

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.

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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 Figure 1.1.



Figure 1.1 G1013 HART to FF Gateway

$1.\ 1 \ {\rm Dimension}$



Figure1.2 Dimension (Unit: mm)

1.2 Structure



4	HART Bottom Board	5	Terminal		
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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.

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1	24V-	2	24V+
G1013	3	NC	4	NC
	5	HART+	6	HART-
PWR	7	NC	8	EARTH
FF	9	FF+	10	FF-
	11	EARTH	12	NC
▲ ● 料博微	13	NC	14	NC
9 10 11 12 13 14 15 16	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

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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 4.2FF 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 block is used to describe device characters in the field, such as device name,				
Resource (RES)	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 can be used to configure HART communication parameters, such baud rate,				
	stop bit, communication overtime, etc.				
	Analog input function block is used to achieve transducer block input data and transfer				
Analog Input (AI)	it to other function blocks, and has the function of range conversion, filtering, and				
	square root, etc.				
Proportional Integral	PID function block has the function of PID control and setting point adjustment, process				
Derivative (PID)	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_TY PE	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_RESUL	Bitstring(32)			N		Status Indication
14	HART_LOC_PARM	DS-272			S	O/S	HART Device Parameter

15	HART_PV1	DS-65		Ν		PV
16	PV_LOC_PARM1	DS-273		D/RO		PV Parameter
17	HART_SV1	DS-65		Ν		SV
18	SV_UNIT1	Unsigned16		D/RO		SV Unit
19	HART_TV1	DS-65		Ν		TV
20	TV_UNIT1	Unsigned16		D/RO		TV Unit
21	HART_QV1	DS-65		Ν		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		Ν		PV
25	PV_LOC_PARM2	DS-273		D/RO		PV Parameter
26	HART_SV2	DS-65		Ν		SV
27	SV_UNIT2	Unsigned16		D/RO		SV Unit
28	HART_TV2	DS-65		Ν		TV
29	TV_UNIT2	Unsigned16		D/RO		TV Unit
30	HART_QV2	DS-65		Ν		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		Ν		TV
38	TV_UNIT3	Unsigned16		D/RO		TV Unit
39	HART_QV3	DS-65		Ν		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		Ν		PV
43	PV_LOC_PARM4	DS-273		D/RO		PV Parameter
44	HART_SV4	DS-65		Ν		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

0001051013-G1013-00	000001 : HART_TB (HARTTB)		
Apply Values			
HART_TB (HARTTB)	🛛 🖾 🖾 🖳 🚝 🛟 🛅 🗃 😮		
Periodic Updates 2 (sec	a 🕂		
OOS LAuto			
Muko			
Process 1/0 Config Alarms	Diagnostics Trends Uthers Block Information		1
Parameter	Value	Type & Extensions	Help
Static Revision	29	u16	The revision level of the static data associated with the function I
Strategy	0	តាទ	The strategy field can be used to identify grouping of blocks. Thi
Update Event Unacknowledged Unacknowledged Unacknowledged Time Stamp Static Rev Relative Index Block Alarm Unacknowledged Alarm State	CTI Unacknowledged CTI Unacknowledged CTI UTI 17972 00:02:09 (MM/DD/YYYY HH:MM:SS) CTI UTI UTI 17972 00:02:09 (MM/DD/YYYY HH:MM:SS) CTI UTI UTI 17972 00:02:09 (MM/DD/YYYY HH:MM:SS) CTI UTI 17972 00:02:09 (MM/DD/YYYY HH:MM:SS)		This alert is generated by any change to the static data. A discrete enumeration which is res to Unachronowedged when at A discrete enumeration which gives an indication of whether the The time when evaluation of the block was stated and a change The static revision of the block whose stated and a change The static revision of the block whose stated and a change The block alm is used for all configuration, hardware, connectic A discrete enumeration which is set to Unacknowledged when at a discrete enumeration which is set to Unacknowledged when at
Time Stamp Subcode Value	Smoth/1/1/1972 00:02:09 (MM/DD//^^/Y HH:MM:SS) Smothad Gud0fsevice Smothad Gudfee		The time when evaluation of the block was started and a change An enumeration specifying the cause of the alert to be reported. The value of the associated parameter at the time the alert was c Number of Device.
		6110	
Err Look Result	Device 2 No Use Device 3 No Use Device 4 No Use	enu	Err Look Result
HART LOC PARM1 Foll addr Full addr Full addr Full advasal rev Fall dev rev Software rev Hardware rev Dev id Num resp preams Max dev vars Tag	0 7 55 1 5 1 5 2 7AG00000	100 max+63 100 100 100 100 100 Range=5 - 20 100 100 (max len = 8)	HART LOC PARM1 Polling Address: Address used by the Host to identify a Field Dev Universal Revision: Revision of the Universal Device Description Field Device Revision: The revision of the Field Device Specific Dev Field Device Software Revision: This revision corresponds to the Hardware Revision: Revision that corresponds to the electronics Field Device Idevice Weyl vientificities the Field Device Number of Response Preambles: Number of Preambles to be ser Maxium Number of Device Variables: This indicates: the last Devi Field Device Tag. Text that is stored in the Field Device, when th
	III	1	•
	Write Changes		Head All

Figure 4.3 HART Equipment Quantity Configuration

4. 4. 2 HART Device Connected Normally

0001051013-G1013-00000001 : HART_TB (HARTTB)						
Apply Values						
HART_TB (HARTTB) 🛛 🖄 🖄 🖳 🚍 😍 💲 🛅 🕜						
V Periodic Updates 2 (sec) 4						
00S Auto						
Process I/O Config Alarms D	isonostics Trends Others Block Information					
Parameter	Value	Type & Extensions	Help			
- Polladdr	0	milmay-63	Poling address, address used by the Host to identify a Field Device, and cha			
- Universal rev	7		Universal Revision-Revision of the Universal Device Description, that the Fie			
- Fld dev rev	1	08	Field Device Revision-Revision of the Field Device Specific Device Descript			
- Software rev	55	u 8	Field Device Software Revision This revision corresponds to the software or			
- Hardware rev		08	Hardware Revision-Revision that corresponds to the electronics hardware of			
- Devid	1		Field Device Identification- Uniquely identifies the Field Device when combine			
May day yare	2	nange=5 · 20	Maxium Number of Device Variables. This indicates the last Device Variable :			
LTag	TAG00000	(max len = 8)	Field Device Tag- Text that is stored in the Field Device, when there are othe			
E a HABT PV1			Device 1 PV Value			
-Value	Gm 0.180971	-	A numerical quantity entered by a user or calculated by the algorithm.			
🖨 Ștatus			282.315.449			
- QUALITY	Good_Cascade	dires.	QUALITY			
LIMITS	NonSpecific NotLimited	erre	SUBSTATUS LIMITS			
Linito	(Chambod					
E A HART LUC PARM1	0.000	- Diaday Farmat	HART LUC PARM1 2014			
L PV UHV	24.000	Display Format=.	31 Upper Hange Value- Defines the operational endpoint from which the Analog			
- PV LISI	37.400	Display Format=	31 Loner Sensor Limit Value- Defines the maximum usable value for the Unner B			
- PV LSL	-37,400	Display Format=.	3fLower Sensor Limit Value- Defines the minimum usable value for the Lower R.			
- PV Min span	0.374	Display Format=.	3fMinimum Span Value- Defines the smallest allowable difference between the I			
- PV Damp	9.000 Sec	Display Format=.	3fD amping Value-Damping time constant applied to both the Digital Value repre			
- PV unit	kPa	env	Device Description units code index for the engineering unit descriptor for the			
└─ Xter Inctn	Linear	area.	Transfer Function- Defines the transformation function that will be applied from			
E HART_SV1			Device 1 SV Value			
-Value	am 15.782	THE CONTRACT OF THE OWNER OWNER OF THE OWNER	A numerical quantity entered by a user or calculated by the algorithm.			
E Status						
	Lood_Lascade	arre	QUALITY			
LIMITS	NotLimited	enu	LIMITS			
• SV_UNIT1	廢	(True	Device Description units code index for the engineering unit descriptor for the			
x						
Write Changes Pread All						

Figure 4.4 HART Device Connected Normally

4. 4. 3 HART Device Connected Abnormally

		0001051013-G1013-00000001 : HART_TB (HARTTB)					
Apply Values							
HART_TB (HARTTB) 🛛 🖄 🖄 🖾 📮 🗣 💲 🔚 😧							
Periodic Updates 2 (sec)	÷						
00S Auto							
Process I/D Config Alarms Dia	gnostics Trends Others Block Information						
Parameter	Value	Type & Extensions	Help				
Static Revision	34	615	The revision level of the static data associated with the function block.				
Strategy	0	016	The strategy field can be used to identify grouping of blocks. This data $_{\rm E}$				
Update Event Unacknowledged Update State Time Stamp Static Rev Relative Index	8월 Unimitaleed 19월 Unimitaleed 19월 1701 / 1972 09:09:00 (MM/DD / ^^^ HH:MM:SS) 19월 0 19월 0	600 600 663 663	This elert is generated by any change to the static data. A discrete enumeration which is use to Unacknowledged when an upd- A discrete enumeration which is use to Unacknowledge dwhen an upd- the static environmentation of the block was stated and a change in al- The static revision of the block whose static parameter was changed a The DD index of the static parameter whose change caused this altert.				
Block Alarm Unacknowledged Alarm State Time Stamp Subcode Value	CH Uninitialized CH Uninitialized CH Uninitialized CH Uther CH Uther CH Uther		The block alarm is used for all configuration, hardware, connection fail A discrete enumeration which is set to Unacknowledged when an alarn A discrete enumeration which gives an indication of whether the alert is The time when evaluation of the block was stated and a change in al- An enumeration accepting the cause of the alert to be reported. The value of the associated parameter at the time the alert was detects				
Number of Device	One Device	880	Number of Device				
Err Look Result	Device 1 Init Failed Device 2 No Use Device 3 No Use Device 4 No L	Jse 🚥	Err Look Result				
➡ HART LOC PARM1	0 0 0 0 0 0 0 0	10 max=63 10 10 10 10 10 10 10 10 10 10 10 10 10	HART LOC PARH Paling Address: Address used by the Host to identify a Field Device, are Universal Revision. Revision to the Universal Device Deciciption, that Field Device Revision: The Heid Device Specific Device De Field Device Revision: This revision corresponds to the software Redvare Revision: Revision that the Redvare to be sent in the Maxim Number of Device Variables: This indicates the last Device Va Field Device Tage Text that is usiden the Field Device Variant to the Software Variant Revision: Revision the Software Revision: Revision the software Variant Revision: Revision the Revision: Advance Variant Revision: Revision the Revision: Advance Variant Revision: Revision the Revision: Advance Variant Revision: Revision the Revision the Revision: Advance Variant Revision: Revision that corresponds to the Revision: Revision: Revision: Revision: Revision the Revision: R				
HART_PV1 	⊗ <u>m</u> 0		Device 1 PV Value A numerical quantity entered by a user or calculated by the algorithm.				
	Bad ConfigurationError		QUALITY SUBSTATUS				
Write Changes Read All							

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
	Green	Flicker	Off	No FF communication	Check FF master device and FF interface device
FF Communication	Green			Power failure	Check power and connection
				Internal failure	Contact technical support
HART Communication	Green	Flicker	Off	Not connected with	Connect master device
				slave device	correctly
				Slave device failure	Check master device and
				Slave device failure	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°C~85°C	
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 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		
EMC	FF Port Test Methods Electromagnetic Compatibility		
EIVIC	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		
Chrysteine Material	Bottom/top cover: ABS /PA6.6		
Structure Material	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

	G1(013	HART to F	F gateway			
			Code		Hardware Interface		
Туре			F (Omitting)		FSK (1200bps)		
Selection					Cod	le	Software Interface
List					MRM (Or	nitting)	HART Master
	G1	013 -	(F	-	HM	I) —	 Sample Selection



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