MS2-DFS050-2020

Smart HART Modem

Model AZ-1SHM

User's Manual

Azbil Corporation

azbil

NOTICE

- Make sure that this manual is available to the user of the product.
- Unauthorized duplication of this user’s manual in part or in whole is forbidden.
- The information and specifications in this manual are subject to change without notice.
- Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.
- Please understand that we cannot in some cases accept responsibility for the results of the use of this equipment by the customer.
- Bluetooth® word mark and logo are registered trademarks of Bluetooth SIG, Inc.
- HART® is a registered trademark of FieldComm Group.
- USB Type-C® is a registered trademark of USB Implementers Forum.
- Wi-Fi® is a registered trademark of Wi-Fi Alliance.
- Windows is a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

Conventions Used in This Manual

■ The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

⚠ **WARNING**	Warnings are indicated when mishandling this product may result in death or serious injury.
⚠ **CAUTION**	Cautions are indicated when mishandling this product may result in minor injury or property damage only.

■ In describing the product, this manual uses the icons and conventions listed below.

⚠	:	Indicates that caution is required in handling.
⃠	:	The indicated action is prohibited.
❗	:	Be sure to follow the indicated instructions.
Note	:	Supplementary explanation.
FYI	:	Reference information.

Safety Precautions

The safety precautions explained below aim to ensure safe and correct use of this product in order to prevent injury to you and others, and to prevent property damage. Please heed these cautions and warnings. Please make sure you understand the safety guidelines before reading the rest of this manual.
Use of this product in a manner not specified by the manufacturer will impair its built-in safety features.

⚠WARNING

	If an explosion-proof field device is used, never open its cover while it is running. There is a danger of an explosion. For the handling of this type of device, refer to the user's manual for the device.
	This device emits radio waves. Keep this device at least 20 cm away from a pacemaker. Otherwise, the pacemaker may malfunction. Radio wave emission can be stopped by changing the settings.

⚠ CAUTION

	Do not touch live terminals. Doing so may cause an electric shock.
	Use this device within the specified operating temperature range (−20 to 50 ºC) and humidity range (5 to 95 % RH). If used outside the above range, this device may malfunction, making communication with connected devices unreliable.
	Do not use this device near a magnetic field. A magnetic field may cause a malfunction, making communication with connected devices unreliable.
	Do not allow water or dust to enter this device. Doing so may cause an electric shock. The jacket cannot perfectly protect this device from water or dust.
	Remove the batteries if this device will not be used for a long time. Otherwise, battery fluid might leak and injure someone.
	Connect only USB-compatible devices to the USB port. Otherwise, there is a danger of fire or damage to the device.
	Before sending a HART signal via the 1SHM, check to make sure that sending a HART signal to the connected system and field devices will not cause any problems. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.
	If other HART hosts are connected at the same time, interference between the device and host primary or secondary HART communication may occur, resulting in a HART communication error. Monitor communication between the device and other hosts by using the Support Tool in passive mode before sending the HART signal from the 1SHM and, if needed, change the settings to avoid simultaneous communication.
	Before using SFN/DE communication from model CFS100 field communication software, make sure that the field device connected to it is not in operation. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.
	Before using the Support Tool in HART master mode, check to make sure that sending a HART signal to the connected system and field devices will not cause any problems. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.

Tips for Avoiding Malware and Hacker Cyber-Attacks

If this product or a computer on the network that is connected to the product becomes infected with malware* or is the target of a cyberattack, the product may malfunction or stop functioning altogether. Please be aware that the normal warranty does not cover restoration work or damage incurred by a malfunction of this product due to malware or a cyberattack. Also, Azbil Corporation will not be liable for compensation for any loss or damage caused by malware or a cyberattack, including opportunity loss, profit loss, business disruptions, data loss, etc.
To reduce the chances of being infected with malware or being the victim of a cyberattack, please implement measures such as those listed below.

- Before using this product, disconnect it and its connected network from the business network. Or, take security measures such as restricting communication with a firewall, etc.
- If you need to temporarily connect a computer for engineering to this product, check in advance that it is not infected with malware using antivirus software or some other means.
- Physically block any unnecessary USB and LAN ports to prevent portable devices from being connected without the security administrator’s permission.
- As a part of maintenance, regularly check for security vulnerabilities, such as unnecessary connected equipment that was not included at the design stage or user accounts that are no longer necessary.
- Providing IT security training for operators and instrument engineers is beneficial. Holding training courses regularly is recommended.

* A general term used to describe unauthorized and harmful programs that perform operations that are not intended by the user of the computer.

To Customers

Please read through this agreement before installing or using the software. This agreement contains the terms and conditions for the use of the software and/or related documents. By installing, copying, or using the software in whole or in part, you agree to be bound by all the terms of the agreement. If you disagree with any of the terms contained herein, please return the unused software and/or related documents right away. In such a case, we may, at our discretion, refund the amount already paid by you in connection with the software and/or related documents.
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Azbil Corporation

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For the purpose of this Agreement:
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“Related Documents” means a set of documents related to the Software.
“Use” means to install the Software in a storage device or memory, or to run it with a CPU.
“Exhibit” means the document sets forth the specific terms and conditions to Use the Software, which is to be submitted by Azbil to You. Exhibit is incorporated in this Agreement upon your receipt thereof.

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2-1. Subject to the terms and conditions of this Agreement, Azbil hereby grants to you a nonexclusive, non-transferable and non-sublicensable license (“License”) to Use the Software to use the system set forth in Exhibit (the “System”). The function of the Software available under the License may be limited during the Trial Use Period set forth in Exhibit.

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2-3. Notwithstanding the foregoing, You may copy the Software for the sole purpose to make a backup file thereof and store it in the number of media set forth in Exhibit.

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2-5. In consideration of the grant of the License, You shall pay to Azbil the license fee in accordance with the terms set forth in Exhibit (“License Fee”). License Fee is not refundable unless otherwise explicitly provided in this Agreement or in Exhibit.

2-6. For the avoidance of doubt, You are not authorized to use Azbil’s company name, product names, trademarks and service marks under the License.

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You hereby acknowledge and agree that: (i) the Software may from time to time be updated at Azbil’s discretion; (ii) Azbil may update the Software and add, modify or reduce certain function thereof, at its discretion; and (iii) the same terms conditions herein apply to the updated Software. You and Azbil shall enter into a software maintenance agreement, if necessary.

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You, without Azbil’s prior written consent, shall not:

(i) Use the Software and/or Related Documents for the purpose other than to use the System;

(ii) Use the Software in the number of computers (whether actual or virtual) more than set forth in Exhibit;

(iii) Use the Software in a computer which functions as a cloud server (whether actual or virtual);

(iv) copy the Software in whole or in part for the purpose other than to make backup files of the Software;

(v) alter, modify or otherwise change the Software and/or Related Documents;

(vi) use the Software not in its entirety, but in part;

(vii) trace, debug, disassemble, decompile or otherwise attempt to analyze or reverse engineer the No Reverse Engineering Software set forth in Exhibit or attempt to discover any source code of the No Reverse Engineering Software;

(viii) sell, lease or license the Software or a storage device contains the Software and/or Related Documents (including a computer to which the Software is installed) to a third party;

(ix) sublicense the Software to a third party or assign the License to a third party;

(x) Use the Software and/or Related Documents together with a third party;

(xi) remove or change the proprietary notice of Azbil and/or a third party;

(xii) Use the Software and/or Related Documents at the location other than set forth in Exhibit;

(xiii) Publish the specification of the Software; or

(xiv) otherwise Use, copy, reproduce, sell, distribute, redistribute, assign, transfer, publicly transmit, lease, license or sublicense the Software and/or Related Documents beyond the extent expressly provided herein.

Article 5. Warranty Period of the Software

The warranty period of the Software commences from the delivery date of the Software (or, if the Software is delivered through the Internet, the date of such delivery) and continues for a period set forth in Exhibit: provided, however, if local

adjustment work is necessary to operate the Software, the warranty period of the Software commences from the date Azbil begins such adjustment work and continues for a period set forth in Exhibit (“Warranty Period”).
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Article 6. Warranty

6-1. Within the Warranty Period, Azbil warrants that the Software, if Used under the suitable environment designated by Azbil, duly functions in accordance with the specifications set forth in the Related Documents provided by Azbil: provided, however, that Azbil does not warrant that the Software will be free of all errors or operate without interruption (“Warranty”). The Warranty does not apply to third party software contained in the Software, which is warranted only by the third party who owns such software.

6-2. If any non-conformance to the Warranty is detected within the Warranty Period, You must promptly notify Azbil and provide Azbil with all available information in written or electronic form so that Azbil can reproduce the non-conformance. If in Azbil’s opinion such non-conformance is attributable to Azbil, Azbil shall at no charge correct it or provide You with guidance to correct it. If the nonconformance of the Software is due to third party software, Azbil will only inform You of cautions to use the Software.

6-3. If a non-conformance to the Warranty is in Azbil’s opinion irremediable or unavoidable, Azbil shall compensate the damage reasonably incurred by You.

6-4. The Warranty does not apply, if a non-conformance is caused:

(i) by natural disaster (including, without limitation, fire, earthquake, thunder, pollution), plague (including, without limitation, infectious disease), war, riots, civil commotion, labor disputes, lockouts, failure of electricity, gas or water supplies, dysfunction or network, transport accidents, traffic jams, enactment, amendment or abolishment of laws or regulations, order or request by governmental or quasi-government authorities, public health emergency or any other force majeure;

(ii) by maintenance of hardware, correction of a non-conformance, or change of the Software by You or a third party, without prior consent of Azbil;

(iii) because you or a third party modified, altered or otherwise changed the Software or other software (including update of the operating system) or installed other software without prior consent of Azbil;

(iv) because You failed to update the version of the Software not in compliance with Azbil’s instruction;

(v) because You failed to provide necessary information and assistance to Azbil for maintenance of the Software;

(vi) because, by an update or version-up of the Software or other software, the Software has fallen out the scope of the operating environment recommended by Azbil;

(vii) by computer virus not attributable to Azbil;

(viii) because You Used the Software in combination with the application not recommended by Azbil, or You installed or maintained the Software not in compliance with Azbil’s instruction, or You Use the Software under the hardware environment not recommended by Azbil; or

(ix) by reason not attributable to Azbil.

6-5. THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR STATUTORY, AND AZBIL SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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7-1. If a third party brings a claim or action against You alleging that the Software infringes any Intellectual Property Right owned by the third party, You shall promptly notify Azbil of such claim or action in a written form.

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IN ANY CASE, AZBIL'S ENTIRE LIABILITY UNDER ANY PROVISION OF THIS AGREEMENT DOES NOT EXCEED IN THE AGGREGATE THE SUM OF THE FEES YOU PAID FOR THE SOFTWARE.

Article 9. Confidentiality

9-1. For the purpose of this Agreement, “Confidential Information” means all technical and business information disclosed by Azbil to You with respect to the Software, including the Software itself, whether designated as confidential or not.

9-2. Notwithstanding the foregoing, Confidential Information does not include information that:

(i) is part of the public domain;

(ii) was in Your possession prior to its disclosure by Azbil;

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(i) not disclose any Confidential Information in whole or in part to any third party other than Your officers and employees who have a strict “need-to-know” to Use the Software and who have undertaken by employment agreement or otherwise to comply with the obligation undertaken by You without the prior written consent of Azbil: provided, however, that You may disclose Confidential Information subject to requirement of a governmental agency or any law requiring disclosure, if You provide prompt advance notice thereof to Azbil reasonably sufficient to enable Azbil to seek a protective order and otherwise prevent public disclosure of such Confidential Information.

(ii) not use Confidential Information beyond the extent necessary to perform the Purpose; or

(iii) not make any reproduction or copy of Confidential Information beyond the extent necessary to use the Software, without the prior written consent of Azbil; and

(iv) return or destroy all Confidential Information or all copies thereof, whether in written or other tangible form, upon Azbil’s request or termination of this Agreement.

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10-1. This Agreement becomes effective from the date when the Software is delivered to You and continues to be effective for a period set forth in Exhibit. If the Software is delivered to you via the Internet, this Agreement becomes effective from the date of such delivery and continues to be effective for a period set forth in Exhibit.

10-2. Notwithstanding the foregoing, You may terminate the Agreement by providing a written termination notice to Azbil at least three (3) months prior to expiration of the above term.

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11-1. Either Azbil or You may terminate this Agreement in whole or in part without any prior notice:

(i) if the other party dishonors a bill or check drawn by it, manifests its inability to repay debts, becomes insolvent, has liabilities exceeding its assets, incurs a suspension of bank transactions, or suffers material deterioration of its credit standing; or if the occurrence of such event is expected;

(ii) if the other party is subject to seizure, provisional seizure, provisional disposition, compulsory enforcement, disposition for failure to pay taxes, or other similar disposition from a third party;

(iii) if a petition for the commencement of bankruptcy, civil rehabilitation, corporate rehabilitation, special liquidation or other similar proceedings is filed with respect

to the other party; or if it is found to be no longer viable for the other party to perform its liabilities to the counterparty hereto due to downsizing of the business or for any other reasons;

(iv) if the other party incurs a disposition of business suspension or revocation or any other similar disposition of the competent authorities;

(v) if the other party attempts to dissolve itself or assign all or a significant part of its business to a third party.

(vi) if the other party conducts wrongful or unjust act with regard to performance of this Agreement; or

(vii) the other party breaches any provision of this Agreement.

11-2. In the event either Azbil or You breaches any provision of this Agreement, all amounts due hereunder shall be accelerated and deemed immediately due and payable to the other party.

11-3. Either Azbil or You may terminate this Agreement under special circumstance where it is not feasible to maintain this Agreement due to reason not attributable to either party.

11-4. Azbil may immediately terminate this Agreement in the event a third party acquires, directly or indirectly, (i) the power to control the management and policies of You, whether through the acquisition of voting securities, by contract or otherwise, or (ii) more than fifty percent (50%) of Your assets whether in a single transaction or series of transactions.

11-5. The termination of this Agreement hereunder will not prevent the terminating party from claiming damages against the other party.

Article 12. Effect of Termination

Upon expiration or termination of this Agreement, You shall delete the files related to the Software and Related Documents (including backup files) from all computers You possess and cease Using the Software in accordance with Azbil's instruction. If You received media which contains the Software and/or Related Documents from Azbil, You shall destroy it or return it to Azbil, in accordance with Azbil's instruction.

Article 13. Survival

The provisions of this Agreement that require or contemplate performance after the expiration or termination of this Agreement in accordance with Article 10 (Term) or 11 (Termination), including, Article 8 (Limitation of Liability), Article 9 (Confidentiality), Section 3 of Article 11 (Termination), Article 12 (Effect of Termination), this Article 13, Article 15 (Export Control) and Article 19 (Governing Law and Dispute Resolution) are enforceable notwithstanding such expiration or termination.

Article 14. Amendment

Azbil may amend this Agreement at any time by sending a notice to You in a manner Azbil deems appropriate. If You do not agree with the amendment, You shall inform so to Azbil and cease Using the Software before the amendment becomes effective. You are deemed to accept the amendment by Using the Software after the amendment becomes effective.

Article 15. Export Control

You agree to comply with all applicable export laws and restrictions and regulations of Japan and the United States of America or foreign agencies or authorities and

take necessary steps, if You:

(i) export the Software (in whole or in part);

(ii) transmit the Software (in whole or in part) outside Your country;

(iii) have a person living outside Your country use the Software (in whole or in part); or

(iv) carry out any other acts under applicable export control laws and regulations.

Article 16. No Waiver

A waiver by either party of any term or condition of this Agreement or any breach thereof, in any one instance, does not mean waiver of such term or condition or any subsequent breach thereof.

Article 17. Injunctive Relief

You understand and agree that in the event of a breach or threatened breach by you of any term or provision of this Agreement will cause irreparable harm to Azbil and that damages or an action at law may not be an adequate remedy for any such breach. Accordingly, in the event of any such breach or threat of same, and notwithstanding any other provisions of this Agreement, Azbil is, in addition to all other remedies that may be available to it, be entitled to injunctive relief (including a temporary restraining order, a temporary or prohibitory injunction and a permanent mandatory or prohibitory injunction) to restrain and prohibit the continuation of any such breach, to compel compliance with the provisions of this Agreement, and to restrain and prohibit any threatened breach in order to protect the proprietary rights of Azbil.

Article 18. Severance

If any provision in this Agreement should be held illegal or unenforceable by a court having jurisdiction, such provision shall be modified to the extent necessary to render it enforceable without losing its intent, or severed from this Agreement if no such modification is possible, and the other provisions of this Agreement remains in full force and effect.

Article 19. Governing Law and Dispute Resolution

1. This Agreement is governed and construed in accordance with the laws of Japan without regard to choice of law rules, and excluding the United Nations Convention on Contracts for the International Sale of Goods.
2. Any dispute arising out of or in connection with this Agreement is subject to the exclusive jurisdiction of the Tokyo District Court in the first instance.

Article 20. Entire Agreement

This Agreement constitutes the entire agreement between the parties concerning the subject matter hereof.

Exhibit (Support Tool)

Company Name	---
Location	---
Name of the System	---
Name of the Software	Azbil HART Modem Support Tool
Number of Computers	as needed
License Fees	none
Terms of Payment	none
No Reverse Engineering Software	Azbil HART Modem Support Tool (With regard to the OSS components included in this product, the applicable OSS license conditions prevail over any other terms and conditions herein.)
Term	effective until terminated by Azbil
Trial Use Period	shall be agreed separately
Warranty Period	12 months
Number of Media for Backup Purpose	as needed

Exhibit (Firmware of the 1SHM)

Company Name	---
Location	---
Name of the System	---
Name of the Software	1SHM Firmware
Number of Computers	1
License Fees	none
Terms of Payment	none
No Reverse Engineering Software	1SHM Firmware (With regard to the OSS components included in this product, the applicable OSS license conditions prevail over any other terms and conditions herein.)
Term	effective until terminated by Azbil
Trial Use Period	shall be agreed separately
Warranty Period	12 months
Number of Media for Backup Purpose	as needed

Contents

Introduction

This user’s manual describes the procedures for setup and operation of the Smart HART Modem Model AZ-1SHM (referred to as the 1SHM below).
Carefully read this manual before using and operating the device In addition, please pay attention to the points below.

Scope of This Manual

This manual is intended for users who are already familiar with the basic features of Microsoft Windows (the concepts of drives, files, folders, etc., as well as window operations) and have the basic knowledge necessary to perform such operations (using the mouse, keyboard, storage media, etc.). For a basic introduction to Microsoft Windows, please refer to the commercially available instructional material.

Notation for Operations in This Manual

In this manual, operations on a PC or tablet connected to the 1SHM are mainly performed using mouse operations.

Notation Used in This Manual

This manual uses the following notation.

Table−1. Notation for menus, commands, and dialog boxes

Notation	Meaning
[File] menu	Menu names are enclosed in square brackets.
[Command]	Command names are given as they appear in the menu and are enclosed in square brackets.
[Sheet Information] dialog box	Dialog box names are given as displayed in the title bar and are enclosed in square brackets. Property sheet names are given in the same manner.
“Control name”	The names of controls in dialog boxes, such as group boxes, text boxes, drop-down lists, checkboxes, and radio buttons, are enclosed in double quotation marks.
<OK> button	Buttons in dialog boxes and on toolbars are enclosed in angle brackets.

Table−2. Notation for mouse operations

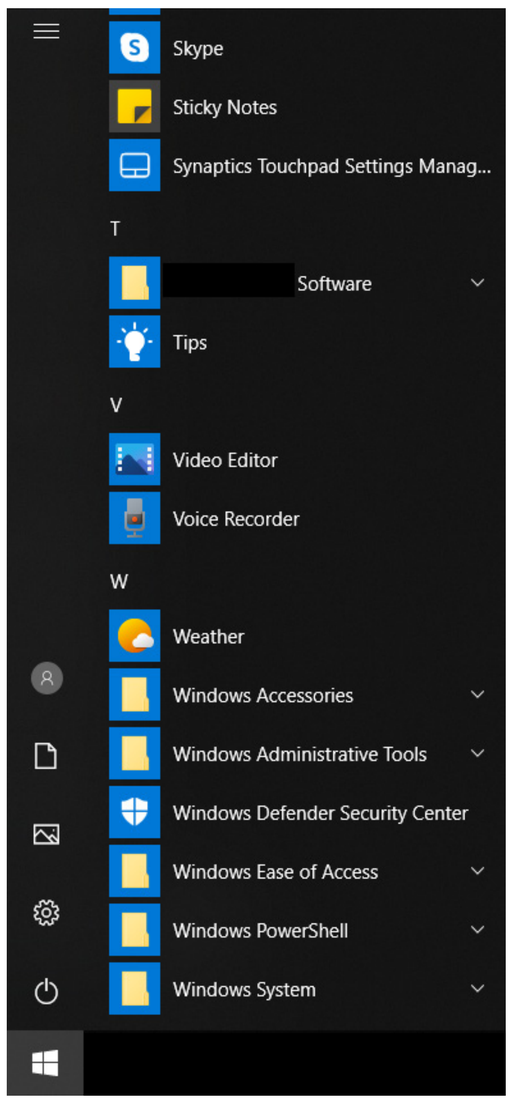
Notation	Meaning
Click	Refers to pressing and quickly releasing a mouse button. A mouse has a left button and a right button. The mouse button is considered to be the left button unless otherwise specified.
Right click	The operation of clicking the right mouse button is called a right click.
Double click	Refers to quickly clicking the left mouse button twice without moving the mouse.

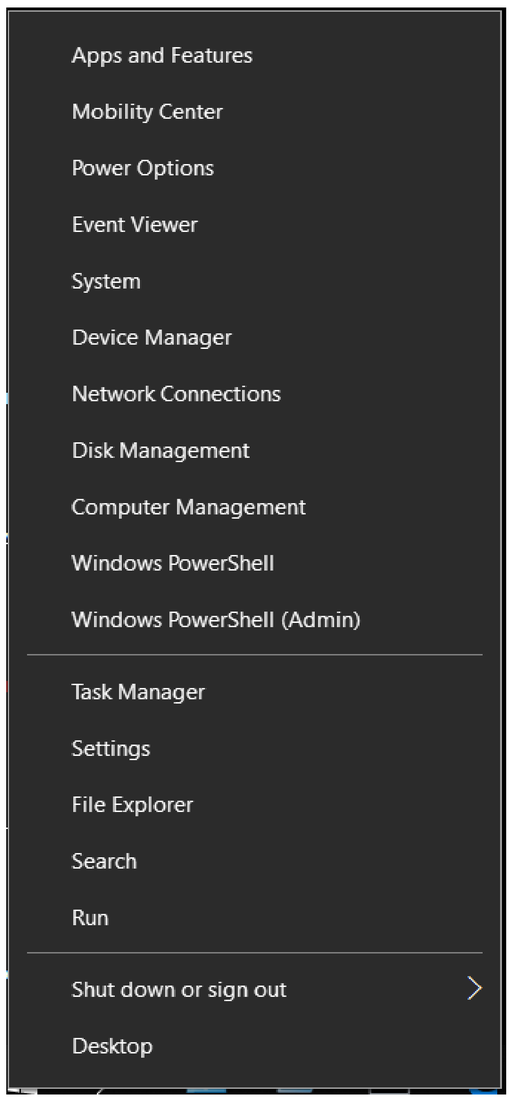
Drag	Refers to clicking an object, continuing to hold down the left mouse button, and moving the mouse so as to move the object.
Drop	Refers to releasing the left button mouse button after dragging something to the desired position.

Table−3. Notation for key operations

Notation	Meaning
<Enter>	Keyboard keys are enclosed in angle brackets. • <Windows> indicates the Windows logo key on the keyboard ( ).
<Shift + A>	A plus sign indicates a combination of key operations. • <Shift + A> indicates pressing the <A> key while holding down the <Shift> key. • <Windows + X> indicates pressing the <X> key while holding down the <Windows> key.
Arrow keys	Collectively refers to the <→>, <←>, <↑>, and <↓> keys.

Table−4. Notation for standard UI menus

Notation	Meaning
[Start]	Indicates the menu displayed by pressing the <Windows> key when the desktop is displayed. All applications and programs are displayed. 

Notation	Meaning
[Quick Link]	Indicates the menu shown when <Windows + X> is pressed. 

Definitions of Terms and Abbreviations

This section describes the terms and abbreviations used in this manual.

Table−5. Definitions of Terms and Abbreviations

Notation	Meaning
1SHM	Smart HART Modem Model AZ-1SHM
HART	Highway Addressable Remote Transducer A communication protocol for enabling two-way communication between the host system and the field device by superimposing digital signals over 4–20 mA analog signals
HART master device	Device that issues HART commands. This refers to HART hosts such as the device management system and maintenance tool.
HART slave device	A device that responds only to HART commands from the HART master device. This applies to HART-compatible field devices.
SFN	An Azbil field communication protocol
DE	An Azbil field communication protocol
CFS100	Azbil’s model CFS100 field communication software
Support Tool	Software that provides functions for 1SHM setup and simplified HART connection diagnosis.
Field device	HART or SFN/DE-compatible instrumentation control devices such as sensors (transmitters) and actuators
Device mode	The mode in which the 1SHM operates as a HART slave device

License key	The code included with this product that is used to apply for authentication
Wi-Fi AP	Wi-Fi access point mode
Wi-Fi STA	Wi-Fi station mode
DHCP	Dynamic Host Configuration Protocol Protocol that automatically configures basic settings for communication

Reference Materials

Table−6. Reference Materials

Document No.	Title
HCF_SPEC-081 FCG TS20081	Token-Passing Data Link Layer Specification (FieldComm Group)
HCF_SPEC-099 FCG TS20099	Command Summary Specification (FieldComm Group)
CM2-CFS100-2001	*Field Communication Software* *Model CFS100 (Common Edition) User's Manual* (Azbil)
CM2-AVP300-2001	*Smart Valve Positioner* *300 Series Model AVP300/301/302 (Integral Type)* *200 Series Model AVP200/201/202 (Remote Type) User's Manual* (Azbil)

Customer Support

If you have any questions or problems, please contact us at support-shm@azbil.com.

Hours are from 9:00 am to 5:00 pm Japan time from Monday to Friday, excluding public holidays and any special company holidays.

Chapter 1 Overview

1.1 What Is the 1SHM?

The 1SHM is a communication interface that connects a field device and the Windows PC or tablet used to adjust or set up the field device.

The 1SHM, through the Support Tool software operating on a Windows PC or tablet, provides simplified diagnostic functions for HART connections, including a communication waveform display, communication details display, and device identification information display for HART communication.

In addition, the 1SHM can supply power to a field device that is not powered, or in device mode it can be used as a HART slave device.

Do not connect this product directly to the communication lines (including public wireless LAN) of telecommunications carriers (mobile communication companies, fixed-line communication companies, Internet providers, etc.).

1.2 Preparation, Use, and Maintenance of the 1SHM

This section describes work required before using the 1SHM, what you can do using the 1SHM, and maintenance.

(A): Preparation
- Authentication of the 1SHM

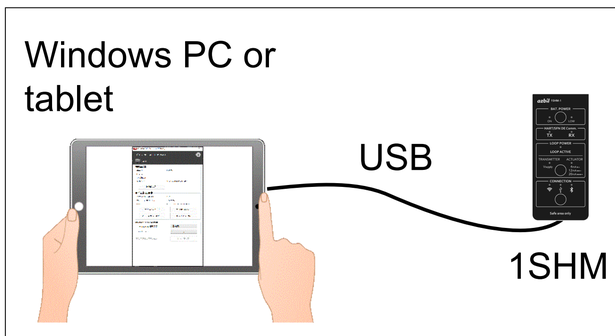
(B): Use
- Connection with a HART host
- Connection with the CFS100
- HART communication diagnostics

(C): Maintenance
- 1SHM firmware update

The things you need to do are shown in (A), (B) and (C) below along with the relevant equipment configuration.

(A) Preparation

Start the Support Tool to activate the 1SHM (i.e., to apply for license authentication and save the related data).
Refer to Chapter 2 Preparation.

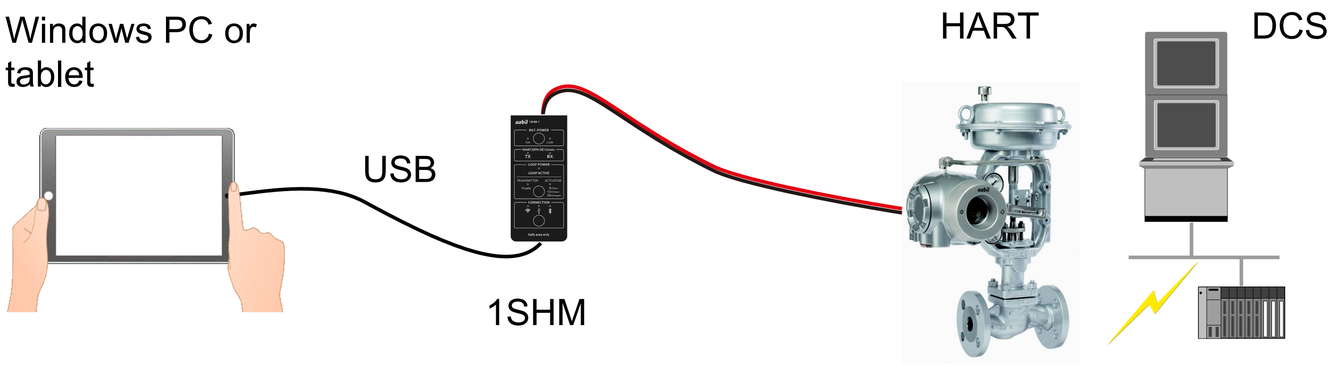


(B) Use

(1) You can use a third-party tool to adjust and set up the field device. The 1SHM will function as the modem for the HART host.

Refer to Chapter 3 Configuration and Calibration of the Field Device and Chapter 5 Supplying Power to the Field Device.

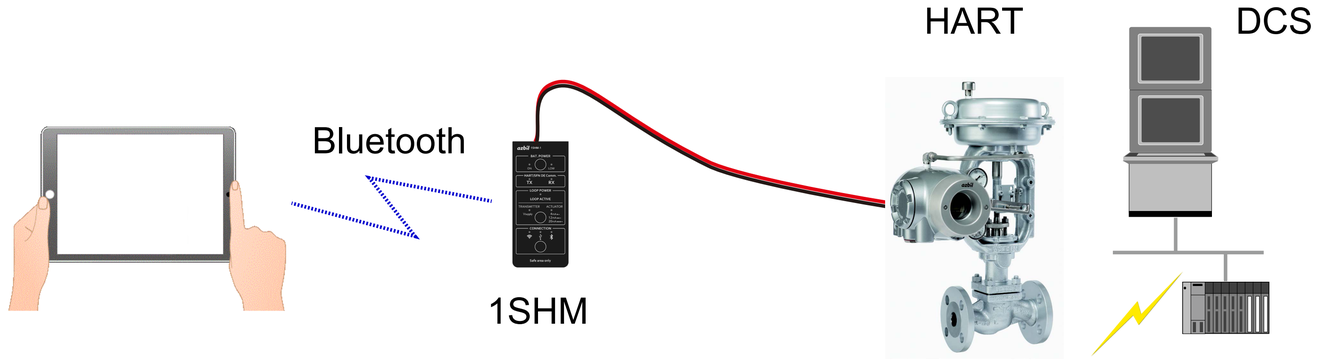
(a) USB connection to the HART host, power supplied from the DCS, etc.



[HART host]
Configuration, calibration and other operations

Power supply from the DCS or other source

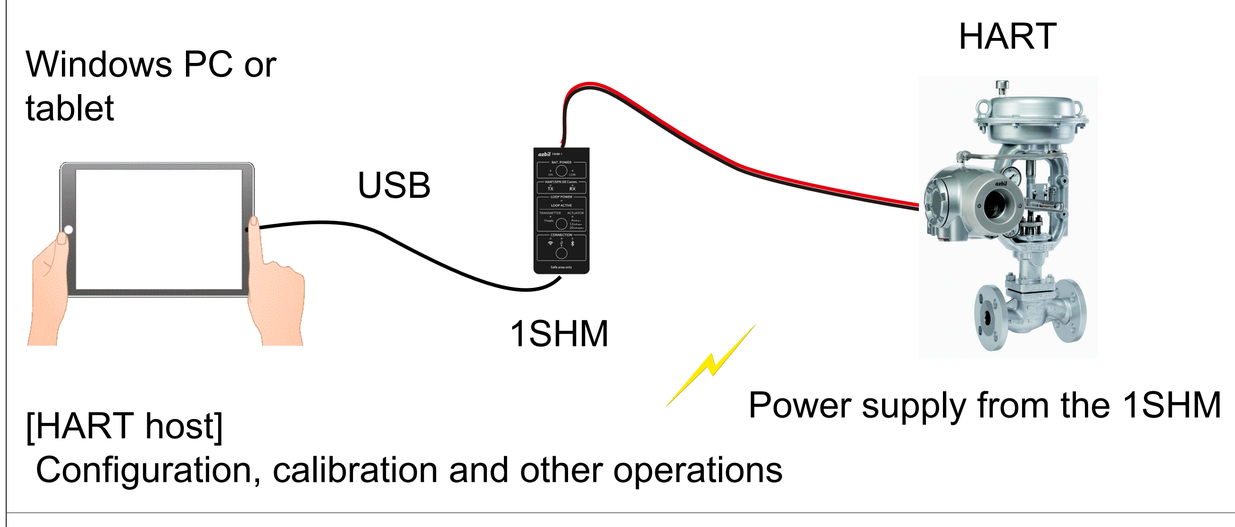
(b) Bluetooth connection to the HART host, power supplied from the DCS, etc.



[HART host]
Configuration, calibration and other operations

Power supply from the DCS or other source

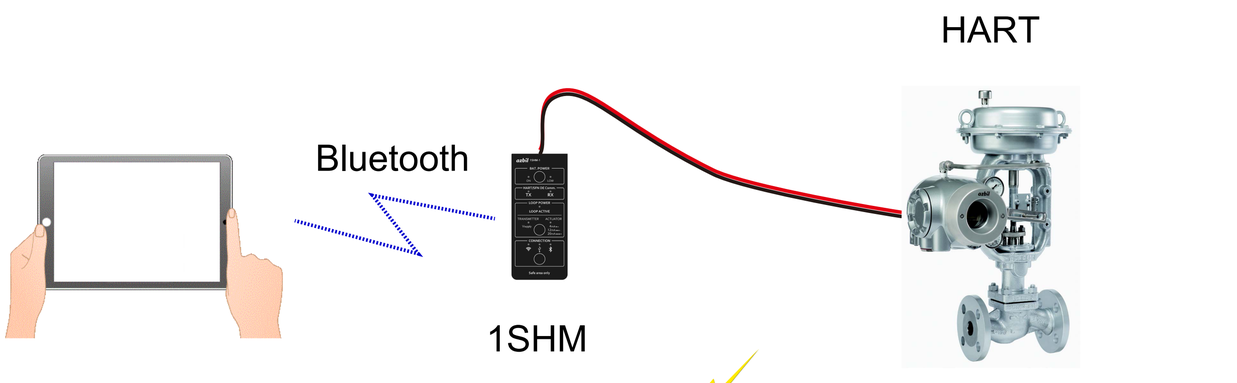
(c) USB connection to the HART host, power supplied from the 1SHM



[HART host]
Configuration, calibration and other operations

Power supply from the 1SHM

(d) Bluetooth connection to the HART host, power supplied from the 1SHM

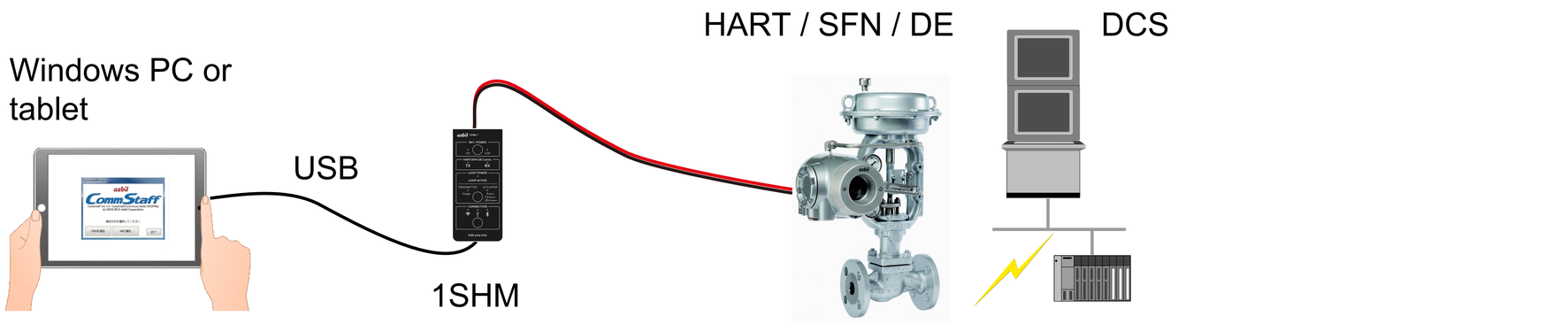


[HART host]
Configuration, calibration and other operations

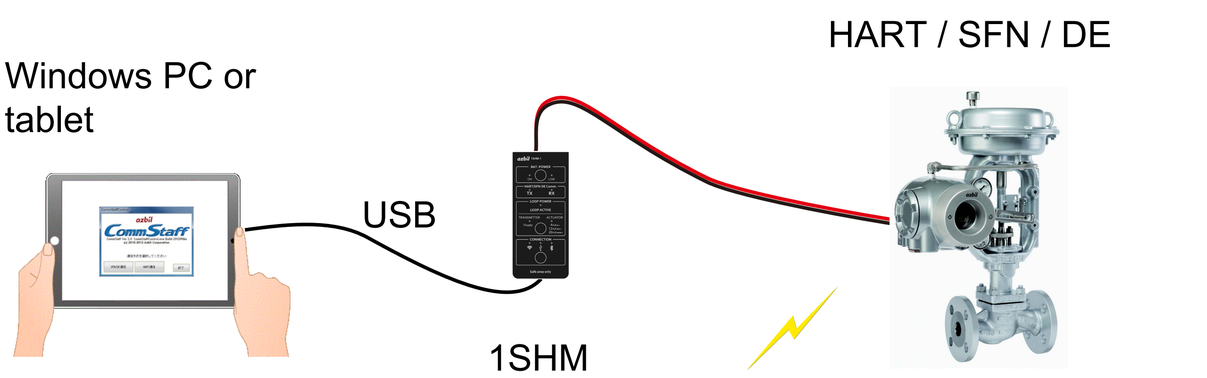
Power supply from the 1SHM

(2) You can use the 1SHM as the modem for model CFS100 that is used to adjust and set up Azbil field devices.
Refer to Chapter 3 Configuration and Calibration of the Field Device and Chapter 5 Supplying Power to the Field Device.

(a) USB connection to the CFS100, power supplied from the DCS, etc.

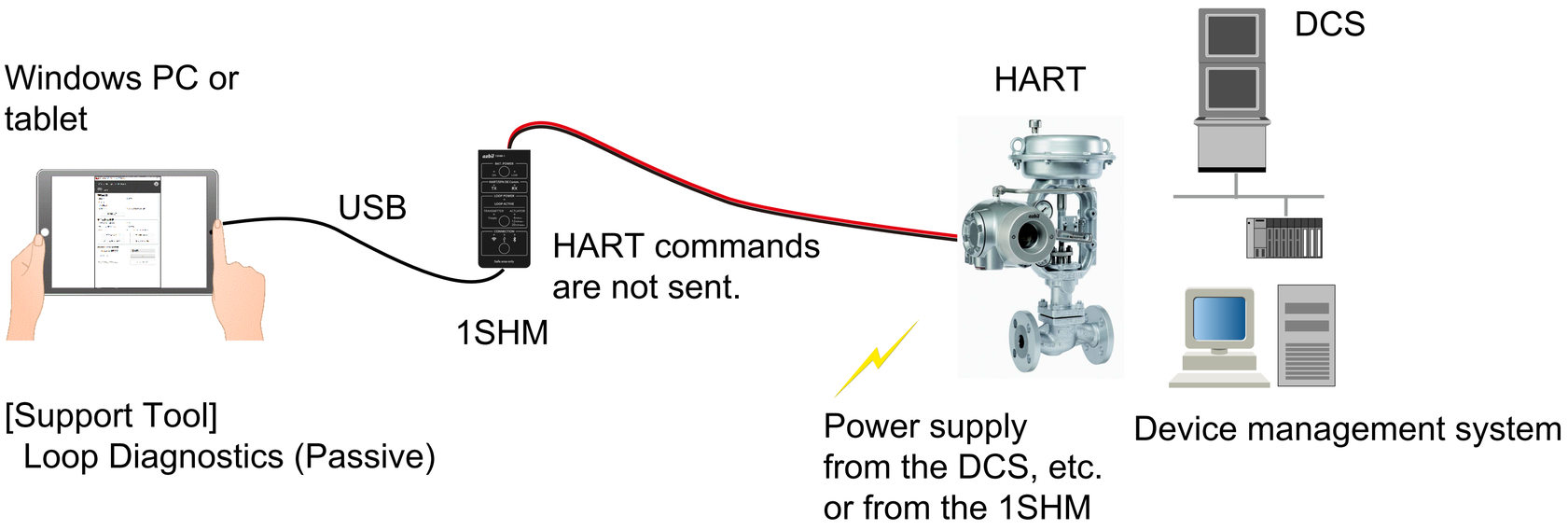


(b) USB connection to the CFS100, power supplied from the 1SHM

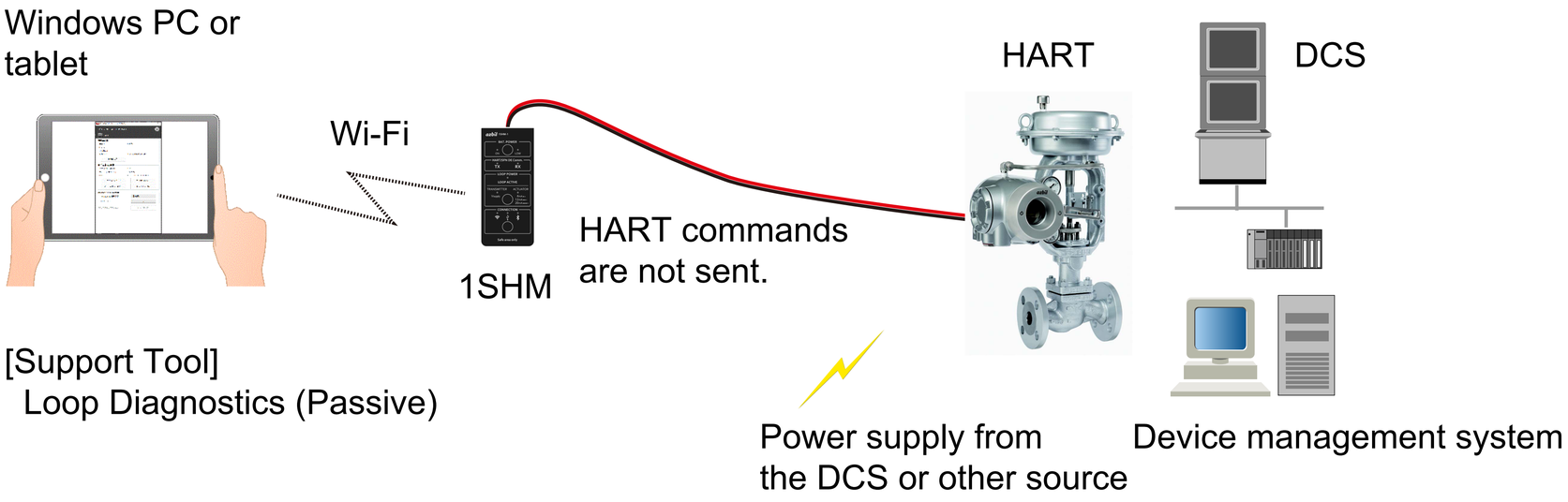


(3) You can use the 1SHM in monitoring mode (without sending HART commands) for simplified HART connection diagnostics by using the Support Tool.
Refer to Chapter 4 Simplified HART Connection Diagnostics.

(a) USB connection to the Support Tool to monitor communication status, power supplied from the DCS, 1SHM, etc.



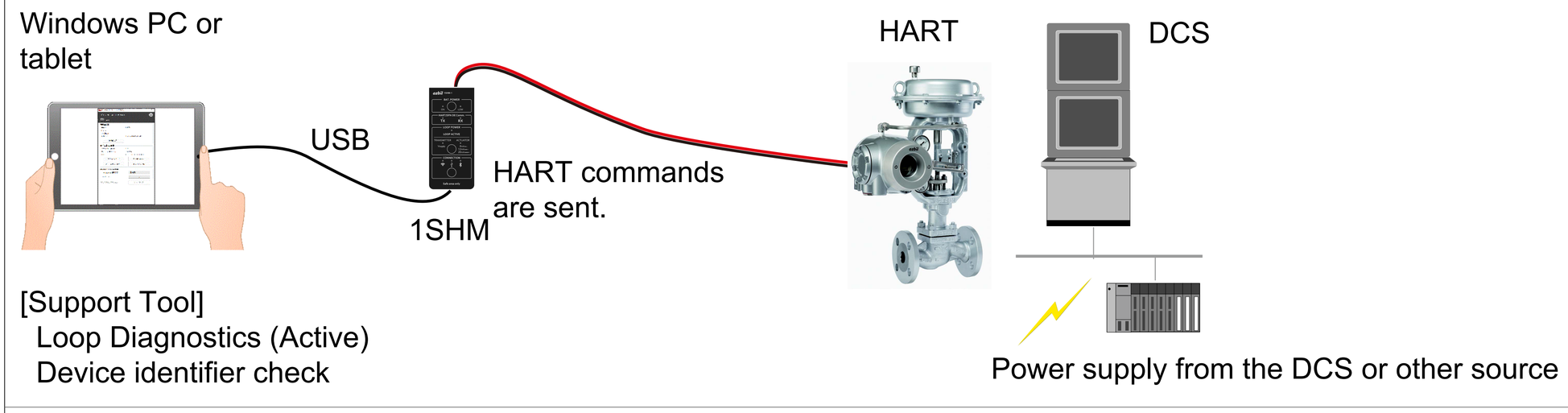
(b) Wi-Fi connection to the Support Tool to monitor communication status, power supplied from the DCS, etc.



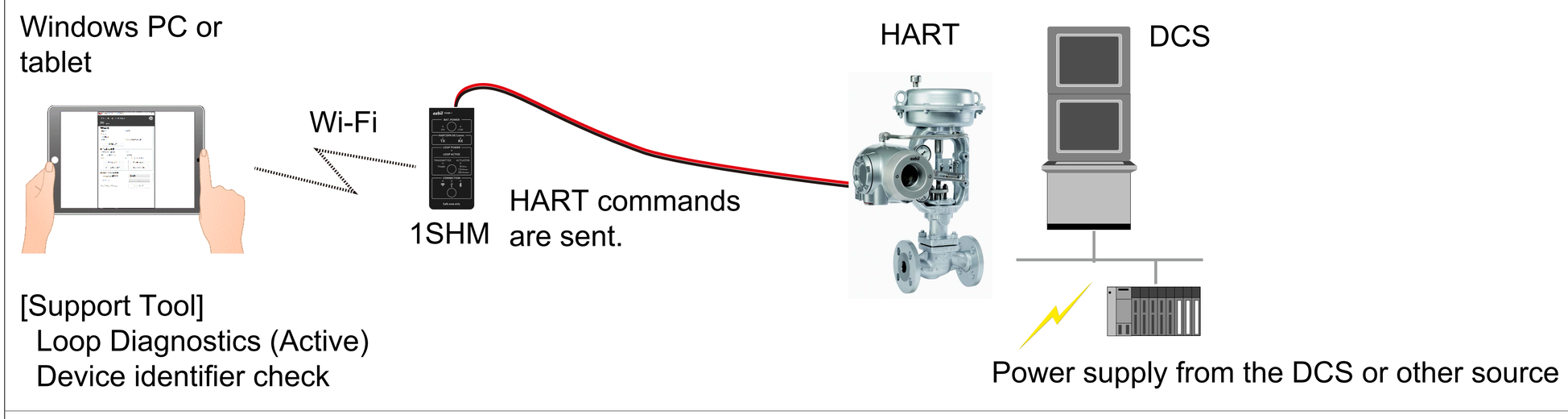
(4) You can use the 1SHM in HART master mode (sending HART commands) for simplified HART connection diagnostics by using the Support Tool.

Refer to Chapter 4 Simplified HART Connection Diagnostics.

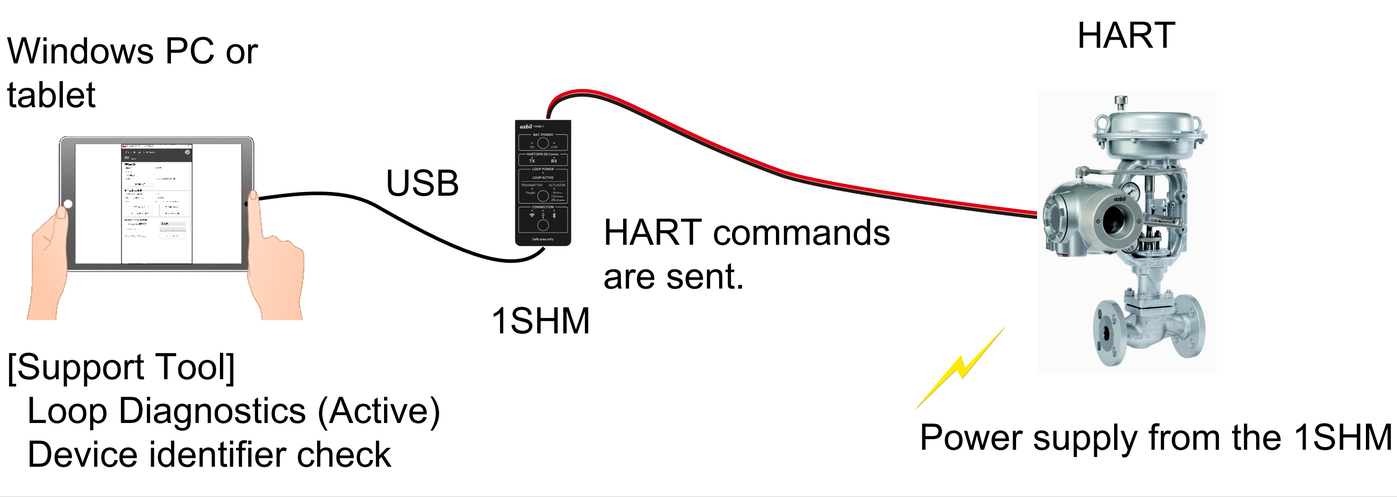
(a) USB connection to the Support Tool to use HART master mode for connection diagnostics, power supplied from the DCS, etc.



(b) Wi-Fi connection to the Support Tool to use HART master mode for connection diagnostics, power supplied from the DCS, etc.

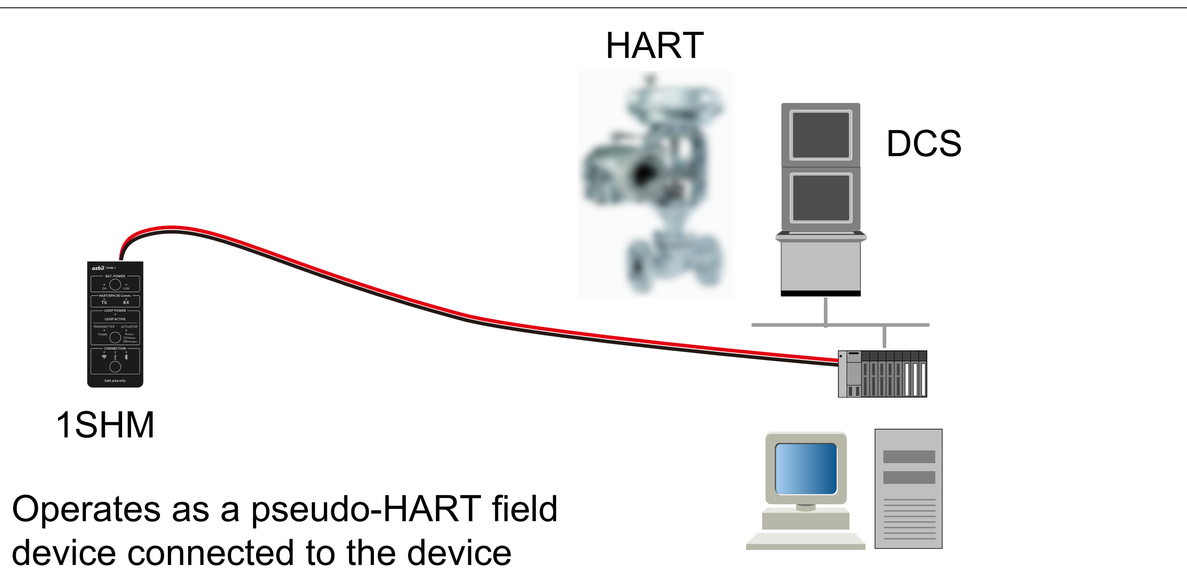


(c) USB connection to the Support Tool to use HART master mode for connection diagnostics, power supplied from the 1SHM



(5) You can operate the 1SHM as a pseudo-HART slave device to check whether HART communication is available if there is no HART field device.

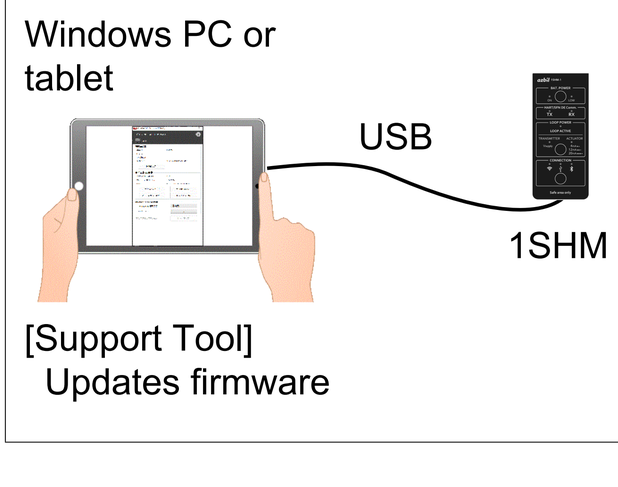
Refer to Chapter 6 Device Mode.



(C) Maintenance

Update the firmware with the Support Tool.

Refer to Chapter 7 Maintenance.



When the 1SHM is connected to the terminals of a field device, a minute leakage current that bypasses the field device flows through the 1SHM. The level of leakage current has no effect on DCS operation but may affect the results of the reference pressure input test of a transmitter.

The amount of leakage current for each voltage level is shown below.

Table 1-1.

Voltage between field device terminals (V)	Leakage current (μA)
24	8
12	4
6	2

Note Leakage current is the result of functions that require a minute current flow through the 1SHM in order to detect voltage for monitoring the control loop characteristics and for safe powering of the loop.

1.3 Overview of the 1SHM

1.3.1 Appearance

⚠ CAUTION

❗	Operating temperature range (−20 to 50 ºC) Use this device within the specified operating humidity range (5 to 95 % RH). If used outside the above range, this device may malfunction, making the communication with connected devices unreliable.
🚫	Do not use this device near magnetic fields. A magnetic field may cause a malfunction, making communication with connected devices unreliable.

Note Do not put an excessive load on the device or cables.

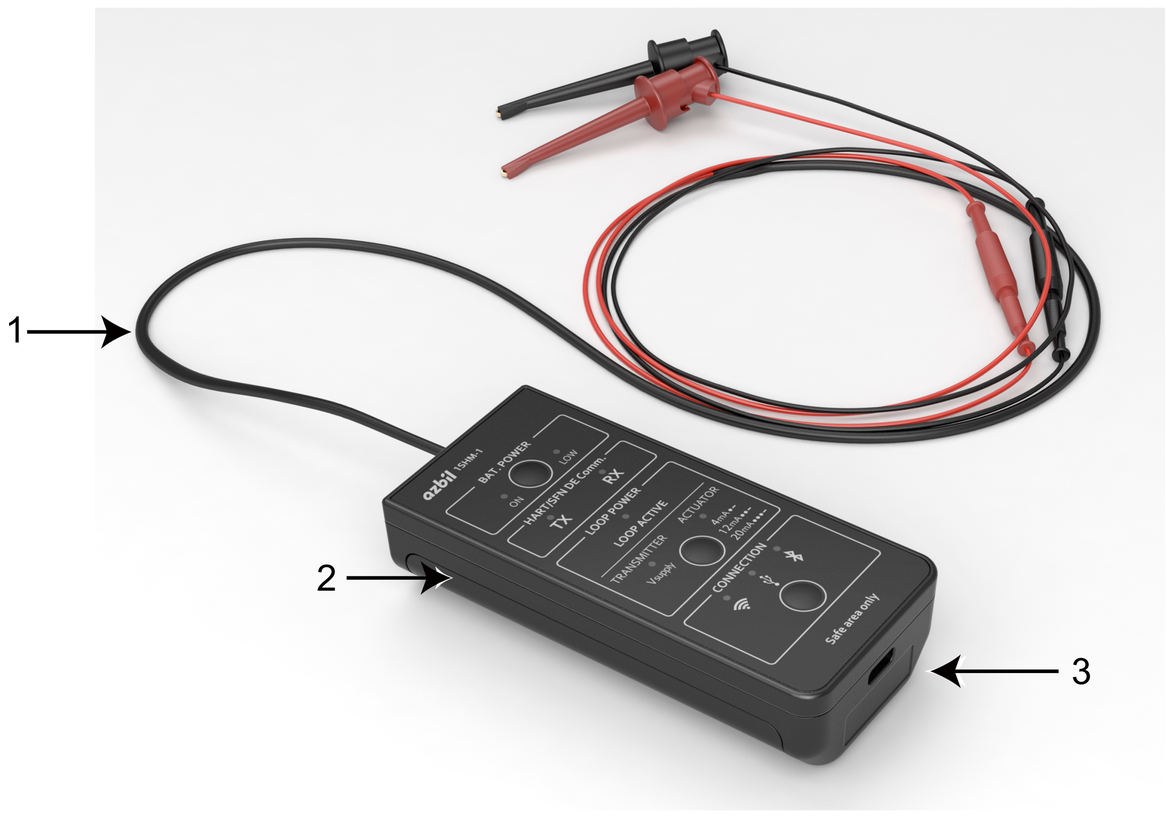


Figure 1-1. Appearance of the 1SHM

Table 1-2. Description of the appearance

1	Field device cable	The cable for connecting the field device. Not removable.
2	The device	The 1SHM itself
3	USB port	USB Type-C port used for a USB cable connection to a Windows PC or tablet

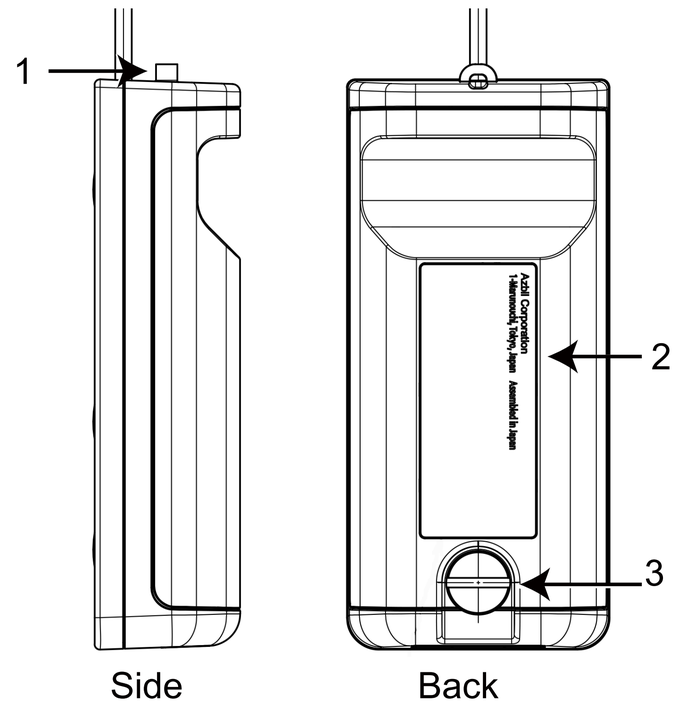


Figure 1-2.

Table 1-3.

1	Strap hole	Put a strap through this hole as needed. A strap is not included with this device.
2	Back cover	The back cover is secured to the main unit with a setscrew. This cover must be properly closed during use.
3	Setscrew	Turn the setscrew counterclockwise to remove the back cover and clockwise to attach it.

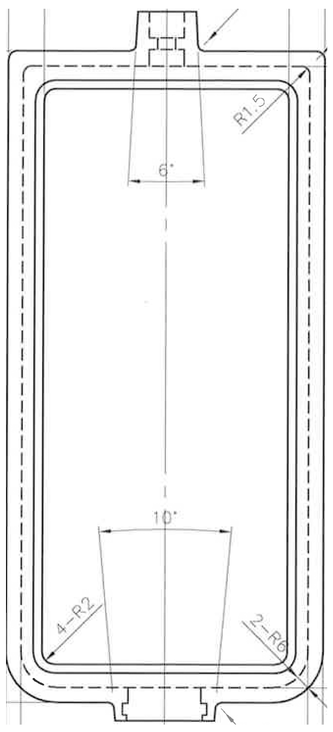


Figure 1-3. Jacket

Table 1-4.

Jacket	Put the jacket on the 1SHM before use to increase the shock resistance.

⚠ CAUTION

⊘	Do not allow water or dust to enter this device. Doing so may cause an electric shock. The jacket cannot perfectly protect this device from water or dust.

Note
- Put the jacket on before use and be careful not to drop this device or subject it to impact.
- When attaching the jacket, do not use excessive force.

1.3.2 Control Panel

The control panel can be used to check the status of the following:

- Battery
- Communication with the field device
- Loop power
- Connection with the PC or tablet

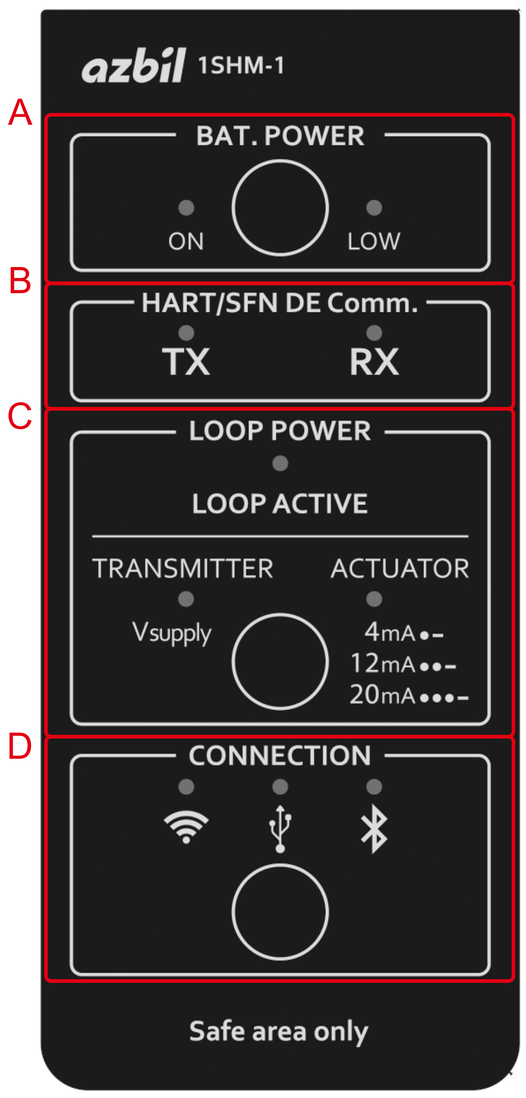


Figure 1-4. Overall view of the control panel

■ A: **BAT.POWER:** shows and changes the status of battery use

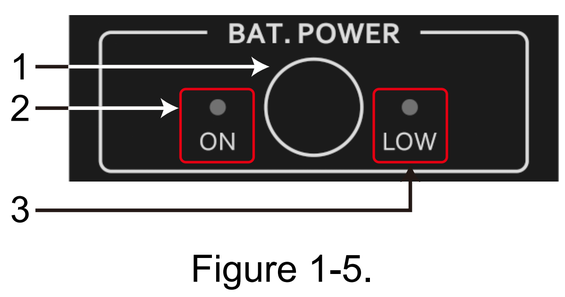


Figure 1-5.

Table 1-5.

1	Battery use button	Switches whether the battery is used or not used. Turn on the battery if there is no USB connection.
2	ON	Green indicator lights up when the battery is in use.
3	LOW	Orange indicator lights up when the battery voltage is low. The battery run outs several minutes after this indicator lights up.

■ B: **HART/SFN DE Comm.:** shows the status of communication with the field device

Figure 1-6.

Table 1-6.

1	TX	Indicator lights up when a signal is sent from the 1SHM.
2	RX	Indicator lights up when a signal is received by the 1SHM.

■ C: **LOOP POWER**: shows and changes the status of loop power supply

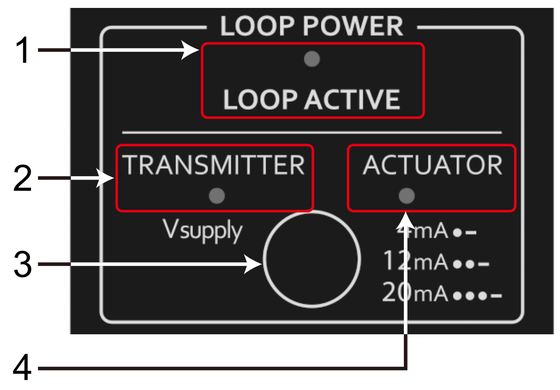


Figure 1-7.

Table 1-7.

1	LOOP ACTIVE	Indicator lights up when the connected field device is receiving power.
2	TRANSMITTER	Indicator lights up when the 1SHM is supplying power to the transmitter (24 V DC).
3	Power supply change button	Switches the power supply setting.
4	ACTUATOR	Indicator lights up when the 1SHM is supplying power to the actuator. The blink pattern changes depending on whether the supplied current is 4, 12, or 20 mA. For details on the blink patterns, refer to **2** in 5.1.2.

■ D: **CONNECTION**: shows and changes the status of connection with the PC or tablet

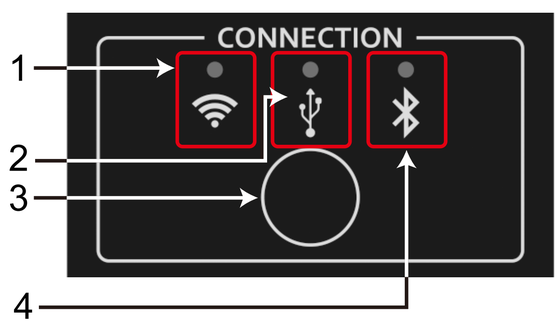


Figure 1-8.

Table 1-8.

1	Wi-Fi connection status	Indicator lights up when the PC or tablet is connected by Wi-Fi (in AP or STA mode).
2	USB connection status	Indicator lights up when the PC or tablet is connected by USB.
3	Connection change button	Changes the method of connection.
4	Bluetooth connection status	Indicator lights up when the PC or tablet is connected by Bluetooth.

MEMO

Chapter 2 Preparation

2.1 Included Items

Check that the following items are included with the product.

Table 2-1. List of included items

Name	Quantity
1SHM (model AZ-1SHM-1B)	1
Field device cable	(attached to the 1SHM)
Cable with test clip	1
Cable with alligator clip	1
USB Type-C cable	1
AAA batteries (for operation check)	3
Silicone jacket	1
Pouch	1
Quick Start Guide	1
License certificate*	1

* Depending on the details of the contract, the license certificate may not be included.

2.2 Required Items

Have the following items on hand in addition to the included items.

2.2.1 Windows PC or Tablet

A Windows PC or tablet is needed for use of the HART host, CFS100, and Support Tool.

■ HART host

Connects to the 1SHM by USB (Windows only) or Bluetooth. Select a Windows PC or tablet suitable for the desired HART host operations and operating conditions.

■ CFS100

Connects to the 1SHM by USB. Refer to the CFS100 specification sheet (SS2-CFS100-0100).

■ Support Tool

- Hardware operating conditions

Table 2-2. Hardware requirements

Main unit	Windows PC or tablet, USB 2.0 or higher USB port
Screen size	400 (W) × 700 (H) pixels or larger

- Software operating conditions

Table 2-3. Software requirements

OS	English or Japanese version of Windows 11/10 (32- or 64-bit) .NET Framework 4.7 or later

Windows administrator privileges are required for operation.

2.3 Preparation

2.3.1 Procedure

For the preparatory work, follow the procedure below. Refer to the indicated section of this manual at each step.

2.3.2 Inserting Batteries

↓

2.3.3 Connecting the USB Cable

↓

2.3.4 Downloading the Support Tool and User's Manual

↓

2.3.5 Installing the USB Driver

↓

2.3.6 Applying for Authentication

↓

2.3.7 Saving the Authorization Data

Figure 2-1. Preparation procedure

2.3.2 Inserting Batteries

Insert batteries into the 1SHM.

⚠ CAUTION

❗	Remove the batteries if this device will not be used for a long time. Otherwise, battery fluid might leak and injure someone.

1 Loosen the setscrew on the back of the main unit to remove the back cover.

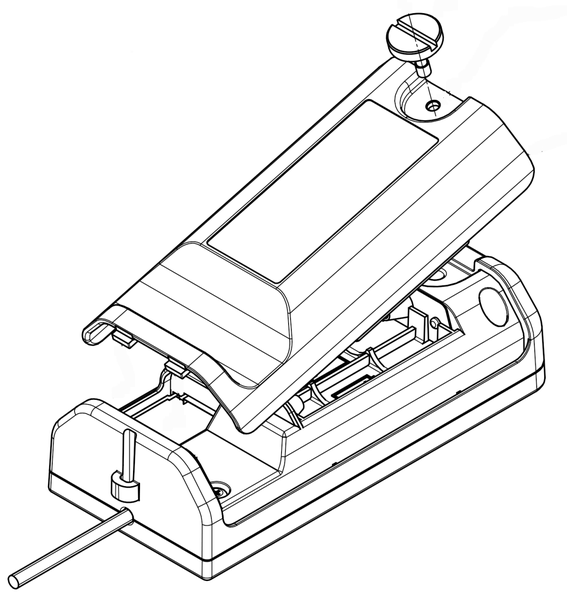


Figure 2-2.

2 Insert AAA batteries.

Put the negative terminal on the spring side.

3 Attach the back cover and tighten the setscrew.

Note
- This device operates without AAA batteries when connected by USB.
- Use nickel-metal hydride (NiMH) batteries or alkaline batteries. When a wireless connection is used, the 1SHM operates continuously for about 4.5 hours with nickel-metal hydride batteries and about 3 hours with alkaline batteries.
- The 1SHM does not have a battery charging function.

2.3.3 Connecting the USB Cable

⚠ CAUTION

⊘	Connect only USB-compatible devices to the USB port. Otherwise, there is a danger of fire or damage to the device.

1 Connect the USB cable to the bottom of the 1SHM and to the Windows PC or tablet.

2 After all the six LEDs under “LOOP POWER” on the control panel light up or blink, the current status is indicated.

Figure 2-3.

FYI When you connect the USB cable to the Windows PC or tablet, the Windows PC or tablet supplies power to the 1SHM. As a result, the 1SHM starts up regardless of whether the button for internal battery use is turned on or off.

2.3.4 Downloading the Support Tool and User's Manual

Download the Support Tool and User's Manual.

1 PC/Tablet

Download the Support Tool.

FYI The latest version of the Support Tool and user's manual can be downloaded from the following URL:
https://www.azbil.com/products/factory/solution/equipment-asset-management/hart-foundation-fieldbus/hdfs-system/smart-hmodem/index.html

2 PC/Tablet

Put the zip file containing the Support Tool in any desired folder on the Windows PC or tablet and unzip it.

It does not need to be installed.

2.3.5 Installing the USB Driver

1 PC/Tablet

Start File Explorer on the Windows PC or tablet.

2 PC/Tablet

Check the "File name extentions" check box in the "Show/hide" group in the [View] menu in File Explorer.

3 PC/Tablet

In the folder you selected in 2.3.4, double-click the unzipped executable file (Azbil.Dfs.HARTModem.SupportTool.exe) to start the Support Tool.

Figure 2-4.

4 Support Tool

If a confirmation dialog box for installation appears, click the <OK> button.

5 Support Tool

Click the <Next> button and follow the instructions given by the installation wizard.

>> The USB driver is automatically installed.

2.3.6 Applying for Authentication

The license must be authenticated before you can use the many different functions of the 1SHM.

Note An authenticated 1SHM can be used in combination with a Windows PC or tablet that was not used for authentication and that is running the Support Tool. There is no authentication system for the Support Tool.

1 Support Tool

Click the <Authentication Request> button on the [Certification] screen of the Support Tool.

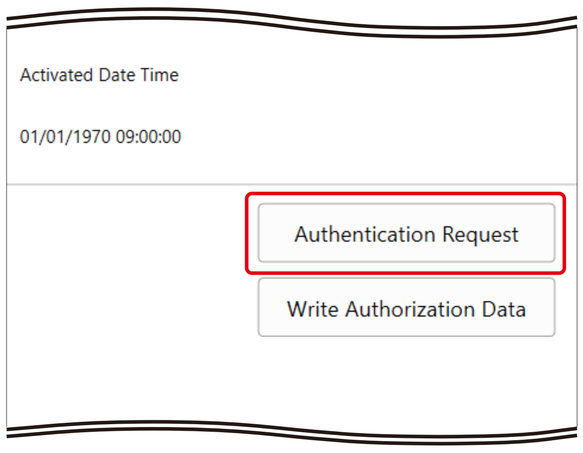


Figure 2-5.

2 Support Tool

Enter the administrator password.

The preset administrator password is “password.”

If you forget the administrator password, you can change it using the “Change password” link in the [Enter administrator password] dialog box. If you do this, any existing settings will all be cleared. Please be aware of this.

Refer to 8.3 for instructions on changing the administrator password.

3 Support Tool

Enter the necessary information on the [Authentication Request] screen.

If you have a license certificate, be sure to enter the license key without the hyphen (“-”). All users must enter the following:

- Last Name
- First Name
- Email Address
- Company
- Country of Residence
- Postal Code

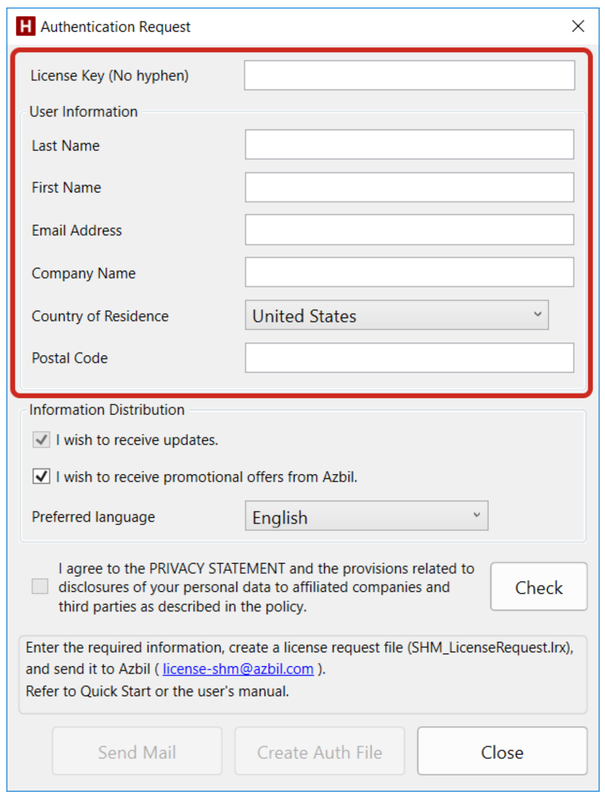


Figure 2-6.

4 Support Tool

Click the <Create Auth File> button.

>> The authentication application file, SHM_LicenseRequest.lrx, is created.

If e-mail software can be used in your environment, you can click the <Send Mail> button to start the e-mail software.

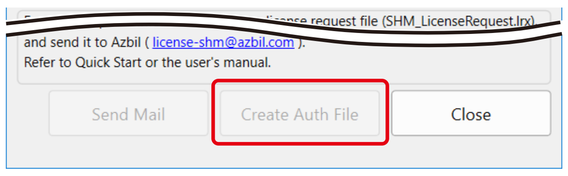


Figure 2-7.

Note
- The authentication application file contains information about the environment of the Windows PC or tablet used for the application.
- A Support Tool that is running on a device other than the Windows PC or tablet used for authentication can be used.

5 Send the authentication application file, without compressing it, as an e-mail attachment to our authentication application address (license-shm@azbil.com).

If your mailer has a function to check the contents of attached files before sending e-mail, you must associate an application with the file extension. In this case, right-click the authentication application file to open the [Properties] menu and click the <Change> button on the [General] tab to specify an application.

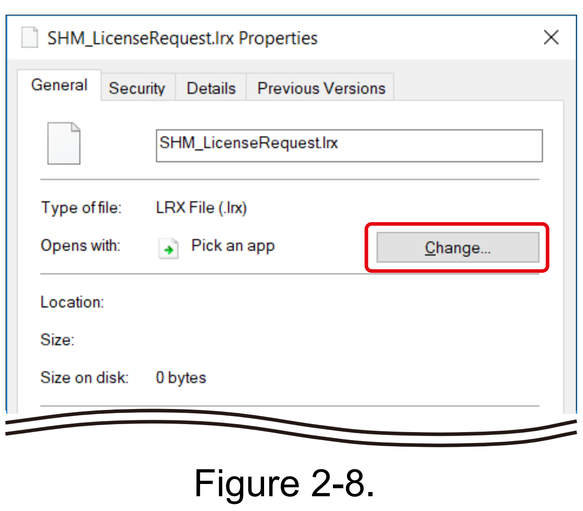


Figure 2-8.

6 PC/Tablet

Check for a reply containing the authorization file, SHM_Certification.lcx.

2.3.7 Saving the Authorization Data

The information in the authorization file must now be input to the 1SHM.

1 PC/Tablet

Place the authorization file received at **6** in 2.3.6, SHM_Certification.lcx, in the desired folder.

2 Support Tool

Open the [Certification] screen of the Support Tool.

3 Support Tool

Click the <Write Authorization Data> button on the [Certification] screen.

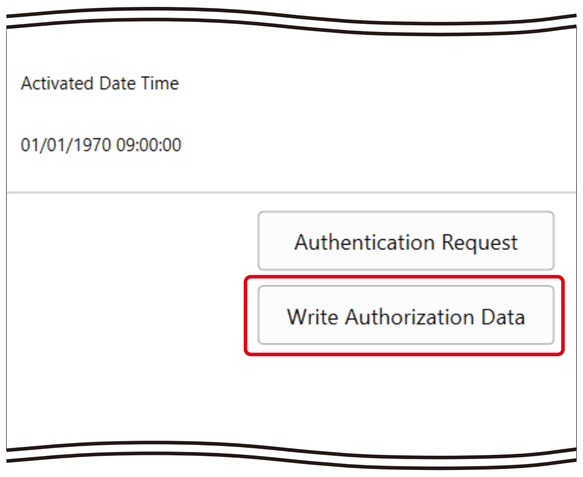


Figure 2-9.

>> The [Please select authorization file] dialog box opens.

4 Support Tool

Select the authorization file and click the <Open> button.

After the authorization file is written, the 1SHM automatically restarts. At this time, the Support Tool automatically shuts down.

2.4 Connecting the 1SHM with the PC or Tablet

The procedure when using a USB or Bluetooth connection is as follows.

2.4.1 USB Connection

Follow the procedure below.
Refer to the listed sections in this manual.

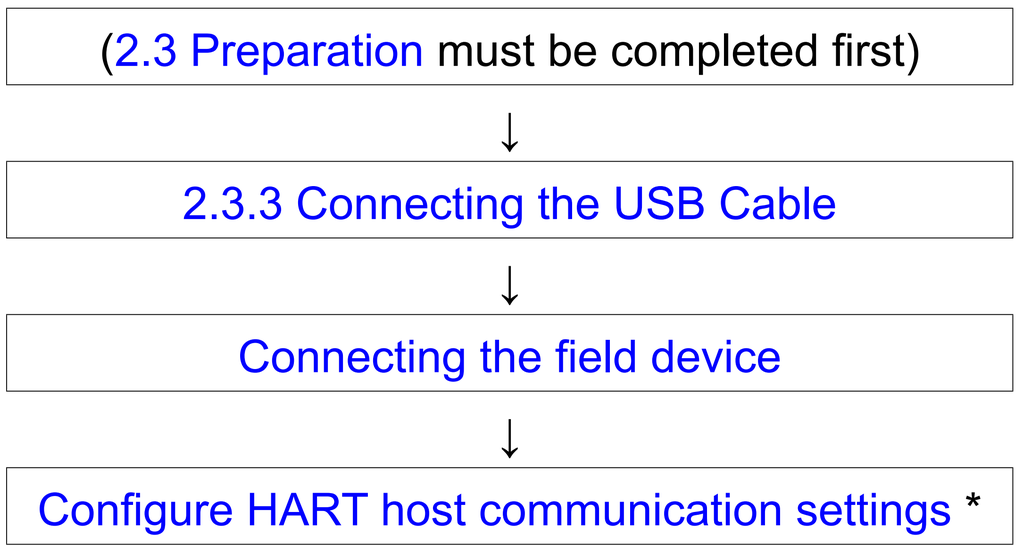


Figure 2-10. Procedure for USB connection

* This step is not necessary to use the Support Tool.

■ Connecting the field device

Connect the field device cable of the 1SHM to the field device.

⚠ WARNING

⃠	If an explosion-proof field device is used, never open its cover while it is running. There is a danger of an explosion. For the handling of this type of device, refer to the user's manual for the device.

⚠ CAUTION

⃠	Do not touch live terminals. Doing so may cause an electric shock.

Note Do not connect a high voltage or high current device to the field device cable.

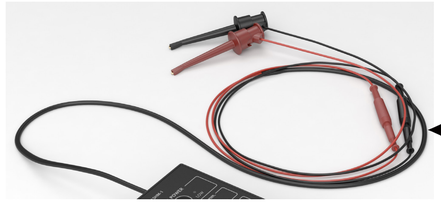


Figure 2-11.

Connect the red cable to the positive side of the field device and the black cable to the negative side. Be sure not to connect them the wrong way.

■ Configure HART host communication settings

This step is not necessary if you use the Support Tool.

Start the HART host device and configure the COM port communication settings.
Select the USB driver (Azbil HART and SFN DE Serial Port) included with the product.

2.4.2 Bluetooth Connection

⚠ WARNING

❗	This device emits radio waves. Keep this device at least 20 cm away from a pacemaker. Otherwise, the pacemaker may malfunction. Radio wave emission can be stopped by changing the settings.

Note Bluetooth connection is prohibited in countries and regions where the wireless device certifications listed in Chapter 10 are invalid.

Follow the procedure below.
Refer to the listed sections in this manual.

(2.3 Preparation must be completed first)

↓

2.3.3 Connecting the USB Cable *

↓

Enable Bluetooth communication*

↓

Remove the USB cable*

↓

Turn on the 1SHM

↓

Set the Bluetooth communication mode

↓

Pair the 1SHM

↓

Connect the field device

↓

Connect the HART host to the 1SHM

Figure 2-12. Procedure for Bluetooth connection

* Not necessary if Bluetooth communication is already enabled.

■ Enable Bluetooth communication

Enable Bluetooth communication using the Support Tool.

1 Support Tool

Open the [Settings] menu of the Support Tool.

>> The [Settings] screen opens.

2 Support Tool

Click the <Advanced Settings> button in the “Wireless Settings” group.

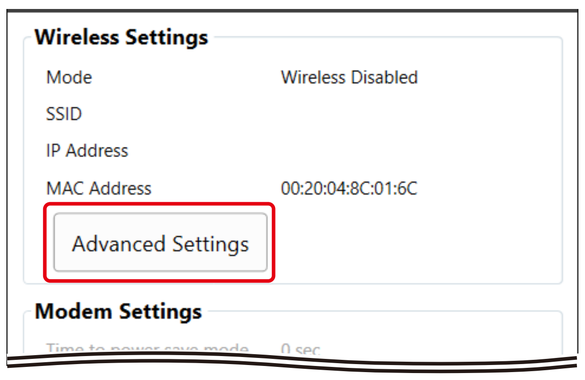


Figure 2-13.

3 Support Tool

The [Wireless settings] screen opens.

Check the [Enable] check box under “Bluetooth” and click the <OK> button.

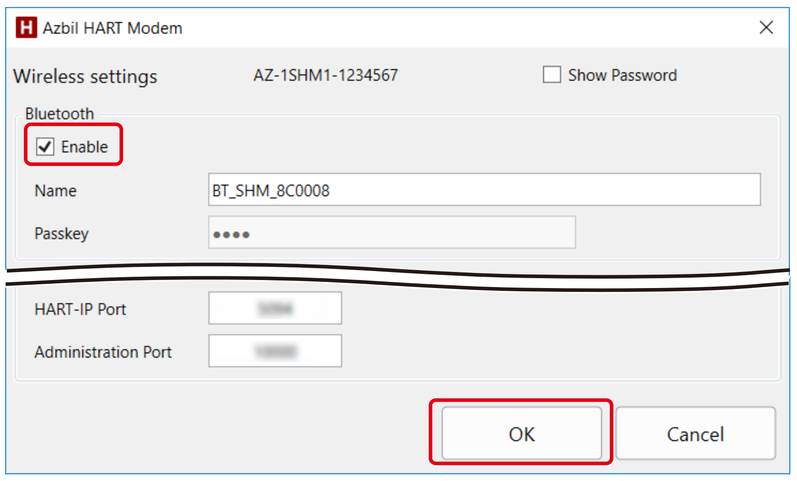


Figure 2-14.

4 Support Tool

Click the <Restart Modem> button on the [Settings] screen.

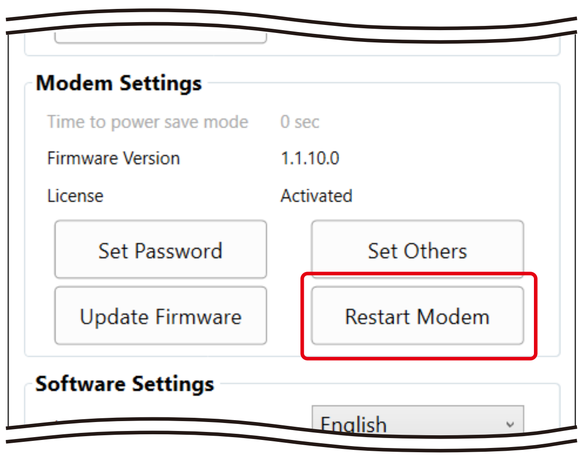


Figure 2-15.

A restart confirmation dialog box opens. Click the <OK> button.

The 1SHM restarts and the changes are applied.

5 1SHM

Remove the USB cable.

■ Turn on the 1SHM

Touch and hold (for three seconds) the battery use button on the 1SHM.

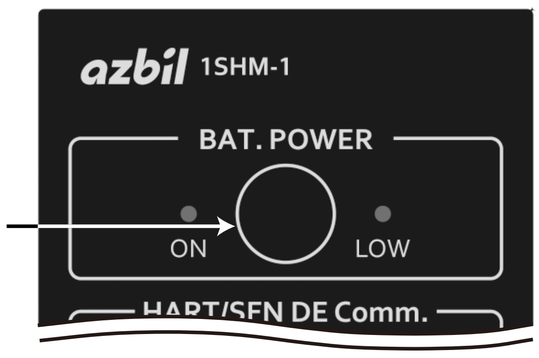


Figure 2-16.

■ Setting the Bluetooth communication mode

Set the Bluetooth communication mode on the 1SHM.

If you wish to make a Bluetooth connection while supplying power to the field device, stop supplying power temporarily and set the mode.

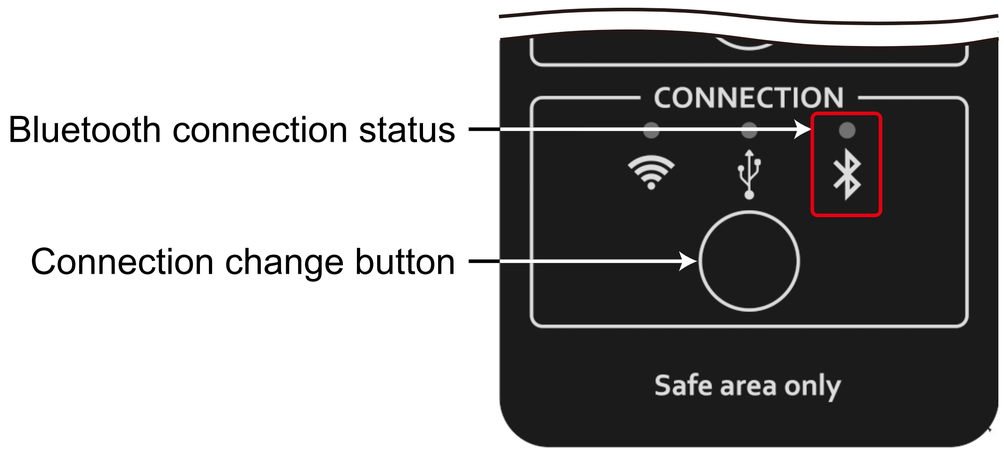


Figure 2-17.

1 1SHM

If the Bluetooth connection status indicator is lit or blinking, proceed to the next section, “Pair the 1SHM.”

2 1SHM

If not, press the connection change button repeatedly until the Bluetooth connection status indicator stays on or blinks.

3 1SHM

If the Bluetooth connection status indicator is blinking, touch and hold (for two seconds) the connection change button.

>> The LED stops blinking and stays on, and the connection method is switched.

■ Pair the 1SHM

Pair the 1SHM following the procedure for the Windows PC or tablet.

The procedure in Windows 10 is shown below.

1 PC/Tablet

Click the Windows <Start> button and select the Settings (gear) icon.

>> The [Windows Settings] screen opens.

2 PC/Tablet

Select “Devices.”

>> The [Bluetooth & other devices] pane opens.

3 PC/Tablet

Turn “Bluetooth” on.

Here, you can see the current status (unconnected, paired, or connected) of the devices that have been connected via Bluetooth.

4 PC/Tablet

Click “Add Bluetooth or other device.”

>> The [Add a device] screen opens.

5 PC/Tablet

Select “Bluetooth.”

>> Devices that can be paired are displayed.

6 PC/Tablet

Select the 1SHM that you wish to connect.

7 PC/Tablet Check that the name of the 1SHM is displayed in the “Other devices” section and that “Connected” is displayed on the [Bluetooth & other devices] pane.

■ Unpair the 1SHM

If the 1SHM is paired with another Windows PC or tablet, unpair it from that PC or tablet. To unpair the devices, follow the procedure for the particular type of device.
The procedure in Windows 10 is shown here.

1 PC/Tablet Click the Windows <Start> button and select the Settings (gear) icon.

>> The [Windows Settings] screen opens.

2 PC/Tablet Select “Bluetooth & other devices.”

>> The [Bluetooth & other devices] pane opens.

3 PC/Tablet Select the relevant 1SHM (the one for which “Connected” is displayed among the displayed devices).

4 PC/Tablet Click the <Remove device> button to unpair it.

■ Connect the field device

Connect the field device cable of the 1SHM to the field device.

⚠ WARNING

⃠	If an explosion-proof field device is used, never open its cover while it is running. There is a danger of an explosion. For the handling of this type of device, refer to the user’s manual for the device.

⚠ CAUTION

⃠	Do not touch live terminals. Doing so may cause an electric shock.

Note Do not connect a high voltage or high current device to the field device side of the cable.

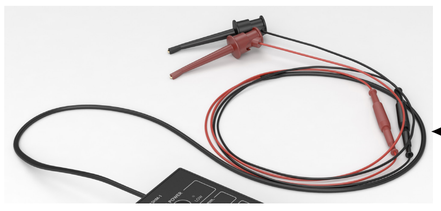


Figure 2-18.

Connect the red cable to the positive side of the field device and the black cable to the negative side.
Be sure not to connect them the wrong way.

■ Connect the HART host to the 1SHM

On the HART host device, specify the connection destination when using Bluetooth communication.

In Windows, one COM port for outgoing data and one COM port for incoming data are used for Bluetooth communication. Specify the outgoing COM port as the connection destination on the HART host (example: HART communication DTM). You can check the outgoing COM port with the following procedure.

1 PC/Tablet

Click the Windows <Start> button and select the Settings (gear) icon.

>> The [Windows Settings] screen opens.

2 PC/Tablet

Select “Bluetooth & other devices.”

>> The [Bluetooth & other devices] pane opens.

3 PC/Tablet

Click “More Bluetooth options.”

>> The [Bluetooth Settings] screen opens.

4 PC/Tablet

Open the [COM Ports] tab on the [Bluetooth Settings] screen.

5 PC/Tablet

A list of port numbers, directions (outgoing or incoming), and names is displayed.

6 PC/Tablet

Check the port number of the 1SHM whose direction is “Outgoing” and whose name is “Connected.”

2.5 Battery Operation

The 1SHM operates on power through the USB connection.

You can operate it with battery power using the following procedure if no USB connection is available.

1 1SHM

Touch and hold (for three seconds) the battery use button.

>> The green “ON” indicator lights up.

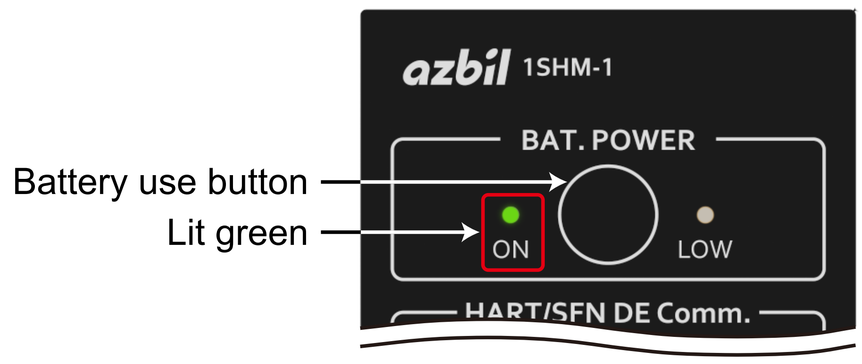


Figure 2-19.

2 1SHM

After use, touch and hold the battery use button for three seconds again to switch off battery use.

FYI If the battery voltage is low, the orange “LOW” indicator lights up. The battery run outs several minutes after this indicator lights up.

Chapter 3 Configuration and Calibration of the Field Device

3.1 Precautions When Using the HART Host

⚠ CAUTION

	Before sending a HART signal via the 1SHM, check to make sure that sending a HART signal to the connected system and field devices will not cause any problems. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.
	If other HART hosts are connected at the same time, interference between the device and host primary or secondary HART communication may occur, resulting in a HART communication error. Monitor communication between the device and other hosts by using the Support Tool in passive mode before sending the HART signal from the 1SHM and, if needed, change the settings to avoid simultaneous communication.
	Before using SFN/DE communication from model CFS100 field communication software, make sure that the field device connected to it is not in operation. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.

3.2 Precautions When Using the CFS100

Precautions for use of the 1SHM with the CFS100 are shown below.

- The COM ports that can be used for SFN/DE communication are COM1 to COM16 (a CFS100 restriction).
- If you select the wrong communication method (SFN/DE communication or HART communication) immediately after starting the CFS100, shut down the CFS100.
- For SFN communication with an AVP300/200, you must connect this device to the OUT terminal of the AVP300/200. (Refer to the user's manual CM2-AVP300-2001.)
  Do not supply power to the OUT terminal.

Chapter 4 Simplified HART Connection Diagnostics

4.1 Checking the Communication Status

1SHM

The status of communication with the field device can be checked with the LED display on the 1SHM.

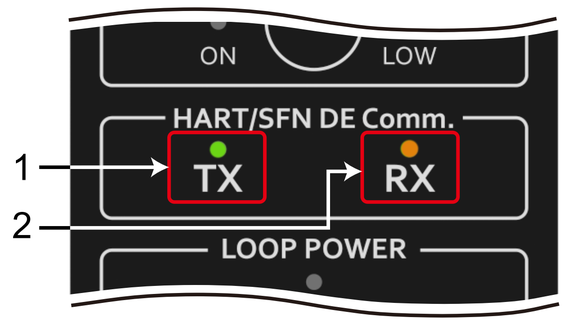


Figure 4-1.

Table 4-1.

1	TX	Green indicator lights up when the 1SHM sends a HART or SFN/DE signal to the field device.
2	RX	Orange indicator lights up when the 1SHM receives a HART or SFN/DE signal from the field device.

4.2 Identifying the 1SHM That the Support Tool Is Communicating with

Support Tool

Check the modem ID, which is the hardware identifier for the 1SHM that the Support Tool is communicating with, on the Support Tool screen.

You can see the information shown in Table 4-2 by clicking the *i* button on the right of the modem ID.

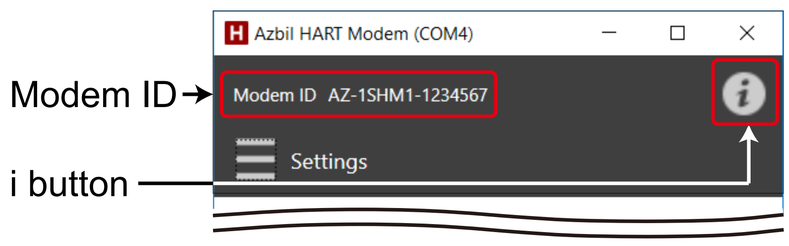


Figure 4-2.

Table 4-2.

Modem ID	Identifier of the 1SHM
SSID	When the 1SHM is wirelessly connected, the SSID (service set identifier) is displayed.
Master Mode	Indicates whether the Support Tool sends HART commands with the primary master address or the secondary master address.

4.3 Monitoring Mode

In monitoring mode, the 1SHM does not send HART signals to the connected loop, but only monitors HART communication in the connected device.

To use the Support Tool in monitoring mode, do the following.

Support Tool

Select [Loop Diagnostics (Passive)] from the Support Tool menu.

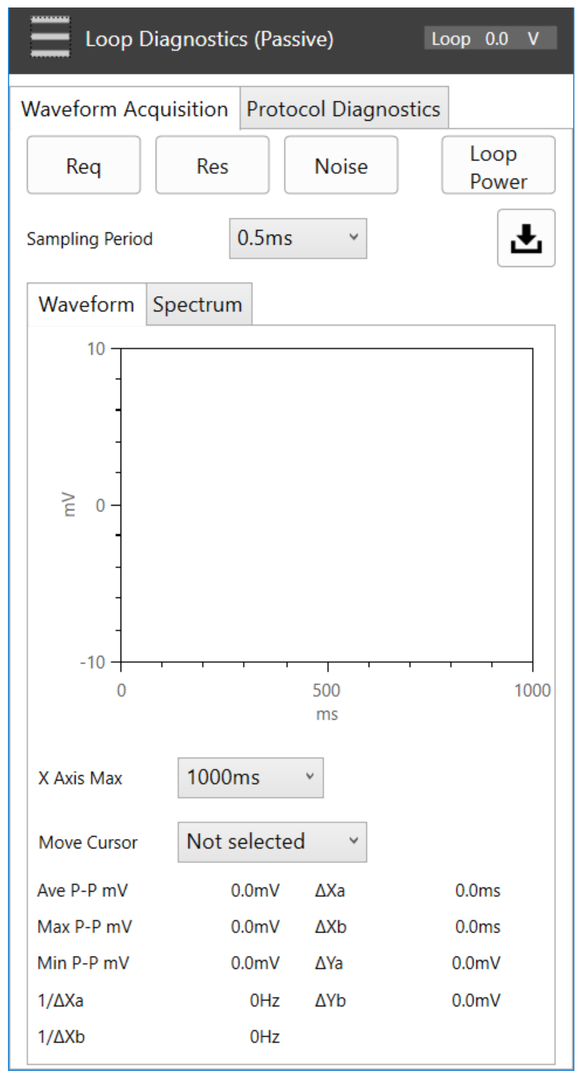


Figure 4-3. [Loop Diagnostics (Passive)] screen

4.3.1 Obtaining a Communication Waveform

Use the [Waveform Acquisition] tab on the [Loop Diagnostics (Passive)] screen.

1

Support Tool

Specify the sampling period (sampling cycle) for the HART waveform.

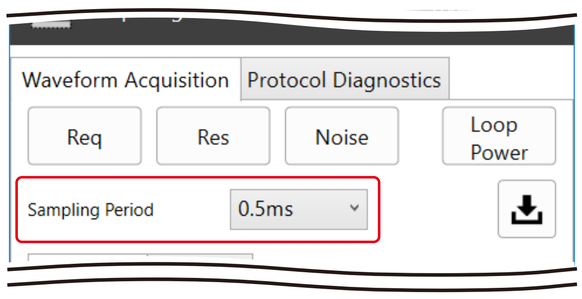


Figure 4-4.

Sampling is done 4,096 times with the specified cycle. If you change the sampling period, the maximum value for the horizontal axis, X Axis Max, on the chart is automatically changed accordingly. However, you can manually change X Axis Max to a desired value.

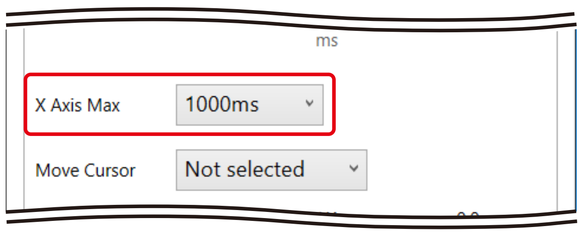


Figure 4-5.

The following table shows the sampling period, the sampling time, and the default X Axis Max when you specify the sampling period.

Table 4-3.

Sampling period	Sampling time	Default X Axis Max
0.02 ms	81.92 ms	10 ms
0.1 ms	409.6 ms	100 ms
0.5 ms	2048 ms	1000 ms
1.0 ms	4096 ms	4000 ms

2 Click one of the following buttons. Sampling begins.

Support Tool

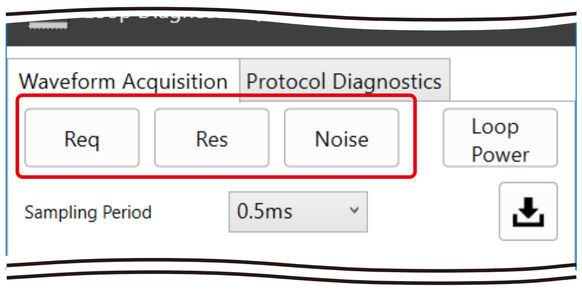


Figure 4-6.

Table 4-4.

Button	Details of sampling
Req	Samples using the start of a HART command as the key. If a command cannot be detected, a timeout occurs.
Res	Samples using the start of a HART response as the key. If a response cannot be detected, a timeout occurs.
Noise	Samples regardless of whether a HART command or response is present when clicked. This is useful for checking the noise level.

3 After sampling is completed, the waveform is displayed in a chart.

Support Tool

The average of the peak-to-peak values (Ave P-P), the highest peak-to-peak value (Max P-P), and the lowest (Min P-P) in the sample are displayed.

If you click the <Req> button with a sampling period of 0.5 ms in an environment with little noise, you can see a command waveform block and a response waveform block that indicate the command and response of the HART communication as shown in the waveform example in Figure 4-7.

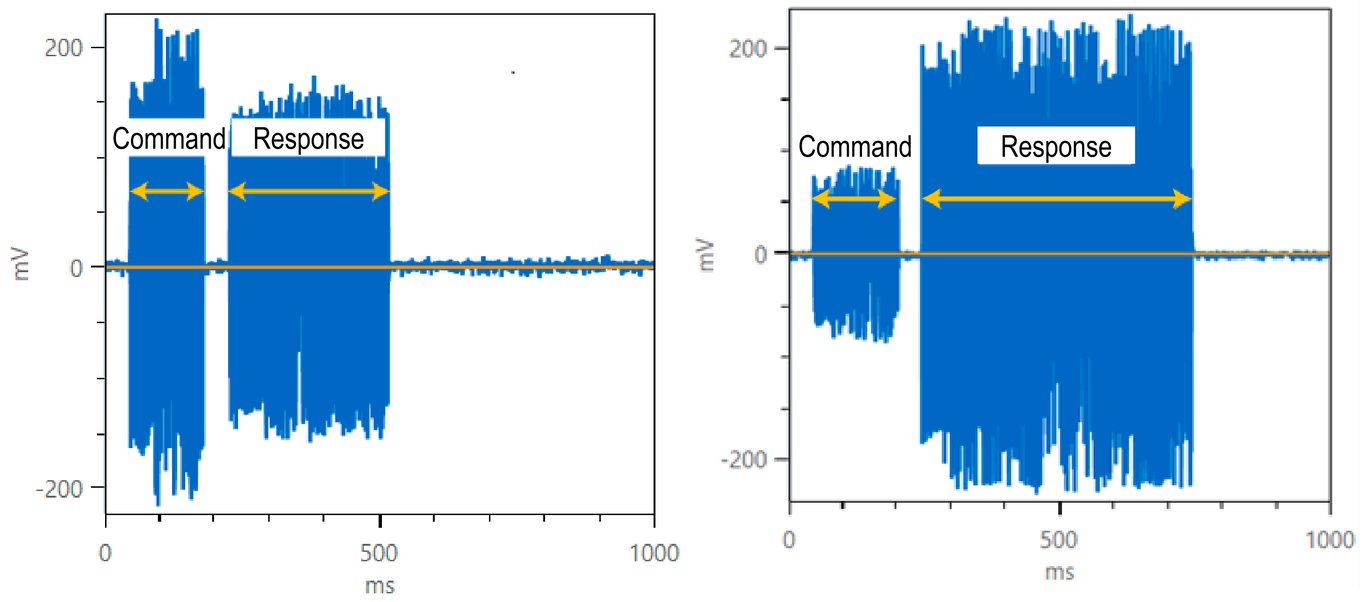


Figure 4-7. Waveform examples of the HART signal when the <Req> button is clicked (sampling period: 0.5 ms)

If the field device does not respond to the command that the HART master (HART host) sends, you see a waveform that does not have the response section shown in Figure 4-7.
In the case of the chart on the right in Figure 4-7, the scale of the vertical axis of the chart (voltage) would change.

If no command transmission from the HART master is detected and there is only noise, the waveforms for the command and response shown in Figure 4-7 do not appear.
Figure 4-8 shows the waveform if you click the <Noise> button with a sampling period of 0.5 ms when there are no HART signals. The automatically calculated scale for the vertical (voltage) axis in the chart is different from in Figure 4-7.

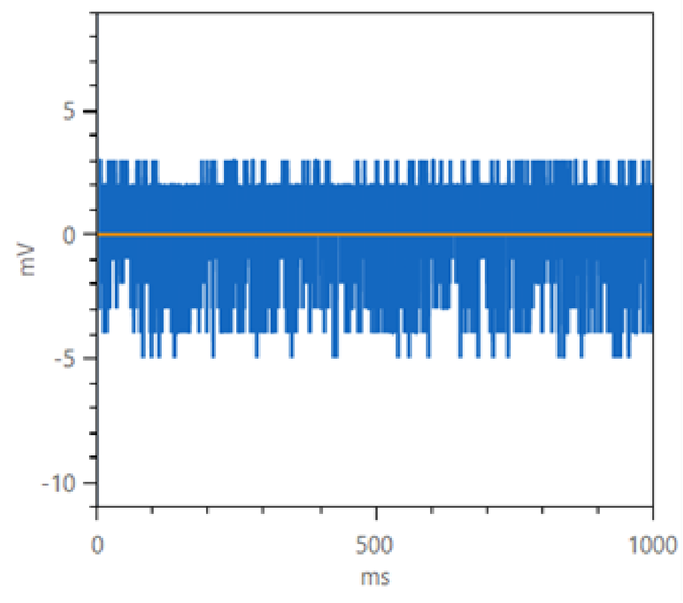


Figure 4-8. Example where there is no HART signal (sampling period: 0.5 ms)

4.3.2 Saving the Communication Waveform

Support Tool

You can save the data plotted in the currently displayed waveform in CSV format by clicking the <Save> button.
Up to 10,000 CSV data lines (a file size of about 930 KB) can be saved.

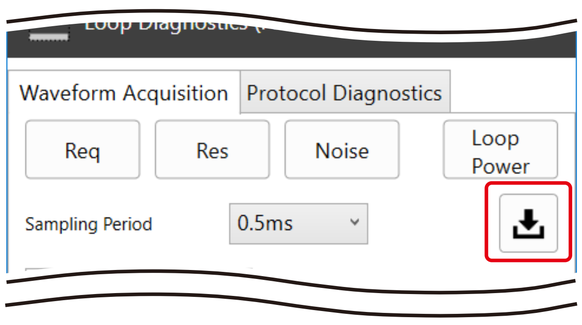


Figure 4-9. <Save> button

4.3.3 Analyzing the Communication Signal Spectrum

Support Tool

You can see the spectrum intensity for each frequency of the sampled signal in a chart by displaying the [Spectrum] tab on the [Waveform Acquisition] tab of the [Loop Diagnostics (Passive)] screen.

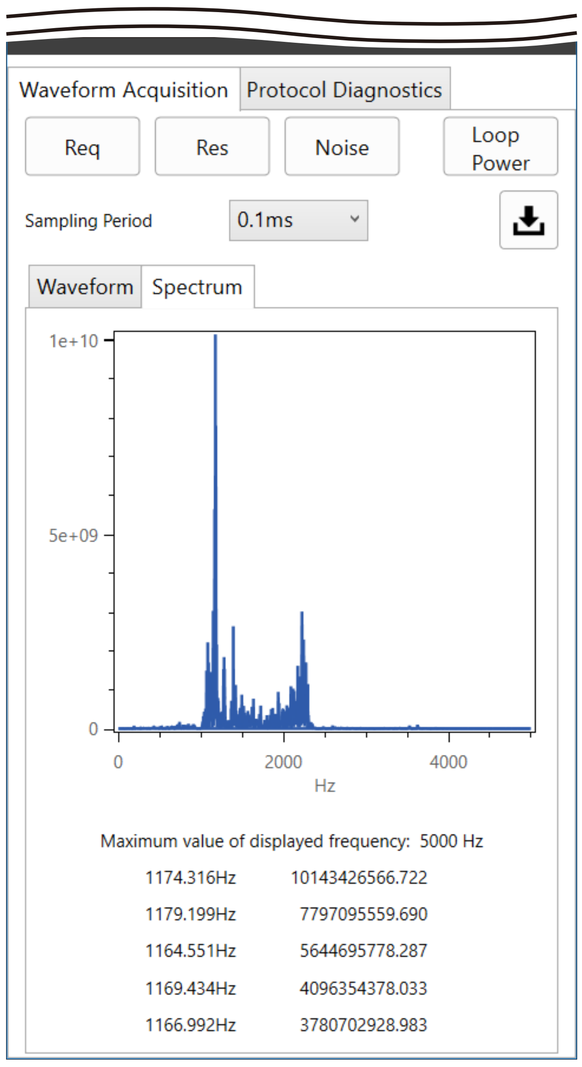


Figure 4-10.

If you have already obtained a communication waveform (see 4.3.1 above), you can see the spectrum analysis result only in the [Spectrum] tab display. The frequencies with the five highest spectrum intensities are displayed below the chart.

The maximum display frequency is different depending on the sampling period.

Table 4-5. Sampling period and maximum display frequency

Sampling period	Max. display frequency	Check of signal level around HART signal
0.02 ms	25000 Hz	Possible
0.1 ms	5000 Hz	
0.5 ms	1000 Hz	Not possible
1.0 ms	500 Hz	

To check the signal level around the HART signal (1200 Hz, 2200 Hz), the sampling period must be set to 0.1 ms or less.

1 Specify the sampling period for the HART waveform.

Support Tool

For details on the periods, refer to Table 4-5.

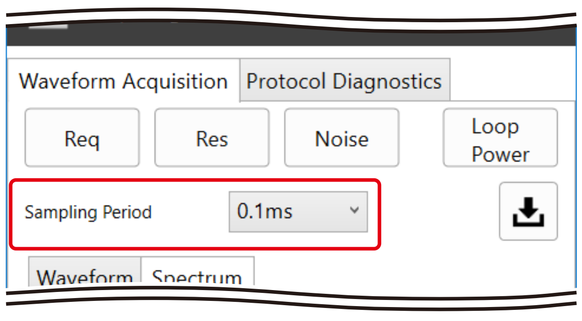


Figure 4-11.

2 Click the <Noise> button.

Support Tool

The <Req> button and the <Res> button are also available when there are HART signals.

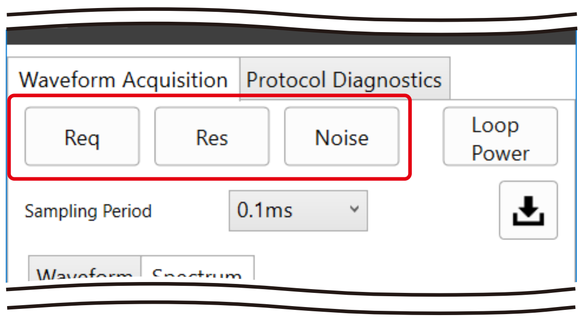


Figure 4-12.

3 After sampling is completed, the results of spectrum analysis are displayed in a chart.

Support Tool

4.3.4 Monitoring the Details of HART Communication

You can display the details of the currently sent HART signal in real time with automatic scrolling by clicking the [Protocol Diagnostics] tab on the [Loop Diagnostics (Passive)] screen (protocol display). You can also check the following details on the same screen:

- Whether the current signal flow is primary or secondary communication
- Expanded device type and device ID of the device
- Communication result (total from the beginning to the end of the scan)

4.3.5 Pausing and Resuming Monitoring

Support Tool

You can stop the updating of the protocol display and view it by clicking the <Stop Capture> button on the [Protocol Diagnostics] tab. Click the <Start Capture> button to resume monitoring the protocol. Upon restarting, data obtained up until that point is deleted.

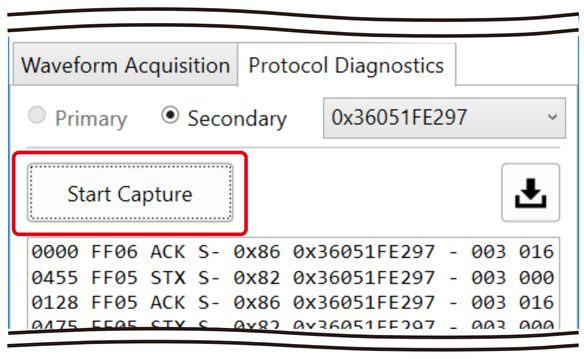


Figure 4-13.

4.3.6 Checking the Results of Communication

Support Tool

The communication result display field dynamically shows the number of sent commands, the number of received responses, and the difference between them (the number of errors) for primary communication and secondary communication.

The display field also shows the number of burst transmissions received as well as the number of frame errors and the number of parity errors.

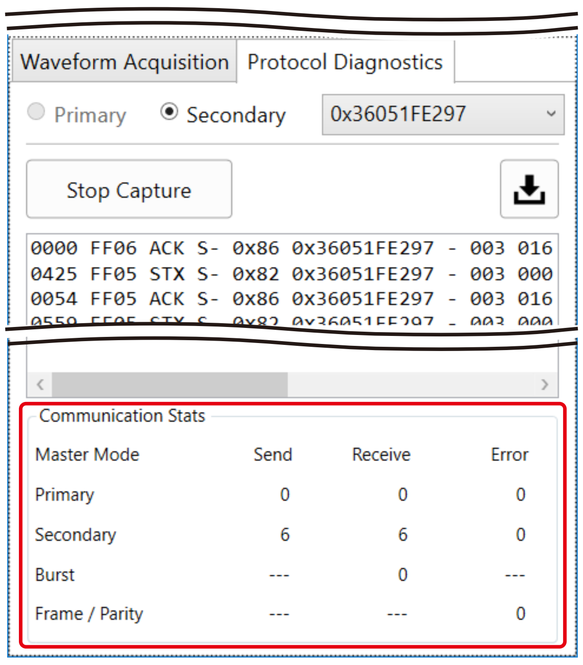


Figure 4-14.

■ Description of the communication details display

This section gives an example of the communication details display and describes the command request and response.

Example: HART command 9 (first line: command, second line: response)

```
0222 FF05 STX P- 0x82 0xB60D241857 - 009 001 - - 0xF6 0xAC

0055 FF05 ACK P- 0x86 0xB60D241857 - 009 015 0x00 0x40 0x00F6410C3C1F91CEC09B70F800 0x04
```

Table 4-6. Command (example of the first line)

Data	Description
0222	Interval since the last communication (unit: ms) 222 ms
FF05	Contains five 0xFF preambles.
STX	Frame type STX: Request (master to field device)
P-	Primary (P), non-burst (-)
0x82	Delimiter field value (HCF_SPEC-081 Figure.4) 0x82: Unique address + asynchronous + STX
0xB60D241857	Long frame address value (HCF_SPEC-081 Figure.6) 0xB60D: Primary master, non-burst, expanded device type 0x241857: Device ID
-	Expansion bytes (HCF_SPEC-081 Figure.5) None
009	Command No. (HCF_SPEC-081 Figure.5) 9 (decimal)
001	Data byte length (HCF_SPEC-081 Figure.5) 1 (decimal)
-	Response code N/A
-	Status byte N/A

Data	Description
0xF6	Request data details (command argument) 0xF6 = 246: primary variable
0xAC	Check byte for HART PDU (HCF_SPEC-081 Figure.5)

Table 4-7. Response (example of the second line)

Data	Description
0055	Interval since the last communication (unit: ms) 55 ms
FF05	Contains five 0xFF preambles.
ACK	Frame type ACK: response (field device to master)
P-	Primary (P), non-burst (-)
0x86	Delimiter field value (HCF_SPEC-081 Figure.4) 0x86: Unique address, asynchronous, ACK
0xB60D241857	Long frame address value (HCF_SPEC-081 Figure.6) 0xB60D: Primary master, non-burst, expanded device type 0x241857: Device ID
-	Expansion bytes (HCF_SPEC-081 Figure.5) None
009	Command number (HCF_SPEC-081 Figure.5) 9 (decimal)
015	Data byte length (HCF_SPEC-081 Figure.5) 15 (decimal) Value that contains command status bytes (one byte for response code and one status byte).
0x00	Communication status / response code (HCF_SPEC-099 Table.10/11) 0x00: no warning or error
0x40	Device status (HCF_SPEC-099 Table.12) 0x40: configuration changed is ON
0x00F6410C3C1F91CEC09B70F800	Command response data details Details of the response data bytes for command 9 (one data item) 0x00 extended field device status 0xF6 slot 0 device variable code (0xF6 = primary variable) … … 0xC0 slot 0 device variable status 0x9B70F800 slot 0 data time stamp
0x04	Check byte for HART PDU (HCF_SPEC-081 Figure.5)

“S-” is shown instead of “P-” for the combination of secondary and non-burst communication.
Also, in the case of burst communication, the frame type display is “BAK” and “PB” is shown instead of “P-.”

4.3.7 Saving the Communication Details

Support Tool

You can save the currently displayed information in CSV format by clicking the <Save> button.
Up to 10,000 CSV data lines (file size of about 930 KB) can be saved.

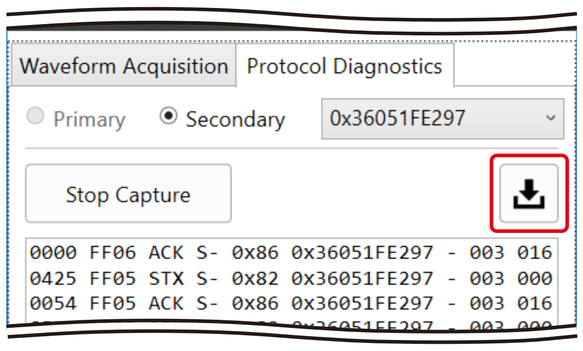


Figure 4-15.

4.4 What Is HART Master Mode?

Support Tool

In HART master mode, the Support Tool serves as the HART master (HART host) and the 1SHM issues HART commands to the connected device. You can switch whether to operate the Support Tool as the primary or secondary master with the procedure described in 4.4.1.

Screens that open from [Loop Diagnostics (Active)], [Device Information], and [Process] on the Support Tool menu operate in HART master mode.

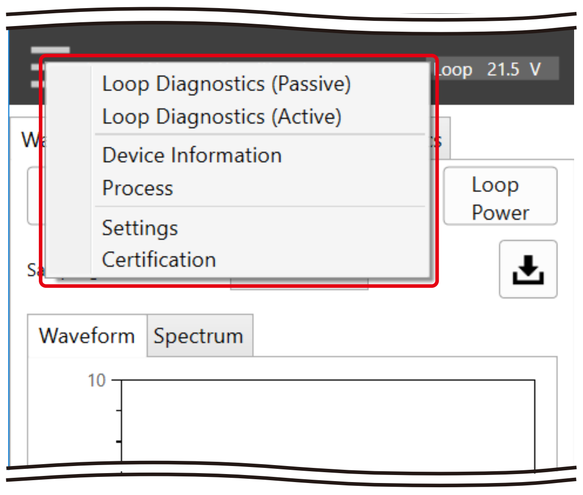


Figure 4-16.

⚠ CAUTION

Before using the Support Tool in HART master mode, check to make sure that sending a HART signal to the connected system and field devices will not cause any problems. Communication may cause fluctuation in analog values (4–20 mA), leading to unexpected behavior of the equipment.

Note If HART communication is detected in the connected loop, HART master mode is unavailable so that the detected communication is not blocked.

4.4.1 Switching between the Primary and Secondary Masters

The user can specify whether the Support Tool communicates as the primary or secondary master when operating in HART master mode.

1 Open [Settings] in the Support Tool.

Support Tool

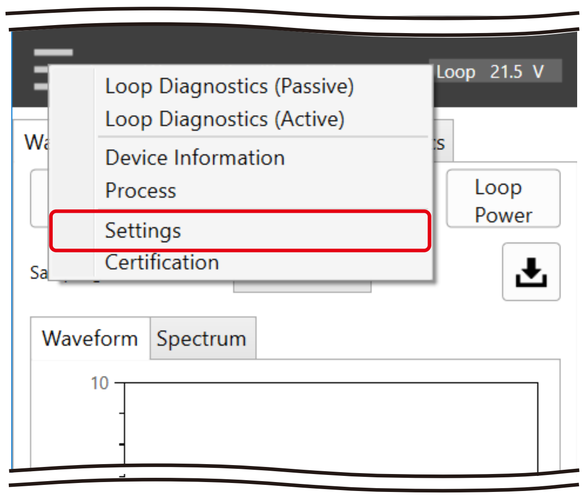


Figure 4-17.

2 Select “Primary” or “Secondary” in the Master Mode drop-down list.

Support Tool >> Changes are applied without restarting the Support Tool.

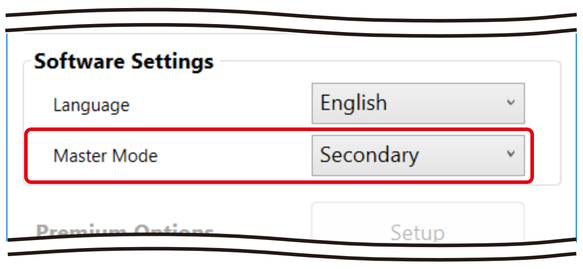


Figure 4-18.

4.4.2 Obtaining a Communication Waveform

Send HART command 0 to the connected HART device and display the waveforms of this command and the response.

1 Check the polling address of the connected device in advance.

Support Tool You can check the polling address by selecting [Device Information] from the menu and performing steps **1** and **2** in 4.5.

2 Open the [Waveform Acquisition] tab on the [Loop Diagnostics (Active)] screen.

Support Tool

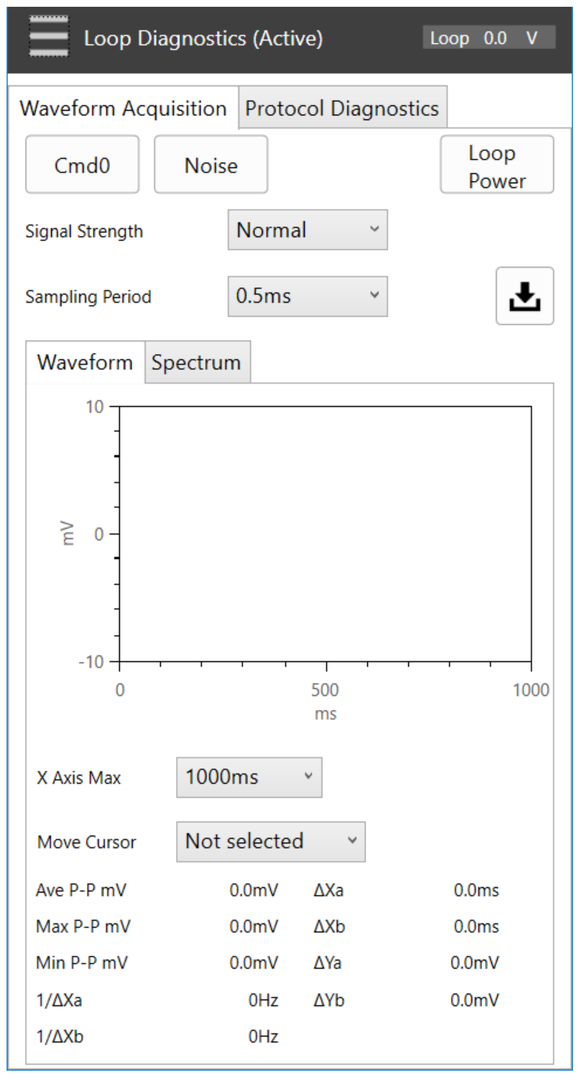


Figure 4-19.

3 Support Tool

Specify the signal strength.

Use “Normal.” If the connected device does not respond, you can select “High” to increase the signal strength and then retry communication.

Note After communication at high signal strength, return the setting to “Normal” and try communicating again.

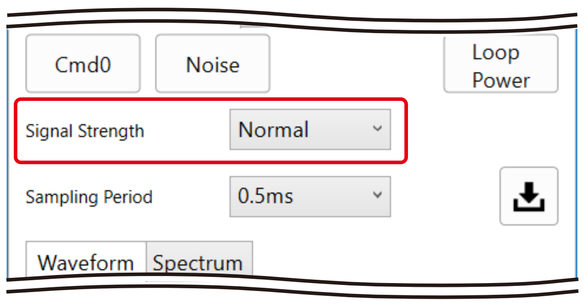


Figure 4-20.

4 Support Tool

Specify the sampling period for the HART waveform.

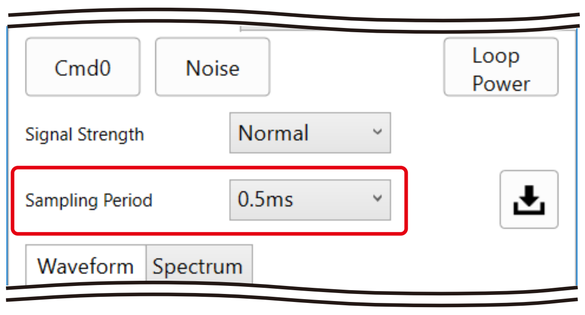


Figure 4-21.

Sampling is done 4,096 times with the specified cycle. If you change the sampling period, X Axis Max on the chart is automatically changed accordingly. However, you can manually change X Axis Max to a desired value.

Table 4-8 shows the sampling period, sampling time, and default X Axis Max for the specified sampling period.

Table 4-8.

Sampling period	Sampling time	Default X Axis Max
0.02 ms	81.92 ms	10 ms
0.1 ms	409.6 ms	100 ms
0.5 ms	2048 ms	1000 ms
1.0 ms	4096 ms	4000 ms

5 Support Tool

Click the <Cmd0> button.

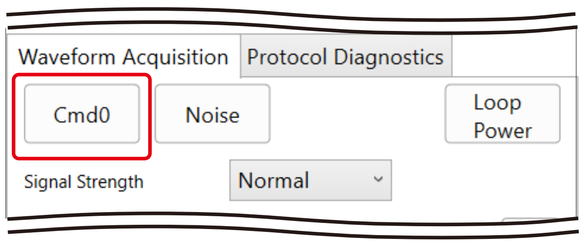


Figure 4-22.

6 In the dialog box, enter the polling address you checked in **1** .

Support Tool

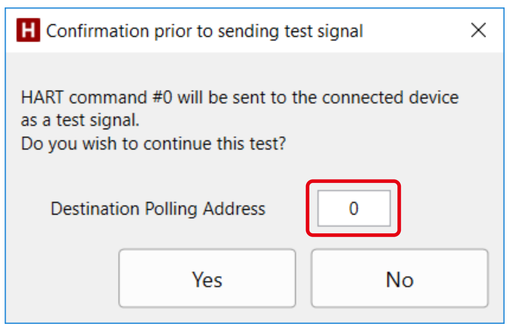


Figure 4-23.

7 Click the <Yes> button.

Support Tool

8 Command 0 is sent to the connected device once, the reply is received, and the waveforms are displayed in a chart.

Support Tool

The average of the peak-to-peak values (Ave P-P), the highest peak-to-peak value (Max P-P), and the lowest (Min P-P) in the sample are displayed.

4.4.3 Obtaining the Noise Waveform

You can also display the noise waveform. As with the <Noise> button on the [Loop Diagnostics (Passive)] screen (**2** in 4.3.1), a HART command is not issued.

1 Specify the sampling period.

Support Tool

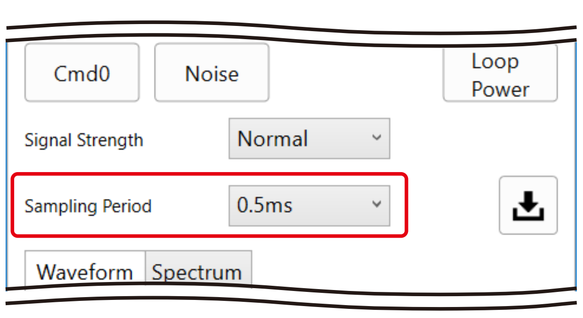


Figure 4-24.

Sampling is done 4,096 times with the specified cycle. If you change the sampling period, X Axis Max on the chart is automatically changed accordingly. However, you can manually change X Axis Max to a desired value.

The following table shows the sampling period, sampling time, and default X Axis Max for the specified sampling period.

Table 4-9.

Sampling period	Sampling time	Default X Axis Max
0.02 ms	81.92 ms	10 ms
0.1 ms	409.6 ms	100 ms
0.5 ms	2048 ms	1000 ms
1.0 ms	4096 ms	4000 ms

2 Support Tool

Click the <Noise> button.

>> Sampling starts when you click the button.

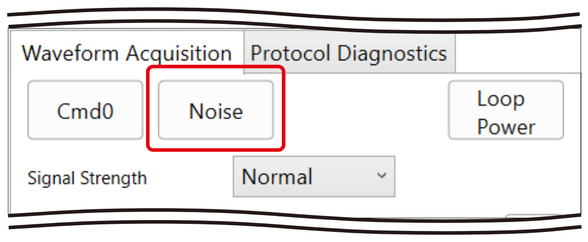


Figure 4-25.

3 Support Tool

After sampling is completed, the waveform is displayed in a chart. The average of the peak-to-peak values (Ave P-P), the highest peak-to-peak value (Max P-P), and the lowest (Min P-P) in the sample are displayed.

4.4.4 Saving the Communication Waveform

Support Tool

You can save the currently displayed chart information in CSV format by clicking the <Save> button. Up to 10,000 CSV data lines (a file size of about 930 KB) can be saved.

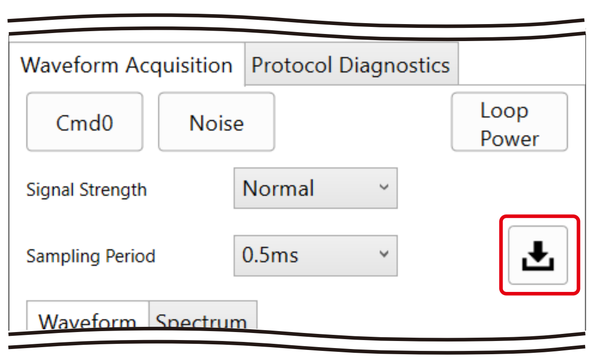


Figure 4-26. <Save> button

4.4.5 Analyzing the Communication Signal Spectrum

You can see the spectrum intensity for each frequency of the sampled signal in a chart by displaying the [Spectrum] tab on the [Waveform Acquisition] tab of the [Loop Diagnostics (Passive)] screen. If you have already obtained a communication waveform (see “Obtaining a Communication Waveform” (4.4.2) or “Obtaining the Noise Waveform” (4.4.3), you can see the spectrum analysis result only on the [Spectrum] tab. The frequencies with the five highest spectrum intensities are displayed below the chart.

The maximum display frequency is different depending on the sampling period.

To check the signal level around the HART signal (1200 Hz, 2200 Hz), the sampling period must be set to 0.1 ms or less.

Table 4-10. Sampling period and maximum display frequency

Sampling period	Maximum display frequency	Check of signal level around HART signal
0.02 ms	25000 Hz	Possible
0.1 ms	5000 Hz	
0.5 ms	1000 Hz	Not possible
1.0 ms	500 Hz	

1 Specify the signal strength and sampling period.

Support Tool

For details on the sampling period, refer to Table 4-10.

2 Click the <Cmd0> or <Noise> button.

Support Tool

If you click the <Cmd0> button, enter the polling address and then click the <OK> button.

3 After sampling is completed, the spectrum analysis results are displayed in a chart.

Support Tool

4.4.6 Monitoring the Details of HART Communication

You can repeatedly send HART command 0 to the connected field device on the [Protocol Diagnostics] tab of the [Loop Diagnostics (Active)] screen to monitor the communication details (protocol display). You can also check the following details on the same screen:

- Whether the communication is primary or secondary
- Expanded device type and device ID of the device
- Communication results (total from the beginning to the end of the transmission)

■ Procedure to start monitoring

1 Check the polling address of the connected device.

Support Tool

You can check the polling address by selecting [Device Information] from the menu and doing steps **1** and **2** in 4.5.

2 Open the [Protocol Diagnostics] tab on the [Loop Diagnostics (Active)] screen.

Support Tool

3 Specify the signal strength. Although “Normal” is usually used, if the connected device does not respond, you can select “High” to increase the signal strength and then retry communication.

Support Tool

Note After communication at high signal strength, return the setting to “Normal” and try communicating again.

4 Click the <Start> button.

Support Tool

5 In the [Confirmation prior to sending test signal] dialog box, enter the polling address you checked in **1** and click the <OK> button.

Support Tool

>> Command 0 is repeatedly sent and communication details and communication results are displayed.

- Details of the communication details display

This section shows an example of the communication details display and describes the command request and response.

Example: HART command 0 (first line: command, second line: response)

0000 FF05 STX S- 0x02 0x00 - 000 000 - - - 0x02

0050 FF05 ACK S- 0x06 0x00 - 000 019 0x00 0x40 0xFE3614050601070801010000050300 6E00 0xEC

Table 4-11. Command (example of the first line)

Data	Description
0000	Interval since the last communication (unit: ms)
FF05	Contains five 0xFF preambles.
STX	Frame type STX: Request (master to field device)
S-	Secondary (S), non-burst (-)
0x02	Delimiter field value (HCF_SPEC-081 Figure.4) 0x02: polling address, asynchronous, STX
0x00	Short frame address value (HCF_SPEC-081 Figure.7) 0x00: secondary master, non-burst, polling address 0
-	Expansion bytes (HCF_SPEC-081 Figure.5) None
000	Command No. (HCF_SPEC-081 Figure.5) 0 (decimal)
000	Data byte length (HCF_SPEC-081 Figure.5) 0 (decimal)
-	Communication status / response code N/A
-	Device status N/A
-	Request data details (command argument) None (command 0)
0x02	Check byte for HART frame (HCF_SPEC-081 Figure.5)

Table 4-12. Response (example of the second line)

Data	Description
0050	Interval from the last communication (Unit: ms) 50 ms
FF05	Contains five 0xFF preambles.
ACK	Frame type ACK: response (field device to master)
S-	Secondary (S), non-burst (-)
0x86	Delimiter field value (HCF_SPEC-081 Figure.4) 0x86: unique address, asynchronous, ACK
0x00	Short frame address value (HCF_SPEC-081 Figure.7) 0x00: secondary master, non-burst, polling address 0
-	Expansion bytes (HCF_SPEC-081 Figure.5) None

Data	Description
000	Command No. (HCF_SPEC-081 Figure.5) 0 (decimal)
019	Data byte length (HCF_SPEC-081 Figure.5) 19 (decimal) Value that contains command status bytes (one byte for response code and one status byte).
0x00	Communication status / response code (HCF_SPEC-099 Table.10/11) 0x00: No warning or error
0x40	Device status (HCF_SPEC-099 Table.12) 0x40: configuration changed is ON.
0xFE36140506010708 01010000050300 6E00	Details of the command response data Details of the response data bytes for command 0 0xFE “254” 0x3614 Expanded device type … … 0x00 Extended field device status
0xEC	Check byte for HART PDU (HCF_SPEC-081 Figure.5)

■ Procedure to stop monitoring

Support Tool

Click the <Stop> button.

>> Transmission of command 0 stops.

After stopping monitoring, you can resume transmission and monitoring of command 0 by clicking the <Start> button. Upon restarting, data obtained up until that point is deleted.

4.4.7 Checking the Results of Communication

Support Tool

The communication result display field dynamically shows the number of sent commands, the number of received responses, and the difference between them (the number of errors) for primary communication and secondary communication.

The display field also shows the number of burst transmissions received as well as the number of frame errors and the number of parity errors.

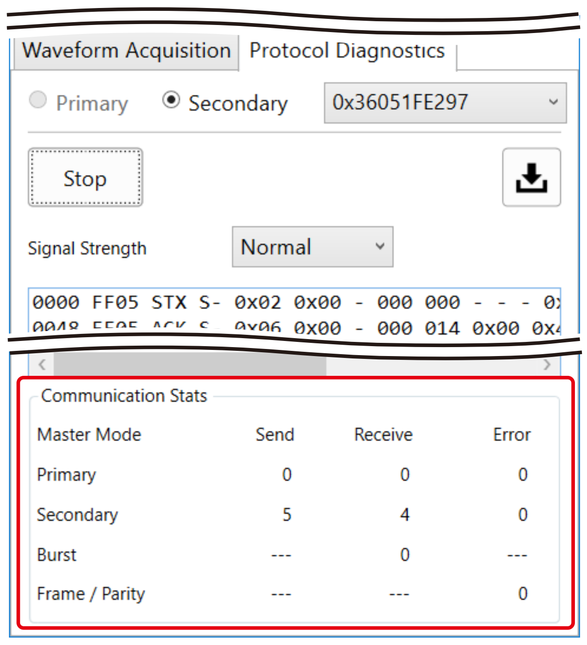


Figure 4-27.

4.4.8 Saving the Communication Details

Support Tool

You can save the currently displayed information in CSV format by clicking the <Save> button.
Up to 10,000 CSV data lines (a file size of about 930 KB) can be saved.

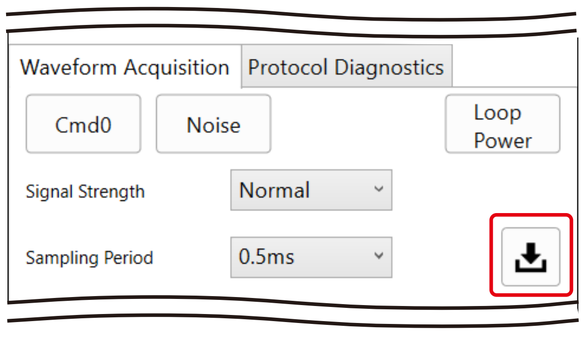


Figure 4-28.

4.5 Checking Information about the Connected Device

Check the connected device information on the [Device Info] screen.
You can list device identification information and parameters obtained with HART universal commands.

1 Open the [Device Info] screen by selecting [Device Information] from the menu of the Support Tool.

Support Tool

2 Click the <Find Device> button.

Support Tool

>> The [Find Device] screen opens.

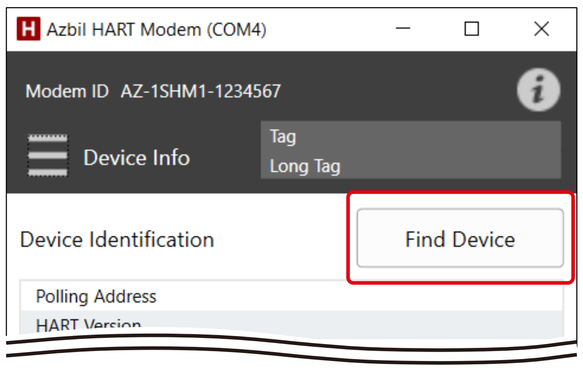


Figure 4-29.

3 Specify the polling address scan range (start and end points) in the range between 0 and 63.

Support Tool

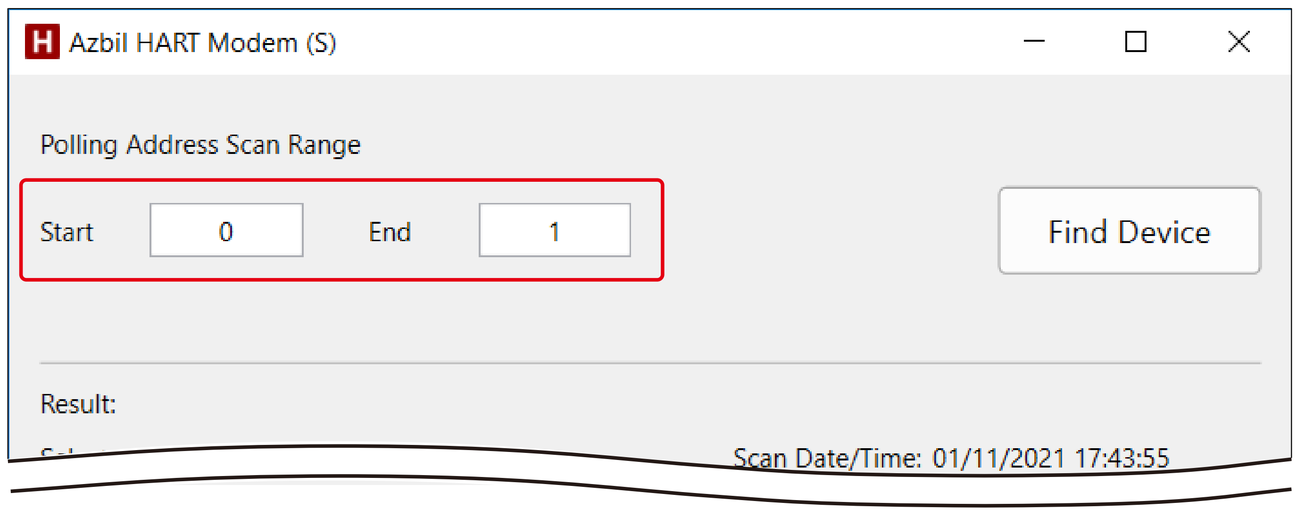


Figure 4-30.

4 When you click the <Find Device> button, the specified scan range is searched.

Support Tool

>> The found devices are listed with their polling addresses.

5 To stop the search before it finishes, click the <Stop> button.

Support Tool

Note If the scan range is wide and the polling address is a high value, searches take time to complete.

6 Select a device displayed in the search results and click the <OK> button.

Support Tool

>> Identification information and parameters are read out from the selected device and displayed in the list.

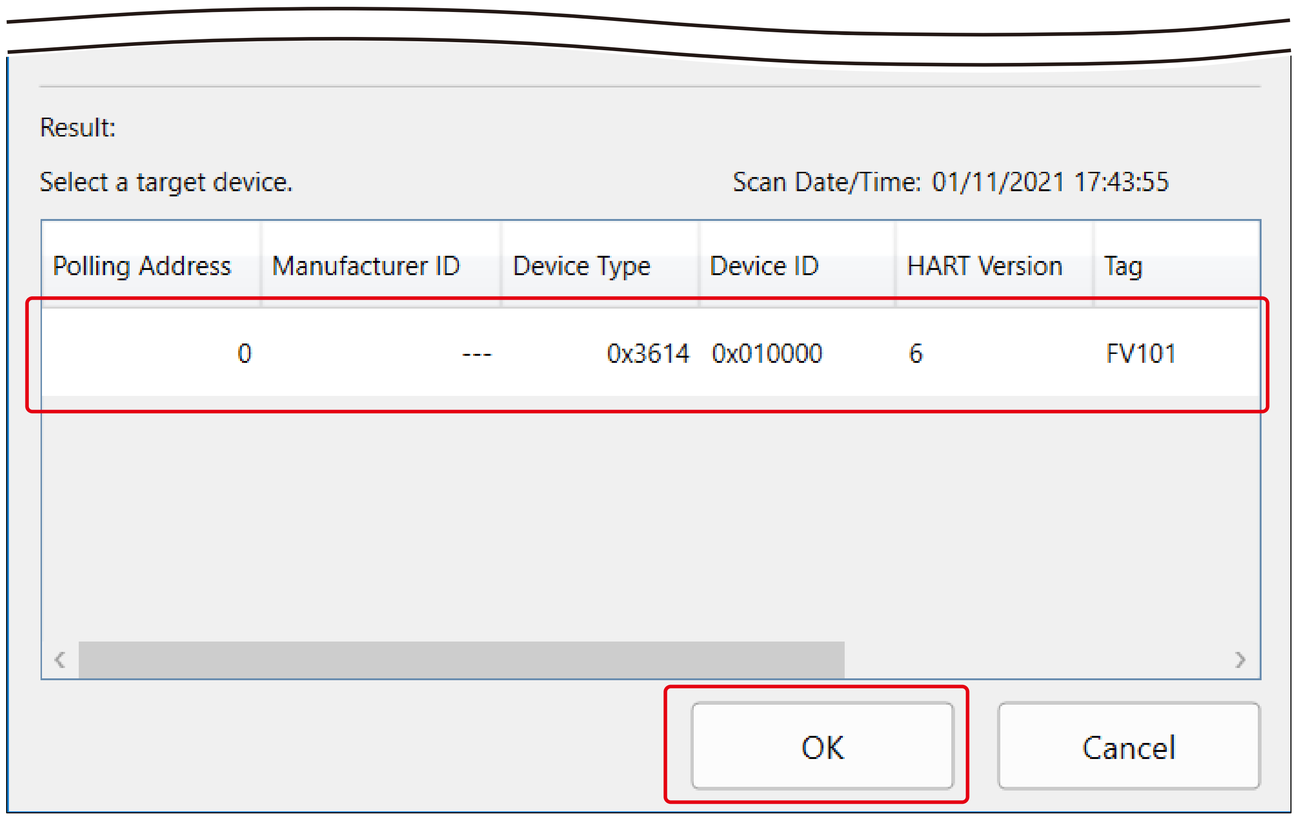


Figure 4-31.

4.6 Checking the Process Variables for the Connected Device

You can display the dynamic variables and loop current value for the selected device in a trend chart on the [Process] screen.

1 Open the [Process] screen by selecting [Process] from the Support Tool menu.

Support Tool

2 Click the <Find Device> button.

Support Tool

>> The [Find Device] screen opens.

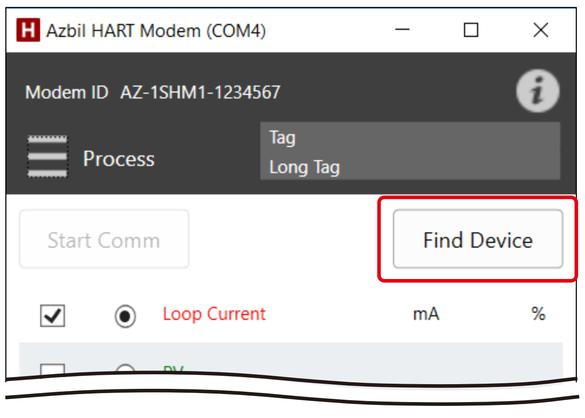


Figure 4-32.

3 Specify the polling address scan range (start and end points) in the range between 0 and 63.

Support Tool

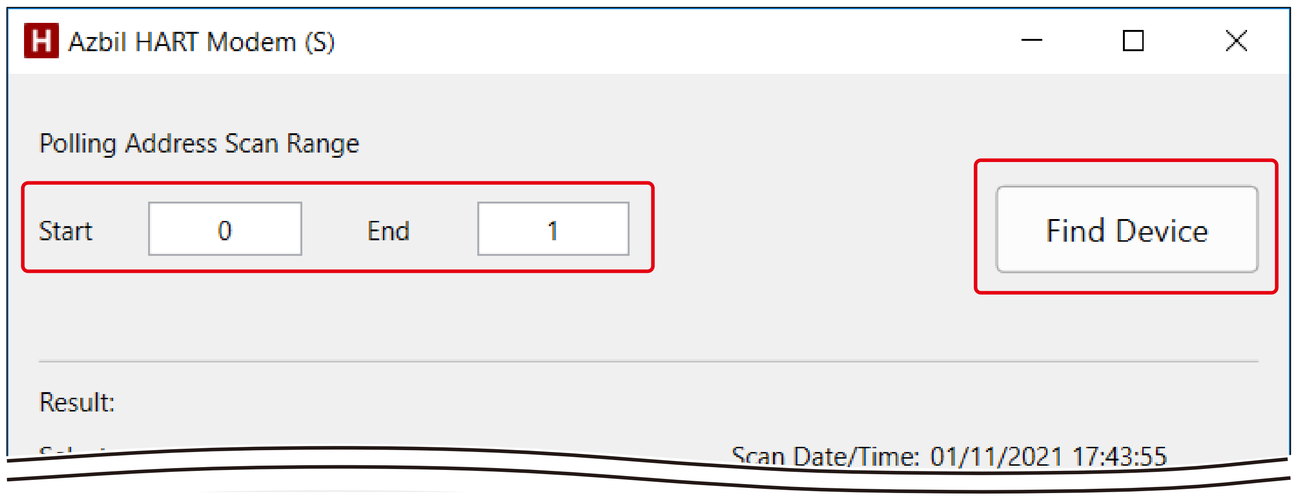


Figure 4-33.

4 When you click the <Find Device> button, the specified scan range is searched.

Support Tool

>> The found devices are listed with their polling addresses.

5 To stop the search before it finishes, click the <Stop> button.

Support Tool

Note If the scan range is wide and the polling address is a high value, searches take time to complete.

6 Select a device displayed in the list and click the <OK> button.

Support Tool

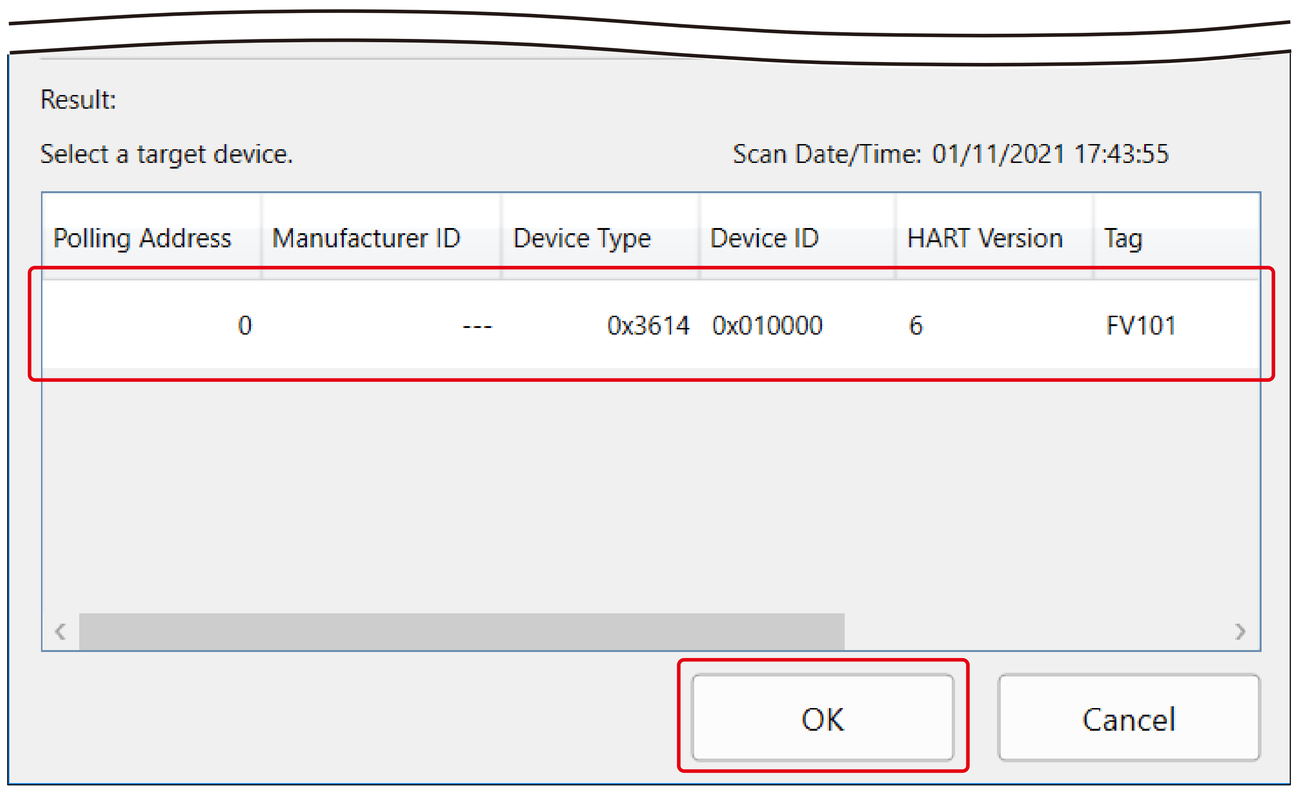


Figure 4-34.

7 Support Tool

Click the <Start Comm> button.

>> Display of Loop Current, the PV, SV, TV, and QV values, and the chart starts.

The line colors in the chart are the same as those of the label text.

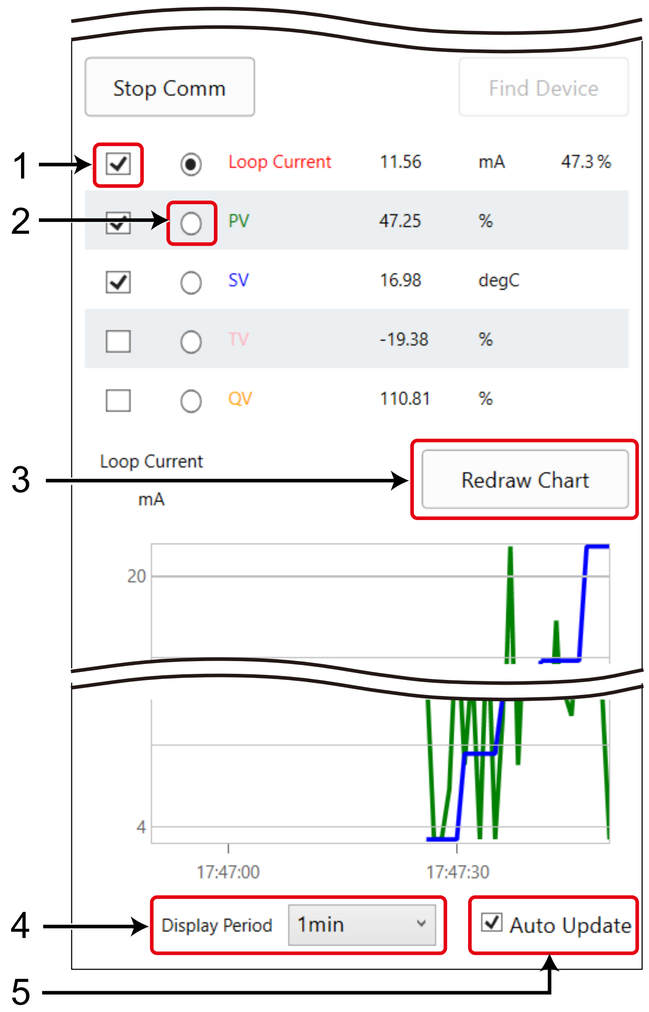


Figure 4-35.

Table 4-13.

1	Check box	Checked items are shown on the chart.
2	Radio button	Selects the basis for the vertical axis of the chart.
3	<Redraw Chart> button	Clicking this button clears the display of the chart.
4	“Display Period” combo box	Switches the chart display period between 1 minute and 5 minutes.
5	“Auto Update” check box	When the check mark is removed, updating of the chart display is paused but data collection continues. Check the check box again to resume display using the current time as the latest value.

8 Support Tool

Click the <Stop Comm> button. Clicking this button stops updating of the chart.

>> To resume updating, click the <Start Comm> button. When updating resumes, data obtained up until that point is deleted.

Chapter 5 Supplying Power to the Field Device

You can supply power to the field device.

This device incorporates a 250 ohm load resistor in series with the power supply.

If you wish to make a Bluetooth connection while supplying power to the field device, set the Bluetooth communication mode first.

Note that, when a Wi-Fi AP or Wi-Fi STA connection is used, this device cannot supply power to the field device.

5.1 Specifying Power Supply Setting Using 1SHM's Control Panel

5.1.1 Checking the Power Supply Status

When the loop connected to the 1SHM is receiving power, the green LOOP ACTIVE indicator is lit.

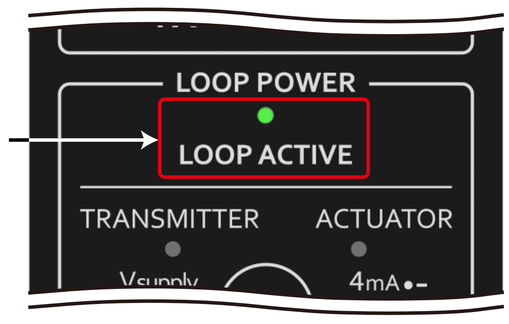


Figure 5-1.

If the loop is not receiving power, you can supply power from the 1SHM as described in the next section.

FYI If you separate a 1SHM that is supplying receiving power from the field device, or set the 1SHM to supply power without connecting the field device, the LOOP ACTIVE indicator may be lit for about 10 seconds. Before connecting the 1SHM to an operating field device, make sure that the LOOP ACTIVE indicator is not lit.

5.1.2 Switching the Power Supply Setting

You can supply power from the 1SHM only if the field device is connected and the LOOP ACTIVE indicator is off.

Note
- If the field device is disconnected while it is receiving power from the 1SHM, the 1SHM stops supplying power.
- You can start supply of power only when the field device is connected.

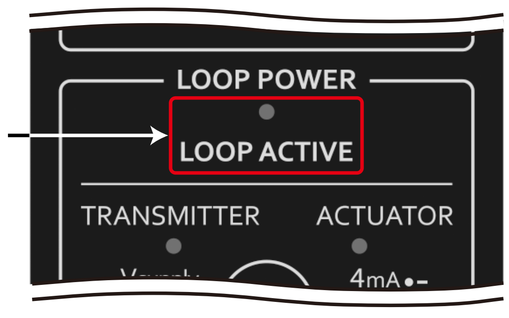


Figure 5-2.

FYI Power is supplied from the device that is connected by USB cable (e.g., a PC or USB-connected battery) when the 1SHM is not using batteries and is connected by the USB cable. When the 1SHM is not connected via USB, power is supplied from its internal batteries.

■ Switching the power supply setting

1 1SHM Touch and hold (for two seconds) the power supply change button until the LOOP ACTIVE indicator starts blinking.

>> Check the current power supply setting with the TRANSMITTER and ACTUATOR indicators.

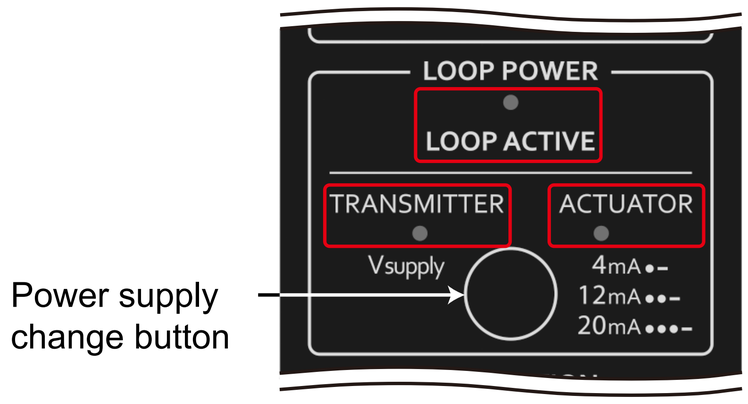
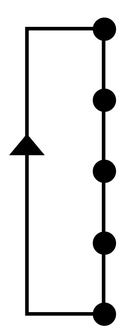


Figure 5-3.

2 1SHM While the LOOP ACTIVE indicator is blinking, press the power supply change button the necessary number of times to switch to the desired power supply setting.

Each press of the button switches the setting in the order shown in Table 5-1 and the TRANSMITTER and ACTUATOR indicators blink or turn off to reflect the setting. The white circle in the table indicates that the indicators light up or turn off depending on the current power supply setting.

Table 5-1.

Power supply switching order	Power supply setting	TRANSMITTER indicator	ACTUATOR indicator
	Not supplying power	Off	Off
	Supplying power to the transmitter	Blinking	○
	Supplying 4 mA to the actuator	○	●— *
	Supplying 12 mA to the actuator	○	●●—*
	Supplying 20 mA to the actuator	○	●●●—*

* Lighting pattern of the ACTUATOR power supply display: ● indicates a short blink and — indicates a long blink.

3 1SHM When the desired power supply setting is displayed, touch and hold (for two seconds) the power supply change button.

Note
- Fast blinking of the LOOP ACTIVE display means that the setting was rejected.
- The power supply function cannot be used for a field device to which almost no current flows immediately after the supply of power starts. This is because the 1SHM automatically stops supplying power if it does not detect a current flow to the device when it begins supplying power.
- If “Actuator power supply 4 mA” is set, an error could cause the current to drop below the minimum necessary for the actuator. You can set the power supply current in detail using the Support Tool (refer to 5.2.2).

Table 5-2. Power supply setting

Status	TRANSMITTER indicator	ACTUATOR indicator
Not supplying power	Off	Off
Supplying power to the transmitter	Lit green	Off
Supplying power to the actuator	Off	Lit green*

* The amount of actuator power supply output cannot be determined.

5.2 Specifying Power Supply Setting Using the Support Tool

5.2.1 Checking the Power Supply Status

You can see the details on the status of power supply from the 1SHM to the connected loop (device) with the Support Tool.

1 Support Tool

Open the [Loop Diagnostics (Passive)] or [Loop Diagnostics (Active)] screen of the Support Tool.

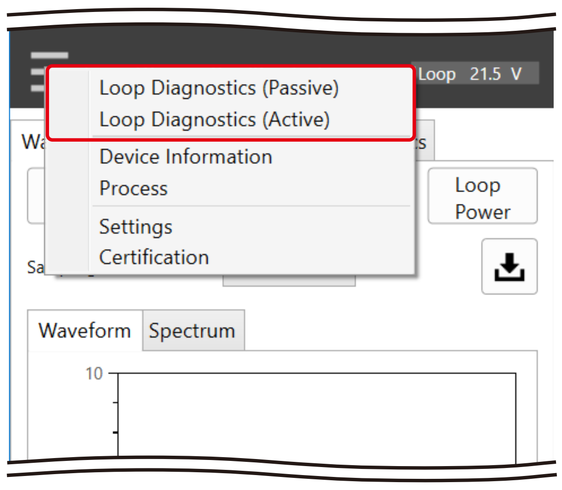


Figure 5-4.

2 Support Tool

Click the <Loop Power> button.

>> The power supply setting screen opens (unless power is supplied from outside the 1SHM).

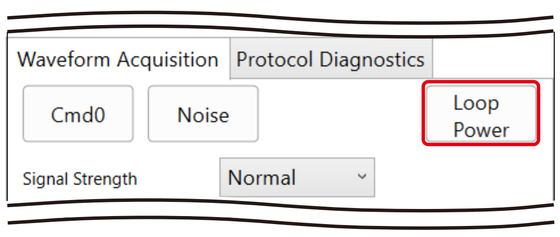


Figure 5-5.

3 Support Tool

Check the current power supply status on the screen.

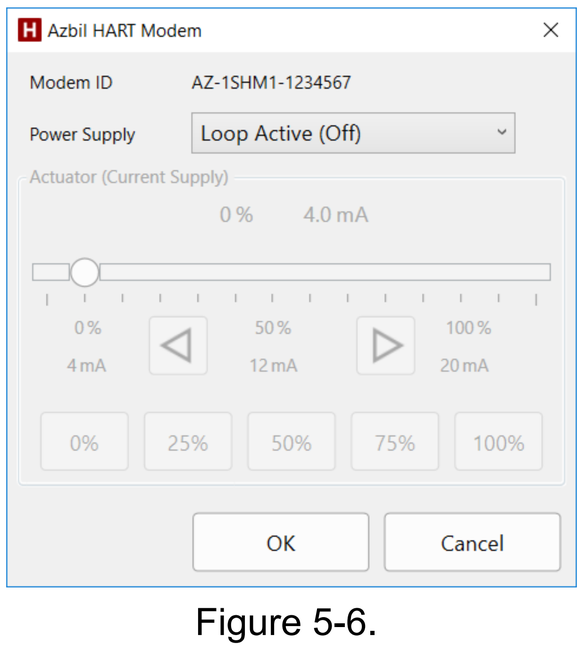


Figure 5-6.

5.2.2 Power Supply Setting

You can set up the supply of power from the 1SHM to the connected loop (device) with the Support Tool.
You can supply power from the 1SHM only if the field device is connected and the LOOP ACTIVE indicator is off.

Note
- If the field device is disconnected while it is receiving power from the 1SHM, the 1SHM stops supplying power.
- You can start supply of power only when the field device is connected.

1 Support Tool

Open the [Loop Diagnostics (Passive)] or [Loop Diagnostics (Active)] screen of the Support Tool.

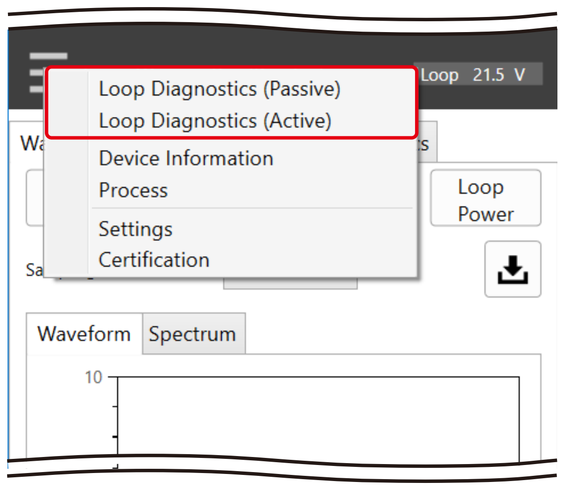


Figure 5-7.

2 Support Tool

Click the <Loop Power> button.

>> The power supply setting screen opens if the field device is connected and power is not being supplied from outside the 1SHM.

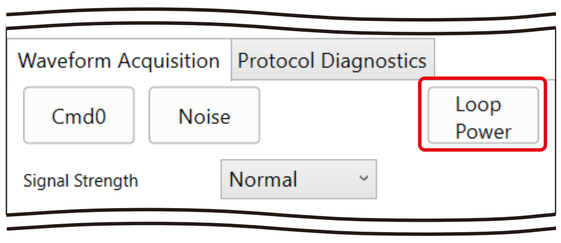


Figure 5-8.

3 Support Tool

After specifying the following on the screen, click the <OK> button to set up the power supply.

Note The power supply function cannot be used for a field device to which almost no current flows immediately after the supply of power starts. This is because the 1SHM automatically stops supplying power if it does not detect a current flow to the device when it begins supplying power.

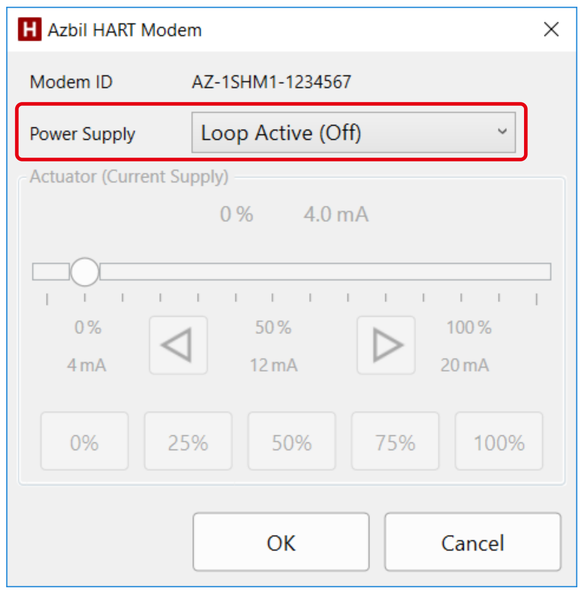


Figure 5-9.

Table 5-3.

Loop Active (Off)	Select this when power is supplied from outside the 1SHM (i.e., the 1SHM does not supply power).
Transmitter (Voltage Supply)	Select this when supplying power to a transmitter (or to an analog input device).
Actuator (Current Supply)	Selectthiswhensupplyingpowertoavalvepositioner(ortoananalogoutputdevice). Specify output current as follows.

- Output current when “Actuator (Current Supply)” is selected

You can set the output current between 2.4 mA (−10 %) and 23.2 mA (120 %) with the slider or button. The maximum current that can be supplied differs depends on the impedance of the device to be powered. You can use the right and left arrow buttons to move the slider one percent at a time. You can also directly specify the output with the buttons for 0, 25, 50, 75, and 100 %.

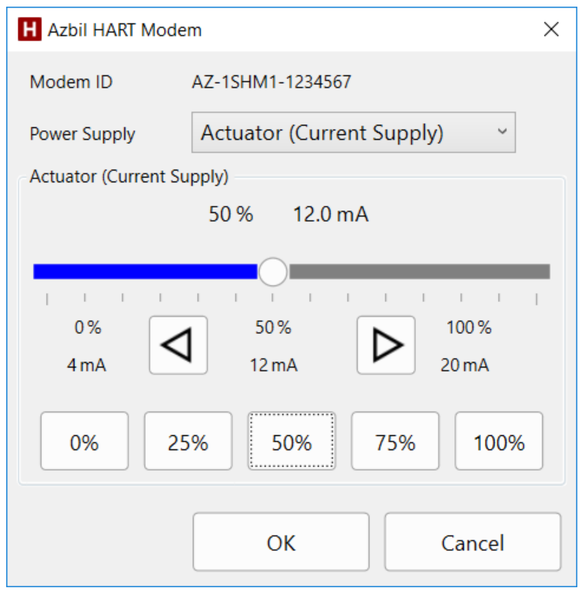


Figure 5-10.

Note If you set a value around 4 mA (0 %), an error could cause the current to drop below the minimum necessary current of the actuator.

Chapter 6 Device Mode

In device mode, the 1SHM operates as a HART slave device.

You can connect the 1SHM to the HART host system as a pseudo-HART field device (manufacturer ID: 0x0036, device type: 0x3617) to check whether HART communication is possible with the current wiring. In this case it is not necessary to start the Support Tool.

In device mode, the 1SHM supports all the HART universal commands and common practice command No. 72 (Squawk).

When Squawk is executed, all six LEDs shown in Figure 1-7 and Figure 1-8 blink for 10 seconds to indicate which 1SHM unit the commands are being sent to.

Note
- When using device mode, the USB cable must be connected or the battery use button on the control panel must be pressed to supply power to the 1SHM.
- When the 1SHM is in device mode, it cannot supply power to the loop.

6.1 Control Panel Display

After the 1SHM starts in device mode, the Bluetooth, USB, and Wi-Fi connection status indicators in the CONNECTION group on the control panel light up sequentially for several seconds.

6.2 Enabling or Disabling Device Mode

The procedure for making the 1SHM operate as a HART slave device (enabling device mode) and for canceling device mode (enabling normal mode) are described below.

6.2.1 Switching from Normal Mode to Device Mode

The following shows how to switch normal mode to device mode.

1

Open the [Settings] screen of the Support Tool.

2

Click the <Set Others> button.

>> The [Set modem parameter] screen opens.

Note If the administrator password has not been entered, you must enter it.

3

Check the “Act as a HART slave device” check box.

4 Specify the polling address with an integer between 0 and 63.

Support Tool When not using a multi-drop connection, specify 0 as the polling address.

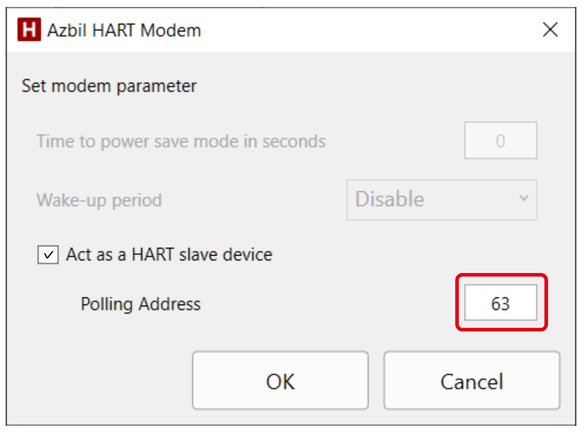


Figure 6-1.

5 Click the <OK> button.

Support Tool >> The screen closes.

6 Click the <Restart Modem> button on the [Settings] screen.

Support Tool >> A restart confirmation dialog box opens.

7 Click the <OK> button.

Support Tool >> The 1SHM restarts and changes are applied. The Support Tool shuts down.

6.2.2 Switching from Device Mode to Normal Mode

The following shows how to switch from device mode to normal mode.

1 Open the [Settings] screen of the Support Tool.

Support Tool

2 Click the <Set Others> button.

Support Tool >> The [Set modem parameter] screen opens.

Note If the administrator password has not been entered, you must enter it.

3 Uncheck the “Act as a HART slave device” check box.

Support Tool

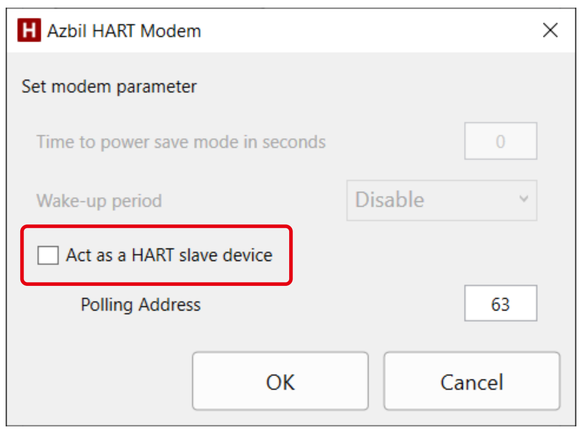


Figure 6-2.

4 Click the <OK> button.

Support Tool >> The [Set modem parameter] screen closes.

5 Click the <Restart Modem> button on the [Settings] screen.

Support Tool >> A restart confirmation dialog box opens.

6 Click the <OK> button.

Support Tool >> The 1SHM restarts and changes are applied. The Support Tool shuts down.

6.2.3 Temporarily Disabling Device Mode

1SHM If you press the power supply change button or the connection change button while the Wi-Fi, USB, and Bluetooth connection status indicators on the control panel are lighting up sequentially after the 1SHM starts in device mode, the 1SHM operates in normal mode until restarted.

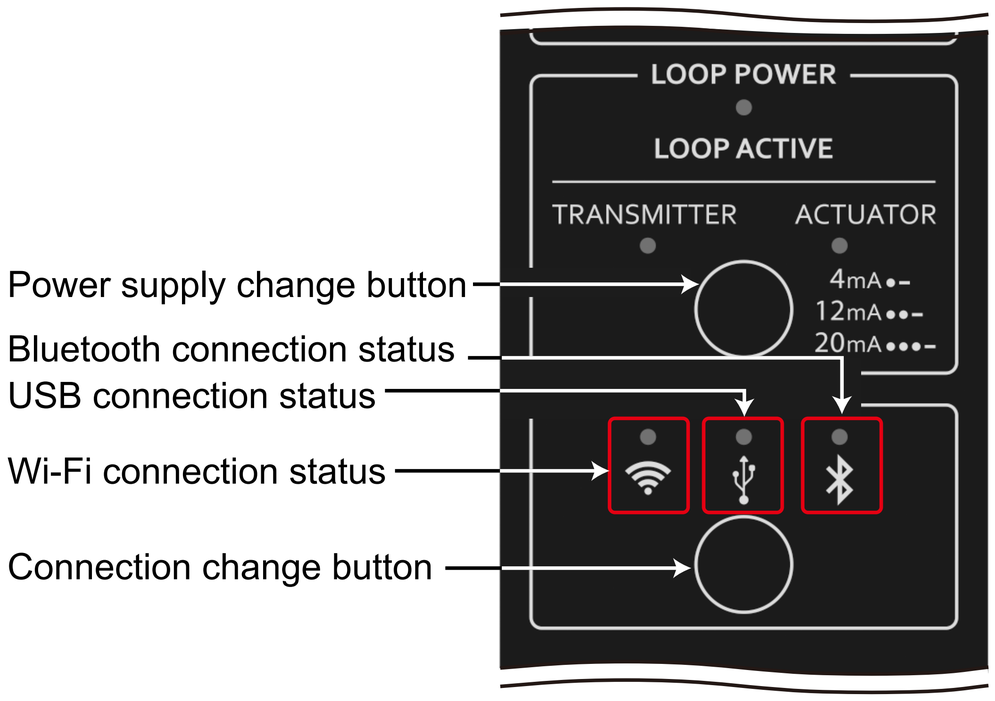


Figure 6-3.

Chapter 7 Maintenance

After checking the version of the 1SHM's firmware, you can update it by writing updated firmware obtained from Azbil to the 1SHM. The latest version of the firmware should be used.

7.1 Checking the Firmware Version

1 Support Tool

Open the [Settings] screen of the Support Tool.

2 Support Tool

Check what is written for "Firmware Version."

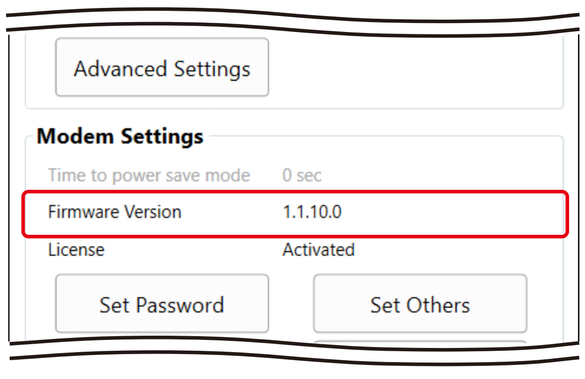


Figure 7-1.

7.2 Updating the Firmware

To update the firmware, connect the 1SHM and the PC or tablet by a USB cable.

1 PC/Tablet

Place the firmware update file (which has a zip extension) obtained from Azbil on the desktop or other desired location.

2 Support Tool

Open the [Settings] screen of the Support Tool.

3 Support Tool

Click the <Update Firmware> button.

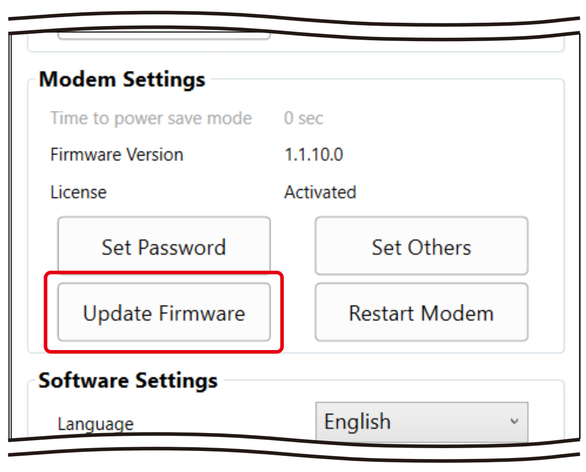


Figure 7-2.

Note If the administrator password has not been entered, you must enter it.

4 Support Tool

Specify the location of the file you selected at **1** on the [Select a file to update firmware] screen and click the <Open> button. Do not remove the USB cable until a message saying “The firmware ... has been updated to version...” or “Updating the firmware ... failed” is displayed.

>> The firmware update is now complete. The Support Tool will shut down.

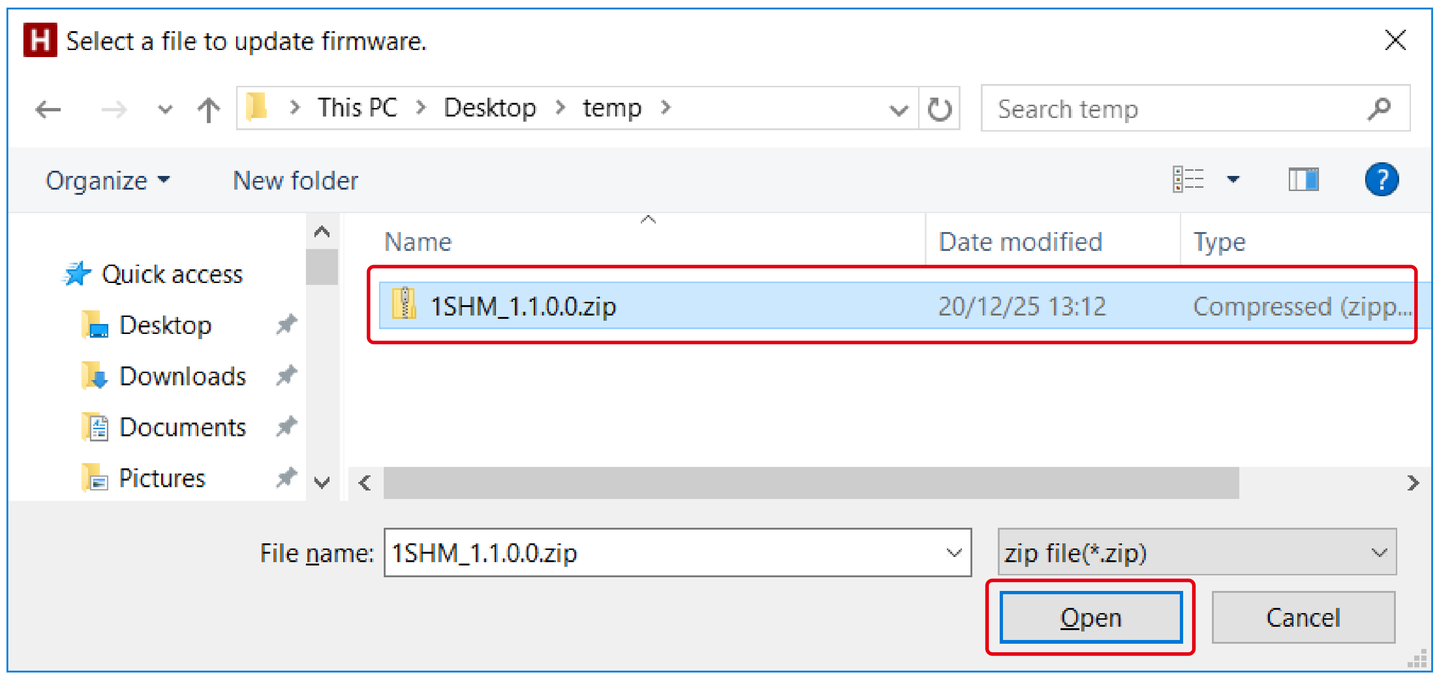


Figure 7-3.

5 If the battery is being used, hold down the battery use button for three seconds to turn off the power.

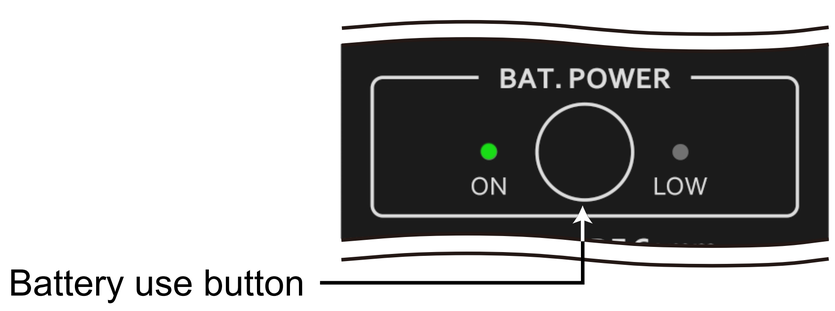


Figure 7-4.

Remove the USB cable.

Note You must turn off the 1SHM at **5** .

6 1SHM Turn on the 1SHM.

7 Support Tool Check that the firmware has been updated from the version number in 7.1 Checking the Firmware Version.

Chapter 8 Advanced Use

8.1 LED Display on the 1SHM Control Panel

When the 1SHM starts, TX and RX light up for an instant and then the LEDs in Table 8-1 and Table 8-2 light up or blink to indicate the status.

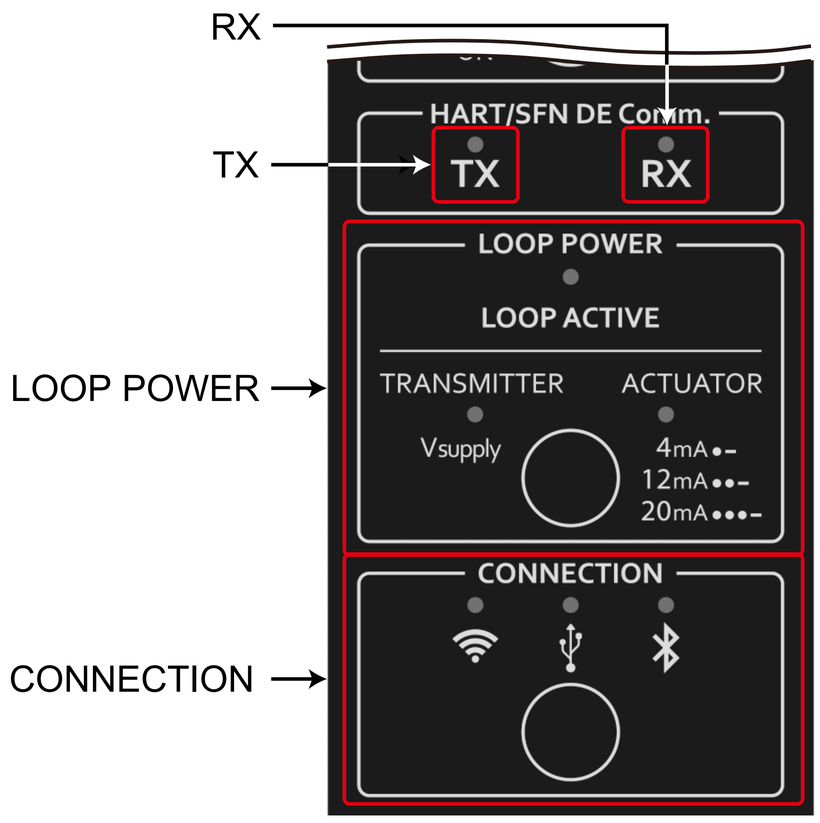


Figure 8-1.

■ If the license key has been provided

Table 8-1. Status of 1SHM and LEDs (with license key)

	Status of 1SHM	LEDs shown in Figure 8-1	
		LOOP POWER	CONNECTION
(1)	Ready for normal use	Lit for 5 seconds after startup	
(2)	Not yet authorized → Although you can use the device as a USB modem, you need to save the authorization data as described in 2.3.7.	Long-cycle blinking for 5 seconds after startup	
(3)	Device mode enabled. → For instructions on switching to normal mode, refer to 6.2.	-	Lit sequentially for several seconds after (1).

■ If the license key has not been provided

Table 8-2. Status of 1SHM and LEDs (without license key)

	Status of 1SHM	LEDs shown in Figure 8-1	
		LOOP POWER	CONNECTION
(1)	Ready for normal use	Lit for 5 seconds after startup	
(2)	Not yet authorized → You need to save the authorization data as described in 2.3.7.	Short-cycle blinking continues.	
(3)	License expiration in 30 days or less	Long-cycle blinking for 5 seconds after startup	
(4)	Continuous usage time is limited.	Repeated long-cycle and short-cycle blinking	

	Status of 1SHM	LEDs shown in Figure 8-1			
		LOOP POWER			CONNECTION
(5)	Continuous usage time was exceeded → You can continue to use the device by turning the power off and then on.	Short-cycle blinking continues.			
(6)	Device mode enabled. → For instructions on switching to normal mode, refer to 6.2.	-	-	-	Lit sequentially for several seconds after (1).

8.2 Checking Authorization

You can check the data on authorization with the following procedure.

1 Support Tool

Open the [Settings] screen of the Support Tool.

2 Support Tool

See what is written for “License” in the “Modem Settings” group.

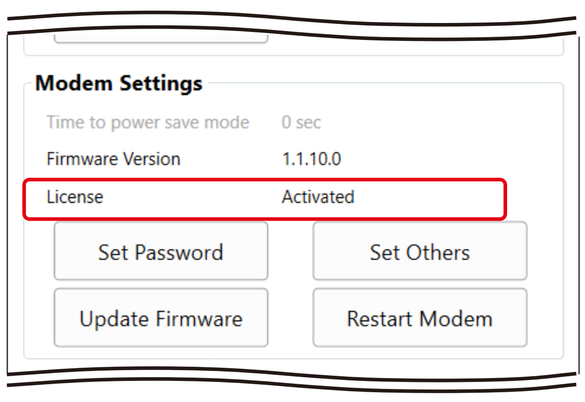


Figure 8-2.

8.3 Changing the Administrator Password

1 Support Tool

Open the [Settings] screen of the Support Tool.

2 Support Tool

Click the <Set Password> button.

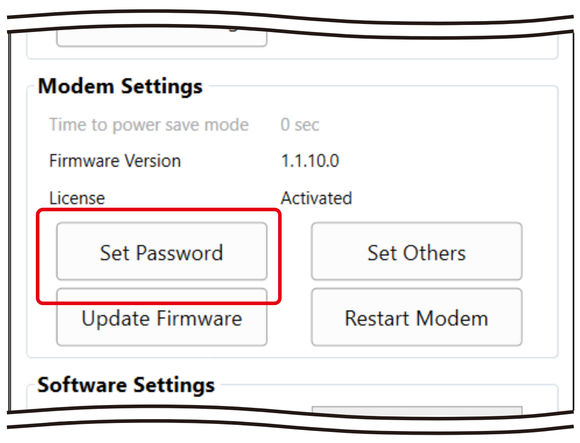


Figure 8-3.

Note If the administrator password has not been entered, you must enter it.

3 Support Tool Close the [Settings] screen.

8.4 Restart

You can restart the 1SHM two ways.

1. Turn the 1SHM off and then on
2. Restart the product from the Support Tool

From the Support Tool, do the following.

1 Support Tool Open the [Settings] screen of the Support Tool.

2 Support Tool Click the <Restart Modem> button.

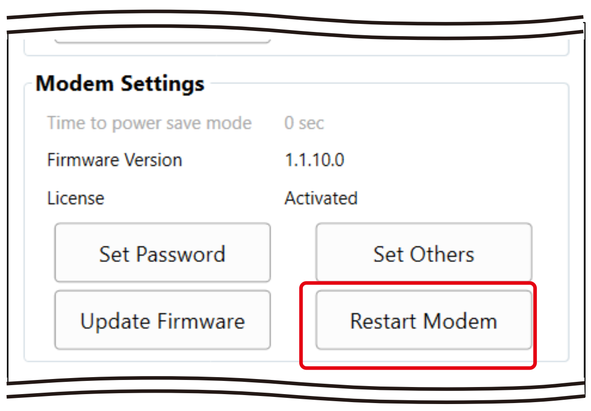


Figure 8-4.

Note If the administrator password has not been entered, you must enter it.

3 Support Tool The 1SHM will restart and the Support Tool will shut down.

8.5 Wireless Connection

Wireless connection is prohibited in countries and regions where the wireless device certifications listed in Chapter 10 are invalid.

8.5.1 Checking the Wireless Setting

You can view the wireless setting of an operating 1SHM in the Support Tool.

1 Support Tool Open the [Settings] screen of the Support Tool.

2 Check what is written in the “Wireless Settings” group.

Support Tool

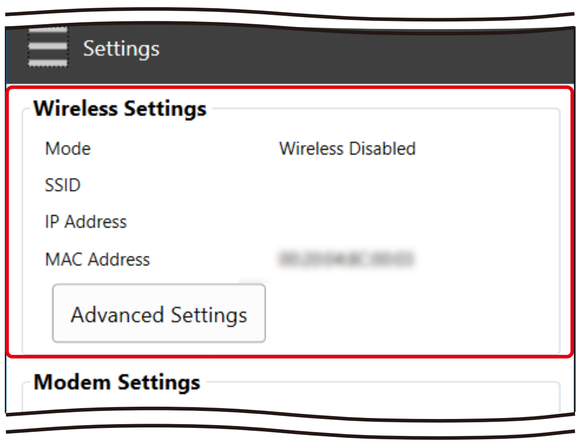


Figure 8-5.

8.5.2 Changing the Wireless Setting with the Support Tool

Wireless connection is prohibited in countries and regions where the wireless device certifications listed in Chapter 10 are invalid.

With the Support Tool, the wireless setting can be configured so that the connection change button on the 1SHM can be used to change to a wireless connection.

1 Open the [Settings] screen of the Support Tool.

Support Tool

2 Click the <Advanced Settings> button in the “Wireless Settings” group.

Support Tool

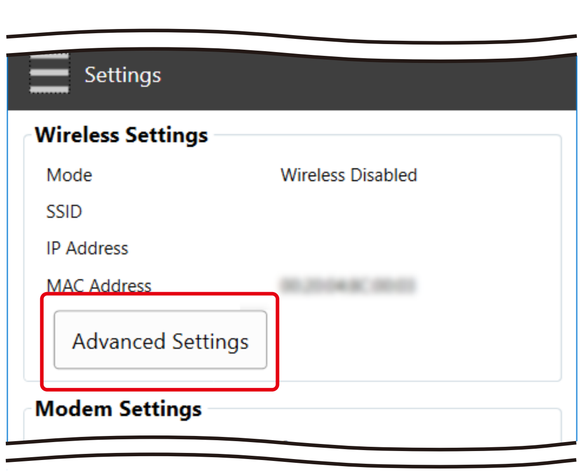


Figure 8-6.

Note If the administrator password has not been entered, you must enter it.

3 Configure the settings according to your needs on the [Wireless Settings] screen.

Support Tool

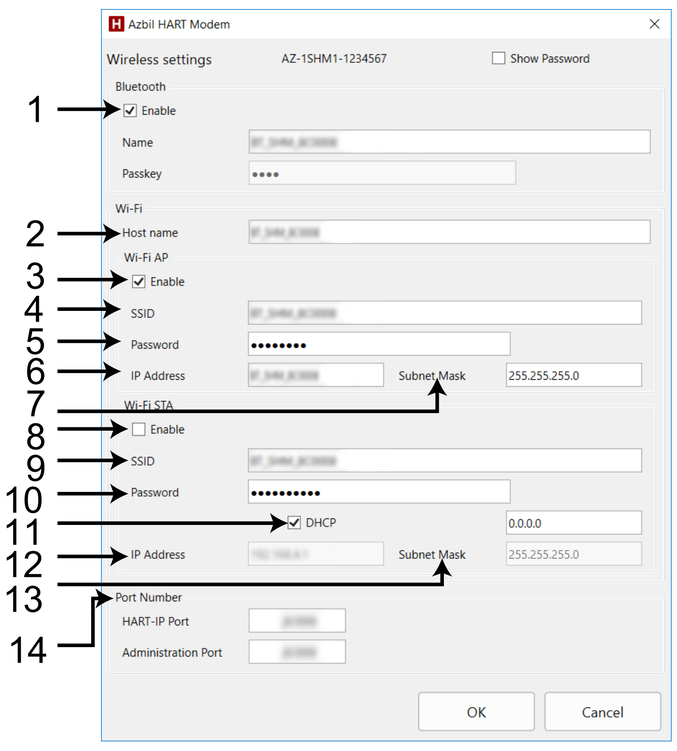


Figure 8-7.

Table 8-3.

Purpose	Setting	
Make Bluetooth selectable from the 1SHM	Check the [Enable] check box at 1.	
Change the Wi-Fi host name	Enter a new host name at 2.	
Make Wi-Fi selectable from the 1SHM	Check the [Enable] check box at 3 or 8. Note: Do not check both check boxes.	
Configure the Wi-Fi AP communication settings	Check the [Enable] check box at 3.	
	4: SSID	Specify the identifier displayed on the Wi-Fi connection screen in the Windows PC or tablet.
	5: Password	Set the Wi-Fi connection password.
	6: IP Address	Set the IP address and subnet mask when making the Wi-Fi AP connection.
	7: Subnet Mask	Set a value consistent with the Wi-Fi adapter in the Windows PC or tablet.
Configuring the Wi-Fi STA communication settings	Check the [Enable] check box (8).	
	9: SSID	Set the SSID of the router that serves as the Wi-Fi server.
	10: Password	Set the router password.
	11: DHCP	Check the check box when using DHCP (Dynamic Host Configuration Protocol).
	12: IP Address	Set the IP address and subnet mask when not using DHCP.
	13: Subnet Mask	
Setting the port number	14: Normally, you do not have to change the port number.	

4 Click the <OK> button.

Support Tool The [Wireless Settings] screen closes.

5 Click the <Restart Modem> button on the [Settings] screen.

Support Tool A restart confirmation dialog box opens.

6 Click the <OK> button.

Support Tool The 1SHM will restart and changes will be applied. The Support Tool will shut down.

8.5.3 Wi-Fi AP Mode

To connect a Windows PC or tablet with Wi-Fi using the 1SHM as the wireless LAN master device, use Wi-Fi AP mode.

You cannot make a Wi-Fi AP connection while supplying power to the field device.

After completing the settings described in 8.5.2, enable the Wi-Fi connection using the procedure described in 8.5.5, and do the following.

1 PC/Tablet

Click the network icon displayed in the Windows task tray on the Windows PC or tablet.

2 PC/Tablet

If the SSID you set at 4 in Figure 8-7 is displayed as a device that can be connected, select it and proceed to **4** .

3 PC/Tablet

If the SSID you set at 4 in Figure 8-7 is not displayed as a device that can be connected, open the [Open Network & Internet settings] menu.

Enable Wi-Fi on the Windows PC or tablet. Go back to **1** .

4 PC/Tablet

Enter the password you checked at 5 in Figure 8-7 and click the <Next> button.

5 PC/Tablet

Confirm that “Connected” is displayed.

8.5.4 Wi-Fi STA Mode

When connecting the 1SHM as a wireless LAN slave device to the already existing wireless LAN master device, use Wi-Fi STA mode.

You cannot make a Wi-Fi STA connection while supplying power to the field device.

After completing the settings described in 8.5.2, enable the Wi-Fi connection using the procedure described in 8.5.5.

1

When you have checked the check box at 11 in Figure 8-7, check that the Wi-Fi router is operating as the DHCP server (bridge mode is not enabled).

8.5.5 Switching the Wireless Connection

With the 1SHM, only wireless connections (Bluetooth and Wi-Fi) previously enabled in the wireless settings in the Support Tool (8.5.2) are usable.

1 1SHM The indicator for the currently selected connection method is lit on the 1SHM.

Figure 8-8. Example of a USB connection

2 1SHM Press the connection change button.

Figure 8-9.

While the currently selected connection method remains lit, the connection method to the right blinks to indicate the method to which the current one can be switched.

If the indicator blinks at high speed, you must enable that connection method in 8.5.2.

3 1SHM Repeatedly press the connection change button until the desired method is selected.

4 1SHM Touch and hold (for two seconds) the connection change button when the desired connection method (Wi-Fi, USB, or Bluetooth connection status indicator) is blinking.

>> The LED stops blinking and stays on, and the connection method is switched.

5 1SHM If both Wi-Fi AP and Wi-Fi STA are enabled (8.5.2), you can switch between Wi-Fi AP and Wi-Fi STA by pressing and holding down the connection change button for two seconds while the Wi-Fi connection status indicator is blinking. You can check which connection is currently enabled in the Support Tool.

For instructions on how to check it, refer to 8.5.1.

8.6 How to Use the Communication Waveform Cursor Sets

Cursor sets are provided for the chart on the [Waveform] tab of the [Waveform Acquisition] tab on the [Loop Diagnostics (Passive)] and [Loop Diagnostics (Active)] screens of the Support Tool.

- Two cursor sets (Xa and Xb) are placed to measure the values in the time axis (horizontal axis) direction
- Two cursor sets (Ya and Yb) are placed to measure the values in the voltage axis (vertical axis) direction

Each cursor set consists of two cursors.

For example, cursor set Xa consists of cursors Xa1 and Xa2. The absolute value of the difference between them is displayed as ΔXa. For the time axis cursor sets, the reciprocal of their difference is also displayed in frequency. This can be used to measure the frequency of HART signals or noise.

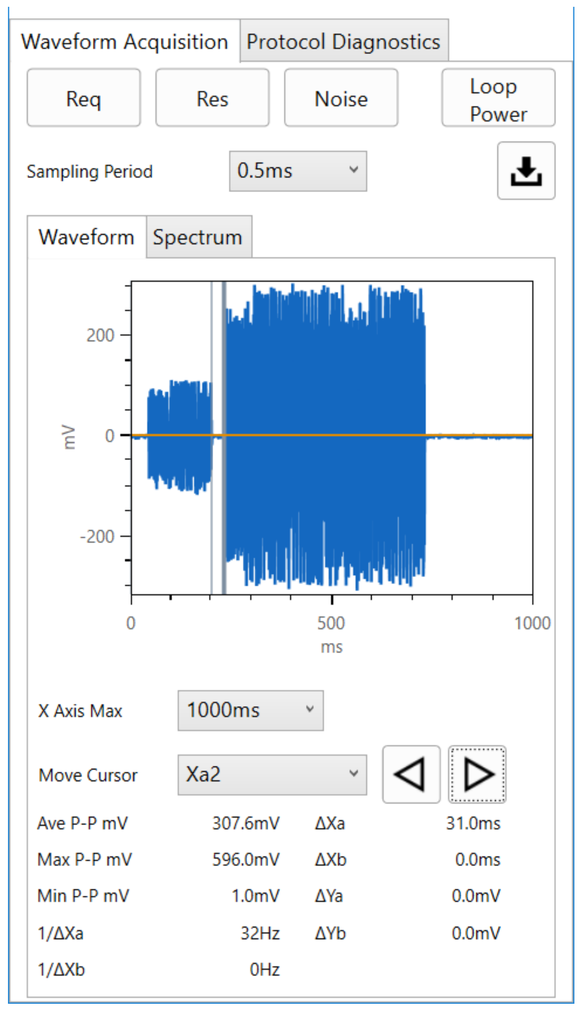


Figure 8-10.

Table 8-4.

Cursor set	Cursor movement specification	Absolute value of difference display (unit)
Xa	Xa1, Xa2	ΔXa (ms), 1/ΔXa (Hz)
Xb	Xb1, Xb2	ΔXb (ms), 1/ΔXb (Hz)
Ya	Ya1, Ya2	ΔYa (mV)
Yb	Yb1, Yb2	ΔYb (mV)

The following illustrates the measurement procedure using cursor set Xa to measure the time between the HART command and response when the HART communication waveform is displayed in the chart.

1 Support Tool

Change “Not Selected” to “Xa1” in the [Move Cursor] combo box.

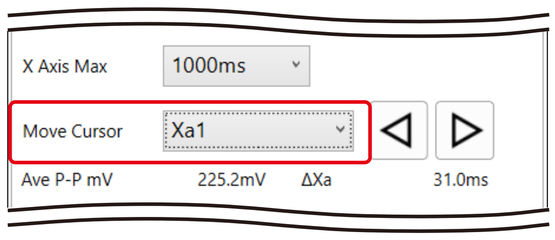


Figure 8-11.

2 Support Tool

Click the end point of the HART command in the chart.

You can move the Xa1 cursor in millisecond increments or decrements by clicking the right or left arrow button.

You can also move it by clicking again on the chart.

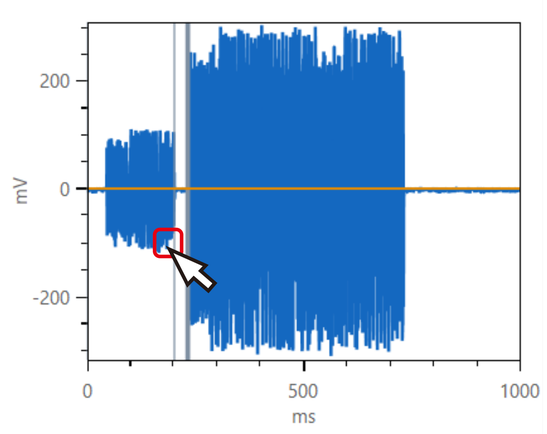


Figure 8-12.

3 Change “Xa1” to “Xa2” in the [Move Cursor] combo box.

Support Tool

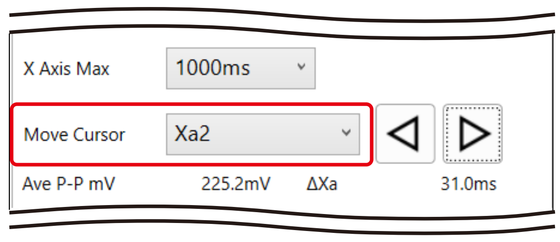


Figure 8-13.

4 Click the start point of the HART response in the chart. Move the Xa2 cursor in the same way as in **2** .

Support Tool

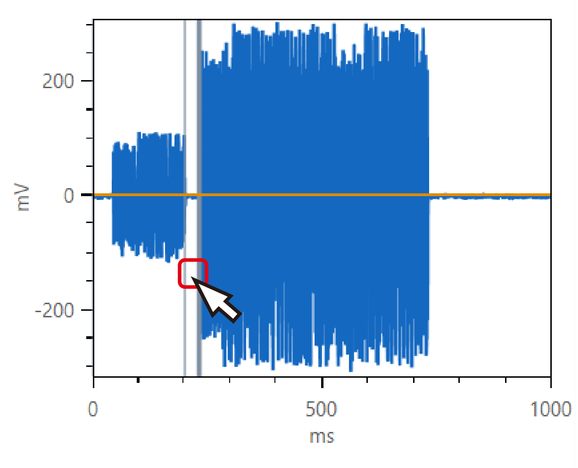


Figure 8-14.

5 The time between the end point of the HART command and the start point of the HART response is displayed in milliseconds in the ΔXa display.

Support Tool

Select “Not Selected” again in the [Move Cursor] combo box.

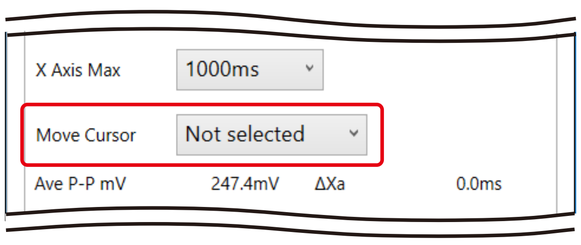


Figure 8-15.

When “Not Selected” is selected in the [Move Cursor] combo box, you can zoom in or out of the chart by placing the mouse cursor on the chart and rotating the mouse wheel or pinching/spreading the chart.

8.7 Changing the Display Language

You can select English or Japanese as the interface language for the Support Tool.

Select the language with the procedure below.

1 Start the Support Tool and open the [Settings] menu.

Support Tool

The [Settings] screen opens.

2 Select a language from the “Language” drop-down list on the [Settings] screen.

Support Tool

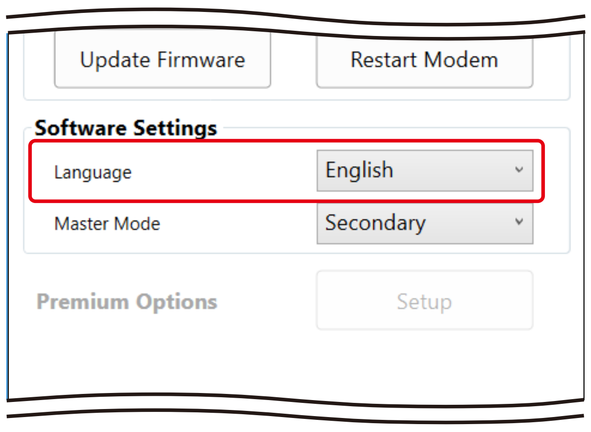


Figure 8-16.

3 Click the <×> button at the right top of the screen of the Support Tool to exit the Support Tool.

Support Tool

4 Start the Support Tool.

Support Tool

The new interface language setting will be applied.

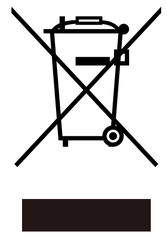
8.8 Disposal

Disposal of Electrical and Electronic Equipment (for Environmental Protection)

This is an industrial product subject to the WEEE Directive.

Do not dispose of electrical and electronic equipment in the same way as household waste.

Old products contain valuable raw materials and must be returned to an authorized collection point for correct disposal or recycling.



When disposing of the 1SHM, please do so appropriately, in compliance with local ordinances.
The 1SHM contains three AAA batteries and one button battery (CR1220).
The button battery can be removed from the battery holder on the board before disposal.

8.8.1 Removing the Batteries

■ Removing the AAA batteries

Loosen the setscrew on the back of the 1SHM to remove the back cover and remove the batteries.

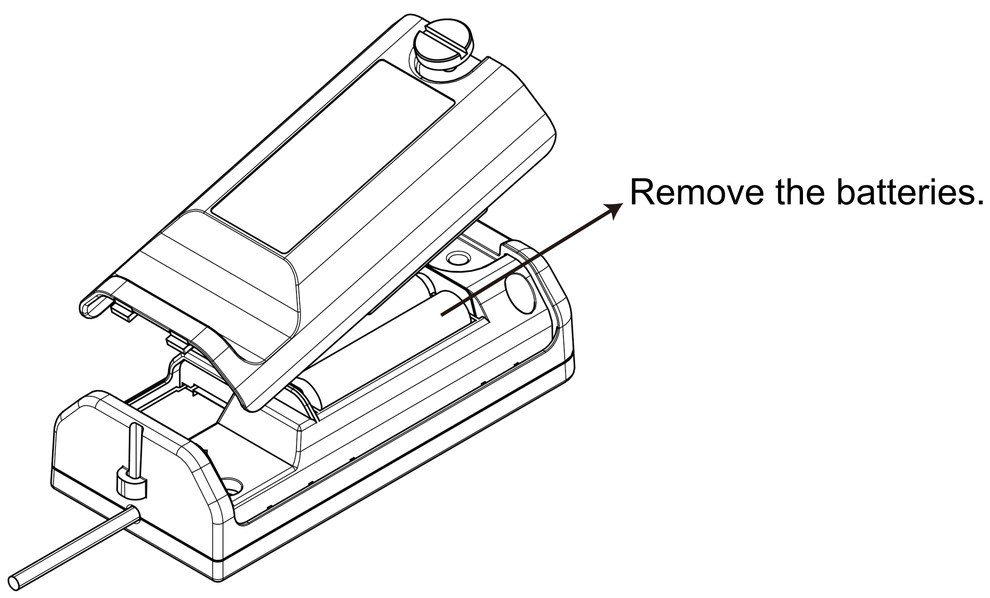


Figure 8-17.

■ Removing the button battery

Note that the following procedure invalidates the product warranty. Do the following only for product disposal.

1 Loosen the setscrew on the back of the 1SHM to remove the back cover.

2 Remove the setscrews (cross recessed screws) at the four corners with a Phillips driver.

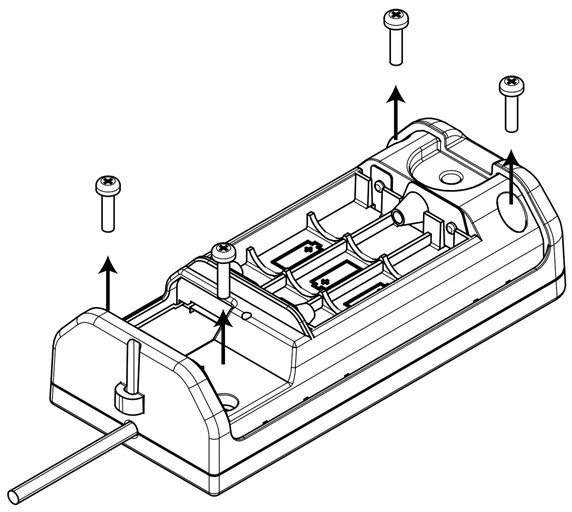
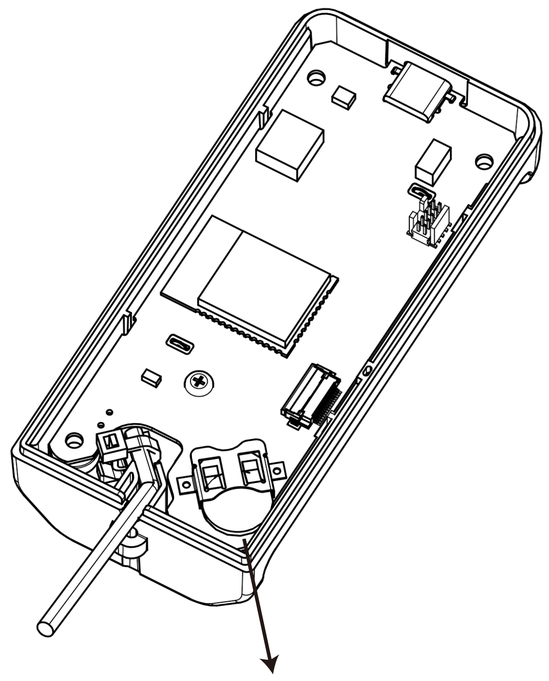


Figure 8-18.

3 Turn over the 1SHM and remove the control panel.

4 Slide the button battery in the direction of the arrow to remove it from the battery holder on the board.



Slide the button battery to remove it.

Figure 8-19.

Chapter 9 Specifications

Table 9-1. Specifications

Power voltage or current rating	
USB power supply	DC 5 V ± 0.25 V, 2 W max.
Power supply from internal batteries	1.2 V DC ±0.06 V × 3 or 1.5 V DC ±0.075 V × 3, 2 W max.
Rating between field connection cables	
Voltage (input)	Maximum rating: ±30 V DC
Power supply voltage (output)	Maximum rating: 25.2 V DC (24 V + 5 %)
Power supply current (output)	Maximum rating: 30 mA
Bluetooth	
Communication distance	10 m
Frequency	2.4 GHz
Standard and version	Classic 4.2
Wireless connection	
Supported standards	IEEE 802.11b/g/n

Table 9-2. Environmental Conditions

Environmental Conditions	
Indoor use / outdoor use	Indoor and outdoor use
Altitude	up to 2000 meter
Temperature range	-20°C to 50°C
Relative humidity range	5% to 95%
Pollution degree	2

Chapter 10 Certification

Model AZ-1SHM-1B has acquired the certifications shown below.

10.1 Certification

Table 10-1. Certification

Technical Standards Conformity (Japan)		R 211-161007
CE *1	2014/53/EU "RED" 2011/65/EU "RoHS"	CE
UKCA (U.K.)	2017 No.1206 2012 No.3032	UK CA
FCC (U.S.A.)		Contains FCC ID: 2AC7Z-ESPWROOM32
ISED (Canada)		Contains IC ID: 21098-ESPWROOM32
SRRC (People's Republic of China)		CMIIT ID : 2023DJ3999
KC (Korea)		R-R-A2B-A145
IMDA (Singapore)		**Complies with IMDA Standards DA107974**
NBTC (Thailand)		Supplier's Declaration of Conformity (SDoC) Registration No. RT.2532

*1. EU, EFTA, Turkey.

Please check the following website for the latest information.
https://www.azbil.com/products/factory/solution/equipment-asset-management/hart-foundation-fieldbus/hdfs-system/smart-hmodem/index.html
We are not liable for any damage in any nature incurred by you as a result of your use of wireless connection (Bluetooth, Wi-Fi) in a country or region other than we have above certifications. We are entitled to claim against you any damage caused by your use of wireless connection in such country or region.

10.2 Manufacturer

Advanced Automation Company, Azbil Corporation
1-12-2 Kawana, Fujisawa-shi, Kanagawa-ken, Japan 251-8522

10.3 Compliance Statement

10.3.1 Federal Communications Commission (FCC) Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following 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: Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

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 18 of the FCC Rules.

10.3.2 ISED (Canada) Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) L'appareil ne doit pas produire de brouillage.

(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

10.3.3 Radiation Exposure Statement

This equipment complies with radio frequency exposure limits set forth by the FCC and Industry Canada for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the device and the user or bystanders. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par la FCC et Industrie Canada pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers. Ce dispositif ne doit pas être utilisé à proximité d'une autre antenne ou d'un autre émetteur.

10.3.4 Korean Certification (KC)

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

10.3.5 NBTC (Thailand)

เครื่องโทรคมนาคมและอุปกรณ์นี้มีความสอดคล้องตามมาตรฐานหรือข้อกำหนดทางเทคนิคของ กสทช.

MEMO

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.
You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

(1) Failure caused by your improper use of azbil product
(noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);

(2) Failure caused for other reasons than Azbil Corporation's product;

(3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;

(4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;

(5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or

(6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

(1) Regulations and standards or laws that your Equipment is to comply with.

(2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.

(3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use

Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down.

You are required to provide your Equipment with safety design such as fool-proof design, *1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance, *3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.

*2. A design that is safe even if the device fails.

*3. Avoidance of device failure by using highly reliable components, etc.

*4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

*5. Nuclear power quality: compliance with JEAG 4121 required

*6. Radiation controlled area: an area governed by the requirements of article 3 of “Rules on the Prevention of Harm from Ionizing Radiation,” article 2 2 4 of “Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation,” article 4 of “Determining the Quantity, etc., of Radiation-Emitting Isotopes,”etc.

*7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

You are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

(1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals

(2) For use of specific purposes, such as:

* Nuclear energy/radiation related facilities
  [When used outside a radiation controlled area and where nuclear power quality is not required]
  [When the limit switch for nuclear power is used]
* Machinery or equipment for space/sea bottom
* Transportation equipment
  [Railway, aircraft, vessels, vehicle equipment, etc.]
* Antidisaster/crime-prevention equipment
* Burning appliances
* Electrothermal equipment
* Amusement facilities
* Facilities/applications associated directly with billing

(3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability

(4) Facilities that are to comply with regulations of governmental/public agencies or specific industries

(5) Machinery or equipment that may affect human lives, human bodies or properties

(6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification.

Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used.

Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals.

System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts.

For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts.

For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run

(2) Maintenance, inspection, adjustment, and repair

(3) Technical guidance and technical education

(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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