Sensata Technologies

ACW and TCW Series with IO Link

New Product Training

Introducing the ACW and TCW Series with IO Link Connection

ACW4 IO Link

TCW4 IO Link

Various sensors are designed with a variety of output types: variable voltage, variable current, serial digital, ratiometric and so on. Not to mention the various field bus outputs.

This means that in order to connect all these various sensors to an Ethernet Fieldbus, each installation must have a custom I/O box which translates the sensor input into the correct fieldbus format.

IO Link solves this problem by creating a connectivity standard for sensors so that they all communicate in the same way. Signals are digital, point-to-point and connect directly to an IO Link Master which handles the interface to the fieldbus.

IO Link features include

- 24 Volt operation
- Maximum 20m connection length
- Digital interface
- Diagnostic and “record-keeping” functions
- Event notification for out-of-spec or warning situations.

Value Proposition

Who is this product for?

- Factory automation
- Robotics
- Other discrete manufacturing operations

What do they want/need to do?

- Standardize the sensor interface
- Connect from the ERP all the way down to the component level
- Have a “Smart and connected” factory (Factory 4.0 or IIOT)

What is our solution?

- ACW4 and TCW4 with IO Link interface

Customer benefits

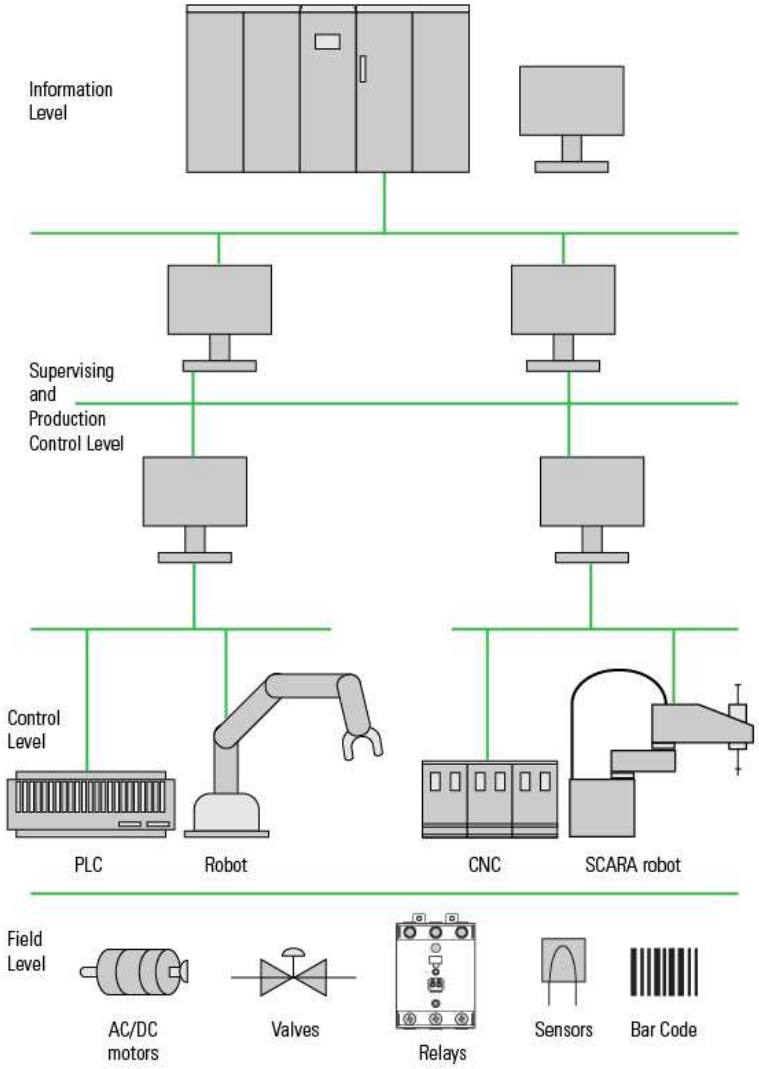
- Standardized connectivity
- Easy to install and configure

- Compact rugged solution
- Internal event generator can help avoid unplanned maintenance

We deliver

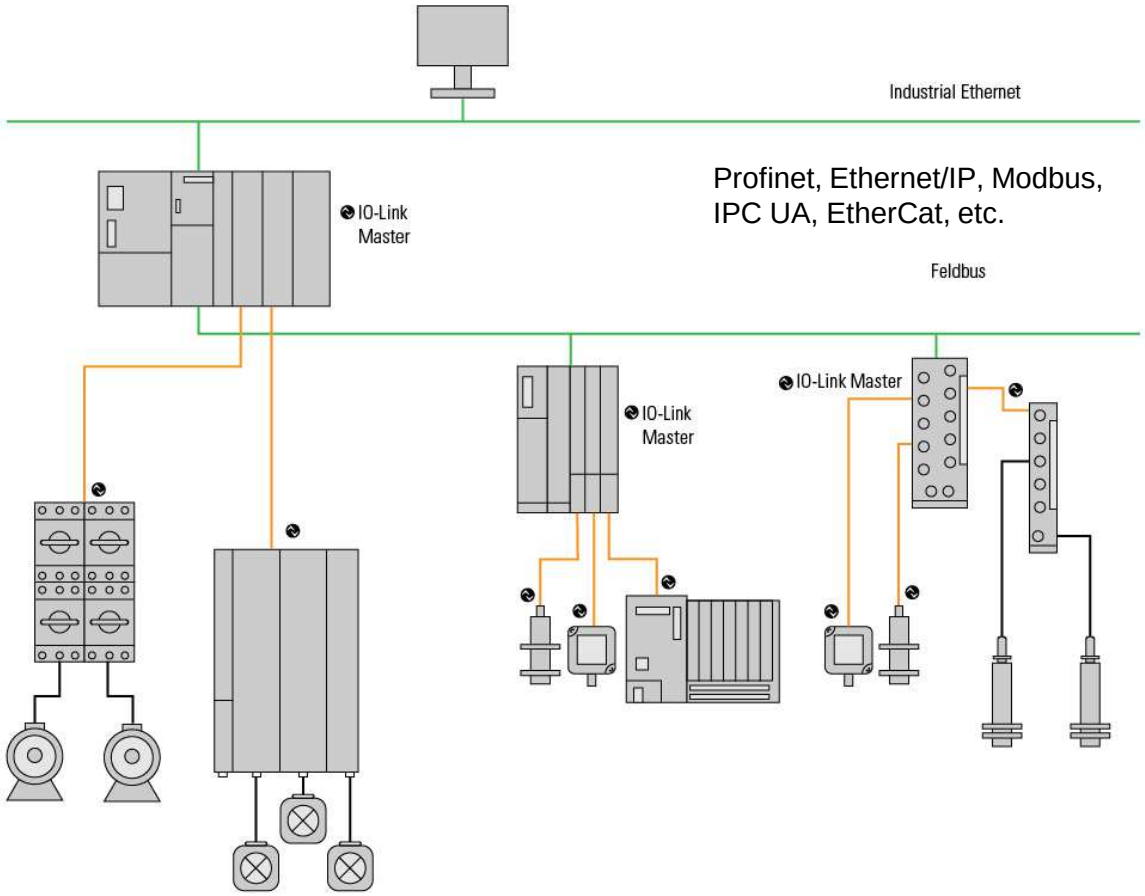
- Operation at industry standard 24 V
- Highest Baud rate available
- Choice of many parameters to adjust
- Built-in electrical protection
- Minimum of IP 65 standard

Traditional Industrial Control Architecture



- **Information Level** – Aggregating performance, through-put, configuration information
- **Supervisory Level** – Operational level providing control level with objectives and monitoring for failures. HMIs used to change inputs.
- **Control Level** – Closing the loop on control and actuation based on field level data. PLCs, CNC, PC's. Control is usually distributed control or Supervisory Control and Data Acquisition (SCADA)
- **Field Level** – Sensors and actuators, sensors output analog or digital signal, actuator create controlled movement directed by the Control level. Sensors must interface to PLC or CNC through an intermediate customized I/O box.

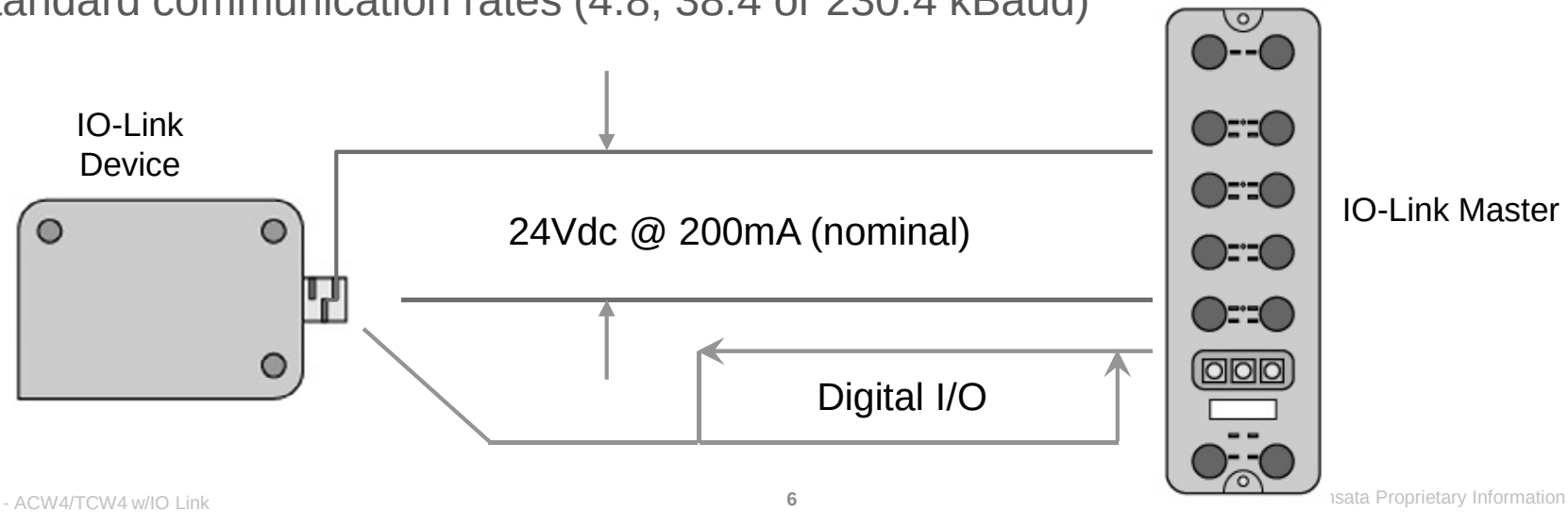
IO-Link Industrial Control Architecture



- **Information Level** – Aggregating performance, through-put, system configuration information and control objectives.
- **Supervisory and Control Level** – in the IO-Link model, these are combined through the use of IO-Link Master modules. Each sensor and actuator reports up through the Master modules to the top level. Operational objectives are still derived from the overall goals at the information level. IO-Link Masters retain information about the linked Master modules and sensors.
- Closing the loop on control and actuation is done at the Master level and reported upwards to the information level. Individual sensors are "managed" and reported by the IO-Link masters that they connect to.
- **Field Level** – Sensors and actuators are all digital and conforming to the IO-Link protocols.

What are the characteristic of an IO - Link Device?

- Component can be either a sensor (data out) or an actuator (data in)
- Operating voltage (24Vdc nominal)
- Point-to-point Device to Master node
- Standard Connector, Pinouts and functions defined.
- Standard data width (16 bits)
- Contains Identifying Information (S/N, Vendor ID, Item ID)
- Self-Monitoring (temperature, operating hours, voltage level)
- Standard communication rates (4.8, 38.4 or 230.4 kBaud)

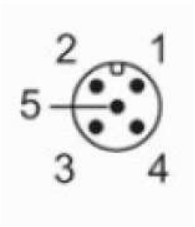


What are IO-Link Connection Standards?

- Device connected to an IO-Link Master (Male Connector)
  - Connection port Class A
    - M5, M8, M12 (4 Pins max)
  - Connection port Class B **(BEI Sensors Standard – see below)**
    - M12, 5 Pin, Pins 2 & 5 can be N/C, DI, DQ, Pwr

- IO-Link Master (Female Connector)
  - **Pin 1** = +13-30 Vdc (24V Nominal)
  - **Pin 2** = Options (N/C, DI, DQ, Pwr)
  - **Pin 3** = 0Vdc (Power common)
  - **Pin 4** = Digital I/O
  - **Pin 5** = Options (N/C, DI, DQ, Pwr)

Pin	Color	Signal
1	Brown	L+
2	White	N.C
3	Blue	L-
4	Black	IO-Link
5	Grey	N.C



BEI SENSORS standard IO-Link Connector

IO - Link Communication Modes

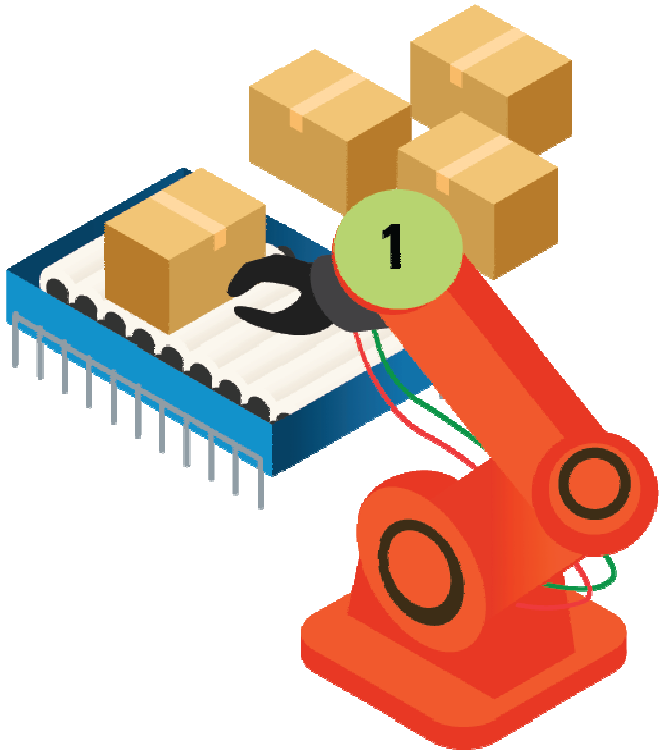
FOUR MODES

- IO-Link, “Administrative” – as needed
- DI – Input Device, Commands - periodic
- DQ = Output Device, Values – periodic
- Deactivated, self explanatory

FOUR DATA TYPES

- Process, current value of process - periodic
- Value Status, validity of the current value – periodic with process data.
- Device data, Information about the device - as needed
- Event data, Reportable event – as needed

Application Example - Robotics



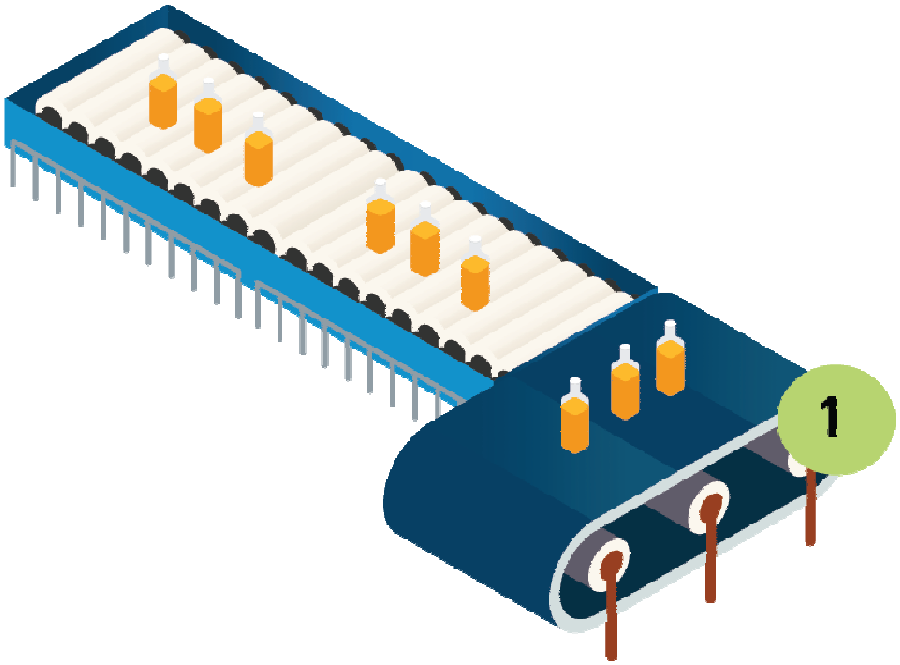
1

LOCATION FOR ACW/TCW
WITH IO LINK

Robotic manipulation of and sortation can require a variety of end effector designs. The operating mechanism could be a servo-controlled gripper, a pneumatic gripper, or even a custom fixture that conforms to the package.

Each may require a different sensor, however they could each be configured within the IO Link system so that no matter which end effector is in use it is visible to the supervisory computer and its status is constantly being monitored. Should anything be outside of the planned parameter an “event” could be reported resulting in a smooth shut down and minimizing material loss.

Application Example – Conveyors



1

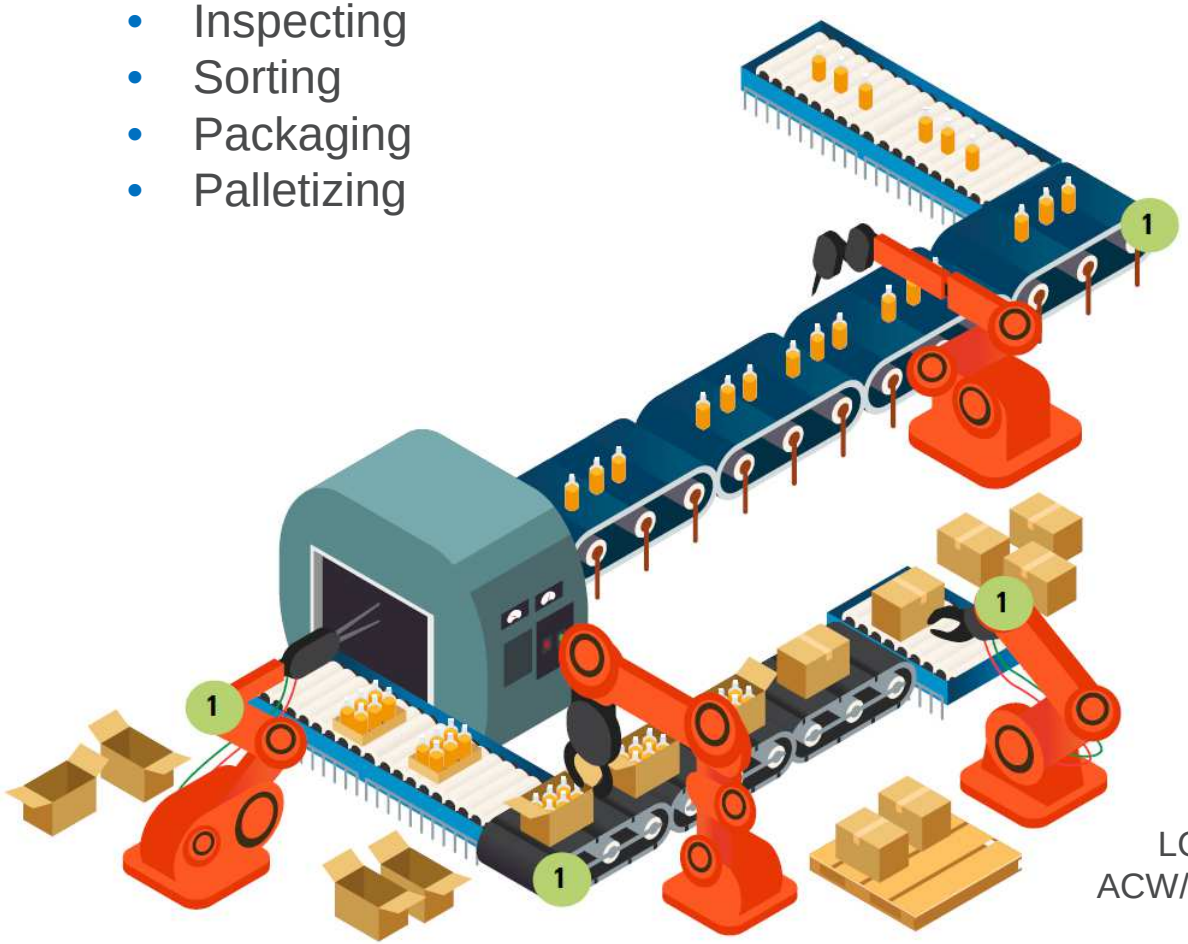
LOCATION FOR ACW/TCW
WITH IO LINK

Increasingly sophisticated packaging solutions combine multiple sensors to allow package sortation system to handle very complex demands.

With multiple sensors, cameras and inspection stations a variety of product can pass through a conveyor system. Each sensor can do its job of informing the conveyor how to handle a particular component and make sure it gets sorted, inspected and ends up in the correct package for final shipment. This is especially important for on-demand package for consumer goods.

Combined Application Example

- Inspecting
- Sorting
- Packaging
- Palletizing



- Capabilities & Features:
- Parameterization on the fly
- Diagnostics
- Compact installation
- Event reporting
- Low power
- Non-contacting modular design
- Single and Multiturn options
- Electrical Protections

1

LOCATIONS FOR
ACW/TCW WITH IO LINK

IO-Link will get you “Industry 4.0 ready”

Factory Automation is a significant market

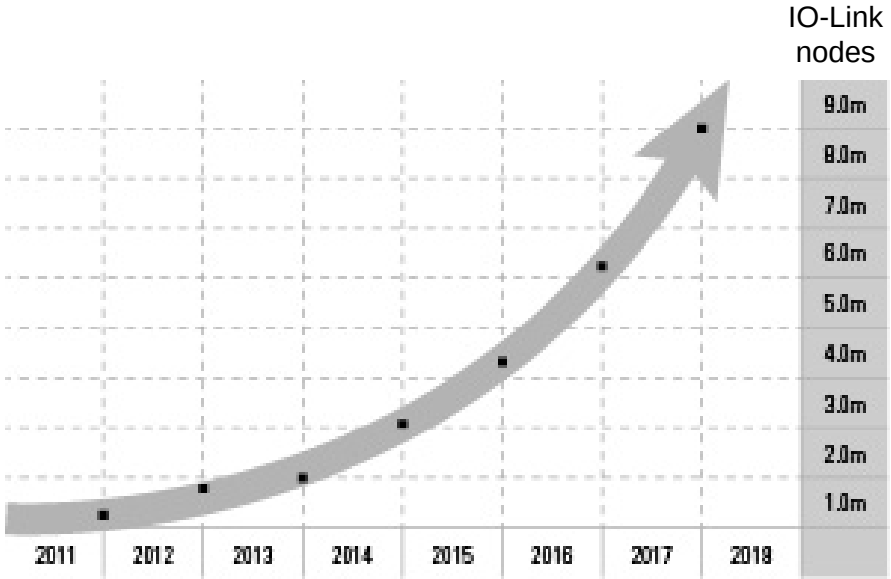
Total Available Market (TAM) of $160M just for position products

Market is growing driven by Industry 4.0 (CAGR 6.5%).

- IO-Link is becoming a major player in automation
- IO-Link brings Industry 4.0 where Ethernet protocols are too expensive at the device level
- A simple point-to-point connection designed as a digital alternative to analog signals

I/O link advantages:

- Standard & cost effective connection
- Diagnostics including remote diagnostics down to the field device
- Field configurable - parameter setting capability
- Self monitoring with events reporting
- Digital communications is more immune to noise
- Field replacements are easy and straightforward



Sensata Technologies – BEI Sensors registered since March 2018 in the PI consortium

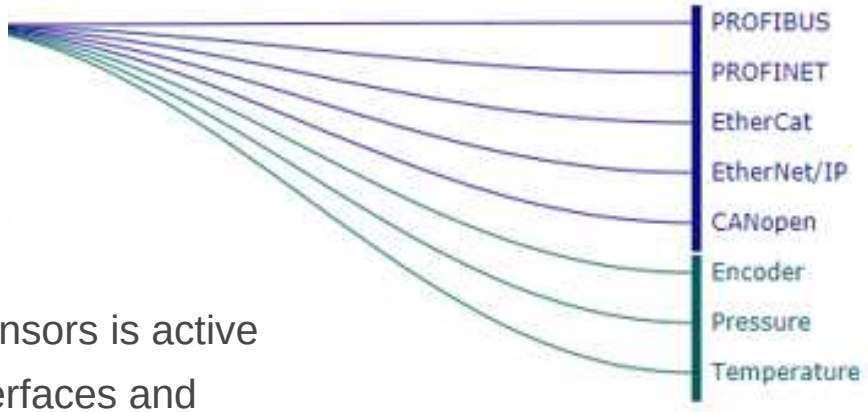
Competency Matrix

The competence matrix displays interactively which technologies, products and services the IO-Link member companies provide. In addition, further information and links about the individual member companies are available such as company logo and a brief description of the company and its product portfolio.

How to manage your profil as an IO-Link member.

Show all

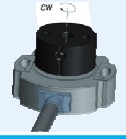
Sensata Technologies • BEI Sensors



Sensata Technologies | BEI Sensors is active in providing communication interfaces and fieldbus solutions since 1998.

PI technologies

IO - Link Competitive Comparison

						
Manufacturer/Model	**IFM RO3100**	**ACW4/**	**TCW4**	**Turck Ri360P0**	**SICK (AHS/AHM36)**	**Novotechnik RFC4800**
Mount	Hollow-shaft	✓ Modular		Hollow-shaft	Shaft, Blind shaft	Modular
Resolution	10,000	12 Bits	12 x 16 Bits	16 x 13 Bits	14 x 12 Bits	14 Bits
Format	Incremental	ST Absolute	MT Absolute	MT Absolute	MT (or ST) Absolute	ST Absolute
Technology	Magnetic	Magnetic		Inductive	Magnetic	Magnetic
Voltage [Vdc]	4.75 – 30	18 – 30		15 – 30	18 – 30 vdc	18…30 vdc
Current [mA]	✗ <150	✓ <40		<50	63	<100 mA
Reverse polarity	Yes	✓ Yes		Yes	Yes	Yes
Short Circuit	Yes	✓ Yes		✗ No Data	✗ No Data	✗ No Data
Overvoltage	✗ No Data	✓ Yes		✗ No Data	✗ No Data	✗ No Data
Max Rev 1/s (Mechanical)	12,000	✓ No limit		✗ 800	9,000	✓ No limit
Parameters	Resolution	✓ Zero Point			Steps/Rev	✓ Zero Point
	Direction	✓ Preset	ST and MT Value		Rotation Direction	✓ Rotation Direction
	HTL/TTL	✓ Rotation Direction			Sample rate	Moving average data
		✓ Resolution	ST and MT Value		Speed	
		✓ Hours of operation				
Events		✓ Temp above limits				Magnet incorrect position
		✓ Battery Low				Magnet missing
		✓ Loss of Synchronization				Internal System Failure
						EEPROM Storage Failure
Type	✗ COM2	COM3		✗ COM2	COM3	COM3
Minimum cycle time [ms]	2.3	✓ 1		3	✗ 3.2	✓ 1
Ambient Temperature [C]	-40 to 85	-40 to 85	-20 to 85	-25 to 85	✗ -20 to 70	✓ -40 to 105; -25 to 85 (M12)
Storage Temperature [C]	-40 to 85	-40 to 85	-20 to 85	No Data	-40 to 100	No Data
Protection	Hsg IP67, Shaft IP65	IP67	IP65	IP68/IP69K	IP65	IP67,IP69K
Shock [g]	100	✓ 200		100	100	50g (6 ms)
Vibe [grms]	20	20		20	20	20, 5 ... 2,000 Hz
Start Torque Nm	2	✓ None		No Data	<50	✓ None

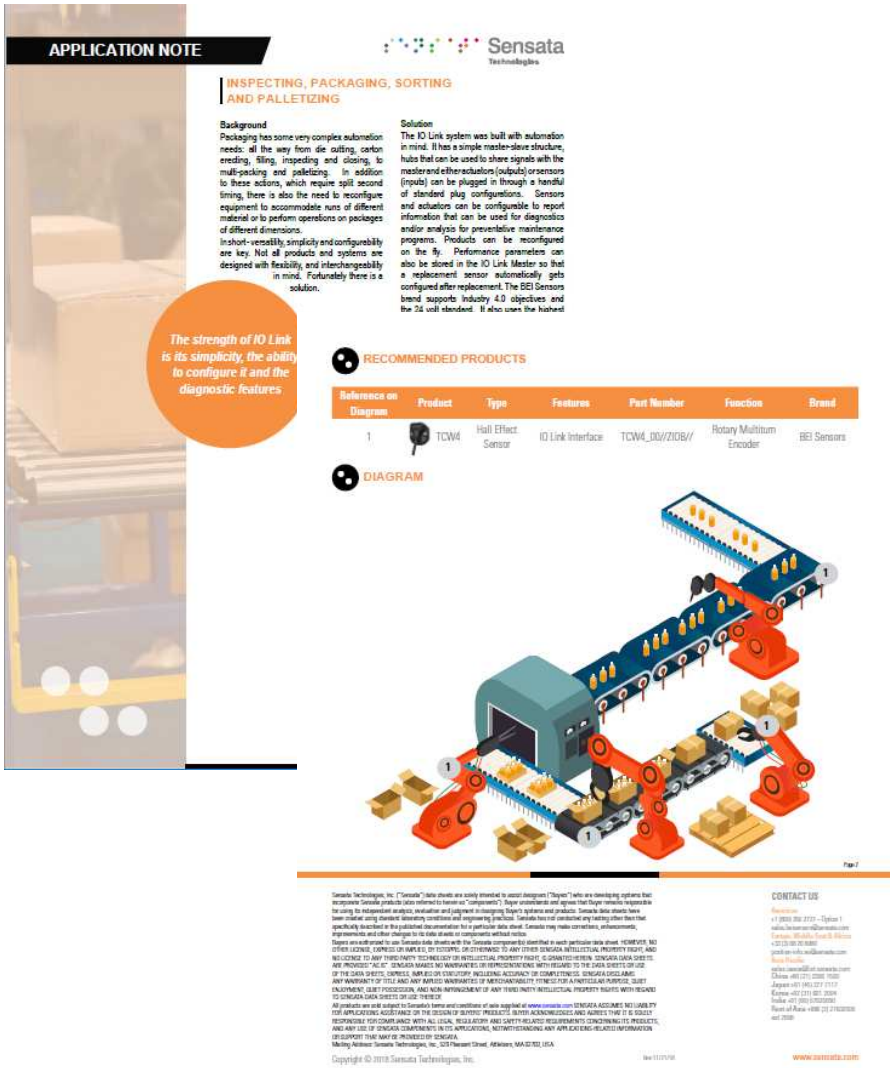
Killshots

ifm	TURCK	novotechnik Siedle Group
High current draw – limited overvoltage protection	Limited circuit protection	Limited circuit protection
Limited communication speed (Com 2)	Limited communication speed (Com 2)	No resolution selection apparently offered
No specific event reporting mentioned	Limited parameter setting and event reporting	High current draw

Application Note

- An electronic version (PDF) of an application note on how these IO Link hall effect sensors are used for Inspecting, Packaging, Sorting and Palletizing is now available as part of the launch package.

- A PDF file will be available for download on the website after the external announcement date.


APPLICATION NOTE

Sensata Technologies

INSPECTING, PACKAGING, SORTING AND PALLETIZING

Background

Packaging has some very complex automation needs: all the way from die cutting, carton erecting, filling, inspecting and closing, to multi-packing and palletizing. In addition to these actions, which require split second timing, there is also the need to reconfigure equipment to accommodate runs of different material or to perform operations on packages of different dimensions.

In short- versatility, simplicity and configurability are key. Not all products and systems are designed with flexibility, and interchangeability in mind. Fortunately there is a solution.

Solution

The IO Link system was built with automation in mind. It has a simple master-slave structure, hubs that can be used to share signals with the master and either actuators (outputs) or sensors (inputs) can be plugged in through a handful of standard plug configurations. Sensors and actuators can be configurable to report information that can be used for diagnostics and/or analysis for preventative maintenance programs. Products can be reconfigured on the fly. Performance parameters can also be stored in the IO Link Master so that a replacement sensor automatically gets configured after replacement. The BEI Sensors brand supports Industry 4.0 objectives and the 24 volt standard. It also uses the highest

The strength of IO Link is its simplicity, the ability to configure it and the diagnostic features

RECOMMENDED PRODUCTS

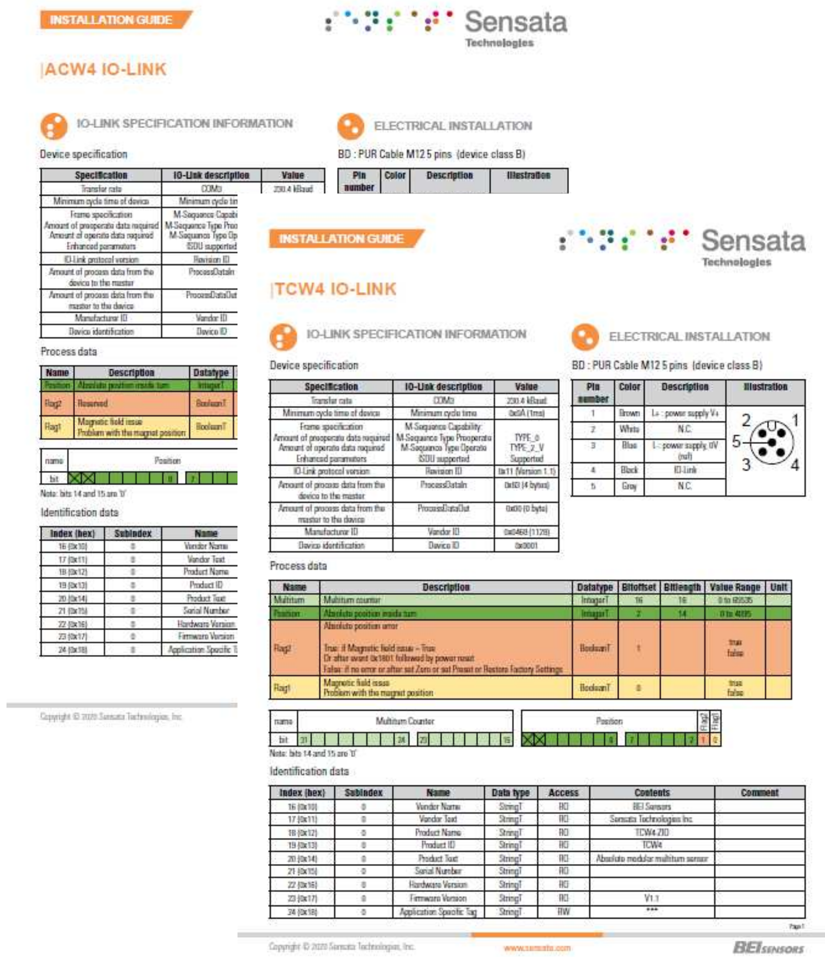
Reference on Diagram	Product	Type	Features	Part Number	Function	Brand
1	TCW4	Hall Effect Sensor	IO Link Interface	TCW4_DD//ZIOB//	Rotary Multiturn Encoder	BEI Sensors

DIAGRAM

CONTACT US

Good to know

- Installation Guides for the ACW4 and TCW4 with IO - Link are available
- A PDF file will be available for download on the website after the external announcement date.


INSTALLATION GUIDE

Sensata Technologies

ACW4 IO-LINK

IO-LINK SPECIFICATION INFORMATION

ELECTRICAL INSTALLATION

INSTALLATION GUIDE

Sensata Technologies

TCW4 IO-LINK

IO-LINK SPECIFICATION INFORMATION

ELECTRICAL INSTALLATION

Device specification

Process data

Identification data

Got questions? Contact us

Americas
+1 (800) 350 2727
sales.beisensors@sensata.com

Europe, Middle East & Africa
+33 (3) 88 20 8080
position-info.eu@sensata.com

Asia
sales.isasia@list.sensata.com

China
+86 (21) 2306 1500

Japan
+81 (45) 277 7117

Korea
+82 (31) 601 2004

India
+91 (80) 67920890

Rest of Asia
+886 (2) 27602006 ext. 2808