IO-Link Data Reference Guide: Q4X Sensor

IO-Link Data Map

This document refers to the following IODD file: Banner_Engineering-Q4X-20150313-IODD1.1.xml for 100/110 mm and 300/310 mm models, and Banner_Engineering-Q4X-600mm-20161205-IODD1.1.xml for 600/610 mm models. 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
IO-Link revision	V1.1
Process Data In length	16 bits
Process Data Out length	N/A
Bit Rate	38400 bps
Minimum cycle time	2.7 ms

Parameter	Value
Port class	A
SIO mode	Yes
Smart sensor profile	Yes
Block parameterization	Yes
Data Storage	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 Q4X IO-Link Process Data is 16 bits in size and includes the measurement distance as shown on the Q4X display (listed in the Process Data in tenths of a millimeter), the state of the stability indicator, and the state of both Q4X output channels. This information is sent to the IO-Link master every 2.7 ms. In Dual TEACH mode, the distance value changes to a percentage value displayed as a whole number.

Process Data Input			
Subindex	Name	Number of Bits	Data Values
1	Channel 1 Output State	1	0=inactive, 1=active
2	Channel 2 Output State	1	0=inactive, 1=active
3	Stability State	1	0=no target/marginal, 1=stable
4	Measurement Value	13	Value in tenths of millimeter

Octet 0								
Subindex	4	4	4	4	4	4	4	4
Bit offset	15	14	13	12	11	10	9	8
Value	0	0	0	1	1	0	1	1

Octet 1								
Subindex	4	4	4	4	4	3	2	1
Bit offset	7	6	5	4	3	2	1	0
Value	1	0	0	1	1	1	0	1
Example	Measured Value (uses bit offset 3 to 15)					Stability State	Channel 2 Output	Channel 1 Output
	88.3 mm					Stable	Inactive	Active

IO-Link Process Data Out (Master to Device)

Not applicable.

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Parameters Set Using IO-Link

These parameters can be read from and/or written to an IO-Link model of the Q4X Laser 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	Sub-Index	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile?	AOI
0	1–16	Direct Parameter Page 1 (incl. Vendor ID & Device ID)				ro			
1	1–16	Direct Parameters Page 2				rw			
2		Standard Command		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 79 = S1 Exit Teach 130 = Restore Factory Settings 160 = Laser Off 161 = Laser On 162 = Start Discovery 163 = Stop Discovery		wo		y	y
3		Data Storage Index (device-specific list of parameters to be stored)				rw			
4–11		*reserved by IO-Link Specification*							
12		**Device Access Locks**							
12	1	Parameter Write Access Lock		0 = off 1 = on	0	rw	y		y
12	2	Data Storage Lock		0 = off 1 = on	0	rw	y		y
12	3	Local Parameterization Lock		0 = off 1 = on	0	rw	y		y
12	4	Local User Interface Lock		0 = off 1 = on	0	rw	y		y
13		Profile Characteristic				ro		y	
14		PDInput Descriptor				ro		y	
15		*unused*							
16		Vendor Name string			Banner Engineering Corp	ro			
17		Vendor Text string				ro			
18		Product Name string				ro			
19		Product ID string				ro			
20		Product Text string				ro		y	
21		Serial Number				ro			
22		Hardware Revision				ro			
23		Firmware Version				ro		y	
24		App Specific Tag (user defined)				rw	y	y	
25–31		*reserved*							
32		Error Count				ro			
33–39		*reserved*							
40		Process Data Input				ro			
41–57		*unused/reserved*							

Index	Sub-index	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile?	AOI
58		Teach-in Channel		0 = Default 1 = BDC1 2 = BDC2	0	rw		y	y
59		**Teach-In Status**							
59	1	Teach State	4-bit Integer	0 = Idle 1 = SP1 Success 4 = Wait for Command 5 = Busy 7 = Error		ro		y	
59	2	SP1 TP1	1-bit	0 = Teachpoint 1 not taught or the last attempt to teach was not successful 1 = Teachpoint 1 was successfully taught		ro		y	y
59	3	SP1 TP2	1-bit	0 = Teachpoint 2 not taught or the last attempt to teach was not successful 1 = Teachpoint 2 was successfully taught		ro		y	y
60		**BDC1 Setpoints**							
60	1	BDC1 Setpoint SP1 (SP1 switch point in Switch or Window mode) (0.1 mm)	16-bit integer	Q4X100: 250–1000 (25–100 mm) Q4X110: 350–1100 (35–110 mm) Q4X300: 250–3000 (25–300 mm) Q4X310: 350–3100 (35–310 mm) Q4X600: 250–6000 (25–600 mm) Q4X610: 350–6100 (35–610 mm)	Q4X100: 500 (50 mm) Q4X110: 600 (60 mm) Q4X300: 1500 (150 mm) Q4X310: 1600 (160 mm) Q4X600: 3000 (300 mm) Q4X610: 3100 (310 mm)	rw	y	y	y
60	2	BDC1 Setpoint SP2 (SP2 switch point in FGS only) (0.1 mm)	16-bit integer		0	rw	y	y	y
61		**BDC1 Configuration**							
61	1	BDC1 Switchpoint Logic	8-bit integer	0 = LO 1 = DO	0	rw	y	y	y
61	2	BDC1 Mode	8-bit integer	1 = 1-pt BGS 128 = 2-pt BGS 129 = Dynamic BGS 130 = 1-pt Window 131 = Dual Teach	128	rw	y	y	y
61	3	Hysteresis (mm)	16-bit integer	0	0	rw	y	y	y
62		**BDC2 Setpoints**							
62	1	BDC2 Setpoint SP1 (SP1 switch point in Switch or Window mode) (0.1 mm)	16-bit integer	Q4X100: 250–1000 (25–100 mm) Q4X110: 350–1100 (35–110 mm) Q4X300: 250–3000 (25–300 mm) Q4X310: 350–3100 (35–310 mm) Q4X600: 250–6000 (25–600 mm) Q4X610: 350–6100 (35–610 mm)	Q4X100: 500 (50 mm) Q4X110: 600 (60 mm) Q4X300: 1500 (150 mm) Q4X310: 1600 (160 mm) Q4X600: 3000 (300 mm) Q4X610: 3100 (310 mm)	rw	y	y	y
62	2	BDC2 Setpoint SP2 (SP2 switch point in FGS only) (0.1 mm)	16-bit integer		0	rw	y	y	y
63		**BDC2 Configuration**							
63	1	BDC2 Switchpoint Logic	8-bit integer	0 = LO 1 = DO	0	rw	y	y	y
63	2	BDC2 Mode	8-bit integer	1 = 1-pt BGS 128 = 2-pt BGS 129 = Dynamic BGS 130 = 1-pt Window 131 = Dual Teach	128	rw	y	y	y
63	3	Hysteresis (0.1 mm)	16-bit integer	0	0	rw	y	y	y
64		**Configuration**							

Index	Sub-index	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile?	AOI
64	1	Response Speed (ms)	8-bit integer	0 = 1.5 ms (Q4X100/110/300/310) or 2 ms (Q4X600/610) 1 = 3 ms (Q4X100/110/300/310) or 5 ms (Q4X600/610) 2 = 10 ms (Q4X100/110/300/310) or 15 ms (Q4X600/610) 3 = 25 ms 4 = 50 ms	Q4X100/110/ 300/310: 2 Q4X600/610: 3	rw	y		y
64	2	Gain	8-bit integer	0 = High 1 = Standard	1	rw	y		y
64	3	Secondary Output Function	8-bit integer	0 = Independent 1 = Complementary 2 = Remote Teach Input 3 = Laser Off 4 = Laser On 5 = Master 6 = Slave 7 = Pulse Frequency Modulation	0	rw	y		y
64	4	Zero Reference Location	8-bit integer	0 = Near 1 = Far	0	rw	y		y
64	5	Shift Zero Reference After Teach	8-bit integer	0 = On 1 = Off	0	rw	y		y
64	6	Display Read	8-bit integer	0 = On 1 = On + Inverted 2 = Off 3 = Off + Inverted	0	rw	y		y
64	7	Pushbutton Lockout	8-bit integer	0 = No 1 = Pushbutton Lock 2 = Operator Lockout	0	rw	y		y
64	8	IOL Filter Time (ms)	16-bit integer	0–65535	0	rw	y		y
65		**BDC1 Vendor Specific Configuration**							
65	1	BDC1 Delay Mode	8-bit unsigned integer	0 = Disabled 1 = On/Off Delay 2 = Oneshot 3 = Totalizer	0	rw	y		y
65	2	BDC1 Delay Timer 1 (ms)	32-bit integer	0–9999	0	rw	y		y
65	3	BDC1 Delay Timer 2 (ms)	32-bit integer	0–9999	0	rw	y		y
65	4	BDC1 Teach Offset Mode	8-bit unsigned integer	0 = Auto 1 = User Selected	0	rw	y		y
65	5	BDC1 User Teach Offset (0.1 mm)	16-bit integer	Q4X100/110: –750–+750 (–75–+75 mm) Q4X300/310: –2750–+2750 (–275–+275 mm) Q4X600/610: –5750–+5750 (–575–+575 mm)	0	rw	y		y
65	6	FGS Window Size (0.1 mm)	16-bit integer	Q4X100/110: 0–750 (0–75 mm) Q4X300/310: 0–2750 (0–275 mm) Q4X600/610: 0–5750 (0–575 mm)	0	rw	y		y
65	7	BDC1 Auto Thresholding (Dual mode only)	8-bit unsigned integer	0 = On 1 = Off 2 = High Speed	0	rw	y		y
66		**BDC2 Vendor Specific Configuration**				rw			
66	1	BDC2 Delay Mode	8-bit unsigned integer	0 = Disabled 1 = On/Off Delay 2 = Oneshot 3 = Totalizer	0	rw	y		y

Index	Sub-index	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile?	AOI
66	2	BDC2 Delay Timer 1 (ms)	32-bit integer	0–9999	0	rw	y		y
66	3	BDC2 Delay Timer 2 (ms)	32-bit integer	0–9999	0	rw	y		y
66	4	BDC2 Teach Offset Mode	8-bit unsigned integer	0 = Auto 1 = User Selected	0	rw	y		y
66	5	BDC2 User Teach Offset (0.1 mm)	16-bit integer	Q4X100/110: –750–+750 (–75–+75 mm) Q4X300/310: –2750–+2750 (–275–+275 mm) Q4X600/610: –5750–+5750 (–575–+575 mm)	0	rw	y		y
66	6	FGS Window Size (0.1 mm)	16-bit integer	Q4X100/110: 0–750 (0–75 mm) Q4X300/310: 0–2750 (0–275 mm)	0	rw	y		y
66	7	BDC2 Auto Thresholding (Dual mode only)	8-bit unsigned integer	0 = On 1 = Off 2 = High Speed	0	rw	y		y
67		**Status**							
67	1	Measurement Value (distance in 0.1 mm)	16-bit integer			ro			y
67	2	Excess Gain Percent (%)	64-bit integer	0–18446744073709551615	0	ro			y
67	3	Stability	8-bit unsigned integer	0 = No target 1 = Marginal/Multiple Peaks 2 = Stable		ro			y
67	4	Multiple Peak State	8-bit unsigned integer	0 = Present 1 = Not Present		ro			y
67	5	Laser Fault Status	8-bit unsigned integer	0 = No Fault 1 = Fault Present		ro			y
67	6	BDC1 Totalizer Counts	16-bit unsigned integer	0–65535	0	ro			y
67	7	BDC2 Totalizer Counts	16-bit unsigned integer	0–65535	0	ro			y
68		**Statistics**							
68	1	Number of Samples	16-bit unsigned integer	0–65535	0	ro			
68	2	Sum	32-bit unsigned integer	0–4294967295	0	ro			
68	3	Sum Squared	64-bit unsigned integer	0–65535	0	ro			
68	4	Minimum	16-bit unsigned integer	0–65535	0	ro			
68	5	Maximum	16-bit unsigned integer	0–65535	0	ro			
69	1	All-time Run Time (0.25 hr)	32-bit unsigned integer	0–4294967295	0	ro			
70	1	Resetable Run Time (0.25 hr)	32-bit unsigned integer	0–4294967295	0	rw			
71		**Pulse Frequency Configuration**							
71	1	Near Frequency (Hz)	16-bit unsigned integer	10–45000	100	rw	y		y
71	2	Far Frequency (Hz)	16-bit unsigned integer	10–45000	600	rw	y		y
72		Display String	8-octet String US_ASCII			ro			y

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 (0x6320)	Error	Parameter error (verify inputs are valid)
36096 (0x8d00)	Error	Laser fault event (laser shut down for safety)

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