



ifm IO-Link Webinar

Implementing a Smart Wiring Solution

Wednesday 29 July



Product Specialist - Industrial Networking

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Presenter



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Host

IO-Link: Implementing a Smart Wiring Solution



 **IO-Link**

WEBINAR

 **WEBINAR**



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Overview

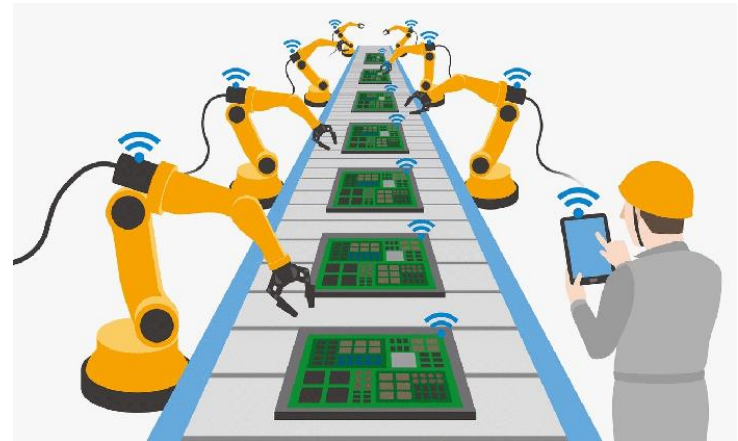
- Why do we need smart wiring systems
- What are the challenges when implementing a wiring system
- Selecting smart sensors and determining what data is available
- Integrating IO-link to your PLC
- Commissioning and monitoring using LR device software
- IOT/I4.0 integration options
- Questions and Answers

**“How to benefit now,
while becoming
Industry 4.0 ready”**



Why do we need smart wiring solutions?

The difference between factories of today and the factories of the future is not what is inside the factories but rather the **network** that connects them and the insights gained from many sources of **data**.



“Industry 4.0 is more about **optimisation** rather than invention”

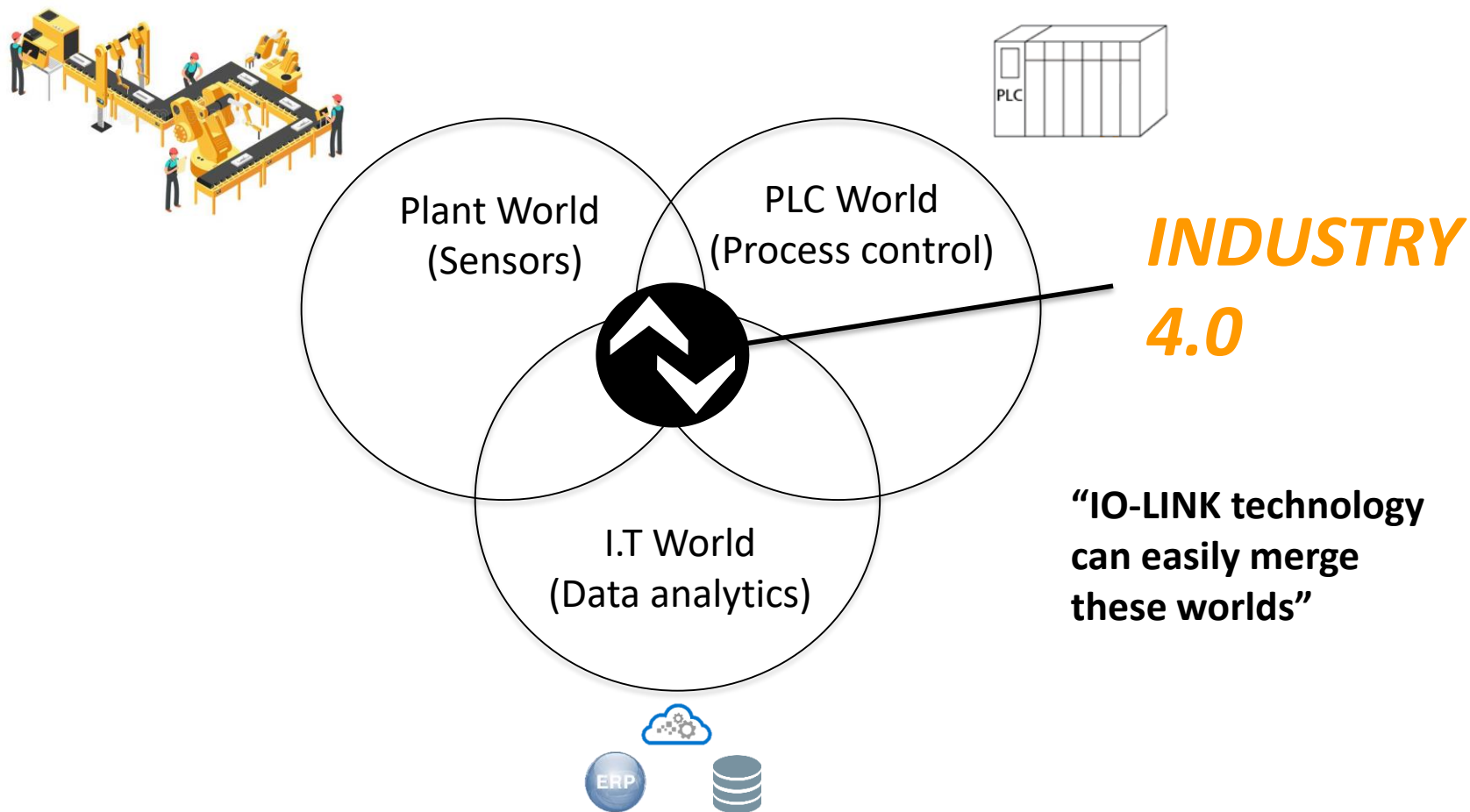


Where does the data come from?

IO-Link sensors
can supply
you with many **terabytes**
of **data**.

[illegible]

Networks need to move data efficiently to where it is needed





Challenges in pursuing Industry 4.0 Solutions

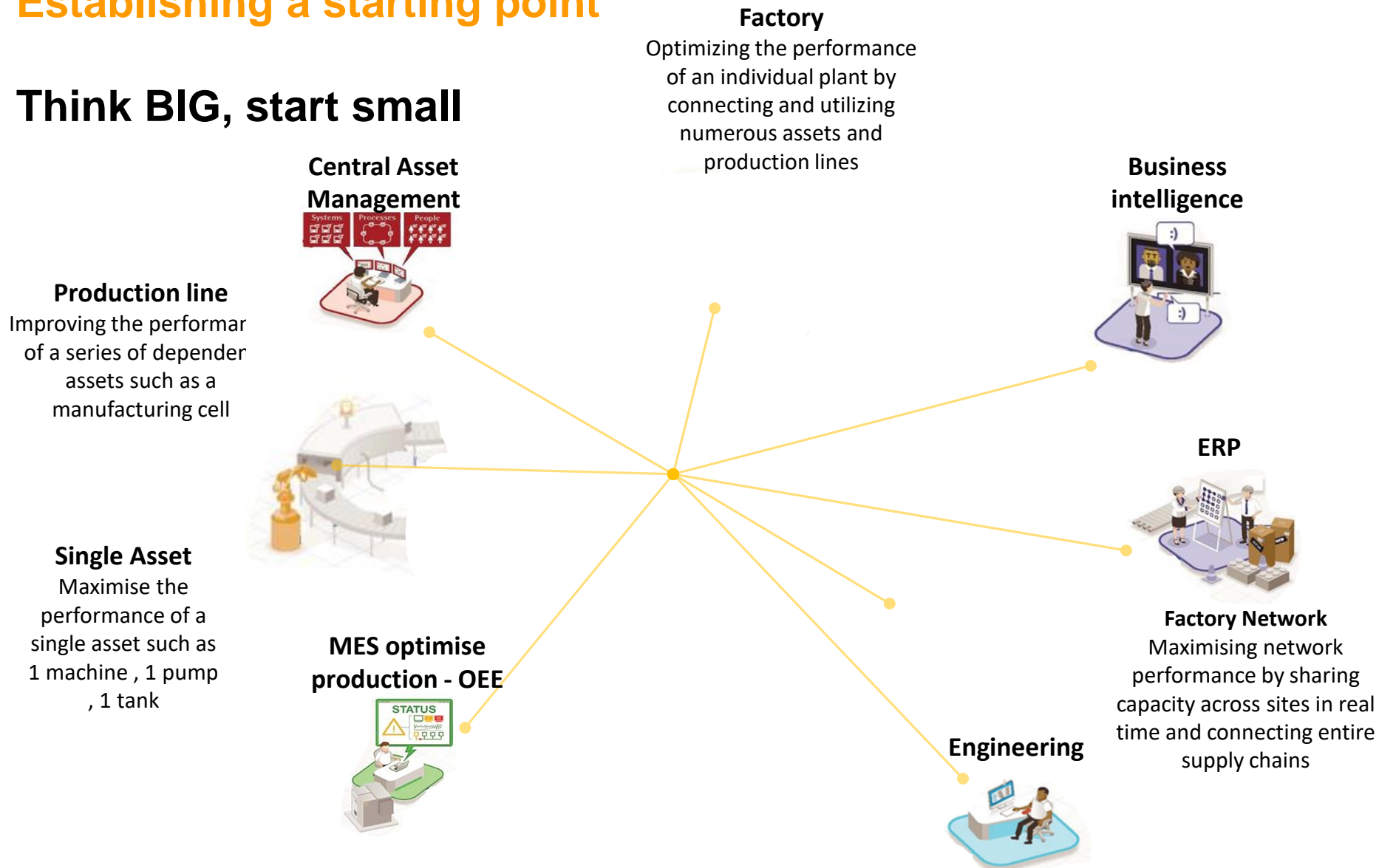
- Establishing a starting point
- Finding solution providers that understand your industry
- Flexibility to communicate with existing systems
- Budget??
- Limited time and resources
- Data security





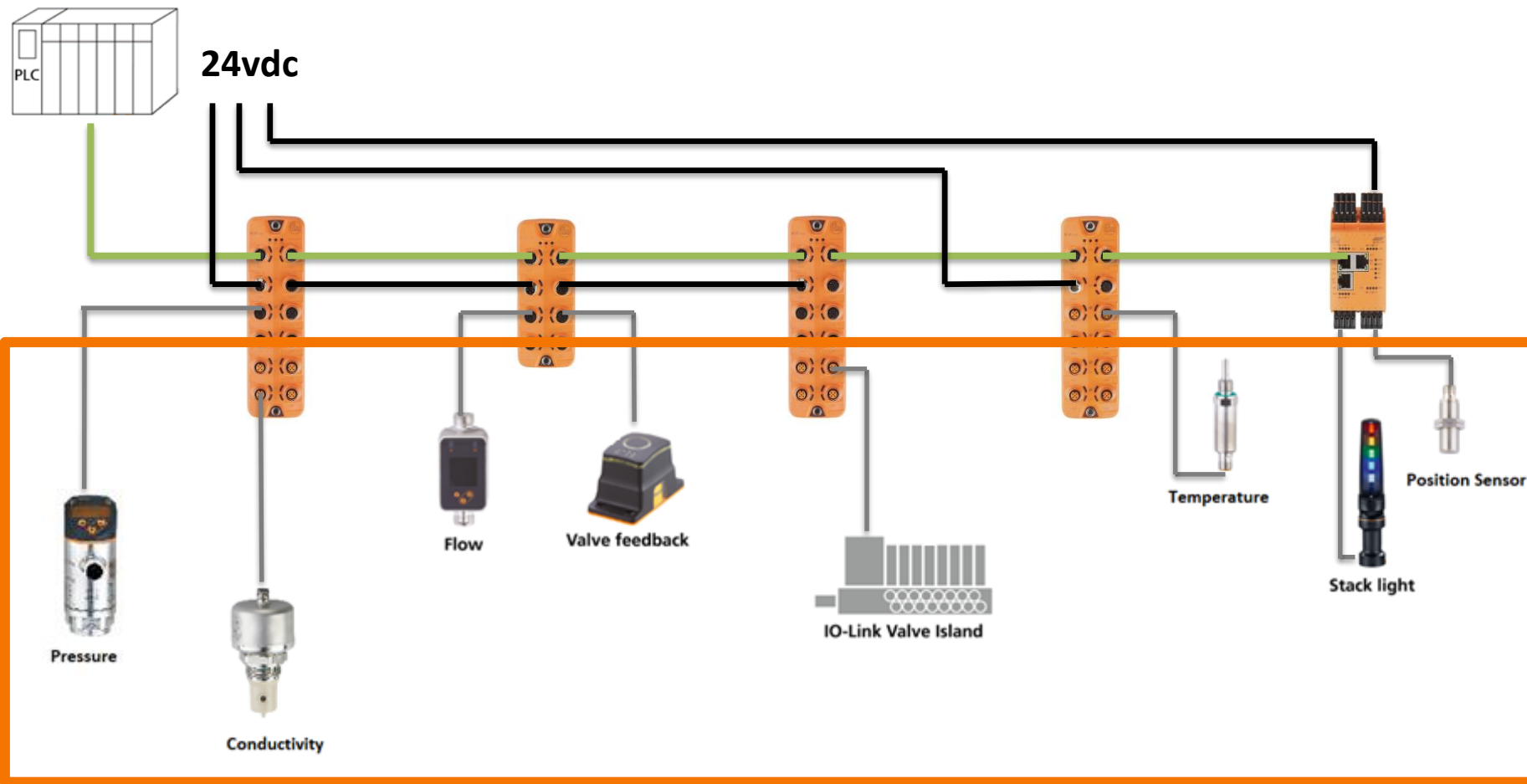
Establishing a starting point

Think BIG, start small





Typical Field Architecture

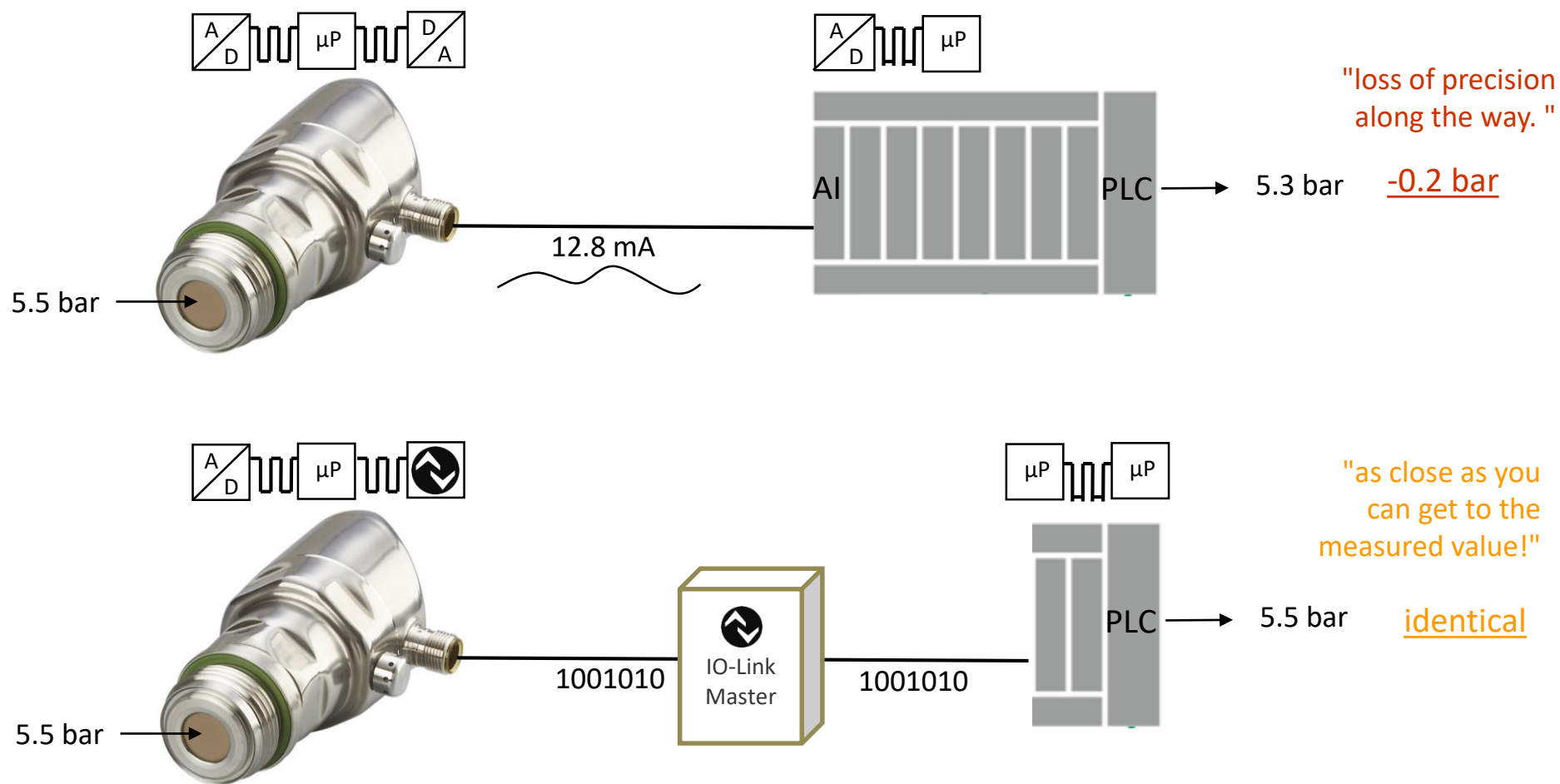




IO-Link Compared to Ethernet Based and Traditional Communication Protocols

	SENSOR COMMUNICATION			
	Binary On/Off	Analog	IO-Link	Ethernet Based
Amount of Data	1 bit	16 bits	32 bytes	Many bytes
Sensor Diagnostics			✓	✓
Remote sensor parameter adjustment			✓	✓
Automatic Sensor Parameter replacement			✓	✓
Standard Sensor Cables	✓	✓	✓	
Digital Communication			✓	✓
Complexity to integrate	✓	✓✓	✓✓	✓✓✓
Cost	\$	\$\$	\$	\$\$\$

IO-Link compared to 4...20mA signals



IO-link and Industry 4.0

What can IO-Link sensors offer in terms of Diagnostics



Mag Flow Sensor

- Measurement Pipe not sufficiently filled
- Measuring element failure (Replace device)
- Display failure
- Process Over range
- Process Under range



Photo Electric Sensor

- Dirty lens
- Object is too close
- Object is too far



Temperature Sensor

- Calibration required
- Temperature range exceeded
- Short circuit
- Device failure

Smart Valve Sensor

- Maintenance required, Wear of parts
- Device Failure
- Device Over / Under temperature
- Valve open and close times too long





What data is available from specific sensors?

IO-Link Device Description

- XML for software interpretation
- PDF for human interpretation

What information does an IODD file contain:

- Process values available from sensor
- Format of process values and order in data stream
- Sensor settings available
- General Information of sensor accessible via io-link i.e. serial number, part number, vendor name etc.
- Diagnostic information and events that the sensor can push via io-link

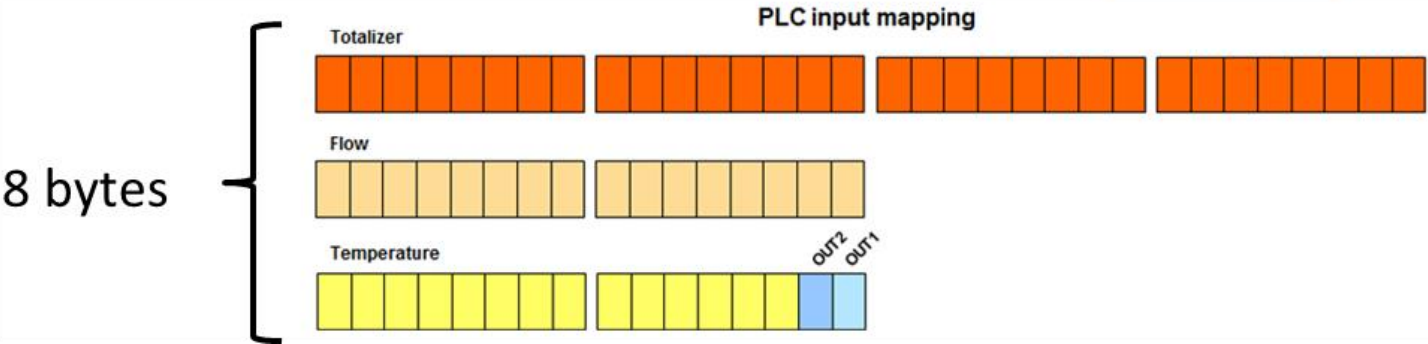


Sensor Specific Data



Process data

Name	Description	Data type	Bit offset	Bit length	Value range	Gradient	Offset	Unit
Totalizer	Quantity meter which continuously totals the volumetric flow since the last reset	Float32T	32		-1999000000 to 9999000000	1	0	l
Flow	Current flow	IntegerT	16	16	(3905) Err 3600 to 3900 (OL) -3599 to 3599 -3900 to -3600 (UL) (-3905) Err	0.1	0	l/min
Temperature	Current temperature	IntegerT	2	14	(1102) Err 1000 to 1100 (OL) -399 to 999 -500 to -400 (UL) (-502) Err	0.1	0	°C
OUT2	Status depends on [OU2]	BooleanT	1		(false) inactive (true) active			
OUT1	Status depends on [OU1]	BooleanT	0		(false) inactive (true) active			





Sensor Specific Data



Sensor settings and information – Read or Change from PLC

Name	Description	Index	Subindex	Data type	Length	Access rights	Default	Value range	Gradient	Offset	Unit
diS	Display settings	106	Sub 0	RecordT	16 Bit	rw					
<i>Display On / OFF</i>			bitOffs 7	BooleanT	1 Bit		(false) On	(false) On (true) OFF			
<i>Display orientation</i>			bitOffs 6	BooleanT	1 Bit		(false) Not rotated	(false) Not rotated (true) Rotated 180°			
<i>Update rate</i>			bitOffs 0	UIntegerT	6 Bit		(2) d2 / medium	(1) d1 / fast (2) d2 / medium (4) d3 / slow			
Uni	Selection of the physical unit	107	Sub 0	UIntegerT	8 Bit	rw	(0) l/min	(0) l/min (1) m³/h			
SEld	Selection of measurement on the sensor display	108	Sub 0	RecordT	16 Bit	rw					
<i>Displayed measurement</i>			bitOffs 0	UIntegerT	15 Bit		(1) FLOW	(1) FLOW (2) TEMP (4) TOTL			
SEL2	Selection of the measurand for the evaluation via [OUT 2]	110	Sub 0	UIntegerT	8 Bit	rw	(1) FLOW	(1) FLOW (2) TEMP			
LFC	Low flow cutoff	111	Sub 0	IntegerT	16 Bit	rw	50	50 to 150	0.1	0	l/min
FPro	Totalizer counting rule	112	Sub 0	UIntegerT	8 Bit	rw	(0) -+	(0) -+ (1) 0+			
Fdir	Preferred direction of flow	114	Sub 0	UIntegerT	8 Bit	rw	(0) +	(0) +			



Sensor Specific Data



Sensor Diagnostic messages – Pushed to PLC

Events

Code	Name	Type	Description
30480 d / 77 10 h	Short circuit	Error	Check installation
35856 d / 8C 10 h	Process variable range over-run	Warning	Process data uncertain. [INFO] This Event will not be transmitted via IO-Link Event mechanism. It is only available by reading Index 37 (Detailed Device Status) or Index 545 (BitCoded_ActiveEvents)
35872 d / 8C 20 h	Measurement range over-run	Error	Check application
35888 d / 8C 30 h	Process variable range under-run	Warning	Process data uncertain. [INFO] This Event will not be transmitted via IO-Link Event mechanism. It is only available by reading Index 37 (Detailed Device Status) or Index 545 (BitCoded_ActiveEvents)
36033 d / 8C C1 h	Measuring pipe not sufficiently filled. Too low conductivity of medium.	Warning	Please check your application
36034 d / 8C C2 h	Measurement data acquisition failure.	Error	Replace device
36035 d / 8C C3 h	Display function failure	Warning	Replace device
36350 d / 8D FE h	Test Event 1	Warning	Event appears by setting index 2 to value 240, Event disappears by setting index 2 to value 241
36351 d / 8D FF h	Test Event 2	Warning	Event appears by setting index 2 to value 242, Event disappears by setting index 2 to value 243



Actuator Specific Data

IO-link process data output

Bit 47	NN
	Buzzer Style
	Buzzer Style
	Buzzer Style
	NN
	NN
	NN
	Buzzer

Bit 39	NN
	Seg.5 Appearance
	Seg.5 Appearance
	Seg.5 Appearance
	NN
	Seg.5 Red
	Seg.5 Green
	Seg.5 Blue

Bit 31	NN
	Seg.4 Appearance
	Seg.4 Appearance
	Seg.4 Appearance
	NN
	Seg.4 Red
	Seg.4 Green
	Seg.4 Blue

Bit 23	NN
	Seg.3 Appearance
	Seg.3 Appearance
	Seg.3 Appearance
	NN
	Seg.3 Red
	Seg.3 Green
	Seg.3 Blue

Bit 15	NN
	Seg.2 Appearance
	Seg.2 Appearance
	Seg.2 Appearance
	NN
	Seg.2 Red
	Seg.2 Green
	Seg.2 Blue

Bit 7	NN
	Seg.1 Appearance
	Seg.1 Appearance
	Seg.1 Appearance
	NN
	Seg.1 Red
	Seg.1 Green
Bit0	Seg.1 Blue





Finding solution providers that understand your industry

IO-Link Consortium

Consortium of major
sensor manufacturers and
industrial manufacturing companies
to promote the IO-Link standard

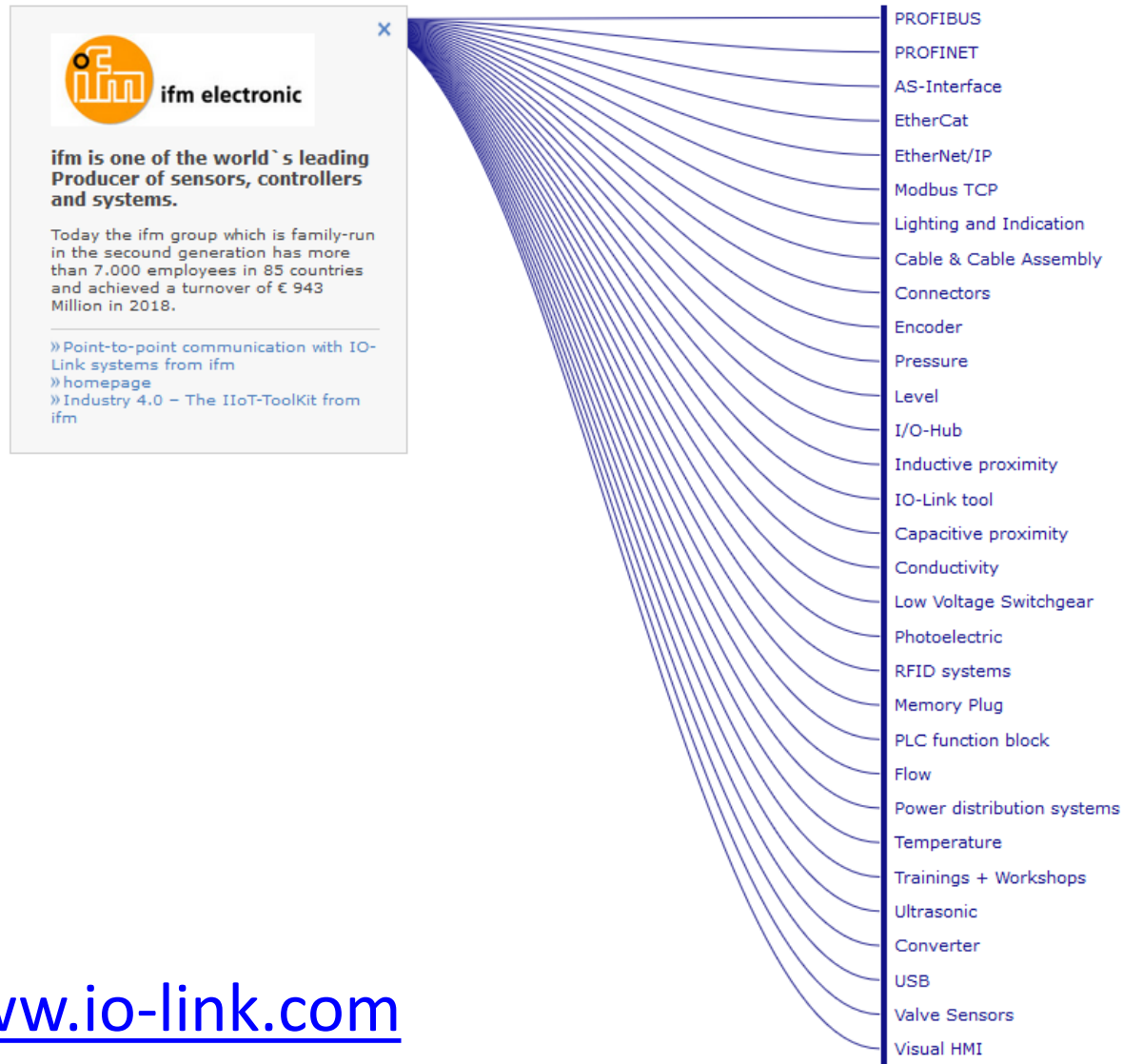


Use
IO-Link
Universal · Smart · Easy

www.io-link.com

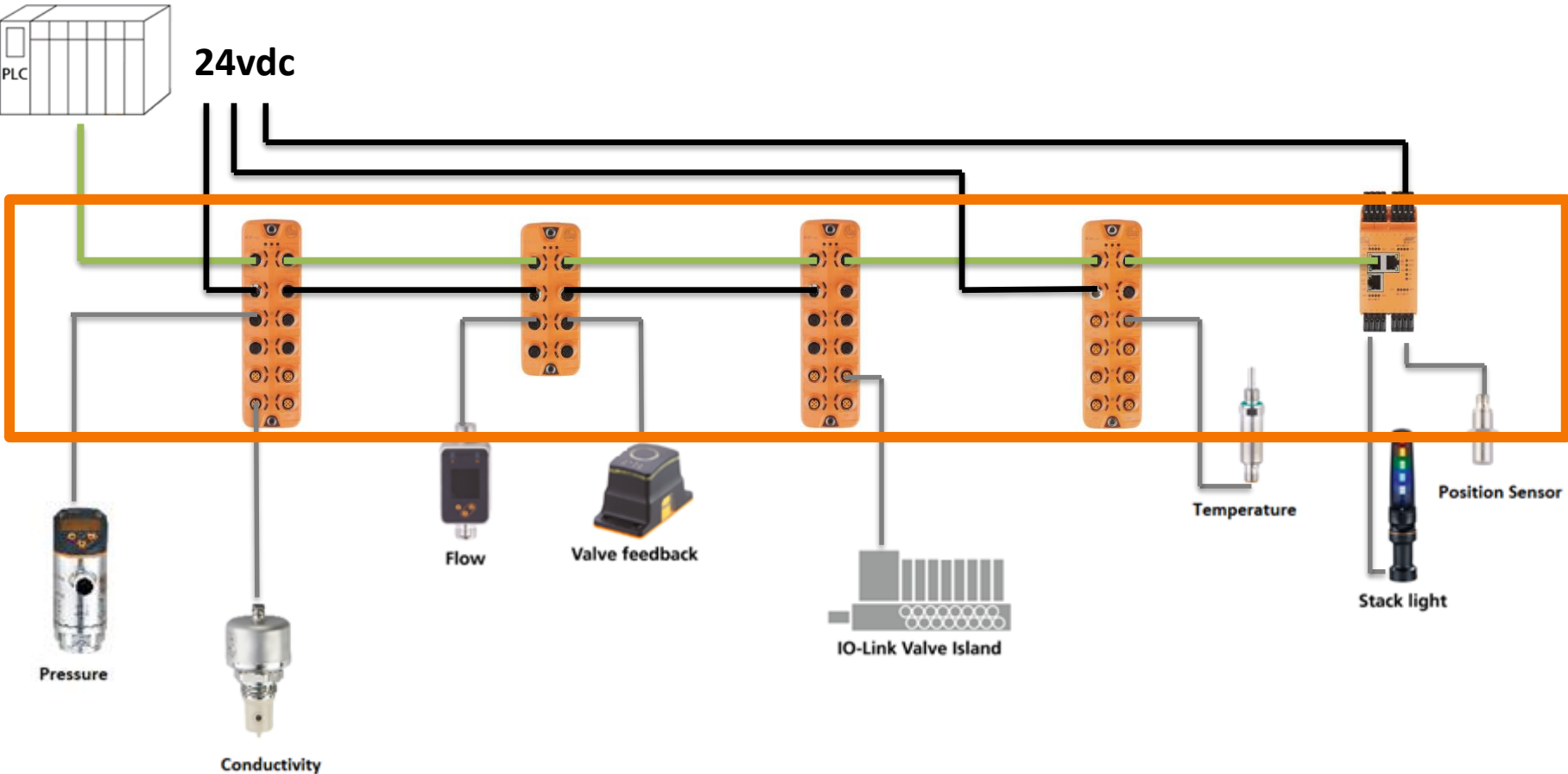


Competency Matrix from IO-Link consortium





Typical Field Architecture – IO modules



Master options : Powerline



- Parameter setting
- Process values
- Field Bus independent

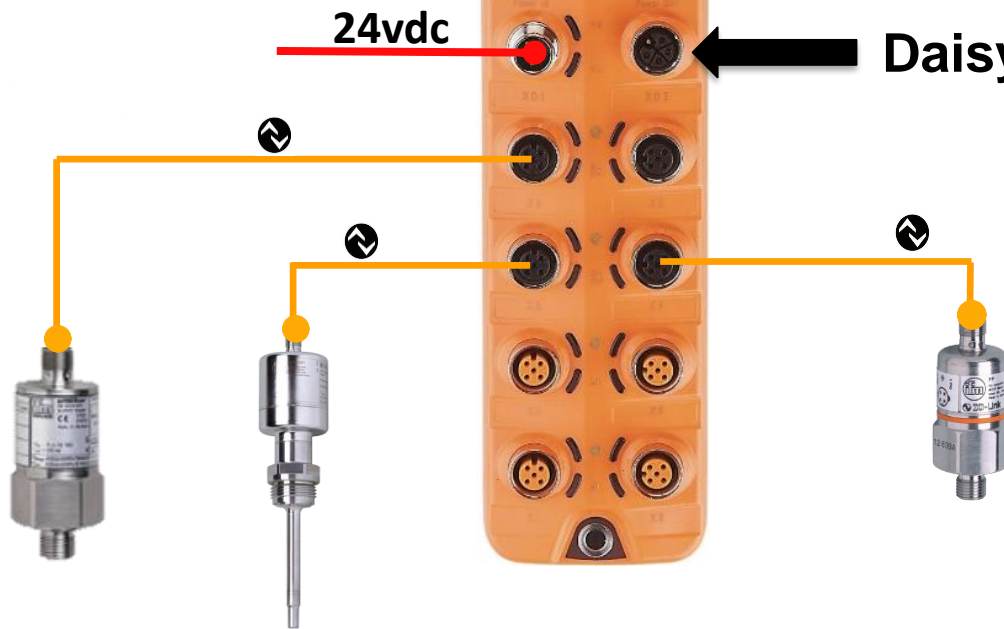


Daisy-chain fieldbus

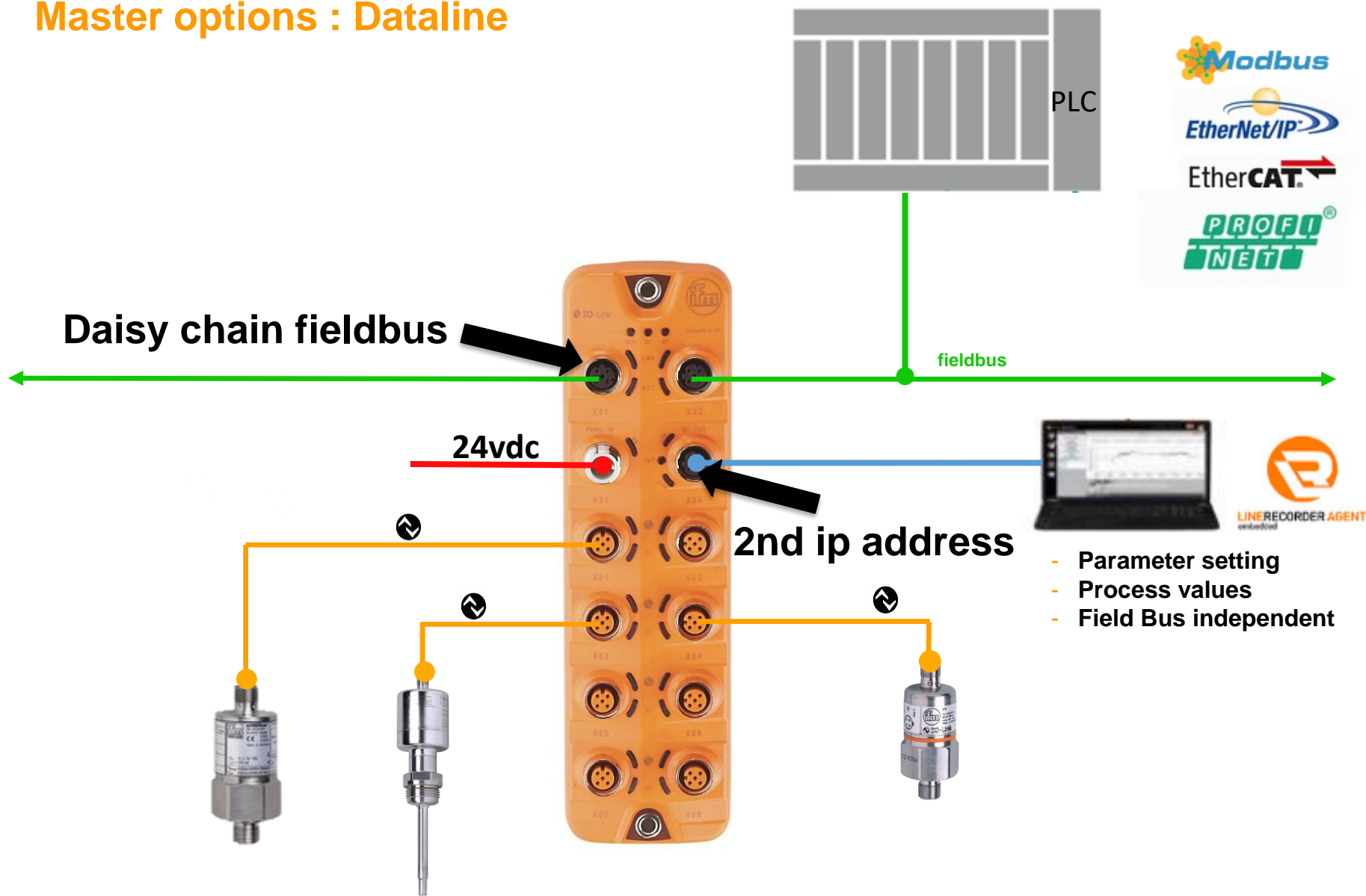


24vdc

Daisy-chain power



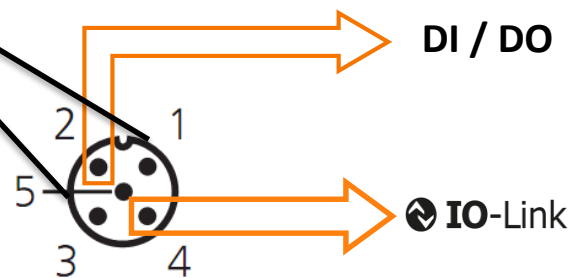
Master options : Dataline



IO-Link Sensor Connection

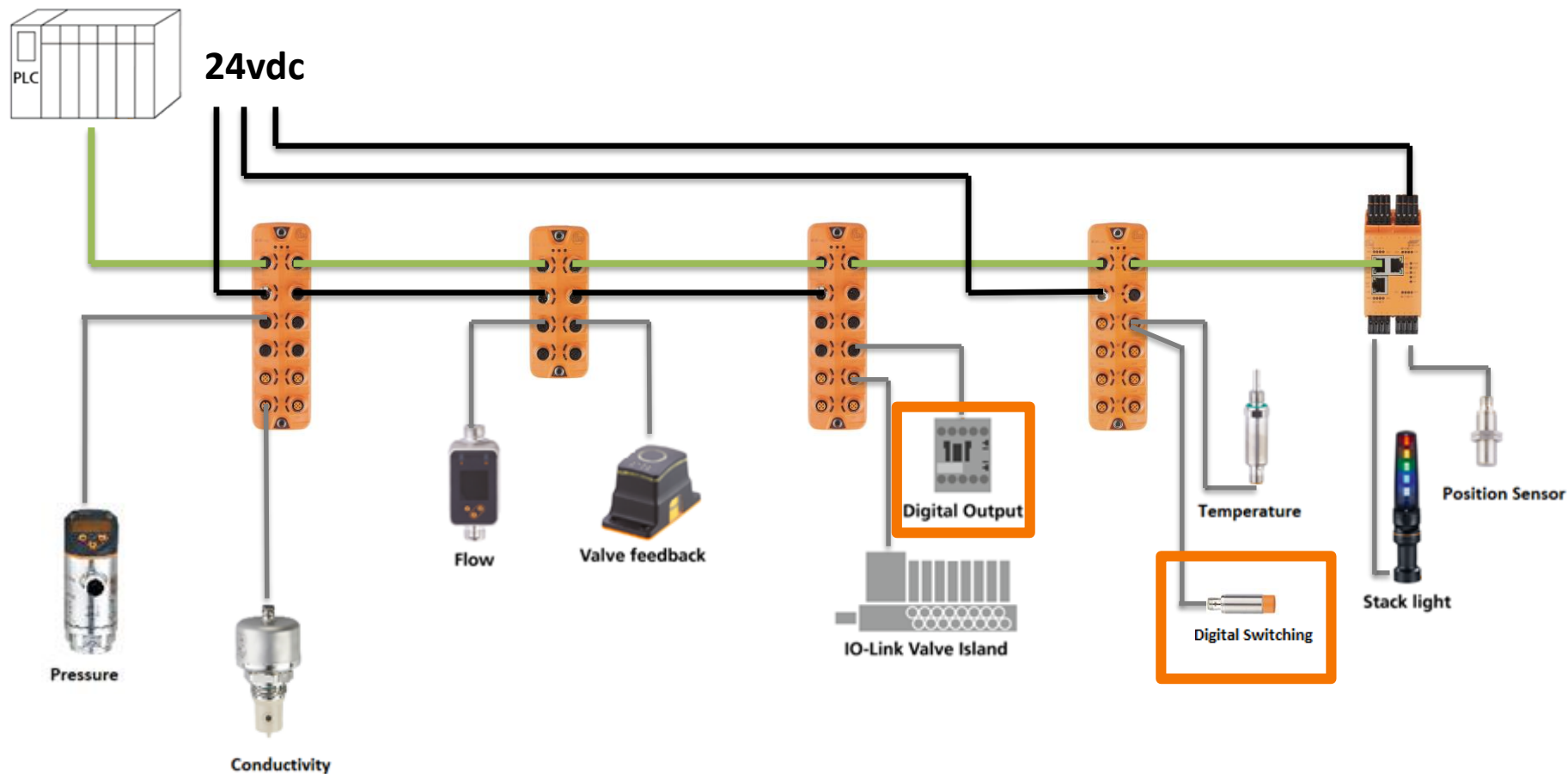


Pin	Description
1	24+
2	DI / DO
3	GND
4	DI/ DO / IO-Link

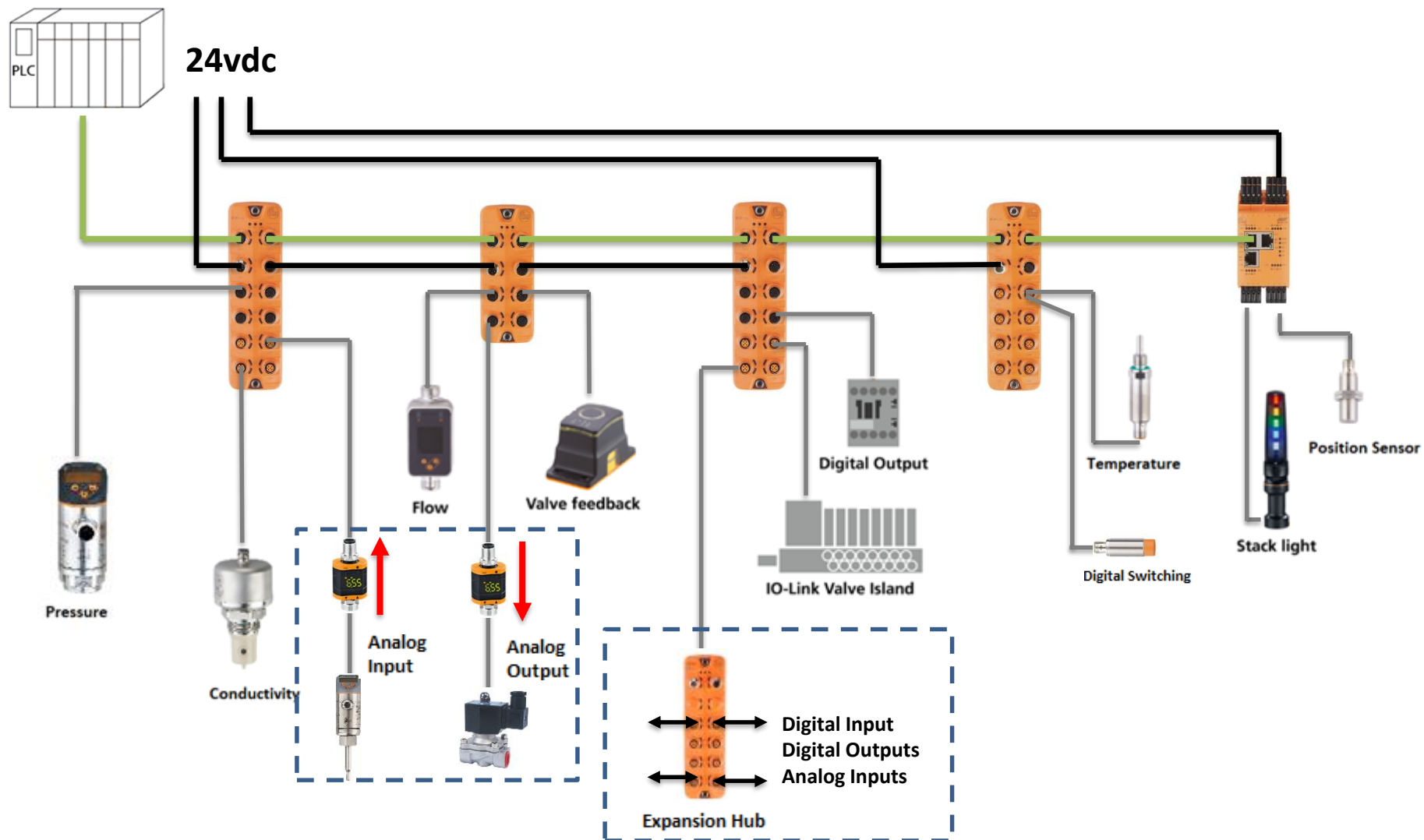




Typical Field Architecture with standard DI/DO devices included



Flexibility to communicate with existing systems



IO-Link Master Data Types

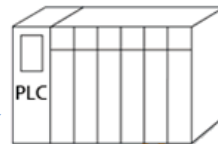
Process Data

- Sensor process values
- Status of the sensor
- Status of the switch outputs

Value status (PQI)

- Status of each port
 - Sensor connected
 - Process data is valid
 - Short circuit
 - Status of the Digital signals
 - Device ID / Vendor ID

Cyclic data



Acyclic data

Device Data (Request)

- Info about the Device
 - Identification
 - Diagnostics
 - Parameters
- Read and write

Event Data (Push)

- If an event occurs
 - Signal is sent to the PLC
 - PLC can read the event
- Events include
 - Warning and error messages
 - Maintenance data



Integrating IO-Link sensors to PLC: Startup packages

ifm.com/za/en/downloadarea

ifm electronic gmbh (DE) | https://www.ifm.com/za/en/downloadarea/ MasterContent

• IO-Link Setup Guide & Software

Vision sensors, 3D sensors

IO-Link Device Description IODD

Identification systems

Photoelectric sensors

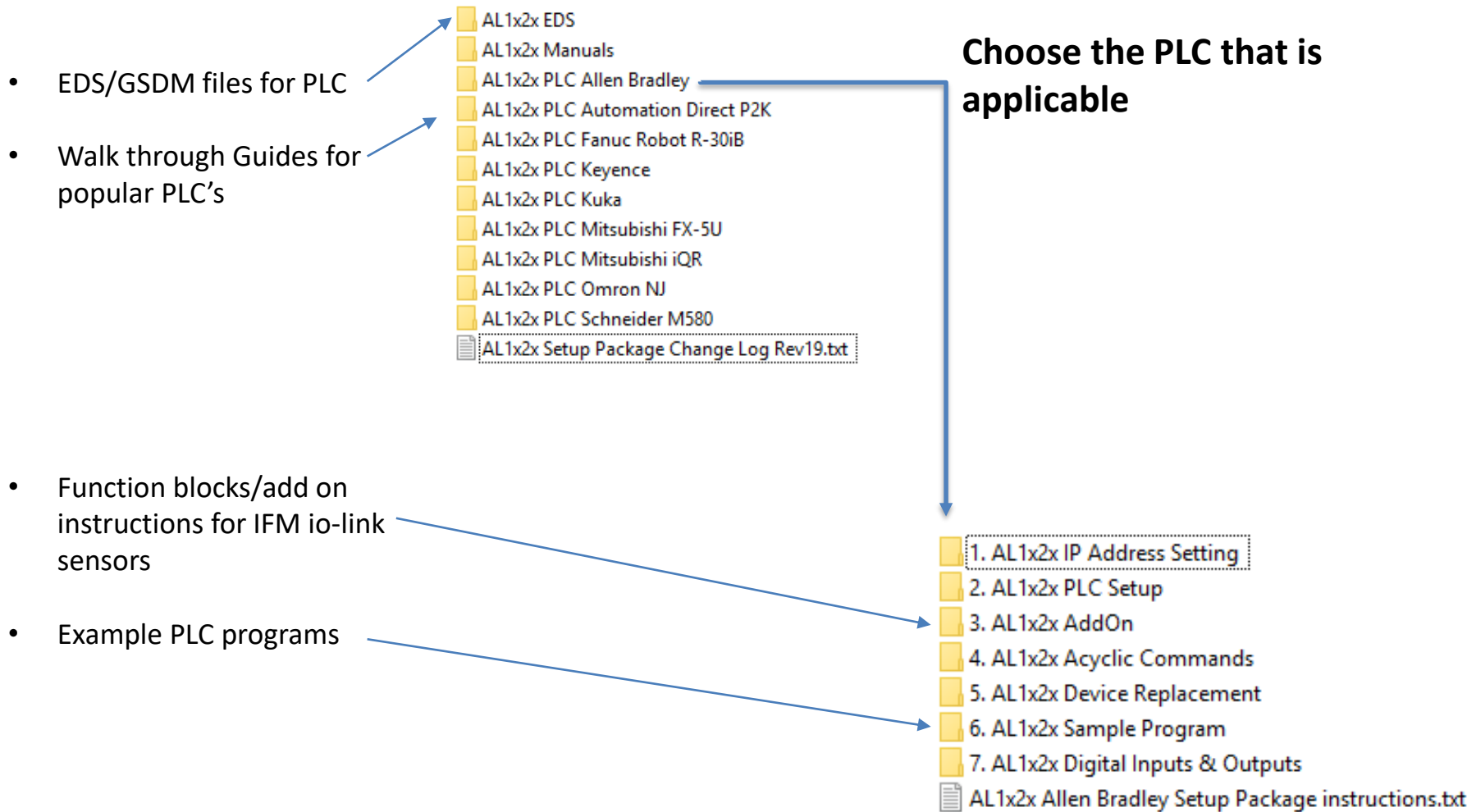
Mobile machines

Safety technology

Condition monitoring of machines

IO-Link System Description UK.pdf	Technology and Application IO-Link Benefits	V1.7	1104 kb	Please log in to download the software
15 IO-Link Master Startup Package:				
Name	Description	Version	Size	Download
Startup Package IO-Link AS-i	CODESYS 3.5 AC6000 AC6001 AC6002 AC6003	V2.0.0	45114 kb	Please log in to download the software
Startup Package IO-Link EtherCAT	Beckhoff Omron Kuka AL1330 AL1331 AL1332 AL1333 AL1930	V10.0.0	32178 kb	Please log in to download the software
Startup Package IO-Link EtherCAT	CODESYS 3.5 AL1030	V1.0.0	22265 kb	Please log in to download the software
Startup Package IO-Link EtherNet/IP	Allen Bradley Omron Schneider Fanuc Robot Keyence Kuka Mitsubishi Automation Direct AL1120 AL1121 AL1122 AL1123 AL1220 AL1221 AL1222 AL1223 AL1320 AL1321 AL1322 AL1323 AL1420 AL1422 AL1920 ZZ1120	V23.0.0	237864 kb	Please log in to download the software
Startup Package IO-Link EtherNet/IP	Allen Bradley AL1020	V5.0.0	8153 kb	Please log in to download the software

Integrating IO-Link sensors to PLC: Startup packages



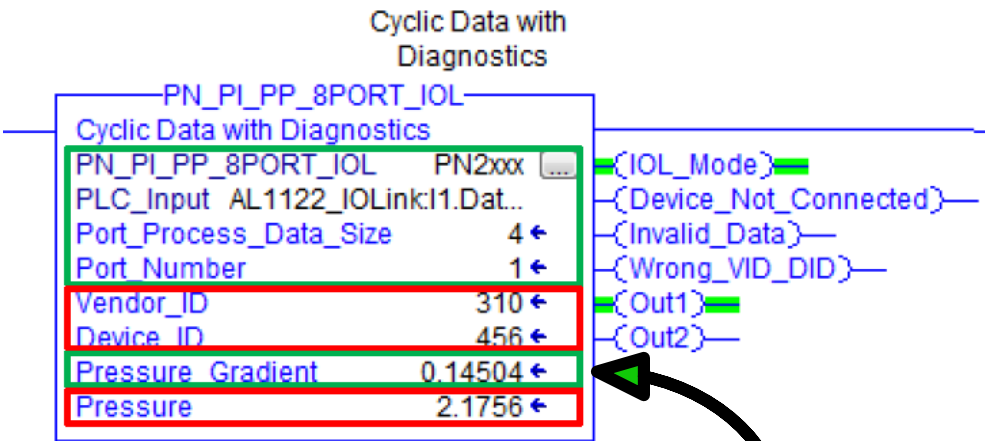
Integrating IO-Link sensors to PLC: Add on instructions

Function block INPUT

- IO-Link master Data tag
- Port number where sensor is connected
- Pressure gradient form IODD file for the specific sensor

Function Block OUTPUT

- Vendor and device ID
- Process value
- Device status and PQI



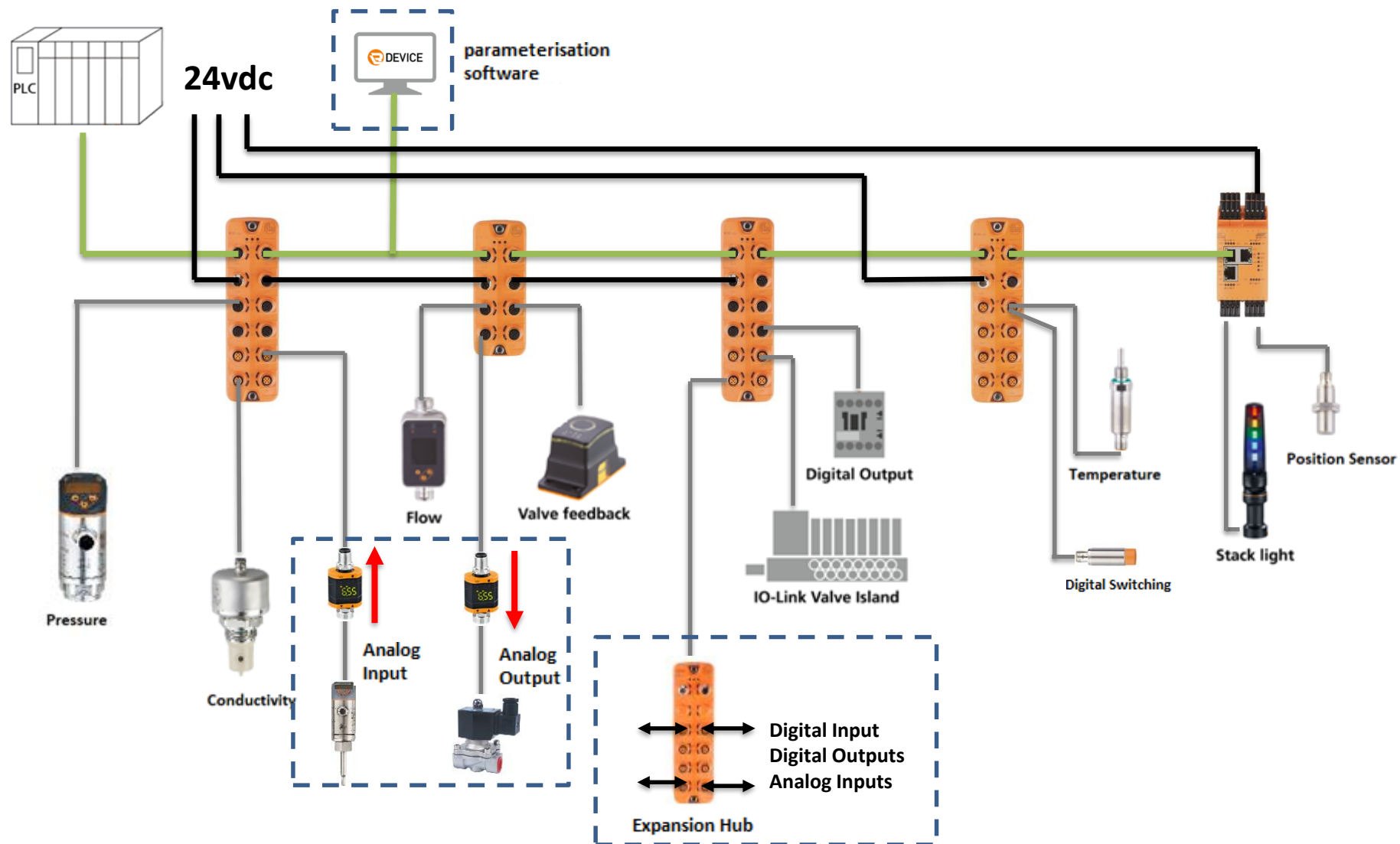
Process Data
Process Data Input

Total BitLength = 16

Name	Description	Datatype	Bitoffset	Bitlength	Value Range	Gradient	Offset	Unit
Pressure	Current pressure	IntegerT	2	14	1051 to 3000 (OL) -100 to 1050	0.14504	0	psi
OUT2	Status depends on [OU2]	BooleanT	1		false inactive true active			
OUT1	Status depends on [OU1]	BooleanT	0		false inactive true active			



Configuring and monitoring sensors



Software

Lets look at the software





Configure IO-Link Master

LR DEVICE x +

localhost:45234/lrd/

DATE: 7/26/20 TIME: 4:09:59 PM

DEVICE

Device catalogue

Fast access

ONLINE

Devices

al1100 (192.168.0.250)

OFFLINE

Vendor

Parameter

IoT

Fieldbus

Port 1

Port 2

Port 3

Port 4

Info

Firmware

Device parameters

Product ID: AL1100_V2

Device ID: 4100000014 d (310 d)

Revision: PT / AL1x0x_cn_pn_v2.3.23

Device state:

Vendor: ifm electronic gmbh

Serial number: 2016_09_28_0207

Device type: IO-Link Master StandardLine Profinet 4 Ports IP 67

Cyclic polling: ☐

Parameter	Value	Unit	Min	Max	Description
Version	AL1x0x_cn_pn_v2.3.23				Firmware version of IO-Link Master
System command	Factory Reset				Factory Reset of IO-Link Master
System command	Reboot				Reboot of IO-Link Master

Device parameters

Type here to search

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Configure IO-Link Sensor

LR DEVICE

localhost:45234/lrd/

Date: 7/26/20 Time: 4:11:35 PM

ifm

DEVICE

Setup

Cockpit

Device catalogue

Fast access

ONLINE

Devices

al1100

P1: TN2511

P3

P4

OFFLINE

Vendor

All

Identification

Parameter

Output configuration

Digital output 1

Digital output 1

Analog Output 2

Analog Output 2

Memory

Fault Configuration Output 1

Fault Configuration Output 2

Setting of the sensor display

Calibration

Setup

Process Data Input

Diagnosis

Device parameters

Product ID: TN2511

Device ID: 582 d (310 d)

Revision: AA / V1.18

Device state: ■

Vendor: ifm electronic gmbh

Serial number: g00971306165

Device type: Electronic temperature sensor, -50...150 °C, IO-Link,

Cyclic polling: ☐

Parameter	Value	Unit	Min	Max	Description
Application Specific Tag	TN2511		0	32	Application Specific Tag
ou1	Hno / Hysteresis fct normally open				Output configuration [OUT 1]
ou2	I / Analog signal 4...20 mA				Output configuration [OUT 2]
P-n	PnP				Output polarity for the switching outputs
dS1	0.0	s	0.0 s	50.0 s	Switching delay for [OUT 1]
dr1	0.0	s	0.0 s	50.0 s	Reset delay for [OUT 1]
SP_FH1	31.5	°C	-49.8 °C	150.0 °C	Switch point 1. [SP1] must be greater than [rP1]. Please take into account the current [rP1] value. [SP1] will be refused if below [rP1]. [SP] = [FH] and [rP] = [FL] if [OU1] = Fno, Fnc.
rP_FL1	28.5	°C	-50.0 °C	149.8 °C	Reset point 1. [rP1] must be smaller than [SP1]. Please take into account the current [SP1] value. [rP1] will be refused if above [SP1]. [rP] = [FL] and [SP] = [FH] if [OU1] = Fno, Fnc.
ASP2	0.0	°C	-50.0 °C	145.0 °C	Analogue start point 2. [ASP2] must be smaller than [AEP2]. Please take into account the current [AEP2]. For info on the minimum hysteresis [AEP2]-[ASP2] please refer to the operating instructions.
AEP2	150.0	°C	-45.0 °C	150.0 °C	Analogue end point 2. [AEP2] must be greater than [ASP2]. Please take into account the current [ASP2]. For info on the min hysteresis [AEP2]-[ASP2] please refer to the operating instructions.
Lo	12.8	°C	-50.0 °C	150.0 °C	Minimum memory value
Hi	39.6	°C	-50.0 °C	150.0 °C	Maximum memory value
Standard Command	Reset [Hi] and [Lo] memory				
Standard Command	Reset [Lo] memory				
Standard Command	Reset [Hi] memory				

Device parameters

Type here to search

@ ifm

4:11 PM 2020/07/26



Give sensor a custom tag name

LR DEVICE

localhost:45234/lrd/

DATE: 7/26/20 TIME: 4:13:27 PM

DEVICE

Device catalogue

Fast access

ONLINE

Devices

al1100

P1: 500-TT-001

P3

P4

OFFLINE

Vendor

Device parameters

Product ID: TN2511

Device ID: 582 d (310 d)

Revision: AA / V1.18

Device state: ■

Vendor: ifm electronic gmbh

Serial number: g00971306165

Device type: Electronic temperature sensor, -50...150 °C, IO-Link,

Cyclic polling: ☐

Application Specific Tag

500-TT-001

0

32

Application Specific Tag

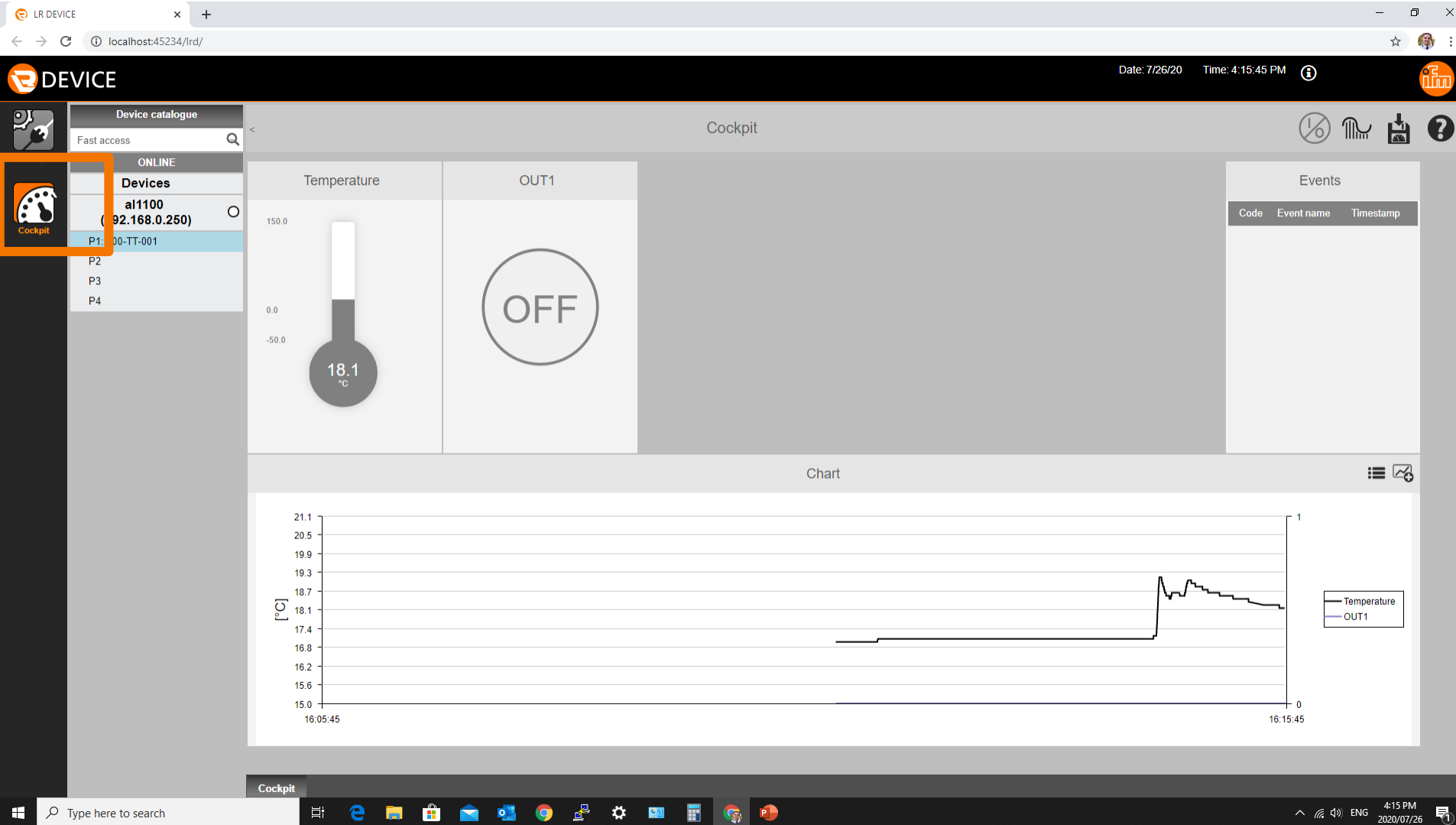
Device parameters

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Monitor sensor values





Configure multiple sensors via io-link

LR DEVICE x +

localhost:45234/lrd/

DATE: 7/26/20 TIME: 4:25:04 PM

DEVICE

Device catalogue

Fast access

ONLINE

Devices

al1100 (192.168.0.250)

P1: 500-TT-001

P2: OID200

P4

OFFLINE

Vendor

Device parameters

Product ID: OID200

Device ID: 373 d (310 d)

Revision: AB / 118

Device state: ■

Vendor: ifm electronic gmbh

Serial number:

Cyclic polling: ☐

Device type: Optical distance sensor. Visible laser light, protection class 2 laser. Connection: 2 switching outputs normally o...

Parameter	Value	Unit	Min	Max	Description
Application Specific Tag	***		0	16	Application Specific Tag
SP. Switch Point 1	(Not used)				Smart Sensor Profile: BDC1 Switchpoints
SP. Switchpoint Logic	Closing Contact				Smart Sensor Profile: BDC1 Switchpoint configuration
ETSP1	199	cm	0 cm	200 cm	Easy-turn Setpoint
Align	20	%	0 %	100 %	Align Signal
dFO	100	ms	0 ms	2000 ms	Time delay after signal loss (100 ms steps)
dS	0	ms	0 ms	2000 ms	Switch-On delay
dr	0	ms	0 ms	2000 ms	Switch-Off delay
Process data limits. Min	5	cm	0 cm	65535 cm	Process data limit values
Process data limits. Max	200	cm	0 cm	65535 cm	Process data limit values
Device Access Locks. Data Storage	Unlocked				Device Access Locks
Device Access Locks. Local Parameterization	Locked				Device Access Locks
Laser	Laser on				Laser configuration
Standard Command	Restore Factory Settings				

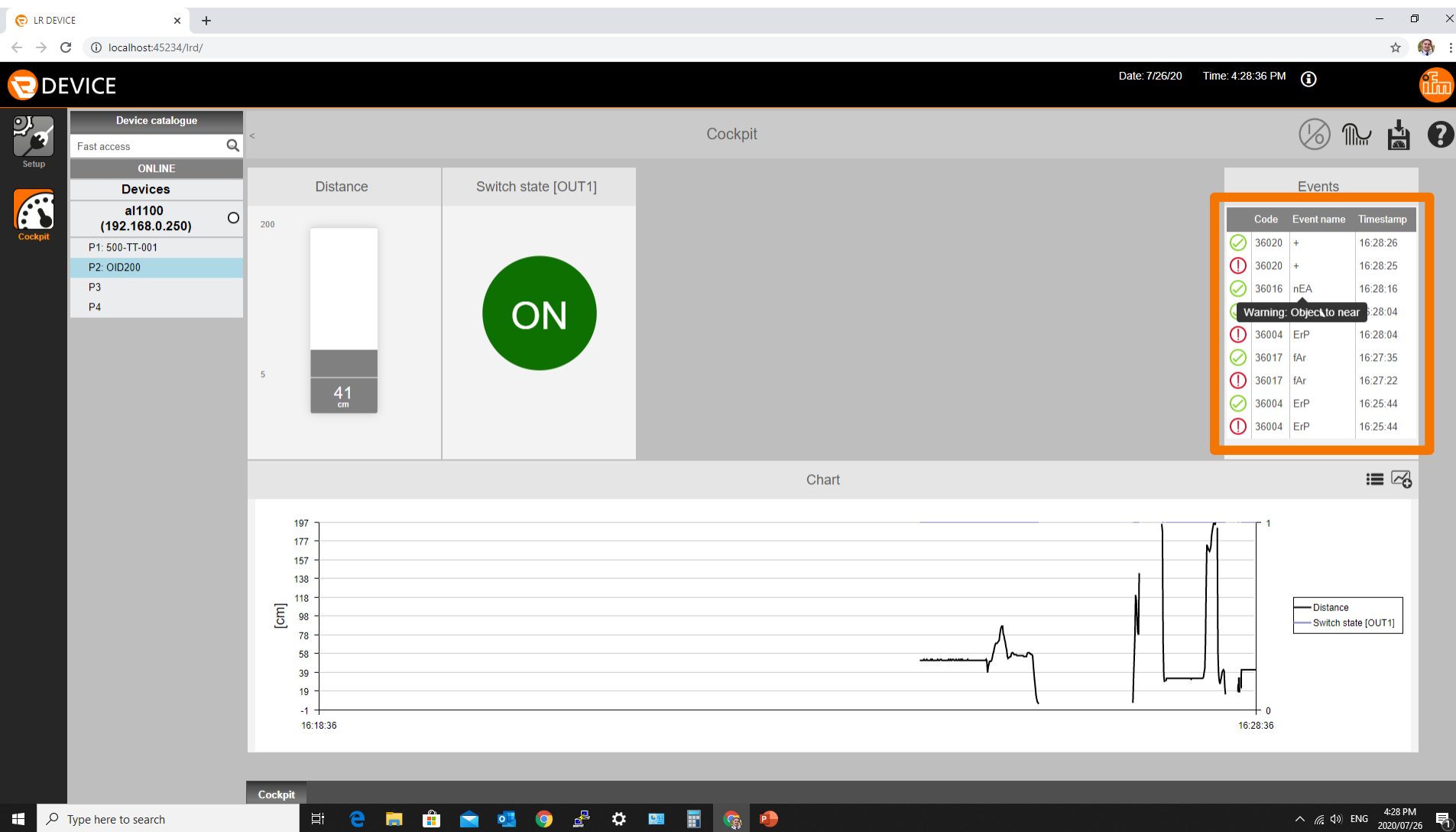
Device

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Diagnostics events pushed from sensor





Not only IFM io-link sensors can be accessed

LR DEVICE x +

localhost:45234/lrd/

DATE: 7/26/20 TIME: 4:38:05 PM

DEVICE

Device catalogue

Fast access

ONLINE

Devices

OFFLINE

Vendor

Müller Industrie-Elektronik GmbH

Load Sensor

MISG-IO Strain Gauge Transmitter with Limit S...

Device parameters

Product ID: FC0252XX-XX Device ID: 13631488 d (1182 d) Revision: Device state:

Vendor: Müller Industrie-Elektronik GmbH Serial number: Device type: Strain Gauge Transmitter with Limit Switch, universal measurand

Parameter	Value	Unit	Min	Max	Description
Application Specific Tag	***		0	32	Application Specific Tag
Function Tag			0	32	Function Tag
Location Tag			0	32	Location Tag
Special pre-filtering	0		0	1	Special pre-filtering
Signal smoothing	0.5	s	0.0 s	60.0 s	Signal smoothing
Auto zero tolerance (% FSO)	5	%	5 %	50 %	Auto zero tolerance (% FSO)
Difference factory zero point vs. user zero point	0.0		-3276.8	3276.7	Difference factory zero point vs. user zero point
Standard Command	Auto-Zero (Tare)				Auto-Zero (Tare)
Service interval in operating hours (input_1 >5%)	8760	h	5 h	87600 h	Service interval in operating hours (input_1 >5%)
Standard Command	Reset Auto-Zero				Reset Auto-Zero
Standard Command	Restore Factory Settings				Restore factory settings
TAG number			0	32	TAG number
Installation			0	16	Installation
Location			0	16	Location
Date of change			0	6	Date of change (DDMMYY)

Device parameters

Type here to search

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io-Link is not limited to sensors

LR DEVICE x +

localhost:45234/lrd/

DATE: 7/26/20 TIME: 4:39:06 PM

DEVICE

Device catalogue

Fast access

ONLINE

Devices

OFFLINE

Vendor

SIEMENS AG

SIRIUS Overload Relay

SIRIUS Overload Relay
IO-Link 3RB24 (3RB24...

Device parameters

Product ID: 3RB2483-4A*1
Vendor: SIEMENS AG

Device ID: 591361 d (42 d)
Serial number:

Revision:

Device type: processing unit for full motor protection (monostable) with IO-Link; size S00...S12, class 5...30; stand-alone inst...

Device state:

Parameter	Value	Unit	Min	Max	Description
Application Specific Name			0	64	Application Specific Name
index131. Ground fault detection	Disable				Ground fault detection
Index131. Cold start	Disable				Cold start
index131. Rated operational current Ie	0.00	A	0.00 A	42949672.95 A	Rated operational current Ie
index131. Trip class [CLASS]	10				Trip class [CLASS]
index131. Response to overload - thermal motor model	Tripping without restart				Response to overload - thermal motor model
index131. Response to overload - thermistor	Tripping without restart				Response to overload - thermistor
index131. Thermistor - monitoring	No				Thermistor - monitoring
index130. Operator panel available	Yes				Operator panel available
index130. Operation at Preset <-> Actual Configuration	Enable				Operation at Preset <-> Actual Configuration
index92. Preset <-> Actual Configuration					Preset <-> Actual Configuration
index92. Group error					Group error
index92. General warning					General warning
index92. Thermistor overload					Thermistor overload

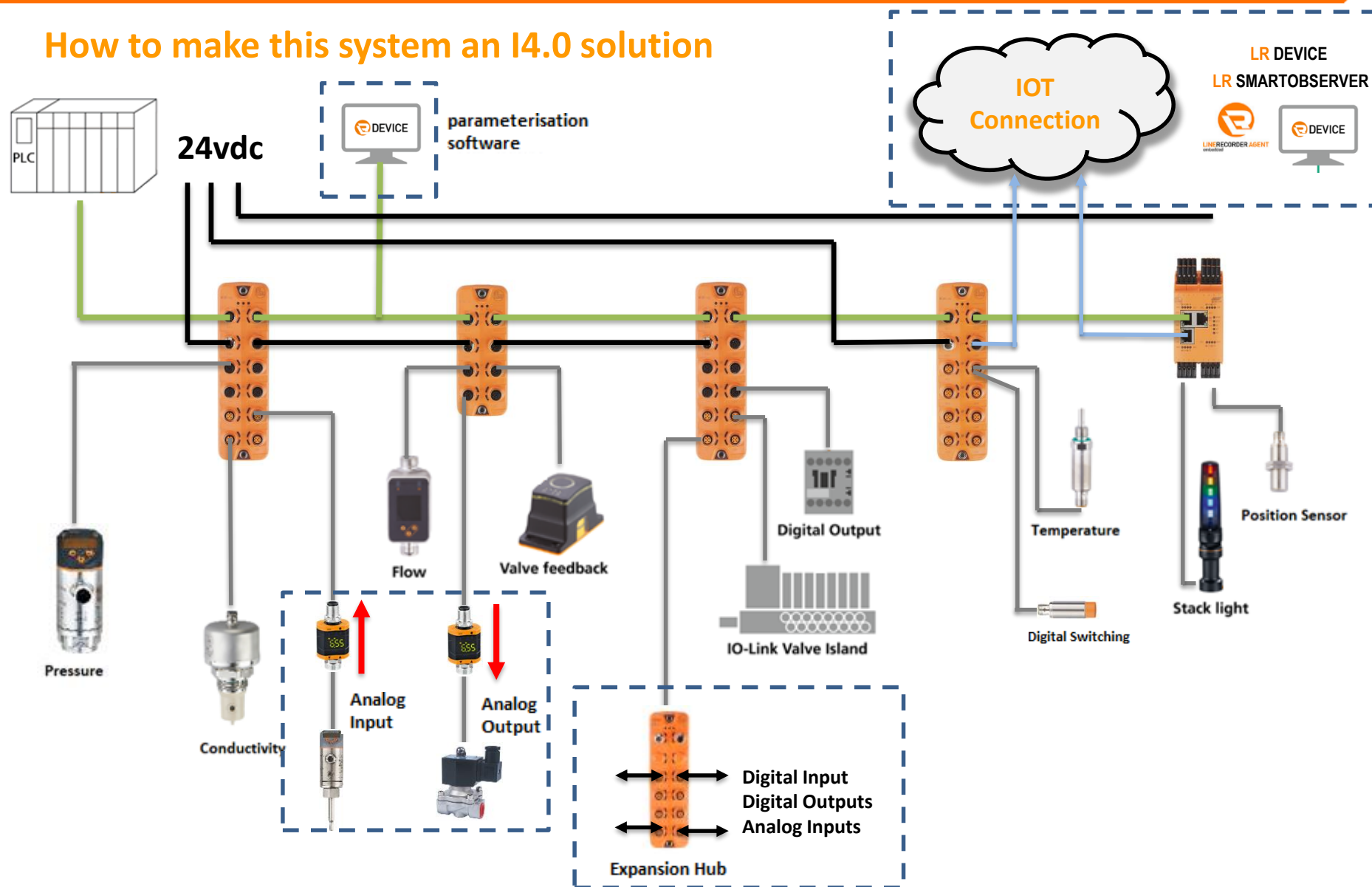
Device parameters

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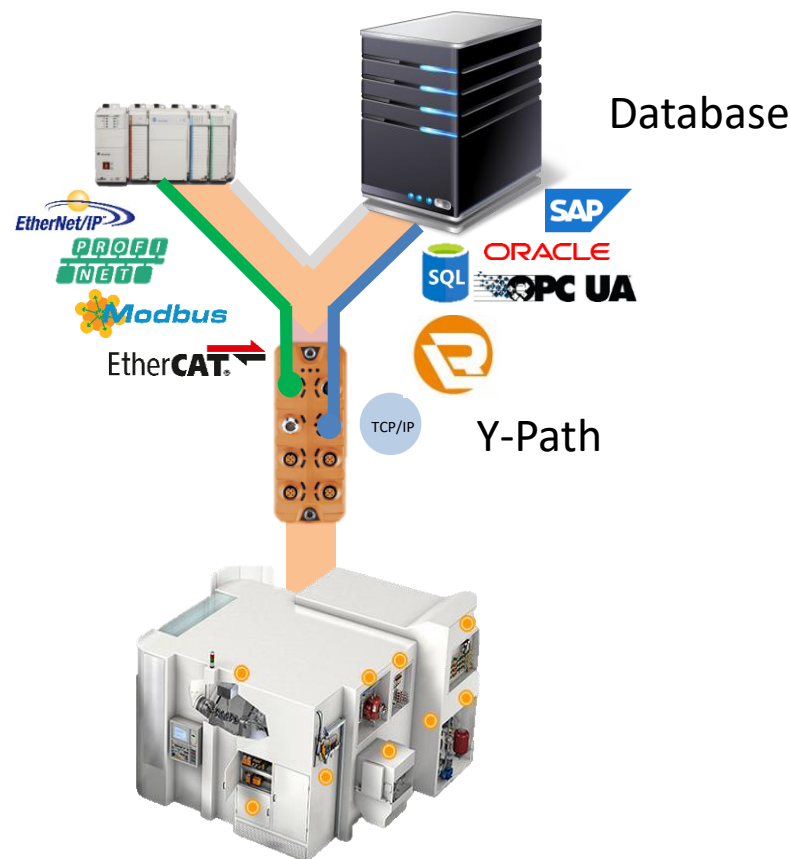
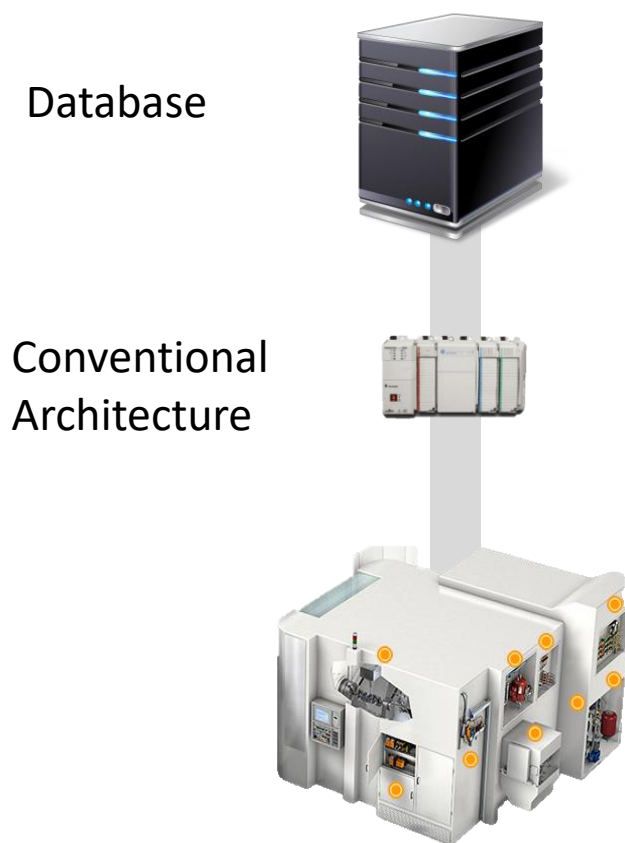
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How to make this system an I4.0 solution



Where should the data go and how does it get there?





Where should the data go and which IT protocol to use



PLC

Field mount IP69K

FieldBus

MQTT / HTTP
JSON
FORMATTED



On-premise or cloud platform for maintenance trending & analytics, developing of machine KPI's, **predictive maintenance**, etc



Supercharging historian & dashboard/**visualization** software without burdening the machine controller / PLC



MES / CMMS integration for more **intelligent production** & maintenance decision-making, sending SMS / email alerts



ERP integration for more informed supply chain data, **automatic replenishment**



ORACLE

PLEX



infor

IQMS[®]
Manufacturing ERP





Challenges overcome in pursuing Industry 4.0 Solutions

- Establishing a starting point
- Finding solution providers that understand your industry
- Flexibility to communicate with existing systems
- Budget??
- Limited time and resources
- Data security



IO-Link Starter Kits

Various IO-Link started kits are available
For different fieldbus protocols

Includes:

- LR Device Software
- IO-Link Master
- Sensor
- Cables and accessories



Let us help you **start** your journey to the
4th Industrial Revolution

Questions & Answers ?





Webinar Schedule

29 July 2020	IO-Link: Implementing a Smart Wiring Solution
05 August 2020	Smart observer – Versatile online monitoring
12 August 2020	ifm's New valve sensor - Continuous position feedback and diagnostics
19 August 2020	Compact Versatile Single Signal Lamp with IO-Link Technology
26 August 2020	IO Link Precise Pressure Sensor with Temperature Monitoring

See the next webinars at the link below:

<https://www.ifm.com/za/en/za/webinars/2020>





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Thank you for participating

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