
HART® Field Device Specification:
GASDNA DA-500 revision 1

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1. INTRODUCTION

1.1 Scope

The Gasdna concentration transmitter, model DA-500, revision 1 complies with HART Protocol Revision 7.6. This document specifies all the device specific features and documents HART Protocol implementation details (e.g., the Device Specific Commands or Common-Practice Commands supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

1.2 Purpose

This specification is designed to complement other documentation (e.g., the *DA-500 User Manual*) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective.

1.3 Who should use this document?

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators, and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations, and performance requirements) used during Field Device development, maintenance, and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

1.4 Abbreviations and definitions

DDC	Direct Digital Controller
DSS	Device Specific Status
FSK	Frequency Shift Keying
HCF	HART Communication Foundation
LED	Light Emitting Diode
LCD	Liquid Crystal Display
MSA	More Status Available
PLC	Programmable Logic Controller

1.5 References

HART Communication Protocol Specification. HCF_SPEC-13. Available from the HCF.

HART FSK Physical Layer Specification. HCF_SPEC-054. Available from the HCF.

HART Token-Passing Data Link Layer Specification. HCF_SPEC-081. Available from the HCF.

HART Universal Command Specification. HCF_SPEC-127. Available from the HCF.

HART Common Practice Command Specification. HCF_SPEC-151. Available from the HCF.

HART Command Summary Specification. HCF_SPEC-099. Available from the HCF.

HART Common Tables Specification. HCF_SPEC-183. Available from the HCF.

DA-500 User Manual. Available from the GASDNA CO., LTD.

2. DEVICE IDENTIFICATION

Manufacturer Name:	GASDNA CO., LTD	Model Name(s):	DA-500
Manufacture ID Code:	248 (6143 Hex) 99	Device Type Code:	585 (E4D8 Hex) 84
HART Protocol Revision	7.6	Device Revision:	1
Number of Device Variables	None		
Physical Layers Supported	FSK		
Physical Device Category	Transmitter, Non-DC-isolated Bus Device		

3. PRODUCT OVERVIEW

The DA-500 is a concentration transmitter that is used to detect flammable gas leaks. The measured concentration value is displayed on the LCD screen for real-time observation. Also, the measured value is converted into a stable analog signal (4~20mA). This analog output can be transmitted to a gas leak alarm device or a controller such as PLC or DDC to form an individual or integrated gas monitoring system.

For output connection, DA-500 has 2 relays controlled by 2 alarm signals. These relays can be used to connect to external alarm devices. The setpoint level of each alarm can be separately set.

The DA-500 also supports an RS-485 channel for communication.

4. PRODUCT INTERFACES

4.1 Process Interface

4.1.1 Sensor Input Channels

This Field Device uses one sensor input channel to connect the external sensor. Information about the sensor input channel can be found in the User Manual.

4.1.2 Actuator Output Channels

This Field Device does not support Actuator Output Channels.

4.2 Host interface

4.2.1 Analog Output: Process Concentration

The two-wire 4-to-20mA current loop is connected on two terminals marked "mA+" and "GND". Refer to the User Manual for connection details.

This is the only analog output from this transmitter, representing the process concentration measurement, linearised and scaled according to the configured range of the instrument. This output corresponds to the Primary Variable. HART Communication is supported on this loop. This device has a CN number of 1.

A guaranteed linear over-range is provided. Detection of device malfunction is not supported. Current values are shown in the table below.

	Direction	Values (percent of range)	Values (mA or V)
Linear over-range	Down	-1.25%	3.8 mA
	Up	+106.25%	21.0 mA
Device malfunction indication	Down: less than	Not supported	Not supported
	Up: greater than	Not supported	Not supported
Maximum current		+106.25%	21.0 mA
Multi-Drop current draw			4.0 mA
Lift-off voltage			18.0 V

4.2.2 Discrete Output: Relay

Two relay output channels corresponding to two alarms are provided for the external output connection. Refer to the User Manual for connection details.

If the measured concentration value is beyond the alarm setpoint, alarm will be triggered. Then the alarm LED will blink on the control panel and the relay will be activated. Refer to the User Manual for the details.

4.2.3 Alternative Physical Layers for HART

The DA-500 provides RS-485 as an alternative physical layer for HART when necessary. This communication can be used at the same time as FSK is in use on the analog signal loop. Refer to the User Manual for details of RS-485 communication parameters and connections.

4.3 Local Interfaces, Jumpers And Switches

4.3.1 Local Controls And Displays

This device has an onboard LCD screen that displays measured concentration and configuration menus. The device is operated non-intrusively using magnetic switches. Refer to the User Manual for description details.

4.3.2 Internal Jumpers And Switches

This device has no internal jumpers and switches for the configuration of operational functions.

5. DEVICE VARIABLES

This Field Device does not expose any Device Variables.

6. DYNAMIC VARIABLES

One Dynamic Variable is implemented.

	Meaning	Units
PV	Measured concentration	%, %LEL, ppm, ppb ⁽¹⁾ (See Section 11.4)

⁽¹⁾ Depending on the specific type of external sensor.

7. STATUS INFORMATION

7.1 Device Status

Bit	Meaning	Description
0	Primary Variable Out of Limits	Not used
1	Non-Primary Variable Out of Limits	Not used
2	Loop Current Saturated	Not used
3	Loop Current Fixed	Set when loop current mode is disabled or command 40 is executed.
4	More Status Available	Set when any alarm is triggered. See Section 7.3 for more details.
5	Cold Start	Set after a power cycle or after the execution of command 42. This bit is cleared for each master individually after recognition of the first command
6	Configuration Changed	Set when the device configuration is modified.
7	Device Malfunction	Not used

7.2 Extended Device Status

Bit	Meaning	Description
0	Maintenance Required	Not used
1	Device Variable Aler	Set if the device is in alarm condition
2	Critical Power Failure	Not used
3	Failure	Not used
4	Out of Specification	Not used
5	Function Check	Not used
6	Not defined	Not used
7	Not defined	Not used

7.3 Additional Device Status (Command #48)

Command #48 returns 1 byte of data to indicate the device status which can be seen in the table below.

Byte	Bit	Meaning	Class	Device Status Bits Set
1	0	Alarm bit 1 (this bit is set when alarm 1 is triggered)	Warning	4
	1	Alarm bit 2 (this bit is set when alarm 2 is triggered)	Warning	4
	2	Not used		
	3	Not used		
	4	Not used		
	5	Not used		
	6	Not used		
	7	Not used		

"Not used" bits are always set to 0.

Depending on the setting of alarm type, the alarm bit will be set if the measured value is beyond the alarm setpoint. Then More Status Available bit of the Device Status byte is also set. If the measured value is not beyond the alarm setpoint, the alarm bit is reset.

The More Status Available bit can be reset by one of the below cases:

- The master sends the command 48 with Request Data Bytes. The field device compares the data bytes received from the master to the current value contained in the device. If there is an exact match then the More Status Available bit corresponding to the requesting master (primary master or secondary master) shall be reset. Otherwise, the More Status Available remains unchanged.
- When the alarm status that triggering the More Status Available bit is cleared, the More Status Available bit is reset.

The below table lists the possible variations and detailed behavior of command 48 status and More Status Available bit. Refer to the *HART Universal Command Specification* for more details.

Initial value		Event	Final value	
MSA	DSS		MSA	DSS
0	0	DSS is set (alarm is triggered)	1	1
1	1	DSS is reset (DSS value is same as last time MSA==0)	0	0
1	1	MSA is reset (field device received a command 48 request that contains an exact match for the current status data)	0	1
0	1	DSS is reset (alarm cleared but command 48 response no longer matches what was last acknowledged by the master)	1	0
1	0	DSS is set (DSS value is same as last time MSA==0)	0	1
1	0	MSA is reset (field device received a command 48 request that contains an exact match for the current status data)	0	0

MSA: More Status Available, DSS: Device Specific Status which is any alarm bit in command 48.

8. UNIVERSAL COMMANDS

Command #3 returns only PV for a total of 9 bytes of response data. See Section 6.

Command #8 returns 0 (not used) for the SV, TV, QV because these variables are not supported in this field device.

Command #9 is redefined to support only 4 variable slots.

Command #14: Transducer serial number is not used, and returns 0.

Command #15: PV alarm selection code returns 250 (none). Write Protect Code is not implemented by this device and returns 251. There is no damping value to be used, PV damping value returns 0.

Command #48: device_specific_status_1 (byte 1) is redefined to indicate the alarm status. (See Section 7.3.)

9. COMMON-PRACTICE COMMANDS

9.1 Supported Commands

The following common-practice commands are implemented:

- 35 Write Primary Variable Range Values
- 40 Enter/Exit Fixed Current Mode
- 42 Perform Device Reset
- 45 Trim Loop Current Zero
- 46 Trim Loop Current Gain

9.2 Burst Mode

This Field Device does not support Burst Mode.

9.3 Catch Device Variable

This Field Device does not support Catch Device Variable.

10. DEVICE-SPECIFIC COMMANDS

The following device-specific commands are implemented:

- 128 Read Alarm Configuration
- 129 Write Alarm Configuration
- 130 Read Sensor Offset
- 131 Write Sensor Offset
- 132 Read Initial Time
- 133 Write Initial Time
- 134 Read Communication Configuration
- 135 Write Communication Configuration
- 136 Read Display Scale Range
- 137 Write Display Scale Range
- 138 Set Analog Input Zero
- 139 Set Analog Input Span

10.1 Command #128: Read Alarm Configuration

This command is to read the alarm (1 and 2) configurations. Parameters used to config alarm includes alarm setpoint, alarm type, alarm reset type, dead time, and dead band. See User Manual for more details about these parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Alarm 1 setpoint
4-7	Float	Alarm 2 setpoint
8	Enum	Alarm type (see Section 11.1)
9	Enum	Alarm reset type (see Section 11.2)
10	Unsigned-8	Alarm dead time
11-14	Float	Alarm dead band

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-31		Undefined
32	Error	Busy
33-127		Undefined

10.2 Command #129: Write Alarm Configuration

This command is to write the alarm (1 and 2) configurations.

Request Data Bytes

Byte	Format	Description
0-3	Float	Alarm 1 setpoint
4-7	Float	Alarm 2 setpoint
8	Enum	Alarm type
9	Enum	Alarm reset type
10	Unsigned-8	Alarm dead time
11-14	Float	Alarm dead band

Response Data Bytes

Byte	Format	Description
0-3	Float	Alarm 1 setpoint
4-7	Float	Alarm 2 setpoint
8	Enum	Alarm type
9	Enum	Alarm reset type
10	Unsigned-8	Alarm dead time
11-14	Float	Alarm dead band

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes received
6-8		Undefined
9	Error	Alarm 1 setpoint too high
10	Error	Alarm 1 setpoint too low
11	Error	Alarm 2 setpoint too high
12	Error	Alarm 2 setpoint too low
13	Error	Dead band too high
14		Undefined
15	Error	Dead band too low
16-27		Undefined

Code	Class	Description
28	Error	Dead time too high
29-31		Undefined
32	Error	Busy
33-127		Undefined

10.3 Command #130: Read Sensor Offset

This command is to read the sensor offset. See User Manual for more details about this parameter.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Offset value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-31		Undefined
32	Error	Busy
33-127		Undefined

10.4 Command #131: Write Sensor Offset

This command is to write the sensor offset. This value is added directly to the measured value.

Request Data Bytes

Byte	Format	Description
0-3	Float	Offset value

Response Data Bytes

Byte	Format	Description
0-3	Float	Offset value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes received
6-8		Undefined
9	Error	Offset value too high
10	Error	Offset value too low
11-31		Undefined
32	Error	Busy
33-127		Undefined

10.5 Command #132: Read Initial Time

This command is to read the initial time. This initial time is used as a start-up delay time to warm up the device before it is fully operational (see Section 12.2). See User Manual for more details about this parameter.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of hours
1	Unsigned-8	Number of minutes

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-31		Undefined
32	Error	Busy
33-127		Undefined

10.6 Command #133: Write Initial Time

This command is to write the initial time.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of hours
1	Unsigned-8	Number of minutes

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of hours
1	Unsigned-8	Number of minutes

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes received
6-8		Undefined
9	Error	Initial time (hour) too high
10		Undefined
11	Error	Initial time (min) too high
12-31		Undefined
32	Error	Busy
33-127		Undefined

10.7 Command #134: Read Communication Configuration

This command is to read the communication configuration. Returned information includes address of device and baud rate. See User Manual for more details about these parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Address of device
1	Enum	Baud rate (see Section 11.3)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-31		Undefined
32	Error	Busy
33-127		Undefined

10.8 Command #135: Write Communication Configuration

This command is to write the communication configuration.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Address of device
1	Enum	Baud rate

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Address of device
1	Enum	Baud rate

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes received
6-8		Undefined
9	Error	Invalid address setting
10-31		Undefined
32	Error	Busy
33-127		Undefined

10.9 Command #136: Read Display Scale Range

This command is to read the display scale range. See User Manual for more details about this parameter.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Float	Display scale range

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Code	Class	Description
1-31		Undefined
32	Error	Busy
33-127		Undefined

10.10 Command #137: Write Display Scale Range

This command is to write the display scale range.

Request Data Bytes

Byte	Format	Description
0-4	Float	Display scale range

Response Data Bytes

Byte	Format	Description
0-4	Float	Display scale range

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes received
6-8		Undefined
9	Error	Display scale range too high
10	Error	Display scale range too low
11-31		Undefined
32	Error	Busy
33-127		Undefined

10.11 Command #138: Set Analog Input Zero

This command is to implement the analog input zero calibration. See User Manual for more details about the calibration sequence.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-8		Undefined

Code	Class	Description
9	Error	Applied process failed! The value applied for zero calibration is too large
10-31		Undefined
32	Error	Busy
33-127		Undefined

10.12 Command #139: Set Analog Input Span

This command is to implement the analog input span calibration. See User Manual for more details about the calibration sequence.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-9		Undefined
10	Error	Applied Process Failed! The value applied for span calibration is too small. Display Scale Range is returned to the previous value
11-31		Undefined
32	Error	Busy
33-127		Undefined

11. TABLES

11.1 Alarm Type Codes

0	H&L (PV value > Alarm 1 setpoint and PV value < Alarm 2 setpoint)
1	L&H (PV value < Alarm 1 setpoint and PV value > Alarm 2 setpoint)
2	L&LL (PV value < Alarm 1 setpoint and PV value < Alarm 2 setpoint)
3	H&HH (PV value > Alarm 1 setpoint and PV value > Alarm 2 setpoint)
4-249	Undefined
250-255	Reserved

11.2 Alarm Reset Type Codes

0	Auto
1	Manual
2-249	Undefined
250-255	Reserved

11.3 Baud rate Codes

0	4800 bps
1	9600 bps
2	19200 bps
3	38400 bps
4	57600 bps
5-249	Undefined
250 - 255	Reserved

11.4 Unit Codes

(a subset of HART Common Table 2, Unit Codes)

57	%
139	ppm
161	%LEL
169	ppb

12. PERFORMANCE

12.1 Sampling Rates

Typical sampling rates are shown in the following table.

Primary concentration sensor sample	10 per second
PV digital value calculation	5 per second
Analog output update	5 per second

12.2 Power-Up

On power-up, a start-up delay is applied to warm up the device. This time delay can be set by Command 133. The default value is 1 minute. During this period, the device still responds to the HART command but the analog output is fixed at 4 mA.

The time is counted down and its value is displayed on the LCD screen. When the warming-up period is completed, the LCD will display the measured value, and the analog output moves to a value representing the measurement.

Fixed-current mode is canceled by power loss.

12.3 Reset

Command 42 ("Device Reset") causes the device to reset its microprocessor. The resulting restart is identical to the normal power-up sequence. (See Section 12.2.)

12.4 Self-Test

This Field Device does not support Self-Test.

12.5 Command Response Times

Minimum	500ms
Typical	600ms
Maximum	700ms

12.6 Busy and Delayed-Response

The transmitter may respond with a "busy" status if a further command is received while a command is executing.

Delayed-response is not used.

12.7 Long Messages

The largest data field used is in the response to Command 9: 39 bytes including the two status bytes.

12.8 Non-Volatile Memory

FLASH is used to hold the device's configuration parameters. New data is written to this memory immediately on the execution of a write command.

12.9 Modes

Fixed current mode is implemented, using Command 40. This mode is cleared by a power loss or reset.

12.10 Write Protection

This Field Device does not support Write Protection.

12.11 Damping

Damping is not implemented on this Field Device.

ANNEX A. CAPABILITY CHECKLIST

Refer to User Manual for more details.

Manufacturer, model and revision	GASDNA DA-500, rev. 1
Device type	Transmitter
HART revision	7.6
Device Description available	Yes
Number and type of sensors	1(external sensor)
Number and type of actuators	0
Number and type of host side signals	1: 4 - 20mA analog
Number of Device Variables	0
Number of Dynamic Variables	1
Mappable Dynamic Variables?	No
Number of common-practice commands	5
Number of device-specific commands	12
Bits of additional device status	2
Alternative operating modes?	No
Burst mode?	No
Write-protection?	No

ANNEX B. DEFAULT CONFIGURATION

Refer to the User Manual for more details.

Parameter	Default value
Lower Range Value	0.0
Upper Range Value	25.0
PV Units	%
Polling address	0
Number of response preambles	5

ANNEX C. REVISION HISTORY

This Field Device Specification has no revision history