DELTA ELECTRONICS, INC.

# RTU-DNET

*DeviceNet Remote I/O Communication Module*

Application Manual

http://www.delta.com.tw/industrialautomation

# ⚠ Warning

✓*Please read this instruction carefully before use and follow this instruction to operate the device in order to prevent damages on the device or injuries to staff.*

✓*Switch off the power before wiring.*

✓ *RTU-DNET is an OPEN TYPE device and therefore should be installed in an enclosure free of airborne dust, humidity, electric shock and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g. key or specific tools are required for operating the enclosure) in case danger and damage on the device may occur.*

✓ *RTU-DNET is to be used for controlling the operating machine and equipment. In order not to damage it, only qualified professional staff familiar with the structure and operation of RTU-DNET can install, operate, wire and maintain it.*

✓*DO NOT connect input AC power supply to any of the I/O terminals; otherwise serious damage may occur. Check all the wirings again before switching on the power and DO NOT touch any terminal when the power is switched on. Make sure the ground terminal ⏚ is correctly grounded in order to prevent electromagnetic interference.*

# 🕮 Table of Contents

# 1 Introduction

1. To ensure correct installation and operation of RTU-DNET, please read this chapter carefully before using your RTU-DNET.
2. This chapter only provides introductory information on RTU-DNET. For more detailed information on DeviceNet protocol, please refer to relevant references or literatures.
3. RTU-DNET is a remote I/O communication module applicable to the connection between DeviceNet and DVP Slim DIDO module and special modules. RTU-DNET offers functions such as status diagnosis, error treatment and so on.

## 1.1 Features

- Supports Group 2 only servers.
- Supports explicit connection via predefined Master/Slave connection set.
- Supports polling
- Supports EDS file configuration in DeviceNet network configuration tools.
- Max. 256 digital I/O points extendable.
- Max. 8 special modules extendable.

## 1.2 Functions

| Item | Explanation |
|---|---|
| Graphic configuration interface | RTU-DNET supports graphic configuration interface in DeviceNet network configuration tools. |
| Data retention | The user can choose either to retain or give up the data in the register when RTU-DNET is offline. |
| Auto extension module identification | The user can automatically identify the special module or the enumber of points on the DVP Slim DI/DO extension unit connected to RTU-DNET through DeviceNet network configuration tool. |
| Diagnosis | RTU-DNET is able to diagnose the status of the special module connected to it. When an error occurs, The ALARM LED on RTU-DNET will flash in red. |
| Status inquiry | RTU-DNET is able to inquire the connection status between itself and the extension module in DeviceNet network configuration tool. |
| Error inquiry | The user can read the error through DeviceNet network configuration tool. |
| Error treatment | The user can choose a method to correct the error through DeviceNet network configuration tool. |
| Flexible configuration | The user can configure the control register (CR) in the special module in any way as the I/O mapping data for DeviceNet. |

## 1.3 Specifications

■ DeviceNet connection

| | |
|---|---|
| Transmission method | CAN |
| Electrical isolation | 500 VDC |
| Interface | Removable connector (5.08mm) |
| Transmission cable | 2-wire twister shielded cable with 2-wire bus power and drain |

■ Communication

| | |
|---|---|
| Message type | I/O polling, explicit |

| | |
|---|---|
| Baud rates | 125 kbps; 250 kbps; 500 kbps |

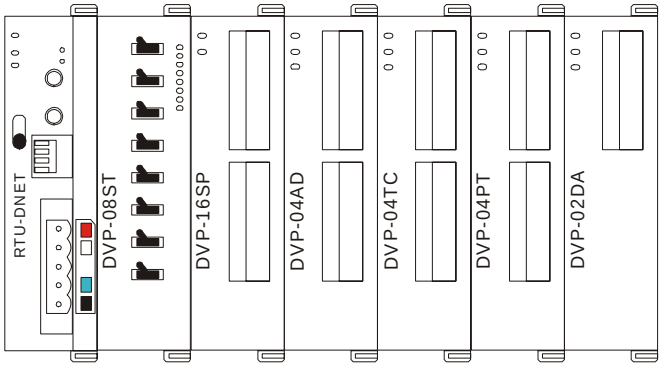
■ Electrical specification

| | |
|---|---|
| Voltage | 11 ~ 25 VDC, supplied by internal bus from PLC MPU |
| Current | 28mA (typical), 125mA impulse current (24 VDC) |

■ Environment

| | |
|---|---|
| Noise immunity | ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge<br>EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV<br>Analog & Communication I/O: 1KV<br>Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV<br>RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m |
| Operation | 0ºC ~ 55ºC (temperature); 50 ~ 95% (humidity); pollution degree 2 |
| Storage | -25ºC ~ 70ºC (temperature); 5 ~ 95% (humidity) |
| Vibration/shock resistance | Standard: IEC 61131-2, IEC 68-2-6 (TEST Fc)/IEC 61131-2 & IEC 68-2-27 (TEST Ea) |
| Certificates | IEC 61131-2, UL508 |

## 1.4 Extension Modules Connectable to RTU-DNET




■ DVP Slim DI/DO extension units connectable to RTU-DNET

| Slim DI/DO (model name) | I/O mapping data (DeviceNet → RTU-DNET) | I/O mapping data (RTU-DNET → DeviceNet) |
|---|---|---|
| DVP-08SM11N | N/A | 8 bits |
| DVP-08SN11R/T | 8 bits | N/A |
| DVP-08SP11R/T | 8 bits | 8 bits |
| DVP-16SP11R/T | 8 bits | 8 bits |
| DVP-08ST | N/A | 8 bits |

■ Special modules connectable to RTU-DNET

| Special module (model name) | Default I/O mapping data (DeviceNet → RTU-DNET) | | I/O mapping data (RTU-DNET → DeviceNet) | |
|---|---|---|---|---|
| | Start CR | Length (words) | Start CR | Length (words) |
| DVP-02DA | CR#10 | 2 | N/A | N/A |
| DVP-04DA | CR#6 | 4 | N/A | N/A |
| DVP-04AD | N/A | N/A | CR#12 | 4 |
| DVP-06AD | N/A | N/A | CR#12 | 6 |

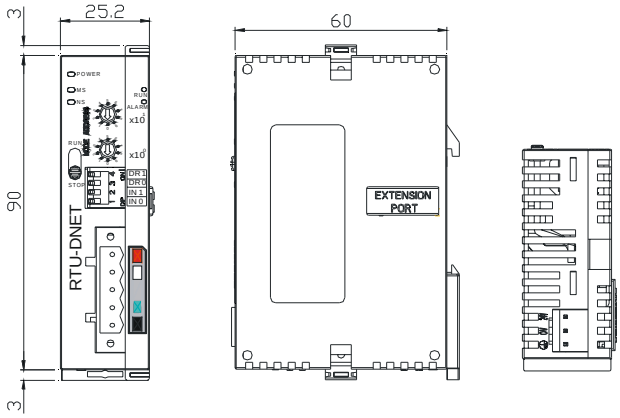
| Special module (model name) | Default I/O mapping data (DeviceNet → RTU-DNET) | | I/O mapping data (RTU-DNET → DeviceNet) | |
|---|---|---|---|---|
| | Start CR | Length (words) | Start CR | Length (words) |
| DVP-04TC | N/A | N/A | CR#14 | 4 |
| DVP-04PT | N/A | N/A | CR#18 | 4 |
| DVP-06XA | CR#10 | 2 | CR#12 | 4 |
| DVP-01PU | CR#42 | 4 | CR#33 | 4 |

Note:

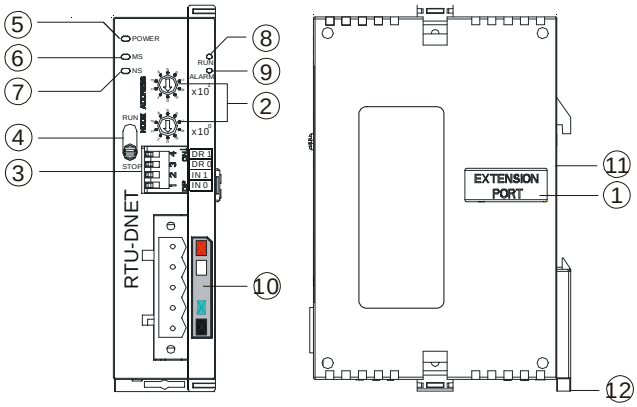
While connected to a special module, the start CR and length of upload/download data of RTU-DNET can be set up in DeviceNet network configuration tool.

## 2 Product Profile & Outline

### 2.1 Dimension




### 2.2 Product Profiles

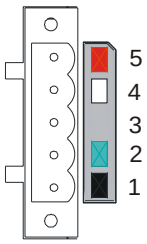



| | |
|---|---|
| 1. Extension port | 7. NS (Network Status) indicator |
| 2. Address switch | 8. RUN indicator |
| 3. Function switch | 9. ALARM indicator |
| 4. RUN/STOP switch | 10. DeviceNet connection port |
| 5. POWER indicator | 11. DIN rail |
| 6. MS (Module Status) indicator | 12. DIN rail clip |

## 2.3 DeviceNet Connection Port

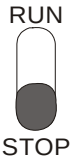
The connector is used on the connection to DeviceNet. Wire by using the connector enclosed with RTU-DNET.

| PIN | Signal | Color | Content |
|---|---|---|---|
| 1 | V- | Black | 0 VDC |
| 2 | CAN_L | Blue | Signal- |
| 3 | SHIELD | - | Shielded |
| 4 | CAN_H | White | Signal+ |
| 5 | V+ | Red | 24 VDC |




## 2.4 RUN/STOP Switch

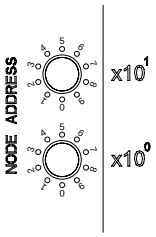
| RUN/STOP action | Explanation |
|---|---|
| STOP → RUN | 1. Re-detecting the extension module.<br>2. Reading/writing the data in the extension module. |
| RUN → STOP | Stop reading/writing the data in the extension module. |




## 2.5 Address Switch

The switch is used on setting up the node address of RTU-DNET on DeviceNet. Range: 00 ~ 63 (64 ~ 99 are forbidden).

| Switch setting | Content |
|---|---|
| 0 ~ 63 | Valid DeviceNet node address |
| 64 ~ 99 | Invalid DeviceNet node address |




Example: If you need to set the node address of RTU-DNET to 26, simply switch the corresponding switch of $x10^1$ to 2 and the corresponding switch of $x10^0$ to 6.

**Note:**

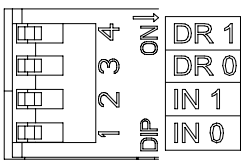
- Please set up the node address when the power is switched off. After the setup is completed, re-power RTU-DNET.
- When RTU-DNET is operating, changing the setting of node address will be invalid.
- Use slotted screwdriver to rotate the switch carefully in case you scratch the switch.

## 2.6 Function Switch

The function switches are for:

- Setting up data retention function (IN0)
- Setting up the baud rate of DeviceNet (DR0 ~ DR1)

| DR1 | DR0 | Baud rate |
|---|---|---|
| OFF | OFF | 125 kbps |
| OFF | ON | 250 kbps |
| ON | OFF | 500 kbps |
| ON | ON | Incorrect setting |



| | | |
|---|---|---|
| IN0 | OFF | When DeviceNet is off, the I/O data in the buffer area will be cleared. |
| | ON | When DeviceNet is off, the I/O data in the buffer area will be held. |
| IN1 | Reserved | |

**Note:**

- Please set up the function switch when the power is switched off. After the setup is completed, re-power RTU-DNET.
- When RTU-DNET is operating, changing the setting of the function switch will be invalid.
- Use slotted screwdriver to adjust the DIP switch carefully in case you scratch the switch.

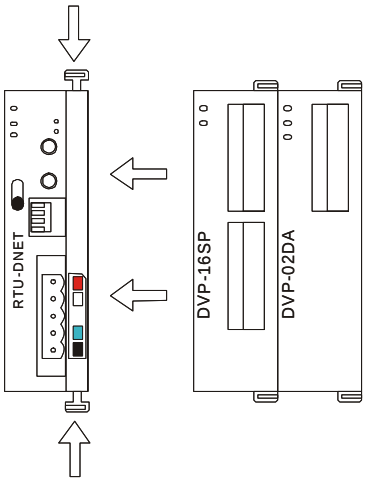
### 2.7 Extension Port

The extension port is used on connecting RTU-DNET to DVP Slim DI/DO extension units and special modules.

## 3 Basic Operation

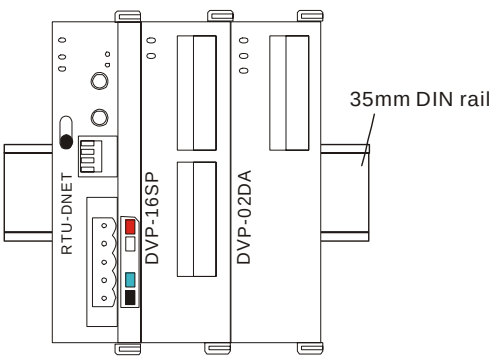
### 3.1 Connecting RTU-DNET to DVP Slim DI/DO Extension Unit

- Open the fixing clips on top and bottom of RTU-DNET. Meet the extension port of Slim DI/DO with RTU-DNET.
- Press the fixing clips on top and bottm of Slim DI/DO and check if the connection is fine.



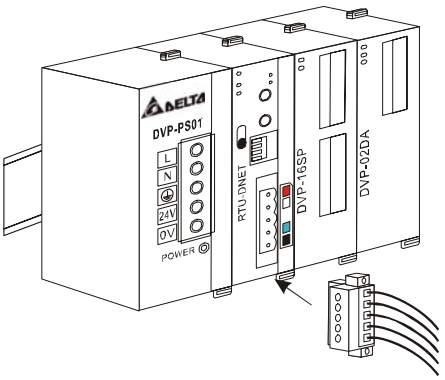

### 3.2 Installing RTU-DNET and DVP Slim DI/DO on DIN Rail

- Use 35mm DIN rail.
- Open the DIN rail clip on RTU-DNET and Slim DI/DO. Insert RTU-DNET and Slim DI/DO onto the DIN rail.
- Clip up the DIN rail clips on RTU-DNET and Slim DI/DO to fix them on the DIN rail, as shown below.



### 3.3 Connecting to DeviceNet Connection Port

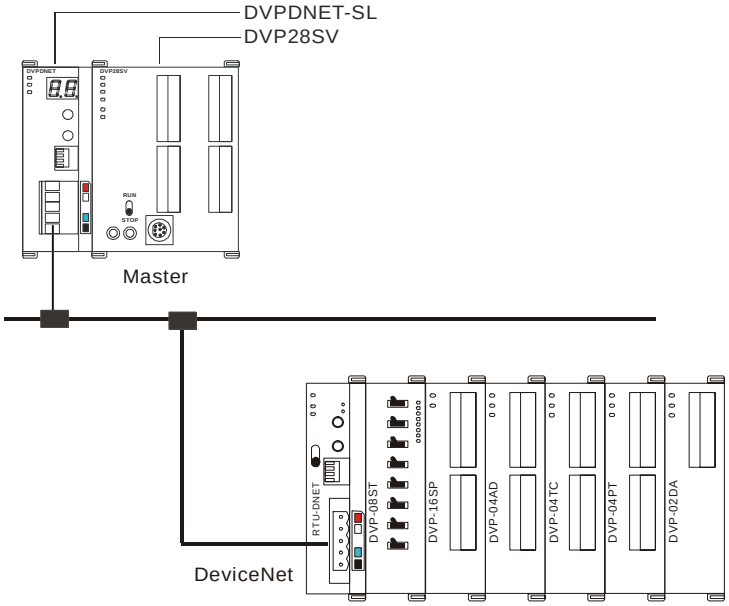
- The colors on the PINs on the DeviceNet connection port match the colors of the connection cables. Make sure you connect the cable to the right PIN.
- We recommend you also apply Delta's power module in the connection.




## 4 How to Configure RTU-DNET

In this section we will introduce how RTU-DNET as a DeviceNet slave realizes the data exchange between DeviceNet master and DVP Slim DI/DO extension unit.

- DeviceNet master sends the data to Slim DI/DO.
- RTU-DENT sends the input data from Slim DI/DO to DeviceNet master.




### 4.1 Terms

| No. | Item | Unit | Explanation |
|---|---|---|---|
| 1 | Control word | Word | For setting up the mode of RTU-DNET, e.g. "H8000" for STOP mode and "H8001" for RUN mode. See 4.3 for more details. |
| 2 | Status word | Word | Displaying the status of RTU-DNET. See 4.3 for more details. |
| 3 | Number of digital input points | Bit | The digital input points shall be 8's multiple. The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16. |
| 4 | Number of digital output points | Bit | The digital output points shall be 8's multiple. The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16. |

| No. | Item | Unit | Explanation |
|---|---|---|---|
| 5 | Length of input data of special module | Word | The length of input data of the special module connected to RTU-DNET |
| 6 | Length of output data of special module | Word | The length of output data of the special module connected to RTU-DNET |
| 7 | Length of input I/O data | Byte | The sum of the length of the status word of RTU-DNET and the input data of the special module connected to it. One input channel of the special module occupies 2 bytes. 8 points of the digital input are counted as 1 byte. |
| 8 | Length of output I/O data | Byte | The sum of the length of the control word of RTU-DNET and theoutput data of the special module connected to it. One output channel of the special module occupies 2 bytes. 8 points of the digital output are counted as 1 byte. |
| 9 | Number of special modules | Unit | The number of special modules connected to RTU-DNET.<br>Range: 0 ~ 8 |
| 10 | Diagnostic interval time | Sec | The interval when RTU-DNET executes diagnosis.<br>Range: 1 ~ 65, Default: 5 secs |
| 11 | Special module offline treatment | N/A | How RTU-DNET will react when the special module connected to it is offline. You can choose “Ignored”, “Alarm” or “Stop DeviceNet IO”. Default: Alarm |
| 12 | Special module erro treatment | N/A | How RTU-DNET will react when it detacts errors. You can choose “Ignored”, “Alarm” or “Stop DeviceNet IO”. Default: Alarm |
| 13 | Reset RTU-DNET | N/A | Reset the configuration of RTU-DNET to default settings. |
| 14 | Add control word and status word to I/O data | N/A | For you to decide whether to add control word and status word to I/O data. When you choose not to do it, the I/O data in RTU-DNET and DeviceNet master will not include control word and status word. If you choose to add them in, the I/O data in RTU-DNET and DeviceNet master will include control word and status word. |
| 15 | Work mode | N/A | For you to set up the work mode of the special module connected to RTU-DNET. When set to “auto mode”, RTU-DNET will configure default CR of the special module as DeviceNet I/O mapping data. When set to “custom mode”, you can configure any CR in the special module as DeviceNet I/O mapping data. |
| 16 | Number of input data connected | --- | The number of input data of the special module connected to RTU-DNET |
| 17 | Number of output data connected | --- | The number of output data of the special module connected to RTU-DNET |
| 18 | Length of input data | Word | The sum of the length of input data of the special modules connected to RTU-DNET |
| 19 | Length of output data | Word | The sum of the length of output data of the special modules connected to RTU-DNET |
| 20 | I/O mapping | N/A | The I/O mapping relation between RTU-DNET and the special module connected to it |

## 4.2 Format of Requet Message and Response Message

1. RTU-DNET supports using DeviceNet explicit messages to poll special modules.

   ■ Format of request messages

| Byte position | Data written into special module | Data read from special module |
|---|---|---|
| 0 | Frag[0]+XID+MAC ID | Frag[0]+XID+MAC ID |

| Byte position | Data written into special module | Data read from special module |
|---|---|---|
| 1 | R/R[0]+Service Code[0x10] | R/R[0]+Service Code[0x0E] |
| 2 | Class ID [0x9C] | Class ID [0x9C] |
| 3 | Instance ID | Instance ID |
| 4 | Attribute ID | Attribute ID |
| 5 | Low byte of Service Data | N/A |
| 6 | High byte of Service Data | N/A |
| 7 | N/A | N/A |

■ Format of response messages

| Byte position | Data written into special module | Data read from special module |
|---|---|---|
| 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 | | Low byte of response data |
| 3 | | High byte of response data |

2. Definitions of DeviceNet Objects for RTU-DNET

■ Class 0x9A – RTU-DNET setup parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance 1

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| 1 | Get | Length of input I/O data | N/A | N/A | The sum of the length of the status word of RTU-DNET and the input data of the module connected to it. (Unit: byte) |
| 2 | Get | Length of output I/O data | N/A | N/A | The sum of the length of the control word of RTU-DNET and the output data of the module connected to it. (Unit: byte) |
| 3 | Get | Number of digital input points (X) | 0 ~ 128 | N/A | The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16. (Unit: bit) |
| 4 | Get | Number of digital output points (Y) | 0 ~ 128 | N/A | The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16. (Unit: bit) |
| 5 | Get | Number of special modules | 0 ~ 8 | N/A | The number of special modules connected to RTU-DNET. |
| 6 | Get | Length of analog input | N/A | N/A | The length of input data of the special module connected to RTU-DNET. (Unit: word) |
| 7 | Get | Length of analog output | N/A | N/A | The length of output data of the special module connected to RTU-DNET. (Unit: word) |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| 8 | Get | Status word | 0~255 | N/A | Displaying the status of RTU-DNET. See 4.3 for more details. |
| 9 | Get/Set | Control word | N/A | N/A | For setting up the mode of RTU-DNET, e.g. “H8000” for STOP mode and “H8001” for RUN mode. See 4.3 for more details. |
| 10 | Get/Set | Diagnostic interval time | 1 ~ 65 secs | 5 secs | The interval when RTU-DNET executes diagnosis. |
| 11 | Get/Set | Special module offline treatment | 0 ~ 2 | 1 | How RTU-DNET will react when the special module connected to it is offline.<br>0: Ignored<br>1: Alarm<br>2: Stop DeviceNet IO |
| 12 | Get/Set | Special module error treatment | 0 ~ 2 | 1 | How RTU-DNET will react when it detects errors.<br>0: Ignored<br>1: Alarm<br>2: Stop DeviceNet IO |
| 13 | Get/Set | RTU-DNET configuration validation | N/A | 0 | Validating the configuration of RTU-DNET when set to “11”. |
| 14 | Get/Set | Reset RTU-DNET | N/A | 0 | Resetting RTU-DNET when set to”10”. After it, the parameter will change to “0” automatically. |

■ Class 0x9B – Extension module setup parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance 1 ~ 8 (parameters for the 1st ~ 8th special modules)

| Attribute ID | Access rule | Name | Range | Default | Explanation | | |
|---|---|---|---|---|---|---|---|
| 1 | Get | Model name | N/A | N/A | Model code for the special module | | |
| 2 | Get | Length of input data | N/A | N/A | The sum of the input data length of special modules connected.<br>Unit: word | | |
| 3 | Get | Length of output data | N/A | N/A | The sum of the output data length of special modules connected.<br>Unit: word | | |
| 4 | Get | Status | 0 ~ 63 | N/A | b0 | 0 | Special module online |
| | | | | | | 1 | Special module offline |
| | | | | | b1 | 0 | Special module normal |
| | | | | | | 1 | Special module in error |
| | | | | | b2 | 0 | Special module and configuration consistent |

| Attribute ID | Access rule | Name | Range | Default | Explanation | | |
|---|---|---|---|---|---|---|---|
| | | | | | | 1 | Special module and configuration inconsistent |
| | | | | | b3 | 0 | Configuration data valid |
| | | | | | | 1 | Configuration data invalid |
| | | | | | b4 | 0 | Special module identifiable |
| | | | | | | 1 | Special module unidentifiable |
| | | | | | b5~b15 | Reserved | |
| 5 | Get/Set | Work mode | 0 ~ 1 | 0 | Work mode of special module<br>0: auto 1: custom | | |
| 6 | Get/Set | Number of input data | 0 ~ 8 | N/A | Number of input data of special modules connected | | |
| 7 | Get/Set | Number of output data | 0 ~ 8 | N/A | Number of output data of special module connected | | |
| 8 | Reserved | | | | | | |
| 9 | Get | Error code | | N/A | Error code in special module | | |
| 10 ~ 19 | Reserved | | | | | | |
| 20 | Get/Set | Start CR for module 1 input data | N/A | N/A | Start CR for the input data of special module 1 | | |
| 21 | Get/Set | Input data length for module 1 | N/A | N/A | Length of input data of special module 1 | | |
| 22 | Get/Set | Start CR for module 2 input data | N/A | N/A | Start CR for the input data of special module 2 | | |
| 23 | Get/Set | Input data length for module 2 | N/A | N/A | Length of input data of special module 2 | | |
| 24 | Get/Set | Start CR for module 3 inptu data | N/A | N/A | Start CR for the input data of special module 3 | | |
| 25 | Get/Set | Input data length for module 3 | N/A | N/A | Length of input data of special module 3 | | |
| 26 | Get/Set | Start CR for module 4 input data | N/A | N/A | Start CR for the input data of special module 4 | | |
| 27 | Get/Set | Input data length for module 4 | N/A | N/A | Length of input data of special module 4 | | |
| 28 | Get/Set | Start CR for module 5 input data | N/A | N/A | Start CR for the input data of special module 5 | | |
| 29 | Get/Set | Input data length for module 5 | N/A | N/A | Length of input data of special module 5 | | |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| 30 | Get/Set | Start CR for module 6 input data | N/A | N/A | Start CR for the input data of special module 6 |
| 31 | Get/Set | Input data length for module 6 | N/A | N/A | Length of input data of special module 6 |
| 32 | Get/Set | Start CR for module 7 input data | N/A | N/A | Start CR for the input data of special module 7 |
| 33 | Get/Set | Input data length for module 7 | N/A | N/A | Length of input data of special module 7 |
| 34 | Get/Set | Start CR for module 8 input data | N/A | N/A | Start CR for the input data of special module 8 |
| 35 | Get/Set | Input data length for module 8 | N/A | N/A | Length of input data of special module 8 |
| 36 ~ 49 | Reserved | | | | |
| 50 | Get/Set | Start CR for module 1 output data | N/A | N/A | Start CR for the output data of special module 1 |
| 51 | Get/Set | Output data length for module 1 | N/A | N/A | Length of output data of special module 1 |
| 52 | Get/Set | Start CR for module 2 output data | N/A | N/A | Start CR for the output data of special module 2 |
| 53 | Get/Set | Output data length for module 2 | N/A | N/A | Length of output data of special module 2 |
| 54 | Get/Set | Start CR for module 3 output data | N/A | N/A | Start CR for the output data of special module 3 |
| 55 | Get/Set | Output data length for module 3 | N/A | N/A | Length of output data of special module 3 |
| 56 | Get/Set | Start CR for module 4 output data | N/A | N/A | Start CR for the output data of special module 4 |
| 57 | Get/Set | Output data length for module 4 | N/A | N/A | Length of output data of special module 4 |
| 58 | Get/Set | Start CR for module 5 output data | N/A | N/A | Start CR for the output data of special module 5 |
| 59 | Get/Set | Output data length for module 5 | N/A | N/A | Length of output data of special module 5 |
| 60 | Get/Set | Start CR for module 6 output data | N/A | N/A | Start CR for the output data of special module 6 |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| 61 | Get/Set | Output data length for module 6 | N/A | N/A | Length of output data of special module 6 |
| 62 | Get/Set | Start CR for module 7 output data | N/A | N/A | Start CR for the output data of special module 7 |
| 63 | Get/Set | Output data length for module 7 | N/A | N/A | Length of output data of special module 7 |
| 64 | Get/Set | Start CR for module 8 output data | N/A | N/A | Start CR for the output data of special module 8 |
| 65 | Get/Set | Output data length for module 8 | N/A | N/A | Length of output data of special module 8 |

■ Class 0x9C – Extension module parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |
| 2 | Get | MaxInstance | UINT |

Instance 1 ~ 8 (CR for the 1st ~ 8th special module)

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Content in CR#0 | UINT |
| 2 | Get/Set | Content in CR#1 | UINT |
| 3 | Get/Set | Content in CR#2 | UINT |
| … | … | … | UINT |
| 9 | Get/Set | Content in CR#8 | UINT |
| 10 | Get/Set | Content in CR#9 | UINT |
| … | … | … | UINT |

Note:

- When you modify the content in CR of the special module through DeviceNet, please read out the content again (Get_Attribute_Single) after the modification and confirm that it has been modified successfully.
- The content in some CRs of the special module cannot be modified. Therefore, please pay attention to these parameters when you are modifying them.

## 4.3 DeviceNet I/O Mapping Data

1. Control word and status word in RTU-DNET

■ Control word

| bit | Status value | Explanation |
|---|---|---|
| 0 | 0 | Setting RTU-DNET to STOP mode |
| | 1 | Setting RTU-DNET to RUN mode |
| 1 | 0/1 | Reserved |

| bit | Status value | Explanation |
|---|---|---|
| 2 | 0/1 | Reserved |
| 3 | 0/1 | Reserved |
| 4 | 0/1 | Reserved |
| 5 | 0/1 | Reserved |
| 6 | 0/1 | Reserved |
| 7 | 0/1 | Reserved |
| 8 | 0/1 | Reserved |
| 9 | 0/1 | Reserved |
| 10 | 0/1 | Reserved |
| 11 | 0/1 | Reserved |
| 12 | 0/1 | Reserved |
| 13 | 0/1 | Reserved |
| 14 | 0/1 | Reserved |
| 15 | 0 | Disabling control word |
| | 1 | Enabling control word |

- Status word

| bit | Status value | Explanation |
|---|---|---|
| 0 | 0 | RTU-DNET detects DI/DO extension unit. |
| | 1 | RTU-DNET does not detect DI/DO extension unit. |
| 1 | 0 | The configurations of RTU-DNET and the extension unit connected to it are consistent. |
| | 1 | The configrations of RTU-DNET and the extension unit connected to it are inconsistent. |
| 2 | 0 | No error occurs in the special module. |
| | 1 | Error occurs in the special module. |
| 3 | 0 | The special module operates normally. |
| | 1 | The special module is detected offline. |
| 4 | 0 | The configuration data are valid. |
| | 1 | The configuration data are invalid. |
| 5 | 0 | RTU-DNET operates normally. |
| | 1 | The power of RTU-DNET is in low voltage. |
| 6 | 0 | RTU-DNET operates normally. |
| | 1 | RTU-DNET detects unidentifiable special module. |
| 7 | 0 | RTU-DNET operates normally. |
| | 1 | More than 8 special modules connected to RTU-DNET, or the number of digital I/O points exceeds 128. |
| 8 | 0/1 | Reserved |
| 9 | 0/1 | Reserved |
| 10 | 0/1 | Reserved |
| 11 | 0/1 | Reserved |
| 12 | 0/1 | Reserved |
| 13 | 0/1 | Reserved |

| bit | Status value | Explanation |
|---|---|---|
| 14 | 0/1 | Reserved |
| 15 | 0/1 | Reserved |

2. I/O data mapping

- If the I/O data do not include control word and status word of RTU-DNET, the I/O data mapping of DeviceNet master and RTU-DNET will be:
  - DeviceNet master → RTU-DNET

| Master (byte) | RTU-DNET | |
|---|---|---|
| 0 | Special module | Low byte of the 1st special module output channel 1 |
| 1 | | High byte of the 1st special module output channel 1 |
| 2 | | Low byte of the 1st special module output channel 2 |
| 3 | | High byte of the 1st special module output channel 2 |
| … | | … |
| N | Slim DI/DO | Y0 ~ Y7 on the 1st Slim DI/DO |
| N+1 | | Y0 ~ Y7 of the 2nd Slim DI/DO |
| … | | … |

  - RTU-DNET → DeviceNet master

| Master (byte) | RTU-DNET | |
|---|---|---|
| 0 | Special module | Low byte of the 1st special module input channel 1 |
| 1 | | High byte of the 1st special module input channel 1 |
| 2 | | Low byte of the 1st special module input channel 2 |
| 3 | | High byte of the 1st special module input channel 2 |
| … | | … |
| N | Slim DI/DO | X0 ~ X7 on the 1st Slim DI/DO |
| N+1 | | X0 ~ X7 on the 2nd Slim DI/DO |
| … | | … |

- If the I/O data include control word and status word of RTU-DNET, the I/O data mapping of DeviceNet master and RTU-DNET will be:
  - DeviceNet master → RTU-DNET

| Master (byte) | RTU-DNET | |
|---|---|---|
| 0 | RTU-DNET | Low byte of control word of RTU-DNET |
| 1 | | High byte of control word of RTU-DNET |
| 2 | Special module | Low byte of the 1st special module output channel 1 |
| 3 | | High byte of the 1st special module output channel 1 |
| 4 | | Low byte of the 1st special module output channel 2 |
| 5 | | High byte of the 1st special module output channel 2 |
| … | | … |
| N | Slim DI/DO | Y0 ~ Y7 of the 1st Slim DI/DO |
| N+1 | | Y0 ~ Y7 of the 2nd Slim DI/DO |

| Master (byte) | RTU-DNET | |
|---|---|---|
| … | | … |

- RTU-DNET → DeviceNet master

| Master (byte) | RTU-DNET | |
|---|---|---|
| 0 | RTU-DNET | Low byte of status word of RTU-DNET |
| 1 | | High byte of status word of RTU-DNET |
| 2 | Special module | Low byte of the 1st special module output channel 1 |
| 3 | | High byte of the 1st special module output channel 1 |
| 4 | | Low byte of the 1st special module output channel 2 |
| 5 | | High byte of the 1st special module output channel 2 |
| … | | … |
| N | Slim DI/DO | X0 ~ X7 of the 1st Slim DI/DO |
| N+1 | | X0 ~ X7 of the 2nd Slim DI/DO |
| … | | … |

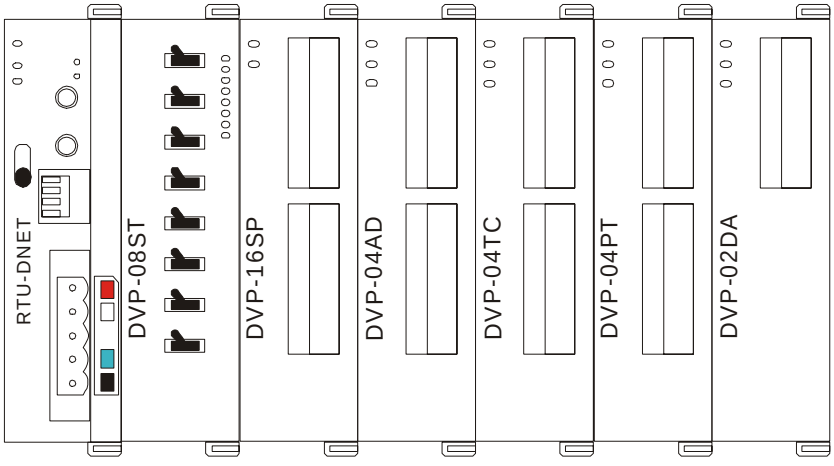
Note:

- If you choose to make the control word and status word of RTU-DNET to be I/O data, the first word in the I/O data area will automatically be distributed to control word and status word.
- In the alignment of RTU-DNET and the extension modules connected to it, the data of special modules appear prior to the data of Slim DI/DO extension units.

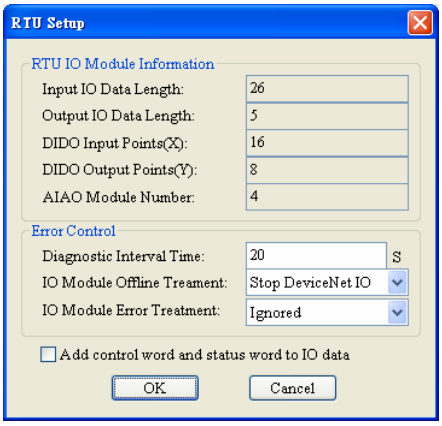
## 4.4 Example

1. How to read the I/O data in the extension module connected to RTU-DNET.

   Assume the extension modules connected to RTU-DNET are:

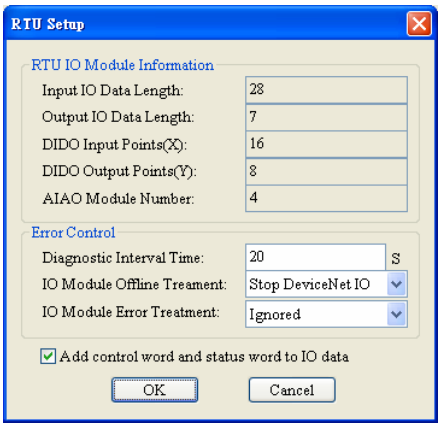



If the I/O data do not include control word and status word of RTU-DNET, the information of the extension module connected to RTU-DNET are as follows:

| Item | Content | Software screen |
|---|---|---|
| DIDO Input Points (X) | 16 bits |  |
| DIDO Output Points (Y) | 8 bits | |
| AIAO Module Number | 4 | |
| Input IO Data Length | 26 bytes | |
| Output IO Data Length | 5 bytes | |

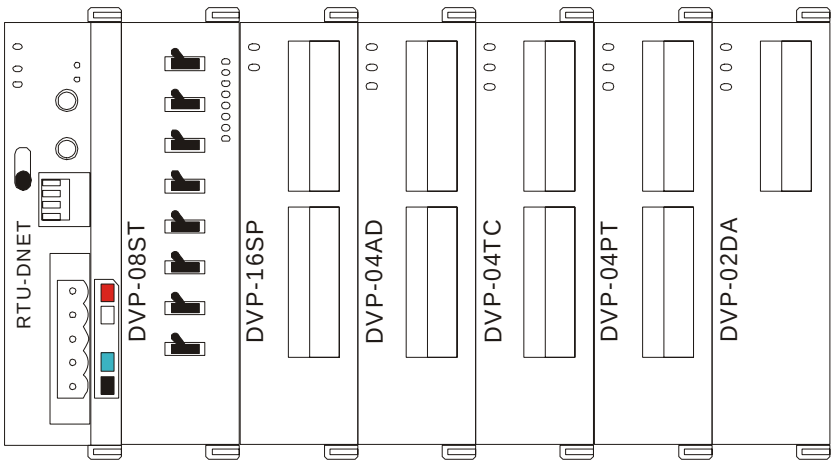


If the I/O data include control word and status word of RTU-DNET, the information of the extension module connected to RTU-DNET are as follows:

| Item | Content | Software screen |
|---|---|---|
| DIDO Input Points (X) | 16 bits |  |
| DIDO Output Points (Y) | 8 bits | |
| AIAO Module Number | 4 | |
| Input IO Data Length | 28 bytes | |
| Output IO Data Length | 7 bytes | |

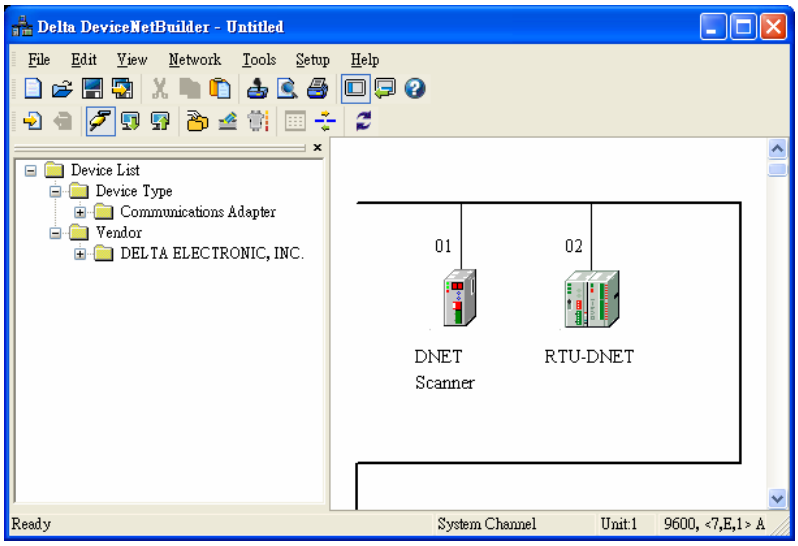


2. How to change the I/O mapping relation between RTU-DNET and special module

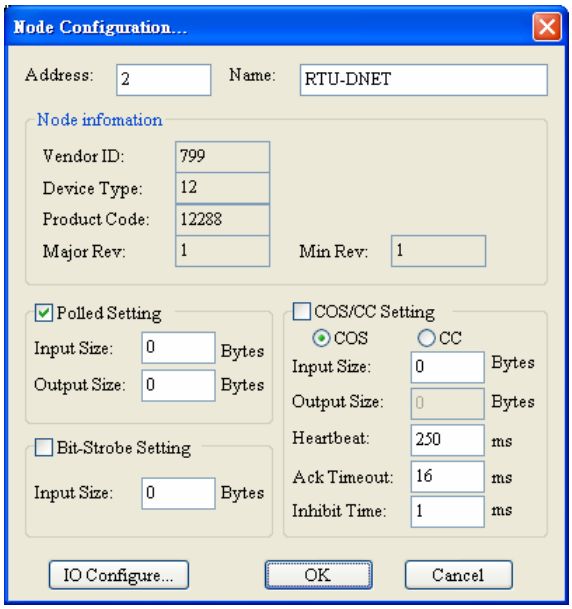



As the figure above, if you need to read the average Celsius degree temperature at CH1 ~ CH4 on DVP-04PT, follow the steps below:

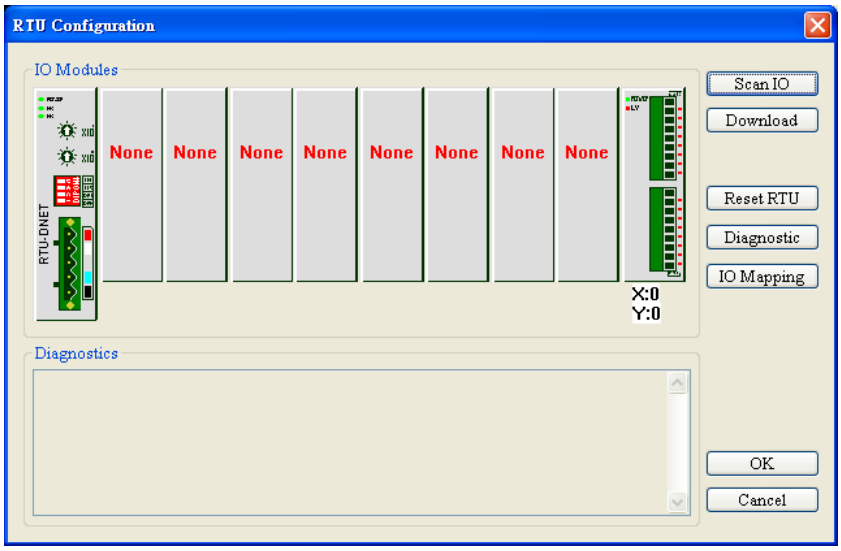
(1) Scan DeviceNet by using DeviceNetBuilder software. After the scan is completed, the nodes on DeviceNet will be displayed on the screen.



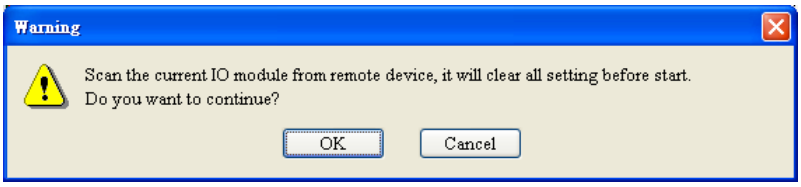

(2) Double click on RTU-DNET icon, and the “Node Configuration…” dialog box will appear.



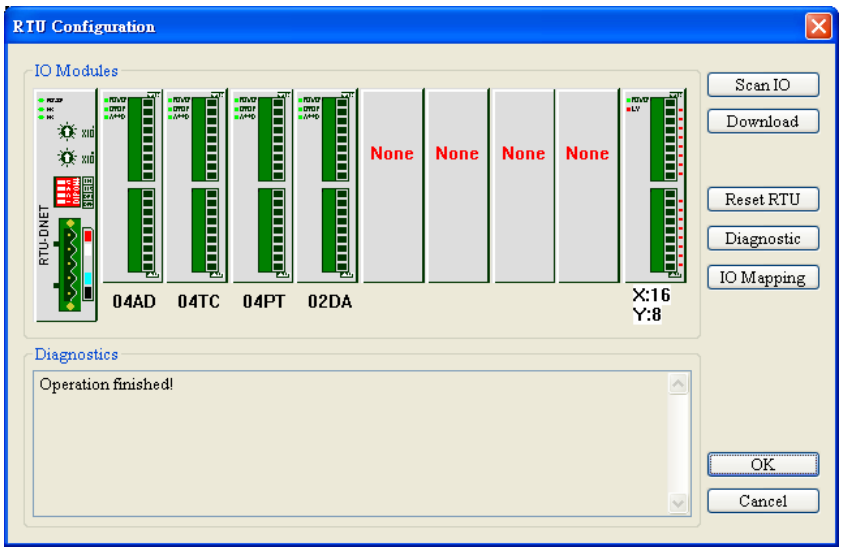

(3) Click on “IO Configure…” button in “Node Cnfiguration…” dialog box, and you will then see “RTU Configuration” page.



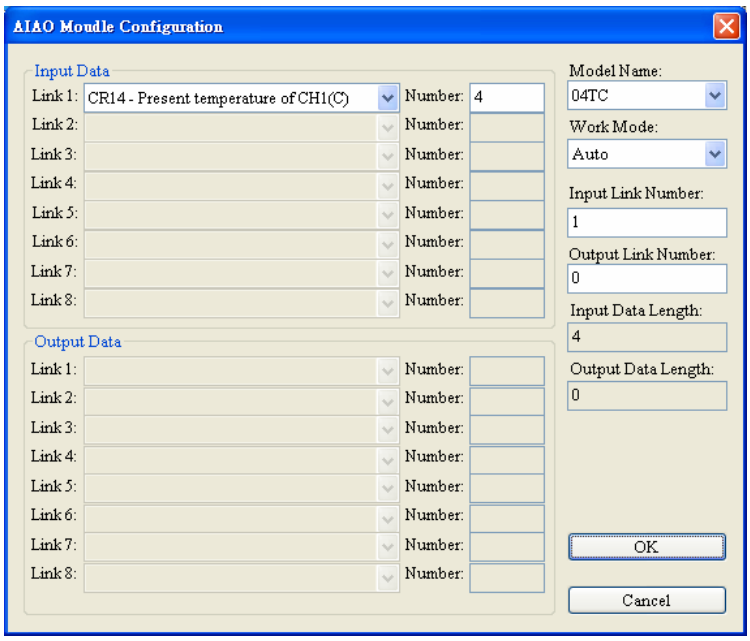

(4) Click on “Scan IO”, and the “Warning” dialog box will appear.



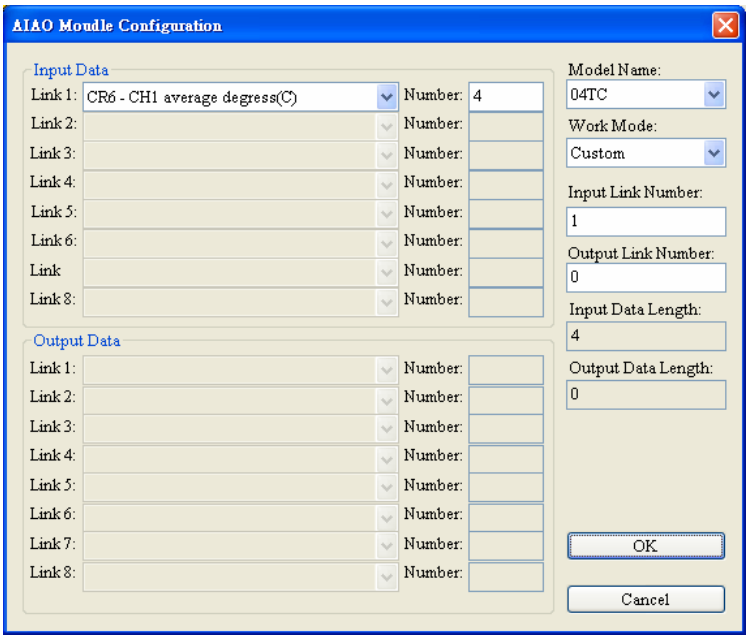

(5) Click on “OK”. DeviceNetBuilder will then display the special module connected and the number of digital I/O points on the “RTU Configuration” page.



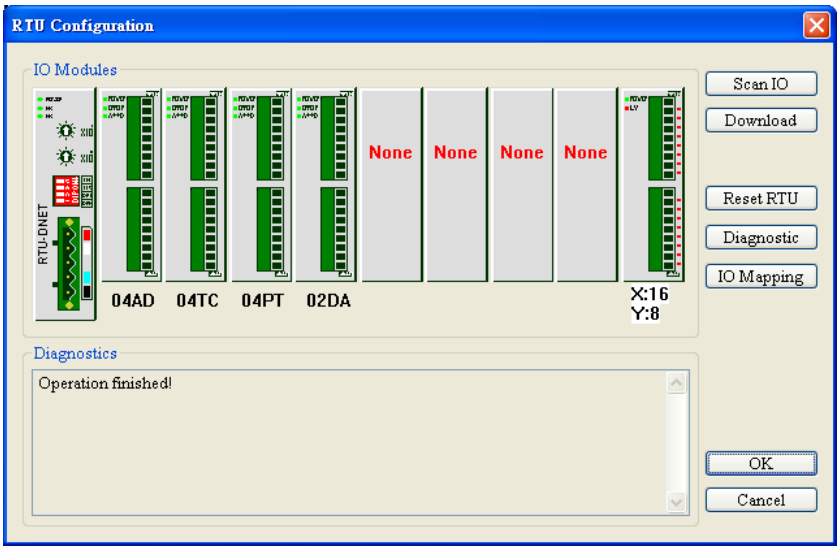

(6) Double click on “04TC” icon, and you will then see the “AIAO Module Configuration” dialog box, as below. The content in Input Data >> Link 1 column is “CR14-Present temperature of CH1(C)”.



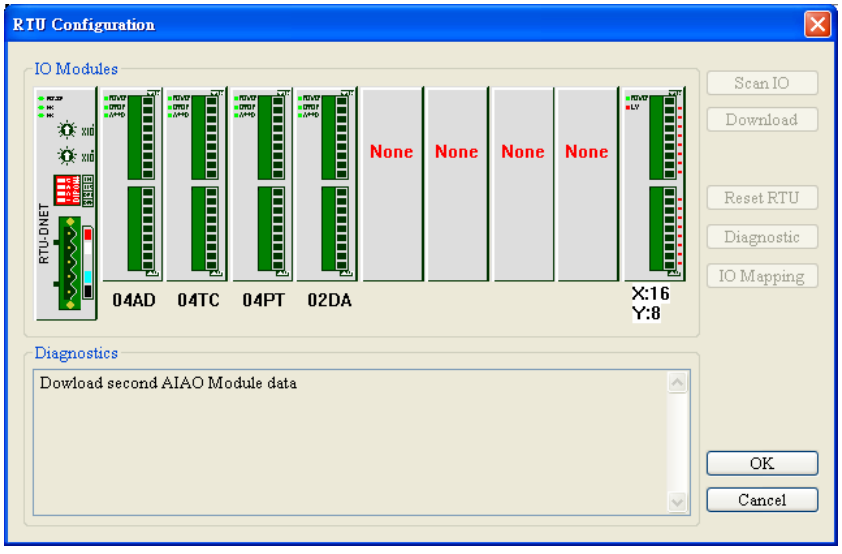

(7) Set the Work Mode to “Custom” and Input Data >> Link 1 to “CR6-CH1 average degree(C)”.




(8) Click on “OK” in “AIAO Module Configuration” page and return to “RTU Configuration” page.




(9) Click on “Dowload” to download the configuration to RTU-DNET.



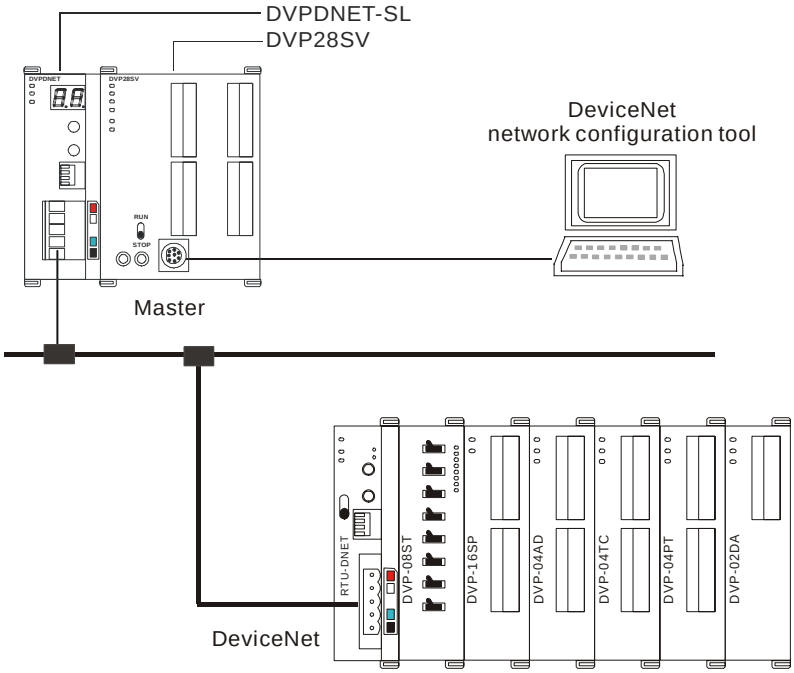

(10) After the download is completed, click on “OK”.

## 5 How to Construct a DeviceNet Network Using RTU-DNET

In this section, we will explain how to configure RTU-DNET and the I/O mapping relation between RTU-DNET and DVPDNET-SL by an application example.

### 5.1 How to Construct DeviceNet by RTU-DNET

1. The DeviceNet network




2. Set up DVPDNET-SL and RTU-DNET according to the table below.

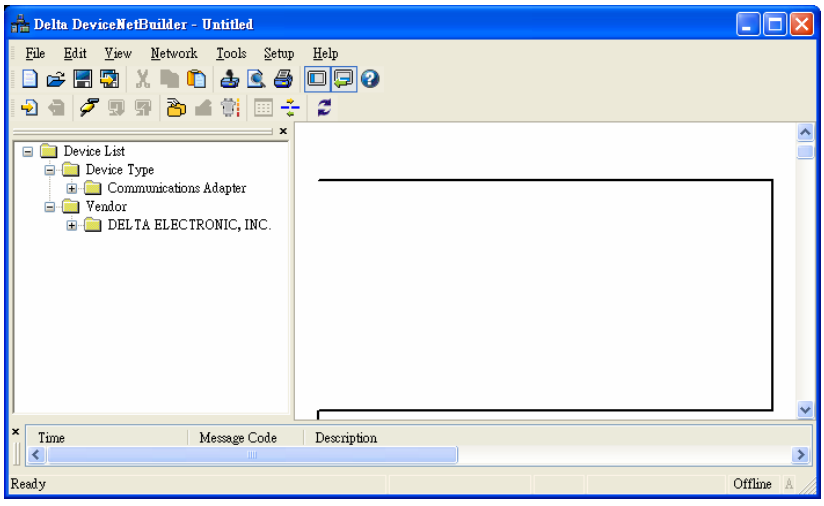
| Module | Node address | Baud rate |
|---|---|---|
| DVPDNET-SL | 1 | 500 kbps |
| RTU-DNET | 2 | 500 kbps |

3. Pleae check if all Slim DI/DO extension units, special modules and RTU-DNET are working normally, if the wiring of the entire network is correct, and if the power supply in DeviceNet is normal.

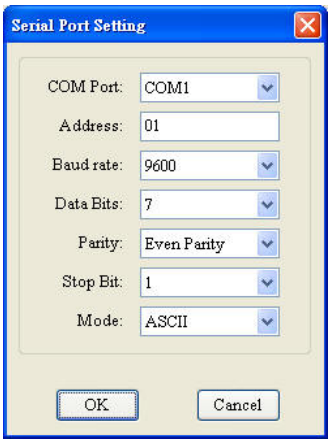
### 5.2 How to Configure Network by DeviceNet Network Configuration Tool

1. Configuration of RTU-DNET

(1) Open DeviceNetBuilder software, as below:



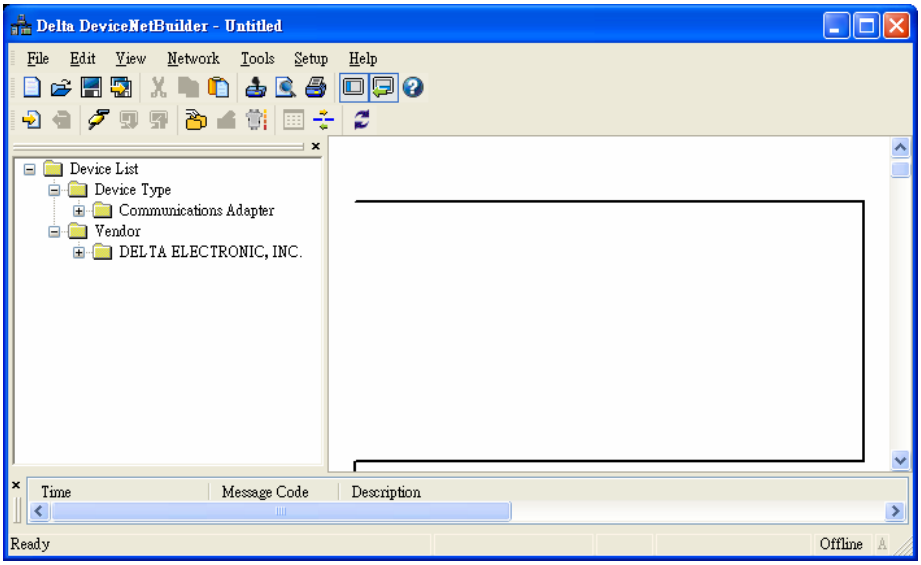
(2) Select “Setup” => “Communication Setting” => “System Channel”, and the “Serial Port Setting” dialog box will appear.



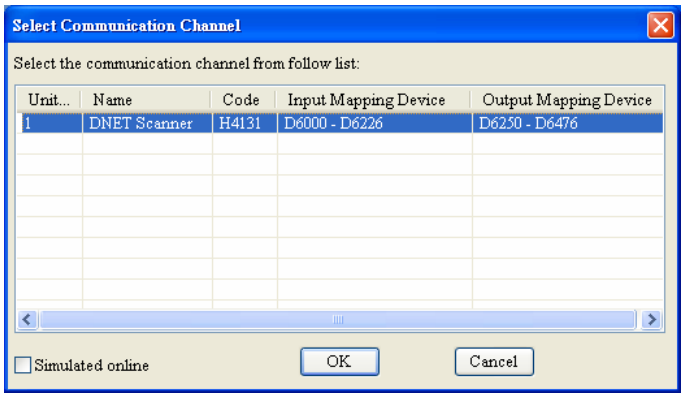

(3) Set up the communication parameters in the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format.

| Item | Function | Default |
|---|---|---|
| COM Port | COM port on the PC to be used to communicate with DVP-SV | COM1 |
| Address | Communication address of DVP-SV | 01 |
| Baud rate | Communication speed between the PC and DVP-SV | 9,600 (bps) |
| Data Bits | Communication protocol between the PC and DVP-SV | 7 |
| Parity | | Even Parity |
| Stop Bit | | 1 |
| Mode | Communication mode between the PC and DVP-SV | ASCII |

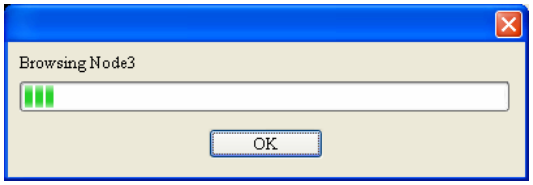
(4) Click on “OK” and return to the main page.



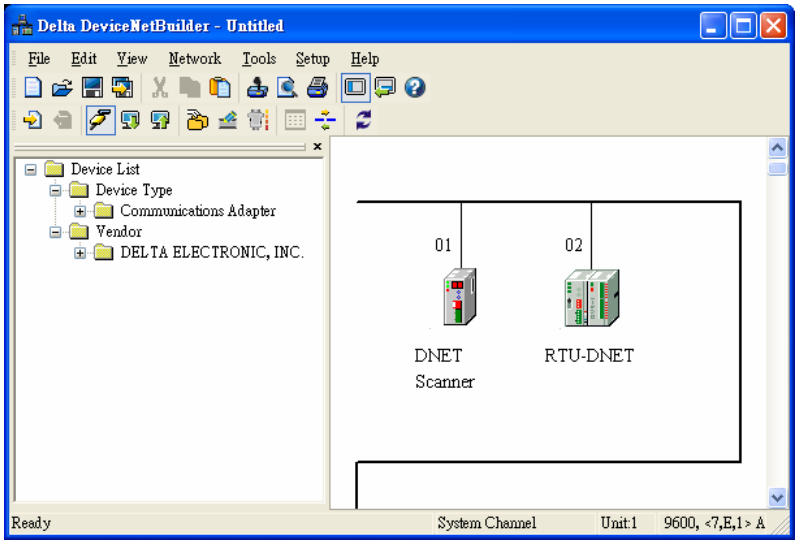

(5) Select “Network” => “Online”, and the “Select Communication Channel” dialog box will appear.



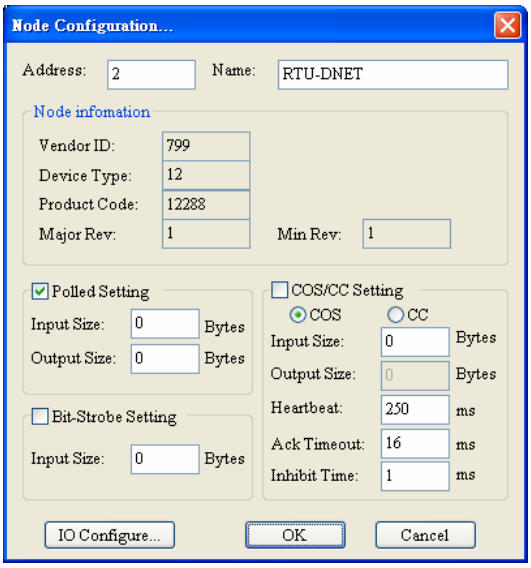

(6) Click on “OK”, and DeviceNetBuilder will start to scan the entire network.



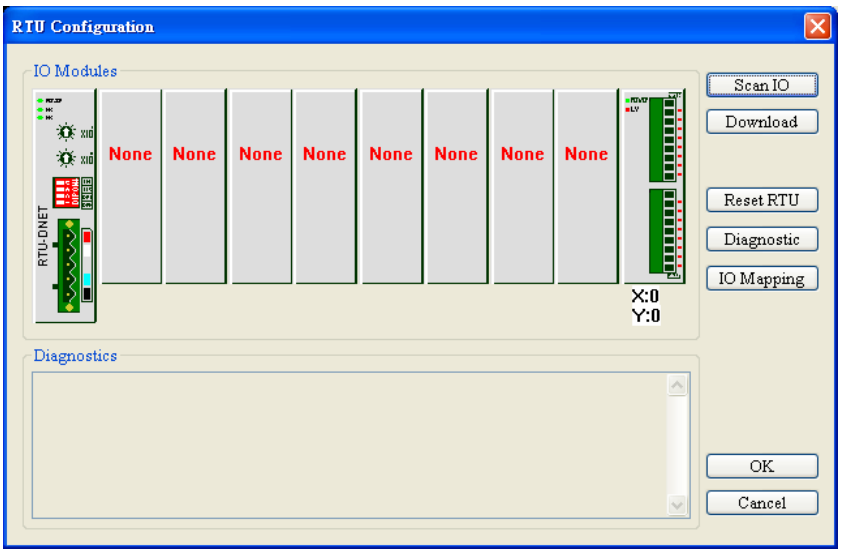

(7) If the bar on the dialog box does not progress, it means the connection between the PC and DVP-SVis abnormal, or there are other programs also usinig the COM port on the PC. After the scan is completed, the dialog box will tell you that the scan is completed, and the icons and device names of all the nodes scanned on the network will be shown on the screen. See the figure below, in which the node address of DVPDNET-SL is 01.



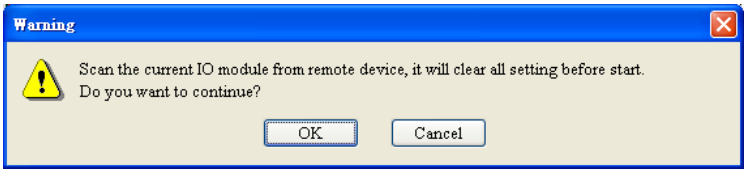

(8) Double click on RTU-DNET (node 02), and the “Node Configuration…dialog box will appear.



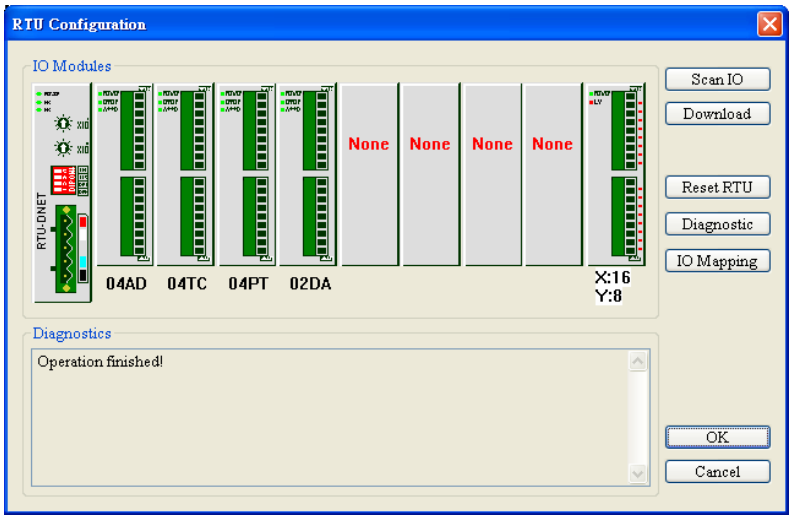

(9) Click on “IO Configure…” button in “Node Configuration" dialog box, and you will then see “RTU Configuration” page.



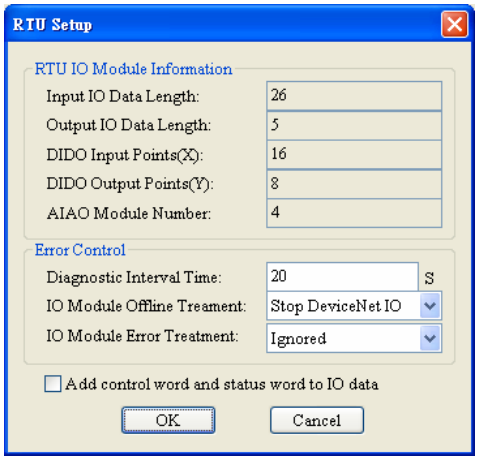

(10) Click on “Scan IO”, and the “Warning” dialog box will appear.




(11) Click on “OK”. DeviceNetBuilder will then detect the special module connected to RTU-DNET and the number of points in the Slim DI/DO extension unit and display the information on “RTU Configuration” page.




(12) Double click on RTU-DNET icon, and you will then see “RTU Setup” dialog box.




(13) Set up the parameters in RTU-DNET and confirm its I/O information.

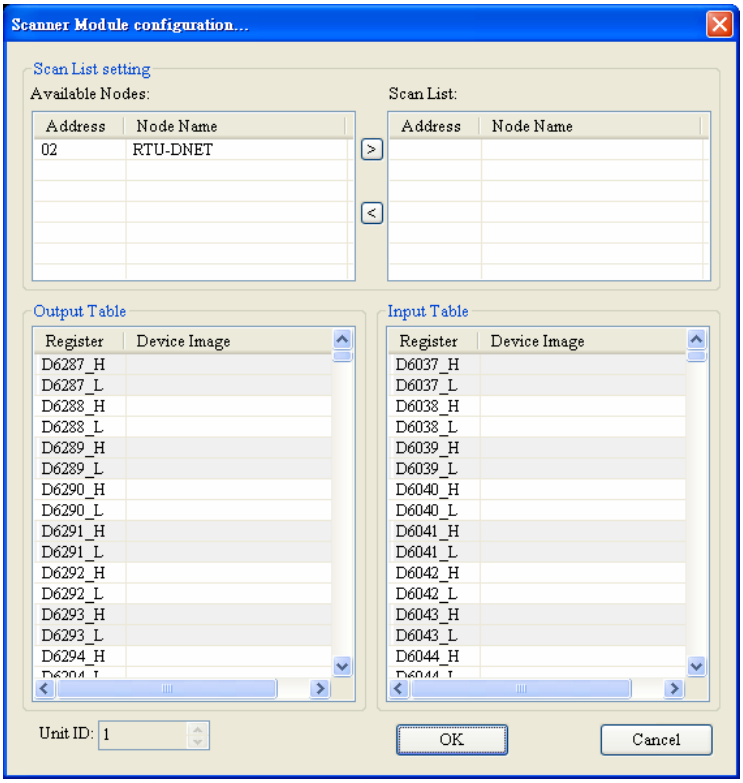
| Item | Function | Default |
|---|---|---|
| Input IO Data Length | The sum of the length of the status word of RTU-DNET and the input data of the special module connected to it. The status word of RTU-DNET occupies 2 bytes. One input channel of the special module occupies 2 bytes. 8 points of the digital input are counted as 1 byte. | N/A |
| Output IO Data Length | The sum of the length of the control word of RTU-DNET and the output data of the special module connected to it. The control word of RTU-DNET occupies 2 bytes. One output channel of the special module occupies 2 bytes. 8 points of the digital output are counted as 1 byte. | N/A |
| DIDO Input Points (X) | The digital input points shall be 8’s multiple. The number will be regarded as 8 when it is less than 8 and regarded as 16 when it is bigger than 8 but less than 16. | N/A |
| DIDO Output Points (Y) | The digital output points shall be 8’s multiple. The number will be regarded as 8 when it is less than 8 and regarded as 16 when it is bigger than 8 but less than 16. | N/A |
| AIAO Module Number | The number of special modules connected to RTU-DNET. Range: 0 ~ 8 | N/A |
| Diagnostic Intervel Time | The interval when RTU-DNET executes diagnosis. Range: 1~ 65 secs | 5 (sec) |
| IO Module Offine Treatment | How RTU-DNET will react when the special module connected to it is offline. You can choose “Ignored”, "Alarm” or “stop DeviceNet IO". | Alarm |

| Item | Function | Default |
|---|---|---|
| IO Module Error Treatment | How RTU-DNET will react when it detects errors. You can choose “Ignored”, “Alarm” or “Stop DeviceNet IO”. | Alarm |
| Add control word and status word to IO data | For you to decide whether to add control word and status word to I/O data. When you choose not to do it, the I/O data in RTU-DNET and DeviceNet master will not include control word and status word. If you choose to add them in, the I/O data in RTU-DNET and DeviceNet master will include control word and status word. | Not to add |

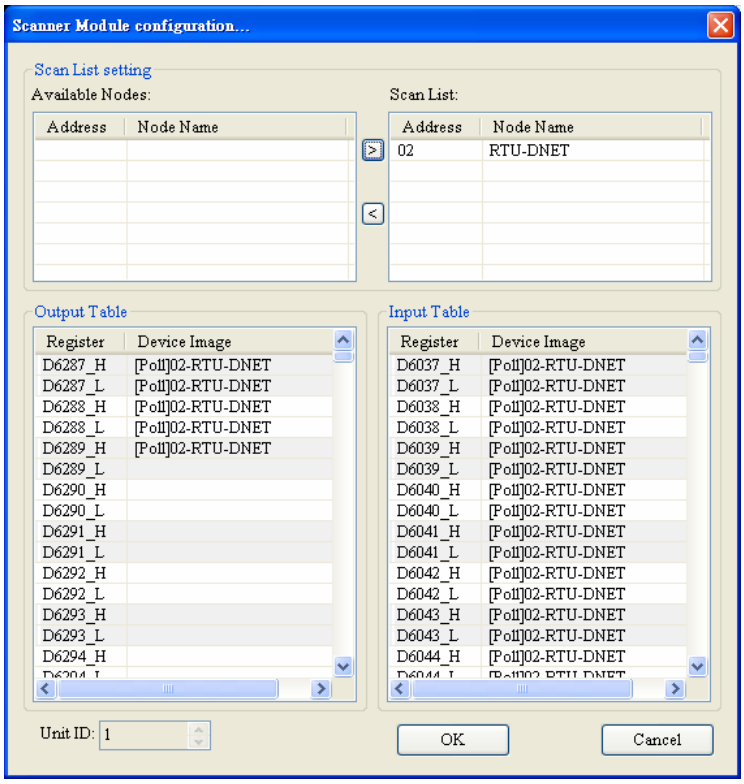
(14) Confirm all the configurations are correct and click on “Download” to download the configuration to RTU-DNET. After the download is completed, click on “OK".

2. Configuration of DVPDNET-SL

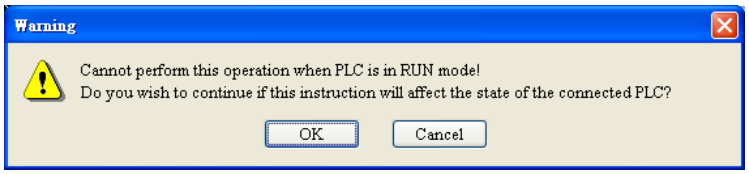
(1) Double click on DNET Scanner (node 01), and the “Scan Module Configuration…” dialog box will appear. You can find the currently available node, RTU-DNET, in the list on the left side. On the right side, there is an empty “Scan List”.



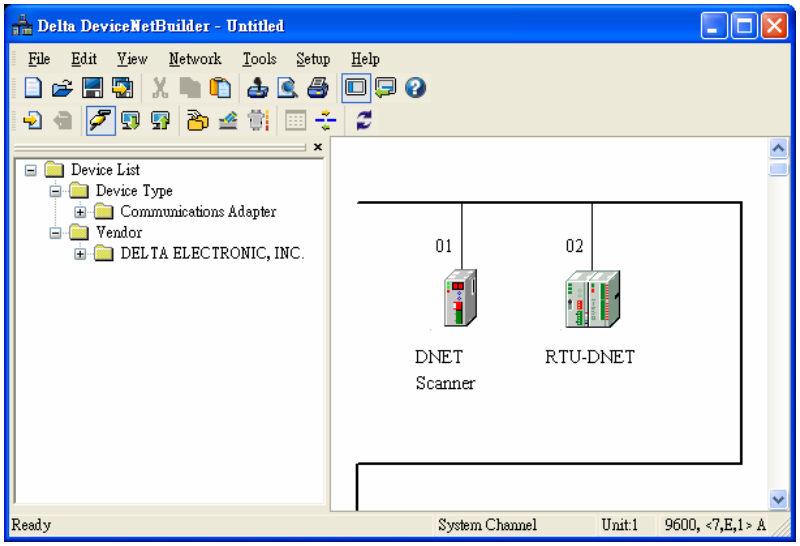

(2) Move the slave devices on DeviceNet in the “Available Nodes” list on the left side to the “Scan List” on the right side. Select a node and click on [>]. Follow the steps to move all the nodes to the scan list.




(3) Confirm all the settings and click on “OK”. Next, download the configuration to DVPDNET-SL. If DVP-SV is in RUN mode while you are downloading the configuration, a "Warning” dialog box will appear.




(4) Click on “OK” to continue the download. Make sure DVP-SV is in RUN mode. Now, you can see the MS LED and NS LED on RTU-DNET become green.




3. Follow the steps given above to configure DeviceNet network. If the I/O data do not include control word and status word of RTU-DNET, the I/O data mapping of DVPDNET-SL and RTU-DNET will be:

(1) DVPDNET-SL → RTU-DNET

| Register in DVPDNET-SL | | Devices in extension module | |
|---|---|---|---|
| D6287H | ⇨ | Special module | High byte of CH1 on DVP-02DA |
| D6287L | | | Low byte of CH1 on DVP-02DA |
| D6288H | | | High byte of CH2 on DVP-02DA |
| D6288L | | | Low byte of CH2 on DVP-02DA |
| D6289H | | Slim DI/DO | Y0 ~ Y7 on DVP-16SP |

(2) RTU-DNET → DVPDNET-SL

| Register in DVPDNET-SL | | Devices in extension module | |
|---|---|---|---|
| D6037H | ⇦ | Speicial module | High byte of CH1 on DVP-04AD |
| D6037L | | | Low byte of CH1 on DVP-04AD |
| D6038H | | | High byte of CH2 on DVP-04AD |
| D6038L | | | Low byte of CH2 on DVP-04AD |
| D6039H | | | High byte of CH3 on DVP-04AD |
| D6039L | | | Low byte of CH3 on DVP-04AD |
| D6040H | | | High byte of CH4 on DVP-04AD |
| D6040L | | | Low byte of CH4 on DVP-04AD |
| D6041H | | | High byte of CH1 on DVP-04TC |
| D6041L | | | Low byte of CH1 on DVP-04TC |
| D6042H | | | High byte of CH2 on DVP-04TC |
| D6042L | | | Low byte of CH2 on DVP-04TC |
| D6043H | | | High byte of CH3 on DVP-04TC |
| D6043L | | | Low byte of CH3 on DVP-04TC |
| D6044H | | | High byte of CH4 on DVP-04TC |
| D6044L | | | Low byte of CH4 on DVP-04TC |
| D6045H | | | High byte of CH1 on DVP-04PT |
| D6045L | | | Low byte of CH1 on DVP-04PT |
| D6046H | | | High byte of CH2 on DVP-04PT |
| D6046L | | | Low byte of CH2 on DVP-04PT |
| D6047H | | | High byte of CH3 on DVP-04PT |
| D6047L | | | Low byte of CH3 on DVP-04PT |
| D6048H | | | High byte of CH4 on DVP-04PT |
| D6048L | | | Low byte of CH4 on DVP-04PT |
| D6049H | | Slim DI/DO | X0 ~ X7 on DVP-08ST |
| D6049L | | | X0 ~ X7 on DVP-16SP |

4. If the I/O data include control word and status word of RTU-DNET, the I/O data mapping of DVPDNET-SL and RTU-DNET will be:

(1) DVPDNET-SL → RTU-DNET

| Register in DVPDNET-SL | | Devices in extension module | |
|---|---|---|---|
| D6287H | | RTU-DNET control word | High byte of control word in RTU-DNET |
| D6287L | | | Low byte of control word in RTU-DNET |
| D6288H | | Special module | High byte of CH1 on DVP-02DA |
| D6288L | ⇨ | | Low byte of CH1 on DVP-02DA |
| D6289H | | | High byte of CH2 on DVP-02DA |
| D6289L | | | Low byte of CH2 on DVP-02DA |
| D6290H | | Slim DI/DO | Y0 ~ Y7 on DVP-16SP |

(2) RTU-DNET → DVPDNET-SL

| Register in DVPDNET-SL | | Devices in extension module | |
|---|---|---|---|
| D6037H | | RTU-DNET status word | High byte of status word in RTU-DNET |
| D6037L | | | Low byte of status word in RTU-DNET |
| D6038H | | Special module | High byte of CH1 on DVP-04AD |
| D6038L | | | Low byte of CH1 on DVP-04AD |
| D6039H | | | High byte of CH2 on DVP-04AD |
| D6039L | | | Low byte of CH2 on DVP-04AD |
| D6040H | | | High byte of CH3 on DVP-04AD |
| D6040L | | | Low byte of CH3 on DVP-04AD |
| D6041H | | | High byte of CH4 on DVP-04AD |
| D6041L | | | Low byte of CH4 on DVP-04AD |
| D6042H | | | High byte of CH1 on DVP-04TC |
| D6042L | | | Low byte of CH1 on DVP-04TC |
| D6043H | | | High byte of CH2 on DVP-04TC |
| D6043L | ⇦ | | Low byte of CH2 on DVP-04TC |
| D6044H | | | High byte of CH3 on DVP-04TC |
| D6044L | | | Low byte of CH3 on DVP-04TC |
| D6045H | | | High byte of CH4 on DVP-04TC |
| D6045L | | | Low byte of CH4 on DVP-04TC |
| D6046H | | | High byte of CH1 on DVP-04PT |
| D6046L | | | Low byte of CH1 on DVP-04PT |
| D6047H | | | High byte of CH2 on DVP-04PT |
| D6047L | | | Low byte of CH2 on DVP-04PT |
| D6048H | | | High byte of CH3 on DVP-04PT |
| D6048L | | | Low byte of CH3 on DVP-04PT |
| D6049H | | | High byte of CH4 on DVP-04PT |
| D6049L | | | Low byte of CH4 on DVP-04PT |
| D6050H | | Slim DI/DO | X0 ~ X7 on DVP-08ST |
| D6050L | | | X0 ~ X7 on DVP-16SP |

## 6 LED Indicator & Trouble-shooting

There are five LED indicators on RTU-DNET. POWER LED displays if the power of RTU-DNET is working normally. RUN LED displays the working status of RTU-DNET. ALRAM LED shows if RTU-DNET is operating normally. NS LED and MS LED display the communication connection status of RTU-DNET.

### 6.1 POWER LED

| LED status | Indication | How to correct |
|---|---|---|
| Off | Power is abnormal. | Make sure RTU-DNET is powered. |
| Green light on | Power is normal. | -- |

### 6.2 NS LED

| LED status | Indication | How to correct |
|---|---|---|
| Off | No power or duplicate ID check has not completed. | 1. Make sure RTU-DNET is powered.<br>2. Make sure the nodes on the bus are communicating normally.<br>3. Make sure at least 1 node or more are communicating on the network through RTU-DNET.<br>4. Check if the baud rate of RTU-DNET is the same as that of the master. |
| Green light blinking | On-line but not connected to DeviceNet | -- |
| Green light on | On-line and connected to DeviceNet normally | -- |
| Red light blinking | On-line but I/O connection timed-out | -- |
| Red light on | Network error, cannot check duplicate ID, no network power or bus-off | 1. Make sure all the devices have their unique node address.<br>2. Check the network for correcting media installation and baud rate.<br>3. Check if the node address of RTU-DNET is valid.<br>4. Check if the network power is normal. |

### 6.3 MS LED

| LED status | Indication | How to correct |
|---|---|---|
| Off | No power or off-line | Make sure RTU-DNET is powered. |
| Green light blinking | Waiting for I/O data, no I/O data or PLC is in STOP mode. | Switch the PLC to RUN status and start I/O data exchange. |
| Green light on | I/O data are normal. | -- |
| Red light blinking | No network power; configuration error | 1. Check if the network power is normal.<br>2. Reset the parameters in RTU-DNET. |
| Red light on | Hardware error | Send your RTU-DNET back to the factory for repair. |

### 6.4 ALARM LED

| LED status | Indication | How to correct |
|---|---|---|
| Off | Normal | -- |
| Red light blinking | RTU-DNET detects low | 1. Make sure RTU-DNET is powered. |

| LED status | Indication | How to correct |
|---|---|---|
| | voltage | 2. Acquire diagnostic information through DeviceNetBuilder. |
| Red light on | Fatal error; errors in configuration data | Acquire diagnostic information through DeviceNetBuilder. |

6.5 RUN LED

| LED status | Indication | How to correct |
|---|---|---|
| Off | RTU-DNET in STOP mode | -- |
| Green light on | RTU-DNET in RUN mode | -- |

## Appendix A: DeviceNet Objects RTU-DNET Supports

- DeviceNet objects

| Class | Object |
|---|---|
| 0x01 | Identity object |
| 0x02 | Message router object |
| 0x03 | DeviceNet object |
| 0x05 | Connection object |
| 0x9A | RTU-DNET setup parameter object |
| 0x9B | Extension module setup parameter object |
| 0x9C | Extension module parameter object |

- Class 0x01 – Identity object

Class attribute

| 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

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | VendorId | UINT |
| 2 | Get | DeviceType | UINT |
| 3 | Get | ProductCode | UINT |
| 4 | Get | Revision<br>MaxRev<br>MinRev | <br>USINT<br>USINT |
| 5 | Get | Status | WORD |
| 6 | Get | Sn | UDINT |
| 7 | Get | ProdName<br>StrLen<br>ASCIIStr | <br>USINT<br>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 |

- Class 0x02 – Message router object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |
| 6 | Get | MaxIdClass | UINT |
| 7 | Get | MaxIdInstance | UINT |

Instance

| 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 |

- Class 0x03 – DeviceNet object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance attribute

| 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<br>AllocationChoice<br>MasterNodeAddress | BYTE<br>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 |

| Service code | Implemented for | | Service name |
|---|---|---|---|
| | Class | Instance | |
| 0x10 | No | Yes | Set_Attribute_Single |
| 0x4B | No | Yes | Allocate_Master/Slave_Connection_Set |
| 0x4C | No | Yes | Release_Master/Slave_Connection_Set |

- Class 0x05 – Connection object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance 1: 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 | WatchdogTim-outAction | 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 |

## Appendix B: DeviceNet Objects Defined by RTU-DNET

- Class 0x9A – RTU-DNET setup parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance 1

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| 1 | Get | Length of input I/O data | N/A | N/A | The sum of the length of the status word of RTU-DNET and the input data of the module connected to it.<br>Unit: byte |
| 2 | Get | Length of output I/O data | N/A | N/A | The sume of the length of the control word of RTU-DNET and the output data of the module connected to it.<br>Unit: byte |
| 3 | Get | Number of digital input points (X) | 0 ~ 128 | N/A | The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16.<br>Unit: bit |
| 4 | Get | Number of digital output points (Y) | 0 ~ 128 | N/A | The number will be regarded as 8 when it is less than 8 and as 16 when it is bigger than 8 but less than 16.<br>Unit: bit |
| 5 | Get | Number of special modules | 0 ~ 8 | N/A | The number of special modules connected to RTU-DNET |
| 6 | Get | Length of analog input | N/A | N/A | The length of input data of the special module connected to RTU-DNET.<br>Unit: word |
| 7 | Get | Length of analog output | N/A | N/A | The length of output data of the special module connected to RTU-DNET.<br>Unit: word |
| 8 | Get | Status word | 0 ~ 255 | N/A | Displaying the status of RTU-DNET.<br>See 4.3 for more details. |
| 9 | Get/Set | Control word | N/A | N/A | For setting up the mode of RTU-DNET, e.g. “H8000” for STOP mode and “H8001” for RUN mode.<br>See 4.3 for more details. |
| 10 | Get/Set | Diagnostic interval time | 1 ~ 65 secs | 5 secs | The interval when RTU-DNET executes diagnosis. |
| 11 | Get/Set | Special module | 0 ~ 2 | 1 | How RTU-DNET will react when the special module connected to it is offline. |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| | | offline treatment | | | 0: Ignored<br>1: Alarm<br>2: Stop DeviceNet IO |
| 12 | Get/Set | Special module error treatment | 0 ~ 2 | 1 | How RTU-DNET will react when it detects errors.<br>0: Ignored<br>1: Alarm<br>2: Stop DeviceNet IO |
| 13 | Get/Set | RTU-DNET configuration validation | N/A | 0 | Validating the configuration of RTU-DNET when set to “11”. |
| 14 | Get/Set | Reset RTU-DNET | N/A | 0 | Resetting RTU-DENT when set to “10”. After it, the parameter will change to “0” automatically. |

Common services

| Service code | Implemented for | | Service name |
|---|---|---|---|
| | Class | Instance | |
| 0x0E | Yes | Yes | Get_Attribute_Single |
| 0x10 | No | Yes | Set_Attribute_Single |

■ Class 0x9B – Extension module setup parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |

Instance 1 ~ 8 (parameters for the 1st ~ 8th special modules)

| Attribute ID | Access rule | Name | Range | Default | Explanation | | |
|---|---|---|---|---|---|---|---|
| 1 | Get | Model name | N/A | N/A | Model code for the special module | | |
| 2 | Get | Length of input data | N/A | N/A | The sum of the input data length of special modules connected.<br>Unit: word | | |
| 3 | Get | Length of output daat | N/A | N/A | The sum of the output data length of special modules connected.<br>Unit: word | | |
| 4 | Get | Status | 0 ~ 63 | N/A | b0 | 0 | Special module online |
| | | | | | | 1 | Special module offline |
| | | | | | b1 | 0 | Special module normal |
| | | | | | | 1 | Spcial module in error |
| | | | | | b2 | 0 | Special module and configuration consistent |
| | | | | | | 1 | Special module and configuration inconsistent |
| | | | | | b3 | 0 | Configuration data valid |
| | | | | | | 1 | Configuration data invalid |
| | | | | | b4 | 0 | Special module identifiable |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| | | | | | 1 Special module unidentifiable |
| | | | | | b5 ~ b15 Reserved |
| 5 | Get/Set | Work mode | 0 ~ 1 | 0 | Work mode of special module<br>0: auto 1: custom |
| 6 | Get/Set | Number of input data | 0 ~ 8 | N/A | Number of input data of special modules connected |
| 7 | Get/Set | Number of output data | 0 ~ 8 | N/A | Number of output data of special modules connected |
| 8 | Reserved | | | | |
| 9 | Get | Error code | | N/A | Error code in special module |
| 10~19 | Reserved | | | | |
| 20 | Get/Set | Start CR for module 1 input data | N/A | N/A | Start CR for the input data of special module 1 |
| 21 | Get/Set | Input data length for module 1 | N/A | N/A | Length of input data of special module 1 |
| 22 | Get/Set | Start CR for module 2 input data | N/A | N/A | Start CR for the input data of special module 2 |
| 23 | Get/Set | Input data length for module 2 | N/A | N/A | Length of input data of special module 2 |
| 24 | Get/Set | Start CR for module 3 input data | N/A | N/A | Start CR for the input data of special module 3 |
| 25 | Get/Set | Input data length for module 3 | N/A | N/A | Length of input data of special module 3 |
| 26 | Get/Set | Start CR for module 4 input data | N/A | N/A | Start CR for the input data of special module 4 |
| 27 | Get/Set | Input data length for module 4 | N/A | N/A | Length of input data of special module 4 |
| 28 | Get/Set | Start CR for module 5 input data | N/A | N/A | Start CR for the input data of special module 5 |
| 29 | Get/Set | Input data length for module 5 | N/A | N/A | Length of input data of special module 5 |
| 30 | Get/Set | Start CR for module 6 input data | N/A | N/A | Start CR for the input data of special module 6 |
| 31 | Get/Set | Input data length for module 6 | N/A | N/A | Length of input data of special module 6 |
| 32 | Get/Set | Start CR for module 7 input data | N/A | N/A | Start CR for the input data of special module 7 |
| 33 | Get/Set | Input data length for module 7 | N/A | N/A | Length of input data of special module 7 |
| 34 | Get/Set | Start CR for module 8 input data | N/A | N/A | Start CR for the input data of special module 8 |
| 35 | Get/Set | Input data length for module 8 | N/A | N/A | Length of input data of special module 8 |
| 36 ~ 49 | Reserved | | | | |
| 50 | Get/Set | Start CR for module 1 output data | N/A | N/A | Start CR for the output data of special module 1 |
| 51 | Get/Set | Output data length | N/A | N/A | Length of output data of special module 1 |

| Attribute ID | Access rule | Name | Range | Default | Explanation |
|---|---|---|---|---|---|
| | | for module 1 | | | |
| 52 | Get/Set | Start CR for module 2 output data | N/A | N/A | Start CR for the output data of special module 2 |
| 53 | Get/Set | Output data length for module 2 | N/A | N/A | Length of output data of special module 2 |
| 54 | Get/Set | Start CR for module 3 output data | N/A | N/A | Start CR for the output data of special module 3 |
| 55 | Get/Set | Output data length for module 3 | N/A | N/A | Length of output data of special module 3 |
| 56 | Get/Set | Start CR for module 4 output data | N/A | N/A | Start CR for the output data of special module 4 |
| 57 | Get/Set | Output data length for module 4 | N/A | N/A | Length of output data of special module 4 |
| 58 | Get/Set | Start CR for module 5 output data | N/A | N/A | Start CR for the output data of special module 5 |
| 59 | Get/Set | Output data length for module 5 | N/A | N/A | Length of output data of special module 5 |
| 60 | Get/Set | Start CR for module 6 output data | N/A | N/A | Start CR for the output data of special module 6 |
| 61 | Get/Set | Output data length for module 6 | N/A | N/A | Length of output data of special module 6 |
| 62 | Get/Set | Start CR for module 7 output data | N/A | N/A | Start CR for the output data of special module 7 |
| 63 | Get/Set | Output data length for module 7 | N/A | N/A | Length of output data of special module 7 |
| 64 | Get/Set | Start CR for module 8 output data | N/A | N/A | Start CR for the output data of special module 8 |
| 65 | Get/Set | Output data length for module 8 | N/A | N/A | Length of output data of special module 8 |

Common services

| Service code | Implemented for | | Service name |
|---|---|---|---|
| | Class | Instance | |
| 0x0E | Yes | Yes | Get_Attribute_Single |
| 0x10 | No | Yes | Set_Attribute_Single |

- Class 0x9C – Extension module parameter object

Class attribute

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Revision | UINT |
| 2 | Get | MaxInstance | UINT |

Instance 1 ~ 8 (CR fpr the 1st ~ 8th special module)

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| 1 | Get | Content in CR#0 | UINT |
| 2 | Get/Set | Content in CR#1 | UINT |
| 3 | Get/Set | Content in CR#2 | UINT |

| Attribute ID | Access rule | Name | Data type |
|---|---|---|---|
| … | … | … | UINT |
| 9 | Get/Set | Content in CR#8 | UINT |
| 10 | Get/Set | Content in CR#9 | UINT |
| … | … | … | UINT |

Common services

| Service code | Implemented for | | Data type |
|---|---|---|---|
| | Claass | Instance | |
| 0x0E | Yes | Yes | Get_Attribute_Single |
| 0x10 | No | Yes | Set_Attribute_Single |