MICROCYBER

G1013
HART to FF Gateway
User Manual

G1013
HART to FF Gateway
- Bus Power Supply
- HART Interface   :
- HART Power   :   9 ~ 32VDC
- Operating Temperature   :   HART
- Isolation Voltage   :   24VDC
                              :   −40 ~ 85℃
                              :   500VAC

Microcyber Corporation

HART to FF Gateway

www.microcyber.cn

G1013

PWR
HART
FF

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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.

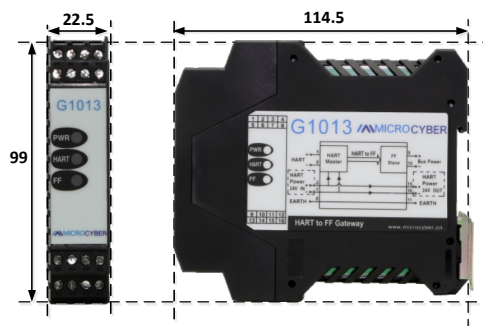Figure1.1 G1013 HART to FF Gateway

1.1 Dimension

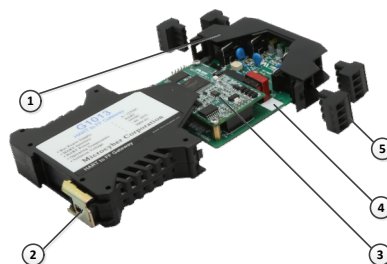Figure1.2 Dimension (Unit: mm)

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

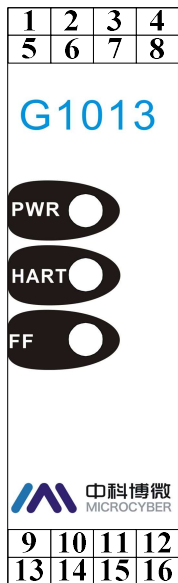G1013 HART to FF Gateway's wiring is shown in Figure 2.1.

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.
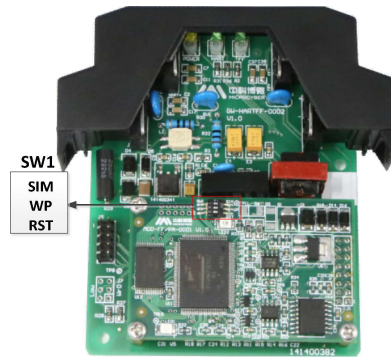
Figure 2.2 G1013 HART to FF gateway hardware switch

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.
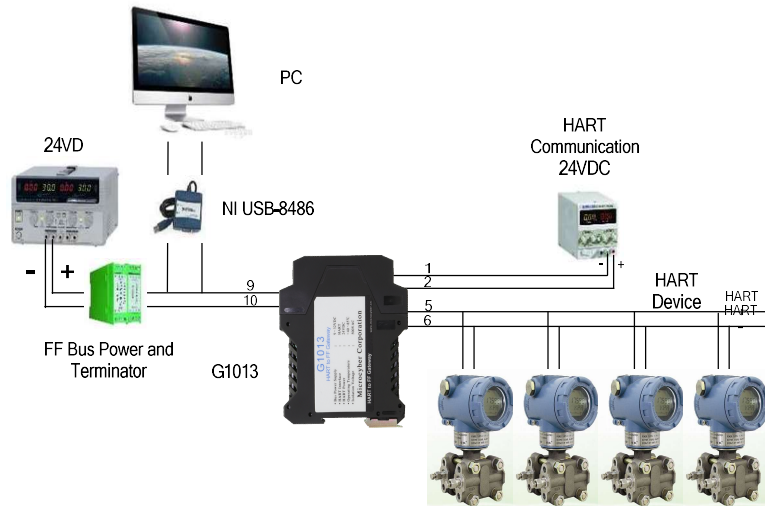
Figure 3.1 HART to FF gateway system connection

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.
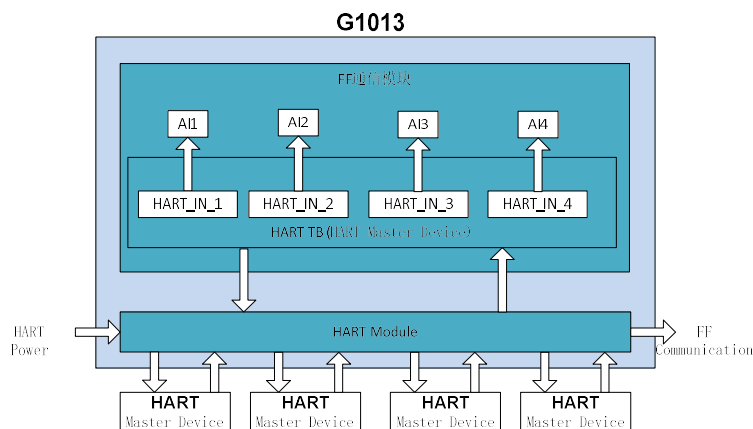
Figure 3.2 HART to FF gateway working principle

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.

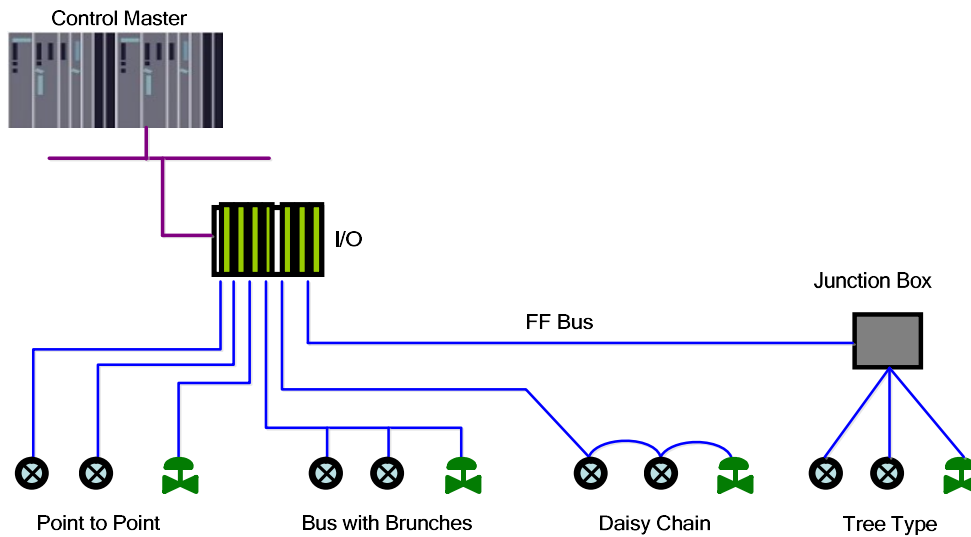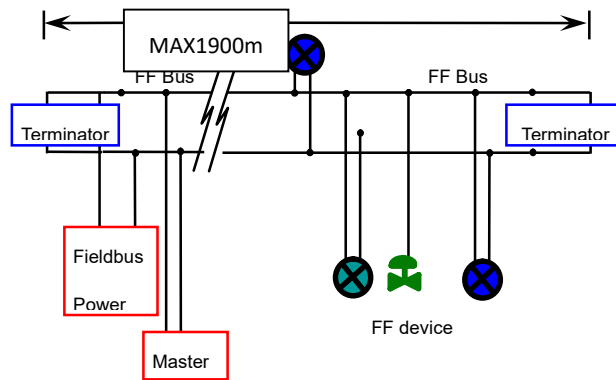| Name	Description
Resource (RES)	Resource block is used to describe device characters in the field, such as device name, manufacture, serial number. There is no input or output parameter in resource block. Generally there is only one resource block for each device.
HART_TB(MTB)	HART_TB can be used to 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.

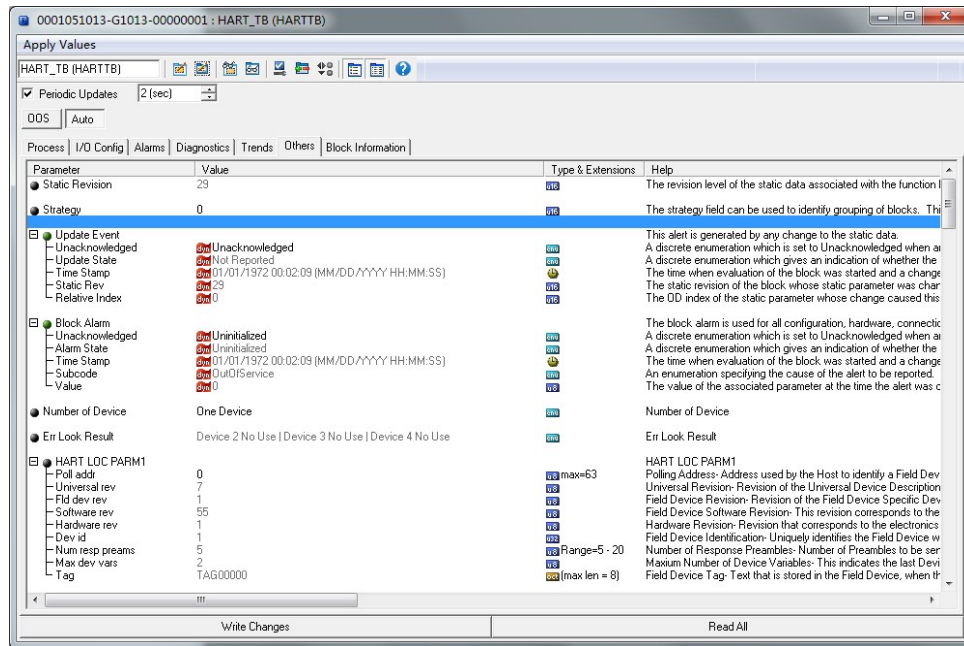### 4.4.1 Configuration for Number of HART devices

Figure 4.3 HART Equipment Quantity Configuration

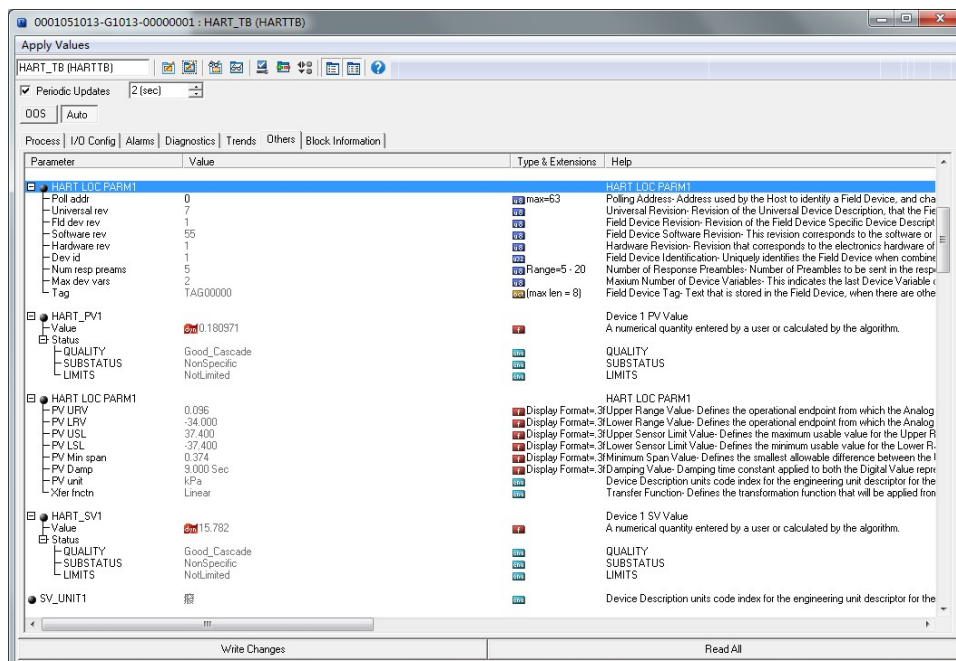### 4.4.2 HART Device Connected Normally

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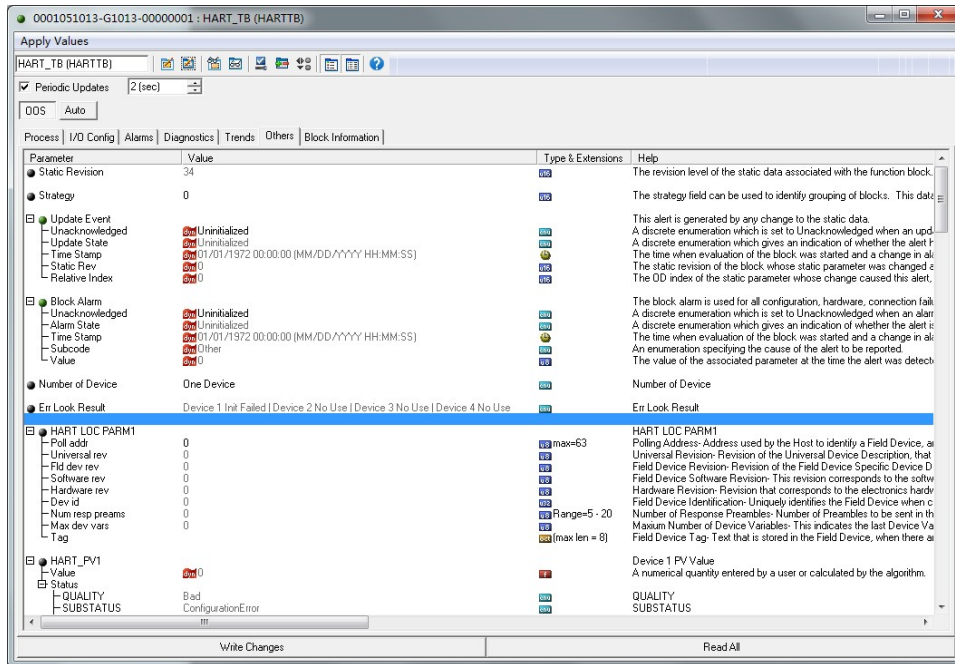
4.4.3 **HART Device Connected Abnormally**

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 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 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				

MICROCYBER CORPORATION