

DeviceNet Remote I/O Analog, Terminal Block Type



ARD-A Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Adopts DeviceNet, standard open Network
 - : Communicates other DeviceNet devices without additional installations
 - : Configurable power and communication system only with communication cables
 - : Connectible max. 63 units per 1 master unit
- Strong against noise and high accuracy (0.3 %) measurement with differential input method (measuring difference between +, - input signal)
- Various I/O range
 - : 0-5 VDC $\pm$, 1-5 VDC $\pm$, 0-10 VDC $\pm$, -5-5 VDC $\pm$, -10-10 VDC $\pm$, DC 4-20 mA, DC 0-20 mA
- Scale function
 - : Settable high/low limit scale value for analog I/O range (setting range: -28,000 to 28,000)
- Various functions
 - : Automatic communication speed recognition, Network voltage monitoring, Input digital filter, Peak/Bottom Hold, hysteresis, reading model name and number of units, I/O and status flag monitoring
- Built-in surge, ESD protection, reverse polarity protection circuit
- Mounting DIN rail and panel method

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death.

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)**
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.**
Failure to follow this instruction may result in explosion or fire.
- 03. Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire.
- 04. Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
- 05. Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

- 01. Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
- 02. Use a dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in fire or electric shock.
- 03. Keep the product away from metal chip, dust, and wire residue which flow into the unit.**
Failure to follow this instruction may result in fire or product damage.
- 04. Do not cut off power or disconnect terminals while operating the unit.**
Failure to follow this instruction may result in fire or malfunction.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- 24 VDC $\pm$ model power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Keep away from high voltage lines or power lines to prevent inductive noise.
In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line. Do not use near the equipment which generates strong magnetic force or high frequency noise.
- This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 2
 - Installation category II

Ordering Information

This is only for reference, the actual product does not support all combinations.
For selecting the specified model, follow the Autonics website.

ARD - ① ② ③

- ① **Type**
A: Analog
- ② **I/O configuration**
I: Input
O: Output
- ③ **I/O points**
04: 4-point

Product Components

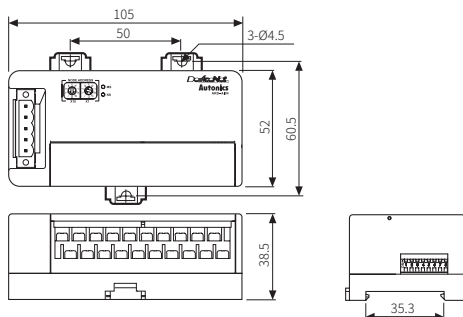
- Product × 1
- Network connector × 1
- Instruction manual × 1
- Terminating resistance × 2

Manual

For proper use of the product, refer to the manuals and be sure to follow the safety considerations in the manuals.
Download the manuals from the Autonics website.

Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics website.

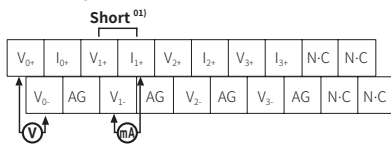


Connections

- For more information, refer to the 'Specifications.'
- When wiring the input/output terminal, tighten the connector screw with a tightening torque of 0.5 N·m.
- When wiring the communication connector, use cable and tap which meet DeviceNet standard, and tighten the connector screw with a tightening torque of 0.5 N·m.
- Connect terminating resistances (recommended: 120 Ω, 1 % of the metallic film, 1/4 W) on both ends of the network cables. Otherwise, impedance fluctuation could cause communication errors.
- Refer to the table below for the cable depending on the communication speed.

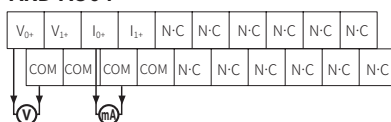
Comm. speed	Comm. distance	Length of branch line	Length of extended branch line
125 kbps	≤ 500 m	≤ 6 m	≤ 156 m
250 kbps	≤ 250 m	≤ 6 m	≤ 78 m
500 kbps	≤ 100 m	≤ 6 m	≤ 39 m

■ ARD-AI04

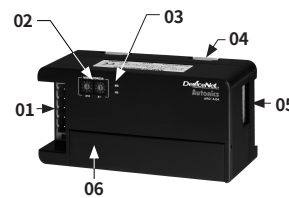


01) For the current input, short between V₀₊ and I₀₊.

■ ARD-AO04



Unit Descriptions



01. **Network connector**
02. **Rotary switch**
For setting NODE ADDRESS
03. **Status indicator**
For unit status (MS) and network status (NS)
04. **Rail lock**
For the DIN rail and panel mount
05. **DIP switch**
For setting the I/O range
06. **I/O terminal block**
For I/O with the external device

■ Network connector

No.	Color	Function	Pinout
5	Red	24 VDC (= +)	
4	White	CAN_H	
3	None	SHIELD	
2	Blue	CAN_L	
1	Black	24 VDC (= -)	

■ Status indicator

Status indicator		Description	Troubleshooting
Unit (MS)	Network (NS)		
Green LED ON	Green LED ON	Normal operation	-
Green LED ON	OFF	Standby of checking duplicated NODE ADDRESS	-
Green LED ON	Green LED Flashing	Standby of normal operation	-
Red LED ON	OFF	Watchdog timer error	Replace the Slave unit.
Red LED Flashing	OFF	Switch setting error	Change the switch setting to valid value and supply the power again.
Red LED Flashing	Green LED ON	Changed NODE ADDRESS during normal operation	Change to the initial NODE ADDRESS when the power was supplied at first.
Green LED ON	Red LED ON	Invalid NODE ADDRESS	Change to the valid NODE ADDRESS and supply the power again.
Red LED ON	Red LED ON	Duplicated NODE ADDRESS	Change NODE ADDRESS not to be duplicated.
		Bus-Off error	Power on the Slave unit again. Check the Master unit, communication cable, terminating resistance and noise of network.
Green LED ON	Red LED Flashing	I/O Connection time out	Check the setting of Master and the user program.

Set NODE ADDRESS

- The NODE ADDRESS of the connected unit must not be duplicated.
- When changing the NODE ADDRESS during operation, the unit status (MS) LED flashes in red, and the unit communicates as the address before. To apply the changed NODE ADDRESS, be sure to power on again.
- The communication speed is automatically set to that of the Master (PC, PLC, etc.). When changing the communication speed during operation, the network status (NS) LED flashes in red, and communication is not possible. Power on again to operate in the normal state.

01. Turn the two rotary switches to set the NODE ADDRESS.

(NODE ADDRESS range: 00 to 63)

- [e.g.]

Rotary switch	X10 (tens digit)	X1 (ones digit)	NODE ADDRESS
	3	3	33

Installation

■ Mounting on the DIN rail

- Pull two Rail locks on the rear part of a unit.
- Place the unit on the DIN rail to be mounted.
- Press the Rail locks to fix the unit tightly.

■ Mounting on the panel

- Pull two rail locks on the rear part of a unit, and there is a fixing bolt hole.
- Place the unit on a panel to be mounted.
- Make a hole on a fixing bolt hole position.
- Fasten the bolt to fix the unit tightly. (tightening torque: ≤ 0.5 N·m)

DIP Switch Setting

- The input/output range can be set via the DIP switch. However, CH0 - CH1 / CH2 - CH3 cannot be set separately.
- SW7: Not used
- SW8: [ON] DIP switch setting
[OFF] communication setting (each channel)
- ON: ■ / OFF: □



■ ARD-AI04

No.	Input range	Max. allowable input range	CH0, CH1			CH2, CH3		
			SW1	SW2	SW3	SW4	SW5	SW6
1	0 to 5 VDC≐	-0.25 to 5.25 VDC≐	□	□	□	□	□	□
2	1 to 5 VDC≐	0.8 to 5.2 VDC≐	■	□	□	■	□	□
3	0 to 10 VDC≐	-0.5 to 10.5 VDC≐	□	■	□	□	■	□
4	-5 to 5 VDC≐	-5.5 to 5.5 VDC≐	■	■	□	■	■	□
5	-10 to 10 VDC≐	-11 to 11 VDC≐	□	□	■	□	□	■
6	DC 4 to 20 mA	DC 3.2 to 20.8 mA	■	□	■	■	□	■
7	DC 0 to 20 mA	DC 0 to 21 mA	□	■	■	□	■	■

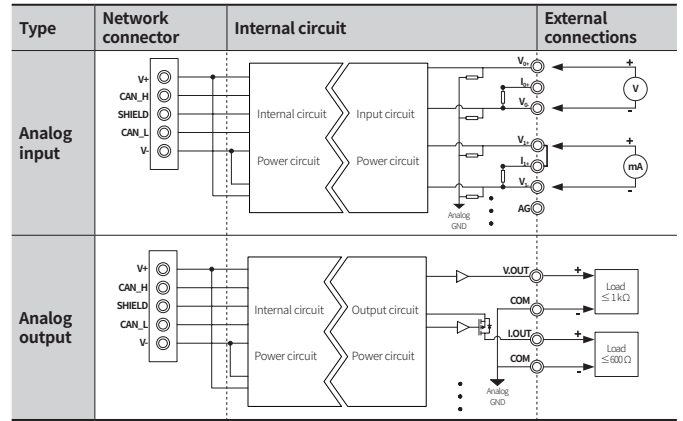
■ ARD-AO04

No.	Output range	Max. allowable output range	CH0, CH1			CH2, CH3		
			SW1	SW2	SW3	SW4	SW5	SW6
1	0 to 5 VDC≐	-0.25 to 5.25 VDC≐	□	□	□	Not used		
2	1 to 5 VDC≐	0.8 to 5.2 VDC≐	■	□	□			
3	0 to 10 VDC≐	-0.5 to 10.5 VDC≐	□	■	□			
4	-5 to 5 VDC≐	-5.5 to 5.5 VDC≐	■	■	□			
5	-10 to 10 VDC≐	-11 to 11 VDC≐	□	□	■			
6	DC 4 to 20 mA	DC 3.2 to 20.8 mA	Not used			□	□	□
7	DC 0 to 20 mA	DC 0 to 21 mA				■	□	□

Specifications

Model		ARD-AI04	ARD-AO04
Power supply		Rated voltage: 24 VDC≐, voltage range: 12-28 VDC≐	
Power consumption		≤ 3 W	
Output points		Input 4-point (switchable voltage/current)	Output 4-point (voltage 2 CH, current 2 CH)
Control I/O	Voltage	0-10 VDC≐, -10-10 VDC≐, 0-5 VDC≐, 1-5 VDC≐, -5-5 VDC≐ (input impedance: ≥ 1 MΩ)	0-10 VDC≐, -10-10 VDC≐, 0-5 VDC≐, 1-5 VDC≐, -5-5 VDC≐ (load resistance: ≥ 1 kΩ)
	Current	DC 4-20 mA, DC 0-20 mA (input impedance: 250 Ω)	DC 4-20 mA, DC 0-20 mA (load resistance: ≤ 600 Ω)
	Max. allowable I/O	± 5 % F.S. of I/O range	
	Resolution	14 bits, 1/16,000	
	Accuracy	At room temperature (25 °C ± 5 °C) range: ± 0.3 % F.S. Out of room temperature range: ± 0.6 % F.S.	
Communication spec.		I/O Slave messaging (group 2 only slave) : supporting Poll command, Bit_strobe command, Cyclic command, COS command	
Communication speed (comm. distance)		125 kbps (≤ 500 m), 250 kbps (≤ 250 m), 500 kbps (≤ 100 m)	
Protocol		DeviceNet	
Insulation method		I/O and internal circuit: non-insulation, DeviceNet and internal circuit: insulation, DeviceNet power: insulation	
Insulation resistance		≥ 200 MΩ (500 VDC≐ megger)	
Noise immunity		± 500 VDC≐ the square wave noise (pulse width: 1 μs) by the noise simulator	
Dielectric strength		Between the charging part and the case: 500 VAC~ at 50/60 Hz for 1 min	
Vibration		1.5 mm amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours	
Shock		500 m/s ² (≈ 50 G) in each X, Y, Z direction for 3 times	
Ambient temperature		-10 to 50 °C, storage: -25 to 75 °C (no freezing or condensation)	
Ambient humidity		35 to 85 %RH, storage: 35 to 85 %RH (no freezing or condensation)	
Protection rating		IP20 (IEC standard)	
Protection circuit		Surge and ESD protection, reverse power protection circuit	
Indicator		Network status (NS) and unit status (MS) indicator (green, red LED)	
Material		Front and body case: PC	
Mounting method		DIN rail or panel mounting	
Certification		CE 标志 ENEC DeviceNet	CE 标志 ENEC DeviceNet compatible
Unit weight (packaged)		≈ 145 g (≈ 210 g)	≈ 145 g (≈ 210 g)

I/O Circuit Diagram



Function

Function		ARD-AI04	ARD-AO04
Basic	Com. speed auto-recognition	●	●
	Network power voltage monitoring	●	●
	Unit power on total time monitoring	●	●
	Unit comment	●	●
	Last maintenance data stored	●	●
Analog	Scaling	●	●
	I/O comment	●	●
	Adjustment gradient	●	●
	Adjustment offset	●	●
	Input conversion points setting	●	-
	Input digital filter	●	-
	Peak/Bottom Hold	●	-
	Disconnected cable detection	●	-
	Input comparison	●	-
	Hysteresis	●	-
	Output setting for error	-	●

■ Communication speed auto-recognition

- It recognizes communication speed when connecting master. Communication speed is able to change only from master unit. After changing communication speed, re-supply the network power to apply the changed communication speed.

■ Network power voltage monitoring

- If network power voltage is lower than the set value, the network power voltage drop flag bit of Status bit is ON. It can be read by Configurator or Explicit message.
- Set monitoring voltage by Explicit message at Network Power voltage (set value) of Application Object.
- Setting range: 0 to 255 (factory default: 12 V, allowable range: ± 1 V)
- Min. supplied power is 12 V for ARD unit. If network voltage is lower than 12 V, the contents of Explicit message reading is not guaranteed.

■ Unit power on total time monitoring

- When total time for supplying power to the unit becomes the SV, Threshold Run Hours Flag bit of Status Bit turns ON. It can be read by Configurator or Explicit message.
- Set the time by Explicit message at Threshold Run Hour of Application Object.
- Setting range: 0 to 429,496,729 hours (factory default: 876,000 hours), measured unit: 0.1 hours (6 minutes)

■ Unit comment

- You can set the comments for the unit (product description) on network. It can be read by Configurator or Explicit message.
- Set comment by Explicit message at Unit Comment of Application Object.
- Setting range: max. 32 characters

■ Last maintenance date

- It saves the last date of maintenance. It can be read/ written by Configurator or Explicit message.
- Set maintenance date by Explicit message at I/O Last Maintenance Data Setting of Analog Input Point Object.
- Data: 0x07DB020E→07DB (2011), 02 (February), 0E (14th)

■ Input conversion points setting

- Conversion cycle is changed by the number of points (point, channel). (conversion cycle: 1 ms/point, when using 4 points, it is 4 ms). It can be read/written by Configurator or Explicit message.
- After changing the number of conversion points, re-supply the network power.
- Set the number of conversion points by Explicit message at Number of AD Conversion Points Setting of Analog Input Point Object.
- Setting range: 1 to 4 points (factory default: 4 points), conversion cycle: 1 ms/1 point

■ Display scale

- Set high/low-limit scale value of analog input or output. It can be read by Configurator or Explicit message.

Default Scaling	Function Choice : Scaling Flag bit ON Scaling Type : Default Scaling (factory default)	It is set as 1,000 per 1 V (mA). In case of 1-5 V, 4-20 mA, it is applied from over min. allowable range 0.8 V (800), 3.2 (3,200). The below input value is break detection. It outputs as min. allowable range.
None Scaling	Function Choice : Scaling Flag bit OFF Scaling Type : Default Scaling	It is set as default value 0 to 16000 (-8000 to 8000). (0-5 V, 1-5 V, 0-10 V, 4-20 mA, 0-20 mA: 0 to 16000, -5-5 V, -10-10 V: -8,000 to 8,000)
User Scaling	Function Choice : Scaling Flag bit ON Scaling Type : User Scaling	Set high/low-limit value to apply at 'Scaling Point 0 %' and 'Scaling Point 100 %.' Setting range: -28,000 to 28,000

■ I/O comment

- You can set the comment for I/O. It is able to read/write by Configurator or Explicit message.
- Set I/O comment by Explicit message at I/O Comment of Analog Input Point Object, Analog Output Point Object.
- Setting range: max. 32 characters

■ Gradient adjustment

- It adjusts the gradient of input/output value or scale value. It is able to read/write by Configurator or Explicit message.
- It is applied when Adjust Gradient Flag bit is set as ON at Function Choice of Analog Input Point Object. Set the range at Adjustment Gradient value.
- Adjustment range: -5 to 5 %, setting range: -500 to 500 (factory default: 0)
- E.g.) When input value is 1000, Adjustment Gradient is 500 (+5 %)

$$X' = aX, a = 1 + \text{Adjustment Gradient} (0.05)$$

$$X = 1000, X' = 1.05 \times 1000 = 1050$$

■ Offset adjustment

- This function is to adjust the error occurring from external analog sensor, etc, not from the unit itself. It is also applied to analog output. It is able to read/write by Configurator or Explicit message.
- It is applied when Adjustment Offset Flag bit is set as ON at Function Choice of Analog Input Point Object. Set the value at Adjustment Offset Value.
- Adjustment range: -5 to 5 %, setting range: -500 to 500 (factory default: 0)
- E.g.) When input range is 0 to 10 V, Full Scale 0 to 16000, input value is 1600 (1 V) and Adjustment Gradient 500 (+5 %),

$$X' = X + b, X = 1600, b = 16000 \times 0.05 \text{ (added input value and percentage of Full Scale)}$$

$$X' = 1600 + 800 = 2400 (1.5 \text{ V})$$

■ Input digital filter

- This function is used when input value vibrates or repeatedly shake by included noise at input signal. Accurate control is available by stable input with this function. It adopts moving average filter method not to affect sampling cycle. It is able to read/write by Configurator or Explicit message.
- It is applied when Moving Average is set as ON at Function Choice of Analog Input Point. Set the number of digital filters at Moving Average Filter of Number.
- Setting range: 0 to 8 (factory default: 3[Moving Average No_8])

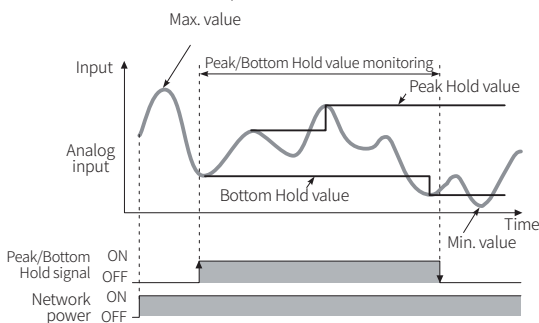
■ Input min./max. value save

• Min./Max. save when power is ON

It saves min./max. input value from power ON the network. (When network power is OFF, the saved min./max. input value are cleared.) It is able to read by Configurator or Explicit message. When Clear Max, Clear Min Flag bit of is ON at Function Choice of Analog Output Point Object, the saved values are cleared and it saves current min./max. value of current input.

• Min./Max. save when Peak/Bottom Hold signal is ON

It memorizes the max./min. value while Peak/Bottom signal is ON. When Peak/Bottom signal is OFF, they are saved. It is able to read by Configurator or Explicit message. It is applied when Peak/Bottom is set as ON at Function Choice of Analog Input Point Object. You can check the value of Peak/Bottom at Peak Value and Bottom Value.

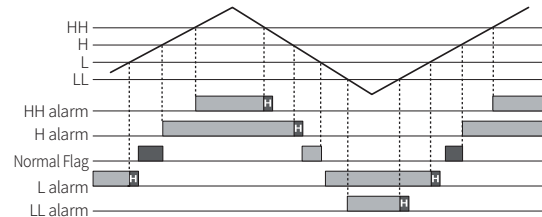


■ Disconnection detection

- When operating analog input cable (voltage/current input) is disconnected, Broken Wire Flag Bit turns ON at Analog Status Flag Read of Analog Input Point Object. (It operates only for 1-5 V, 4-20 mA input range.) It is able to read by Configurator or Explicit message.
- If this value is below -5 %, it recognizes disconnection and displays '32767' as data value.

■ Input comparison

- It compares analog input value or the operation value and alarm set value (HH, H, L, LL) and Analog Status Bit flag turns ON at Function Choice of Analog Input Point Object. It is able to read by Configurator or Explicit message.
- If the value is within the setting range between 'H' and 'L', it is available to apply by turning ON Pass Signal Flag bit at Analog Status Flag Read of Analog Input Point Object and turning ON/OFF Comparator Flag bit at Function Choice.



■ Hysteresis

- In case of comparison output, this function is to increase stability of comparison output against vibration of input signal or chattering. It is able to read by Configurator or Explicit message.
- It is applied when Compare Bit flag turns ON at Function Choice of Analog Input Point Object. Set the value at Hysteresis Value.
- Setting range: 0 to 16,383 (factory default: 0)

■ Output value setting for com. error

- When communication error occurs, this function is to set output value of output unit by each channel. It is able to read by Configurator or Explicit message.
- Set Fault state at Fault Action of Analog Output Point.
- Setting range: 0 to 3 (factory default: 1)
 - 0: Hold Last State-maintains the last status, 2: High Limit-outputs max. value,
 - 1: Low Limit-outputs min. value, 3: Zero Count-outputs 0 %

■ Status flag monitoring

- When the network power voltage is lower than the set value or unit operation time is over the set value, monitoring is available by Status Bit of Application Object. It is able to read by Configurator or Explicit message.
- Flag Bit
 - Bit 0: Reserved, Bit 1: Network Power/Voltage Drops (below the set level),
 - Bit 2: Life State (Unit), Bit 3: Reserved, Bit 4: Reserved, Bit 5: Reserved, Bit 6: Reserved,
 - Bit 7: Reserved

■ Analog data allotment

- This function is to allot analog data. Select the desired data to transmit it to the master unit. It is able to read by Configurator or Explicit message.
- Set the allotment at Analog Data 1/2 Allocation selection of Analog Output Point.
- Setting range: 0 to 2 (factory default: 0)
 - 0: Analog Input Value, 1: Peak Value, 2: Bottom Value