IO-Link: Identification information of ADIO IO-Link Hub

You can see the relevant parameters and identity details of ADIO hubs, such as the manufacturer and firmware version.

• atIOLink: Click the **IODD Catalog** or **Master PORT no.** tab **> Device information** tab

Index (dec.)	Sub index	Parameter	Access	Data length	Data type	Value / Range
0x00 (0)	8	Vendor ID 1 (MSB)	RO	2-byte	UINT8	0x0383 (899) = Autonics Corporation
	9	Vendor ID 2 (LSB)				
	10	Device ID 1 (MSB)	RO	3-byte	UINT8	0x30005 (196613) = ADIO-IL-MA08EAA1-HUB3
	11	Device ID 2				
	12	Device ID 3 (LSB)				

■ Read and write the identification data

You can read or change the vendor-specific parameters to identify the ADIO hubs.

• atIOLink: Click the **Master PORT no.** tab **> Parameters** tab **> Identification Menu**

Index (dec.)	Sub index	Parameter	Access	Data length	Data type	Value / Range
0x10 (16)	0	Vendor Name	RO	64-byte	String	Autonics Corporation
0x11 (17)	0	Vendor Text	RO	64-byte	String	Sensor & Controller, www.autonics.com
0x12 (18)	0	Product Name	RO	64-byte	String	ADIO-IL-MA08EAA1-HUB3
0x13 (19)	0	Product ID	RO	64-byte	String	ADIO-IL
0x14 (20)	0	Product Text	RO	64-byte	String	Analog Input 8 Channel A1
0x15 (21)	0	Serial Number	RO	16-byte	String	YYYYMMDDnn [01]
0x16 (22)	0	Hardware version	RO	4-byte	String	1.0
0x17 (23)	0	Firmware version	RO	4-byte	String	1.00.000r [02]
0x18 (24)	0	Application Specific Tag	RW	64-byte	String	*** [03]

01) Y = year / M = month / D = day / n = sequential number

02) major.minor.patch

03) You can write a product description such as its installation location or roles in the system.

IO-Link: Configuration of Parameter Data

You can read or configure the parameter data for the ADIO hubs.

• atIOLink: click the **Master PORT no.** tab **> Parameters** tab **> Parameter Menu**

Index (dec.)	Sub index	Parameter	Access	Data length	Data type	Default value
0x59 (89)	0	Process data alignment [02]	RW	1-byte	-	1: Right
0xF0 (240)	0	Analog mode [01]	RW	8-byte	-	3: -10 to 10 V
	1 to 8			1-byte		
0xF1 (241)	0	Resolution [02]	RW	8-byte	-	0: 16-bit
	1 to 8			1-byte		
0xF2 (242)	0	Pin assignment [01]	RW	8-byte	-	1: Pin 4
	1 to 8			1-byte		
0xF5 (245)	0	Process data format [02]	RW	8-byte	-	2: Dimensioned (mV, µA)
	1 to 8			1-byte		
0xF6 (246)	0	Switch point 1 [03]	RW	16-byte	UINT8	-
	1 to 8			2-byte		
0xF7 (247)	0	Switch point 2 [03]	RW	16-byte	UINT8	-
	1 to 8			2-byte		
0xF8 (248)	0	Switch point enable [03]	RW	2-byte	Boolean	0: Disabled
	1 to 16			1-byte		
0x4A (74)	0	Operating hours alarm setting	RW	4-byte	UINT8	100000
0x0C (12)	2	Data storage lock	RW	2-byte	Boolean	0: False
0x82 (130)	0	Restore factory settings	WO	1-byte	-	-
0xFF (255)	0	Reset	WO	1-byte	-	-

01) The set of parameters for analog input configuration.

02) The set of parameters for setting the display format of analog input value.

03) The set of parameters for setting the switch point of analog input value.

■ Process data alignment

When you use the resolution of less than 16 bits, the process data alignment can be configured. In the case of resolutions such as 10, 12, and 14 bits, analog input data is filled with zeros in some bits and then transmitted as a 16-bit value.

• This process data alignment does not affect the 'dimensioned' data format.

Index (dec.)	Subindex	Bit size	Value / Range
0x59 (89)	0	16	0: Left (left-aligned) 1: Right (right-aligned)

0: Left-aligned

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Resolution 16-bit															
Resolution 14-bit														0	0
Resolution 12-bit												0	0	0	0
Resolution 10-bit										0	0	0	0	0	0

1: Right-aligned

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
															Resolution 16-bit
0	0														Resolution 14-bit
0	0	0	0												Resolution 12-bit
0	0	0	0	0	0										Resolution 10-bit

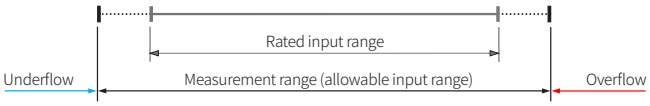
■ Analog mode

You can configure the analog input properties, such as input type and range, for each port. Subindex 0 allows you to access the analog mode for all ports, while the sub-indices from 1 to 8 allow you to read or change the analog mode for each corresponding port.

Index (dec.)	Subindex	Byte size	Port no.	Value / Range
0xF0 (240)	0	8	Port 0 to 7	0: Voltage input, 0 to10 V 1: Current input, 4 to 20 mA 3: Voltage input, -10 to 10 V 5: Current input, 0 to 20 mA 255: Port OFF
	1	1	Port 0	
	2	1	Port 1	
	3	1	Port 2	
	4	1	Port 3	
	5	1	Port 4	
	6	1	Port 5	
	7	1	Port 6	
	8	1	Port 7	

■ Underflow and overflow

If the measured analog value exceeds the maximum and minimum values of the allowable input range, based on the configured analog mode for each port, the corresponding bits in the process data input (Byte 19 to 20) are set to 1.



Rated input range	Underflow range	Overflow range
0 to 10 V	< -0.5 V	> 10.5 V
-10 to 10 V	< -10.5 V	> 10.5 V
4 to 20 mA	< 3.8 mA	> 20.5 mA
0 to 20 mA	-	> 20.5 mA

■ Resolution

You can configure the resolution of analog signals for each port. Subindex 0 allows you to access the resolution for all ports, while sub-indices from 1 to 8 allow you to read or change the resolution for each corresponding port.

• This resolution does not affect the 'dimensioned' data format.

Index (dec.)	Subindex	Byte size	Port no.	Value / Range
0xF1 (241)	0	8	Port 0 to 7	0: 16-bit 1: 14-bit 2: 12-bit 3: 10-bitw
	1	1	Port 0	
	2	1	Port 1	
	3	1	Port 2	
	4	1	Port 3	
	5	1	Port 4	
	6	1	Port 5	
	7	1	Port 6	
	8	1	Port 7	

■ Pin assignment

You can select the analog input pins (Pin 2 / Pin 4) for each port. Subindex 0 allows you to access the value of pin assignment for all ports, while sub-indices from 1 to 8 allow you to read or change the pin assignment for each corresponding port.

Index (dec.)	Subindex	Byte size	Port no.	Value / Range
0xF2 (242)	0	8	Port 0 to 7	0: Pin 2 1: Pin 4
	1	1	Port 0	
	2	1	Port 1	
	3	1	Port 2	
	4	1	Port 3	
	5	1	Port 4	
	6	1	Port 5	
	7	1	Port 6	
	8	1	Port 7	

■ Process data format

The analog values are digitalized in the ADIO hubs. The format of the digitalized values is determined by the process data format, analog mode, resolution, and process data alignment. Each port is allocated 2 bytes of process input data for IO-Link data exchange, and the analog value is displayed based on the process data format.
You can configure the data format through this parameter.
Subindex 0 allows you to access the process data format for all ports, while sub-indices from 1 to 8 allow you to read or change the format for each corresponding port.

Index (dec.)	Subindex	Byte size	Port no.	Value / Range
0xF5 (245)	0	8	Port 0 to 7	0: Signed 1: Unsigned 2: Dimensioned (mV, µA)
	1	1	Port 0	
	2	1	Port 1	
	3	1	Port 2	
	4	1	Port 3	
	5	1	Port 4	
	6	1	Port 5	
	7	1	Port 6	
	8	1	Port 7	

0: Signed data format

The digitalized value is represented as a signed value (positive or negative) using the two's complement. Typically, the most significant bit (MSB) is used as the sign bit, and the analog input signal is calculated using the following formulas.

• For the voltage input

Analog mode		Data format	
Nominal range	Allowable range	Positive (MSB = 0)	Negative (MSB = 1)
-10 to 10 V	-10.5 to 10.5 V	$[V_{In}] = P_{In} \times (\frac{V_{max}}{2^{(R-1)}-1})$	$[V_{In}] = (P_{In} - 2^{R}) \times (\frac{V_{max}}{2^{(R-1)}-1})$
0 to 10 V	-0.5 to 10.5 V		

- P_{In} : Measured input value on each port
- R : Resolution (□-bit)
- V_{max} : Maximum allowable input voltage

• For the current input

Analog mode		Data format
Nominal range	Allowable range	Positive (MSB = 0)
0 to 20 mA	0 to 20.5 mA	$[I_{In}] = P_{In} \times (\frac{I_{max} - I_{min}}{2^{(R-1)}-1}) + I_{min}$
4 to 20 mA	3.8 to 20.5 mA	

- P_{In} : Measured input value on each port
- R : Resolution (□-bit)
- I_{max} / I_{min} : Maximum / minimum allowable input current

[Example] Calculate the digitalized value of a 9 V signal

01. The applied voltage signal to the ADIO hub is 9 V and the parameters are configured as shown in the table below.

Parameter	Configured value
Process data alignment	1: Right
Analog mode	0: 0 to 10 V
Resolution	1: 14-bit
Process data format	0: Signed

02. When monitoring the value of the process data input in atIOLink, it is represented as 7465 (0x1D, 0x29). Since the MSB of 7465 (0x1D, 0x29) is 0, it indicates that a positive number is being detected. (7465 = 00**0**1 1101 0010 1001 $_{Bin}$)
03. When deriving the result using the formula for converting positive voltage inputs, you can figure out that the original analog signal has been successfully digitalized.

· Input signal = $7465 \times (\frac{10.5\ V}{2^{(14-1)}-1}) = 9.5\ V$

[Example] Calculate the digitalized value of a -5 V signal

01. The applied voltage signal to the ADIO hub is -5 V and the parameters are configured as shown in the table below.

Parameter	Configured value
Process data alignment	0: Left
Analog mode	3: -10 to 10 V
Resolution	2: 12-bit
Process data format	0: Signed

02. When monitoring the value of the process data input in atIOLink, it is represented as 49920 (0xC3, 0x00). This input value is left-aligned; therefore, the voltage input value with resolution is 0xC30 (3120). Since its MSB is 1, it indicates that a negative number is being detected. (49920 = **1**100 0011 0000 0000 $_{Bin}$)
03. When deriving the result using the formula for converting negative voltage inputs, you can figure out that the original analog signal has been successfully digitalized.

· Input signal = $(3120 - 2^{12}) \times (\frac{10.5\ V}{2^{(12-1)}-1}) = -5.0\ V$

1: Unsigned data format

The digitalized value is represented as a number ranging from 0x0000 to 0xFFFF, depending on the resolution.
The analog input signal is calculated using the following formulas.

• For voltage input

Analog mode		Data format
Nominal range	Allowable range	
-10 to 10 V	-10.5 to 10.5 V	$[V_{In}] = P_{In} \times (\frac{V_{max} - V_{min}}{2^R - 1}) + V_{min}$
0 to 10 V	-0.5 to 10.5 V	

- P_{In} : Measured input value on each port
- R : Resolution (□-bit)
- V_{max} / V_{min} : Maximum / minimum allowable input voltage

• For current input

Analog mode		Data format
Nominal range	Allowable range	
0 to 20 mA	0 to 20.5 mA	$[I_{In}] = P_{In} \times (\frac{I_{max} - I_{min}}{2^R - 1}) + I_{min}$
4 to 20 mA	3.8 to 20.5 mA	

- P_{In} : Measured input value on each port
- R : Resolution (□-bit)
- I_{max} / I_{min} : Maximum / minimum allowable input current

[Example] Calculate the digitalized value of a 10 mA signal

01. The applied current signal to the ADIO hub is 10 mA and the parameters are configured as shown in the table below.

Parameter	Configured value
Process data alignment	0: Left
Analog mode	1: 4 to 20 mA
Resolution	2: 12-bit
Process data format	1: Unsigned

02. When monitoring the value of the process data input in atIOLink, it is represented as 31888 (0x7C, 0x90). This input value is left-aligned; therefore, the current input value with resolution is 0x7C9 (1993). ($31888 = \underline{0111\ 1100\ 1001}\ 0000_{Bin}$)
03. When deriving the result using the formula for converting current inputs, you can figure out that the original analog signal has been successfully digitalized.

· Input signal = $1993 \times (\frac{20.5 - 3.8}{2^{12} - 1}) + 3.8 = 11.92$ mA

2: Dimensioned data format

The values of input voltage and current are digitized with the unit of mV or µA and transmitted to the process data. When converting to the digital value, the resolution is 16-bit, and the data is right-aligned. Unlike the data format previously described, the configured resolution and process data alignment have no effect on the dimensioned data format. The analog input signal is calculated using the following formulas.

• For voltage input

Analog mode	Data format	
Nominal range	Positive (MSB = 0)	Negative (MSB = 1)
-10 to 10 V	$[V_{In}] = \frac{P_{In}}{1000}$	$[V_{In}] = \frac{P_{In} - 65536}{1000}$
0 to 10 V		

- P_{In} : Measured input value on each port

• For current input

Analog mode	Data format
Nominal range	Positive (MSB = 0)
0 to 20 mA	$[I_{In}] = \frac{P_{In}}{1000}$
4 to 20 mA	

- P_{In} : Measured input value on each port

[Example] Calculate the digitalized value of a 9 V signal

01. The applied voltage signal to the ADIO hub is 9 V and the parameters are configured as shown in the table below.

Parameter	Configured value
Analog mode	0: 0 to 10 V
Process data format	2: Dimensioned

02. When monitoring the value of the process data input in atIOLink, it is represented as 9570 (0x25, 0x62). For voltage input, the value is digitized in mV units; therefore, it needs to be converted into V units.
03. When deriving the result using the formula for converting positive voltage inputs, you can figure out that the original analog signal has been successfully digitalized.

· Input signal = $\frac{9570}{1000} = 9.570$ V

[Example] Calculate the digitalized value of a -5 V signal

01. The applied voltage signal to the ADIO hub is -5 V and the parameters are configured as shown in the table below.

Parameter	Configured value
Analog mode	3: -10 to 10 V
Process data format	2: Dimensioned

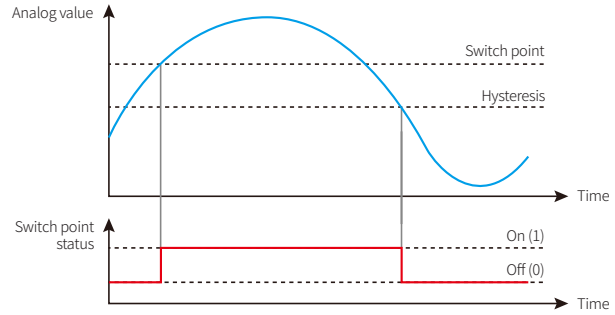
02. When monitoring the value of the process data input in atIOLink, it is represented as 60533 (0xEC, 0x75). For voltage input, the value is digitized in mV units; therefore, it needs to be converted into V units.
03. When deriving the result using the formula for converting negative voltage inputs, you can figure out that the original analog signal has been successfully digitalized.

· Input signal = $\frac{60533 - 65536}{1000} = -5.003$ V

■ Switch point 1, 2

You can designate two switch points for each port. These switch points should be designated within the rated range of voltage or current input. If the measured input values exceed these switch points, the corresponding bits in the process data input (Byte 0 to 1) are set to 1.

- Hysteresis: Voltage input = 5 mV / Current input = 10 µA
- The switch points are right-aligned. You need to consider these switch points when configuring the resolution and process data format.



Subindex 0 allows you to access the switch points for all ports, while sub-indices from 1 to 8 allow you to read or change the switch points for each corresponding port.

Index (dec.)	Subindex	Byte size	Port no.	Value / Range
0xF6 (246)	0	16	Port 0 to 7	Value for switch point 1 (e.g.: 50 $_{dec}$ → 0.050 V)
	1	2	Port 0	
	2	2	Port 1	
	3	2	Port 2	
	4	2	Port 3	
	5	2	Port 4	
	6	2	Port 5	
	7	2	Port 6	
	8	2	Port 7	
0xF7 (247)	0	16	Port 0 to 7	Value for switch point 2 (e.g.: 50 $_{dec}$ → 0.050 V)
	1	2	Port 0	
	2	2	Port 1	
	3	2	Port 2	
	4	2	Port 3	
	5	2	Port 4	
	6	2	Port 5	
	7	2	Port 6	
	8	2	Port 7	

■ Switch point enable

You can enable or disable the switch point 1 and 2 for each port. Subindex 0 allows you to access this parameter for all ports, while sub-indices from 1 to 16 allow you to read or change the setting of this parameter for each corresponding port.

- Disabled: The corresponding bits in the process data input are set to 0.
- Enabled: If the measured input value exceeds the switch points, the corresponding bits in the process data input are set to 1.

Index (dec.)	Subindex	Bit size	Port no.	Value / Range
0xF8 (248)	0	16	Port 0 to 7	0: Disabled 1: Enabled
	1	1	Port 0 - switch point 1	
	2	1	Port 1 - switch point 1	
	3	1	Port 2 - switch point 1	
	4	1	Port 3 - switch point 1	
	5	1	Port 4 - switch point 1	
	6	1	Port 5 - switch point 1	
	7	1	Port 6 - switch point 1	
	8	1	Port 7 - switch point 1	
	9	1	Port 0 - switch point 2	
	10	1	Port 1 - switch point 2	
	11	1	Port 2 - switch point 2	
	12	1	Port 3 - switch point 2	
	13	1	Port 4 - switch point 2	
	14	1	Port 5 - switch point 2	
	15	1	Port 6 - switch point 2	
	16	1	Port 7 - switch point 2	

■ Operating hours alarm setting

You can configure the operating hours of the ADIO hub.
When the operating hour reaches the set value, an event will be triggered for notifications.

Index (dec.)	Subindex	Byte size	Value / Range
0x4A (74)	0	4	0 to 131071 hours

■ Data storage lock

You can prevent the upload of the ADIO hub's configuration when using Data Storage (DS) mode.

Index (dec.)	Subindex	Byte size	Value / Range
0x0C (12)	2	2	0: False (Unlocked) 1: True (Locked)

■ Restore factory settings

You can restore the parameter configuration of the ADIO hub to its factory default settings.

- atIOLink: Click the **Parameter Menu > RESTORE FACTORY SETTINGS**
- Commands: Activate the 'Restore factory settings' parameter. The index is 0x82, and the subindex is 0.

■ Reset

Restart the ADIO hub.

- Commands: Activate the 'Reset' parameter. The index is 0xFF, and the subindex is 0.

IO-Link: Diagnostic Information

You can see the diagnotic information for the ADIO hub.

- atIOLink: Click the **Master PORT no.** tab **> Parameters** tab **> Diagnosis Menu**

■ Operating hours

You can see the total operating hours of the ADIO hub.

Index (dec.)	Subindex	Access	Data length	Data type	Value / Range
0x48 (72)	0	RO	4-byte	-	Operating hours

IO-Link: Event and Error Monitoring

You can monitor the event and error history of the ADIO hub.

- atIOLink: Click the **Master PORT no.** tab **> Events** tab

■ Event code

Event code (dec.)	Description
0x1821 (6177)	Operating time alarm
0x5111 (20753)	Low sensor voltage (US)
0x7710 (30480)	Short circuit on Pin 1
0x8C20 (35872)	Measurement value is out of range

■ Error code

Error code (dec.)	Description
0x8011 (32785)	Index not available
0x8012 (32786)	Subindex not available
0x8023 (32803)	Access Denied
0x8030 (32816)	Parameter value out of range
0x8033 (32819)	Parameter length overrun
0x8034 (82820)	Parameter length underrun

IO-Link: Process Data Input Monitoring

You can monitor the process data input status of the ADIO hub.

• atIOLink: Click the **Master PORT no.** tab **> Process data** tab

No.	Parameter	Description
1.	Switch point 1, 2	When the measured input value on a standard I/O port exceeds the switch point, the corresponding bits are set.
2.	Analog value	You can see the measured voltage or current input value for each standard I/O port.
3.	Pin 1 short	When a short circuit occurs between Pin 1 and Pin 3 on a standard I/O port, the corresponding bits are set.
4.	Analog value underflow	When the measured voltage or current input value is less than the minimum rated input range on a standard I/O port, the corresponding bits are set. [e.g.] When the rated input range is from 4 to 20 mA, the ADIO hub detects if the measured value has decreased to 3 mA.
5.	Analog value overflow	When the measured voltage or current input value is greater than the maximum rated input range on a standard I/O port, the corresponding bits are set. [e.g.] When the rated input range is from -10 to 10 V, the ADIO hub detects if the measured value has increased to 11 V.
6.	Low supply voltage	When the supply power (US1) of the ADIO hub is less than 18 VDC⎓, the corresponding bit is set.

■ Process data input structure

Parameter	Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Switch point 1	**Byte 0**	Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0
Switch point 2	**Byte 1**	Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0
Analog value	**Byte 2 to 3**	Port 0							
	Byte 4 to 5	Port 1							
	Byte 6 to 7	Port 2							
	Byte 8 to 9	Port 3							
	Byte 10 to 11	Port 4							
	Byte 12 to 13	Port 5							
	Byte 14 to 15	Port 6							
	Byte 16 to 17	Port 7							
Pin 1 short	**Byte 18**	Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0
Analog value underflow	**Byte 19**	Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0
Analog value overflow	**Byte 20**	Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0
Low supply voltage	**Byte 21**	-	-	-	-	-	-	-	US1 status