IO-Link Data Reference Guide: Q5XKIL and KUL

IO-Link Data Map

This document refers to the following IODD file: Banner_Engineering-Q5X-Analog-20210518-IODD1.1.xml. The IODD file and support files can be found on www.bannerengineering.com, under the download section of the product family page.

Communication Parameters

The following communication parameters are used.

Parameter	Value	Parameter	Value
IO-Link revision	V1.1	Port class	A
Process Data In length	32 bits	SIO mode	Yes
Process Data Out length	8 bits	Smart sensor profile	Yes
Bit Rate	38400 bps	Block parameterization	Yes
Minimum cycle time	3.6 ms	Data Storage	Yes
Device ID	589828	ISDU Supported	Yes

IO-Link Process Data In (Device to Master)

Process Data In is transmitted cyclically to the IO-Link master from the IO-Link device.

The Q5X Analog IO-Link Process Data is 32-bits and includes two types of measurements, and for some configurations, the state of the stability indicator, and the state of both output channels. This information is sent to the IO-Link master every 3.6 ms.

Process Data (If Binary Data Is Included)

Process Data Input			
Subindex	**Name**	**Number of Bits**	**Data Values**
1	BDC1 Output State	1	0 = inactive 1 = active
2	Analog State	1	0 = inactive 1=active
3	Stability State	1	0 = no target/marginal 1 = stable
4	Measurement 1 Value	13	Value depends on "Configuration.Measurement 1 Selection"
5	Measurement 2 Value	16	Value depends on "Configuration.Measurement 2 Selection"

Octet 0								
Subindex	5	5	5	5	5	5	5	5
Bit offset	31	30	29	28	27	26	25	24
Value	0	0	0	0	0	0	1	0

Octet 1								
Subindex	5	5	5	5	5	5	5	5
Bit offset	23	22	21	20	19	18	17	16
Value	1	0	1	1	0	1	1	0

Octet 2								
Subindex	4	4	4	4	4	4	4	4
Bit offset	15	14	13	12	11	10	9	8

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Octet 2								
Value	0	0	0	1	1	1	1	1

Octet 3								
Subindex	4	4	4	4	4	3	2	1
Bit offset	7	6	5	4	3	2	1	0
Value	1	1	1	1	1	1	0	1

Example Based on the Value Above

BDC1 Output = Active
Analog Output = Inactive
Stability State = Stable
Measurement 1 Value = 1023
Measurement 2 Value = 694

Process Data (If Binary Data Is Not Included)

Process Data Input			
Subindex	**Name**	**Number of Bits**	**Data Values**
1	Measurement 1 Value	16	Value depends on "Configuration.Measurement 1 Selection"
2	Measurement 2 Value	16	Value depends on "Configuration.Measurement 2 Selection"

Octet 0								
Subindex	2	2	2	2	2	2	2	2
Bit offset	31	30	29	28	27	26	25	24
Value	0	0	0	0	0	0	1	1

Octet 1								
Subindex	2	2	2	2	2	2	2	2
Bit offset	23	22	21	20	19	18	17	16
Value	0	1	0	0	1	0	1	1

Octet 2								
Subindex	1	1	1	1	1	1	1	1
Bit offset	15	14	13	12	11	10	9	8
Value	0	1	1	0	0	1	1	1

Octet 3								
Subindex	1	1	1	1	1	1	1	1
Bit offset	7	6	5	4	3	2	1	0
Value	1	0	0	0	1	1	1	1

Example Based on the Value Above

Measurement 1 Value = 26511
Measurement 2 Value = 843

Process Data In Measurement Device

Process Data Input			
Subindex	**Name**	**Number of Bits**	**Data Values**
1	Measurement Value	16	The measurement device value
2	Measurement Scale	8	The measurement device scale
3	Stability State	1	0=no target/marginal, 1=stable
4	Analog State	1	0=inactive, 1=active
5	BDC1 Output State	1	0=inactive, 1=active

Octet 0								
Subindex	1	1	1	1	1	1	1	1
Bit offset	31	30	29	28	27	26	25	24
Value	0	0	0	0	0	0	0	1

Octet 1								
Subindex	1	1	1	1	1	1	1	1
Bit offset	23	22	21	20	19	18	17	16
Value	1	1	1	1	1	1	0	1

Octet 2								
Subindex	2	2	2	2	2	2	2	2
Bit offset	15	14	13	12	11	10	9	8
Value	1	1	1	1	1	1	1	0

Octet 3								
Subindex						3	4	5
Bit offset	7	6	5	4	3	2	1	0
Value	N/A	N/A	N/A	N/A	N/A	0	1	0

Example Based on the Value Above

Measurement Value = 509

Measurement Scale = –2

Stability State = no target/marginal

Scaled Measurement Value: 5.09 m

Analog State = Active

BDC1 Output State = Inactive

IO-Link Process Data Out (Master to Device)

Process Data Out transmits cyclically from the IO-Link master to the IO-Link device, which can be used to control the enabling/ disabling of the transducer.

Process Data Output			
Subindex	**Name**	**Number of Bits**	**Data Values**
1	Transducer Disable	1	0 = Active 1 = Inactive

Octet 0								
Subindex	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	1
Bit offset	7	6	5	4	3	2	1	0
Value	0	0	0	0	0	0	0	1

Example Based on the Value Above

Transducer Disable = 1 (Inactive)

Parameters Set Using IO-Link

These parameters can be read from and/or written to an IO-Link model of the Q5X Analog sensor. Also included is information about whether the variable in question is saved during Data Storage and whether the variable came from the IO-Link Smart Sensor Profile.

Unlike Process Data In, which is transmitted from the IO-Link device to the IO-Link master cyclically, these parameters are read or written acyclically as needed.

Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
0	1-16	Direct Parameter Page 1 (incl. Vendor ID & Device ID)				ro		
1		**Direct Parameters 2**						
2		Standard Command	8-bit Uinteger	65 = SP1 Single Value Teach 67 = SP1 Two Value Teach TP1 68 = SP1 Two Value Teach TP2 71 = SP1 Dynamic Teach Start 72 = SP1 Dynamic Teach Stop 78 = SP1 Save Teach 79 = SP1 Teach Exit 130 = Restore Factory Settings 160 = Laser Off 161 = Laser On 162 = Start discovery 163 = Stop discovery		wo		y
12		**Device Access Locks**						
	1	Parameter Write Access Lock		0 = off 1 = on	0	rw		
	2	Data Storage Lock		0 = off, 1 = on	0	rw		
	3	Local Parameterization Lock		0 = off, 1 = on	0	rw		
	4	Local User Interface Lock		0 = off, 1 = on	0	rw		
16		Vendor Name string		Banner Engineering Corporation		ro		
17		Vendor Text string		More Sensors. More Solutions.		ro		
18		Product Name string		Q5X		ro		
19		Product ID string		Q5XKULAF2000-Q8 or Q5XKILAF2000-Q8		ro		
20		Product Text string		Laser Measurement Sensor		ro		
21		Serial Number				ro		
23		Firmware Version				ro		
24		App Specific Tag (user defined)				rw	y	
36		Device Status	8-bit integer	0=Device is OK 4=Failure		ro		
37		Detailed Device Status	Array[6] of 3-octet			ro		
40		Process Data Input		see Process Data In		ro		
41		Process Data Output		see Process Data Out		ro		
58		**Teach-in Channel**						
58	1	Teach-in Channel	8-bit Uinteger	0 = Default, 1 = BDC1, 192 = AO1	0	rw		y
59		**Teach-In Status**						
	1	Teach State	4-bit integer	0 = Idle 1 = SP1 Success 4 = Wait for Command 5 = Busy 7 = Error		ro		y
	2	SP1 TP1	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
	3	SP1 TP2	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
60		**BDC1 Setpoints**						

Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
	1	BDC1 Setpoint SP1	32-bit integer	50 mm..3000 mm	250 mm	rw	y	y
	2	BDC1 Setpoint SP2 (FGS mode only)	32-bit integer	50 mm..3000 mm	0 mm	rw	y	y
61		**BDC1 Configuration**						
	1	BDC1 Switchpoint Logic	8-bit integer	0 = LO, 1 = DO	0	rw	y	y
	2	BDC1 Mode	8-bit integer	1 = One-Point BGS 128 = Two-Point static BGS 129 = Dynamic BGS 130 = One-Point Window (FGS) 131 = Dual Teach	128	rw	y	y
	3	BDC1 Hysteresis	16-bit integer	–3000 mm..+3000 mm	0	rw	y	y
64		**Configuration**						
	1	Response Speed	8-bit Uinteger	0 = 0.5ms 1 = 1.0ms 2 = 2.0ms 3 = 3.0ms 4 = 5.0ms	3	rw	y	
	2	Secondary Output Function	8-bit Uinteger	0 = Disabled 1 =Remote Teach Input 2 = Laser Off 3 = Laser On 4 = Master 5 = Slave 6 = Trigger	0	rw	y	
	3	Zero Reference Location	8-bit Uinteger	0 = Near, 1 = Far	0	rw	y	
	4	Shift Zero Reference After Teach	8-bit Uinteger	0=Off, 1=Off	0	rw	y	
	5	Display Read	8-bit Uinteger	0 = On 1 = On, Inverted 2 = Off 3 = Off, Inverted	0	rw	y	
	6	Display Units	8-bit Uinteger	0 = Centimeters 1 = Inches 2 = Millimeters	0	rw	y	
	7	Pushbutton Lockout	8-bit Uinteger	0 = No Lock-out 1 = Pushbuttons Locked 2 = Operator Lockout	0	rw	y	
	8	Output Polarity	8-bit Uinteger	0 = Default, 1 = PNP, 2 = NPN	0	rw	y	
	9	IOL Filter Time	16-bit Uinteger	0-65535	0	rw	y	
	10	Include Binary Data in Process Data	8-bit Uinteger	0 = Include 1 = Don't Include 2 = Measurement Device	0	rw	y	
	11	Process Data Measurement 1 Selection	8-bit Uinteger	0 = Disabled 1 = Excess Gain 2 = Excess Gain ÷ 10 3 = Channel 1 Dual Mode Percent 4 = Analog Output Value ÷ 10	1	rw	y	
	12	Process Data Measurement 2 Selection	8-bit Uinteger	0 = Disabled 1 = Distance Measurement Value 2 = Displayed Distance Measurement Value 3 = Analog Output Value	1	rw	y	
65		**BDC1 Vendor Specific Configuration**						
	1	BDC1 Delay Mode	8-bit Uinteger	0 = Disabled 1 = On-Off Delay 2 = Oneshot 3 = Totalizer	0	rw	y	
	2	BDC1 Delay Time 1	32-bit Uinteger	0..90000	0ms	rw	y	

Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
	3	BDC1 Delay Time 2	32-bit Uinteger	0..90000	0ms	rw	y	
	4	BDC1 BGS Teach Offset Mode	8-bit Uinteger	0 = Auto, 1 = User Selected	0	rw	y	
	5	BDC1 FGS Window Size Mode	8-bit Uinteger	0 = Auto, 1 = User Selected	0	rw	y	
	6	BDC1 User Teach Offset	16-bit integer	-2905 mm..+2905 mm	0mm	rw	y	
	7	BDC1 FGS User Window Size	16-bit integer	0 mm..2905 mm	0mm	rw	y	
	8	BDC1 Auto-Thresholding	8-bit Uinteger	0 = On 1 = Off 2 = High Speed	1	rw	y	
67		**Status**						
	1	Measurement 1 Value	32-bit integer			ro		
	2	Excess Gain	32-bit integer			ro		
	3	Stability	8-bit Uinteger	0=No target 1=Marginal/Multiple Peaks 2=Stable		ro		
	4	Multiple Peak State	8-bit Uinteger	0 = Multiple peaks not present 1 = Multiple peaks present		ro		
	5	Emitter Status	8-bit Uinteger	0 = Active, 1 = Inactive		ro		
	6	Laser Fault Status	8-bit Uinteger	0 = Not present, 1 = Laser fault present		ro		
	7	BDC1 Totalizer Counts	16-bit Uinteger			ro		
	8	Analog Output Value	16-bit Uinteger			ro		
69		**All-Time Run Time**						
	1	Run counter (0.25 hr)	32-bit Uinteger			ro		
70		**Resettable Run Time**						
	1	Run counter (0.25 hr)	32-bit Uinteger		0	rw		
72		**Display String**						
	1	Line 1	5-octet String US_ASCII			ro		
74		**AO1 Setpoints**						
	1	Analog Setpoint SP1	32-bit Uinteger	95 mm..2905 mm		rw	y	
	2	Analog Setpoint SP2	32-bit Uinteger	95 mm..2905 mm		rw	y	
75		**AO1 Configuration**						
	1	Output Type	8-bit Uinteger	0 = 4-20 mA, 1 = 0-10 V		rw	y	
	2	Teach Selection	8-bit Uinteger	0 = 2-point, 1 = 1-point	0	rw	y	
	3	Slope	8-bit Uinteger	0 = Positive, 1 = Negative	0	rw	y	
	4	Loss of Signal	8-bit Uinteger	0 = Hold, 1 = Low, 2 = High	1	rw	y	
	5	Midpoint Teach Offset Size	32-bit integer	-2905 mm..2905 mm	0	rw	y	
	6	Trigger	8-bit Uinteger	0 = Trigger Sample 1 = Trigger Average 2 = Trigger Max 3 = Trigger Min 4 = Trigger Range 5 = Trigger Track Max 6 = Trigger Track Min	1	rw	y	
	7	Average	8-bit Uinteger	0 = 1 1 = 2 2 = 4 3 = 8 4 = 16 5 = 32 6 = 64 7 = 128 8 = 256 9 = 512	4	rw	y	
76		**All-Time Run Time Event Time**						

Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
	1	Event Time (0.25 hr)	32-bit Uinteger	0..2147483647	0	rw	y	
77		**Resettable Run Time Event Time**						
	1	Event Time (0.25 hr)	32-bit Uinteger	0..2147483647	0	rw	y	
16512		**MDC Descriptor**		**Measuring Data Channel Descriptor - Smart Sensor Profile 2nd Edition**				
16512	1	Lower Limit	32-bit integer			ro		
16512	2	Upper Limit	32-bit integer			ro		
16512	3	Unit	16-bit uinteger	1010 = m		ro		
16512	4	Scale	8-bit integer	-2 = range shift of 10^{-2}		ro		

IO-Link Events

Events are acyclic transmissions from the IO-Link device to the IO-Link master. Events can be error messages and/or warning or maintenance data.

Code	Type	Description
25376 (0×6320)	Error	Parameter error (check datasheet and values)
36000 (0×8CA0)	Warning	All-time Run Time Event (Event indicating the corresponding configured running time has elapsed.)
36001 (0×8CA1)	Warning	Resettable Run Time Event (Event indicating the corresponding configured running time has elapsed.)
36003 (0×8CA3)	Notification	Teach Completed Event (Event indicating a teach has been completed.)
36004 (0×8CA4)	Notification	Factory Settings Restored Event (Event indicating that the factory settings have been restored.)
36005 (0×8CA5)	Notification	Teach Coerced Event (Event indicating a taught condition resulting in a setpoint being coerced. Taught was updated.)
36007 (0×8CA7)	Notification	Teach Failed Event (Event indicating an invalid target condition was attempted to be taught. Taught setpoint was not updated.)
36096 (0×8d00)	Error	Laser fault event (laser shut down for safety)
36097 (0×8D01)	Error	System Fault Event (Contact Banner Engineering to resolve.)

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