



What does Process Automation Understand under Diagnosis?

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Technical Track

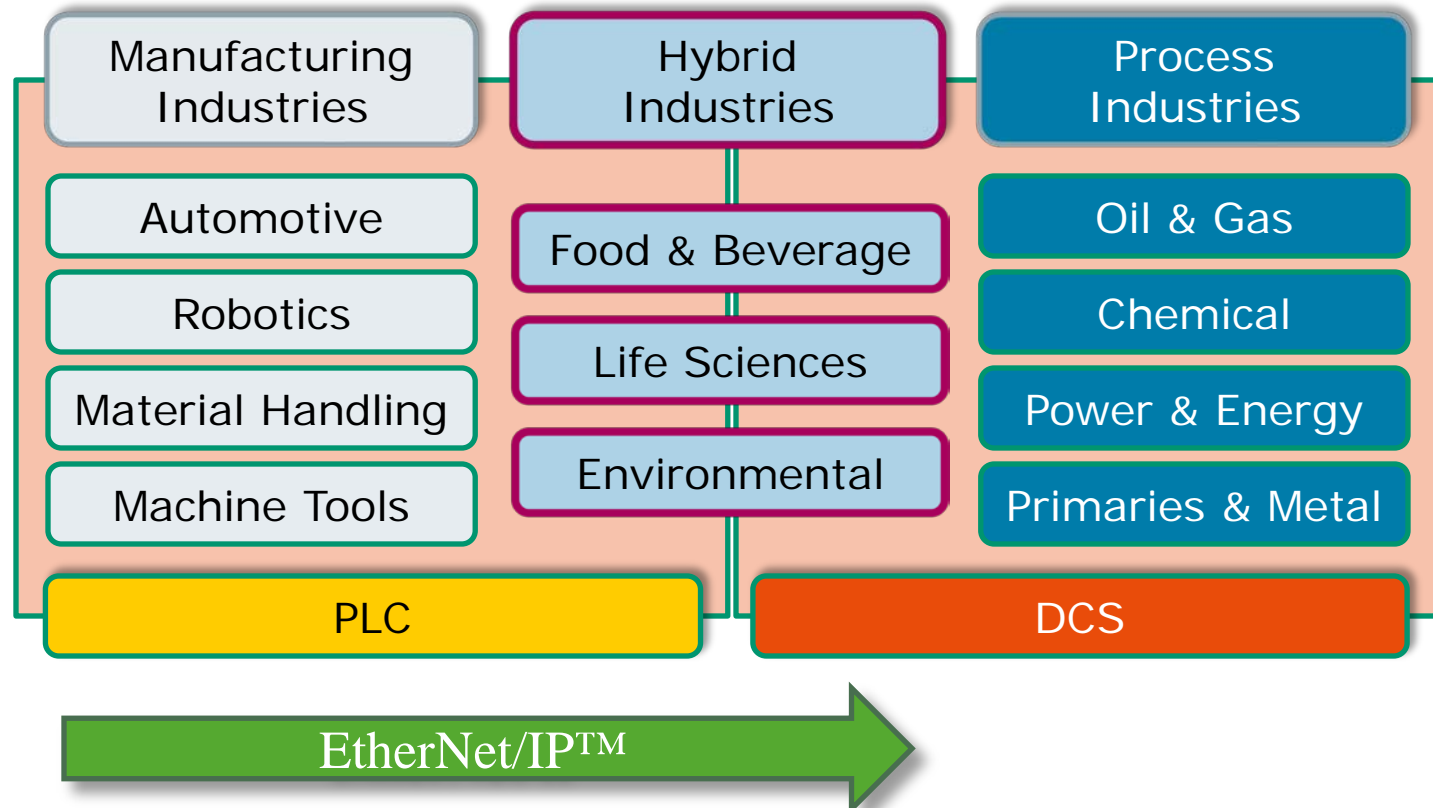
What does Process Automation Understand under Diagnosis?

Overview

- ▶ Factory and Process Automation
- ▶ Same roof but different tasks and focuses
- ▶ Field devices diagnostics
- ▶ NAMUR NE107 recommendation
- ▶ Digital communication protocols and NE107
- ▶ EtherNet/IP™ and NE107 possible implementation

What does Process Automation Understand under Diagnosis?

Factory and Process Automation



What does Process Automation Understand under Diagnosis?

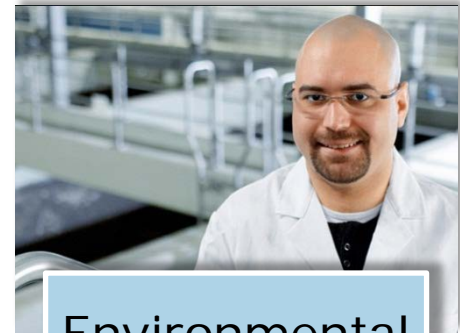
Hybrid industries?



Food &
Beverage



Life Sciences



Environmental

What does Process Automation Understand under Diagnosis?

Process industries?



Chemicals



Oil & Gas



Power &
Energy



Primaries &
Metals

What does Process Automation Understand under Diagnosis?

Industrial Tasks	
Process Automation	Factory Automation
Typical tasks : heating, cooling, mixing, separating, analyzing, calibrating	Moving, adjusting, mechanical processing, lubricating
Outdoor plants, wide areas, high requirements on big temperature ranges and	Compact plants, skids, indoor, low requirements on big temperature ranges and
Continuous process control, analog values	State recognition, binary signals are dominating
Law regulation, Approval certificates for components	

What does Process Automation Understand under Diagnosis?



► Process Automation focus

- Safety
- No shut down button
- Long-term running (~20 years)
- Running without downtime (~3 years)

► Requirements

- Protect high investment
- Efficient life cycle management
- Predictive maintenance

Intelligent field devices are able to fulfill these requirements!

What does Process Automation Understand under Diagnosis?

Operator console



Process configuration,
monitoring and operation



Focus on running processes

Maintenance console



Performance and condition
management of fieldbus devices

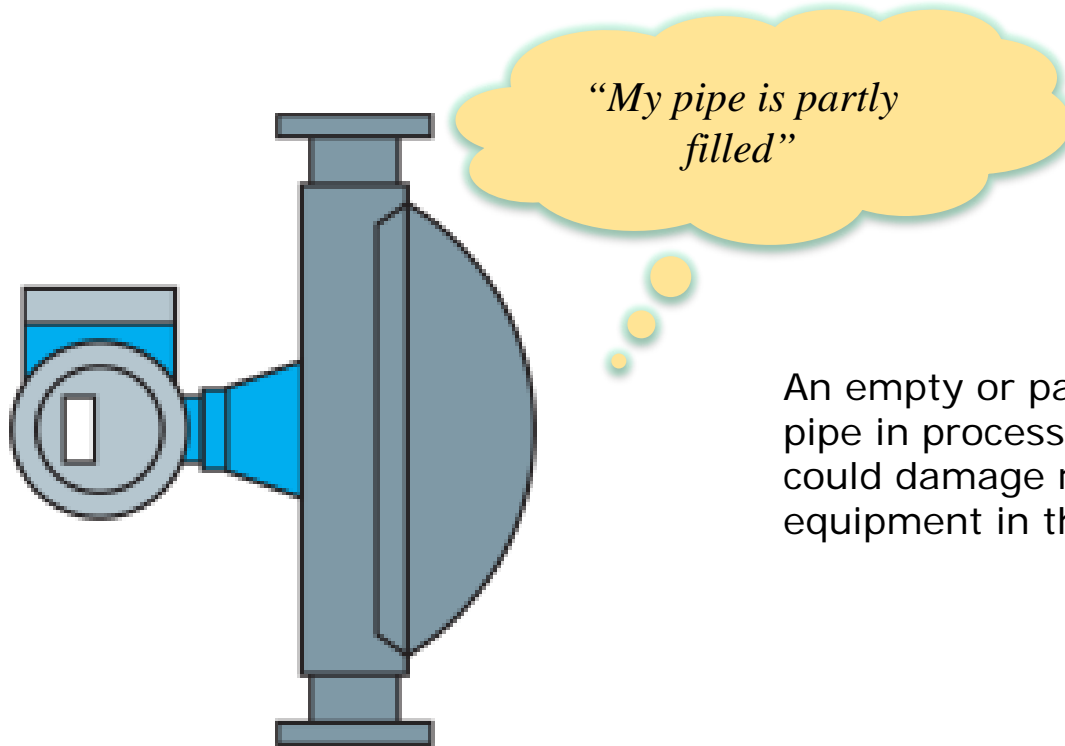


Focus on running assets

Need to understand themselves

What does Process Automation Understand under Diagnosis?

Diagnostic Information

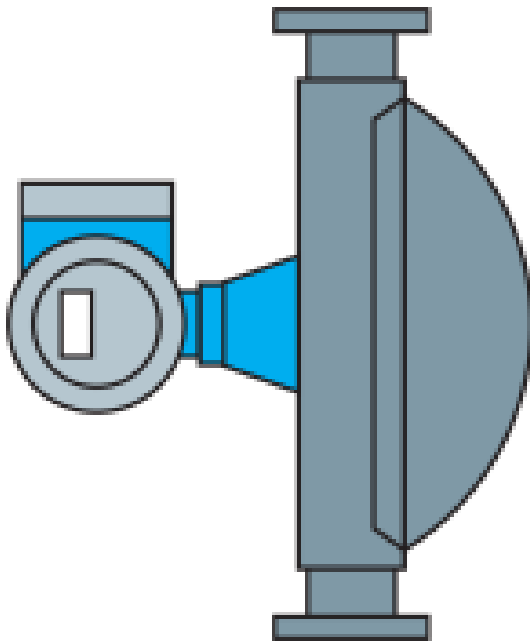


An empty or partially filled pipe in process application could damage running equipment in the process.

Note: in 4-20mA technology, only failure current shown. Digital communication unlocks field device diagnostic information !

What does Process Automation Understand under Diagnosis?

► Diagnostic information



Delivers several types of diagnostic information

Sensor/Actuator element failures
Tube temperature sensor defect
Exciter coils defective
Carrier tube temperature sensor defective
Electronic failures
Critical Failure Fault
EEPROM Failure
Totalizer Checksum Fault
Configuration/servicing failures
Board Incompatibility
Software Update in progress
Communication I/O Failure Fault
Simulation active
Configuration error
Process induced failures
Oscillation Amplitude Limit
Excitation Current Limit
Fluid Inhomogeneous
Noise Limit
Sensor Asymmetry Exceeded Fault
Corrosion
Erosion
Coating -Build Up
Air Entrainment
Slug Flow
Cavitation
Empty Pipe

Sensor related

Electronics related

Configuration
Service related

Process induced

What does Process Automation Understand under Diagnosis?

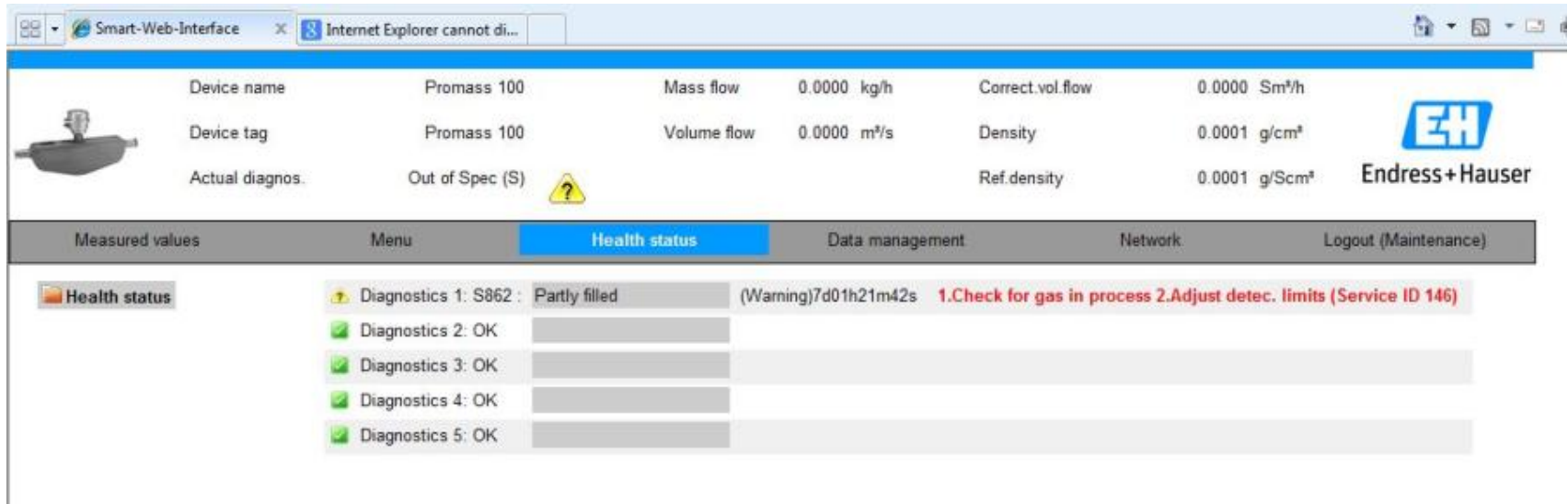
Standardized overview in maintenance console

Instrument health status


	Failure (F)
	Function check (C)
	Out of specification (S) <u>Diagnostics 1:</u> S862 Partly filled pipe <input type="text"/> <u>Remedy information:</u> 1.Check for gas in process, 2. Adjust detection limits (Service ID:146) <input type="text"/>
	Maintenance required (M)

What does Process Automation Understand under Diagnosis?

Diagnostic information in web server








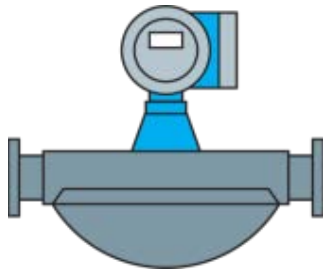
The screenshot shows a web browser window titled "Smart-Web-Interface" displaying diagnostic data for a "Promass 100" device. The data is organized into a table with columns for device name, tag, actual diagnosis, mass flow, volume flow, density, and ref. density. A yellow warning icon is present next to the "Actual diagnos." field, which is "Out of Spec (S)". Below the table is a navigation menu with "Health status" selected. The "Health status" section shows a list of diagnostics: "Diagnostics 1: S862 : Partly filled" with a warning icon and a red message "1.Check for gas in process 2.Adjust detec. limits (Service ID 146)", and "Diagnostics 2: OK", "Diagnostics 3: OK", "Diagnostics 4: OK", and "Diagnostics 5: OK" with green checkmark icons.

Device name	Promass 100	Mass flow	0.0000 kg/h	Correct.vol.flow	0.0000 Sm ³ /h
Device tag	Promass 100	Volume flow	0.0000 m ³ /s	Density	0.0001 g/cm ³
Actual diagnos.	Out of Spec (S) 	Ref.density	0.0001 g/Scm ³		

Measured values Menu **Health status** Data management Network Logout (Maintenance)

Health status

-  Diagnostics 1: S862 : Partly filled (Warning)7d01h21m42s **1.Check for gas in process 2.Adjust detec. limits (Service ID 146)**
-  Diagnostics 2: OK
-  Diagnostics 3: OK
-  Diagnostics 4: OK
-  Diagnostics 5: OK



What does Process Automation Understand under Diagnosis?

- ▶ Who is NAMUR?
- ▶ NAMUR is an international association of process automation industry end users. It publishes recommendation documents to help end users by sharing best practices and to guide suppliers and industry foundations on future technology and product development. NAMUR represents approximately 15,000 process control experts, of whom approximately 300 are active in 33 working groups. Member companies include Novartis, BASF, Bayer, Evonik, Shell and Clariant.



What does Process Automation Understand under Diagnosis?

NE107 Status Signals and Symbols



Out of **S**pecifications



Function **C**heck



Maintenance
Required





Failure

What does Process Automation Understand under Diagnosis?

Digital communication protocols and NE107 Implementation



 <p>NAMUR</p>	<p>Selbstüberwachung und Diagnose von Feldgeräten Self-Monitoring and Diagnosis of Field Devices</p>	<p>NE 107</p> 
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Digital communication protocols focused on Process Automation have already implemented NAMUR recommendation in their specs.

What does Process Automation Understand under Diagnosis?

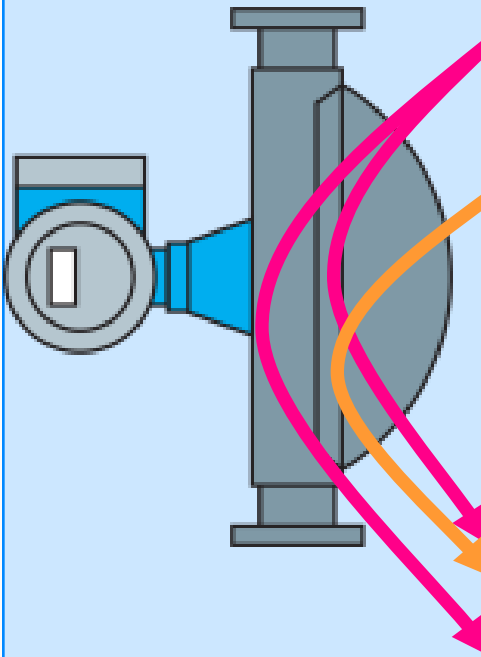
Example of NE107 with FOUNDATION Fieldbus (FF912)



- ▶ Four categories of diagnostic information
- ▶ Four severity grades
- ▶ Sixteen possibilities to map NE107 status signal to a diagnostic information
- ▶ Sixteen left possibilities for assigning independently “process induced diagnostic information”

What does Process Automation Understand under Diagnosis?

Manufacturer: Implementation



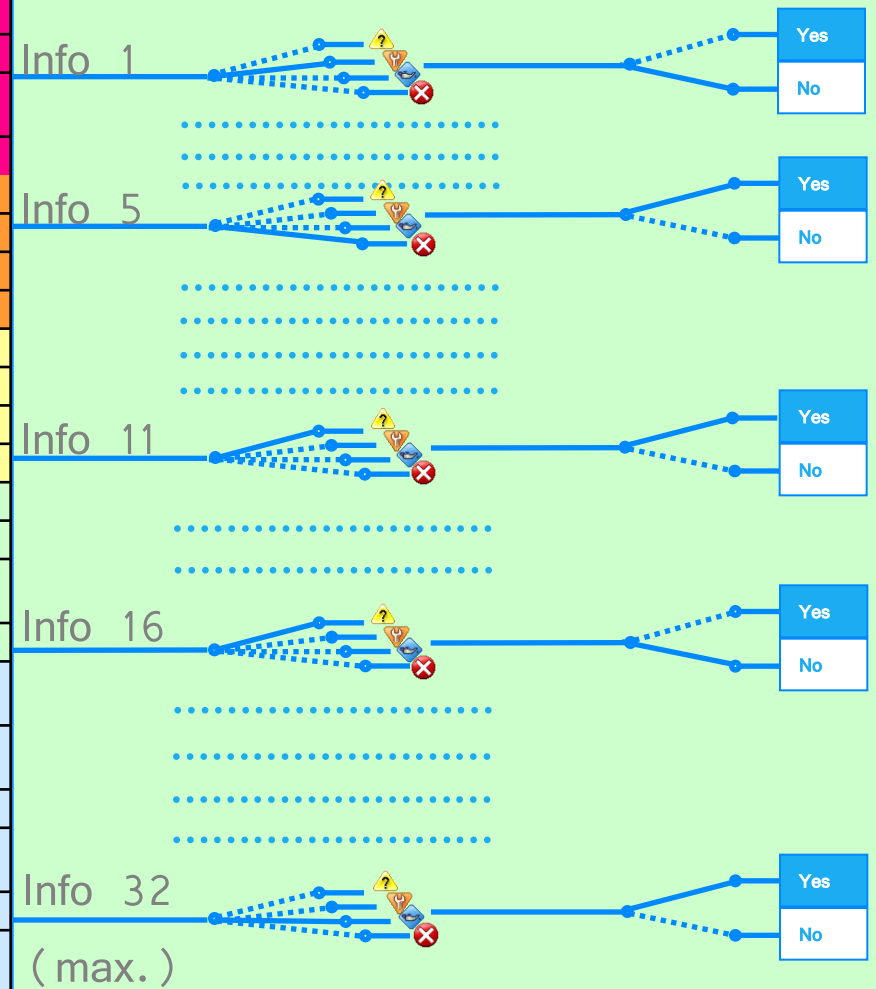
Diagnostics

- Sensor Highest Severity
- Electronic Highest Severity
- Configuration Highest Severity
- Process Highest Severity
- Sensor High Severity
- Electronic High Severity
- Configuration High Severity
- Process High Severity
- Sensor Low Severity
- Electronic Low Severity
- Configuration Low Severity
- Process Low Severity
- Sensor Lowest Severity
- Electronic Lowest Severity
- Configuration Lowest Severity
- Process Lowest Severity
- Process Diagnostic Message XY
- Process Diagnostic Message 23
-
- Process Diagnostic Message X
-
- Process Diagnostic Message Z

User: Configuration

Assignment

DCS Mapping



What does Process Automation Understand under Diagnosis?

EtherNet/IP™ and NE107 possible implementation

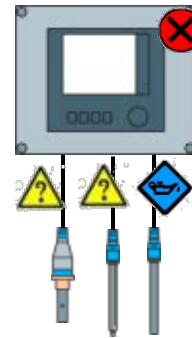
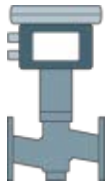
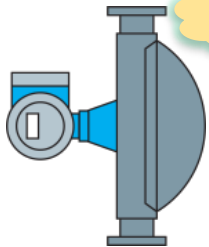
Input assembly proposal



Diagnostic No.	NE107 Status Signal	Channel	Data0, Data1, ...Data N
2 Byte	1 Byte	1 Byte	N Bytes

E.g. N°802 : “pipe partially filled”

“My pipe is partly filled”



What does Process Automation Understand under Diagnosis?

EtherNet/IP™ and NE107 possible implementation

Value

Data0, Data1,
...Data N

4 Bytes (Real, Double Integer)

N Bytes

E.g. mass flow, volume flow, density...

Status

1 Byte E.g. BAD, GOOD or UNCERTAIN →
related to the measured value. 0x80,
0x0C, 0x40

Padding

1 Byte

Unit

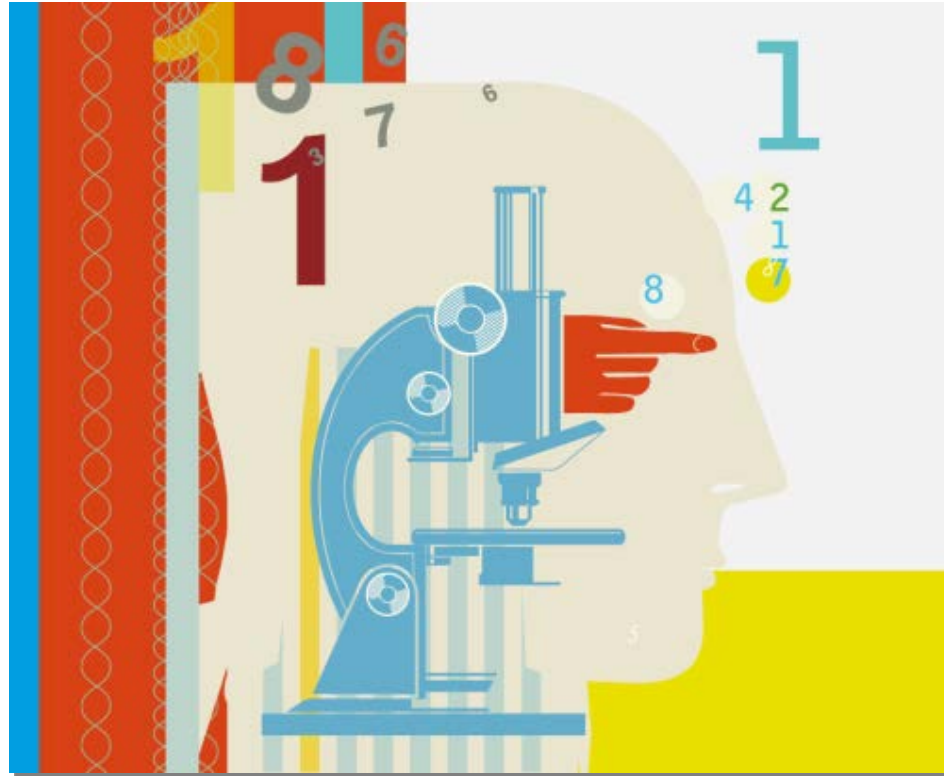
1 Byte E.g. ounces/hours. 0x86E, see CIP
Spec, Vol 1 Appendix D, Vendor Specific
range

What does Process Automation Understand under Diagnosis?

Conclusion

- ▶ Process automation is asking for diagnostic information
- ▶ Standardized assignment of diagnostic information to NE107 status signal needed for EtherNet/IP™
- ▶ Further technical investigations needed to get NE107 recommendation into CIP specifications.

I appreciate your questions



Endress+Hauser 
People for Process Automation