

## 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](http://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  | 16 bits   | SIO mode               | Yes   |
| Process Data Out length | N/A       | Smart sensor profile   | Yes   |
| Bit Rate                | 38400 bps | Block parameterization | Yes   |
| Minimum cycle time      | 2.7 ms    | 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.



## 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<br>(incl. Vendor ID & Device ID)             |        |  |                         | ro            |               |                       |     |
| 1         | 1-16      | Direct Parameters Page 2   |        |  |                         | rw            |               |                       |     |
| 2         |           | Standard Command   |        | 65 = SP1 Single Value Teach<br>67 = SP1 Two Value Teach TP1<br>68 = SP1 Two Value Teach TP2<br>71 = SP1 Dynamic Teach Start<br>72 = SP1 Dynamic Teach Stop<br>79 = S1 Exit Teach<br>130 = Restore Factory Settings<br>160 = Laser Off<br>161 = Laser On<br>162 = Start Discovery<br>163 = Stop Discovery |                         | wo            |               | y                     | y   |
| 3         |           | Data Storage Index (device-specific list of parameters to be stored) |        |  |                         | rw            |               |                       |     |
| 4-11      |           | <i>reserved by IO-Link Specification</i>                             |        |  |                         |               |               |                       |     |
| <b>12</b> |           | <b>Device Access Locks</b>   |        |  |                         |               |               |                       |     |
| 12        | 1         | Parameter Write Access Lock  |        | 0 = off<br>1 = on  | 0                       | rw            | y             |                       | y   |
| 12        | 2         | Data Storage Lock  |        | 0 = off<br>1 = on  | 0                       | rw            | y             |                       | y   |
| 12        | 3         | Local Parameterization Lock  |        | 0 = off<br>1 = on  | 0                       | rw            | y             |                       | y   |
| 12        | 4         | Local User Interface Lock  |        | 0 = off<br>1 = on  | 0                       | rw            | y             |                       | y   |
| 13        |           | Profile Characteristic   |        |  |                         | ro            |               | y                     |     |
| 14        |           | PDInput Descriptor   |        |  |                         | ro            |               | y                     |     |
| 15        |           | <i>unused</i>  |        |  |                         |               |               |                       |     |
| 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     |           | <i>reserved</i>  |        |  |                         |               |               |                       |     |
| 32        |           | Error Count  |        |  |                         | ro            |               |                       |     |
| 33-39     |           | <i>reserved</i>  |        |  |                         |               |               |                       |     |
| 40        |           | Process Data Input   |        |  |                         | ro            |               |                       |     |
| 41-57     |           | <i>unused/reserved</i>   |        |  |                         |               |               |                       |     |

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

| 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)<br>or 2 ms (Q4X600/610)<br>1 = 3 ms (Q4X100/110/300/310) or<br>5 ms (Q4X600/610)<br>2 = 10 ms (Q4X100/110/300/310)<br>or 15 ms (Q4X600/610)<br>3 = 25 ms<br>4 = 50 ms | Q4X100/110/ 300/310: 2<br>Q4X600/610: 3 | rw            | y             |                       | y   |
| 64        | 2         | Gain                                      | 8-bit integer          | 0 = High<br>1 = Standard  | 1                                       | rw            | y             |                       | y   |
| 64        | 3         | Secondary Output Function                 | 8-bit integer          | 0 = Independent<br>1 = Complementary<br>2 = Remote Teach Input<br>3 = Laser Off<br>4 = Laser On<br>5 = Master<br>6 = Slave<br>7 = Pulse Frequency Modulation  | 0                                       | rw            | y             |                       | y   |
| 64        | 4         | Zero Reference Location                   | 8-bit integer          | 0 = Near<br>1 = Far   | 0                                       | rw            | y             |                       | y   |
| 64        | 5         | Shift Zero Reference After Teach          | 8-bit integer          | 0 = On<br>1 = Off   | 0                                       | rw            | y             |                       | y   |
| 64        | 6         | Display Read                              | 8-bit integer          | 0 = On<br>1 = On + Inverted<br>2 = Off<br>3 = Off + Inverted  | 0                                       | rw            | y             |                       | y   |
| 64        | 7         | Pushbutton Lockout                        | 8-bit integer          | 0 = No<br>1 = Pushbutton Lock<br>2 = Operator Lockout   | 0                                       | rw            | y             |                       | y   |
| 64        | 8         | IOL Filter Time (ms)                      | 16-bit integer         | 0-65535   | 0                                       | rw            | y             |                       | y   |
| <b>65</b> |           | <b>BDC1 Vendor Specific Configuration</b> |                        |   |   |               |               |                       |     |
| 65        | 1         | BDC1 Delay Mode                           | 8-bit unsigned integer | 0 = Disabled<br>1 = On/Off Delay<br>2 = Oneshot<br>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<br>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)<br>Q4X300/310: -2750+2750 (-275+275 mm)<br>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)<br>Q4X300/310: 0-2750 (0-275 mm)<br>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<br>1 = Off<br>2 = High Speed   | 0                                       | rw            | y             |                       | y   |
| <b>66</b> |           | <b>BDC2 Vendor Specific Configuration</b> |                        |   |   | rw            |               |                       |     |
| 66        | 1         | BDC2 Delay Mode                           | 8-bit unsigned integer | 0 = Disabled<br>1 = On/Off Delay<br>2 = Oneshot<br>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<br>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)<br>Q4X300/310: -2750+2750 (-275+275 mm)<br>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)<br>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<br>1 = Off<br>2 = High Speed  | 0       | rw            | y             |                       | y   |
| <b>67</b> |           | <b>Status</b>                           |                            |  |         |               |               |                       |     |
| 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<br>1 = Marginal/Multiple Peaks<br>2 = Stable   |         | ro            |               |                       | y   |
| 67        | 4         | Multiple Peak State                     | 8-bit unsigned integer     | 0 = Present<br>1 = Not Present   |         | ro            |               |                       | y   |
| 67        | 5         | Laser Fault Status                      | 8-bit unsigned integer     | 0 = No Fault<br>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   |
| <b>68</b> |           | <b>Statistics</b>                       |                            |  |         |               |               |                       |     |
| 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            |               |                       |     |
| <b>71</b> |           | <b>Pulse Frequency Configuration</b>    |                            |  |         |               |               |                       |     |
| 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<br>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) |