PROFI-5000 User Manual

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

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Revision Note

Date	Author	Version	Revision
2009/10/01	**Jeff Ma**	**1.0**	Release
2012/06/08	**Ryan Lin**	**1.1**	Add PROFI-5017/ PROFI-5017C/ PROFI-5024
2013/06/18	**Ryan Lin**	**1.2**	Add PROFI-5018

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1. Introduction

1.1. Overview

PROFIBUS is an open, digital communication system with a wide range of applications, particularly in the fields of factory automation and process automation. PROFIBUS is suitable for both fast, time-critical applications and complex communication tasks. PROFIBUS-DP is a famous protocol that enables simple, fast, cyclic and deterministic process data exchange between Master and assigned Slave.

The PROFI-5000 Compact Remote I/O Module is specially designed for the slave device of PROFIBUS DP protocol. To setup PROFIBUS network, users can choose and configure I/O modules by using the GSD file without any other setting tools.

1.2. Product Information

Type		Model	Description
Digital Output		PROFI-5045	24-channel Isolated Digital Output
Digital Input		PROFI-5051	24-channel Isolated Digital Input
		PROFI-5052	12-channel Isolated Digital Input
		PROFI-5053	24-channels Dry Contact Non-Isolated Digital Input
Digital Input and Digital Output		PROFI-5050	16-channel Non-Isolated Digital Input and 8-channel Non-Isolated Digital Output
		PROFI-5055	8-channel Isolated Digital Input and 8-channel Isolated Digital Output
Power Relay Output		PROFI-5060	8-channel Isolated Digital Input and 4-channel Relay Output
Analog Input	Voltage & Current	PROFI-5017	8-Ch Isolated Analog Voltage Input
		PROFI-5017C	8-Ch Isolated Analog Current Input
	Thermocouple	PROFI-5018	10-Ch Isolated Thermocouple Input
Analog Output		PROFI-5024	4-Ch Isolated Analog Voltage & Current Output

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1.3. Features

- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**

Protocol & Hierarchy	DP-V0 Slave
Supports Transmission Rate (Kbps)	9.6, 19.2, 45.45, 93.75, 187.5, 500, 1500, 3000, 6000, 12000
Transmission Rate Setting	detected automatically
Address Setting	0~99 set by Rotary switches
Indicators	PWR and RUN LED
I/O modules Configuration	Configured by GSD file
Network Isolation Protection	High Speed iCoupler
DC Isolation Protection	3000VDC on PROFIBUS side

- **PROFI-5017/ PROFI-5017C/ PROFI-5018/PROFI-5024**

Protocol & Hierarchy	DP-V0 Slave
Supports Transmission Rate (Kbps)	9.6, 19.2, 45.45, 93.75, 187.5, 500, 1500, 3000, 6000, 12000
Transmission Rate Setting	detected automatically
Address Setting	0~126 set by Rotary switches or SAA-telegram
Indicators	PWR LED and RUN LED,ERR LED
I/O modules Configuration	Configured by GSD file
Network Isolation Protection	High Speed iCoupler
DC Isolation Protection	3000VDC on PROFIBUS side

1.4. Specifications

- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**

PROFIBUS Interface	9-pin D-Sub(Female)
PROFIBUS Controller	Profichip VPCLS2
PROFIBUS Transceiver	ADI ADM2486 iCoupler Isolated transceiver
Transmission Rate	Up to 12Mbps
Power Requirement	10V ~ 40V
Power Consumption	1W
Operating Temp.	-25℃ ~ +75℃
Storage Temp.	-30℃ ~ +85℃

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Humidity	5% ~ 95%(Non Condensing)
Dimensions	91x128x52 mm

- **PROFI-5017/ PROFI-5017C**

PROFIBUS Interface	9-pin D-Sub(Female)
PROFIBUS Controller	Siemens SPC3
PROFIBUS Transceiver	ADI ADM2486 iCoupler Isolated transceiver
Transmission Rate	Up to 12Mbps
Power Requirement	10V ~ 40V
Power Consumption	3W
Operating Temp.	-25℃ ~ +75℃
Storage Temp.	-30℃ ~ +85℃
Humidity	5% ~ 95%(Non Condensing)
Dimensions	91x128x52 mm

- **PROFI-5018**

PROFIBUS Interface	9-pin D-Sub(Female)
PROFIBUS Controller	Siemens SPC3
PROFIBUS Transceiver	ADI ADM2486 iCoupler Isolated transceiver
Transmission Rate	Up to 12Mbps
Power Requirement	10V ~ 40V
Power Consumption	3.5W
Operating Temp.	-25℃ ~ +75℃
Storage Temp.	-30℃ ~ +85℃
Humidity	5% ~ 95%(Non Condensing)
Dimensions	91x130x52 mm

- **PROFI-5024**

PROFIBUS Interface	9-pin D-Sub(Female)
PROFIBUS Controller	Siemens SPC3
PROFIBUS Transceiver	ADI ADM2486 iCoupler Isolated transceiver
Transmission Rate	Up to 12Mbps
Power Requirement	10V ~ 40V
Power Consumption	4W

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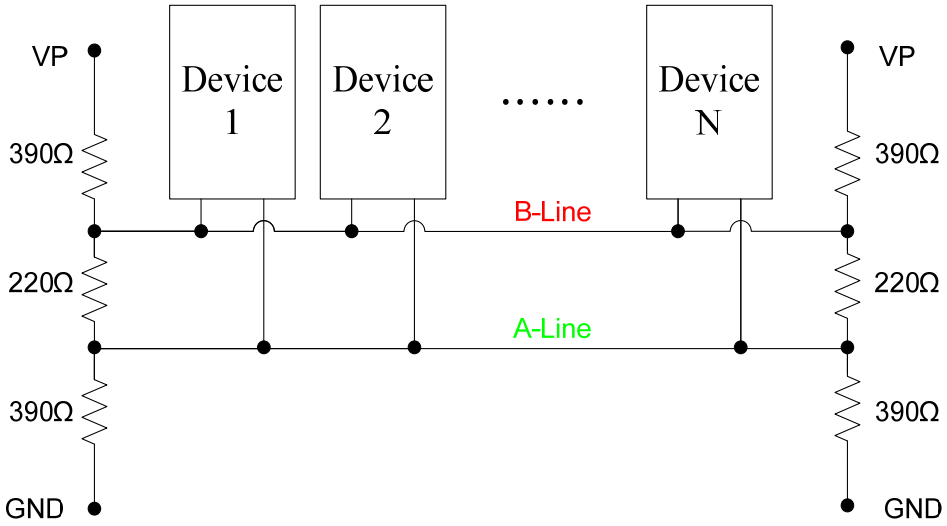
Operating Temp.	-25℃ ~ +75℃
Storage Temp.	-30℃ ~ +85℃
Humidity	5% ~ 95%(Non Condensing)
Dimensions	91x128x52 mm

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2. Hardware

2.1. Bus Wiring

In order to minimize the reflection effect of the signal transmission, PROFIBUS device has to fit with an active terminal resistor at both first node and last node, as shown below



However, the number of station in PROFIBUS network is also restricted. According to PROFIBUS specification, it is up to 32 stations connected in a PROFIBUS segment. If more than 32 stations are connected, the PROFIBUS repeater must be used to link the individual bus segments.

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2.2. PROFIBUS Cable and Transmission Distance

The PROFIBUS cable with following properties has different transmission distance with respect to different transmission rate, shown in the following table

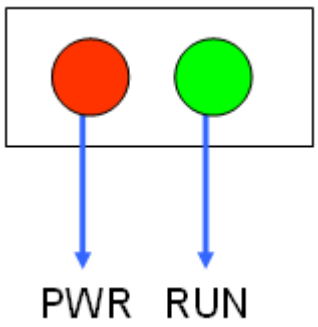
1. Impedance :135~165Ω
2. Capacity : lower than 30 pF/m
3. Loop resistance : lower than 110Ω/Km
4. Wire diameter : larger than 0.65mm
5. Core cross-section : larger than 0.34mm^2

Transmission Rate(Kbps)	Transmission Distance per Segment (meter)
9.6, 19.2, 45.45, 93.75	1200
187.5	1000
500	400
1500	200
3000, 6000, 12000	100

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2.3. Status Indicator

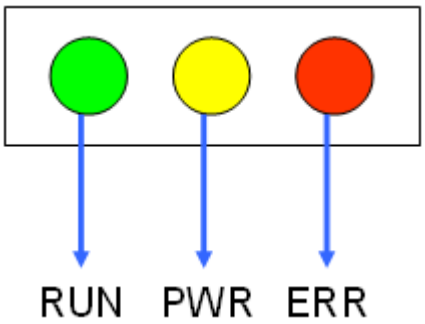
- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**



It provides two status indicator, they are PWR LED (red) and RUN LED (green). When the power is supplied to module, PWR LED will turn on; If CHK_CFG procedure is finished, RUN LED will turn on. The table explains the relationship between them.

Status Indicator	Meaning	Recommend solution
PWR ON & RUN OFF	Master not Ready, or Address not Match or Cfg Fault(Note 2.)	1. Check the address setting of module and DP-master. 2. Sets the DP-Master to operation mode. 3. Make sure of the consistency of Module Selection.
PWR ON & RUN ON	Module is in clear mode or Operate mode*.	N/A

- **PROFI-5017/ PROFI-5017C/ PROFI-5018/ PROFI-5024**



It provides three types of status indicator, they are PWR LED (yellow), ERR LED (red) and RUN LED (green). When the power is supplied to module, PWR LED will turn on; If CHK_CFG procedure is finished, RUN LED will turn on and ERR LED will turn off. The table explains the relationship between

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them.

Status Indicator	Meaning	Recommend solution
ERR ON & RUN OFF	Offline Mode	Check the address setting of module and DP-master.
ERR Flash(10Hz)	Stop Mode	Check the DP-Master is ready to communicate with module.
ERR Flash(2Hz)	Prm Fault	Check the setting of module in the master interface and make sure of the consistency.
ERR Flash(1Hz)	Cfg Fault	Same as above
ERR ON & RUN ON	Clear Mode	Sets the DP-Master from clear mode to operation mode
ERR OFF & RUN ON	Operate Mode	
PWR & ERR Flash Interlace(2Hz)	Diag Exist (Diag. Msg. Request)	Check the Input/Output value that if exceed/under the limit

Note 1: “Prm Fault” is the abbreviation of “Parameter Fault”; It means that the number of parameter data which receive from DP-Master is not consistency with DP-Slave (PROFI-5017(C)), and it could due to the difference between module installation and master setting.

Note 2:“Cfg Fault” is the abbreviation of “Configuration Fault”, it means that the number of configuration data which receive from DP-Master is not consistency with DP-Slave (PROFI-5017(C)), and it could due to the wrong order of installation.

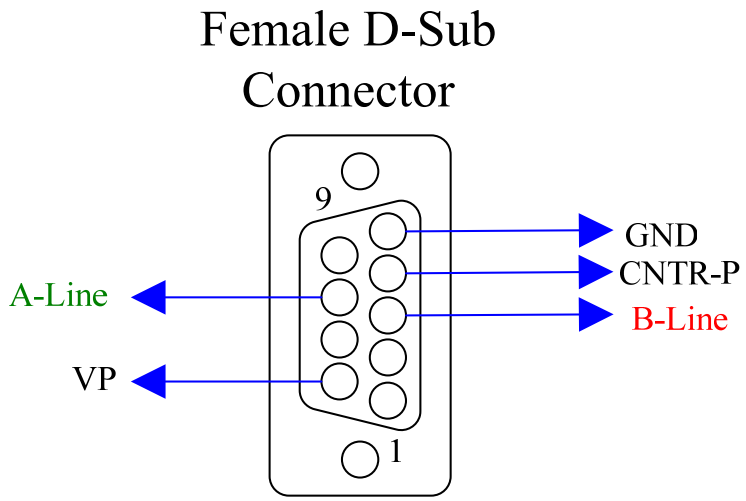
Note *: there are four kinds of state in PROFIBUS DP Master.

1. Offline mode: Master not active on the bus.
2. Stop mode: Master only transmit token on the bus, and PROFIBUS DP is not active.
3. Clear mode: DP Master active, but all output are zero or set to fail-safe state.
4. Operate mode: DP Master full active.

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2.4. Connector

The connector of PROFI-5000 is shown below



Pin No.	Signal	Meaning
3	B-Line	Receive/Transmit data - plus
4	CNTR-P	Repeater control signal, RTS signal
5	GND	Power ground of active terminator
6	VP	Power 5 volt of active terminator
8	A-Line	Receive/Transmit data - minus

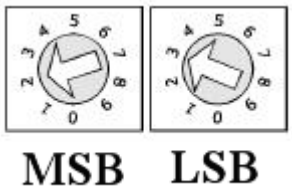
Note: The connector of PROFI-5000 has no terminators; users must use the connector with the terminator inside. The power of the terminator will provide by terminal device.

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2.5. Node Address

According to PROFIBUS specification, the station address which from 0 to 126 is valid, and the address 126 is a special address that supports the remote setting SSA telegram from Class 2 DP-Master.

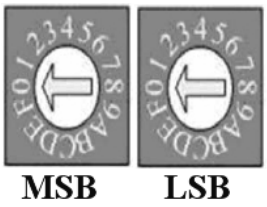
- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**



- The figure shown above is the decimal rotary switch. It dominates the node (station) address of PROFI-5000. The left side switch is high nibble of address and the other one is low nibble of address.
- It doesn't support SSA service for setting node address.

EX 1 : MSB = 2, LSB = 3, node address => (2*10+3) = 23

- **PROFI-5017/ PROFI-5017C/ PROFI-5018/ PROFI-5024**



- The figure shown above is the decimal rotary switch. It dominates the node (station) address of PROFI-5000. The switch is which labeled MSB is high nibble of address and the other one is low nibble of address.
- Module applies the setting of rotary switch as its address if the address is valid. While the address is invalid, module loads the pre-saved value from EEPROM. Moreover, if the address is invalid (126) again, module awaits the SSA telegram and applies it. (Note: If you want to clear the setting stored at EEPROM, you just adjust rotary switch to FF before the power supplied).

Rotary	Pre-saved address	SSA Telegram	Station Address

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Switch(dec)	(EEPROM)		
0~125	Do not care	No Accept	Rotary Switch
126~254	0~125	No Accept	Pre-saved address(EEPROM)
	126(default)	Accept with address 0~125	SSA Telegram and save address to EEPROM
	127~254	impossible	N/A
255	Clear to 126	Accept with address 0~125	SSA telegram and save address to EEPROM

Note 1: Only one DP-Slave station with address 126 permitted in the bus.

Note 2: if you want to change the station address after data exchange, PROFI-5017(C) should return to Wait-Prm state and wait for one second to apply the new address.

EX 1 : MSB = 0, LSB = B, node address => (0*16+11) = 11

EX 2 : MSB =7, LSB = 9, node address => (7*16+9) = 121

EX 3 : MSB =7, LSB = F, EEPROM = 15,
126 < (7*16+F) = 127 < 254
node Address = Pre-saved address (EEPROM) = 15

EX 4 : MSB = 8, LSB = A, EEPROM = 126,
126 < (8*16+A) = 128 < 254
node Address = SSA Telegram and save address to EEPROM

EX 5 : MSB = F, LSB = F,
(F*16+F) = 255
Station Address = SSA Telegram and save address to EEPROM

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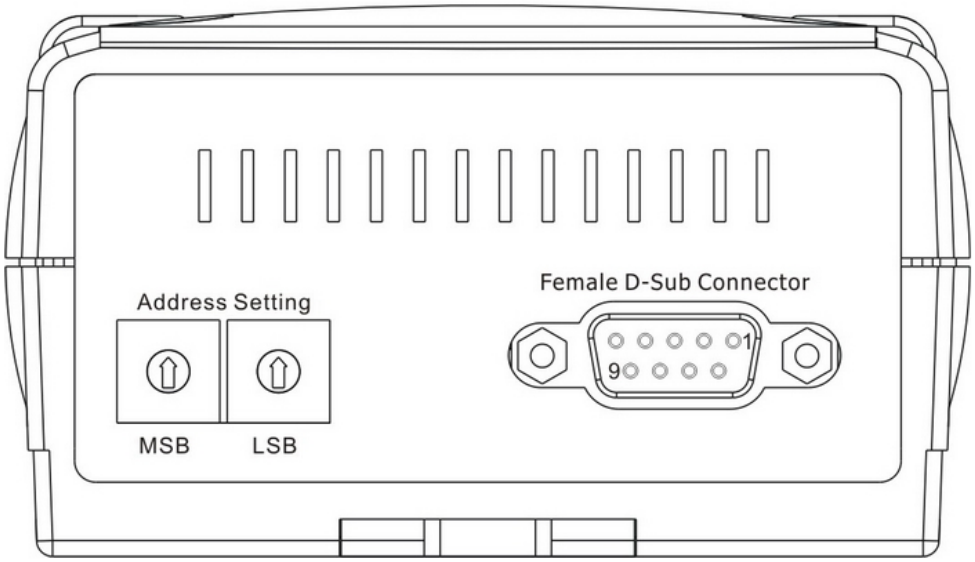
2.6. Baud rate support

PROFI-5000 supports the entire baud rates of PROFIBUS. They are 9.6Kbps, 19.2Kbps, 45.45Kbps, 187.5Kbps, 500Kbps, 1.5Mbps, 3Mbps, 6Mbps, and 12Mbps. Because PROFI-5000 has a functionality of auto- detection for baud rates, users don't need to set the baud rate manually.

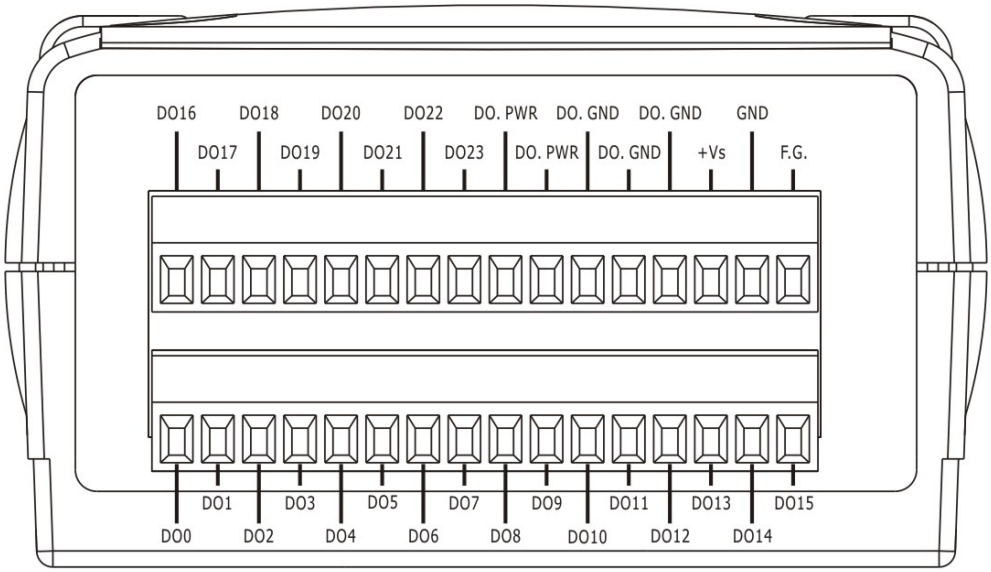
Note: Many baud rates only are supported by the particular cable or speed. For the detail, please refer to the above section "**PROFIBUS Cable and Transmission Distance"**

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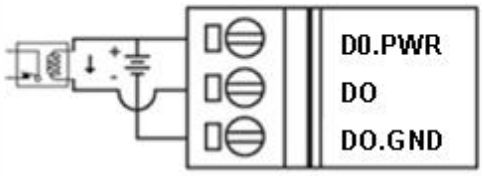
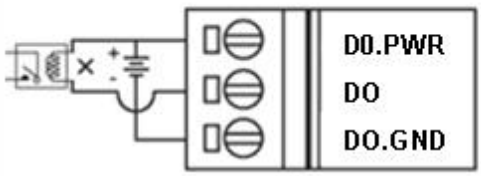
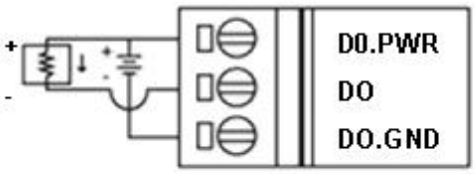
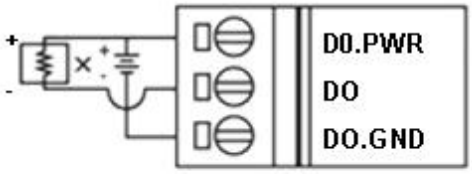
2.7. Pin assignment and I/O wiring



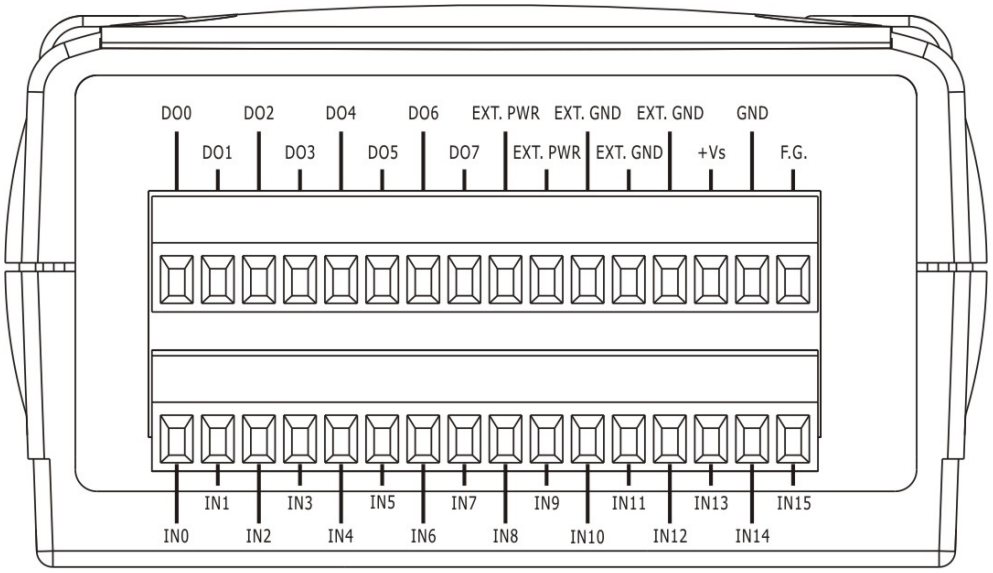
- PROFI-5045



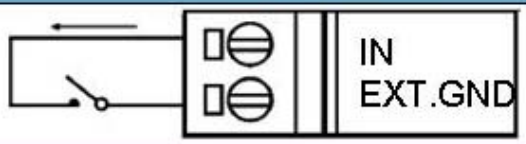
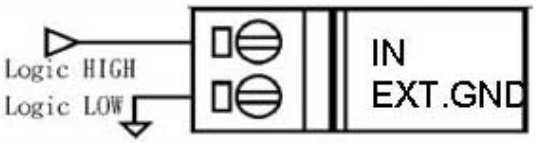
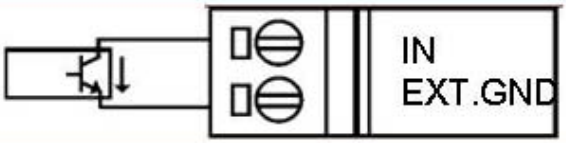
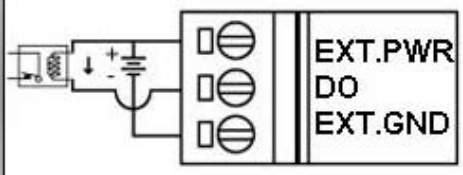
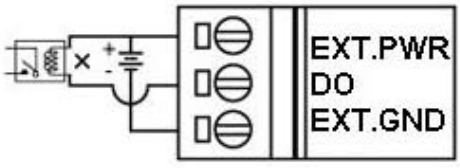
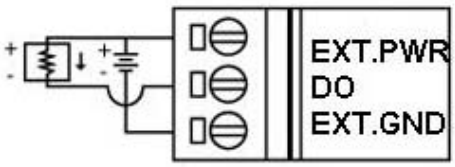
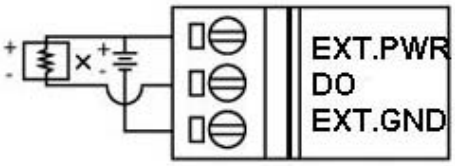
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Output Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Drive Relay	Relay ON	Relay OFF
		
Resistance Load		

- PROFI-5050

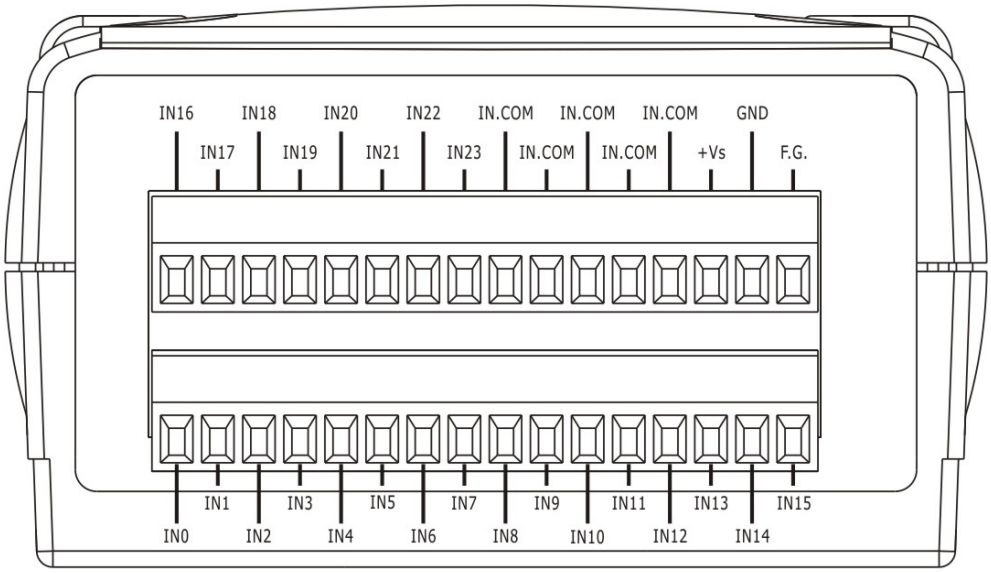


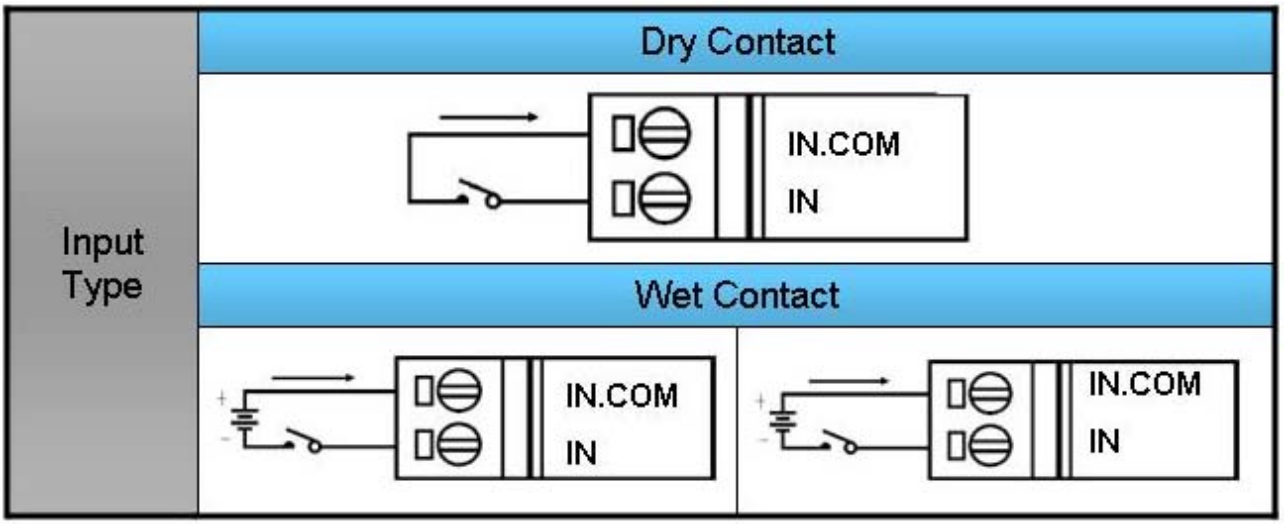
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</td></tr>
<tr><td colspan="2">TTL/CMOS</td></tr>
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<tr><td colspan="2">Open Collector</td></tr>
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<tr><td rowspan="3">Output Type</td><td>ON State LED ON
Readback as 1</td><td>OFF State LED OFF
Readback as 0</td></tr>
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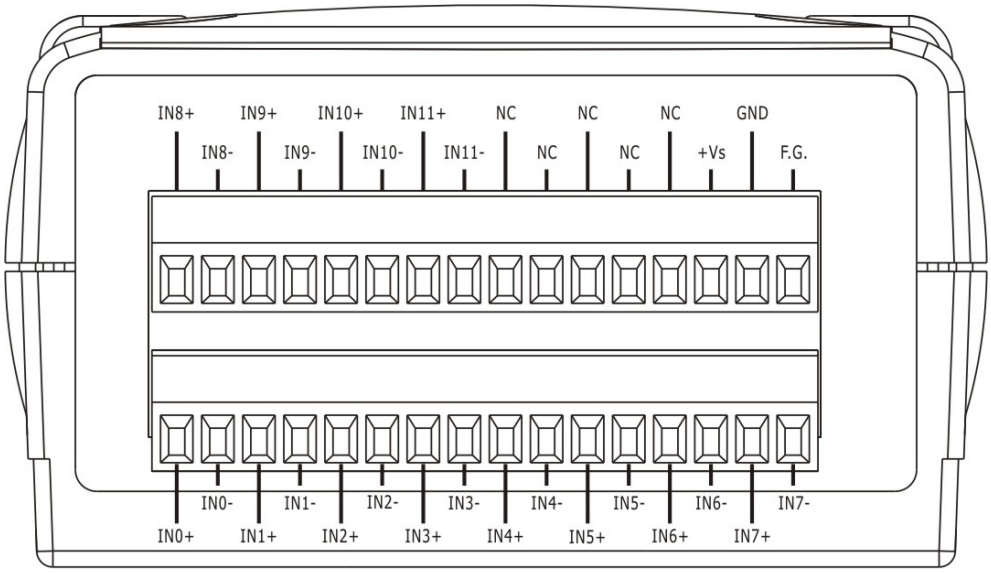
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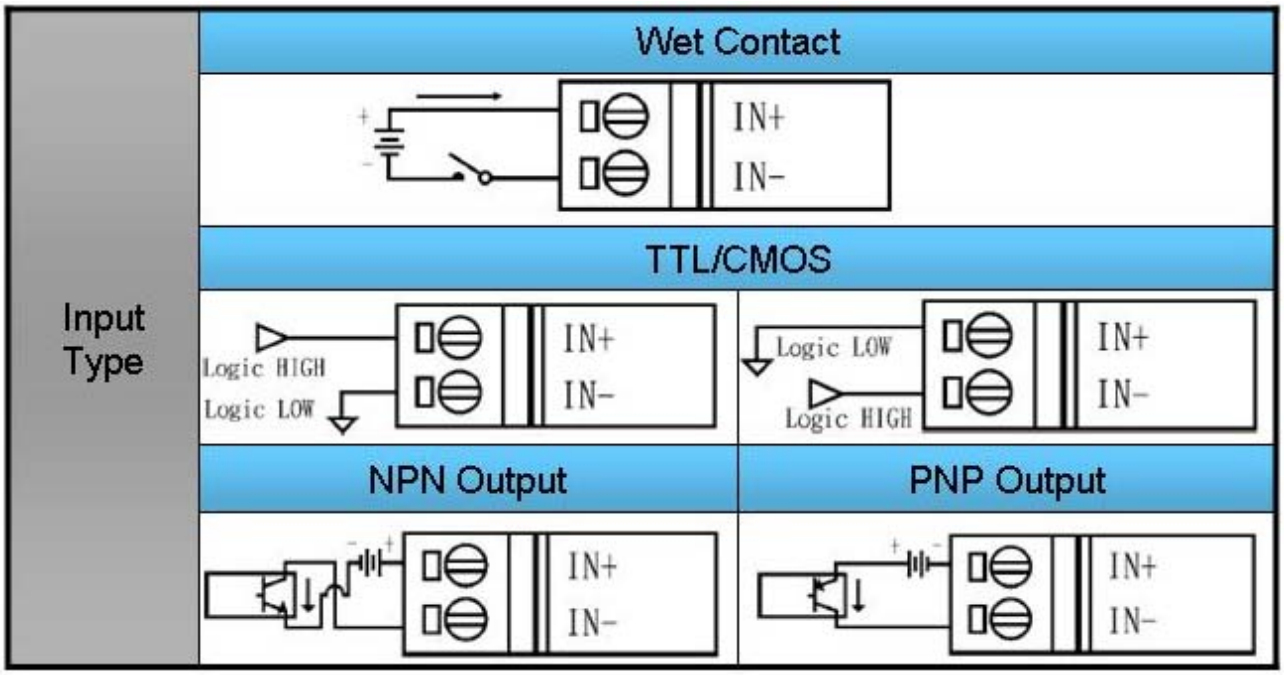




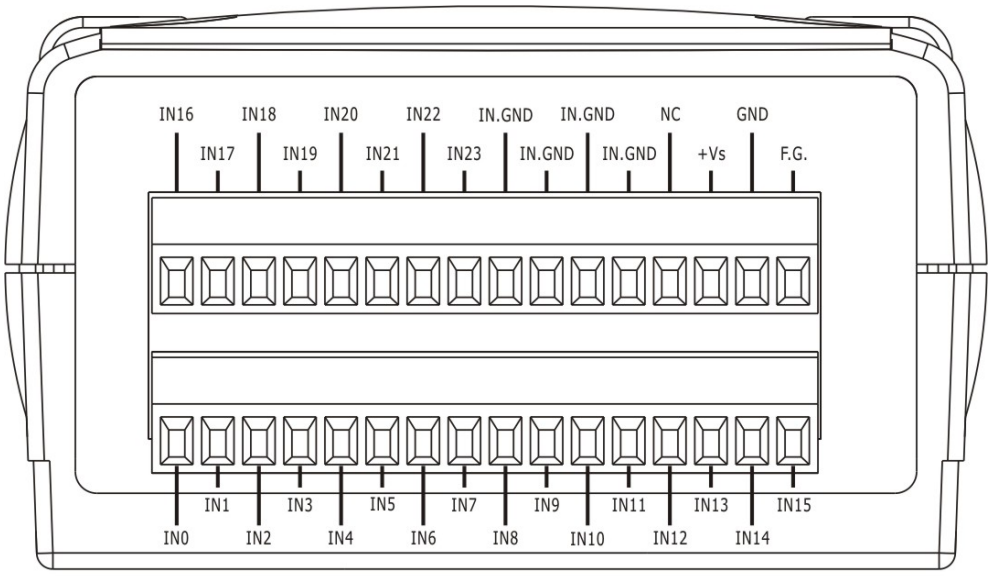
- PROFI-5052



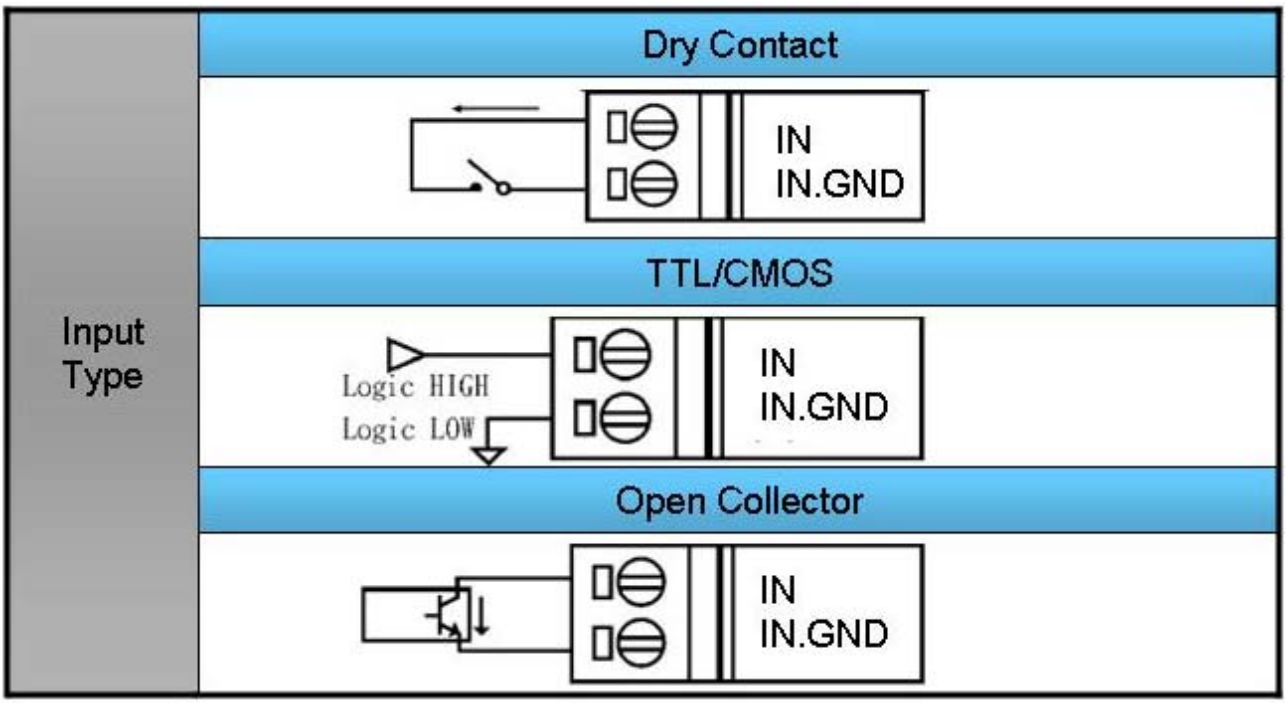
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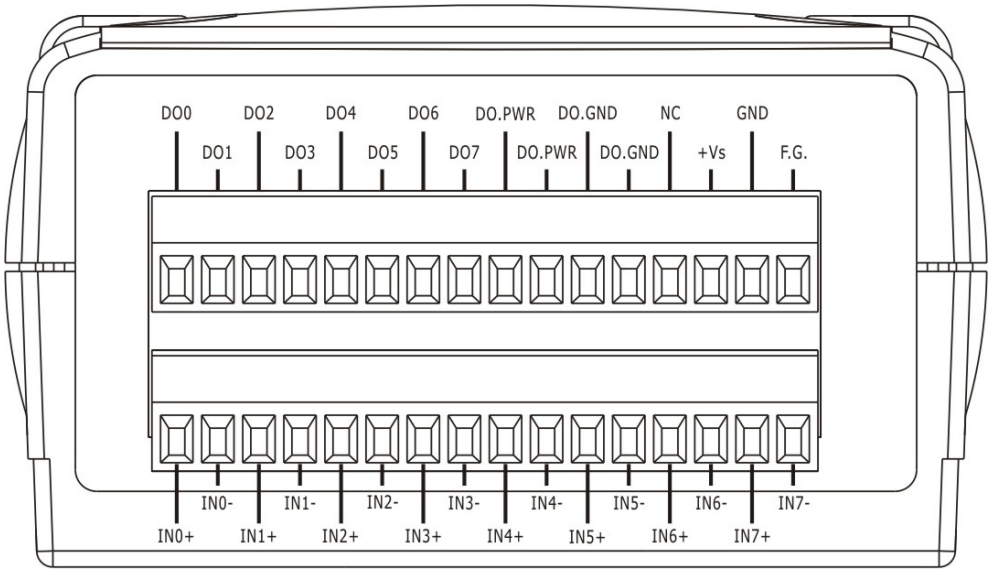
- PROFI-5053



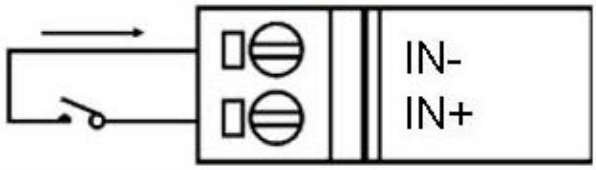
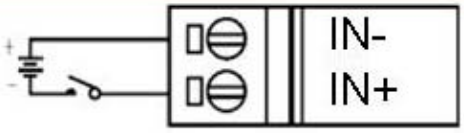
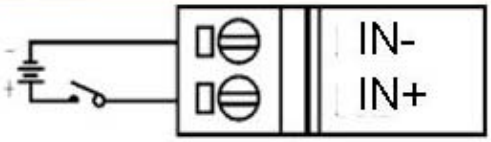
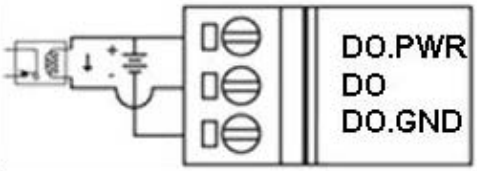
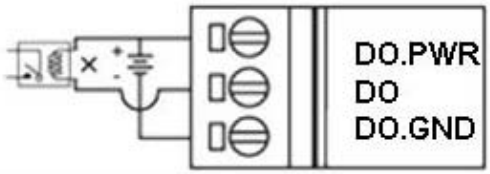
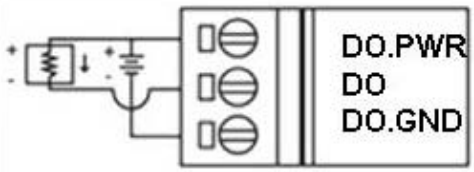
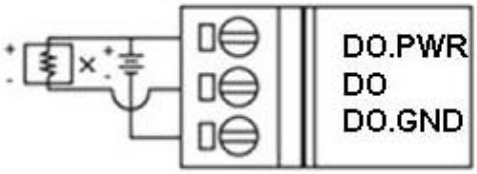
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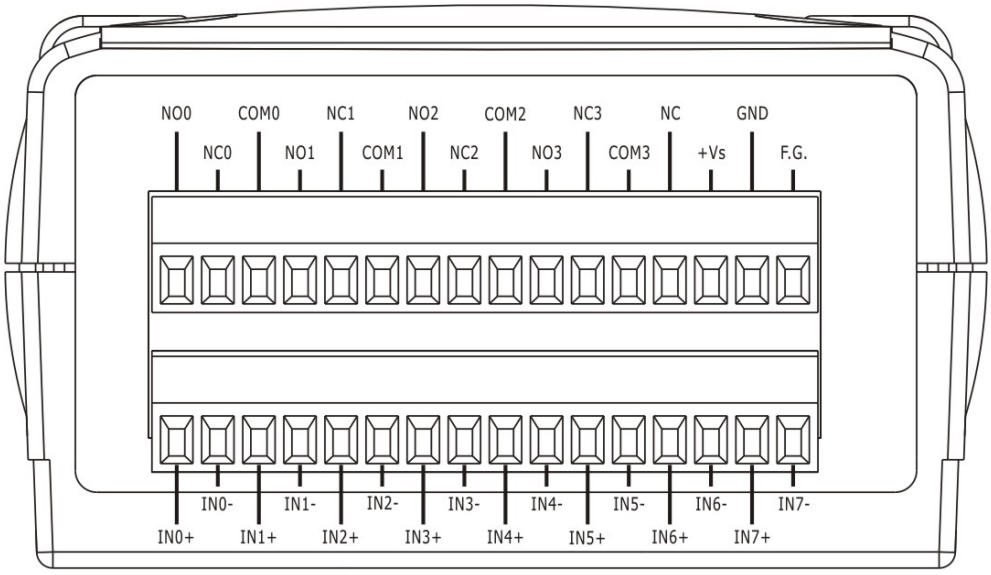
- PROFI-5055



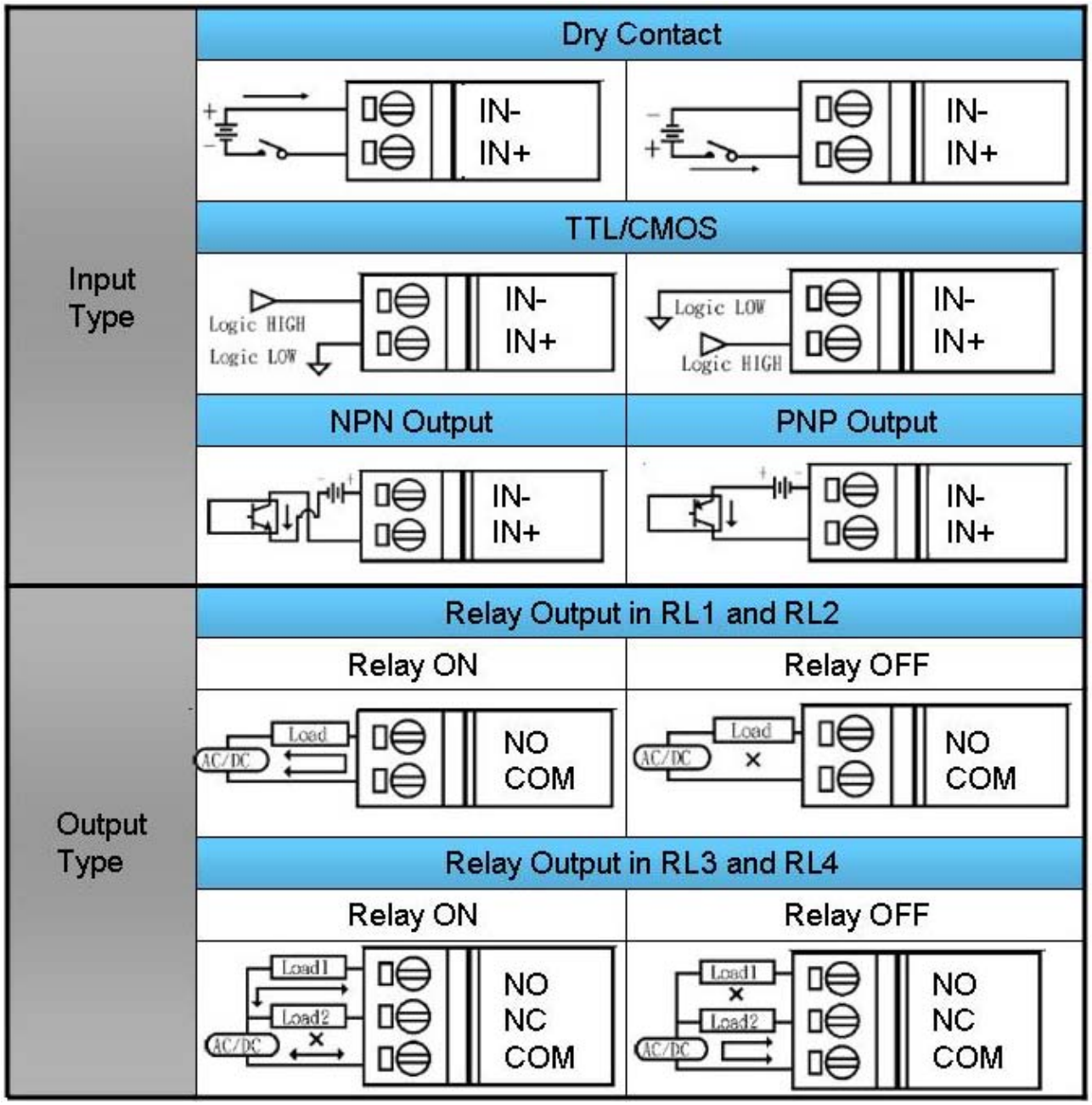
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<table>
<tr><td rowspan="3">Input Type</td><td colspan="2">Dry Contact</td></tr>
<tr><td colspan="2">
</td></tr>
<tr><td colspan="2">Wet Contact</td></tr>
<tr><td></td><td>
</td><td>
</td></tr>
<tr><td>Output Type</td><td>ON State LED ON
Readback as 1</td><td>OFF State LED OFF
Readback as 0</td></tr>
<tr><td></td><td>Relay ON</td><td>Relay OFF</td></tr>
<tr><td>Drive Relay</td><td>
</td><td>
</td></tr>
<tr><td>Resistance Load</td><td>
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- PROFI-5060

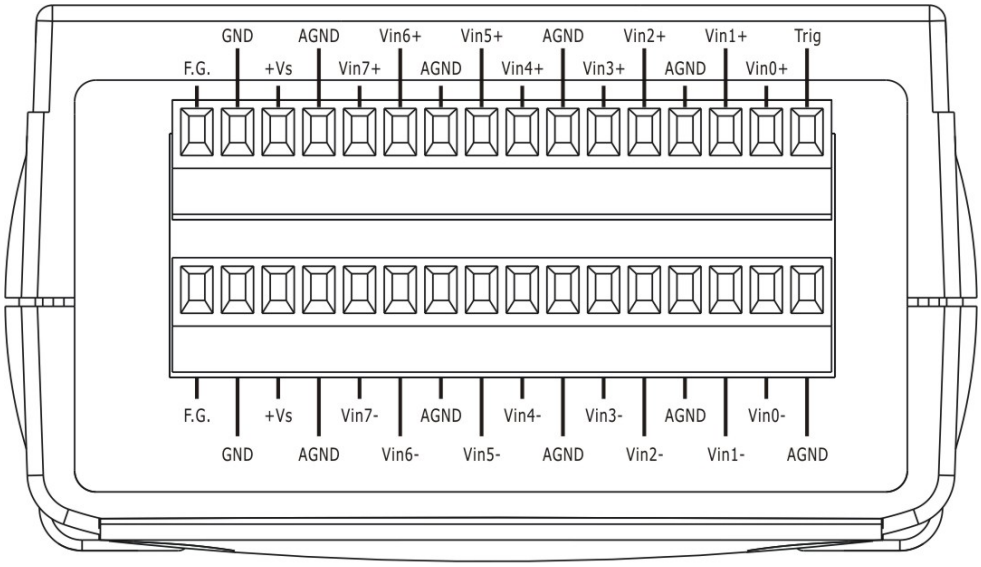


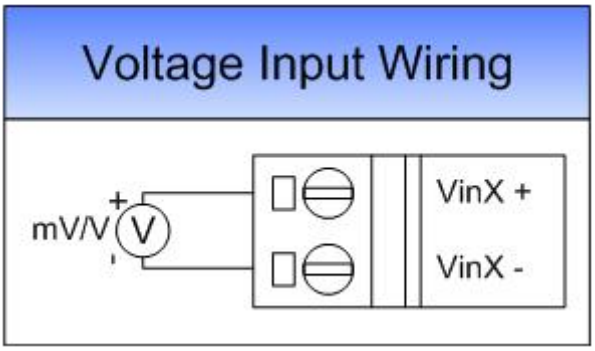
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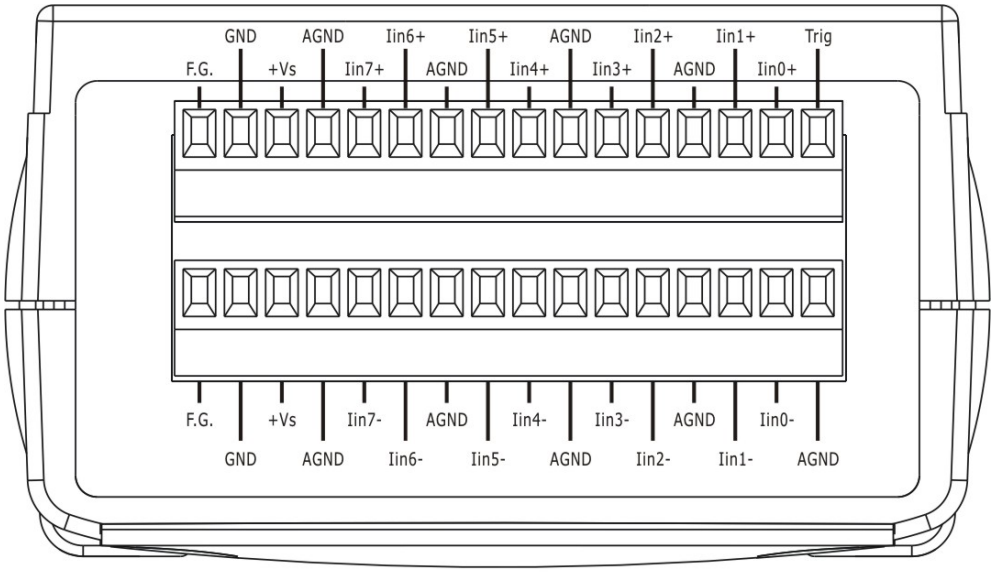
- PROFI-5017

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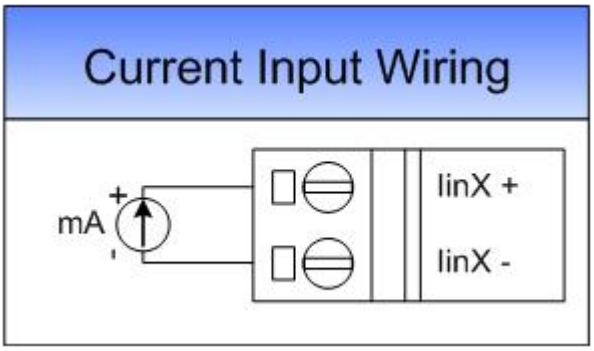




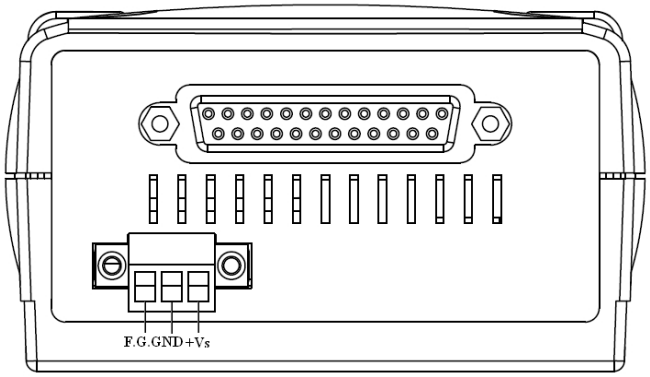
- PROFI-5017C

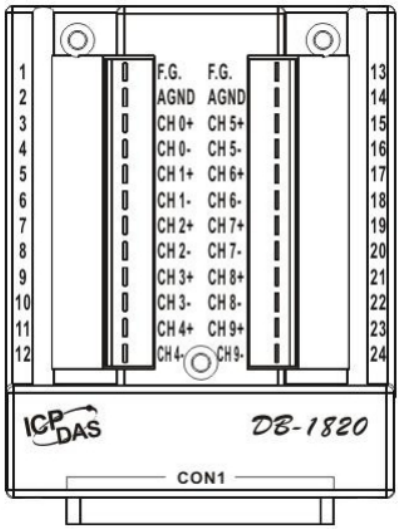


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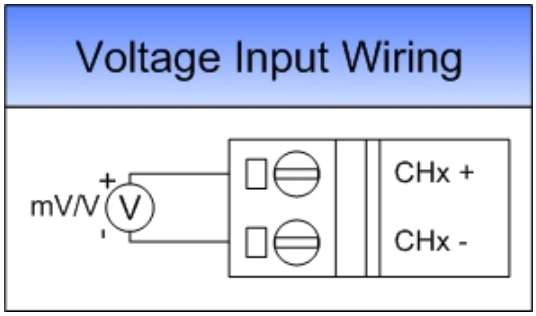
- PROFI-5018+DB-1820(transformation connector)

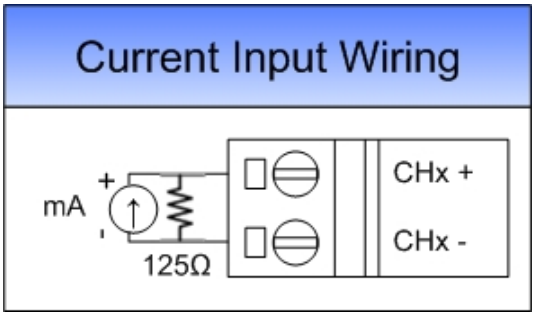




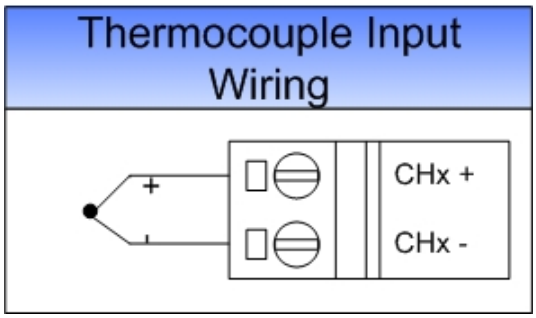
Pin Assignment	Terminal	No.	Pin Assignment
+5V	01	14	AGND
CJC	02	15	CH 0+
CH 0-	03	16	CH 1+
CH 1-	04	17	CH 2+
CH 2-	05	18	CH 3+
CH 3-	06	19	CH 4+
CH 4-	07	20	CH 5+
CH 5-	08	21	CH 6+
CH 6-	09	22	CH 7+
CH 7-	10	23	CH 8+
CH 8-	11	24	CH 9+
CH 9-	12	25	N.C.
N.C.	13	Shield	F.G.

25-pin Female D-Sub Connector

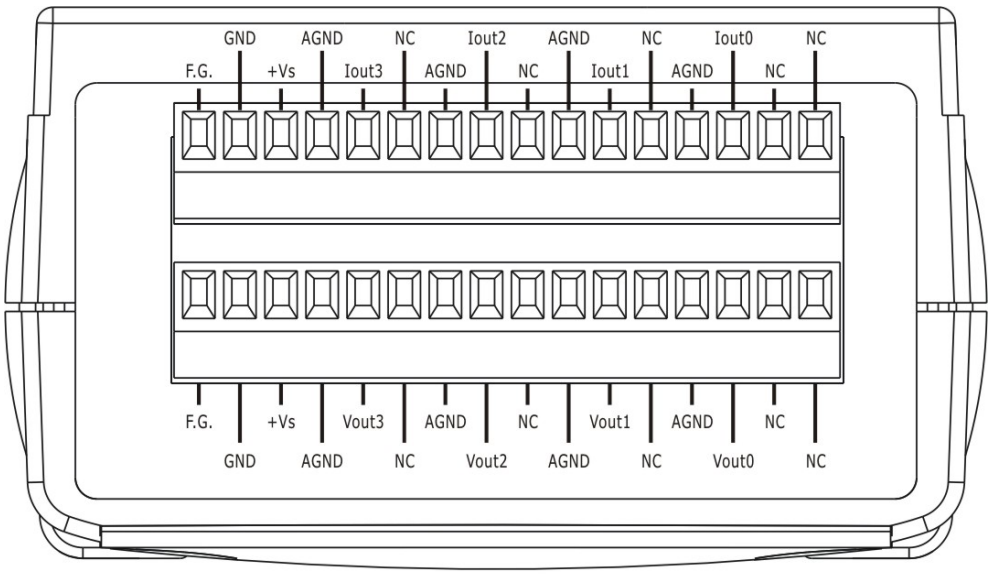


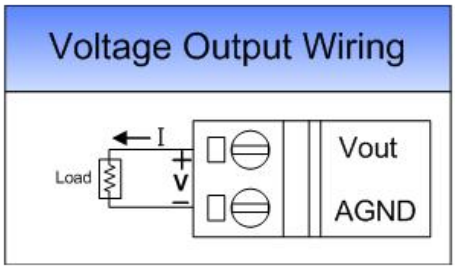


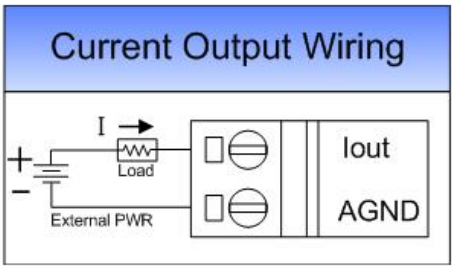
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- PROFI-5024



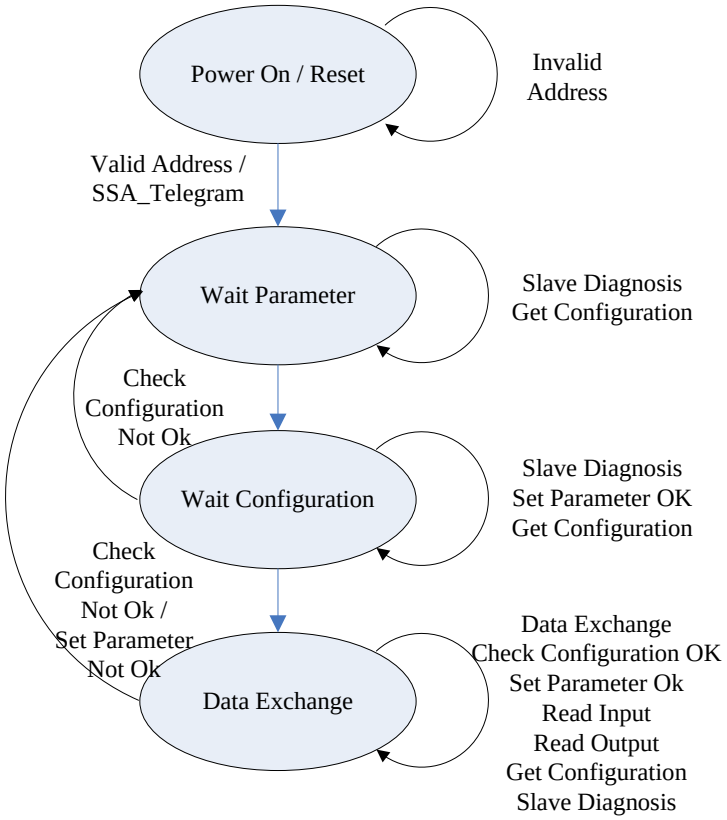




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3. PROFIBUS DP System

The flow chart of the DP-slave



Before DP-Slave changes to data exchange state, it employs some telegrams to initialize and establish the connection with DP-Master. These telegrams include Slave Diagnosis (Slave_Diag), Set Parameter (Set_Prm), Check Configuration (Chk_Cfg), Slave Diagnosis, Data Exchange (Data_Exch) and optional global control (GC). The explanation is as follows:

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3.1. Power On / Reset

While the power supplied, PROFI-5000 loads the value of rotary switches first and decides to apply it immediately. Be attention to duplicate address setting with others, it may occur any unpredictable accident.

3.2. Wait Parameterization

In order to establish the connection completely, the DP-Slave should obtain enough information from the DP-Master. The DP-Slave applies the parameterization data to the I/O module of DP-Slave. DP-master divided these parameters into two parts: one is master-related parameter, and another one is module-related parameter. Master-related parameters provide the common setting between DP-Master and DP-Slave (e.g. Byte-Order). Module-related parameters provide the fundamental setting of the I/O modules in DP-Slave. If the parameters have been applied successfully, DP-state will switch to wait configuration, otherwise return to wait parameter.

System Parameters - Byte Order

Byte order is an important factor related to the memory allocation. Big-endian byte order (Motorola format) allocates more significant byte in lower memory address. On the other hand, little-endian Byte order (Intel format) allocates more significant byte in higher memory address.

For example, the integer which value is 0x0400(hex) will allocates 0x40(hex) in the first byte of the memory allocated to the integer and 0x00(hex) in the second byte.

- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**
  - Module has no parameterization data.

- **PROFI-5017/ PROFI-5017C**
  PROFI-5017(C) is a standard analog input module; it requires the parameter of “Data Format”, “Data Range” and “Diag Enable” to establish the connection completely.

  Data range means the measurement type (voltage, current) and range.
  1. Volt Inp. Range: +/- 10.0 V
  2. Volt Inp. Range: +/- 5.0 V

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3. Volt Inp. Range: +/- 2.5 V
4. Volt Inp. Range: +/- 1.25 V
5. Curr Inp. Range: 0 ~20000uA

Data format can be selected either engineer unit format or hexadecimal format.

1. Engineer-unit format
2. Hexadecimal format

Diag Enable is a flag that determines PROFI-5017(C) whether diagnostic message will report or not.

- **PROFI-5018**

PROFI-5018 is a Thermocouple input module; it requires the parameter of “Data Format”, “Filter Selection”, “CJC Enable”, “Channel Enable”, “Diag Enable”, “Type Code” and “CJC-Offset” to establish the connection completely.

Data format can be selected either engineer unit format or hexadecimal format.

1. Engineer-unit
2. 2’s Complement HEX

Filter Selection can be selected either 60Hz rejection or 50Hz rejection.

CJC Enable is a flag that determines PROFI-5018 whether CJC(cold junction compensation) will enable or not.

Channel Enable is a flag that determines PROFI-5018 whether current channel will acquisition data or not.

Diag Enable is a flag that determines PROFI-5018 whether diagnostic message will report or not.

Type Code means the measurement type (voltage, current, temperature) and range.

1. +/- 15 mV
2. +/- 50 mV
3. +/- 100 mV

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4. +/- 500 mV
5. +/- 1.0 V
6. +/- 2.5 V
7. +/- 20mA (external 125 Ohm)
8. +4 ~ 20mA (external 125 Ohm)
9. Thermocouple J type
10. Thermocouple K type
11. Thermocouple T type
12. Thermocouple E type
13. Thermocouple R type
14. Thermocouple S type
15. Thermocouple B type
16. Thermocouple N type
17. Thermocouple C type
18. +0 ~ 20mA (external 125 Ohm)

CJC Offset is used to adjust CJC.

- **PROFI-5024**

PROFI-5024 is a standard analog output module; it requires the data of "Data Format" and "Diag Enable" to establish the connection completely.

Data format can be selected either engineer unit format or hexadecimal format and output type (voltage, current).

1. Engineer-unit format(mV)
2. Hexidecimal format(Voltage)
3. Engineer-unit format(mA)
4. Hexidecimal format(Current)
5. Engineer-unit format(uA)

Diag Enable is a flag that determines PROFI-5024 whether diagnostic message will report or not.

On the other hand, PROFI-5024 has the Safe Value output mechanism. It can output the Safe Value while PROFI-5024 has been changed to stop mode (or offline mode). The safe value can make sure of the correctness of operating. There are three modes in safe value for users: Retain Last Value, Clear Output and Switch to Substitute Value.

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"Retain Last Value" is that PROFI-5024 retain the last valid output value for the corresponding channel.

"Clear Output" clear the corresponding channel to analog zero volt, analog zero ampere.

"Substitute Value" follows Safe mode selection in module parameter, it is setting by user, it must be obey the data range of corresponding data format and type-code.

3.3. Wait Configuration

Configuration data generates by configuration tools according to GSD file. The users select the module he wants, and configuration data generate correspondingly.

If the module installed is not consistency with configuration, "configuration fault" diagnosis message will report by slave device.

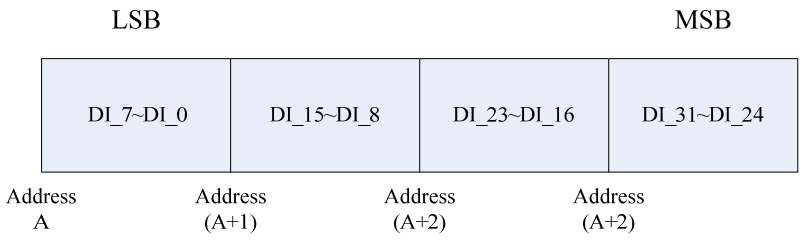
3.4. Data Exchange

After the configuration procedure has been accomplished, PROFI-5000 exchanges I/O data with the DP-Master cyclically. In following section, we introduce the Numeric Notation and Byte Order briefly.

- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**

  Byte Order

  It support only little-endian Byte Order. The digital input or output module arrange its data as follow (for example: 4-Byte INPUT).



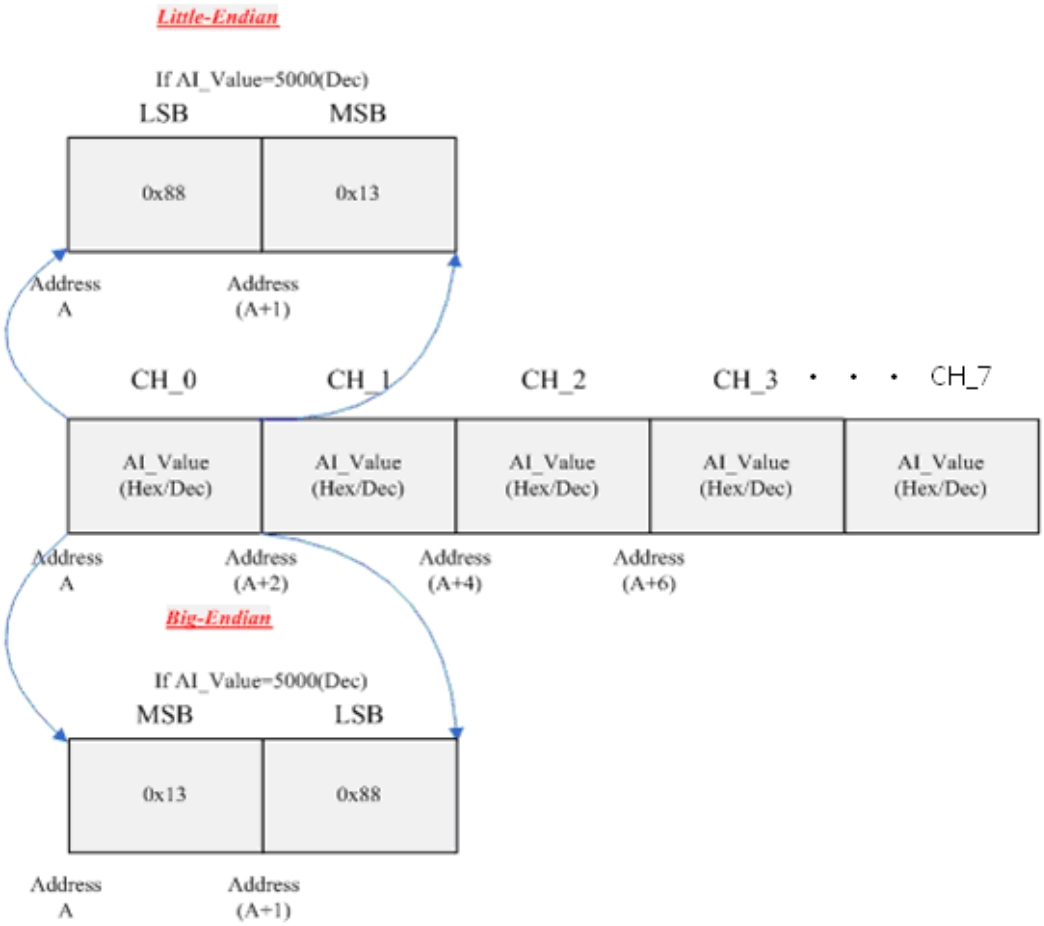
- **PROFI-5017/ PROFI-5017C**

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Byte Order

PROFI-5017(C) has 8 analog channels. Every channel has 2 bytes. For example, the following figure shows data arrangement of PROFI-5017(C).

Note: The order of I/O data is ranked by channel's identifier, so the channel with lower ID has priority over the channel with higher ID.



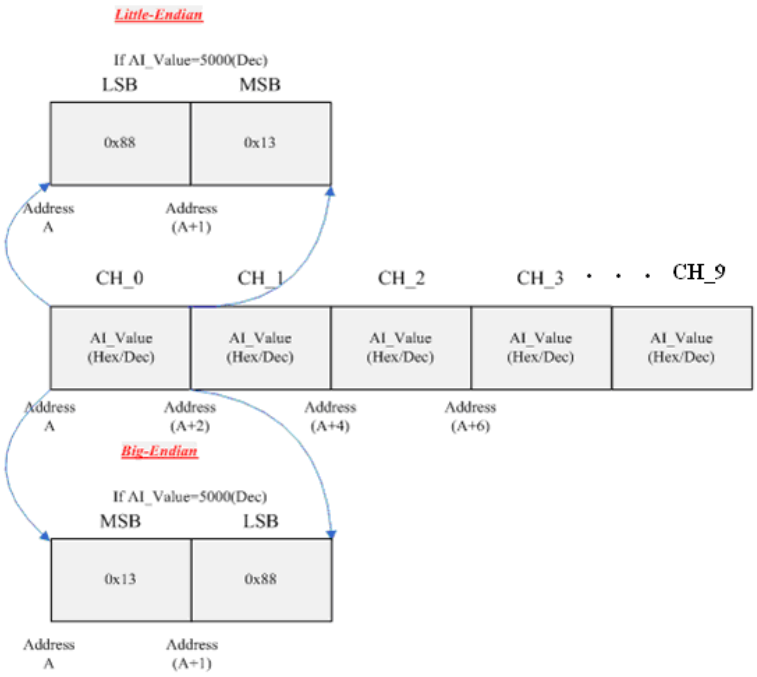
- **PROFI-5018**

Byte Order

PROFI-5018 has 10 analog channels. Every channel has 2 bytes. For example, the following figure shows data arrangement of PROFI-5018.

Note: The order of I/O data is ranked by channel's identifier, so the channel with lower ID has priority over the channel with higher ID.

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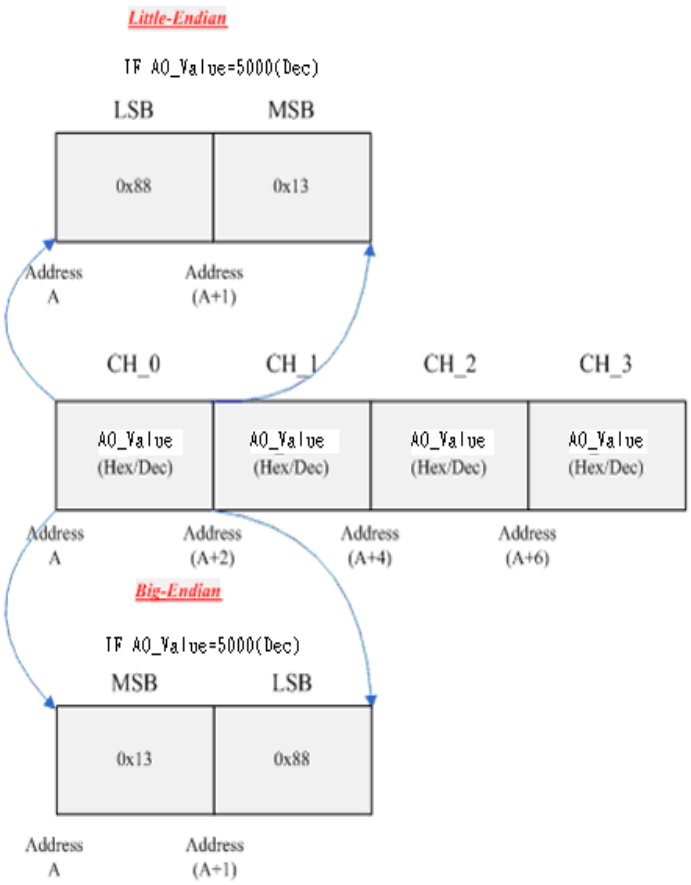
- **PROFI-5024**

Byte Order

PROFI-5024 has 4 analog channels. Every channel has 2 bytes. For example, the following figure shows data arrangement of PROFI-5024.

Note: The order of I/O data is ranked by channel's identifier, so the channel with lower ID has priority over the channel with higher ID.

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3.4.1. Numeric Representation

- **PROFI-5017/ PROFI-5017C**

+/- 10 V ：

The range for Engineer-Unit: -10000~10000(mV)
The range for 2's complement hexadecimal: 0000~1FFF (0v ~ 10v), 2000~3FFF (-10v~1.22mV)
Conversion from Engineer-Unit to 2's complement hexadecimal:

$$\text{HexValue}=\frac{EngineerValue}{10000}\times 8192-1 \qquad \text{if } 0 \leqq \text{EngineerValue} \leqq 10000$$

$$\text{HexValue}=\frac{EngineerValue}{10000}\times 8192+16384 \qquad \text{if } -10000 \leqq \text{EngineerValue} < 0$$

Measurement Value	Decimal	Hexadecimal
+10v(Engineer mode)	10000	0x2710
0v(Engineer mode)	0	0x0000
-10v(Engineer mode)	-10000	0xD8F0
+10v(Hex mode)	8191	0x1FFF
+5v(Hex mode)	4095	0x1000

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0v(Hex mode)	0	0x0000
-5v(Hex mode)	12288	0x3000
-10v(Hex mode)	8192	0x2000

+/- 5 V ：

The range for Engineer-Unit: -5000~5000(mV)
The range for 2's complement hexadecimal: 0000~1FFF (0v ~ 5v), 2000~3FFF (-5v~0.61mV)
Conversion from Engineer-Unit to 2's complement hexadecimal:

HexValue= $\frac{EngineerValue}{5000}$ × 8192-1 if 0≦EngineerValue≦5000

HexValue= $\frac{EngineerValue}{5000}$ × 8192+16384 if -5000≦EngineerValue＜0

Measurement Value	Decimal	Hexadecimal
+5v(Engineer mode)	5000	0x1388
0v(Engineer mode)	0	0x0000
-5v(Engineer mode)	-5000	0xEC78
+5v(Hex mode)	8191	0x1FFF
+2.5v(Hex mode)	4095	0x1000
0v(Hex mode)	0	0x0000
-2.5v(Hex mode)	12288	0x3000
-5v(Hex mode)	8192	0x2000

+/- 2.5 V ：

The range for Engineer-Unit: -2500~2500(mV)
The range for 2's complement hexadecimal: 0000~1FFF (0v ~ 2.5v), 2000~3FFF (-2.5v~0.3mV)
Conversion from Engineer-Unit to 2's complement hexadecimal:

HexValue= $\frac{EngineerValue}{2500}$ × 8192-1 if 0≦EngineerValue≦2500

HexValue= $\frac{EngineerValue}{2500}$ × 8192+16384 if -2500≦EngineerValue＜0

Measurement Value	Decimal	Hexadecimal
+2.5v(Engineer mode)	2500	0x09C4
0v(Engineer mode)	0	0x0000

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-2.5v(Engineer mode)	-2500	0xF63C
+2.5v(Hex mode)	8191	0x1FFF
+1.25v(Hex mode)	4095	0x1000
0v(Hex mode)	0	0x0000
-1.25v(Hex mode)	12288	0x3000
-2.5v(Hex mode)	8192	0x2000

+/- 1.25 V ：

The range for Engineer-Unit: -1250~1250(mV)
The range for 2's complement hexadecimal: 0000~1FFF (0v ~ 1.25v), 2000~3FFF (-1.25v~0.15mV)
Conversion from Engineer-Unit to 2's complement hexadecimal:

$$\text{HexValue}=\frac{EngineerValue}{1250}\times 8192-1 \qquad \text{if } 0\leqq \text{EngineerValue}\leqq 1250$$

$$\text{HexValue}=\frac{EngineerValue}{1250}\times 8192+16384 \qquad \text{if } -1250\leqq \text{EngineerValue}< 0$$

Measurement Value	Decimal	Hexadecimal
+1.25v(Engineer mode)	1250	0x04E2
0v(Engineer mode)	0	0x0000
-1.25v(Engineer mode)	-1250	0xFB1E
+1.25v(Hex mode)	8191	0x1FFF
+0.675v(Hex mode)	4095	0x1000
0v(Hex mode)	0	0x0000
-0.675v(Hex mode)	12288	0x3000
-1.25v(Hex mode)	8192	0x2000

0 ~ 20 mA ：

The range for Engineer-Unit: 0~20000(uA)
The range for 2's complement hexadecimal: 0000~1FFF (0mA ~ 20mA)
Conversion from Engineer-Unit to 2's complement hexadecimal:

$$\text{HexValue}=\frac{EngineerValue}{20000}\times 8192-1 \qquad \text{if } 0\leqq \text{EngineerValue}\leqq 20000$$

Measurement Value	Decimal	Hexadecimal
20mA(Engineer mode)	20000	0x4E20
10mA(Engineer mode)	10000	0x2710

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0mA(Engineer mode)	0	0x0000
20mA(Hex mode)	8191	0x1FFF
10mA(Hex mode)	4095	0x1000
0mA(Hex mode)	0	0x0000

- **PROFI-5018**

Type Code	Measurement Type	Data Format	Max. Value	Min. Value
00	-15mV to +15mV	Engineer Unit	+15000	-15000
		2's Complement HEX	7FFF	8000
01	-50mV to +50mV	Engineer Unit	+5000	-5000
		2's Complement HEX	7FFF	8000
02	-100mV to +100mV	Engineer Unit	+10000	-10000
		2's Complement HEX	7FFF	8000
03	-500mV to +500mV	Engineer Unit	+5000	-5000
		2's Complement HEX	7FFF	8000
04	-1V to +1V	Engineer Unit	+10000	-10000
		2's Complement HEX	7FFF	8000
05	-25V to +25V	Engineer Unit	+25000	-25000
		2's Complement HEX	7FFF	8000
06	-20mA to +20mA	Engineer Unit	+20000	-20000
		2's Complement HEX	7FFF	8000
7	+4mA to +20mA	Engineer Unit	+20000	+4000
		2's Complement HEX	7FFF	1999
0E	J Type	Engineer Unit	+12000	-2100
		2's Complement HEX	7FFF	E99a
0F	K Type	Engineer Unit	+13720	-2700
		2's Complement HEX	7FFF	E6D0
10	T Type	Engineer Unit	+4000	-2700
		2's Complement HEX	7FFF	A99A
11	E Type	Engineer Unit	+10000	-2700
		2's Complement HEX	7FFF	DD71
12	R Type	Engineer Unit	+17650	-500
		2's Complement HEX	7FFF	FC60
13	S Type	Engineer Unit	+17650	-500
		2's Complement HEX	7FFF	FC60

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14	B Type	Engineer Unit	+18200	+00000
		2's Complement HEX	7FFF	0000
15	N Type	Engineer Unit	+13000	-2700
		2's Complement HEX	7FFF	E56B
16	C Type	Engineer Unit	+23200	+00000
		2's Complement HEX	7FFF	0000
1A	0mA to +20mA	Engineer Unit	+20000	+00000
		2's Complement HEX	7FFF	0000

- **PROFI-5024**

+/-10V :

The range for Engineer-Unit: -10000~10000(mV)
The range for 2's complement hexadecimal:
0000~7FFF (0v ~ 10v), 8000~FFFF (-10v~0.3mV)

Conversion from Engineer-Unit to two's complement hexadecimal:

$$\text{HexValue}=\frac{EngineerValue}{10000}\times 32768-1 \quad \text{if } 0 \leqq \text{EngineerValue} \leqq 10000$$

$$\text{HexValue}=\frac{EngineerValue}{10000}\times 32768+65536 \quad \text{if-}10000 \leqq \text{EngineerValue} < 0$$

Measurement Value	Decimal	Hexadecimal
10v(Engineer mode)	10000	0x2710
0v(Engineer mode)	0	0x0000
-10v(Engineer mode)	-10000	0xD8F0
10v(Hex mode)	32767	0x7FFF
0v(Hex mode)	0	0x1000
-10v(Hex mode)	-32768	0x8000

+20mA :
The range for Engineer-Unit: -20000~20000(uA)
The range for 2's complement hexadecimal: 0000~7FFF (0v ~ +20mA)

Conversion from Engineer-Unit to 2's complement hexadecimal:

$$\text{HexValue}=\frac{EngineerValue}{20000}\times 32768-1$$

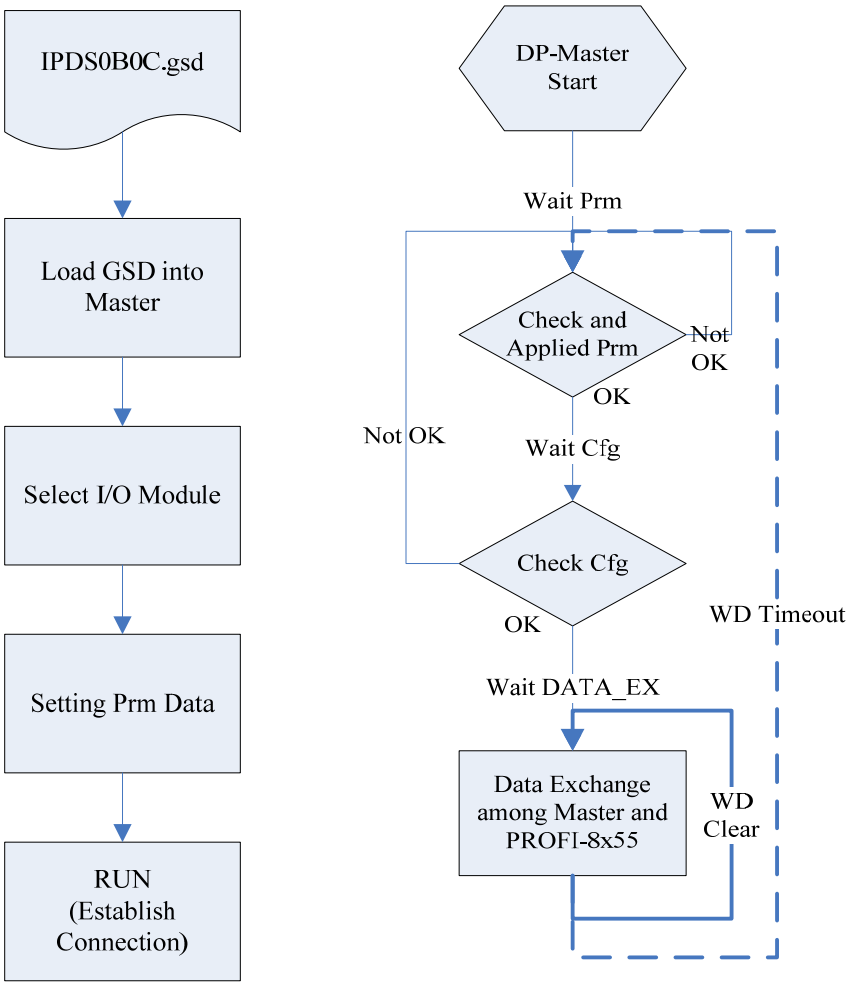
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Measurement Value	Decimal	Hexadecimal
20mA(Engineer mode)	20000	0x4E20
0mA(Engineer mode)	0	0x0000
20mA(Hex mode)	32767	0x7FFF
0mA(Hex mode)	0	0x0000

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3.5. Establish connection with PROFI-5000

Before establish the connection between DP-Master and PROFI-5000, user should obey the following step first.



First, users must load the electronic device description file(GSD file) of the PROFI-5000(IPDS0C47) into the DP-Master, and select the corresponding modules. Finally change your DP-master from Offline state to Operate state. While DP-Master changes to operate mode, PROFI-5000 will initial the modules and wait for Chk_Cfg telegram in order. If there is no error occurs, PROFI-5000 proceeds into data exchange state. Users can observe the status indicator LED to know the state of PROFI-5000. At the meantime, if there is any error occurs, PROFI-5000 will return to wait configuration.

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3.6. Diagnostic Message Report

The diagnostic messages report to DP-Master when the DP-Slave has errors or the unusual event occurs. Usually, It report diagnosis due to following standard channel-related event.

- **PROFI-5045/ PROFI-5050/ PROFI-5051/ PROFI-5052/ PROFI-5053/ PROFI-5055/ PROFI-5060**
  - It doesn't support diagnostic message report.

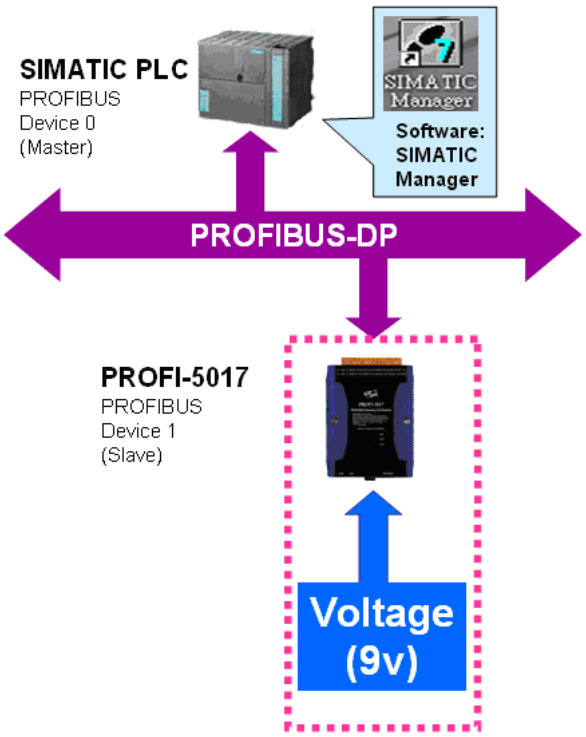
- **PROFI-5017/ PROFI-5017C/ PROFI-5018/ PROFI-5024**
  - It support error code "2","3","7" and "8".
  - PROFI-5018 support additional error code "5" and "6".

Error Code	Error Type
0	Reserved
1	Short Circuit
2	Under-voltage
3	Over-voltage
4	Overload
5	Over-temperature
6	Line/wire Break
7	Upper Limit Value Exceeded (Current)
8	Lower Limit Value Exceeded(Current, Sensor)
9	Error
10~15	Reserved
16~31	Manufacture Specific/Device-Related

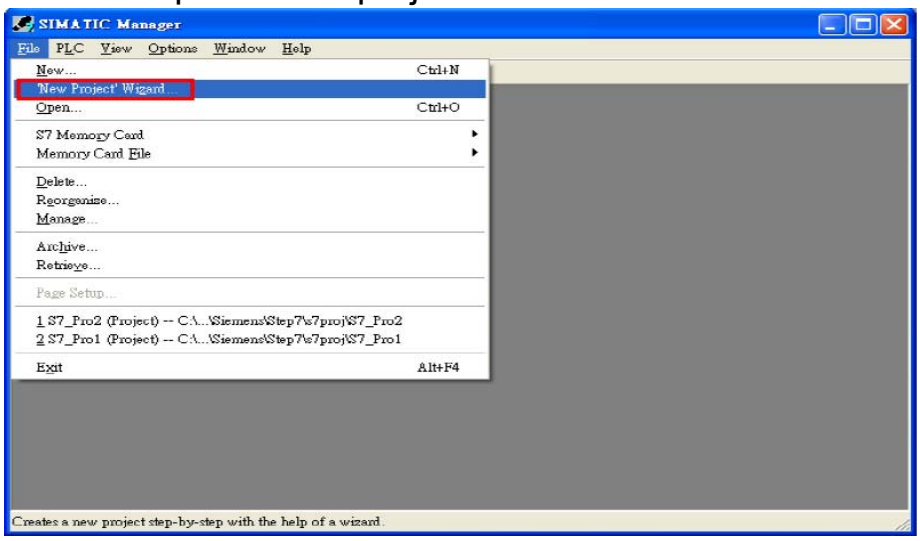
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4. PROFI-5000 Guideline (for SIMATIC Step 7)

In this example, we use Siemens S7-300 PLC (as a PROFIBUS master)、a PROFI-5017 (as a PROFIBUS slave) to read voltage(9v) from channel 0~channel 7.

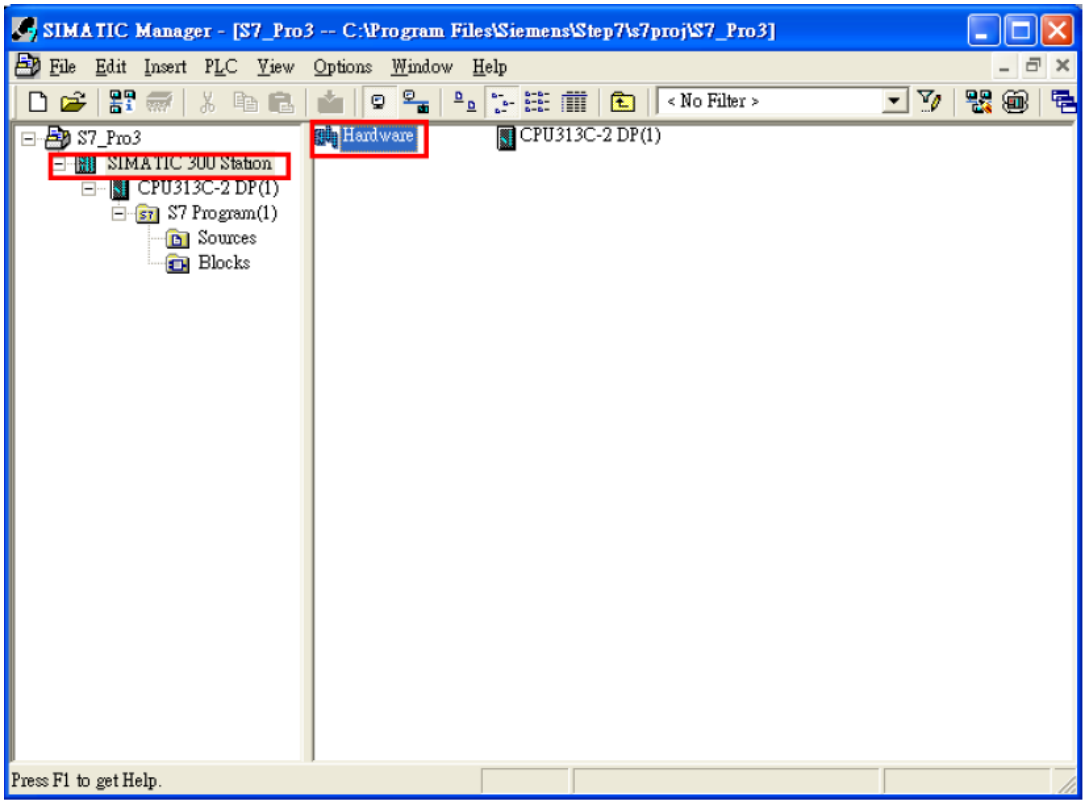


Step 1：Open “SIMATIC Manager” tool and select “New Project Wizard” to open a new project.



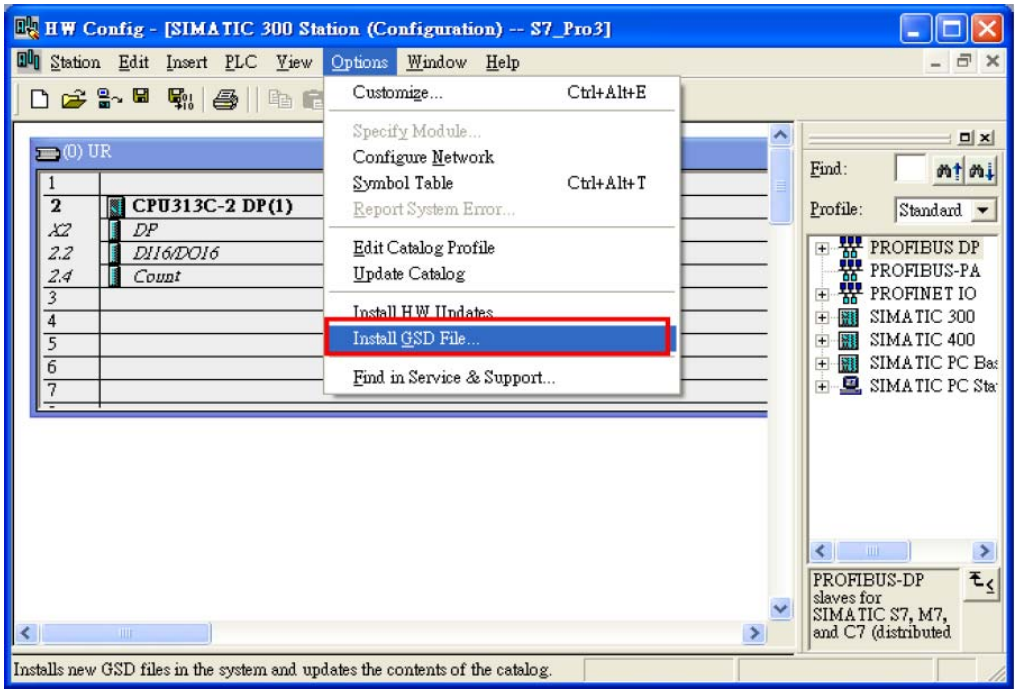
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Step 2：Double Click “Hardware” to open “HW Config”



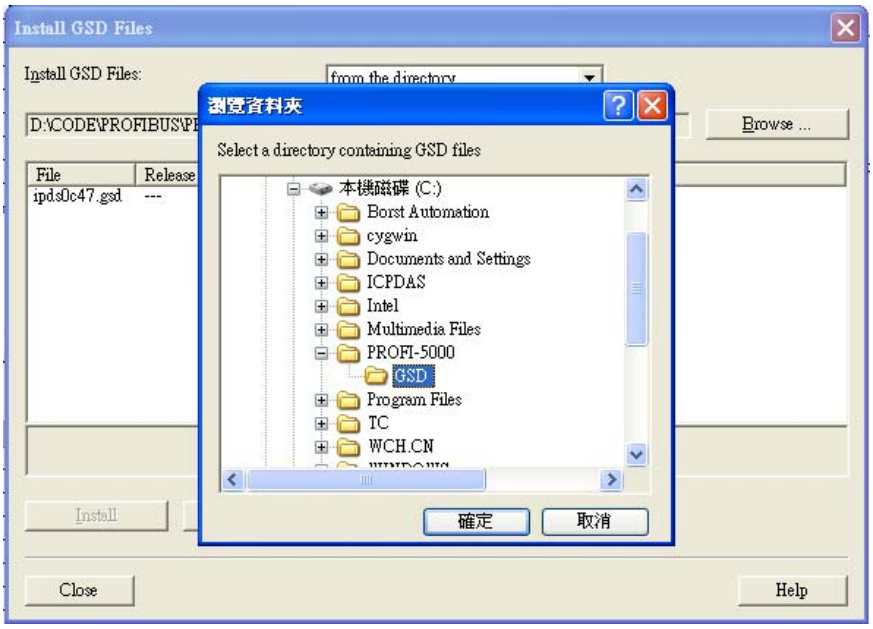
Step 3：Install GSD file

a. Click “Install GSD File”

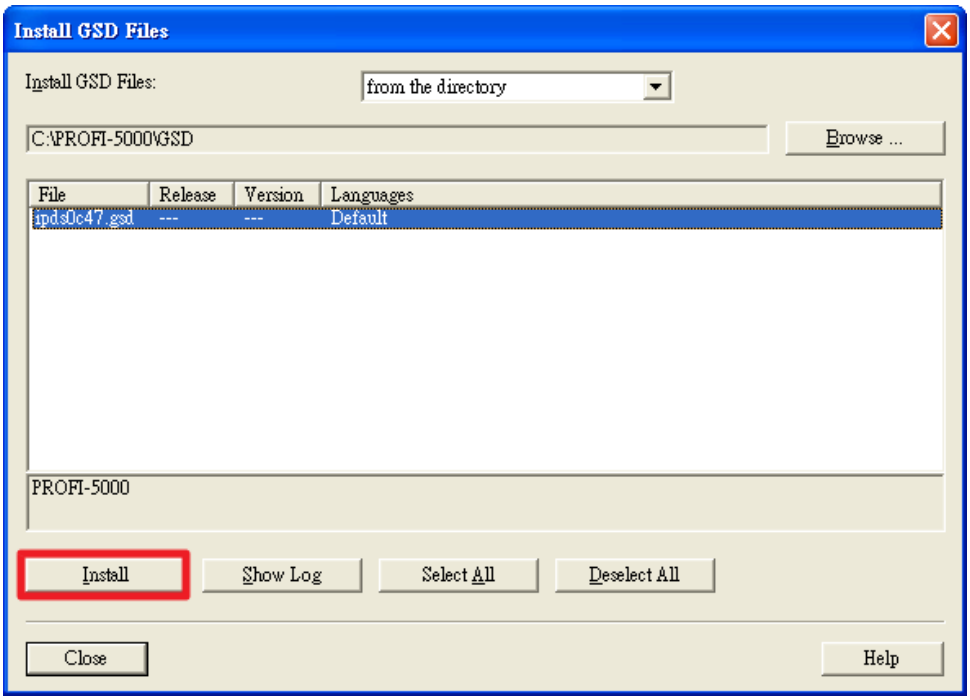


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b. Select the directory of PROFI-5017's GSD file(ipds0c47.gsd) and click "OK"

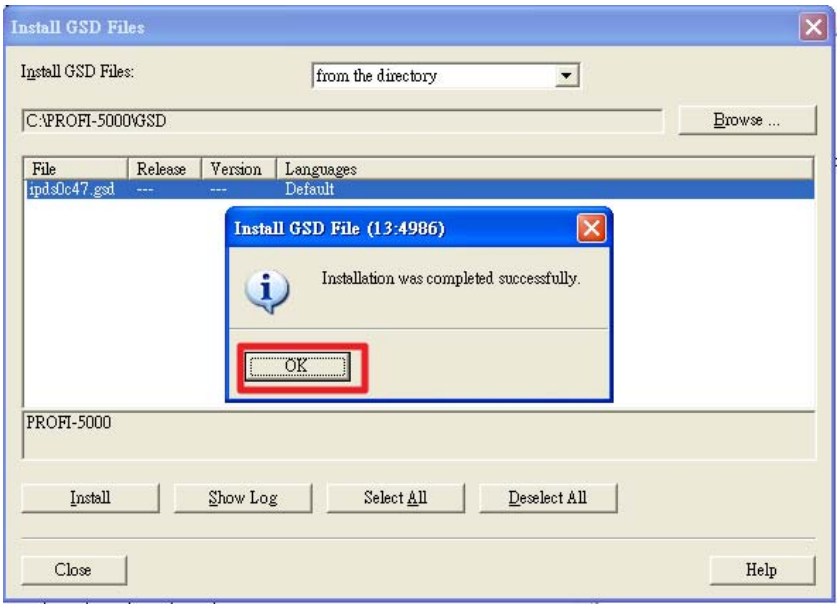


c. Click "Install"



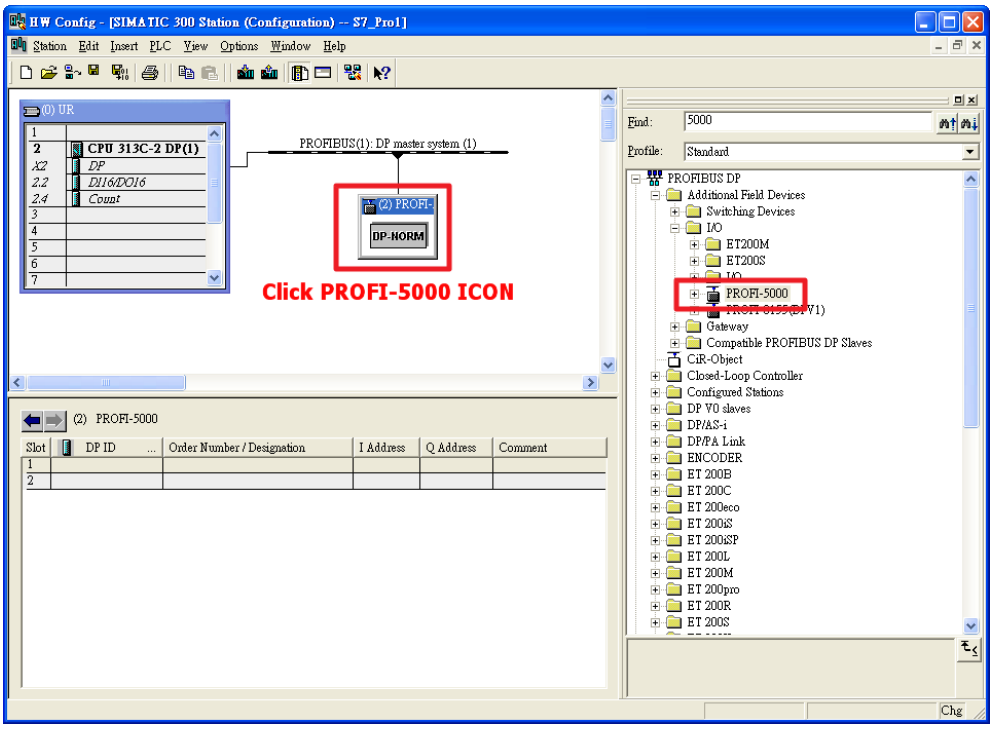
d. Click ""OK"

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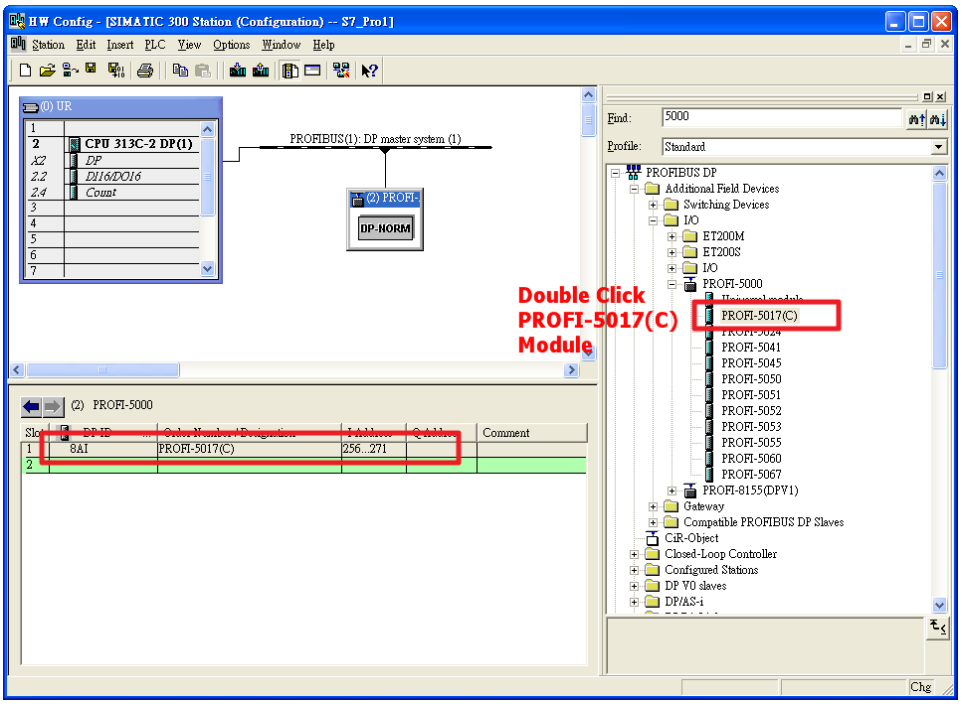
Step 4：Setup PROFI-5017 module

a. Select PROFI-5000 module



b. Add a “PROFI-5017(C) module”

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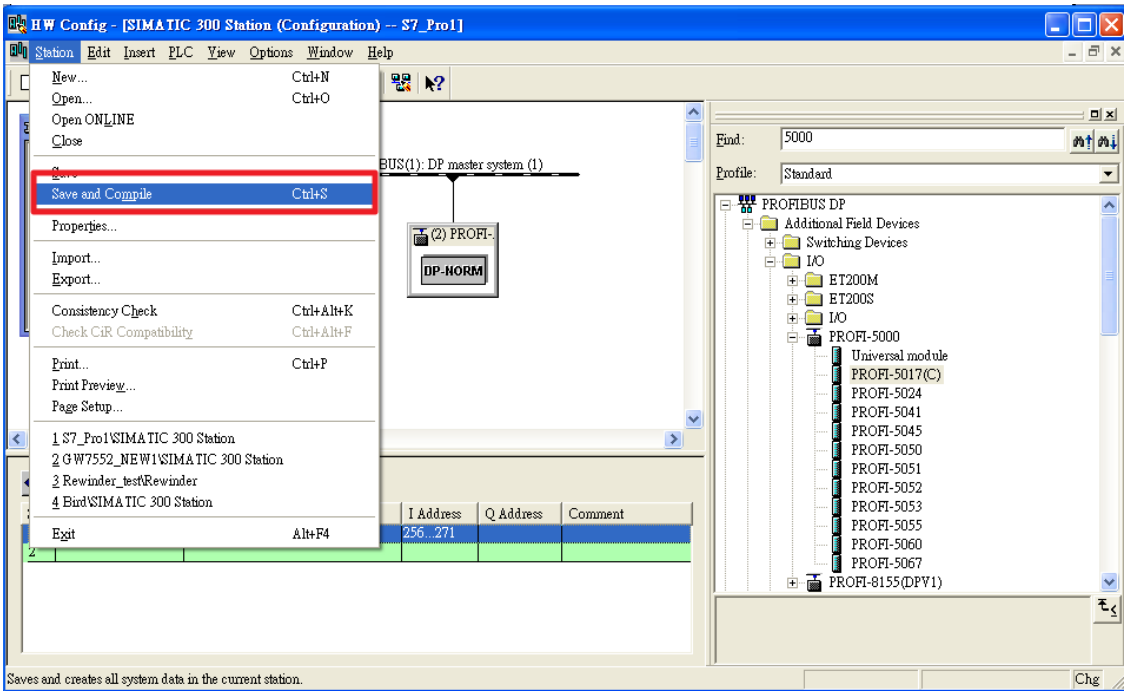


Step 5：Setup the parameters of the PROFI-5017

a. Use the default setting

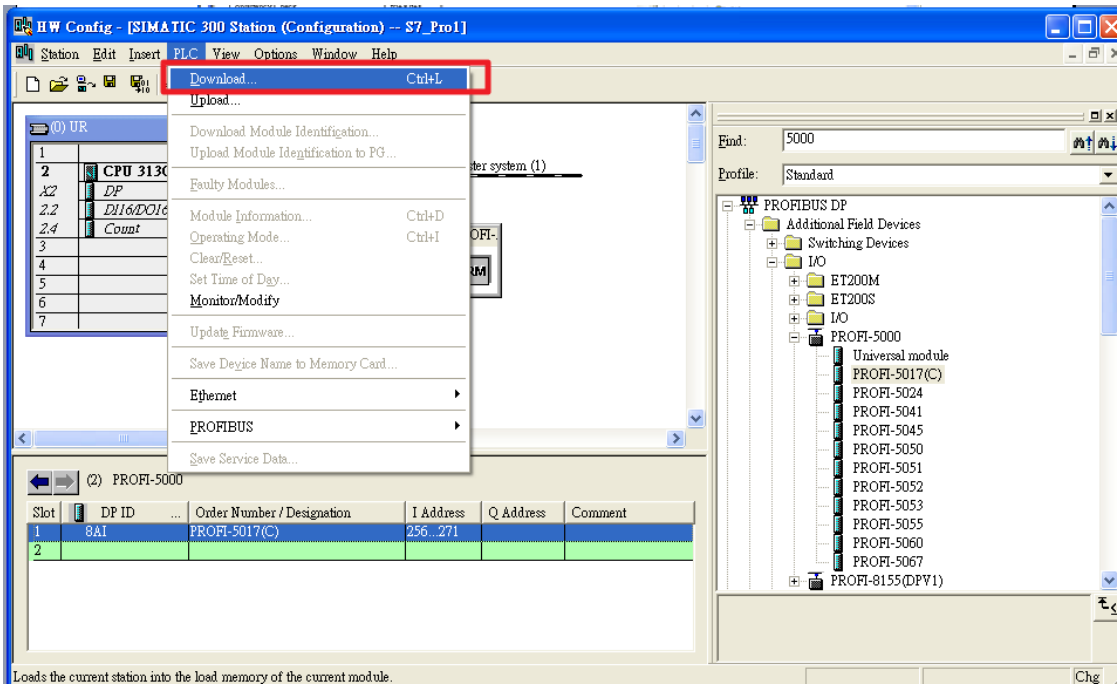
Step 6：Download the HW settings into SIMATIC PLC

a. Click “Save and Compile”



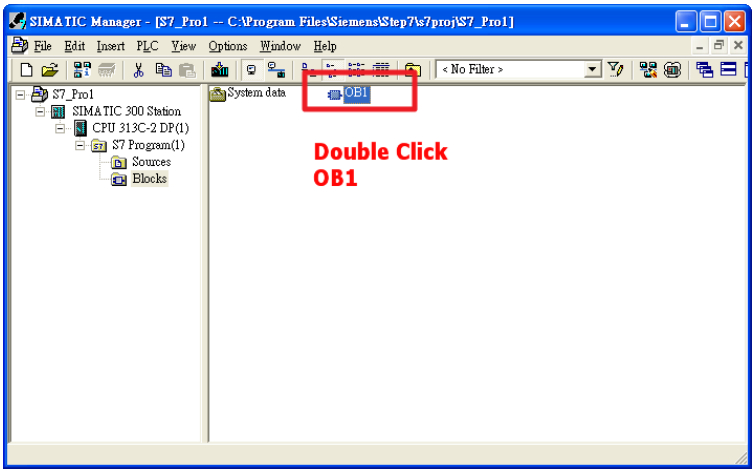
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b. Click “Download”



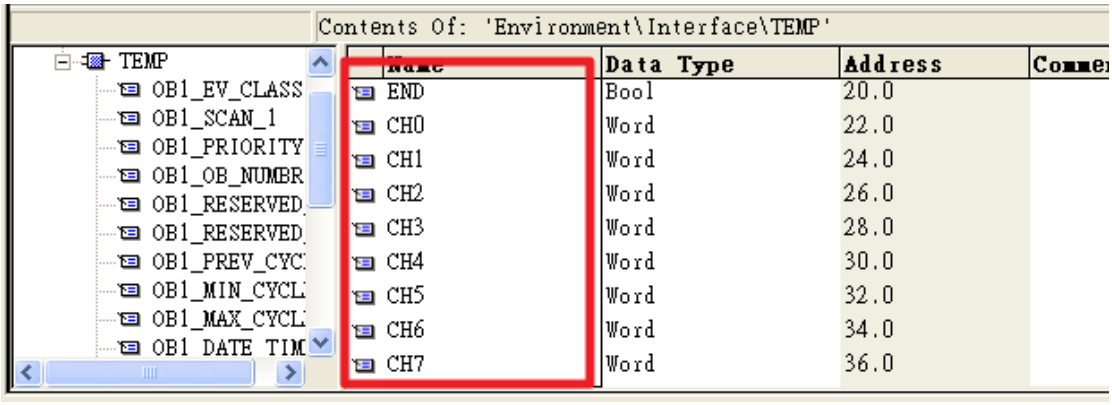
Step 7：Edit “OB1”

a. Double click “OB1”

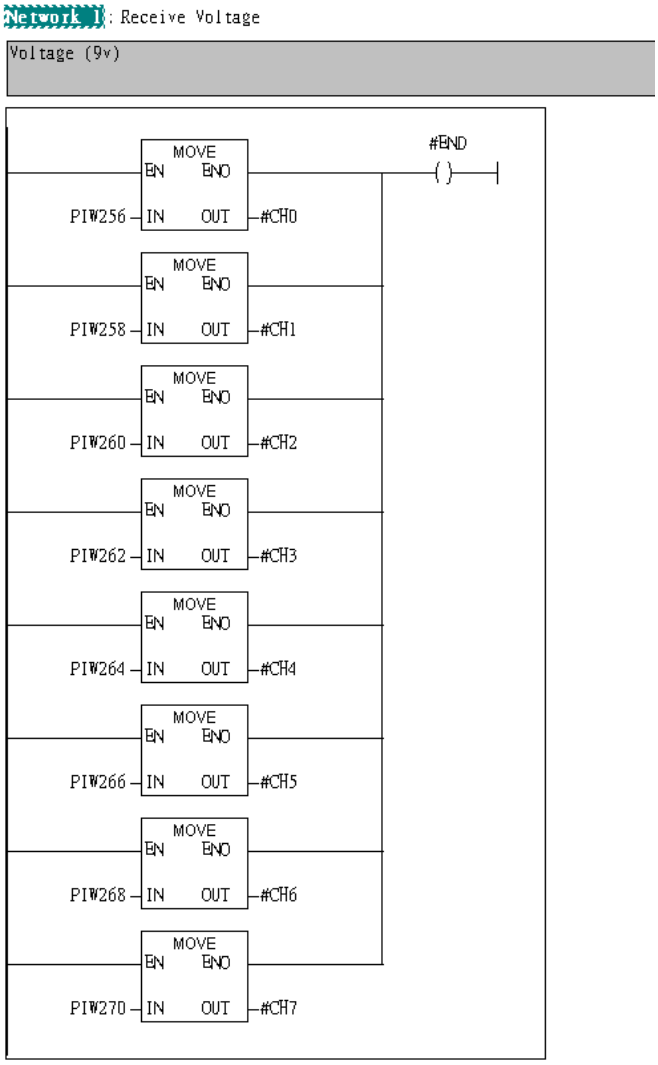


b. Variables used in the example LAD Program

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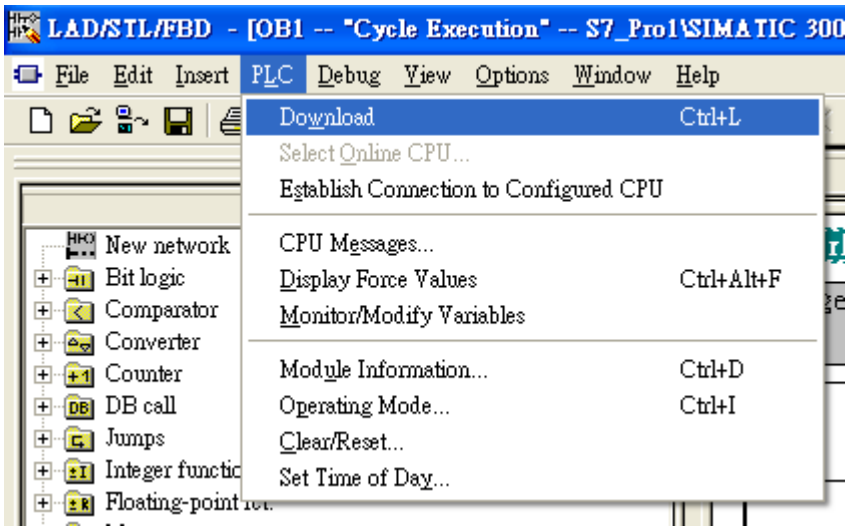


c. Program



Step 8：Download the settings into SIMATIC PLC

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Step 9：Make sure the RUN LED of the PROFI-5017 is ON.

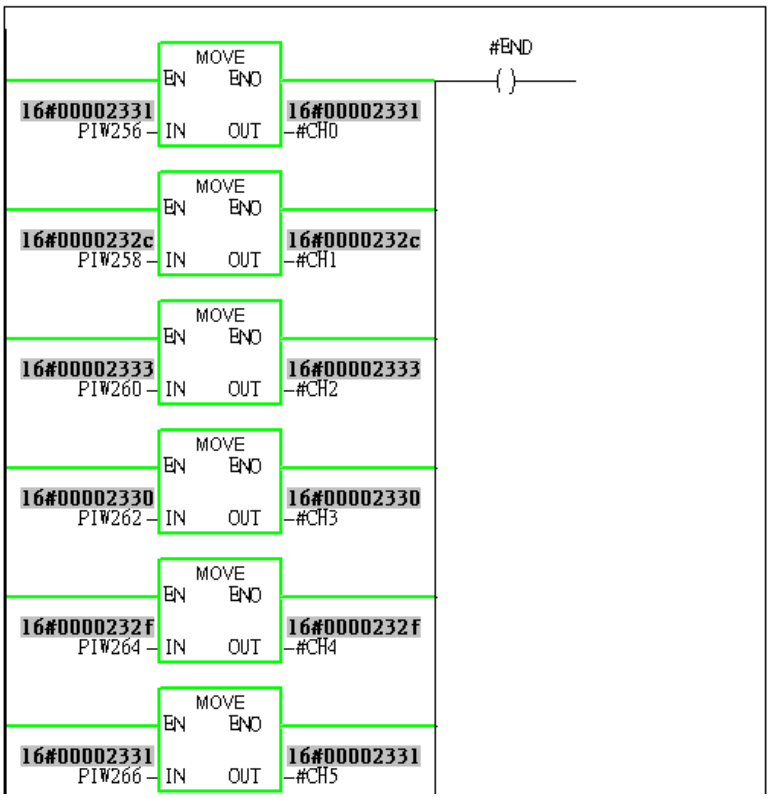


Step 10：read voltage from channel 0~channel 7

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Network 1: Receive Voltage

Voltage (9v)



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5. Appendix A：FAQ

1. HOW to reads voltage(9v) from PROFI-5017 (for SIMATIC Step7)?

2. HOW to reads current(10mA) from PROFI-5017C (for SIMATIC Step7)?

3. HOW to sends voltage(9v) from PROFI-5024 (for SIMATIC Step7)?

4. HOW to sends current(10mA) from PROFI-5024 (for SIMATIC Step7)?

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