ADDENDUM TO OPERATING INSTRUCTIONS

ZIRKOR200

HART Protocol

SICK
Sensor Intelligence.

Described product

ZIRKOR200 HART Protocol

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Legal information

Original document

This document is an original document of SICK AG.

Contents

1 Introduction

1.1 Scope

The ZIRKOR oxygen analyzer complies with HART protocol revision 7.0. This document specifies all the device specific features and documents HART protocol implementation details (e.g. the engineering unit code supported). The functionality of this field device described sufficiently 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 ZIRKOR Installation & Operation 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 References

- HART Smart Communications Protocol Specification. HCF_SPEC-12. Available from the HCF
- ZIRKOR Installation & Operation Manual

2 Device Specific Information

2.1 Device Identification

Manufacturer ID Code :	24621 (602D HEX)	**Device Type Code :**	57555 (E0D3 HEX)
HART Protocol Revision :	7.0	**Device Revision :**	1
Number of Device Variables :	3		
Physical Layers Supported :	FSK		
Physical Device Category :	Transmitter		

2.2 Device Variables

There are three device variables:

Num	Name	Classification	Unit Codes	Min/Max
0	Oxygen level	81	% (0x5159)	0/25
1	O2 sensor voltage	83	mV (0x5324)	n/a
2	O2 sensor temperature	64	°C (0x4020)	n/a

2.3 Dynamic Variables

Three dynamic variables are supported.

The assignment of the dynamic variables is fixed.

2.4 Status Information

2.4.1 Device Status

The device status is binary coded.

Bit 7 (“Field Device Malfunction”) is set when there is a permanent failure of the device.

- Internal communication error
- ZIRKOR fatal error

Bit 5 (“Cold Start”) is set at power-up.

Bit 4 (“More Status Available”) is set whenever any alarm or failure is detected. Command #48 gives further details.

Bit 2 (“Analog Output Saturated”). A linear range is allowed from 3.6 mA to 20.4 mA. When the loop current reaches these levels, the flag “Analog Output Saturated” is set.

Bit 0 (“PV Out of Range”) is set if the primary value (PV) is exceeding the sensor limits.

2.4.2 Extended Device Status

The field device cannot predict, in advance, when the maintenance will be required. This bit is set if an electronic or mechanical failure is detected. It will be identical to the “Field Device Malfunction” flag. “Device Variable Alert” is not used.

2.4.3 Additional Device Status (Command #48)

Command #48 returns 25 byte of data, with the following status information:

Byte	Bit	Meaning	Class	Device Status Bit Set
0	0	O2 sensor offset out of tolerance	Warning	4
	1	O2 sensor slope out of tolerance	Warning	4
	2	Reference air flow too low	Error	4, 7
	3	Test gas flow too low	Error	4, 7
	4	System not heating up	Error	4, 7
	5	Thermocouple failure	Error	4, 7
	6	O2 sensor signal out of range	Error	4, 7
	7	Error probe heater	Error	4, 7
1	0	Electronic temperature out of specification	Warning	4
	1	Probe temperature too low	Warning	4
	2	Probe temperature too high	Warning	4
	3	O2 limit alarm 1	Warning	4
	4	O2 limit alarm 2	Warning	4
	5	Data fault EEprom, Hardware Error	Error	4, 7
	6	Memory measured value active	Warning	4
	7	Auto calibration error	Error	4, 7
2	0-7	Not used		
3	0-7	Not used		
4	0-7	Not used		
5	0	O2 sensor calibration ok	Mode	
	1	O2 sensor calibration fault	Error	4
	2	O2 sensor calibration active	Mode	
	3	O2 sensor calibration pending	Mode	
	4-7	Not used		
6	0-7	Not used		
8	0-7	Standardized status 0		
9	0-7	Standardized status 1		
10	0	Analog channel 0 saturated		
	1	Analog channel 1 saturated		
	2	Analog channel 2 saturated		
	3	Analog channel 3 saturated		
	4-7	Not used		
11	0-7	Standardized status 2		
12	0-7	Standardized status 3		
13	0	Analog channel 0 fixed		
	1	Analog channel 1 fixed		
	2	Analog channel 2 fixed		
	3	Analog channel 3 fixed		
	4-7	Not used		
14-24	0-7	Not used		

Not used bits are always set to 0.

3 Commands

3.1 Universal Commands

#14	Units for sensor limits and minimum span are fixed as % (unit code 57 decimal)

3.2 Common-Practice Commands

3.2.1 Supported Commands

The following common-practice commands are implemented:

#33	Read dynamic variables
#34	Write damping value
#35	Write range values
#42	Perform master reset
#47	Write transfer function
#49	Write primary value (PV) sensor serial number
#59	Write number of preambles

3.2.2 Burst Mode

ZIRKOR supports the following burst mode commands:

#109	Write burst mode command number
#110	Burst mode control

3.2.3 Catch Device Variable

ZIRKOR does not support catch device variable.

3.2.4 Device Specific Commands

The following device-specific commands are implemented:

#200	Read ftype data
#201	Write ftype data
#202	Read ntype data
#203	Write ntype data
#204	Read utype data
#205	Issue execute command

3.2.5 Command #200: Read FType Data

The command is used to read float values from the instrument. The float value to read is defined by the code parameter.

Request Data Bytes

Byte	Format	Description
0	Byte	Code

Response Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Float	Data

Command Specific Response Codes

Code	Class	Description
0	Success	No command specific errors
1-5		Undefined
6		Transmitter specific error – internal CRC error
7-127		Undefined

3.2.6 Command #201: Write FType Data

The command is used to write float values to the instrument. The parameter to write is defined by the code parameter.

Request Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Float	Data (to write)

Response Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Float	Data (written)

Command Specific Response Code

Code	Class	Description
0	Success	No command specific errors
1		Undefined
2		Invalid selection
3-4		Undefined
5		Too few data bytes received
6		Transmitter specific error – internal CRC error
7-127		Undefined

3.2.7 Command #202: Read NType Data

The command is used to read long integer values from the instrument. The parameter to read is defined by the code parameter.

Request Data Bytes

Byte	Format	Description
0	Byte	Code

Response Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Long	Data

Command Specific Response Codes

Code	Class	Description
0	Success	No command specific errors
1-5		Undefined
6		Transmitter specific error – internal CRC error
7-127		Undefined

3.2.8 Command #203: Write NType Data

The command is used to write long integer values to the instrument. The parameter to write is defined by the code parameter.

Request Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Long	Data (to write)

Response Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Long	Data (written)

Command Specific Response Codes

Code	Class	Description
0	Success	No command specific errors
1		Undefined
2		Invalid selection
3-4		Undefined
5		Too few data bytes received
6		Transmitter specific error – internal CRC error
7-127		Undefined

3.2.9 Command #204: Read UType Data

The command is used to read short integer values from the instrument. The parameter to read is defined by the code parameter.

Request Data Bytes

Byte	Format	Description
0	Byte	Code

Response Data Bytes

Byte	Format	Description
0	Byte	Code
1	Byte	Dimension
2-5	Short	Data

Command Specific Response Codes

Code	Class	Description
0	Success	No command specific errors
1-5		Undefined
6		Transmitter specific error – internal CRC error
7-127		Undefined

3.2.10 Command #205: Issue Execute Function

Commands to start execution of function in the analyzer. The command is used to start calibration of the analyzer.

Request Data Bytes

Byte	Format	Description
0	Byte	Code

Response Data Bytes

Byte	Format	Description
0	Byte	Code

Command Specific Response Codes

Code	Class	Description
0	Success	No command specific errors
1		Undefined
2		Invalid selection
3-4		Undefined
5		Too few data bytes received
6		Transmitter specific error – internal CRC error
7-127		Undefined

4 Tables

4.1 Transfer Function Code

0	Linear
1-255	Undefined

4.2 Codes

Code	Meaning	Type	Access
0	Oxygen value	FType	Read
1	O2 sensor voltage	FType	Read
2	O2 sensor temperature	FType	Read
3	O2 current output	FType	Read
4	Status signals	NType	Read/Write
5	O2 calibration status	UType	Read
6-9	Not defined		
10	O2 sensor offset	FType	Read/Write
11	O2 sensor slope	FType	Read/Write
12	O2 limit1 alarm	FType	Read/Write
13	O2 limit1 alarm function	NType	Read/Write
14	O2 limit2 alarm	FType	Read/Write
15	O2 limit2 alarm function	NType	Read/Write
16	O2 lower range	FType	Read/Write
17	O2 upper range	FType	Read/Write
18	O2 current output average time	NType	Read/Write
19	Not used		
20	O2 single point calibration	NType	Read/Write
21	O2 two point calibration	NType	Read/Write
22-25	Not used		
26	Device type	UType	Read
27-255	Not used		

4.3 Units

Code	Unit
0-35	Undefined
36	mA
37-56	Undefinied
57	%
58-250	Undefined
251	No unit
252-255	Undefined

4.4 Write Protect Code

Code	Description
0	Not write protected
1-255	Undefined

4.5 Unit Codes

4.5.1 Oxygen Level Unit Codes

0x5139	%

4.5.2 Temperature Unit Codes

0x4020	°C

4.5.3 O2 Sensor Voltage Unit Codes

0x5324	mV

5 Performance

5.1 Power Up

On power up, the cold flag is set

5.2 Reset

Command #42 – Device Reset – causes the device to reset it communication microcontroller. The resulting restart is identical to the normal power up sequence.

5.3 Busy and Delayed Response

The analyzer may respond with status “busy” to HART commands if a further command is received while the analyzer communication module is occupied with other tasks.

Delayed response is not used.

5.4 Long Messages

Not used

5.5 Non Volatile Memory

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

5.6 Modes

Fixed current mode is not supported by ZIRKOR.

5.7 Write Protection

Write protection is not supported.

6 Appendix

6.1 Capability Checklist

Device Type	Oxygen Analyzer
HART Revision	7.0
Device Description Available	Yes
Number And Type of Sensors	1/1
Number And Type of Host Side Signals	1 : 4-20 mA analog
Number of Device Variables	3
Number of Dynamic Variables	3
Mappable Dynamic Variables	No
Number of Common Practice Commands	9
Number of Device Specific Commands	6
Bits of Additional Device Status	56
Alternative Operating Modes	No
Burst Mode	Yes
Write Protection	No

6.2 Default Configuration

Parameter	**Default Value**
Lower Range Value	0
Upper Range Value	25
Primary Value Unit	%
Write Protection	Off
Transfer Function	Linear
Number of Response Preambles	5

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