A1110 WirelessHART Adapter

User Manual

MICROCYBER

Version

No.	Version no.	Remark
1	1.1	Software version 1.1

A1110 WirelessHART Adapter

NOTICE
In order to ensure personal and property safety and get the best product experience, you must read all the contents of the document before using, installing and maintaining products.

SATETY TIPS
Special attention should be paid to the contents of this manual in order to ensure the safety of personal property. The content that may cause potential safety problems is expressed as warning. Please refer to the information before the operation.

WARNING
This manual and the description of the products are not designed for nuclear industrial applications. Do not touch wires or terminals. The potential high voltage on the lead may cause electric shock.

Catalogue

Catalogue

1. Overview

> **WARNING**
>
> Please pay attention to the following guidelines, otherwise it may cause serious personal injury.
> - Ensure that the construction personnel are with relevant qualifications.
> - Ensure that the working environment of the equipment is consistent with the appropriate hazardous locations certifications.
> - Use extreme caution when making contact with the leads and terminals.

1.1 Introduction

A1110 WirelessHART Adapter (hereinafter referred to as A1110) is in line with the latest version of HART7.6 specification. It can seamlessly integrate the original HART equipment into WirelessHART network and protect the original assets. A1110 provides a variety of power supply modes, such as 4-20mA loop, DC power supply and battery. A1110 makes all HART device data read access at any location possible, meanwhile it supports remote configuration and maintenance.

1.2 Features

- Provide WirelessHART network seamless integration solution
- Support HART5, 6, 7 device
- Support 2, 3 and 4 wire HART device
- Support 4-20mA loop and external power supply mode
- Reliability of wireless data higher than 99.9%
- Conform to HART7.6 specification standard

1.3 Basic Operation

A1110 collects dynamic variables, process data and alarm information of HART device and uploads the information to WirelessHART network.

- **HART port**

HART port is connected to traditional HART device. As HART master, A1110 communicates with traditional HART device in 4-20mA loop, collects connected HART device information and uploads the information to the WirelessHART network. A1110 can also serve as HART slave device, configured by software (or HART handheld).

- **Management and communication of sub device**

A1110 can support up to 4 HART device connections. WirelessHART Gateway can get network information of A1110 and HART devices and communicate with HART devices through A1110. A1110 uses Burst mechanism to upload data periodically, and users can configure the data upload time flexibly.

1.4 Notes

1.4.1 Electrical

A1110 supports 4-20mA loop and external power supply. The two types of power supply use different wiring modes, which need to be configured by configuration software. Please refer to details in chapter "4.2 Adapter function configuration".

A1110 is connected into 4-20mA loop and realizes self-power supply through energy acquisition. A1110 will cause 2.5V loop voltage drop, not affecting 4-20mA signal in the loop. When using loop power supply, the power supply mode should be configured as loop power supply, and A1110 will adopt 4-20mA loop power supply mode by default.

A1110 uses external DC power supply (such as batteries, other DC power sources) to supply power (power supply voltage: 11-30VDC). When external power supply is used, the mode of power supply should be configured as external power supply.

1.4.2 WirelessHART Device Installation

WARNING

Power order

Before the WirelessHART Gateway's installation and normal operation, no wireless device can be powered on. In addition, wireless devices power on should be started from the nearest node to the Gateway, which make the installation of the network simpler and faster. The ad packet activation mode in the Gateway ensures that the new device is able to access the network faster.

Installation position

If possible, the A1110 shall be arranged vertically upwards or downwards, and be away from any large structure, building or conductive surface at least 30cm, so as to communicate with other devices stably. If A1110 is installed horizontally, the wireless communication range may be reduced.

Wiring duct entrance

When A1110 is installed in the wiring duct entrance of device, the approved thread sealant should be applied, which is waterproof and lubricating to facilitate the disassembly of A1110 Adapter.

Power supply

The minimum loop load should be 250 Ω.

When A1110 is communicated and charged through standard 4-20 mA loop, it will cause 2.5V voltage drop in the loop. There should be at least 2.5V voltage margin at the maximum loop current (25 mA for typical 4-20mA HART device). A1110 will not affect 4-20mA signal.

When A1110 is supplied by external DC power, the voltage range is 11-30VDC.

Load resistor

If necessary, load resistor can be added as shown in figure 3-4, figure 3-6, figure 3-7 and figure 3-9. The resistor should be sufficient to meet application requirement (minimum 1W). When adding a load resistor, it should be ensured that the bare wire is not touched by the shell or exposed metal.

1.5 Service support

NOTICE
For more information, please refer to the relevant sections of the user manual or visit www.microcyber.cn for more technical documents. For any questions and feedback during usage, please write to specialists.wireless@microcyber.cn for help.

2. First Connection

> **WARNING**
>
> Failure to comply with these installation standards may lead to death or serious injury.
> - The installation can only be performed by qualified personnel.
> - An explosion may cause death or serious injury.
> - Verify that the working environment of the device is consistent with corresponding certification of hazardous sites.
> - Electrocution shock may lead to death or serious injury.
> - Use extreme caution when making contact with the leads and terminals.
> - When installing, it is necessary to ensure at least 20cm distance between the antenna and the person.

2.1 Overview

> **WARNING**
>
> Please do not cut off power when A1110 is operating, otherwise it will lead to unforeseeable consequences.

This section shows how to connect A1110 for the first time and the configuration that should be done before joining to the field network.
The following items are required to complete this task:
- A1110 WirelessHART Adapter
- WirelessHART Gateway
- PC/ portable computer
- WirelessHartMPT configuration software
- standard HART Modem
- 1200 Ω resistor
- 24 VDC (nominal) power supply

2.2 Gateway Configuration

As for the connection of Microcyber G1100 WirelessHART Gateway (hereinafter referred to as Gateway) and A1110 Adapter, please refer to chapter "1 Create / Establish WirelesHART Gateway" from *WirelessHART Quick Start* for Gateway's simple connection and configuration information.
If you use other brand WirelessHART Gateways, please check their manuals.

2.3 Configuration Software

"WirelessHartMPT" is Microcyber WirelessHART configuration software. Please use PC or portable

computer to install it (better the latest version), which can be downloaded from http://www.microcyber.cn/ruanjian/ or available by contacting Microcyber. After installation, it will show as figure 2-1:
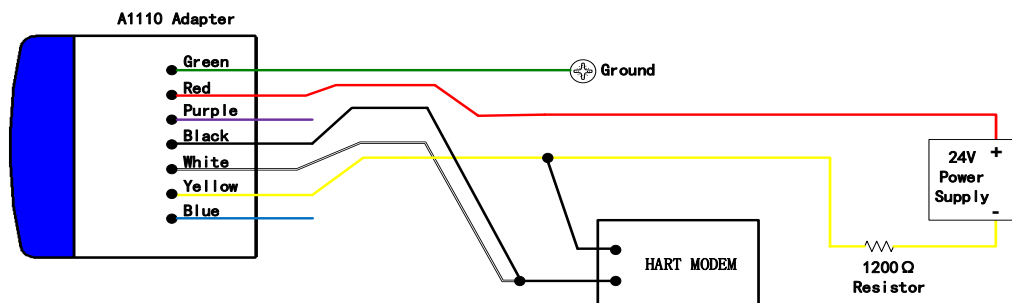
Figure 2-1 WirelessHartMPT configuration software shortcut
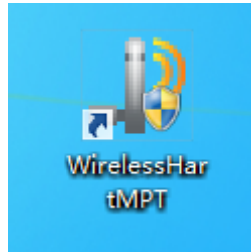
2.4 Configuration Connection Diagram

A1110 Adapter, powered by the 24V power supply, using 1200 Ω resistor to limit the current to 20 mA, and 1200 Ω resistor should be enough to meet the application requirements (minimum 3W). Figure 2-2 gives a detailed description of the connection mode of the A1110 configuration.

Figure 2-2 A1110 configuration connection mode

2.5 Device Access Network

The initial configuration steps are as follows:

1. Open "WirelessHartMPT" configuration software, select available serial port and choose "Settings" > "Serial Port".

2. After selection of the serial port, the left side of the window will display the selected serial port name and number. Select this serial port, click the right mouse button and select "Node 0-15" > "Node 15" (Adapter factory default HART short address is 15, please scan according to the correct address if user has changed it). Then configuration tool will start searching devices (single node

search). When succeed, it will show as figure 2-3. The left window displays the searched device labels, and the right window shows the searched devices list, including device labels, manufacturers, device types, and date of production.

Figure 2-3 WirelessHartMPT configuration software device list interface
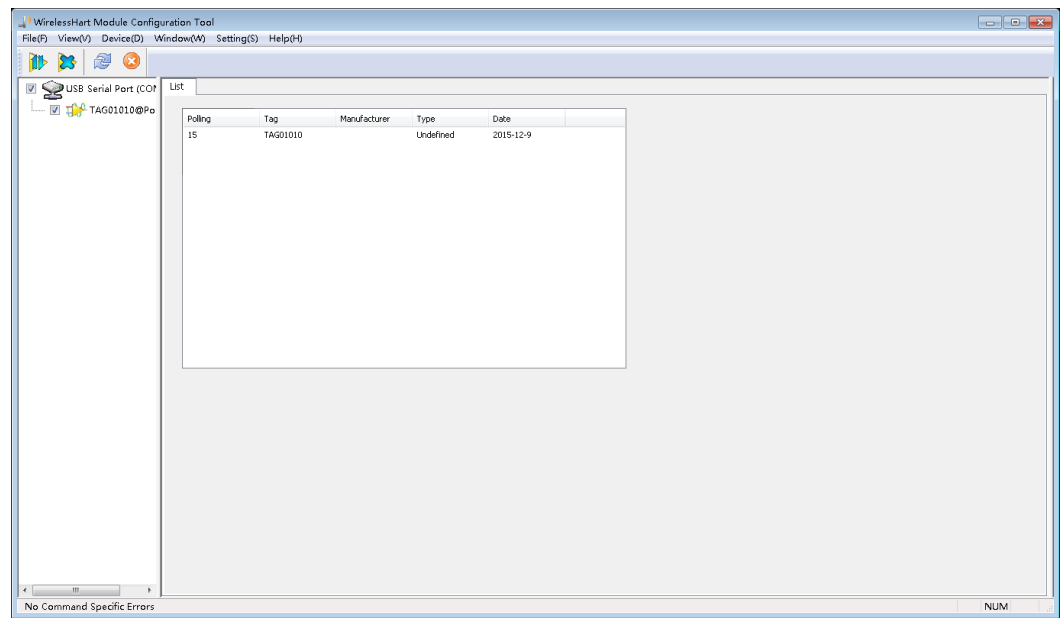
3. After successfully searching the device, click the device label on the left window and enter the window as shown in Figure 2-4 to begin to read and write parameters of the A1110.

Figure 2-4 WirelessHartMPT configuration software device basic information interface
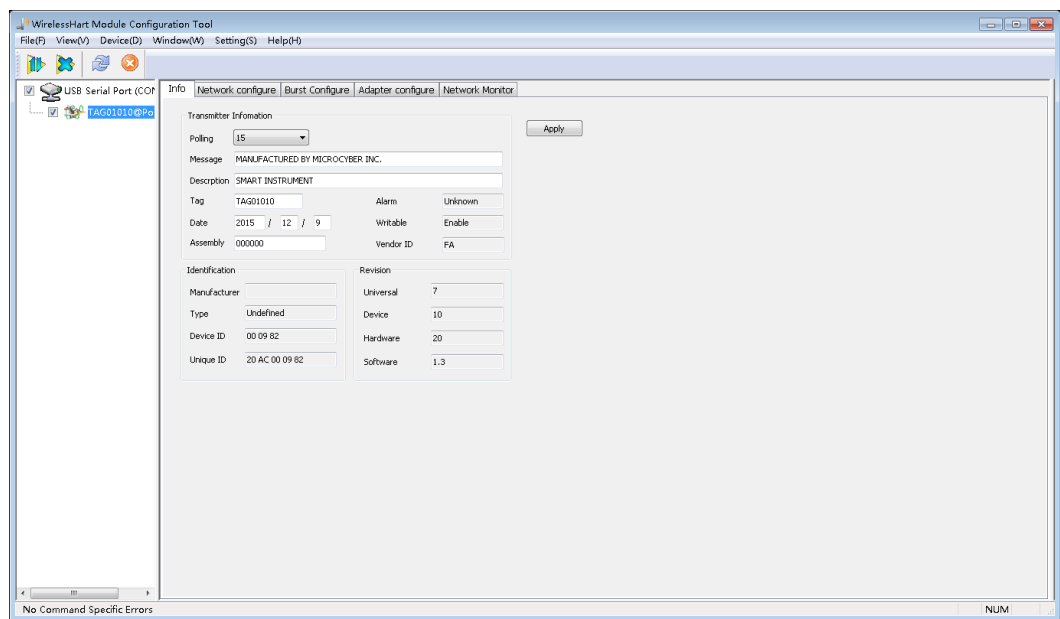
4. Click the "Network Configure" column on the right window of Figure 2-4 and the configuration interface will display information as shown in Figure 2-5.

Figure 2-5 WirelessHartMPT configuration software network information configuration interface
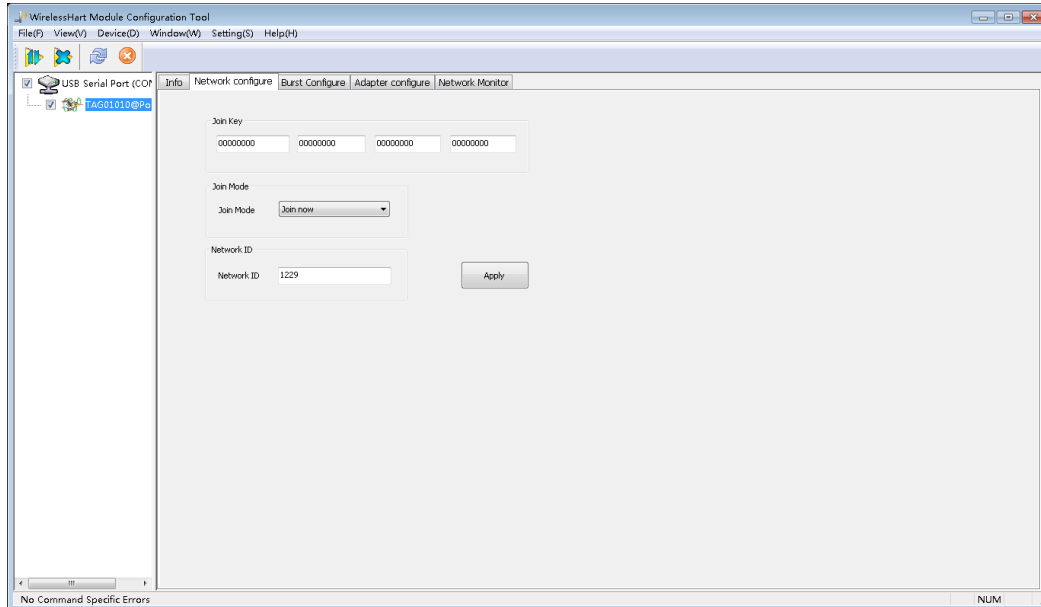
(1) Configure A1110's join key, network ID (must be consistent with the Gateway):
   Network ID: 1229
   Secret key: 00000000 00000000 00000000 00000000
   Click "Apply" button to complete the setting of the above parameters.
(2) Modify the join mode：
   Join mode：Join now
(3) Click the "Apply" button to complete the setting of the above parameters, and A1110 will be ready to enter the network.
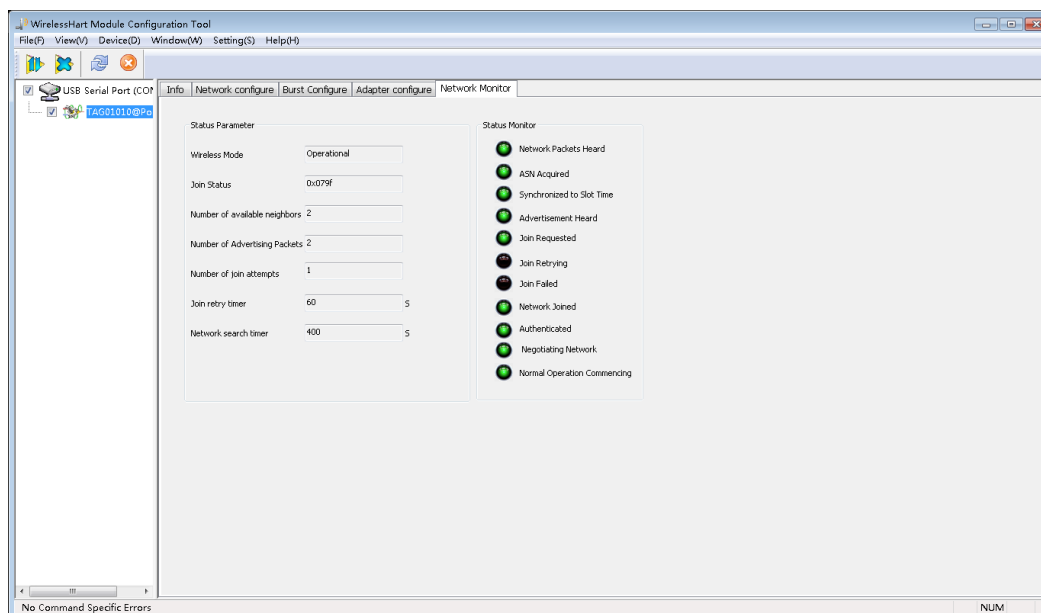
2.6 Monitoring Network Process

After setting up the Gateway and A1110, A1110 will be ready to join the wireless network built by the Gateway.

Monitoring Adapter to network
Click the "Network Monitor" bar in Figure 2-5 to enter the interface as shown in Figure 2-6. The interface can be used to observe the access status of A1110. When the green light before the "Normal Operation" item is lit, it indicates that A1110 has successfully joined the wireless network built by the Gateway.
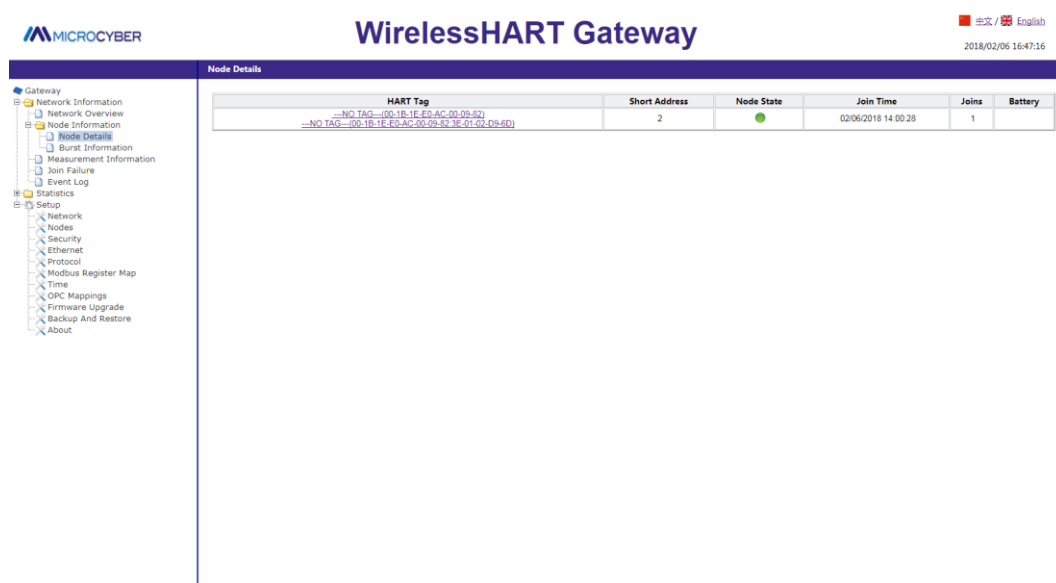
Figure 2-6 Network Monitoring Interface of WirelessHartMPT Configuration Software

Monitoring Network Status

In Gateway webpage, select "Network Information" > "Node Information" > "Node Details", enter the webpage of Figure 2-7. The webpage may observe detailed information about wireless network nodes.

Figure 2-7 Detail Page for Network Nodes

First Connection

Monitoring Process Data

In Gateway webpage, select "Network Information" > "Measurement Information", enter webpage of Figure 2-8. The page may observe process data of wireless network nodes.

Figure 2-8 Webpage Measurement Information Page

More details refer to Gateway webpage.

3. Installation

WARNING

Explosion can cause death or serious injury.

- Shall verify whether device working environment is consistent with the responding certification of hazardous sites.
- Electrostatic discharge can damage electronic devices.
- Shall use personnel grounding devices before touching electronic devices or leads and terminals.
- Electric shock can cause death or serious injury. Device leads and terminals may have high voltage if the device is installed in high voltage environment and has fault status or been incorrectly installed.
- Shall be very careful when touching leads and terminals.
- Not follow these installation guidelines can cause death or serious injury.
- Ensure installation is done only by qualified personnel.
- Ensure at least 20cm distance between antenna and personnel when installing the device.

3.1 Overview

This section explains how to correctly install A1110 and make electronic connection.

3.2 Installation

3.2.1 Installation Method

Usually A1110 is directly connected onto conduit entrance of HART device. 1/2 NPT male coupling of A1110 can be directly installed onto housing of HART device. For the field devices with other type couplings, such as M20, screw Adapter can be used.

1. Install HART device based on standard installation practices, and ensure to use qualified screw sealant on all the screw couplings.

2. Connect A1110 onto HART device according to Figure 3-1, if A1110 is installed into conduit entrance of HART device.。

3. Please refer to Figure 3-3 ~ Figure 3-9, connect A1110 adaptor to HART device.

4. Close shell cover of HART device, but don't screw it over-tightly, to avoid damage the device.

Figure 3-1 Direct Installation
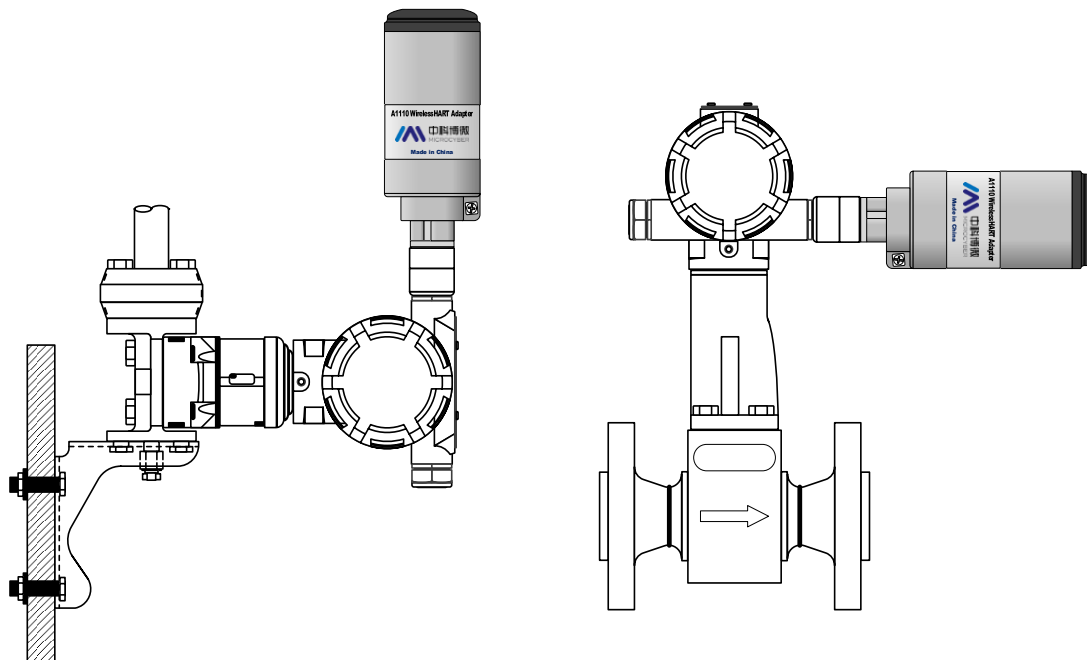
3.2.2 Antenna

A1110 antenna is built-in omnidirectional antenna. A1110 shall be vertically installed (horizontal installation will weaken signal), and over 30cm distance from any metal. A1110 may be disturbed by nearby other 2.4 GHz ISM frequency band signal, and these disturbances may cause intermittent message retransmission and loss. To keep optimal antenna signal intensity, shall timely clear away accumulated materials on surface of the antenna, such as dust, fiber, snow and ice. Pay attention that the antenna not to be subjected to too hard external force, avoiding damage.

3.2.3 Wiring Port

The following table describes A1110 wiring and colorful wires' function. These wires all are drawn out through 1/2NPT outlet of A1110. Detail wiring methods refer to Section 3.3.

Wire Color	Specification	Description
Purple	20AWG	External Power+
Green	20AWG	Ground
Red	20AWG	Loop Powered+
Black	20AWG	HART Communication
White	20AWG	HART Communication
Yellow	20AWG	Power Supply-
Blue	20AWG	Reserved

3.3 Wiring

This section introduces wiring method when A1110 and sub-devices are taken as repeater.

3.3.1 Wiring Method of Being Repeater

A1110 can be taken as repeater. Now A1110 does not connect to other HART devices, and usually put in the place where signal cannot arrive or is weak, to route other WirelessHART devices in the network. It has improved reliability of the whole WirelessHART network and path stability.

A1110 as repeater usually uses external power supply (such as battery, other DC power), voltage range is 11-30VDC. Purple lead connects power supply (+) positive pole, yellow lead connects power supply (-) negative pole. External power is available if using WirelessHartMPT configuration software. Other wiring is shown in Figure 3-2.

Figure 3-2 Wiring Diagram of A1110 as Repeater

3.3.2 Loop Powered Wiring Method

When A1110 is loop powered, its power supply shall be configured to loop powered (Configuration process refer to Section 4.2).

To ensure normal work of A1110, loop must have 250Ω resistor at least. If 4-20mA loop has no necessary resistor, resistor shall be connected according to Figure 3-4, 3-6, 3-7.

NOTICE

When adding load resistor, shall ensure naked conductor not to touch shell or other exposed metal.

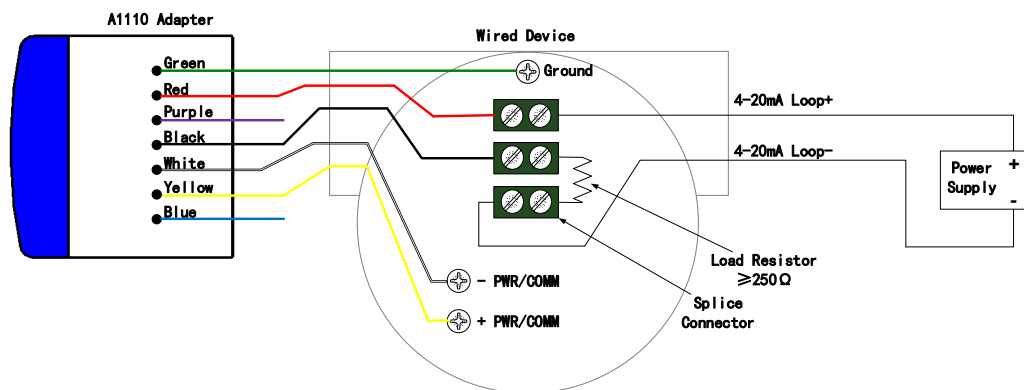Figure 3-3 Two-wire Device Wiring When Loop Powered

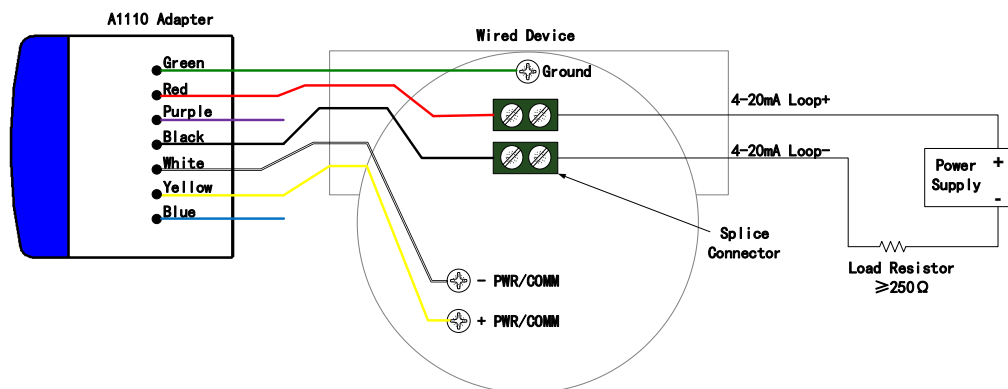Figure 3-4 Two-wire Device Wiring When Loop Powered (with resistor)

Figure3-5 Four-wire Device Wiring When Loop Powered
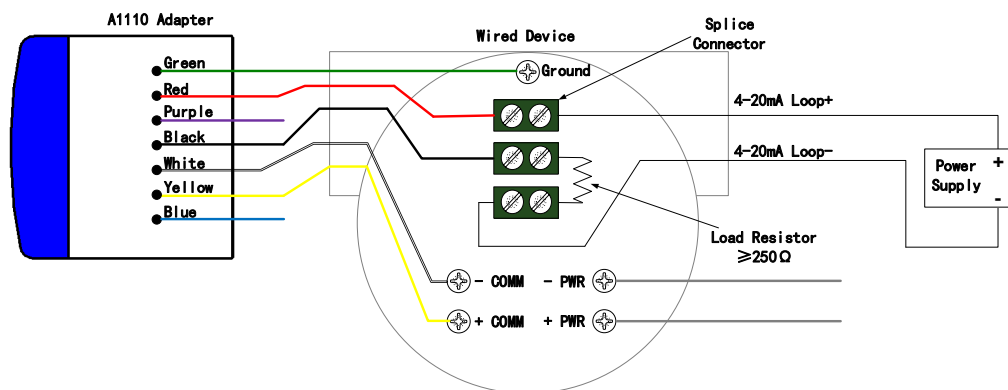
Figure 3-6 Four-wire Device Wiring When Loop Powered (with resistor)
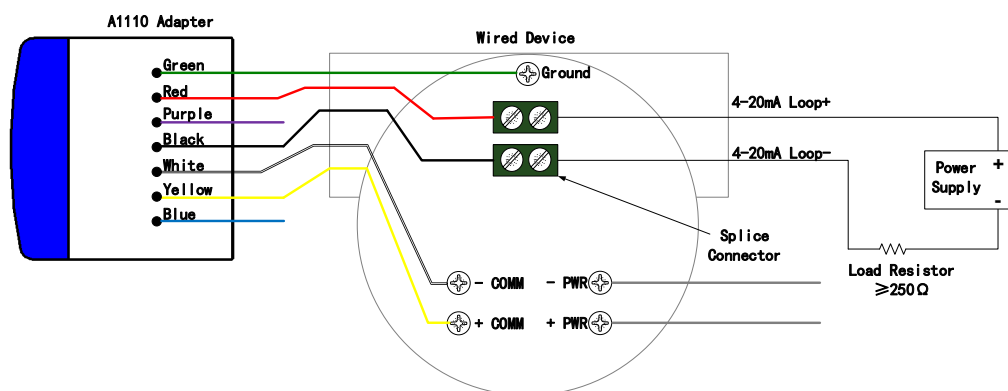
Figure 3-7 Multiple Sub Devices Wiring When Loop Powered
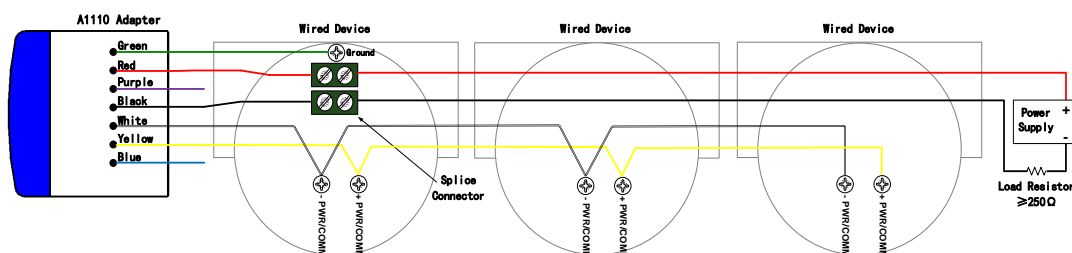
3.3.3 Wiring Method of External Power

When A1110 uses external power, it is configured by WirelessHartMPT configuration software, power supply voltage range is 11-30VDC.

To ensure normal work of A1110, sub device loop must have 250Ω resistor at least. If sub device loop has no this resistor, shall connect resistor according Figure 3-9.

NOTICE

When adding load resistor, shall ensure naked conductor not to touch shell or other exposed metal.

Installation

Figure 3-8 Two-wire Device Wiring When Using External Power

Figure 3-9 Device Wiring When Using External Power (with resistor)

4. Operation

WARNING

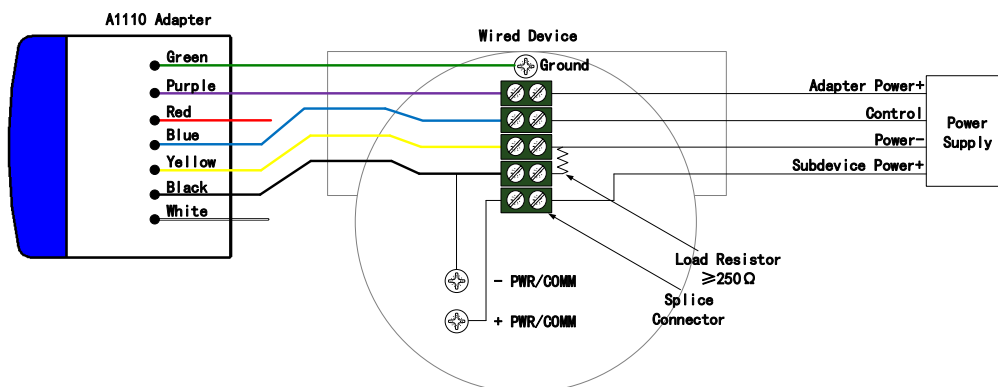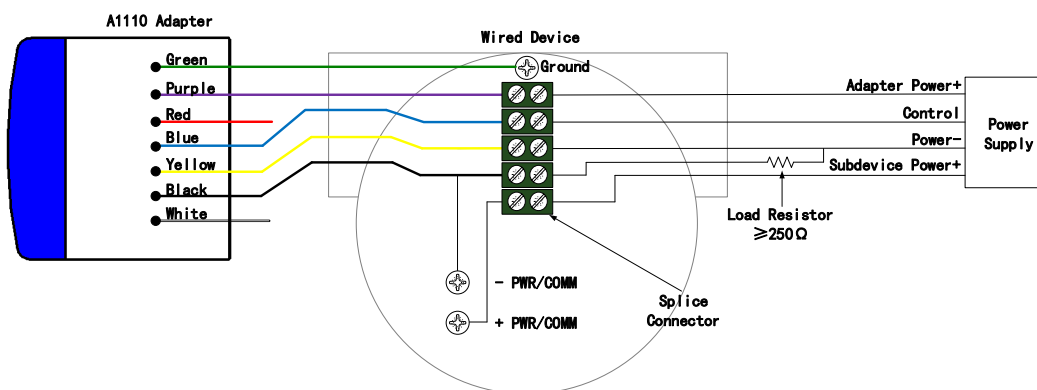Not follow these installation guidelines can cause death or serious injury:
- Installation shall be done only by qualified personnel.
- Explosion can cause death or serious injury.
- Shall verify whether device working environment is consistent with the responding certification of hazardous sites.
- Electric shock can cause death or serious injury.
- Shall be very careful when touching leads and terminals.
- Ensure at least 20cm distance between antenna and personnel when installing the device.

4.1 Device Startup

A1110 has two power supply modes, respectively are loop powered and external power. For different power supply mode, start time will be different. When loop powered, A1110 shall be "charged" firstly, and enters working status only at its working voltage. But using external power, it can enter working status after power-on at once.

Configuration Mode

When A1110 is configured with the status as "Don't attempt to join" (shown as Figure 4-1), A1110 is under configuration mode. When A1110 is in the status "Don't attempt to join" and configuration fails, A1110 may be under the initial status. Configure again after 5 minutes, and then reset A1110 after finished.

When A1110 is under configuration mode, the parameters including Burst, access-network information and other related can be configured.

NOTICE

Be unable to make any communication before completing initialization of A1110 if loop powered. After startup, initialization time is about 1-5 minutes.

Be unable to make any communication before completing initialization of A1110 if using external power. After startup, initialization time is about 10s-5mins.

Configuration cannot be done during A1110 joining the network. If configured, unknown error in communication may appear.

Figure 4-1 View A1110 Joining Mode
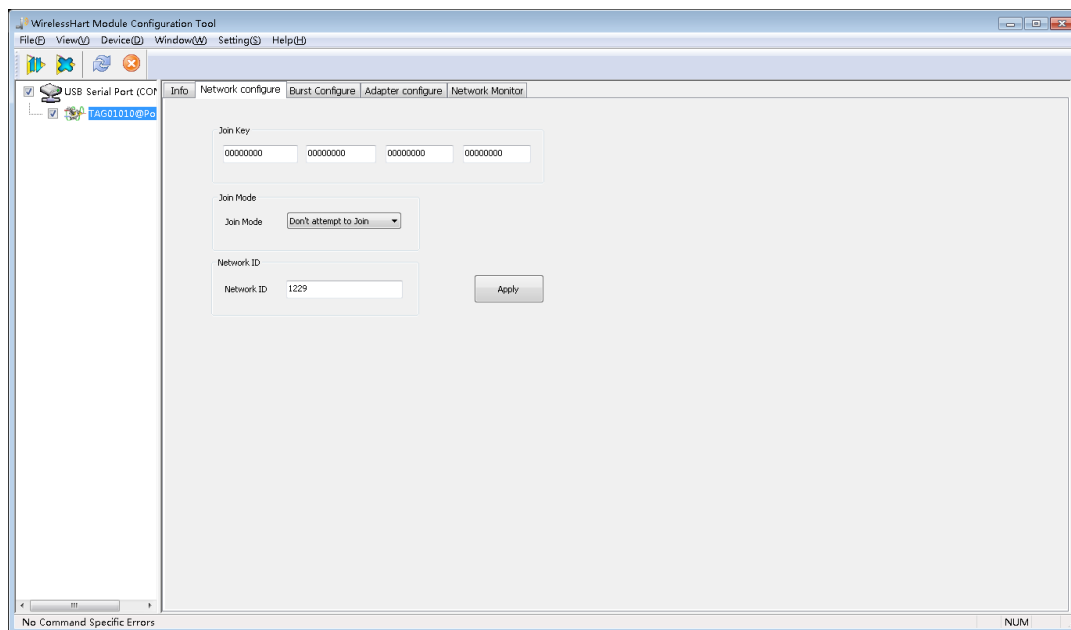
4.2 A1110 Function Configuration

Using "WirelessHartMPT" configuration software, connection mode refers to Section "2. Initial Connection", enter A1110 configuration interface, shown as Figure 4-2.

Figure 4-2 Configuration Interface of A1110 Adaptor

The following describes the various parts of the configuration interface:

Start address

During A1110 initialization, the start address of the connected HART device is scanned, ranging from 0-63, not greater than the scan end address.

End address:

A1110 scan the connected HART device until to the end address during initialization, ranging from 0-63, not less than the scan start address. If you want the Adapter is powered on without scanning the HART device, the scan start address and scan end address could be configured as 63.
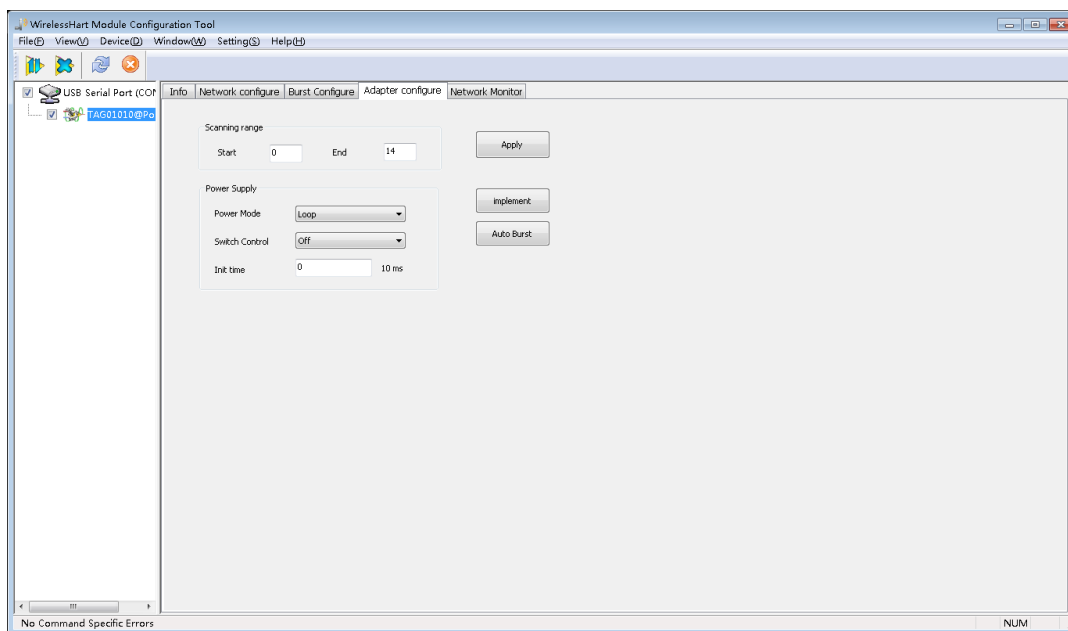
Perform:

By clicking this button, the A1110 will perform a new scan of the connected HART device to see if there has been a change in the HART device connection, which lasts about 5 minutes.

Auto Burst:

Click this button, A1110 will perform automatic Burst mode. The A1110 will automatically configure Burst messages for itself and its HART devices. The previous user's configuration will be overwritten to the default configuration: Burst cycle is 32 seconds, command number is 3, Burst mode is on.

Power Mode:

A1110 has loop power supply and external power supply two power supply modes, corresponding to different wiring methods.

NOTICE
If the connection mode is not consistent with the power supply mode configuration, it will cause uncertain problems such as sub-equipment not going online and communication failure.

When A1110 is configured as loop power supply mode, the A1110 takes power from the 4-20mA loop, and the A1110 takes a certain amount of time to "charge" to complete the initialization. The A1110 Burst period in loop power supply mode should be configured for a minimum of 4 seconds and only one 4 seconds period. If configured for less than 4 seconds or more than 4 seconds, the A1110 may be disconnected.

When the A1110 is configured for external power supply mode, the A1110 voltage range is 11-30VDC. In the external power supply mode, the minimum configuration interval for the A1110 Burst period is 1 second and only one second can be used. If configured for more than one second, the Adapter may be disconnected.

Operation

4.3 Default configuration

A1110 parameter	Defaults
Power supply mode	Loop power supply
WirelessHART network ID	0
WirelessHART Join the key	0x00000000 00000000 00000000 00000000
WirelessHART join mode	Don't attempt to join
Number of HART retransmissions	3
HART short address	15
HART scan start address	0
HART scan stop address	14
HART preamble number	5
PV value	Signal strength
PV unit	dB
SV value	Signal strength percentage
SV unit	%
Burst command	Command 3
Burst number	10
Burst cycle	32 seconds
Burst mode	Closed

Troubleshooting

5. Troubleshooting

No.	Phenomenon	Recommended measures
Wired troubleshooting		
1	During the 4-20mA loop check, the HART device was found not to be worked properly	1、 Based on A1110 caused by the pressure drop of 2.5V, to determine the total pressure drop of the system. 2、 Check if there is enough voltage in the circuit.
2	Can not communicate with HART device or A1110	1、 Check to see if the wiring is correct. 2、 Check if the A1110 and HART devices have enough supply voltage. 3、 Check if the WirelessHartMPT configuration software sets to the correct A1110 address. 4、 Check if there is a 250 Ω resistor. 5、 5、 Turn off the power to the device and try again.
3	The A1110 can not detect the HART device	1、 Check that the A1110's power supply configuration is consistent with the actual wiring or not. 2、 Check the wiring is correct or not. 3、 Check if the A1110 and HART devices have enough supply voltage. 4、 Check if there is a 250 Ω resistor.
Wireless network troubleshooting		
1	A1110 does not appear in the Gateway device list	1、 Check whether the A1110 power supply is normal, you can use the configuration software to connect the device to confirm. 2、 Check if the A1110 is within the communicable distance. 3、 Confirm that the configuration parameters of the A1110 are correct. Check whether the network ID and join key of the A1110 are the same as the "Network ID" and "Join Key" in the Gateway "Wireless Network Settings" page. 4、 Confirm that the "Current Packet Status" item in the "Wireless Network Settings" page of the wireless Gateway is "Activated". 5、 Wait for a while (20 minutes). 6、 Turn off the power to the device and try again. 7、 For details, refer to the section "Troubleshooting the G1100 WirelessHART Gateway User Manual".
2	After the A1110 Adapter joins the G1100 Gateway,	1、 In the "Node Information" page of the Gateway, locate the Adapter and click the node label column

	process data can not be seen on the Measurement Information page	of the device to check whether the device is configured with Burst mode. You can take advantage of the Gateway's online configuration function, set it up and set it for 1-5 minutes, then check the "Measurement Information" page for process data.
3	A1110 After configuring Burst mode, there is no data in the measurement information page	1、 Check Burst configuration options are correct. 2、 Check the number of online devices and the corresponding Burst period. WirelessHART network bandwidth is limited, try to reduce the number of Burst period used by each device. 3、 If you reduce the Burst period, it still can not display the process data, need to further reduce the period, restart the Gateway or Adapter.
4	Bandwidth-limited error	1、 Reduce the data update rate for the A1110 and HART devices. 2、 Add more wireless points to increase the communication path. 3、 Check if the A1110 is routed through a "restricted" routing point. 4、 Create a new network using another smart wireless Gateway.
Configuration troubleshooting		
1	You can not configure the A1110 with the WirelessHartMPT configuration software	1、 Check whether the configuration of the A1110 power supply is consistent with the actual wiring. 2、 Check the wiring is correct. 3、 Check if the A1110 and HART devices have enough supply voltage. 4、 Check if there is a 250 Ω resistor.
2	A1110 can not communicate with HART devices	1、 Check whether the configuration of the A1110 power supply is consistent with the actual wiring. 2、 Check the connection between the A1110 and the HART device. 3、 Check if there is a 250 Ω resistor for HART communication. 4、 Check if the HART device is working properly. 5、 Power off the A1110 and turn it on again, try again.

6. Specifications

System	
Platform	WirelessHART network
Support the number of sub-devices	4
Support sub-device type	2,3 or 4-wire HART device
Conforms to HART protocol version	HART7.6
Support sub device HART protocol version	HART5、6、7
Install the interface	1/2 NPT

RF	
Working frequency	2.4GHz...2.48GHz
Channel number	15
Transmission rate	250kbps
RF Output Power	10dBm
Receiving sensitivity	-90 dBm
Transmission distance	Outdoor 200 meters, indoor 50 meters
Antenna	Integrated omnidirectional antenna
Upload data period	1 second -60 minutes

Working conditions	
Power supply	4-20mA circuit loop power, external DC power supply
External power supply voltage	24VDC (11-30), overload protection (55VDC)
Equipment circuit pressure drop	2.5V
Operating temperature	-40°C - 85°C
Working humidity	0-100%
Storage temperature	-40°C - 85°C

Standards compliant	
Degree of protection	IP67

7. Glossary

Term	Definition
Add a key	Hexadecimal security code that allows wireless field devices to join wireless field networks. The value of the key for adding a Gateway and device must be exactly the same.
Device ID	Provide a hexadecimal number that uniquely identifies the device.
Network reliability	A measure of the connectivity between Gateway and wireless field devices. According to the number of received messages and the expected number of messages calculated, all routes included.
Path	Wireless connection between two devices in a wireless network. Also known as jumping.
Path stability	A measure of the connectivity between two devices in a wireless network.According to the received message data and the expected number of messages to calculate.
Wireless site network	WirelessHART network, consisting of wireless Adapters, smart wireless Gateways, and multiple wireless field devices.

Appendix A: Product Specifications

A.1 Functional Specifications

Input
2, 3 or 4-wire HART powered device

Output
IEC 62591 （WirelessHART）

Surroundings
Operating temperature range: -40 to 85 ℃
Operating humidity range: 0-100% relative humidity

EMC performance
Conform to:
GB-T 17626.2-2006
GB-T 17626.4-2008
GB-T 17626.5-2008

Update rate
1 second -60 minutes, configurable by the user.

A.2 Physical Specifications

Electrical connections
When connected to a 4-20mA supply loop, the A1110 is self-powered by energy harvesting. The A1110 causes a 2.5V drop in the loop, but it does not affect the 4-20mA signal in the loop.

Power supply
The minimum load in the loop is 250 Ω.
For proper operation of sub-equipment, the loop supply must have a minimum 2.5 V margin at 250 Ω load.
The supply current limit is 0.5A.
The supply voltage limit is 30VDC.

Material
Aluminum

Appendix

Antenna

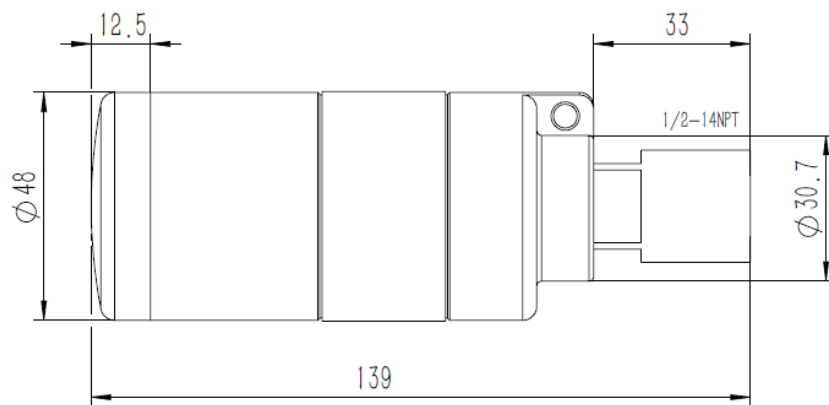PVC integrated omnidirectional antenna

Shell protection level

IP67

Installation

The A1110 can be connected directly to the conduit of any 2, 3 or 4-wire HART device. The standard mounting thread is 1/2 NPT and can be mounted to the M20 interface using the M20 Adapter.

A.3 Dimensional drawings

Figure A-1 A1110 Dimensions(Unit:mm)

Appendix

A.4Ordering Information

★ Standard products represent the most common options, if you choose non-standard products, need to be ordered separately.The delivery lead time for using extended products needs to be agreed separately.

Model	Product description	
A1110	Wireless Adapter	
Output		
W	Wireless	
Power input		
Standard		Standard
A	Circuit to take power, external power supply	★
Install the connector		
Standard		Standard
1	$^1/_2$ - 14 NPT	★
Wireless update rate, operating frequency and protocol		
Standard		Standard
A3	The update rate can be configured by the user，2.4GHz DSSS，WirelessHART	★
Antenna		
Standard		Standard
A9	Omni-directional antenna	★
Typical model：A1110 W A 1 A3 A9		

Appendix B: Product Certification

B.1 FCC and IC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: This device may not cause harmful interference. When installing the device, make sure that there is a minimum spacing of 20cm between the antenna and the person.