IO-Link Data Reference Guide: Q90R Analog (KI Models)

IO-Link Data Map

This document refers to the following IODD file: Banner_Engineering-Q90R-Analog-20240124-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	48-bit		SIO mode	Yes
Process Data Out length	N/A		Smart sensor profile	Yes
Bit Rate	38400 bps		Block parameterization	Yes
Minimum cycle time	3.9 ms		Data Storage	Yes
			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 Q90R IO-Link Process Data is 48-bits and can be configured using parameter data to include the measurement distance, the state of the stability indicator, and/or the state of both output channels. This information is sent to the IO-Link master every 3.9 ms.

Process Data Configuration 1: Digital Measurement Sensor

Type the short description of the topic here

Subindex	Name	Number of Bits	Data Values
1	Distance Measurement Value	32	0 to 21000(1)
2	Measurement Scale	8	-3 = range shift of 10^{-3}
3	Stability State	1	0 = no target or marginal, 1 = valid
4	BDC1 State	1	0 = Inactive, 1 = Active
5	AO1 State	1	0 = Inactive, 1 = Active

Octet 0								
Subindex	1	1	1	1	1	1	1	1
Bit offset	47	46	45	44	43	42	41	40
Value	0	0	0	0	0	0	0	0

Octet 1								
Subindex	1	1	1	1	1	1	1	1
Bit offset	39	38	37	36	35	34	33	32
Value	0	0	0	0	0	0	0	0

Octet 2								
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	1	0	1

(1) Measurement Value Exceptions:
- Out of range (-) = –2147483640
- Out of range (+) = 2147483640
- No measurement data = 2177483644

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Octet 3								
Subindex	1	1	1	1	1	1	1	1
Bit offset	23	22	21	20	19	18	17	16
Value	1	0	0	1	0	1	1	0

Octet 4								
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	0	1

Octet 5								
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	1	1	1

Example with Digital Measurement Sensor

Based on the values in the Digital Measurement Sensor example:

- Measurement Value: 1430
- Measurement Scale: -3
  Scaled Measurement Value: 1.430m
- Stability State : Valid
- BDC1 State: Active
- AO1 State: Active

Process Data Configuration 2: Distance and Excess Gain

Type the short description of the topic here

Subindex	Name	Number of Bits	Data Values
1	Distance Measurement Value	32	0 to 21000
2	Excess Gain Measurement Value	16	

Octet 0								
Subindex	1	1	1	1	1	1	1	1
Bit offset	47	46	45	44	43	42	41	40
Value	0	0	0	0	0	0	0	0

Octet 1								
Subindex	1	1	1	1	1	1	1	1
Bit offset	39	38	37	36	35	34	33	32
Value	0	0	0	0	0	0	0	0

Octet 2								
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	1	0	1

Octet 3								
Subindex	1	1	1	1	1	1	1	1
Bit offset	23	22	21	20	19	18	17	16
Value	1	0	0	1	0	1	1	0

Octet 4								
Subindex	2	2	2	2	2	2	2	2

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

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

Example for Distance and Excess Gain

Based on the values in the Distance and Excess Gain example:

- Measurement Value: 1430 (1.43 m)
- Excess Gain: 509

Process Data Configuration 3: Distance and Excess Gain with Binary Data

Type the short description of the topic here

Process Data In - Distance and Excess Gain with Binary Data			
Subindex	**Name**	**Number of Bits**	**Data Values**
1	Distance Measurement Value	32	0 to 21000
2	Excess Gain Measurement Value	8	(restricted 0–255×)
3	Stability State	1	0=no target or marginal, 1=valid
4	BDC1 State	1	0=inactive, 1=Active
5	AO1 State	1	0=inactive, 1=Active

Octet 0								
Subindex	1	1	1	1	1	1	1	1
Bit offset	47	46	45	44	43	42	41	40
Value	0	0	0	0	0	0	0	0

Octet 1								
Subindex	1	1	1	1	1	1	1	1
Bit offset	39	38	37	36	35	34	33	32
Value	0	0	0	0	0	0	0	0

Octet 2								
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	1	0	1

Octet 3								
Subindex	1	1	1	1	1	1	1	1
Bit offset	23	22	21	20	19	18	17	16
Value	1	0	0	1	0	1	1	0

Octet 4								
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	1

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Octet 5								
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	1	1	1

Example with Distance and Excess Gain with Binary Data

Based on the values in the Distance and Excess Gain with Binary Data example:

- Measurement Value: 1430 (1.43 m)
- Excess Gain: 253
- Stability State: Valid
- BDC1 State: Active
- AO1 State: Active

IO-Link Process Data Out (Master to Device)

Not applicable.

Parameters Set Using IO-Link

These parameters can be read from and/or written to an IO-Link model of the Q90R 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	1-15	Direct Parameter Page 1 (incl. Vendor ID & Device ID)				ro		
0	16	Standard Command		65 = SP1 Single Value Teach 66 = SP2 Single Value Teach 130 = Restore Factory Settings 162 = Start discovery 163 = Stop discovery		wo		
1	1-16	Direct Parameters Page 2				rw		
2		Standard Command	8-bit Uinteger	65 = SP1 Single Value Teach 66 = SP2 Single Value Teach 126 = Locator Start 127 = Locator Stop 129 = Application Reset 131 = Back-to-box		wo		y
3		Data Storage Index (device-specific list of parameters to be stored)						
12		Device Access Locks	16-bit Record					
16		Vendor Name string	64-octet string	Banner Engineering Corporation		ro		
17		Vendor Text string	64-octet string	More Sensors. More Solutions		ro		
18		Product Name string	64-octet string	Q90R		ro		
19		Product ID string	64-octet string			ro		
20		Product Text string	64-octet string	More Sensors. More Solutions		ro		y
21		Serial Number	16-octet string			ro		
22		Hardware Version	64-octet string			ro		
23		Firmware Version	64-octet string			ro		y
24		App Specific Tag (user defined)	32-octet string			rw	y	y
25		Function Tag	32-octet string			rw	y	y
26		Location Tag	32-octet string			rw	y	y
36		Device Status	8-bit Uinteger	0=Device is OK 4=Failure		ro		
37		Detailed Device Status	Array[6] of 3-octet			ro		
38-39		Reserved						
40		Process Data Input		see Process Data In		ro		
41-57		Reserved/Unused						
58		Teach-in Channel	8-bit Uinteger	0=Default, 1=BDC1, 192=AO1	0	rw		
59		**Teach-In Status**						

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Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
59	1	Teach State: 4-bit Integer	4-bit Uinteger	0 = Idle 1 = SP1 Success 2 = SP2 Success 3 = SP1 SP2 Success 4 = Wait for Command 5 = Busy 7 = Error		ro		y
59	2	SP1 TP1	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
59	3	SP1 TP2	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
59	4	SP2 TP1	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
59	5	SP2 TP2	1-bit integer	0 = not taught or unsuccessful 1 = successfully taught		ro		y
60		**BDC1 Setpoints**						
60	1	BDC1 Setpoint SP1 (Switch or Window mode) (mm)	32-bit Integer	100-20000	15000	rw	y	y
60	2	BDC1 Setpoint SP2 (Window mode only) (mm)	32-bit Integer	100-20000 = distance in mm 0 = Switch Point Mode	0	rw	y	y
61		**BDC1 Configuration**						
61	1	BDC1 Switchpoint Logic	8-bit Uinteger	0 = LO (NO), 1 = DO (NC)	0	rw	y	y
61	2	BDC1 Mode	8-bit Uinteger	1 = Switch Mode/Single Point Mode 2 = Window Mode	1	rw	y	y
61	3	Hysteresis	16-bit Uinteger	0–15000	50	rw	y	y
64		**Configuration**						
64	1	Response Speed	8-bit Uinteger	0 = Fast 1 = Medium 2 = Slow	1	rw	y	
64	2	Peak Select Mode	8-bit Uinteger	0 = Strongest Peak, 1 = First Peak	1	rw	y	
64	3	Output Polarity	8-bit Uinteger	0 = NPN, 1 = PNP	1	rw	y	
64	4	Process Data Filter Time (ms)	16-bit Uinteger	0–65535 ms	0	rw	y	
64	5	Process Data Layout	8-bit Uinteger	0=Digital Measurement Sensor 1=Distance and Excess Gain 2=Distance and Excess Gain with Binary Data	0	rw	y	
64	6	Remote Input Mode	8-bit Uinteger	0 = Disabled, 1 = Teach	0	rw	y	
64	7	LEDs Disabled	8-bit Uinteger	0 = Enabled, 1 = Disabled	0	rw	y	
64	8	Minimum amplitude required for target detection	32-bit Integer	100–10000	100	rw	y	
64	9	Limit Filter Enabled	8-bit Uinteger	0 = Disabled, 1 = Enabled	0	rw	y	
64	10	Limit Filter Positive Hold Time (ms)	32-bit Integer	50–3600000	1000	rw	y	
64	11	Limit Negative Hold Time (ms)	32-bit Integer	50–3600000	1000	rw	y	
64	12	Limit Filter Positive Distance (mm)	32-bit Integer	0–1000	150	rw	y	
64	13	Limit Filter Negative Distance (mm)	32-bit Integer	0–1000	150	rw	y	
65		**BDC1 Vendor Specific Configuration**						
65	1	BDC1 Delay On (ms)	32-bit Uinteger	0–60000, 0 = disabled	0	rw	y	
65	2	BDC1 Delay Off (ms)	32-bit Uinteger	0–60000, 0 = disabled	500	rw	y	
65	3	BDC1 Teach Offset (mm)	32-bit Integer	–20000 to 20000	100	rw	y	
67		**Status**						
67	1	Distance Measurement (mm)	32-bit Integer	0–21000	0	ro	y	
67	2	Excess Gain	32-bit Integer	0–2147483647	0	ro	y	
67	3	Stability	8-bit Uinteger	0 = No Target 1 = Marginal Target 2 = Strong Target	0	ro	y	
67	4	Fault Status	8-bit Uinteger	0 = No Fault Present, 1 = Fault Present	0	ro	y	
67	5	Analog Output Value	32-bit integer		0	ro	y	
67	6	Temperature	32-bit Integer		0	ro	y	
67	7	Last Taught Temperature	32-bit Integer		0	ro	y	

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Index	Subindex	Name	Length	Value Range	Default	Access Rights	Data Storage?	Smart Sensor Profile
69		All-Time Run Time (0.25 hr)	32-bit Uinteger	0–4294967295	0	ro	y	
70		Resettable Run Time (0.25 hr)	32-bit Uinteger	0–4294967295	0	rw		
74		**AO1 Setpoints**						
74	1	Setpoint SP1 (mm)	32-bit integer	100-20000	300	rw	y	
74	2	Setpoint SP2 (mm)	32-bit integer	100-20000	20000	rw	y	
75		**AO1 Configuration**						
75	1	Output Type	8-bit Uinteger	0 = 4–20mA 128 = 0–10V 129 = 0.5–4.5V	128	rw	y	
75	2	Slope	8-bit Uinteger	0 = Positive, 1 = Negative	0	rw	y	
75	3	Loss of Signal	8-bit Uinteger	0 = Hold 1 = Low 2 = High	1	rw	y	
75	4	Average	8-bit Uinteger	0 = 1 1 = 2 2 = 4 3 = 8 4 = 16 5 = 32 6 = 64 7 = 128	0	rw	y	
76		All-Time Run Time Event Time (0.25 hr)	32-bit Uinteger	0–4294967295, 0 = disable raising event	0	rw	y	
77		Resettable Run Time Event Time (0.25 hr)	32-bit Uinteger	0–4294967295, 0 = disable raising event	0	rw	y	
78		**Active Sensing Range**						
78	1	Active Sensing Range Near (mm)	32-bit Integer	0–21000	0	rw	y	
78	2	Active Sensing Range Far (mm)	32-bit Integer	0–21000	21000	rw	y	
16512		**MDC Descriptor**		**Measuring Data Channel Descriptor - Smart Sensor Profile 2nd Edition**				
16512	1	Lower Limit	32-bit Integer		–32000	ro	y	
16512	2	Upper Limit	32-bit Integer		32000	ro	y	
16512	3	Unit	16-bit Uinteger	1010 = m	1010	ro	y	
16512	4	Scale	8-bit Integer	–3 = range shift of 10^{-3}	-3	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	Name	Description
25376 (0x6320)	Error	Parameter error	Check datasheet and values
36000 (0x8ca0)	Warning	All-time Run Time Event	Event indicating the corresponding configured running time has elapsed
36001 (0x8ca1)	Warning	Resettable Run Time Event	Event indicating the corresponding configured running time has elapsed
36003 (0x8ca3)	Notification	Teach Completed Event	Event indicating a teach has been completed
36004 (0x8ca4)	Notification	Factory Settings Restored Event	Event indicating that the factory settings have been restored
36005 (0x8ca5)	Notification	Teach Coerced Event	Event indicating a taught condition resulting in a setpoint being coerced; taught was updated
36007 (0x8ca7)	Notification	Teach Failed Event	Event indicating an invalid target condition was attempted to be taught; taught setpoint was not updated
36096 (0x8d00)	Error	Transceiver Fault Event	Event indicating that an error has occurred with the radar transceiver
36097 (0x8d01)	Error	System Fault Event	Contact Banner Engineering to resolve

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