation]

Displaying the current firmware version in hex, e.g. version V1.00 is indicated as H’0100.

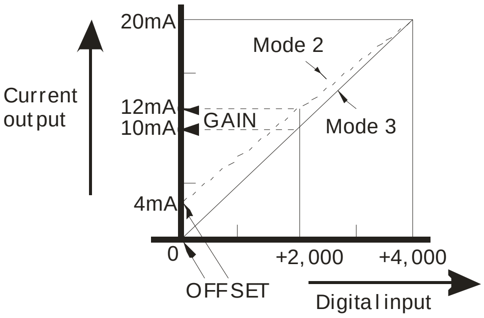
2.7 D/A Conversion Curve

2.7.1 Voltage Output Mode



Mode 0 of CR#1	0V ~ +10V; GAIN = 5V (2,000$_{LSB}$), OFFSET = 0V (0$_{LSB}$).
Mode 1 of CR#1	2V ~ +10V; GAIN = 6V (2,400$_{LSB}$), OFFSET = 2V (800$_{LSB}$).
GAIN	The voltage output value when the digital input value = K2,000. Range: -4V ~ +20V (0$_{LSB}$ ~ +4,000$_{LSB}$)
OFFSET	The voltage output value when the digital input value = K0. Range is -5V ~ +5V (-2,000$_{LSB}$ ~ +2,000$_{LSB}$).
GAIN - OFFSET	Range: +1V ~ +15V (+400$_{LSB}$ ~ +6,000$_{LSB}$).

2.7.2 Current Output Mode



Mode 2 of CR#1	4mA ~ +20 mA; GAIN = 12mA (2,400$_{LSB}$), OFFSET = 4mA (800$_{LSB}$).
Mode 3 of CR#1	0mA ~ +20mA; GAIN = 10mA (2,000$_{LSB}$), OFFSET = 0mA (0$_{LSB}$).
GAIN	The current output value when the digital input value = K2,000. Range: -8mA ~ +40mA (0$_{LSB}$ ~ +4,000$_{LSB}$).
OFFSET	The current output value when the digital input value = K0. Range: -10mA ~ +10mA (-2,000$_{LSB}$ ~ +2,000$_{LSB}$).
GAIN - OFFSET	Range: +2mA ~ +30mA (+400$_{LSB}$ ~ +6,000$_{LSB}$).

The user can adjust the conversion curves according to the actual needs by changing the OFFSET value and GAIN value.

2.7.3 Adjusting D/A Conversion Curve in Voltage Output Mode

1. Description

- Take 04DA for example. When CR#1 is set as voltage output mode (mode 0), the OFFSET value will be set as 0V (K0) and GAIN value as 5V (K2,000), i.e. output voltage 0 ~ 10V will correspond to values 0 ~ +4,000.
- When CR#1 is set as voltage output mode (mode 1), the OFFSET value will be set as 2V (K800) and GAIN value as 6V (K2,400), i.e. output voltage 2V ~ +10V will correspond to values 0 ~ +4,000.
- If you cannot use the default voltage input mode (mode 0 and mode 1), you can make adjustments on the D/A conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 0V (K0) and GAIN as 2.5V (K1,000).
- You only need to set up the D/A conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.

2. Devices

- X0 = On: Set the output mode of the signals at CH1 ~ CH4 as mode 1.
- X1 = On: Set OFFSET value of CH1 ~ CH4 as 0V (K0) and GAIN value as 2.5V (K1,000).
- M0 = On: Disable adjustment on D/A conversion curve.

3. Program explanation

- When X0 = On, set CR#1 as K585 (H’249, i.e. 0000 <u>0010 0100 1001</u> in binary) and the signal output mode at CH1 ~ CH4 as mode 1 (voltage output mode).
- When X1 = On, write K0 (OFFSET value of CH1 ~ CH4) into CR#18 ~ 21 and K1,000 (GAIN value of CH1 ~ CH4) into CR#24 ~ 27.
- When X1 goes from On to Off, set M0 = On to disable the adjustment on D/A conversion curve. Write K585 (H’249, i.e. 0000 <u>0010 0100 1001</u> in binary) into CR#33 to disable the adjustment on D/A conversion curve in CH1 ~ CH4.

4. Program example

Ladder diagram:

Explanation:

Set CH1 ~ CH4 as mode 1 (voltage output mode)

Set the OFFSET value of CH1 ~ CH4

Set the GAIN value of CH1 ~ CH4

Disable adjustment on D/A conversion curve

2.7.4 Adjusting D/A Conversion Curve in Current Output Mode

1. Description
   - Take 04DA for example. When CR#1 is set as current output mode (mode 2), the OFFSET value will be set as 4mA (K800) and GAIN value as 12mA (K2,400), i.e. input current 4mA ~ +20mA will correspond to values 0 ~ +4,000.
   - When CR#1 is set as current output mode (mode 3), the OFFSET value will be set as 0mA (K0) and GAIN value as 10mA (K2,000), i.e. output current 0mA ~ +20mA will correspond to values 0 ~ +4,000.
   - If you cannot use the default current output mode (mode 2 and mode 3), you can make adjustments on the D/A conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 6mA (K1,200) and GAIN as 13mA (K2,600).
   - You only need to set up the D/A conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.
2. Devices
   - X0 = On: Set the output mode of the signals at CH1 ~ CH4 as mode 3.
   - X1 = On: Set OFFSET value of CH1 ~ CH4 as 6mA (K1,200) and GAIN value as 13mA (K2,600).
   - M0 = On: Disable adjustment on D/A conversion curve.
3. Program explanation
   - When X0 = On, set CR#1 as K1755 (H'6DB, i.e. 0000 0110 1101 1011 in binary) and the signal output mode at CH1 ~ CH4 as mode 3 (current output mode).
   - When X1 = On, write K1,200 (OFFSET value of CH1 ~ CH4) into CR#18 ~ 21 and K2,600 (GAIN value of CH1 ~ CH4) into CR#24 ~ 27.
   - When X1 goes from On to Off, set M0 = On to disable the adjustment on D/A conversion curve. Write K585 (H'249, i.e. 0000 0010 0100 1001 in binary) into CR#33 to disable the adjustment on D/A conversion curve in CH1 ~ CH4.
4. Program example

Ladder diagram:

Explanation:

Set CH1 ~ CH4 as mode 3 (current output mode)

Set the OFFSET value of CH1 ~ CH4

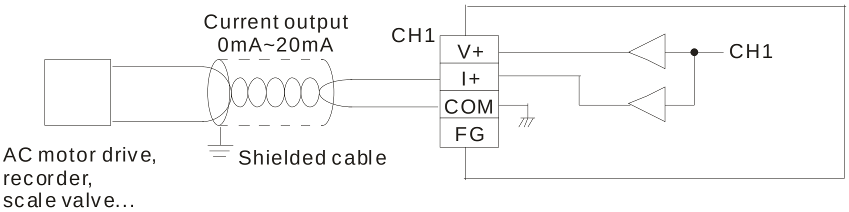
Set the GAIN value of CH1 ~ CH4

Disable adjustment on D/A conversion curve

2.8 The Applications

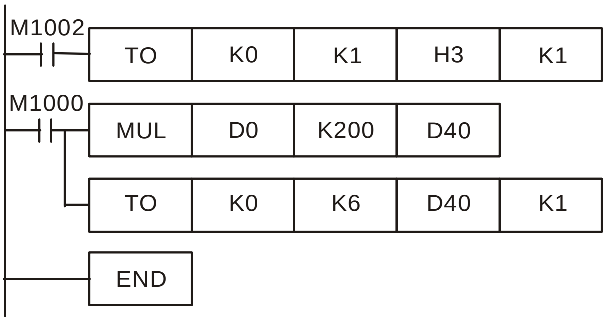
2.8.1 Analog Current Output

1. Explanation
   - Assume there is an equipment that has to convert the current 0mA ~ 20mA supplied into analog values for the analog input terminal on the equipment.
   - Set the output signals of the D/A module as mode 3, i.e. the current output mode (0mA ~ 20mA)
2. Devices
   - D0: current output from CH1
   - D40: digital value converted corresponding to the output current from CH1
3. Wiring
   - Connect the analog current output signal to be controlled to CH1 of DVP04DA (as shown below).



4. Program explanation
   - When PLC goes from STOP to RUN, set CH1 as current output mode (mode 3).
   - In the current mode of DVP04AD, the value range for 0 ~ 20mA is K0 ~ K4,000. D0 is the current output value, which is 1/200 of the actual output current digital value (i.e. 20/4,000 = 1/200). Multiply the value in D0 with 200 and store the value obtained into data register D40 for DVP04DA to designate a current output.
5. Example program

Ladder diagram:



Explanation:

Set as mode 3 (current output mode)

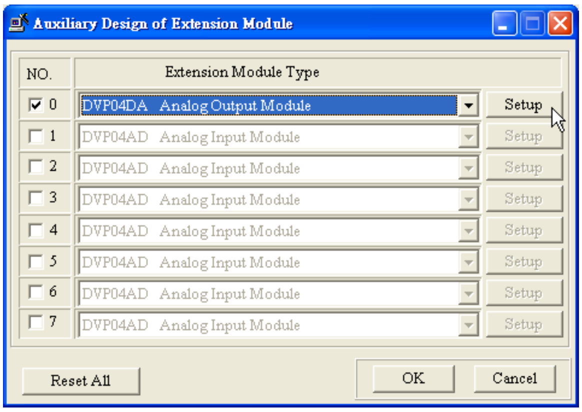
D0 is the current output value from CH1

D40 is the corresponding digital value of output current from CH1

2.8.2 How to Set the Module Wizard in WPLSoft

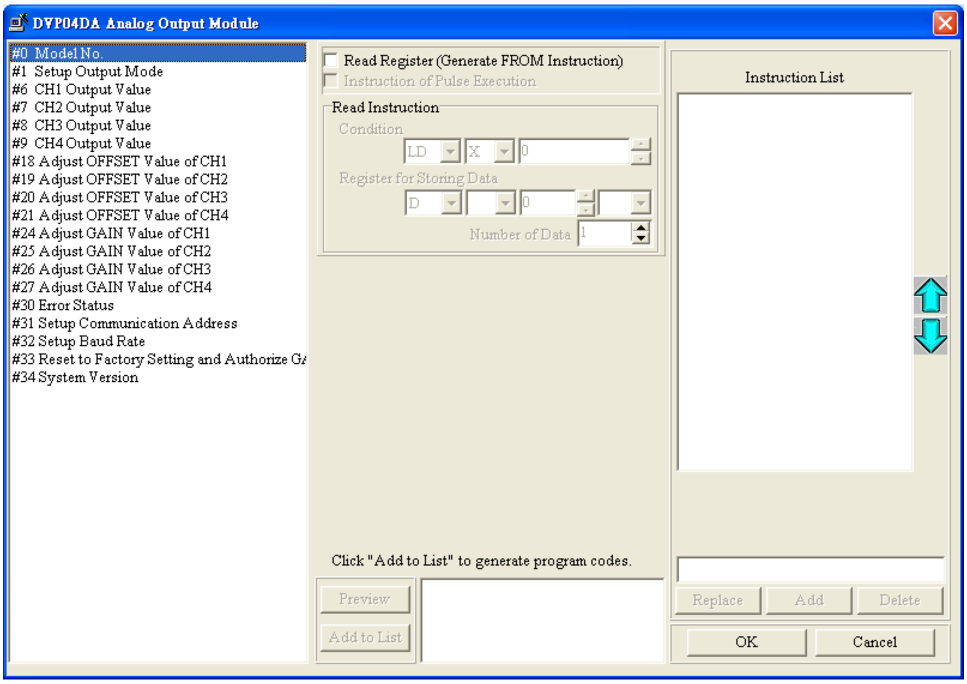
1. Open WPLSoft and click on .

2. You will see the “Auxiliary Design of Extension Module” window. Click on NO, “0” and select “DVP04DA Analog Output Module”. Click on “Setup” button next.


Auxiliary Design of Extension Module

NO.	Extension Module Type	
☑ 0	DVP04DA Analog Output Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.


DVP04DA Analog Output Module

#0 Model No.
#1 Setup Output Mode
#6 CH1 Output Value
#7 CH2 Output Value
#8 CH3 Output Value
#9 CH4 Output Value
#18 Adjust OFFSET Value of CH1
#19 Adjust OFFSET Value of CH2
#20 Adjust OFFSET Value of CH3
#21 Adjust OFFSET Value of CH4
#24 Adjust GAIN Value of CH1
#25 Adjust GAIN Value of CH2
#26 Adjust GAIN Value of CH3
#27 Adjust GAIN Value of CH4
#30 Error Status
#31 Setup Communication Address
#32 Setup Baud Rate
#33 Reset to Factory Setting and Authorize G
#34 System Version

☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution

Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data: 1

Click "Add to List" to generate program codes.

4. Next, let’s take 2.8.1 Analog current output as example.

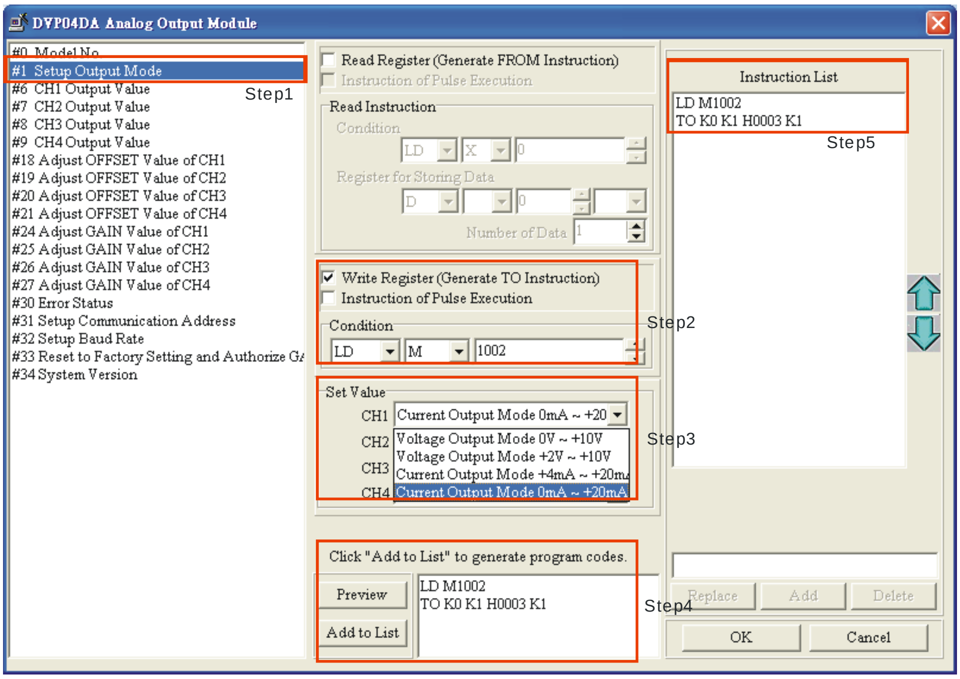
Step 1: Select "#1 Set Up Output Mode”

Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”.

Step 3: Set CH1 as “Current Output Mode 0mA ~ +20mA”

Step 4: Click “Preview” to check if the generated program codes are correct.

Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#1 is completed.



☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value
CH1 Current Output Mode 0mA ~ +20
CH2 Voltage Output Mode 0V ~ +10V
Voltage Output Mode +2V ~ +10V
CH3 Current Output Mode +4mA ~ +20m
CH4 Current Output Mode 0mA ~ +20mA

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K1 H0003 K1
```

Instruction List:

```
LD M1002
TO K0 K1 H0003 K1
```

5. Setting up CR#6 is similar to the setup of CR#1.

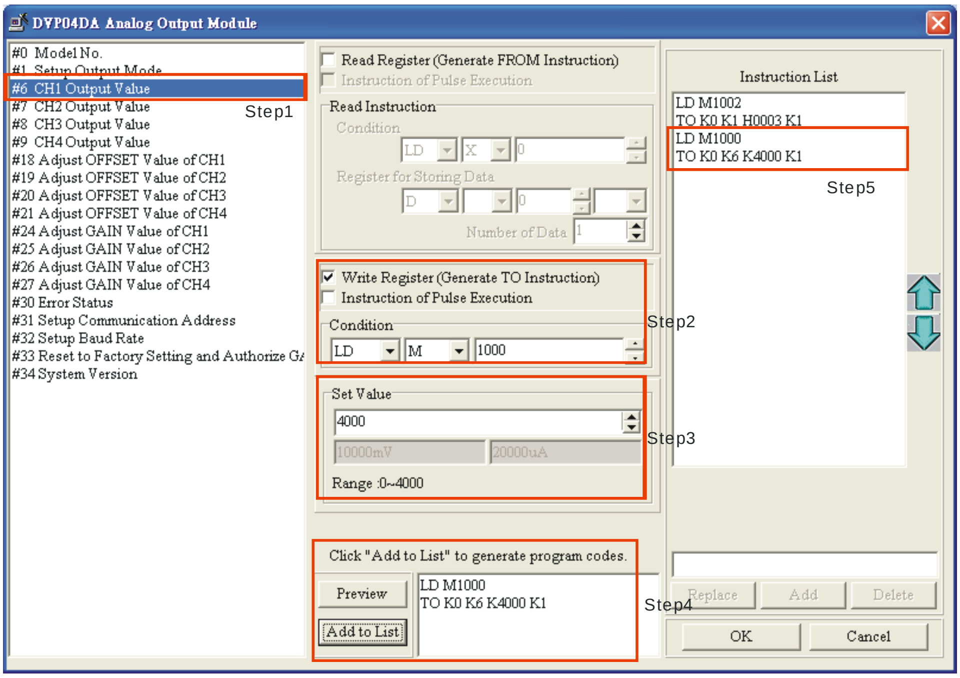
   Step 1: Select “#6 CH1 Output Value".

   Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1000”.

   Step 3: Set the value as “4,000”

   Step 4: Click “Preview” to check if the generated program codes are correct.

   Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#6 is completed.



☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1000

Set Value: 4000
10000mV 20000uA
Range :0~4000

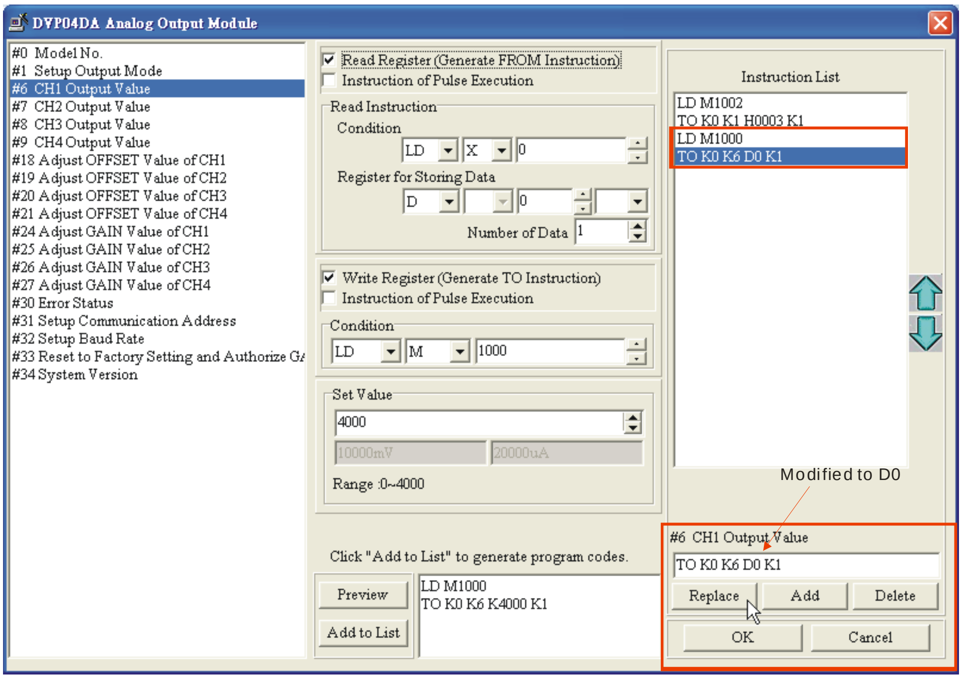
Click "Add to List" to generate program codes.

```
LD M1000
TO K0 K6 K4000 K1
```

Instruction List:

```
LD M1002
TO K0 K1 H0003 K1
LD M1000
TO K0 K6 K4000 K1
```

6. If there is the need, you can modify or add new instruction codes in the “Instruction List”. For example, if you want to modify the output value in CR#6, click on the item to be modified in the instruction list and modify K4,000 into D0. Click on “Replace” to save the modification.



#0 Model No.
#1 Setup Output Mode
#6 CH1 Output Value
#7 CH2 Output Value
#8 CH3 Output Value
#9 CH4 Output Value
#18 Adjust OFFSET Value of CH1
#19 Adjust OFFSET Value of CH2
#20 Adjust OFFSET Value of CH3
#21 Adjust OFFSET Value of CH4
#24 Adjust GAIN Value of CH1
#25 Adjust GAIN Value of CH2
#26 Adjust GAIN Value of CH3
#27 Adjust GAIN Value of CH4
#30 Error Status
#31 Setup Communication Address
#32 Setup Baud Rate
#33 Reset to Factory Setting and Authorize G
#34 System Version

☑ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data: 1

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1000
Set Value: 4000
10000mV 20000uA
Range :0~4000

Click "Add to List" to generate program codes.

```
LD M1000
TO K0 K6 K4000 K1
```

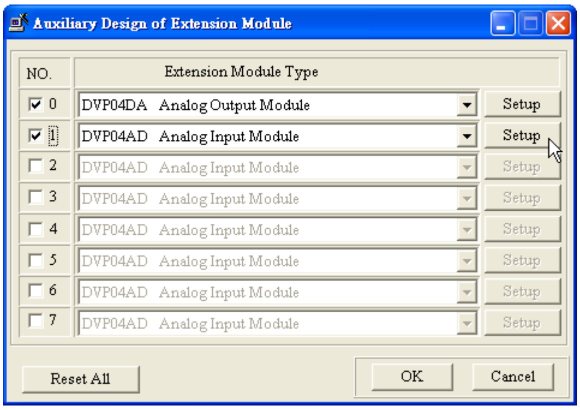
Instruction List

```
LD M1002
TO K0 K1 H0003 K1
LD M1000
TO K0 K6 D0 K1
```

Modified to D0

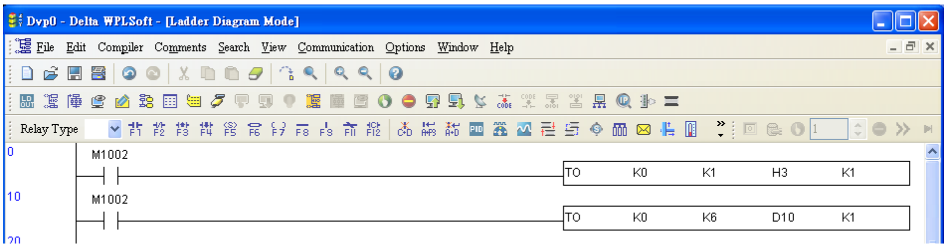
#6 CH1 Output Value: TO K0 K6 D0 K1

7. The setups of other CR parameters can follow the steps illustrated above.
8. After you complete all the setups, click on “OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



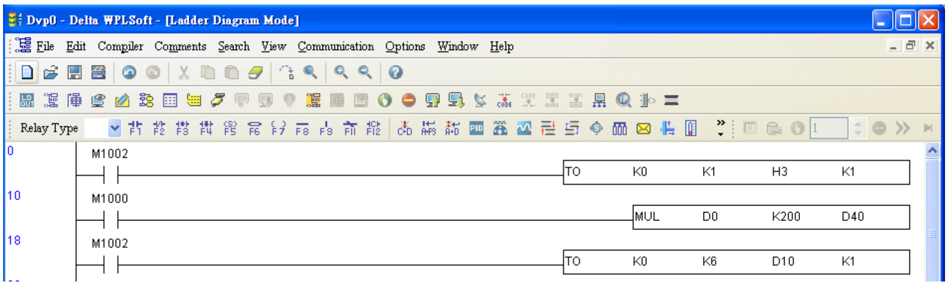
NO.	Extension Module Type
☑ 0	DVP04DA Analog Output Module
☑ 1	DVP04AD Analog Input Module
☐ 2	DVP04AD Analog Input Module
☐ 3	DVP04AD Analog Input Module
☐ 4	DVP04AD Analog Input Module
☐ 5	DVP04AD Analog Input Module
☐ 6	DVP04AD Analog Input Module
☐ 7	DVP04AD Analog Input Module

9. After you complete the setups of all the modules, click on “OK” to generate the program below.



```
0   M1002   TO  K0  K1  H3   K1
10  M1002   TO  K0  K6  D10  K1
```

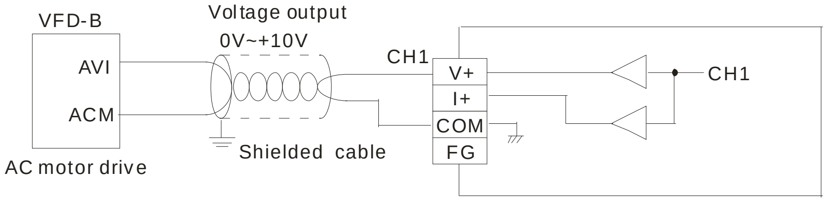
10. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.



```
0   M1002   TO   K0  K1    H3   K1
10  M1000   MUL  D0  K200  D40
18  M1002   TO   K0  K6    D10  K1
```

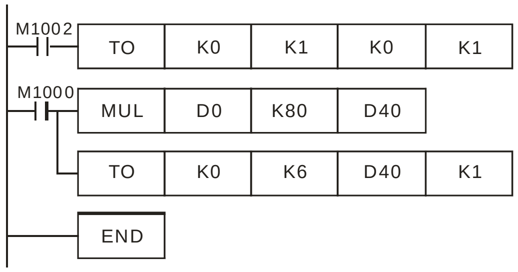
2.8.3 Measuring the Speed of AC Motor Drive

1. Description
   - VFD-B series AC motor drive offers analog input terminal AVI/ACM for accepting external analog voltage 0V ~ 10V and controlling the frequency 0 ~ 50Hz of VFD-B. Therefore, you can use DVP04DA for controlling the speed of the AC motor drive.
   - Set the output signals of D/A module as mode 0, i.e. the voltage output mode (0V ~ 10V).
2. Devices
   - D0: the frequency of VFD-B (0 ~ 50Hz).
   - D40: the corresponding digital value of output voltage from CH1
3. Wiring
   - Connect the analog input terminal AVI/ACM on VFD-B to CH1 of DVP04DA (as shown below).



4. Program explanation
   - When PLC goes from STOP to RUN, set CH1 as voltage output mode (mode 0).
   - In the voltage mode of DVP04AD, The value range for 0 ~ 10V is K0 ~ K4,000. D0 is the frequency of the AC motor drive (0 ~ 50Hz), which is 80 times of the actual voltage output digital value (4,000/50 = 80). Multiply the value in D0 with 80 and store the value obtained into data register D40 for DVP04DA to designate a voltage output.
5. Program example

Ladder diagram:



Explanation:

Set as mode 0 (voltage output mode)

D0 = the frequency of AC motor drive (0 ~ 50Hz). Store the operational result into D40.

D40 is the corresponding digital value of output voltage from CH1

3.1 The A/D and D/A Conversion

In industrial automation, many measuring units are transmitted by analog signals. The most frequently adopted range for the signals are voltage -10 ~ 10V and current -20 ~ 20mA. To use the analog signals as the parameters for PLC operations, you have to convert them into digital values first. Furthermore, many control signals are analog signals. The most frequently adopted range for the signals are voltage 0 ~ 10V and current 0 ~ 20mA. Therefore, the data in the PLC have to be converted into analog signals for controlling the peripheral devices.

For example, the voltage -10 ~ 10V is first converted into values -4,000 ~ +4,000 by an XA module, and the PLC will read/write the control registers (CR) in the XA module by FROM/TO instructions. The signals sent back to the PLC for operations will be digital K-4,000 ~ K4,000. In addition, data 0 ~ 4,000 in the PLC are converted into voltage 0 ~ 10V by a XA module. The output voltage can therefore be used for controlling the peripheral analog devices.

3.2 Introduction

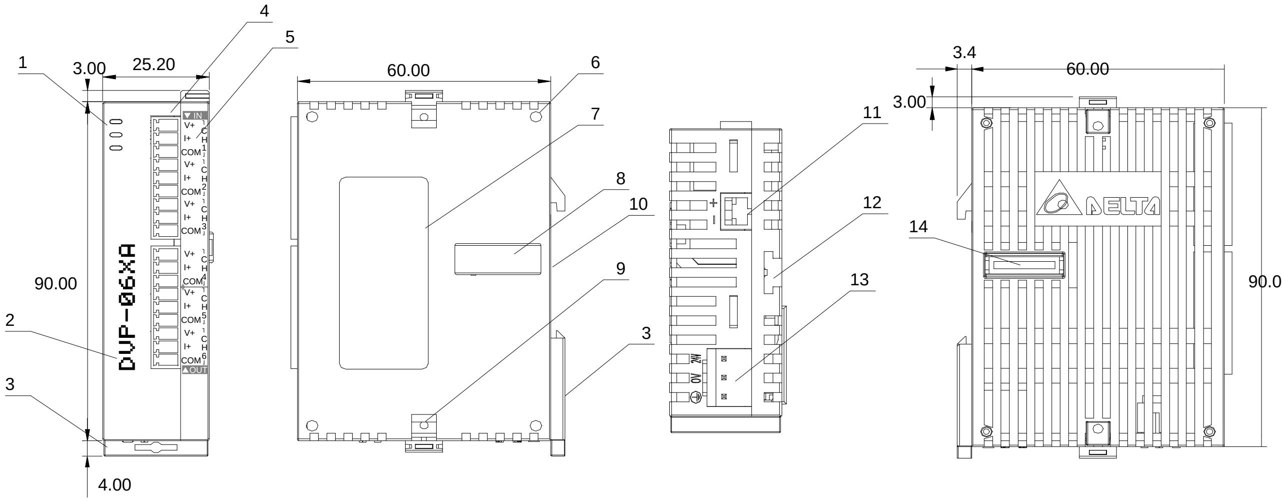
The data in DVP06XA mixed analog input/output module receives external 4 points of analog input signals (voltage or current) and converts them into 12-bit digital signals. For the analog signal output, DVP06XA receives 2 groups of 12-bit digital data coming from the PLC MPU and converts the digital data into 2 points of analog output signals (voltage or current). The MPU can read/write the data in the module by using FROM/TO instructions. There are 49 16-bit control registers in the module.

For the analog signal input, you can select voltage input or current input by the wiring. Range for voltage input: ±10V (±2,000, resolution: 5mV). Range for current input: ±20mA (±1,000, resolution: 20μA).

For the analog signal output, you can select voltage output or current output by the wiring. Range for voltage output: 0V ~ +10V (0 ~ 4,000, resolution: 2.5mV). Range for current output: 0mA ~ 20mA (0 ~ 4,000, resolution: 5μA).

3.3 Product Profile and Outline

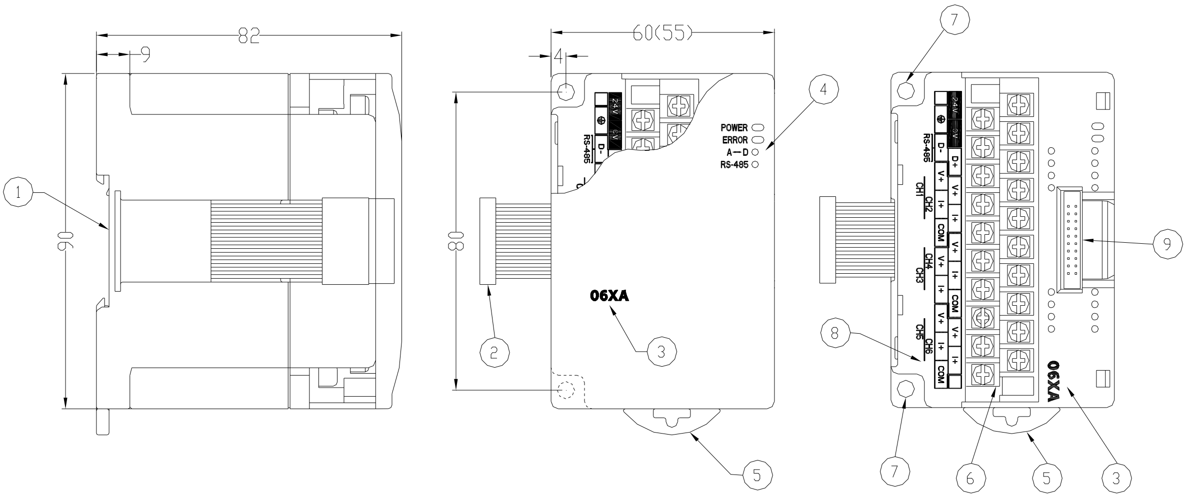
3.3.1 DVP06XA-S



Unit: mm

1. Power, ERROR and A↔D indicators	10. DIN rail (35mm)	I/O terminals	V+	V+
2. Model name	11. RS-485 communication port		I+	I+
3. DIN rail clip	12. Mounting hole for extension unit/module		COM1	COM3
4. Terminals	13. Power input		FG	FG
5. I/O terminals	14. Connection port for extension unit/module		V+	V+
6. Fixing hole for extension unit/module			I+	I+
7. Nameplate			COM2	COM4
8. Connection port for extension unit/module			FG	FG
9. Fixing clip for extension unit/module			-	-

3.3.2 DVP06XA-H2 (DVP06XA-H)



Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Fixing hole
3. Model name	8. I/O terminals (See below)
4. Power, ERROR and A↔D indicators	9. Connection port for extension unit/module
5. DIN rail clip	

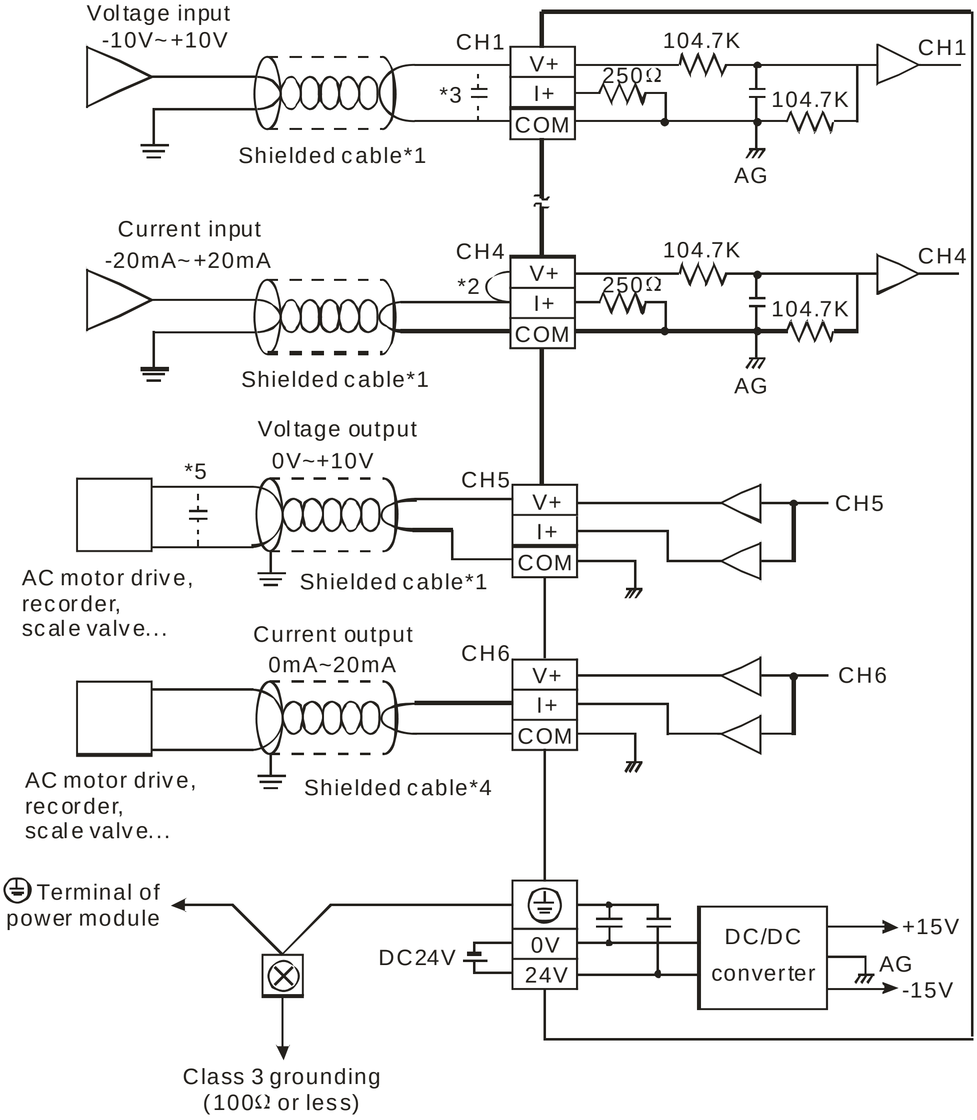
I/O terminals:

24V	0V	D+	V+	I+	V+	I+	COM	V+	I+	
	⏚	D-	V+	I+	COM	V+	I+	V+	I+	COM

CH2 CH4 CH6

CH1 CH3 CH5

3.4 External Wiring



*1: When performing analog input, please isolate other power wirings.

*2: When the XA module is connected to current signals, make sure you short-circuit "V+” and “I+” terminals.

*3: If the ripples at the loaded input terminal are too significant that causes noise interference on the wiring, connect the wiring to 0.1 ~ 0.47μF 25V capacitor.

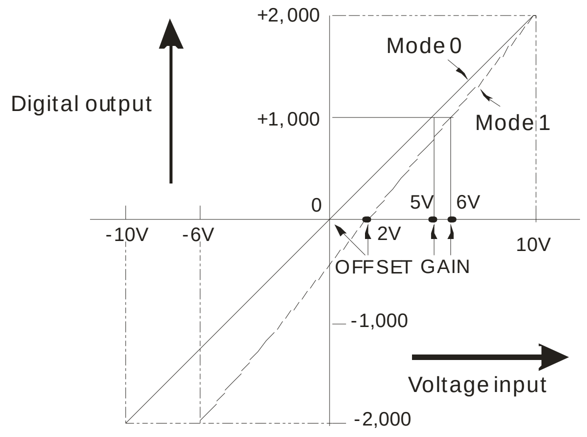
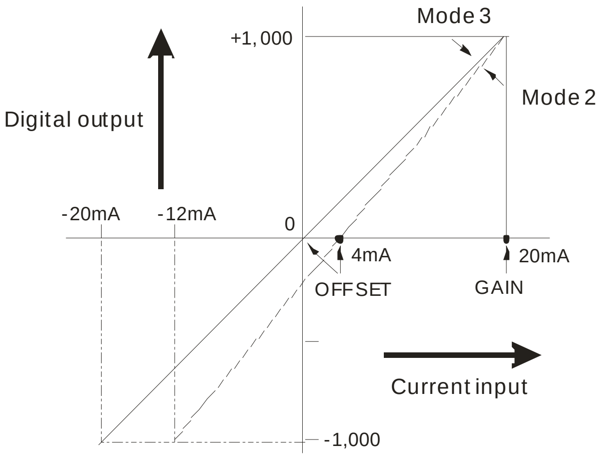
*4: When performing analog output, please isolate other power wirings.

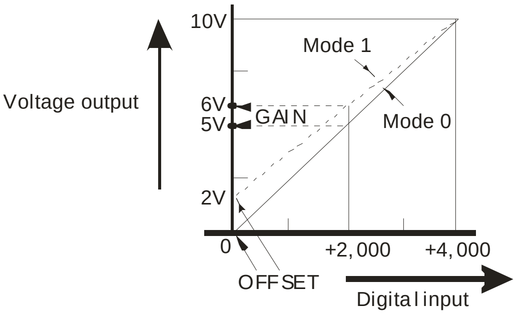
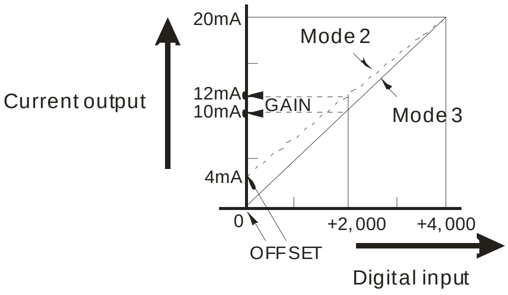
*5: If the ripples at the loaded output terminal are too significant that causes noise interference on the wiring, connect the wiring to 0.1 ~ 0.47μF 25V capacitor.

*6: Please connect the ⏚ terminal on both the power module and XA module to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

✎ ***Warning:*** *DO NOT wire empty terminal* ●.

3.5 Specifications

Analog/Digital (A/D)	Voltage input	Current input
Power supply voltage	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%)	
Analog input channel	4 channels/module	
Range of analog input	±10V	±20mA
Range of digital conversion	±2,000	±1,000
Resolution	12 bits (1_{LSB} = 5mV)	11 bits (1_{LSB} = 20μA)
Input impedance	200KΩ or higher	250Ω
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range 0 ~ 55°C, 32 ~ 131°F	
Response time	3ms × the number of channels	
Isolation	Between analog and digital channels	
Range of absolute input	±15V	±32mA
Digital data format	13 significant bits out of 16 bits are available; in 2's complement	
Average function	Yes; available for setting up in CR#2 ~ CR#5 Range: K1 ~ K4,096 (06XA-S), K1 ~ K20 (06XA-H)	
Self-diagnosis	Upper and lower bound detection/channel	
A/D conversion curve (Default: mode 0)	Mode 0: (-10V ~ +10V), Mode 1: (-6V ~ +10V)  	
	Mode 2: (-12mA ~ +20mA), Mode 3: (-20mA ~ +20mA)  	

Digital/Analog (D/A)	Voltage output	Current output
Analog output channel	2 channels/module	
Range of analog output	0 ~ 10V	0 ~ 20mA
Range of digital data	0 ~ 4,000	0 ~ 4,000
Resolution	12 bits (1_{LSB} = 2.5 mV)	12 bits (1_{LSB} = 5μA)
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range 0 ~ 55°C, 32~131°F	
Output impedance	0.5Ω or lower	
Response time	3 ms × the number of channels	
Max. output current	20mA (1KΩ ~ 2MΩ)	-
Tolerable load impedance	-	0 ~ 500Ω
Digital data format	13 significant bits out of 16 bits are available; in 2's complement	
Isolation	Isolation between inner circuit and analog output terminal. There is no isolation between channels.	
Protection	The voltage output is protected by short circuit. Please also be aware that being short circuit for too long period of time may cause damage on internal circuit. The current output can be open circuit.	
Communication mode (RS-485)	ASCII/RTU mode. Communication baud rates available: 4,800/9,600/19,200/38,400/57,600/115,200 bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1). RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No. 0 is the closest to MPU and No. 7 is the furthest. Max. 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	
Conversion characteristic curve (default setting is 0)	Mode 0: (0V ~ +10V), Mode 1: (2V ~ +10V)  Mode 2: (4mA ~ +20 mA), Mode 3: (0mA ~ +20mA) 	
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	International standards: IEC1131-2, IEC 68-2-6 (TEST Fc)/IEC1131-2 & IEC 68-2-27 (TEST Ea)	
Power Supply		
Max. rated power consumption	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%), (-S) 2W, (-H) 2.5W, supplied by external power	

3.6 CR (Control Register)

3.6.1 CR in DVP06XA

<table>
<tr><th colspan="5">DVP06XA</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’40C8</td><td>O</td><td>R</td><td>Model name</td><td colspan="16">Set up by the system.
DVP06XA-S model code = H’00CC
DVP06XA-H model code = H’0604
DVP06XA-H2 model code = H’6604</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’40C9</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">I/O mode setting</td><td colspan="2">CH6</td><td colspan="2">CH5</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Input mode (CH1 ~ CH4): Default = H’0000. Take CH1 for example:
Mode 0 (b2 ~ b0 = 000): Voltage output (-10V ~ +10V).
Mode 1 (b2 ~ b0 = 001): Voltage output (-6V ~ +10V).
Mode 2 (b2 ~ b0 = 010): Current output (-12mA ~ +20mA).
Mode 3 (b2 ~ b0 = 011): Current output (-20mA ~ +20mA).
Output mode (CH5 ~ CH6): Take CH5 for example:
Mode 0 (b13 ~ b12 = 00): Voltage output (0V ~ 10V).
Mode 1 (b13 ~ b12 = 01): Voltage output (2V ~ 10V).
Mode 2 (b13 ~ b12 = 10): Current output (4mA ~ 20mA).
Mode 3 (b13 ~ b12 = 11): Current output (0mA ~ 20mA).</td></tr>
<tr><td>#2</td><td>H’40CA</td><td>O</td><td>R/W</td><td>CH1 average time</td><td colspan="16" rowspan="4">Range for DVP06XA-S: K1 ~ K4,096
Range for DVP06XA-H: K1 ~ K20
Default = K10</td></tr>
<tr><td>#3</td><td>H’40CB</td><td>O</td><td>R/W</td><td>CH2 average time</td></tr>
<tr><td>#4</td><td>H’40CC</td><td>O</td><td>R/W</td><td>CH3 average time</td></tr>
<tr><td>#5</td><td>H’40CD</td><td>O</td><td>R/W</td><td>CH4 average time</td></tr>
<tr><td>#6</td><td>H’40CE</td><td>X</td><td>R</td><td>CH1 input average</td><td colspan="16" rowspan="4">Average of input signals at CH1 ~ CH4</td></tr>
<tr><td>#7</td><td>H’40CF</td><td>X</td><td>R</td><td>CH2 input average</td></tr>
<tr><td>#8</td><td>H’40D0</td><td>X</td><td>R</td><td>CH3 input average</td></tr>
<tr><td>#9</td><td>H’40D1</td><td>X</td><td>R</td><td>CH4 input average</td></tr>
<tr><td>#10</td><td>H’40D2</td><td>X</td><td>R/W</td><td>CH5 output value</td><td colspan="16" rowspan="2">Range: K0 ~ K4,000
Default = K0. Unit: LSB</td></tr>
<tr><td>#11</td><td>H’40D3</td><td>X</td><td>R/W</td><td>CH6 output value</td></tr>
<tr><td>#12</td><td>H’40D4</td><td>X</td><td>R</td><td>CH1 input present value</td><td colspan="16" rowspan="4">Present value of input signals at CH1 ~ CH4</td></tr>
<tr><td>#13</td><td>H’40D5</td><td>X</td><td>R</td><td>CH2 input present value</td></tr>
<tr><td>#14</td><td>H’40D6</td><td>X</td><td>R</td><td>CH3 input present value</td></tr>
<tr><td>#15</td><td>H’40D7</td><td>X</td><td>R</td><td>CH4 input present value</td></tr>
<tr><td colspan="2">#16 ~ #17</td><td colspan="19">Reserved</td></tr>
<tr><td>#18</td><td>H’40DA</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH1</td><td colspan="16" rowspan="4">Offset setting of CH1 ~ CH4. Default = K0. Unit: LSB.
When voltage input, range: K-1,000 ~ K1,000
When current input, range: K-1,000 ~ K1,000</td></tr>
<tr><td>#19</td><td>H’40DB</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH2</td></tr>
<tr><td>#20</td><td>H’40DC</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H’40DD</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH4</td></tr>
<tr><td>#22</td><td>H’40DE</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH5</td><td colspan="16" rowspan="2">Offset setting of CH5 ~ CH6. Default = K0.Unit: LSB.
Range: K-2,000 ~ K2,000</td></tr>
<tr><td>#23</td><td>H’40DF</td><td>O</td><td>R/W</td><td>Adjusted OFFSET value of CH6</td></tr>
<tr><td>#24</td><td>H’40E0</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH1</td><td colspan="16" rowspan="2">GAIN setting of CH1 ~ CH4. Default = K1,000. Unit: LSB.
When voltage input, range: K-800 ~ K4,000
When current input, range: K-800 ~ K2,600</td></tr>
<tr><td>#25</td><td>H’40E1</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH2</td></tr>
</table>

<table>
<tr><th colspan="5">DVP06XA</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#26</td><td>H’40E2</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH3</td><td colspan="16" rowspan="2"></td></tr>
<tr><td>#27</td><td>H’40E3</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH4</td></tr>
<tr><td>#28</td><td>H’40E4</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH5</td><td colspan="16" rowspan="2">GAIN setting of CH5 ~ CH6. Default = K2,000. Unit: LSB. Range: K0 ~ K4,000</td></tr>
<tr><td>#29</td><td>H’40E5</td><td>O</td><td>R/W</td><td>Adjusted GAIN value of CH6</td></tr>
<tr><td>#30</td><td>H’40E6</td><td>X</td><td>R</td><td>Error status</td><td colspan="16">Register for storing all error status. See the table of error status for more information.</td></tr>
<tr><td>#31</td><td>H’40E7</td><td>O</td><td>R/W</td><td>Communication address setting</td><td colspan="16">For setting RS-485 communication address. Range: 01 ~ 255. Default = K1</td></tr>
<tr><td>#32</td><td>H’40E8</td><td>O</td><td>R/W</td><td>Communication speed (baud rate) setting</td><td colspan="16">4,800/9,600/19,200/38,400/57,600/115,200bps are available.
ASCII data format: 7-bits, Even, 1 stop bit (7, E, 1).
RTU data format: 8-bits, Even, 1 stop bit (8, E, 1).
Default = H’0002.
b0: 4,800 bps
b1: 9,600 bps (Default)
b2: 19,200 bps
b3: 38,400 bps
b4: 57,600 bps
b5: 115,200 bps
b6 ~ b13: reserved
b14: High/low bit exchange of CRC checksum (only valid in RTU mode)
b15: Switch between ASCII/RTU mode. 0 = ASCII mode (default)</td></tr>
<tr><td rowspan="3">#33</td><td rowspan="3">H’40E9</td><td rowspan="3">O</td><td rowspan="3">R/W</td><td rowspan="3">Returning to default setting; OFFSET/GAIN tuning authorization</td><td>b15</td><td>b14</td><td>b13</td><td>b12</td><td>b11</td><td>b10</td><td>b9</td><td>b8</td><td>b7</td><td>b6</td><td>b5</td><td>b4</td><td>b3</td><td>b2</td><td>b1</td><td>b0</td></tr>
<tr><td colspan="2">CH6</td><td colspan="2">CH5</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Default = H’0000.
Take the setting of CH1 for example:
1. When b0 = 0, the user is allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1.
2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0 (OFFSET/GAIN tuning register latched); b1 = 1 (OFFSET/GAIN tuning register non-latched). This function is only valid when in RS-485 communication.
3. When b2 = 1, all settings will return to default values, except for CR#18 and CR24.
Take the setting of CH5 for other example:
1. (b13, b12) = 00: adjustable, latched
2. (b13, b12) = 01: adjustable, non-latched
3. (b13, b12) = 10: not adjustable.
4. (b13, b12) = 11: returning to default setting and reset b12 and b13 as 0.</td></tr>
<tr><td>#34</td><td>H’40EA</td><td>O</td><td>R</td><td>Firmware version</td><td colspan="16">Displaying the current firmware version in hex.</td></tr>
<tr><td colspan="2">#35 ~ #48</td><td colspan="19">For system use</td></tr>
<tr><td colspan="21">Symbols: O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485
LSB (Least Significant Bit):
1. Voltage input: 1_{LSB} = 10V/2,000 = 5mV. 2. Current input: 1_{LSB} = 20mA/1,000 = 20μA.
3. Voltage input: 1_{LSB} = 10V/4,000 = 2.5mV. 4. Current input: 1_{LSB} = 20mA/4,000 = 5μA.</td></tr>
</table>

The corresponding parameters address H’40C8 ~ H’40EA of CR#0 ~ CR#48 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

3.6.2 Explanation of CR

CR#0: Model name

[Explanation]

1. DVP06XA-S Model code = H’00CC.
2. DVP06XA-H Model code = H’0604.
3. DVP06XA-H2 Model code = H’6604.
4. You can read the model name in the program to see of the extension module exists.

CR#1: Input mode setting

[Explanation]

1. b0 ~ b11 are used for setting up the working mode of the 4 channels in analog input (A/D). There are 4 modes for each channel which can be set up separately. For example, if you need to set up CH1: mode 0 (b2 ~ b0 = 000), CH2: mode 1 (b5 ~ b3 = 001), CH3: mode 2 (b8 ~ b6 = 010), and CH4: mode 3 (b11 ~ b9 = 011), b0 ~ b11 have to be set as H’688.
2. b12 ~ b15 are used for setting up the working mode of the 2 channels in analog output (D/A). There are 4 modes for each channel which can be set up separately. For example, if you need to set up CH5: mode 2 (b13 ~ b12 = 10) and CH6: mode 1 (b15 ~ b14 = 01), b12 ~ b15 have to be set as H’5. Default value = H’0000.
3. Input mode settings (CH1 ~ CH4): Take CH1 for example:

   Mode 0 (b2 ~ b0 = 000): Voltage output (-10V ~ +10V).
   Mode 1 (b2 ~ b0 = 001): Voltage output (-6V ~ +10V).
   Mode 2 (b2 ~ b0 = 010): Current output (-12mA ~ +20mA).
   Mode 3 (b2 ~ b0 = 011): Current output (-20mA ~ +20mA).
4. Output mode settings (CH5 ~ CH6): Take CH5 for example

   Mode 0 (b13 ~ b12=00): Voltage output (0V ~ 10V).
   Mode 1 (b13 ~ b12=01): Voltage output (2V ~ 10V).
   Mode 2 (b13 ~ b12=10): Current output (4mA ~ 20mA).
   Mode 3 (b13 ~ b12=11): Current output (0mA ~ 20mA).

CR#2, 3, 4, 5: Average time at CH1 ~ CH4

[Explanation]

1. The settings of average times of the signals at CH1 ~ CH4. Default = K10.
2. Range for DVP06XA-S: K1 ~ K4,096
3. Range for DVP06XA-H: K1 ~ K20
4. Please note that the average time settings at CR#2 ~ CR#5 only need to be written in once.

CR#6, 7, 8, 9: Input average values at CH1 ~ CH4

[Explanation]

1. The average of the signals at CH1 ~ CH4 obtained from the settings in CR#2 ~ CR#5.
2. If the settings in CR#2 ~ CR#5 is 10, the content in CR#6 ~ CR#9 will be the average of the most recent 10 signals at CH1 ~ CH4.

CR#10, 11: Output digital values at CH5 ~ CH6

[Explanation]

The settings of output values at CH5 and CH6. Range: K0 ~ K4,000. Default = K0. Unit: LSB.

CR#12, 13, 14, 15: Input present values at CH1 ~ CH4

[Explanation]

The present value of input signals at CH1 ~ CH4.

CR#18, 19, 20, 21: Adjusted OFFSET value of CH1 ~ CH4

[Explanation]

1. The OFFSET settings for signals at CH1 ~ CH4. Default = K0. Unit: LSB.
   Range when voltage input: K-1,000 ~ K1,000
   Range when current input: K-1,000 ~ K1,000.
2. The adjusted OFFSET value of CH1 ~ CH4, representing the analog input voltage or current when the analog signal is converted into digital value 0.
   The adjustable range of voltage: -5V ~ +5V (-1,000$_{\text{LSB}}$ ~ +1,000$_{\text{LSB}}$).
   The adjustable range of current: -20mA ~ +20mA (-1,000$_{\text{LSB}}$ ~ +1,000$_{\text{LSB}}$).

CR#22, 23: Adjusted OFFSET value of CH5 ~ CH6

[Explanation]

1. The OFFSET settings for signals at CH5 ~ CH6. Default = K0. Unit: LSB. Range: K-2,000 ~ K2,000.
2. The adjusted OFFSET value of CH5 ~ CH6, representing the analog output voltage or current when the digital output value is 0 after calculation. Range: -2,000 ~ +2,000
   The adjustable range of voltage: -5V ~ +5V (-1,000$_{\text{LSB}}$ ~ +1,000$_{\text{LSB}}$).
   The adjustable range of current: -20mA ~ +20mA (-1,000$_{\text{LSB}}$ ~ +1,000$_{\text{LSB}}$).

CR#24, 25, 26, 27: Adjusted GAIN value of CH1 ~ CH4

[Explanation]

1. The GAIN settings for signals at CH1 ~ CH4. Default = K1,000. Unit: LSB.
   Range when voltage input: K-800 ~ K4,000
   Range when current input: K-800 ~ K2,600.

2. The adjusted GAIN value of CH1 ~ CH4, representing the analog input voltage or current when the analog signal is converted into digital value 1,000.
   The adjustable range of voltage: -4V ~ +20V (-800$_{LSB}$ ~ +4,000$_{LSB}$).
   The adjustable range of current: -16mA ~ +52mA (800$_{LSB}$ ~ +2,600$_{LSB}$).
3. Please note that: GAIN value – OFFSET value = +200$_{LSB}$ ~ +3,000$_{LSB}$ (voltage) or +200 $_{LSB}$ ~ +1,600 $_{LSB}$ (current). When GAIN – OFFSET is small (steep oblique), the resolution of output signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of output signal will be rougher and variation on the digital value will be smaller.

CR#28, 29: Adjusted GAIN value of CH5 ~ CH6

[Explanation]

1. The GAIN settings for signals at CH5 ~ CH6. Default = K2,000. Unit: LSB. Range: K0 ~ K4,000.
2. The adjusted GAIN value of CH5 ~ CH6, representing the analog output voltage or current when the digital output value is 2,000 after calculation.
   The adjustable range of voltage: -4V ~ +20V (0$_{LSB}$ ~ +4,000$_{LSB}$).
   The adjustable range of current: -8mA ~ +40mA (0$_{LSB}$ ~ +4,000$_{LSB}$).
3. Please note that: GAIN value – OFFSET value = +400$_{LSB}$ ~ +6,000$_{LSB}$ (voltage or current). When GAIN – OFFSET is small (steep oblique), the resolution of output signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of output signal will be rougher and variation on the digital value will be smaller.

CR#30: Data register for storing all errors

[Explanation]

CR#30: error status value. See the table below:

Error	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H’1)	Reserved	0	0	0	0	0	0	0	1
Incorrect analog input value	K2 (H’2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4 (H’4)		0	0	0	0	0	1	0	0
OFFSET/GAIN error	K8 (H’8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H’10)		0	0	0	1	0	0	0	0
Abnormal conversion value range	K32 (H’20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64 (H’40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		1	0	0	0	0	0	0	0

Note: *Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error*

Example:

DA part: If the digital input exceeds 4,000, analog input value error (K2) will happen. If the analog output exceeds 10V, both analog input value error (K2) and digital range error (K32) will happen.

AD part: “Abnormal conversion value range” (K32) will occur when in voltage mode, the digital conversion is lower than -2,000 or higher than 2,000, or in current mode, the analog input is lower than -1,000 or higher than 1,000.

CR#31: RS-485 communication address setting

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1. This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#32: Communication speed (baud rate) setting

[Explanation]

The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200bps (bps stands for bits per second). Default = H'0002.

b0 = 1:	4,800 bps
b1 = 1:	9,600 bps (default)
b2 = 1:	19,200 bps
b3 = 1:	38,400 bps
b4 = 1:	57,600 bps
b5 = 1:	115,200 bps
b6 ~ b13:	Reserved
b14:	High/low bit exchange of CRC checksum (only valid in RTU mode)
b15:	Switch between ASCII/RTU mode. 0: ASCII (default); 1: RTU. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1); RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#33: Returning to default setting; OFFSET/GAIN tuning authorization

[Explanation]

For authorization on some internal functions, e.g. OFFSET/GAIN tuning. The latched function will store the output setting in the internal memory before the power is cut off. Default setting = H'0000.

Take the setting of CH1 of CH1 ~ CH4 for example:

1. When b0 = 0, the user is allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1.
2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0: OFFSET/GAIN tuning registers are latched; b1 = 1: OFFSET/GAIN tuning registers are non-latched. This function is only valid when in RS-485 communication.
3. When b2 = 1, all settings will return to default value except for CR#31 and CR#32.

Take the setting of CH5 of CH5 ~ CH6 for example:

1. (b13, b12) = 00: Adjustable, latched
2. (b13, b12) = 01: Adjustable, latched
3. (b13, b12) = 10: Not adjustable
4. (b13, b12) = 11: Returning to default setting except for CR#31 and CR#32 and reset b13 and b12 as 0

CR#34: Firmware version

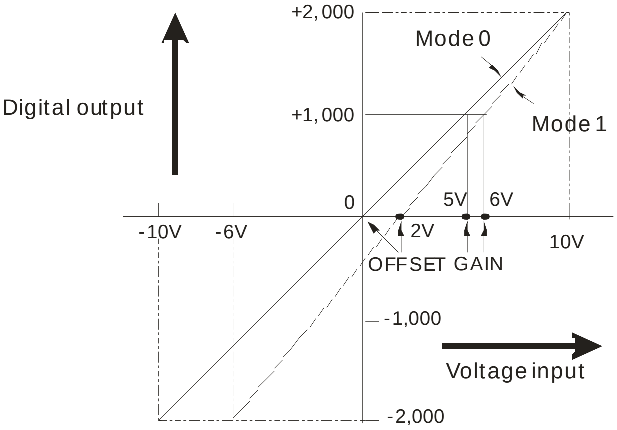
[Explanation]

Displaying the current firmware version in hex, e.g. version V1.00 is indicated as H'0100.

3.7 A/D and D/A Conversion Curve

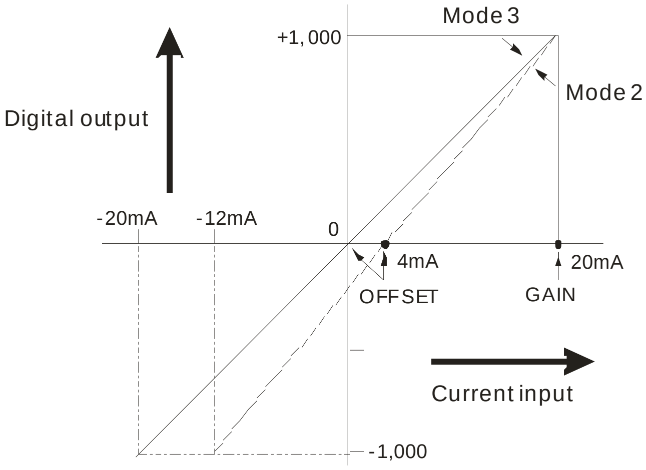
3.7.1 Adjusting A/D Conversion Curve of CH1 ~ CH4

1. Voltage input mode



Mode 0 of CR#1	-10V ~ +10V, GAIN = 5V (1,000$_{LSB}$), OFFSET = 0V (0$_{LSB}$).
Mode 1 of CR#1	-6V ~ +10V, GAIN = 6V (1,200$_{LSB}$), OFFSET = 2V (400$_{LSB}$).
GAIN	The voltage input value when the digital output value = 1,000. Range: -4V ~ +20V (-800$_{LSB}$ ~ + 4,000$_{LSB}$)
OFFSET	The voltage input value when the digital output value = 0. Range: -5V ~ +5V (-1,000$_{LSB}$ ~ +1,000$_{LSB}$)
GAIN - OFFSET	Range: +1V ~ +15V (+200$_{LSB}$ ~ +3,000$_{LSB}$)

2. Current input mode

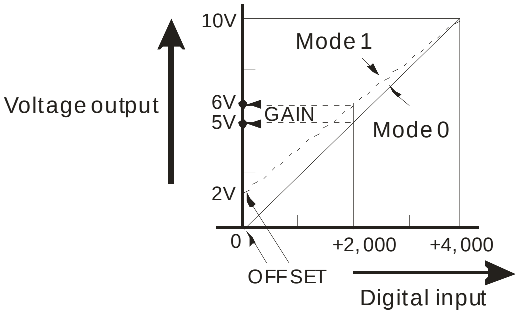


Mode 2 of CR#1	-12mA ~ +20mA, GAIN = 20mA (1,000$_{LSB}$), OFFSET = 4mA (200$_{LSB}$).
Mode 3 of CR#1	-20mA ~ +20mA, GAIN = 20mA (1,000$_{LSB}$), OFFSET = 0mA (0$_{LSB}$).
GAIN	The current input value when the digital output value = +1,000. Range: -20mA ~ +20mA (-800$_{LSB}$ ~ +2,600$_{LSB}$).
OFFSET	The current input value when the digital output value = 0. Range: -16mA ~ +52mA (-1,000$_{LSB}$ ~ +1,000$_{LSB}$)。
GAIN - OFFSET	Range: +4mA ~ +32mA (200$_{LSB}$ ~ +1,600$_{LSB}$).

The user can adjust the conversion curves according to the actual needs by changing the OFFSET value (CR#18 ~ CR#21) and GAIN value (CR#24 ~ CR#27).

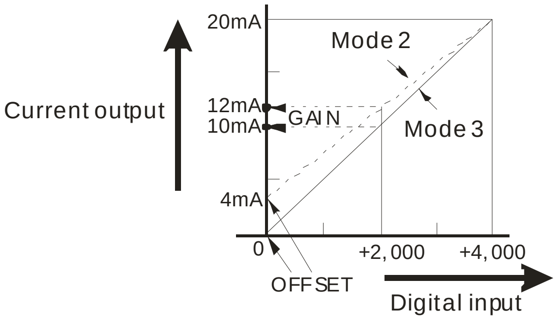
3.7.2 Adjusting D/A Conversion Curve of CH5 ~ CH6

1. Voltage output mode



Mode 0 of CR#1	0V ~ +10V, GAIN = 5V (2,000$_{LSB}$), OFFSET = 0V (0$_{LSB}$)
Mode 1 of CR#1	2V ~ +10V, GAIN = 6V (2,400$_{LSB}$), OFFSET = 2V (800$_{LSB}$)
GAIN	The voltage output value when the digital input value = K2,000. Range: -4V ~ +20V (0$_{LSB}$ ~ +4,000$_{LSB}$)
OFFSET	The voltage output value when the digital input value = K0. Range: -5V ~ +5V (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)
GAIN - OFFSET	Range: +1V ~ +15V (+400$_{LSB}$ ~ +6,000$_{LSB}$)

2. Current output mode



Mode 2 of CR#1	4mA ~ +20mA, GAIN = 12mA (2,400$_{LSB}$), OFFSET = 4mA (800 $_{LSB}$).
Mode 3 of CR#1	0mA ~ +20mA, GAIN = 10mA (2,000$_{LSB}$), OFFSET = 0mA (0$_{LSB}$).
GAIN	The current output value when the digital input value = K2,000. Range: -8mA ~ +40mA (0$_{LSB}$ ~ +4,000$_{LSB}$)
OFFSET	The current output value when the digital input = K0. Range: -10mA ~ +10mA (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)
GAIN - OFFSET	Range: +2mA ~ +30mA (+400$_{LSB}$ ~ +6,000$_{LSB}$).

The user can adjust the conversion curves according to the actual needs by changing the OFFSET value and GAIN value.

3.7.3 Adjusting A/D Conversion Curve in Voltage Input Mode

1. Description

- When CR#1 (b11 ~ b0) is set as voltage input mode (mode 0), the OFFSET value will be set as 0V (K0) and GAIN value as 5V (K4,000), i.e. input voltage -10V ~ +10V will correspond to values -2,000 ~ +2,000.
- When CR#1 (b11 ~ b0) is set as voltage input mode (mode 1), the OFFSET value will be set as 2V (K400) and GAIN value as 6V (K1,200), i.e. input voltage -6V ~ +10V will correspond to values -2,000 ~ +2,000.

- If you cannot use the default voltage input mode (mode 0 and mode 1), you can make adjustments on the A/D conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 0V (K0) and GAIN as 2.5V (K500).
- You only need to set up the A/D conversion curve for once. Set up CR#33 (b11 ~ b0) (OFFSET/GAIN tuning authorization) to prevent incorrect operations.

2. Devices
   - X0=On: Set the input mode of the signals at CH1 as mode 1.
   - X1=On: Set the OFFSET value of CH1 as 0V (K0) and GAIN value as 2.5V (K500).
   - M0=On: Disable adjustment on A/D conversion curve
3. Program explanation
   - When X0 = On, set CR#1 as K1 (H'1, i.e. 0000 0000 0000 0001 in binary) and the signal input mode at CH1 ~ CH4 as mode 1 (voltage input mode).
   - When X1 = On, write K0 (OFFSET value of CH1) into CR#18 and K500 (GAIN value of CH1) into CR#24.
   - When X1 goes from On to Off, set M0 = On to disable the adjustment on A/D conversion curve. Write K1 (H'1, i.e. 0000 0000 0000 0001 in binary) into CR#33 to disable the adjustment on A/D conversion curve in CH1.
4. Program example

Ladder diagram:

Explanation:

Set CH1 as mode 1 (voltage input mode)

Set the OFFSET value of CH1

Set the GAIN value of CH1

Disable adjustment on A/D conversion curve in CH1

3.7.4 Adjusting A/D Conversion Curve in Current Input Mode

1. Description
   - When CR#1 (b11 ~ b0) is set as current input mode (mode 2), the OFFSET value will be set as 4mA (K200) and GAIN value as 20mA (K1,000), i.e. input current -12mA ~ +20mA will correspond to values -1,000 ~ +1,000.
   - When CR#1 (b11 ~ b0) is set as current input mode (mode 3), the OFFSET value will be set as 0mA (K0) and GAIN value as 20mA (K1,000), i.e. input current -20mA ~ +20mA will correspond to values -1,000 ~ +1,000.
   - If you cannot use the default current input mode (mode 2 and mode 3), you can make adjustments on the A/D conversion curve according to your actual need. For example, Set the OFFSET of CH1 ~ CH4 as 5mA (K250) and GAIN as 20mA (K1,000).
   - You only need to set up the A/D conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning

authorization) to prevent incorrect operations.

2. Devices
   - X0=On: Set the input mode of the signals at CH1 ~ CH4 as mode 3.
   - X1=On: Set OFFSET value of CH1 ~ CH4 as 5mA (K250) and GAIN value as 20mA (K1,000).
   - M0=On: Disable adjustment on A/D conversion curve.
3. Program explanation
   - When X0 = On, set CR#1 as K1755 (H’6DB, i.e. 0000 <u>0110 1101 1011</u> in binary) and the signal input mode at CH1 ~ CH4 as mode 3 (current input mode).
   - When X1 = On, write K250 (OFFSET value of CH1 ~ CH4) into CR#18 ~ 21 and K1,000 (GAIN value of CH1 ~ CH4) into CR#24 ~ 27.
   - When X1 goes from On to Off, set M0 = On to disable the adjustment on A/D conversion curve. Write K585 (H’249, i.e. 0000 <u>0010 0100 1001</u> in binary) into CR#33 to disable the adjustment on A/D conversion curve in CH1 ~ CH4.
4. Program example

Ladder diagram:

Explanation:

Set CH1 ~ CH4 as mode 3 (current input mode)

Set the OFFSET value of CH1 ~ CH4

Set the GAIN value of CH1 ~ CH4

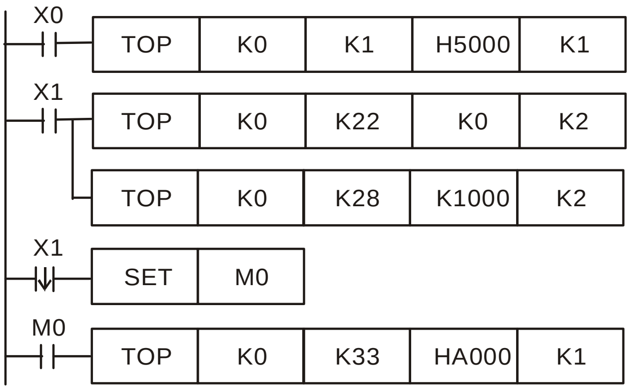
Disable adjustment on A/D conversion curve

3.7.5 Adjusting D/A Conversion Curve in Voltage Output Mode

1. Description
   - When CR#1 (b15 ~ b12) is set as voltage output mode (mode 0), the OFFSET value will be set as 0V (K0) and GAIN value as 5V (K2,000), i.e. output voltage 0 ~ +10V will correspond to values 0 ~ +4,000.
   - When CR#1 (b15 ~ b12) is set as voltage output mode (mode 1), the OFFSET value will be set as 2V (K800) and GAIN value as 6V (K2,400), i.e. output voltage 2V ~ +10V will correspond to values 0 ~ +4,000.
   - If you cannot use the default voltage input mode (mode 0 and mode 1), you can make adjustments on the D/A conversion curve according to your actual need. For example, Set the OFFSET of CH5 ~ CH6 as 0V (K0) and GAIN as 2.5V (K1,000).
   - You only need to set up the D/A conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.
2. Devices
   - X0=On: Set the output mode of the signals at CH5 ~ CH6 as mode 1.
   - X1=On: Set OFFSET value of CH5 ~ CH6 as 0V (K0) and GAIN value as 2.5V (K1,000).
   - M0=On: Disable adjustment on D/A conversion curve.

3. Program explanation
   - When X0 = On, set CR#1 as K20,480 (H’5000, i.e. 0101 0000 0000 0000 in binary) and the signal output mode at CH5 ~ CH6 as mode 1 (voltage output mode).
   - When X1 = On, write K0 (OFFSET value of CH51 ~ CH6) into CR#22 ~ 23 and K1,000 (GAIN value of CH5 ~ CH6) into CR#28 ~ 29.
   - When X1 goes from On to Off, set M0 = On to disable the adjustment on D/A conversion curve. Write K4,096 (H’A000, i.e. 1010 0000 0000 0000 in binary) into CR#33 to disable the adjustment on D/A conversion curve in CH5 ~ CH6.
4. Program Example

Ladder diagram:



Explanation:

Set CH5 ~ CH6 as mode 1 (voltage output mode)

Set the OFFSET value of CH5 ~ CH6

Set the GAIN value of CH5 ~ CH6

Disable adjustment on D/A conversion curve

3.7.6 Adjusting D/A Conversion Curve in Current Output Mode

1. Description
   - When CR#1 is set as current output mode (mode 2), the OFFSET value will be set as 4mA (K800) and GAIN value as 12mA (K2,400), i.e. input current 4mA ~ +20mA will correspond to values 0 ~ +4,000.
   - When CR#1 is set as current output mode (mode 3), the OFFSET value will be set as 0mA (K0) and GAIN value as 10mA (K2,000), i.e. output current 0mA ~ +20mA will correspond to values 0 ~ +4,000.
   - If you cannot use the default current output mode (mode 2 and mode 3), you can make adjustments on the D/A conversion curve according to your actual need. For example, Set the OFFSET of CH5 ~ CH6 as 6mA (K1,200) and GAIN as 13mA (K2,600).
   - You only need to set up the D/A conversion curve for once. Set up CR#33 (OFFSET/GAIN tuning authorization) to prevent incorrect operations.
2. Devices
   - X0=On: Set the output mode of the signals at CH5 ~ CH6 as mode 3.
   - X1=On: Set OFFSET value of CH5 ~ CH6 as 6mA (K1,200) and GAIN value as 13mA (K2,600).
   - M0=On: Disable adjustment on D/A conversion curve.
3. Program explanation
   - When X0 = On, set CR#1 as H’F000 (i.e. 1111 0000 0000 0000 in binary) and the signal output mode at CH5 ~ CH6 as mode 3 (current output mode).
   - When X1 = On, write K1,200 (OFFSET value of CH5 ~ CH6) into CR#22 ~ 23 and K2,600 (GAIN

value of CH5 ~ CH6) into CR#28 ~ 29.

- When X1 goes from On to Off, set M0 = On to disable the adjustment on D/A conversion curve. Write H’A000 (i.e. 1010 0000 0000 0000 in binary) into CR#33 to disable the adjustment on D/A conversion curve in CH5 ~ CH6.

4. Program example

Ladder diagram:

Explanation:

Set CH5 ~ CH6 as mode 3 (current output mode)

Set the OFFSET value of CH5 ~ CH6

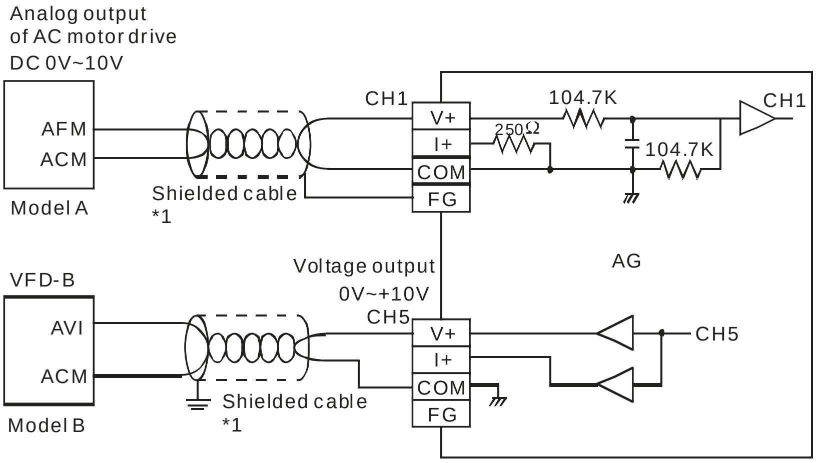
Set the GAIN value of CH5 ~ CH6

Disable adjustment on D/A conversion curve

3.8 The Applications

3.8.1 Speed Tracing of AC Motor Drive

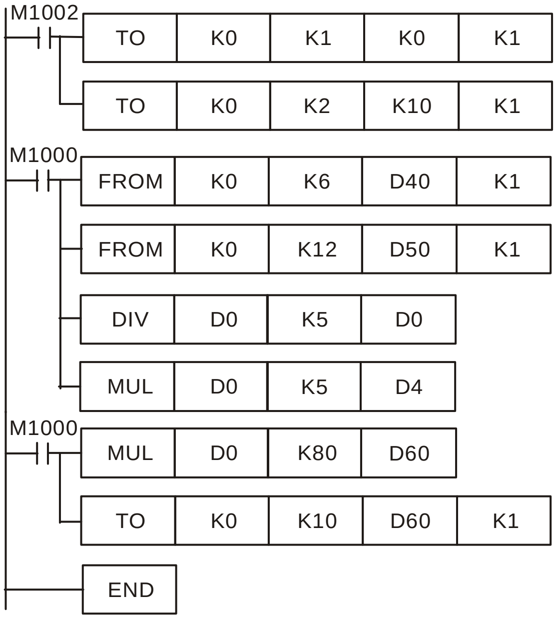
1. Description
   - The multi-functional analog voltage output terminal (AFM) on VFD-B series AC motor drive model A offers signals of current speed (0 ~ 50Hz) which corresponds to 0 ~ 10V DC analog output signals to DVP06XA, and DVP06XA will then offer analog voltage output to the analog voltage input terminal (AVI) on VFD-B series AC motor drive model B, for realizing the auto speed tracing of the AC motor drive.
   - Set the input signals of CH1 as mode 0, i.e. the voltage input mode (-10V ~ 10V)
   - Set the output signal of CH5 as mode 0, i.e. the voltage output mode (0V ~ 10V).
2. Devices
   - D0: present voltage value measured
   - D4: frequency of VFD-B model A
   - D40: average value of the input signals at CH1
   - D50: present value of input signal at CH1
   - D60: corresponding digital value of output voltage at CH5
3. Wiring
   - Connect the analog voltage output terminal (AFM/ACM) on VFD-B model A to CH1 of DVP06XA and connect the analog voltage input terminal (AVI/ACM) on VFD-B model B to CH5 of DVP06XA (as shown on the next page).



4. Program explanation

- When PLC goes from STOP to RUN, due to that VFD-B model A offers analog voltage output 0 ~ 10V DC, you have to set CH1 ~ CH4 as voltage input mode (mode 0) and CH5 ~ CH6 as voltage output mode (mode 0). Together set the average time of the input signals at CH1 as 10.
- Save the present value of the input signal measured into D50.
- In the voltage mode of DVP06XA, The value range for 0 ~ 10V DC is K0 ~ K2,000. D50 is 200 times of the actual voltage value (i.e. 2,000/10 = 200). Divide the value in D50 by 200 and store the value obtained into D0 which will be the actual value of the voltage measured.
- D0 is 5 times of the actual voltage value (i.e. 0 ~ 50.0Hz corresponds to 0 ~ 10V). Multiply the value in D0 with 5 and store the value obtained into data register D4 which will be the actual frequency value
- In the voltage output mode of DVP06XA, the value range for 0 ~ 10V is K0 ~ K4,000. D4 is the frequency of the AC motor drive (0 ~ 50Hz), which is 80 times of the actual output voltage digital value (i.e. 50/4,000 = 80). Multiply the value in D4 with 80 and store the value obtained into data register D60 for DVP06XA to designate a voltage output.

5. Program example

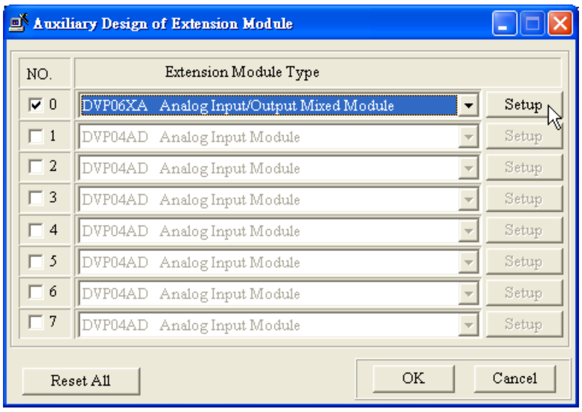


Ladder diagram:						Explanation:
M1002	TO	K0	K1	K0	K1	Set CH1 ~ CH6 as mode 0
	TO	K0	K2	K10	K1	Set the average time of CH1 signals as 10
M1000	FROM	K0	K6	D40	K1	Store the average value of CH1 signals into D40
	FROM	K0	K12	D50	K1	Store the present value of input signal into D50
	DIV	D0	K5	D0		D50/200 = D0, the voltage measured
	MUL	D0	K5	D4		D0*5 = D4, the output frequency of VFD-B model A
M1000	MUL	D0	K80	D60		D4 as the frequency (0 ~ 50Hz) of VFD-B model B and store the operational result into D60.
	TO	K0	K10	D60	K1	D60 is the corresponding digital value of output voltage from CH5.
	END					

3.8.2 How to Set the Module Wizard in WPLSoft

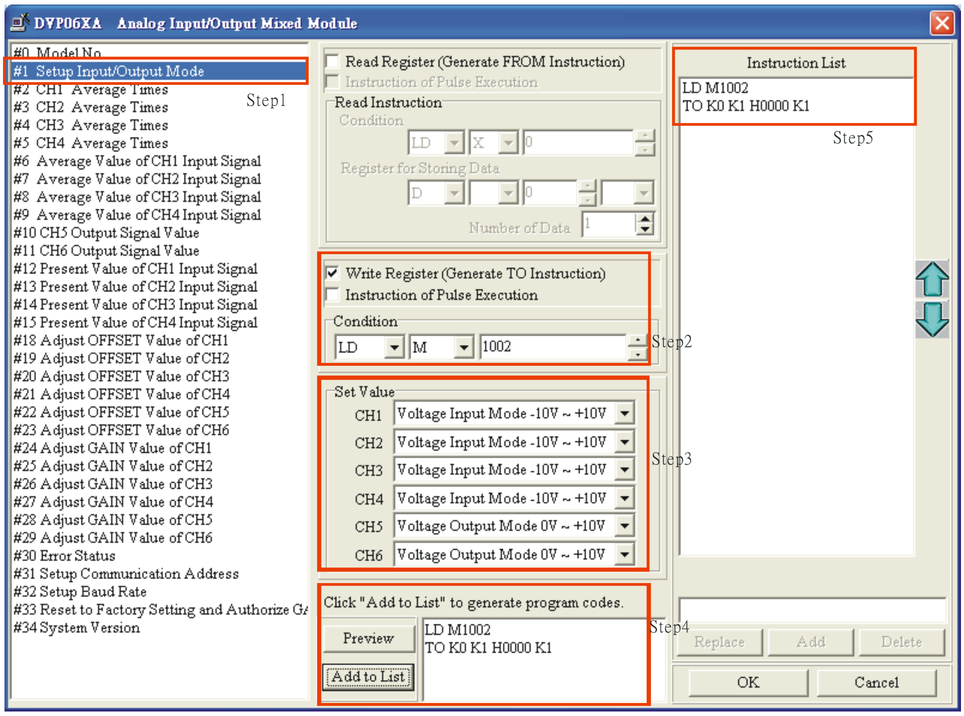
1. Open WPLSoft and click on .

2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP06XA Analog Input/Output Mixed Module”. Click on “Setup” button next.



NO.	Extension Module Type	
☑ 0	DVP06XA Analog Input/Output Mixed Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.



#0 Model No
#1 Setup Input/Output Mode
#2 CH1 Average Times
#3 CH2 Average Times
#4 CH3 Average Times
#5 CH4 Average Times
#6 Average Value of CH1 Input Signal
#7 Average Value of CH2 Input Signal
#8 Average Value of CH3 Input Signal
#9 Average Value of CH4 Input Signal
#10 CH5 Output Signal Value
#11 CH6 Output Signal Value
#12 Present Value of CH1 Input Signal
#13 Present Value of CH2 Input Signal
#14 Present Value of CH3 Input Signal
#15 Present Value of CH4 Input Signal
#18 Adjust OFFSET Value of CH1
#19 Adjust OFFSET Value of CH2
#20 Adjust OFFSET Value of CH3
#21 Adjust OFFSET Value of CH4
#22 Adjust OFFSET Value of CH5
#23 Adjust OFFSET Value of CH6
#24 Adjust GAIN Value of CH1
#25 Adjust GAIN Value of CH2
#26 Adjust GAIN Value of CH3
#27 Adjust GAIN Value of CH4
#28 Adjust GAIN Value of CH5
#29 Adjust GAIN Value of CH6
#30 Error Status
#31 Setup Communication Address
#32 Setup Baud Rate
#33 Reset to Factory Setting and Authorize G
#34 System Version

☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data: 1

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value
CH1: Voltage Input Mode -10V ~ +10V
CH2: Voltage Input Mode -10V ~ +10V
CH3: Voltage Input Mode -10V ~ +10V
CH4: Voltage Input Mode -10V ~ +10V
CH5: Voltage Output Mode 0V ~ +10V
CH6: Voltage Output Mode 0V ~ +10V

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K1 H0000 K1
```

Instruction List

```
LD M1002
TO K0 K1 H0000 K1
```

4. Next, let’s take 3.8.1 Speed tracing of AC motor drive as example.

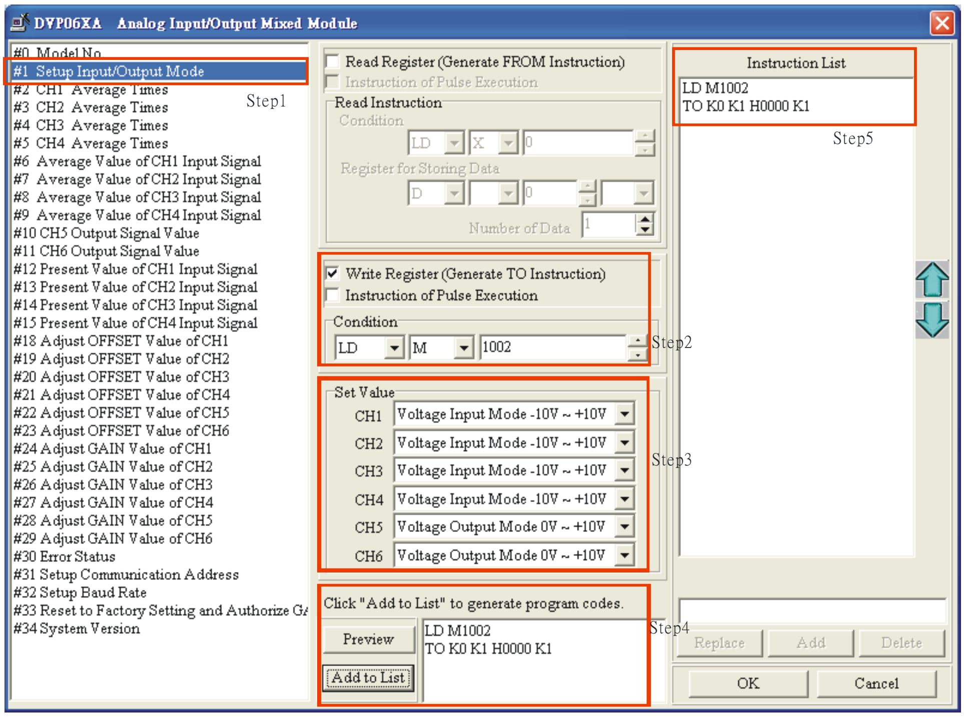
   Step 1: Select “#1 Set up Input/Output Mode”.

   Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”.

   Step 3: Set CH1 ~ CH4 as “Voltage Input Mode -10V ~ +10V” and CH5 ~ CH6 as “Voltage Output Mode 0V ~ +10V”.

   Step 4: Click “Preview” to check if the generated program codes are correct.

   Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#1 is completed.



DVP06XA Analog Input/Output Mixed Module

#1 Setup Input/Output Mode

☐ Read Register (Generate FROM Instruction)

☑ Write Register (Generate TO Instruction)

☐ Instruction of Pulse Execution

Condition: LD M 1002

Set Value

CH1: Voltage Input Mode -10V ~ +10V

CH2: Voltage Input Mode -10V ~ +10V

CH3: Voltage Input Mode -10V ~ +10V

CH4: Voltage Input Mode -10V ~ +10V

CH5: Voltage Output Mode 0V ~ +10V

CH6: Voltage Output Mode 0V ~ +10V

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K1 H0000 K1
```

Instruction List

```
LD M1002
TO K0 K1 H0000 K1
```

5. Setting up CR#2 is similar to the setup of CR#1.

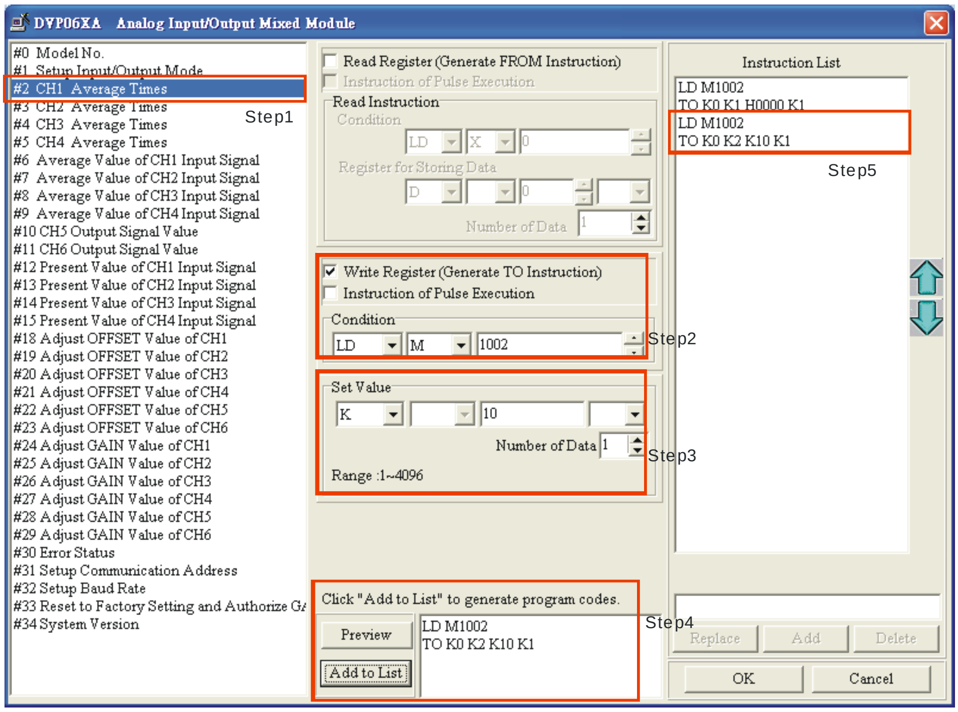
   Step 1: Select “#2 CH1 Average Times”.

   Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”.

   Step 3: Set the set value as “K10” and number of data as “1”

   Step 4: Click “Preview” to check if the generated program codes are correct.

   Step 5: Click "Add to List” to display the instruction codes in “Instruction List". The setup of CR#2 is completed.



DVP06XA Analog Input/Output Mixed Module

#2 CH1 Average Times

☐ Read Register (Generate FROM Instruction)

☑ Write Register (Generate TO Instruction)

☐ Instruction of Pulse Execution

Condition: LD M 1002

Set Value: K 10

Number of Data: 1

Range :1~4096

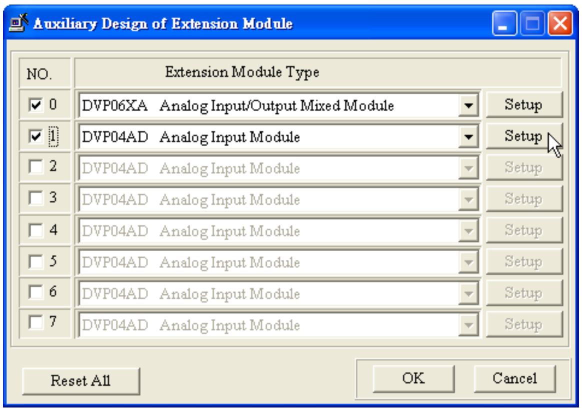
Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K2 K10 K1
```

Instruction List

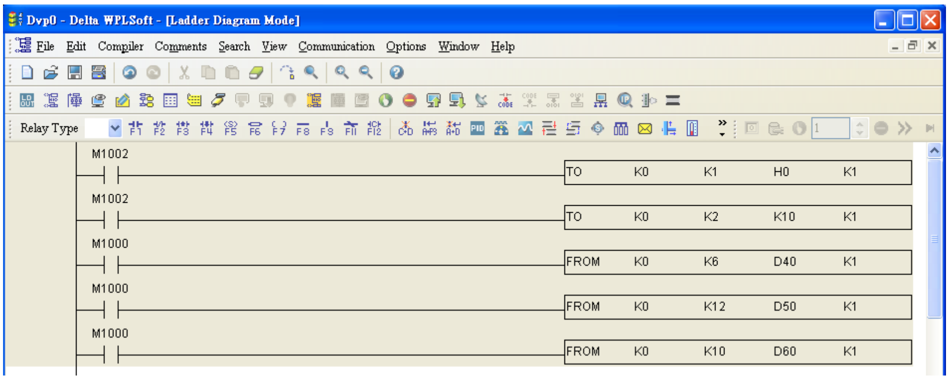
```
LD M1002
TO K0 K1 H0000 K1
LD M1002
TO K0 K2 K10 K1
```

6. The setup of other CR parameters can follow the steps illustrated above.
7. After you complete all the setups, click on "OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



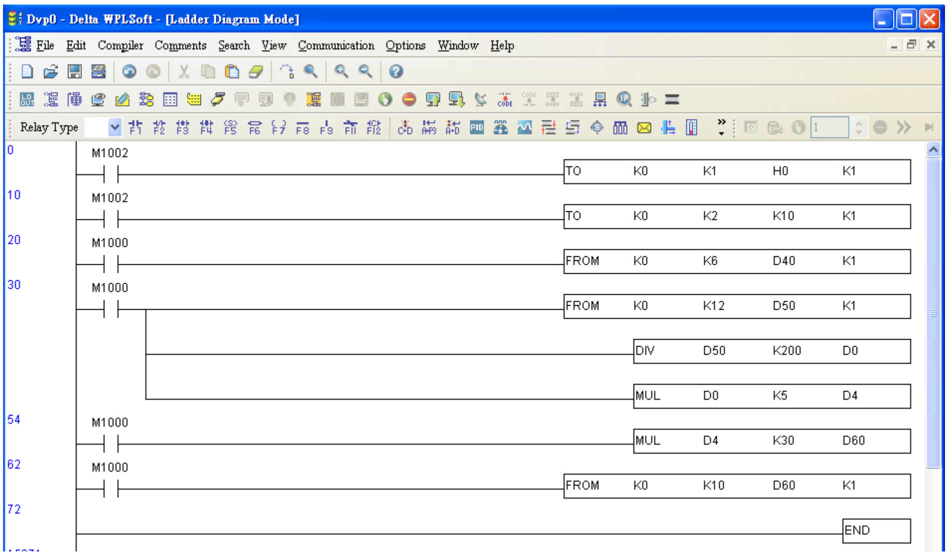
NO.	Extension Module Type	
☑ 0	DVP06XA Analog Input/Output Mixed Module	Setup
☑ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

8. After you complete the setups of all the modules, click on "OK" to generate the program below.



```
M1002
--| |--------------------[TO    K0   K1    H0    K1]
M1002
--| |--------------------[TO    K0   K2    K10   K1]
M1000
--| |--------------------[FROM  K0   K6    D40   K1]
M1000
--| |--------------------[FROM  K0   K12   D50   K1]
M1000
--| |--------------------[FROM  K0   K10   D60   K1]
```

9. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.



```
0   M1002
    --| |--------------------[TO    K0   K1    H0    K1]
10  M1002
    --| |--------------------[TO    K0   K2    K10   K1]
20  M1000
    --| |--------------------[FROM  K0   K6    D40   K1]
30  M1000
    --| |--+-----------------[FROM  K0   K12   D50   K1]
           |
           +---------------------[DIV   D50   K200  D0]
           |
           +---------------------[MUL   D0    K5    D4]
54  M1000
    --| |------------------------[MUL   D4    K30   D60]
62  M1000
    --| |--------------------[FROM  K0   K10   D60   K1]
72
    -------------------------------------------[END]
```

MEMO

4.1 The Basic Concept of Platinum Temperature Sensor (PT100)

Platinum temperature sensor is highly accurate and stable and the quality of linearity between -200°C and 600°C is fairy good. Generally speaking, the temperature coefficient of PT100 temperature sensor is significant at low temperature -200°C ~ -100°C, and the quality of linearity is good at middle temperature 100°C ~ 300°C. The temperature coefficient becomes small the temperature is high, i.e. 300°C ~ 500°C. The resistance of PT100 is 100Ω when the temperature is at 0°C, which is the standard for a metallic temperature sensor.

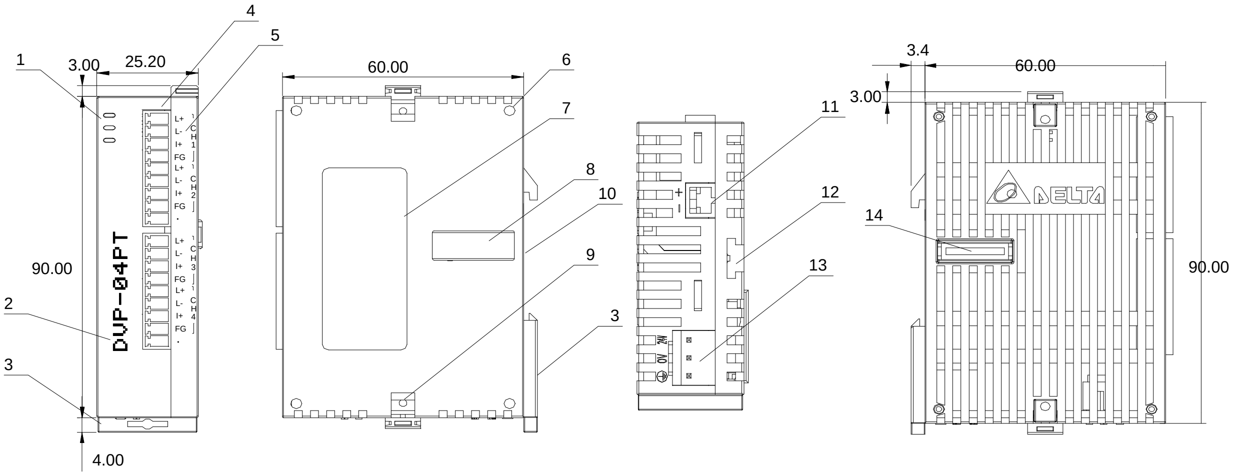
The use of PT100 temperature sensor should avoid the working current that is too big in order to reduce self-heating. It can therefore confine the rated current to be below 2mA. The self-heating of 1mW of PT100 will cause a temperature variation of 0.02°C ~ 0.75°C. Therefore, reducing the current of PT100 can also reduce the temperature variation. However, if the current is too small, PT100 will be interfered by noise easily. In the case, it is appropriate to confine the current between 0.5mA and 2mA.

4.2 Introduction

DVP04PT temperature measurement module is able to receive 4 points of platinum temperature sensors (PT100 3-WIRE 100Ω 3850 PPM/°C (DIN 43760 JIS C1604-1989)) and convert them into 14-bit digital signals. The data in DVP04PT can be read/written by using FROM/TO instructions in the program of DVP-PLC MPU. There are 49 16-bit control registers in the module. The power unit is separate from the module and is compact in size and easy to install. You can select temperature displayed in Celsius (°C) or Fahrenheit (°F). Resolution of temperature in Celsius: 0.1°C and in Fahrenheit: 0.18°F.

4.3 Product Profile and Outline

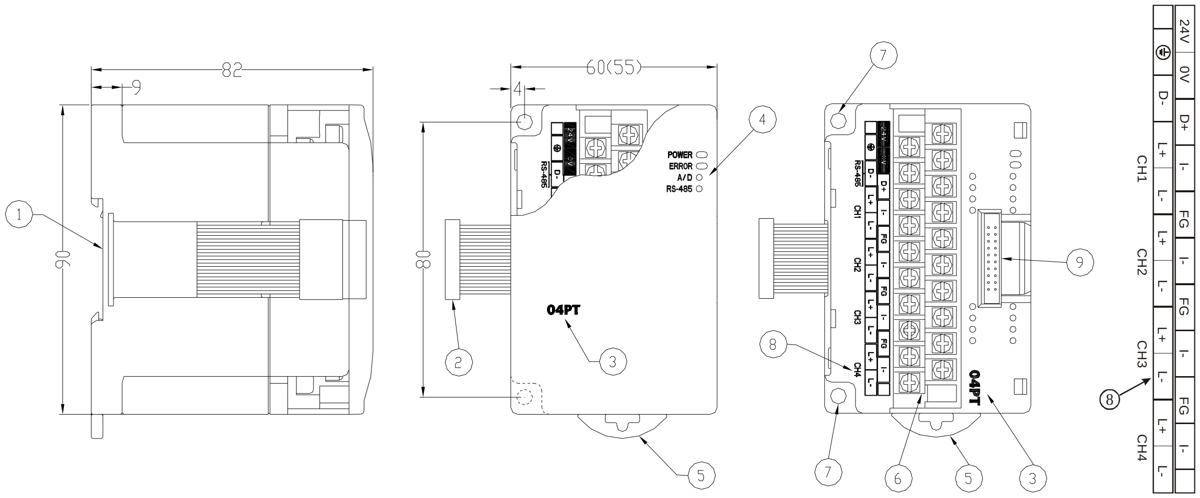
4.3.1 DVP04PT-S



Unit: mm

1. POWER, ERROR, RUN indicators	10. DIN rail (35mm)	5. Terminals	L+	L+
2. Model name	11. RS-485 communication port		L-	L-
3. DIN rail clip	12. Mounting hole for extension unit/module		I+	I+
4. Terminals	13. Power input		FG	FG
5. I/O terminals	14. Connection port for extension unit/module		L+	L+
6. Mounting hole for extension unit/module			L-	L-
7. Nameplate			I+	I+
8. Connection port for extension unit/module			FG	FG
9. Fixing clip for extension unit/module			-	-

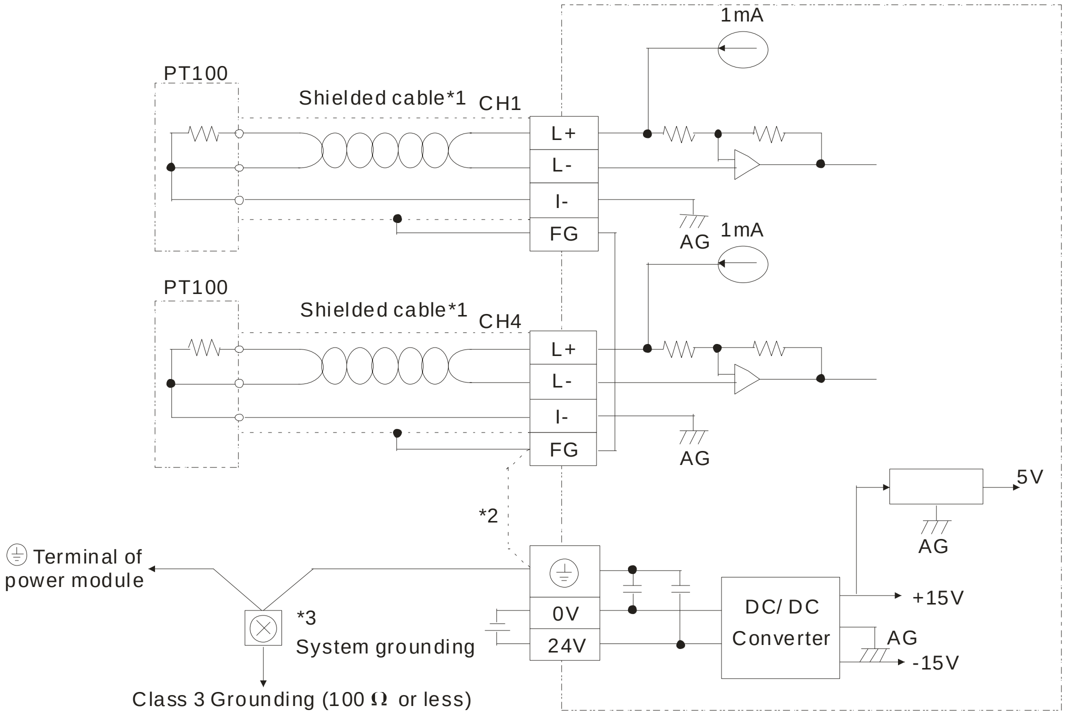
4.3.2 DVP04PT-H2 (DVP04PT-H)



Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. Power, ERROR, RUN indicators	9. Mounting port for extension unit/module
5. DIN rail clip	

4.4 External Wiring

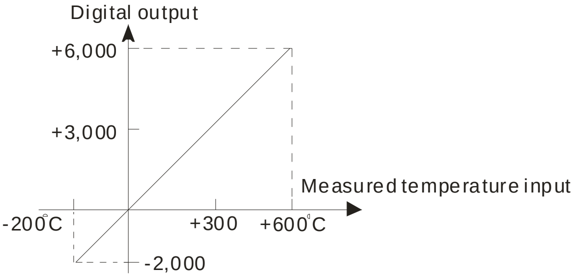
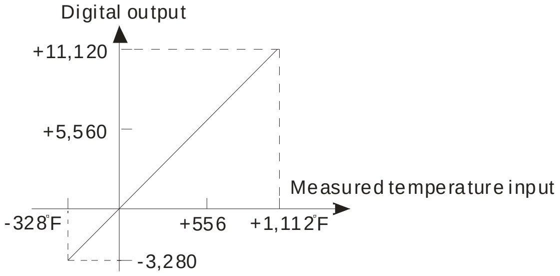


*1: Wiring for analog input should adopt cables of PT100 temperature sensor or double shielded cable and should be separated from other power cables that may cause interference. Please use 3 wires for PT100.

*2: Terminal FG is the ground location for noise suppression.

*3: Please connect the ⏚ terminal on both the power module and DVP04PT temperature measurement module to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

4.5 Functions and Specifications

Temperature measurement module (04PT)	Celsius (°C)	Fahrenheit (°F)
Power supply voltage	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%)	
Analog input channel	4 channels/module	
Applicable sensors type	3-WIRE PT100Ω 3850 PPM/°C (DIN 43760 JIS C1604-1989)	
Current excitation	1mA	
Temperature input range	-200 ~ 600	-328 ~ 1,112
Range of digital conversion	K-2,000 ~ K6,000	K-3,280 ~ K11,120
Resolution	14 bits (0.1°C)	14 bits (0.18°F)
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range of 0 ~ 55°C, 32 ~ 131°F	
Response time	200ms × the number of channels	
Isolation	Isolation between digital area and analog area. No isolation among channels.	
Digital data format	13 significant bits out of 16 bits are available; in 2's complement.	
Average function	Yes; available for setting up in CR#2 ~ CR#5. Range for DVP04PT-S: K1 ~ K4,095; Range for DVP04PT-H: K1 ~ K20.	
Self-diagnosis	Upper and lower bound detection/channel	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1), RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No.0 is the closest to MPU and No.7 is the furthest. Maximum 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	
Temperature/digital curve	Temperature mode: °C 	
	Temperature mode: °F 	
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	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)	
Power Supply		
Max. rated power consumption	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%), (-S)2W, (-H)2.5W, supplied by external power	

4.6 CR (Control Register)

4.6.1 CR in DVP04PT

<table>
<tr><th colspan="5">DVP04PT</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4064</td><td>O</td><td>R</td><td>Model name</td><td colspan="16">Set up by the system.
DVP04PT-S model code = H’008A
DVP04PT-H model code = H’0402
DVP04PT-H2 model code = H’6402</td></tr>
<tr><td colspan="2">#1</td><td colspan="19">Reserved</td></tr>
<tr><td>#2</td><td>H’4066</td><td>O</td><td>R/W</td><td>CH1 average time</td><td colspan="16" rowspan="4">Range for DVP04PT-S: K1 ~ K4,095
Range for DVP04PT-H: K1 ~ K20
Default = K10</td></tr>
<tr><td>#3</td><td>H’4067</td><td>O</td><td>R/W</td><td>CH2 average time</td></tr>
<tr><td>#4</td><td>H’4068</td><td>O</td><td>R/W</td><td>CH3 average time</td></tr>
<tr><td>#5</td><td>H’4069</td><td>O</td><td>R/W</td><td>CH4 average time</td></tr>
<tr><td>#6</td><td>H’406A</td><td>X</td><td>R</td><td>Average °C temperature measured at CH1</td><td colspan="16" rowspan="4">Average of Celsius temperature measured at CH1 ~ CH4.
Unit: 0.1°C</td></tr>
<tr><td>#7</td><td>H’406B</td><td>X</td><td>R</td><td>Average °C temperature measured at CH2</td></tr>
<tr><td>#8</td><td>H’406C</td><td>X</td><td>R</td><td>Average °C temperature measured at CH3</td></tr>
<tr><td>#9</td><td>H’406D</td><td>X</td><td>R</td><td>Average °C temperature measured at CH4</td></tr>
<tr><td colspan="2">#10 ~ #11</td><td colspan="19">Reserved</td></tr>
<tr><td>#12</td><td>H’4070</td><td>X</td><td>R</td><td>Average °F temperature measured at CH1</td><td colspan="16" rowspan="4">Average of Fahrenheit temperature measured at CH1 ~ CH4.
Unit: 0.1°F</td></tr>
<tr><td>#13</td><td>H’4071</td><td>X</td><td>R</td><td>Average °F temperature measured at CH2</td></tr>
<tr><td>#14</td><td>H’4072</td><td>X</td><td>R</td><td>Average °F temperature measured at CH3</td></tr>
<tr><td>#15</td><td>H 4073</td><td>X</td><td>R</td><td>Average °F temperature measured at CH4</td></tr>
<tr><td colspan="2">#16 ~ #17</td><td colspan="19">Reserved</td></tr>
<tr><td>#18</td><td>H’4076</td><td>X</td><td>R</td><td>Present °C temperature measured at CH1</td><td colspan="16" rowspan="4">Present Celsius temperature measured at CH1 ~ CH4.
Unit: 0.1°C</td></tr>
<tr><td>#19</td><td>H’4077</td><td>X</td><td>R</td><td>Present °C temperature measured at CH2</td></tr>
<tr><td>#20</td><td>H’4078</td><td>X</td><td>R</td><td>Present °C temperature measured at CH3</td></tr>
<tr><td>#21</td><td>H’4079</td><td>X</td><td>R</td><td>Present °C temperature measured at CH4</td></tr>
<tr><td colspan="2">#22 ~ #23</td><td colspan="19">Reserved</td></tr>
<tr><td>#24</td><td>H’407C</td><td>X</td><td>R</td><td>Present °F temperature measured at CH1</td><td colspan="16" rowspan="4">Present Fahrenheit temperature measured at CH1 ~ CH4.
Unit: 0.1°F</td></tr>
<tr><td>#25</td><td>H’407D</td><td>X</td><td>R</td><td>Present °F temperature measured at CH2</td></tr>
<tr><td>#26</td><td>H’407E</td><td>X</td><td>R</td><td>Present °F temperature measured at CH3</td></tr>
<tr><td>#27</td><td>H’407F</td><td>X</td><td>R</td><td>Present °F temperature measured at CH4</td></tr>
<tr><td colspan="2">#28</td><td colspan="19">Reserved</td></tr>
<tr><td>#29</td><td>H’40B3</td><td>X</td><td>R/W</td><td>PID mode setting</td><td colspan="16">Can be used for PID settings in DVP04TC-S V3.08 and versions above. Set H'5678 to enable PID mode, other set values are invalid. Default: H’0000. See 5.12.1 for details.</td></tr>
</table>

<table>
<tr><th colspan="5">DVP04PT</th><th colspan="16">Description</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#30</td><td>H’4082</td><td>X</td><td>R</td><td>Error status</td><td colspan="16">Register for storing all error status. See the table of error status for more information.</td></tr>
<tr><td>#31</td><td>H’4083</td><td>O</td><td>R/W</td><td>Communication address stetting</td><td colspan="16">For setting up RS-485 communication address.
Range: 01 ~ 255. Default = K1.</td></tr>
<tr><td>#32</td><td>H’4084</td><td>O</td><td>R/W</td><td>Communication speed (baud rate) setting</td><td colspan="16">4,800/9,600/19,200/38,400/57,600/115,200bps are available. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1)
RTU data format: 8-bit, Even, 1 stop bit (8, E, 1)
Default = H’0002.
b0: 4,800 bps
b1: 9,600 bps (Default)
b2: 19,200 bps
b3: 38,400 bps
b4: 57,600 bps
b5: 115,200 bps
b6 ~ b13: reserved
b14: High/low bit exchange of CRC checksum (only valid in RTU mode)
b15: Switch between ASCII/RTU mode. 0 = ASCII (default)</td></tr>
<tr><td rowspan="2">#33</td><td rowspan="2">H’4085</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Returning to default setting</td><td colspan="4">ERR LED</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Take the setting of CH1 for example:
1. b0 and b1 are reserved.
2. When b2 is set as 1, all the settings will return to default settings except for CR#31 and CR#32.
ERR LED definition:
1. b12 corresponds to CH1. When b12 = 1 or the scale exceeds the range, ERR LED will flash.
2. b13 corresponds to CH2. When b13 = 1 or the scale exceeds the range, ERR LED will flash.
3. b14 corresponds to CH3. When b14 = 1 or the scale exceeds the range, ERR LED will flash.
4. b15 corresponds to CH4. When b15 = 1 or the scale exceeds the range, ERR LED will flash.</td></tr>
<tr><td>#34</td><td>H’4086</td><td>O</td><td>R</td><td>Firmware version</td><td colspan="16">Displaying the current firmware version in hex.</td></tr>
<tr><td colspan="2">#35 ~ #48</td><td colspan="19">For system use.</td></tr>
<tr><td colspan="21">Symbols: O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485
The corresponding parameters address H’4064 ~ H’4086 of CR#0 ~ CR#34 are provided for user to read/write data by RS-485 communication.
1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).</td></tr>
</table>

4.6.2 Explanation on CR

CR#0: Model name

[Explanation]

1. DVP04PT-S model code = H’008A.
2. DVP04PT-H model code = H’0402.
3. DVP04PT-H2 model code = H’6402.
4. You can read the model name in the program to see if the extension module exists.

CR#2, 3, 4, 5: Average time at CH1 ~ CH4

[Explanation]

1. The times to average the temperature measured at CH1 ~ CH4. Please note that the average time set in CR#2 ~ CR#5 need to be written in only once.
2. Range for DVP04PT-S: K1 ~ K4,095. Default = K10.
3. Range for DVP04PT-H: K1 ~ K20. Default = K10.

CR#6, 7, 8, 9: Average Celsius temperature measured at CH1 ~ CH4

[Explanation]

1. The average Celsius temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. Unit: 0.1°C.
2. For example, if the average time is set as 10, the contents in CR#6 ~ CR#9 will be the average of the most recent 10 temperature signals in Celsius at CH1 ~ CH4.

CR#12, 13, 14, 15: Average Fahrenheit temperature measured at CH1 ~ CH4

[Explanation]

1. The average Fahrenheit temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. Unit: 0.1°F.
2. For example, if the average time is set as 10, the contents in CR#12 ~ CR#15 will be the average of the most recent 10 temperature signals in Fahrenheit at CH1 ~ CH4.

CR#18, 19, 20, 21: Present Celsius temperature measured at CH1 ~ CH4

[Explanation]

Displaying the present temperature in Celsius at CH1 ~ CH4. Unit: 0.1°C.

CR#24, 25, 26, 27: Present Fahrenheit temperature measured at CH1 ~ CH4

[Explanation]

Displaying the present temperature in Fahrenheit at CH1 ~ CH4. Unit: 0.1°F.

CR#29: PID mode setting

[Explanation]

For DVP04PT-S V3.08 and later versions, when CR#29 is set to H’5678, CR#0 ~ CR#34 can be used for PID setting (see 5.12.1). CR#29 is for normal mode when it is in other settings. Default = H’0000.

*The PID mode for DVP04PT-S only supports heating.

CR#30: Data register for storing all errors

[Explanation]

CR#30: error status value. See the table below:

Error	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H'1)	Reserved	0	0	0	0	0	0	0	1
Incorrect analog input value	K2 (H'2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4 (H'4)		0	0	0	0	0	1	0	0
Reserved	K8 (H'8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H'10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32 (H'20)		0	0	1	0	0	0	0	0
Incorrect average time setting	K64 (H'40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H'80)		1	0	0	0	0	0	0	0

✎ ***Note:*** *Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error*

CR#31: RS-485 communication address setting

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1. This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#32: Communication speed (baud rate) setting

[Explanation]

The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200bps (bps stands for bits per second). Default = H'0002.

b0 = 1: 4,800 bps
b1 = 1: 9,600 bps (default)
b2 = 1: 19,200 bps
b3 = 1: 38,400 bps
b4 = 1: 57,600 bps
b5 = 1: 115,200 bps
b6 ~ b13: Reserved
b14: High/low bit exchange of CRC checksum (only valid in RTU mode)
b15: Switch between ASCII/RTU mode. 0: ASCII (default); 1: RTU. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1); RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#33: Returning to default setting; definition of ERR LED

[Explanation]

Default = H'F000. Take the setting of CH1 for example:

b0 and b1 are reserved. When b2 is set as 1, all the settings will return to default settings except for CR#31 and CR#32.

Definition of ERR LED:

1. b12 corresponds to CH1. When b12 = 1 or the scale exceeds the range, ERR LED will flash.
2. b13 corresponds to CH2. When b13 = 1 or the scale exceeds the range, ERR LED will flash.
3. b14 corresponds to CH3. When b14 = 1 or the scale exceeds the range, ERR LED will flash.

4. b15 corresponds to CH4. When b15 = 1 or the scale exceeds the range, ERR LED will flash.

CR#34: Firmware version

[Explanation]

Displaying the current firmware version in hex, e.g. version V1.00 is indicated as H’0100.

4.7 The Applications

4.7.1 PT100 Temperature Measurement System

1. Description
   - Measuring temperature by PT100 temperature sensor.
2. Devices
   - D20 ~ D23: average Celsius temperature at CH1 ~ CH4
   - D30 ~ D33: average Fahrenheit temperature at CH1 ~ CH4
   - D40 ~ D43: present Celsius temperature at CH1 ~ CH4
   - D50 ~ D53: present Fahrenheit temperature at CH1 ~ CH4
3. Program explanation
   - When PLC goes from STOP to RUN, set the average time of input signals at CH1 ~ CH4 as 10.
   - Store the average Celsius temperature at CH1 ~ CH4 into D20 ~ D23.
   - Store the average Fahrenheit temperature at CH1 ~ CH4 into D30 ~ D33.
   - Store the present Celsius temperature at CH1 ~ CH4 into D40 ~ D43.
   - Store the present Fahrenheit temperature at CH1 ~ CH4 into D50 ~ D53.
   - DVP04PT stores the obtained temperature value to CR. Therefore, you only need to read the content in the CR to obtain the measured temperature. Unit of the temperature: 0.1°C or 0.1°F.
4. Program example

Ladder diagram:

Explanation:

Set the average time at CH1 ~ CH4 as 10

Read average Celsius degrees at CH1 ~ CH4

Read average Fahrenheit degrees at CH1 ~ CH4

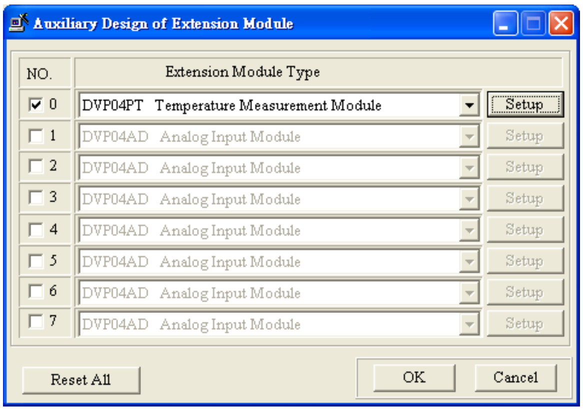
Read present Celsius temperature at CH1 ~ CH4

Read present Fahrenheit temperature at CH1 ~ CH4

4.7.2 How to Set the Module Wizard in WPLSoft

1. Open WPLSoft and click on .

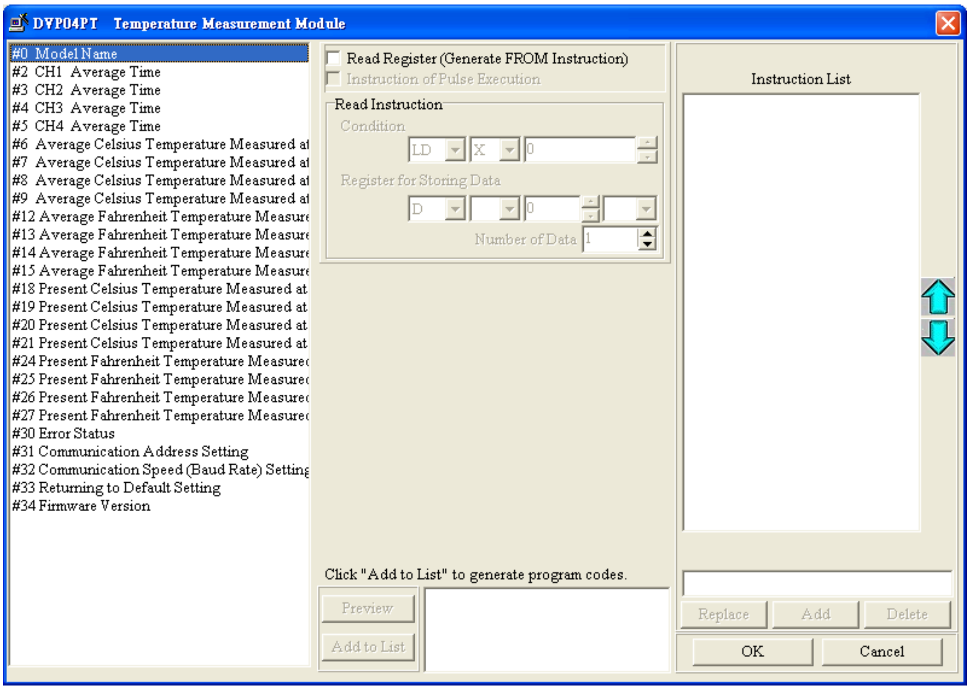
2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP04PT Temperature Measurement Module”.



Auxiliary Design of Extension Module

NO.	Extension Module Type	
☑ 0	DVP04PT Temperature Measurement Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.



DVP04PT Temperature Measurement Module

#0 Model Name
#2 CH1 Average Time
#3 CH2 Average Time
#4 CH3 Average Time
#5 CH4 Average Time
#6 Average Celsius Temperature Measured at
#7 Average Celsius Temperature Measured at
#8 Average Celsius Temperature Measured at
#9 Average Celsius Temperature Measured at
#12 Average Fahrenheit Temperature Measure
#13 Average Fahrenheit Temperature Measure
#14 Average Fahrenheit Temperature Measure
#15 Average Fahrenheit Temperature Measure
#18 Present Celsius Temperature Measured at
#19 Present Celsius Temperature Measured at
#20 Present Celsius Temperature Measured at
#21 Present Celsius Temperature Measured at
#24 Present Fahrenheit Temperature Measurec
#25 Present Fahrenheit Temperature Measurec
#26 Present Fahrenheit Temperature Measurec
#27 Present Fahrenheit Temperature Measurec
#30 Error Status
#31 Communication Address Setting
#32 Communication Speed (Baud Rate) Setting
#33 Returning to Default Setting
#34 Firmware Version

☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution

Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data: 1

Click "Add to List" to generate program codes.

4. Next, let’s take 4.7.1 PT100 temperature measurement system as example.

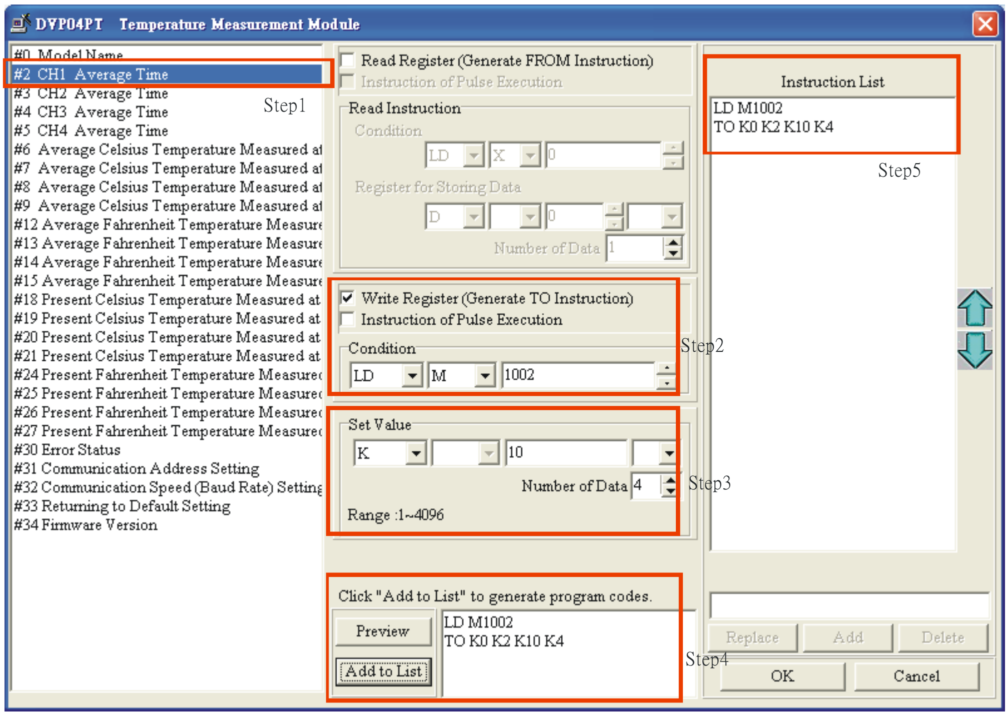
Step 1: Select “#2 CH1 Average Time”.

Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”,

Step 3: Set the set value as “K10” and number of data as “4”.

Step 4: Click “Preview” to check if the generated program codes are correct.

Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#2 ~ CR#5 is completed.



DVP04PT Temperature Measurement Module

#0 Model Name
#2 CH1 Average Time
#3 CH2 Average Time
#4 CH3 Average Time
#5 CH4 Average Time
#6 Average Celsius Temperature Measured at
#7 Average Celsius Temperature Measured at
#8 Average Celsius Temperature Measured at
#9 Average Celsius Temperature Measured at
#12 Average Fahrenheit Temperature Measure
#13 Average Fahrenheit Temperature Measure
#14 Average Fahrenheit Temperature Measure
#15 Average Fahrenheit Temperature Measure
#18 Present Celsius Temperature Measured at
#19 Present Celsius Temperature Measured at
#20 Present Celsius Temperature Measured at
#21 Present Celsius Temperature Measured at
#24 Present Fahrenheit Temperature Measurec
#25 Present Fahrenheit Temperature Measurec
#26 Present Fahrenheit Temperature Measurec
#27 Present Fahrenheit Temperature Measurec
#30 Error Status
#31 Communication Address Setting
#32 Communication Speed (Baud Rate) Setting
#33 Returning to Default Setting
#34 Firmware Version

☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data 1

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value: K 10
Number of Data 4
Range :1~4096

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K2 K10 K4
```

Instruction List

```
LD M1002
TO K0 K2 K10 K4
```

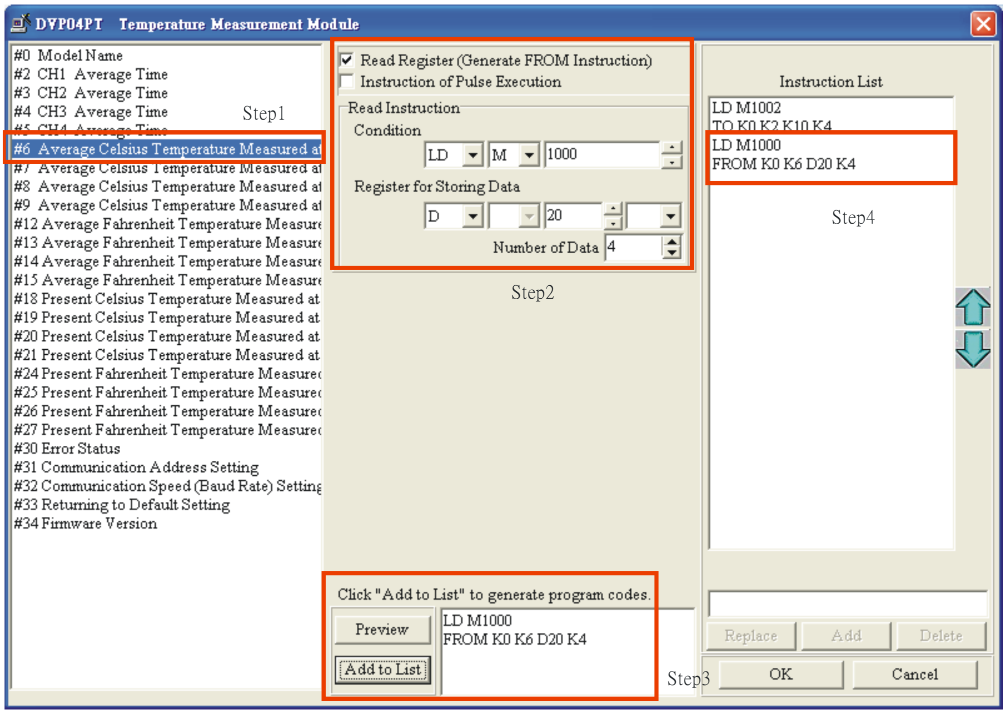
5. Setting up CR#6 ~ CR#9 is similar to the setup of CR#2 ~ CR#5.

Step 1: Select "#6 Average Celsius Temperature Measured at CH1”

Step 2: Check “Read Register” to generate FROM instruction. Set the condition as "LD M1000”, register for storing data as “D20” and number of data as “4”

Step 3: Click “Preview” to check if the generated program codes are correct.

Step 4: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#6 ~ CR#9 is completed.



DVP04PT Temperature Measurement Module

#0 Model Name
#2 CH1 Average Time
#3 CH2 Average Time
#4 CH3 Average Time
#5 CH4 Average Time
#6 Average Celsius Temperature Measured at
#7 Average Celsius Temperature Measured at
#8 Average Celsius Temperature Measured at
#9 Average Celsius Temperature Measured at
#12 Average Fahrenheit Temperature Measure
#13 Average Fahrenheit Temperature Measure
#14 Average Fahrenheit Temperature Measure
#15 Average Fahrenheit Temperature Measure
#18 Present Celsius Temperature Measured at
#19 Present Celsius Temperature Measured at
#20 Present Celsius Temperature Measured at
#21 Present Celsius Temperature Measured at
#24 Present Fahrenheit Temperature Measurec
#25 Present Fahrenheit Temperature Measurec
#26 Present Fahrenheit Temperature Measurec
#27 Present Fahrenheit Temperature Measurec
#30 Error Status
#31 Communication Address Setting
#32 Communication Speed (Baud Rate) Setting
#33 Returning to Default Setting
#34 Firmware Version

☑ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD M 1000
Register for Storing Data: D 20
Number of Data 4

Click "Add to List" to generate program codes.

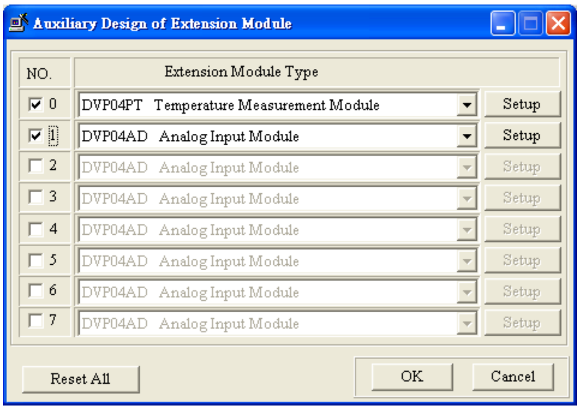
```
LD M1000
FROM K0 K6 D20 K4
```

Instruction List

```
LD M1002
TO K0 K2 K10 K4
LD M1000
FROM K0 K6 D20 K4
```

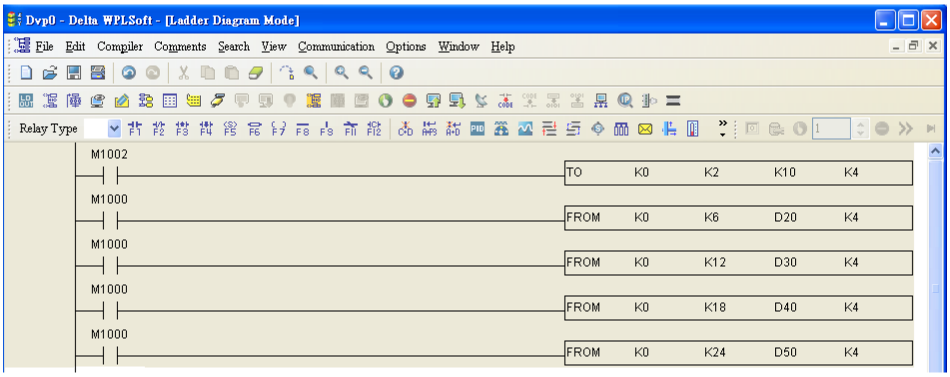
6. The setup of other CR parameters can follow the steps illustrated above.

7. After you complete all the setups, click on “OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



NO.	Extension Module Type	
☑ 0	DVP04PT Temperature Measurement Module	Setup
☑ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

8. After you complete the setups of all the modules, click on “OK” to generate the program below.



```
M1002
--| |----------------------- TO    K0  K2   K10  K4
M1000
--| |----------------------- FROM  K0  K6   D20  K4
M1000
--| |----------------------- FROM  K0  K12  D30  K4
M1000
--| |----------------------- FROM  K0  K18  D40  K4
M1000
--| |----------------------- FROM  K0  K24  D50  K4
```

9. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.

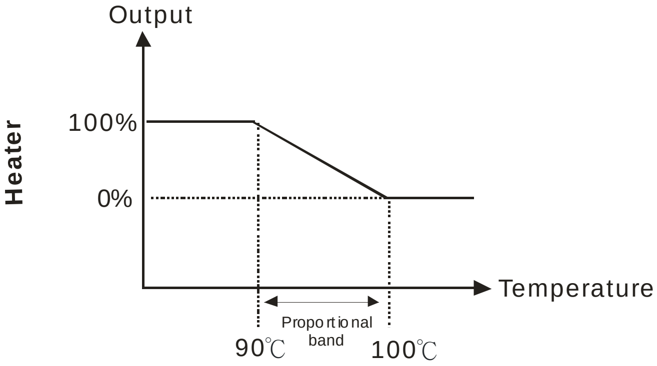
4.8 PID Functions

PID functions are only available in DVP04PT-H2 V1.02 and versions above and DVP04PT-S V3.08 and versions above.

4.8.1 P (Proportional) Control

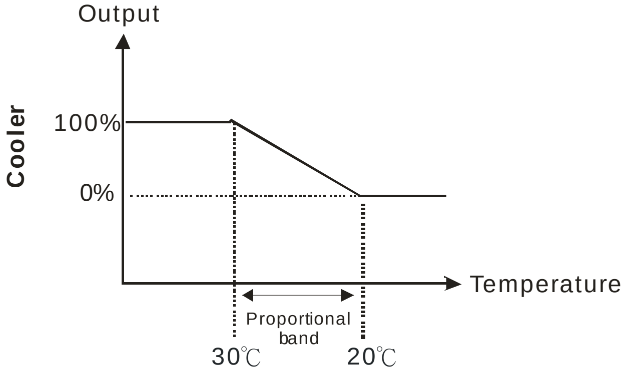
The proportional control refers to that the output is in proportional to the error. When the temperature is lower than the proportional band and the output is 100%, the control will enter the proportional band, and the output will gradually in smaller proportional to the error. When the set temperature value (SV) is consistent with the present temperature value (PV) (i.e. no error), the output will be 0%. (Error = SV – PV)

In a heater: SV = 1,000 (100°C), K_P = 100 (10°C). See the figure below for the relation between temperature and output.



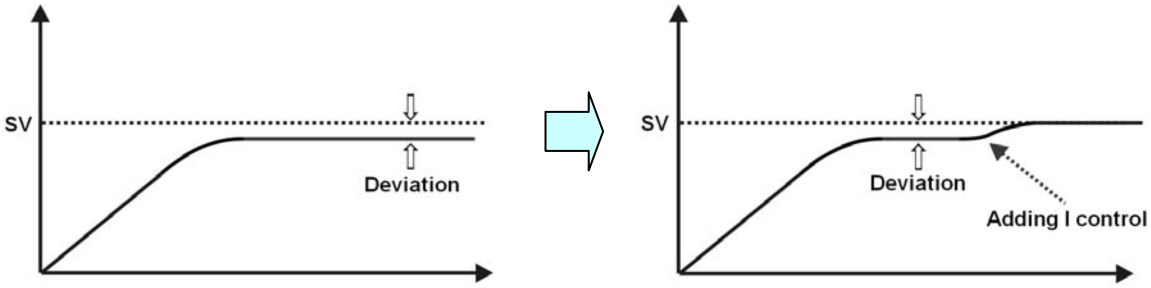
In a cooler: SV = 200 (20°C), K_P = 100 (10°C). See the figure below for the relation between temperature and output.

*DVP04PT-S does not support cooler.



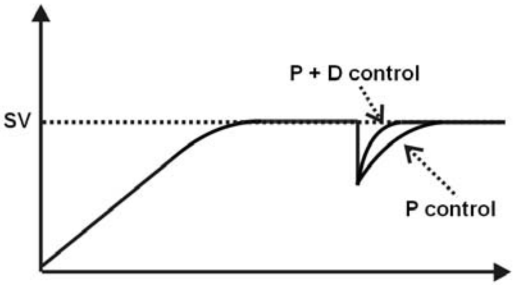
4.8.2 I (Integral) Control

With only P control, the controlled temperature will be deviated in a certain level from the set temperature. Therefore, we adopt integral control with the proportional control. As time passes by, the deviation of value will disappear, and the controlled temperature will be consistent with the set temperature.

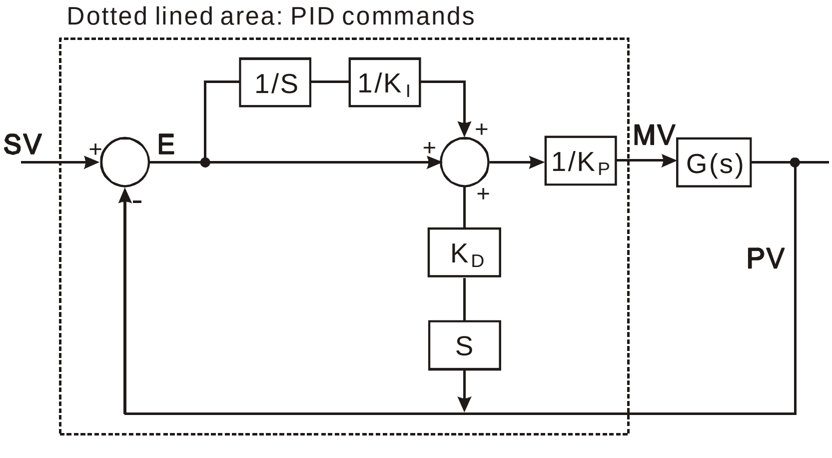


4.8.3 D (Derivative) Control

The derivative control is capable of offering bigger output in response to strong interference and restoring the control to its original status.



4.8.4 Control Chart



4.8.5 Basic PID Operation Formula

$$MV = \frac{1}{K_P}\left[E + \frac{1}{K_I}\left(E\frac{1}{S}\right) + K_D * PVS\right]$$

In which the error is fixed to: $\mathrm{E} = \mathrm{SV} - \mathrm{PV}$

To avoid the sudden derivative value that is too big caused by the activation of PID command for the first time, we therefore adopt the differentiation of PV.

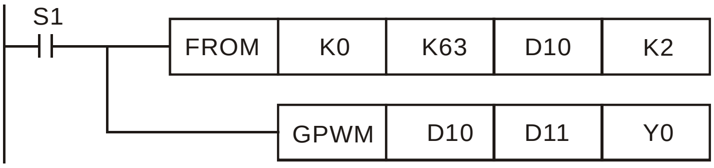
4.9 PID Control Method

DVP04PT offers 2 types of control modes for the PID control.

4.9.1 Cyclic Control Mode

- DVP04PT-S (the wiring is the same as that of DVP04PT-H2)

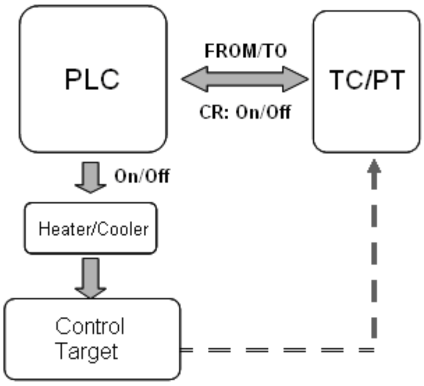
You can determine the output cycle depending on the control environment. If the temperature in the environment changes slowly, you can make the output cycle longer. Output Width = Cycle × Output %. Use the output width and output cycle in GPWM instruction for the cyclic control. Connect the heater or cooler to Y0. For example, supposed you make the output cycle 3 seconds, enter K3,000 into D11. D10 = Output % × K3,000/1,000. The unit of Output % is 0.1%. See below for the program design:



```
S1
FROM  K0   K63  D10  K2
GPWM  D10  D11  Y0
```

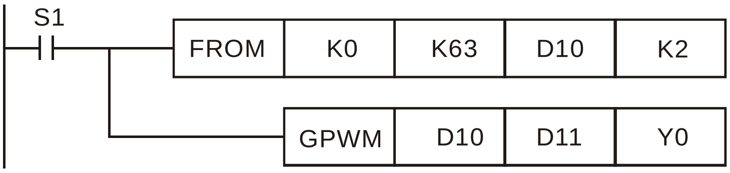
- DVP04PT-H2

If the heater or cooler you are using is controlled by a power supply switch, the control has to be done with GPWM instruction as a cyclic control. Please refer to the wiring method below:

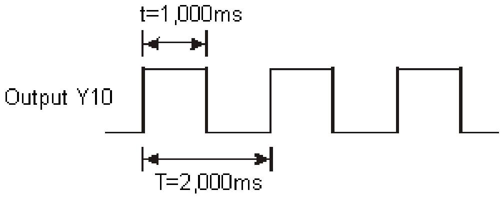


You have to read two control registers (CR) from the DVP04TC module. The first CR shows the operational cycle, and the second shows the operational width. The cyclic control works with GPWM instruction of DVP-PLC. For example, the sensor receives signals from CH1 of DVP04TC. The output width of CH1 is read in CR#63, and the output cycle of CH1 is read in CR#64. Use FROM instruction to read CR#63 and CR#64 and conduct the cyclic control by the output width and cycle contained in GPWM instruction.

Connect the heater or cooler to Y0. See below for the program design:



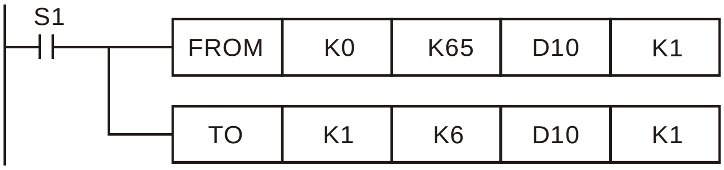
Assume the width is 1,000 and cycle is 2,000, the output pulses will be like:



4.9.2 Analog Output Control

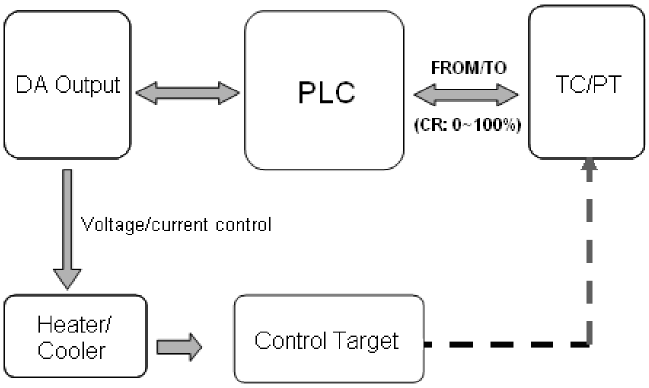
- DVP04PT-S (the wiring is the same as that of DVP04PT-H2)

Read the Output % (0 ~ 100%) and correspond it to the analog output value in DVP04DA to control the heater. For example, with the analog output 0 ~ 4,000 (0 ~ 10V) from DVP04DA-S, connect the heater to the voltage output of DVP04DA-S and read the CR for Output %. Output Value = 8,000 x Output % / 1,000 (unit: 0.1%). Conduct analog output with this value by TO instruction.



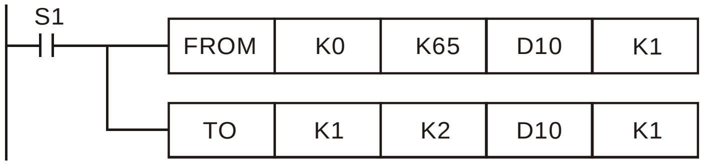
- DVP04PT-H2

If your heater or cooler is controlled by voltage or current, the control has to be done with analog output. Please refer to the wiring method below:

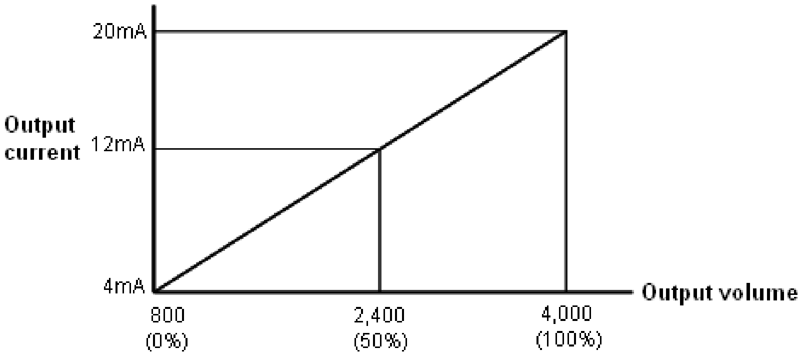


To control the heater or cooler by analog output, you have to set up the range of the analog output. Use FROM instruction to read the output volume from DVP04PT and TO instruction to send the output volume to the analog output.

Example: Output range of heater/cooler 800 ~ 4000 (4 ~ 20mA). Use the heater/cooler with DVP04DA-H2 to conduct analog output. The heater/cooler is connected to the current output of DVP04DA-H2. We set up the upper limit (4000) and the lower limit (800) of output and read the digital output value from DVP04PT-H2. Use FROM instruction to read the output value to D10, and use TO instruction to conduct output from DVP04DA-H2. See below for the program design:



The relation between output volume and output current:

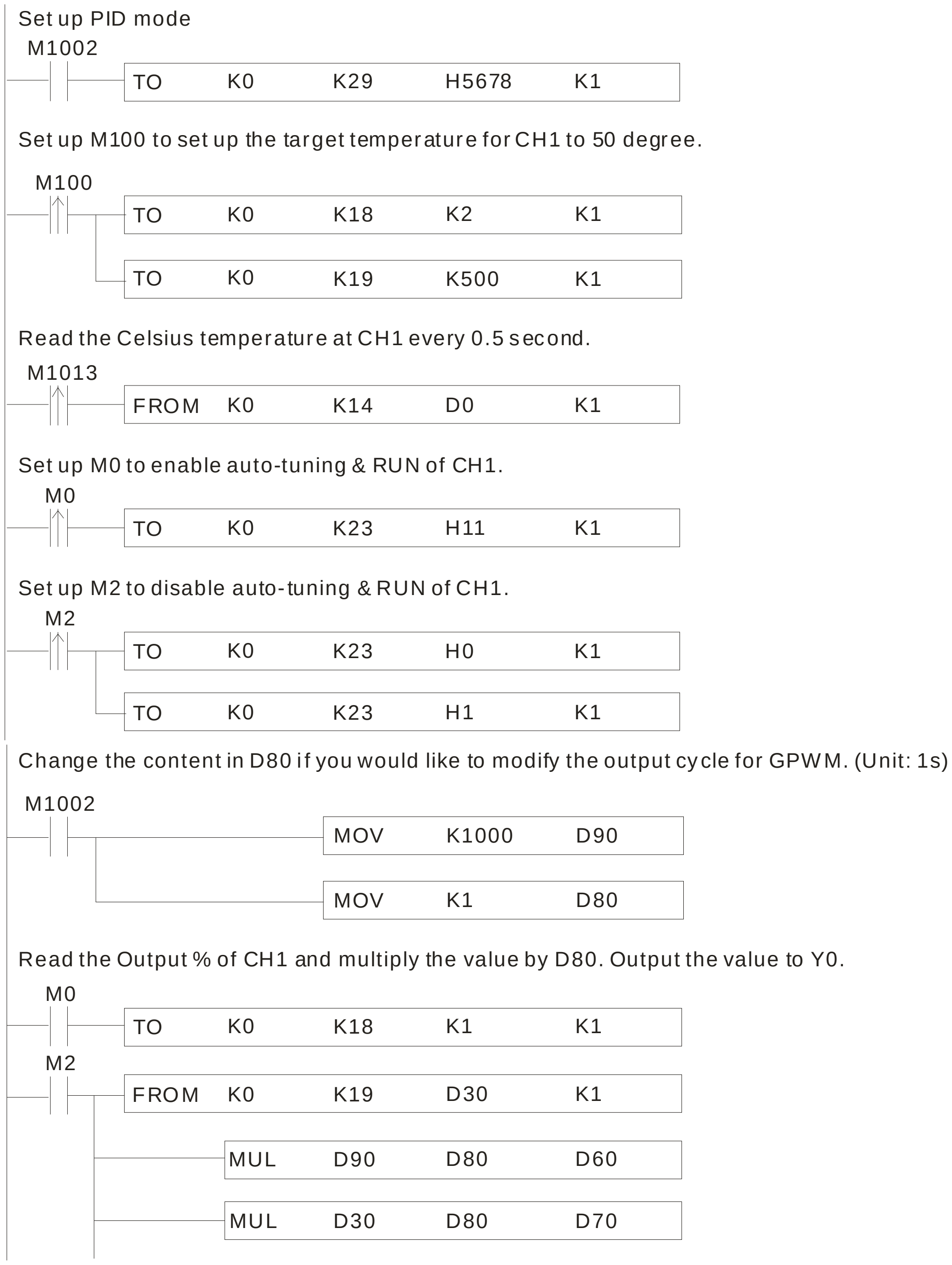


4.10 PID Application Example

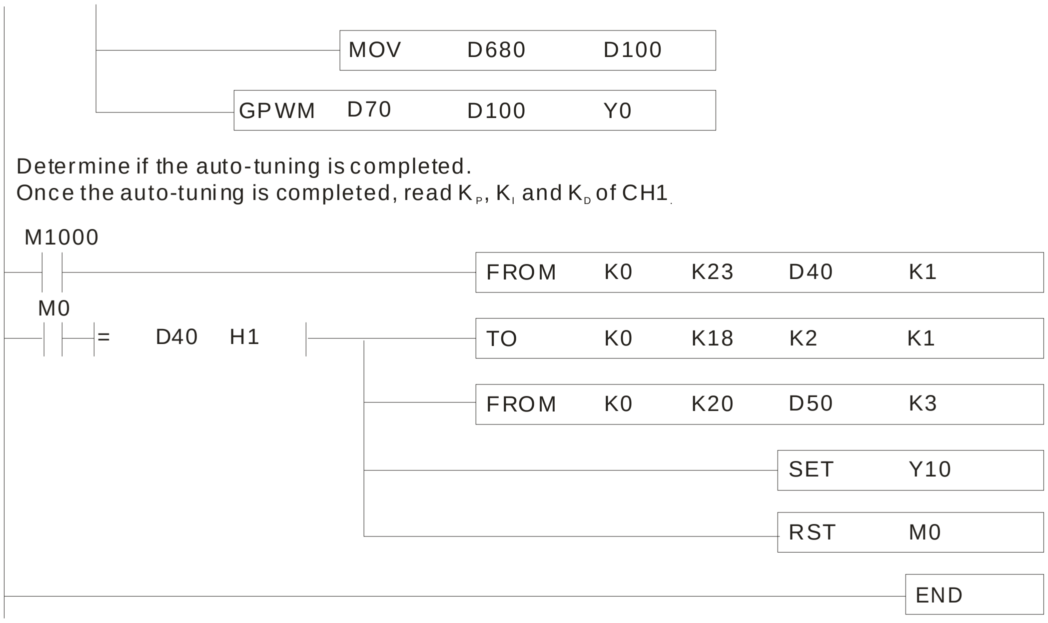
4.10.1 DVP04PT-S

Targets:

1. Set M100 = On to set up target temperature for CH1.
2. Set M0 = On to set up "auto-tuning" for CH1 and enable PID function.
3. Wait for the completion of "auto-tuning" for CH1 (Y10 = On), and the program will automatically extract K_P, K_I and K_D and set M0 = Off to stop "auto-tuning".
4. Once the "auto-tuning" is completed, you only need to enable manual PID (set M2 = On) for the next time.

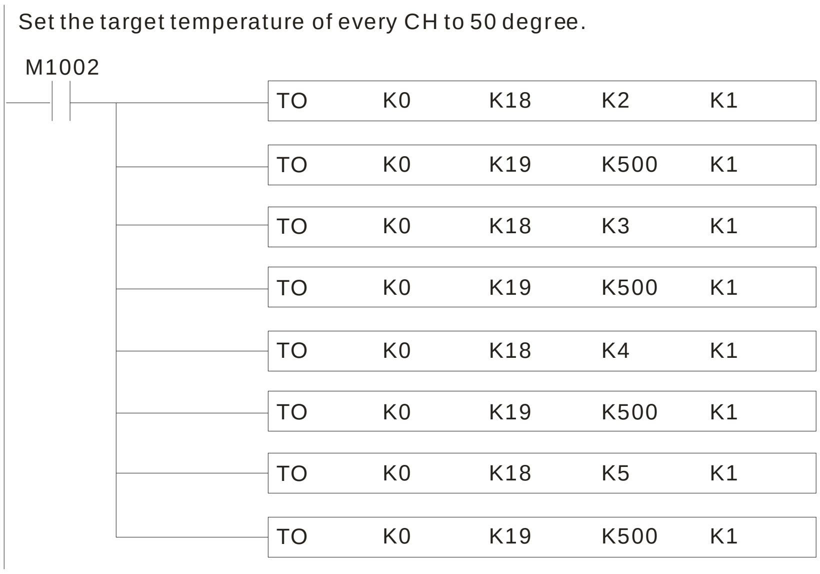


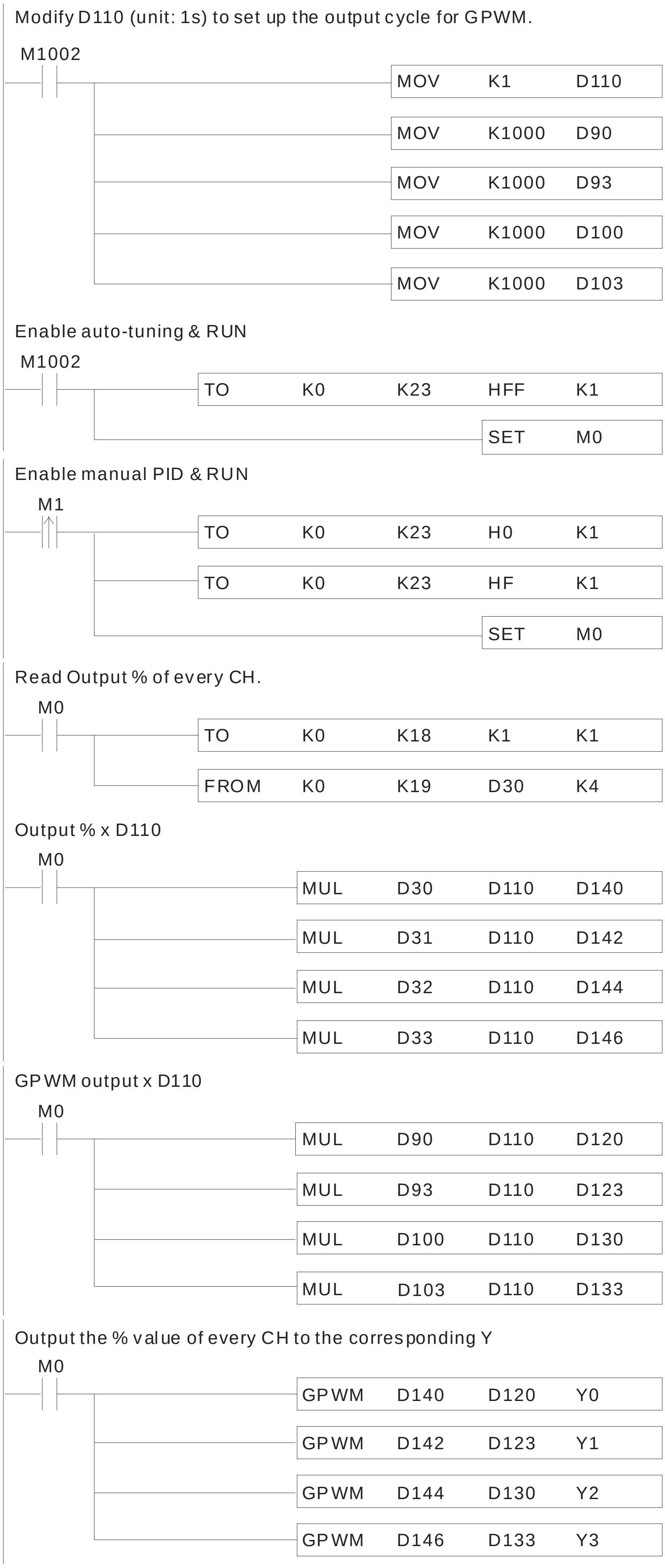
```
Set up PID mode
M1002
  TO    K0    K29    H5678   K1

Set up M100 to set up the target temperature for CH1 to 50 degree.
M100
  TO    K0    K18    K2      K1
  TO    K0    K19    K500    K1

Read the Celsius temperature at CH1 every 0.5 second.
M1013
  FROM  K0    K14    D0      K1

Set up M0 to enable auto-tuning & RUN of CH1.
M0
  TO    K0    K23    H11     K1

Set up M2 to disable auto-tuning & RUN of CH1.
M2
  TO    K0    K23    H0      K1
  TO    K0    K23    H1      K1

Change the content in D80 if you would like to modify the output cycle for GPWM. (Unit: 1s)
M1002
  MOV   K1000  D90
  MOV   K1     D80

Read the Output % of CH1 and multiply the value by D80. Output the value to Y0.
M0
  TO    K0    K18    K1      K1
M2
  FROM  K0    K19    D30     K1
  MUL   D90   D80    D60
  MUL   D30   D80    D70
```



Targets:

1. Set PLC RUN and enable PID auto-tuning of CH1 ~ CH4.
2. Wait for the completion of "auto-tuning” for CH1 ~ CH4 (Y10 = On), and the program will automatically extract K_P, K_I and K_D of CH1 ~ CH4 and set M0 = Off to stop “auto-tuning”.
3. Once the “auto-tuning” is completed, you only need to enable manual PID (set M1 = On) for the next time.





Modify D110 (unit: 1s) to set up the output cycle for GPWM.

Enable auto-tuning & RUN

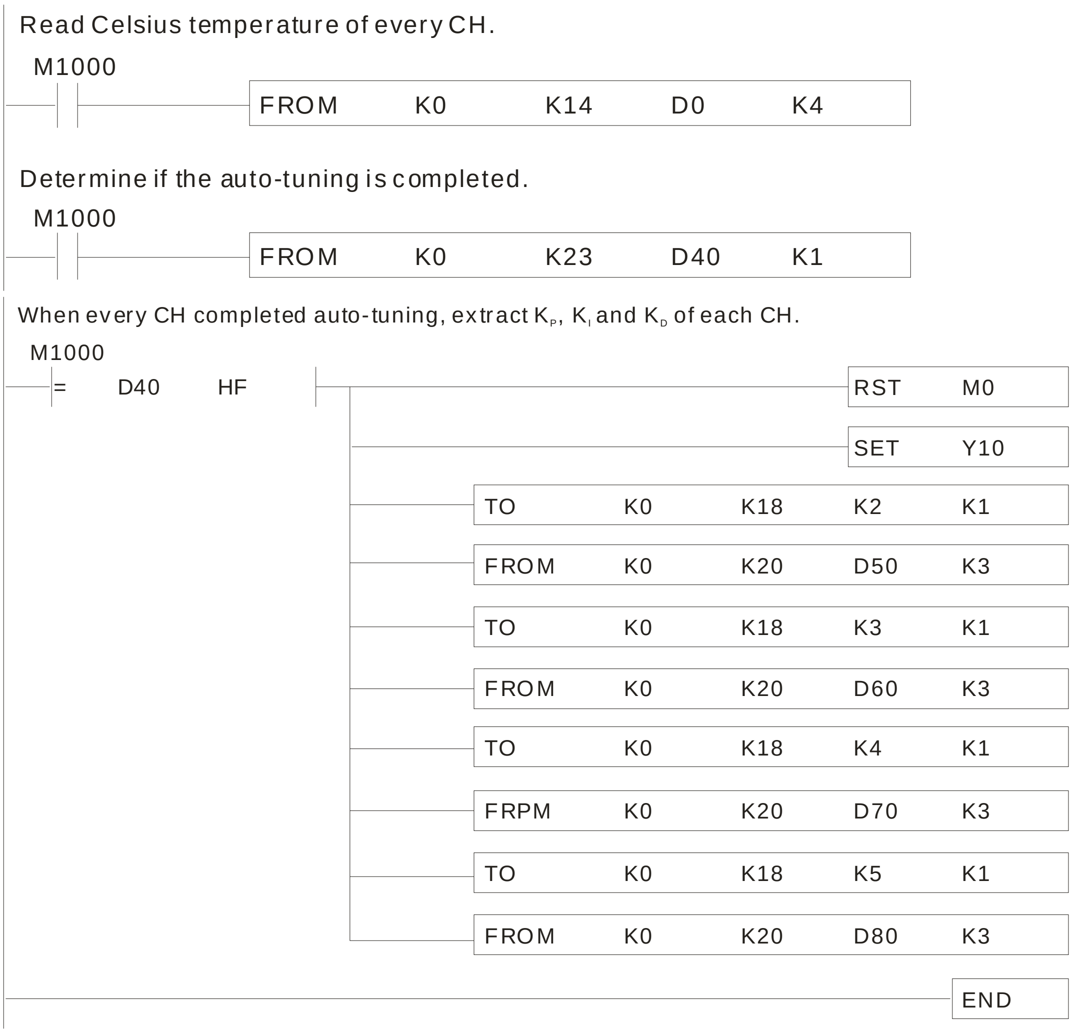
Enable manual PID & RUN

Read Output % of every CH.

Output % x D110

GPWM output x D110

Output the % value of every CH to the corresponding Y



Read Celsius temperature of every CH.

```
M1000
FROM   K0   K14   D0   K4
```

Determine if the auto-tuning is completed.

```
M1000
FROM   K0   K23   D40   K1
```

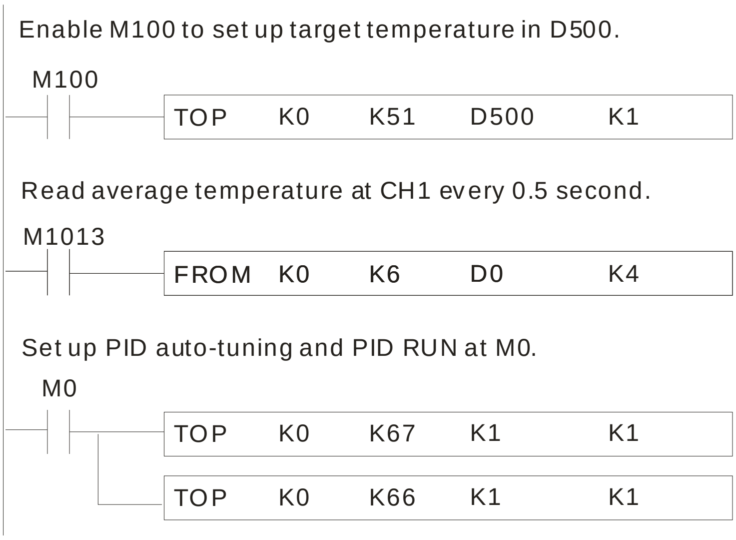
When every CH completed auto-tuning, extract K_P, K_I and K_D of each CH.

```
M1000
=   D40   HF
                RST    M0
                SET    Y10
                TO     K0   K18   K2    K1
                FROM   K0   K20   D50   K3
                TO     K0   K18   K3    K1
                FROM   K0   K20   D60   K3
                TO     K0   K18   K4    K1
                FRPM   K0   K20   D70   K3
                TO     K0   K18   K5    K1
                FROM   K0   K20   D80   K3
END
```

4.10.2 DVP04PT-H2

Targets:

1. Set up target temperature.
2. Set up "auto-tuning", enable PID function and wait for the completion of "auto-tuning"
3. Once the “auto-tuning” is completed, you only need to enable manual PID for the next time.



Enable M100 to set up target temperature in D500.

```
M100
TOP    K0   K51   D500   K1
```

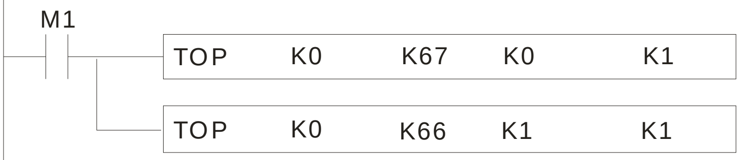
Read average temperature at CH1 every 0.5 second.

```
M1013
FROM   K0   K6    D0     K4
```

Set up PID auto-tuning and PID RUN at M0.

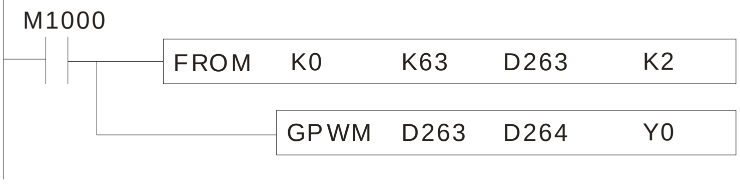
```
M0
TOP    K0   K67   K1     K1
TOP    K0   K66   K1     K1
```

Set up PID manual and PID RUN at M1.



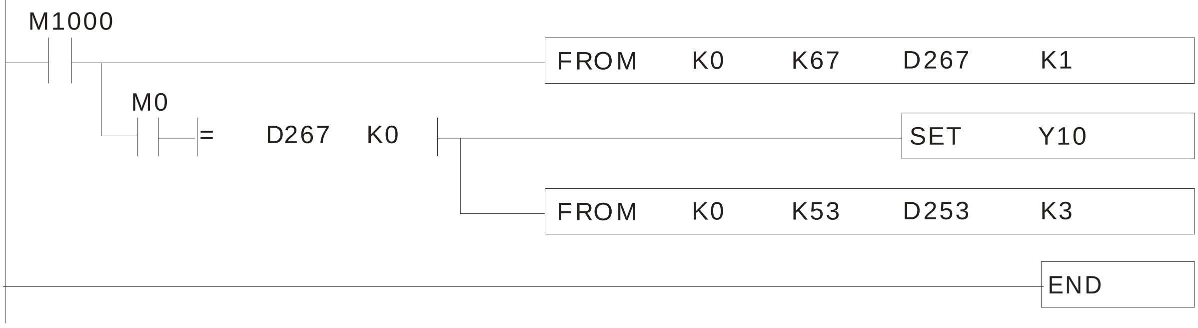
```
TOP   K0   K67   K0   K1
TOP   K0   K66   K1   K1
```

Read output width, output cycle and execute width adjustment instruction.



```
FROM   K0     K63    D263   K2
GPWM   D263   D264   Y0
```

Auto-tuning CR = K0 indicates that the auto-tuning is completed.
Once the auto-tuning is completed, read K_P, K_I and K_D.



```
FROM   K0     K67   D267   K1
=      D267   K0
SET    Y10
FROM   K0     K53   D253   K3
END
```

4.11 PID Control Registers (CR)

4.11.1 For DVP04PT-S

CR#	PID Mode Content Description	CR#	PID Mode Content Description
CR#0	Model name	CR#17	CH4 K_P
CR#2	Output % at CH1	CR#19	CH1 K_I
CR#3	Output % at CH2	CR#20	CH2 K_I
CR#4	Output % at CH3	CR#21	CH3 K_I
CR#5	Output % at CH4	CR#22	CH4 K_I
CR#6	CH1 average degrees (°C)	CR#24	CH1 K_D
CR#7	CH2 average degrees (°C)	CR#25	CH2 K_D
CR#8	CH3 average degrees (°C)	CR#26	CH3 K_D
CR#9	CH4 average degrees (°C)	CR#27	CH4 K_D
CR#10	Set temperature at CH1	CR#28	Run/Stop & Auto turning
CR#11	Set temperature at CH2	CR#29	Enter PID mode(H'5678)
CR#12	Set temperature at CH3	CR#30	Error Code
CR#13	Set temperature at CH4	CR#31	CH1 Sampling time
CR#14	CH1 K_P	CR#32	CH2 Sampling time
CR#15	CH2 K_P	CR#33	CH3 Sampling time
CR#16	CH3 K_P	CR#34	CH4 Sampling time

4.11.2 Explanation on PID CR in DVP04PT-S

CR#2,3,4,5 : Output percentage (%)

[Explanation]

The result obtained from the PID operation. Unit: 0.1%. For example, if the result is 100, the output percentage will be 10%.

CR#10,11,12,13 : Set temperature value

[Explanation]

For setting up the target temperature. Unit: 0.1 degree. Supposed the target temperature is 100°C, write “1000" into the CR by using TO instruction.

CR#14,15,16,17 : K_P value

[Explanation]

K_P: Constant of proportional control, i.e. proportional band. Please refer to the PID operation formula and set up an appropriate parameter.

Output MV (%) = $E / K_P \times 100\%$

Example:

Set up $K_P = 10$, $E = 1$, $K_I = 0$, $K_D = 0$ (Close K_I, K_D)

MV (%) = $1 / 10 \times 100\% = 10\%$

The output percentage displayed in CR#62 will be 10%.

CR#19,20,21,22：K_I value

[Explanation]

K_I: Constant of integration

1. If you only conduct proportional control, the controlled temperature will be deviated from the set temperature. However, with the integration, the deviation will gradually disappear by time, and the controlled temperature will be consistent with the set temperature.
2. To disable the integration function, set the CR to "0".
3. If the curve shape is too gentle, adjust K_I. The closer to 0 the K_I, the steeper the curve.

CR#24,25,26,27：K_D value

[Explanation]

K_D: Constant of differentiation

1. K_D offers bigger operational value to combat severe external interference and returns the control to its original status as soon as possible.
2. To disable the differentiation function, set the CR to “0”.
3. If the output fluctuates too much, adjust K_D. The closer to 0 the K_D, the smaller the fluctuation.

CR#28：Run/Stop & Auto turning

[Explanation]

bit	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Function	Reserved	Auto-tuning				RUN/STOP			
Channel		CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

EX: To set CH3 to RUN and auto-tuning,
(b7, b6, b5, b4, b3, b2, b1, b0) should be set to (0, 1, 0, 0, 0, 1, 0, 0).
After the auto-tuning is completed, the bit for auto-tuning will return to 0,
i.e. (b7, b6, b5, b4, b3, b2, b1, b0) will be set to (0, 0, 0, 0, 0, 1, 0, 0).

CR#31,32,33,34：Sampling time (s)

[Explanation]

The sampling times in a time unit (s). The conversion time of each channel in the temperature measurement module is approximately every 1 second. If the temperature in the control environment does not vary too much, set up longer sampling time, which also means if the temperature varies quickly, set up shorter sampling time. Range: 1 ~ 30. If the value is smaller than 1, 1 will be automatically written into the CR. If the value is bigger than 30, 30 will be automatically written into the CR. Cycle time = sampling time.

Range	Default
1~30	2

4.11.3 For DVP04PT-H2

CR#				Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH1	CH2	CH3	CH4																			
#51	#71	#91	#111	O	R/W	Set temperature value	Range: K-1000 ~ K8,000. Default = K0															
#52	#72	#92	#112	O	R/W	Sampling time (s)	Range: K1 ~ K30 (s). Default = K2															
#53	#73	#93	#113	O	R/W	K_P value	Default = K121															
#54	#74	#94	#114	O	R/W	K_I value	Integral constant. Default = K2,098															
#55	#75	#95	#115	O	R/W	K_D value	Derivative constant. Default = K-29.															
#56	#76	#96	#116	O	R/W	Upper limit of I value	Range: K-32,760 ~ K32,760. Default = K0															
#57	#77	#97	#117	O	R/W	Lower limit of I value	Range: K-32,760 ~ K32,760. Default = K0.															
#58	#78	#98	#118	X	R	I value	Current accumulated offset value. Default = K0															
#59	#79	#99	#119	O	R/W	Heating/cooling	0: Heater, 1: Cooler. Default = K0															
#60	#80	#100	#120	O	R/W	Upper limit of output	Range: K-32,760 ~ K32,760. Default = K4,000															
#61	#81	#101	#121	O	R/W	Lower limit of output	Range: K-32,760 ~ K32,760. Default = K0															
#62	#82	#102	#122	X	R	Output percentage (%)	Range: K0 ~ K1,000 (Unit: 0.1%). Default = K0															
#63	#83	#103	#123	X	R	Output width (ms)	Width of control output. Unit: ms. Default = K0															
#64	#84	#104	#124	X	R	Output cycle (ms)	Cycle of control output. Unit: ms. Default = K0															
#65	#85	#105	#125	X	R	Output volume	Default = K0															
#66	#86	#106	#126	X	R/W	PID_RUN/STOP	0: STOP, 1: RUN. Default = K0															
#67	#87	#107	#127	X	R/W	Auto-tuning	0: Disabled, 1: Auto-tuning. Default = K0															

※ The CR# listed above do not support RS-485 read/write.

4.11.4 Explanation on PID CR in DVP04PT-H2

CR#51, 71, 91, 111: Set temperature value

[Explanation]

For setting up the target temperature. Unit: 0.1 degree. Supposed the target temperature is 100°C, write “1000" into the CR by using TO instruction. Range: -1,000 ~ 8,000. If the value is smaller than -1,000, -1,000 will be automatically written in to the CR. If the value is bigger than 8,000, 8,000 will be automatically written into the CR.

Range	Default
-1,000 ~ 8,000	0

CR#52, 72, 92, 112: Sampling time (s)

[Explanation]

The sampling times in a time unit (s). The conversion time of each channel in the temperature measurement module is approximately every 1 second. If the temperature in the control environment does not vary too much, set up longer sampling time, which also means if the temperature varies quickly, set up shorter sampling time. Range: 1 ~ 30. If the value is smaller than 1, 1 will be automatically written into the CR. If the value is bigger than 30, 30 will be automatically written into the CR. Cycle time = sampling time.

Range	Default
1 ~ 30	2

CR#53 ,73, 93, 113: K_P value

[Explanation]

K_P: Constant of proportional control, i.e. proportional band. Please refer to the PID operation formula and set up an appropriate parameter.

Output MV (%) = E / K_P × 100%

Example:

Set up $K_P = 10$, $E = 1$, $K_I = 0$, $K_D = 0$ (Close K_I, K_D)

MV (%) = 1 / 10 × 100% = 10%

The output percentage displayed in CR#62 will be 10%.

CR#54, 74, 94, 114: K_I value

[Explanation]

K_I: Constant of integration

1. If you only conduct proportional control, the controlled temperature will be deviated from the set temperature. However, with the integration, the deviation will gradually disappear by time, and the controlled temperature will be consistent with the set temperature.
2. To disable the integration function, set the CR to "0".
3. If the curve shape is too gentle, adjust K_I. The closer to 0 the K_I, the steeper the curve.

CR#55, 75, 95, 115: K_D value

[Explanation]

K_D: Constant of differentiation

1. K_D offers bigger operational value to combat severe external interference and returns the control to its original status as soon as possible.
2. To disable the differentiation function, set the CR to “0”.
3. If the output fluctuates too much, adjust K_D. The closer to 0 the K_D, the smaller the fluctuation.

CR#56, 76, 96, 116/CR#57, 77, 97, 117: Upper limit/lower limit of I value

[Explanation]

When both upper limit and lower limit are 0, the upper/lower limit function for I value will be closed, which means there will not be upper/lower limit for I value. When the upper limit is set to be smaller than the lower limit, the upper limit and lower limit will automatically switch with each other.

CR#59, 79, 99, 119: Heating/cooling

[Explanation]

For selecting heating or cooling control. Set the CR to “0” if your control target is a heater. Set the CR to “1” if your control target is a cooler. The default setting is heater.

Setting	Selection
0	Heater
1	Cooler
Default: Heater	

CR#60, 80, 100, 120/CR#61, 81, 101, 121: Upper limit/lower limit of output

[Explanation]

The output volume is calculated from the upper limit and lower limit. For example, if the upper/lower limit is set to 0 ~ 4,000, when the output comes to 10%, the output volume will be 400. Please set up this CR according to the analog output you are using.

CR#62, 82, 102, 122: Output percentage (%)

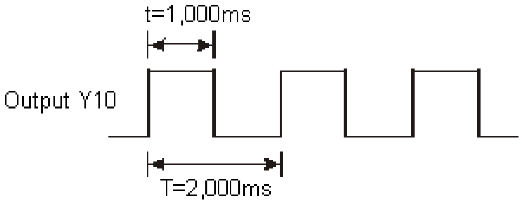
[Explanation]

The result obtained from the PID operation. Unit: 0.1%. For example, if the result is 100, the output percentage will be 10%.

CR#63, 83, 103, 123; CR#64, 84, 104, 124: Output width (ms); Output cycle (ms)

[Explanation]

If you are using the cyclic control mode to control your target, please read the two CRs. For example, if the cycle is 2,000 and width 1,000, the output pulse will shape like below:



CR#65, 85, 105, 125: Output volume

[Explanation]

Formula of output volume:

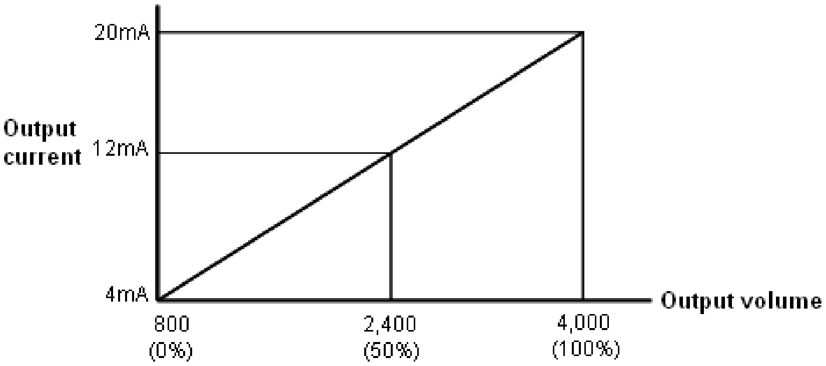
Output Volume = (Output Upper Limit – Output Lower Limit) × Output % + Output Lower Limit

Example:

Control by current 4 ~ 20mA (800 ~ 4,000)

Output upper limit: 4,000

Output lower limit: 800



Remarks:

1. Set K_P, K_I, and K_D to “0" to close the PID function. If you would like to use proportional control only, set K_I and K_D to “0”.
2. If you do not know how to tune PID parameters in your control environment, use “auto-tuning” to generate K_P, K_I and K_D and further modify them into better K_P, K_I and K_D. To use the auto-tuning, set the auto-tuning CR to “1”. After the auto-tuning is completed, the CR will automatically return to “0”.
3. If you would like to fill in your own K_P, K_I and K_D, please set up K_P first according to your experiences and set K_I and K_D to “0” to close the integral and derivative control functions. Adjust K_P first and next K_I and K_D. We recommend you to adjust K_I decreasingly and K_D downwards from 0.
4. If the output percentage fluctuates too much, please adjust K_D. The closer K_D value to 0, the less fluctuating the output percentage is. If the curve is too smooth, please adjust K_I. The bigger the K_I, the smoother the curve.

5.1 The Thermocouple Temperature Sensor

The thermocouple is generated by Seebeck Effect. Generally speaking, a thermocouple is composed of conductors of two different materials. When a temperature difference occurs at the two ends of the thermocouple, the thermocouple will generate a voltage signal in proportional to the temperature difference. The voltage signal ranges from tens of uV to thousands of uV; therefore, we need to magnify the voltage when using it.

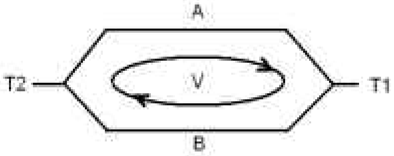
The thermocouple temperature sensor indicates temperature by differential voltage, and it has already eliminated external interferences when two pairs of data are performing differential operation. Therefore, it is much more stable than a thermistor, resistive thermometer or thermal resistor and is widely applied in the industry.

The thermocouple is a loop constructed by two different metallic wires welded or twisted together (see the figure below). Different metals make two junctions in the loop. One junction is called “measuring junction” or “hot junction”, and the other is “reference junction” or “cold junction”. Placing the two junctions in different temperatures will cause a loop voltage (i.e. Seebeck Effect), and the loop voltage is in proportional to the temperature difference between the two junctions.

The loop voltage and the two junctions equate:

$$V = \int_{T_1}^{T_2} (Q_A - Q_B) dT \qquad \text{(A)}$$

In which Q = the heat conduction coefficient of the metal



How a thermocouple works

In fact, the heat conduction coefficient of Q_A and Q_B have nothing to do with the temperature. Therefore, equation (A) can be simplified into equation (B), a more frequently used equation:

$$V = \alpha (T_2 - T_1) \qquad \text{(B)}$$

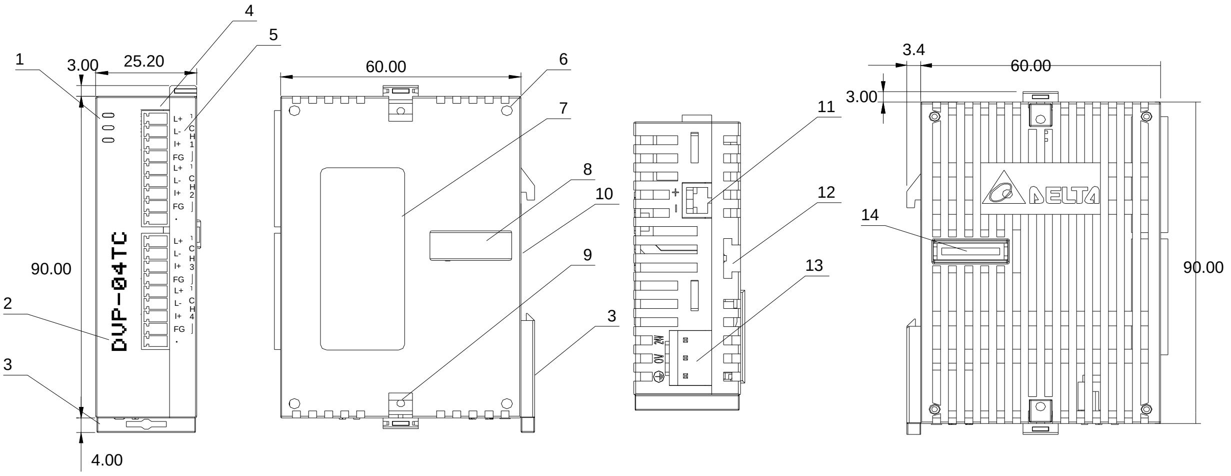
There are two types of thermocouple thermometers, wrapped thermocouple and bare thermocouple. The wrapped thermocouple is wrapped with a layer of metal as protection, similar to an electrically-heated spoon. The wrapped thermocouple is used for measuring temperature of liquid and the bare thermocouple is for measuring gas temperature. Different thermocouples sense different temperature ranges and output signals, and the maximum temperature sensible varies with different materials and wires of different diameters.

5.2 Introduction

DVP04TC is able to receive 4 points of external thermocouple temperature sensors (J-type, K-type, R-type, S-type, T-type) and convert them into 14-bit digital signals. The data in DVP04TC can be read/written by using FROM/TO instructions in the program of DVP-PLC MPU. There are 49 16-bit control registers (CR) in DVP04TC. The power unit and module of DVP04TC are separate, compact in size and easy to install. You can select temperatures in Celsius (resolution: 0.1°C) or Fahrenheit (resolution: 0.18°F).

5.3 Product Profile & Outline

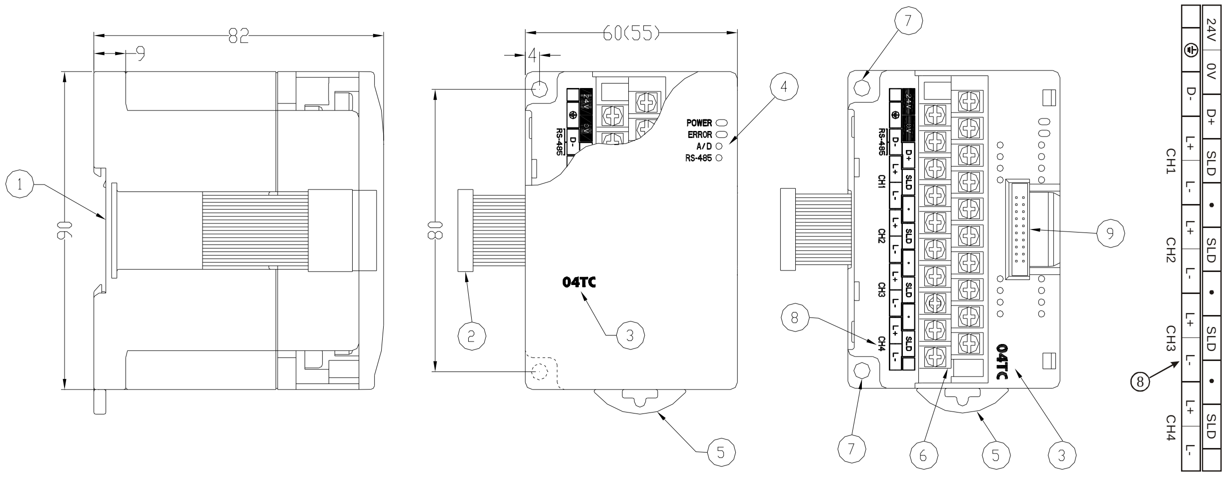
5.3.1 DVP04TC-S



Unit: mm

1. POWER, ERROR,RUN indicators	10. DIN rail (35mm)	5. I/O terminals	L+	L+
2. Model name	11. RS-485 communication port		L-	L-
3. DIN rail clip	12. Fixing rail for extension unit/module		SLD	SLD
4. I/O terminals	13. Power i		-	-
5. I/O point indicator	14. Connection port for extension unit/module		L+	L+
6. Fixing hole for extension unit/module			L-	L-
7. Nameplate			SLD	SLD
8. Mounting hole for extension unit/module			-	-
9. Fixing clip for extension unit/module			-	-

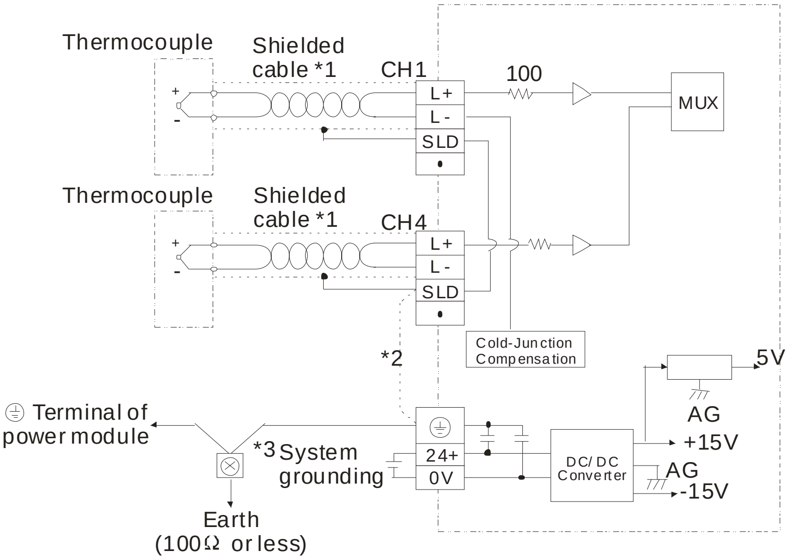
5.3.2 DVP04TC-H2 (DVP04TC-H)



Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. Power, RUN and A/D indicators	9. Mounting port for extension unit/module
5. DIN rail clip	

5.4 External Wiring



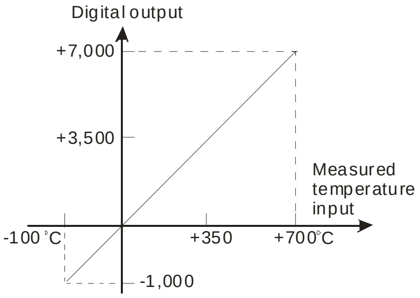
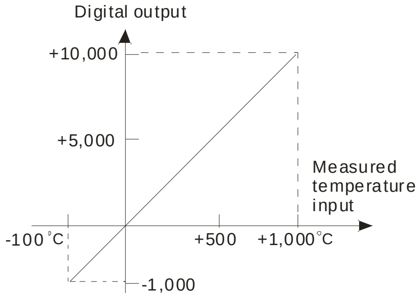
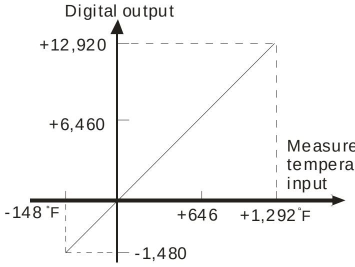
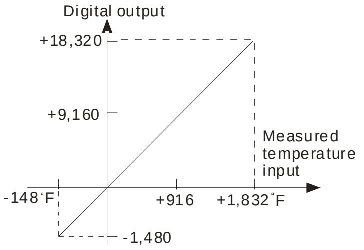
*1: The wiring used for analog input should adopts the connection cable or shielding cable of thermocouple temperature sensor J-type, K-type R-type S-type and T-type and should be separated from other power cable or wirings that may cause interference.

*2: Terminal SLD is the ground location for noise suppression.

*3: Please connect the ⏚ terminal on both the power module and DVP04TC to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

5.5 Functions

Temperature Measurement Module (04TC)	Celsius (°C)	Fahrenheit (°F)
Power supply voltage	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%)	
Analog input channel	4 channels/module	
Applicable sensor types	J-type, K-type, R-type, S-type, T-type Floating thermocouple	
Range of input temperature	J-type: -100°C ~ 700°C K-type: -100°C ~ 1000°C R-type: -10°C ~ 1,700°C S-type: -10°C ~ 1,700°C T-type: -100°C ~ 350°C	J-type: -148°F ~ 1,292°F K-type: -148°F ~ 1,832°F R-type: -14°F ~ 3,092°F S-type: -14°F ~ 3,092°F T-type: -148°F ~ 662°F
Range of digital conversion	J-type: K-1,000 ~ K7,000 K- type: K-1,000 ~ K10,000 R-type: K-100 ~ K17,000 S-type: K-100 ~ K17,000 T-type: K-1,000 ~ K3,500	J-type: K-1,480 ~ K12,920 K-type: K-1,480 ~ K18,320 R-type: K-140 ~ K30,920 S-type: K-140 ~ K30,920 T-type: K-1,480 ~ K6,620
Resolution	14 bits (0.1°C)	14 bits (0.18°F)
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range of 0 ~ 55°C (32 ~ 131°F)	
Response time	200ms × the number of channels	
Isolation method	Isolation between digital area and analog area. No isolation among channels.	
Isolation	Field to Digital Area: 500V Field to Analog Area: 500V Analog area to Digital Area: 500V Field to 24VDC: 500V	

Temperature Measurement Module (04TC)	Celsius (°C)	Fahrenheit (°F)
Digital data format	13 significant bits out of 16 bits are available; in 2's complement	
Average function	Yes; available for setting up in CR#2 ~ CR#5; range: K1 ~ K20	
Self-diagnosis	Upper and lower bound detection/channel	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1), RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No.0 is the closest to MPU and No.7 is the furthest. Maximum 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	
Temperature/digital curve	Temperature mode: °C J-type thermocouple  K-type thermocouple  	
	Temperature mode: °F J-type thermocouple  K-type thermocouple  	
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	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)	
Power Supply		
Max. rated power consumption	24V DC (20.4V DC ~ 28.8V DC) (-15% ~ +20%), (-S)2W, (-H)2.5W, supplied by external power	

5.6 CR (Control Register)

5.6.1 CR in DVP04TC

<table>
<tr><th colspan="5">DVP04TC</th><th colspan="16">Explanation</th></tr>
<tr><th>CR#</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4096</td><td>O</td><td>R</td><td>Model type</td><td colspan="16">Set up by the system.
DVP04TC-S model code = H’008B
DVP04TC-H model code = H’0403
DVP04TC-H2 model code = H’6403</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’4097</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td rowspan="2">Thermocouple type</td><td colspan="4">Reserved</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Take the setting of CH1 for example:
1. When (b2, b1, b0) is set as (0,0,0), choose J-type
2. When (b2, b1, b0) is set as (0,0,1), choose K-type
3. When (b2, b1, b0) is set as (0,1,0), choose R-type
4. When (b2, b1, b0) is set as (0,1,1), choose S-type
5. When (b2, b1, b0) is set as (1,0,0), choose T-type</td></tr>
<tr><td>#2</td><td>H’4098</td><td>O</td><td>R/W</td><td>CH1 average time</td><td colspan="16" rowspan="4">Range of settings in CH1 ~ CH4:
Range for DVP04TC-S: K1 ~ K4,096.
Range for DVP04TC-H: K1 ~ K20.
Default = K10</td></tr>
<tr><td>#3</td><td>H’4099</td><td>O</td><td>R/W</td><td>CH2 average time</td></tr>
<tr><td>#4</td><td>H’409A</td><td>O</td><td>R/W</td><td>CH3 average time</td></tr>
<tr><td>#5</td><td>H’409B</td><td>O</td><td>R/W</td><td>CH4 average time</td></tr>
<tr><td>#6</td><td>H’409C</td><td>X</td><td>R</td><td>Average °C temperature measured at CH1</td><td colspan="16" rowspan="4">Average Celsius temperature measured at CH1 ~ CH4.
Unit: 0.1°C</td></tr>
<tr><td>#7</td><td>H’409D</td><td>X</td><td>R</td><td>Average °C temperature measured at CH2</td></tr>
<tr><td>#8</td><td>H’409E</td><td>X</td><td>R</td><td>Average °C temperature measured at CH3</td></tr>
<tr><td>#9</td><td>H’409F</td><td>X</td><td>R</td><td>Average °C temperature measured at CH4</td></tr>
<tr><td>#10</td><td>H’40A0</td><td>X</td><td>R</td><td>Average °F temperature measured at CH1</td><td colspan="16" rowspan="4">Average Fahrenheit temperature measured at CH1 ~ CH4
Unit: 0.1°F</td></tr>
<tr><td>#11</td><td>H’40A1</td><td>X</td><td>R</td><td>Average °F temperature measured at CH2</td></tr>
<tr><td>#12</td><td>H’40A2</td><td>X</td><td>R</td><td>Average °F temperature measured at CH3</td></tr>
<tr><td>#13</td><td>H’40A3</td><td>X</td><td>R</td><td>Average °F temperature measured at CH4</td></tr>
<tr><td>#14</td><td>H’40A4</td><td>X</td><td>R</td><td>Present °C temperature measured at CH1</td><td colspan="16" rowspan="4">Present Celsius temperature measured at CH1 ~ CH4
Unit: 0.1°C</td></tr>
<tr><td>#15</td><td>H’40A5</td><td>X</td><td>R</td><td>Present °C temperature measured at CH2</td></tr>
<tr><td>#16</td><td>H’40A6</td><td>X</td><td>R</td><td>Present °C temperature measured at CH3</td></tr>
<tr><td>#17</td><td>H’40A7</td><td>X</td><td>R</td><td>Present °C temperature measured at CH4</td></tr>
<tr><td colspan="2">#18</td><td colspan="19">Reserved</td></tr>
<tr><td>#19</td><td>H’40A9</td><td>X</td><td>R</td><td>Present °F temperature measured at CH1</td><td colspan="16" rowspan="2">Present Fahrenheit temperature measured at CH1 ~ CH4
Unit: 0.1°F</td></tr>
<tr><td>#20</td><td>H’40AA</td><td>X</td><td>R</td><td>Present °F temperature measured at CH2</td></tr>
<tr><td>#21</td><td>H’40AB</td><td>X</td><td>R</td><td>Present °F temperature measured at CH3</td><td colspan="16" rowspan="2"></td></tr>
<tr><td>#22</td><td>H’40AC</td><td>X</td><td>R</td><td>Present °F temperature measured at CH4</td></tr>
<tr><td colspan="2">#23</td><td colspan="19">Reserved</td></tr>
<tr><td>#24</td><td>H’40AE</td><td>O</td><td>R/W</td><td>OFFSET value of CH1</td><td colspan="16" rowspan="3">Adjustable OFFSET settings at CH1 ~ CH4
Range: -1,000 ~ +1,000
Default = K0
Unit: 0.1°C</td></tr>
<tr><td>#25</td><td>H’40AF</td><td>O</td><td>R/W</td><td>OFFSET value of CH2</td></tr>
<tr><td>#26</td><td>H’40B0</td><td>O</td><td>R/W</td><td>OFFSET value of CH3</td></tr>
</table>

DVP04TC					Explanation															
CR#	RS-485 parameter address	Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#27	H’40B1	O	R/W	OFFSET value of CH4																
#28		Reserved																		
#29	H’40B3	X	R/W	PID mode setting	Can be used for PID settings in DVP04TC-S V3.08 and versions above. Set H'5678 to enable PID mode, other set values are invalid. Default: H’0000. See 5.12.1 for details.															
#30	H’40B4	X	R	Error status	Register for storing all error status. See the table of error status for more information.															
#31	H’40B5	O	R/W	Communication address setting	For setting up RS-485 communication address. Range: 01 ~ 255. Default = K1															
#32	H’40B6	O	R/W	Communication speed (baud rate) setting	4,800/9,600/19,200/38,400/57,600/115,200bps are available. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) Default = H’0002. b0: 4,800 bps b1: 9,600 bps (Default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5: 115,200 bps b6 ~ b13: reserved b14: High/low bit exchange of CRC checksum (only valid in RTU mode) b15: Switch between ASCII/RTU mode. 0 = ASCII (default)															
#33	H’40B7	O	R/W	Returning to default setting and ERR LED definition	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
					ERR LED				CH4			CH3			CH2			CH1		
					Take the setting of CH1 for example: 1. b0 and b1 are reserved. 2. When b2 is set as 1, all the settings will return to default settings except for CR#31 and CR#32. ERR LED definition (default of b12 ~ b15 = 1111): 1. b12 corresponds to CH1. When b12 = 1 or the scale exceeds the range, ERR LED will flash. 2. b13 corresponds to CH2. When b13 = 1 or the scale exceeds the range, ERR LED will flash. 3. b14 corresponds to CH3. When b14 = 1 or the scale exceeds the range, ERR LED will flash. 4. b15 corresponds to CH4. When b15 = 1 or the scale exceeds the range, ERR LED will flash.															
#34	H’40B8	O	R	Firmware version	Displaying the current firmware version in hex.															
#35 ~ #48		For system use.																		

Symbols:
O: latched
X: non-latched (available when using RS-485 communication, not available when connected to MPU)
R: Able to read data by FROM instruction or RS-485 communication
W: Able to write data by using TO instructions or RS-485

The corresponding parameters address H’4096 ~ H’40C6 of CR#0 ~ CR#48 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

5.6.2 Explanation on CR

CR#0: Model name

[Explanation]

1. DVP04TC-S model code = H’008B.
2. DVP04TC-H model code = H’0403.
3. DVP04TC-H2 model code = H’6403.
4. You can read the model name in the program to see if the extension module exists.

CR#1: Thermocouple type

[Explanation]

1. The working mode of the 4 channels in the sensors selected by the temperature measurement module. There are 5 modes (J-type, K-type, R-type, S-type and T-type) for each channel which can be set up separately. Default = H’0000.
2. Take the setting of CH1 for example:
   When (b2, b1, b0) is set as (0,0,0), choose J-type
   When (b2, b1, b0) is set as (0,0,1), choose K-type
   When (b2, b1, b0) is set as (0,1,0), choose R-type
   When (b2, b1, b0) is set as (0,1,1), choose S-type
   When (b2, b1, b0) is set as (1,0,0), choose T-type
3. When you set CH1 as J-type (b2 ~ b0 = 000), CH2 as K-type (b5 ~ b3 = 001), CH3 as R-type (b8 ~ b6 = 010) and CH4 as S-type (b11 ~ b9 = 011), you have to set CR#1 as H’0688. The higher bits (b12 ~ b15) will be reserved.

CR#2, 3, 4, 5: CH1 ~ CH4 average time

[Explanation]

1. The times to average the temperature measured at CH1 ~ CH4. Please note that the average time set in CR#2 ~ CR#5 need to be written in only once.
2. Range for DVP04TC-S: K1 ~ K4,096. Default = K10.
3. Range for DVP04TC-H: K1 ~ K20. Default = K10.

CR#6, 7, 8, 9: Average Celsius temperature measured at CH1 ~ CH4

[Explanation]

1. The average Celsius temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. Unit: 0.1°C.
2. For example, if the average time is set as 10, the contents in CR#6 ~ CR#9 will be the average of the most recent 10 temperature signals in Celsius at CH1 ~ CH4.

CR#10, 11, 12, 13: Average Fahrenheit temperature measured at CH1 ~ CH4

[Explanation]

1. The average Fahrenheit temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. Unit: 0.1°F.
2. For example, if the average time is set as 10, the contents in CR#10 ~ CR#13 will be the average of the most recent 10 temperature signals in Fahrenheit at CH1 ~ CH4.

CR#14, 15, 16, 17: Present Celsius temperature measured at CH1 ~ CH4

[Explanation]

Displaying the present temperature in Celsius at CH1 ~ CH4. Unit: 0.1°C.

CR#19, 20, 21, 22: Present Fahrenheit temperature measured at CH1 ~ CH4

[Explanation]

Displaying the present temperature in Fahrenheit at CH1 ~ CH4. Unit: 0.1°F..

CR#24, 25, 26, 27: OFFSET value of CH1 ~ CH4.

[Explanation]

Adjustable OFFSET settings at CH1 ~ CH4. Range: -1,000 ~ +1,000. Default = K0. Unit: 0.1°C

CR#29: PID mode setting

[Explanation]

For DVP04TC-S V3.08 and later version, when CR#29 is set to H’5678, CR#0 ~ CR#34 can be used for PID setting (see 5.12.1). CR#29 is in normal mode when it is in other settings. Default = H’0000.

*The PID mode for DVP04TC-S only supports heating.

CR#30: Data register for storing all errors

[Explanation]

CR#30: error status value. See the table below:

Error status	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H’1)	Reserved	0	0	0	0	0	0	0	1
Wiring to empty external contact	K2 (H’2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4 (H’4)		0	0	0	0	0	1	0	0
OFFSET error	K8 (H’8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H’10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32 (H’20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64 (H’40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		1	0	0	0	0	0	0	0

***Note:** Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error*

CR#31: RS-485 communication address setting

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1. This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#32: Communication speed (baud rate) setting

[Explanation]

The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200bps (bps stands for bits per second). Default = H’0002.

b0 = 1:	4,800 bps
b1 = 1:	9,600 bps (default)
b2 = 1:	19,200 bps
b3 = 1:	38,400 bps
b4 = 1:	57,600 bps
b5 = 1:	115,200 bps
b6 ~ b13:	Reserved
b14:	High/low bit exchange of CRC checksum (only valid in RTU mode)
b15:	Switch between ASCII/RTU mode. 0: ASCII (default); 1: RTU. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1); RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.

CR#33: Returning to default setting; definition of ERR LED

[Explanation]

Default = H’F000. Take the setting of CH1 for example:

b0 and b1 are reserved. When b2 is set as 1, all the settings will return to default settings except for CR#31 and CR#32.

Definition of ERR LED:

1. b12 corresponds to CH1. When b12 = 1 or the scale exceeds the range, ERR LED will flash.
2. b13 corresponds to CH2. When b13 = 1 or the scale exceeds the range, ERR LED will flash.
3. b14 corresponds to CH3. When b14 = 1 or the scale exceeds the range, ERR LED will flash.
4. b15 corresponds to CH4. When b15 = 1 or the scale exceeds the range, ERR LED will flash.

CR#34：Firmware version

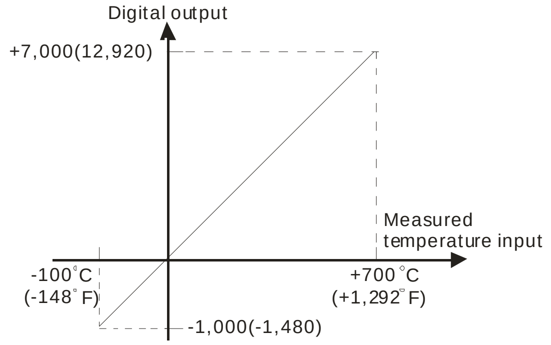
[Explanation]

Displaying the current firmware version in hex, e.g. version V1.00 is indicated as H’0100.

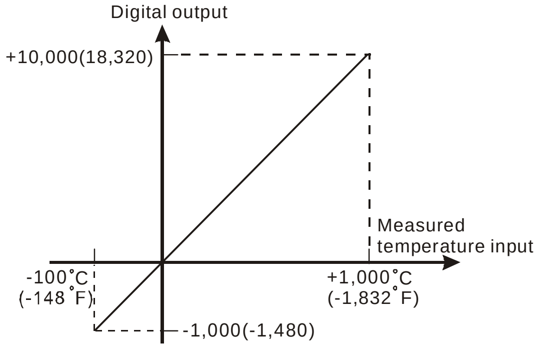
5.7 Temperature / Digital Curve

Temperature measurement modes:

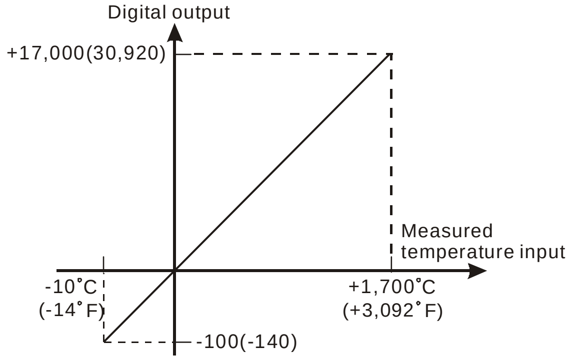
J-type thermocouple



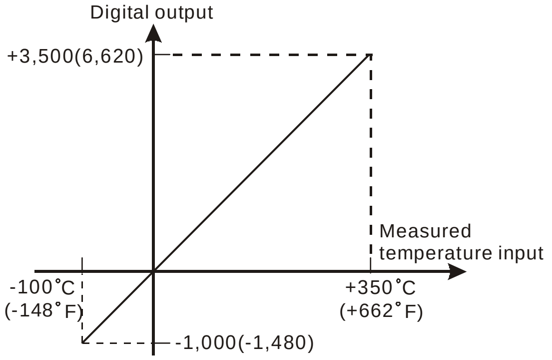
K-type thermocouple



R-type / S-type thermocouple



T-type thermocouple



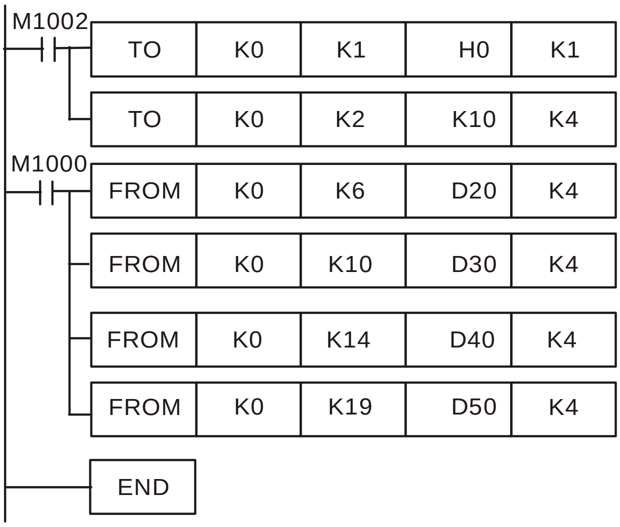
5.8 The Applications

5.8.1 Thermocouple Temperature Measurement System

1. Description
   - Measuring temperature by thermocouple temperature sensor.
2. Devices
   - D20 ~ D23: average Celsius temperature at CH1 ~ CH4
   - D30 ~ D33: average Fahrenheit temperature at CH1 ~ CH4
   - D40 ~ D43: present Celsius temperature at CH1 ~ CH4
   - D50 ~ D53: present Fahrenheit temperature at CH1 ~ CH4
3. Program explanation
   - When PLC goes from STOP to RUN, set the average time of input signals at CH1 ~ CH4 as 10.
   - Store the average Celsius temperature at CH1 ~ CH4 into D20 ~ D23.
   - Store the average Fahrenheit temperature at CH1 ~ CH4 into D30 ~ D33.
   - Store the present Celsius temperature at CH1 ~ CH4 into D40 ~ D43.
   - Store the present Fahrenheit temperature at CH1 ~ CH4 into D50 ~ D53.
   - DVP04TC stores the obtained temperature value to CR. Therefore, you only need to read the content in the CR to obtain the measured temperature. Unit of the temperature: 0.1°C or 0.1°F.

4. Program example

Ladder diagram:



Explanation:

Set the thermocouple of CH1 ~ CH4 as J-type

Set the average time at CH1 ~ CH4 as 10

Read average Celsius degrees at CH1 ~ CH4

Read average Fahrenheit degrees at CH1 ~ CH4

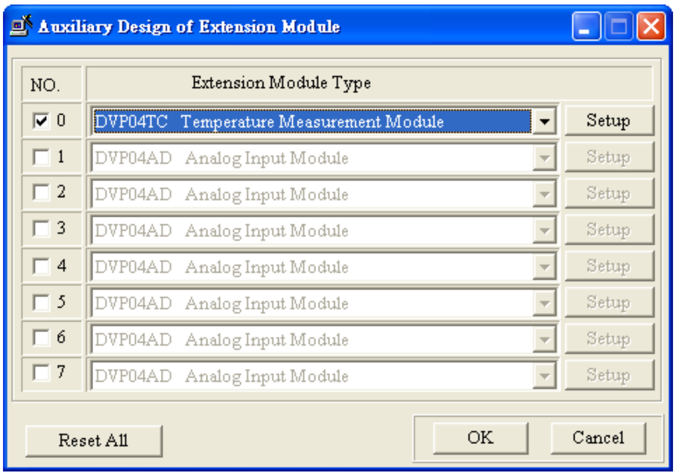
Read present Celsius temperature at CH1 ~ CH4

Read present Fahrenheit temperature at CH1 ~ CH4

5.8.2 How to Set the Module Wizard in WPLSoft

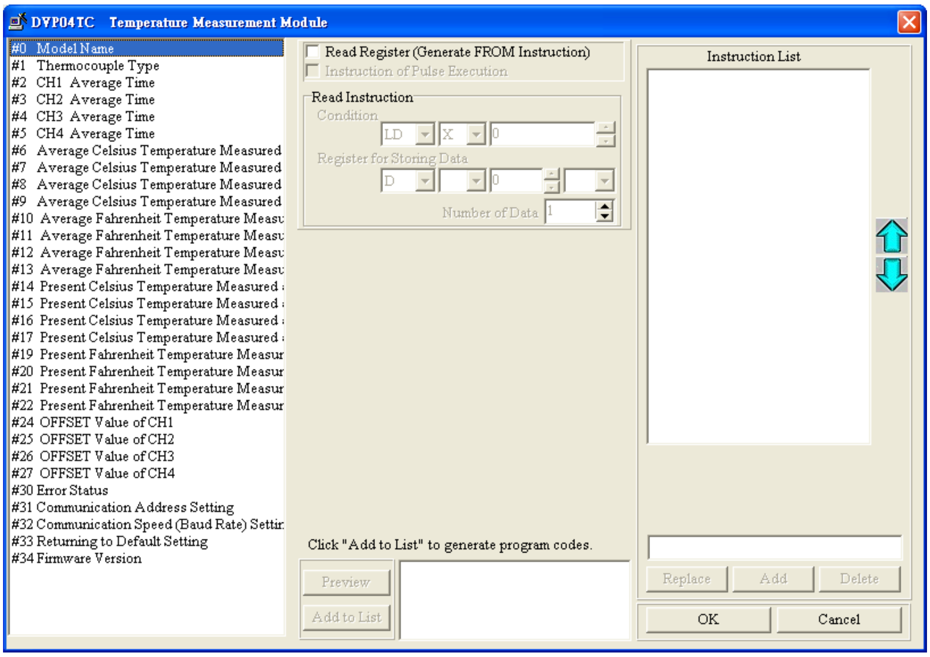
1. Open WPLSoft and click on .

2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP04TC Temperature Measurement Module”.



NO.	Extension Module Type	
☑ 0	DVP04TC Temperature Measurement Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.



4. Next, let's take 5.8.1 Thermocouple temperature measurement system as example.

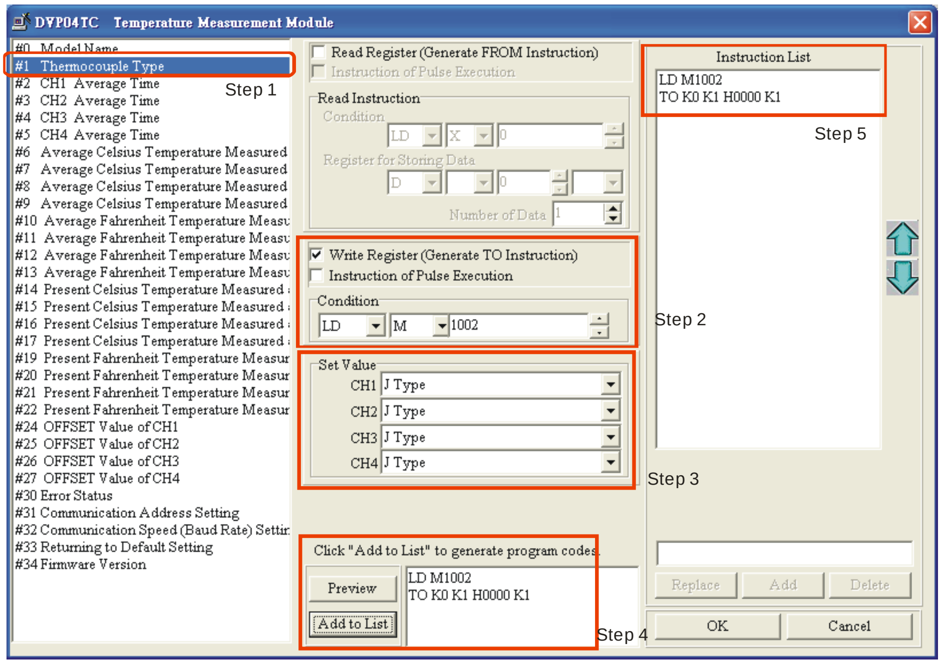
Step 1: Select "#1 Thermocouple Type".

Step 2: Check "Write Register" to generate TO instruction. Set the condition as "LD M1002",

Step 3: Set CH1 ~ CH4 as "J Type"

Step 4: Click "Preview" to check if the generated program codes are correct.

Step 5: Click "Add to List" to display the instruction codes in "Instruction List". The setup of CR#1 is completed.



☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value
CH1 J Type
CH2 J Type
CH3 J Type
CH4 J Type

```
LD M1002
TO K0 K1 H0000 K1
```

5. Setting up CR#2 is similar to the setup of CR#1.

Step 1: Select "#2 CH1 Average Time"

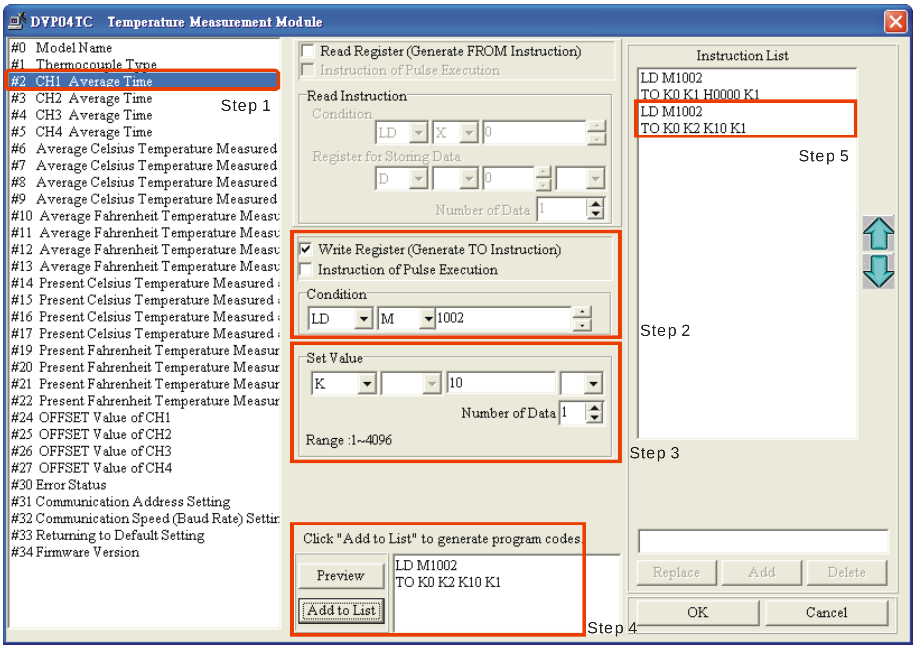
Step 2: Check "Write Register" to generate TO instruction. Set the condition as "LD M1000".

Step 3: Set the set value as "K10" and number of data as "1".

Step 4: Click "Preview" to check if the generated program codes are correct.

Step 5: Click "Add to List" to display the instruction codes in "Instruction List". The setup of CR#2 ~

CR#5 is completed.



☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

Set Value: K 10
Number of Data: 1
Range :1~4096

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K2 K10 K1
```

Instruction List:

```
LD M1002
TO K0 K1 H0000 K1
LD M1002
TO K0 K2 K10 K1
```

6. Setting up CR#6 ~ CR#9 is similar to the setup of CR#2 ~ CR#5.

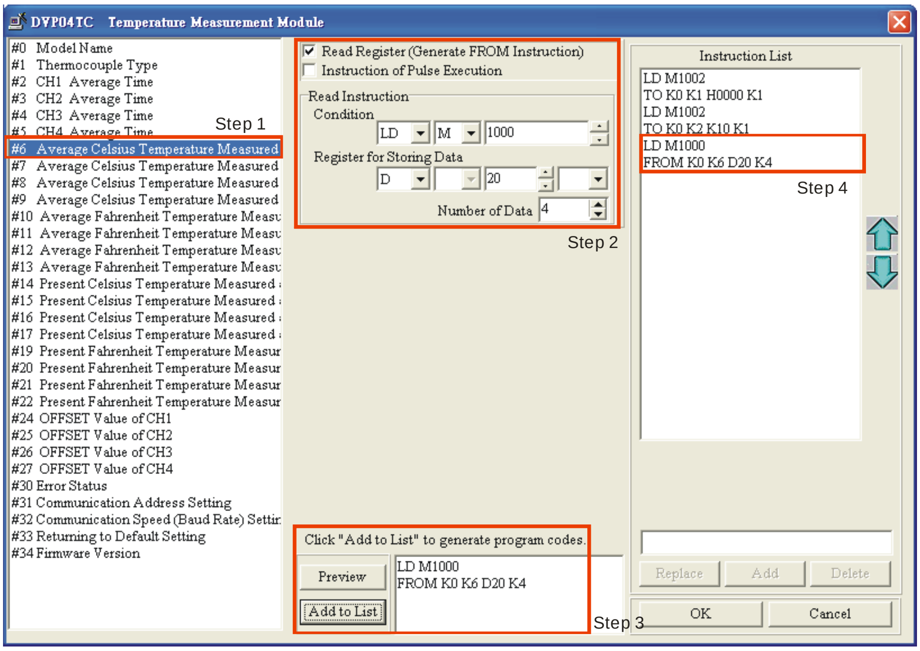
   Step 1: Select "#6 Average Celsius Temperature Measured at CH1"

   Step 2: Check “Read Register” to generate FROM instruction. Set the condition as "LD M1000”.

   Step 3: Set the register for storing data as “D20” and number of data as “4”.

   Step 4: Click “Preview” to check if the generated program codes are correct.

   Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#6 ~ CR#9 is completed.



☑ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD M 1000
Register for Storing Data: D 20
Number of Data: 4

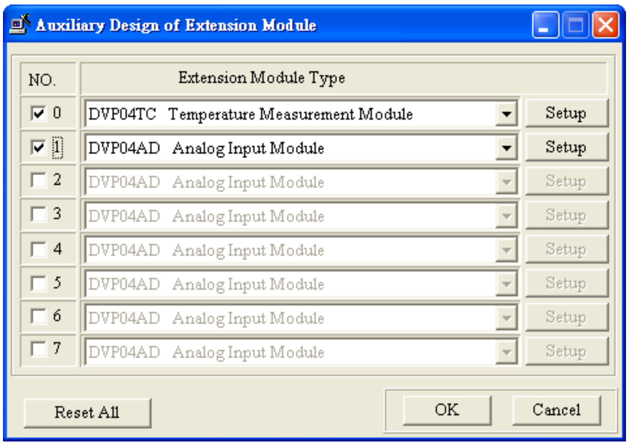
Click "Add to List" to generate program codes.

```
LD M1000
FROM K0 K6 D20 K4
```

Instruction List:

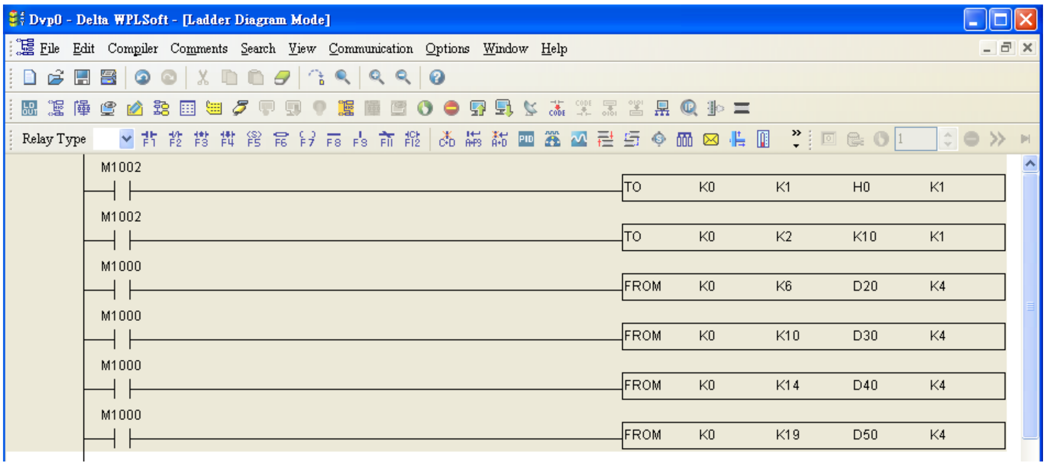
```
LD M1002
TO K0 K1 H0000 K1
LD M1002
TO K0 K2 K10 K1
LD M1000
FROM K0 K6 D20 K4
```

7. The setup of other CR parameters can follow the steps illustrated above.
8. After you complete all the setups, click on “OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



NO.	Extension Module Type	
☑ 0	DVP04TC Temperature Measurement Module	Setup
☑ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

9. After you complete the setups of all the modules, click on “OK” to generate the program below.



```
M1002
--| |------------------------- TO     K0   K1    H0    K1
M1002
--| |------------------------- TO     K0   K2    K10   K1
M1000
--| |------------------------- FROM   K0   K6    D20   K4
M1000
--| |------------------------- FROM   K0   K10   D30   K4
M1000
--| |------------------------- FROM   K0   K14   D40   K4
M1000
--| |------------------------- FROM   K0   K19   D50   K4
```

10. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.

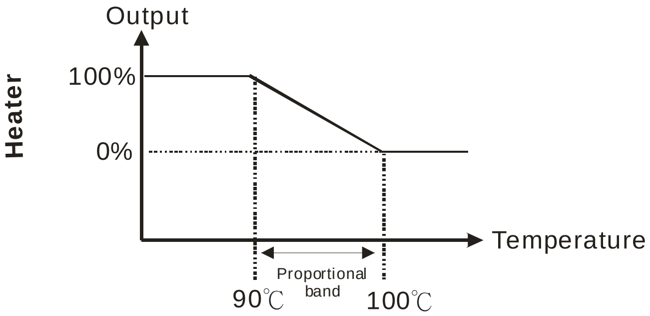
5.9 PID Functions

PID functions are only available in DVP04TC-H2 V1.02 and versions above and DVP04TC-S V3.08 and versions above.

5.9.1 P (Proportional) Control

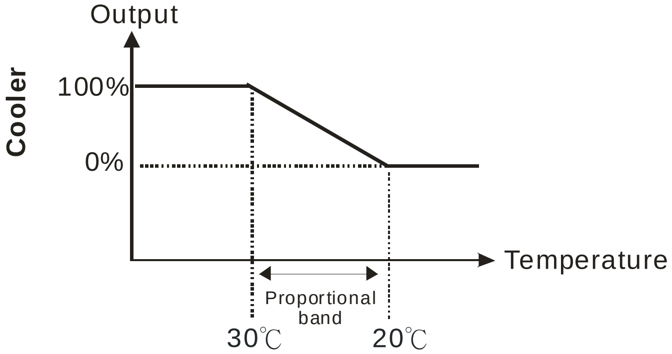
The proportional control refers to that the output is in proportional to the error. When the temperature is lower than the proportional band and the output is 100%, the control will enter the proportional band, and the output will gradually in smaller proportional to the error. When the set temperature value (SV) is consistent with the present temperature value (PV) (i.e. no error), the output will be 0%. (Error = SV – PV)

In a heater: SV = 1,000 (100°C), K_P = 100 (10°C). See the figure below for the relation between temperature and output.



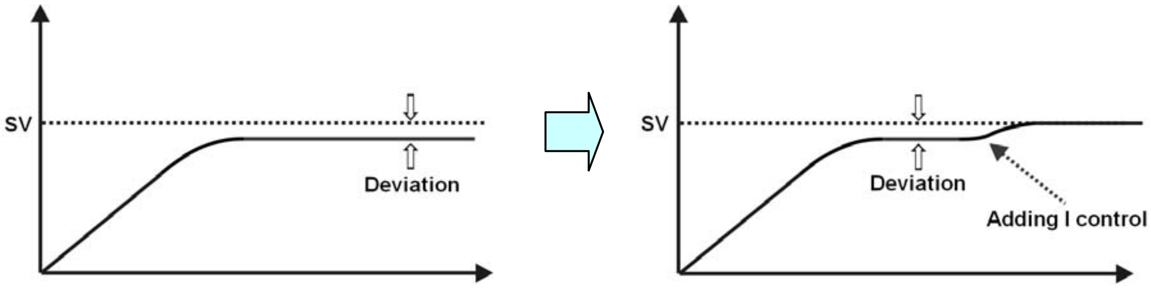
In a cooler: SV = 200 (20°C), K_P = 100 (10°C). See the figure below for the relation between temperature and output.

*DVP04TC-S does not support cooler.



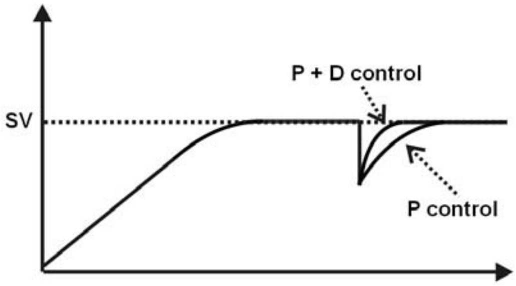
5.9.2 I (Integral) Control

With only P control, the controlled temperature will be deviated in a certain level from the set temperature. Therefore, we adopt integral control with the proportional control. As time passes by, the deviation of value will disappear, and the controlled temperature will be consistent with the set temperature.

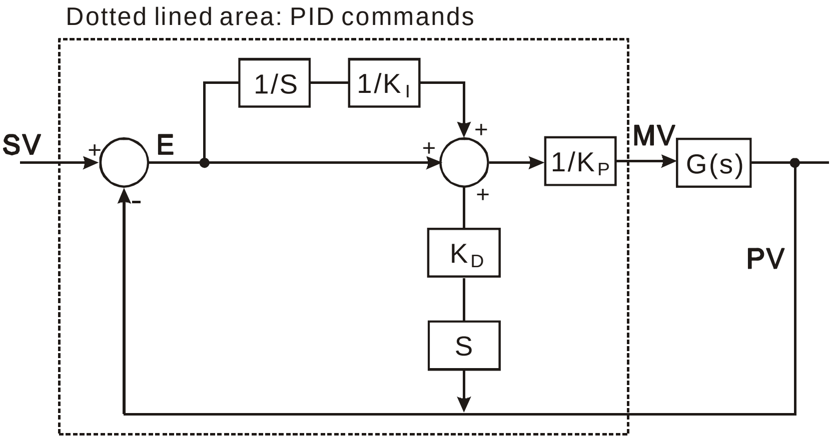


5.9.3 D (Derivative) Control

The derivative control is capable of offering bigger output in response to strong interference and restoring the control to its original status.



5.9.4 Control Chart



5.9.5 Basic PID Operation Formula

$$MV = \frac{1}{K_P}\left[E + \frac{1}{K_I}\left(E\frac{1}{S}\right) + K_D * PVS\right]$$

In which the error is fixed to: $E = SV - PV$

To avoid the sudden derivative value that is too big caused by the activation of PID command for the first time, we therefore adopt the differentiation of PV.

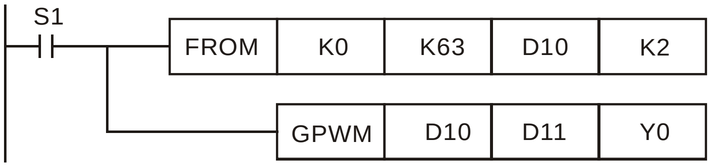
5.10 PID Control Method

DVP04TC offers 2 types of control modes for the PID control.

5.10.1 Cyclic Control Mode

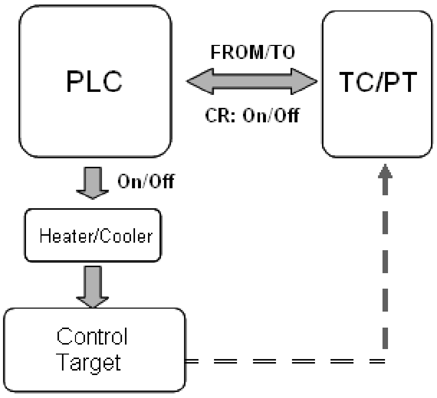
◆ DVP04TC-S (the wiring is the same as that of DVP04TC-H2)

You can determine the output cycle depending on the control environment. If the temperature in the environment changes slowly, you can make the output cycle longer. Output Width = Cycle × Output %. Use the output width and output cycle in GPWM instruction for the cyclic control. Connect the heater or cooler to Y0. For example, supposed you make the output cycle 3 seconds, enter K3,000 into D11. D10 = Output % × K3,000/1,000. The unit of Output % is 0.1%. See below for the program design:

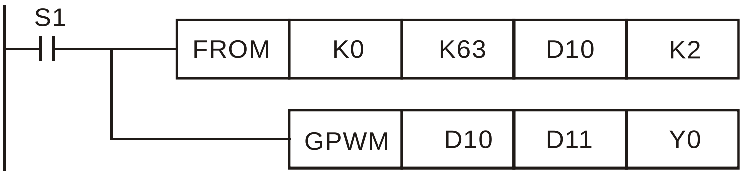


◆ DVP04TC-H2

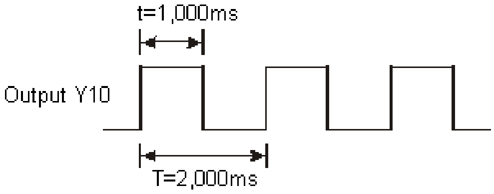
If the heater or cooler you are using is controlled by a power supply switch, the control has to be done with GPWM instruction as a cyclic control. Please refer to the wiring method below:



You have to read two control registers (CR) from the DVP04TC module. The first CR shows the operational cycle, and the second shows the operational width. The cyclic control works with GPWM instruction of DVP-PLC. For example, the sensor receives signals from CH1 of DVP04TC. The output width of CH1 is read in CR#63, and the output cycle of CH1 is read in CR#64. Use FROM instruction to read CR#63 and CR#64 and conduct the cyclic control by the output width and cycle contained in GPWM instruction. Connect the heater or cooler to Y0. See below for the program design:



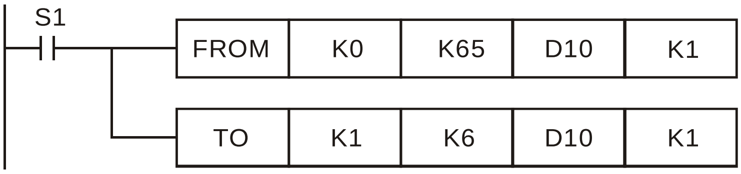
Assume the width is 1,000 and cycle is 2,000, the output pulses will be like:



5.10.2 Analog Output Control

- ◆ DVP04TC-S (the wiring is the same as that of DVP04TC-H2)

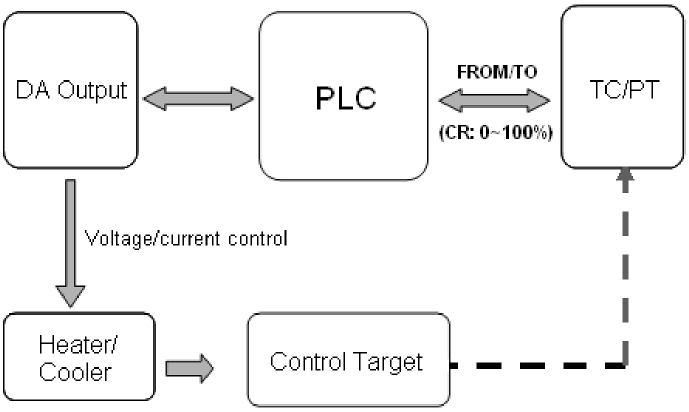
Read the Output % (0 ~ 100%) and correspond it to the analog output value in DVP04DA to control the heater. For example, with the analog output 0 ~ 4,000 (0 ~ 10V) from DVP04DA-S, connect the heater to the voltage output of DVP04DA-S and read the CR for Output %. Output Value = 8,000 × Output % / 1000 (unit: 0.1%). Conduct analog output with this value by TO instruction.



- ◆ DVP04TC-H2

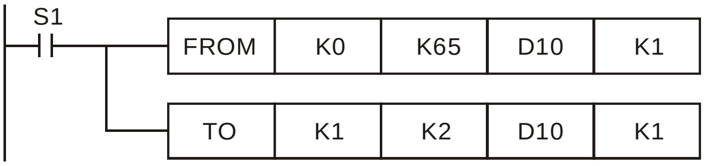
If your heater or cooler is controlled by voltage or current, the control has to be done with analog output.

Please refer to the wiring method below:

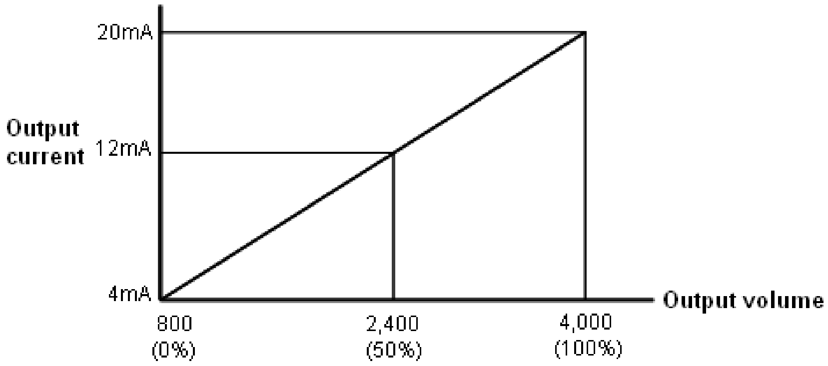


To control the heater or cooler by analog output, you have to set up the range of the analog output. Use FROM instruction to read the output volume from DVP04TC and TO instruction to send the output volume to the analog output.

Example: Output range of heater/cooler 800 ~ 4000 (4 ~ 20mA). Use the heater/cooler with DVP04DA-H2 to conduct analog output. The heater/cooler is connected to the current output of DVP04DA-H2. We set up the upper limit (4000) and the lower limit (800) of output and read the digital output value from DVP04TC-H2. Use FROM instruction to read the output value to D10, and use TO instruction to conduct output from DVP04DA-H2. See below for the program design:



The relation between output volume and output current:

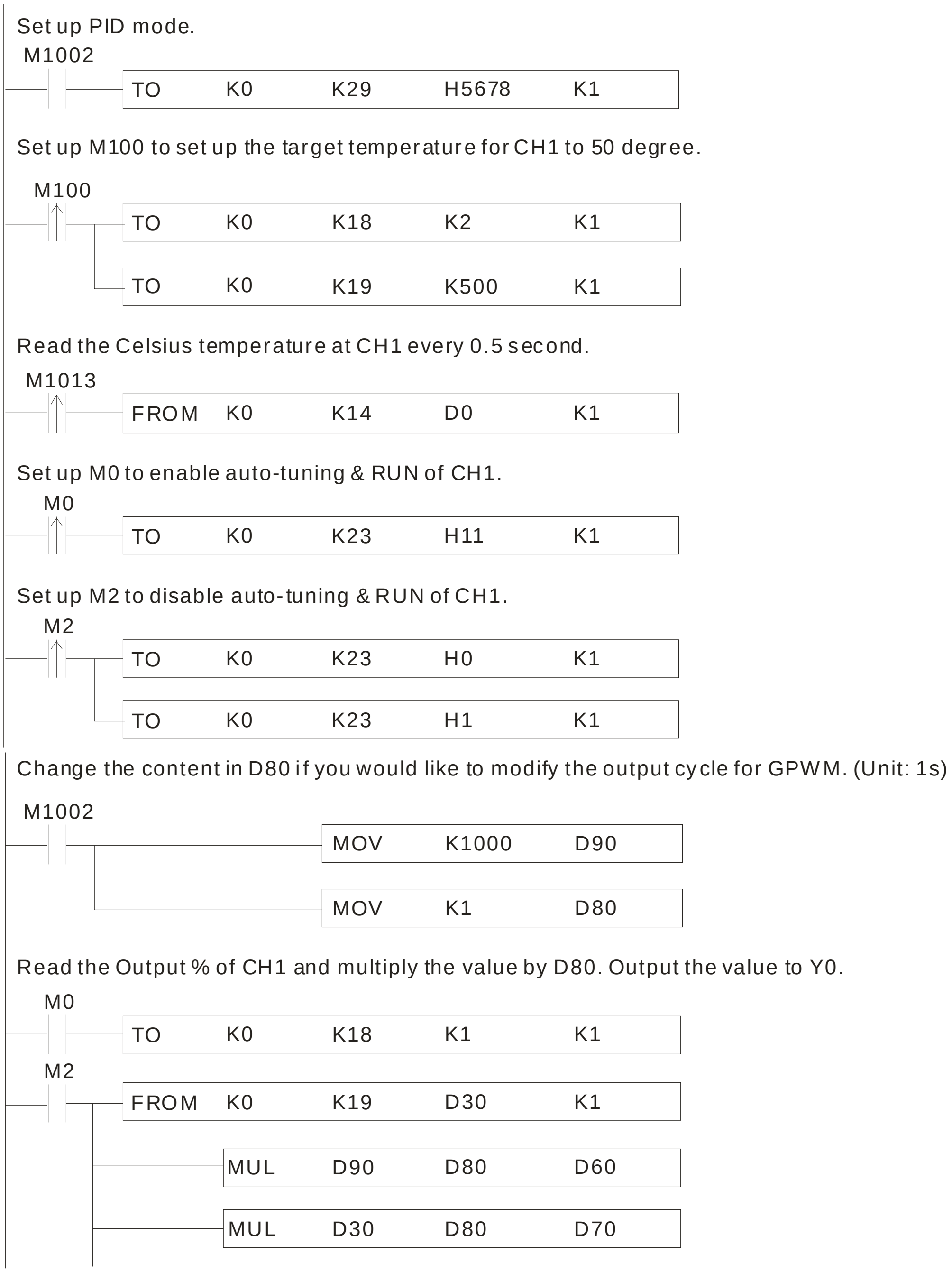


5.11 PID Application Example

5.11.1 DVP04TC-S

Targets:

1. Set M100 = On to set up target temperature for CH1.
2. Set M0 = On to set up “auto-tuning” for CH1 and enable PID function.
3. Wait for the completion of “auto-tuning” for CH1 (Y10 = On), and the program will automatically extract K_P, K_I and K_D and set M0 = Off to stop “auto-tuning".
4. Once the “auto-tuning” is completed, you only need to enable manual PID (set M2 = On) for the next time.



Set up PID mode.

Set up M100 to set up the target temperature for CH1 to 50 degree.

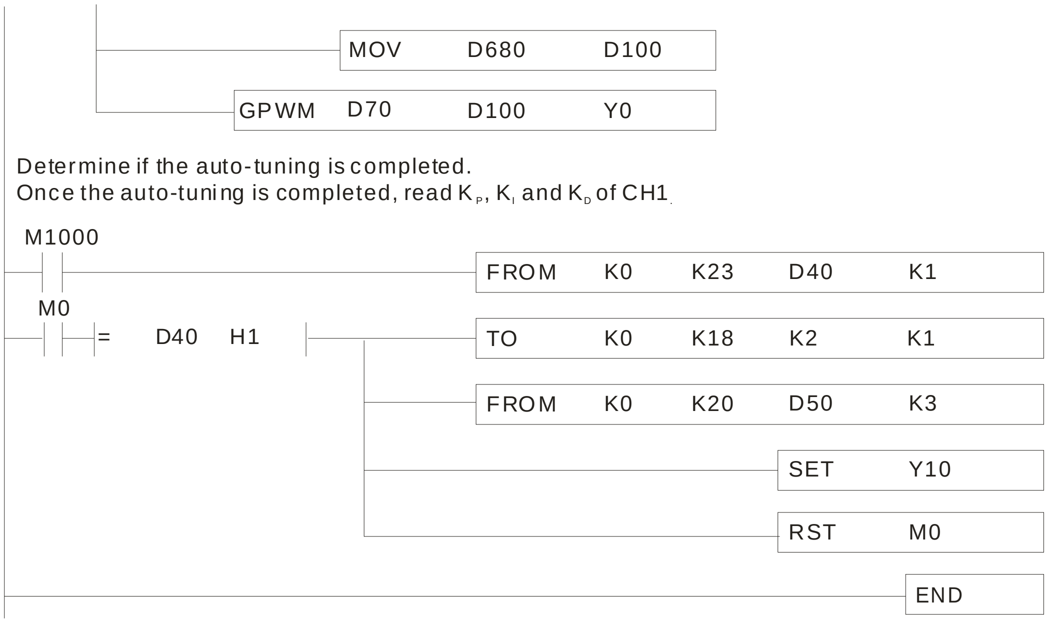
Read the Celsius temperature at CH1 every 0.5 second.

Set up M0 to enable auto-tuning & RUN of CH1.

Set up M2 to disable auto-tuning & RUN of CH1.

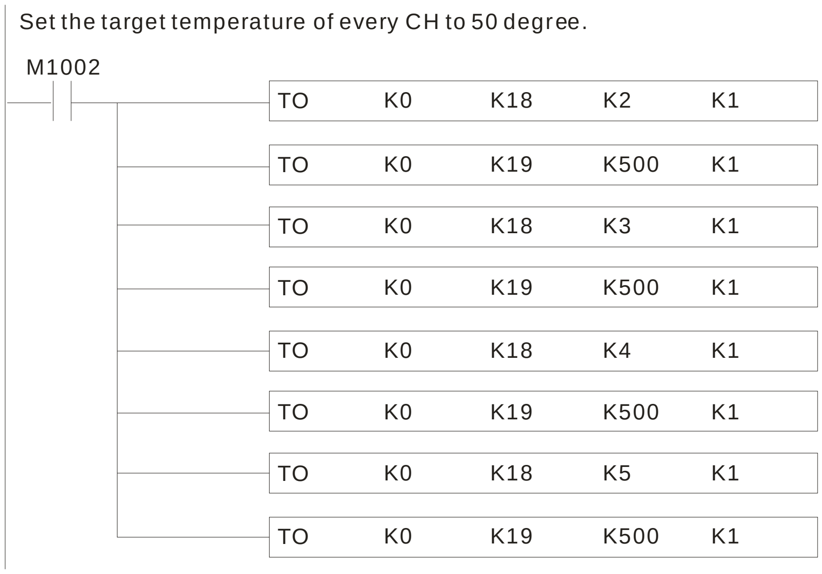
Change the content in D80 if you would like to modify the output cycle for GPWM. (Unit: 1s)

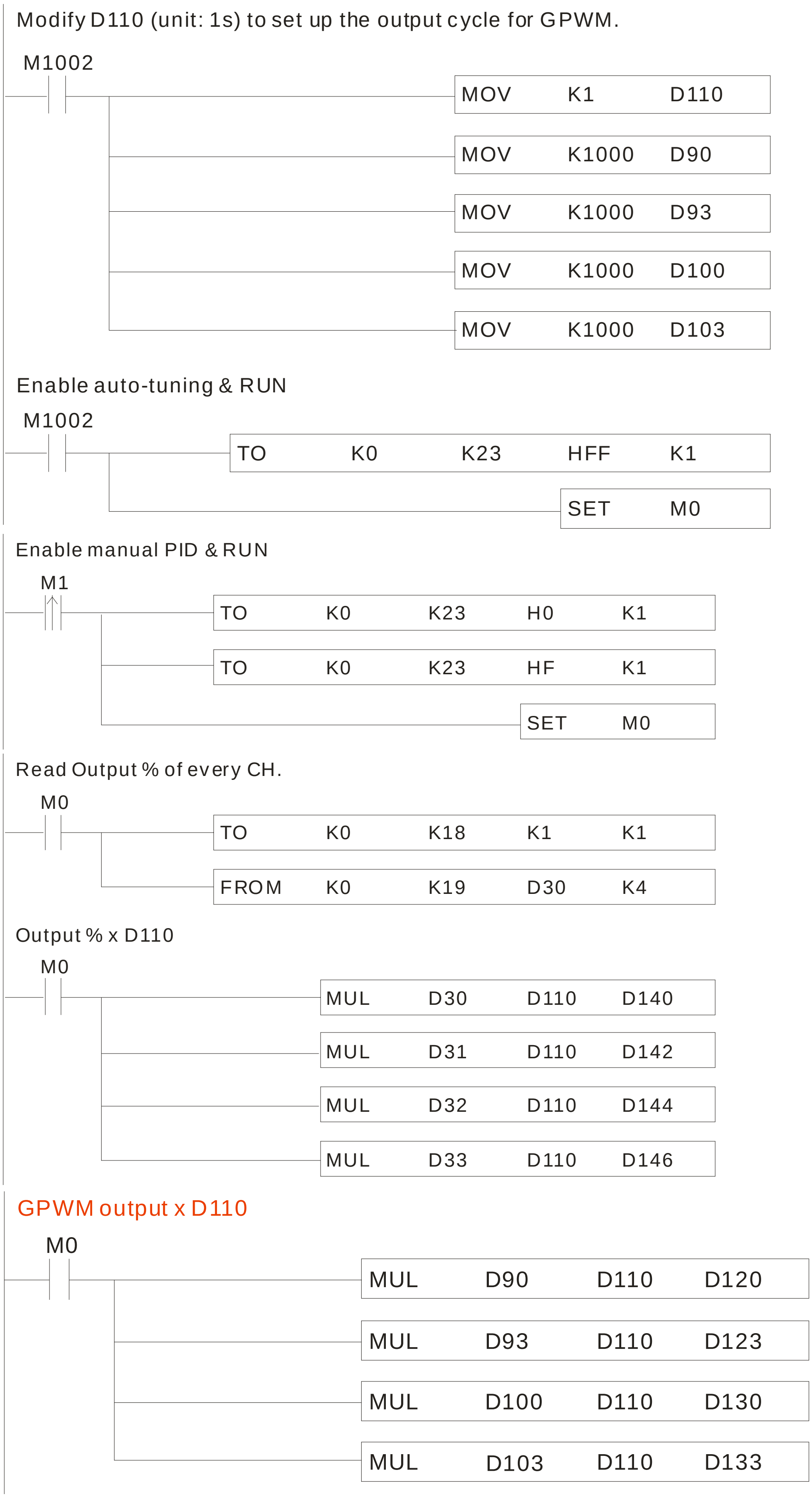
Read the Output % of CH1 and multiply the value by D80. Output the value to Y0.



Targets:

1. Set PLC RUN and enable PID auto-tuning of CH1 ~ CH4.
2. Wait for the completion of “auto-tuning” for CH1 ~ CH4 (Y10 = On), and the program will automatically extract K_P, K_I and K_D of CH1 ~ CH4 and set M0 = Off to stop “auto-tuning”.
3. Once the “auto-tuning” is completed, you only need to enable manual PID (set M1 = On) for the next time.





Modify D110 (unit: 1s) to set up the output cycle for GPWM.

```
M1002
MOV   K1     D110
MOV   K1000  D90
MOV   K1000  D93
MOV   K1000  D100
MOV   K1000  D103
```

Enable auto-tuning & RUN

```
M1002
TO    K0    K23    HFF    K1
SET   M0
```

Enable manual PID & RUN

```
M1
TO    K0    K23    H0    K1
TO    K0    K23    HF    K1
SET   M0
```

Read Output % of every CH.

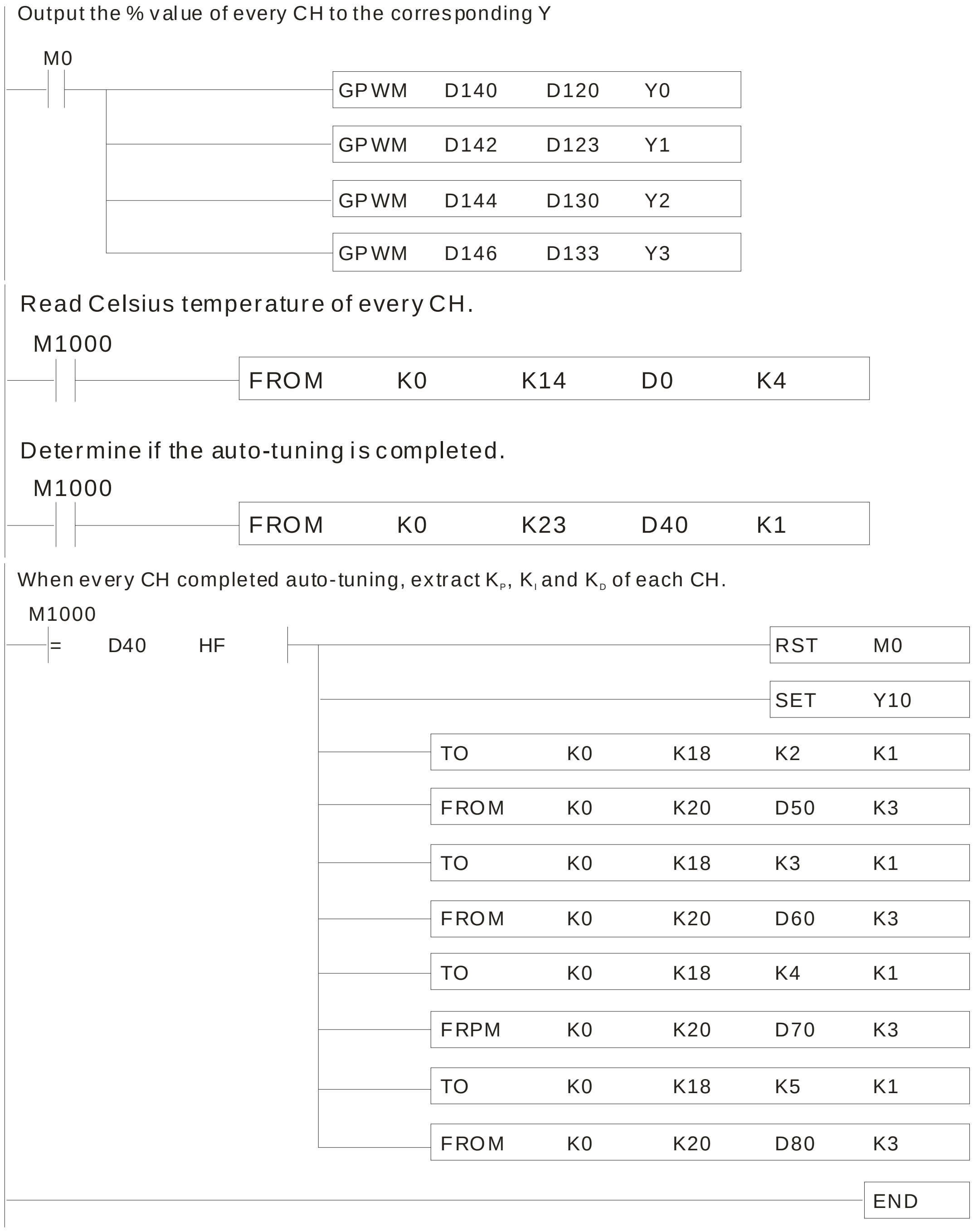
```
M0
TO    K0    K18    K1     K1
FROM  K0    K19    D30    K4
```

Output % x D110

```
M0
MUL   D30   D110   D140
MUL   D31   D110   D142
MUL   D32   D110   D144
MUL   D33   D110   D146
```

GPWM output x D110

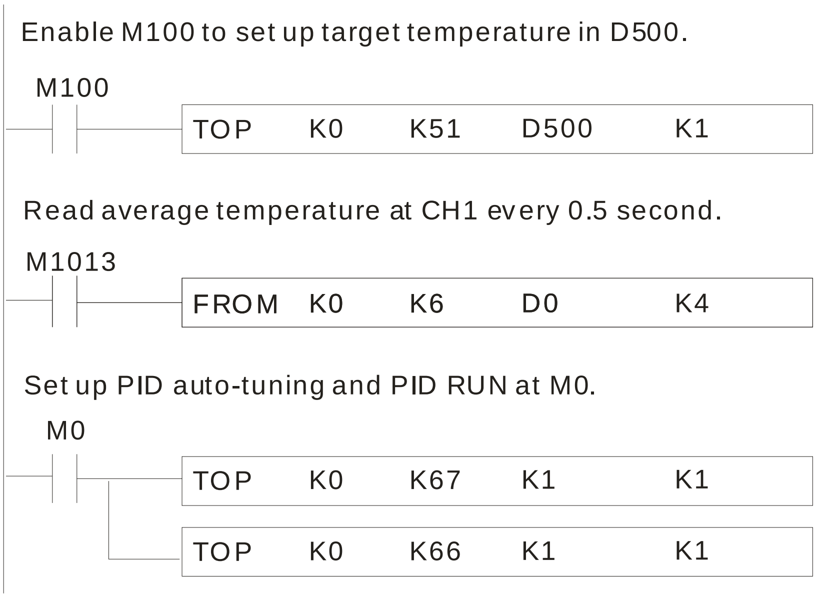
```
M0
MUL   D90    D110   D120
MUL   D93    D110   D123
MUL   D100   D110   D130
MUL   D103   D110   D133
```



5.11.2 DVP04TC-H2

Targets:

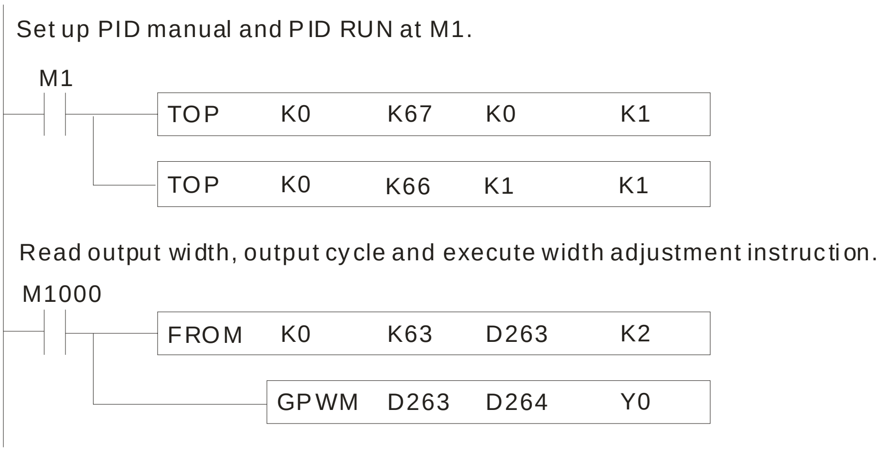
1. Set up target temperature.
2. Set up "auto-tuning”, enable PID function and wait for the completion of "auto-tuning”
3. Once the “auto-tuning” is completed, you only need to enable manual PID for the next time.



Enable M100 to set up target temperature in D500.

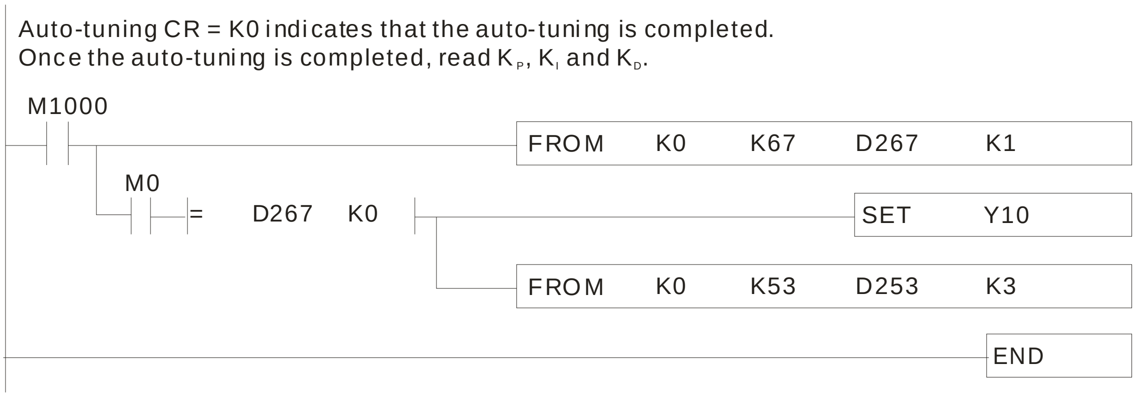
Read average temperature at CH1 every 0.5 second.

Set up PID auto-tuning and PID RUN at M0.



Set up PID manual and PID RUN at M1.

Read output width, output cycle and execute width adjustment instruction.



Auto-tuning CR = K0 indicates that the auto-tuning is completed.
Once the auto-tuning is completed, read K_P, K_I and K_D.

5.12 PID Control Registers (CR)

5.12.1 For DVP04TC-S

CR#	PID Mode Content Description	CR#	PID Mode Content Description
CR#0	Model name	CR#17	CH4 K_P
CR#1	Thermocouple type	CR#19	CH1 K_I
CR#2	Output % at CH1	CR#20	CH2 K_I
CR#3	Output % at CH2	CR#21	CH3 K_I
CR#4	Output % at CH3	CR#22	CH4 K_I
CR#5	Output % at CH4	CR#24	CH1 K_D
CR#6	CH1 average degrees (°C)	CR#25	CH2 K_D
CR#7	CH2 average degrees (°C)	CR#26	CH3 K_D
CR#8	CH3 average degrees (°C)	CR#27	CH4 K_D
CR#9	CH4 average degrees (°C)	CR#28	Run/Stop & Auto turning
CR#10	Set temperature at CH1	CR#29	Enter PID mode(H’5678)
CR#11	Set temperature at CH2	CR#30	Error Code
CR#12	Set temperature at CH3	CR#31	CH1 Sampling time
CR#13	Set temperature at CH4	CR#32	CH2 Sampling time
CR#14	CH1 K_P	CR#33	CH3 Sampling time
CR#15	CH2 K_P	CR#34	CH4 Sampling time
CR#16	CH3 K_P		

5.12.2 Explanation on PID CR in DVP04TC-S

CR#2,3,4,5：Output percentage (%)

[Explanation]

The result obtained from the PID operation. Unit: 0.1%. For example, if the result is 100, the output percentage will be 10%.

CR#10,11,12,13：Set temperature value

[Explanation]

For setting up the target temperature. Unit: 0.1 degree. Supposed the target temperature is 100°C, write “1000" into the CR by using TO instruction.

CR#14,15,16,17：K_P value

[Explanation]

K_P: Constant of proportional control, i.e. proportional band. Please refer to the PID operation formula and set up an appropriate parameter.

$$\text{Output MV (\%)} = E / K_P \times 100\%$$

Example:

Set up K_P = 10, E = 1, K_I = 0, K_D = 0 (Close K_I, K_D)

MV (%) = 1 / 10 × 100% = 10%

The output percentage displayed in CR#62 will be 10%.

CR#19,20,21,22：K_I value

[Explanation]

K_I: Constant of integration

1. If you only conduct proportional control, the controlled temperature will be deviated from the set temperature. However, with the integration, the deviation will gradually disappear by time, and the controlled temperature will be consistent with the set temperature.
2. To disable the integration function, set the CR to "0".
3. If the curve shape is too gentle, adjust K_I. The closer to 0 the K_I, the steeper the curve.

CR#24,25,26,27：K_D value

[Explanation]

K_D: Constant of differentiation

1. K_D offers bigger operational value to combat severe external interference and returns the control to its original status as soon as possible.
2. To disable the differentiation function, set the CR to “0”.
3. If the output fluctuates too much, adjust K_D. The closer to 0 the K_D, the smaller the fluctuation.

CR#28：Run/Stop & Auto turning

[Explanation]

bit	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Function	Reserved	Auto-tuning				RUN/STOP			
Channel		CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

EX: To set CH3 to RUN and auto-tuning,

(b7, b6, b5, b4, b3, b2, b1, b0) should be set to (0, 1, 0, 0, 0, 1, 0, 0).

After the auto-tuning is completed, the bit for auto-tuning will return to 0,

i.e. (b7, b6, b5, b4, b3, b2, b1, b0) will be set to (0, 0, 0, 0, 0, 1, 0, 0).

CR#31,32,33,34：Sampling time (s)

[Explanation]

The sampling times in a time unit (s). The conversion time of each channel in the temperature measurement module is approximately every 1 second. If the temperature in the control environment does not vary too much, set up longer sampling time, which also means if the temperature varies quickly, set up shorter sampling time. Range: 1 ~ 30. If the value is smaller than 1, 1 will be automatically written into the CR. If the value is bigger than 30, 30 will be automatically written into the CR. Cycle time = sampling time.

Range	Default
1~30	2

5.12.3 PID CR in DVP04TC-H2

CR#				Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH1	CH2	CH3	CH4																			
#51	#71	#91	#111	O	R/W	Set temperature value	Range: K-1000 ~ K8,000. Default = K0															
#52	#72	#92	#112	O	R/W	Sampling time (s)	Range: K1 ~ K30 (s). Default = K2															
#53	#73	#93	#113	O	R/W	K_P	Default = K121															
#54	#74	#94	#114	O	R/W	K_I	Integral constant. Default = K2,098															
#55	#75	#95	#115	O	R/W	K_D	Derivative constant. Default = K-29.															
#56	#76	#96	#116	O	R/W	Upper limit of I value	Range: K-32,760 ~ K32,760. Default = K0															
#57	#77	#97	#117	O	R/W	Lower limit of I value	Range: K-32,760 ~ K32,760. Default = K0.															
#58	#78	#98	#118	X	R	I value	Current accumulated offset value. Default = K0															
#59	#79	#99	#119	O	R/W	Heating/cooling	0: Heater, 1: Cooler. Default = K0															
#60	#80	#100	#120	O	R/W	Upper limit of output	Range: K-32,760 ~ K32,760. Default = K4,000															
#61	#81	#101	#121	O	R/W	Lower limit of output	Range: K-32,760 ~ K32,760. Default = K0															
#62	#82	#102	#122	X	R	Output percentage (%)	Range: K0 ~ K1,000 (Unit: 0.1%). Default = K0															
#63	#83	#103	#123	X	R	Output width (ms)	Width of control output. Unit: ms. Default = K0															
#64	#84	#104	#124	X	R	Output cycle (ms)	Cycle of control output. Unit: ms. Default = K0															
#65	#85	#105	#125	X	R	Output volume	Default = K0															
#66	#86	#106	#126	X	R/W	PID_RUN/STOP	0: STOP, 1: RUN. Default = K0															
#67	#87	#107	#127	X	R/W	Auto-tuning	0: Disabled, 1: Auto-tuning. Default = K0															

※ The CR# listed above do not support RS-485 read/write.

5.12.4 Explanation on CR

CR#51, 71, 91, 111: Set temperature value

[Explanation]

For setting up the target temperature. Unit: 0.1 degree. Supposed the target temperature is 100°C, write “1000" into the CR by using TO instruction. Range: -1,000 ~ 8,000. If the value is smaller than -1,000, -1,000 will be automatically written in to the CR. If the value is bigger than 8,000, 8,000 will be automatically written into the CR.

Range	Default
-1,000 ~ 8,000	0

CR#52, 72, 92, 112: Sampling time (s)

[Explanation]

The sampling times in a time unit (s). The conversion time of each channel in the temperature measurement module is approximately every 1 second. If the temperature in the control environment does not vary too much, set up longer sampling time, which also means if the temperature varies quickly, set up shorter sampling time. Range: 1 ~ 30. If the value is smaller than 1, 1 will be automatically written into the CR. If the value is bigger than 30, 30 will be automatically written into the CR. Cycle time = sampling time.

Range	Default
1 ~ 30	2

CR#53 ,73, 93, 113: K_P value

[Explanation]

K_P: Constant of proportional control, i.e. proportional band. Please refer to the PID operation formula and set up an appropriate parameter.

Output MV (%) = E / K_P × 100%

Example:

Set up K_P = 10, E = 1, K_I = 0, K_D = 0 (Close K_I, K_D)

MV (%) = 1 / 10 × 100% = 10%

The output percentage displayed in CR#62 will be 10%.

CR#54, 74, 94, 114: K_I value

[Explanation]

K_I: Constant of integration

1. If you only conduct proportional control, the controlled temperature will be deviated from the set temperature. However, with the integration, the deviation will gradually disappear by time, and the controlled temperature will be consistent with the set temperature.
2. To disable the integration function, set the CR to "0".
3. If the curve shape is too gentle, adjust K_I. The closer to 0 the K_I, the steeper the curve.

CR#55, 75, 95, 115: K_D value

[Explanation]

K_D: Constant of differentiation

4. K_D offers bigger operational value to combat severe external interference and returns the control to its original status as soon as possible.
5. To disable the differentiation function, set the CR to “0”.
6. If the output fluctuates too much, adjust K_D. The closer to 0 the K_D, the smaller the fluctuation.

CR#56, 76, 96, 116/CR#57, 77, 97, 117: Upper limit/lower limit of I value

[Explanation]

When both upper limit and lower limit are 0, the upper/lower limit function for I value will be closed, which means there will not be upper/lower limit for I value. When the upper limit is set to be smaller than the lower limit, the upper limit and lower limit will automatically switch with each other.

CR#59, 79, 99, 119: Heating/cooling

[Explanation]

For selecting heating or cooling control. Set the CR to "0" if your control target is a heater. Set the CR to "1" if your control target is a cooler. The default setting is heater.

Setting	Selection
0	Heater
1	Cooler
Default: Heater	

CR#60, 80, 100, 120/CR#61, 81, 101, 121: Upper limit/lower limit of output

[Explanation]

The output volume is calculated from the upper limit and lower limit. For example, if the upper/lower limit is set to 0 ~ 4,000, when the output comes to 10%, the output volume will be 400. Please set up this CR according to the analog output you are using.

CR#62, 82, 102, 122: Output percentage (%)

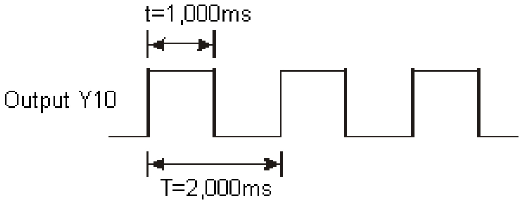
[Explanation]

The result obtained from the PID operation. Unit: 0.1%. For example, if the result is 100, the output percentage will be 10%.

CR#63, 83, 103, 123; CR#64, 84, 104, 124: Output width (ms); Output cycle (ms)

[Explanation]

If you are using the cyclic control mode to control your target, please read the two CRs. For example, if the cycle is 2,000 and width 1,000, the output pulse will shape like below:



CR#65, 85, 105, 125: Output volume

[Explanation]

Formula of output volume:

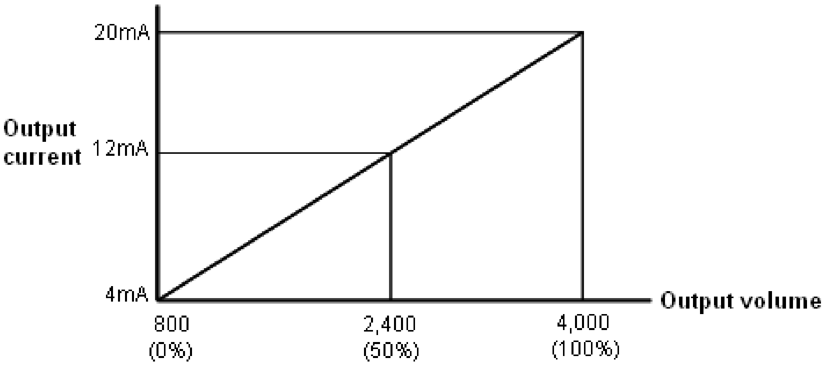
Output Volume = (Output Upper Limit – Output Lower Limit) × Output % + Output Lower Limit

Example:

Control by current 4 ~ 20mA (800 ~ 4,000)

Output upper limit: 4,000

Output lower limit: 800



Remarks:

1. Set K_P, K_I, and K_D to “0" to close the PID function. If you would like to use proportional control only, set K_I and K_D to “0”.

2. If you do not know how to tune PID parameters in your control environment, use “auto-tuning” to generate K_P, K_I and K_D and further modify them into better K_P, K_I and K_D. To use the auto-tuning, set the auto-tuning CR to “1”. After the auto-tuning is completed, the CR will automatically return to “0”.

3. If you would like to fill in your own K_P, K_I and K_D, please set up K_P first according to your experiences and set K_I and K_D to “0” to close the integral and derivative control functions. Adjust K_P first and next K_I and K_D. We recommend you to adjust K_I decreasingly and K_D downwards from 0.
4. If the output percentage fluctuates too much, please adjust K_D. The closer K_D value to 0, the less fluctuating the output percentage is. If the curve is too smooth, please adjust K_I. The bigger the K_I, the smoother the curve.

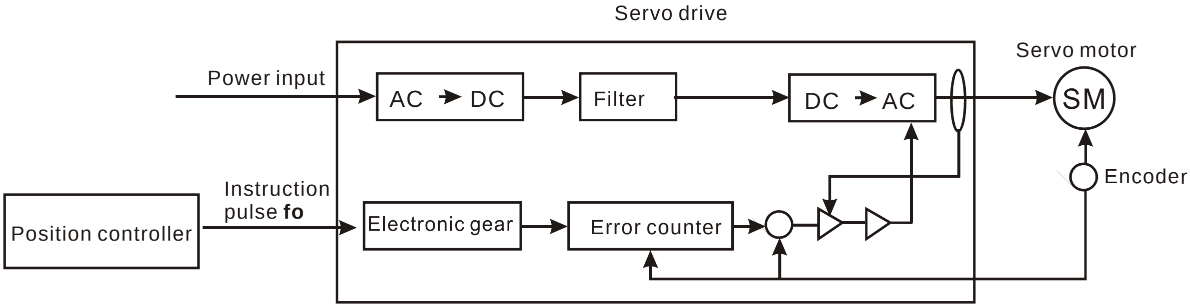
5.13 Hardware Properties of Temperature Controllers

- DVP04TC and temperature controllers of other brands need 20 ~ 30 minutes of warm-up time. The higher the ambient temperature, the longer warm-up time required.
- For ensuring hardware performance, each sensor channel can only be adjusted after the module is warmed up. The error in sensor varies upon different brands. We suggest you choose a high quality sensor for achieving higher accuracy on temperature measurement.
- Simple test can be conducted by users for checking the function of each channel.
    1. Short-circuit the channel you are using, and the measured temperature should be the temperature currently inside the module, i.e. the CJC temperature (CR#29). For instance, if the current temperature is 26 degree, connect the positive end of CH1 to the negative end (0v), i.e. short-circuit the channel, and the measured temperature should approach 26 degree.
    2. In addition, input 21.848mv to the channel and the measured temperature should be 400 degree plus the measured temperature in short circuit condition. For example, given the temperature measured in short circuit condition is 26 degree, when the channel receives input as 21.848mV, the measured temperature should be 426 degree.
    3. If the test results are consistent with the above description (the channels operates in good condition) but errors still exist, please check other factors which could possibly influence normal operation of the temperature controller.

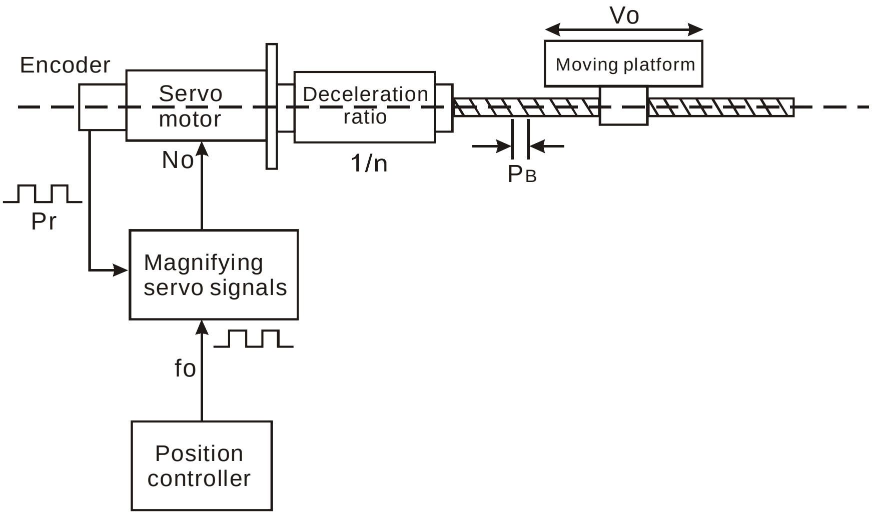
MEMO

6.1 The Concept of Servo Drive System

The speed and positioning control of the step or servo drive system are usually applied in the system requiring accurate control to transmit power. The driving system receives pulse instructions, pulses and frequency to control the angle and speed of the rotation of motor. See the configuration of the system below.



The instruction pulses are input into the error counter via the electronic gear. The error counter counts the number of pulses and compares the pulses with the other input feedback pulse. After this, it adjusts the rotation speed of the servo motor until the frequencies of both streams of pulses are equal. The number of pulses and frequency of pulses sent by the position controller are based on the equipment determined by the servo drive system and the speed or position determined by the user. See the figure below for the relations between all kinds of equipment parameters and instruction pulses.



Equipment parameters:

P_B: Screw pitch

1/n: Deceleration ratio

△S: Linear movement of the working object for 1 revolution of the motor

$$\boxed{\Delta S = P_B \times \frac{1}{n}}$$

△ℓ: Linear movement of the working object obtained by every feedback pulse

$$\boxed{\Delta\ell = \frac{\Delta S}{P_f} = \frac{P_B \times {}^{1}\!/_{n}}{P_f}}$$

P_f: Feedback pulse, i.e. pulses sent from 1 revolution of the encoder inside the servo motor. The value is usually fixed.

The positioning resolution (mm/pulse) $\Delta\ell_0$ will be determined by the equipment parameters, which is the linear movement of the working object generated by every instruction pulse sent.

$$f_0 \times \text{Electronic gear ratio} = P_f$$

$$\Delta \ell_0 = \frac{\Delta S}{f_0} = \frac{\Delta S}{P_f} \times \text{Electronic gear ratio}$$

When the electronic gear ratio ＞ 1, $\triangle\ell_0$ ＞ $\triangle\ell$, which means the positioning resolution is degrading.

Example 1:

Assume we have known that the feedback pulse is 4,000ppr and want the rotation speed of the motor to be 3,000rpm when the instruction pulses are at 100KPPS, how should we set up the electronic gear ratio?

[Solve]

3,000rpm = 3,000 revolutions per minute = 500 revolutions per second

f_0 × electronic gear ratio = 4,000ppr × 500 revolutions per seccond ⇨ Electronic gear ratio = 2

Example 2:

Assume the feedback pulses P_f is at 4,000ppr, the screw pitch P_B = 10mm and the deceleration ratio 1/n = 1, what is the electronic gear ratio when the positioning resolution = 0.01mm/pulse?

[Solve]

Electronic gear ratio = $\Delta\ell_0 \times \frac{P_f}{P_B \times {}^{1}/_{n}} = 0.01 \times \frac{4000}{10} = 4$

i.e. 1 pulse sent by the instruction pulse f_0 will be converted into 4 pulses by the electronic gear and the servo motor will rotate for 4 steps (1 step = 10/4,000mm) and the screw rotate for 0.01mm.

6.2 The Positioning Controller

The positioning controller estimates how many pulses and the pulse frequency (i.e. the pulse instruction) required according to the equipment parameters, speed and distance set up in the servo motor system by the user and sends the instruction to the servo drive. We have discussed about the equipment parameter in the last section. Here, we are going to talk about the two target parameters, speed and distance.

- The speed parameter

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \underbrace{\frac{\text{Distance}}{\text{Circle}}}_{B} \text{ x } \underbrace{\frac{\text{Circle}}{\text{Number of pulses}}}_{1/A} \text{ x } \underbrace{\frac{\text{Number of pulses}}{\text{Time}}}_{PPS,\, pulse/sec}$$

$$V = \underbrace{\frac{\text{Number of pulses}}{\text{Time}}}_{PPS,\, pulse/sec} \quad \propto \text{Speed}$$

A = number of pulses required for 1 motor revolution; B = distance moved for 1 motor revolution. Both A and B are set up in the positioning controller according to the equipment parameters in the servo system. “PPS” refers to “pulse per second”. The positioning controller will calculate the frequency and number of pulses of the pulse instruction according to the set equipment parameters A, B and the speed.

- The position parameter

  There are two ways to indicate position:

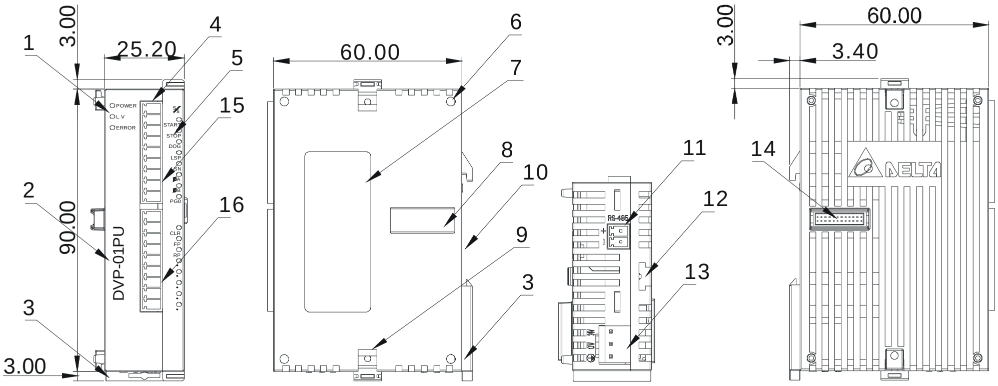
  1. The number of pulses as the unit: Since we have known the number of pulses required for the servo motor system to reach the target position, the positioning controller sends out the designated number of pulses according to the value set.
  2. Distance as the unit: According to the parameters set in the servo motor system by the user, the positioning controller converts the distance into number of pulses and sends it to the servo.

6.3 Introduction

The maximum output pulse of the PU module can be up to 200KPPS, and the pulse output interfance adopts the high-speed differential output (Line Driver). The PU module is built-in with 8 motion control modes and 2 types of pulse acceleration curves, trapezoid curve and S curve. One PU module is able to control the 1-axis step or servo drive system. The PLC MPU is able to read/write the data in the module by FROM/TO instruction. Maximum 8 PU modules can be connected to a PLC MPU for 8 independent axis controls.

6.4 Product Profile and Outline

6.4.1 01PU-S



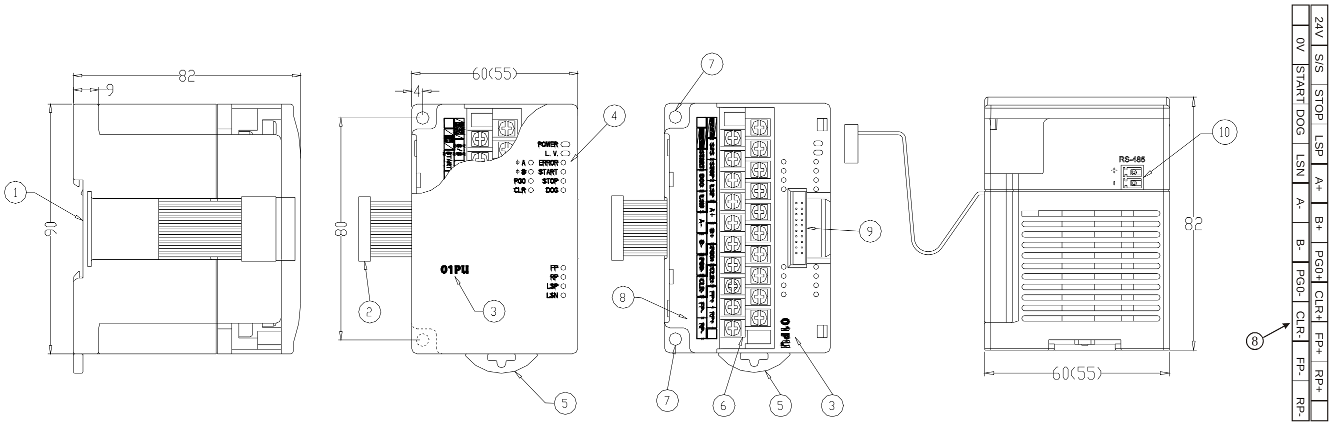
Unit: mm

1. POWER, LV and ERROR indicators	9. Fixing clip for extension unit/module
2. Model name	10. DIN rail (35mm)
3. DIN rail clip	11. RS-485 communication port
4. Terminals	12. Mounting raril for extension unit/module
5. Terminal indicator	13. Power input
6. Mounting hole for extension unit/module	14. Connection port for extension unit/module
7. Nameplate	15. Upper terminals
8. Connection port for extension unit/module	16. Lower terminals

I/O Terminals:

Upper terminals	Lower terminals
S/S	A-
START	B+
STOP	B-
DOG	CLR+
LSP	CLR-
LSN	FP+
PG0+	FP-
PG0-	RP+
A+	RP-

6.4.2 01PU-H2 (01PU-H)



Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. Status indicators	9. Connection port for extension unit/module
5. DIN rail clip	10.RS-485 communication

6.5 I/O Terminals and LED Indicators

6.5.1 I/O terminals

Type	Terminal	Description	Response feature
Power supply	+24V, 0V	Power input: DC24V (-15% ~ +20%), Current consumption: 100mA	-
Input	START	Starting input	4ms/12ms
	STOP	Stopping input	4ms
	LSP	Right limit input	1ms
	LSN	Left limit input	1ms
	ΦA+, ΦA-	MPG A-phase pulse input +, - (differential signal input)	200kHz
	ΦB+, ΦB-	MPG B-phase pulse input +, - (differential signal input)	200kHz
	PG0+, PG0-	Zero signal input terminal +, - (differential signal input)	4ms
	DOG	2 variations according to different operation modes: (1) DOG signal when in zero return (2) Interruption signal inserted in signal-speed or 2-speed sections	1ms
	S/S	Common terminal of input points START, STOP, DOG, LSP, and LSN	-
Output	CLR+, CLR-	Clearing signal (clearing signals in the error counter in servo drive)	4ms
	FP+, FP-	1. FP/RP mode: forward pulse output 2. Pulse/direction: pulse output 3. A/B phase mode: A-phase output	200kHz
	RP+, RP-	1. FP/RP mode: reverse pulse output 2. Pulse/direction: direction output 3. A/B phase mode: B-phase output	200kHz

6.5.2 LED Display

Power	Power indicator, +5V internal power is normal
L.V.	Low voltage indicator; On when the external power supply is less than 19.5V
ERROR	Error indicator (On/Off/flash); flashes when the error code register is not “0”
START	Starting input indicator
STOP	Stopping input indicator
DOG	DOG input indicator
FP	Forward pulse output indicator
RP	Reverse pulse output indicator
LSP	Right limit input indicator
LSN	Left limit input indicator
ΦA	MPG A-phase pulse input indicator
ΦB	MPG B-phase pulse input indicator
PG0	Zero signal input indicator
CLR	Clearing signal output indicator

6.6 Specifications

6.6.1 Functions

Item	Description
Power supply	DC24V(-15% ~ +20%); current consumption: 70 ± 10mA; startup transient current:1.3A
Max. number of connected modules (axes)	8 modules (axes), which will not occupy any I/O points
Distance	Set up by CR. Range: -2,147,483,648 ~ +2,147,483,647 Units: um, mdeg, 10^{-4} inch, pulse Multiplications: 10^0, 10^1, 10^2, 10^3 Options: absolute position or relative displacement
Speed	Set up by CR. Range: -2,147,483,648 ~ +2,147,483,647 (conversion of 10 ~ 200KPPS of pulses) Unit: pulse/s, cm/min, 10deg/min, inch/min
Pulse output methods	In 3 modes: Pulse/Dir, FP (CW)/RP (CCW), A/B, by differential output
External input points	Isolated by photocoupler. LED indicators for all I/O signals Input points: START, STOP, LSP, LSN, DOG (24V DC/5mA) Input points: ΦA, ΦB, PG0 (5 ~ 24V DC/6 ~ 15mA)
External output points	Isolated by photocoupler. LED indicators for all I/O signals Output points: FP and RP are differential signals (5V) Output point CLR is transistor NPN open collector (5 ~ 24V DC, less than 20mA)
Position control program	PLC program with FROM/TO instructions
Data exchange with MPU	The CR data can be read/written by using FROM/TO instructions. If the data are 32-bit, 2 CRs will be required to process the data.
When connected to DVP-PLC MPU in series	The modules are numbered from 0 ~ 7 with 0 is the closest and 7 furthest to the MPU. Up to 8 modules can be connected to the MPU without occupying any digital I/O points.

6.6.2 Specifications of input terminals

Item	START, STOP	LSN, LSP, DOG	ΦA±, ΦB±	PG0±
Input voltage	24V DC ± 10%		5 ~ 24V DC	
Signal format	SINK/SOURCE		Differential or transistor open collector	
Input current	5 ± 1mA		6 ~15mA	
Response feature	15ms	1ms	200kHz	1ms
Loop insulation	Photocoupler			
Operation indication	LED is On indicates the input signal is On.			

6.6.3 Specifications of output terminals

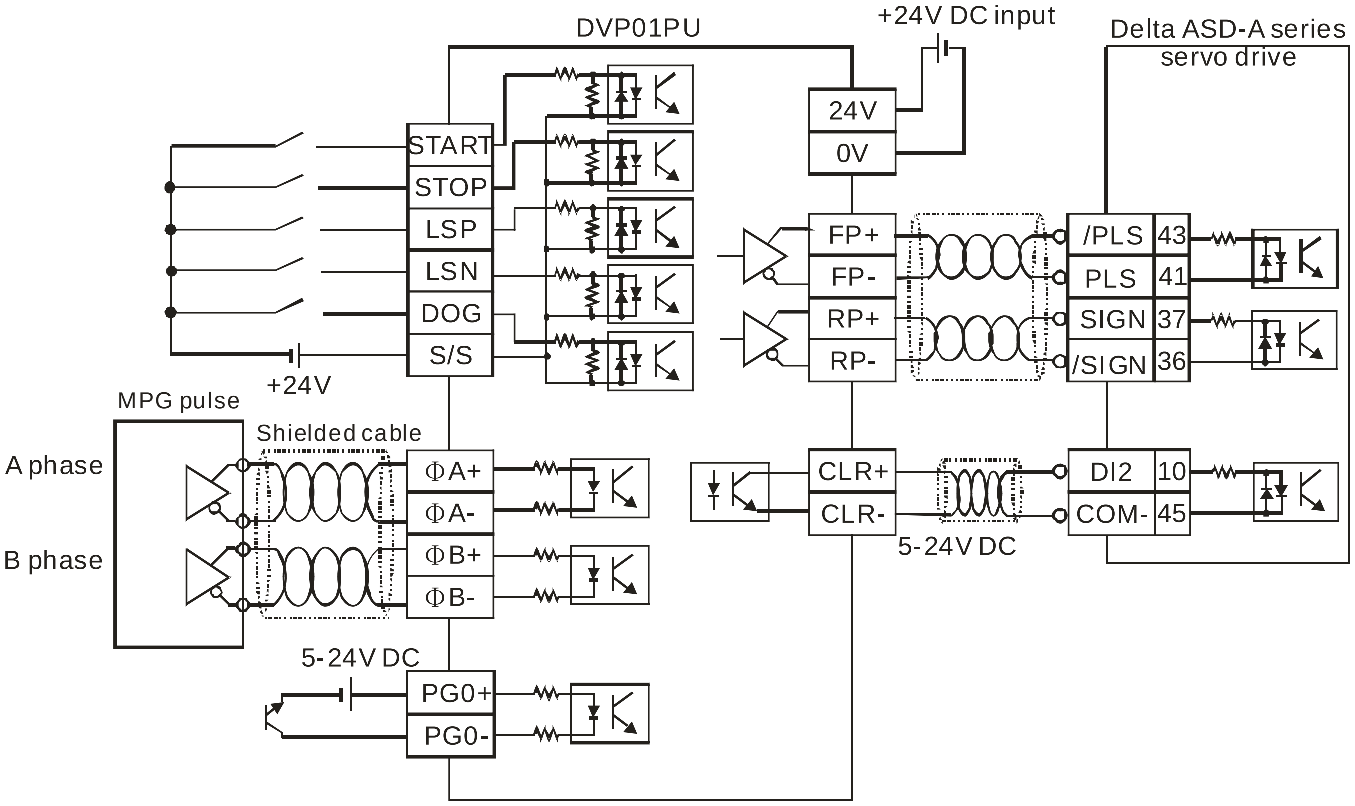
Item	FP±， RP±	CLR±
Output mode	Forward pulse (FP±)/reverse pulse (RP±) Pulse output (FP±)/direction control (RP±) A(FP±)/B (RP±) phase output	Clearing signals in the error counter in servo drive
Output format	Differential output	Transistor NPN open collector
Drive current	-	5 ~ 24V DC
Load current	-	Less than 20mA
Output voltage	Differential output 5V	-
Response feature	200kHz	130ms
Operation indication	LED is On indicates the input signal is On.	

6.6.4 Environment

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	International standards: IEC61131-2, IEC 68-2-6(TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)

6.6.5 External wiring

The PU Position Control Module + Delta ASD-A series servo drive



6.7 CR (Control Register)

6.7.1 CR in DVP01PU-S

CR#		Address	Latched/ Attribute		Content	Setup range	Default
HW	LW						
	#0	H'4190	O	R	Model name	Set up by the system; read only.	H'0110
#2	#1	H'4191	O	R/W	Number of pulses required for 1 motor revoluation (A)	1 ~ +2,147,483,647 PLS/REV	2,000
#4	#3	H'4193	O	R/W	Distance the motor rotates for 1 revolution (B)	1 ~ +2,147,483,647 *1	1,000
	#5	H'4195	O	R/W	Parameter setting	b0 ~ b15	H'0000
#7	#6	H'4196	O	R/W	Max. speed (V_{MAX})	0 ~ +2,147,483,647 *2	200,000
#9	#8	H'4198	O	R/W	Bias speed (V_{BIAS})	0 ~ +2,147,483,647 *2	0
#11	#10	H'419A	O	R/W	JOG speed (V_{JOG})	0 ~ +2,147,483,647 *2	5,000
#13	#12	H'419C	O	R/W	Zero return speed (V_{RT})	0 ~ +2,147,483,647 *2	50,000
#15	#14	H'419E	O	R/W	Zero return deceleration speed (V_{CR})	0 ~ +2,147,483,647 *2	1,000
	#16	H'41A0	O	R/W	The number of PG0 in zero return mode (N)	0 ~ +32,767 PLS	0
	#17	H'41A1	O	R/W	The number of pulses in zero return mode (P)	-32,768 ~ +32,767 PLS	0
	#18	H'41A2	O	R/W	Zero return mode	b0 ~ b1	B'00
#20	#19	H'41A3	O	R/W	Setup of zero point (HP)	0 ~ ±999,999 *1	0
	#21	H'41A5	O	R/W	Acceleration time (T_{ACC})	10 ~ +32,767 ms	100

CR#		Address	Latched/ Attribute		Content	Setup range	Default
HW	LW						
	#22	H’41A6	O	R/W	Deceleration time (T_{DEC})	10 ~ +32,767 ms	100
#24	#23	H’41A7	X	R/W	Target position (I) P(I)	-2,147,483,648 ~ +2,147,483,647 *1	0
#26	#25	H’41A9	X	R/W	Operation speed (I) V(I)	-2,147,483,648 ~ +2,147,483,647 *1	1,000
#28	#27	H’41AB	X	R/W	Target position (II) P(II)	-2,147,483,648 ~ +2,147,483,647 *1	0
#30	#29	H’41AD	X	R/W	Operation speed (II) V(II)	0 ~ +2,147,483,647 *1	2,000
	#31	H’41AF	X	R/W	Operation instruction	b0 ~ b13	H’0000
	#32	H’41B0	X	R/W	Work mode	b0 ~ b13	H’0001
#34	#33	H’41B1	X	R/W	Current position (CP)	-2,147,483,648 ~ +2,147,483,647 *1	0
#36	#35	H’41B3	X	R/W	Current speed (CS)	0 ~ +2,147,483,647 PPS	0
	#37	H’41B5	O	R/W	Communication address and baud rate setting	b0 ~ b15; Default: ASCII, 9600,7,E,1; @1	H’0182
	#38	H’41B6	X	R/W	Execution status	b0 ~ b10	H’XXXX
	#39	H’41B7	X	R	Error code	See 6.7.3	H’0000
	#40	H’41B8	X	R/W	Numerator of MPG electronic gearing	See 6.7.3	H’0001
	#41	H’41B9	X	R/W	Denominator of MPG electronic gearing	See 6.7.3	H’0001
#43	#42	H’41BA	X	R/W	Input frequency of MPG	Frequency of MPG pulse input	0
#45	#44	H’41BC	X	R/W	Accumulated number pulses by MPG	Accumulated by the number of pulse input from MPG	0
	#46	H’41BE	X	R/W	Response speed of MPG input		5
	#47	H’41BF	X	R	Terminal status		H’XXXX
	#48	H’41C0	O	R	Firmware version	Displayed in hex.	H’0100

*1: Selectable units: um/rev, m deg/rev and 10^{-4} inch/rev.

*2: The setting of unit is in accordance with b0 and b1 of CR#5.

❖ CR#32 ~ CR#48 are different from those in DVP01PU-H.

❖ The corresponding parameters address H’4190 ~ H’41C0 of CR#0 ~ CR#48 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

6.7.2 CR in DVP01PU-H

CR#		Address	Latched/ Attribute		Content	Setup range	Default
HW	LW						
	#0	H’4190	O	R	Model name	Set up by the system; read only.	H’0110
#2	#1	H’4191	O	R/W	Number of pulses required for 1 motor revoluation (A)	1 ~ +2,147,483,647 PLS/REV	2,000
#4	#3	H’4193	O	R/W	Distance the motor rotates for 1 revolution (B)	1 ~ +2,147,483,647 *1	1,000
	#5	H’4195	O	R/W	Parameter setting	b0 ~ b15	H’0000
#7	#6	H’4196	O	R/W	Max. speed (V_{MAX})	0 ~ +2,147,483,647 *2	200,000
#9	#8	H’4198	O	R/W	Bias speed (V_{BIAS})	0 ~ +2,147,483,647 *2	0
#11	#10	H’419A	O	R/W	JOG speed (V_{JOG})	0 ~ +2,147,483,647 *2	5,000
#13	#12	H’419C	O	R/W	Zero return speed (V_{RT})	0 ~ +2,147,483,647 *2	50,000
#15	#14	H’419E	O	R/W	Zero return deceleration speed (V_{CR})	0 ~ +2,147,483,647 *2	1,000
	#16	H’41A0	O	R/W	The number of PG0 in zero return mode (N)	0 ~ +32,767 PLS	0

CR#		Address	Latched/ Attribute		Content	Setup range	Default
HW	LW						
	#17	H'41A1	O	R/W	The number of pulses in zero return mode (P)	-32,768 ~ +32,767 PLS	0
	#18	H'41A2	O	R/W	Zero return mode	b0 ~ b1	B'00
#20	#19	H'41A3	O	R/W	Setup of zero point (HP)	0 ~ ±999,999 *1	0
	#21	H'41A5	O	R/W	Acceleration time (T_{ACC})	10 ~ +32,767 ms	100
	#22	H'41A6	O	R/W	Deceleration time (T_{DEC})	10 ~ +32,767 ms	100
#24	#23	H'41A7	X	R/W	Target position (I) P(I)	-2,147,483,648 ~ +2,147,483,647 *1	0
#26	#25	H'41A9	X	R/W	Operation speed (I) V(I)	-2,147,483,648 ~ +2,147,483,647 *1	1,000
#28	#27	H'41AB	X	R/W	Target position (II) P(II)	-2,147,483,648 ~ +2,147,483,647 *1	0
#30	#29	H'41AD	X	R/W	Operation speed (II) V(II)	0 ~ +2,147,483,647 *1	2,000
	#31	H'41AF	X	R/W	Operation instruction	b0 ~ b13	H'0000
	#32	H'41B0	X	R/W	Work mode	b0 ~ b12	H'0001
#34	#33	H'41B1	X	R/W	Current position (CP)	-2,147,483,648 ~ +2,147,483,647 PLS	0
#36	#35	H'41B3	X	R/W	Current speed (CS)	0 ~ +2,147,483,647 PPS	0
#38	#37	H'41B5	X	R/W	Current position (CP)	-2,147,483,648 ~ +2,147,483,647 *1	0
#40	#39	H'41B7	X	R/W	Current speed (CS)	0 ~ +2,147,483,647 PPS	0
	#41	H'41B9	O	R/W	Communication address	1 ~ 255	1
	#42	H'41BA	O	R/W	Communication protocol	b0 ~ b15; Default: ASCII, 9600,7,E,1	H'8002
	#43	H'41BB	X	R/W	Execution status	b0 ~ b10	H'XXXX
	#44	H'41BC	X	R	Error code	See 6.7.3	H'0000
	#45	H'41BD	X	R/W	Numerator of MPG electronic gearing	See 6.7.3	H'0001
	#46	H'41BE	X	R/W	Denominator of MPG electronic gearing	See 6.7.3	H'0001
#48	#47	H'41BF	X	R/W	Input frequency of MPG	Frequency of MPG pulse input	0
#50	#49	H'41C1	X	R/W	Accumulated number pulses by MPG	Accumulated by the number of pulse input from MPG	0
	#51	H'41C3	X	R/W	Response speed of MPG input		5
	#52	H'41C4	X	R	Terminal status		H'XXXX
	#53	H'41C5	O	R	Firmware version	Displayed in hex.	H'XXXX

*1: Selectable units: um/rev, m deg/rev and 10^{-4} inch/rev.

*2: The setting of unit is in accordance with b0 and b1 of CR#5.

❖ CR#32 ~ CR#48 are different from those in DVP01PU-S.

❖ The corresponding parameters address H'4190 ~ H'41C5 of CR#0 ~ CR#53 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7, E, 1),); RTU data format (8-bit, Even, 1 stop bit (8, E, 1)).
3. Function: H'03 (read many data from register); H'06 (write 1 word datum into register); H'10 (write many word data into register).

6.7.3 Explanation on CR

Please be noted that the contents of CR#32 ~ CR#48 in DVP01PU-S are different from those of CR#32 ~ CR#53 in DVP01PU-H.

CR#0: Model name

[Explanation]

Set up by the system; read only. You can read the model name in the program to see if the extension module exists.

CR#1, 2: Number of pulses required for 1 motor revolution (A); Range: 1 ~ 2,147,483,647 PLS/REV.

[Explanation]

1. Normally, we can set up the electronic gear ratio in a servo drive. Therefore, the number of pulses required for 1 motor revolution does not always equal the number of pulses generated by the encoder for 1 servo motor revolution.

   Number of pulses required for 1 motor revolution (A) × electronic gear *(CMX/CDV)* = pulses generated by 1 encoder revolution.

2. The setting of unit is in accordance with b0 and b1 of CR#5. When the unit is set as machine unit or combined unit, parameter A will be valid. **When the unit is set as motor unit, parameter A will be invalid.**

CR#3, 4: Distance the motor rotates for 1 revolution (B); Range: 1 ~ 2,147,483,647 unit/REV.

[Explanation]

1. There are 3 units available to be set up in b0 and b1 of CR#5.

   B = 1 ~ +2,147,483,647 (um/Rev, mdeg/Rev, 10^{-4} inch/Rev)

2. The setting of unit is in accordance with b0 and b1 of CR#5. When the unit is set as machine unit or combined unit, parameter B will be valid. **When the unit is set as motor unit, parameter B will be invalid.**

CR#5: Parameter setting

[Explanation]

b0 ~ b15 represents the following meaning:

1. The unit is set in b0 and b1 of CR#5

b1	b0	Unit	Explanation
0	0	Motor	Unit: pulse
0	1	Machine	Unit: length, angle
1	0	Combined	Unit for position: length, angle (machine unit) Unit for speed: pulse (motor unit)
1	1		

Item	Displacement	Motor unit	Combined unit	Machine unit
Position	B_1	pulse	Um = 10^{-3} mm	
	B_2	pulse	m deg = 10^{-3} deg	
	B_3	pulse	10^{-4} inch	
Speed	B_1	pulse/sec (PPS)	cm/min	
	B_2	pulse/sec (PPS)	10 deg/min	
	B_3	pulse/sec (PPS)	inch/min	

Position:

Zero point【HP】(CR#19,#20), target position (I)【P(I)】(CR#23,#24), target position (II)【P(II)】(CR#27,#28), current position【CP】(CR#33,#34).

Speed:

Maximum speed【V_{MAX}】(CR#6,#7), bias speed【V_{BIAS}】(CR#8,#9), JOG speed【V_{JOG}】(CR#10,#11), zero return speed【V_{RT}】(CR#12,#13), Zero return deceleration speed【V_{CR}】(CR#14,#15), operation speed (I)【V(I)】(CR#25,#26), operation speed (II)【V(II)】(CR#29,#30).

Example 1:

Motor unit b[1:0] = 00 ⇨ Position: pulse; Speed: pulse/sec (PPS).

Settings: target position P(I): 10,000 (pulse); operation speed V(I): 10K (PPS)

[Explanation]

The position control module only needs to send out 10,000 pulses (frequency: 10KPPS) to move to the target position. The distance moved by every pulse is calculated by the equipment parameter and has nothing to do with the settings in CR#1, #2 (A) and CR#3, #4 (B).

Example 2:

Machine unit b[1:0] = 01 ⇨ Position: um; Speed: cm/min.

Assume CR#1, #2 (A) = 1,000 (pulse/REV), CR#3, #4 (B) = 100 (um/REV), target position P(I) = 10,000 (um), and operation speed V(I) = 1,000 (cm/min), what are the number of pulses and their frequency from the pulse instruction of the position control module?

[Explanation]

$$\text{Distance} = \underbrace{\frac{\text{Distance}}{\text{Number of revolutions}}}_{B}\ \text{x}\ \underbrace{\frac{\text{Number of revolutions}}{\text{Distance}}}_{1/A}\ \text{x}\ \text{Number of pulses}$$

Number of pulses required from the position control module to move to P(I)

$$= \frac{P(I)um}{B/A} = P(I) \times \frac{A}{B} = 100{,}000\ \text{pulse}$$

Operaion speed V(I): 6 (cm/min) = 60,000/60 (um/sec)

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \underbrace{\frac{\text{Distance}}{\text{Number of revolutions}}}_{B} = \underbrace{\frac{\text{Number of revolutions}}{\text{Number of pulses}}}_{1/A} = \underbrace{\frac{\text{Number of pulses}}{\text{Time}}}_{\text{PPS, pulse/sec}}$$

The position control module calculates the pulse frequency (PPS)

$$= V(I)\ \text{x} \frac{10^4}{60}\ \text{x} \frac{A}{B} = \frac{60{,}000}{60}\ \text{x} \frac{1{,}000}{100} = 10{,}000\ \text{PPS}$$

Example 3:

Combined unit b[1:0] = 10, 11 ⇨ Position: um; Speed: pulse/sec (PPS)

Assume CR#1, #2 (A) = 2,000 (Pulse/REV), CR#3, #4 (B) = 100 (um/REV), target position P(I) = 10,000 (um), and operation speed V(I) = 10K (PPS), what is the number of pulses from the pulse instruction of the position control module?

[Explanation]

The position control module calculates the number of pulses required to reach P(I)

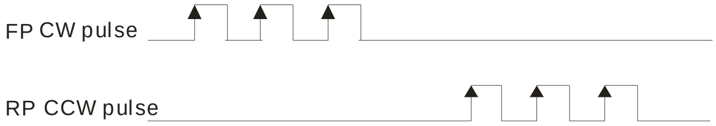
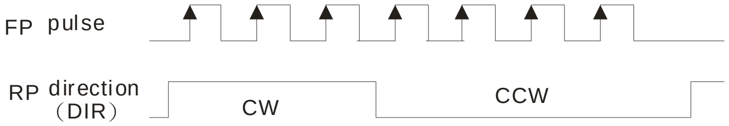
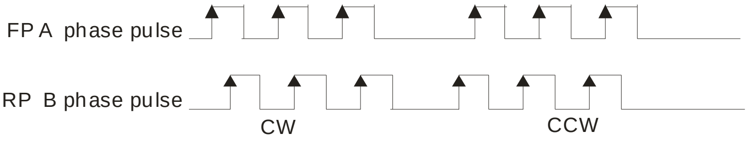
$$= \frac{P(I)\ um}{B/A} = P(I) \times \frac{A}{B} = 200{,}000\ PULSE$$

2. The multiplication of position is set in b2 and b3 of CR#5.

   Position: zero point【HP】(CR#19,#20), target position (I)【P(I)】(CR#23,#24), target position (II)【P(II)】(CR#27,#28) and current position【CP】(CR#33,#34). The【CP】(CR#33,#34) value has to be multiplied by the multiplication values below:

b3	b2	Multiplication
0	0	Position × 10^0
0	1	Position × 10^1
1	0	Position × 10^2
1	1	Position × 10^3

3. The pulse output type is set in b4 and b5 of CR#5.

b5	b4	Pulse output type (positive logic)	Explanation
0	0		FP + RP
0	1		Pulse + direction
1	0		A/B phase pulse
1	1		

4. LSP input polarity is set in b6 of CR#5.

   b[6] = 0: positive logic enabled. When LSP input signal is On, LSP signal will be generated.

   b[6] = 1: negative logic enabled. When LSP input signal is Off, LPS signal will be generated.

5. LSN input polarity is set in b7 of CR#5.

   b[7] = 0: positive logic enabled. When LSN input signal is On, LSN signal will be generated.

   b[7] = 1: negative logic enabled. When LSN input signal is Off, LSN signal will be generateed.

6. The direction of zero return is set in b8 of CR#5.

   b[8] = 0: decreasing CP value towards zero

   b[8] = 1: increasing CP value towards zero

7. The rotation direction is set in b9 of CR#5.

   b[9] = 0: CP value increasing

   b[9] = 1: CP value decreasing

8. The DOG triggering mode is set in b10 of CR#5.

b[10] = 0: triggering rising-edge

b[10] = 1: triggering falling-edge (valid in interrupting single-speed positiong mode and interrupting 2-speed positioning mode)

9. The DOG polarity is set in b11 of CR#5.

   b[11] = 0: positive logic enabled. When DOG input signal is On, DOG signal will be generated.

   b[11] = 1: negative logic enabled. When DOG input signal is Off, DOG signal will be generated.

10. The type of acceleration curve is set in b12 of CR#5.

    b[12] = 0: trapezoid acceleration curve

    b[12] = 1, S acceleration curve

11. The START response time is set in b13 of CR#5.

    DVP01PU-S

    b[13] = 0: 4m

    b[13] = 1: 12ms (with input noise fileter)

    DVP01PU-H

    b[13] = 0: 15ms

    b[13] = 1: 50ms (with input noise filter)

12. The START input polarity is set in b14 of CR#5.

    b[14] = 0: positive logic enable. When START input signal is On, the output will be enabled.

    b[14] = 1: negative logic enabled. When START input signal is Off, the output will be enabled.

13. The STOP input polarity is set in b15 of CR#5.

    b[15] = 0: positive logic enabled. When STOP input signal is On, the output will be enabled.

    b[15] = 1: negative logic enabled. When STOP input signal is Off, the output will be enabled.

CR#6, 7: Maximum speed (V_{MAX})

[Explanation]

1. The maximum speed for all operation modes. Range: 0 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.

CR#8, 9: Bias speed (V_{BIAS})

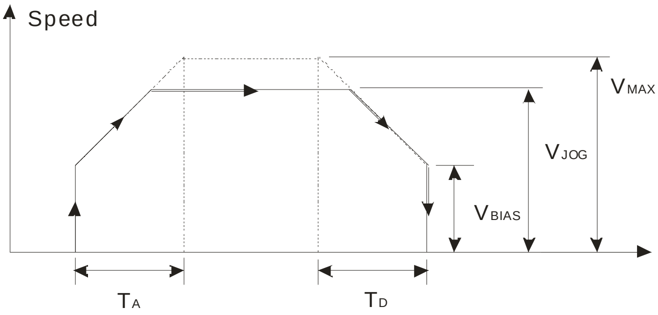
[Explanation]

1. The starting speed of pulse output. Range: 0 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. Please be aware of the frequency in the resonance area of the step motor in a step drive system.To safely activate the drive, set the bias speed above the frequency in the resonance area.

CR#10, 11: JOG speed (V_{JOG})

[Explanation]

1. Range: 0 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. Range limitation: $V_{MAX} > V_{JOG} > V_{BIAS}$. If $V_{JOG} > V_{MAX}$, V_{JOG} output = V_{MAX}; if $V_{JOG} < V_{BIAS}$, V_{JOG} output = V_{BIAS}.
4. V_{JOG} is not allowed to be changed during the execution.



CR#12, 13: Zero return speed (V_{RT})

[Explanation]

1. Range: 0 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. Range limitation: $V_{MAX} > V_{RT} > V_{BIAS}$.
4. V_{RT} is not allowed to be changed during the execution.

CR#14, 15: Zero return deceleration speed (V_{CR})

[Explanation]

1. Range: 0 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. When zero return is executed, the motor will run at the zero return speed V_{RT}. When it reaches DOG signal, the motor will decelerate to the zero return deceleration speed $V_{CR.}$
4. In order to accurately position at the zero point, we suggest you set V_{CR} in low speed.
5. V_{CR} is not allowed to be changed during the execution.

CR#16: The number of PG0 in zero return mode (N)

[Explanation]

1. Range: 0 ~ +32,767 (PULSE).
2. Reference signal for motor to decelerate and stop. After detecting a DOG signal, the module will start to count the number of pulses (N) to the zero point. See CR#18 for more details on the zero return mode.

CR#17: The number of pulses in zero return mode (P)

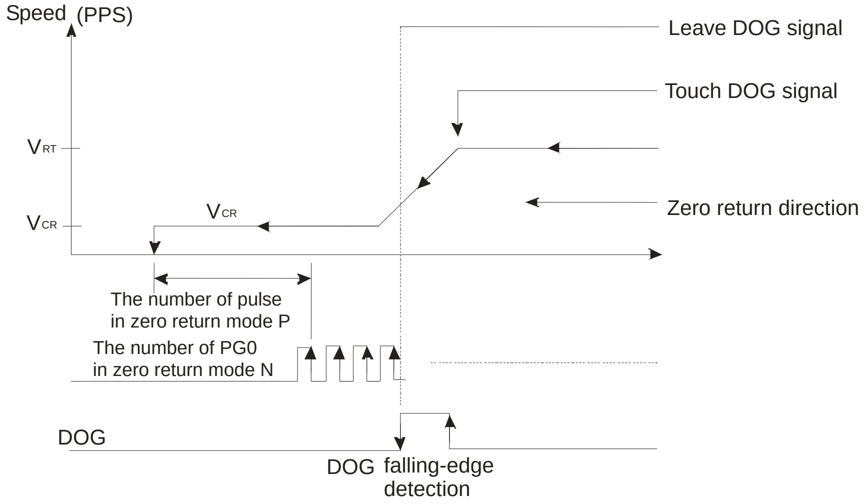
[Explanation]

1. Range: -32,768 ~ 32,767 (PULSE). The negative values are the numbers of pulses (P) in forward direction. The positive values are the numbers of pulses (P) in reverse direction.
2. Reference signal for motor to decelerate and stop. See CR#18 for more details on the zero return mode.

CR#18: Zero return mode

[Explanation]

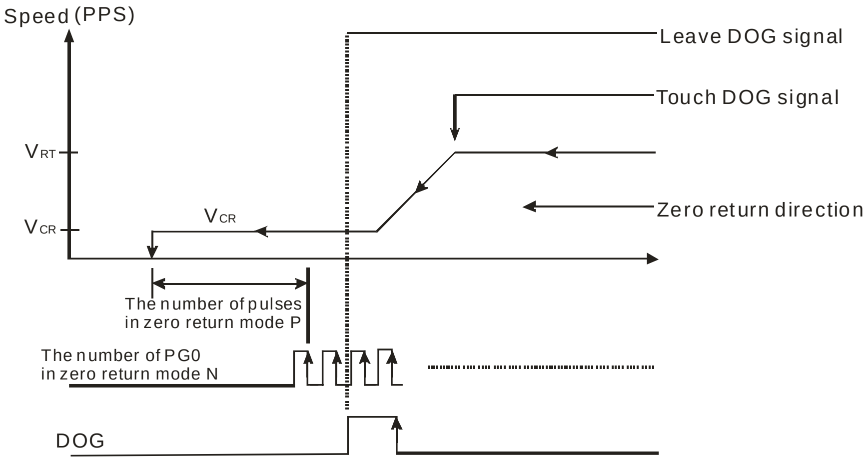
1. Zero return modes:
   b[0] = 0: normal mode
   b[0] = 1: overwrite mode
2. Detecting DOG falling-edge in zero return mode:
   b[1] = 0: On
   b[1] = 1: Off
3. b[1:0] = 00 ⇨ normal mode; DOG falling-edge detection in zero return mode is On.
   Zero return mode: The motor runs at the zero return speed V_{RT}, and when it reaches DOG signal, the motor will decelerate to the zero return deceleration speed $V_{CR.}$ After it further detects a falling edge of DOG signal, the motor will output N pulses and P pulses before it stops.
   - If N and P are too small, the motor will decelerate to V_{CR} when reaching a DOG signal. After the motor detects a DOG falling edge and if N is reached, the motor will stop immediately after P is reached even the motor has not arrived at V_{CR}.
   - Assume N and P are set as “0”, the motor will stop immediately after it reaches a DOG signal and detects DOG falling edge.



4. b[1:0] = 10 ⇨ normal mode; DOG falling-edge detection in zero return mode in Off.
   Zero return mode: The motor runs at the zero return speed V_{RT}, and when it reaches DOG signal, the motor will decelerate to the zero return deceleration speed $V_{CR.}$ After it outputs N pulses and P pulses, the motor will stops.
   - If N and P are too small, the motor will decelerate to V_{CR} when reaching a DOG signal. After N is

reached, the motor will stop immediately after P is reached even the motor has not arrived at V_{CR}.

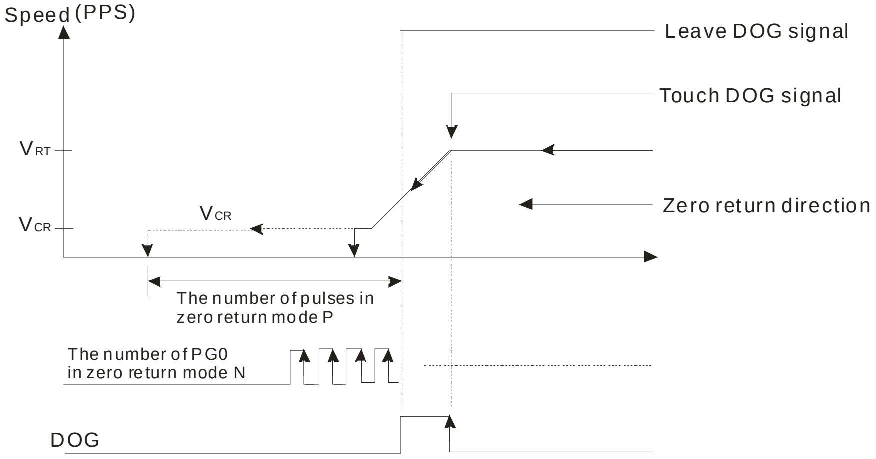
- Assume N and P are set as “0”, the motor will stop immediately after it reaches a DOG signal.



5. b[1:0] = 01 ➩ overwrite mode; DOG falling-edge detection in zero return mode in On.

   Zero return mode: The motor runs at the zero return speed V_{RT}, and when it reaches DOG signal, the motor will decelerate to the zero return deceleration speed $V_{CR.}$ After it further detects a falling edge of DOG signal, the motor will output N pulses and P pulses before it stops.

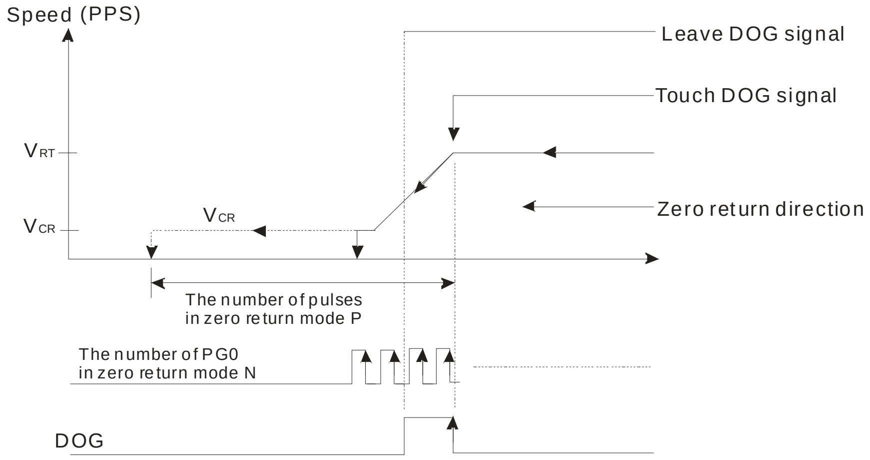
   - If N and P are too small, the motor will decelerate to V_{CR} when reaching a DOG signal. After the motor detects a DOG falling edge and if N is reached, the motor will stop immediately after P is reached even the motor has not arrived at V_{CR}.
   - Assume N and P are set as “0”, the motor will stop immediately after it reaches a DOG signal.



6. b[1:0] = 11 ➩ overwrite mode; DOG falling-edge detection in zero return mode in Off.

   Zero return mode: The motor runs at the zero return speed V_{RT}, and when it reaches DOG signal, the motor will decelerate to the zero return deceleration speed $V_{CR.}$ After it outputs N pulses and P pulses, the motor will stops.

   - If N and P are too small, the motor will decelerate to V_{CR} when reaching a DOG signal. After N is reached, the motor will stop immediately after P is reached even the motor has not arrived at V_{CR}.
   - Assume N and P are set as “0”, the motor will stop immediately after it reaches a DOG signal.



CR#19, 20: Setup of zero point (HP)

[Explanation]

1. Range: 0 ~ ±999,999 (unit: set in b0 and b1 of CR#5).
2. When the zero return is completed, the current position (CP) will be updated to a zero point (HP). (CP is set up in CR#33, #34 for DVP01PU-S and in CR#37, #38 for DVP01PU-H)

CR#21: Acceleration time (T_{ACC})

[Explanation]

1. Time required for the acceleration from the bias speed (V_{BIAS}) set in CR#8, #9 to the maximum speed V_{MAX} set in CR#6, #7.
2. T_{ACC} will be regarded as 10ms when it is set shorter than 10ms, and as 32,767ms when it is set longer than 32,767ms.
3. For S acceleration curve, if you want a complete S acceleration curve control, please set V_{MAX} equivalent to the operation speed.

CR#22: Deceleration time (T_{DEC})

[Explanation]

1. Time required for the deceleration from the maximum speed V_{MAX} set in CR#6, #7 to the bias speed (V_{BIAS}) set in CR#8, #9.
2. T_{DEC} will be regarded as 10ms when it is set shorter than 10ms, and as 32,767ms when it is set longer than 32,767ms.
3. For S acceleration curve, if you want a complete S acceleration curve control, please set V_{MAX} equivalent to the operation speed.

CR#23, 24: Target position (I) (P(I))

[Explanation]

1. Range: -2,147,483,648 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).

2. Attribute of P(I):
    - Absolute coordinate (CR#31_b7=0)
      Representing the position starting from "0". When P(I) is larger than the current position (CR#33, #34), the motor will be in forward rotation. When P(I) is smaller than the current potition, the motor will be in reverse rotation.
    - Relative coordinate (CR#31_b7=1)
      Representing the distance the motor has travelled from the current position (CR#33, #34). When P(I) is a positive value, the motor will be in forward rotation. When P(I) is a negative value, the motor will be in reverse rotation.
3. The multiplication of P(I) should be modified according to the settings in b2 and b3 of CR#5.

CR#25, 26: Operation speed (I) (V(I))

[Explanation]

1. Range: -2,147,483,648 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. Range limitation: $V_{MAX} > V(I) > V_{BIAS}$
4. When the module operates in variable speed (CR#32_b4=1), V(I) can be modified during the operation. "+" in front of V(I) refers to forward rotation, and "-" refers to reverse rotation.

CR#27, 28: Target position (II) (P(II))

[Explanation]

1. Range: -2,147,483,648 ~ +2,147,483,647 (unit: set in b0 and bi of CR#5).
2. Attribute of P(II):
    - Absolute coordinate (CR#31_b7 = 0)
      Representing the position starting from "0". When P(II) is larger than the current position (CR#33, #34), the motor will be in forward rotation. When P(II) is smaller than the current potition, the motor will be in reverse rotation.
    - Relative coordinate (CR#31_b7 = 1)
      Representing the distance the motor has travelled from the current position (CR#33, #34). When P(II) is a positive value, the motor will be in forward rotation. When P(II) is a negative value, the motor will be in reverse rotation.
3. The multiplication of P(II) should be modified according to the settings in b2 and b3 of CR#5.

CR#29, 30: Operation speed (II) (V(II))

[Explanation]

1. Range: -2,147,483,648 ~ +2,147,483,647 (unit: set in b0 and b1 of CR#5).
2. Corresponding to 10 ~ 200KPPS pulse. Pulses exceeding 200K will output at 200K; pulses less than 10 will output at 10.
3. Range limitation: $V_{MAX} > V(II) > V_{BIAS}$.

CR#31: Operation instruction

[Explanation]

1. CR#31_b0 : error reset; timing: 0→1

   b[0] = 1: The error will be reset. The ERROR indicator will be off and the flags in CR#38_b5 (for DVP01PU-S) and CR#43_b5 (for DVP01PU-H) will be reset as “0”.

2. CR#31_b1: software STOP; timing: 0→1

   b[1] = 0→1: The function is the same as external force STOP. The PU position control module will decelerate and stop positioning.

3. CR#31_b2: stopping forward pulses; timing: 1

   b[2] = 1: The forward running is forbidden, and the forward running instruction will be invalid. An error message will appear if a forward-running instruction is given.

4. CR#31_ b3: stopping reverse pulses; timing: 1

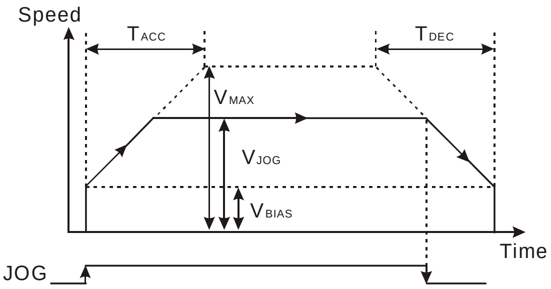
   b[3] = 1: The reverse running is forbidden, and the reverse running instruction will be invalid. An error message will appear if a reverse-running instruction is given.

5. CR#31_b4: enabling JOG+

   b[4] = 1: JOG+ sends out forward pulses (CW)

6. CR #31_b5: enabling JOG-

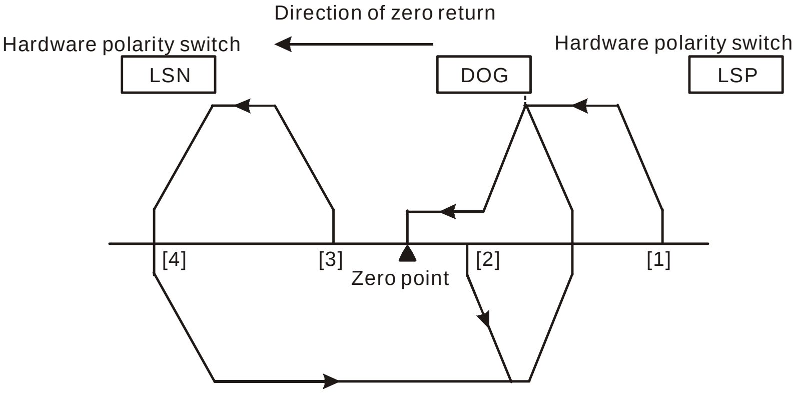
   b[5] = 1: JOG- sends out reverse pulses (CCW)



7. CR#31_b6: enabling zero return

   b[6] = 0→1: Starting the execution of zero return. The motions of zero return vary depending on different current positions (CP). There are four different occasions.

   Route of zero return operation:



CP1: Starting from position [1], to the right hand side of zero point and DOG; DOG = Off.

CP2: Starting from position [2], to the right hand side of zero point; DOG = On.

CP3: Starting from position [3], to the left hand side of zero point and DOG; DOG = Off, LSN = Off.

CP4: Starting from position [4], to the left hand side of zero point and DOG; DOG = Off, LSN = On.

8. CR#31_b7: absolute position setup

   b[7] = 0: Absolute coordinate positioning

   b[7] = 1: Relative coordinate positioning

9. CR#31_b8: software START

   b[8] = 0→1: Starting work mode as set in CR#32

10. CR#31_b10: clear CP

    b[10] = 0→1: CP cleared as “0"

11. CR#31_b12: CLR signal output mode

    b[12] = 0: When zero return is completed, CLR will output signals to the servo drive (for approx. 130ms) as the clear signal for the error counter in the servo.

    b[12] = 1: CLR output point as general output point controlled by On/Off of b[13]

12. CR#31_b13: CLR output On/Off

    b[13] = 0: CLR is Off.

    b[13] = 1: CLR is On.

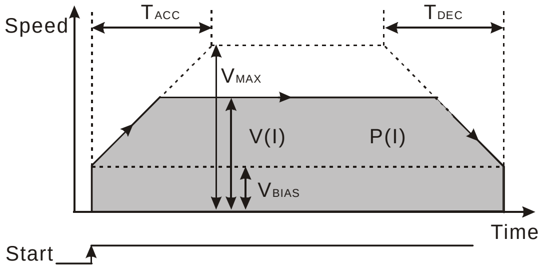
CR#32: Work mode

[Explanation]

1. CR#32_b0: single-speed positioning operation

   When b[0] is triggered and START ON, the 1st positioning program will start to execute. The number of motion steps and speed are determined by P(I) and V(I).

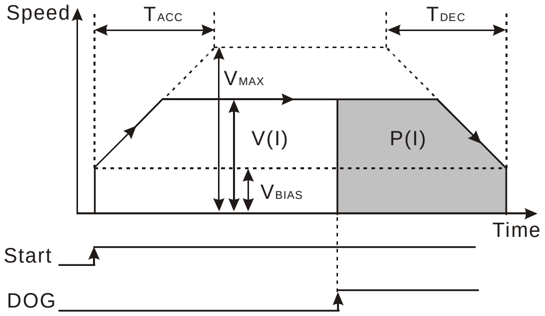
   - The relative coordinate positioning is determined by the sign bit of the control register for P(I).
   - The absolute coordinate positioning is determined by P(I) (set in CR#23, #24). Forward running when the absolute coordinate is bigger than the current position; reverse running when the absolute coordinate is smaller than the current position.
   - The operation speed will be stable from V_{BIAS} accelerating to the expected V(I). When the speed is approaching the P(I) value set in the control register, the PU position control module will start to decelerate to V_{BIAS} and stop.
   - The control registers involved: CR#8, #9 (V_{BIAS}), CR#25, #26 (V(I)), CR#6, #7 (V_{MAX}), CR#23, #24 (P(I)), CR#21 (T_{ACC}), and CR#22 (T_{DEC}).



2. CR#32_b1: interrupting single-speed positioning operation

When b[1] is triggered and START ON, the PU module will start to send out pulses. When the external DOG signal is executed, the P(I) value will be reloaded in.

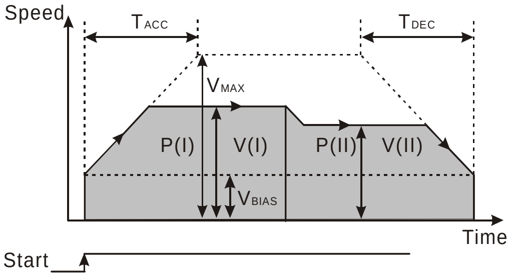
- The relative coordinate positioning is determined by the sign bit of the control register for P(I).
- The absolute coordinate positioning is determined by P(I) (set in CR#23, #24). Forward running when the absolute coordinate is bigger than the current position; reverse running when the absolute coordinate is smaller than the current position.
- The operation speed will be stable from V_{BIAS} accelerating to the expected V(I). When encountering DOG signals during the pulse output, the PU module will send out the number of steps in P(I). When the speed is approaching the P(I) value set in the control register, the PU module will start to decelerate to V_{BIAS} and stop.
- The control registers involved: CR#8, #9 (V_{BIAS}), CR#25, #26 (V(I)), CR#6, #7 (V_{MAX}), CR#23, #24 (P(I)), CR#21 (T_{ACC}), and CR#22 (T_{DEC}).



3. CR#32_b2: 2-speed positioning operation

When b[2] is triggered and START ON, the 2^{nd} positioning program will start to execute. The 2^{nd} positioning program will start immediately after the 1^{st} positioning program reaches P(I).

- The relative coordinate positioning is determined by the sign bit of the control register for P(I).
- The absolute coordinate positioning is determined by P(I) (set in CR#23, #24). Forward running when the absolute coordinate is bigger than the current position; reverse running when the absolute coordinate is smaller than the current position.
- The operation speed will be stable from V_{BIAS} accelerating to the expected V(I). After the PU module sends out the number of pulses equivalent to P(I), it will accelerate/decelerate again from V(I) to V(II) and operate at V(II) stably untl P(II) is reached. The PU module will then decelerate to V_{BIAS} and stop. Total P(I) + P(II) pulses are sent during the operation.
- The control registers involved: CR#8, #9 (V_{BIAS}), CR#25, #26 (V(I)), CR#6, #7 (V_{MAX}), CR#23, #24 (P(I)), CR#27, #28 (P(II)), CR#21 (T_{ACC}), and CR#22 (T_{DEC}).

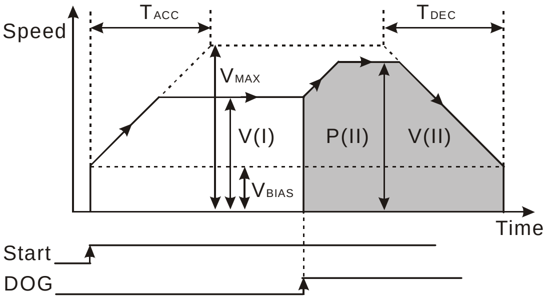


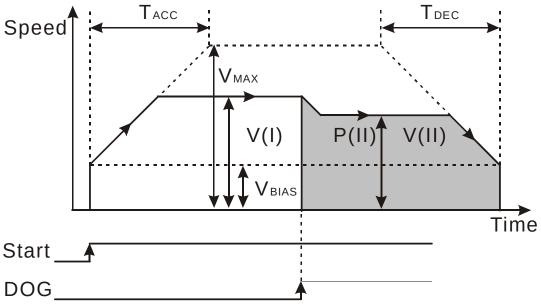
The output accelerates to V(I) and operates at V(I) stably until it reaches P(I). It will then accelerate or decelerate to V(II) and operates at V(II) stably until it reaches P(II) and stops.

4. CR#32_b3: interrupting 2-speed positioning operation

   When b[3] is triggered and START ON, the 2nd positioning program will start immediately after an external DOG signal is enabled during the 1st positioning program. The PU module will then start to send out pulses.

   - The relative coordinate positioning is determined by the sign bit of the control register for P(I).
   - The absolute coordinate positioning is determined by P(I) (set in CR#23, #24). Forward running when the absolute coordinate is bigger than the current position; reverse running when the absolute coordinate is smaller than the current position.
   - The operation speed will be stable from V_{BIAS} accelerating to the expected V(I). When encountering DOG signals during the pulse output, the PU module will accelerate/decelerate again from V(I) to V(II) and operate at V(II) stably. In the 2nd positioning program, the external STOP input will force the PU module immediately stop the pulse output.
   - The control registers involved: CR#8, #9 (V_{BIAS}), CR#25, #26 (V(I)), CR#6, #7 (V_{MAX}), CR#23, #24 (P(I)), CR#27, #28 (P(II)), CR#21 (T_{ACC}), and CR#22 (T_{DEC}).





   The output accelerates to V(I) and operates at V(I) stably until it reaches P(I). After the external DOG signal is enabled, the output will then accelerate or decelerate to V(II) and operates at V(II) stably until it reaches P(II) and stops.

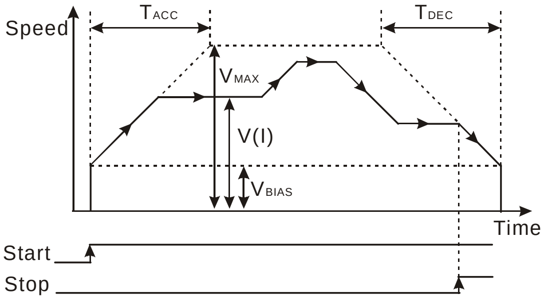
5. CR#32_b4: variable speed operation

   When b[4] is triggered and START ON, the PU module will start to operate at variable speed V(I) and send out pulses.

   - The relative coordinate positioning is determined by the sign bit of the control register for P(I).
   - The absolute coordinate positioning is determined by P(I) (set in CR#23, #24). Forward running when the absolute coordinate is bigger than the current position; reverse running when the absolute coordinate is smaller than the current position.
   - The operation speed will be stable from V_{BIAS} accelerating to the expected V(I). During the pulse output, you can modify the speed V(I) at your choice, and the PU module will accelerate or decelerate according to the setting. At this time, the external STOP input contact cannot force the

PU module to stop sending out pulses. If you would like the pulse output to be stopped, you can only do so by setting up b1 of CR#31 (software STOP).

- The control registers involved: CR#8, #9 (V_{BIAS}), CR#25, #26 (V(I)), CR#6, #7 (V_{MAX}), CR#23, #24 (P(I)), CR#21 (T_{ACC}), and CR#22 (T_{DEC}).



6. CR#32_b5: manual pulse generator input operation

   b[5] = 1: enabling MGP input operation. For DVP01PU-S, see CR#40 ~ CR#46; for DVP01PU-H, see CR#45 ~ CR#51.

7. CR#32_b6: STOP mode

   b[6] = 0: During the running of motor, when encountering STOP signal input, the motor will decelerate to stop. When the next motion instruction comes in, the motor will ignore the unfinished distance and immediately execute the distance in the next step.

   b[6] = 1: During the running of the motor, when encountering STOP signal input, the motor will decelerate to stop. When the next motion instruction comes in, the motor will complete the unfinished distance before executing the next positioning step.

8. CR#32_b7: manual pulse generator range

   b[7] = 0: No limitation on MPG pulse output.

   b[7] = 1: The range of MPG pulse output is limited within P(I) and P(II). When the range is exceeded, the pulse deceleration will stop.

9. CR#32_b8: LSP/LSN stop mode:

   b[8] = 0: During the running of the motor, the motor decelerates to stop when encountering LSP/LSN signal inputs.

   b[8] = 1: During the running of the motor, the motor stops immediately when encountering LSP/LSN signal inputs.

10. CR#32_b9, b10, b11: MASK setting

    MASK settings include single-speed positioning, 2-speed positioning, interrupting single-speed positioning, and interrupting 2-speed positioning.

    b[11 ~ 9] = K0(000) or other values: No MASK function.

    b[11 ~ 9] = K1(001): Triggering MASK by the rising edge of input terminal ΦA±

    b[11 ~ 9] = K2(010): Triggering MASK by the falling edge of input terminal ΦA±

    b[11 ~ 9] = K3(011): Triggering MASK by the rising edge of input terminal ΦB±

    b[11 ~ 9] = K4(100): Triggering MASK by the falling edge of input terminal ΦB±

11. CR#32_b12: returning to default setting

    b[12] = 1: All parameters return to default setting.

12. CR#32_b13: Settings of current position, current speed and display unit (in DVP01PU-S)

    b[13] = 0: current position in CR#34, #33; current speed in CR#36, #35; display unit: pulse b[13] = 1: current position in CR#34, #33); current speed in CR#36, #35); display unit: unit

CR#33, 34: Current position

[Explanation]

1. Range: -2,147,483,648 ~ +2,147,483,647.
2. The units for DVP01PU-S and DVP01PU-H are different.
   - For DVP01PU-S:

     The unit is determined by the setting of CR#32_b13 (PLS/unit).

     After the zero return is completed, the zero point position in CR#19, #20 will be put into CR#33, #34.
   - For DVP01PU-H:

     The unit is displayed in PLS.

     After the zero return is completed, the zero point position in CR#19, #20 will be put into CR#33, #34 and CR#37, #38.

CR#35, 36: Current speed

[Explanation]

1. Range: 0 ~ +2,147,483,647.
2. The units for DVP01PU-S and DVP01PU-H are different.
   - For DVP01PU-S:

     The unit is determined by the setting of CR#32_b13 (PPS/unit).
   - For DVP01PU-H:

     The unit is displayed in PPS.

CR#37, 38: RS-485 communication protocol and communication address/execution status/current position

[Explanation]

The definition of CR#37, #38 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S

  CR#37: RS-485 communication protocol and communication address

  (This setting is only valid for RS-485 communication and will be invalid when connected to a PLC MPU.)

b[#]	Explanation
b0 = 1	4,800 bps
b1 = 1	9,600 bps (default)
b2 = 1	19,200 bps
b3 = 1	38,400 bps
b4 = 1	57,600 bps
b5 = 1	115,200 bps
b6 = 1	Reserved

b[#]	Explanation
b7	ASCII/RTU modes: b7 = 0: RTU mode (Format: 8, E, 1) b7 = 1: ASCII mode (Format: 7, E, 1) (default)
b8 ~ b15	RS-485 communication address (default = K1); range: 01 ~ 255

CR#38: Execution status

b[#]	Explanation
b0	b[0] = 0: The system is waiting for running instruction. b[0] = 1: PU is executing position control (pulse output in progress).
b1	b[1] = 1: Forward pulse output is in progress.
b2	b[2] = 1: Reverse pulse output is in progress.
b3	b[3] = 1: Zero return is completed and is reset by the user program. When PU is re-powered, b[3] will be reset as “0”.
b4	b[4] = 1: The 32-bit "current position CP (CR#33, #34)" overflows. When PU is re-powered or when zero return is completed, b[4] will be reset as “0” automatically.
b5	b[5] = 1: The execution encounters error. The error code is stored in CR#39 (DVP01PU-S) and CR#44 (DVP01PU-H).
b6	When PU executes zero return or reset the error (only when error occurs), b[6] will be reset. When PU finishes zero return or general position control, b[6] will be set as “1”.
b7	When PU is operating, STOP input On will stop the output of PU and b[7] will be set as “1”, indicating that the operation of PU is currently paused.
b8	Reserved
b9	b[9] = 1: MPG pulse input (counting up)
b10	b[10] = 1: MPG pulse input (counting down)
b10 ~ b15	Reserved

- For DVP01PU-H:

CR#37, #38: current position

Range: -2,147,483,648 ~ +2,147,483,647.

The setting of unit is in accordance with b0 and b1 of CR#5. After the zero return is completed, the zero point position in CR#19, #20 will be put into CR#33, #34 and CR#37, #38.

CR#39, 40: Error code/MPG parameter setting/current speed

[Explanation]

The definition of CR#39, #40 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

CR#39：Error codes

Error code	Explanation
H’0000	No error
H’0001	Incorrect target position (I)
H’0002	Incorrect target position (II)
H’0010	Incorrect operation speed (I)
H’0011	Incorrect operation speed (II)
H’0012	Incorrect zero return deceleration speed (V_{CR})
H’0013	Incorrect zero return speed (V_{RT})
H’0014	Incorrect JOG speed (V_{JOG})
H’0020	Forward pulse is forbidden
H’0021	Reverse pulse is forbidden
H’0030	Low voltage
H’0080	Hardware error in internal memory
H’0081	Incorrect written in data in internal memory

CR#40: Numerator of MPG electronic gearing

- For DVP01PU-H:

CR#39, 40: Current speed

The setting of unit is in accordance with b0 and b1 of CR#5.

CR#41: MPG parameter setting/communication address

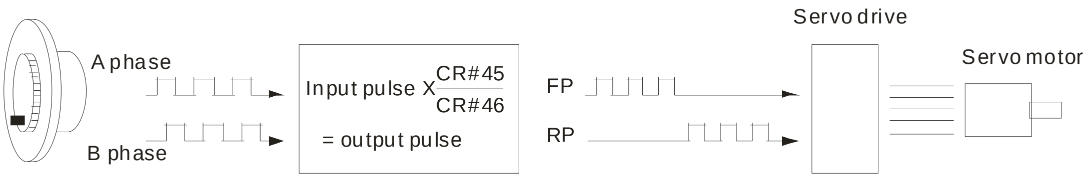
[Explanation]

The definition of CR#41 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

CR#41: Denominator of MPG electronic gearing

1. Set b5 of CR#32 as "1” to enable the work mode of MPG input.
2. Generate A/B phase pulse input by MPG to ΦA and ΦB. See the figure below for the relation between FP/RP input pulse and output pulse.



3. During the operation, if LSP or LSN is enabled, the output will stop immediately. If LSP is enabled, the forward pulse will be forbidden and reverse pulse will be allowed. If LSN is enabled, the reverse pulse will be forbidden and forward pulse will be allowerd.
4. CR#38 b6 = Off: Positioning is not completed. When the positioning is completed, CR#38 b6 = On.
5. The pulses input generated by MPG re proportional to the electronic gearing (CR#40, #41)

- For DVP01PU-H:

CR#41: Communication address

Range: 1 ~ 255; default = 1

CR#42, 43: MPG parameter setting/communication protocol/execution status

[Explanation]

The definition of CR#42, #43 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

  CR#42, #43: Input frequency of MPG

  The frequency will not be affected by the MPG electronic gearing ratio

- For DVP01PU-H:

  CR#42：Communication protocol

b[#]	Function explanation
b0 = 1	4,800 bps
b1 = 1	9,600 bps (default)
b2 = 1	19,200 bps
b3 = 1	38,400 bps
b4 = 1	57,600 bps
b5 = 1	115,200 bps
b6 = 1	Reserved
b7	ASCII/RTU modes: b7 = 0: RTU mode (Format: 8, E, 1) b7 = 1: ASCII mode (Format:7, E, 1) (default)
b8 ~ b15	RS-485 communication address (default = K1); range: 01 ~ 255

- **CR#43:** Execution status

b[#]	Explanation
b0	b[0] = 0: The system is waiting for running instruction. b[0] = 1: PU is executing position control (pulse output in progress).
b1	b[1] = 1: Forward pulse output is in progress.
b2	b[2] = 1: Reverse pulse output is in progress.
b3	b[3] = 1: Zero return is completed and is reset by the user program. When PU is re-powered, b[3] will be reset as “0”.
b4	b[4] = 1: The 32-bit "current position CP (CR#33, #34)" overflows. When PU is re-powered or when zero return is completed, b[4] will be reset as “0” automatically.
b5	b[5] = 1: The execution encounters error. The error code is stored in CR#39 (DVP01PU-S) and CR#44 (DVP01PU-H).
b6	When PU executes zero return or resets the error (only when error occurs), b[6] will be reset. When PU finishes zero return or general position control, b[6] will be set as “1”.
b7	When PU is operating, STOP input On will stop the output of PU and b[7] will be set as “1”, indicating that the operation of PU is currently paused.

b[#]	Explanation
b8	Reserved
b9	b[9] = 1: MPG pulse input (counting up)
b10	b[10] = 1: MPG pulse input (counting down)
b10 ~ b15	Reserved

CR#44, 45: MPG parameter setting/error code

[Explanation]

The definition of CR#44, #45 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

  CR#44, 45: Accumulated number of MPG input pulses

  Forward pulses are accumulated by "plus", and reverse pulses are accumulated by "minus". The accumulated value will not be affected by the settings in CR#40 and CR#41 (electronic gear ratio).

- For DVP01PU-H:

  CR#44: Error codes

Error code	Explanation
H'0000	No error
H'0001	Incorrect target position (I)
H'0002	Incorrect target position (II)
H'0010	Incorrect operation speed (I)
H'0011	Incorrect operation speed (II)
H'0012	Incorrect zero return deceleration speed (V_{CR})
H'0013	Incorrect zero return speed (V_{RT})
H'0014	Incorrect JOG speed (V_{JOG})
H'0020	Forward pulse is forbidden
H'0021	Reverse pulse is forbidden
H'0030	Low voltage
H'0080	Hardware error in internal memory
H'0081	Incorrect written in data in internal memory

CR#45: Numerator of MPG electronic gearing

CR#46: MPG parameter setting

[Explanation]

The definition CR#46 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

  CR#46: Response speed of MPG input

  1. The faster the response speed, the more synchronous the pulse output and MPG pulse input.
  2. The slower the response speed, the more possible the pulse output lags behind MPG pulse

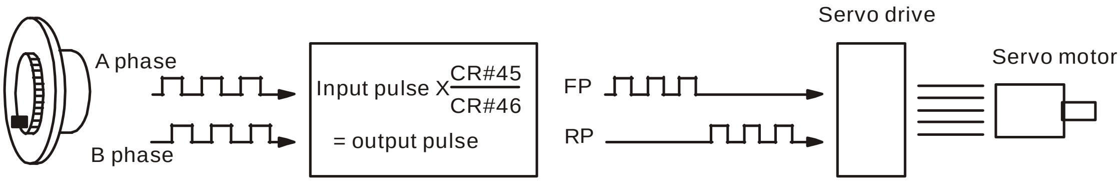
input

Set value	Response speed
≧5	4ms (default)
4	32ms
3	108ms
2	256ms
1 or 0	500ms

- For DVP01PU-H:

  CR#46: Denominator of MPG electronic gearing

  1. Set b5 of CR#32 as "On" to enable the work mode of MPG input.
  2. Generate A/B phase pulse input to ΦA and ΦB by MPG. See the figure below for the relation between FP/RP input pulse and output pulse.



  3. During the operation, if LSP or LSN is enabled, the output will stop immediately. If LSP is enabled, the forward pulse will be forbidden, and reverse pulse will be allowed. If LSN is enabled, the reverse pulse will be forbidden, and forward pulse will be allowed.
  4. b6 of CR#43 = Off: the positioning is not completed. When the positioning is completed, b6 of CR#43 will be On.
  5. The pulse input generated by MPG is proportional to the electronic gearing (CR#45, CR#46).

CR#47, 48: Terminal status/firmware version/MPG parameter setting

[Explanation]

The definition of CR#47, CR#48 in DVP01PU-S and DVP01PU-H are different.

- For DVP01PU-S:

  CR#47: Terminal status

bit #	Status	Description
b0	START input	When START input is On, b0 = On.
b1	STOP input	When STOP input is On, b1= On.
b2	DOG input	When DOG input is On, b2 = On.
b3	PG0 input	When PG0 input is On, b3 = On.
b4	LSP input	When LSP input is On, b4 = On.
b5	LSN input	When LSN input is On, b5 = On
b6	A phase input	When A phase input is On, b6 = On.
b7	B phase input	When B phase input is On, b7 = On.

bit #	Status	Description
b8	CLR output	When CLR output is On, b8 = On.
b9 ~ b15	Reserved	

CR#48: Firmware version

The firmware version is displayed in hex, e.g. V1.00 is indicated as H'0100.

- For DVP01PU-H:

CR#47, 48: Input frequency of MPG

The frequency will not be affected by the MPG electronic gearing ratio

CR#49, 50: Accumulated number of MPG input pulses (for DVP01PU-H)

[Explanation]

1. Forward pulses are accumulated by "plus", and reverse pulses are accumulated by "minus".
2. The accumulated value will not be affected by the settings in CR#45 and CR#46 (electronic gear ratio).

CR#51: Response speed of MPG input (for DVP01PU-H)

[Explanation]

1. The faster the response speed, the more synchronous the pulse output and MPG pulse input.
2. The slower the response speed, the more possible the pulse output lags behind MPG pulse input

Set value	Response speed
≧5	4ms (default)
4	32ms
3	108ms
2	256ms
1 or 0	500ms

CR#52: Terminal status (for DVP01PU-H)

[Explanation]

bit #	Status	Description
b0	START input	When START input is On, b0 = On.
b1	STOP input	When STOP input is On, b1= On.
b2	DOG input	When DOG input is On, b2 = On.
b3	PG0 input	When PG0 input is On, b3 = On.
b4	LSP input	When LSP input is On, b4 = On.
b5	LSN input	When LSN input is On, b5 = On
b6	A phase input	When A phase input is On, b6 = On.
b7	B phase input	When B phase input is On, b7 = On.
b8	CLR output	When CLR output is On, b8 = On.
b9 ~ b15	Reserved	

CR#53: Firmware version (for DVP 01PU-H)

[Explanation]

The firmware version is displayed in hex, e.g. V1.00 is indicated as H’0100.

6.8 Motion Modes and Application Examples

The PU module has 8 motion modes:

1. Mechanical zero return	5. 2-speed positioning
2. JOG operation	6. Interrupting 2-speed positioning
3. Single-speed positioning	7. Variable speed operation
4. Interrupting single-speed positioning	8. MPG input

The processing priority when many work modes are enabled at the same time:

1. STOP	6. Variable speed operation
2. Mechanical zero return	7. Single-speed positioning
3. JOG+ operation	8. Interrupting single-speed positioning
4. JOG- operation	9. 2-speed positioning
5. MPG input	10. Interrupting 2-speed positioning

When a work mode is enabled during the execution of one of the work modes, the PU module will remain in the original work mode.

There are two pulse acceleration curves:

1. Trapezoid curve
2. S curve

The corresponding control registers in different motion modes:

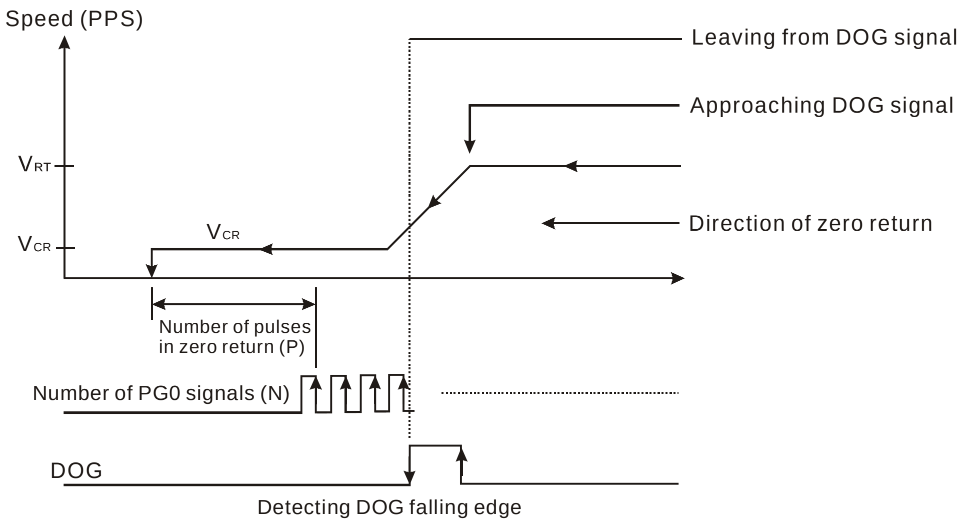
CR#		Parameter (Code)	Motion Modes							
Hi word	Lo word		JOG	Zero Return	Single-speed positioning	Interrupting single-speed positioning	2-speed positioning	Interrupting 2-speed positioning	Variable speed	MPG input
(#2)#2	(#1)#1	Number of pulses required per revolution of the motor (A)	No need to be set up if the unit (CR#5_b0, b1) is motor. Machine unit or combined unit will need to be set up.							
(#4)#4	(#3)#3	Distance created for 1 motor revolution (B)								
-	(#5)#5	Parameter setting	◎	◎	◎	◎	◎	◎	◎	◎
(#7)#7	(#6)#6	Maximum speed (V_{MAX})	◎	◎	◎	◎	◎	◎	◎	◎
(#9)#9	(#8)#8	Bias speed (V_{BIAS})	◎	◎	◎	◎	◎	◎	◎	◎
(#11)#11	(#10)#10	JOG speed (V_{JOG})	◎	-	-	-	-	-	-	-
(#13)#13	(#12)#12	Zero return speed (V_{RT})	-	◎	-	-	-	-	-	-
(#15)#15	(#14)#14	Zero return deceleration speed (V_{CR})								
-	(#16)#16	Number of PG0 signals (N)								
-	(#17)#17	Number of pulse signals (P)								
-	(#18)#18	Zero return mode								
(#20)#20	(#19)#19	Definition of zero point (HP)								
-	(#21)#21	Acceleration time (T_{ACC})	◎	◎	◎	◎	◎	◎	◎	—
-	(#22)#22	Deceleration time (T_{DEC})	◎	◎	◎	◎	◎	◎	◎	—
(#24)#24	(#23)#23	Target position (I) (P(I))	-	-	◎	◎	◎	◎	-	◎
(#26)#26	(#25)#25	Operation speed (I) (V(I))	-	-	◎	◎	◎	◎	◎	-
(#28)#28	(#27)#27	Target position (II) (P(II))	-	-	-	-	◎	◎	-	◎

CR#		Parameter (Code)	Motion Modes							
Hi word	Lo word		JOG	Zero Return	Single-speed positioning	Interrupting single-speed positioning	2-speed positioning	Interrupting 2-speed positioning	Variable speed	MPG input
(#30)#30	(#29)#29	Operation speed (II) (V(II))	-	-	-	-	◎	◎	-	-
-	(#31)#31	Operation instruction	◎	◎	◎	◎	◎	◎	◎	◎
-	(#32)#32	Work mode	◎	◎	◎	◎	◎	◎	◎	◎
(#34)#34	(#33)#33	Current position CP (PLS)	◎	◎	◎	◎	◎	◎	◎	◎
(#36)#36	(#35)#35	Current speed CS (PPS)	◎	◎	◎	◎	◎	◎	◎	◎
(-)#38	(-)#37	Current position CP (unit)	◎	◎	◎	◎	◎	◎	◎	◎
(-)#40	(-)#39	Current speed CS (unit)	◎	◎	◎	◎	◎	◎	◎	◎
-	(#40)#45	Numerator of electronic gear	-	-	-	-	-	-	-	◎
-	(#41)#46	Denominator of electronic gear	-	-	-	-	-	-	-	◎
(#42)#48	(#43)#47	MPG input frequency	-	-	-	-	-	-	-	◎
(#44)#50	(#45)#49	Accumulated number of MPG input pulses	-	-	-	-	-	-	-	◎
-	(#46)#51	Response speed of MPG input	-	-	-	-	-	-	-	◎

◎ refers to the control register for the motion mode.
(#No.) refers to CR# for DVP01PU-S; #No. refers to CR# for DVP01PU-H.

6.8.1 Zero Return

1. Control requirements
   - Write K64 (H’40, i.e. b6 = 1) into CR#31 to enable the zero return mode.
   - The zero return will be executed immediately after the DOG signal is triggered.
2. Devices
   - X0 = On: execute single-speed positioning
   - X1 = On: execute zero return
   - X0, X1 = Off: stop the execution and set the current position to 0
3. Zero return mode (normal mode, detecting DOG falling edge in zero return = On)

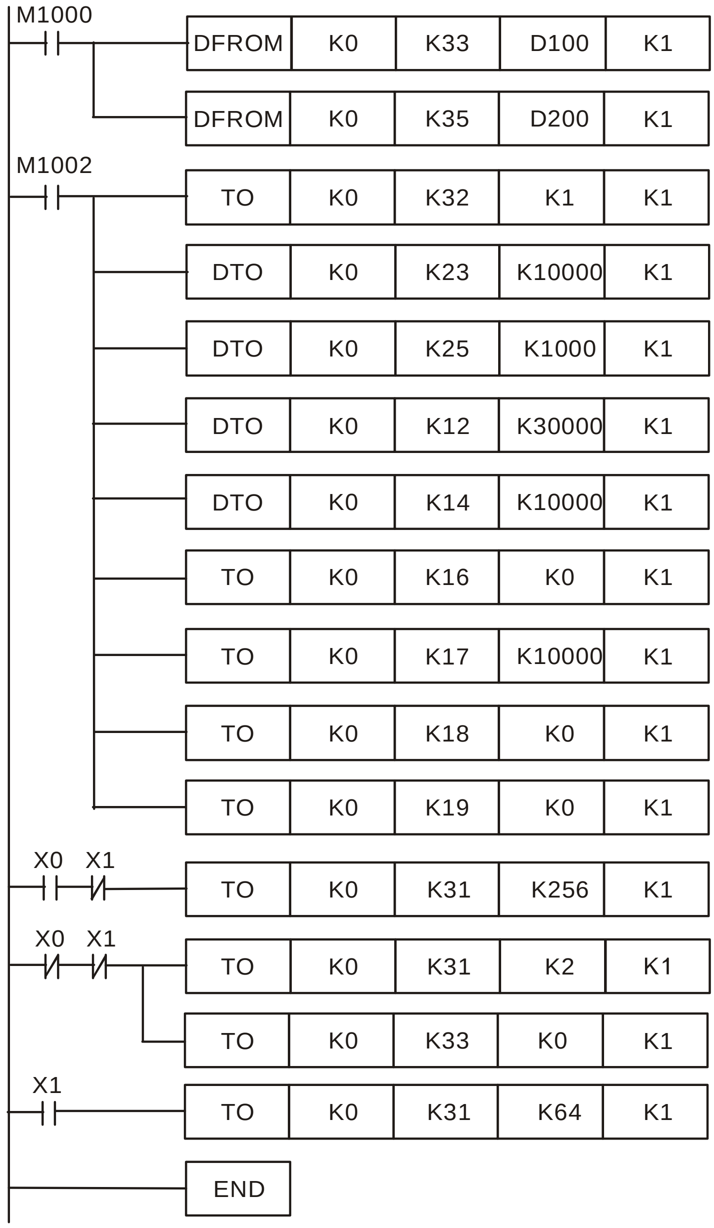


4. Program explanation
   - Read CR#33, #34 (current position) and CR#35, #36 (current speed).

- Write K1 (H’1, i.e. b0 = 1) into CR#32 to set up the single-speed positioning mode.
- Set up CR#23, #24 (target position) and CR#25, #26 (operation speed V(I)).
- Set up CR#12 ~ #19 to complete the parameter settings for zero return.
- When X0 = On, write K256 (H’100, i.e. b8 = 1) into CR#31 to enter single-speed positioning mode.
- When X1 = On, write K64 (H’40, i.e. b6 = 1) into CR#31 to enable the zero return.
- When X0, X1 = Off, stop all the executions and set the current position to 0.

5. Program example

Ladder diagram:



Ladder diagram:	Explanation:
DFROM K0 K33 D100 K1	Read current position
DFROM K0 K35 D200 K1	Read current speed
TO K0 K32 K1 K1	Set up as single-speed positioning mode
DTO K0 K23 K10000 K1	Set up target position
DTO K0 K25 K1000 K1	Set up operation speed
DTO K0 K12 K30000 K1	Set up zero return speed
DTO K0 K14 K10000 K1	Set up zero return deceleration speed
TO K0 K16 K0 K1	Set up the number of PG0 signals in zero return mode (N)
TO K0 K17 K10000 K1	Set up the number of pulse signals in zero return mode (P)
TO K0 K18 K0 K1	Select zero return mode
TO K0 K19 K0 K1	Define the position of zero point
TO K0 K31 K256 K1	Enter single-speed positioning mode
TO K0 K31 K2 K1	Stop all executions
TO K0 K33 K0 K1	Set the current position to 0
TO K0 K31 K64 K1	Enable zero return
END	

6.8.2 Single-speed Positioning

1. Control requirements

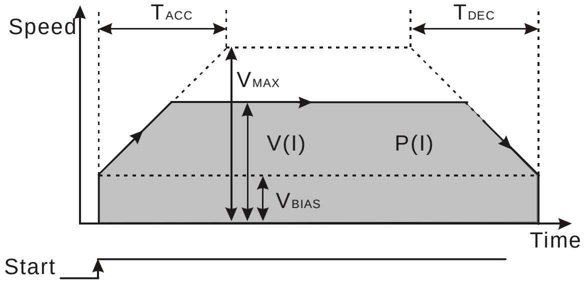
- Write K1 (H’1, i.e. b0 = 1) into CR#32 to enable the single-speed positioning.
- Set up CR#23, #24 (target position) and CR#25, #26 (target speed).

2. Devices

- X0 = On: software starts (and stops after the target position and operation speed are reached)

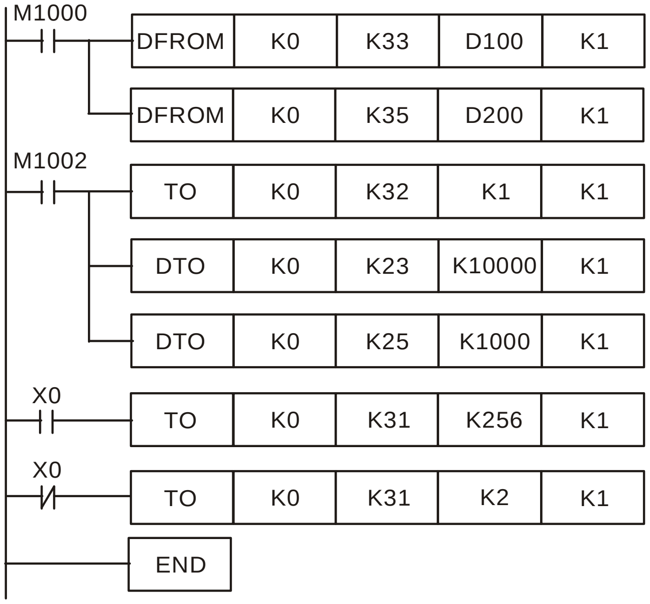
- X0 = Off: stop the execution (controlled by the software)

3. Single-speed positioning mode



4. Program explanation
    - Read CR#33, #34 (current position) and CR#35, #36 (current speed).
    - Write K1 (H’1, i.e. b0 = 1) into CR#32 to set up the single-speed positioning mode
    - Set up CR#23, #24 (target position) and CR#25, #26 (operation speed).
    - When X0 = On, write K256 (H’100, i.e. b8 = 1) into CR#31 to enter the single-speed positioning mode.
    - When X0 = Off, stop the execution of single-speed positioning.
5. Program example

Ladder diagram: Explanation:



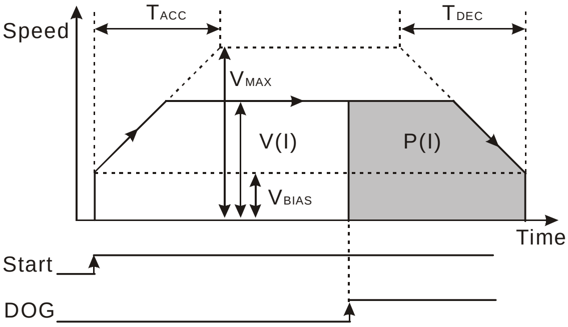
```
M1000
 DFROM  K0  K33  D100    K1    Read the current position
 DFROM  K0  K35  D200    K1    Read the current speed
M1002
 TO     K0  K32  K1      K1    Set up as single-speed positioning.
 DTO    K0  K23  K10000  K1    Set up the target position
 DTO    K0  K25  K1000   K1    Set up the operation speed
X0
 TO     K0  K31  K256    K1    Enable the single-speed positioning mode
X0 (normally closed)
 TO     K0  K31  K2      K1    Stop all executions
END
```

6.8.3 Interrupting Single-speed Positioning

1. Control requirements
    - Write K2 (H’2, i.e. b1 = 1) into CR#32 to enable interrupting single-speed positioning.
    - Set up CR#23, #24 (target position) and CR#25, #26 (target speed).
    - The DOG signal has to be input from the external DOG terminal.
2. Devices
    - X0 = On: software starts (The execution follows the operation speed. After the DOG signal is triggered, the target position will be calculated. The software will stop when the target position is reached.)

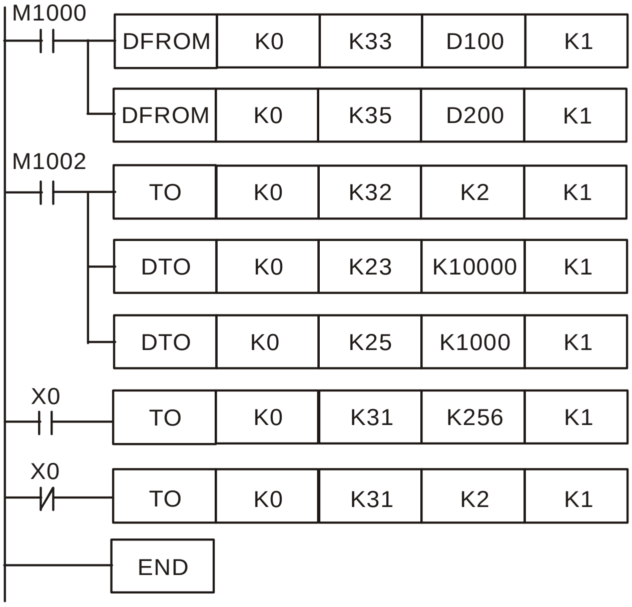
- X0 = Off: stop the execution (controlled by the software)

3. Interrupting single-speed positioning mode



4. Program explanation
   - Read CR#33, #34 (current position) and CR#35, #36 (current speed).
   - Write K2 (H’2, i.e. b1 = 1) into CR#32 to set up the single-speed positioning mode.
   - Set up CR#23, #24 (target position) and CR#25, #26 (operation speed).
   - When X0 = On, write K256 (H’100, i.e. b8 = 1) into CR#31 to enter the interrupting single-speed positioning mode.
   - The execution follows the operation speed. After the DOG signal is triggered, the target position will be calculated. The software will stop when the target position is reached.
   - When X0 = Off, stop the execution of interrupting single-speed positioning.
5. Program example

Ladder diagram:



M1000	DFROM	K0	K33	D100	K1	Read the current position
	DFROM	K0	K35	D200	K1	Read the current speed
M1002	TO	K0	K32	K2	K1	Set up as interrupting single-speed positioning mode
	DTO	K0	K23	K10000	K1	Set up the target position
	DTO	K0	K25	K1000	K1	Set up operation speed
X0	TO	K0	K31	K256	K1	Enable the interrupting single-speed positioning mode
X0	TO	K0	K31	K2	K1	Stop all executions
	END					

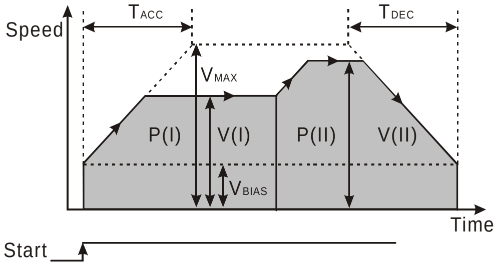
Explanation:

6.8.4 2-speed Positioning

1. Control requirements
   - Write K4 (H’4, i.e. b2 = 1) into CR#32 to enable 2-speed positioning.
   - Set up CR#23, #24 (target position I) and CR#25, #26 (target speed I).
   - Set up CR#27, #28 (target position II) and CR#29, #30 (target speed II).
2. Devices

- X0 = On: software starts
- X0 = Off: stop the execution (controlled by the software)

3. 2-speed positioning mode

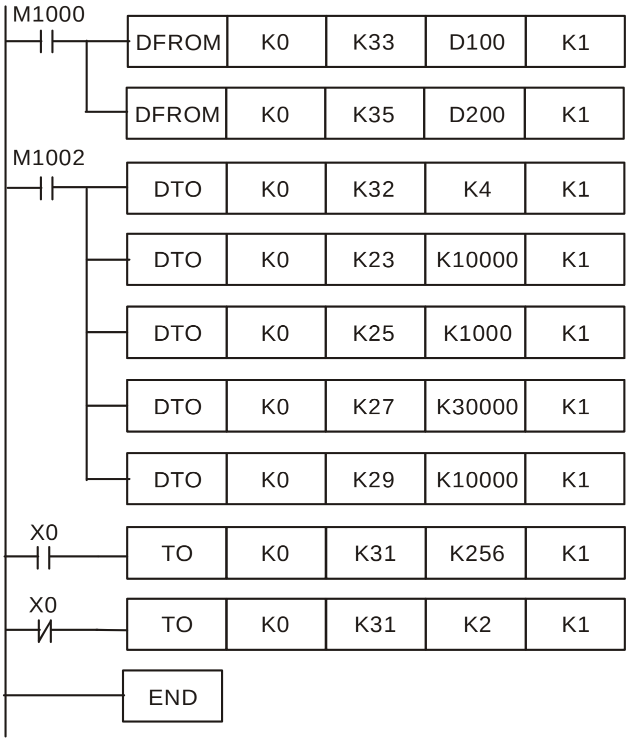


4. Program explanation

- Read CR#33, #34 (current position) and CR#35, #36 (current speed).
- Write K4 (H’4, i.e. b2 = 1) into CR#32 to set up the 2-speed positioning mode.
- Set up CR#23, #24 (target position I) and CR#25, #26 (target speed I).
- Set up CR#27, #28 (target position II) and CR#29, #30 (target speed II).
- When X0 = On, write K256 (H’100, i.e. b8 = 1) into CR#31 to enter the 2-speed positioning mode.
- Once the mode is enabled, the execution will follow operation speed (I) and enter the execution by operation speed (II) after the 1st movement is completed. The execution will stop after operation speed (II) is reached.
- When X0 = Off, stop the execution of 2-speed positioning.

5. Program example

Ladder diagram:



Ladder diagram:						Explanation:
M1000	DFROM	K0	K33	D100	K1	Read the current position
	DFROM	K0	K35	D200	K1	Read the current speed
M1002	DTO	K0	K32	K4	K1	Set up as 2-speed positioning mode
	DTO	K0	K23	K10000	K1	Set up target position I
	DTO	K0	K25	K1000	K1	Set up operation speed I
	DTO	K0	K27	K30000	K1	Set up target position II
	DTO	K0	K29	K10000	K1	Set up operation speed II
X0	TO	K0	K31	K256	K1	Enable the 2-speed positioning mode
X0	TO	K0	K31	K2	K1	Stop the execution
	END					

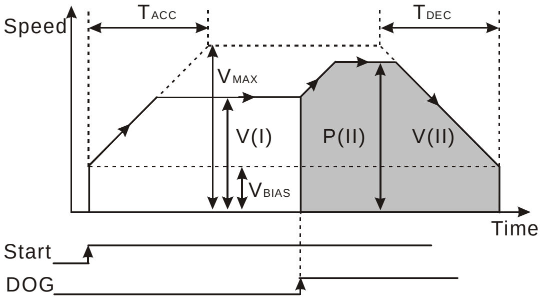
6.8.5 Interrupting 2-speed Positioning

1. Control requirements

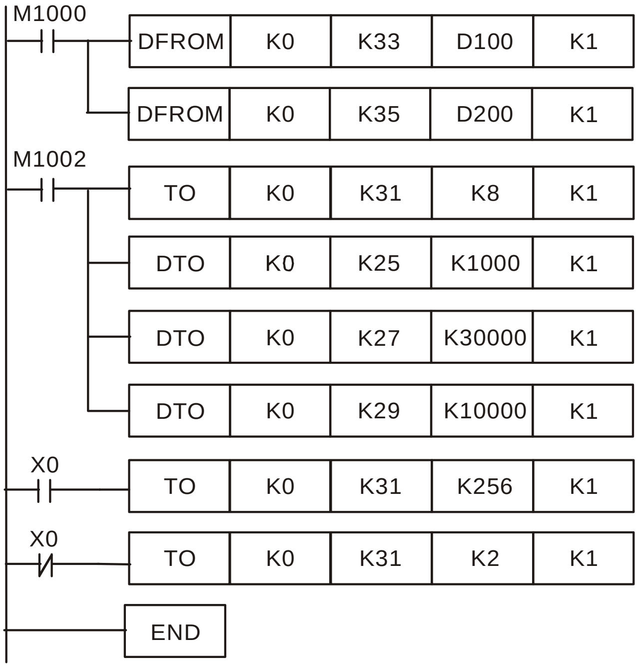
- Write K8 (H’8, i.e. b3 = 1) into CR#32 to enable interrupting 2-speed positioning

- Set up CR#25, #26 (target speed I).
- Set up CR#27, #28 (target position II) and CR#29, #30 (target speed II).

2. Devices
   - X0 = On: software starts.
   - X0 = Off: stop the execution (controlled by the software)
3. Interrupting 2-speed positioning mode



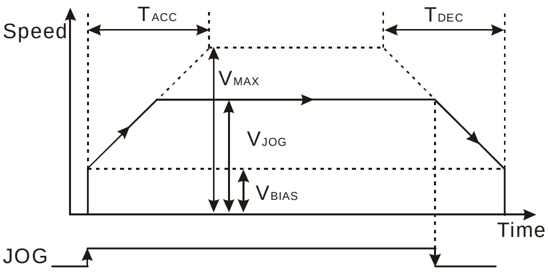
4. Program explanation
   - Read CR#33, #34 (current position) and CR#35, #36 (current speed).
   - Write K8 (H’8, i.e. b3 = 1) into CR#32 to set up the interrupting 2-speed positioning mode.
   - Set up CR#25, #26 (target speed I). It is not necessary to set up CR#23, #24 (target position I) in this mode.
   - Set up CR#27, #28 (target position II) and CR#29, #30 (target speed II).
   - When X0 = On, write K256 (H’100, i.e. b8 = 1) into CR#31 to enter the interrupting 2-speed positioning mode.
   - The execution follows the operation speed (I). After the DOG signal is triggered, the execution will enter operation speed (II) and stop after the target position is reached.
   - When X0 = Off, stop the execution of interrupting 2-speed positioning.
5. Program example



Ladder diagram:	Explanation:
M1000 DFROM K0 K33 D100 K1	Read the current position
DFROM K0 K35 D200 K1	Read the current speed
M1002 TO K0 K31 K8 K1	Set up as interrupting 2-speed positioning mode
DTO K0 K25 K1000 K1	Set up operation speed I
DTO K0 K27 K30000 K1	Set up target position II
DTO K0 K29 K10000 K1	Set up operation speed II
X0 TO K0 K31 K256 K1	Enable the interrupting 2-speed positioning mode
X0 TO K0 K31 K2 K1	Stop the exeuction
END	

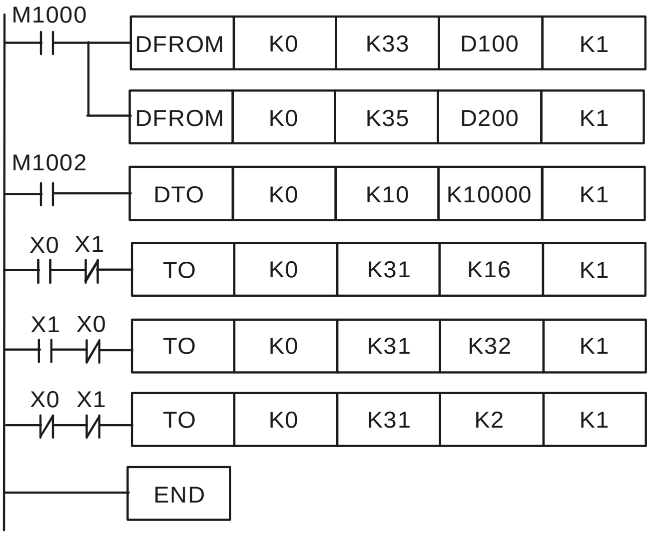
6.8.6 JOG Oeration

1. Control requirements
    - Set up JOG operation speed in CR#10.
    - Set up CR#31: K16 for forward pulses/K32 for reverse pulses/K0 for stopping output.
2. Devices
    - X0 = On: JOG forward pulse output.
    - X1 = On: JOG reverse pulse output.
    - X0, X1 = Off: stop the execution.
3. JOG operation mode



4. Program explanation
    - Read CR#33, #34 (current position) and CR#35, #36 (current speed).
    - Set up JOG speed in CR#10, #11.
    - X0 = On: JOG+ forward pulse output
    - X1 = On: JOG- reverse pulse output
    - X0, X1 = Off: stop the JOG operation.
5. Program example

Ladder diagram:



Explanation:

Read the current position

Read the current speed

Set up as JOG operation mode

JOG+ forward pulse output

JOG- reverser pulse output

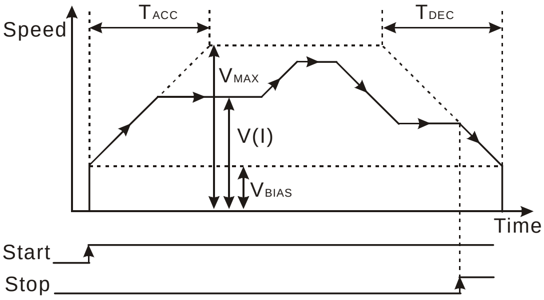
Stop JOG operation

6.8.7 Variable Speed Operation Mode

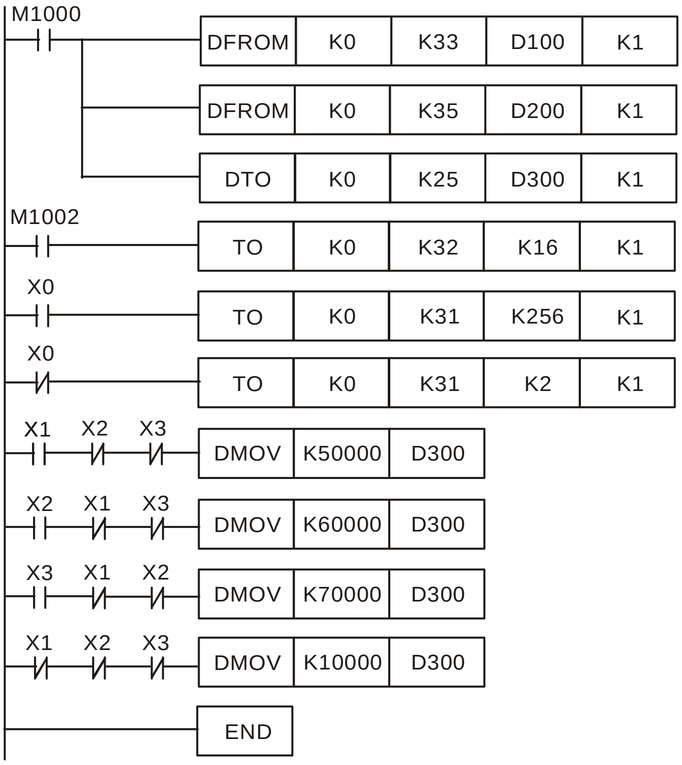
1. Control requirements
    - Set up CR#25 for variable speed operation (+/- for the direction).
    - Write K16 (H’10, i.e. b4 = 1) to enable the variable speed operation mode.
2. Devices

- X0 = On/Off: enable/disable variable speed operation.
- X1 = On: set up the variable speed as 50kHz.
- X2 = On: set up the variable speed as 60kHz.
- X3 = On: set up the variable speed as 70kHz.

3. Variable speed operation mode



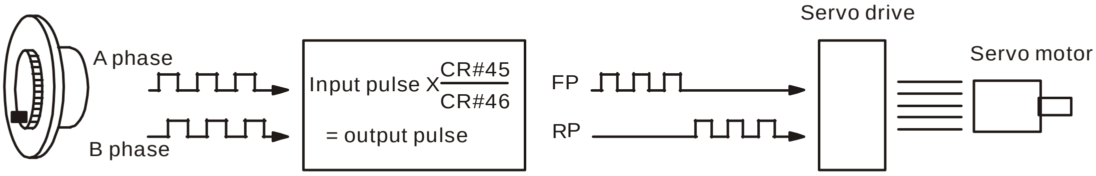
4. Program explanation
   - Read CR#33, #34 (current position) and CR#35, #36 (current speed).
   - Set up CR#25, #26 for the variable speed operation and D300 as the register (+/- for the direction).
   - Write K16 (H'10, i.e. b4 = 1) into CR#32 to set up as variable speed operation mode.
   - Set X0 = On to enable the variable speed operation mode; set X0 = Off to disable the variable speed operation mode.
   - When X1 = On, the variable speed = 50kHz.
   - When X2 = On, the variable speed = 60kHz.
   - When X3 = On, the variable speed = 70kHz.
   - X1, X2, X3 = Off, the variable speed is fixed at 10kHz.
5. Program example



Ladder diagram:	Explanation:
M1000 -| |- DFROM K0 K33 D100 K1	Read the current position
DFROM K0 K35 D200 K1	Read the current speed
DTO K0 K25 D300 K1	Set up as the operation speed mode
M1002 -| |- TO K0 K32 K16 K1	Set up as variable speed operation mode
X0 -| |- TO K0 K31 K256 K1	Enable variable speed operation mode
X0 -|/|- TO K0 K31 K2 K1	Disable variable speed operation mode
X1 -| |- X2 -|/|- X3 -|/|- DMOV K50000 D300	Variable speed = 50kHz
X2 -| |- X1 -|/|- X3 -|/|- DMOV K60000 D300	Variable speed = 60kHz
X3 -| |- X1 -|/|- X2 -|/|- DMOV K70000 D300	Variable speed = 70kHz
X1 -|/|- X2 -|/|- X3 -|/|- DMOV K10000 D300	Variable speed fixed as 10kHz
END	

6.8.8 MPG (Manual Pulse Generator) Mode

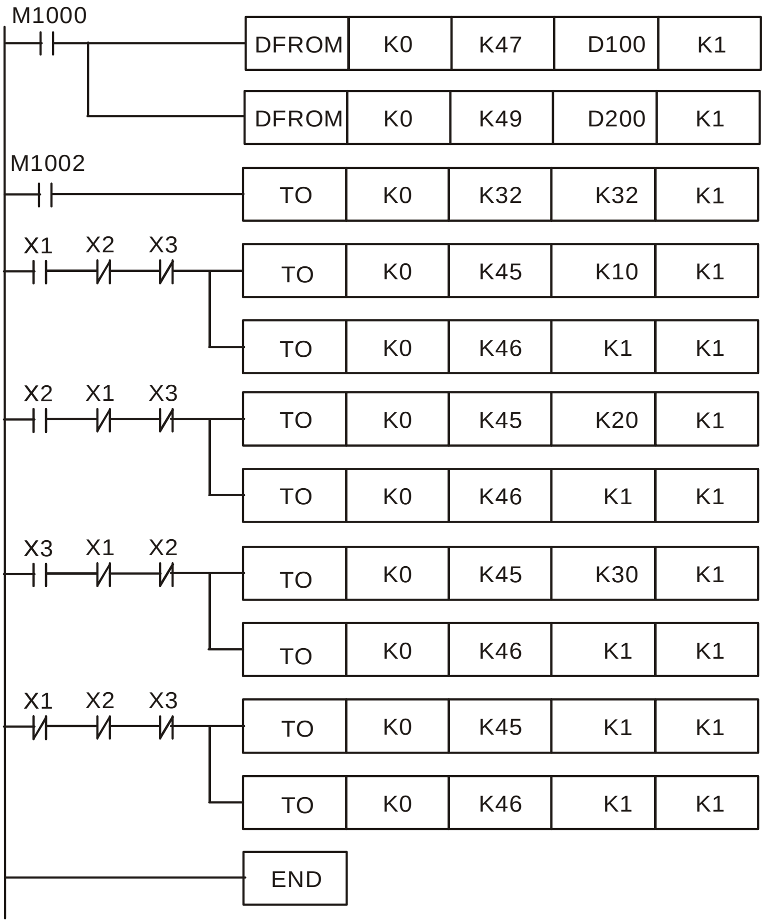
1. Control requirements (ex: DVP01PU-H)
   - Read the MPG input frequency in CR#47, #48.
   - Read the number of MPG input pulses in CR#49, #50.
   - Write K32 (H’20, i.e. b5 = 1) into CR#32 to enable MPG mode.
   - Set up electronic gear ratio in CR#45 (numerator) and CR#46 (denominator).
2. Devices
   - Write K32 (H’20, i.e. b5 = 1) into CR#32 to set the gear ratio as 1: 1.
   - X1 = On: set up the gear ratio as 1: 10.
   - X2 = On: set up the gear ratio as 1: 20.
   - X3 = On: set up the gear ratio as 1: 30.
3. MPG mode



4. Program explanation
   - Read CR#47, #48 (MPG input frequency) and CR#49, #50 (number of MPG input pulses)
   - Write K32 (H’20, i.e. b5 = 1) into CR#32 to set up as MPG input mode.
   - When X1 = On, the gear ratio = 1: 10.
   - When X2 = On, the gear ratio = 1: 20.
   - When X3 = On, the gear ratio = 1: 30.
   - X1, X2, X3 = Off, the gear ratio is fixed as 1: 1.

5. Program example:

Ladder diagram:



Explanation:

Read the MPG input frequency

Read the number of MPG input pulses

Set up as MPG input mode

MPG gear ratio = 1: 10.

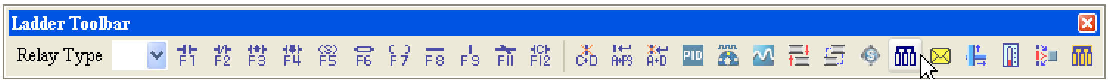
MPG gear ratio = 1: 20

MPG gear ratio = 1: 30

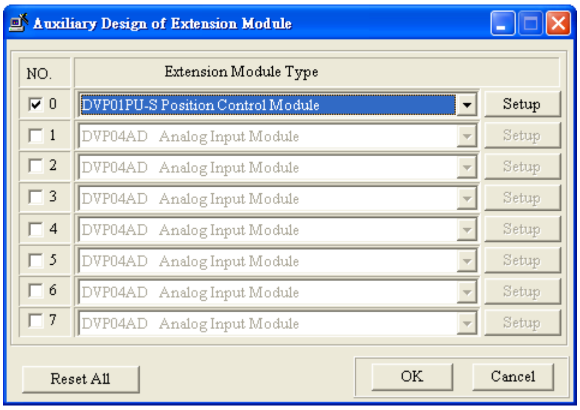
MPG gear ratio = 1: 1

6.8.9 How to Set the Module Wizard in WPLSoft

1. Open WPLSoft and click on



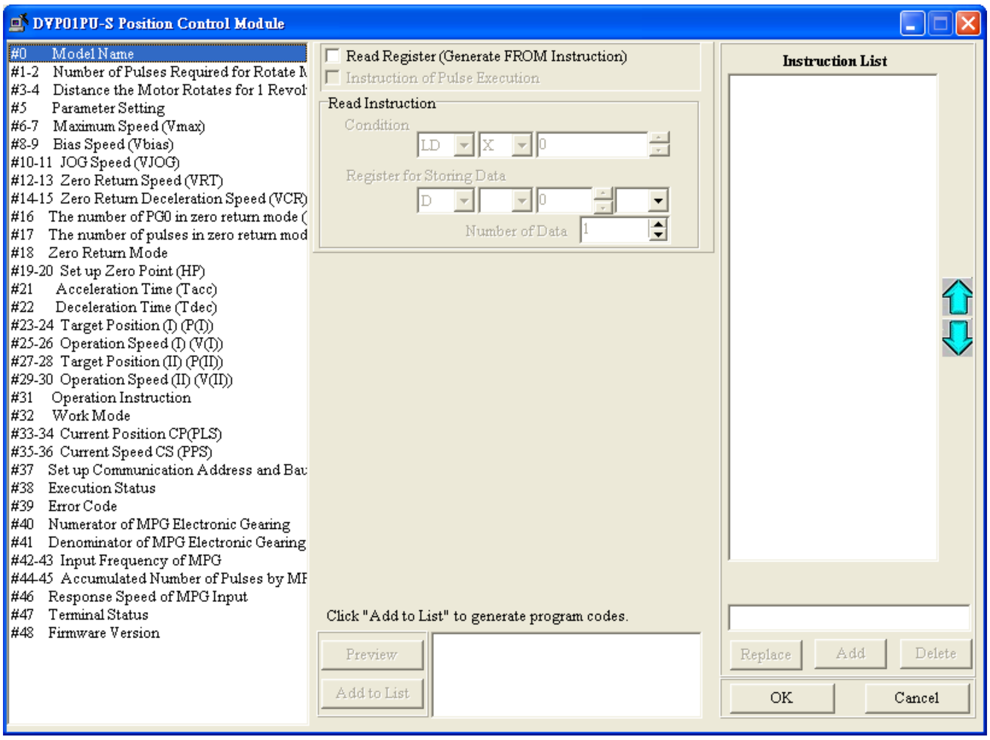
2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP01PU-S Position Control Module”.



Auxiliary Design of Extension Module

NO.	Extension Module Type	
☑ 0	DVP01PU-S Position Control Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.

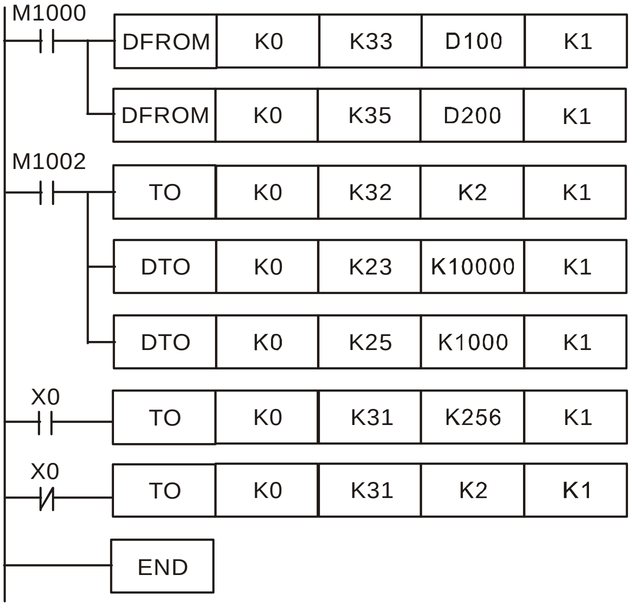


#0 Model Name
#1-2 Number of Pulses Required for Rotate M
#3-4 Distance the Motor Rotates for 1 Revol
#5 Parameter Setting
#6-7 Maximum Speed (Vmax)
#8-9 Bias Speed (Vbias)
#10-11 JOG Speed (VJOG)
#12-13 Zero Return Speed (VRT)
#14-15 Zero Return Deceleration Speed (VCR)
#16 The number of PG0 in zero return mode (
#17 The number of pulses in zero return mod
#18 Zero Return Mode
#19-20 Set up Zero Point (HP)
#21 Acceleration Time (Tacc)
#22 Deceleration Time (Tdec)
#23-24 Target Position (I) (P(I))
#25-26 Operation Speed (I) (V(I))
#27-28 Target Position (II) (P(II))
#29-30 Operation Speed (II) (V(II))
#31 Operation Instruction
#32 Work Mode
#33-34 Current Position CP(PLS)
#35-36 Current Speed CS (PPS)
#37 Set up Communication Address and Bau
#38 Execution Status
#39 Error Code
#40 Numerator of MPG Electronic Gearing
#41 Denominator of MPG Electronic Gearing
#42-43 Input Frequency of MPG
#44-45 Accumulated Number of Pulses by MF
#46 Response Speed of MPG Input
#47 Terminal Status
#48 Firmware Version

Click "Add to List" to generate program codes.

4. Next, let's take 6.8.3 Interrupting single-speed positioning as example.

Ladder diagram:



Explanation:

Read the current position

Read the current speed

Set up as interrupting single-speed positioning mode

Set up the target position

Set up the operation speed

Enable interrupting single-speed positioning

Stop all executions

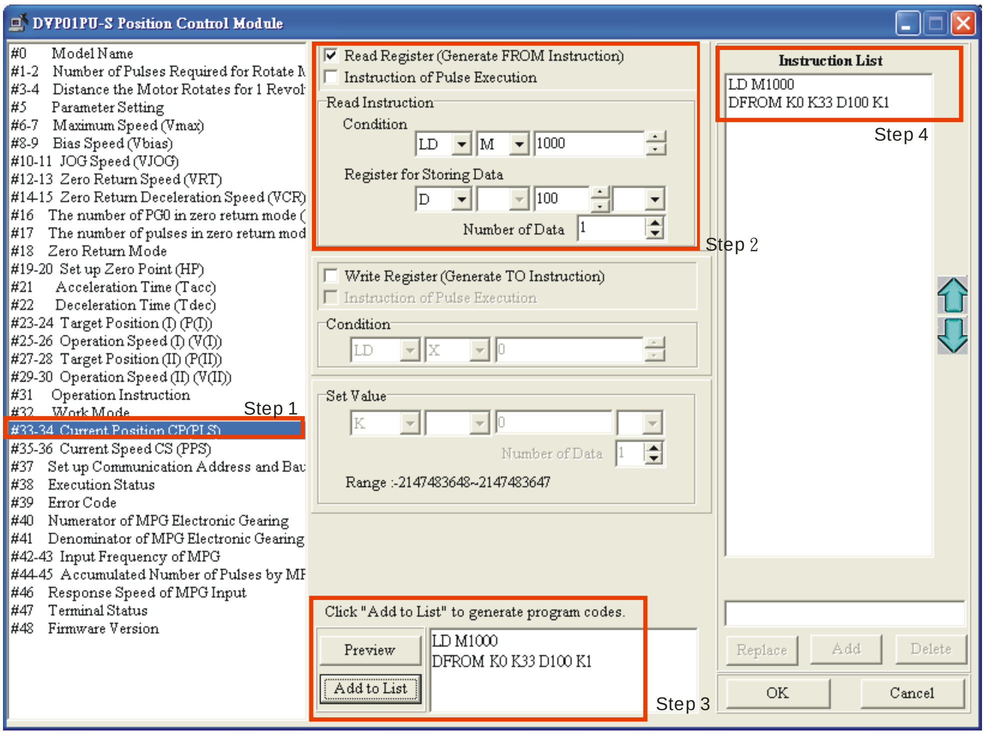
5. Set up the current position CP (PLS) in CR#33 and #34.

Step 1: Select "#33-34 Current Position CP (PLS)".

Step 2: Chheck "Read Register" to generate DFROM instruction. Set the condition as "LD M1000" Set the register for storing data as "D100" and number of data as "1".

Step 3: Click "Preview" to check if the generated program codes are corret.

Step 4: Click "Add to List" to display the instruction codes in "Instruction List". The setup of CR#33, #34 is completed.



☑ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD M 1000
Register for Storing Data: D 100
Number of Data: 1

☐ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD X 0
Set Value: K 0
Number of Data: 1
Range :-2147483648~2147483647

Click "Add to List" to generate program codes.

```
LD M1000
DFROM K0 K33 D100 K1
```

Instruction List

```
LD M1000
DFROM K0 K33 D100 K1
```

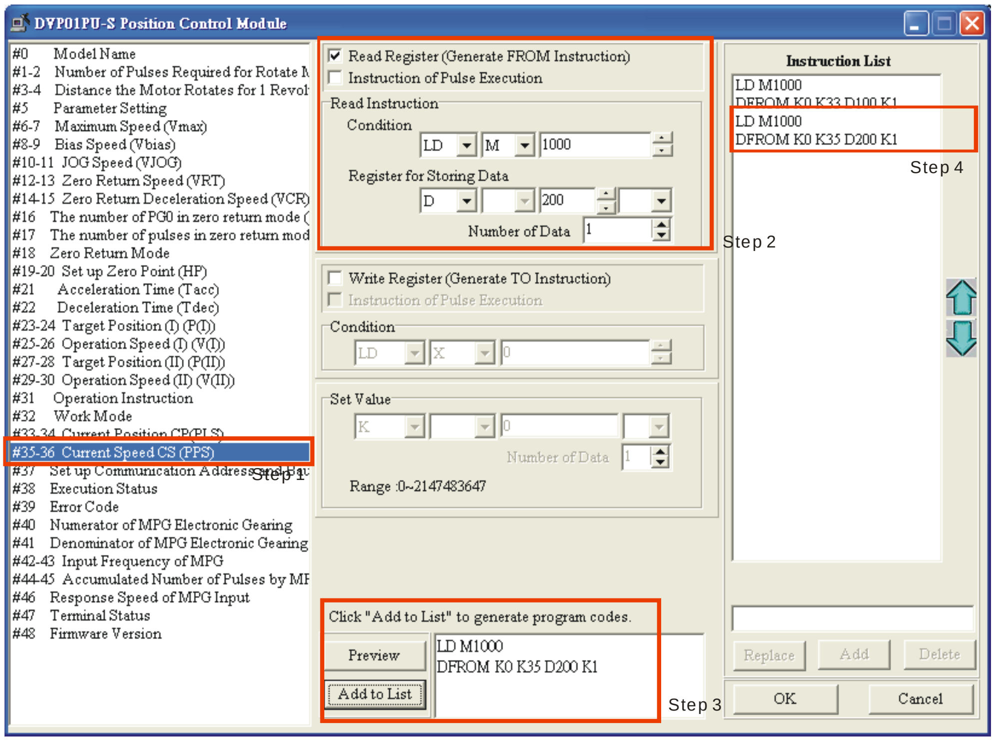
6. Setting up CR#35, #36 is similar to the setup of CR#33, #34.

   Step 1: Select “#35-36 Current Speed CS (PPS)”

   Step 2: Check “Read Register” to generate DFROM instruction. Set the condition as “LD M1000” Set the register for storing data as “D200” and number of data as “1”.

   Step 3: Click “Preview” to check if the generated program codes are correct.

   Step 4: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#35, #36 is completed.



☑ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution
Read Instruction
Condition: LD M 1000
Register for Storing Data: D 200
Number of Data: 1

☐ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD X 0
Set Value: K 0
Number of Data: 1
Range :0~2147483647

Click "Add to List" to generate program codes.

```
LD M1000
DFROM K0 K35 D200 K1
```

Instruction List

```
LD M1000
DFROM K0 K33 D100 K1
LD M1000
DFROM K0 K35 D200 K1
```

7. Setting up CR#32 is similar to the setup of CR#33 ~ #36.

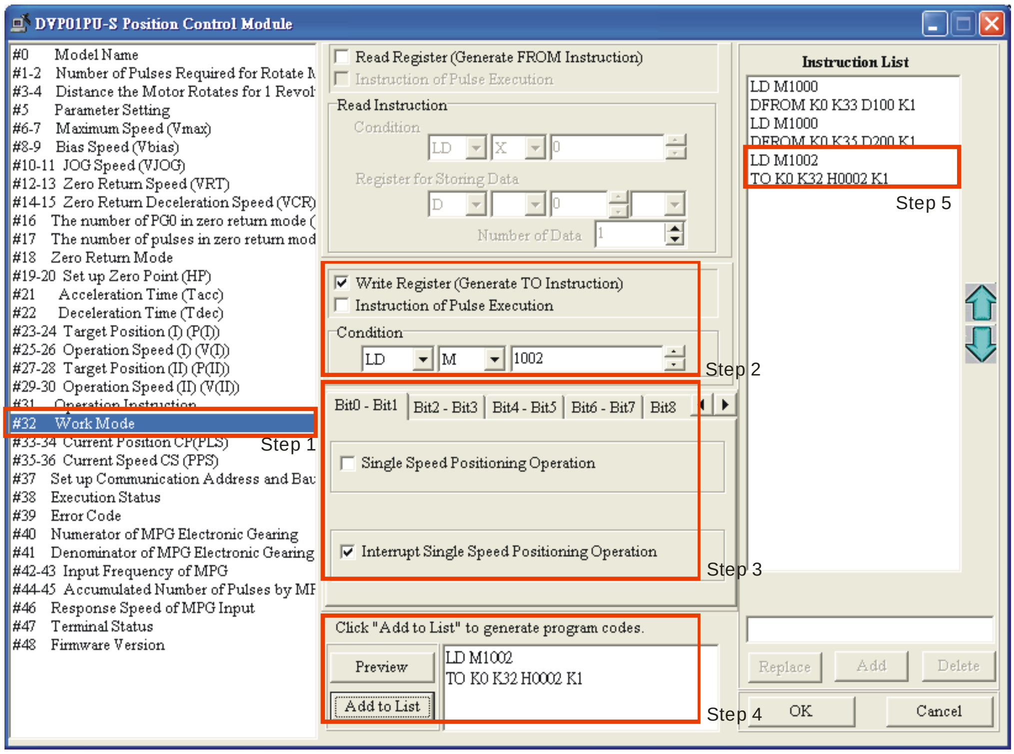
   Step 1: Select “#32 Work Mode”

Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD M1002”

Step 3: Check “Interrupting Single-Speed Positioning Operation"

Step 4: Click “Preview” to check if the generated program codes are correct.

Step 5: Click “Add to List” to display instruction codes in “Instruction List”. The setup of CR#32 is completed.



#0 Model Name
#1-2 Number of Pulses Required for Rotate M
#3-4 Distance the Motor Rotates for 1 Revol
#5 Parameter Setting
#6-7 Maximum Speed (Vmax)
#8-9 Bias Speed (Vbias)
#10-11 JOG Speed (VJOG)
#12-13 Zero Return Speed (VRT)
#14-15 Zero Return Deceleration Speed (VCR)
#16 The number of PG0 in zero return mode (
#17 The number of pulses in zero return mod
#18 Zero Return Mode
#19-20 Set up Zero Point (HP)
#21 Acceleration Time (Tacc)
#22 Deceleration Time (Tdec)
#23-24 Target Position (I) (P(I))
#25-26 Operation Speed (I) (V(I))
#27-28 Target Position (II) (P(II))
#29-30 Operation Speed (II) (V(II))
#31 Operation Instruction
#32 Work Mode
#33-34 Current Position CP(PLS)
#35-36 Current Speed CS (PPS)
#37 Set up Communication Address and Bau
#38 Execution Status
#39 Error Code
#40 Numerator of MPG Electronic Gearing
#41 Denominator of MPG Electronic Gearing
#42-43 Input Frequency of MPG
#44-45 Accumulated Number of Pulses by MP
#46 Response Speed of MPG Input
#47 Terminal Status
#48 Firmware Version

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD M 1002

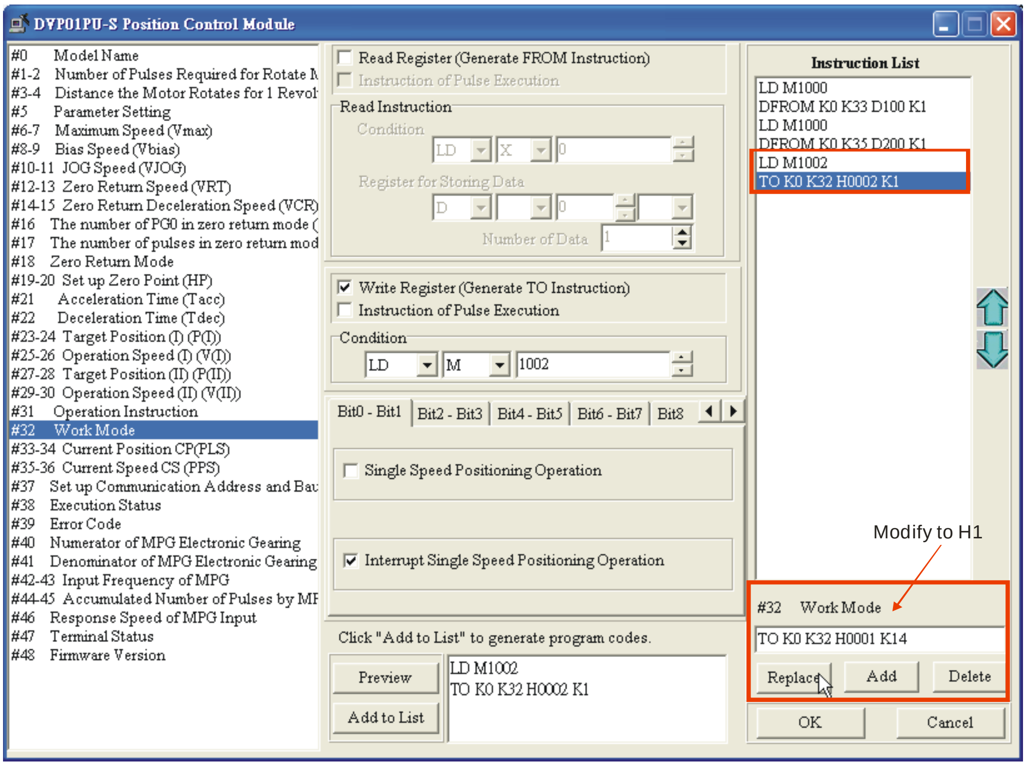
☐ Single Speed Positioning Operation
☑ Interrupt Single Speed Positioning Operation

```
LD M1002
TO K0 K32 H0002 K1
```

Instruction List:

```
LD M1000
DFROM K0 K33 D100 K1
LD M1000
DFROM K0 K35 D200 K1
LD M1002
TO K0 K32 H0002 K1
```

8. You can modify or add instruction codes in “Instruction List” if necessary. For example in the setup of CR#32 Work Mode, click on the instruction in the Instrcution List to be modified and modify “interrupting single-speed positioning” (H2) into “single-speed positioning” (H1). Click “Replace” to enable “single-speed positoning” mode.



DVP01PU-S Position Control Module

#0 Model Name
#1-2 Number of Pulses Required for Rotate N
#3-4 Distance the Motor Rotates for 1 Revol
#5 Parameter Setting
#6-7 Maximum Speed (Vmax)
#8-9 Bias Speed (Vbias)
#10-11 JOG Speed (VJOG)
#12-13 Zero Return Speed (VRT)
#14-15 Zero Return Deceleration Speed (VCR)
#16 The number of PG0 in zero return mode (
#17 The number of pulses in zero return mod
#18 Zero Return Mode
#19-20 Set up Zero Point (HP)
#21 Acceleration Time (Tacc)
#22 Deceleration Time (Tdec)
#23-24 Target Position (I) (P(I))
#25-26 Operation Speed (I) (V(I))
#27-28 Target Position (II) (P(II))
#29-30 Operation Speed (II) (V(II))
#31 Operation Instruction
#32 Work Mode
#33-34 Current Position CP(PLS)
#35-36 Current Speed CS (PPS)
#37 Set up Communication Address and Bau
#38 Execution Status
#39 Error Code
#40 Numerator of MPG Electronic Gearing
#41 Denominator of MPG Electronic Gearing
#42-43 Input Frequency of MPG
#44-45 Accumulated Number of Pulses by MF
#46 Response Speed of MPG Input
#47 Terminal Status
#48 Firmware Version

☐ Read Register (Generate FROM Instruction)
☐ Instruction of Pulse Execution

Read Instruction
Condition: LD X 0
Register for Storing Data: D 0
Number of Data: 1

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution

Condition: LD M 1002

☐ Single Speed Positioning Operation

☑ Interrupt Single Speed Positioning Operation

Click "Add to List" to generate program codes.

```
LD M1002
TO K0 K32 H0002 K1
```

Instruction List

```
LD M1000
DFROM K0 K33 D100 K1
LD M1000
DFROM K0 K35 D200 K1
LD M1002
TO K0 K32 H0002 K1
```

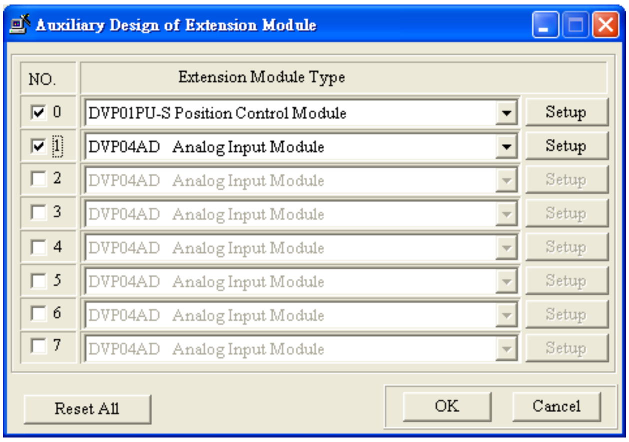
Modify to H1

#32 Work Mode

```
TO K0 K32 H0001 K14
```

9. The setup of other CR parameters can follow the steps illustrated above.

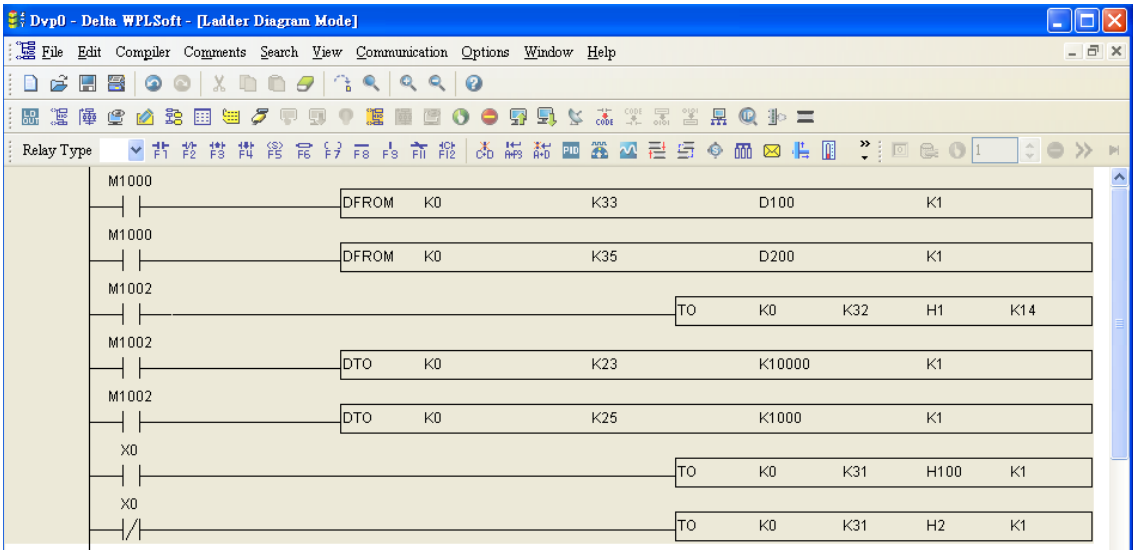
10. After you complete all the setups, click on “OK” to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



Auxiliary Design of Extension Module

NO.	Extension Module Type	
☑ 0	DVP01PU-S Position Control Module	Setup
☑ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

11. After you complete the setups of all the modules, click on “OK” to generate the program below.



```
M1000
--| |------------------ DFROM  K0   K33   D100    K1
M1000
--| |------------------ DFROM  K0   K35   D200    K1
M1002
--| |------------------ TO     K0   K32   H1      K14
M1002
--| |------------------ DTO    K0   K23   K10000  K1
M1002
--| |------------------ DTO    K0   K25   K1000   K1
X0
--| |------------------ TO     K0   K31   H100    K1
X0
--|/|------------------ TO     K0   K31   H2      K1
```

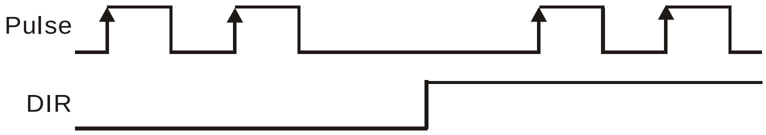
12. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.

MEMO

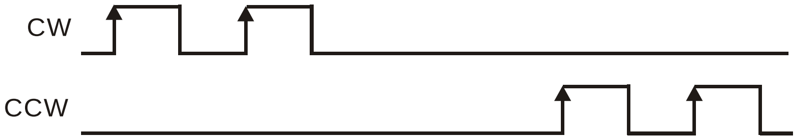
7.1 The Concept of High-Speed Counting Pulses

In the application of controlling step and servo positioning by pulse output, “pulse + direction”, “forward/reverse running” and “A/B phase” are three most frequently adopted pulse types.

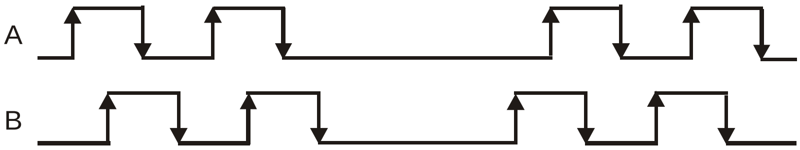
- **Pulse+ direction:** The 1-phase 1 output type. Pulse (or CLK) is the pulse input signal; DIR controls the running direction of the step or servo motor.



- **Forward/reverse:** The 1-phase 2 outputs type. CW is the forward pulses, and CCW is the reverse pulses.



- **A/B phase:** The 2-phase 2 outputs type. A phase and B phase are in quadrature.



The three I/O pulse types illustrated above are the types adopted in general step or servo controllers. Therefore, the high-speed counter also support this three types of input pulse signals.

Giving the feedback pulse signals from the encoder of the step or servo controller to the high-speed counter will obtain the actual number of pulses which can be further used in comparing if the position is reached or determining if the pulse counting reaches its target, in order to enhance the accuracy of the positioning.

7.2 Introduction

7.2.1 DVP01HC-H-H

1. DVP01HC-H hardware high-speed counting input module is able to accept external counting pulse signals of 200kHz. DVP-EH series MPU writes or reads the data in DVP01HC-H through FROM/TO instructions. There are 32 16-bit registers (CR) in DVP01HC-H. The 32-bit parameters are composed of 2 continuous control registers. The module can execute itself after the control registers in the module are set up.
2. There are three counting modes (1-phase 1 input, 1-phase 2 inputs or 2-phase 2 inputs, 16-bit or 32-bit) by writing TO instruction into the control register in the module.
3. The source of input signals can be a 1-phase or 2-phase encoder. The voltage level can be 5V, 12V or 24V. In addition, DVP01HC-H offers instruction input terminal (PRESET) and disabling counting instruction input terminal (DISABLE) for setting up the initial value. When you wire, be sure to connect 24V, A24+, B24+, P24+, D24+, A12+, B12+, A5+, B5+, P5+ and D5+ to the positive potential, and 0V, A24-, B24-, P24-, D24-, A12-, B12-, A5-, B5-, P5- and D5- to the negative potential.

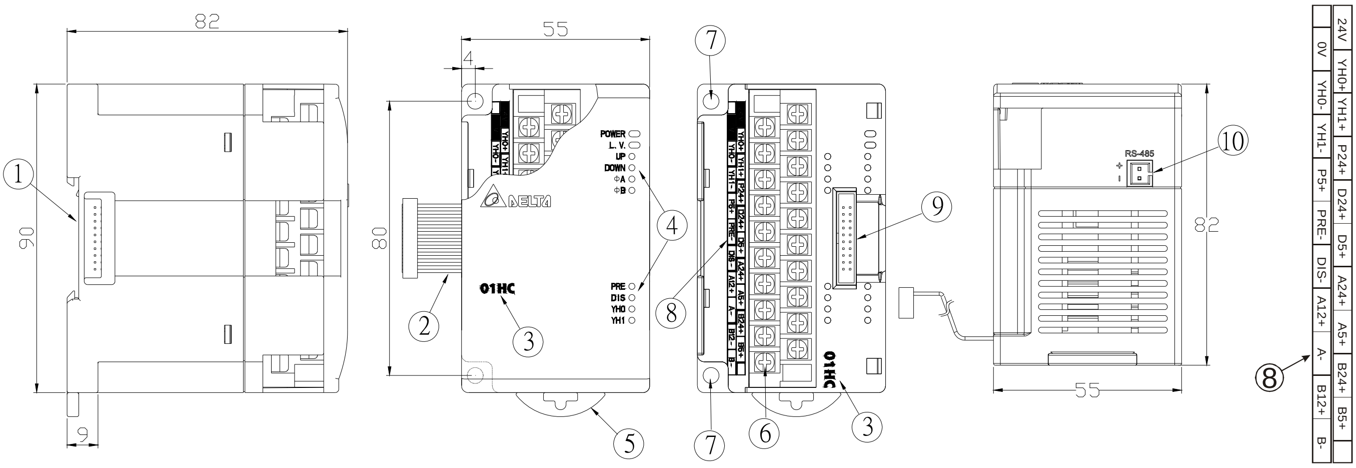
4. DVP01HC-H has 2 output points, YH0 and YH1. When the present value in the hardware high-speed counter equals the set value, the corresponding output point will start to execute. The transistors of the output points are independent and isolated.

7.2.2 DVP02HC-H

1. DVP02HC-H hardware high-speed counting input module is able to accept 2 groups of external counting pulse signals of 200kHZ. DVP-EH series MPU writes or reads the data in DVP02HC-H through FROM/TO instructions. There are 34 16-bit registers (CR) in DVP02HC-H. The 32-bit parameters are composed of 2 continuous control registers. The module can execute itself after the control registers in the module are set up.
2. There are three counting modes (1-phase 1 input, 1-phase 2 inputs or 2-phase 2 inputs, 16-bit or 32-bit) by writing TO instruction into the control register in the module. The source of input signals can be a 1-phase or 2-phase encoder. The voltage level can be 24V. In addition, DVP02HC-H offers instruction input terminal (PRESET) and disabling counting instruction input terminal (DISABLE) for setting up the initial value.
3. Sink mode or Source mode are available for the input wiring.
4. DVP02HC-H has 2 output points, YH0 (CH0) and YH1 (CH1). When the present value in the hardware high-speed counter equals the set value, the corresponding output point will start to execute. The transistors of the output points are independent and isolated.

7.3 Product Profile and Outline

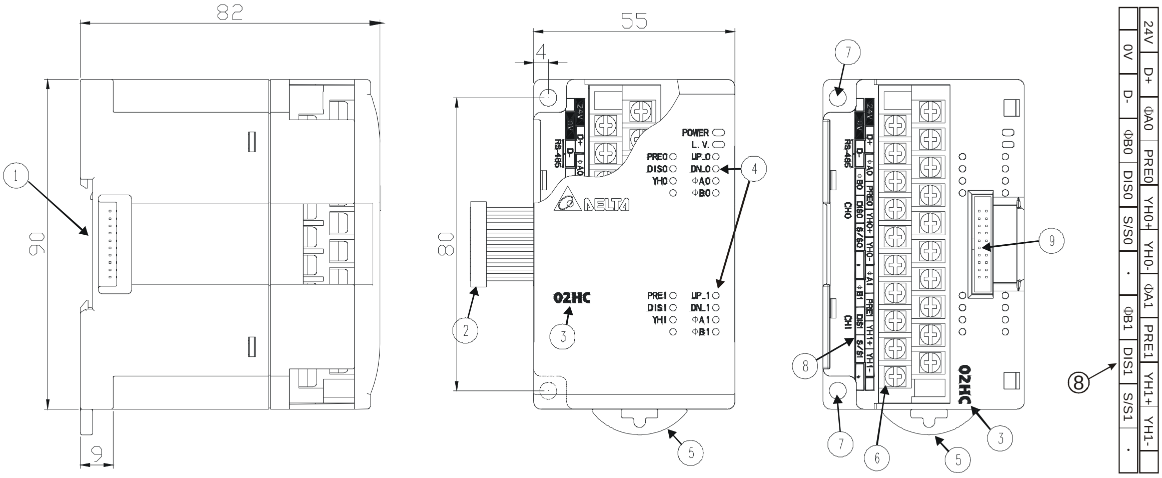
7.3.1 DVP01HC-H



Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connection port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. POWER, RUN, ERROR indicators	9. Mounting port for extension unit/module
5. DIN rail clip	10. RS-485 communication port

7.3.2 DVP02HC-H



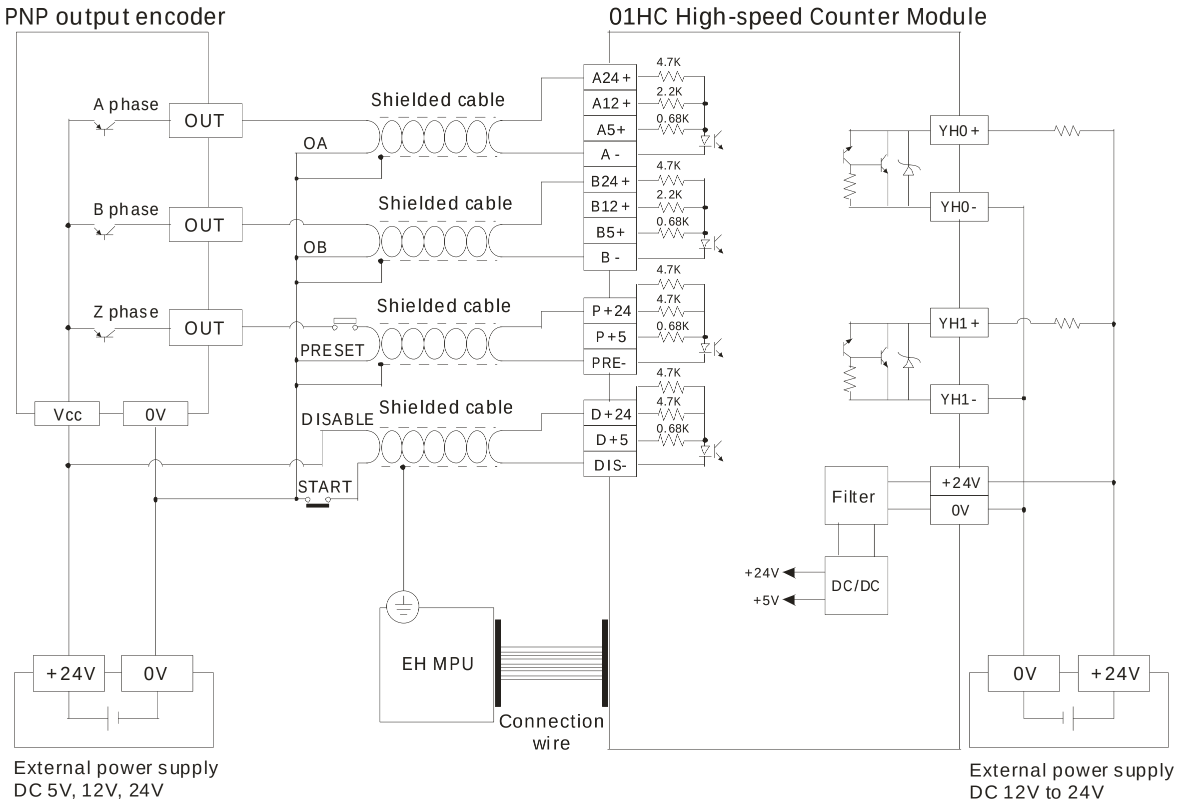
Unit: mm

1. DIN rail (35mm)	6. Terminals
2. Connecting port for extension unit/module	7. Mounting hole
3. Model name	8. I/O terminals
4. POWER, RUN, ERROR indicators	9. Mounting port for extension unit/module
5. DIN rail clip	

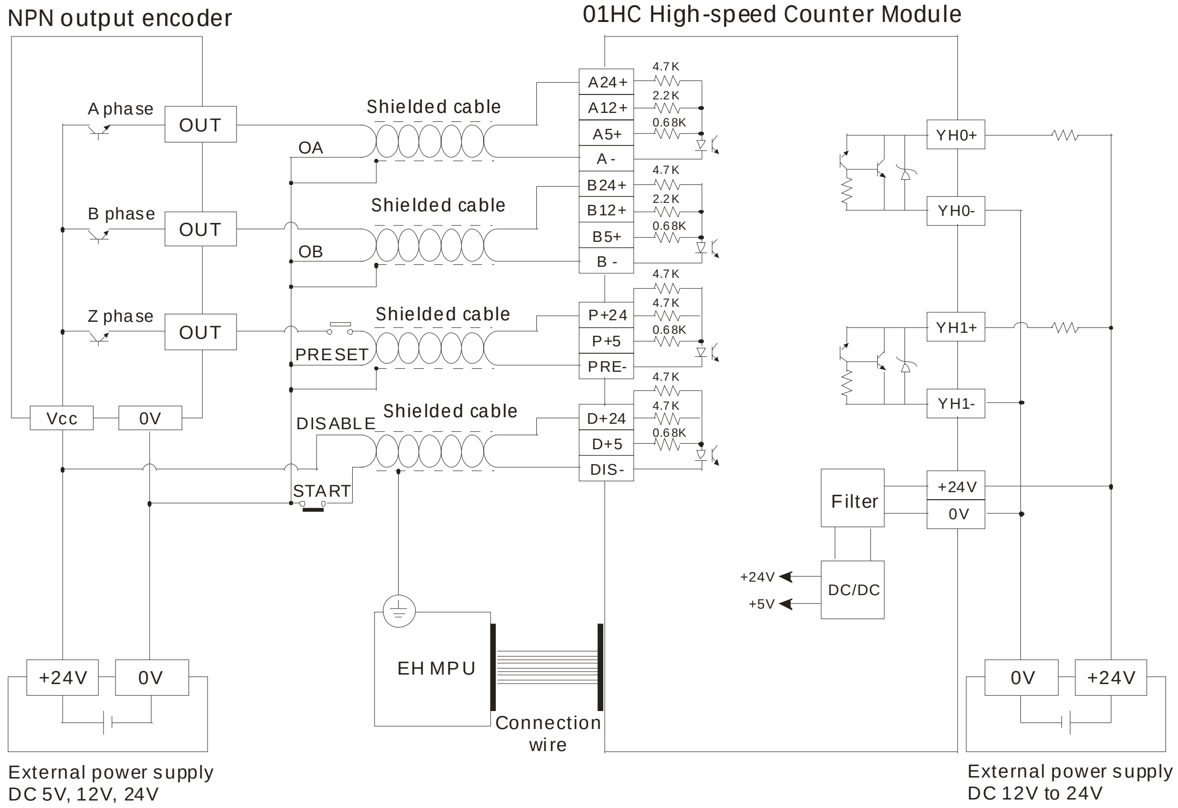
7.4 External Wiring

7.4.1 DVP01HC-H

1. Wiring for PNP output encoder:



2. Wiring for NPN output encoder:

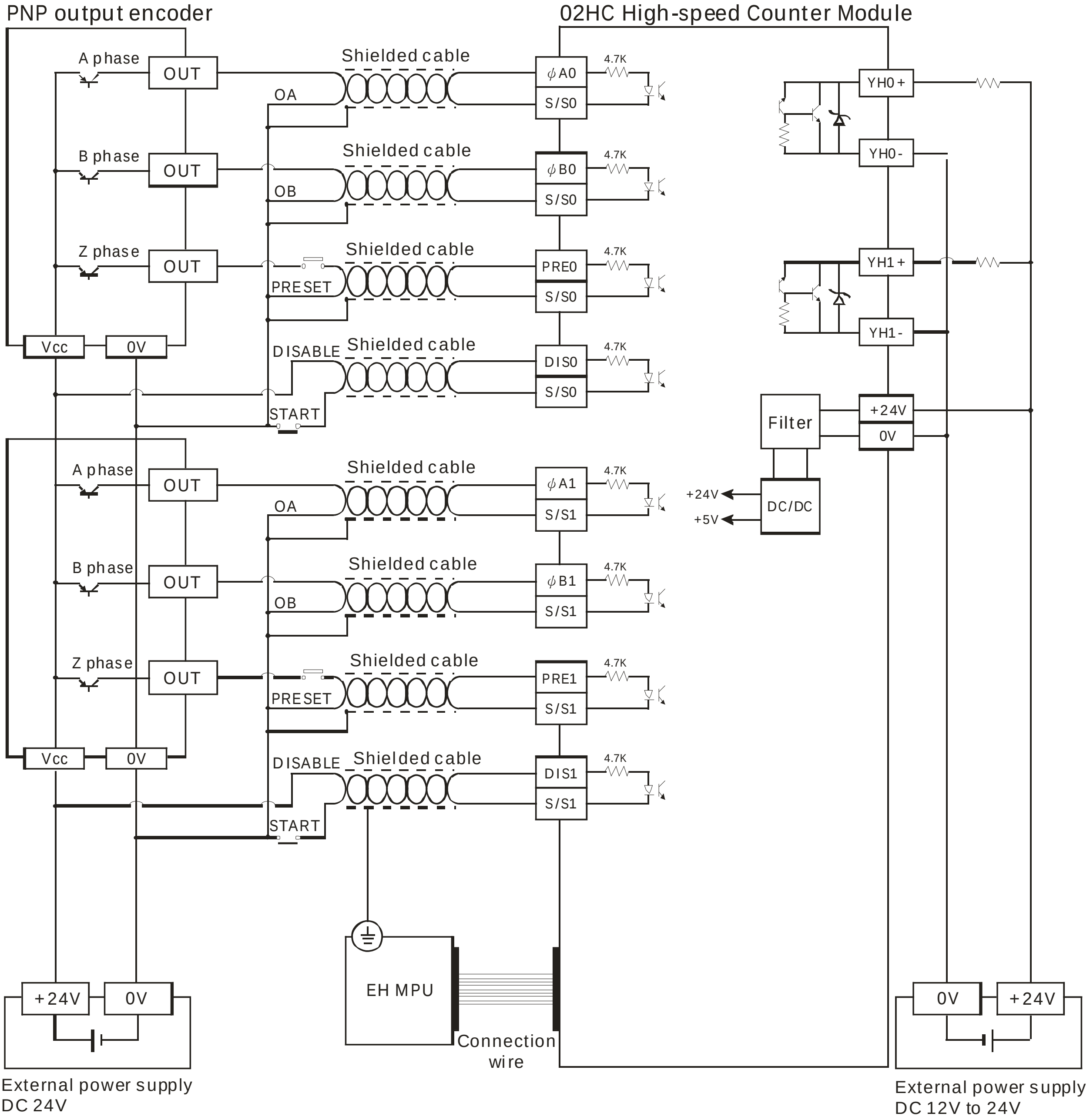


3. The start-up current for DVP01HC-H I_{PEAK} = 0.8A; normal working current I_{MAX} = 0.2A (the input voltage is set as +24V).

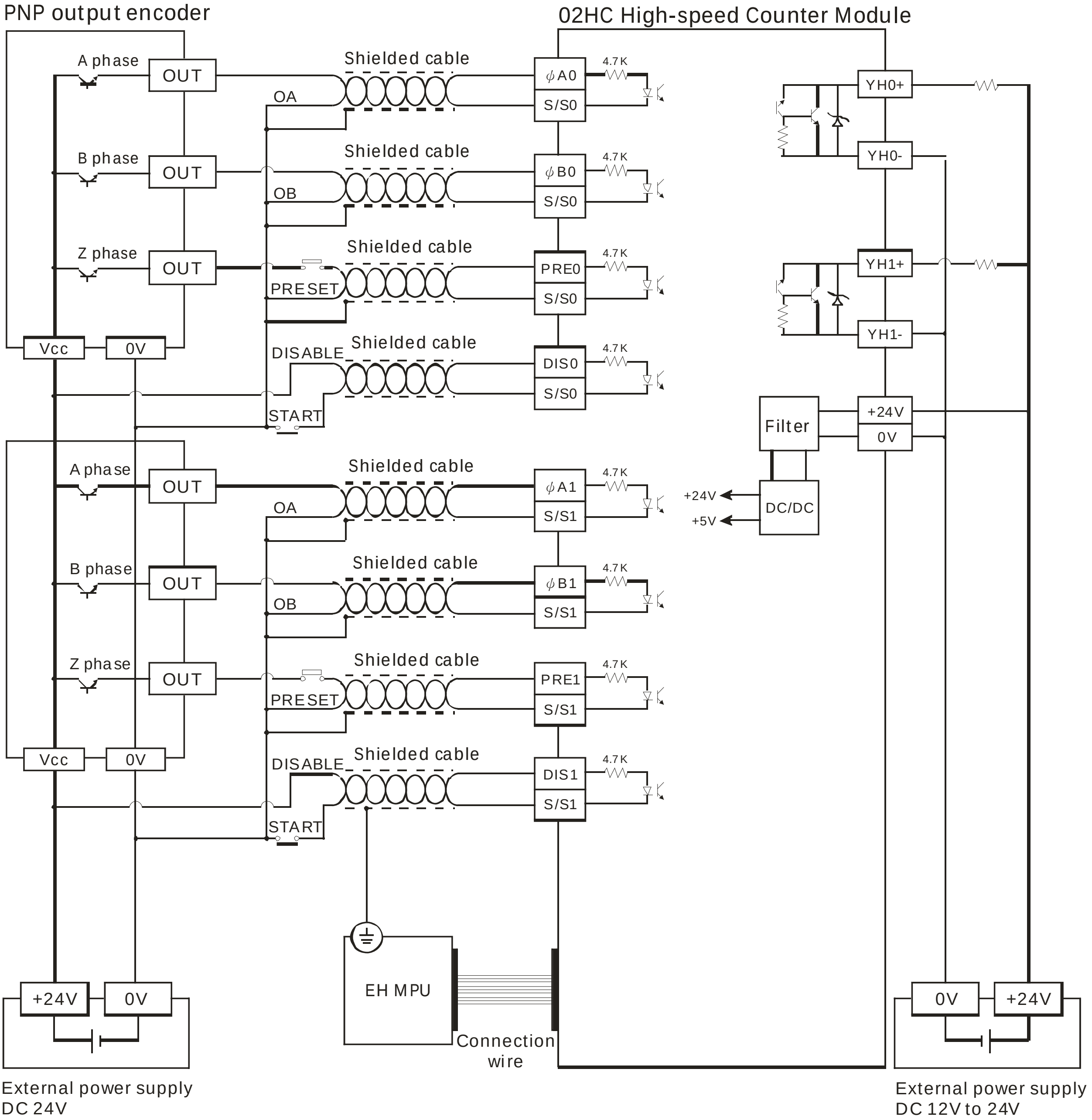
4. For example, If the input voltage = 24V, the input current will be 24V/4.7k = 5.1mA, and so on.

7.4.2 DVP02HC-H

1. Wiring for PNP output encoder:



2. Wiring for NPN output encoder:

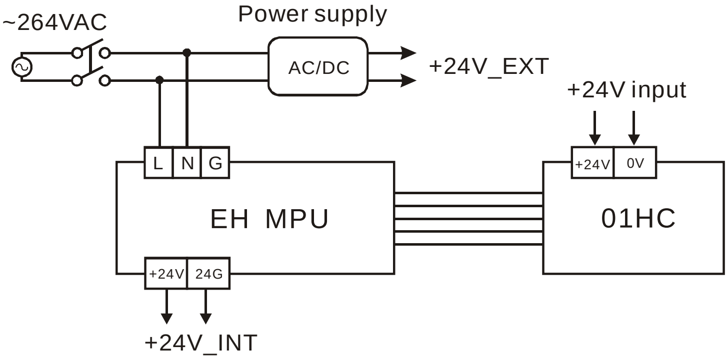


3. The start-up current for DVP02HC-H I_{PEAK} = 0.8A; normal working current I_{MAX} = 0.2A (the input voltage is set as +24V).
4. The input voltage = 24V, and the input current = 24V/4.7k = 5.1mA

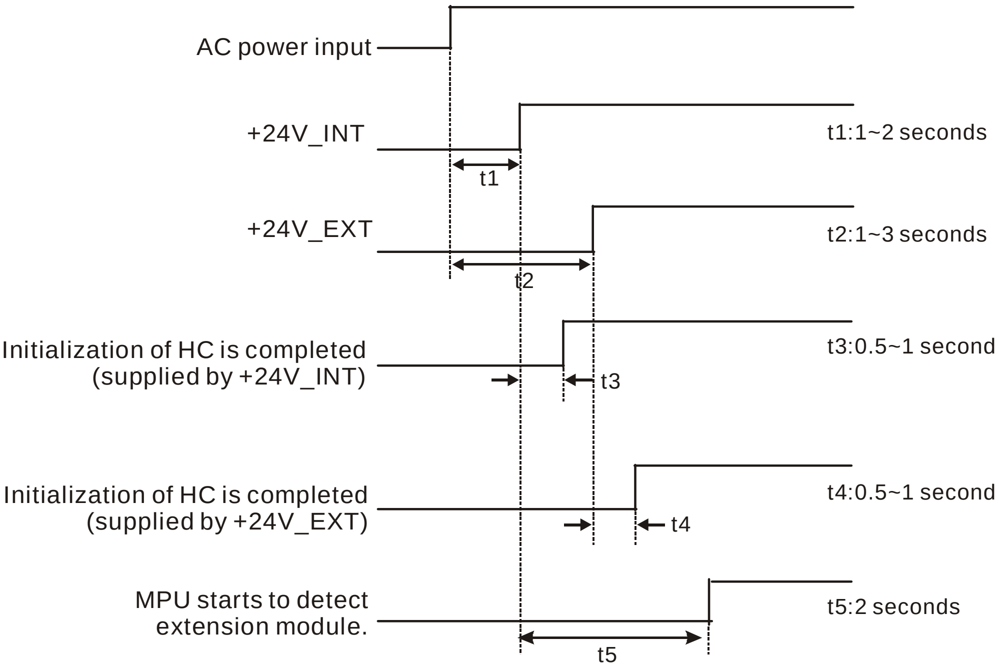
7.4.3 Wiring of Power Supply & Powering Timing

The MPU starts to detect the extension module after it is powered. Therefore, if the external +24V DC power supply does not enter the HC module, or the power is supplied after the EH MPU detects the extension module, connection failure will appear. See below for the wiring of power supply and the powering timing.

- Wiring of power supply



- Power supply timing chart:

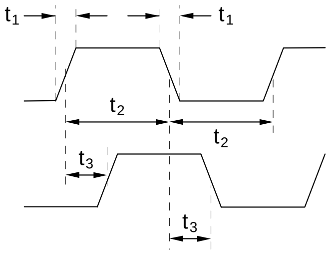
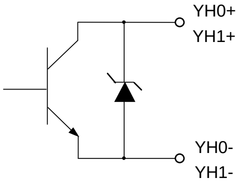


- Timing analysis:

+24V_INT as power supply: t5 > t3, power On, and the connection to the HC module is normal.

+24V_EXT as power supply: The HC module utilizes the DC+24V supplied by the power supplier, and the start-up time t2 is unknown. Therefore, you have to make sure that t2 + t4 < t1 + t5 to ensure that the MPU is able to detect the connected HC module.

7.5 Specifications

Item		**1-phase input**		**2-phase (A, B) input**		
		1 input	2 inputs	Normal frequency	Double frequency	4 times frequency
Input signal	Voltage level	DVP01HC-H: Terminals [A24+], [B24+]: DC24V ±10% Terminals [P24+], [D24+]: DC12V ~ 24V ±10% Terminals [A12+], [B12+]: DC12V ± 10% Terminals [A5+], [B5+], [P5+], [D5+]: DC5V ±10% Select only one suitable voltage level for each “+” signal (A: A phase, B: B phase, P: preset, D: disable)				
		DVP02HC-H: Terminals [ΦA0], [ΦB0], [PRE0], [DIS0], [ΦA1] , ΦB1], PRE1], DIS1]: DC24V ±10% ΦA: A phase, ΦB: B phase, PRE: preset, DIS: disable				
	Max. counting frequency	200kHZ	200kHZ	200kHZ	100kHZ	50kHZ
	Pulse form	 t1: time of rising/falling ≦ 0.8us t2: On/Off pulse width ≧ 2.5us t3: phase difference between A- and B- phase ≧ 1us PRESET input: input pulse width ≧ 50us DISABLE input: input pulse width ≧ 50us				
Counting specifications	Counting mode	There are 3 counting modes: counting up/down (A-/B- phase, 2-phase 2 inputs), forward/reverse pulse (1-phase 2 inputs) and pulse/direction (1-phase 1 input)				
	Range	DVP01HC-H: 32-bit mode: -2,147,483648 ~ +2,147,483,647 16-bit mode: 0 ~ 65,535 (upper limit is set in CR#2,3)				
		DVP02HC-H: 32-bit mode: -2,147,483648 ~ +2,147,483,647 16-bit mode: 0 ~ 65,535 (upper limit is set in CH0_CR#4,5 and CH1_CR#6,7)				
	Comparison method	DVP01HC-H: There are 2 comparison values corresponding to 2 output points, YH0 and YH1. When the present value = set value, the output point will be On by real-time hardware circuit comparison and output settings.				
		DVP02HC-H: There are 2 comparison values. CH0 corresponds to YH0, and CH1 corresponds to YH1. When the present value = set value, the output point will be On by real-time hardware circuit comparison and output settings.				
Output signal	Output type	YH0+: output point YH0; transistor: collector YH0-: output point YH0; transistor: emitter YH1+: output point YH1; transistor: collector YH1-: output point YH1; transistor: emitter 				
	Output	5V ~ 30V DC, 0.5A				
Series connection with DVP-PLC		The modules are numbered from 0 to 7 automatically by their distance from the MPU. Max. 8 modules are allowed to connect to the MPU and will not occupy any digital I/O points.				

Item	1-phase input		2-phase (A, B) input		
	1 input	2 inputs	Normal frequency	Double frequency	4 times frequency
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600 bps. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1), RTU data format: 8-bit, Even, 1 stop bit (8, E, 1). RS-485 cannot be used when connected to PLC MPU in series.				
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	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)				

Power Supply	
Max. rated power consumption	24V DC (20.4VDC ~ 28.8VDC) (-15% ~ +20%), 2W; supplied by external power.

7.6 CR (Control Register)

7.6.1 CR in DVP01HC-H

CR#		Address	Latched/ attribute		Register content	Description
HW	LW					
	#0	H'415E	O	R	Model name	Set up by the system, read only. DVP01HC-H model code = H'0120
	#1	H'415F	X	R/W	Counting up/down	1-phase 1 input (Software) counting up/down setting b0 = 0: counting up b0 = 1: counting down; default = K0
#3	#2	H'4160	X	R/W	Length of ring counting	16-bit counting mode, default = K65,535
	#4	H'4162	X	R/W	Instruction	Default = K0
	#5	H'4163	X	R/W	Counting mode	Range: K0 ~ K11; default = K0
#6 ~ #9		Reserved				
#11	#10	H'4168	X	R/W	Preset value	Preset value in the counter; default = K0
#13	#12	H'416A	X	R/W	YH0 comparison value	YH0 output comparison value; default = K0
#15	#14	H'416C	X	R/W	YH1 comparison value	YH1 output comparison value; default = K0
#16 ~ #19		Reserved				
#21	#20	H'4172	X	R/W	Presnet value in counter	Default = K0.
#23	#22	H'4174	X	R/W	Max. present value	Default = K0.
#25	#24	H'4176	X	R/W	Min. present value	Default = K0.
	#26	H'4178	O	R	Comparison result	-
	#27	H'4179	O	R	Action status	Counting up/down indication, On/Off status of terminals
#28		Reserved				
	#29	H'417B	X	R/W	Errors	Registers for storing all errors. See the table of error stautus for more information.
	#30	H'417C	X	R	Firmware version	Displaying the current firmware version in hex.
	#31	H'417D	O	R/W	Communication address	For setting up RS-485 communication oaddress Range: 01 ~ 255; default = K1

CR#		Address	Latched/ attribute		Register content	Description
HW	LW					
	#32	H’417E	O	R/W	Baud rate	For setting up communication speed. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) Default = H’8002 b0: 4,800 bps b1: 9,600 bps (default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5 ~ b14: reserved b15=0: RTU mode; b15 = 1: ASCII mode (default)

Symbols:

O: latched

X: non-latched (available when using RS-485 communication, not available when connected to MPU)

R: Able to read data by FROM instruction or RS-485 communication

W: Able to write data by using TO instructions or RS-485

The corresponding parameters address H’415E ~ H’417E of CR#0 ~ CR#32 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

7.6.2 CR in DVP02HC-H

CR#		Address	Latched/ attribute		Register content	Description
HW	LW					
	#0	H’415E	O	R	Model name	Set up by the system, read only. DVP02HC-H model code = H’0220
	#1	H’415F	X	R/W	Counting up/down	1-phase 1 input (Software) counting up/down setting. Up: 0, Down: 1 CH0 => b0 = 0: counting up; b0 = 1: counting down CH1 => b1 = 0: counting up; b1 = 1: counting down default = K0
	#2	H’4160	X	R/W	Instruction	Default = K0
	#3	H’4161	X	R/W	Counting mode	Range: K0 ~ K11; default = K0
#5	#4	H’4162	X	R/W	Length of ring counting at CH0	16-bit counting mode, default = K65,535
#7	#6	H’4164	X	R/W	Length of ring counting at CH1	16-bit counting mode, default = K65,535
#9	#8	H’4166	X	R/W	Preset value at CH0	Default = K0
#11	#10	H’4168	X	R/W	Preset value at CH1	Default = K0
#13	#12	H’416A	X	R/W	YH0 comparison value	YH0 output comparison value at CH0; default = K32,767
#15	#14	H’416C	X	R/W	YH1 comparison value	YH1 output comparison value at CH1; default = K32,767
#17	#16	H’416E	X	R/W	Present value at CH0	Default = K0
#19	#18	H’4170	X	R/W	Max. present value at CH0	Default = K0
#21	#20	H’4172	X	R/W	Min. present value at CH0	Default = K0
#23	#22	H’4174	X	R/W	Present value at CH1	Default = K0
#25	#24	H’4176	X	R/W	Max. present value at CH1	Default = K0
#27	#26	H’4178	X	R/W	Min. present value at CH1	Default = K0
	#28	H’417A	X	R	Comparison result	-

CR#		Address	Latched/ attribute		Register content	Description
HW	LW					
	#29	H’417B	O	R	Action status	Counting up/down indication, On/Off status of terminals of CH0 and CH1
#30			Reserved			
	#31	H’417D	X	R	Errors	Registers for storing all errors. See the table of error stautus for more information.
	#32	H’417E	O	R	Firmware version	Displaying the current firmware version in hex
	#33	H’417F	O	R/W	Communication address	For setting up RS-485 communication oaddress Range: 01 ~ 254; default = K1
	#34	H’4180	O	R/W	Baud rate	For setting up communication speed. ASCII data format: 7-bit, Even, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even, 1 stop bit (8, E, 1) Default = H’8002 b0: 4,800 bps b1: 9,600 bps (default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5 ~ b14: reserved b15=0: RTU mode; b15 = 1: ASCII mode (default)

Symbols:

O: latched

X: non-latched (available when using RS-485 communication, not available when connected to MPU)

R: Able to read data by FROM instruction or RS-485 communication

W: Able to write data by using TO instructions or RS-485

The corresponding parameters address H’415E ~ H’4180 of CR#0 ~ CR#34 are provided for user to read/write data by RS-485 communication.

1. Supports communication baud rate: 4,800, 9,600, 19,200, 38,400, 57,600 bps.
2. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, Even, 1 stop bit (7,E,1),); RTU data format (8-bit, Even, 1 stop bit (8,E,1)).
3. Function: H’03 (read many data from register); H’06 (write 1 word datum into register); H’10 (write many word data into register).

7.6.3 Explanation on CR

CR#0: Model name

[Explanation]

1. DVP01HC-H model code = H’0120.
2. DVP02HC-H model code = H’0220.
3. You can read the model name in the program to see if the extension module exists.

CR#1: Counting up/down

[Explanation]

1-phase 1 input (Software) counting up/down mode

- For DVP01HC-H:

1. b0 of CR#1 is for setting up counting up or counting down. b0 = 0: counting up; b0 = 1: counting down.
2. Default = K0, counting up

- For DVP02HC-H:

1. b0 of CR#1 is for setting up counting up or counting down of CH0. b0 = 0: counting up; b0 = 1: counting down.
2. b1 of CR#1 is for setting up counting up or counting down of CH1. b1 = 0: counting up; b1 = 1: counting down.
3. Default = K0, counting up

CR#2, 3: Length of ring counting/insturciton/counting mode

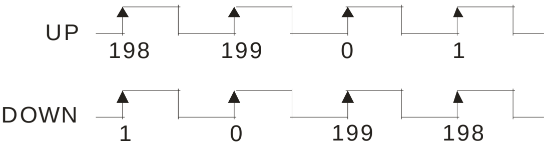
[Explanation]

The definitions of CR#2, #3 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#2, #3: Length of ring counting

1. 16-bit counting mode. Default = K65,535
2. Range: K2 ~ k65,535.
3. See the figure below for how the present value changes when the length of ring counting is set as K200.



Counting up: present value 199+1⇨0

Counting down: present value 0-1⇨199

4. Notes:
   - The CR has to be written in in 32-bit mode.
   - The CR can only be written in when the value to be written in is bigger than or equals the present value.
   - The CR can only be set up when the counter stops counting, or the counting mode is 16-bit mode.

■ For DVP02HC-H:

CR#2: Instruction.

1. The settings of instruction parameters for CH0 and CH1 (Default = K0).

CR#2	'0' (Off)	'1' (On)
b0	Counting at CH0 disabled	Counting at CH0 enabled
b1	Preset at CH0 disabled	Preset at CH0 enabled
b2	YH0 output disabled	YH0 output enabled
b3	Reserved	
b4	Counting at CH1 disabled	Counting at CH1 enabled
b5	Preset at CH1 disabled	Preset at CH1 enabled
b6	YH1 output disabled	YH1 output enabled

CR#2	'0' (Off)	'1' (On)
b7	Reserved	
b8	N/A	Reset YH0 output
b9	N/A	Set up YH0 output
b10	N/A	Reset YH1 output
b11	N/A	Set up YH1 output
b12	N/A	Reset error flag
b13 ~ b15	Reserved	

- When b0 is set as 1, terminal DIS of CH0 will be Off. The counter will allow input pulse signals.
- When b1 is set as 0, terminal PRE of CH0 will be disabled.
- When b2 is set as 1, YH0 (CH0 hardware comparison output) will be enabled.
- When b4 is set as 1, terminal DIS of CH1 will be Off. The counter will allow input pulse signals.
- When b5 is set as 0, terminal PRE of CH1 will be disabled.
- When b6 is set as 1, YH1 (CH1 hardware comparison output) will be enabled.
- When b8 is set as 1, YH0 output will be reset to Off.
- When b9 is set as 1, YH0 output will be set as On.

- When b10 is set as 1, YH1 output will be reset to Off.
- When b11 is set as 1, YH1 output will be set as On.
- When b12 is set as 1, all error flags (CR#31) will be reset.

2. Notes:
   - After setting up CR#2 is completed, b8 ~ b12 will be automatically reset to 0.
   - Before setting up the counting mode in CR#3, you have to disable the counting first (set b0, b4 of CR#2 as 0).

CR#3: Counting mode (K0 ~ K11).

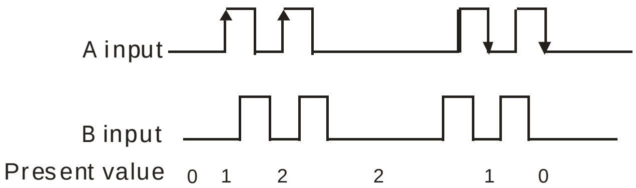
1. The counting mode of CH0 is set by b3 ~ b0 of CR#3, and the counting mode of CH1 is set by b7 ~ b4 of CR#3. Default = K0.

Counting mode		CH0_CR#3 (b3 ~ b0)		CH1_CR#3 (b7 ~ b4)	
		32-bit	16-bit	32-bit	16-bit
2-phase 2 inputs	Normal frequency (1 edge counting)	K0 (H’0)	K1(H’1)	K0 (H’0)	K1 (H’1)
	Double frequency (2 edge counting)	K2 (H’2)	K3 (H’3)	K2 (H’2)	K3 (H’3)
	4 times frequency (4 edge counting)	K4 (H4)	K5 (H’5)	K4 (H’4)	K5 (H’5)
1-phase 2 inputs	Up/down (add/subtract pulse)	K6 (H’6)	K7 (H’7)	K6 (H’6)	K7 (H’7)
1-phase 1 input	Up/down (hardware) *1	K8 (H’8)	K9 (H’9)	K8 (H’8)	K9 (H’9)
	Up/down (software) *2	K10 (H’A)	K11 (H’B)	K10 (H’A)	K11 (H’B)

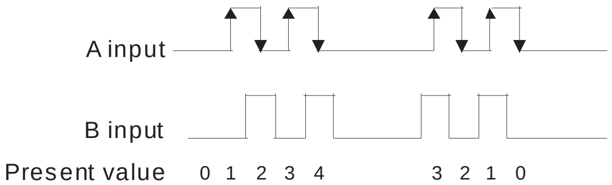
*1: Counting up/down is controlled by external input control.
*2: Counting up/down is controlled by internal control register CR#1.

2. Counting mode K0 ~ K11
   - 2-phase 2 inputs (K0 ~ K5)

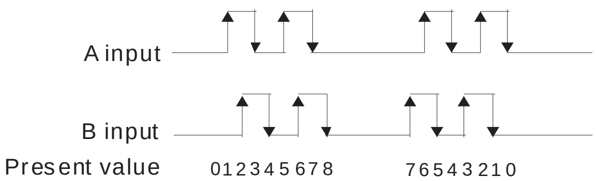
Normal frequency (K0, K1)



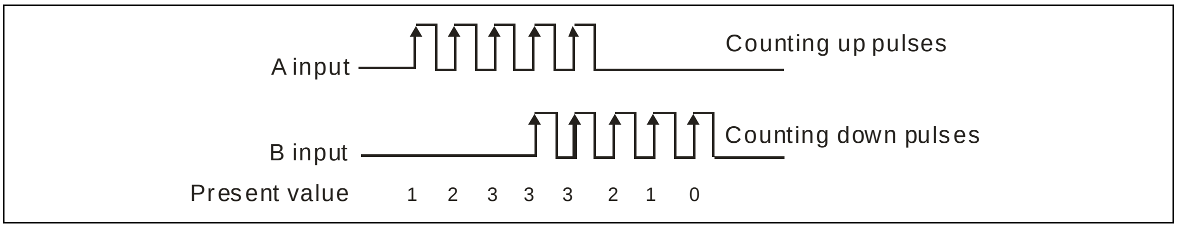
Double frequency (K2, K3)



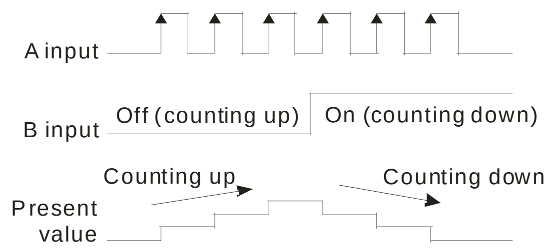
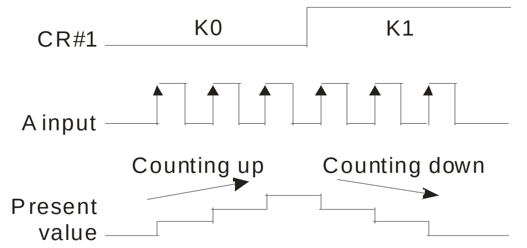
4 times frequency (K4, K5)



- 1-phase 2 inputs (K6, K7)

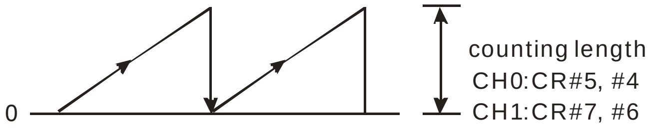


- 1-phase 1 input (K8 ~ K11)

Counting up/down controlled by external input (K8, K9)	Counting up/down controlled by internal CR (K10, K11)
	

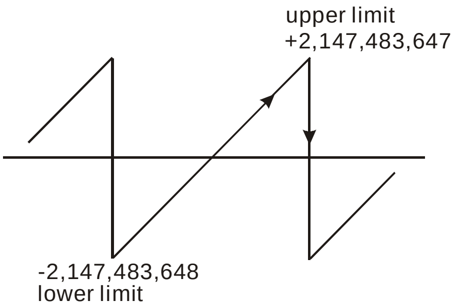
3. 16-bit mode

- When in 16-bit counting mode, all present values will be positive values. Range: 0 ~ 65,535. When overflow occurs during the counting, the present value will turn from upper limit to 0, or 0 to upper limit. The upper limit of CH0 is set in CR#5, #4, and the upper limit of CH1 is set in CR#7, #6.



4. 32-bit mode

- When in 32-bit counting mode, the counting range will be -2,147,483,648 ~ 2,147,483,647. When overflow occurs during the counting, the present value will turn from upper limit to lower limit, or lower limit to upper limit. The upper limit is fixed at +2,147,483,647 and lower limit at -2,147,483,648.



5. Notes:

- The CR can only be written in when the countings at CH0 and CH1 are disabled (b0_CR#2 = 0, b4_CR#2 = 0).
- After the CR is written, some CRs will be initialized, i.e. CR#1 = 0, CR#4, #5 = 65,535, CR#6, #7 = 65,535, CR#8, #9 = 0, 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, CR#26, #27 = 0.

CR#4, 5: Instruction/counting mode

[Explanation]

The definitions of CR#4, #5 for DVP01HC-H and DVP02HC-H are different.

- For DVP01HC-H:

CR#4: Instruction

1. The settings of instruction parameters (Default = K0).

CR#2	'0' (Off)	'1' (On)
b0	Counting disabled	Counting enabled
b1	YH0 output disabled	YH0 output enabled
b2	YH1 output disabled	YH1output enabled
b3	YH0/YH1 enabled independently	YH0/YH1 enabled interactively
b4	Preset disabled	Preset enabled
b5 ~ b7	Reserved	

CR#2	'0' (Off)	'1' (On)
b8	N/A	Reset error flag
b9	N/A	Reset YH0 output
b10	N/A	Reset YH1 output
b11	N/A	Set up YH0 output
b12	N/A	Set up YH1 output
b13 ~ b15	Reserved	

- When b0 is set as 1, terminal DIS will be Off. The counter will allow input pulse signals.
- When b1 is set as 1, YH0 (hardware comparison output) will be enabled.
- When b2 is set as 1, YH1 (hardware comparison output) will be enabled.
- When b3 is set as 1, YH0 and YH1 outputs will be interlocked, i.e. when YH0 = On, YH1 will be Off and when YH1 = On, YH0 will be Off. When b3 is set as 0, YH0 and YH1 outputs will work independently.
- When b4 is set as 0, terminal PRE will be disabled.
- When b8 is set as 1, all error flags (CR#29) will be reset.
- When b9 is set as 1, YH0 output will be reset to Off.
- When b10 is set as 1, YH1 output will be reset to Off.
- When b11 is set as 1, YH0 output will be set as On.
- When b12 is set as 1, YH1 output will be seet as On.

2. Notes:
   - After setting up CR#2 is completed, b8 ~ b12 will be automatically reset to 0.
   - Before setting up the counting mode in CR#5, you have to disable the counting first (set b0 of CR#4 as 0).

CR#5: Counting mode (K0 ~ K11) (Default = K0)

1. The counting mode is set by b3 ~ b0 of CR#5.

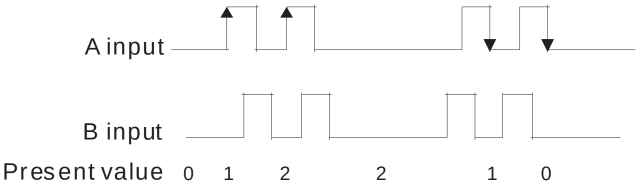
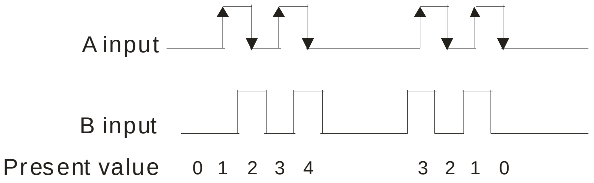
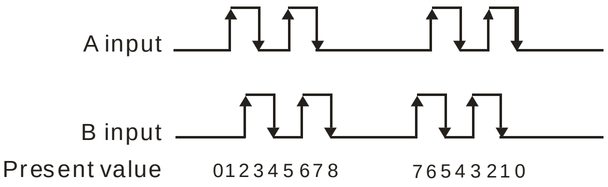
Counting mode		CR#5 (b3 ~ b0)	
		32-bit	16-bit
2-phase 2 inputs	Normal frequency (1 edge counting)	K0 (H'0)	K1 (H'1)
	Double frequency (2 edge counting)	K2 (H'2)	K3 (H'3)

Counting mode		CR#5 (b3 ~ b0)	
		32-bit	16-bit
	4 times frequency (4 edge counting)	K4 (H’4)	K5 (H’5)
1-phase 2 inputs	(Up/down) (add/subtract pulse)	K6 (H’6)	K7 (H’7)
1-phase 1 input	Up/down (hardware) *1	K8 (H’8)	K9 (H’9)
	Up/down (software) *2	K10 (H’A)	K11(H’B)

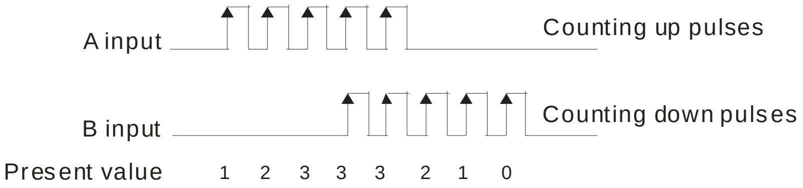
*1: Counting up/down is controlled by external input.
*2: Counting up/down is controlled by internal control register CR#1.

2. Counting mode K0 ~ K11

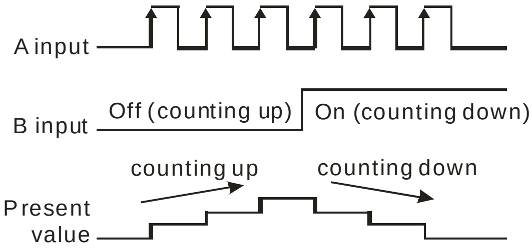
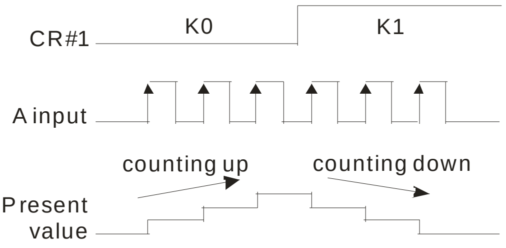
- 2-phase 2 inputs (K0 ~ K5)

Normal frequency (K0, K1)	B phase input = Off: Counting up when A phase input goes from Off to On. B phase input = Off: Counting down when A phase input goes from On to Off. 
Double frequency (K2, K3)	B phase input = Off (On): Counting up when A phase input goes from Off to On (On to Off) B phase input = Off (On): Counting down when A phase input goes from On to Off (Off to On) 
4 times frequency (K4, K5)	

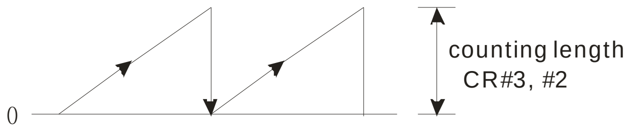
- 1-phase 2 inputs (K6, K7)



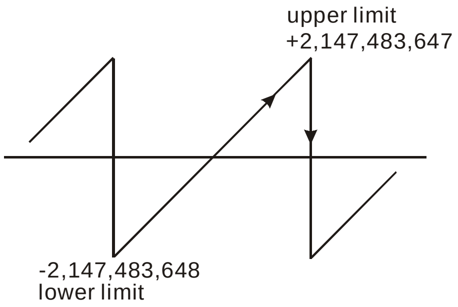
- 1-phase 1 input (K8 ~ K11)

Counting up/down controlled by external (hardware) input (K8, K9)	Counting up/down controlled by internal (software) CR (K10, K11)
	

3. 16-bit mode
   - When in 16-bit counting mode, all present values will be positive values. Range: 0 ~ 65,535. When overflow occurs during the counting up, the present value will turn from upper limit to 0. When overflow occurs during the counting down, the present value will turn from 0 to upper limit. The upper limit is set in CR#3, #2.



4. 32-bit mode
   - When in 32-bit counting mode, the counting range will be -2,147,483,648 ~ 2,147,483,647. When overflow occurs during the counting up, the present value will turn from upper limit to lower limit. When overflow occurs during the counting down, the present value will turn from lower limit to upper limit. The upper limit is fixed at +2,147,483,647 and lower limit at -2,147,483,648.

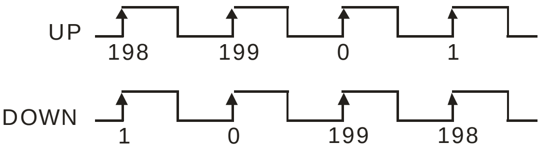


5. Notes:
   - The CR can only be written in when the counting is disabled (b0_CR#4 = 0).
   - After the CR is written, some CRs will be initialized, i.e. CR#1 = 0, CR#2, #3 = 65,535, CR#10 = 0, CR#12, #13 = 32,767, CR#14, #15 = 32,767, CR#20, #21 = 0, CR#22, #23 = 0, CR#24, #25 = 0.

■ For DVP02HC-H:

CR#4, #5: Length of ring counting at CH0

1. 16-bit counting mode. Default = K65,535.
2. Range: K2 ~ k65,535.
3. See the figure below for how the present value changes when the length of ring counting is set as K200.



Counting up: present value 199+1⇨0

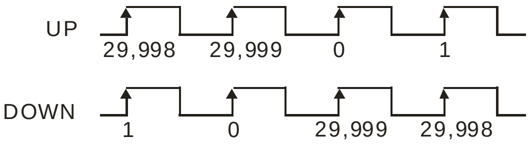
Counting down: present value 0-1⇨199

4. Notes:
   - You have to write in values in 32-bit by using DTO instruction.
   - Writing in values is only allowed whtn the value to be written in is bigger than or equals the present value.
   - The setting up is only allowed when the counter stops couonting and the counting mode is a 16-bit one.

CR#6, 7: Length of ring counting at CH1 (for DVP02HC-H)

[Explanation]

1. 16-bit counting mode. Default = K65,535.
2. Range: K2 ~ K65,535.
3. See the figure below for how the present value changes when the length of ring counting is set as K30,000..



Counting up: present value 29,999+1⇨0

Counting down: present value 0-1⇨29,999

4. Notes:
   - You have to write in values in 32-bit by using DTO instruction.
   - Writing in values is only allowed when the value to be written in is bigger than or equals the present value.
   - The setting up is only allowed when the counter stops couonting and the counting mode is a 16-bit one.

CR#8, 9: Preset value at CH0 (for DVP02HC-H)

[Explanation]

1. CR#8 is for lower word, and CR#9 is for upper word (Default = K0).
2. When the external PRE0 signal goes from Off to On, the contents in CR#9, #8 will be written into CR#17, #16 (present value at CH0).
3. Note: Writing in preset value in 16-bit mode will clear CR#9 to 0.

CR#10, 11: Preset value at counter

[Explanation]

1. CR#10 is for lower word, and CR#11 is for upper word (Default = K0).
2. Note: Writing in preset value in 16-bit mode will clear CR#11 to 0.

■ For DVP01HC-H:

CR#10, #11: Preset values at the counter

When the external PRE signal goes from Off to On, the contents in CR#11, #10 will be written into CR#21, #20 (present value at the counter).

■ For DVP02HC-H:

CR#10, #11: Preset values at CH1

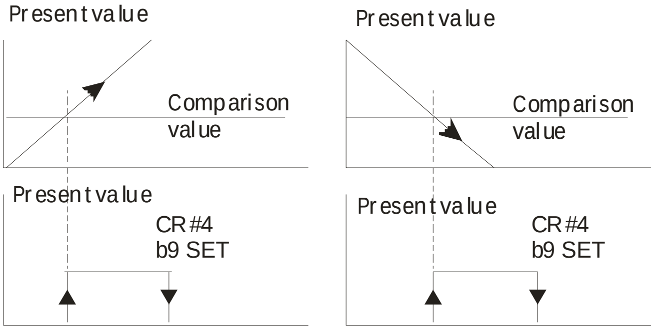
When the external PRE1 signal goes from Off to On, the contents in CR#11, #10 will be written into CR#23, #22 (present value at CH1).

CR#12, 13: YH0 comparison value

[Explanation]

■ For DVP01HC-H:

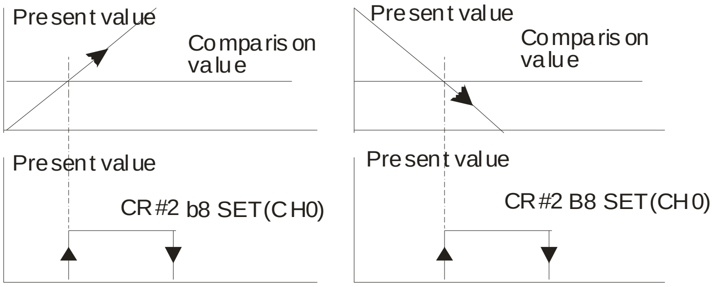
1. CR#12, #13 are for YH0 output comparison value. CR#12 is for lower word, and CR#13 is for upper word (Default = K32,767).
2. When the present value in the counter equals YH0 comparison value, YH0 output will be On and latched. You can use b9 of CH#4 to clear the output points.



3. Notes:
   - If you use PRESET or TO instruction to make the present value equal YH0 comparison value, YH0 output will be Off. Only when the counting (+1 or -1) occurs will the present value be compared with the set value. When the two values are equal, the output point will immediately be On.
   - Writing in YH0 comparison value in 16-bit mode will clear CR#13 to 0.

■ For DVP02HC-H:

1. CR#12, #13 are for YH0 output comparison value of CH0. CR#12 is for lower word, and CR#13 is for upper word. (Default = K32,767).
2. When the present value in the counter equals YH0 comparison value, YH0 output will be On and latched. You can use b8 of CR#2 to clear the output points.



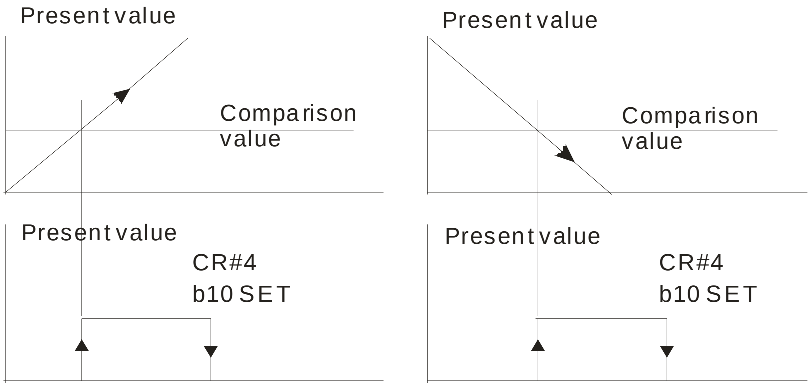
3. Notes:
    - If you use PRESET or TO instruction of CH0 to make the present value equal comparison value, YH0 output will be Off. Only when the counting (+1 or -1) occurs will the present value be compared with the set value. When the two values are equal, the output point will immediately be On.
    - Writing in YH0 comparison value in 16-bit mode will clear CR#13 to 0.

CR#14, 15: YH1 comparison value

[Explanation]

■ For DVP01HC-H:

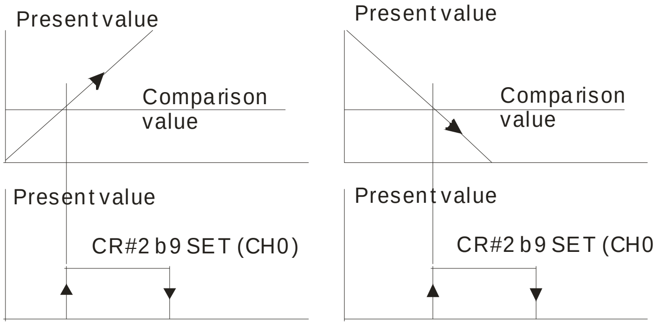
1. CR#14, #15 are for YH1 output comparison value. CR#14 is for lower word, and CR#15 is for upper word (Default = 0).
2. When the present value in the counter equals YH1 comparison value, YH1 output will be On and latched. You can use b10 of CR#4 to clear the output points.



3. Notes:
    - If you use PRESET or TO instruction to make the present value equal YH1 comparison value, YH1 output will be Off. Only when the counting (+1 or -1) occurs will the present value be compared with the set value. When the two values are equal, the output point will immediately be On.
    - Writing in YH1 comparison value in 16-bit mode will clear CR#15 to 0.

■ For DVP02HC-H:

1. CH#14, #15 are for YH1 output comparison value of CH1. CR#14 is for lower word, and CR#15 is for upper word. (Default = K32,767).
2. When the present value in the counter equals YH1 comparison value, YH1 output will be On and latched. You can use b9 of CH#2 to clear the output points.



3. Notes:
   - If you use PRESET or TO instruction of CH0, CH1 to make the present value equal comparison value, CH0_YH0 and CH1_YH1 will be Off. Only when the counting (+1 or -1) occurs will the present value be compared with the set value. When the two values are equal, the output point will immediately be On.
   - Writing in YH0 comparison value in 16-bit mode will clear CR#13 to 0. Writing in YH1 comparison value in 16-bit mode will clear CR#15 to 0.

CR#16, 17: Present value at CH0 (for DVP02HC-H)

[Explanation]

1. CR#16 is for lower word, and CR#17 is for upper word. (Default = K0).
2. Notes:
   - Write in values in 32-bit.
   - In 16-bit mode, the value written in should be smaller than the length of ring counting of CH0 (CR#4, #5)
   - In 16-bit mode, writing in present value of CH0 will clear CR#17 to 0.

CR#18, 19: Maximum present value at CH0 (for DVP02HC-H)

[Explanation]

1. CH#18 is for lower word, and CH#19 is for upper word. (Default = K0).
2. CR#18, #19 record the maximum value ever counted in the counter at CH0.

CR#20, 21: Present value/minimum present value at CH0

[Explanation]

The definitions of CR#20, #21 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#20, #21: Present value.

1. CR#20 is for lower word, and CR #21 is for upper word. (Default = K0).
2. Notes:
   - Write in values in 32-bit.
   - In 16-bit mode, the value written in should be smaller than the length of ring counting of CH1 (CR#2, #3).
   - In 16-bit mode, writing in present value will clear CR#21 to 0.

■ For DVP02HC-H:

CR#20, #21: Minimum present value at CH0

1. CR#20 is for lower word, and CR#21 is for upper word. (Default = K0).
2. CR#20, #21 record the minimum value ever counted in the counter at CH0.

CR#22, 23: Maximum present value/present value at CH1

[Explanation]

The definitions of CR#22, #23 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#22, #23: Maximum present value

1. CR#22 is for lower word, and CR #23 is for upper word. (Default = K0).
2. CR#22, #23 record the maximum value ever counted in the counter.

■ For DVP02HC-H:

CR#22, #23: Present value at CH1.

1. CR#22 is for lower word, and CR#23 is for upper word. (Default = K0).
2. Notes:
    - Write in values in 32-bit.
    - In 16-bit mode, the value written in should be smaller than the length of ring counting of CH1 (CR#6, #7).
    - In 16-bit mode, writing in present value of CH1 will clear CR#23 to 0.

CR#24, 25: Minimum present value/maximum present value at CH1

[Explanation]

The definitions of CR#24, #25 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#24, #25: Minimum present value.

1. CR#24 is for lower word, and CR#25 is for upper word. (Default = K0)
2. CR#24, #25 record the minimum value ever counted in the counter

■ For DVP02HC-H:

CR#24, #25: Maximum present value at CH1.

1. CR#24 is for lower word, and CR#25 is for upper word. (Default = K0)
2. CR#24, #25 record the maximum value ever counted in the counter at CH1.

CR#26, 27: Comparison result/action status/minimum present value at CH1

[Explanation]

The definitions of CR#26, #27 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#26: Comparison result.

The comparison result of the present value in the counter and set values in YH0 and YH1:

CR#26		‘0’ (Off)	‘1’ (On)
YH0	b0	SV≧PV	SV < PV
	b1	SV≠PV	SV = PV
	b2	SV≦PV	SV > PV
b3		Reserved	

CR#26		‘0’ (Off)	‘1’ (On)
YH1	b4	SV≧PV	SV < PV
	b5	SV≠PV	SV = PV
	b6	SV≦PV	SV > PV
b7 ~ b15		Reserved	

PV: present value; SV: set value

CR#27: Action status.

The indication of counting up/down and terminal status (On/Off):

CR#27	‘0’ (Off)	‘1’ (On)
b0	-	Counting up
b1	-	Counting down
b2	A input Off	A input On
b3	B input Off	B input On
b4	PRE input Off	PRE input On

CR#27	‘0’ (Off)	‘1’ (On)
b5	DIS input Off	DIS input On
b6	YH0 output Off	YH0 output On
b7	YH1 output Off	YH1 output On
b8 ~ b15	Reserved	

- For DVP02HC-H:

CR#26, #27: Minimum present value at CH1

1. CR#26 is for lower word, and CR#27 is for upper word. (Default = K0)
2. CR#26, #27 record the minimum value ever counted in the counter at CH1.

CR#28: Comparison result (for DVP02HC-H)

[Explanation]

The comparison result of the present value in the counter at CH0, CH1 and set values in YH0, YH1:

CR#28		‘0’ (Off)	‘1’ (On)
YH0 (CH0)	b0	SV≧PV	SV < PV
	b1	SV≠PV	SV = PV
	b2	SV≦PV	SV > PV
b3		Reserved	

CR#28		‘0’ (Off)	‘1’ (On)
YH1 (CH1)	b4	SV≧PV	SV < PV
	b5	SV≠PV	SV = PV
	b6	SV≦PV	SV > PV
b7 ~ b15		Reserved	

PV: present value; SV: set value

CR#29: Error status/action status

[Explanation]

The definitions of CR#29 for DVP01HC-H and DVP02HC-H are different.

- For DVP01HC-H:

CR#29: Error status.

The data registers for storing all error statuses.

CR#29	Error status
b1 ~ b3, b7 ~ b15	Reserved
b4	CR# designated by FROM/TO instruction exceeds the range.
b5	Overflow when the present value in counting up exceeds the upper limit. (The upper limit for 16-bit mode is stored in CR#2. The upper limit for 32-bit mode is K2,147,483,647.)
b6	Overflow when the present value in counting down falls below the lower limit. (The lower limit for 16-bit mode is 0. The lower limit for 32-bit mode is K-2,147,483,648.)

- For DVP02HC-H:

CR#29: Action status.

The indication of counting up/down and terminal status (On/Off) of CH0 (b0 ~ b6) and CH1 (b8 ~ b14):

CR#29_CH0	'0' (Off)	'1' (On)
b0	-	Counting up (Up_0)
b1	-	Counting down (Dn_0)
b2	A0 input Off	A0 input On
b3	B0 input Off	B0 input On
b4	PRE0 input Off	PRE0 input On
b5	DIS0 input Off	DIS0 input On
b6	YH0 output Off	YH0 output On
b7	Reserved	

CR#29_CH1	'0' (Off)	'1' (On)
b8	-	Counting up(Up_1)
b9	-	Counting down (Dn_1)
b10	A1 input Off	A1 input On
b11	B1 input Off	B1 input On
b12	PRE1 input Off	PRE1 input On
b13	DIS1 input Off	DIS1 input On
b14	YH1output Off	YH1 output On
b15	Reserved	

CR#30: Firmware version (for DVP01HC-H)

[Explanation]

The firmware version is displayed in hex, e.g. V1.00 is indicated as H'0100.

CR#31: Communication address/error status

[Explanation]

The definitions of CR#31 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#31: Communication address

For setting up RS-485 communication address. Range: 01 ~ 255; default = K1.

■ For DVP02HC-H:

CR#31: Error status

The data register for storing all error statuses.

CR#31	Error status
b0	Overflow when the present value in CH0 counting up exceeds the upper limit. (The upper limit for 16-bit mode is stored in CR#2 and CR#5. The upper limit for 32-bit mode is K2,147,483,647.)
b1	Overflow when the present value in CH0 counting down falls below the lower limit. (The lower limit for 16-bit mode is 0. The lower limit for 32-bit mode is K-2,147,483,648.)
b2	Overflow when the present value in CH1 counting up exceeds the upper limit. (The upper limit for 16-bit mode is stored in CR#6 and CR#7. The upper limit for 32-bit mode is K2,147,483,647.)
b3	Overflow when the present value in CH1 counting down falls below the lower limit. (The lower limit for 16-bit mode is 0. The lower limit for 32-bit mode is K-2,147,483,648.)
b4 ~ b5	Reserved
b6	CR# designated by FROM/TO instruction exceeds the range.
b7	The setting of RS-485 communication (CR#33, CR#34) is incorrect.
b8 ~ b15	Reserved

CR#32: Communication speed (baud rate) setting/firmware version

[Explanation]

The definitions of CR#32 for DVP01HC-H and DVP02HC-H are different.

■ For DVP01HC-H:

CR#32: Baud rate

1. The setting of RS-485 communication speed, available in 4,800, 9,600, 19,200, 38,400 and 57,600bps (bps stands for bits per second). Default = H’8002.
2. The format of ASCII data is 7 bits, Even, 1 stop bit (7, E, 1); the format of RTU data is 8 bits, Even, 1 stop bit (8, E, 1).

CR#32	Baud rate
b0 = 1	4,800bps
b1 = 1	9,600bps
b2 = 1	19,200bps
b3 = 1	38,400bps

CR#32	Baud rate
b4=1	57,600bps
b5 ~ b14	Reserved
b15	b15 = 1: ASCII, b15 = 0: RTU

■ For DVP02HC-H:

CR#32: Firmware version

The firmware version is displayed in hex, e.g. V1.00 is indicated as H’0100.

CR#33: Communication address setting (for DVP02HC-H)

[Explanation]

The setting of RS-485 communication address. Range: 01 ~ 254. Default = K1.

CR#34: Communication speed (baud rate) setting (for DVP02HC-H)

[Explanation]

1. Baud rate could be 4,800, 9,600, 19,200, 38,400, 57,600 bps. Default is H’8002.
2. The format of ASCII data is 7 bits, Even, 1 stop bit (7, E, 1); the format of RTU data is 8 bits, Even, 1 stop bit (8, E, 1).

CR#32	Baud rate
b0 = 1	4,800bps
b1 = 1	9,600bps
b2 = 1	19,200bps
b3 = 1	38,400bps

CR#32	Baud rate
b4 = 1	57,600bps
b5 ~ b14	Reserved
b15	b15 = 1: ASCII, b15 = 0: RTU

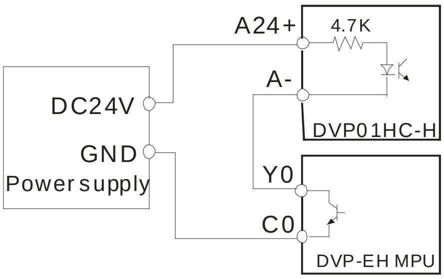
7.7 The Applications

7.7.1 1-phase 1 Input Counting Up/Counting Down. Take DVP01HC-H as Example:

1. Description
   - Set CR#4 to K0 (H’0) to disable the counting of DVP01HC-H.
   - Set CR#5 to K11 (H’B) to enter 1-phase 1 input 16-bit mode.
   - Set CR#1 to decide counting up or counting down. (Default = counting up)

- Enable the counter.

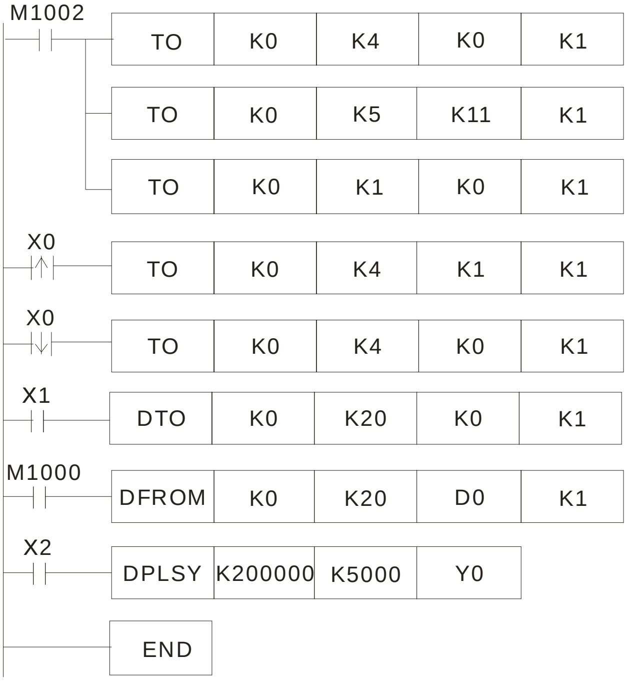
2. Devices
    - X0 = On: Enable the counter
    - X0 = Off: Stop counting
    - X1 = On: Clear the present value after the counting is completed.
    - X2 = On: DVP32EH00T MPU outputs 1-phase 1 pulse signals from Y0 to A-phase input of DVP01HC-H.
3. Wiring



4. Program explanation
    - When PLC goes from STOP to RUN, set CR#4 to K0 (H'0) to disable the counter.
    - Set CR#5 to K11 (H'B), i.e. 1-phase 1 input 16-bit mode.
    - Set CR#1 to decide counting up or counting down. (Default = K0, counting up).
    - When X0 = On, the counter will be enabled and start to count.
    - When X0 = Off, the counter will be disabled.
    - After the counting is completed, turn On X1 to clear the "present value" recorded in CR#20.
    - On/Off of X2 decides whether DVP-EH PLC offers 200kHZ output (5,000 pulses).

5. Program example

Ladder diagram:



Explanation:

Disable the counting of the counter.

Set to 1-phase 1 input 16-bit mode.

Set to counting up or counting down

Enable the counting of the counter.

The counting stops.

Clear “present value” recorded in CR#20.

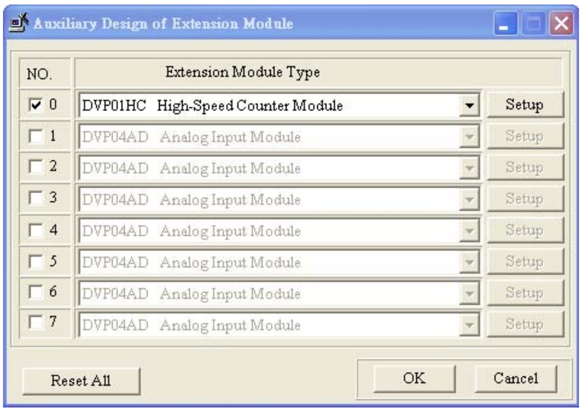
Read “present value” recorded in CR#20

DVP-EH outputs counting pulses.

7.7.2 How to Set the Module Wizard in WPLSoft

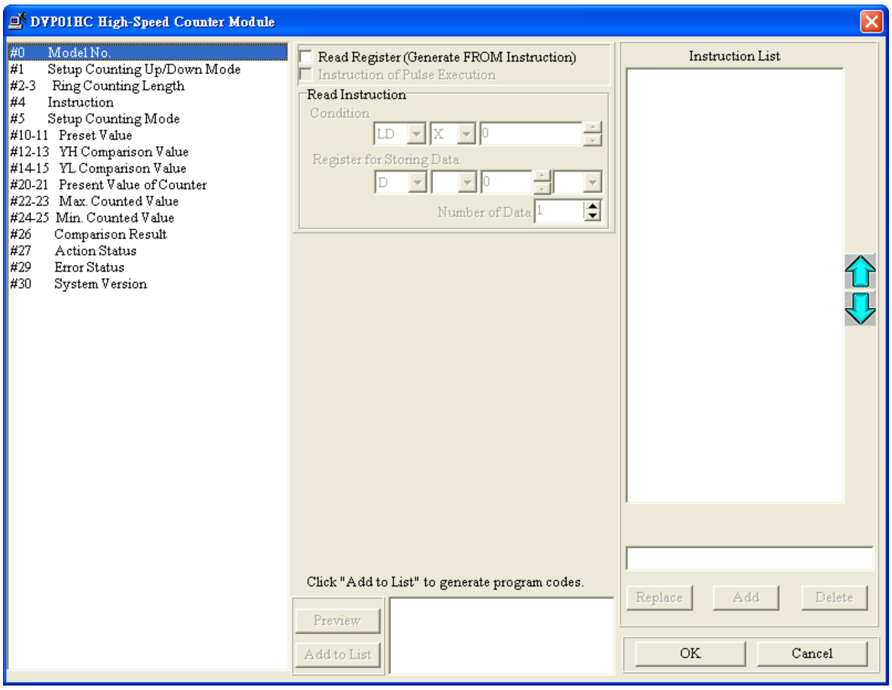
1. Open WPLSoft and click on

2. You will see the “Auxiliary Design of Extension Module” window. Click on NO. “0” and select “DVP01HC High-Speed Counter Module”.


Auxiliary Design of Extension Module

NO.	Extension Module Type	
☑ 0	DVP01HC High-Speed Counter Module	Setup
☐ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

3. You will then see this window.



4. Next, let's take 7.7.1 1-phase 1 input counting up/counting down as example.

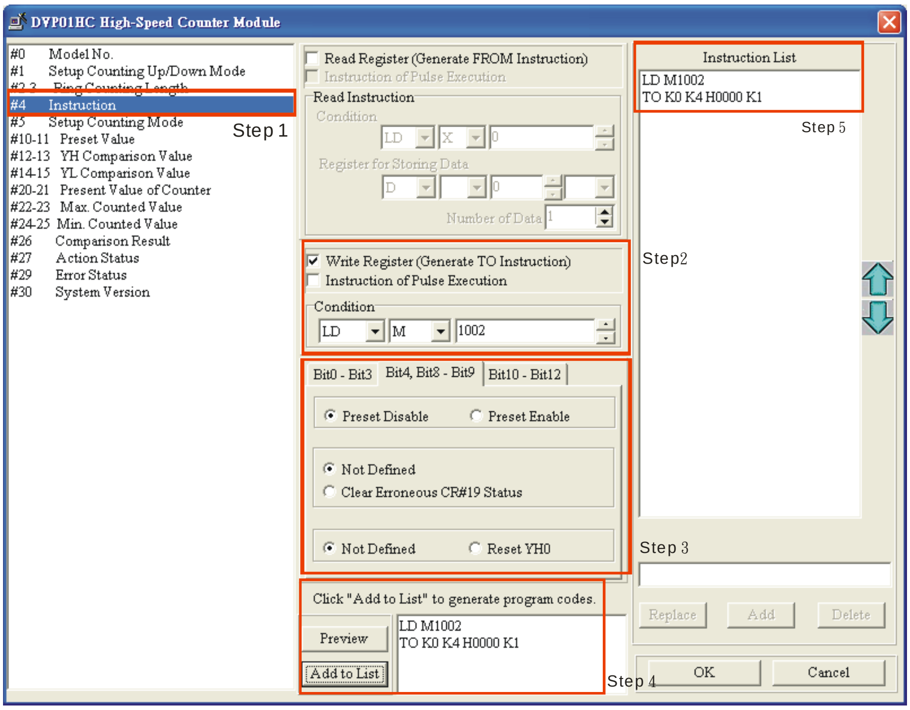
Step 1: Select "#4 Instruction".

Step 2: Check "Write Register" to generate TO instruction. Set the condition as "LD M1002".

Step 3: Set Bit0~Bit3 and Bit4~Bit9 to "Preset Disable".

Step 4: Click "Preview" to check if the generated program codes are correct.

Step 5: Click "Add to List" to display the instruction codes in "Instruction List". The setup of CR#4 is completed.



☑ Write Register (Generate TO Instruction)

☐ Instruction of Pulse Execution

Condition: LD M 1002

● Preset Disable

● Not Defined

● Not Defined

```
LD M1002
TO K0 K4 H0000 K1
```

5. Setting up CR#5 is similar to the setup pf CR#4.

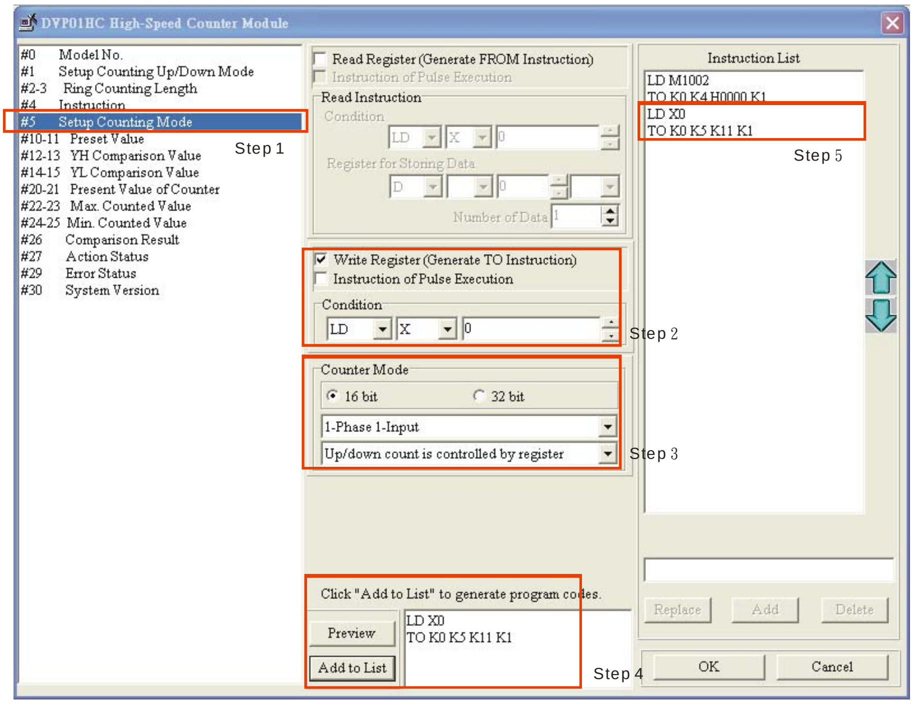
Step 1: Select “#5 Setup Counting Mode”.

Step 2: Check “Write Register” to generate TO instruction. Set the condition as “LD X0”.

Step 3: Set the Counter Mode to “16 bit”, “1-Phase 1-Input” and “Up/down count is controlled by register”

Step 4: Click “Preview” to check if the generated program codes are correct.

Step 5: Click “Add to List” to display the instruction codes in “Instruction List”. The setup of CR#5 is completed.



#0 Model No.
#1 Setup Counting Up/Down Mode
#2-3 Ring Counting Length
#4 Instruction
#5 Setup Counting Mode
#10-11 Preset Value
#12-13 YH Comparison Value
#14-15 YL Comparison Value
#20-21 Present Value of Counter
#22-23 Max. Counted Value
#24-25 Min. Counted Value
#26 Comparison Result
#27 Action Status
#29 Error Status
#30 System Version

☑ Write Register (Generate TO Instruction)
☐ Instruction of Pulse Execution
Condition: LD X 0

Counter Mode: ● 16 bit ○ 32 bit
1-Phase 1-Input
Up/down count is controlled by register

Click "Add to List" to generate program codes.

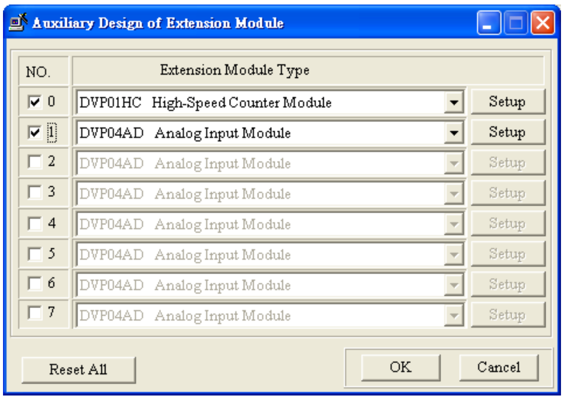
```
LD X0
TO K0 K5 K11 K1
```

Instruction List:

```
LD M1002
TO K0 K4 H0000 K1
LD X0
TO K0 K5 K11 K1
```

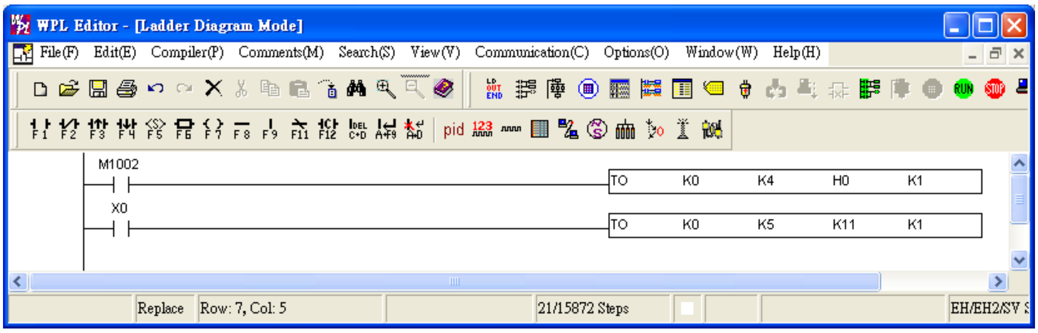
6. The setup of other CR parameters can follow the steps illustrated above.

7. After you complete all the setups, click on "OK" to return to the “Auxiliary Design of Extension Module” window and continue to set up other modules.



NO.	Extension Module Type	
☑ 0	DVP01HC High-Speed Counter Module	Setup
☑ 1	DVP04AD Analog Input Module	Setup
☐ 2	DVP04AD Analog Input Module	Setup
☐ 3	DVP04AD Analog Input Module	Setup
☐ 4	DVP04AD Analog Input Module	Setup
☐ 5	DVP04AD Analog Input Module	Setup
☐ 6	DVP04AD Analog Input Module	Setup
☐ 7	DVP04AD Analog Input Module	Setup

8. After you complete the setups of all the modules, click on “OK” to generate the program below.



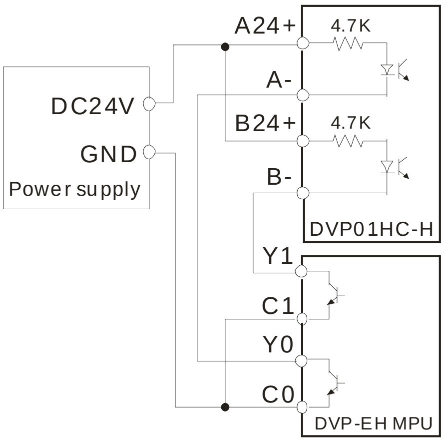
```
M1002
--| |------------------------------ TO  K0  K4  H0   K1
X0
--| |------------------------------ TO  K0  K5  K11  K1
```

Replace | Row: 7, Col: 5 | 21/15872 Steps | EH/EH2/SV

9. If you need to add in other control programs, you can edit the program directly in the ladder diagram window in WPLSoft.

7.7.3 1-phase 2 Inputs Counting Up/Counting Down. Take DVP01HC-H as Example:

1. Description
   - Set CR#4 to K0 (H'0) to disable the counting of DVP01HC-H.
   - Set CR#5 to K7 (H'7) to enter 1-phase 2 inputs 16-bit mode.
   - Enable the counter.
2. Devices
   - X0 = On: Enable the counter
   - X0 = Off: Stop counting
   - X1 = On: Clear the present value after the counting is completed.
   - X2 = On: DVP32EH00T MPU outputs pulses from Y0 to A-phase input of DVP01HC-H.
   - X3 = On: DVP32EH00T MPU outputs pulses from Y2 to B-phase input of DVP01HC-H.
3. Wiring

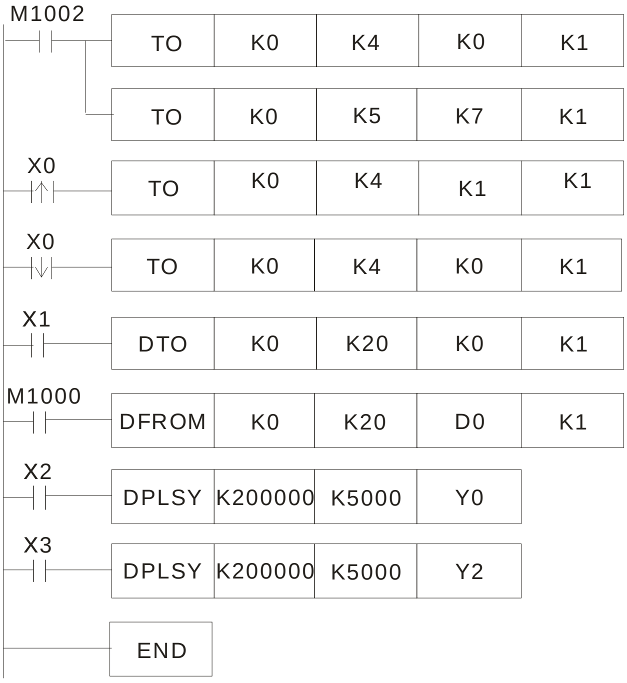


4. Program explanation
   - When PLC goes from STOP to RUN, set CR#4 to K0 (H'0) to disable the counter.
   - Set CR#5 to K7 (H'7), i.e. 1-phaes 2 inputs16-bit mode.
   - When X0 = On, the counter will be enabled and start to count.
   - When X0 = Off, the counter will be disabled.
   - After the counting is completed, turn On X1 to clear the "present value" recorded in CR#20.
   - Store the "present value" recorded in CR#20 to D0 register of the PLC.
   - When X2 = On, DVP-EH MPU outputs pulses from Y0 to A-phase input of DVP01HC-H for counting up.
   - When X3 = On, DVP-EH MPU outputs pulses from Y2 to B-phase input of DVP01HC-H for

counting down.

5. Program example

Ladder diagram:



Explanation:

Diable the counting of the counter.

Set to 1-phase 2 inputs 16-bit mode.

Enable the counting of the counter.

The counting stops.

Clear “present value” recorded in CR#20.

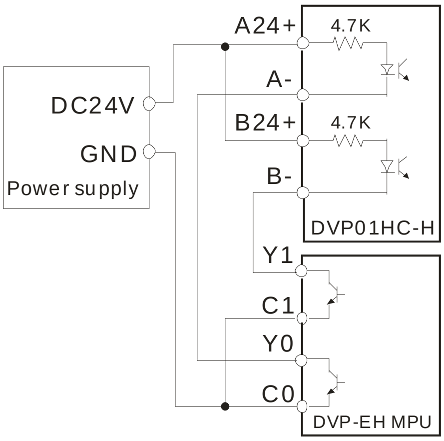
Read “present value” recorded in CR#20.

DVP-EH outputs counting pulses (A-phase)

DVP-EH outpus counting pulses (B-phase)

7.7.4 2-phase 2 Inputs (A/B-phase) Counting Mode. Take DVP01HC-H as Example:

1. Description
   - Set CR#4 to K0 (H’0) to disable the counting of DVP01HC-H.
   - Set CR#5 to K1 (H’1) to enter 2-phaes 2 inputs 16-bit (normal frequency) mode.
   - Enable the counter.
2. Devices
   - X0 = On: Enable the counter; X0 = Off: disable the counter.
   - X1 = On: Clear the present value after the counting is completed.
   - X2 = On: DVP32EH00T MPU outputs 2-phase pulses from Y0/Y1 to A/B-phase input of DVP01HC-H.
3. Wiring



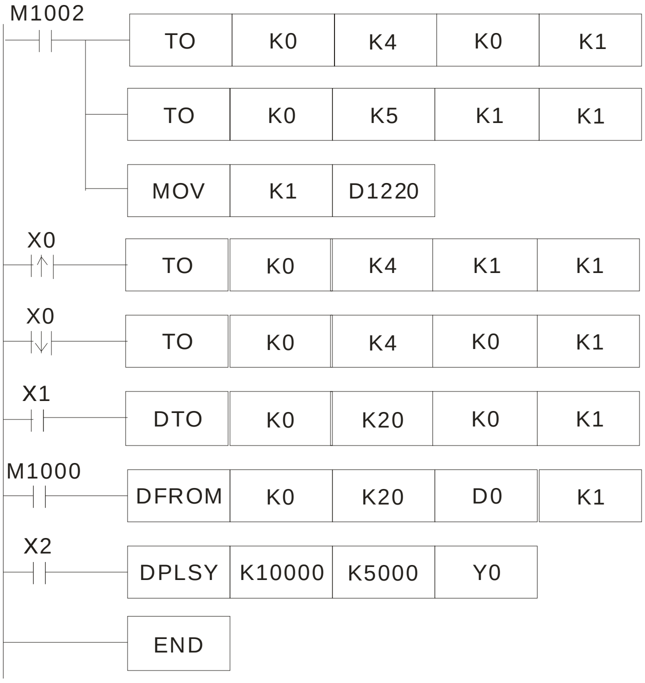
4. Program explanation
   - When PLC goes from STOP to RUN, set CR#4 to K0 (H’0) to disable the counter.

- Set CR#5 to K1 (H'1), i.e. 2-phase 2 inputs 16-bit (normal frequency) mode.
- Write K1 into D1220 of DVP-EH MPU to output 2-phase 2 (A/B-phase pulses) from Y0/Y1.
- When X0 = On, the counter will be enabled and start to count.
- When X0 = Off, the counter will be disabled.
- After the counting is completed, turn On X1 to clear the "present value" recorded in CR#20.
- Store the "present value" recorded in CR#20 to D0 register of the PLC.
- When X2 = On, DVP32EH00T MPU outputs 100kHZ 2-phase pulses from Y0/Y1 to A/B-phase input of DVP01HC-H.

5. Program example

Ladder diagram:

Explanation:



Disable the counting of the counter.

Set to 2-phase 2 inputs 16-bit (normal frequency) mode.

DVP-EH outputs A/B-phase pulses from Y0/Y1.

Enable the counting of the counter.

The counting stops.

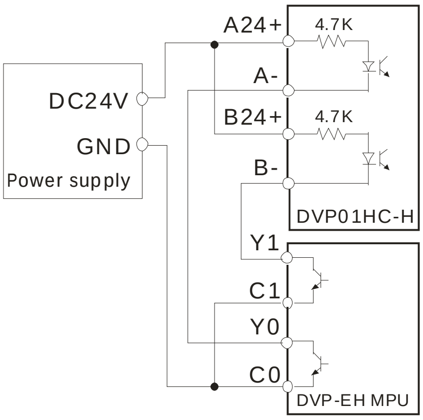
Clear "present value" recorded in CR#20.

Read "present value" recorded in CR#20.

DVP-EH outputs counting pulses (A/B-phase)

7.7.5 Application Scenario: When the Counting Reaches Its Target. Take DVP01HC-H as Example:

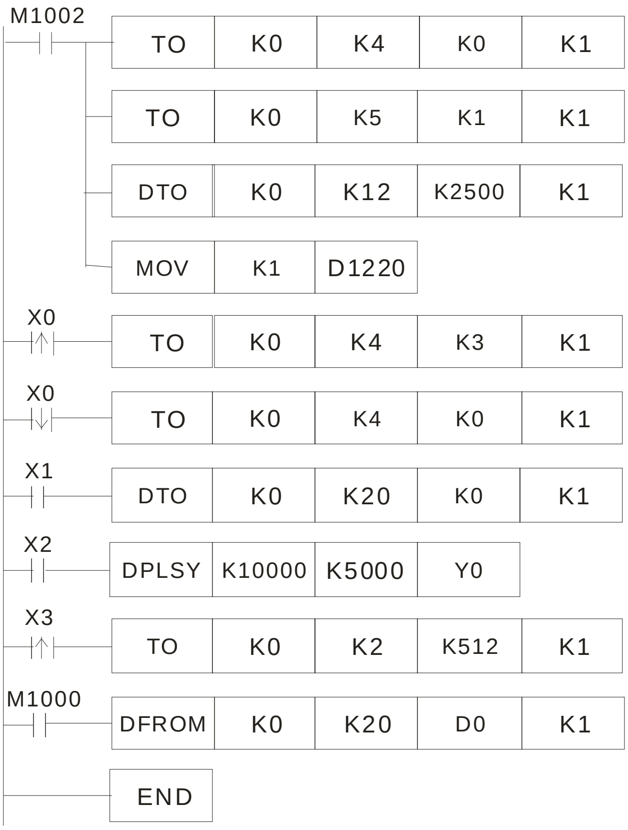
1. Description
    - Set CR#4 to K0 (H'0) to disable the counting of DVP01HC-H.
    - Set CR#5 to K1 (H'1) to enter 2-phase 2 inputs 16-bit (normal frequency) mode.
    - Set up the target value in CR#12 (YH0 comparison value).
    - Enable the counter.
2. Devices
    - X0 = On: Enable the counter and YH0 output when the comparison reaches its targe. X0 = Off: Disable the counter and YH0 output when the comparison reaches its targe.
    - X1 = On: Clear the present value after the counting is completed.
    - X2 = On: DVP32EH00T outputs 2-phase pulses from Y0/Y1 to A/B-phase input of DVP01HC-H.
    - X3 = On: Clear YH0 output when the counting reaches its target.
3. Wiring



4. Program explanation
   - When PLC goes from STOP to RUN, set CR#4 to K0 (H'0) to disable the counter.
   - Set CR#5 to K1 (H'1), i.e. 2-phase 2 inputs 16-bit (normal frequency) mode.
   - Set up the target value in CR#12 (YH0 comparison value).
   - Write K1 into D1220 of DVP-EH MPU to output A/B-phase pulses from Y0/Y1.
   - When X0 = On, the counter will be enabled and start to count.
   - When X0 = Off, the counter will be disabled.
   - After the counting is completed, turn On X1 to clear the "present value" recorded in CR#20.
   - When X2=On, DVP32EH00T MPU outputs 10kHZ 2-phase pulses from Y0/Y1 to A/B-phase input of DVP01HC-H.
   - After the counting reaches is target and YH0 output, you can clear YH0 output if X3 = On.
   - Store the "present value" recorded in CR#20 to D0 register of the PLC.
5. Program example

Ladder diagram:

Explanation:



Disable the counting of the counter.

Set to 2-phase 2 inputs 16-bit (normal frequency) mode.

Set up the target value.

DVP-EH outputs A/B-phase pulses from Y0/Y1.

Enable the counting of the counter.

The counting stops.

Clear "present value" recorded in CR#20.

DVP-EH outputs counting pulses (A/B-phase)

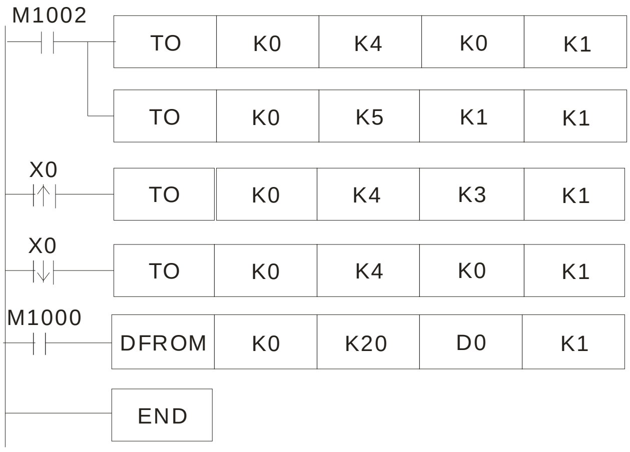
After the counting reaches is target and YH0 output, YH0 output can be cleared if X3 = On.

Read "present value" recorded in CR#20.

7.7.6 Encoder Output Pulses Counting. Take DVP01HC-H as Example:

1. Description
    - This application realizes the output pulse counting of an encoder by a high-speed counter module.
    - Due to that DVP01HC-H stores the present value in the CR register; therefore, you only need to read the content in the register and compare it with the actual number of pulses. The offset value obtained from the comparison can be used as the compensation for the next pulse output, that is, the feedback adjustment.
    - If you can monitor the value obtained on a human machine interface, you will be able to acquire the pulse output condition at any time. Further, you can convert the pulse value into distance value to be used as the moving distance datum for your reference after the pulse output.
2. Devices
    - D0: present counting value.
    - X0: Swith to enable/disable the counting.
3. Program explanation
    - When PLC goes from STOP to RUN, the counting will be disabled first. In the disabled mode, set the counting mode to 2-phase 2 inputs.
    - When X0 goes from Off to On, the counter will be enabled. When X0 goes from On to Off, the counter will be disabled.
    - After the counter is enabled, the present value obtained will be stored in D0 register.
4. Program example

Ladder diagram:



Explanation:

Disable the counting of the counter.

Set to 2-phase 2 inputs 16-bit (normal frequency) mode.

Enable the counting of the counter.

The counting stops.

Read “present value” recorded in CR#20.

MEMO

8 DVP-EH MPU Function Extension Card

8.1 Outline

Only DVP-EH and DVP-EH2 series PLC support function extension cards. The functions of the extension cards include: digital points extension, analog points extension, digital switch, analog rotary switches, adding communication ports, establishing MODEM functions and so on. In terms of application, the extension card enhances the function of DVP-EH series MPU. Each extension card has its own definition in the special relay or special register inside PLC, which improves the handiness of applications.

8.2 Introduction

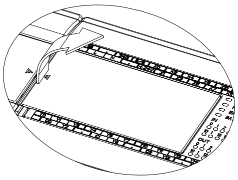
DVP series function extension cards include: DVP-F232 (RS-232 card), DVP-F422 (RS-422 card), DVP-F2AD (analog input card), DVP-F2DA (analog output card), DVP-F232S (COM3 RS-232 card), DVP-F485S (COM3 RS-485 card), DVP-F8ID (digital input DIP switch card), DVP-F4IP (digital input point extension card), DVP-F2OT (digital transistor input extension card), DVP-F6VR (analog input extension card) and DVP-256FM (data backup memory card). See the following sections for detailed introduction of each card.

DVP series function extension cards solve the problems frequently occurring in the applications of PLC, for example:

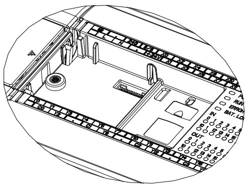
When to use?	Solution
You are modifying the system specifications and are short of 1 ~ 4 input points or 1 ~ 2 output points.	DVP-F4IP or DVP-F2OT
The output point of the MPU is relay, and you happen to need 1 ~ 2 transistor points.	DVP-2OT
You do not have enough installation space, but you still would like to process analog signals.	DVP-F2AD or DVP-F2DA
You would like to have 1 ~ 2 points of analog output to control the rotation speed of AC motor drive.	DVP-F2DA
You would like the small control system to receive 1 ~ 2 points of analog signals.	DVP-F2AD
You would like the PLC to connect to PC, HMI and AC motor drive at the same time.	DVP-F232S or DVP-F485S
There are many PLCs which need to download programs quickly (PLC copy)	DVP-256FM
You are setting up parameters but do not want to waste input points.	DVP-F8ID
The built-in COM2 is RS-485, but you actually need RS-232 or RS-422.	DVP-F232 or DVP-F422
You would like to remote control PLC by MODEM.	DVP-F232
3 ~ 8 parameters have to be adjusted all the time according to the actual condition.	DVP-F6VR

8.3 Installation & Maintenance

1. Switch off the power of the PLC and open the extension slot when you install or remove the extension card or memory card. See the figure below for where to insert the card. If you are installing a function extension card, please attach the correct model sticker onto the terminal in case you make mistakes on the wiring.



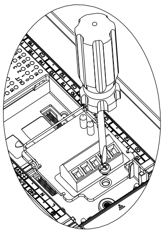
⇨



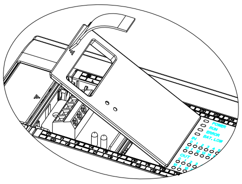
2. How to install/remove function extension card: Place the card vertically into the slot and screw it

tightly.

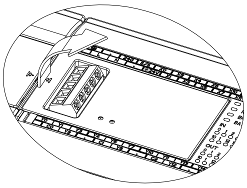
Install



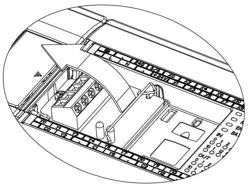
⇨



Remove

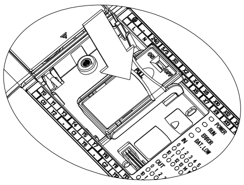


⇨

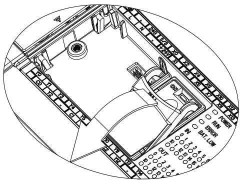


3. How to install (turn On or Off the switch according to the actual condition) /remove backup memory card:

Installation



Removal



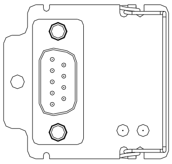
4. Installation check

Switch on the PLC and connect it to WPLSoft on the PC. Go to “View” -> “Workspace” and select the connected model in the workspace. WPLSoft next detects the configuration of the PLC and displays the result in the workspace, including the type of the extension card and status (On/Off) of the backup memory card. See WPLSoft user manual for more details.

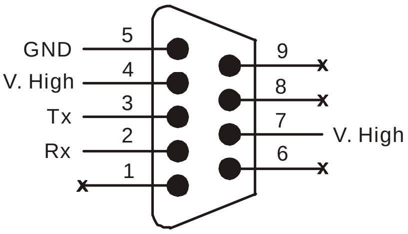
8.4 Product Introduction

8.4.1 DVP-F232 (RS-232 card)

1. Outline (DB-9 male)



2. Terminals



V. High: logic high and logic 1

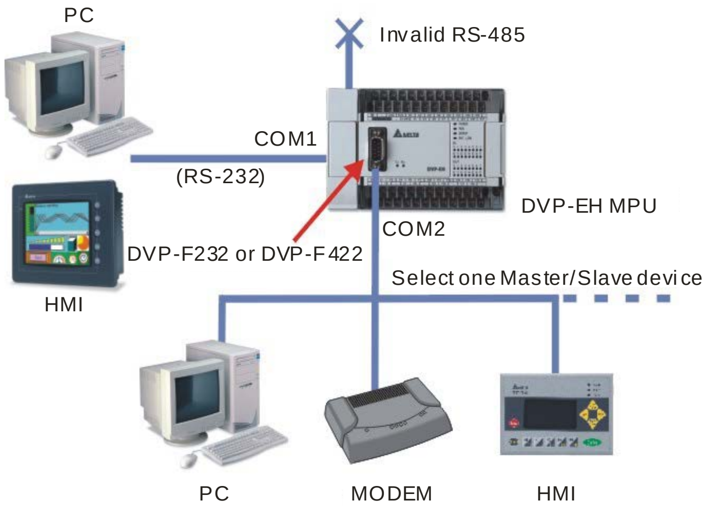
- Please note the signal from PIN 2 and PIN 3 when the communication port is connected to PC or HMI.

3. Communication protocol

Item		Explanation
Model name		DVP-F232
Transmission specification		RS-232C
Isolation method		No isolation
Transmission distance		15m
Power consumption		30mA/DC5V (supplied by PLC MPU)
Communication protocol	Mode	Master/Slave, semi-duplex, bidirectional data transmission / receiving
	Baud rate	110 ~ 115,200 bps (bit/sec)
	Data bit	7 or 8
	Stop bit	1 or 2
	Parity bit	None, Even, Odd
Communication indication		TX (data transmission), RX (data receiving)
Connectable device		Devices with RS-232C interface

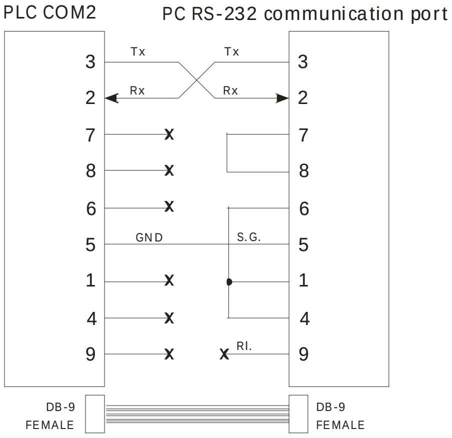
4. Functions

- Your PLC MPU is built in with COM1 (RS-232) and COM2 (RS-485), and you would like COM2 to be RS-232 and connect to PC or a MODEM. In this case, you can adopt DVP-F232. Except for the communication interface, other communication functions of DVP-F232 are the same as the existing COM2, and it can be a Slave or Master, supporting baud rate 9,600 ~ 115,200bps. However, please note that when DVP-F232, the RS-485 on the existing COM2 will become invalid, and COM2 will be occupied by DVP-F232 (RS-232). See below for the system connection:

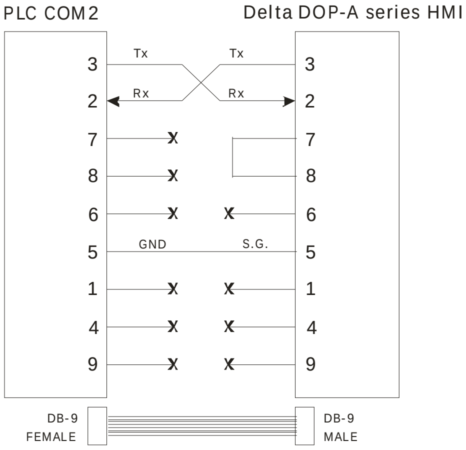


5. Slave mode application

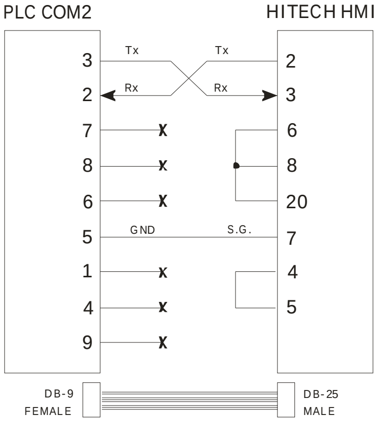
- Connect to PC



- Connect to Delta DOP-A series HMI



- Connect to HITECH HMI



6. Master mode application

- With DVP-F232, PLC MPU is able to connect to remote MODEM by using WPLSoft conducting monitoring or upload/download of program.
- How to connect:

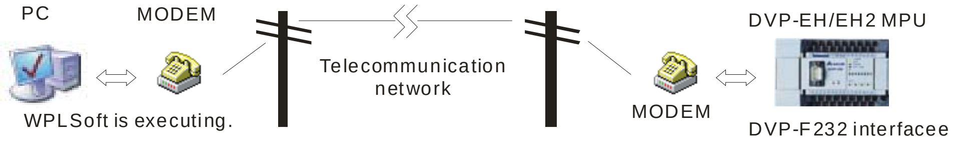
  1. Connect the PC (Master) to MODEM by COM PORT (RS-232).

  2. Connect MODEM to general telephone line and further connect it to MODEM on PLC MPU (Slave).

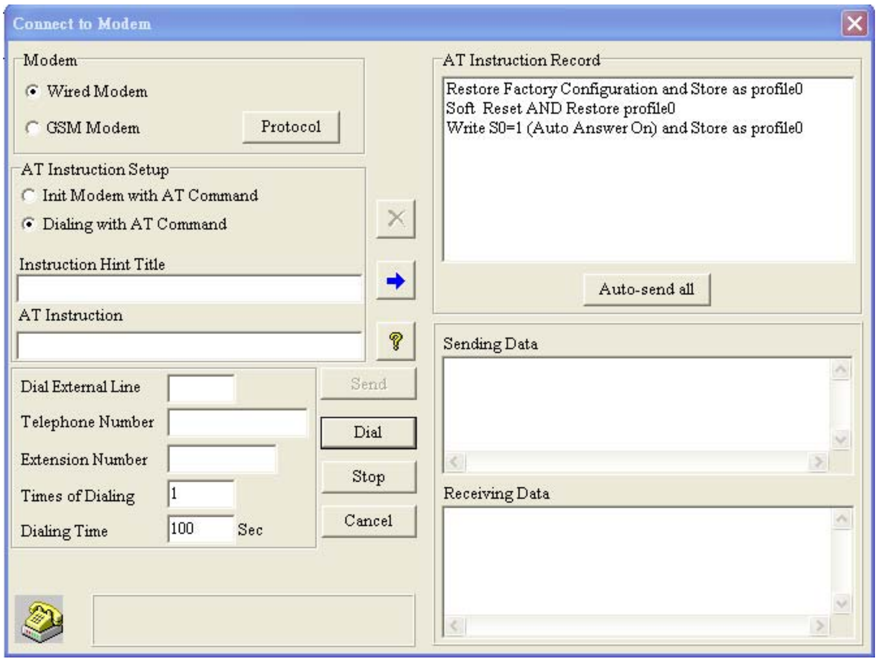
  3. Connect MODEM on the Slave end to COM1 (RS-232) of PLC MPU through RS-232

connection cable.

4. Please note that you have to insert the telephone line into the LINE socket on MODEM instead of the PHONE socket.
5. Follow the example below to connect the 2 MODEMs to PLC and PC and switch on the MODEM.



- Step 1: Set M1184 to On in the PLC (enable MODEM).
- Step 2: Set M1185 to On (enable PLC initializing MODEM).
- Step 3: Check the result of MODEM initialization. M1186 = On: successful; M1187 = On: failed.
- Step 4: WPLSoft is ready for the connection after the initialization. In WPLSoft, go to "Options" => "Modem Connection" (you have to install the driver of MODEM first). The dial-up window will next appear. Following the example below to set up the dial-up information.



Modem
● Wired Modem
○ GSM Modem

AT Instruction Setup
○ Init Modem with AT Command
● Dialing with AT Command

Instruction Hint Title

AT Instruction

Dial External Line

Telephone Number

Extension Number

Times of Dialing 1

Dialing Time 100 Sec

AT Instruction Record

Restore Factory Configuration and Store as profile0
Soft Reset AND Restore profile0
Write S0=1 (Auto Answer On) and Store as profile0

1. Dial External Line: Only required if you are dialing an external line through a telephone terminal.
2. Telephone number: The recipient's telephone number. No interval between the area code/country code and the number, e.g. 88633626301.
3. Extension number: Only required if necessary.
4. Dialing times: Re-dial times if the connection fails.
5. Click on "Dial" and start the connection.

- When the dial-up is successful, the "MODEM is connecting" dialog box will disappear, and now you can monitor the remote PLC by WPLSoft. M1188 will be On when the PLC detects a remote control signal is coming in. You can check M1188 and see if the PLC is monitored by a remote device.

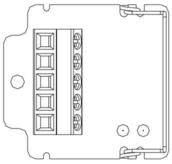
7. Please note
   - You cannot modify the baud rate when the MODEM is connecting. The baud rate of MODEM on PLC is fixed to 9,600bps and cannot be modified.
   - The MODEM on PLC has to support Auto Answer (AA) function. The baud rate of MODEM at two ends has to be at least 9,600bps.
   - Special M definition for DVP-EH/EH2 MODEM connection (valid when PLC RUN or STOP):

Device	Function	Remark
M1184	Enabling MODEM function.	M1184 = On validates the following actions.
M1185	Enabling initialization of MODEM.	Off after the initialization is completed.
M1186	Initialization of MODEM fails.	Off when M1185 = On
M1187	Initialization of MODEM is completed.	Off when M1185 = On
M1188	Displaying whether MODEM is connecting currently	On: connecting

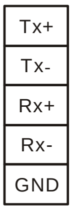
8. Remarks
   - You need DVP-F232 in PLC to validate the connection to MODEM. All special M registers listed in the table above will be invalid without DVP-F232.
   - After you enable MODEM (M1884 = On), you have to initialize MODEM first (M1185 = On). PLC will not be able to conduct Auto Answer function if the MODEM has not been initialized.
   - After the initialization is completed, PLC will enter Auto Answer mode automatically.
   - If the connection to the remote PC is stopped, MODEM will enter standby mode automatically. If you shut down MODEM now, you will have to initialize it again next time you switch it on.
   - The initialization format: ATZ, ATS0 = 1.

8.4.2 DVP-F422 (RS-422 card)

1. Outline



2. Terminals



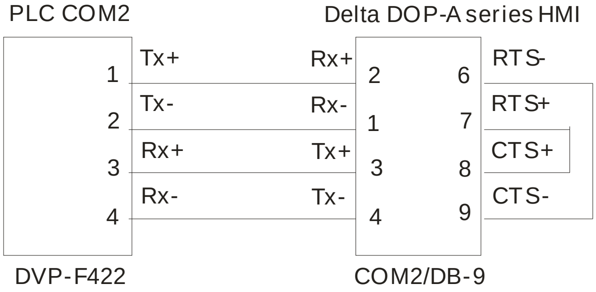
Tx+: Transmission +
Tx-: Transmission -
Rx+: Receiving +
Rx-: Receiving -

3. Communication protocol

Item	**Explanation**
Model name	DVP-F422
Transmission specification	RS-422
Isolation method	No isolation
Transmission distance	500m
Power consumption	30mA/DC5V (supplied by PLC MPU)

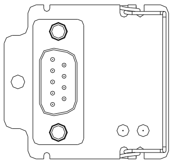
Item		Explanation
Communication protocol	Mode	Master/Slave, semi-duplex, bidirectional data transmission/receiving
	Baud rate	110 ~ 115,200bps (bit/sec)
	Data bit	7 or 8
	Stop bit	1 or 2
	Parity bit	None, Even, Odd
Communication indication		TX (data transmission), RX (data receiving)
Connectable device		Devices with RS-422 interface

4. Functions
   - If you would like COM2 to be RS-422 and connect the PLC to an HMI or other remote peripheral devices, use DVP-F422. Except for the communication interface, the communication functions of DVP-F422 are the same as the existing COM2. However, please note that with DVP-F422, the RS-485 on the existing COM2 will become invalid, and PLC will set COM2 to RS-422.
   - See the example below for connecting the PLC to COM2 on Delta’s HMI: RS-422 of Delta's DOP-A series HMI at COM2 and set it to MODE 2. (MODE 1: RS-232; MODE 2: RS-422; MODE 3: RS-485)

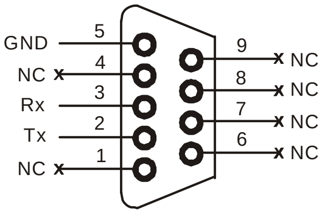


8.4.3 DVP-F232S (COM3 RS-232 card)

1. Outline (DB-9 female)



2. Terminals



Notes:

- Please note the signal from PIN 2 and PIN 3 when the communication port is connected to PC or HMI. <u>The PIN definitions of DVP-F232S are different from the definitions of DVP-F232.</u>

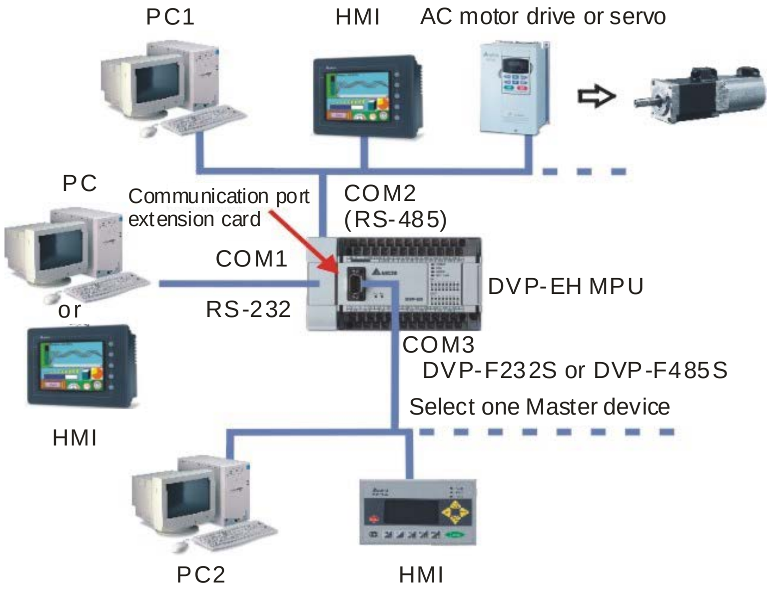
3. Communication protocol

Item	Explanation
Model name	DVP-F232S

Item		Explanation
Transmission specification		RS-232C
Isolation method		No isolation
Transmission distance		15m
Power consumption		30mA/DC5V (supplied by PLC MPU)
Communication protocol	Mode	Slave, semi-duplex, bidirectional data transmission/receiving
	Baud rate	9,600/19,200/38,400bps (bit/sec)
	Data bit	7
	Stop bit	1
	Parity bit	Even
Communication indication		TX (data transmission), RX (data receiving)
Connectable device		Devices with RS-232C interface

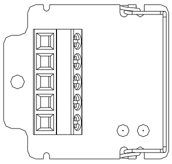
4. Functions

- When COM1 (RS-232) and COM2 (RS-485) built-in in the PLC are not enough for the operation, use DVP-F232S to supplement a COM3 (RS-232 or RS-485 interface). DVP-F232S is the same as COM1 in terms of the functions but only supports baud rate 9,600/19,200/38,400bps and communication format ASCII, 7, E, 1. With COM3, the scam time of PLC will at least increase by 0.8 ~ 2ms.
- Please note that if COM2 works in Slave mode and is connected to PC1 executing WPLSoft, and COM3 is connected to PC2 executing WPLSoft as well, PC1 and PC2 will not be able to execute ladder diagram monitoring at the same time. Other communication functions will work normally. COM1 is not restricted by this rule.

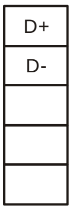


8.4.4 DVP-F485S (COM3 RS-485 card)

1. Outline



2. Terminals



D+: + signal
D-: - signal

3. Communication protocol

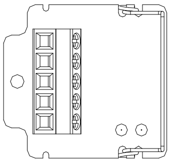
Item		Explanation
Model name		DVP-F485
Transmission specification		RS-485 standard
Isolation method		No isolation
Transmission distance		500m
Power consumption		30mA/DC5V (supplied by PLC MPU)
Communication protocol	Mode	Slave, semi-duplex, bidirectional data transmission/receiving
	Baud rate	9,600/19,200/38,400bps ((bit/sec)
	Data bit	7
	Stop bit	1
	Parity bit	Even
Communication indication		TX (data transmission), RX (data receiving)
Connectable device		Devices with RS-485 interface

4. Functions

- When COM1 (RS-232) and COM2 (RS-485) built-in in the PLC are not enough for the operation, use DVP-F232S to supplement a COM3 (RS-232 or RS-485 interface). DVP-F485S is the same as COM1 in terms of the functions but only supports baud rate 9,600/19,200/38,400bps and communication format ASCII, 7, E, 1. With COM3, the scam time of PLC will at least increase by 0.8 ~ 2ms.
- Please note that if COM2 works in Slave mode and is connected to PC1 executing WPLSoft, and COM3 is connected to PC2 executing WPLSoft as well, PC1 and PC2 will not be able to execute ladder diagram monitoring at the same time. Other communication functions will work normally. COM1 is not restricted by this rule.

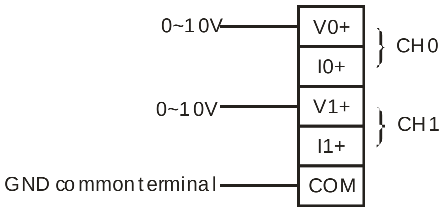
8.4.5 DVP-F2AD

1. Outline

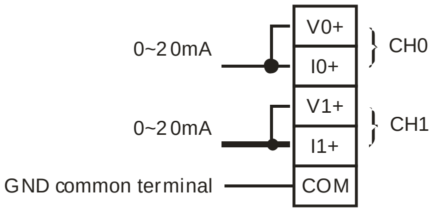


2. Terminals

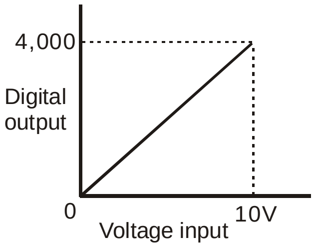
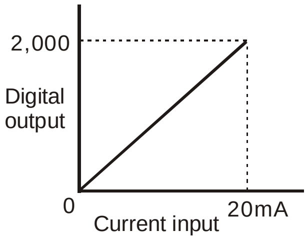
- Voltage input



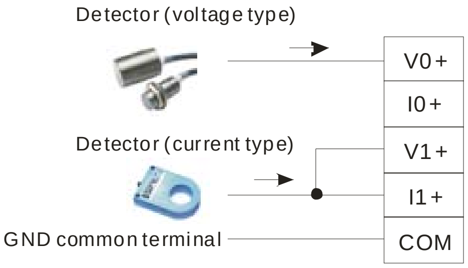
- Current input



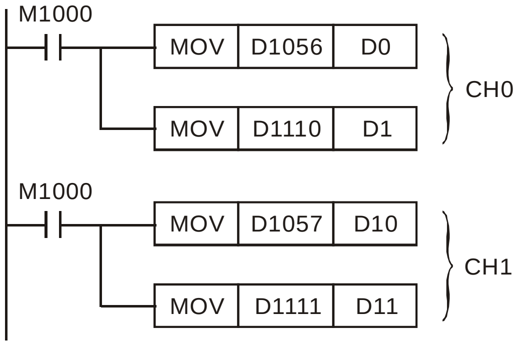
3. Range of input signals
   - Voltage: less than 15V DC (Negative voltage is not allowed.)
   - Current: less than 30mA (Negative polarity is not allowed.)
4. Functions
   - DVP-F2AD offers 2 analog signal input points, featuring:

<table>
<tr><th colspan="2">Item</th><th>Voltage input</th><th>Current input</th></tr>
<tr><td colspan="2">Analog signal</td><td>DC 0 ~ +10V</td><td>DC 0 ~ 20mA</td></tr>
<tr><td colspan="2">Resolution (12-bit)</td><td>2.5mV (10/4,000)</td><td>10uA (20/2,000)</td></tr>
<tr><td colspan="2">Input impedance</td><td>40KΩ</td><td>250Ω</td></tr>
<tr><td colspan="2">Conversion update time</td><td colspan="2">Set up in D1118 (≧K5, unit: ms)</td></tr>
<tr><td colspan="2">Conversion curve</td><td> </td><td> </td></tr>
<tr><td rowspan="2">Digital output</td><td>Present value</td><td>D1056 (CH0)</td><td>D1057 (CH1)</td></tr>
<tr><td>Average value</td><td>D1110 (CH0)</td><td>D1111 (CH1)</td></tr>
</table>

5. Application
   - Read the special D register which corresponds to the present value or average value in the program to obtain the A/D conversion value of the corresponding channel. SV in D1118 refers to the update time of the present value of digital output.
   - Wiring

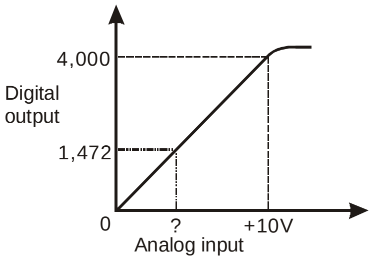


   - Program example



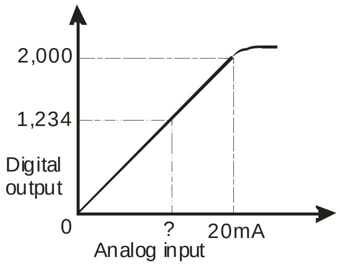
- ■ A/D conversion at CH0: Present value = D0, average value = D1.
- ■ A/D conversion at CH1: Present value = D10, average value = D11.

- How to calculate A/D conversion value at CH0: The detector (voltage type) generates a voltage signal input at CH0. If D1 reads K1,472, it refers to:



$$\text{Input voltage} = 1{,}472 \times \frac{10\text{V}}{4{,}000} = 3.68\text{V}$$

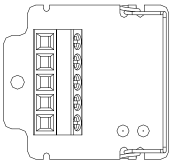
- How to calculate A/D conversion value at CH1: The detector (current type) generates a current signal input at CH1. If D11 reads K1,234, it refers to:



$$\text{Input current} = 1{,}234 \times \frac{20\text{mA}}{2{,}000} = 12.34\text{mA}$$

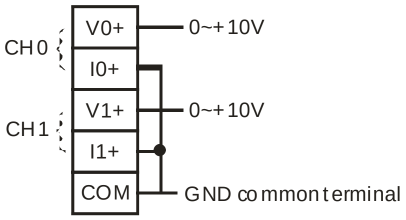
8.4.6 DVP-F2DA

1. Outline

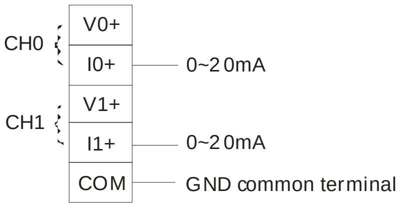


2. Terminals

- Voltage output: Output load: 1K ~ 2MΩ

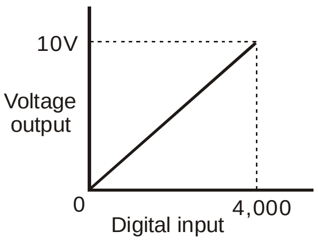
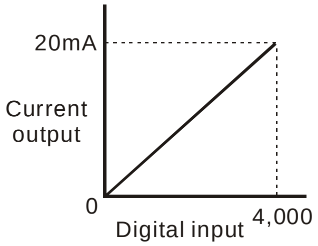


- Current input: Output load: 0 ~ 500Ω



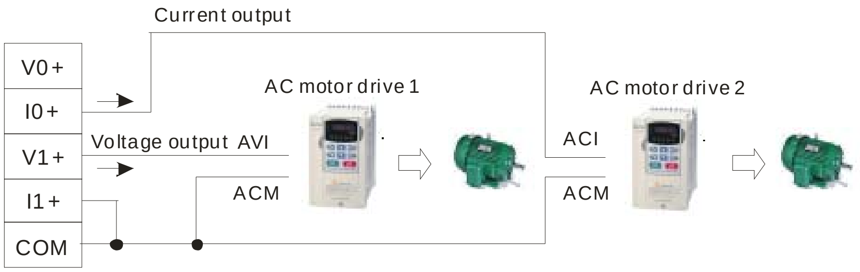
3. Functions

- DVP-F2DA offers 2 analog signal output points, featuring:

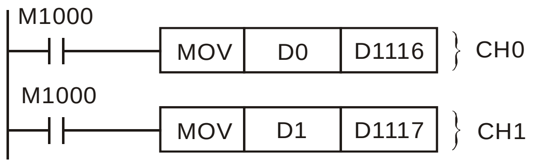
Item	Voltage input	Current input
Analog signal	DC 0 ~ +10V	DC 0 ~ 20mA
Resolution (12-bit)	< 0.5Ω	< 0.5Ω
Input impedance	2.5mV (10/4,000)	5uA (20/4,000)
Conversion update time	Set up in D1118 (≧K5, unit: ms)	
Digital value input	D1116 (CH0)	D1117 (CH1)
Conversion curve		

4. Application

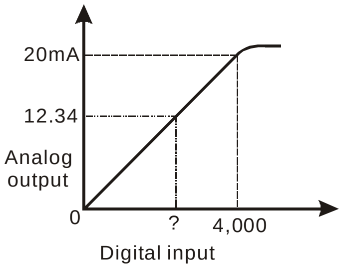
- Use MOV instruction to move the digital value to D1116 (CH0) or D1117 (CH1), and you will obtain the corresponding voltage output values.
- Wring



- Program example

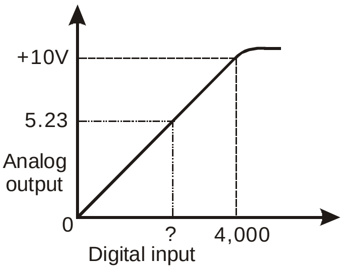


- How to calculate D/A conversion value at CH0: DVP-F2DA generates a current signal output to ACI terminal on AC motor drive for revolution speed control. If you would like the current signal to be 12.34mA, D0 should be:



$$D0 = 12.34\text{mA} \times \frac{4{,}000}{20\text{mA}} = 2{,}468$$

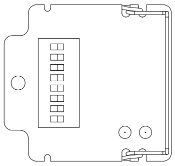
- How to calculate D/A conversion value at CH1: DVP-F2DA generates a voltage signal output to AVI terminal on AC motor drive for revolution speed control. If you would like the voltage signal to be 5.23V, D1 should be:



$$D1 = 5.23\text{V} \times \frac{4{,}000}{10\text{V}} = 2{,}092$$

8.4.7 DVP-F8ID

1. Outline



2. Functions

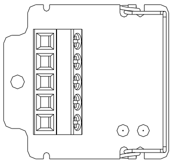
- DVP-F8ID digital switch card offers 8 On/Off input signals (DI0 ~ DI7). You can use API 109 SWRD instruction to read the value in it. DVP-F8ID is generally used as an interface for setting up external data input, which saves you X input points.

3. Application

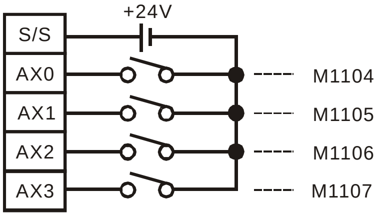
- Whenever a scan cycle is completed, DVP-F8ID will automatically read the data in the 8-bit digital switches and store their statuses into special auxiliary relays M1104 ~ M1111. You can use the 8 special M registers for operations directly in the program.
- How to set up PLC station No.:

8.4.8 DVP-F4IP

1. Outline



2. Terminals



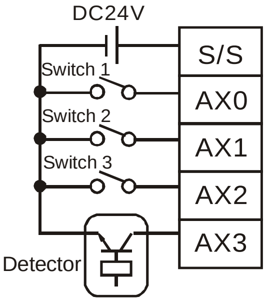
3. Functions

- DVP-F4IP offers 4 digital input points with photocoupler isolation. Whenever a scan cycle is completed, DVP-F4IP will automatically read the data in the 4-bit digital input points and store their statuses into special auxiliary relays M1104 ~ M1107. You can use the 4 special M registers for operations directly in the program.

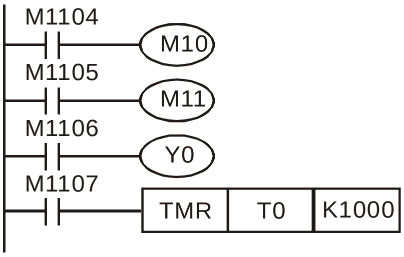
Item	Input specification
Input type	DC (SINK or SOURCE)
Input signal current	Approx. 5mA/DC24V
Action level	Off → On >16V DC On → Off <14.4V DC

4. Application

- Wiring



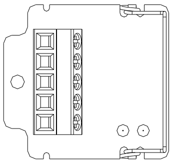
- Program example



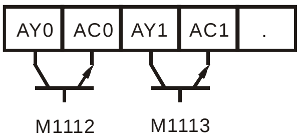
- Devices
  - ■ Input terminals AX0 ~ AX3 correspond to M1104 ~ M1109.
  - ■ With new input points AX0 ~ AX3, the external switch 1 ~ 3 and the detector control respectively M10, M11, Y0 and T0.

8.4.9 DVP-F2OT

1. Outline



2. I/O sketch



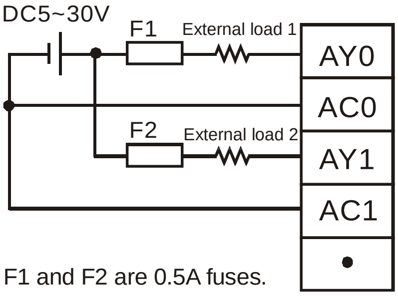
3. Functions

- DVP-F2OT offers 2 digital output points (output type: transistor). Use M1112 and M1113 to drive the output points.

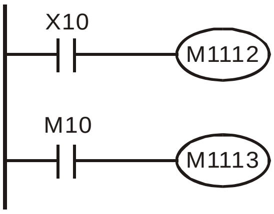
Item	Output specification
Current specification	0.3A/1 point
Voltage specification	30V DC
Maximum load	9W/1 point
Response time	Off → On 20us; On → Off 30us

4. Application

- Wiring



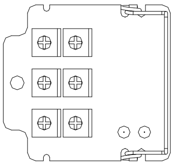
- Program example



- Devices
  - Output terminals AY0 ~ AY1 correspond to M1112 ~ M1113.
  - New output points AY0 and AY1 are connected to load 1 and load 2 and controlled by X10 and M10.

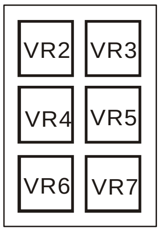
8.4.10 DVP-F6VR

1. Outline



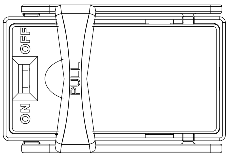
2. Functions

- DVP-EH MPU is built-in with two analog rotary switches, VR0 and VR1. DVP-F6VR extends the rotary switches to VR2 ~ VR7. For how to extend, please refer to API 85 VRRD and API 86 VRSC in *DVP-PLC Application Manual: Programming*.



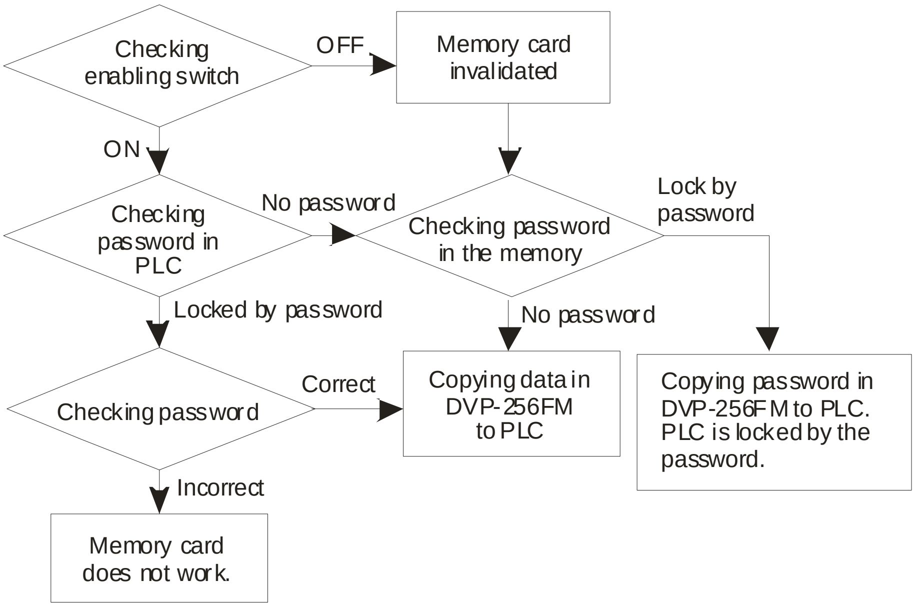
8.4.11 DVP-256FM

1. Outline



2. Functions

- DVP-256FM is a data backup memory card. There is an enabling switch on the card which will be checked when the PLC is switched on. The card will not be applicable if the enabling switch is Off; that is, you will not be able to switch On/Off the card when the power of PLC is on. Read/write of DVP-256FM is only allowed when the enabling switch is On.
- During the copy of data, the password check will be executed as well. If there is a password in DVP-256FM, it will be copied to PLC as well, locking up the PLC with the password. See the flowchart below.
- Data upload to PLC with DVP-256FM installed in the MPU and the power is on:



- Data stored in DVP-256FM to be copied into PLC:

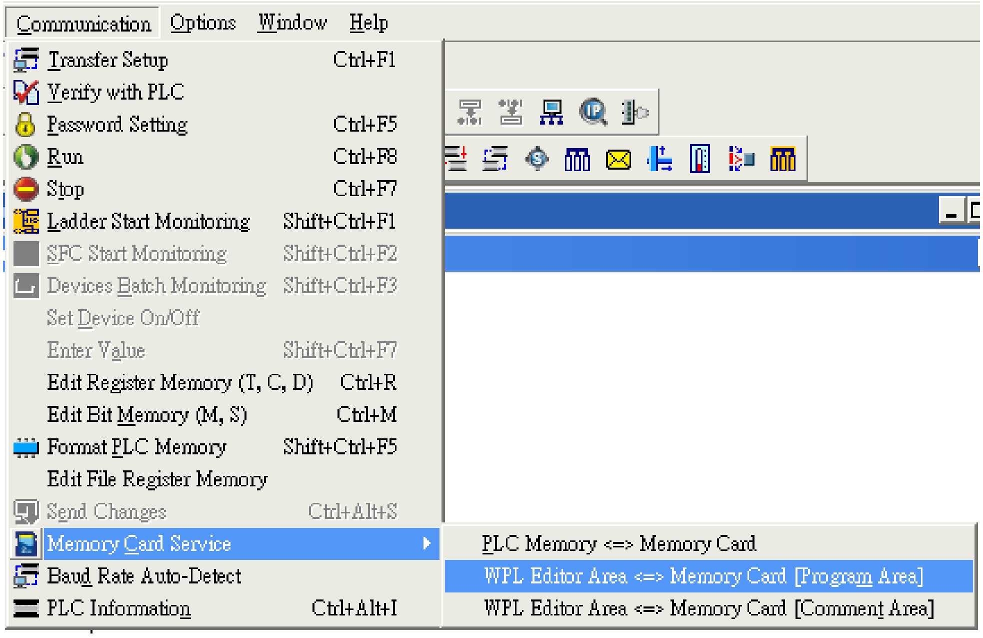
Data block	Range	Default
Program area	15,872 steps	All NOP instruction
Data registers	D0 ~ D999	K0

Data block	Range	Default
	D1035, D1038	K0
	D1101	K0
	D1102	K1,600
	D1103	K2,000
	D1200	K500
	D1201	K999
	D1202	K2,000
	D1203	K4,095
	D1204 ~ D1207	K-1
	D1208	K100
	D1209	K199
	D1210	K220
	D1211	K234
	D1212	K235
	D1213	K255
	D1214	K500
	D1215	K899
	D1216	K200
	D1217	K999
	D1218	K2,000
	D1219	K9999
	D2000 ~ D9999	K0
File register	0 ~ 4,999	K0
Auxiliary relays	M0 ~ M999	Off
	M1035, M1101	Off
	M2000 ~ M4095	Off
Step points	S0 ~ S1023	Off
Timers	T0 ~ T255	K0
Counters	C0 ~ C255	K0
Password	4 characters	Off

- Apart from data backup, DVP-256FM can also be used for PLC copy. Set up the program area, file registers and other relevant latched parameters of PLC MPU by WPLSoft or HPP and go to “Communication” => “Memory Card Service” in WPLSoft, you will be able to write the main data blocks in the PLC into DVP-256FM. You can insert this DVP-256FM into another DVP-EH MPU. Once the MPU is switched on, the data in DVP-256FM will be uploaded to corresponding data areas in the PLC. This is the quick PLC copy function but only applicable to DVP-EH MPU with at least 32 points.
- To read/write the data in DVP-256FM, use WPLSoft or HPP02. However, only limited data areas can be edited and saved. Take HPP02 as example, only the program area can be saved. See the user manual of HPP02 for more details. WPLSoft is able to save every data area in DVP-256FM.

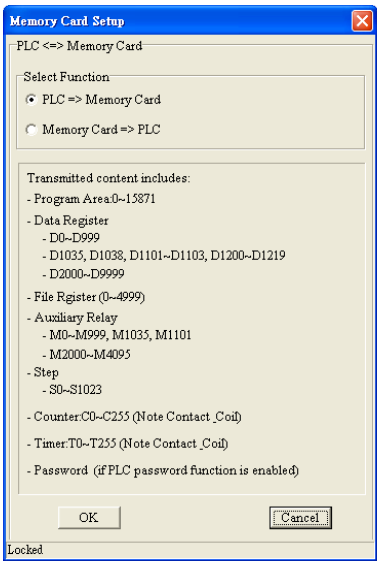
Follow the instructions below:

- Insert DVP-256FM into a PLC and read/write DVP-256FM by WPLSoft. Before you operate any functions in WPLSoft, make sure that you have already switch On the enabling switch on DVP-256FM before switch on the PLC. Also, the PLC has to be connected to PC, and you have to confirm the successful connection after switching on the PLC before acquiring or saving data on DVP-256FM. Next, open WPLSoft, select “Communication” => "Memory Card Service”



- There are 3 modes in “Memory Card Service”:
  - PLC Memory <=> Memory Card: You can choose either to copy the data in DVP-256FM to the PLC or copy the data in the PLC to DVP-256FM.
  - WPL Editor Area <=> Memory Card [Program Area]: You can choose either to copy the program edited in WPLSoft to DVP-256FM or read the PLC program in DVP-256FM to WPLSoft editing area.
  - WPL Editor Area <=> Memory Card [Comment Area]: You can choose either to copy the comments in the WPLSoft editing area to DVP-256FM or read out the comments in DVP-256FM. The comments in DVP-256FM can only be uploaded to the WPLSoft editing area but not DVP-EH MPU. There is no space in the memory of DVP-EH MPU for storing comments.

- How to set up the 3 modes:



● PLC => Memory Card
○ Memory Card => PLC

Transmitted content includes:
- Program Area:0~15871
- Data Register
  - D0~D999
  - D1035, D1038, D1101~D1103, D1200~D1219
  - D2000~D9999
- File Rgister (0~4999)
- Auxiliary Relay
  - M0~M999, M1035, M1101
  - M2000~M4095
- Step
  - S0~S1023
- Counter:C0~C255 (Note Contact _Coil)
- Timer:T0~T255 (Note Contact _Coil)
- Password (if PLC password function is enabled)

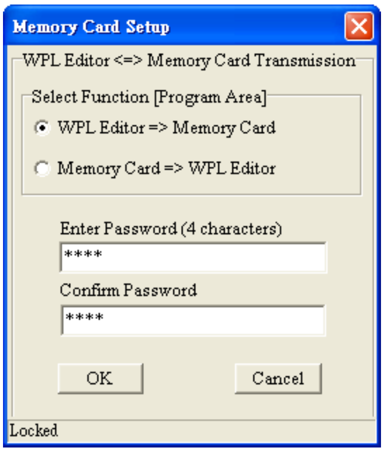
Locked

"Locked" refers to DVP-256FM is protected by a password.

PLC Memory <=> Memory Card

Functions:

- PLC Memory => Memory Card
  - a) Assumed the data in the PLC are not protected by a password, but DVP-256FM is, the data will still be written into DVP-256FM and its password will be unlocked.
  - b) Assumed the data in the PLC are protected by a password, the data and password will be written into DVP-256FM no matter DVP-256FM is with or without a password.
- Memory Card => PLC Memory (PLC has to be in STOP status.) The passwords in DVP-256FM and the PLC will be compared. PLC will not be able to read the data in DVP-256FM if the two passwords are different.



● WPL Editor => Memory Card
○ Memory Card => WPL Editor

Enter Password (4 characters)
****
Confirm Password
****

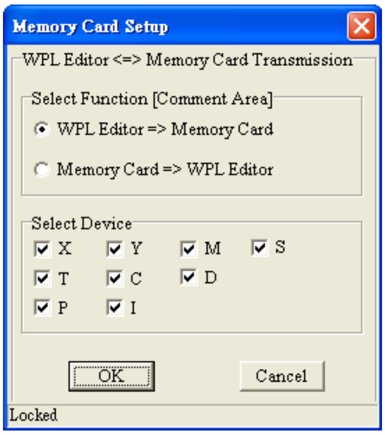
Locked

"Locked" refers to DVP-256FM is protected by a password.

WPL Editor Area <=> Memory Card [Program Area]

Functions:

- WPL Editor Area => Memory Card [Program Area]
  - a) If you do not enter any password in the password column, the existing password, whether the data in DVP-256FM are protected by a password or not, will be cleared after the data transmission is completed.
  - b) If you enter a new password in the password column, the data in DVP-256FM will be protected by the new password after the data transmission is completed.
- Memory Card [Program Area] => WPL Editor Area
  If DVP-256FM is with a password, you will be asked to enter the password before the data transmission. If you do not enter the password, or the password you enter is incorrect, you will see an error message and will not be able to read the data in DVP-256FM.



WPL Editor <=> Memory Card Transmission

Select Function [Comment Area]

● WPL Editor => Memory Card

○ Memory Card => WPL Editor

Select Device

☑ X ☑ Y ☑ M ☑ S
☑ T ☑ C ☑ D
☑ P ☑ I

"Locked" refers to DVP-256FM is protected by a password.

WPL Editor Area <=> Memory Card [Comment Area]

Functions:

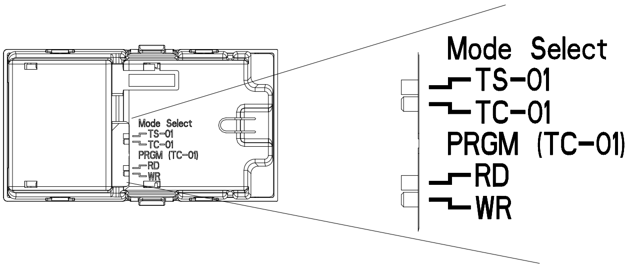
- WPL Editor Area => Memory Card [Comment Area]
  a) Select devices. During the data transmission, all the comments in the devices checked will be written into DVP-256FM.
  b) The comments in special D registers (D1000 ~ D1999) and special M registers (M1000 ~ M1999) will not be written in to DVP-256FM.
  c) The capacity for comments in DVP-256FM is 32KB, for 16,000 Chinese characters or 32,000 English characters.
- Memory Card [Comment Area] => WPL Editor Area
  You can further edit or modify the comments in DVP-256FM uploaded to WPLSoft editing area.

9.1 Functions

1. Insert DVPDU01 directly into the extension slot of DVP-EH MPU (of at least 32 points), and you will be able to set up and monitor the PLC.
2. DVPDU01 can be connected to the 60-cm connection cable (accessory) and RS-232 (COM1) of DVP series PLC.
3. DVPDU01 is able to set up and monitor a PLC or control registers in the PLC as well as copying program.

9.2 Introduction

1. DVPDU01 has two operation modes. You can find the switch for switching between the two modes at the bottom of DVPDU01. The default mode is TS-01, which will be displayed when DVPDU01 is switched on.
2. DVPDU01 bottom:



TS-01

TC-01

3. TS-01 mode

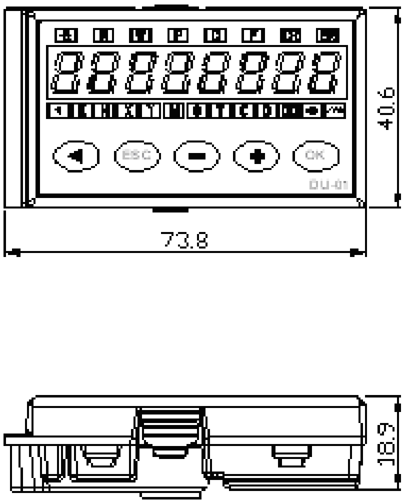
   In this mode, DVPDU01 displays the RTC and the data read from or written into bit devices (X, Y, M, S), word devices (T, C, D) in the PLC and control registers in the extension module. It also supports read/write of 32-bit data in the data register. Besides, DVPDU01 displays the boot screen settings and sleep mode, which can be a monitor for a fixed device. You can connect DVPDU01 to DVP-ES MPU which is without a RTC by a connection cable, the microprocessor inside DVPDU01 will start to time from 00-00-00 (with slight inaccuracy), and DVPDU01 is able to RUN/STOP the PLC.
4. TC-01 mode

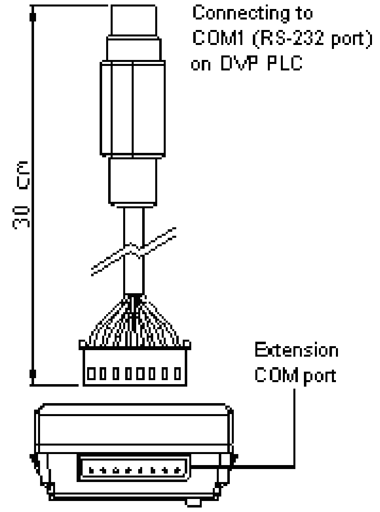
   In this mode, DVPDU01 is able to read/write the program area (P), data registers (D) and file registers (F) in the PLC as well as copying and transferring the program. DVPDU01 supports password function and DVP series PLC.

9.3 Product Profile and Outline

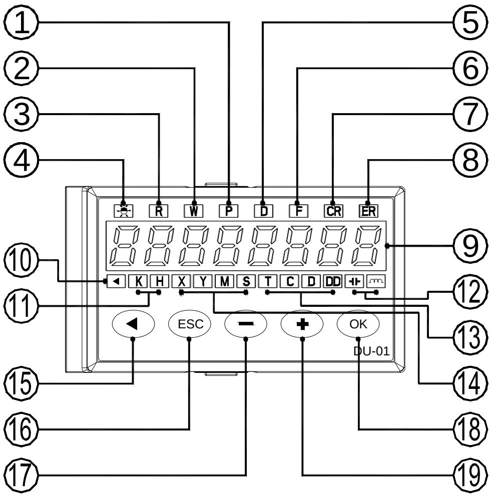
9.3.1 Profile & Accessory Dimension

You can use the connection cable (accessory) to connect DVPDU01 (at the extension port) and COM1 (RS-232) of DVP series PLC. Therefore, besides being inserted in the extension slot of DVP-EH/EH2 MPU, DVPDU01 can also be connected to DVP-ES/EX//SA/SC/SS/SX MPU by a connection cable.





9.3.2 Outline

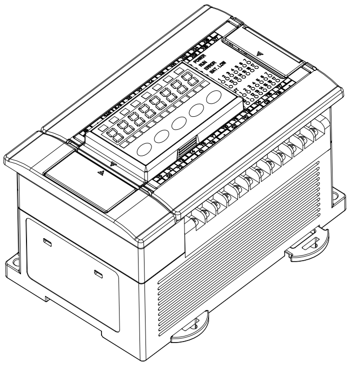


1. P: Program area indication (TC-01)	11. K (decimal), H (hex) indication
2. W: Write (WR) action indication (TC-01)	12. Contact and coil of timer/counter indication
3. R: Read (RD) action indication (TC-01)	13. Word devices T, C, D, DD (32-bit) indication
4. “In communication” indication	14. Bit devices X, Y, M, S indication
5. D: Data register indication (TC-01)	15. Left key / RUN (TC-01)
6. F: File register indication (TC-01)	16. ESC key (back to previous level)
7. CR: Control register indication (in extension module)	17. Enter value or select device
8. ER: Error message display	18. OK key
9. Display area	19. Enter value or select device
10. Enter ◀ indication	

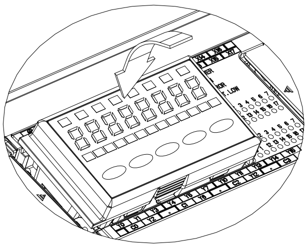
9.3.3 Installation and Wiring

1. Install DVPDU01 in the extension slot of DVP-EH/EH2 MPU. Switch off the power of MPU before the installation. DVPDU01 connects to MPU by a high-density connector; therefore, please follow the instructions below during the installation and removal of DVPDU01. Slide the bottom of DVPDU01

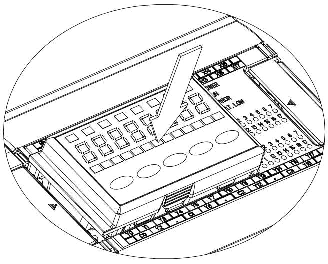
tiltedly into the extension slot and press it down. DO NOT insert and press it in vertically in case of damages on the device.



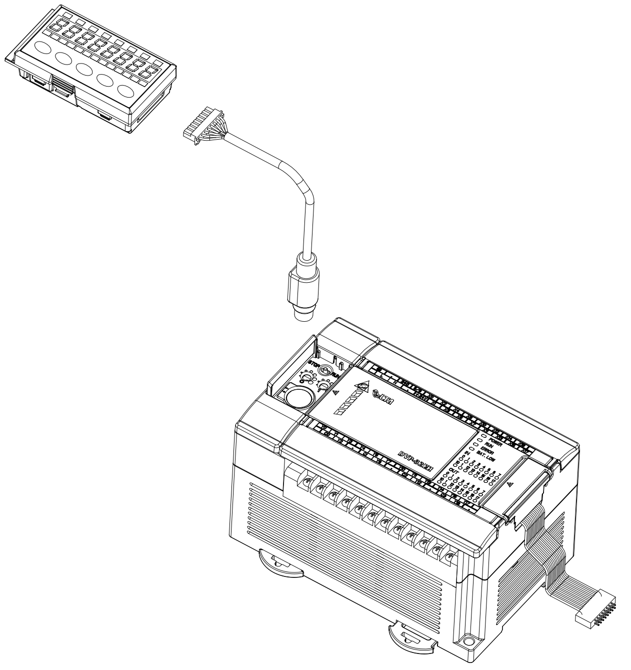
○



✕



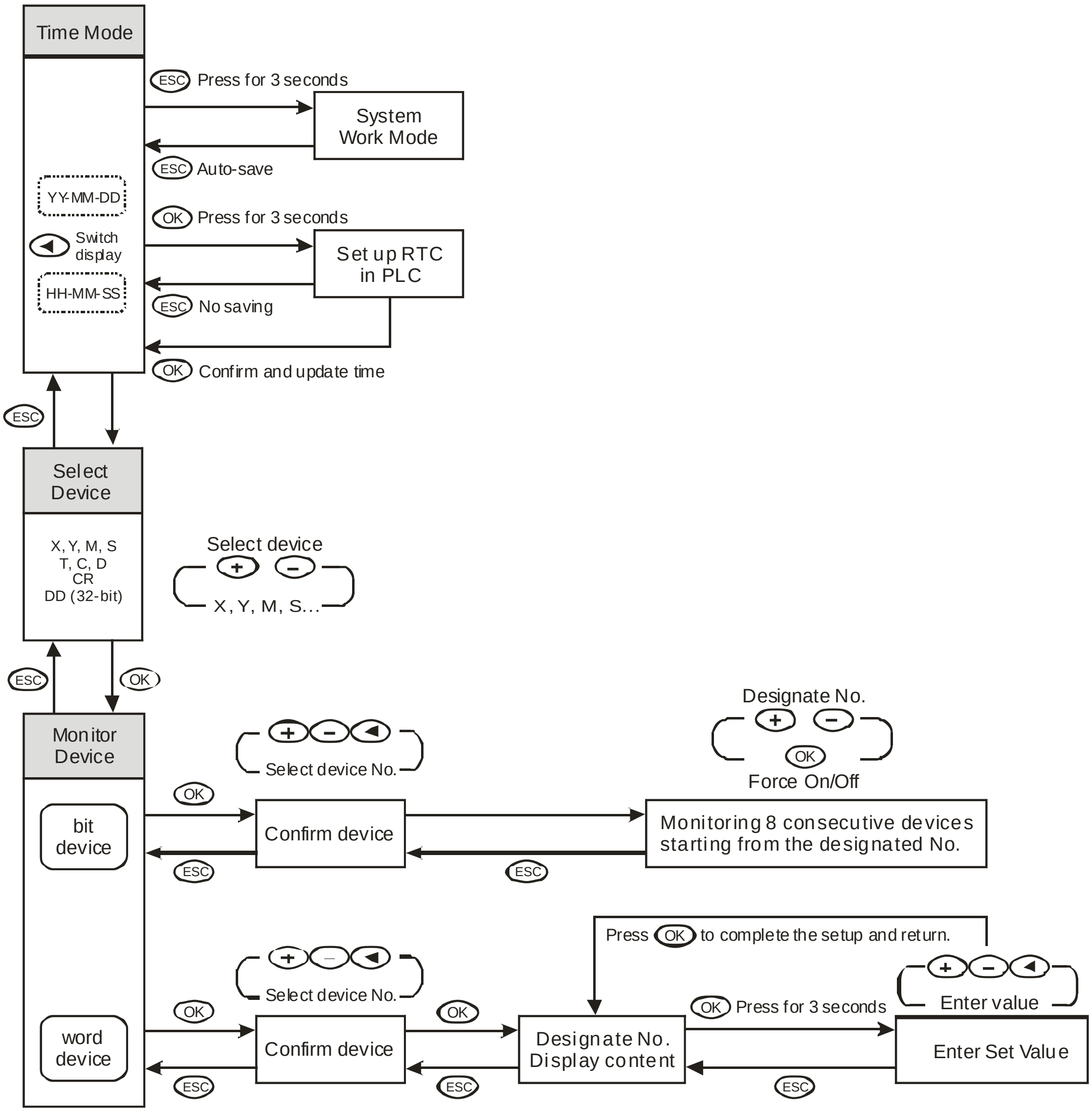
2. DVPDU01 can be connected to DVP series PLC by a connection cable. The power of the PLC does not need to be switched off.



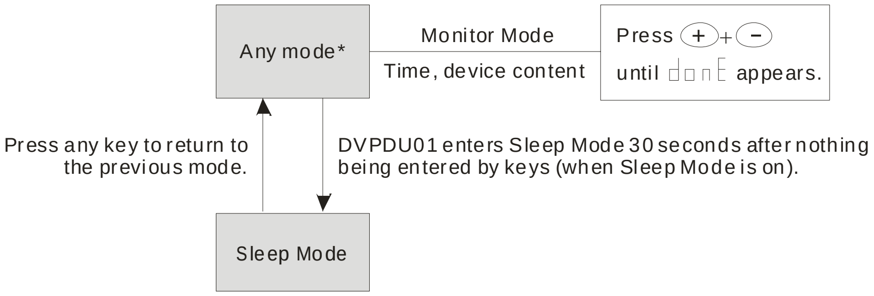
9.4 Operation

9.4.1 TS-01 Mode

1. Switch to TS-01 mode (you can find the switch at the bottom of the device).
2. The operation:

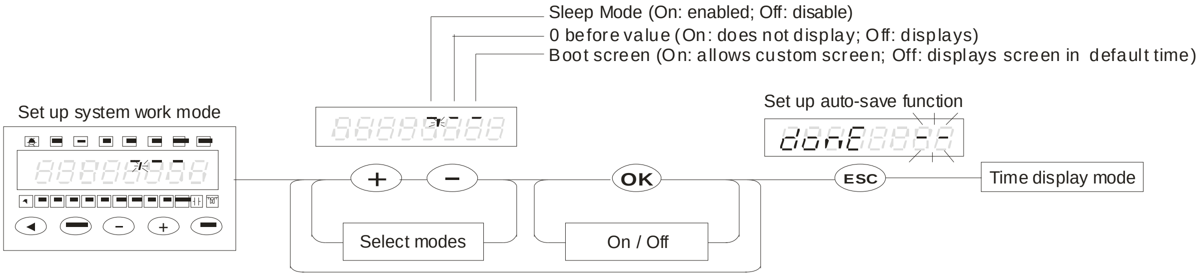


3. Set up boot screen (press ⊕ and ⊖ at the same time)

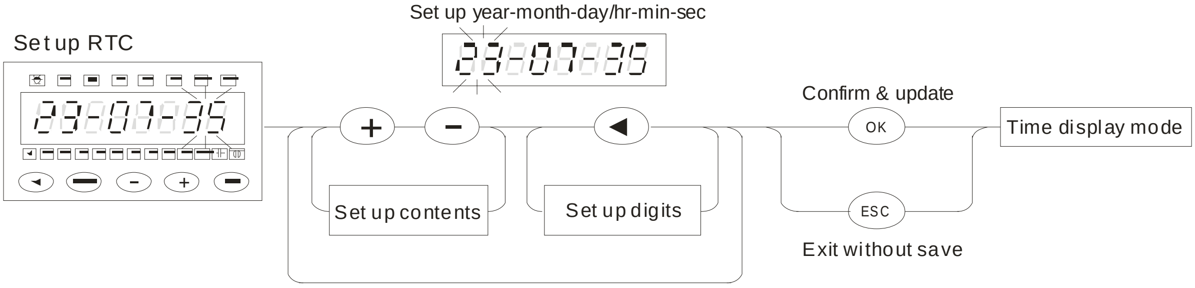


*Note: Does not include the system work modes.

4. Set up system work mode

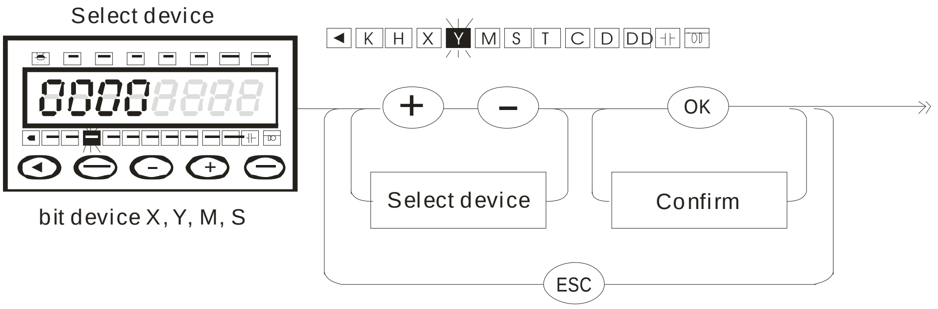


5. Set up RTC (real-time clock)

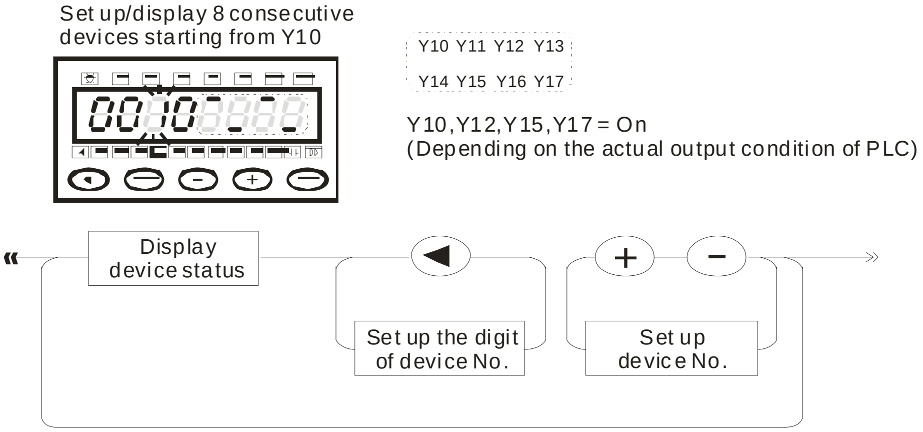


6. Select device (bit devices X, Y, M, S)

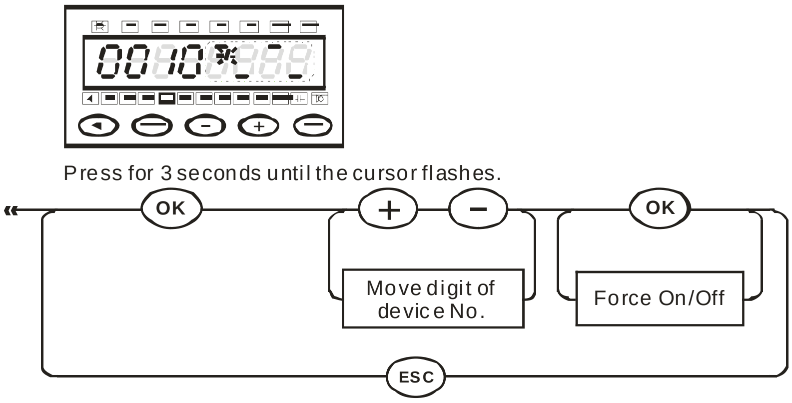
Step 1:



Step 2:

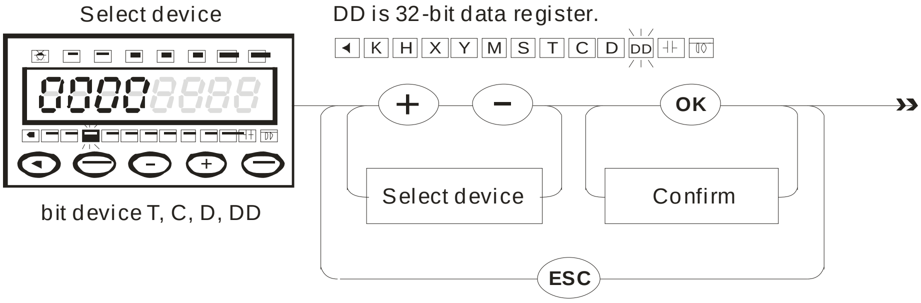


Step 3:

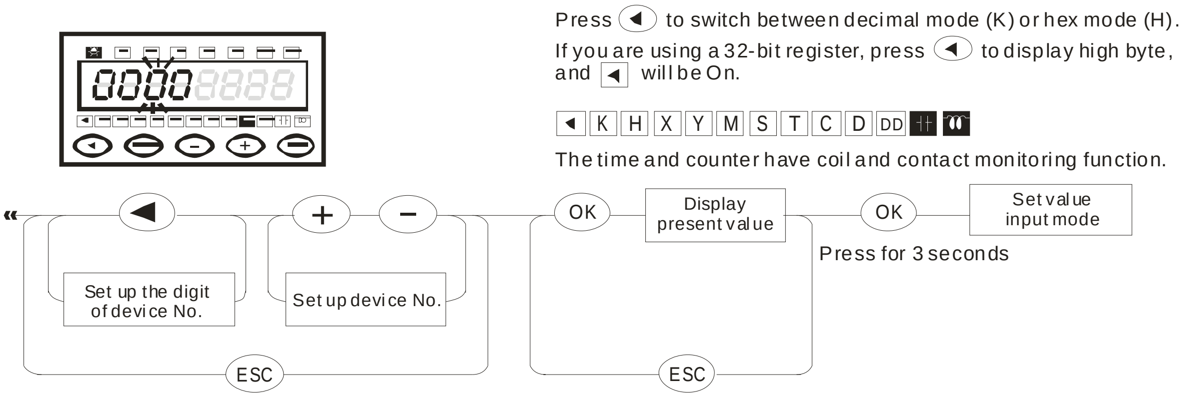


7. Select device (bit devices T, C, D, DD)

Step 1:



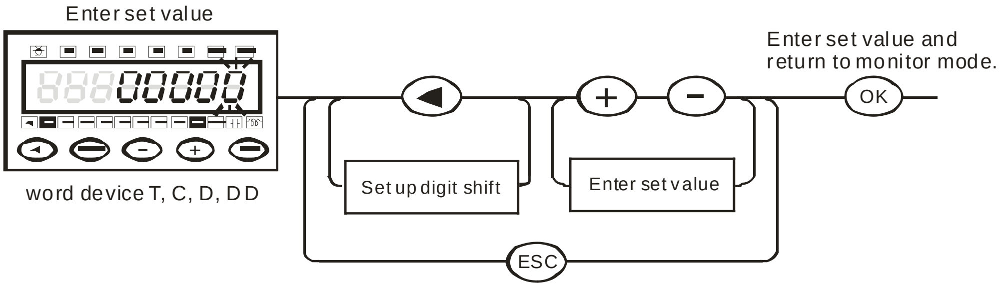
Step 2:


Press ◄ to switch between decimal mode (K) or hex mode (H).
If you are using a 32-bit register, press ◄ to display high byte, and ◄ will be On.

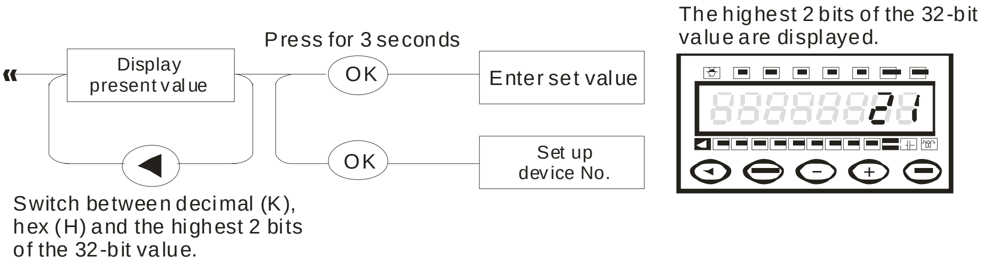
The time and counter have coil and contact monitoring function.

8. Enter set value (word devices T, C, D, DD)

Step 1:

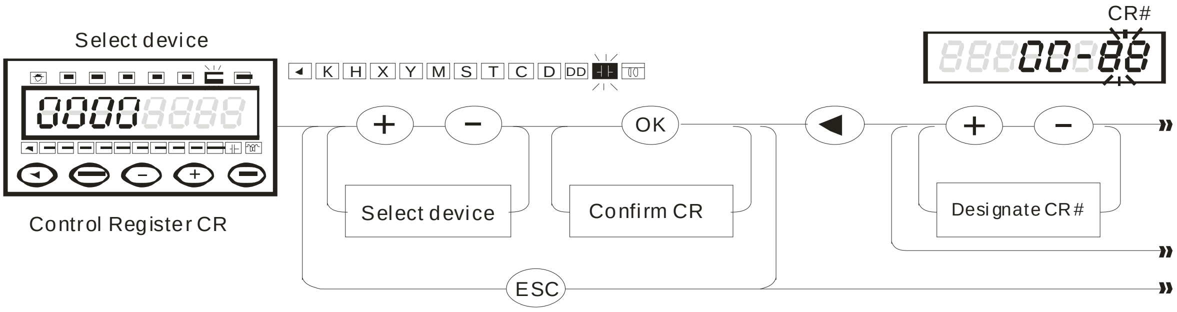


Step 2:

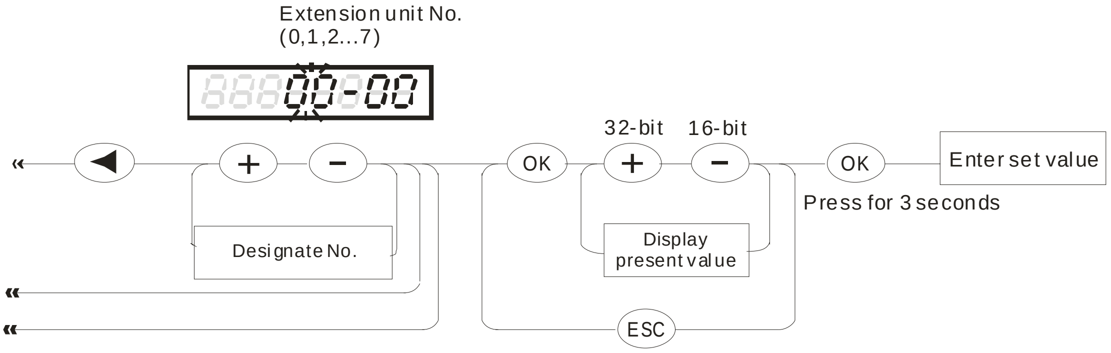


9. Select device (control register CR)

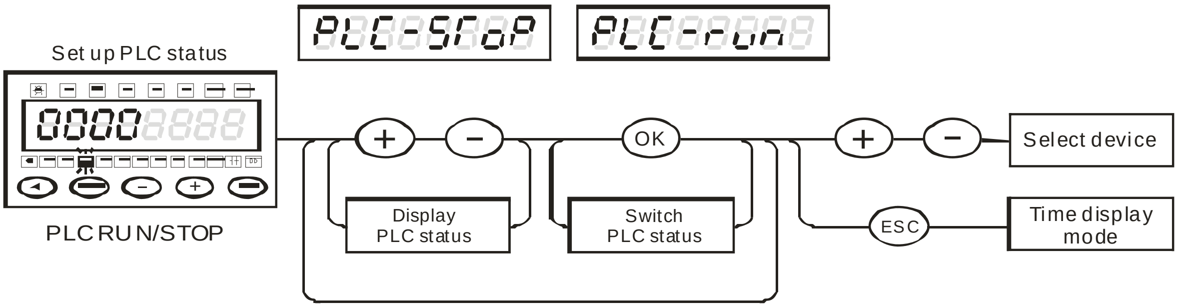
Step 1:



Step 2:

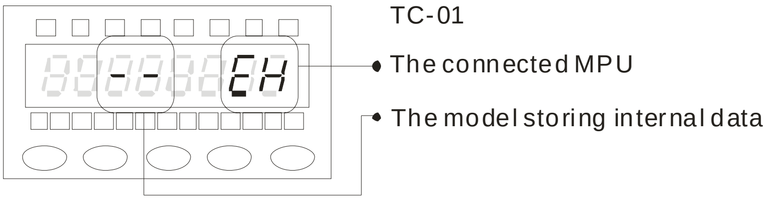


10. Set up PLC status (RUN/STOP)



9.4.2 TC-01 Mode

1. Switch to TC-01 mode (you can find the switch at the bottom of the device). Set up RD (read data in P, D, F area from MPU) or WR (write data in P, D, F in TC-01 into MPU).

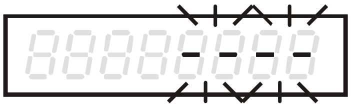


2. Set up password key

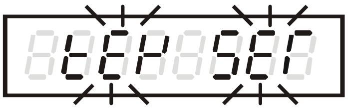
   You can set up the password key in WPLSoft to unlock to read and write the data in the PLC locked by a password as only as the key you set up is the same as the password in the PLC. You have to remove the password key also in WPLSoft.

   - How to set up password key

     Press ESC for 3 seconds in RD or WR mode to enter the password setup screen:



     Open WPLSoft => Options => TC-01 Password Key Setup => Set TC-01 Password Key and follow the instructions:



     After you can display “KEY SET” on the screen, press ESC and exit.

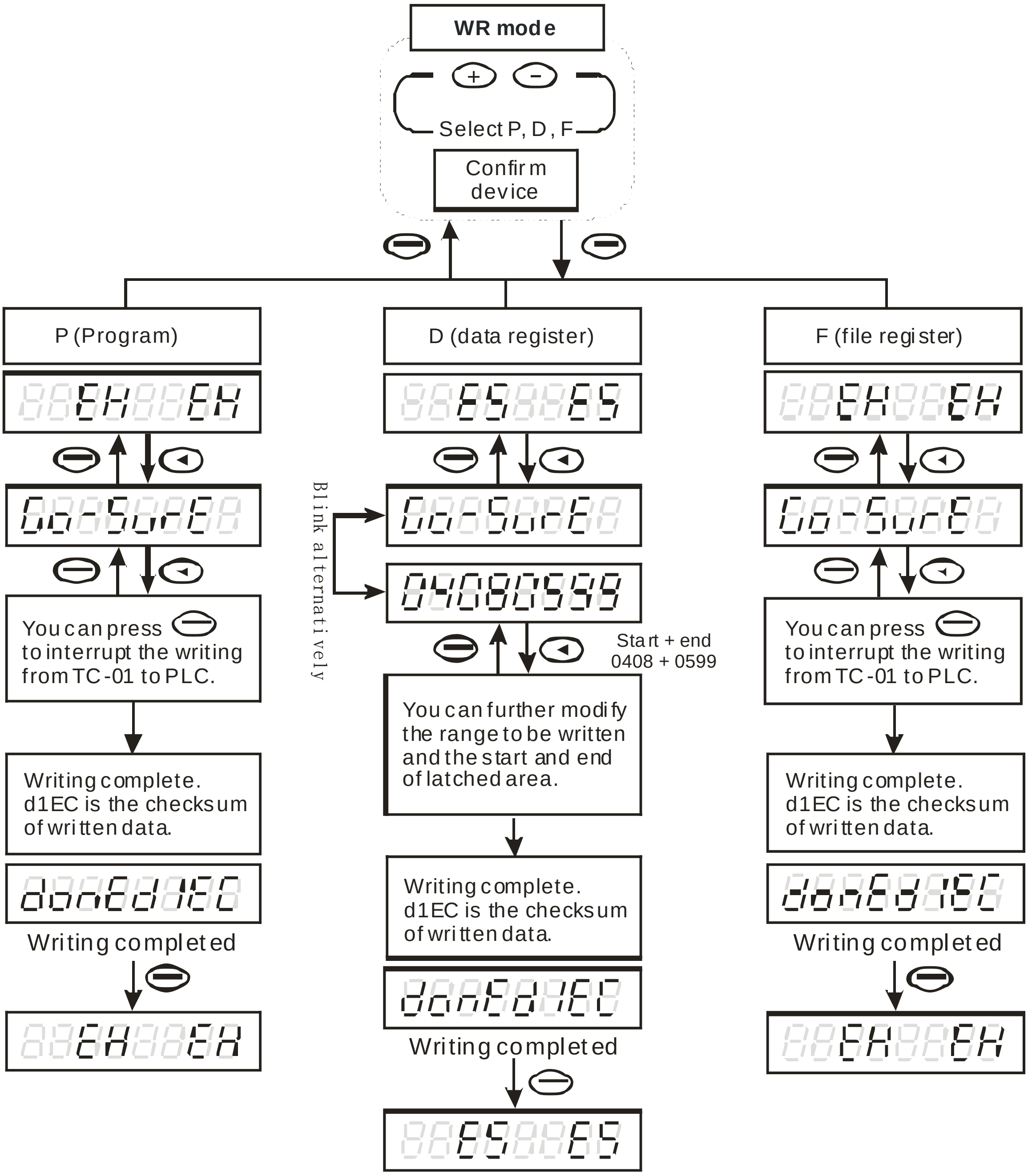
   - With the password key, you will be able to write data into the PLC which is without a password or whose password is the same as the one you set up in TC-01. If the PLC has no password in it, the password will be written also into the PLC as a protection.
   - To clear the password, follow the steps above until you can display “KEY CLR” on the screen. In WPLSoft, go to Options => TC-01 Password Key Setup => Clear TC-01 Password Key and follow the instructions.

3. How to clear the data in P, D, F, areas: Select the area you would like to clear (P, D or F) and press ⊕ and ⊖ at the same time. Next, press ESC to exit.

4. RD mode:


RD mode
+
-
Select P, D, F
Confirm device
P (Program)
D (data register)
F (file register)
--EH
--ES
--EH
Go-SurE
Go-SurE
Go-SurE
You can press
to interrupt the reading of P area.
You can further modify the range to be read and the start and end of latched area.
You can press
to interrupt the reading of F area.
Reading completed. d1EC is the checksum of written data.
Enter start address
UP-0408
Enter end address
dn-0599
Reading completed. 2746 is the checksum of written data.
donEd1EC
donE2746
Reading completed
Reading completed
EH EH
EA EH
You can press
in interrupt the reading.
donE2746
Reading completed
ES ES

5. WR mode:



9.5 Error Codes

Code	Explanation & How to Solve
Error-00	RD P error due to PLC is locked by password and you do not have a password key in TC-01 or the key is incorrect. Remove the password in WPLSoft or set up the key in TC-01 mode.
Error-01	WR P error due to PLC is locked by password, you do not have a password key in TC-01, the key is incorrect or the source model is different from the target model.
Error-02	RD D error due to illegal reading range. (D only refers to general data registers, excluding special D registers.)
Error-03	WR D error due to the source model is different from the target model.
Error-04	RD F error due to DVP-ES MPU does not have file registers in it.
Error-05	WR F error due to the source model is different from the target model.
Error-06	PLC is in RUN status. Writing P area is prohibited.

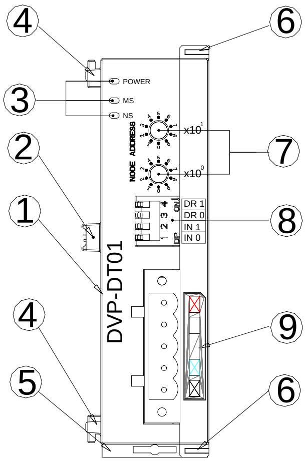
10.1 DVPDT01-S: DeviceNet Communication Module

10.1.1 Features

1. Supports Group 2 only servers.
2. Supports explicit connection via Predefined Master/Slave Connection Set. (Explicit message)
3. Supports Polling connection.
4. The connection size is fixed to 4 bytes of input and 4 bytes of output.
5. Supports EDS file configuration in DeviceNet configuration tools.

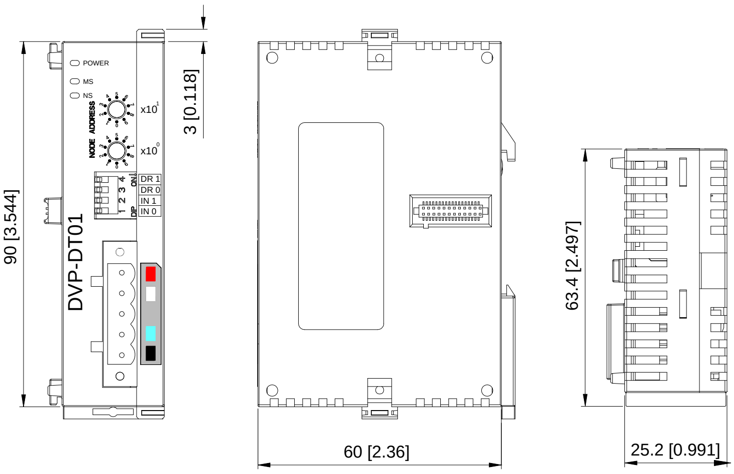
10.1.2 Product Profile and Outline

1. Product profile



① Model name
② Extension port
③ Power, MS, NS LED
④ Extension hole for mounting unit or module
⑤ DIN rail clip
⑥ Extension clip
⑦ Address switch
⑧ Function switch
⑨ DeviceNet connection port

2. Dimension



Unit: mm [inches]

10.1.3 Specifications

DeviceNet connection

Interface	Pluggable connector (5.08mm)
Transfe method	CAN
Transfer cable	2-wire twisted shielded cable with 2-wrie bus power cable and drain
Electrical isolation	500V DC

Communication

Message types	I/O Polling
	Explicit
Baud rates	125 k bps
	250 k bps
	500 k bps
Product code	80
Product type	12
Supplier ID	799 (Delta Electronics Inc.)

Electrical specification

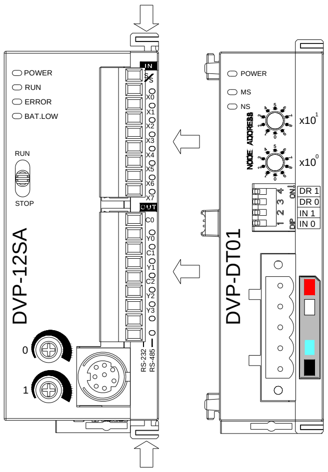
DeviceNet	Module supply voltage: All other power derived from PLC controller power supply
	Network input current: less than 50mA (24V DC)

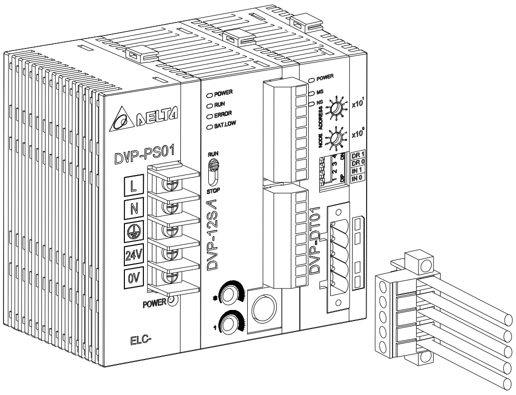
Environment

Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV, Analog & Communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m
Operation/storage	Operation: 0°C ~ 55°C (temperature), 50 ~ 95% (humidity), Pollution degree 2 Storage: -40°C ~ 70°C (temperature), 5 ~ 95% (humidity)
Vibration/shock resistance	Standard: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC6131-2 & IEC 68-2-27 (TEST Ea)
Standard	Standard: IEC 61131-2,UL508

10.1.4 Installation and Configuration

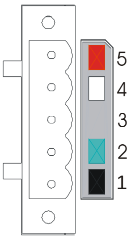
1. Install DVPDT01-S with PLC MPU





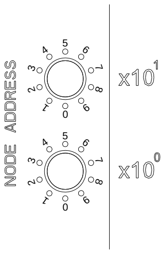
2. PIN definition of DeviceNet connector

PIN	Signal	Color	Content
1	V-	Black	0V DC
2	CAN_L	Blue	Signal-
3	Drain	-	Shield
4	CAN_H	White	Signal+
5	V+	Red	24V DC



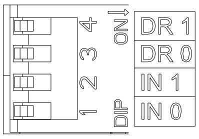
3. MAC ID setting

Switch setting	Content
0 ~ 63	Valid DeviceNet MAC ID setting
95	Set module entry update mode
Other	Invalid DeviceNet MAC ID setting



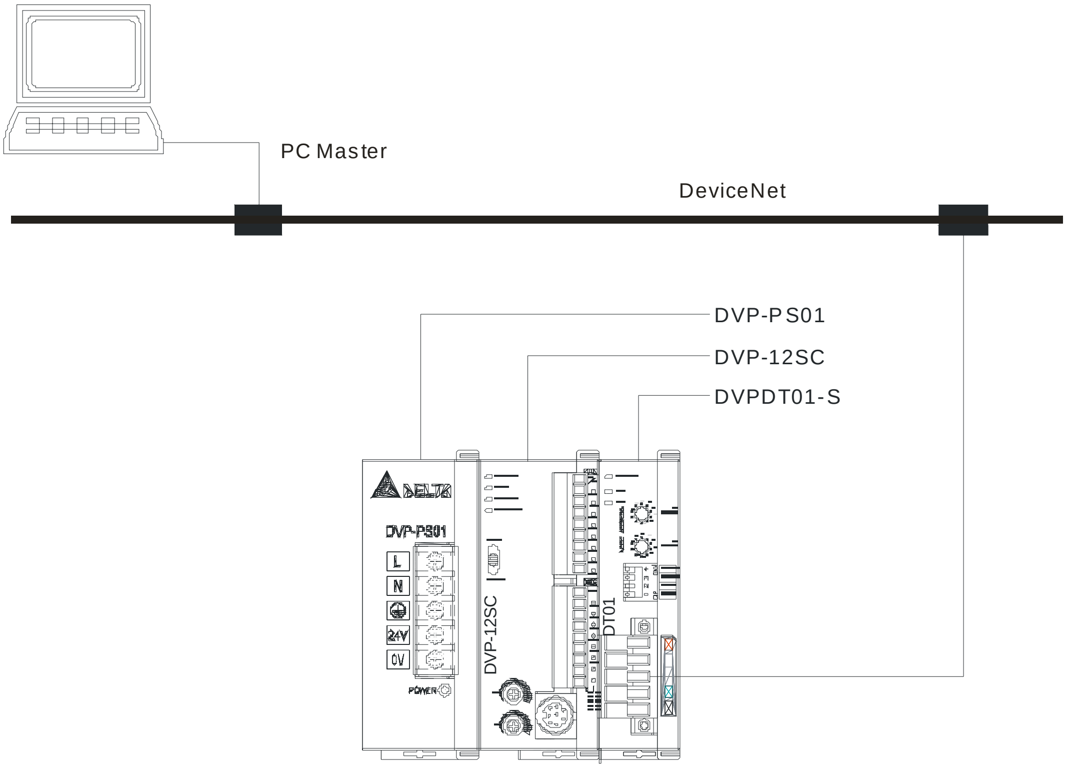
4. Function switch setting

DR1	DR0	Baud rate
Off	Off	125k bps
Off	On	250k bps
On	Off	500k bps
On	On	Auto baud rate (not recommend)
IN0	On: Hold the input and output buffer data when DeviceNet is not communicable. Off: Clear the input and output buffer data when DeviceNet is not communicable.	
IN1	Reserved	

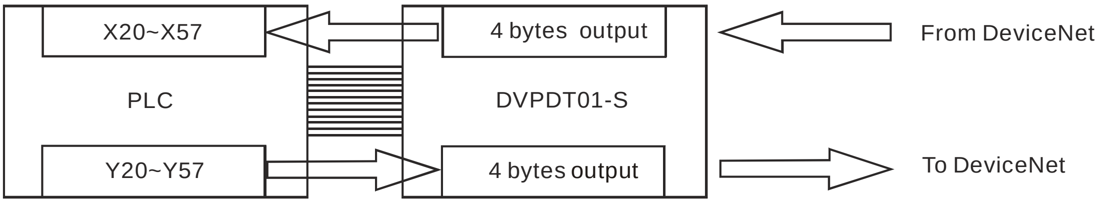


10.1.5 The Applications

1. Connect DVPDT01-S to DeviceNet



2. DVPDT01-S offers a fixed 4-byte input and 4-byte output in DeviceNet. Supposed DVPDT01-S is the first extension module in the network, Y20 ~ Y57 of the PLC will map to the 4-byte input data in DVPDT01-S and the data will be sent to the master in DeviceNet. The 4-byte output data returned from the master in DeviceNet will then map to X20 ~ X57 of the PLC by DVPDT01-S.
3. Data mapping

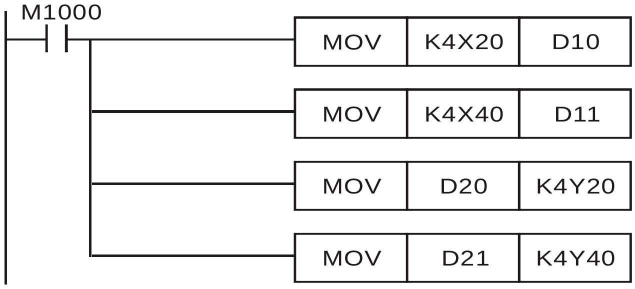


4. Cable length and baud rate

- The maximum cable length in a segment depends on the transmission speed. DeviceNet communicates at speeds from 125k bps to 500k bps over distances from 100 to 500 meters.

Baud rate (bps)	125k	250k	500k
Length (m)	500	250	100

5. Program example



- In the example, the 4 bytes of data returned from the master in DeviceNet which are mapped to X20 ~ X57 are moved to D10 and D11. Next, the data in D20 and D21 will be written into Y20 ~ Y57 and sent to DVPDT01-S. DVPDT01-S further sends these data to the master in DeviceNet.

10.1.6 Troubleshooting

MS LED status	Indication	How to correct
Off	No power; Duplicating ID has not completed.	1. Check if the power of DVPDT01-S is on. 2. Make sure one or more nodes are communicating on the network. 3. Make sure at least one other node on the network is operational at the same time and its baud rate is the same as that of DVPDT01-S.
Flashing in green	Online, but not connected to DeviceNet	--
Green on	Online and one or more connections have been established.	--
Flashing in red	Online, but I/O connection time-out occurs.	--
Red on	Network failure. Failed ID duplication or Bus-off.	1. Make sure all nodes have a unique address. 2. Check the network and correct the media installation and baud rate.

MS LED status	Indication	How to correct
Off	No power; off-line	Check if the power of DVPDT01-S is on.
Flashing in green	Waiting for I/O data	DVPDT01-S has passed all operational tests and is waiting to exchange I/O data.
Green on	I/O operation in progress	--
Flashing in red	Configuration problem	Re-power DVPDT01-S
Red on	Hardware error	Return to manufacturer or distributor for repair.

NS LED	MS LED	Indication	How to correct
Off	Off	No power.	Check if the power of DVPDT01-S is on.
Off	Green on	Duplicating ID has not completed.	Make sure at least one other node on the network is operational at the same time and its baud rate is the same as that of DVPDT01-S.
Red on	Flashing in red	No 24V DC power from DeviceNet	Check if the network cable is connected to DVPDT01-S and the 24V DC power.
Red on	Red on	Hardware error; no network power.	Return to manufacturer or distributor for repair.
Red on	Green on	MAC ID error; Bus-off.	Change the MAC ID setting and re-power DVPDT01-S.
Green on	Off	DVPDT01-S updates firmware	Make sure the MAC ID setting is 0 ~ 63 and re-power DVPDT01-S.

10.1.7 DeviceNet Objects DVPDT01-S Supports

1. Object classes

- The communication interface supports the following object classes:

Class	Object
0x01	Identity
0x02	Message router
0x03	DeviceNet
0x05	Connection

2. Class 0x01 identity

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT
2	Get	MaxInstance	UINT
3	Get	NumberofInstances	UINT
6	Get	MaxIdClass	UINT
7	Get	MaxIdInstance	UINT

- Instance 1: PLC instance

Attribute ID	Access rule	Name	Data type
1	Get	VendorId	UINT
2	Get	DeviceType	UINT
3	Get	ProductCode	UINT
4	Get	Revision MajRev MinRev	USINT USINT
5	Get	Status	WORD
6	Get	Sn	UDINT
7	Get	ProdName StrLen ASCIIStr	USINT STRING

- Common services

Service Code	Implemented for		Service Name
	Class	Instance	
0x05	No	Yes	Reset
0x0e	Yes	Yes	Get_Attribute_Single
0x10	No	No	Find_Next_Object_Instance

3. Class 0x02 message router

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT
6	Get	MaxIdClass	UINT

Attribute ID	Access rule	Name	Data type
7	Get	MaxIdInstance	UINT

- Instance 1:

Attribute ID	Access rule	Name	Data type
2	Get	NumAvailable	UINT
3	Get	NumActive	UINT

- Common services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0e	Yes	Yes	Get_Attribute_Single

4. Class 0x03 DeviceNet

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1: drive instance

Attribute ID	Access rule	Name	Data type
1	Get	MACID	USINT
2	Get	BaudRate	USINT
3	Get/Set	BusofInterrupt	BOOL
4	Get/Set	BusofCounter	USINT
5	Get	AllocationInfo AllocationChioce MasterNodeAddress	BYTE USINT
6	Get	MACIDSwitchChanged	BOOL
7	Get	BaudRateSwitchChanged	BOOL
8	Get	MACIDSwitchValue	USINT
9	Get	BaudRateSwitchValue	USINT

- Common services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release_Master/Slave_Connection_Set

5. Class 0x05 connection

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1: Master/Slave explicit message connection

Attribute ID	Access rule	Name	Data type
1	Get	State	USINT
2	Get	InstanceType	USINT
3	Get	TransportClassTrigger	USINT
4	Get	ProducedConnectionId	UINT
5	Get	ConsumedConnectionId	UINT
6	Get	InitialCommCharacteristics	BYTE
7	Get	ProducedConnectionSize	UINT
8	Get	ConsumedConnectionSize	UINT
9	Get/Set	ExpectedPackedRate	UINT
12	Get/Set	WatchdogTimeoutAction	USINT
13	Get	Produced Connection Path Length	USINT
14	Get	Produced Connection Path	EPATH
15	Get	Consumed Connection Path Length	USINT
16	Get	Consumed Connection Path	EPATH

- Instance 2: polled I/O connection

Attribute ID	Access rule	Name	Data type
1	Get	State	USINT
2	Get	InstanceType	USINT
3	Get	TransportClassTrigger	USINT
4	Get	ProducedConnectionId	UINT
5	Get	ConsumedConnectionId	UINT
6	Get	InitialCommCharacteristics	BYTE
7	Get	ProducedConnectionSize	UINT
8	Get	ConsumedConnectionSize	UINT
9	Get/Set	ExpectedPackedRate	UINT
12	Get/Set	WatchdogTimeoutAction	USINT
13	Get	Produced Connection Path Length	USINT
14	Get	Produced Connection Path	EPATH
15	Get	Consumed Connection Path Length	USINT
16	Get	Consumed Connection Path	EPATH

- Common services

Service Code	Implemented for		Service Name
	Class	Instance	
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

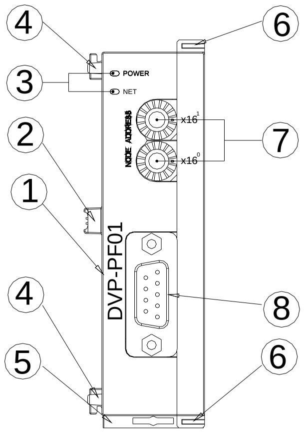
10.2 DVPPF01-S: Profibus-DP Slave Module

10.2.1 Features

1. Cyclical data exchange process
2. Supports SYNC and FREEZE for data synchronization between master and slaves.
3. Supports auto baud rate detection.
4. Supports 12MHz baud rate in DP network.
5. The cyclical data size is fixed to 4 bytes of input and 4 bytes of output.
6. Supports GSD file configures by using configuration tools.

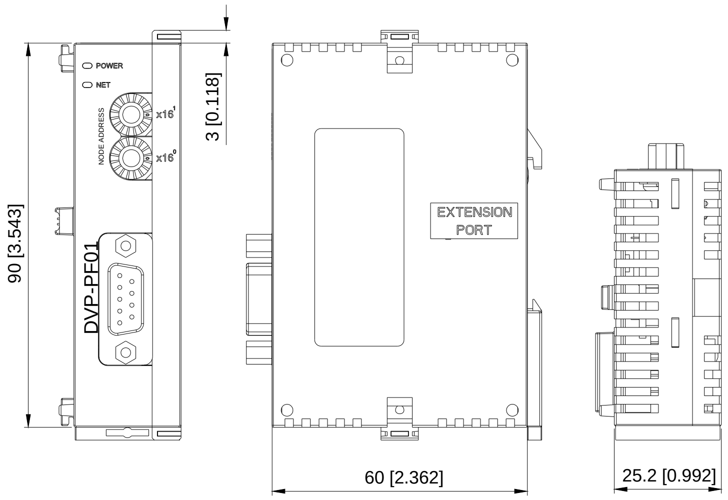
10.2.2 Product Profile and Outline

1. Product profile



① Model name
② Extension port
③ Power/NET LED
④ Extension hole for mounting unit or module
⑤ DIN rail clip
⑥ Extension clip
⑦ Address switch
⑧ Profibus connector

2. Dimension



Unit: mm [inches]

10.2.3 Specifications

DP Connection

Interface	DB9 connector
Transmission method	High-speed RS-485
Transmission cable	2-wire twisted shielded cable
Electrical isolation	500V DC

Communication

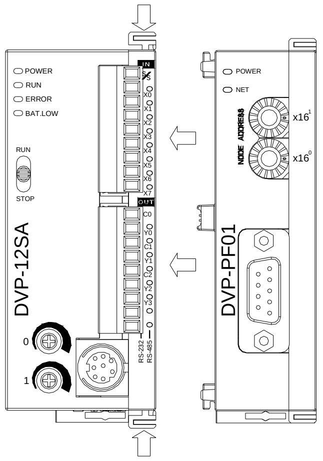
Message types	DPV0, cyclical data exchange
Device ID	09B9 HEX
GSD file	DELT09B9.GSD
Model Name	DVPPF01
Baud rates (Auto detected)	9.6k bps, 19.2k bps, 93.75k bps, 187.5k bps, 500k bps, 1.5M bps, 3M bps, 6M bps, 12M bps.

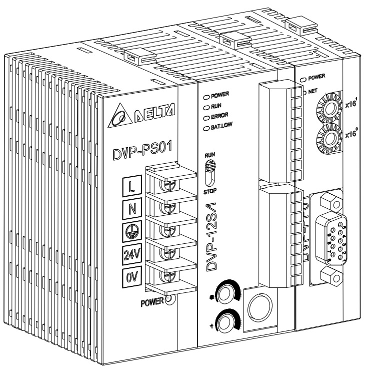
Environment

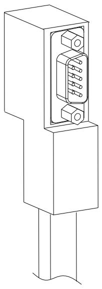
Noise Immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV, Analog & Communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m
Operation/storage	Operation: 0°C ~ 55°C (temperature), 50 ~ 95% (humidity), Pollution degree 2 Storage: -40°C ~ 70°C (temperature), 5 ~ 95% (hHumidity)
Vibration/shock resistance	Standard: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)
Standard	Standard: IEC 61131-2, UL508

10.2.4 Installation and configuration

1. Install DVPPF01-S with PLC MPU







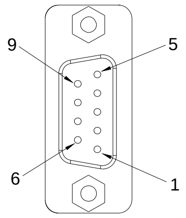
2. Cable length and baud rate

- The maximum cable length in a segment depends on the transmission speed. Profibus-DP communicates at speeds from 9.6k bps to 12M bps over distances from 100 to 1,200 meters

Baud rate (bps)	9.6k	19.2k	93.75k	187.5k	500k	1.5M	3M	6M	12M
Length (m)	1,200	1,200	1,200	1,000	400	200	100	100	100

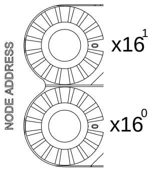
3. PIN definition of DP connector

PIN	Definition	Content
1	--	N/C
2	--	N/C
3	RxD/TxD-P	Sending/receiving data P (B)
4	--	N/C
5	DGND	Data reference potential (C)
6	VP	Positive voltage
7	--	N/C
8	RxD/TxD-N	Sending/receiving data N (A)
9	--	N/C



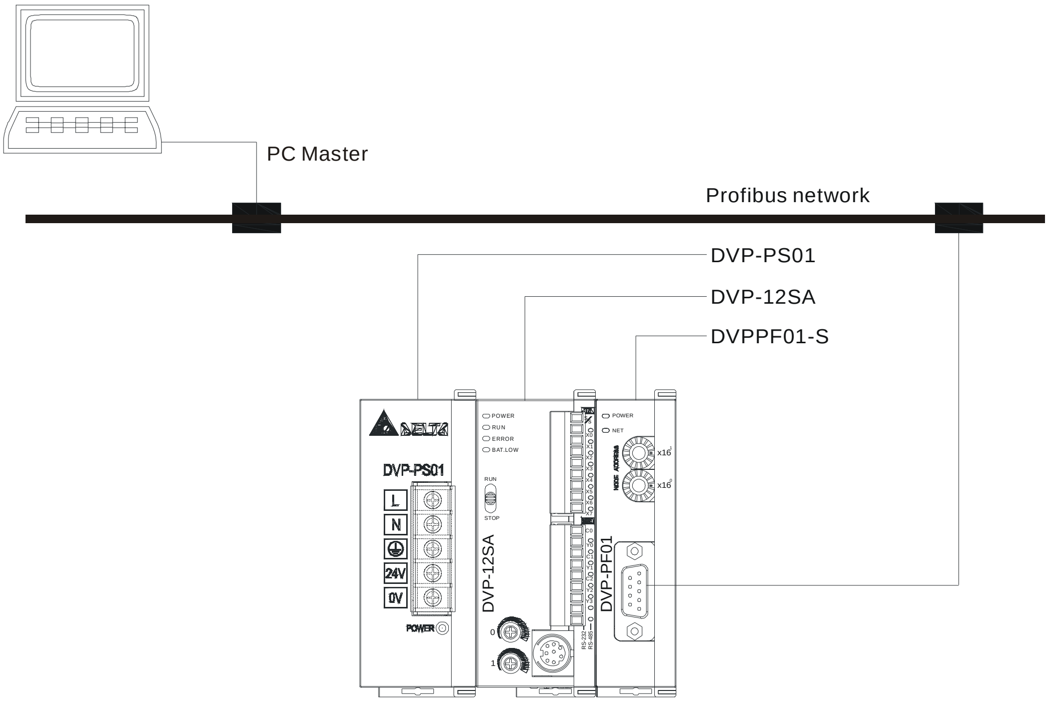
4. MAC ID setting

Address	Content
H'1 ~ H'7D	Valid Profibus address.
H'0 or H'7E ~ H'FF	Invalid Profibus address. NET LED will flash rapidly in red if the node address is within the address range.

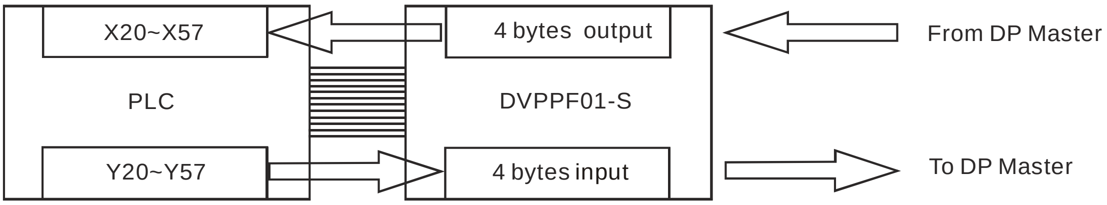


10.2.5 The Applications

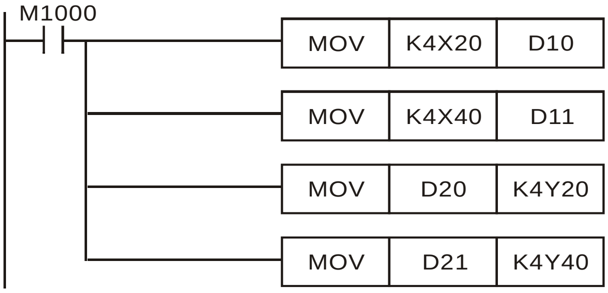
1. Connect DVPPF01-S to Profibus-DP



2. DVPPF01-S offers a fixed 4-byte input and 4-byte output in Profibus-DP. Supposed DVPPF01-S is the first extension module in the network, Y20 ~ Y57 of the PLC will map to the 4-byte input data in DVPPF01-S and the data will be sent to the master in Profibus-DP. The 4-byte output data returned from the master in Profibus-DP will then map to X20 ~ X57 of the PLC by DVPPF01-S.
3. Data mapping



4. Program example



- In the example, the 4 bytes of data returned from the master in Profibus-DP which are mapped to X20 ~ X57 are moved to D10 and D11. Next, the data in D20 and D21 will be written into Y20 ~ Y57 and sent to DVPPF01-S. DVPPF01-S further sends these data to the master in Profibbus-DP.

10.2.6 Troubleshooting

1. NET LED

LED Status	Indication	How to correct
Off	No power supply	Check if DVPPF01-S is powered.
Flashing rapidly in red	Invalid Profibus address	Check whether the switch setting is valid. Valid range = 1~ 125. Set to valid range and re-power DVPPF01-S..
Flashing in red	Communication to Profibus is successful, but no cyclical data exchange.	--
Red on	No connection to Profibus	1. Check that DP network installation is OK. 2. Check that PLC is working. 3. Check that switch address setting match with configuration in DP master.

2. Power LED

LED Status	Indication	How to correct
Green on	Power on	--
Off	No power	Check if DVPPF01-S is powered.

10.2.7 About Profibus-DP

- Profibus is an international, open and vendor- independent communication protocol widely applied in manufacturing, production, processing and building automation and other automation control fields.
- The Profibus system contains 3 types of protocols depending on different application demands: Profibus-DP, Profibus-PA and Profibus-FMS.
  - ■ Profibus-DP (Decentralized Periphery)
    Profibus-DP is a fast and low-cost communication system exclusively designed for high-speed data transmission. Profibus-DP is widely adopted, particularly in a remote I/O

system, motor control center and frequency inverter. Using Profibus-DP to connect the automation system to separate peripheral devices gives you the best performance.

- Profibus-PA (Process Automation)

  Profibus-PA (normally attached with MBP-IS transmission technology) is for remote automation. Being the extension of Profibus-DP, Profibus-PA is exclusively supports intrinsic safety in data transmission by applying MBP-IS port to an area in danger of explosion. Profibus-PA is able to connect a sensor and PLC to bus.

- PROFIBUS-FMS (Fieldbus Message Specification)

  Profibus-FMS is a multiple master communication designed for communication at the cell level, offering a cyclic or acyclic medium-speed data transmission between the control equipment and cell-level controller. Profibus-FMS offers transmission service for a large amount of data, and its strong functions and flexibility satisfy a wide range of applications.

MEMO

11.1 Introduction

1. DVPPCC01 supports the copy of program, parameter and password of DVP series PLC. DVPPCC01 reads or writes the program and parameter in the PLC through COM port on the PLC. DVPPCC01 also supports password function, which is a safe tool for data transmission.
2. Before the data transmission, set up a desired mode (RD or WR) before plugging DVPPCC01 into the COM port on the PLC. While DVPPCC01 is reading the data in the PLC, DO NOT switch off DVPPCC01 or plug it off from the PLC before the data transmission is completed in case you will lose the data.
3. PLC models DVPPCC01 supports and read/write devices:

Device type / Models	Program area	PLC device area		
	Program steps	D register	M device	File register
DVP-ES/EX/SS	4k	D0 ~ D599	M0 ~ M1279	N/A
DVP-SA/SX/SC	8k	D0 ~ D4999	M0 ~ M4095	1,600
DVP-EH/EH2/SV	16k	D0 ~ D9999	M0 ~ M4095	10,000

11.2 Specifications

Item	Description
Data retention	10 years
Write-in times	At least 10,000 times
Transmission speed	9,600/19,200 bps (ES/EX/SS supports 9,600bps only)
Storage	-25°C ~ 70°C (temperature), 5 ~ 95% (humidity)
Operation	0°C ~ 55°C (temperature), 50 ~ 95% (humidity), pollution degree 2
Noise immunity	ESD: ±4KV Air Discharge EFT: Power Line: 2KV RS: 0.15MHz ~ 80MHz, 10V/m Surge : ±1KV
Vibration/shock resistance	International standard: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)

11.3 Operation and Functions

1. Read and write

Step	RD (read) (PLC → DVPPCC01)	WR (write) (DVP- PCC01 → PLC)
1	Set the RD/WR switch to “RD”	Set the RD/WR switch to “WR” and check if the PLC is in STOP status.
2	Insert DVPPCC01 into the COM port on the PLC and wait for 5 seconds.	Insert DVPPCC01 into the COM port on the PLC and wait for 5 seconds.
3	After the reading is completed, “OK” LED will be On.	After the writing is completed, “OK” LED will be On.
4	Remove DVPPCC01 from the PLC.	Remove DVPPCC01 from the PLC.

2. Password protection
   - Supposed DVPPCC01 is to write data into a PLC, and the PLC is already locked by a password, DVPPCC01 will compare the password key in it with the password in the PLC for a verification. The data can only be written into the PLC under a successful verification. See the explanation below for how to set up the password key in DVPPCC01.

    - ■ Write the password key to be set in DVPPCC01 into D1086 and D1087 of the PLC by DVPHPP02 or WPLSoft. And set On M1086 in the PLC.
    - ■ Switch DVPPCC01 to RD and plug the communication port of DVPPCC01 into the COM port of the PLC. DVPPCC01 then starts to read the program and parameters in the PLC.
    - ■ After the reading, DVPPCC01 will check whether M1086 in the PLC is On. If so, DVPPCC01 will next read the values in D1086 and D1087 and the values will be regarded as the password key. After that, the “OK” LED on DVPPCC01 will be On, indicating that all the reading has been completed. Next, remove DVPPCC01 from the PLC.

- The password key consists of 4 digits; each digit represents an 8-bit value and corresponds to an ASCII code (only visible words are acceptable). D1086 and D1087 store the 4-digit password key. See the example (entering password 1234 by WPLSoft) below:

Password key / Password setting	D1086		D1087	
	High byte	Low byte	High byte	Low byte
ASCII code (hex)	Digit 1	Digit 2	Digit 3	Digit 4
	1 (0x31 = H31)	2 (0x32 = H32)	3 (0x33 = H33)	4 (0x34 = H34)

3. Read/write from DVPPCC01 to PLC:

PCC01 / PLC		Read		Write	
		No password	With password	No password	With password
RUN	No password	Able to read	Incorrect password in verification	Unable to write	Unable to write
	With password	Unable to read	Unable to read	Unable to write	Unable to write
STOP	No password	Able to read	Incorrect password in verification	Able to write	Write in with the password
	With password	Unable to read	Unable to read	Incorrect password in verification	Able to write only after the verification of correct password

4. Executing RUN/STOP of PLC
    - For DVP-ES/EX series MPU which is without RUN/STOP switch on it, DVPPCC01 is able to executing RUN/STOP for the PLC. How to work: Plug in DVPPCC01 (in WR mode) while the PLC is in RUN status, and DVPPCC01 is unable to write data into the PLC. Wait unit the ERR LED and OK LED flashes synchronously for 30 seconds and press ERASE button, which will switch the RUN status to STOP. At this point, remove DVPPCC01 from the PLC and plug it in again and wait until the data transmission is completed. When OK LED is On for 30 seconds, press ERASE button again, and the PLC will be switch from STOP into RUN status again.
5. Clearing data in DVPPCC01
    - Plug DVPPCC01 into the COM port of the PLC and wait for the power indicator to be On for 5 seconds. Press ERASE button. When OK LED is constantly On, the data will be completely cleared. Remove DVPPCC01 from the PLC.
6. Copying data
    - When DVPPCC01 writes data into the PLC, you can choose either to copy the program and parameters or simply copying the program. To do so, you have to set up M1085 in the PLC before the copying. M1085 = Off: DVPPCC01 copies the program and parameters. M1085 =

On: DVPPCC01 copies only the program.

- How to set up M1085
  - Set On or Off M1085 in the PLC (depending on the area you would like to copy)
  - Switch DVPPCC01 to RD mode and plug the communication port of DVPPCC01 into the COM port of the PLC.
  - DVPPCC01 will start to read M1085 in the PLC. After the reading is completed, OK LED on DVPPCC01 will be constantly On, indicating the reading has been competed. Next, remove DVPPCC01 from the PLC.
- Maximum time for read/write:

Model	M1085 = Off		M1085 = On	
	Read	Write	Read	Write
DVP-ES/EX/SS	35 sec.	45 sec.	30 sec.	35 sec.
DVP-SA/SX/SC	1 min. 10 sec.	1 min. 15 sec.	1 min. 5 sec.	1 min. 10 sec.
DVP-EH/SV	2 min. 50 sec.	3 min.	1 min. 10 sec.	1 min. 20 sec.

11.4 Troubleshooting

1. When DVPPCC01 is reading/writing, and ERR LED is constantly On or flashing, see the error message table below for how to solve the problems.
2. When DVPPCC01 is reading/writing, and the power of PLC is suddenly shut down, or DVPPCC01 is removed from the PLC, the following scenarios will occur:
   - While reading: The data in DVPPCC01 will be lost. Re-power the PLC or plug DVPPCC01 into the PLC again.
   - While writing: The data in the PLC will be lost. Re-power the PLC or plug DVPPCC01 into the PLC again.
3. Error messages
   - When DVPPCC01 completes reading the data in the PLC, it will record the model type of the PLC as well. Supposed the capacity of the program to be written into the PLC is different from what has been recorded in DVPPCC01, DVPPCC01 will not write in it, and ERR LED will start to flash. See the table below for other error messages:

Error Message	Indicator		Cause & how to correct
	ERR	OK	
Internal memory error; failed connection	☼ On	● Off	The hardware of DVPPCC01 may be malfunctioned. Please change it.
Incorrect PLC model	◐ flashing	● Off	Make sure the program in DVPPCC01 is compatible with the connected PLC model.
Operational error; unable to write	◐ Flashing at the same time	◐	1. DVPPCC01 has no data in it but still executes the writing. Make sure there is program inside DVPPCC01 and the operation mode (RD/WR) of DVPPCC01. Set the PLC to STOP. 2. The communication formats in DVPPCC01 and the PLC are incompatible. Set the PLC to STOP and re-power it. Make sure the communication format of the PLC is ASCII 9,600, 7, E, 1. 3. The program in DVPPCC01 is illegal. Make sure the program is correct.
Operational error; unable to read	◐ Flashing interchangingly	◑	1. PLC is protected by password. Remove the password. 2. The communication formats in DVPPCC01 and the PLC are incompatible. Set the PLC to STOP and re-power it. Make sure the communication format of the PLC is ASCII 9,600, 7, E, 1.

Error Message	Indicator		Cause & how to correct
	ERR	OK	
Inconsistent password	☼ On	◐ Flashing	1. DVPPCC01 is in RD mode and protected by a password. Clear the data in DVPPCC01 (See 11.3). 2. DVPPCC01 is in WR mode, and the PLC is protected by a password. Unlock the password in the PLC or set up a password in DVPPCC01 as the same one in the PLC (See 11.3).
ERASE completed	● Off	☼ On	1. Press ERASE button on DVPPCC01 to erase the memory in DVPPCC01. After this, OK LED will be constantly On. 2. To conduct RD/WR function again in DVPPCC01, re-power the PLC or remove DVPPCC01 and plug it in again..

11.5 ASCII Code Conversion

The password in the PLC is composed of 4 digits, and each digit represents an 8-bit value which corresponds to one ASCII code. The password only accepts visible words, and you can only enter 0 ~ 9 and A ~ Z for the password by DVPHPP02. However, in WPLSoft, you are able to enter all visible words. Therefore, the values set in D1086 and D1087 have to be visible words; otherwise, you will not be able to unlock the password in the PLC by WPLSoft or DVPHPP02.

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
HEX	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
HEX	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
ASCII	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
HEX	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
ASCII	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
HEX	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
ASCII	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
HEX	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
ASCII	P	Q	R	S	T	U	V	W	X	Y	Z	☒	☒	☒	☒	☒
HEX	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
ASCII	`	a	b	C	d	e	f	g	h	i	j	k	l	M	n	o
HEX	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F
ASCII	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	☒

Note: '☒' represents invisible words. Please do not use it.

12.1 Introduction

1. To make sure that you are able to correctly install and operate DNA02, please read this chapter carefully before starting to use DNA02 and keep this handy for your quick reference.
2. This chapter only provides introductory information and guidelines on DNA02. Details of DeviceNet protocol are not included. For more information on DeviceNet protocol, please refer to relevant references or literatures.
3. DNA02 is defined as DeviceNet slave communication module to be used on the connection between DeviceNet network and Delta programmable logic controller, Delta AC motor drive, Delta servo drive, Delta temperature controller and Delta human machine interface. In addition, the custom function of DNA02 allows the custom equipment with Modbus protocol to connect to DeviceNet network.

12.1.1 DNA02 Brief

1. MODULE STATUS indicator and NETWORK STATUS indicator display the connection status between DNA02 and DeviceNet. SCAN PORT indicator displays the connection status between DNA02 and the equipments. For more details on LED indicators, see 12.4.
2. DNA02 sets up its node address in DeviceNet by two rotary switches. For more details on the switches, see 12.2.
3. Functions of DIP switches: selecting equipments connected to DNA02, selecting communication port of DNA02, setting up the baud rate between DNA02 and the master. For more details on DIP switches, see 12.2.
4. DeviceNet interface connects DNA02 to DeviceNet network. For more details, see 12.2.
5. The communication ports allows DNA02 to connect with Delta programmable logic controller, Delta AC motor drive, Delta temperature controller, Delta servo drive, Delta human machine interface and equipment with Modbus protocol. For more details, see 12.2.

12.1.2 Features

1. Supports Group 2 only servers
2. Supports explicit connection in the pre-defined master/slave connection group
3. Supports polling
4. Supports EDS files in DeviceNet network configuration tools
5. Specifications:

DeviceNet connector

Type	Removable connector (5.08mm)
Transmission method	CAN
Transmission cable	2 communication cables, 2 power cables and 1 shielded cable
Electrical isolation	500V DC

Communication

Message type	I/O polling
	Explicit
Baud rate	125 k bps (bit/sec)
	250 k bps (bit/sec)
	500 k bps (bit/sec)

Electrical specification

DeviceNet voltage	11 ~ 25V DC (Network power input connector)

Environment

Operation temperature	-4 ~ 122^{o}F (-10 ~ 50^{o}C)
Storage temperature	-4 ~ 140^{o}F (-20 ~ 60^{o}C)
Humidity	<90% (under normal pressure)
Altitude	Max.: 1,000m
Shock/vibration immunity	0.5G 9 ~ 200Hz

Safety standard

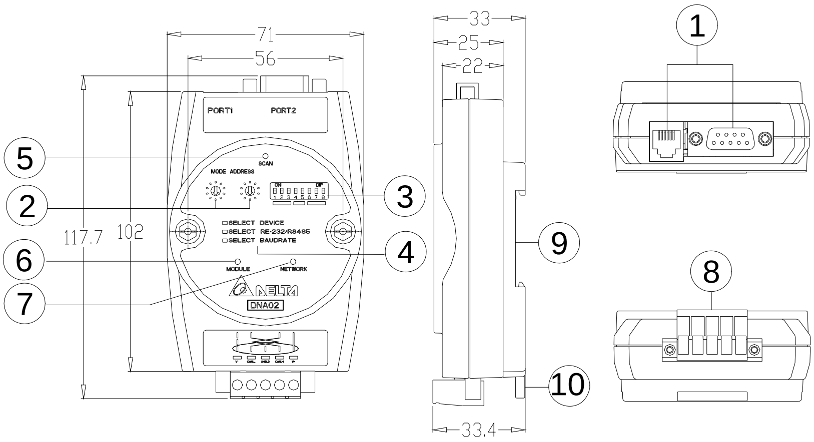
Under EN50178 standard

Certifications

CE certified and UL certified

12.2 Components

12.2.1 Product Profile and Outline



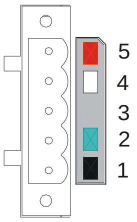
Unit: mm

1. Communication ports	6. MS (Module Status) indicator
2. Address setup rotary switches	7. NS (Network Status) indicator
3. Function setup DIP switches	8. DeviceNet connector
4. Descriptions for DIP switches	9. DIN rail
5. SP (Scan Port) indicator	10. DIN rail clip

12.2.2 DeviceNet Connector

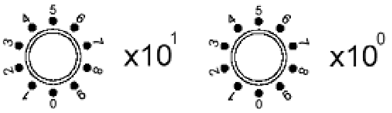
To connect with DeviceNet network, you can use the connector enclosed with DNA02 or any connectors you can buy in the store for wiring.

PIN	Signal	Color	Description
1	V-	Black	0V DC
2	CAN_L	Blue	Signal-
3	SHIELD	-	Shielded cable
4	CAN_H	White	Signal+
5	V+	Red	24V DC



12.2.3 Address Setup Rotary Switch

The two rotary switches SW1 and SW2 set up the node address on DeviceNet in decimal form. Setup range: 00 ~ 63 (64 ~ 99 are forbidden).



1. Example:

   If you need to set the node address of DNA02 as 26, simply switch the corresponding rotary switch of X10^1 to "2" and the corresponding rotary switch of X10^0 to "6".

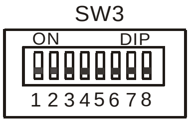
Address setting	Description
0 ~ 63	Valid DeviceNet node address
64 ~ 99	Invalid DeviceNet node address

2. Note:

   The changed values on SW1 or SW2 are only valid when DNA02 is re-powered. When DNA02 is operating, changing the set value of node address will be invalid.

12.2.4 Function Setup DIP Switch

The DIP switch SW3 is to be used on the equipment connected to DNA02, the selection of communication ports and setting up the baud rate of DNA02 and the master in DeviceNet.



1. Selecting equipment connected to DNA02

PIN 3	PIN 2	PIN 1	Equipment
Off	Off	On	AC motor drive
Off	On	Off	Programmable logic controller
Off	On	On	Temperature controller
On	Off	Off	Servo drive
On	Off	On	Human machine interface
On	On	Off	Custom equipment
On	On	On	Configuration mode

- Example

  If the equipment connected to DNA02 is Delta servo drive, you only need to switch PIN 3 in SW3 to "On" and PIN 1 and PIN 2 to "Off" and re-power DNA02.

- Note:

The changed setting of DIP switch is only valid when DNA02 is re-powered. When DNA02 is operating, changing the setting of DIP switch will be invalid.

2. Selecting DNA02 communication mode

PIN 5	PIN 4	Communication mode
Off	Off	RS-485
On	On	RS-232
Off	On	Incorrect setting
On	Off	

- Note

  The changed setting of communication mode is only valid when DNA02 is re-powered. When DNA02 is operating, changing the setting of communication mode will be invalid.

3. Setting up baud rate

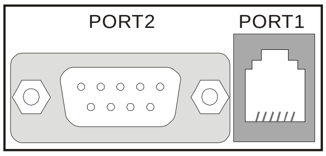
PIN 8	PIN 7	PIN 6	Baud rate of slave device
Reserved	Off	Off	125k bps
	Off	On	250k bps
	On	Off	500k bps
	On	On	Auto baud rate detection

- Note:

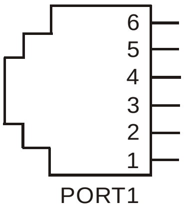
  The changed setting of the baud rate of DeviceNet is only valid when DNA02 is re-powered. When DNA02 is operating, changing the baud rate will be invalid.

12.2.5 Communication ports on DNA02

The communication ports on DNA02 are used for the connection with the equipment (Delta programmable logic controller, Delta AC motor drive, Delta temperature controller, Delta servo drive, Delta human machine interface and custom equipment).



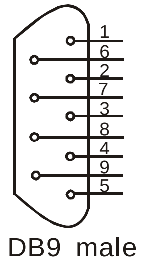
1. PORT 1 PIN definition

PORT 1 sketch	PIN	Description
	1	N.C.
	2	GND
	3	DATA-
	4	DATA+
	5	N.C.
	6	N.C.

- Note:

  PORT 1 supports RS-485 communication only.

2. PORT 2 PIN definition

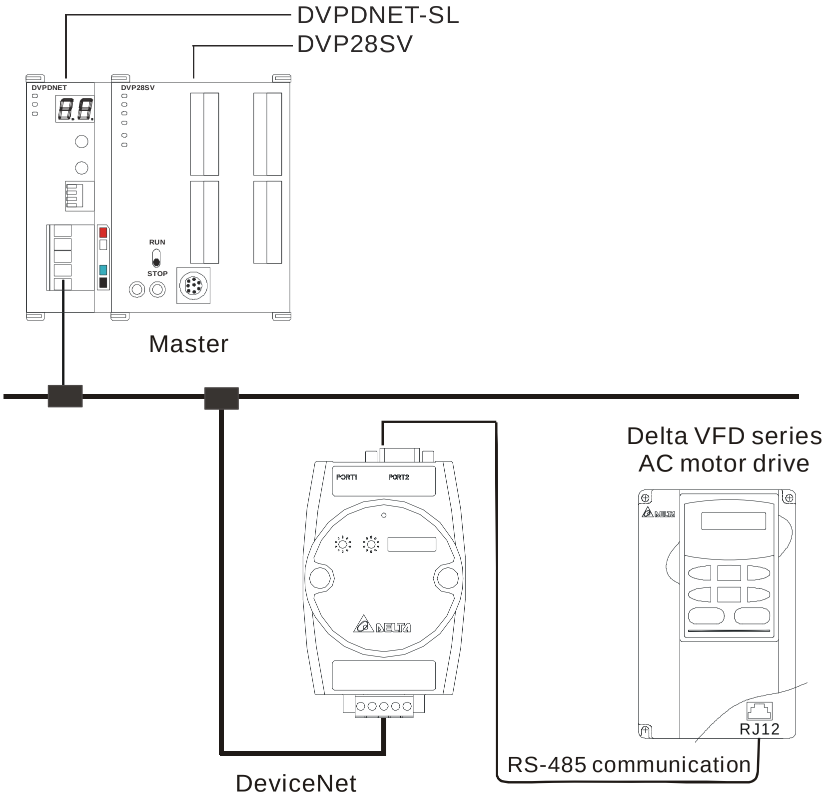
PORT 2 sketch	PIN	RS-232	RS-485
	1	N.C.	N.C.
	2	RXD	N.C.
	3	TXD	DATA-
	4	N.C.	N.C.
	5	GND	N.C.
	6	N.C.	N.C.
	7	N.C.	N.C.
	8	N.C.	DATA+
	9	N.C.	N.C.

- Note

  PORT 2 supports RS-232 and RS-485 communication only.

12.3 Functions of DNA02

12.3.1 When DNA02 is connected to Delta VFD series AC motor drive



1. Baud rate and the setting of communication format

   Before connecting Delta AC motor drive to the BUS, first set up the node address of the AC motor drive as 01, baud rate as 38,400bps and communication format as 8, N, 2; RTU (the format is fixed; other formats will be invalid).

2. Modifying parameters in AC motor drive in the configuration software

   When the configuration software is used for modifying a parameter in AC motor drive, DNA02 will read the maximum value, minimum value and read/write attribute of the parameter and decide if the value modified by the user falls within the modifiable range and whether to modify the parameter.

3. Reading and modifying parameters

- DNA02 allows you to inquire Delta AC motor drive by explicit messages. The format of rthe inquiry is shown in the table below.

Byte position	Data written into AC motor drive	Data read from AC motor drive
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [0]+Service code [0x10]	R/R [0]+Service code [0x0E]
2	Class ID [0x0F]	Class ID [0x0F]
3	Instance ID LSB	Instance ID LSB
4	Instance ID MSB	Instance ID MSB
5	Attribute ID	Attribute ID
6	Service data LSB	N/A
7	Service data MSB	N/A

- Format of messages responded

Byte position	Data written into AC motor drive	Data read from AC motor drive
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [1]+Service code [0x10]	R/R [1]+Service code [0x0E]
2	N/A	Response data LSB
3	N/A	Response data MSB

- Note

  When modifying parameters in the parameter table of the device, make sure that the parameter allows you to modify it before you modify it.

4. I/O data mapping (Default)

- AC motor drive → DeviceNet master

Node address of AC motor drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’2101	-		Status of command control						-			LED status of AC motor drive				
H’2102	Displaying frequency command															

- DeviceNet master → AC motor drive

Node address of AC motor drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’2000	Control command of AC motor drive															
H’2001	Frequency command of AC motor drive															

- Explanation
  - ■ When the equipment connected to DNA02 is an AC motor drive, the length of data downloaded from DNA02 to the AC motor drive is preset as 2 words at addresses H’2000 and H’2001. DNA02 is able to download maximum 8 words to AC motor drive. The length of data uploaded to DNA02 from AC motor drive is preset as 2 words at addresses H’2101 and H’2102 and DNA02 is able to be uploaded maximum 8 words.
  - ■ The length of data transmitted from DNA02 to the AC motor drive is preset as 2 words. If you need to extend the length, you have to first set up Class 0x95>>Instance1>>Attribute2 as the

destination value and next set up Attribute11 ~ Attribute 18. The length of data transmitted from the AC motor drive to DNA02 is preset as 2 words. If you need to extend the length, you have to first set up Class 0x95>>Instance1>>Attribute3 as the destination value and next set up Attribute25 ~ Attribute32.

- Length of I/O data to be exchanged and address for I/O mapping can be modified through changing Class 0x95 as listed below. The modification will be valid after DNA02 is re-powered. Maximum 16 words are allowed for I/O data exchange.
- If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x95 into H’0001 and re-power DNA02. Please note that doing so can only recover the current I/O data mapping in the AC motor drive.
- Class 0x95 Data Config

Instance0:

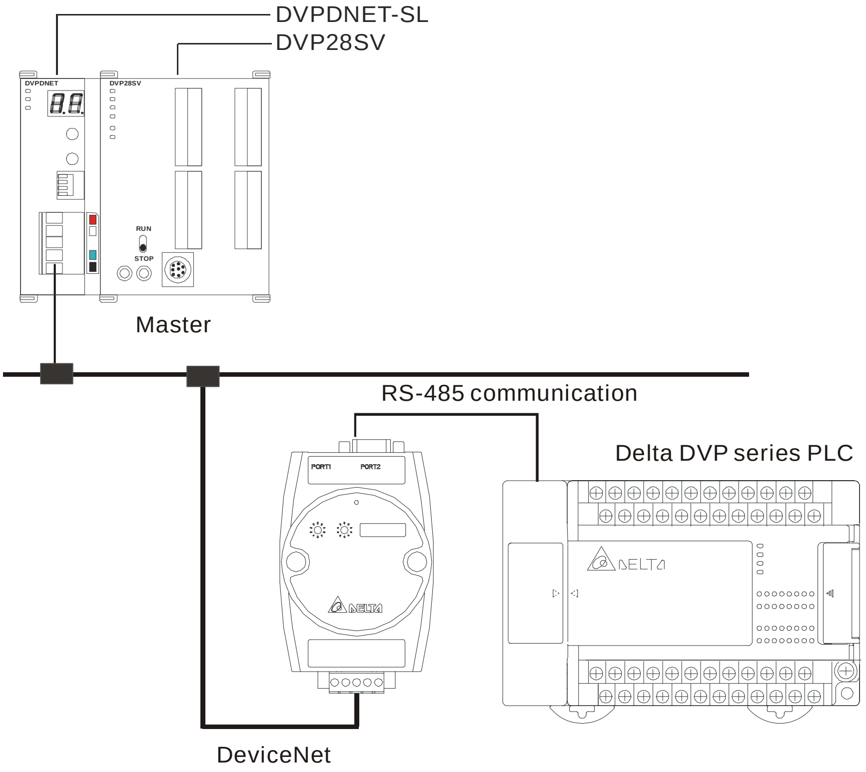
Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset parameter	USINT	H’0000
2	Get/Set	Length of input data	USINT	2 words
3	Get/Set	Length of output data	USINT	2 words
11	Get/Set	Data_in [0]	UINT	H’2000
12	Get/Set	Data_in [1]	UINT	H’2001
13	Get/Set	Data_in [2]	UINT	H’FFFF
14	Get/Set	Data_in [3]	UINT	H’FFFF
15	Get/Set	Data_in [4]	UINT	H’FFFF
16	Get/Set	Data_in [5]	UINT	H’FFFF
17	Get/Set	Data_in [6]	UINT	H’FFFF
18	Get/Set	Data_In [7]	UINT	H’FFFF
25	Get/Set	Data_out [0]	UINT	H’2101
26	Get/Set	Data_out [1]	UINT	H’2102
27	Get/Set	Data_out [2]	UINT	H’FFFF
28	Get/Set	Data_out [3]	UINT	H’FFFF
29	Get/Set	Data_out [4]	UINT	H’FFFF
30	Get/Set	Data_out [5]	UINT	H’FFFF
31	Get/Set	Data_out [6]	UINT	H’FFFF
32	Get/Set	Data_out [7]	UINT	H’FFFF

In the table above, Data_in refers to the data transmitted from DeviceNet master to AC motor drive, and Data_out refers to the data transmitted from the AC motor drive to DeviceNet master.

12.3.2 When DNA02 is connected to Delta DVP series programmable logic controller



1. Baud rate and the setting of communication format

   Before connecting the PLC to bus, set the node address of PLC as 01 and the communication format as 115,200 bps; 7, E, 1; ASCII (the format is fixed; other formats will be invalid).

2. Class 0x96 parameter

   - Instance0

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

   - Instance1 through 9

Instance ID	Description
1	S device of PLC
2	X device of PLC
3	Y device of PLC
4	M device of PLC
5	T device of PLC (bit device)
6	T device of PLC (word device)
7	C device of PLC (bit device)
8	C device of PLC (word device)
9	D device of PLC

All Instances in the table do not support any Attribute.

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x32	No	Yes	Read PLC data
0x33	No	Yes	Write PLC data

3. Format of inquiries and messages responded

- DNA02 allows you to inquire PLC by explicit messages. The format of inquiry is shown in the table below.

Byte position	Data read from PLC	Data written into PLC
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [0]+Service code [0x32]	R/R [0]+Service code [0x33]
2	Class ID [0x96]	Class ID [0x96]
3	Instance ID	Instance ID
4	Position address LSB	Position Address LSB
5	Position address MSB	Position Address MSB
6	Number LSB	Service data LSB
7	Number MSB	Service data MSB

- Explanation
  - "Position address" refers to the No. of the device in the register of PLC. For example, the position address of M0 is 0 and that of D100 is 100.
  - "Number" refers to the number of PLCs. When the read device is a word device, "Number" refers to the number of words read; when the read device is a bit device, "Number" refers to the number of bits read.
  - Bit devices, S, X, Y and M in DVP-PLC allow the reading of maximum 16 bits and writing in of only 1 bit (either 0 or 1). Devices T, C and D in DVP-PLC allow the reading of maximum 3 words and writing in of 1 word. See the table below.

Device in PLC	Max. length to be read allowed	Max. length to be written in allowed
S	16 bits	1 bit
X	16 bits	Not support
Y	16 bits	1 bit
M	16 bits	1 bit
T (bit device)	16 bits	1 bit
C (bit device)	16 bits	1 bit
T (word device)	3 words	1 word
C (word device)	3 words	1 word
D (word device)	3 words	1 word

- Format of messages responded

Byte position	Data read from PLC	Data written into PLC
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [1]+Service code [0x32]	R/R [1]+Service code [0x33]
2 ~ 7	Response data	N/A

- If error occurs during the communication, DNA02 will send the error code to the master. See the table below for the definitions of error codes.

Error code		Definition
Byte 1	Byte 2	
0x08	0xFF	Service not supported (Invalid service code)
0x16	0xFF	Object polled does not exist (Illegal instance ID or class ID)
0x20	0x01	Communication instruction is illegal
0x20	0x02	The register address is illegal
0x20	0x03	The register No. in PLC exceeds the range
0x20	0x04	Cannot respond to the inquiry
0x20	0x07	DNA02 and PLC communication error

4. I/O data mapping (default)

- PLC → DeviceNet master

Project	Start address of I/O data mapping	Default length of I/O data mapping	Max. Length of I/O data mapping	Unit	Description
PLC→DeviceNet	D408 (H’1198)	6	128	word	(M/8)+(D*2)<=Max size (256 bytes)
	M256 (H’0900)	10	256	bit	

- DeviceNet master → PLC

Project	Start address of I/O data mapping	Default length of I/O data mapping	Max. Length of I/O data mapping	Unit	Description
DeviceNet→PLC	D500 (H’11F4)	6	128	word	(M/8)+(D*2)<=Max size (256 bytes)
	M512 (H’0A00)	10	256	bit	

- Explanation
  - When the equipment connected to DNA02 is PLC, the length of data downloaded from DNA02 to PLC is preset as 7 words at addresses D500 ~ D505 and M512 ~ M521. DNA02 is able to download maximum 128 words to the word device D, T, and C and 256 bits to bit devices M, Y, and S in PLC, but the total data length downloaded to M and D should be no more than 256 bytes. The length of data uploaded from the PLC to DNA02 is preset as 7 words at addresses D408 ~ D413 and M256 ~ M265. DNA02 is able to be uploaded maximum 128 words from the word device D, T, and C and 256 bits to bit devices M, Y, and S in PLC but the total data length uploaded from M and D should be no more than 256 bytes.
  - The length of I/O data to be exchanged and address for mapping can be modified through changing Class 0x97 as listed below. The modification will be valid after DNA02 is re-powered. Maximum 16 words are allowed for I/O data exchange.
  - If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x97 into H0001 and re-power DNA02. Please note that doing so can only recover

the current I/O data mapping in the PLC.

- Class 0x97 Data Config

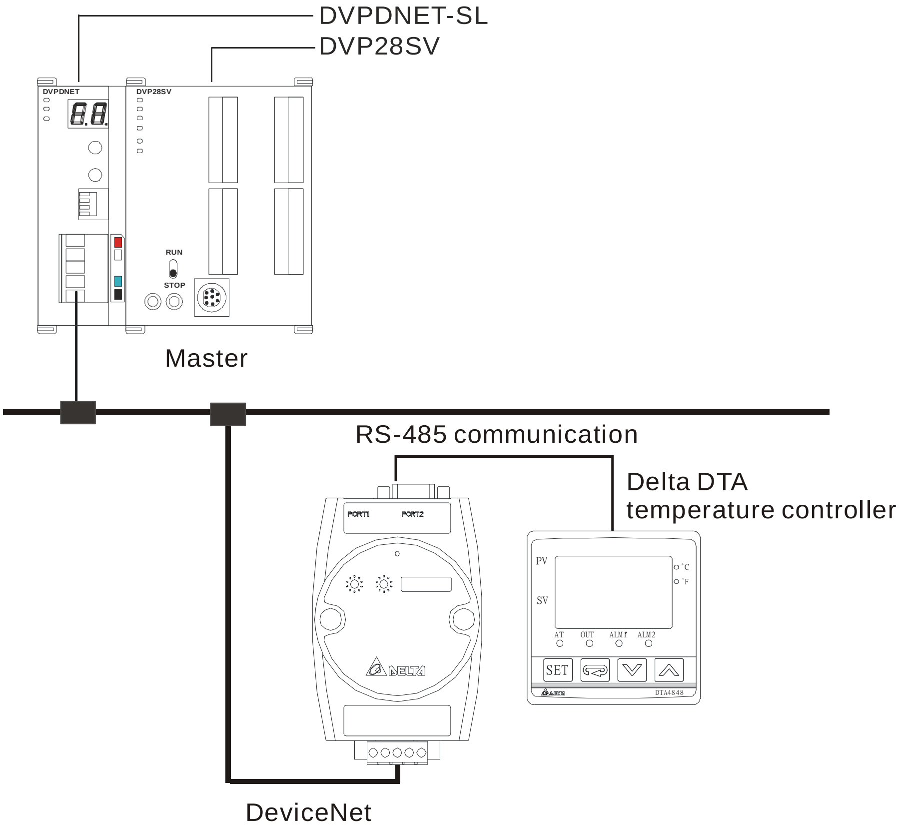
Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset parameter	USINT	H’0000
2	Get/Set	M_dlen_in	UINT	A bits
3	Get/Set	D_dlen_in	UINT	6words
4	Get/Set	M_dlen_out	UINT	A bits
5	Get/Set	D_dlen_out	UINT	6words
6	Get/Set	M_in_start_adr	UINT	H’0100
7	Get/Set	D_in_start_adr	UINT	H’0198
8	Get/Set	M_out_start_adr	UINT	H’0200
9	Get/Set	D_out_start_adr	UINT	H’01F4
10	Get/Set	Comm Timeout	UINT	H’0020

12.3.3 When DNA02 is connected to Delta DTA temperature controller



1. Baud rate and the setting of communication format

Before connecting Delta temperature controller to bus, set the node address of the temperature controller as 01 and the communication format as 38,400 bps; 7, E, 1; ASCII (the format is fixed; other formats will be invalid). Before the communication with DTA series temperature controller, you have to set the content of H’471A as H’0001 to allow the write-in of communication.

2. Reading and modifying parameters

- DNA02 allows you to inquire Delta temperature controller by explicit messages. The format of inquiry is shown in the table below:

Byte position	Data written into temperature controller	Data read from temperature controller
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [0]+Service code [0x10]	R/R [0]+Service code [0x0E]
2	Class ID [0x98]	Class ID [0x98]
3	Instance ID LSB	Instance ID LSB
4	Instance ID MSB	Instance ID MSB
5	Attribute ID	Attribute ID
6	Service data LSB	N/A
7	Service data MSB	N/A

- Format of messages responded:

Byte position	Data written into temperature controller	Data read from temperature controller
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [1]+Service code [0x10]	R/R [1]+Service code [0x0E]
2	N/A	Response data LSB
3	N/A	Response data MSB

3. I/O data mapping (Default)

- Temperature controller → DeviceNet master

Node address of AC motor drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’4700	Present temperature value (PV)															
H’4719	RUN/STOP															

- DeviceNet master → temperature controller

Node address of AC motor drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’4701	Set temperature value (SV)															
H’4719	RUN/STOP															

- Explanation
  - When the equipment connected to DNA02 is DTA series temperature controller, the length of data downloaded from DNA02 to DTA is preset as 2 words at addresses H’4701 and H’4719. DNA02 is able to download maximum 8 words. The length of data uploaded to DNA02 from DTA is preset as 2 words at addresses H’4700 and H’4719. DNA02 is able to be uploaded maximum 8 words.
  - Length of I/O data to be exchanged and address for mapping can be modified through changing Class 0x99 as listed below. The modification will be valid after DNA02 is re-powered. Maximum 16 words are allowed for I/O data exchange.
  - If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x99 into H’0001 and re-power DNA02. Please note that doing so can only recover the current I/O data

mapping in PLC.

- Class 0x99 Data Config

Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1 (DTA):

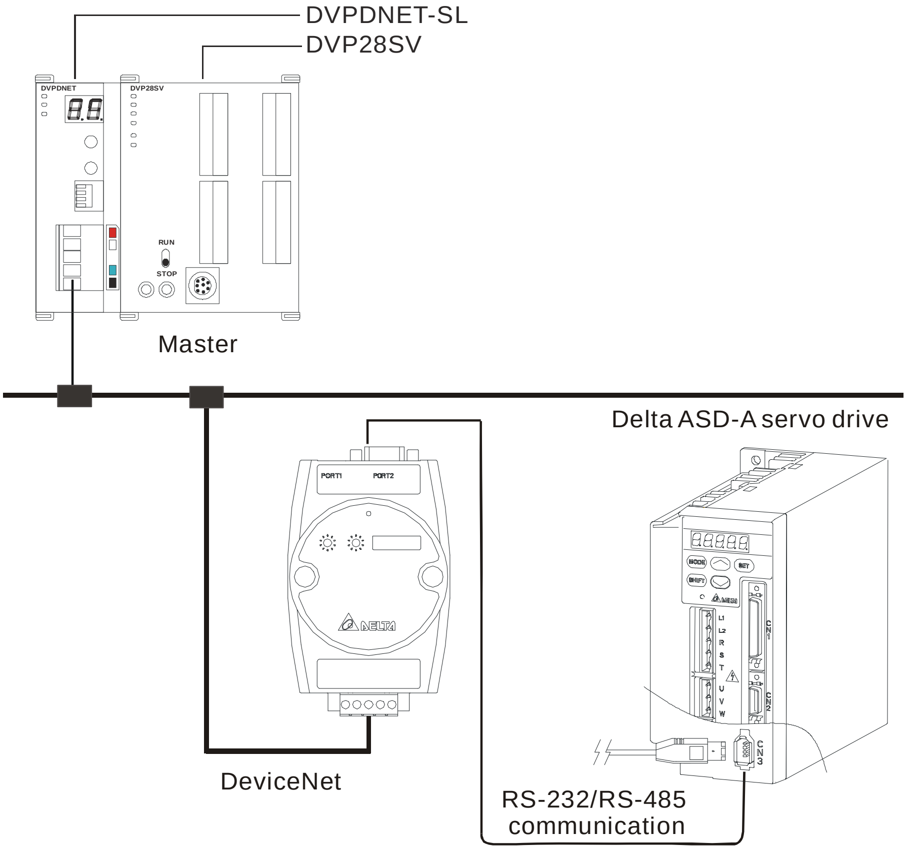
Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset parameter	USINT	H’0000
2	Get/Set	Input data length	USINT	2 words
3	Get/Set	Output data length	USINT	2 words
11	Get/Set	Data_in [0]	UINT	H’4701
12	Get/Set	Data_in [1]	UINT	H’4719 (for DTA)
13	Get/Set	Data_in [2]	UINT	H’FFFF
14	Get/Set	Data_in [3]	UINT	H’FFFF
15	Get/Set	Data_in [4]	UINT	H’FFFF
16	Get/Set	Data_in [5]	UINT	H’FFFF
17	Get/Set	Data_in [6]	UINT	H’FFFF
18	Get/Set	Data_in [7]	UINT	H’FFFF
25	Get/Set	Data_out [0]	UINT	H’4700
26	Get/Set	Data_out [1]	UINT	H’4719 (for DTA)
27	Get/Set	Data_out [2]	UINT	H’FFFF
28	Get/Set	Data_out [3]	UINT	H’FFFF
29	Get/Set	Data_out [4]	UINT	H’FFFF
30	Get/Set	Data_out [5]	UINT	H’FFFF
31	Get/Set	Data_out [6]	UINT	H’FFFF
32	Get/Set	Data_out [7]	UINT	H’FFFF

Data_in refers to the data transmitted from DeviceNet master to DTA. Data_out refers to the data transmitted from DTA to DeviceNet master.

Common Services

Service Code	Implemented for		Service name
	Class	Instance	
0x05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_single
0x10	No	Yes	Set_Attribute_single

12.3.4 When DNA02 is connected to Delta ASD-A series servo drive



1. Baud rate and the setting of communication format

   Before connecting Delta servo drive to bus, set the node address of the servo drive as 01 and the communication format as 115,200; 7, E, 1; ASCII (the format is fixed; other formats will be invalid). Assume the equipment connected to DNA02 is ASDA-A0121LA, you have to configure the following parameters before connecting the servo drive to DNA02.

   - P3-00 = H’0001 (set node address to 1)
   - P3-01 = H’0005 (set baud rate to 115,200 bps)
   - P3-02 = H’0001 (set communication format as ASCII,7,E,1)
   - P3-05 = H’0002 (select RS-485 communication)
   - P3-05 = H’0000 (select RS-232 communication)
   - P3-06 = H’00FF (set DI1 ~ DI8 to valid communication control)

2. Reading and modifying parameters

   - DNA02 allows you to inquire Delta servo drive by explicit messages. The format of inquiry is shown in the table below.

Byte position	Data written into servo drive	Data read from servo drive
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [0]+Service code [0x10]	R/R [0]+Service code [0x0E]
2	Class ID [0x9A]	Class ID [0x9A]
3	Instance ID LSB	Instance ID LSB
4	Instance ID MSB	Instance ID MSB
5	Attribute ID	Attribute ID
6	Service Data LSB	N/A
7	Service Data MSB	N/A

- Format of messages responded

Byte position	Data written into servo drive	Data read from servo drive
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [1]+Service code [0x10]	R/R [1]+Service code [0x0E]
2	N/A	Response data LSB
3	N/A	Response data MSB

- Note

  When modifying parameters in the parameter table of Delta ASD-A servo drive, make sure that the parameter allows you to modify it before you modify it.

3. I/O data mapping (Default)

- Servo drive → DeviceNet master

Node address of servo drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’0409	-								Digital output DO1 ~ DO5							

- DeviceNet Master → Servo drive

Node address of servo drive	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’0407	-								Digital input DI1 ~ DI8							

- Explanation:
  - When the equipment connected to DNA02 is a servo drive, the length of data downloaded from DNA02 to the servo drive is preset as 1 word at addresses H’0407 (corresponding address of DI1 ~ DI8). DNA02 is able to download maximum 16 words. The length of data uploaded to DNA02 from the servo drive is preset as 1 word at addresses H’0409 (corresponding address of DO1 ~ DO5). DNA02 is able to be uploaded maximum 16 words.
  - The length of I/O data to be exchanged and address for mapping can be modified through changing Class9B s listed below. The modification will be valid after DNA02 is re-powered. Maximum 32 words are allowed for I/O data exchange.
  - If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x9B into H’0001 and re-power DNA02. Please note that doing so can only recover the current I/O data mapping in servo drive.
  - Class 0x9B Data Config

    Instance0:

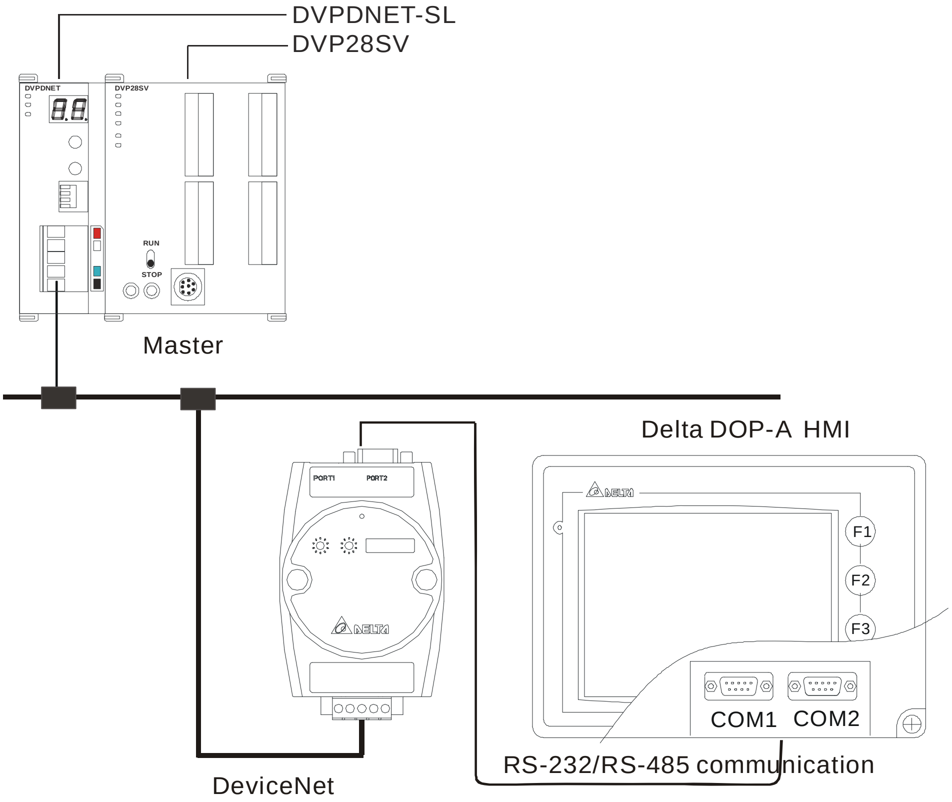
Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1:

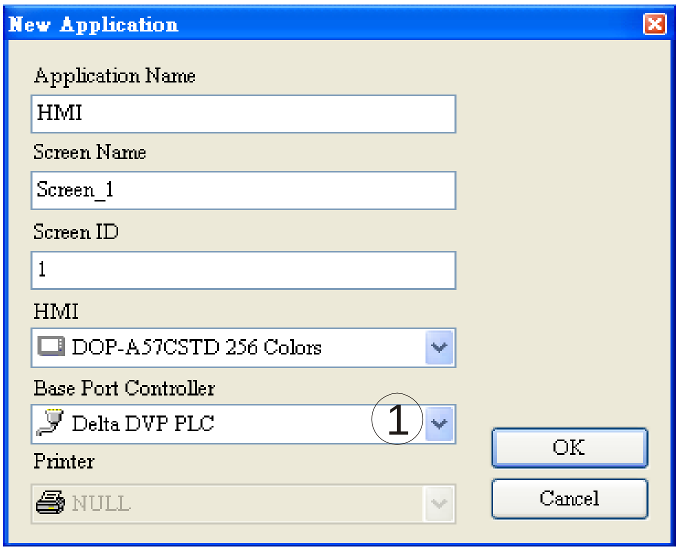
Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset parameter	USINT	H’0000
2	Get/Set	Input data length	USINT	1 words
3	Get/Set	Output data length	USINT	1 words
11	Get/Set	Data_in [0]	UINT	H’0407
12	Get/Set	Data_in [1]	UINT	H’FFFF
13	Get/Set	Data_in [2]	UINT	H’FFFF
14	Get/Set	Data_in [3]	UINT	H’FFFF
15	Get/Set	Data_in [4]	UINT	H’FFFF
16	Get/Set	Data_in [5]	UINT	H’FFFF
17	Get/Set	Data_in [6]	UINT	H’FFFF
18	Get/Set	Data_in [7]	UINT	H’FFFF
19	Get/Set	Data_in [8]	UINT	H’FFFF
20	Get/Set	Data_in [9]	UINT	H’FFFF
21	Get/Set	Data_in [10]	UINT	H’FFFF
22	Get/Set	Data_in [11]	UINT	H’FFFF
23	Get/Set	Data_in [12]	UINT	H’FFFF
24	Get/Set	Data_in [13]	UINT	H’FFFF
25	Get/Set	Data_in [14]	UINT	H’FFFF
26	Get/Set	Data_in [15]	UINT	H’FFFF
31	Get/Set	Data_out [0]	UINT	H’0409
32	Get/Set	Data_out [1]	UINT	H’FFFF
33	Get/Set	Data_out [2]	UINT	H’FFFF
34	Get/Set	Data_out [3]	UINT	H’FFFF
35	Get/Set	Data_out [4]	UINT	H’FFFF
36	Get/Set	Data_out [5]	UINT	H’FFFF
37	Get/Set	Data_out [6]	UINT	H’FFFF
38	Get/Set	Data_out [7]	UINT	H’FFFF
39	Get/Set	Data_out [8]	UINT	H’FFFF
40	Get/Set	Data_out [9]	UINT	H’FFFF
41	Get/Set	Data_out [10]	UINT	H’FFFF
42	Get/Set	Data_out [11]	UINT	H’FFFF
43	Get/Set	Data_out [12]	UINT	H’FFFF
44	Get/Set	Data_out [13]	UINT	H’FFFF
45	Get/Set	Data_out [14]	UINT	H’FFFF
46	Get/Set	Data_out [15]	UINT	H’FFFF

Data_in refers to data transmitted from DeviceNet master to servo drive. Data_out refers to data transmitted from the servo drive to DeviceNet master.

12.3.5 When DNA02 is connected to Delta DOP-A series human machine interface



1. Baud rate and the setting of communication format
    - Before connecting the Delta HMI to bus, set the node address of HMI as 01 and the communication format as 115,200; 7, E, 1; ASCII (the format is fixed; other formats will be invalid).
    - When DNA02 is connected to Delta DOP series HMI, please set up the baud rate and format following the procedure listed below.
        - ■ Open software Screen Editor and select “File>>New”. You will see the dialog box as below.



New Application

Application Name: HMI

Screen Name: Screen_1

Screen ID: 1

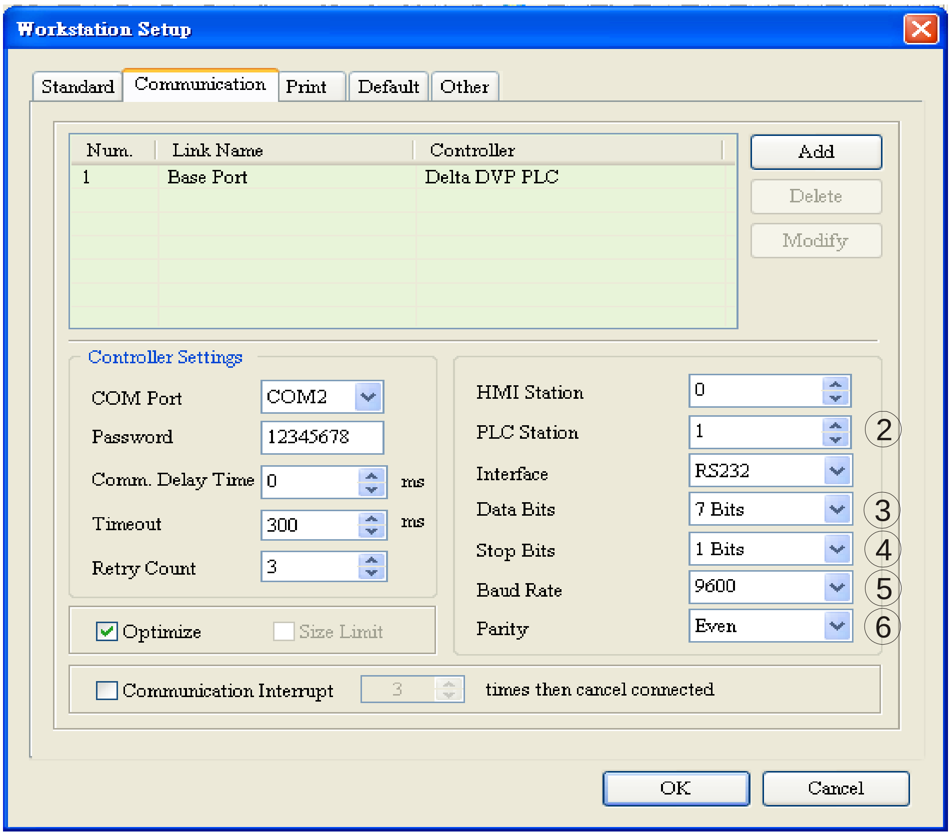
HMI: DOP-A57CSTD 256 Colors

Base Port Controller: Delta DVP PLC ①

Printer: NULL

- ■ Follow ① and set the Base Port Controller to “Delta DVP PLC”. Click ”OK” to create a new file.

- ■ Select “Options>>Configuration>>Communication” and you will see the dialog box as below.

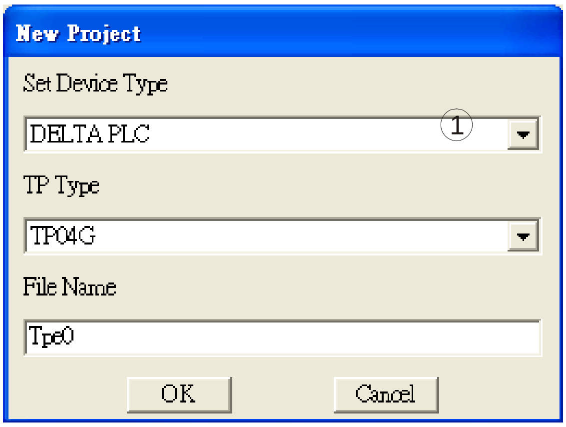


Num.	Link Name	Controller
1	Base Port	Delta DVP PLC

COM Port: COM2
Password: 12345678
Comm. Delay Time: 0 ms
Timeout: 300 ms
Retry Count: 3
☑ Optimize ☐ Size Limit
HMI Station: 0
PLC Station: 1
Interface: RS232
Data Bits: 7 Bits
Stop Bits: 1 Bits
Baud Rate: 9600
Parity: Even
☐ Communication Interrupt 3 times then cancel connected

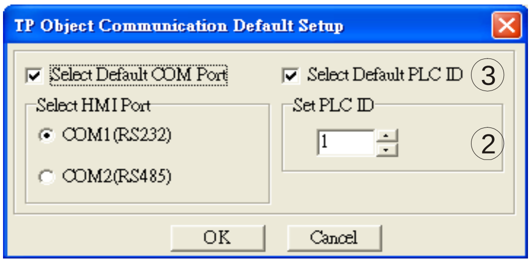
- ■ Follow ② ~ ⑥ and set the PLC Station to 1 and communication format to 115,200, 7, E, 1,A SCII. Click ”OK”.

- ● When DNA02 is connected to TP04/TP02, please set up the baud rate and format following the procedure listed below.
  - ■ Open TPEditor and select “File>>New”. You will see the dialog box as below.



Set Device Type: DELTA PLC
TP Type: TP04G
File Name: Tpe0

  - ■ Follow ① and set the Device Type to “Delta PLC”. Click ”OK” to create a new file.
  - ■ Select “Tools>>TP Object Communication Default Setting” and you will see the dialog box as below.



- Follow ② ③ and set PLC ID to “1”. Check ”Select Default PLC ID” and click ”OK” to complete the setting.

2. I/O data mapping (Default)

- DOP series HMI writes DNA02

Node address of DNA02	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D0	DOP writes register of DNA02															
D1	DOP writes register of DNA02															
D2	DOP writes register of DNA02															
D3	DOP writes register of DNA02															

- DNA02 → DeviceNet master

Node address of DNA02	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D0	Content of register D0															
D1	Content of register D1															
D2	Content of register D2															
D3	Content of register D3															

- DOP series HMI reads DNA02

Node address of DNA02	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D32	DOP reads register of DNA02															
D33	DOP reads register of DNA02															
D34	DOP reads register of DNA02															
D35	DOP reads register of DNA02															

- DeviceNet master → DNA02

Node address of DNA02	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D32	Content of register D32															
D33	Content of register D33															
D34	Content of register D34															
D35	Content of register D35															

- Explanation
  - When the equipment connected to DNA02 is DOP series HMI, the length of data written to DNA02 from DOP is preset as 4 words from the preset devices D0 ~ D3. The maximum length of data written from DOP series HMI to device D of DNA02 is 32 words. The length of data in DNA02 read by DOP series HMI is preset as 4 words from the preset devices D32 ~ D35. The maximum length of data in device D of DNA02 read by DOP series HMI is 32

words.

- The length of I/O data to be exchanged can be modified through changing Class9C as listed below, but the start device of I/O mapping cannot be changed. The modification will be valid after DNA02 is re-powered. Maximum 64 words are allowed for I/O data exchange.
- If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x9C into H'0001 and re-power DNA02. Please note that doing so can only recover the current I/O data mapping in HMI.
- Class 0x9C Data Config

Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1:

Attribute ID	Access rule	Name	Data yype	Default
1	Get/Set	Reset parameter	USINT	H'0000
2	Get/Set	Input data length	USINT	4 words
3	Get/Set	Output data length	USINT	4 words

12.3.6 When DNA02 is connected to custom equipment

In the custom mode, DNA02 can still establish EXP/IO connection when there is no equipment connected to it.

1. Settings of the equipment connected to DNA02 in custom mode

   Before connecting the custom equipment to bus through DNA02, you have to configure and check the following parameters.

   - Configuration of the equipment: RS-485 or RS-232 communication
   - Node address of the equipment: 01
   - Baud rate of the equipment: 19,200bps
   - Communication format of the equipment: 8, N, 2, RTU
   - According to the actual need, configure the I/O mapping between DNA02 and the equipment in the configuration software.

2. Reading and modifying parameters in the custom equipment

   - DNA02 allows you to inquire the custom equipment by explicit messages (fits in Modbus protocol). The format of inquiry is shown in the table below.

Byte position	Data written into custom equipment	Data read from custom equipment
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [0]+Service code [0x10]	R/R [0]+Service code [0x0E]
2	Class ID [0x9E]	Class ID [0x9E]
3	Instance ID LSB	Instance ID LSB
4	Instance ID MSB	Instance ID MSB
5	Attribute ID	Attribute ID
6	Service Data LSB	N/A
7	Service Data MSB	N/A

- Format of messages responded:

Byte position	Data written into custom equipment	Data read from custom equipment
0	Frag [0]+XID+MAC ID	Frag [0]+XID+MAC ID
1	R/R [1]+Service code [0x10]	R/R [1]+Service code [0x0E]
2	N/A	Response data LSB
3	N/A	Response data MSB

3. Class 0x9E Custom_Parameter

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1: Parameter Instance 1 through N

  Parameter attribute

Attribute ID	Access rule	Name	Data type
1	Get/Set	Parameter Value	-

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

- Explanation
  - When you need to use DeviceNet Config software to read the parameters in the custom equipment, you have to first make sure that the equipment supports the Modbus function code, 0x03 (read), 0x06 (write) and so on.
  - You have to acquire the Modbus address of the parameter before reading the parameter.
  - How to read: Plus 0x0001 in Modbus address as Instance value and 0x0001 as Attribute value.
  - Assume you read the Modbus address of the custom equipment as 0x011E, use DeviceNet Config software and read Instance = 0x011E + 0x0001 and Attribute = 0x01.

4. I/O data mapping (Default)

- Custom equipment → DeviceNet master

Node address of custom equipment	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’2101	Relevant to the equipment connected															
H’2102	Relevant to the equipment connected															

- DeviceNet master → custom equipment

Node address of custom equipment	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
H’2000	Relevant to the equipment connected															
H’2001	Relevant to the equipment connected															

- Explanation

- When the equipment connected to DNA02 is custom equipment, the length of data downloaded from DNA02 to the equipment is preset as 2 words at addresses H’2101 and H’2102. DNA02 is able to download maximum 4 words. The length of data uploaded to DNA02 from the equipment is preset as 2 words at addresses H’2000 and H’2001. DNA02 is able to be uploaded maximum 4 words. The I/O mapping can be modified by changing Class9F.
- The length of I/O data to be exchanged and address for mapping can be modified through changing Class9F as listed below. The modification will be valid after DNA02 is re-powered. Maximum 8 words are allowed for I/O data exchange.
- If you are to return the I/O mapping to default setting, change Attribute1 of Instance1 of Class 0x9F into H’0001 and re-power DNA02. Please note that doing so can only recover the current I/O data mapping in the custom equipment.
- Class 0x9F Custom Data Config

Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

Instance1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset parameter	USINT	H’0000
2	Get/Set	Input data length	USINT	2 words
3	Get/Set	Output data length	USINT	2 words
9	Get/Set	Data_in [0]	UINT	H’2000
10	Get/Set	Data_in [1]	UINT	H’2001
11	Get/Set	Data_in [2]	UINT	H’FFFF
12	Get/Set	Data_in [3]	UINT	H’FFFF
17	Get/Set	Data_out [0]	UINT	H’2101
18	Get/Set	Data_out [1]	UINT	H’2102
19	Get/Set	Data_out [2]	UINT	H’FFFF
20	Get/Set	Data_out [3]	UINT	H’FFFF

If DNA02 fails to connect to DeviceNet by explicit messages due to the modification on the I/O mapping between DNA02 and the equipment connected to it (e.g. dlen_in, dlen_out, data_in, data_out, etc), the I/O mapping between DNA02 and the equipment connected to it will not be able to return to default setting through explicit messages.

- In the custom mode, DNADNA02 can still establish EXP/IO connection when there is no equipment connected to it and the I/O mapping of DNA02 can be returned to default setting.

Instance2 EEPROM read/write:

Attribute ID (decimal)	Access rule	Name	Default
30	Get/Set	AMD reset parameter	H’0000
71	Get/Set	PLC reset parameter	H’0000
90	Get/Set	DTA reset parameter	H’0000

Attribute ID (decimal)	Access rule	Name	Default
150	Get/Set	ASDA reset parameter	H’0000
224	Get/Set	DOP reset parameter	H’0000
200	Get/Set	Custom reset parameter	H’0000

In the custom mode, if you are to return the I/O mapping of AC motor drive to default setting, change Attribute30 of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

In the custom mode, if you are to return the I/O mapping of PLC to default setting, change Attribute71 of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

In the custom mode, if you are to return the I/O mapping of temperature controller to default setting, change Attribute90 of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

In the custom mode, if you are to return the I/O mapping of servo drive to default setting, change Attribute150 of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

In the custom mode, if you are to return the I/O mapping of HMI to default setting, change Attribute224of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

In the custom mode, if you are to return the I/O mapping of the custom equipment to default setting, change Attribute200 of Instance2 of Class 0x9F into H’0001 and re-power DNA02.

Common Services:

Service Code	Implemented for		Service name
	Class	Instance	
005	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Instance3 Modbus baud rate setting

Attribute ID (decimal)	Access rule	Name	Range (Note 1)	Default value (Note 1)
1	Get/Set	AMD baud rate setting	1 ~ 2	2
2	Get/Set	PLC baud rate setting	1 ~ 4	4
3	Get/Set	DT baud rate setting	1 ~ 2	2
4	Get/Set	ASDA baud rate setting	1 ~ 4	4
5	Get/Set	DOP baud rate setting	1 ~ 4	4
6	Get/Set	CUSTOM baud rate setting	1 ~ 4	1

Note 1: The baud rates of the codes are in the table below.

Code	Baud rate
1	19,200 bps
2	38,400 bps
3	57,600 bps
4	115,200 bps

12.4 LED Indicators & Trouble-shooting

There are 3 LED indicators on DNA02, Network Status LED, Module Status LED and Scan Port LED, for displaying the connection status of the communication.

12.4.1 Network Status LED

LED status	Indication	How to deal with it?
Off	No power; Duplicating ID has not completed	1. Check the power of DNA02 and see if the connection is normal. 2. Check if the node communication on the BUS is normal. 3. Make sure at least 1 node is normally communicating with the network through DNA02.
Green light flashes	Online, but not connected to DeviceNet	--
Green light on	Online, and connected to DeviceNet normally	--
Red light flashes	Online, but I/O connection time-out occurs.	--
Red light on	Network failure. Failed ID duplication or Bus-off.	1. Make sure all node addresses on the BUS are not repeated. 2. Check if the network installation is normal. 3. Check if the baud rate of DNA02 is consistent with that of the BUS. 4. Check if the station No. of DNA02 is valid. 5. Check if your choice of switch on DNA02 is consistent with the actual connected equipment. 6. Check if DNA02 is correctly wired with the equipment.

12.4.2 Module Status LED

LED status	Indication	How to deal with it?
Off	No power; off-line	Check the power of DNA02 and see if the connection is normal.
Green light flashes	Waiting for I/O data, no I/O data or PLC program is being edited.	DNA02 has passed operation test and is waiting for I/O data
Green light on	I/O operation in progress normally.	--
Red light flashes	Configuration problem; DNA02 is not connected to equipment	1. Reset parameters in DNA02. 2. Check if DNA02 is correctly wired with the equipment.
Red light on	EEPROM is damaged, or other hardware error.	Send back to factory for repair.

12.4.3 Scan Port LED

LED status	Indication	How to deal with it?
Off	No power	Check the power of DNA02 and see if the connection is normal.
Green light flashes	DNA-02 is reading the default value in the equipment. DNA02 obtains the parameters from the equipment and initializes some of the attributes.	
Green light on	Communication between DNA-02 and the equipment is normal.	
Red light flashes	CRC check fails, or the equipment sends back error information.	1. Check if the communication format of the equipment is correctly set up. 2. Check carefully if the installation is correct.
Red light on	Connection fails, or no connection.	1. Check if DNA02 is correctly connected with the equipment. 2. Restart the connection and make sure the communication cable meets the specification.

12.5 DeviceNet Objects DNA02 Supports

This section provides details of the objects, instances and attributes supported by DNA02 in DeviceNet network.

12.5.1 DeviceNet Object

1. Object Classes

Class	Object
0x01	Identity
0x02	Message router
0x03	DeviceNet
0x05	Connection
0x0F	Parameter
0x93	Base Object
0x95	AMD config Object
0x96	PLC parameter
0x97	PLC config Object
0x98	DT parameter
0x99	DT config
0x9A	ASDA paramter
0x9B	ASDA config

2. Class 0x01 Identity

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT
2	Get	MaxInstance	UINT
3	Get	NumberofInstances	UINT
6	Get	MaxIdClass	UINT
7	Get	MaxIdInstance	UINT

- Instance 1: Drive Instance

Attribute ID	Access rule	Name	Data type
1	Get	Vendor ID	UINT
2	Get	DeviceType	UINT
3	Get	ProductCode	UINT
4	Get	Revision MajRev MinRev	USINT USINT
5	Get	Status	WORD
6	Get	Sn	UDINT
7	Get	ProdName StrLen ASCIIStr	USINT STRING

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x05	No	Yes	Reset
0x0e	Yes	Yes	Get_Attribute_Single
0x10	Yes	No	Find_Next_Object_Instance

3. Class 0x02 Message router

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT
6	Get	MaxIdClass	UINT
7	Get	MaxIdInstance	UINT

- Instance 1:

Attribute ID	Access rule	Name	Data type
2	Get	NumAvailable	UINT
3	Get	NumActive	UINT

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x0e	Yes	Yes	Get_Attribute_Single

4. Class 0x03 DeviceNet

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1: Drive Instance

Attribute ID	Access rule	Name	Data type
1	Get	MAC ID	USINT
2	Get	BaudRate	USINT
3	Get/Set	BusofInterrupt	BOOL
4	Get/Set	BusofCounter	USINT
5	Get	AllocationInfo AllocationChioce MasterNodeAddress	 BYTE USINT
6	Get	MACIDSwitchChanged	BOOL
7	Get	BaudRateSwitchChanged	BOOL
8	Get	MACIDSwitchValue	USINT
9	Get	BaudRateSwitchValue	USINT

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release_Master/Slave_Connection_Set

5. Class 0x05 Connection

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1: Master/Slave Explicit Message Connection

Attribute ID	Access rule	Name	Data type
1	Get	State	USINT
2	Get	InstanceType	USINT
3	Get	TransportClassTrigger	USINT
4	Get	ProducedConnectionId	UINT
5	Get	ConsumedConnectionId	UINT
6	Get	InitialCommCharacteristics	BYTE
7	Get	ProducedConnectionSize	UINT
8	Get	ConsumedConnectionSize	UINT
9	Get/Set	ExpectedPackedRate	UINT
12	Get/Set	WatchdogTimeoutAction	USINT
13	Get	Produced Connection Path Length	USINT
14	Get	Produced Connection Path	EPATH
15	Get	Consumed Connection Path Length	USINT
16	Get	Consumed Connection Path	EPATH

- Instance 2: Polled I/O Connection

Attribute ID	Access rule	Name	Data type
1	Get	State	USINT
2	Get	InstanceType	USINT
3	Get	TransportClassTrigger	USINT
4	Get	ProducedConnectionId	UINT
5	Get	ConsumedConnectionId	UINT
6	Get	InitialCommCharacteristics	BYTE
7	Get	ProducedConnectionSize	UINT
8	Get	ConsumedConnectionSize	UINT
9	Get/Set	ExpectedPackedRate	UINT
12	Get/Set	WatchdogTimeoutAction	USINT
13	Get	Produced Connection Path Length	USINT

Attribute ID	Access rule	Name	Data type
14	Get	Produced Connection Path	EPATH
15	Get	Consumed Connection Path Length	USINT
16	Get	Consumed Connection Path	EPATH

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

6. Class 0x93 Base object

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Paremeter: Instance 1

Attribute ID	Access rule	Name	Data type	Default
1	Get	Sfversion	UINT	1100
2	Get/Set	LossDNTreat	USINT	1
3	Get/Set	LossSPTreat	USINT	1
4	Get/Set	MODtime (0…255)	USINT	50
11	Get	USErrCord1	USINT	0
12	Get	USErrCord2	USINT	0
13	Get	USErrCord3	USINT	0
14	Get	USErrCord4	USINT	0
15	Get	USErrCord5	USINT	0

7. Class 0x0F AMD_Parameter

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT
2	Get	MaxInstance	UINT
8	Get	ParaClassDescriptor	WORD
9	Get	ConfAssemblyInst	UINT
10	Get	NativeLanguage	USINT

- Paremeter: Instance 1 ~ Instance 216

Attribute ID	Access rule	Name	Data type
1	Get/Set	Parameter Value	-
2	Get	Link Path Size	USINT

Attribute ID	Access rule	Name	Data type
3	Get	Link Path	-
4	Get	Descriptor	WORD
5	Get	Data Type	USINT
6	Get	Data Size	USINT

- Common Services

Service code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

8. Class 0x95 AMD_DataConf

- Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Reset Parameter	USINT	H’0066
2	Get/Set	dlen_in	USINT	2
3	Get/Set	dlen_out	USINT	2
11	Get/Set	Data_in [0]	UINT	H’2000
12	Get/Set	Data_in [1]	UINT	H’2001H
13	Get/Set	Data_in [2]	UINT	H’FFFF
14	Get/Set	Data_in [3]	UINT	H’FFFF
15	Get/Set	Data_in [4]	UINT	H’FFFF
16	Get/Set	Data_in [5]	UINT	H’FFFF
17	Get/Set	Data_in [6]	UINT	H’FFFF
18	Get/Set	Data_in [7]	UINT	H’FFFF
25	Get/Set	Data_out [0]	UINT	H’2101
26	Get/Set	Data_out [1]	UINT	H’2102
27	Get/Set	Data_out [2]	UINT	H’FFFF
28	Get/Set	Data_out [3]	UINT	H’FFFF
29	Get/Set	Data_out [4]	UINT	H’FFFF
30	Get/Set	Data_out [5]	UINT	H’FFFF
31	Get/Set	Data_out [6]	UINT	H’FFFF
32	Get/Set	Data_out [7]	UINT	H’FFFF

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

9. Class 0x96 PLC_Access

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1 through 9

Instance ID	Description
1	S device of PLC
2	X device of PLC
3	Y device of PLC
4	M device of PLC
5	T device of PLC (bit device)
6	T device of PLC (word device)
7	C device of PLC (bit device)
8	C device of PLC (word device)
9	D device of PLC

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x32	No	Yes	Get_PLC_Data
0x33	No	Yes	Set_PLC_Data

- All instances in Class 0x96 do not support any Attribute.

10. Class 0x97 DVP PLC_Config

- Class attributes

Attribute ID	Access rule	Name	Data type	Default
1	Get	Revision	UINT	-

- Instance 1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/Set	Rest Parameter	USINT	H’0066
2	Get/Set	M_dlen_in	UINT	H’000A
3	Get/Set	D_dlen_in	UINT	H’0006
4	Get/Set	M_dlen_out	UINT	H’000A
5	Get/Set	D_dlen_out	UINT	H’0006
6	Get/Set	M_in_start_adr	UINT	H’0100

Attribute ID	Access rule	Name	Data type	Default
7	Get/Set	D_in_start_adr	UINT	H’0198
8	Get/Set	M_out_start_adr	UINT	H’0200
9	Get/Set	D_out_start_adr	UINT	H’01F4
10	Get/Set	Comm Timeout	UINT	H’0020

- Common Services

Service code	Implemented for		Service Name
	Class	Instance	
0X05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

11. Class 0x98 DT_Parameter

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Paremeter: Instance 1 ~ Instance 63

Attribute ID	Access rule	Name	Data type
1	Get/Set	Parameter Value	-
2	Get	Link Path Size	USINT

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

12. Class 0x99 DT_DataConfig

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1

Attribute ID	Access rule	Name	Data type	Default
1	Get	Reset parameter	UINT	H’0066
2	Get/Set	dlen_in	USINT	2
3	Get/Set	dlen_out	USINT	2
11	Get/Set	data_in [0]	UINT	H’4701
12	Get/Set	data_in [1]	UINT	H’4719
13	Get/Set	data_in [2]	UINT	H’FFFF
14	Get/Set	data_in [3]	UINT	H’FFFF
15	Get/Set	data_in [4]	UINT	H’FFFF

Attribute ID	Access rule	Name	Data type	Default
16	Get/Set	data_in [5]	UINT	H'FFFF
17	Get/Set	data_in [6]	UINT	H'FFFF
18	Get/Set	data_in [7]	UINT	H'FFFF
25	Get/Set	data_out [0]	UINT	H'4700
26	Get/Set	data_out [1]	UINT	H'4719
27	Get/Set	data_out [2]	UINT	H'FFFF
28	Get/Set	data_out [3]	UINT	H'FFFF
29	Get/Set	data_out [4]	UINT	H'FFFF
30	Get/Set	data_out [5]	UINT	H'FFFF
31	Get/Set	data_out [6]	UINT	H'FFFF
32	Get/Set	data_out [7]	UINT	H'FFFF

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0X05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

13. Class 0x9A ASDA_Parameter

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Parameter: Instance 1 ~ Instance 138

Attribute ID	Access rule	Name	Data type
1	Get/Set	Parameter Value	-

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

14. Class 0x9B ASDA_DataConfig

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/set	resetparameter	UINT	H'0066
2	Get/Set	dlen_in	USINT	1

Attribute ID	Access rule	Name	Data type	Default
3	Get/Set	dlen_out	USINT	1
11	Get/Set	data_in [0]	UINT	H’0407
12	Get/Set	data_in [1]	UINT	H’FFFF
13	Get/Set	data_in [2]	UINT	H’FFFF
14	Get/Set	data_in [3]	UINT	H’FFFF
15	Get/Set	data_in [4]	UINT	H’FFFF
16	Get/Set	data_in [5]	UINT	H’FFFF
17	Get/Set	data_in [6]	UINT	H’FFFF
18	Get/Set	data_in [7]	UINT	H’FFFF
19	Get/Set	data_in [8]	UINT	H’FFFF
20	Get/Set	data_in [9]	UINT	H’FFFF
21	Get/Set	data_in [10]	UINT	H’FFFF
22	Get/Set	data_in [11]	UINT	H’FFFF
23	Get/Set	data_in [12]	UINT	H’FFFF
24	Get/Set	data_in [13]	UINT	H’FFFF
25	Get/Set	data_in [14]	UINT	H’FFFF
26	Get/Set	data_in [15]	UINT	H’FFFF
31	Get/Set	data_out [0]	UINT	H’0409
32	Get/Set	data_out [1]	UINT	H’FFFF
33	Get/Set	data_out [2]	UINT	H’FFFF
34	Get/Set	data_out [3]	UINT	H’FFFF
35	Get/Set	data_out [4]	UINT	H’FFFF
36	Get/Set	data_out [5]	UINT	H’FFFF
37	Get/Set	data_out [6]	UINT	H’FFFF
38	Get/Set	data_out [7]	UINT	H’FFFF
39	Get/Set	data_out [8]	UINT	H’FFFF
40	Get/Set	data_out [9]	UINT	H’FFFF
41	Get/Set	data_out [10]	UINT	H’FFFF
42	Get/Set	data_out [11]	UINT	H’FFFF
43	Get/Set	data_out [12]	UINT	H’FFFF
44	Get/Set	data_out [13]	UINT	H’FFFF
45	Get/Set	data_out [14]	UINT	H’FFFF
46	Get/Set	data_out [15]	UINT	H’FFFF

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0X05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

15. Class 0x9C DOP_DataConfig

- Class attributes

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance 1:

Attribute ID	Access rule	Name	Data type	Default
1	Get/set	resetparameter	UINT	66H
2	Get/Set	dlen_in	USINT	4
3	Get/Set	dlen_out	USINT	4

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0X05	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

16. Class 0x9E Custom_Parameter

- Class attributes

Attribute ID	Access rule	Name	Data Type
1	Get	Revision	UINT

- Parameter: Instance 1 ~ Instance N

Attribute ID	Access rule	Name	Data Type
1	Get/Set	Parameter Value	-

- Common Services

Service code	Implemented for		Service name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

17. Class 0x9F Custom Data Config

- Instance0:

Attribute ID	Access rule	Name	Data type
1	Get	Revision	UINT

- Instance1:

Attribute ID	Access rule	Name	Data Type	Default
1	Get/Set	resetparameter	USINT	H’0066
2	Get/Set	dlen_in	USINT	2 words
3	Get/Set	dlen_out	USINT	2 words
9	Get/Set	Data_in [0]	UINT	H’2000
10	Get/Set	Data_in [1]	UINT	H’2001
11	Get/Set	Data_in [2]	UINT	H’FFFF

Attribute ID	Access rule	Name	Data Type	Default
12	Get/Set	Data_in [3]	UINT	H’FFFF
17	Get/Set	Data_out [0]	UINT	H’2101
18	Get/Set	Data_out [1]	UINT	H’2102
19	Get/Set	Data_out [2]	UINT	H’FFFF
20	Get/Set	Data_out [3]	UINT	H’FFFF

- Instance 2 EEPROM read/write

Attribute ID (decimal)	Access rule	Name	Data type
30	Get/Set	AMD reset parameter	H’0066
71	Get/Set	PLC reset parameter	H’0066
90	Get/Set	DTA reset parameter	H’0066
150	Get/Set	ASDA reset parameter	H’0066
	Get/Set	DOP reset parameter	H’0066
200	Get/Set	Custom reset parameter	H’0066

- Instance 3 Modbus baud rate setting

Attribute ID(decimal)	Access rule	Name	Range	Default
1	Get/Set	AMD baud rate setting	1 ~ 2	2
2	Get/Set	PLC baud rate setting	1 ~ 4	4
3	Get/Set	DT baud rate setting	1 ~ 2	2
4	Get/Set	ASDA baud rate setting	1 ~ 4	4
5	Get/Set	DOP baud rate setting	1 ~ 4	4
6	Get/Set	CUSTOM baud rate setting	1 ~ 4	1

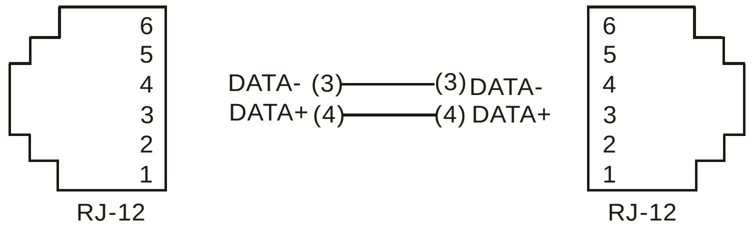
- Common Services

Service code	Implemented for		Service name
	Class	Instance	
005	Yes	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

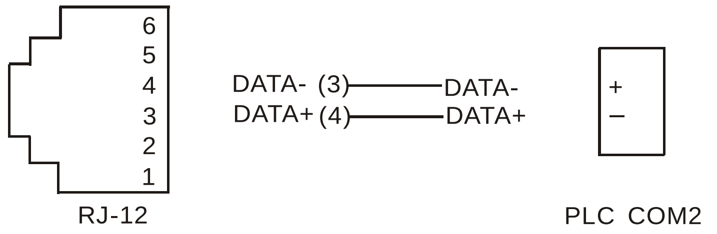
12.6 Connection of DNA02 with Other Equipment

12.6.1 Communication Wirings When Connected to Equipment Through PORT 1

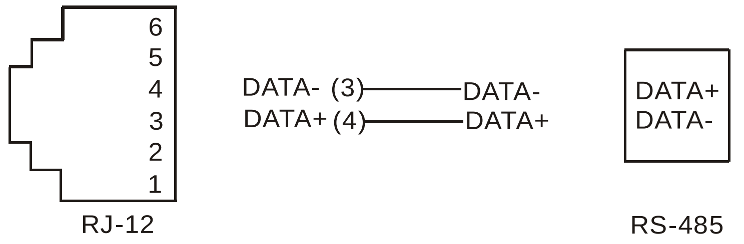
1. When DNA02 is connected to Delta VFD series AC motor drive: By RS-485 communication; using standard cable with RJ-12 connectors is suggested.

DNA02 RJ-12 (RS-485)	VFD series AC motor drive RJ-12 (RS-485)
	

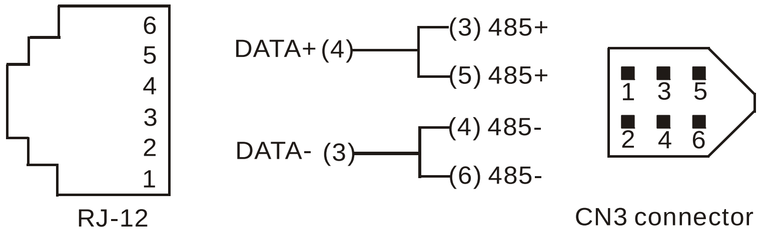
2. When DNA02 is connected to Delta DVP series PLC: By RS-485 communication.

<table>
<tr><th>DNA02
RJ-12 (RS-485)</th><th>DVP-PLC
RS-485 wiring terminal</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

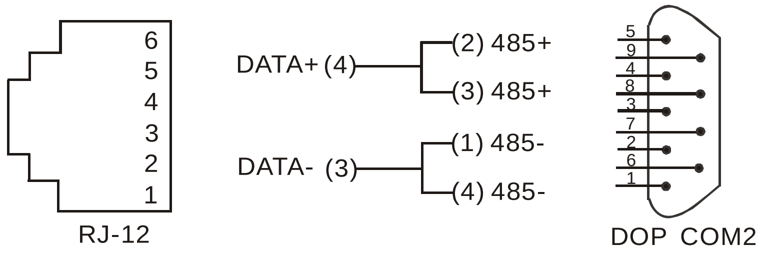
3. When DNA02 is connected to Delta DTA series temperature controller: By RS-485 communication.

<table>
<tr><th>DNA02
RJ-12 (RS-485)</th><th>DTA RS-485
wiring terminal</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

4. When DNA02 is connected to Delta ASD-A series servo drive: By RS-485 communication.

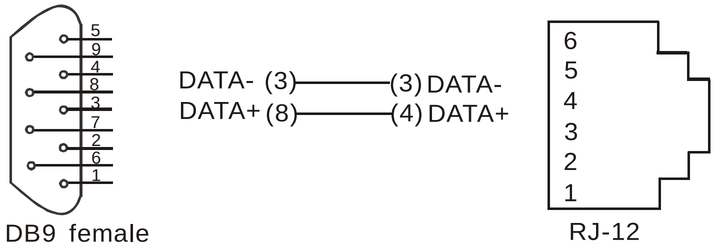
<table>
<tr><th>DNA02
RJ-12 (RS-485)</th><th>ASDA
CN3 connector (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

5. When DNA02 is connected to Delta DOP series human machine interface: By RS-485 communication.

<table>
<tr><th>DNA02
RJ-12 (RS-485)</th><th>DOP
DB9 male (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

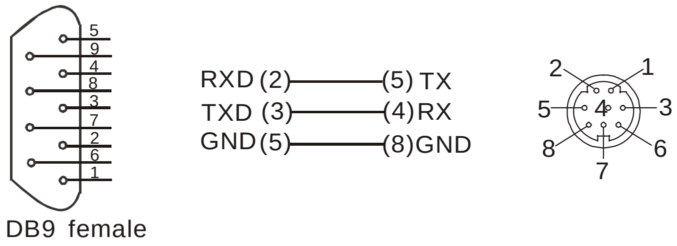
12.6.2 Communication Wirings When Connected to Equipment Through PORT 2

1. When DNA02 is connected to Delta VFD series AC motor drive: By RS-485 communication.

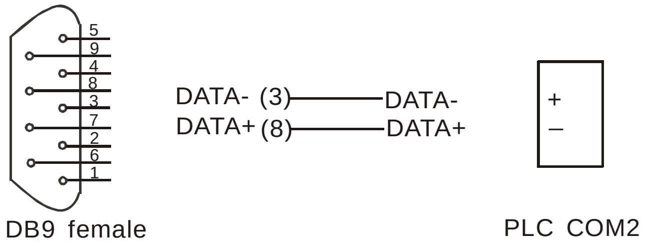
<table>
<tr><th>DNA02
DB9 female (RS-485)</th><th>VFD series AC motor drive
RJ-11 (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

2. When DNA02 is connected to DVP series PLC

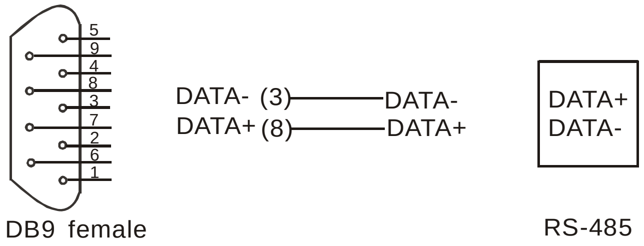
- By RS-232 communication; using standard DVPACAB215/DVPACAB230 is suggested.

<table>
<tr><th>DNA02
DB9 female (RS-232)</th><th>DVP-PLC
8 pin Mini DIN male (RS-232)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

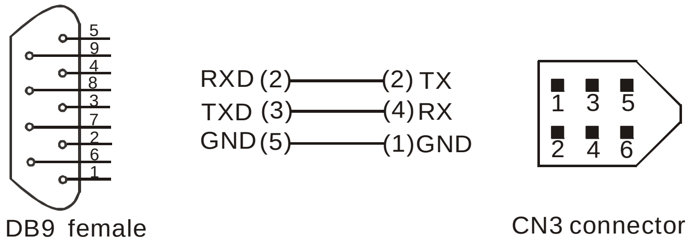
- By RS-485 communication

<table>
<tr><th>DNA02
DB9 female (RS-485)</th><th>DVP-PLC
RS-485 wiring terminal (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

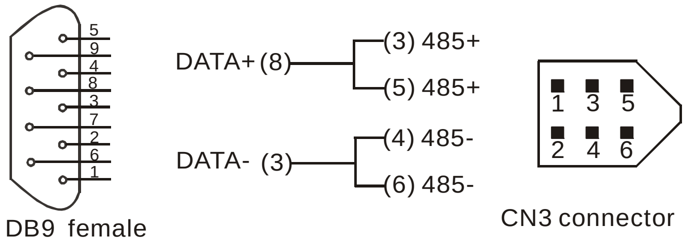
3. When DNA02 is connected to Delta DTA series temperature controller: By RS-485 communication.

<table>
<tr><th>DNA02
DB9 female (RS-485)</th><th>DTA
RS-485 wiring terminal (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

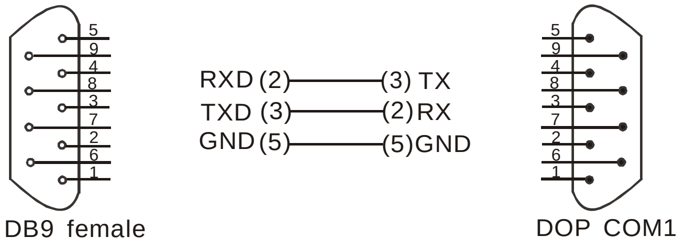
4. When DNA02 is connected to Delta ASD-A series servo drive
   - By RS-232 communication

<table>
<tr><th>DNA02
DB9 female (RS-232)</th><th>ASDA
CN3 connector (RS-232)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

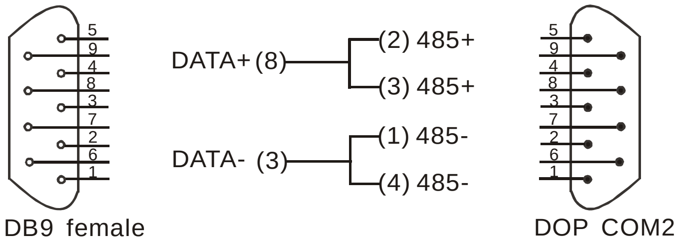
   - By RS-485 communication

<table>
<tr><th>DNA02
DB9 female (RS-485)</th><th>ASDA
CN3 connector (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

5. When DNA02 is connected to Delta DOP series human machine interface
   - By RS-232 communication

<table>
<tr><th>DNA02
DB9 female (RS-232)</th><th>DOP
DB9 male (RS-232)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

   - By RS-485 communication

<table>
<tr><th>DNA02
DB9 female (RS-485)</th><th>DOP
DB9 male (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

13.1 Introduction to COA02

1. To make sure that you are able to correctly install and operate COA02, please read this chapter carefully before starting to use COA02 and keep this handy for your quick reference.

2. This chapter only provides introductory information and guidelines on COA02. Details of CANopen protocol are not included. For more information on CANopen protocol, please refer to relevant references or literatures.

3. COA02 is defined as CANopen slave station communication module to be used on the connection between CANopen network and Delta programmable logic controller, Delta AC motor drive, Delta servo drive, Delta temperature controller and Delta human machine interface. In addition, the custom function of COA02 allows the custom equipment with Modbus protocol to connect with CANopen network.

13.1.1 COA02 Brief

4. RUN indicator and ERROR indicator display the connection status between COA02 and CANopen. SCAN PORT indicator displays the connection status between COA02 and the equipment. For more details on LED indicators, see 13.4.

5. COA02 sets up its node address in CANopen by two rotary switches. For more details on the switches, see 13.2.

6. Functions of DIP switches: selecting equipment connected to COA02, selecting communication port of COA02, setting up the baud rate between COA02 and the master. For more details on DIP switches, see 13.2.

7. CANopen interface connects COA02 to CANopen network. For more details, see 13.2.

8. The communication ports allows COA02 to connect with Delta programmable logic controller, Delta AC motor drive, Delta temperature controller, Delta servo drive, Delta human machine interface and equipment with Modbus protocol. For more details, see 13.2.

13.1.2 Features

2. Functions supported:
    - CAN2.0A protocol.
    - CANopen DS301 V4.02.
3. Services supported:
    - PDO (Process Data Object):
      PDO1 ~ PDO8: RxPDO maps the equipment parameters writable; TxPDO maps the equipment parameters readable. PDO information is in peer for transmitting real-time data.
    - SDO (Service Data Object):
      SDO information adopts ”custom machine/servo” mode for configuring slave nodes and visiting the object dictionary of every node. There are two types of SDO: request SDO and response SDO.
    - SOP (Special Object Protocol):
        - Supports the default COB-ID between the connection of pre-definited master and slave.
        - Supportes broadcasting service (when the address is 0).

  - Supports SYNC service.
  - Supports Emergency service
- NMT (Network Manegment)
  - Supports NMT Module control.
  - Supports NMT Error control.
  - Supports Boot-up.
- Services not supported
  - Time Stamp service.

4. Specifications:

CANopen connector

Type	Removable connector (5.08mm)
Transmission method	CAN
Transmission cable	2 communication cables, 2 power cables and 1 shielded cable
Electrical isolation	500V DC

Communication

Message type	PDO
	SDO
	SYNC
	Emergency
	NMT
Baud rate	10 k bps (bit/sec.)
	20 k bps (bit/sec.)
	50 k bps (bit/sec.)
	125 k bps (bit/sec.)
	250 k bps (bit/sec.)
	500 k bps (bit/sec.)
	800 k bps (bit/sec.)
	1 M bps (bit/sec.)
Supplier ID	477

Electrical specification

CANopen voltage	11 ~ 25V DC

Environment

Operation temperature	-4 ~ 122°F (-10 ~ 50°C)
Storage temperature	-4 ~ 140°F (-20 ~ 60°C)
Humidity	< 90%, (under normal pressure)
Altitude	Max. 1,000m
Shock/vibration immunity	0.5G 9 ~ 200Hz

Safety standard

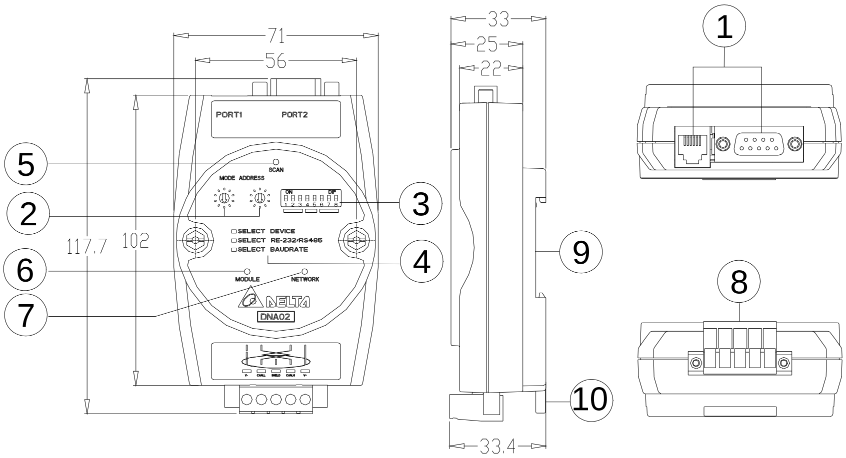
Under EN50178 standard

Certifications

CE and UL certified

13.2 Components

13.2.1 Product Profile and Outline



Unit: mm

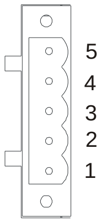
1. Communicaton ports	6. RUN indicator
2. Address setup rotary switches	7. ERROR indicator
3. Function setup DIP switches	8. CANopen connector
4. Descriptions for DIP switches	9. DIN rail
5. SP (Scan Port) indicator	10. DIN rail clip

13.2.2 CANopen Connector

To connect with CANopen network, you can use the connector enclosed with COA02 or any connectors you can buy in the store for wiring.

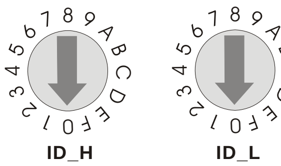
- Connect to th bus on CANopen
- Connect to the CANopen communication port on COA02

PIN	Signal	Description
1	V-	0V DC
2	CAN_L	Signal-
3	SHIELD	Shielded cable
4	CAN_H	Signal+
5	V+	24V DC



13.2.3 Address Setup Rotary Switch

The two rotary switches SW1 and SW2 set up the node address on CANopen network in hexadecimal form. Setup range: 01 ~ 7F (80 ~ FF are forbidden).



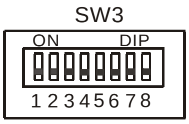
1. Example:
   If you need to set the node address of COA02 as 26 (H'1A), simply switch the corresponding rotary switch of ID_H to "1" and the corresponding rotary switch of ID_H to "A".

Address setting	Description
0 ~ 7F	Valid CANopen node address
80 ~ FF	Invalid CANopen node address

2. Note:
   The changed values on SW1 or SW2 are only valid when COA02 is re-powered. When COA02 is operating, changing the set value of node address will be invalid.

13.2.4 Function Setup DIP switch

The DIP switch SW3 is to be used on the equipment connected to COA02, the selection of communication ports and setting up the baud rate of COA02 and the master in CANopen.



1. Selecting equipment connected to COA02

PIN 3	PIN 2	PIN 1	Equipment
Off	Off	On	AC motor drive
Off	On	Off	Programmable logic controller
Off	On	On	Temperature controller
On	Off	Off	Servo drive
On	Off	On	Human machine interface
On	On	Off	Custom equipment
On	On	On	Test mode

- Example
  If the equipment connected to COA02 is Delta servo drive, you only need to switch PIN 3 in SW3 to “On”, PIN 1 and PIN 2 to “Off” and re-power COA02.
- Note:
  The changed setting of DIP switch is only valid when COA02 is re-powered. When COA02 is operating, changing the setting of DIP switch will be invalid.

2. Selecting COA02 communication mode

PIN 5	PIN 4	Communication mode
Off	Off	RS-485
On	On	RS-232
Off	On	Incorrect setting
On	Off	

- Note:
  The changed setting of the communication mode is only valid when COA02 is re-powered. When COA02 is operating, changing the setting of communication mode will be invalid.

3. Setting up baud rate

PIN 8	PIN 7	PIN 6	Baud rate
Off	Off	Off	10k bps
Off	Off	On	20k bps

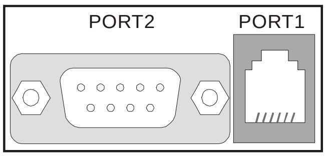
PIN 8	PIN 7	PIN 6	Baud rate
Off	On	Off	50k bps
Off	On	On	125k bps
On	Off	Off	250k bps
On	Off	On	500k bps
On	On	Off	800k bps
On	On	On	1M bps

- Note:

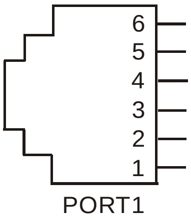
  The changed setting of the baud rate of CANopen is only valid when COA02 is re-powered. When COA02 is operating, changing the baud rate will be invalid.

13.2.5 Communication Ports on COA02

The communication ports on COA02 are used for the connection the equipment (Delta programmable logic controller, Delta AC motor drive, Delta temperature controller, Delta servo drive, Delta human machine interface and custom equipment).



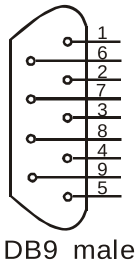
1. PORT 1 PIN definition:

PORT 1 sketch	PIN	Description
	1	N.C.
	2	GND
	3	DATA-
	4	DATA+
	5	N.C.
	6	N.C.

- Note:

  PORT 1 supports RS-485 communication only.

2. PORT 2 PIN definition:

PORT2 sketch	PIN	RS-232	RS-485
	1	N.C.	N.C.
	2	RXD	N.C.
	3	TXD	DATA-
	4	N.C.	N.C.
	5	GND	N.C.
	6	N.C.	N.C.
	7	N.C.	N.C.
	8	N.C.	DATA+
	9	N.C.	N.C.

- Note:

  PORT 2 supports RS-232 and RS-485 communication only.

13.3 Functions of COA02

COA02 can be connected to different equipment. The functions of COA02 vary upon the equipment connected to it.

13.3.1 Common Functions

COA02 supports NMT, SYNC, EMERGENCY, PDO and SDO, among which the functions of NMT, SYNC and SDO are fixed, and the functions of others vary upon the equipment connected to COA02.

1. NMT module control

   This function controls the status of node controlling NMT slave through NMT master.

   - Format

     Master → COA02

COB-ID	Byte 0	Byte 1
0 (H’000)	Command specifier (CS)	Node-ID

   If Node-ID =0, the “command specifier” will be broadcasted to all COA02 (CANopen slaves). Every slave will have to execute NMT.

   - Commands

     See below for the functions of all command specifiers:

Command specifier (CS)	Function
H’01	Enable remote node
H’02	Disable remote node
H’80	Enter pre-operation status
H’81	Reset application layer
H’82	Reset communication

   - Explanation

     Switching COA02 whose node ID = 6 to pre-operation status.

COB-ID	Byte 0	Byte 1
H’000	H’80	H’06

2. NMT error control

   This function is applicable to NMT slave node sending its own operational status back to NMT master.

   - After COA02 is initialized and enters pre-operation status, COA02 will send out the only BOOT-UP signal.

     COA02 → master

COB-ID	Byte 0
1792(H’700)+Node-ID	H’00

   - Supposed COA02 sends out one status signal during the operation, its format will be:

     COA02 → master

COB-ID	Byte 0
1792(H’700)+Node-ID	NMT status

   NMT status:

Stop: H’04; Operation in progress: H’05; Pre-operation: H’7F.

- Explanation: Assume the Node-ID of a COA02 is 6

When COA02 operation is in progress:

COB-ID	Byte 0
H’706	H’05

When COA02 is shut down:

COB-ID	Byte 0
H’706	H’04

When COA02 is in pre-operation status:

COB-ID	Byte 0
H’706	H’7F

Communication reset or application layer reset:

COB-ID	Byte 0
H’706	H’00

3. Synchronous signal -- SYNC

SYNC signal is sent out by the loop of CANopen master. SYNC does not contain any data, and its main purpose is to request the PDO of slave node to operate in synchronous communication mode. In this way, you can set to synchronous or asynchronous mode while using PDO.

- Format

Master → COA02

COB-ID
128(H’080)

4. SDO service

All SDO message are fixed at 8 bytes.

- Request: Master → COA02

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
1536(H’600) +Node-ID	Request code	Object index		Sub-index of object	Request data			
		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

- Response: COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
1408(H’580) +Node-ID	Response code	Object index		Sub-index of object	Response data			
		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

- If the “request code” (or “response code”) is different, the corresponding “request data” (or “response data”) will also be different. See the table below.

Request code	Explanation	Byte 4	Byte 5	Byte 6	Byte 7
H’23	Write a 4-byte datum	bit7-0	bit15-8	bit23-16	bit31-24
H’2B	Write a 2-byte datum	bit7-0	bit15-8	H’00	H’00
H’2F	Write a 1-byte datum	bit7-0	H’00	H’00	H’00

Request code	Explanation	Byte 4	Byte 5	Byte 6	Byte 7
H’40	Read data	H’00	H’00	H’00	H’00
H’80	Stop the current SDO command	H’00	H’00	H’00	H’00

Response code	Instruction explanation	Byte 4	Byte 5	Byte 6	Byte 7
H’43	Read 4-byte data	bit7-0	bit15-8	bit23-16	bit31-24
H’4B	Read 2-byte data	bit7-0	bit15-8	H’00	H’00
H’4F	Read 1-byte data	bit7-0	H’00	H’00	H’00
H’60	Read 1/2/4-byte data	H’00	H’00	H’00	H’00
H’80	Stop SDO command	End code			

- When COA02 detects an SDO error, SDO data transmission will be terminated, and COA02 will respond SDO master with an end code. See the table below for all end codes:

End code (16#)		Description
0503	0000	Transmission in sections: “toggle bit” has not been changed
0504	0000	SDO protocol time-out
0504	0001	“Request code” is invalid or unknown
0504	0002	Invalid block length (in block mode)
0504	0003	Invalid serial number (in block mode)
0504	0004	CRC error (in block mode)
0504	0005	Memory is full
0601	0000	When polling an object parameter, a polling fault appears
0601	0001	Try to execute reading request to a write only parameter
0601	0002	Try to execute writting request to a read only parameter
0602	0000	The requested index object does not exist in the object dictionary
0604	0041	Object parameters could not be mapped into PDO
0604	0042	The number or length of the parameters to be mapped have exceeded the maximum PDO’s length
0604	0043	Common parameters are incompatible
0604	0047	AC motor drive is incompatible inside
0606	0000	Polling fails because of hardware error.
0607	0010	Data type doesn’t match; the length of service parameters doesn’t match
0607	0012	Data type doesn’t match; the length of service parameters is too long
0607	0013	Data type doesn’t match; the length of service parameters is too short
0609	0011	Sub-index doesn’t exit.
0609	0030	Having exceeded the parameters’ value selection range (only for writing authority)
0609	0031	Written parameters are too big
0609	0032	Witten parameters are too small
0609	0036	The maximum value of the parameter is less than the minimum value
0800	0000	General error occurs
0800	0020	Parameters could not be transmitted to or stored to application layer

End code (16#)		Description
0800	0021	For the reason of local control, parameters could not be transmitted to or stored to application layer
0800	0022	Because of the present status of AC motor drive, parameters could not be transmitted or stored to application layer
0800	0023	Dynamic creating of the object dictionary fails or object dictionary does not exit (e.g. object dictionary was created from a file, if this file has an error, then the creating of object dictionary will fail)

- Explanation: Supposed there is a slave COA02 (Node-ID = 6)

1. Read the ID if the COA02 supplier (index H’1018, sub-index H’01)

   Master → COA02:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’606	H’40	H’18	H’10	H’01	H’00	H’00	H’00	H’00

   COA02 → master:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’586	H’43	H’18	H’10	H’01	H’DD	H’01	H’00	H’00

2. Read the maximum output frequency of AC motor drive (index 2001H, sub index 01H, supposed the value is 60.00Hz)

   Master → COA02:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’606	H’40	H’01	H’20	H’01	H’00	H’00	H’00	H’00

   COA02 → master:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’586	H’4B	H’01	H’20	H’01	H’70	H’17	H’00	H’00

3. Write the maximum output frequency of AC motor drive (supposed the value is 50.00Hz)

   Master → COA02:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’606	H’2B	H’01	H’20	H’01	H’88	H’13	H’00	H’00

   COA02 → master:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’586	H’60	H’01	H’20	H’01	H’00	H’00	H’00	H’00

4. Index 1408 does not exist. If you read or write1408/01, COA02 will respond with an end code.

   Master → COA02:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’606	H’2B	H’08	H’14	H’01	H’88	H’13	H’00	H’00

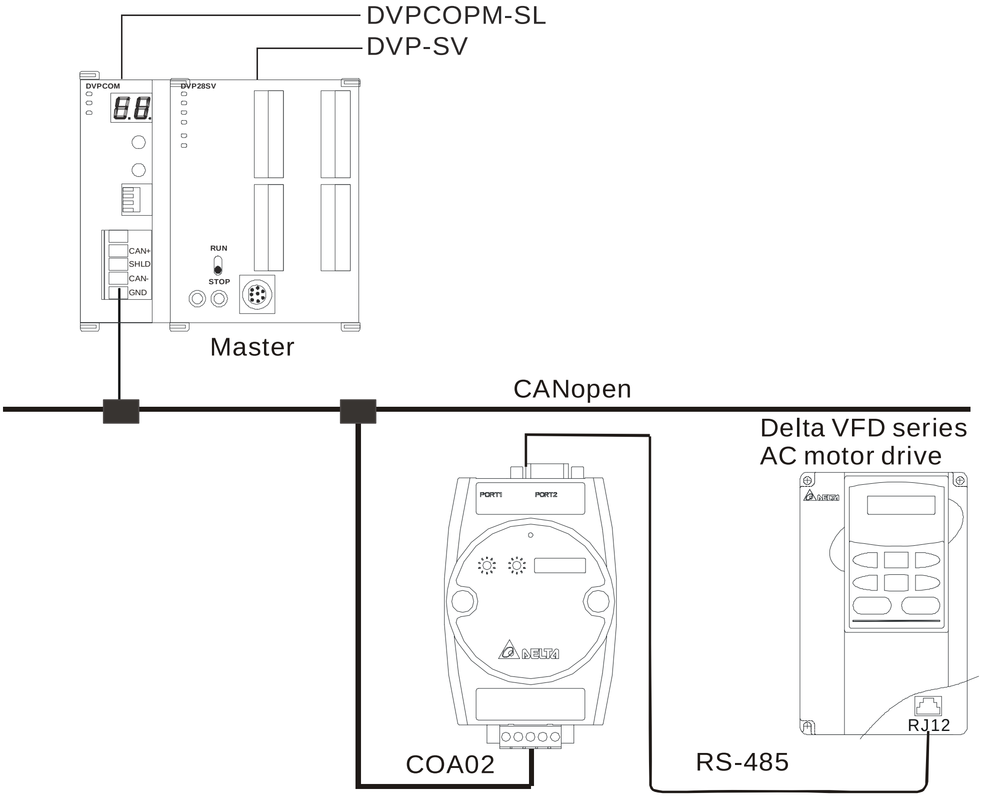
COA02 → master:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'586	H'80	H'08	H'14	H'01	H'00	H'00	H'02	H'06

- Note:

  When COA02 is connected to different equipments, see 13.5.1 "Communication Objects in Object Dictionary" for the corresponding relations beween index (sub index) and equipment parameters.

13.3.2 When COA02 is connected to AC motor drive



1. Setting up baud rate and communication format
   - Before connecting the AC motor drive to the bus, first set the communication address of the AC motor drive to 01, baud rate to 38,400bps and communication format to 8, N, 2; RTU (the format is fixed; other formats will be invalid).
   - To adjust the baud rate, follow the steps listed below.
     - ■ Set up the DIP switch SW3 of COA02 to custom equipment mode.
     - ■ Connect COA02 to the bus of CANopen and enable the operation of COA02.
     - ■ Modify the index parameter 5003/02 (main index: H'5003, sub index: H'02).

       5003/02 = 1 → 19,200; 8, N, 2; RTU

       5003/02 = 2 → 38,400; 8, N, 2; RTU (Default)
     - ■ Return SW3 of COA02 back to AC drive mode and re-power COA02.
     - ■ Adjust the baud rate of the AC drive to the corresponding one.
2. Functions & features

   In addition, COA02 also supports the following two functions.

- Emergency object – EMERGENCY

  When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.

  ■ Format

  COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H'080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

  - Error register

    The value in the error register will be mapped to index address H'1001 in the object dictionary. Value = 0 indicates that no error occurs. Value = 1 indicates that a general error takes place. Value = H'80 indicates that an internal error in the equipment occurs.

  - Emergency error code

    ♦ Internal communication error

    This error indicates the communication error between COA02 and AC motor drive (e.g. communicate failure). When such error occurs, the emergency error code will be H'8101, and the value in the error register will become 1.

    ♦ CANopen bus communication error

    This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H'8130, and the value in the error register will become 1.

    ♦ Insufficient length of PDO data

    This error indicates that the length of Receive PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H'8210, and the value in the error register will become 1.

    ♦ Internal error in the equipment

    This error indicates the error taken place inside the AC motor drive (e.g. AC motor drive in low voltage). When such error occurs, the emergency error code will be H'FFXX (XX refers to the error code of the AC motor drive), and the value in the error register will become H'80. After the error is eliminated, the emergency error code will become H'0000.

    ♦ Eliminating error

    When an error is eliminated, the emergency error code will become H'0000.

  ■ Explanation

  Take the COA02 slave of node ID = 6 as the object and compare the EMERGENGY messages sent out by COA02 in different error conditions.

  - When in internal communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	01	81	01	00	00	00	00	00

  - When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

- When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

- When the AC motor drive in low voltage (internal error of the equipment)

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	0E	FF	80	00	00	00	00	00

(When in low voltage, the error code in AC motor drive will be H’0E.)

- When internal error in the equipment has been eliminated

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	80	00	00	00	00	00

- When the error is eliminated

Still other errors existing:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

All errors are eliminated:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

- Note:

COA02 sends out EMERGENCY message only when error occurs.

- PDO service

COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated.

- ■ PDO1 (Default: Open)

- TxPDO1 (COA02 → master):

Send the status data of the salve (COA02) to the master. Preset the length of data to be mapped to 2 byte and the content to be mapped to status word. You can map any readable paramemters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’180 + Node-ID	Status word							

- RxPDO1 (master → COA02):

Send the control data of the master to the slave (COA02). Preset the length of the data to be mapped to 2 bytes and the content to be mapped to control word. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’200 + Node-ID	Control word							

- PDO2 ~ PDO8 (Default: Close)
  - TxPDO (COA02 → master):

    Send the status data of the slave (COA02) to the master. Preset the length of the data to be mapped to 0 byte. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’xxxx +Node-ID								

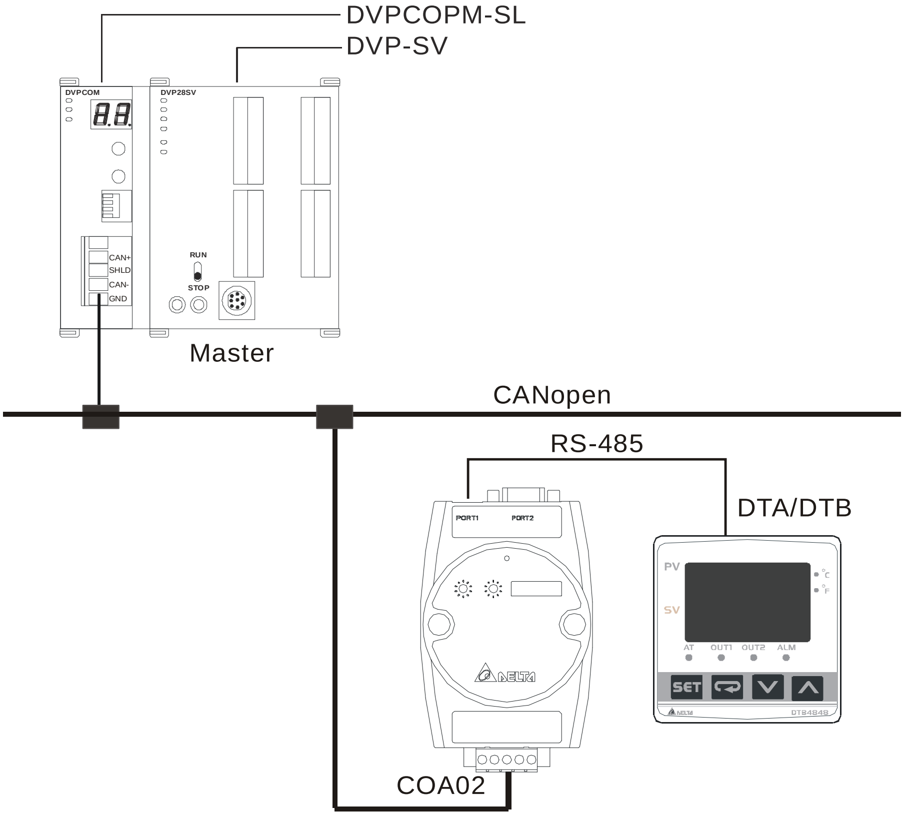
  - RxPDO (master → COA02):

    Send the control data of the master to the slave (COA02). Preset the length of the data to be mapped to 0 byte. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’yyyy +Node-ID								

- Data transmission mode
  - TxPDO in COA02 supports many modes: synchronously non-cyclic, synchronously cyclic, synchronous RTR, asynchronous RTR and asynchronous modes.

13.3.3 When COA02 is connected to temperature controller (DTA/DTB)



1. Setting up baud rate and communication format
   - Before connecting the temperature controller to the bus, first set up the communication address of the temperature controller to 01, baud rate to 38,400bps and communication format to 7, E, 1;

ASCII (the format is fixed; other formats will be invalid).

- Before communicating with DTA series temperature controller, first set the content of H’471A to H’0001 to allow the write-in of communication.
- Before communicating with DTB series temperature controller, first set the content of H’0810 to H’FF00 to allow the write-in of communication.
- To adjust the baud rate, follow the steps listed below.
    - Set up the DIP switch SW3 of COA02 to custom equipment mode.
    - Connect COA02 to the bus of CANopen and enable the operation of COA02.
    - Modify the index parameter 5003/04.

      5003/04 = 1 → 19,200; 7, E, 1; ASCII

      5003/04 = 2 → 38,400; 7, E, 1; ASCII (Default)
    - Return SW3 of COA02 back to temperature controller mode and re-power COA02.
    - Adjust the baud rate of the temperature controller to the corresponding one.

2. Functions & features

In addition, COA02 also supports the following two functions.

- Emergency object – EMERGENCY

  When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.
    - Format

      COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H’080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

- Error register

  The value in the error register will be mapped to index address H’1001 in the object dictionary. Value = 0 indicates that no error occurs. Value = 1 incicates that a general error takes place. Value = H’80 indicates that an internal error in the equipment occurs.
- Emergency error code
    - Internal communication error

      This error indicates the communication error between COA02 and the temperature controller (e.g. communication failure). When such error occurs, the emergency error code will be H’8101, and the value in the error register content will become 1.
    - CANopen bus communication error

      This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H’8130, and the value in the error register will become 1.
    - Insufficient length of PDO data

      This error indicates that the length of Receive PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H’8210, and the value in the error register will become 1.
    - Internal error in the equipment

      This error indicates the error taken place inside the temperature controller (e.g. the temperature has not been acquired immediately after the controller is switched on). When such error occurs, the emergency error code will be H’FFXX (XX refers to the error code of the temperature controller), and the value in the error register will become H’80.

- ♦ Eliminating error

  When an error is eliminated, the emergency error code will become H’0000.

- ■ Explanation

  Take the COA02 slave of node ID = 6 as the object and compare the EMERGENCY messages sent out by COA02 in different error conditions.

- When in internal communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	01	81	01	00	00	00	00	00

- When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

- When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

- When the temperature has not yet been acquired (internal error of the equipment)

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	02	FF	80	00	00	00	00	00

(When temperature has not been acquired, the error code in the temperature controller will be H’02.)

- When the error is eliminated.

  Still other errors existing:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

All errors are eliminated:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

- Note:

  COA02 sends out EMERGENCY message only when error occurs.

- PDO service

  COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated.

- ■ PDO1(Default: Open)

- TxPDO1 (COA02 → master):

  Send the status data of the slave (COA02) to the master. Preset the length of data to be mapped to 2 bytes and the content to be mapped to present temperature value. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’180 + Node-ID	PV							

- RxPDO1 (master → COA02):

  Send the control data of the master to the slave (COA02). Preset the length of data to be mapped to 2 bytes and the content to be mapped to present temperature value. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’200 + Node-ID	SV							

- ■ PDO2 ~ PDO8 (Default: Close)
  - TxPDO (COA02 → master):

    Send the status date of the slave (COA02) to the master. Preset the length of data to be mapped to 0 byte. You can map any readable parameter, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’xxxx +Node-ID								

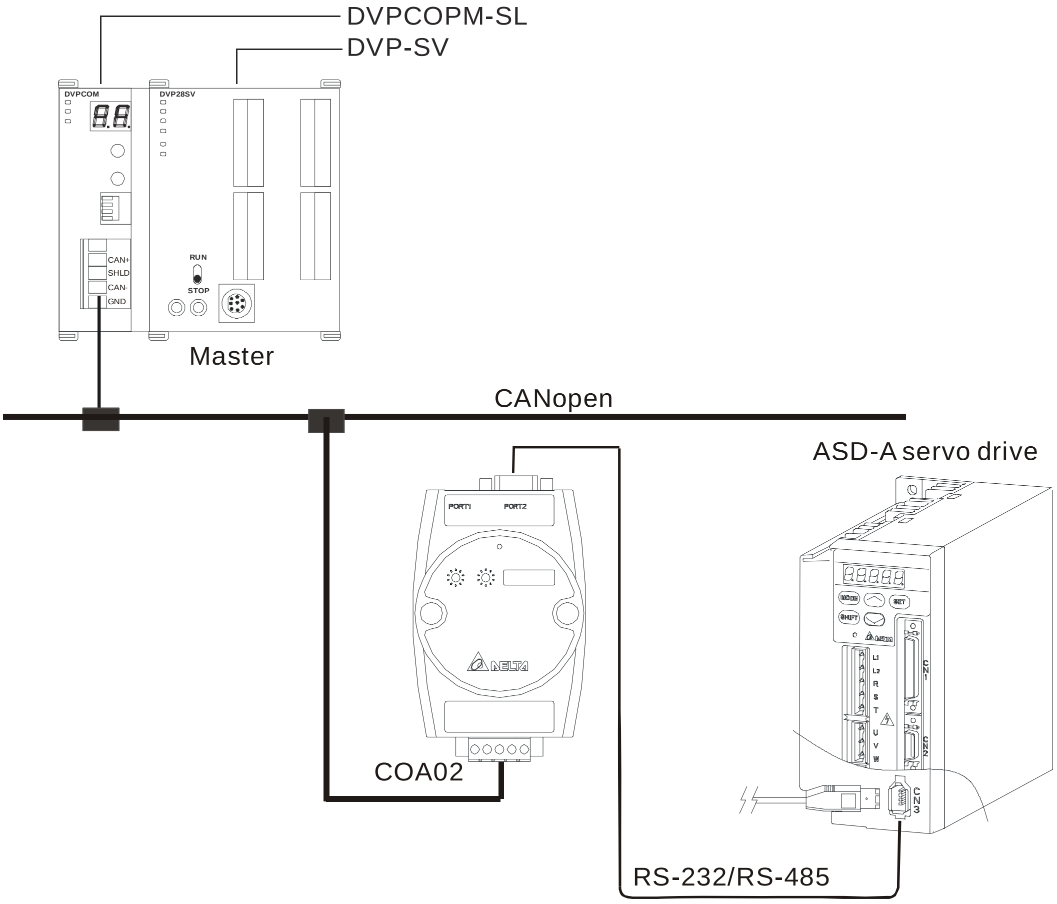
  - RxPDO (master → COA02):

    Send the control data of the master to the slave (COA02). Preset the length of the data to be mapped to 0 byte. You can map any readbable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’yyyy +Node-ID								

- ■ Data transmission mode
  - TxPDO in COA02 supports many modes: synchronously non-cyclic, synchronous cyclic, synchronous RTR, asynchronous RTR and asynchronous modes.

13.3.4 When COA02 is connected to ASD-A servo drive



1. Setting up baud rate and and communication format
   - Before connecting the servo drive to the bus, first set the communication address of the servo drive to 01, baud rate to 115,200bps and communication format to 7, E, 1; ASCII (the format is fixed; other formats will be invalid).
   - To adjust the baud rate, follow the steps listed below.
     - Set up the DIP switch SW3 of COA02 to custom equipment mode.
     - Connect COA02 to the bus of CANopen and enable the operation of COA02.
     - Modify the index parameter 5003/05.

       5003/05 = 1 → 19,200; 7, E, 1; ASCII

       5003/05 = 2 → 38,400; 7, E, 1; ASCII

       5003/05 = 3 → 57,600; 7, E, 1; ASCII

       5003/05 = 4 → 115,200; 7, E, 1; ASCII (Default)
     - Return SW3 of COA02 back to servo drive mode and re-power COA02.
     - Adjust the baud rate of the servo drive to the corresponding one.
2. Functions & features

   In addition, COA02 also supports the following two functions.
   - Emergency object – EMERGENCY

     When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.
     - Format

       COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H'080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

- Error register

  The value in the error register will be mapped to index address H'1001 in the object dictionary. Value = 0 indicates that no error occrs. Value = 1 incicates that a general error takes place. Value = H'80 indicates that an internal error in the equipment occurs.

- Emergency error code
  - ♦ Internal communication error

    This error indicates the communication error between COA02 and the servo drive (e.g. communication failure). When such error occurs, the emergency error code will be H'8101, and the value in the error register will become 1.
  - ♦ CANopen bus communication error

    This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H'8130, and the value in the error register will become 1.
  - ♦ Insufficient length of PDO data

    This error indicates that the length of Receivce PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H'8210, and the value in the error register will become 1.
  - ♦ Internal error in the equipments

    This error indicates the error taken place inside the servo drive (e.g. sevo drive conducts emergency stop). When such error occurs, the emergency error code will be H'FFXX (XX refers to the error code of the servo drive), and the value in the error register will become H'80.
  - ♦ Eliminating error

    When an error is eliminated, the emergency error code will become H'0000.

■ Explanation

Take the COA slave of node ID = 6 as the object and compare the EMERGENCY messages sent out by COA02 in different error conditions.

- When in internal communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	01	81	01	00	00	00	00	00

- When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

- When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

- When the servo drive conducts emergency stop (internal error of the equipment)

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	0D	FF	80	00	00	00	00	00

(When stops urgently, the error code of srovo drive is H'0D)

- Error removed

When there is still other error exiting

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

When all errorss have been removed

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

- Note

Only when error status has changed that COA02 could send EMMERGENCY message.

- PDO service

COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated.

- ■ PDO1 (Default: Open)
  - TxPDO1 (COA02 → master):

Send the status data of the slave (COA02) to the master. Preset the length of data to be mapped to 2 bytes and the content to be mapped to “status word of digital output contact”. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'180 + Node-ID	DO1~DO5							

- RxPDO1 (master → COA02)：

Send the control data of the master to the slave (COA02). Preset the length of data to be mapped to 2 bytes and the content to be mapped to “control word of digital input contact”. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'200 + Node-ID	DI1~DI8							

- ■ PDO2 ~ PDO8 (Default: Close)
  - TxPDO (COA02 → master):

Send the status date of the slave (COA02) to the master. Preset the length of data to be mapped to 0 byte. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'xxxx +Node-ID								

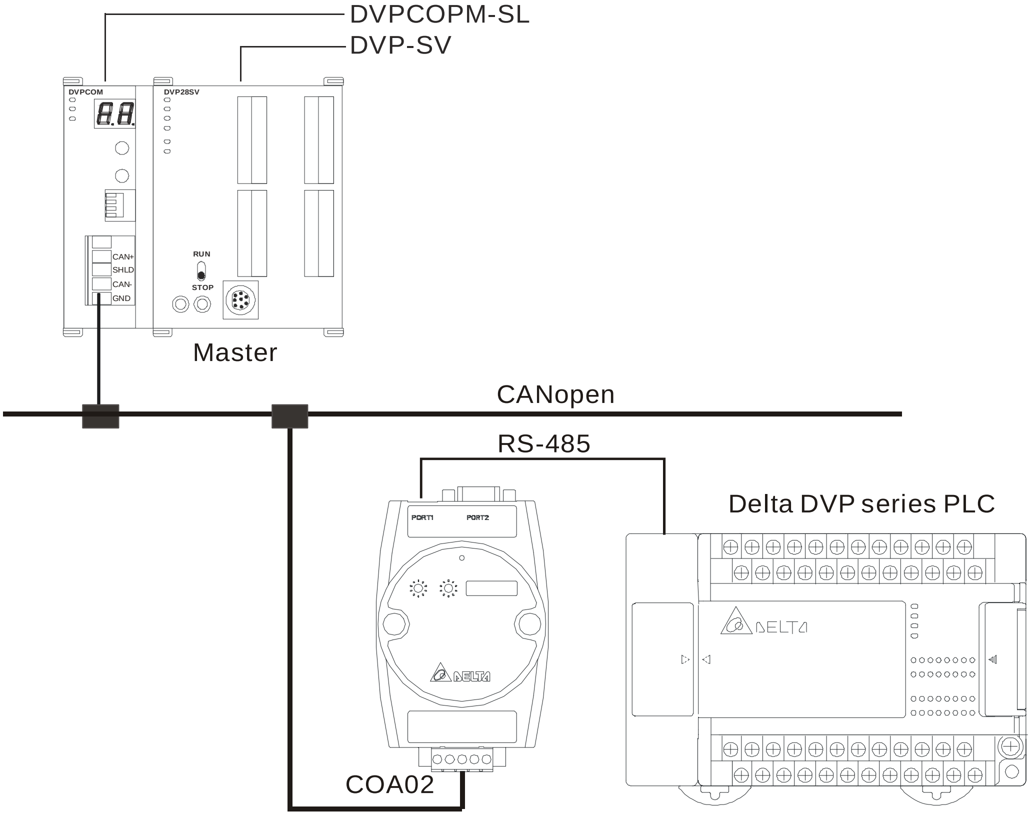
- RxPDO (master→COA02):

Send the control data of the master to the slave (COA02). Preset the length of data to be mapped to 0 byte. You can map any readable parameters, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'yyyy +Node-ID								

- Data transmission mode
  - TxPDO in COA02 supports many modes: synchronously non-cyclic, synchronously cyclic, synchronously RTR, asynchronously RTR and asynchronous modes.

13.3.5 When COA02 is connected to programmable logic controller



1. Setting up baud rate and communication format
   - Before connecting the PLC to the bus, first set up the communication address of the PLC to 01, baud rate to 115,200bps and communication format to 7, E, 1; ASCII (the format is fixed; other formats will be invalid).
   - To adjust the baud rate, follow the steps listed below.
     - Set up the DIP switch SW3 of COA02 to custom equipment mode.
     - Connect COA02 to the bus of CANopen and enable the operation of COA02.
     - Modify the index parameter 5003/03

       5003/03 = 1 → 19,200; 7, E, 1; ASCII

       5003/03 = 2 → 38,400; 7, E, 1; ASCII

       5003/03 = 3 → 57,600; 7, E, 1; ASCII

       5003/03 = 4 → 115,200; 7, E, 1; ASCII (Default)
     - Return SW3 of COA02 back to PLC mode and re-power COA02.
     - Adjust the baud rate of the PLC to the corresponding one.

2. Functions & features

In addition, COA02 also supports the following two functions.

- Emergency object – EMERGENCY

  When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.

  - Format

    COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H’080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

    - Error register

      The value in the error register will be mapped to index address H’1001 in the object dictionary. Value = 0 indicates that no error occurs. Value = 1 incicates that a general error takes place. Value = H’80 indicates that an internal error in the equipment occurs.

    - Emergency error code

      - Internal communication error

        This error indicates the communication error between COA02 and PLC (e.g. communication failure). When such error occurs, the emergency error code will be H’8101, and the value in the error register will become 1.

      - CANopen bus communication error

        This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H’8130, and the value in the error register will become 1.

      - Insufficient length of PDO data

        This error indicates that the length of Receive PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H’8210, and the value in the error register will become 1.

      - Eliminating error

        When an error is eliminated, the emergency error code will become H’0000.

  - Explanation

    Take the COA02 slave of node ID = 6 as the object and compare the EMERGENCY messages sent out by COA02 in different error conditions.

    - When in internal communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	01	81	01	00	00	00	00	00

    - When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

    - When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

- When the error is eliminated.

  Still other errors exiting:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

All errors are eliminated:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

- Note

  COA02 sends out EMMERGENCY message only when error occurs.

- PDO service

  COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated.

  - Particularly for PLC, the PDO parameters in COA02 are divided into an upload area and download area, featuring:
    - TxPDO

      TxPDO is only able to map parameter D (upload start address+0) ~ D (upload start address+31), the 32 registers, in the upload area. By modifying the upload start address, you can obtain different upload areas. For example,

      When the upload start address = 0, the upload area will be D0 ~ D31.

      When the upload start address = 10, the upload area will be D10 ~ D41.
    - RxPDO

      RxPDO is only able to map parameter D (download start address+0) ~ D (download start address+31), the 32 registers, in the download area. By modifying the download start address, you can obtain different download areas. For example,

      When the download start address = 0, the download area will be D0 ~ D31.

      When the download start address = 10, the download area will be D10 ~ D41.
    - Note: See 13.5.1 “Communication Objects in Object Dictionary” for the corresponding index and sub-index of upload start address, download start address and all mapping parameters.
  - PDO1 (Default: Open)
    - TxPDO1 (COA02 → master):

      Send the status data of the slave (COA02) to the master. Preset the length of data to be mapped to 8 bytes and the content to be mapped to “the 1st ~ 4th registers in the upload area”. You can map any parameters in the upload area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’180 + Node-ID	D (up+0)		D (up+1)		D (up+2)		D (up+3)	

- RxPDO1 (master → COA02):

  Send the control data of the master to the slave (COA02). Preset the length of the data to be mapped to 8 bytes and the content to be mapped to “the 1st ~ 4th registers in the download area”. You can map any parameters in the download area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’200 + Node-ID	D (down +0)		D (down +1)		D (down +2)		D (down +3)	

- ■ PDO2 ~ PDO8 (Default: Close)

- TxPDO (COA02 → master):

  Send the status data of the slave (COA02) to the master. Preset the lengrh of the data to be mapped to 0 byte. You can map any parameters in the upload area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’xxxx +Node-ID								

- RxPDO (master → COA02):

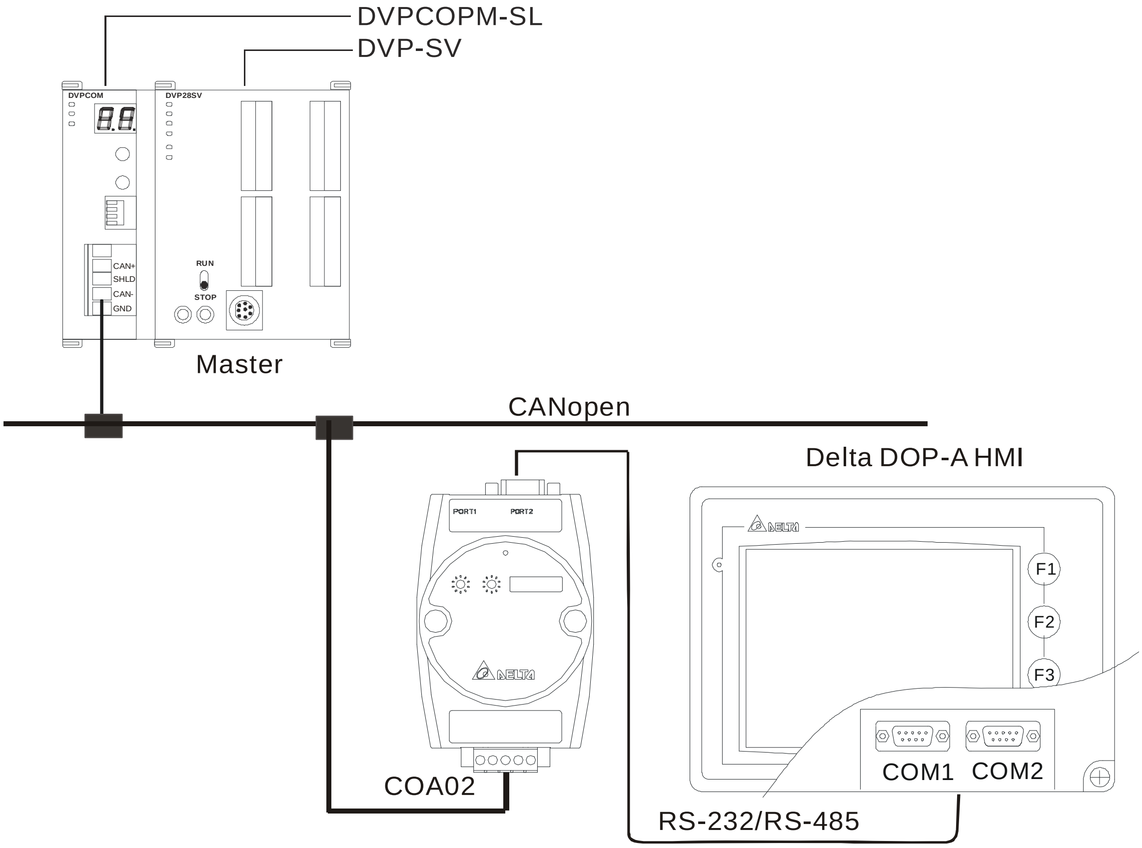
  Send the control data of the master to the slave (COA02). Preset the length of data to be mapped to 0 byte. You can map any parameters in the download area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’yyyy +Node-ID								

- ■ Data transmission mode

- TxPDO in COA02 supports many modes: synchronous non-cyclic, synchronous cyclic, synchronous RTR, asynchronous RTR and asynchronous modes.

13.3.6 When COA02 is connected to Delta DOP-A HMI



1. Setting up baud rate and communication format

- Before connecting the HMI to the bus, first set up the baud rate to 115,200bps and communication format to 7, E, 1; ASCII (the format is fixed; other formats will be invalid).
- HMI as the master and COA02 as the slave. There are 64 virtual D devices (D0 ~ D63) in COA02. CANopen master and HMI are able to map, read and write the virtual D devices in COA02.
- To adjust the baud rate, follow the steps listed below.
  - Set up the DIP switch SW3 of COA02 to custom equipment mode.
  - Connect COA02 to the bus of CANopen and enable the operation of COA02.
  - Modify the index parameter 5003/06.

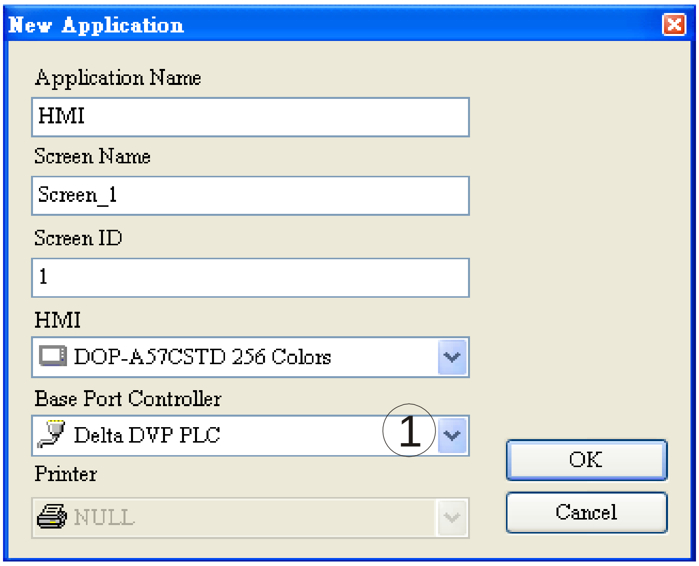
    5003/06 = 1 → 19,200; 7, E, 1; ASCII

    5003/06 = 2 → 38,400; 7, E, 1; ASCII

    5003/06 = 3 → 57,600; 7, E, 1; ASCII

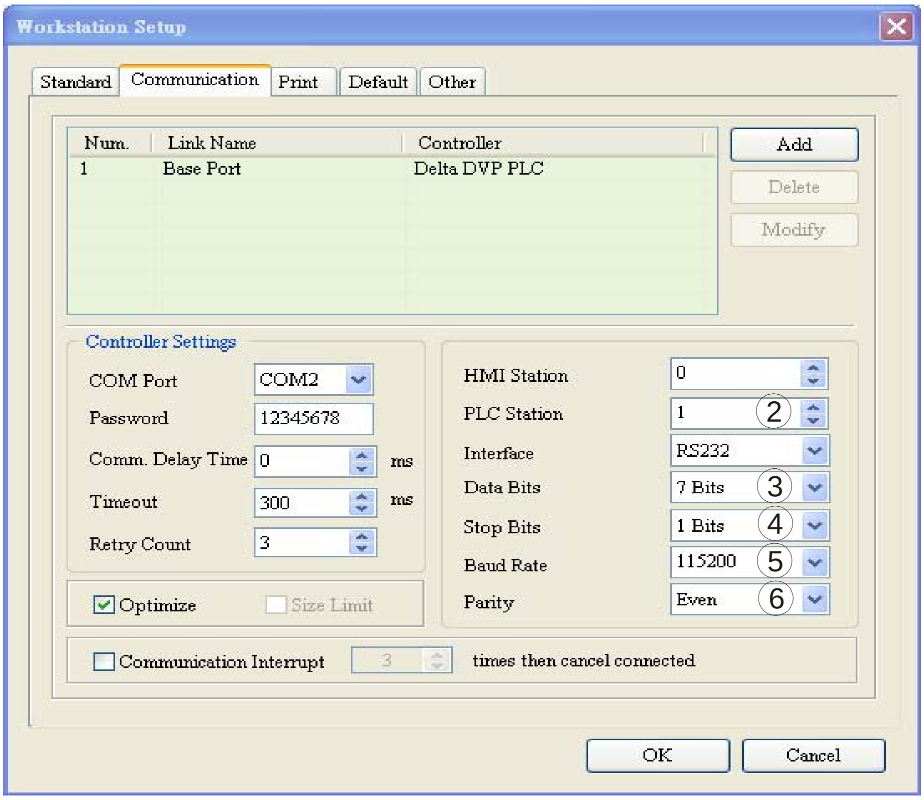
    5003/06 = 4 → 115,200; 7, E, 1; ASCII (Default)
  - Return SW3 of COA02 back to HMI mode and re-power COA02.
  - Adjust the baud rate of the HMI to the corresponding one.
- When COA02 is connected to DOP HMI, set up the baud rate and communication format following the steps below.

- Open Screen Editor and select “File => New”. You will see the dialog box below.



Application Name: HMI
Screen Name: Screen_1
Screen ID: 1
HMI: DOP-A57CSTD 256 Colors
Base Port Controller: Delta DVP PLC ①
Printer: NULL

- Select “Delta DVP PLC” to be the Base Port Controller, as step ①. Click “OK” to create a new file.
- Select “Options => Configuration => Communication”, and you will see the dialog box below.



Num.	Link Name	Controller
1	Base Port	Delta DVP PLC

Controller Settings

COM Port: COM2
Password: 12345678
Comm. Delay Time: 0 ms
Timeout: 300 ms
Retry Count: 3
☑ Optimize ☐ Size Limit

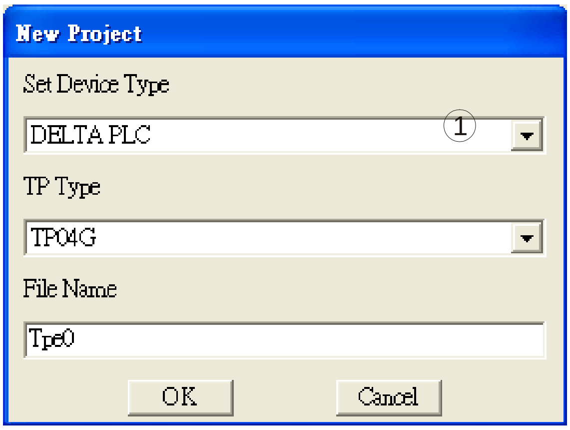
HMI Station: 0
PLC Station: 1 ②
Interface: RS232
Data Bits: 7 Bits ③
Stop Bits: 1 Bits ④
Baud Rate: 115200 ⑤
Parity: Even ⑥

☐ Communication Interrupt 3 times then cancel connected

- Follow step ② ~ ⑥: PLC Station = 1; communication format = 115,200, 7, E, 1, ASCII. Click ”OK”.

● When the HMI connected to DNA02 is TP04/TP02, and then please set up its communication speed and format following the procedure listed below.

- Open TPEditor and select “File => New”. You will see the dialog box below.

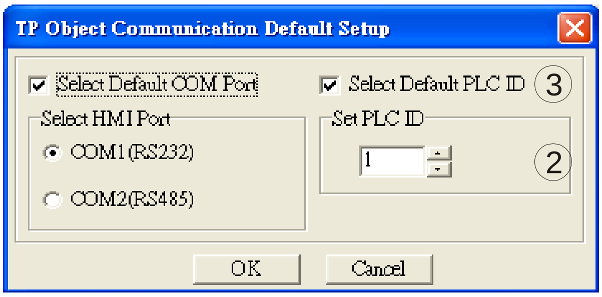


Set Device Type: DELTA PLC

TP Type: TP04G

File Name: Tpe0

- Select “DELTA PLC” in Set Device Type column, as step ①. Click “OK” to create a new file.
- Select “Tools => TP Object Communication Default Setting”, and you will see the dialog box below.



☑ Select Default COM Port

Select HMI Port: ● COM1(RS232) ○ COM2(RS485)

☑ Select Default PLC ID

Set PLC ID: 1

- Follow step ② ~ ③: Set PLC ID = 1; check “Select Default PLC ID”. Click “OK”.

2. Functions & features

In addition, COA02 also supports the following two functions.

- Emergency object – EMERGENCY

  When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.

  - Format

    COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H’080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

- Error register

  The value in the error register will be mapped to index address H’1001 in the object dictionary. Value = 0 indicates that no error occurs. Value = 1 indicates that a general error takes place. Value = H’80 indicates that an internal error in the equipment occurs.

- Emergency error code

  - ♦ CANopen bus communication error

    This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H’8130, and the value in the error register will become 1.

  - ♦ Insufficient length of PDO data

    This error indicates that the length of Receive PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H’8210, and the value in the error register will become 1.

- ♦ Eliminating error

  When an error is eliminated, the emergency error code will become H’0000.

- ■ Explanation

  Take the COA02 slave of node ID = 6 as the object and compare the EMERGENCY messages sent out by COA02 in different error conditions.

  - When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

  - When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

  - When the error is eliminated

    Still other errors exiting:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

    All errors are eliminated:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

  - Note:

    COA02 sends out EMERGENCY message only when error occurs.

- PDO service

  COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated..

  - ■ Particularly for PLC, the PDO parameters in COA02 are divided into an upload area and download area, featuring:
    - TxPDO

      TxPDO is only able to map 32 registers, D32 ~ D63 in the upload area.
    - RxPDO

      RxPDO is only able to map 32 registers, D32 ~ D63 in the download area.
  - ■ PDO1 (Default: Open)
    - TxPDO1 (COA02 → master):

      Send the status data of the slave (COA02) to the master. Preset the length of data to be mapped to 8 bytes and the content to be mapped to “the 1st ~ 4th registers in the upload area”. You can map any parameters in the upload area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’180 + Node-ID	D32		D33		D34		D35	

Note: See 13.5.1 “Communication Objects in Object Dictionary” for the corresponding index and sub-index of upload start address, download start address and all mapping parameters.

- RxPDO1 (master → COA02):

  Send the control data of the master to the slave (COA02). Preset the length of data to be mapped to 8 bytes and the content to be mapped to “the 1st ~ 4th registers in the download area”. You can map any parameters in the download area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’200 + Node-ID	D0		D1		D2		D3	

■ PDO2 ~ PDO8 (Default: Close)

- TxPDO (COA02 → master):

  Send the status data of the slave (COA02) to the master. Preset the length of the data to be mapped to 0 byte. You can map any parameters in the download area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’xxxx +Node-ID								

- RxPDO (master → COA02):

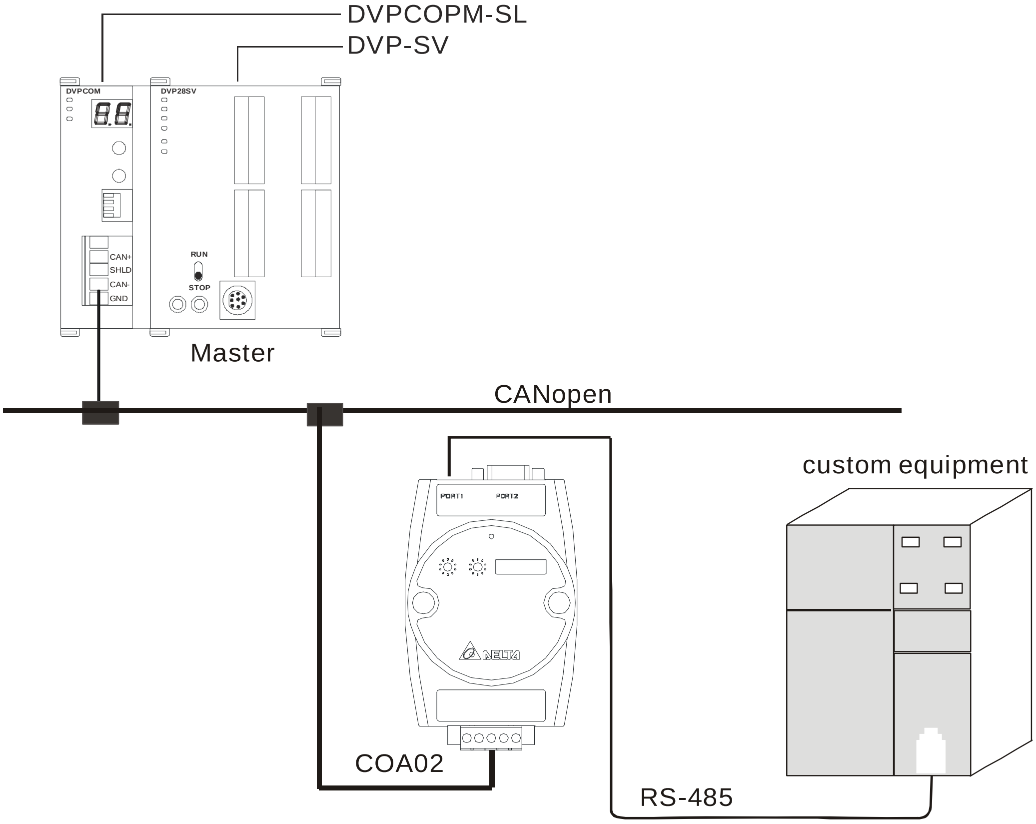
  Send the control data of the master to the slave equipment (COA02). Preset the length of the data to be mapped to 0 byte. You can map any parameters in the download area, maximum 8 bytes.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’yyyy +Node-ID								

■ Data transmission mode

TxPDO in COA02 supports many modes: synchronously non-cyclic, synchronously cyclic, synchronous RTR, asynchronous RTR and asynchronous modes.

13.3.7 When COA02 is connected to custom equipment



1. Setting up baud rate and communication format
   - Before connecting the custom equipment to the bus, first set up the communication address of the equipment to 01, baud rate to 19,200bps and communication format to 8, N, 2; RTU (the format is fixed; other formats will be invalid).
   - To adjust the baud rate, follow the steps listed below.
     - Modify the index parameter 5003/07.

       5003/07 = 1 → 19,200; 8, N, 2; RTU (Default)

       5003/07 = 2 → 38,400; 8, N, 2; RTU

       5003/07 = 3 → 57,600; 8, N, 2; RTU

       5003/07 = 4 → 115,200; 8, N, 2; RTU
     - Re-power COA02 and adjust the baud rate of the custom equipment to the corresponding one.

       Note: When COA02 is connected to custom equipment, COA02 will enter the pre-run status automatically after it is powered in any configuration, which allows you to adjust the baud rate and so on in that mode.
2. Functions & features

   In addition, COA02 also supports the following two functions.
   - Emergency object – EMERGENCY

     When COA02 detects an internal error, it will send an EMCY message to the CANopen bus.
     - Format

       COA02 → master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128(H’080) +Node-ID	Emergency error code		Error register	00	00	00	00	00
	LSB	MSB						

- Error register

  The value in the error register will be mapped to index address H’1001 in the object dictionary. Value = 0 indicates that no error occurs. Value = 1, it indicates that a general error takes place. Value = H’80 indicates that an internal error in the equipment occurs.

- Emergency error code
  - ♦ CANopen bus communication error

    This error indicates the communication error between CANopen master and COA02 slave (e.g. master disconnection). When such error occurs, the emergency error code will be H’8130, and the value in the error register will become 1.
  - ♦ Insufficient length of PDO data

    This error indicates that the length of Receive PDO data actually sent out is shorter than the set data length. When such error occurs, the emergency error code will be H’8210, and the value in the error register will become 1.
  - ♦ Eliminating error

    When an error is eliminated, the emergency error code will become H’0000.

■ Explanation

Take the COA02 slave of node ID = 6 as the object and compare the EMERGENCY messages sent out by COA02 in different error conditions.

- When in CANopen bus communication error

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	30	81	01	00	00	00	00	00

- When in insufficient PDO data length

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	10	82	01	00	00	00	00	00

- When the error is eliminated.

  Still other errors exiting:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	01	00	00	00	00	00

All errors are eliminated:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
86	00	00	00	00	00	00	00	00

- Note:

  COA02 sends out EMERGENCY message only when error occurs.

● PDO service

COA02 supports PDO1 ~ PDO8. For COA02, COB-ID of PDO can be modified but cannot be repeated.

- Particularly for custom equipment, the PDO parameters in COA02 are divided into an upload area and download area, featuring:
    - TxPDO

      TxPDO is only able to map 32 parameters (sub-index addess) in the upload area (index H'5001). For example,

      5001/01 (1st word of TxPDO1)
      5001/02 (2nd word of TxPDO1)

      If you would like to correspond the 1st word of TxPDO1 to a certain Modbus address (parameter address) of the connected equipment, you can write the Modbus address into 5001/01. The same rule also applies to other sub-index addresses.
    - RxPDO

      RxPDO is only able to map 32 parameters (sub-index addess) in the download area (index H'5000). For example,

      5000/01 (1st word of RxPDO1)
      5000/02 (2nd word of RxPDO1)

      If you would like to correspond the 1st word of RxPDO1 to a certain Modbus address (parameter address) of the connected equipment, you can write the Modbus address into 5000/01. The same rule also applies to other sub-index addresses.
    - Note: See 13.5.1 "Communication Objects in Object Dictionary" for the corresponding index and sub-index of upload start address, download start address and all mapping parameters.
- PDO1 (Default: Open)
    - TxPDO1 (COA02 → master):

      Send the status data of the slave (COA02) to the master. Preset the length of data to be mapped to 0 byte. You can map maximum 8 bytes in the 1st word of TxPDO 1 ~ 4th word of TxPDO1 in the upload area. The mapping relation is corresponding and fixed. For example,

      Word 1 (byte 0 & byte 1) → 1st word of TxPDO1
      Word 2 (byte 2 & byte 3) → 2nd word of TxPDO1
      Word 3 (byte 4 & byte 5) → 3rd word of TxPDO1
      Word 4 (byte 6 & byte 7) → 4th word of TxPDO1

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H'180 + Node-ID								

-
    - RxPDO1 (master → COA02):

      Send the contol data of the master to the slave (COA02). Preset the length of the data to be mapped to 0 byte. You can map maximum 8 bytes in the 1st word of RxPDO 1 ~ 4th word of RxPDO1 in the download area. The mapping relation is corresponding and fixed. For example,

      Word 1 (byte 0 & byte 1) → 1st word of RxPDO1;

Word 2 (byte 2 & byte 3) → 2nd word of RxPDO1

Word 3 (byte 4 & byte 5) → 3rd word of RxPDO1

Word 4 (byte 6 & byte 7) → 4th word of RxPDO1

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’200 + Node-ID								

- ■ PDO2 ~ PDO8 (Default: Close)
  - TxPDO (COA02 → master):

    Send the status data of the slave equipment (COA02) to the master. Preset the length of the data to be mapped to 0 byte. You can map maximum 8 bytes. Same as TxPDO1, PDO2 ~ PDO8 map RxPDO2 ~ RxPDO8. The mapping relation is corresponding and fixed.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’xxxx +Node-ID								

  - RxPDO (master → COA02):

    Send the control data of the master to the slave (COA02). Preset the length of the data to be mapped to 0 byte. You can map maximum 8 bytes. Same as RxPDO1, PDO2 ~ PDO8 map RxPDO2 ~ RxPDO8 in the download area. The mapping relation is corresponding and fixed.

Default COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H’yyyy +Node-ID								

- ■ Explanation

  If the custom equipment is a Delta VFD-B AC motor drive, and we would like to control its RUN/STOP, frequency input and monitor its operation status and frequency, follow the explanations below:
  - Map the 1st word of RxPDO1 and 2nd word of RxPDO1 in RxPDO1 and map the 1st word of TxPDO1 and 2nd word of TxPDO1 in TxPDO1.
  - Write the Modbus address corresponding to VFD-B in the index address of COA02 through SDO, e.g. H’2000 → 5000/01, H’2001 → 5000/02; H’2101 → 5001/01, H’2103 → 5001/02.
  - In this way, we will be able to control the control word (H’2000), frequency command (H’2001) and monitor the status word (H’2101) and running frequency (H’2103) in VFD-B through RxPDO1 and TxPDO1.
  - Note: You can only map the Modbus address of 16-bit word device in the dowbload area and upload area.
- ■ Data transmission mode
  - TxPDO in COA02 supports many modes: synchronously non-cyclic, synchronously cyclic, synchronous RTR, asynchronous RTR and asynchronous modes.

13.4 LED Indicators & Trouble-shooting

There are 3 LED indicators on COA02, RUN, ERROR and SCAN, for displaying the connection status of the communication in COA02.

13.4.1 RUN LED

LED Status	COA02 Status	How to deal with it
Off	No power	Check the power of COA02 and make sure the connection is normal.
Green light 1 flash	Stop	
Green light flashes	Pre-operation	
Green light On	Operating	
Red light On	NODE-ID error	Check if the setting of NODE-ID of COA02 is correct.

13.4.2 ERROR LED

LED Status	COA02 Status	How to deal with it
Off	No error	COA02 operation is normal.
Red light 2 flashes	Erroneous control occurs.	1. Check if the connection between COA02 and the master station is intact. 2. Check if the communication between COA02 and the master station is normal.
Red light On	bus OFF	1. Check if the bus connection is normal. 2. Re-power COA02.

13.4.3 SCAN LED

LED Status	COA02 Status	How to deal with it
Off	No power	Check the power of COA02 and make sure the connection is normal.
Green light flashes	The correct information of the equipment connected has not been detected.	Re-connect COA02 to the equipment.
Green light On	The communication with the equipment connected is normal.	
Red light flashes	CRC check fails	1. Check if the communication cable between COA02 and the equipment is correct. 2. Check if there is electromagnetic interference nearby.
Red light On	Connection fails, or no connection	1. Check if the communication format of the equipment is correct. 2. Check if COA02 and the equipment are correctly connected. 3. Restart the connection and make sure the communication cable meets the specification.

13.5 Object Dictionary

1. Communication objects in the object dictionary:

Index	Sub-index	Object name	Data type	Access autorization	Default
H’1000	H’00	Equipment type	Unsigned 32 bits	R	0x00000000
H’1001	H’00	Error register	Unsigned 8 bits	R	0
H’1003		Predefined error field			
	H’00	Number of errors	Unsigned 8 bits	R	0
	H’01	Standard error field	Unsigned 32 bits	R	0

Index	Sub-index	Object name	Data type	Access autorization	Default
H'1005	H'00	COB-ID SYNC message	Unsigned 32 bits	RW	0x00000080
H'1008	H'00	Equipment name of supplier	Visible charater string	R	COA02
H'100C	H'00	Protection time	Unsigned 16 bits	RW	0
H'100D	H'00	Life time factor	Unsigned 8 bits	RW	0
H'1014	H'00	COB-ID emergency message	Unsigned 32 bits	R	0x80 + Node-ID
H'1016		Pulsant time of the user			
	H'00	Number of items	Unsigned 8 bits	R	1
	H'01	Pulsant time of the user	Unsigned 32 bits	RW	0
H'1017	H'00	Pulsant time of generator	Unsigned 16 bits	RW	0
H'1018		Identification object			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	Supplier code	Unsigned 32 bits	R	0x000001DD
	H'02	Product code	Unsigned 32 bits	R	Denpens on the connected equipment
	H'03	Version	Unsigned 32 bits	R	0x00010002
H'1400		RxPDO1 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO1	Unsigned 32 bits	RW	0x00000200+Node-ID
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	0
H'1401		RxPDO2 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO2	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	0
H'1402		RxPDO3 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO3	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	0
H'1403		RxPDO4 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO4	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	0
H'1404		RxPDO5 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO5	Unsigned 32 bits	RW	0x80000000

Index	Sub-index	Object name	Data type	Access autorization	Default
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	0
H’1405		RxPDO6 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	3
	H’01	COB-ID of RxPDO6	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	0
H’1406		RxPDO7 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	3
	H’01	COB-ID of RxPDO7	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	0
H’1407		RxPDO8 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	3
	H’01	COB-ID of RxPDO8	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	0
H’1600		RxPDO1 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	Denpens on the connected equipment
	H’01	The first mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’01	The sencond mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’02	The third mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’03	The forth mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
H’1601		RxPDO2 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’01	The sencond mapped object	Unsigned 32 bits	RW	0
	H’02	The third mapped object	Unsigned 32 bits	RW	0
	H’03	The fourth mapped object	Unsigned 32 bits	RW	0
H’1602		RxPDO3 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’01	The sencond mapped object	Unsigned 32 bits	RW	0
	H’02	The third mapped object	Unsigned 32 bits	RW	0
	H’03	The fourth mapped object	Unsigned 32 bits	RW	0
H’1603		RxPDO4 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0

Index	Sub-index	Object name	Data type	Access autorization	Default
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The sencond mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1604		RxPDO5 mapping parameter			
	H'00	Number of items	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The sencond mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1605		RxPDO6 mapping parameter			
	H'00	Number of items	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The sencond mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1606		RxPDO7 mapping parameter			
	H'00	Number of items	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The sencond mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1607		RxPDO8 mapping parameter			
	H'00	Number of items	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The sencond mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1800		TxPDO1 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO1	Unsigned 32 bits	RW	0x00000180+Node-ID
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1801		TxPDO2 communication parameter			
	H'00	Number of items	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO2	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Forbidden time	Unsigned 16 bits	RW	50

Index	Sub-index	Object name	Data type	Access autorization	Default
	H’05	Timer	Unsigned 16 bits	RW	100
H’1802		TxPDO3 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	COB-ID of TxPDO3	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1803		TxPDO4 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	COB-ID of TxPDO4	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1804		TxPDO5 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	COB-ID of TxPDO5	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1805		TxPDO6 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	COB-ID of TxPDO6	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1806		TxPDO7 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	TxPDO7 的 COB-ID	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1807		TxPDO8 communication parameter			
	H’00	Number of items	Unsigned 8 bits	R	5
	H’01	COB-ID of TxPDO8	Unsigned 32 bits	RW	0x80000000
	H’02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H’03	Forbidden time	Unsigned 16 bits	RW	50
	H’05	Timer	Unsigned 16 bits	RW	100
H’1A00		TxPDO1mapping parameter			

Index	Sub-index	Object name	Data type	Access autorization	Default
	H’00	Number of items	Unsigned 8 bits	RW	Denpens on the connected equipment
	H’01	The first mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’02	The sencond mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’03	The third mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
	H’04	The fourth mapped object	Unsigned 32 bits	RW	Denpens on the connected equipment
H’1A01		TxPDO2 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A02		TxPDO3mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A03		TxPDO4			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A04		TxPDO5 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A05		TxPDO6 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A06		TxPDO7 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0

Index	Sub-index	Object name	Data type	Access autorization	Default
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0
H’1A07		TxPDO8 mapping parameter			
	H’00	Number of items	Unsigned 8 bits	RW	0
	H’01	The first mapped object	Unsigned 32 bits	RW	0
	H’02	The sencond mapped object	Unsigned 32 bits	RW	0
	H’03	The third mapped object	Unsigned 32 bits	RW	0
	H’04	The fourth mapped object	Unsigned 32 bits	RW	0

2. Parameter objects of Delta VFD series AC motor drive in the object dictionay

- Main index: H’2000-----user parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	00-00	Identity code of the AC motor drive
2	00-01	Displaying of drive’s rated current
3	00-02	Parameter reset
┆	┆	┆
9	00-08	Setting up parameter protection password
A	00-09	Control method
B	00-10	Reserved

- Main index: H’2001-----basic parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	01-00	Setting up max. operation paramerer frequncy
2	01-01	Setting up motor’s rated frequncy
3	01-02	Setting up motor’s rated voltage
┆	┆	┆
16	01-21	Setting up the 4th deceleration time
17	01-22	Setting upf JOG deceleration time
18	01-23	Setting up the unit of acceleration/deceleration time

- Main index: H’2002-----operation method parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	02-00	Setting up the source of the 1st frequency instruction
2	02-01	Setting up the source of the 1st operation instruction
3	02-02	Selecting the stop method of motor
┆	┆	┆
E	02-13	Setting up the source of the 2nd frequency instruction
F	02-14	Setting up the source of the 2nd operation instruction
10	02-15	Keyboard frequency instruction

- Main index: H’2003-----output function parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	03-00	Multi-function output relay
2	03-01	Multi-function output MO1
3	03-02	Multi-function ouput MO2
┆	┆	┆
D	03-12	Fan control
E	03-13	Break release frequency
F	03-14	Break engage frequncy

- Main index: H’2004-----input function parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	04-00	AUI analog input bias
2	04-01	AUI bias polarity
3	04-02	AUI input gain
┆	┆	┆
18	04-23	Deceleration ratio of deceleration gear
19	04-24	Index angle for simple index function
1A	04-25	Deceleration time for simple index function

- Main index: H’2005-----multi-step speed and PLC parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	05-00	Setting up the 1st step speed frequency
2	05-01	Setting up the 2nd step speed frequency
3	05-02	Setting up the 3rd step speed frequency
┆	┆	┆
21	05-32	Setting up the unit of operation time
22	05-33	The amplitude of wobble vibration
23	05-34	Wobble skip frequency

- Main index: H’2006-----protection parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	06-00	Over-voltage stall prevention
2	06-01	Over-current stall prevention during accel
3	06-02	Over-current stall prevention during operation
┆	┆	┆
11	06-16	User-defined low-voltage detection level
12	06-17	User-defined low-voltage detection time
13	06-18	Reserved

- Main index: H’2007-----motor parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	07-00	Motor rated current

Sub-index (hex)	Parameter No.	Parameter funcion
2	07-01	Motor no-load current
3	07-02	Torque compensation
┆	┆	┆
E	07-13	Slip compensation time constant
F	07-14	Accumulative motor operation time (min)
10	07-15	Accumulative motor operation time (day)

- Main index: H’2008-----special parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	08-00	DC braking current level
2	08-01	DC braking time during start-up
3	08-02	DC braking time during stopping
┆	┆	┆
15	08-20	Speed search frequncy during start-up
16	08-21	Auto reset time at restart after fault
17	08-22	Compensation coefficient for motor instability

- Main index: H’2009----- communication parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	09-00	Communication address
2	09-01	Transmission speed
3	09-02	Transmission fault treatment
4	09-03	Time-out detection
5	09-04	Communication protocol
6	09-05	Reserved
7	09-06	Reserved
8	09-07	Response delay time

- Main index: H’200A-----PID control parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	10-00	Selecting PID feedback input terminal
2	10-01	Gain over the PID detection value
3	10-02	Proportional gain (P)
┆	┆	┆
F	10-14	PG slip compensation limit
10	10-15	PG output sampling time
11	10-16	PID offset level

- Main index: H’200B-----multiple motors control parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	11-00	Selecting V/f curve

Sub-index (hex)	Parameter No.	Parameter funcion
2	11-01	Start-up frequency of the auxiliary motor
3	11-02	Stop frequency of the auxiliary motor
4	11-03	Delay time before starting the auxiliary motor
5	11-04	Delay time before stopping the auxiliary motor
6	11-05	Sleep/wake up detection time
7	11-06	Sleep frequency
8	11-07	Wake-up frequency

- Main index: H’2020-----communication control parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	H’2000	Control instruction
2	H’2001	Frequcny instruction
3	H’2002	E．F．On / Reset instruction

- Main index: H’2021-----communication status parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	H’2100	Error code
2	H’2101	Status word
3	H’2102	Frequency instruction
┆	┆	┆
F	H’210E	Number of PG pulses within unit time (high)
10	H’210F	Output frequency（KW）
11	H’2110	Reserved

- Main index: H’2022-----communication status parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	H’2200	Feadback signal (XXX.XX%)
2	H’2201	Defined by user (low word)
3	H’2202	Defined by user (high word)
4	H’2203	AVI analog input (XXX.XX%)
5	H’2204	ACI analog input (XXX.XX%)
6	H’2205	AUI analog input (XXX.XX%)

3. Parameter objects of Delta temperature controller (DTA) in the object dictionay

- Main index: H’2047-----communication parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	H’4700	Process value
2	H’4701	Set value
3	H’4702	Upper limit alarm 1
┆	┆	┆
1C	H’471B	Software version

Sub-index (hex)	Parameter address	Parameter funcion
2A	H’4729	AT setting
2C	H’472B	Error code
34	H’4733	CT monitor value

4. Parameter objects of Delta temperature controller (DTB) in the object dictionay

- Main index: H’2010-----communication parameter

Sub-index (hex)	Parameter address	Parameter funcion
1	H’1000	Process value
2	H’1001	Set value
3	H’1002	Upper-limit of temperature range
┆	┆	┆
66	H’1065	Link pattern number setting of the correspond pattern
67	H’1066	Link pattern number setting of the correspond pattern
68	H’1067	Link pattern number setting of the correspond pattern

- Main index: H’2020-----communication parameters

Sub-index (hex)	Parameter address	Parameter funcion
1	H’2000	Setting up pattern 0 ~ 7 temperature set point
2	H’2001	Setting up pattern 0 ~ 7 temperature set point
3	H’2002	Setting up pattern 0 ~ 7 temperature set point
┆	┆	┆
BE	H’20BD	Setting up pattern 0 ~ 7 excution time
BF	H’20BE	Setting up pattern 0 ~ 7 excution time
C0	H’20BF	Setting up pattern 0 ~ 7 excution time

- Main index: H’2047-----communication parameters

Sub-index (hex)	Parameter address	Parameter funcion
24	H’4723	Setting up control RUN/STOP
25	H’4724	Temperature unit
26	H’4725	Selecting decimal point position
27	H’4726	Selecting communication write-in
28	H’4727	PID AT setting
5B	H’475A	Setting up valve feedback status
2C	H’472B	Auto-tunning valve feedback status

5. Parameter objects of Delta servo drive (ASD-A) in object dictionay

- Main index: H’2000-----moniter parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	0-00H	Firmware version
2	0-01H	Drive error code

Sub-index (hex)	Parameter No.	Parameter funcion
3	0-02H	Drive status
┆	┆	┆
F	0-14H	Block data read/write register 5
10	0-15H	Block data read/write register 6
11	0-16H	Block data read/write register 7

- Main index: H’2001-----basic parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	1-00H	Setting up external pulse input type
2	1-01H	Setting up control mode and input source of control instruction
3	1-02H	Setting up speed and torque limit
┆	┆	┆
37	1-54H	Position completed width bits
38	1-55H	Maximum speed limit
39	1-56H	Output overload warning

- Main index: H’2002-----extension parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	2-00H	Proportional position loop gain
2	2-01H	Position loop gain switching rate
3	2-02H	Position feed forward gain
┆	┆	┆
3F	2-63H	Electronic gear ratio
40	2-64H	Setting up proportion value setting
41	2-65H	Torque limit mixed mode

- Main index: H’2003-----communication parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	3-00H	Setting up communication address
2	3-01H	Communication speed
3	3-02H	Communication protocol
4	3-03H	Transmission error treatment
5	3-04H	Communication time-out detection
6	3-05H	Selecting communication port
7	3-06H	Communication control on digital input contact
8	3-07H	Communication feedback delay time

- Main index: H’2004-----diagnosis parameters

Sub-index (hex)	Parameter No.	Parameter funcion
1	4-00H	Recording error
2	4-01H	Recording error

Sub-index (hex)	Parameter No.	Parameter funcion
3	4-02H	Recording error
┆	┆	┆
16	4-21H	Analog monitor output drift adjustment (ch2)
17	4-22H	Analog speed input drift value
18	4-23H	Analog torque input drift value

6. Parameter objects of Delta DVP series PLC in the object dictionay

- Main index: 3000H-----download area paramerters (D divice)

  down → download start address

Sub-index (hex)	Parameter address	Parameter funcion	Parameter type
1	H’1000+down	D (down+0)	word
2	H’1001+down	D (down+1)	word
3	H’1002+down	D (down+2)	word
┆	┆	┆	word
16	H’101D+down	D (down+29)	word
17	H’101E+down	D (down+30)	word
18	H’101F+down	D (down+31)	word

- Main index: H’3001-----upload area parameters (D device)

  up → upload start address

Sub-index (hex)	Parameter address	Parameter funcion	Parameter type
1	H’1000+ up	D (up+0)	word
2	H’1001+ up	D (up +1)	word
3	H’1002+ up	D (up +2)	word
┆	┆	┆	word
16	H’101D+ up	D (up +29)	word
17	H’101E+ up	D (up +30)	word
18	H’101F+ up	D (up +31)	word

- Main index: 3002H-----start adddress

Sub-index (hex)	Parameter funcion	Default value	Parameter type
1	Download start address	0	word
2	Upload start address	256 (0100H)	word

- Main index: H’3100 ~ H’3199-----step S

Index (hex)	Parameter address	Parameter funcion	Parameter type
3100/01	H’0000	S0	bit
3100/02	H’0001	S1	bit
┆	┆	┆	bit
3100/FE	H’00FD	S253	bit
3101/01	H’0100	S256	bit

Index (hex)	Parameter address	Parameter funcion	Parameter type
3101/02	H’0101	S257	bit
┆	┆	┆	bit
3101/FE	H’01FD	S509	bit
3102/01	H’0200	S512	bit
3102/02	H’0201	S513	bit
┆	┆	┆	bit

- Main index: H’3200 ~ H’3299-----input point X

Index (hex)	Parameter address	Parameter funcion	Parameter type
3200/01	H’0400	X0	bit
3200/02	H’0401	X1	bit
┆	┆	┆	bit
3200/FE	04FDH	X375	bit

- Main index: H’3300 ~ H’3399-----input point Y

Index (hex)	Parameter address	Parameter funcion	Parameter type
3300/01	H’0500	Y0	bit
3300/02	H’0501	Y1	bit
┆	┆	┆	bit
3300/FE	H’05FD	Y375	bit

- Main index: H’3400 ~ H’3499-----timer T (bit device)

Index (hex)	Parameter address	Parameter funcion	Parameter type
3400/01	H’0600	T0	bit
3400/02	H’060	T1	bit
┆	┆	┆	bit
3400/FE	H’06FD	T253	bit

- Main index: H’3500 ~ H’3599-----timer T (word device)

Index (hex)	Parameter address	Parameter funcion	Parameter type
3500/01	H’0600	T0	word
3500/02	H’0601	T1	word
┆	┆	┆	word
3500/FE	H’06FD	T253	word

- Main index: H’3600 ~ H’3699-----auxiliary relay M

Index (hex)	Parameter address	Parameter funcion	Parameter type
3600/01	H’0800	M0	bit
3600/02	H’0801	M1	bit
┆	┆	┆	bit
3600/FE	H’08FD	M253	bit

Index (hex)	Parameter address	Parameter funcion	Parameter type
3601/01	H’0900	M256	bit
3601/02	H’0901	M257	bit
┆	┆	┆	bit
3601/FE	H’09FD	M509	bit
3602/01	H’0A00	M512	bit
3602/02	H’0A01	M513	bit
┆	┆	┆	bit

- Main index: H’3700 ~ H’3799-----counter C (bit device)

Index (hex)	Parameter address	Parameter funcion	Parameter type
3700/01	H’0E00	C0	bit
3700/02	H’0E01	C1	bit
┆	┆	┆	bit
3700/FE	H’0EFD	C253	bit

- Main index: H’3800 ~ H’3899-----counter C (word device)

Index (hex)	Parameter address	Parameter funcion	Parameter type
3800/01	H’0E00	C0	word
3800/02	H’0E01	C1	word
┆	┆	┆	word
3800/C8	H’0EC7	C199	word
3800/C9	H’0EC8	C200	Dword
3800/CA	H’0EC9	C201	Dword
┆	┆	┆	word
3800/FE	H’0EFD	C253	Dword

- Main index: H’3900 ~ H’3999-----register D

Index (hex)	Parameter address	Parameter funcion	Parameter type
3900/01	H’1000	D0	word
3900/02	H’1001	D1	word
┆	┆	┆	word
3900/FE	H’10FD	D253	word
3901/01	H’1100	D256	word
3901/02	H’1101	D257	word
┆	┆	┆	word
3901/FE	H’11FD	D509	word
3902/01	H’1200	D512	word
3902/02	H’1201	D513	word
┆	┆	┆	word

7. Parameter objects of Delta DOP-A series HMI in yjr object dictionay

   Virtual D parameters of COA02 arel listed as bellow:

- Main index: H’4000-----download area parameters

Sub-index (hex)	Parameter address	Parameter funcion	Parameter type
1	H’1000	D0	word
2	H’1001	D1	word
3	H’1002	D2	word
┆	┆	┆	word
18	H’101D	D29	word
19	H’101E	D30	word
20	H’101F	D31	word

- Main index: H’4001-----upload area parameters

Sub-index (hex)	Parameter No.	Parameter funcion	Parameter type
1	H’1020	D32	word
2	H’1021	D33	word
3	H’1022	D34	word
┆	┆	┆	word
18	H’103D	D61	word
19	H’103E	D62	word
20	H’103F	D63	word

8. Parameter objects of custom equipment in the object dictionay

- Main index: H’5000-----download area parameters

Sub-index (hex)	Parameter funcion
1	1st word of RxPDO 1
2	2nd word of RxPDO 1
3	3rd word of RxPDO 1
4	4th word of RxPDO 1
5	1st word of RxPDO 2
6	2nd word of RxPDO 2
7	3rd word of RxPDO 2
8	4th word of RxPDO 2
9	1st word of RxPDO 3
A	2nd word of RxPDO 3
B	3rd word of RxPDO 3
C	4th word of RxPDO 3
D	1st word of RxPDO 4
E	2nd word of RxPDO 4
F	3rd word of RxPDO 4
10	4th word of RxPDO 4
11	1st word of RxPDO 5
12	2nd word of RxPDO 5
13	3rd word of RxPDO 5

Sub-index (hex)	Parameter funcion
14	4th word of RxPDO 5
15	1st word of RxPDO 6
16	2nd word of RxPDO 6
17	3rd word of RxPDO 6
18	4th word of RxPDO 6
19	1st word of RxPDO 7
1A	2nd word of RxPDO 7
1B	3rd word of RxPDO 7
1C	4th word of RxPDO 7
1D	1st word of RxPDO 8
1E	2nd word of RxPDO 8
1F	3rd word of RxPDO 8
20	4th word of RxPDO 8

- Main index: H’5001-----upload area parameters

Sub-index (hex)	Parameter funcion
1	1st word of TxPDO 1
2	2nd word of TxPDO 1
3	3rd word of TxPDO 1
4	4th word of TxPDO 1
5	1st word of TxPDO 2
6	2nd word of TxPDO 2
7	3rd word of TxPDO 2
8	4th word of TxPDO 2
9	1st word of TxPDO 3
A	2nd word of TxPDO 3
B	3rd word of TxPDO 3
C	4th word of TxPDO 3
D	1st word of TxPDO 4
E	2nd word of TxPDO 4
F	3rd word of TxPDO 4
10	4th word of TxPDO 4
11	1st word of TxPDO 5
12	2nd word of TxPDO 5
13	3rd word of TxPDO 5
14	4th word of TxPDO 5
15	1st word of TxPDO 6
16	2nd word of TxPDO 6
17	3rd word of TxPDO 6
18	4th word of TxPDO 6

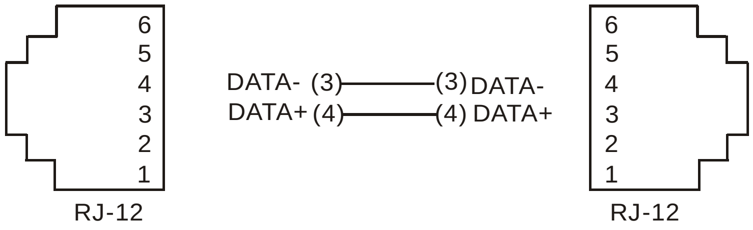
Sub-index (hex)	Parameter funcion
19	1st word of TxPDO 7
1A	2nd word of TxPDO 7
1B	3rd word of TxPDO 7
1C	4th word of TxPDO 7
1D	1st word of TxPDO 8
1E	2nd word of TxPDO 8
1F	3rd word of TxPDO 8
20	4th word of TxPDO 8

13.6 Connection of COA02 with Other Equipment

1. Communication wirings when connected to equipment through PORT1.

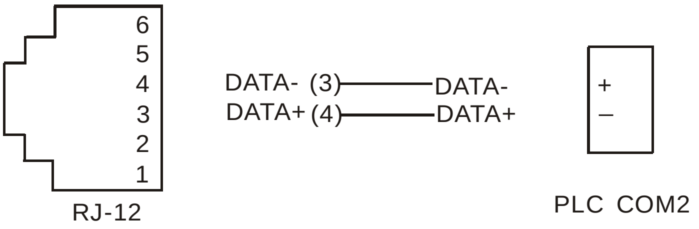
- When COA02 is connected to Delta VFD series AC motor drive:

  By RS-485 communication; using standard cable with RJ-12 connectors is suggested.

<table>
<tr><th>COA02
RJ-12 (RS-485)</th><th>VFD series AC motor drive
RJ-12 (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

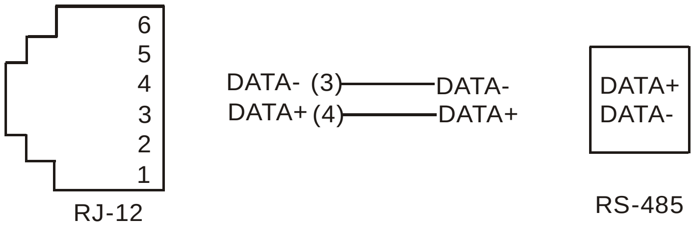
- When COA02 is connected to Delta DVP series PLC:

  By RS-485 communication

<table>
<tr><th>COA02
RJ-12 (RS-485)</th><th>DVP-PLC
RS-485 wiring terminal</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

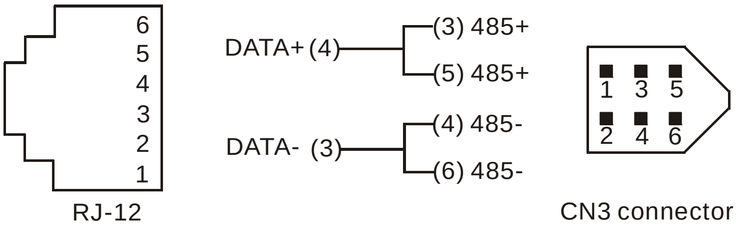
- When COA02 is connected to Delta DTA/DTB series temperature controller:

  By RS-485 communication

<table>
<tr><th>COA02
RJ-12 (RS-485)</th><th>DTA/DTB
RS-485 wiring terminal</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

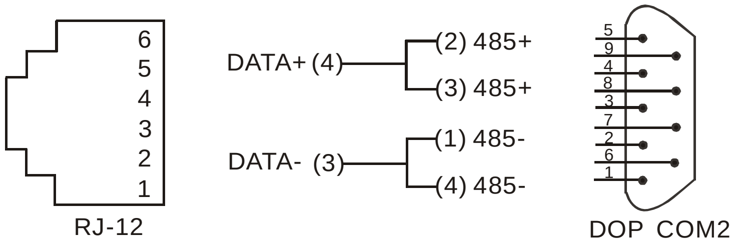
- When COA02 is connected to Delta ASD-A series servo drive:

  By RS-485 communication

COA02 RJ-12 (RS-485)	ASD-A CN3 conncetor (RS-485)
	

- When COA02 is connected to Delta DOP series human machine interface:

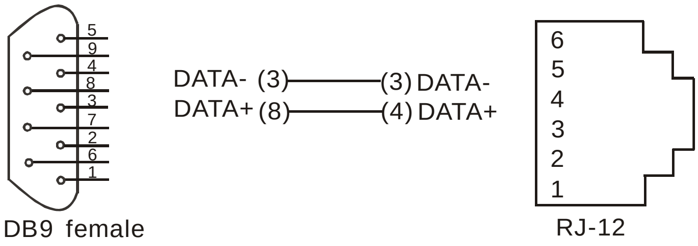
  By RS-485 communication

COA02 RJ-12 (RS-485)	DOP DB9 male (RS-485)
	

2. Communication wirings when connected to equipment through PORT2.

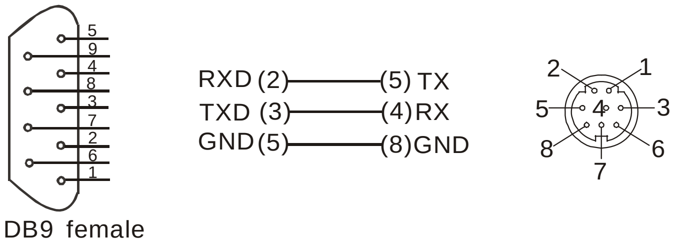
- When COA02 is connected to Delta VFD series AC motor drive:

  By RS-485 communication

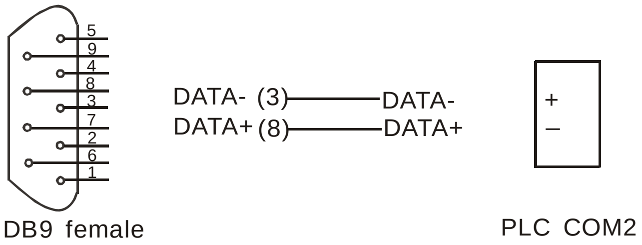
COA02 DB9 female (RS-485)	VFD series AC motor drive RJ-12 (RS-485)
	

- When COA02 is connected to Delta DVP series PLC:

  By RS-232 communication; using standard DVPACAB215/DVPACAB230 is suggested.

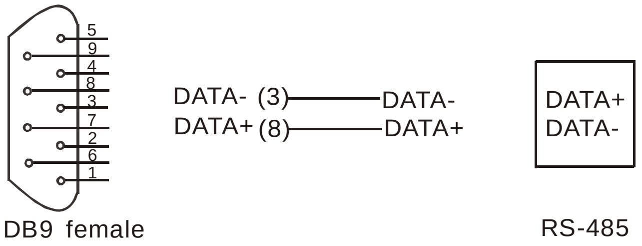
COA02 DB9 female (RS-232)	DVP-PLC 8 pin Mini DIN male (RS-232)
	

By RS-485 communication

<table>
<tr><th>COA02
DB9 female (RS-485)</th><th>DVP-PLC RS-485
wiring terminal (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

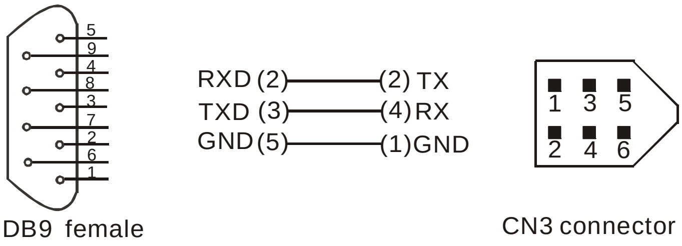
- When COA02 is connected to Delta DTA/DTB series temperature controller:

  By RS-485 communication

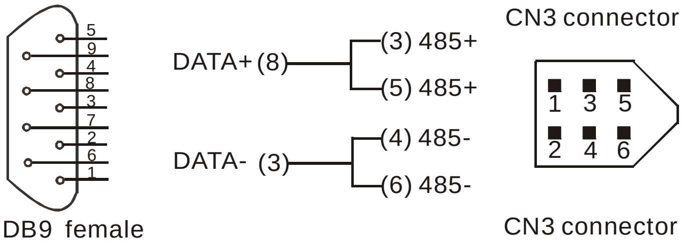
<table>
<tr><th>COA02
DB9 female (RS-485)</th><th>DTA/DTB
RS-485 wiring terminal (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

- When COA02 is connected to Delta ASD-A servo drive:

  By RS-232 communication

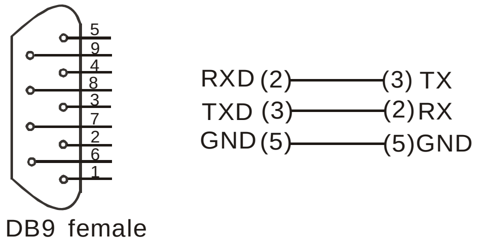
<table>
<tr><th>COA02
DB9 female (RS-232)</th><th>ASDA
CN3 connector (RS-232)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

RS-485 communication

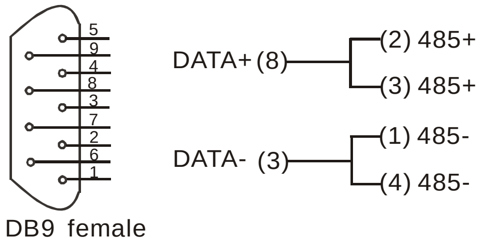
<table>
<tr><th>COA02
DB9 female (RS-485)</th><th>ASDA
CN3 connector (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

- When COA02 is connected to Delta DOP series human machine interface:

  By RS-232 communication

<table>
<tr><th>COA02
DB9 female (RS-232)</th><th>DOP
DB9 male (RS-232)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

By RS-485 communication

<table>
<tr><th>COA02
DB9 female (RS-485)</th><th>DOP
DB9 male (RS-485)</th></tr>
<tr><td colspan="2">
</td></tr>
</table>