LoRaWAN Node BB-WSW Series

Industrial LoRaWAN Node

Certification

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.
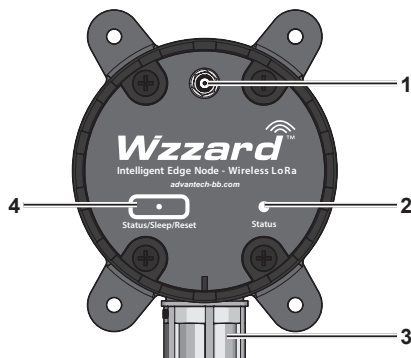
NCC

根據NCC低功率電波輻射性電機管理辦法規定：
第十二條　經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。
第十四條　低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

Package List

- 1 x Industrial LoRaWAN node
- 1 x Antenna
- 1 x Cable (BB-WSW2C42 with 2 x cable)

Overview

No	Item
1	Antenna slot
2	Status LED
3	Cable conduit
4	Status/Sleep/Reset button

Buttons and LED

The device includes a multifunction button. The various functions are described as follows:

- Operation mode: Press the button to send modbus/sensor data via LoRaWAN.
- Press and hold the button for 5 seconds until the LED starts to blink to reboot the device.
- Press and hold the button for 15 seconds until the LED continues blinking to reset the device to factory default settings.

Configuring the LoRaWAN

It is recommended to configure the LoRaWAN before installing in a permanent location.

The following procedure is written for a Windows operating system.

1. Locate the screws securing the device cap and remove them.
2. Remove the cap to expose the internal connectors.
3. A type A male to micro B USB cable is required for the following step. Connect the micro USB connector to the slot on the device.
4. Power up the target computer and allow it to boot up completely.
5. Connect the remaining end to a USB slot on a computer.
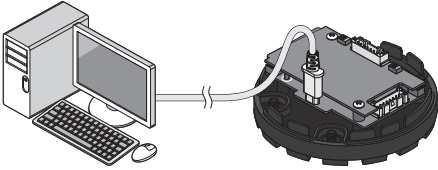

6. Once the device and computer are connected, the computer detects the USB connection and a virtual COM port is created.

   In the event that the USB connection is not detected by the operating system, use the following instructions to download and install the required driver:

   ■ Open a browser and navigate to the following website: https://www.silabs.com/products/interface/usb-bridges/classic-usb-bridges/device.cp2104.

   ■ For Windows 7/8 operating systems, download the CP210x_Windows_Driver.

   ■ For Windows 10 operating systems, download the CP210x_Universal_Windows_Driver

   ■ After downloading, install the driver on the computer.
   NOTE: you may be required to obtain administrator privilege to install.

7. Open the operating system's Device Manager. Go to **Start** > Control Panel > Device Manager and select COM & LPT port entry.
8. Click the drop-down menu to select the installed COM port and click **Apply**.
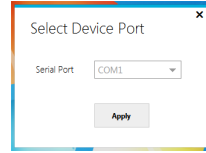
The LoRa Wzzard Utility displays as shown in the following figure.

For further information about the LoRa Wzzard Utility, refer to "Starting the LoRaWAN Node Utility".

Once the device is configured, it can be disconnected from the computer to prepare it for installation on the selected site. After the device is installed and connected to respective sensor, the LoRa Wzzard Utility is then used to customize system, device, and radio settings and connect it to the Internet/network.

9. Disconnect the USB cable from the slot on the device.
10. Replace the cap on the device and secure it with the screws if it is necessary at this time.

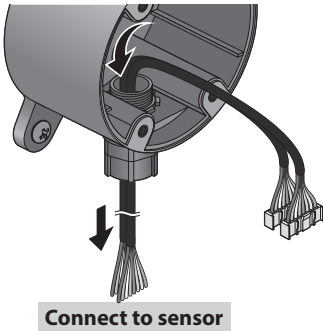   See "Hardware Installation" to continue.

Step one, wall mounting:

1. Locate the area to install and mark the four screw locations. If necessary, drill pilot holes.
   If installing in concrete, it is recommended to use wall sinks.
2. Align the LoRaWAN to the holes on the location and secure with the screws.
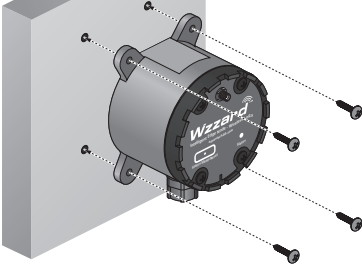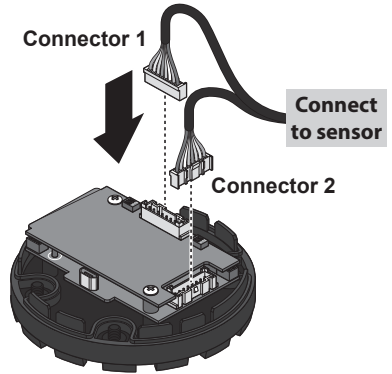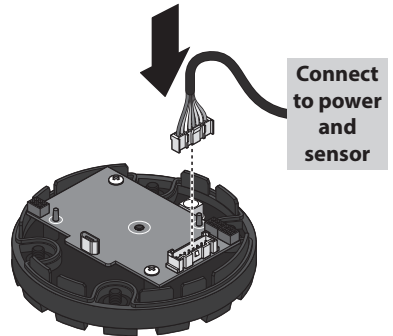

Step two, routing data cables:

3. Insert the sensor cable through the channel on the device.
   NOTE: Position the cable connector so that it can be connected to the board.

Connect to sensor

4. Connect the sensor cables to the connectors on the device.
   ■ Node with AI/DI/DO

Connector 1

Connect to sensor

Connector 2

■ Node with RS485

Connect to power and sensor

5. Align the top cover with the base and install while gently pulling the data cable slack.
   If there is resistance when pulling, do not pull the cable further to avoid damaging the connector.
6. Secure the top cover with the screws.
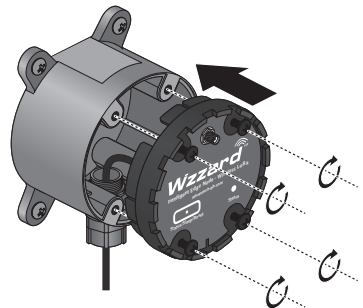
Step three, installing the antenna:

7. Connect the antenna by rotating the antenna connector in a clockwise direction.

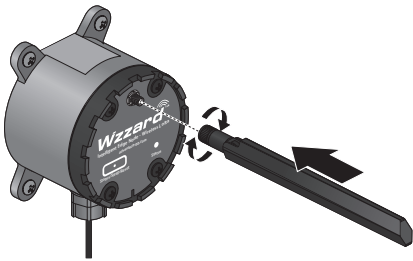**NOTE:** Positioning of antenna is crucial for effective wireless connectivity.

PIN Definition

The following pin definitions are for the cables supported by the listed LoRaWAN devices:

- Node with AI/DI/DO
    - BB-WSW2C42100-1 (915 MHz)
    - BB-WSW2C42100-2 (868 MHz)
    - BB-WSW2C42100-3 (923 MHz)

PIN	Color	Connector 1 Definition	Connector 2 Definition
1	Grey	AI1	PWR
2	White	GND	V-
3	Blue	AI2	DI1
4	Green	GND	GND
5	Yellow	AI3	DI2
6	Pink	GND	GND
7	Red	AI4	DO
8	Brown	GND	GND

- Node with RS485
    - BB-WSW2C00015-1 (915 MHz)
    - BB-WSW2C00015-2 (868 MHz)
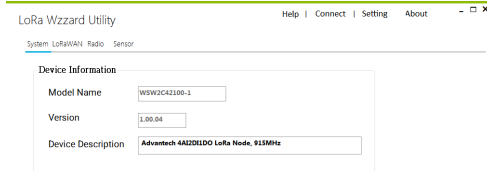   - BB-WSW2C00015-3 (923 MHz)

PIN	Color	Definition
1	Grey	PWR
2	White	V-
3	Blue	NC
4	Green	NC
5	Yellow	NC
6	Pink	NC
7	Red	D+
8	Brown	D-

Starting the LoRaWAN Node Utility

System Page

The System page displays the BB-WSW node information.

Right click on the System page to select reboot the BB-WSW node, reset BB-WSW node or upgrade the firmware.
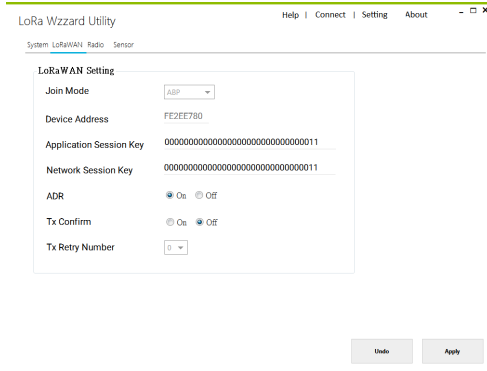

Item	Description
Model Name	Display the model name of the device.
Version	Display the current firmware version of the device.
Device Description	Display the description of the device.

LoRaWAN Page

The LoRaWAN page allows users to configuration the LoRaWAN settings.

Item	Description
Join Mode	Click the drop-down menu to select the LoRaWAN join mode.
ADR	Click the radio button to enable the mechanism for optimizing data rates, airtime and energy consumption in the network.
Tx Confirm	Click the radio button to enable the function that confirm the transmission is success or not via a ACK frame from remote LoRaWAN receiver.
Tx Retry Number	Click the drop-down menu to select the number of retransmission that LoRaWAN sender considers the transmission failed.
Join Mode is ABP	
Device Address	Display the 4 bytes hexadecimal device address of end device.
Application Session Key	Enter the key used for encryption and decryption of the LoRaWAN packet payload.

Item	Description
Network Session Key	Enter the key used to check the validity of messages (MIC check).
Join Mode is OTAA	
Device EUI	Display the 8 bytes hexadecimal unique identifier of end device.
Application EUI	Enter the 8 bytes hexadecimal unique identifier of the application provider of the end device.
Application Key	Enter the key used to derive the session keys.

Radio

The Radio page allows users to configuration the LoRa Radio settings.

Item	Description
Band	Display the LoRaWAN radio band for different region: AS923, EU868, or US915.
RF Power (dBm)	Display the output power of the radio.
Data Rate	Click the drop-down menu to select the settings of LoRa Spreading Factor (SF), Bandwidth and Data Rate. LoRa operates with SF from 7 to 12. SF7 is the shortest time on air, SF12 is the longest time.
Channel Frequency (Hz)	Enter the LoRa channel frequency. The frequency range for the radio band is as following: • AS923: 920,000,000 ~ 925,000,000 Hz. • EU868: 863,000,000 ~ 870,000,000 Hz. • US915: The frequency of channel is fixed. Each channel frequency needs to be separated by more than 200,000 Hz.
Channel Selection	Click the check box to select the LoRa channel to use.

Digital/Analog Input

The Digital/Analog Input page allows users to configuration the DI/AI settings.
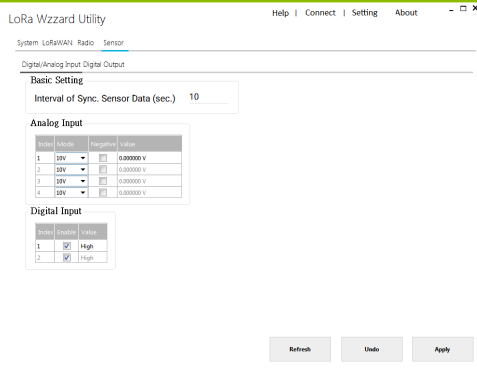
Item	Description
Interval of Sync. Sensor Data (sec.)	Enter the value to define the interval defines how often the LRPv2 node reads DI/AI data.
Analog Input	Set the setting for the analog inputs: • Mode: Click the drop-down menu to select AI measure mode. • Negative: Click the check box to set enable if the analog input may be negative value possibly. • Value: Display the analog input value.
Digital Input	Set the setting for the digital inputs: • Enable: Click the check box to enable to read DI data or not. • Value: Display the digital input value.

Digital Output

The Digital Output page allows users to configuration the DO settings.
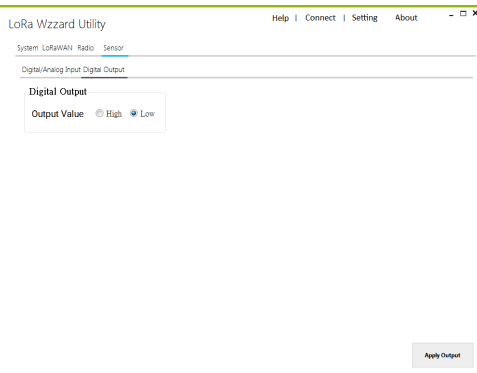
Item	Description
Digital Output	Click the radio button to write a High or Low value to a digital pin.

Modbus

UART

The UART page allows users to configuration the UART settings. The UART settings must to match with the settings on the attached Modbus RTU device.
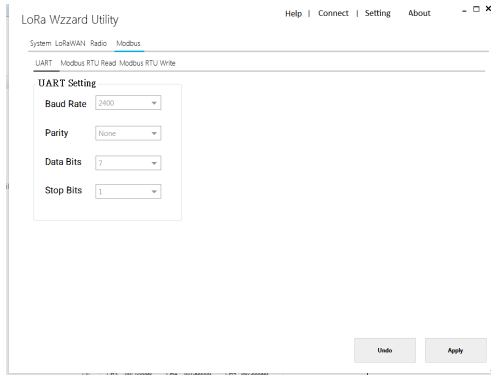
Item	Description
Baud Rate	Click the drop-down menu to select the transmission speeds of the connected devices.
Parity	Click the drop-down menu to select the method of detecting errors in transmission.
Data Bits	Click the drop-down menu to select the number of data bits in each character.
Stop Bits	Click the drop-down menu to select the end of every character allows the receiving signal hardware to detect the end of a character.

Modbus RTU Read

The Modbus RTU Read page allows users to configuration the Modbus Read settings.
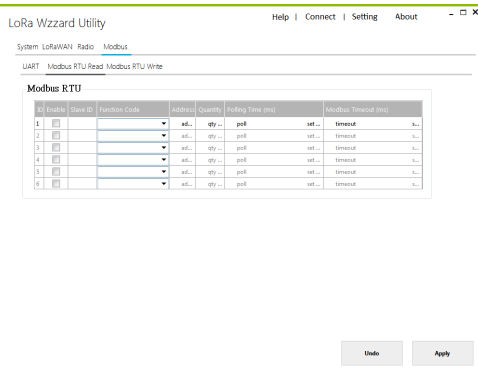
Item	Description
Enable	Click the check box to enable the Modbus Read command function.
Slave ID	Enter the value to define the unique unit address of Modbus slave.

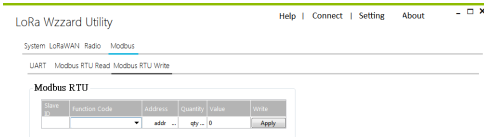| Item	Description
Function Code	Click the drop-down menu to select the master device delivers packets to the slave device containing instructions as defined in the function code fields.
Address	Enter to designate the read from starting address for the Modbus registry.
Quantity	Enter to designate the number of read cycles. Each function code has different quantity range. • 01: 1 ~ 32 • 02: 1 ~ 32 • 03: 1 ~ 23 • 04: 1 ~ 23
Polling Time (ms)	Enter the value to specify the frequency with which the Modbus command is re-issued.
Modbus Timeout (ms)	Enter the value to specify the time duration in milliseconds for the LRPv2 node to wait for a response after it has issued a command.

Modbus RTU Write

The Modbus RTU Write page allows users to configuration the Modbus Write settings.

Item	Description
Slave ID	Enter the value to define the unique unit address of Modbus slave.
Function Code	Click the drop-down menu to select the master device delivers packets to the slave device containing instructions as defined in the function code fields.
Address	Enter to designate the write from starting address for the Modbus registry.
Quantity	Enter to designate the number of write cycles. Each function code has different quantity range. • 05: 1 • 06: 1
Value	Enter the value to specify the value written to Modbus Slave.
Write	Click **Apply** to write the settings to Modbus RTU.

Device Payload

Common

Common Uplink

ACK

When device receive setting frame from LoRaWAN network server, the device will send ACK frame to network server, representing the device has set setting frame.

FPort: 64

Bytes	1	1	2
	Sport	Ret	Checksum

- Sport: Previous setting frame FPort
- Ret: 0x0 is successful and 0x1 is unsuccessful
- Checksum: Previous setting frame checksum

Common Downlink

System Set

System set frame can set system command to device include reboot or reset to default.

FPort: 9

Bytes	1
	cmd

- cmd: 0x1 is reboot and 0x2 is reset to default

BB-WSW2C00015

Uplink

Modbus Uplink Data

Modbus uplink data length is not fixed, it depend on Modbus payload, can be 6 to 51 bytes.

FPort: 5

Bytes	1	2	1	1	Not Fixed (1-46)
	ID	Addr	FL	TR	Payload

- ID: Modbus slave ID
- Addr: Modbus address
- FL: Function code and payload length
- TR: Transactions and return code
- Payload: Modbus payload from Modbus sensor

bits	3	5
	Function	Length

- Function: Modbus function code
- Length: this frame payload length, unit is words or bits depend on function code

bits	4	4
	Transactions	Return

- Transactions: device transactions index
- Return: if return is 1, representing Modbus protocol is timeout

Downlink

Modbus Transactions Set

WSW2C00015 can set Modbus transaction from remote.

FPort: 5

Bytes	1	1	1	2	2	1
	Tran	En	ID	Addr	Poll	FL

- Tran: A number representing index of Modbus transactions, can be 1 ~ 6
- En: Representing whether Modbus transactions is enable or disable, can be 1 or 0
- ID: Representing slave ID used for Modbus transactions, can be 1 ~ 247 or 255
- Addr: Representing slave address used for Modbus transactions, can be 1 ~ 65535
- Poll: Representing polling interval time, can be 1 ~ 65535, unit is 10 secs
- FL: Function code and payload length

bits	3	5
	Function	Length

- Modbus function code, can be 1 ~ 4
- Length: Representing read length used for Modbus transactions , can be 1 ~ 32 (FC is 1 or 2) and 1 ~ 23 (FC is 3 or 4)

Modbus Write

Bytes	1	1	2	Not Fixed (1-46)
	ID	FC	Addr	Payload

- ID: Modbus slave ID
- FC: Function code, can be 5 or 6
- Addr: Modbus slave address
- Payload: Write Data
- Example:

	ID	FC	Addr	Payload
coil	01	05	0001	01
register	01	06	0001	0001

Uplink

Sensor Uplink Data

FPort: 6

Bytes	2	2	2	2	2	1
	AI1_R	AI2_R	AI3_R	AI4_R	AIM	DIDO

- AI[N]_R: Analog input [N] Raw data, can be 0 to 65535
- AIM: Analog input mode

Bits	1	3	1	3
	AI4_NEG	AI4_MODE	AI3_NEG	AI3_MODE
Bits	1	3	1	3
	AI2_NEG	AI2_MODE	AI1_NEG	AI1_MODE

- ■ AI[N]_MODE: Representing analog input [N] operate mode

AI[N]_MODE	
0	Disable
1	10V
2	5V
3	1V
4	20mA

- ■ AI[N]_ENG: Representing analog input [N] whether support negative value, can be 0 or 1.
- DIDO: Digital input and digital output

Bits	2	1	1	1	1	1	1
	reserve	DO1_E	DO1_A	DI2_E	DI2_V	DI1_E	DI1_V

- ■ DI[N]_V: Digital input [N] data, can be 0 or 1.
- ■ DI[N]_E: Digital input [N] enable or disable, can be 0 or 1.
- ■ DO1_A: Digital output 1 on or off, can be 0 or 1.
- ■ DO1_E: Digital output 1 enable or disable, can be 0 or 1.

Example: FF010000ABCD020194013E
    AI1 Raw Data: 0xFF01 (65281)
    AI2 Raw Data: 0x0000 (0)
    AI3 Raw Data: 0xABCD (43981)
    AI4 Raw Data: 0x0201 (513)
    AI mode: 0x9401
        AI4 Eng: 1
        AI4 mode: 1 (001b)
        AI4 Rang: -10 V ~ 10 V
        AI4 = -10 + ((10 - (-10)) / 65535) * 513 = -9.8434 V
        AI3 Eng : 0
        AI3 mode: 4 (100b)
        AI3 Rang: 0 mA ~ 20 mA

AI3 = 0 + ((20 - (0)) / 65535) * 43981 = 13.4221 mA
AI2 Eng: 0
AI2 mode : 0 (0b)
AI2 is disable
AI1 Eng: 0
AI1 mode : 1(1b)
AI1 Rang: 0 V ~ 10 V
AI1 = 0 + ((10 - (0)) / 65535) *6 5281 = 9.9612 V
DIDO: 0x3E (0011 1110 b)

Bits	2	1	1	1	1	1	1
	reserve	DO1_E	DO1_A	DI2_E	DI2_V	DI1_E	DI1_V
Value	00	1	1	1	1	1	0
3E	3			E			

DI1_V: 0
DI1_E: 1
DI2_V: 1
DI2_E: 1
DO1_A: 1 ON
DO1_E: 1

Downlink

Interval Set

FPort: 7

Bytes	1	2
	reserve	Interval

- Interval: Representing polling interval time, 1 ~ 65535, 10 sec. units
- Example:

	reserve	interval
10sec	00	0001

Digital Output Set

FPort: 13

Bytes	1	2
	Action	reserve

- Action: Signifies if digital output is on or off
- Example:

	action	reserve
Do on	01	00
Do off	00	00

Specifications

Power

- **Internal:** Two 3.6-V 2500-mAh lithium AA batteries
- **Optional:** External input 9 ~ 36 V_{DC}

Mechanical

- **Physical Connection:** 12.7 mm (0.5") conduit, sensor interface cable included; 8-wire, 26-gage, 1.8 m (70.87")
- **Sensor Inputs:**
  - Analog input: ±10 V_{DC}, ±5 V_{DC}, ±1 V_{DC}, 0 ~ 20 mA
  - Digital input: 0 ~ 48 V_{DC}
  - Digital output: 0 ~ 30 V_{DC}
- **Optional External Antenna:** RP-SMA, omnidirectional, 1.5 dBi, 868 ~ 915 MHz; length, 170 mm (6.69")
- **Mounting:** Magnetic mounting via an internal magnet Holding force, 2.13 kg (4.7 lbs); four mounting ears, M5 (#10)
- **Enclosure:** IP66-rated, fiber-reinforced polyester PBT
- **Weight:** 0.4 kg (0.88 lbs)

Technology

- **Wireless:** LoRaWAN 868/915/923 MHz
- **LED:** Network connectivity

Environmental

- **Installation:** Indoor or outdoor
- **Operating Temperature:** -40°C ~ 75°C (-40°F ~ 167°F)
- **Storage Temperature:** -40°C ~ 85°C (-40°F ~ 185°F)
- **Operating Humidity:** 10 ~ 95% noncondensing

Digital Inputs

- **Voltage Range:**
  - Dry contact : Logic level 0: close to GND
  - Logic level 1: open
  - Wet contact:
    Logic level 0: 0 ~ 1 V_{DC}
    Logic level 1: 3 ~ 30 V_{DC}
- **V_{IL}:** 0.8 V (max)
- **V_{IH}:** 2 V (min)
- **Pull-Up Current:** 32 µA
- **Type:** Source/Sink (PNP/NPN) software-selectable input
- **Isolation:** None
- **Channels:** 2ch

Digital Outputs

- **Voltage Range:** 0 ~ 30 V_{DC}
- **Output Type:** Open drain
- **Output Current:** 100 mA max
- **Protection:** Current limit protection
- **Isolation:** None

Analog Inputs

- **Input Range:** ±10 V_{DC}, ±5 V_{DC}, ±1 V_{DC}, 0 ~ 20 mA
- **Resolution:** 16 bit
- **Input Load Resistance:** 10MΩ (voltage), 120Ω (current)
- **Accuracy:**
  - ±0.1% (voltage) at 25°C
  - ±0.2% (current) at 25°C

Serial Communication

- **Port Type:** RS485
- **No. of Ports:** 1
- **Protocol:** Modbus RTU
- **Data Bits:** 8
- **Stop Bits:** 1, 2
- **Parity:** None, odd, even, space, mark
- **Baud Rate:** 2400 ~ 115200 bps
- **Serial Signals:** Data+, Data-
- **Protection:** Built-in 15 kV ESD protection for all signals

Console for Configuration

- **Port Type:** Micro USB
- **No. of Ports:** 1
- **Data Bits:** 8
- **Stop Bits:** 1
- **Parity:** None
- **Baud Rate:** 115200 bps
- **Serial Signals:** TxD, RxD

Regulatory Approvals

- **Shock:** IEC60068-2-27
- **Free Fall:** IEC60068-2-32
- **Vibration:** IEC60068-2-6

For more information on this and other Advantech products, please visit our website at:
  http://www.advantech.com/products/
For technical support and service:
  http://www.advantech.com/support/