# MICROCYBER

# G1013
# HART to FF Gateway
# User Manual

# Warning

1. Please don't take off/install gateway at random.
2. Please check if the power of gateway meets the power request in the User Manual.

**Version: V2.1**

**Disclaimer**

The contents of this manual have been checked to confirm the consistency of the described hardware and software. Because the error can not be completely excluded, there is no guarantee of absolute consistency. However, we will regularly check the data in this manual and make necessary corrections in subsequent versions. Any suggestions for improvement are welcome.

**Microcyber Corporation, 2021**

Technical data changes at any time

# Company Introduction

**Microcyber Corporation** established as a high-tech enterprise by the Shenyang Institute of Automation Chinese Academy of Sciences, mainly engages in advanced industrial control systems, equipments, instruments and chips for industrial process automation control solutions in the research, development, production and application. Microcyber undertakes a number of national scientific and technical key task and "863" project, national science and technology programs for intelligent manufacturing equipment development and it is the national network control system engineering research center construction support unit.

Microcyber Corporation successfully developed the first internationally certified fieldbus protocol master stack, the first nationally certified fieldbus instrument, and the first German TüV certified safety instrument in China. It co-chaired with other units to formulate the first domestic industrial Ethernet protocol standard EPA, the first industrial wireless communication protocol standard WIA-PA, and become the IEC international standard. Microcyber Corporation's products and technology have won two national second prize for scientific and technological progress, one national scientific and technological invention award, one first prize for scientific and technological progress of the Chinese Academy of Sciences, and one first prize for scientific and technological progress of Liaoning Province. The United States Emerson, Britain Rotork, Britain and other top enterprises have adopted key technologies or components in their products and successfully completed more than 200 large-scale automation projects.

Microcyber is the FF member, the HART member and the Profibus National Organization (PNO) member.

Microcyber passes the Authentication of ISO 9001:2008 Quality System and automotive industry ISO/TS16949 quality system certification. We have laid a solid foundation for the company's entrepreneurship and sustainable development with excellent R & D team, rich experience in automation engineering design and implementation, industry leading products, huge market network and excellent corporate culture.

Carrying employee ideal, creating customer value and promoting enterprise development.

# Content

# Chapter 1 Overview

G1013 HART to FF Gateway, designed by Microcyber Corporation is a gateway device for HART protocol and FF protocol. As HART master, G1013 HART to FF Gateway communicates with HART slave via HART interface, it can convert dynamic variables in the device to FF device variables output. G1013 HART to FF Gateway is shown as Figure1.1.



Figure1.1 G1013 HART to FF Gateway
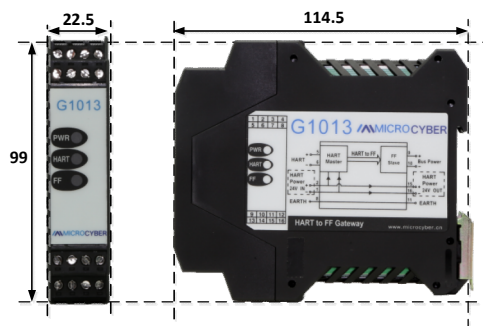
## 1.1 Dimension



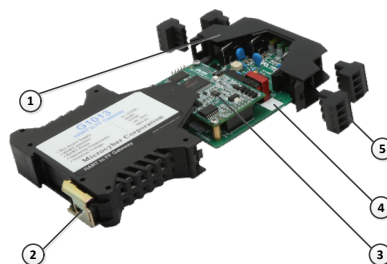Figure1.2 Dimension (Unit: mm)

## 1.2 Structure



Figure1.3 Structure

| 1 | Upside Housing | 2 | Bottom Housing | 3 | FF Communication Board |
|---|---|---|---|---|---|

| 4 | HART Bottom Board | 5 | Terminal | | |

## Chapter 2 Installation

G1013 HART to FF Gateway is 99×22.5×114.5mm, supporting standard DIN rail installation.

### 2.1 Wiring

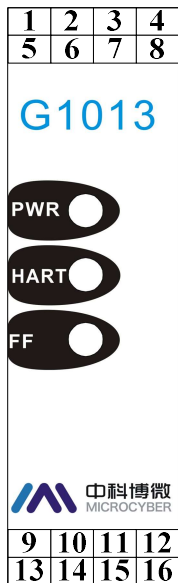G1013 HART to FF Gateway's wiring is shown in Figure 2.1.

| | | | |
|---|---|---|---|
| 1 | 24V- | 2 | 24V+ |
| 3 | NC | 4 | NC |
| 5 | HART+ | 6 | HART- |
| 7 | NC | 8 | EARTH |
| 9 | FF+ | 10 | FF- |
| 11 | EARTH | 12 | NC |
| 13 | NC | 14 | NC |
| 15 | 24V+ | 16 | 24V- |

Figure 2.1 G1013 HART to FF gateway terminal definition

G1013 HART to FF Gateway is powered by FF bus, and the HART part shall be with 24V external powered. The recommended is TP cable, and it shall improve device's anti-electromagnetic interference ability.

### 2.2 DIP Switch Setting

There is a 3-bit DIP switch for G1013 HART to FF Gateway, shown in Figure 2.2.

- SIM: Simulation switch, can be used for "simulation function".
- WP: Write protection, all the write operation for FF smart pressure transmitter shall be refused, which avoid data modification at random.
- RST: Reset, reset device date to factory original. Power off the device at first, and made the switch at ON, and then power on the device, the device shall be reset to factory original.
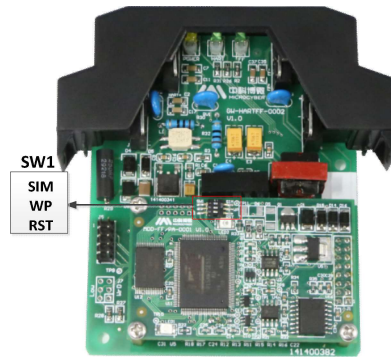
Figure 2.2 G1013 HART to FF gateway hardware switch

# Chapter 3 Working Principle

HART to FF gateway is a converter for HART protocol to FF protocol. As a HART master device, it can connect HART bus device in single-point mode or multiple-point mode. It can connect 4 HART devices. As a FF slave device, the gateway can convert HART device dynamic date to FF function block channel data, and transfer to control system via function block output. The system connection is shown in Figure 3.1.
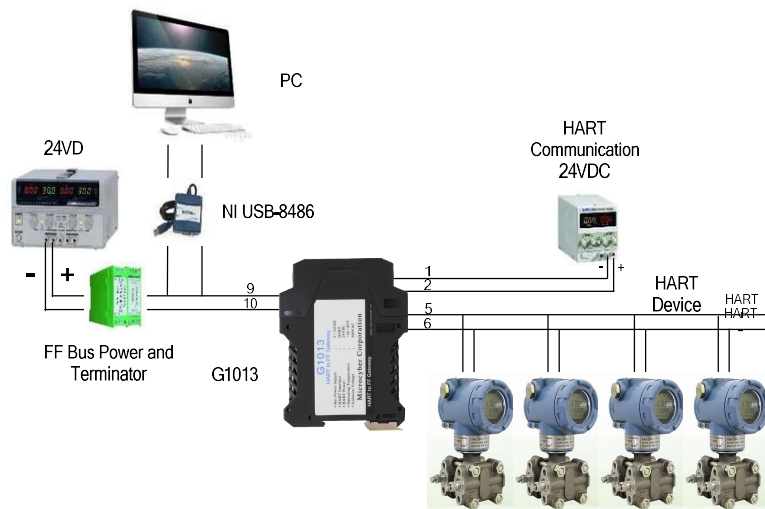


Figure 3.1 HART to FF gateway system connection

HART to FF gateway consists of two boards, one is FF communication board and the other one is HART interface board. FF communication board is a universal board and it can be used in different devices, for FF bus communication. HART interface board is only used in G1013, for signal isolation, signal convert, FF/PA communication module power, and HART device power, etc. The working principle for G1013 is shown in Figure 3.2.
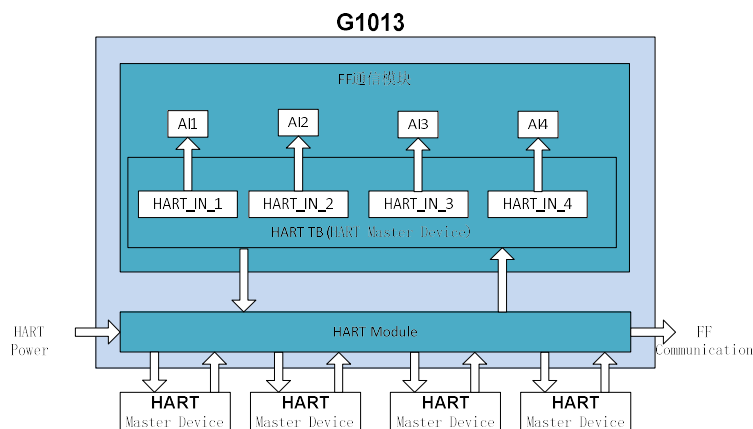


Figure 3.2 HART to FF gateway working principle

## Chapter 4 Gateway Configuration

### 4.1 Topology Connection

FF device supports multiple network topology connections, shown as Figure 4.1. The FF device bus connection is shown in Figure 4.2, the bus ends is connected with terminal matched resistance to ensure signal quality. The maximum length is 1900m, it shall be prolonged to 10km with repeaters.



Figure 4.1 FF Network Topology



Figure 4.2FF Bus Connection

### 4.2 Function Block Description

For default configuration for G1013, there is 1 RES function block complying with FF specification, 1 HART transducer block (HART_TB), 4 AI function blocks and 1 PID function block. AI function blocks support 16 channels, and 16 channels and 4 devices' PV, SV, TV and QV are corresponding.

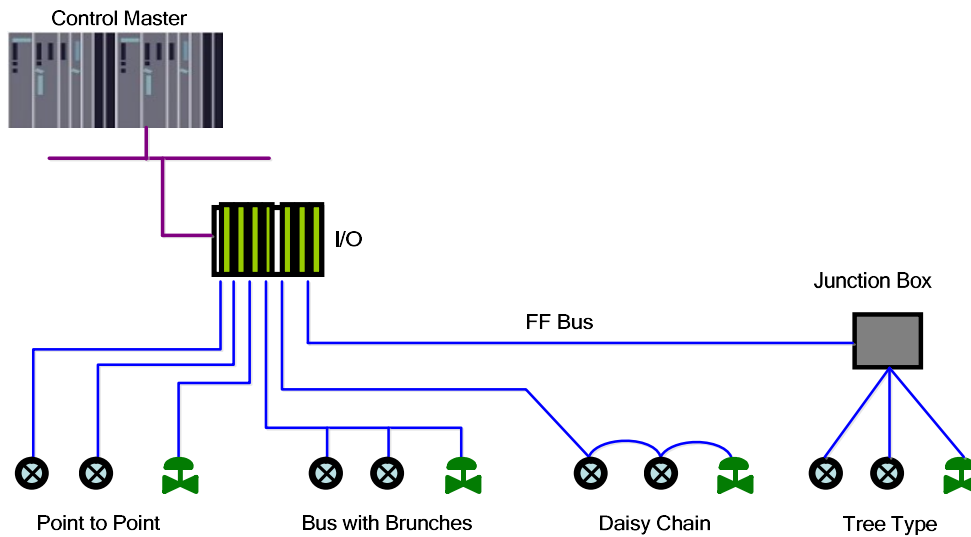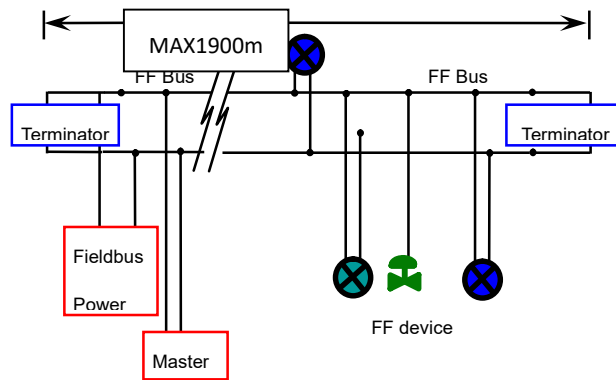| Name | Description |
|---|---|
| Resource (RES) | Resource block is used to describe device characters in the field, such as device name, manufacture, serial number. There is no input or output parameter in resource block. Generally there is only one resource block for each device. |
| HART_TB(MTB) | HART_TB can be used to configure HART communication parameters, such baud rate, stop bit, communication overtime, etc. |
| Analog Input (AI) | Analog input function block is used to achieve transducer block input data and transfer it to other function blocks, and has the function of range conversion, filtering, and square root, etc. |
| Proportional Integral Derivative (PID) | PID function block has the function of PID control and setting point adjustment, process value(PV) filtering and alarm, output tracking, etc. |

### 4.3 HART Transducer Block Configuration Parameters

| No | Parameter Name | Data Type | Valid Range | Default Vale | Save | Mode | Function Description |
|---|---|---|---|---|---|---|---|
| 1 | ST_REV | Unsigned16 | | 0 | S/RO | | Statistic Revision |
| 2 | TAG_DESC | OctString(32) | | Spaces | S | | Bit Number |
| 3 | STRATEGY | Unsigned16 | | 0 | S | | Strategy |
| 4 | ALERT_KEY | Unsigned8 | 1-255 | 0 | S | | Alarm |
| 5 | MODE_BLK | DS-69 | | O/S | S | | Mode |
| 6 | BLOCK_ERR | Bitstring(2) | | | D/RO | | Error |
| 7 | UPDATA_EVT | DS-73 | | | D | | Statistic Data Update Case |
| 8 | BLOCK_ALM | DS-72 | | | D | | Function Block Alarm |
| 9 | TRANSDUCER_TYPE | Unsigned16 | | 65535 | N/RO | | Transducer Block Type |
| 10 | XD_ERROR | Unsigned8 | | 0 | D/RO | | Transducer Block Error Description |
| 11 | SENSOR_TYPE | Unsigned16 | | 65535 | D/RO | | Sensor Type |
| 12 | NUMBER_DEVICE | Unsigned8 | 0-4 | 0 | S | O/S | Number of HART Devices |
| 13 | ERR_LOOK_RESULT | Bitstring(32) | | | N | | Status Indication |
| 14 | HART_LOC_PARM1 | DS-272 | | | S | O/S | HART Device Parameter |

| 15 | HART_PV1 | DS-65 | | | N | | PV |
|---|---|---|---|---|---|---|---|
| 16 | PV_LOC_PARM1 | DS-273 | | | D/RO | | PV Parameter |
| 17 | HART_SV1 | DS-65 | | | N | | SV |
| 18 | SV_UNIT1 | Unsigned16 | | | D/RO | | SV Unit |
| 19 | HART_TV1 | DS-65 | | | N | | TV |
| 20 | TV_UNIT1 | Unsigned16 | | | D/RO | | TV Unit |
| 21 | HART_QV1 | DS-65 | | | N | | QV |
| 22 | QV_UNIT1 | Unsigned16 | | | D/RO | | QV Unit |
| 23 | HART_LOC_PARM 2 | DS-272 | | | S | O/S | HART Device Parameter |
| 24 | HART_PV2 | DS-65 | | | N | | PV |
| 25 | PV_LOC_PARM2 | DS-273 | | | D/RO | | PV Parameter |
| 26 | HART_SV2 | DS-65 | | | N | | SV |
| 27 | SV_UNIT2 | Unsigned16 | | | D/RO | | SV Unit |
| 28 | HART_TV2 | DS-65 | | | N | | TV |
| 29 | TV_UNIT2 | Unsigned16 | | | D/RO | | TV Unit |
| 30 | HART_QV2 | DS-65 | | | N | | QV |
| 31 | QV_UNIT2 | Unsigned16 | | | D/RO | | QV Unit |
| 32 | HART_LOC_PARM 3 | DS-272 | | | S | O/S | HART Device Parameter |
| 33 | HART_PV3 | DS-65 | | | N | | PV |
| 34 | PV_LOC_PARM3 | DS-273 | | | D/RO | | PV Parameter |
| 35 | HART_SV3 | DS-65 | | | N | | SV |
| 36 | SV_UNIT3 | Unsigned16 | | | D/RO | | SV Unit |
| 37 | HART_TV3 | DS-65 | | | N | | TV |
| 38 | TV_UNIT3 | Unsigned16 | | | D/RO | | TV Unit |
| 39 | HART_QV3 | DS-65 | | | N | | QV |
| 40 | QV_UNIT3 | Unsigned16 | | | D/RO | | QV Unit |
| 41 | HART_LOC_PARM 4 | DS-272 | | | S | O/S | HART Device Parameter |
| 42 | HART_PV4 | DS-65 | | | N | | PV |
| 43 | PV_LOC_PARM4 | DS-273 | | | D/RO | | PV Parameter |
| 44 | HART_SV4 | DS-65 | | | N | | SV |
| 45 | SV_UNIT4 | Unsigned16 | | | D/RO | | SV Unit |
| 46 | HART_TV4 | DS-65 | | | N | | TV |

| 47 | TV_UNIT4 | Unsigned16 | | | D/RO | | TV Unit |
| 48 | HART_QV4 | DS-65 | | | N | | QV |
| 49 | QV_UNIT4 | Unsigned16 | | | D/RO | | QV Unit |

### 4.3.1 HART Transform Block Configuration Parameters

HART transducer block provides 4 groups of variables, and they are corresponding to 4 HART slave devices. The user may read related device information and dynamic variables information by configuration of HART slave polling address.

**DS-272 HART Device Parameter HART LOC PARM**

The new added data type DS-272 is HART device parameters, including HART slave polling address and device basic information, including: HART protocol revision, transmitter revision, software revision, hardware revision, device ID, number of requested prefix characters, number of variables, tag number, etc.

| Data Member | Data Type | Function Description |
|---|---|---|
| POLLING_ADDRESS | USIGN8 | HART slave polling address, range 0~63 |
| UNIVERSAL_REVISION | USIGN8 | HART protocol revision |
| TRANSMITTER_REVISION | USIGN8 | Transmitter revision |
| SOFTWARE_REVISION | USIGN8 | Software revision |
| HARDWARE_REVISION | USIGN8 | Hardware revision |
| DEVICE_ID | USIGN32 | Device ID |
| RESPONSE_PREAMBLES | USIGN8 | Number of requested prefix characters |
| MAX_NUM_DEVICE_VARIABLES | USIGN8 | Number of variables |
| TAG | OctString | Tag number |

**DS-273 HART PV Related Parameter MOD_LOC_PARM**

The new added data type DS-273 is device PV related parameters, they are: read-only parameters, including: upper range, lower range, sensor upper range, sensor lower range, minimum span, damp, unit and linearization, etc.

| Data Member | Data Type | Function Description |
|---|---|---|
| UPPER | FLOAT | Upper range |
| LOWER | FLOAT | Lower range |

| UPPERLIMIT | FLOAT | Sensor upper range |
|---|---|---|
| LOWERLIMIT | FLOAT | Sensor lower range |
| MINSPAN | FLOAT | Minimum span |
| DAMP | FLOAT | Damp |
| FORCEDUNIT | USIGN16 | Unit |
| FUNCT | USIGN8 | Linearization |

4.3.2 **HART Transducer Block List**

**ERR_LOOK_RESULT Parameter Description**

ERR_LOOK_RESULT parameter is HART device status display mark, and it is divided into four groups for displayed devices.

The detailed description is shown as following:

**ERR_LOOK_RESULT**

| Value | Description | Value | Description |
|---|---|---|---|
| 0 | Device 1 No Use | 16 | Device 3 No Use |
| 1 | Device 1 Init Failed | 17 | Device 3 Init Failed |
| 2 | Device 1 Comm Failed | 18 | Device 3 Comm Failed |
| 3 | Reserved | 19 | Reserved |
| 4 | Reserved | 20 | Reserved |
| 5 | Reserved | 21 | Reserved |
| 6 | Reserved | 22 | Reserved |
| 7 | Reserved | 23 | Reserved |
| 8 | Device 2 No Use | 24 | Device 4 No Use |
| 9 | Device 2 Init Failed | 25 | Device 4 Init Failed |
| 10 | Device 2 Comm Failed | 26 | Device 4 Comm Failed |
| 11 | Reserved | 27 | Reserved |
| 12 | Reserved | 28 | Reserved |
| 13 | Reserved | 29 | Reserved |
| 14 | Reserved | 30 | Reserved |
| 15 | Reserved | 31 | Reserved |

## 4.4 **HART Transducer Block Configuration Example**

Following is an example with NI- Configurator of how to configure HART transducer block.

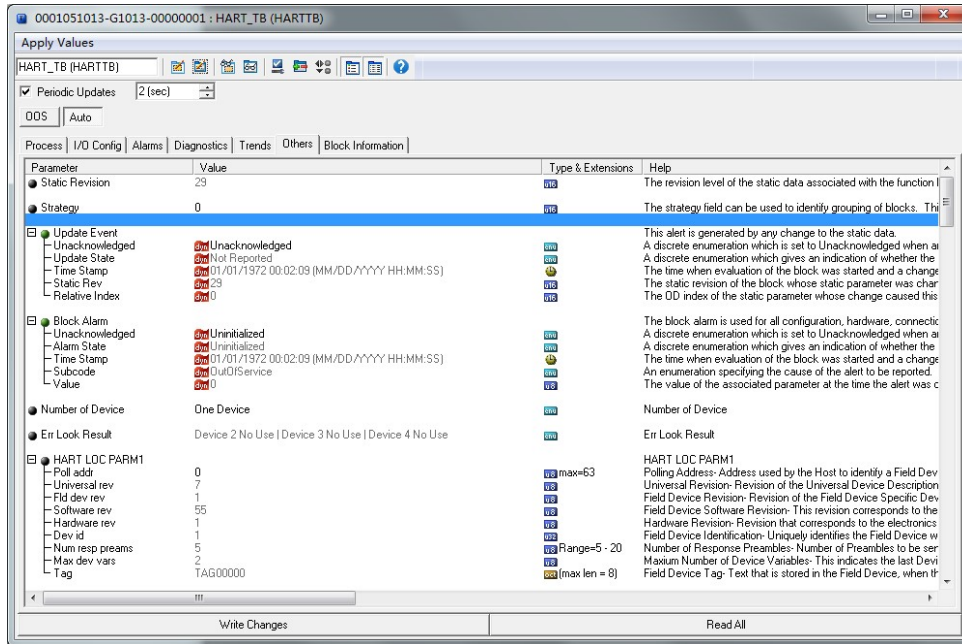### 4.4.1 Configuration for Number of HART devices



Figure 4.3 HART Equipment Quantity Configuration

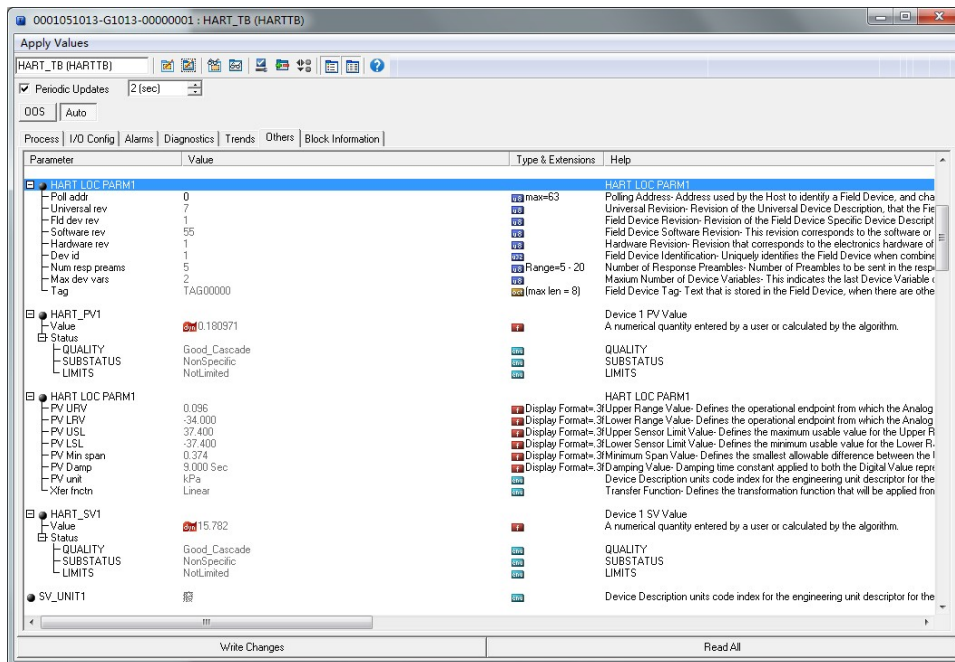### 4.4.2 HART Device Connected Normally



Figure 4.4 HART Device Connected Normally
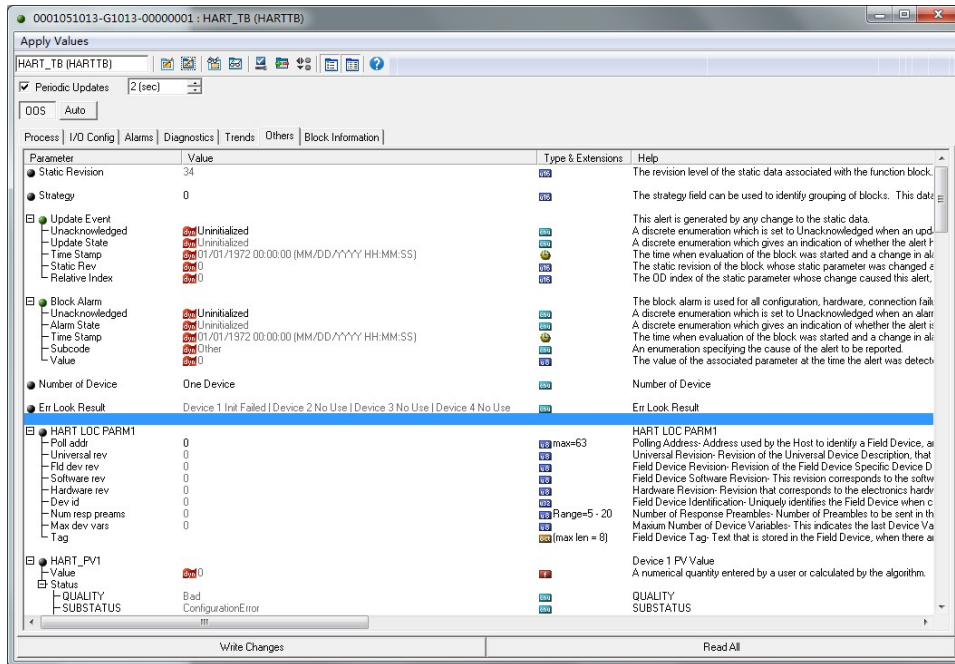
### 4.4.3 **HART Device Connected Abnormally**



Figure 4.5 HART Device Connected Abnormally

Following is an example of configure 1 HART device to describe HART transducer block (HART_TB):

◆ Switch HART transducer block mode to OOS;

◆ Modify connected Number of Device to One Device;

◆ Known connected HART device polling address is 0, then modify Poll Addr of HART LOC PARM1 to 0;

◆ Switch HART transducer block mode to Auto;

◆ If the communication is not successful, the function block mode shall be at OOS, meanwhile Device 1 Init Failed shall appear in Err Look Result;

◆ If the communication is successful, Device 1 Init Failed shall disappear in Err Look Result. Meanwhile all the parameters in HART LOC PARM1 shall refresh, and PV, SV, TV and QV shall be read from HART device automatically.

## Chapter 5 Maintenance

● Simple maintenance

| LED Indicator Light | Color | Normal | Abnormal | Reason | Solution |
|---|---|---|---|---|---|
| FF Communication | Green | Flicker | Off | No FF communication | Check FF master device and FF interface device |
| | | | | Power failure | Check power and connection |
| | | | | Internal failure | Contact technical support |
| HART Communication | Green | Flicker | Off | Not connected with slave device | Connect master device correctly |
| | | | | Slave device failure | Check master device and connection |
| | | | | Internal failure | Contact technical support |
| HART Power | Yellow | On | Off | Power failure | Check power and connection |
| | | | | Internal failure | Contact technical support |

● Daily maintenance is only for device cleansing.

● Failure maintenance: Please return to factory if there is failure.

## Chapter 6 Technical Specification

### 6.1 Basic Parameter

| | |
|---|---|
| Measurement Object | HART slave device |
| HART Power | 24VDC |
| FF Bus Power | 9~32VDC |
| Bus Protocol | 2-wire, FF Protocol |
| Isolation Voltage | HART and FF bus interface, 500VAC |
| Temperature Range | -40℃~85℃ |
| Humility Range | 5~95%RH |
| Start Time | ≤5s |
| Refresh Time | 0.2s |

### 6.2 Performance Index

| | |
|---|---|
| Protection Level | Housing protection grade up to IP20 |
| EMC | EMC Requirements for Electrical Equipment for GB/T 18268.1-2010 *Measurement, Control and Laboratory Part 1: Disturbance Resistance Requirements* for Industrial Places in General Requirements<br><br>FF Port Test Methods Electromagnetic Compatibility Requirements for Electrical Equipment GB/T 18268.23-2010 *Measurement, Control and Laboratory Part 23: Test Configuration, Working Conditions and Performance Criteria for Special Requirements with Integrated or Remote Signal Conditioning Transmitters* |

### 6.3 Physical Performance

| | |
|---|---|
| Weight | 0.2kg |
| Structure Material | Bottom/top cover: ABS /PA6.6<br><br>Screw: stainless steel |

### 6.4 Default Communication Parameter

| | |
|---|---|
| Number of Slave | 0 |
| Slave Polling Address | 0,1, 2, 3 |

### 6.5 Supported HART Command

| | |
|---|---|
| 0 | Read device only mark |
| 3 | Read dynamic variable and PV current |

| 12 | Read device information |
|----|-------------------------|
| 13 | Read device mark, description and date |
| 14 | Read PV sensor information |
| 15 | Read device primary variables' information |
| 16 | Read last assembly line number |

# Appendix 1 Type Selection List

| Type Selection List | G1013 | | HART to FF gateway | | |
|---|---|---|---|---|---|
| | | | Code | | Hardware Interface |
| | | | F（Omitting） | | FSK (1200bps) |
| | | | | Code | Software Interface |
| | | | | MRM（Omitting） | HART Master |
| | G1013 - | （ F - | HM ） | —— | Sample Selection |

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