IQ-Sense

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■ Overview

Sensors and PLCs are growing together

Thanks to intelligent linking to the PLC, IQ-Sense can now be used to implement significantly more flexibility and reliability of the sensors. The uniform exchange of data presents a great number of advantages – for plant construction as well as for its operation.

For example, the new IntelliTeach® function permits machine and plant constructors to achieve fast commissioning, since all settings for the IQ-Sense devices can be made using the PLC. Values set once on a sensor can be transmitted to other sensors without problem.

Sensors can be exchanged during operation without any extra work since the PLC automatically reestablishes all sensor settings.

Furthermore, IQ-Sense permits channel-specific system diagnostics. Wire break, short-circuit, maladjustment or module/sensor failure are automatically signaled, and parameterization errors are avoided. It is therefore possible to reduce downtimes and to increase plant availability.

Summary of features
- Low wiring overhead thanks to polarity-independent two-wire design
- Fast commissioning and dynamic modification of parameters by IntelliTeach
- High plant availability thanks to signals and displays for preventive maintenance (e.g. warning of surplus light emission in case of contamination or maladjustment of optical sensors)
- Avoidance of mutual influencing of sensors due to anti-interference function
- Channel-specific system diagnostics
- Fast replacement of sensors due to automatic re-parameterization without renewed teach-in.

Wiring system

IQ-Sense uses a two-wire system between sensor and channel of the IQ-Sense module. Standard unshielded cables with a maximum permissible length of 50 m can be used for this point-to-point connection. The cable is used for both the power supply and data communication.

Configuration/parameterization

Uniform configuration tools such as STEP 7 or COM PB permit uniform and central data management of the configuration and parameterization data for all sensors.

The static settings of the various types of sensor, such as "optical" and "ultrasonic", are defined by sensor profiles which are already present in STEP 7 or in the GSD file of the IQ-Sense modules and which can be set there.

Settings which can be modified during operation can be taught directly on the sensor or defined by the PLC using IntelliTeach.

Processing of the process values

All process values, settings and sensor-specific data are present in the PLC program and are available throughout the system. A supplied function block for SIMATIC S7 supports the provision and evaluation of these data for the S7 programming engineer.

Diagnostics

No additional hardware is required for transmission of the diagnostics information. This is carried out event-driven via the two-wire line. The messages associated with channel-specific sensor diagnostics are embedded both in the S7 system diagnostics and in the PROFIBUS DP standard diagnostics. Access to these messages is therefore identical to that with all other automation components.

IntelliTeach

IntelliTeach is the specification of the variable sensor settings by the PLC or by an Human-Machine-Interface device (OP operator panel, field PG), and presents the following advantages for you:
- Commissioning: a sensor is trained using the current objects. Using IntelliTeach, the determined settings can be copied to any number of further sensors.
- During operation: various batch-dependent settings can be saved in the PLC, called as required, and downloaded to the sensors.

Parameter management

The configuration data of the sensors together with the static settings are set in the configuring tool and saved in the CPU. The settings can be modified during operation and are saved on the IQ-Sense module. No settings are saved in the sensor itself. If a sensor is replaced, all settings are automatically reestablished by the IQ-Sense module.

EMC

IQ-Sense complies with the following EMC guidelines:
- Electrostatic discharge resistance according to IEC 61000-4-2: 8 kV air discharge, 4 kV indirect discharge
- High-frequency resistance according to IEC 61000-4-3: 10 V/m
- Fast transient resistance according to IEC 61000-4-4: 2 kV
- RF conducted interference according to IEC 61000-4-6: 10 kV
- Emitted interference requirements according to EN 55011: Group 1, Level B (permissible also in residential and office buildings).

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■ Overview

Opto-BERO with IQ-Sense, C 40 design

The photoelectric proximity switches react to changes in the received quantity of light. The light beam emitted from the emitter diode is interrupted or reflected by the object to be detected.

These sensors detect all objects regardless of their composition, whether metal, wood or plastic.

Depending on the type of BERO, the interruption or reflection of the light beam is evaluated. The following operating modes are possible with IQ-Sense:

■ Diffuse sensors (energetic)
■ Diffuse sensors with background suppression
■ Retroreflective sensors

Features:

■ C 40 IQ-Sense and K 80 IQ-Sense designs
■ IntelliTeach functionality
■ Integral anti-interference function
■ Advanced failure signal (contamination/maladjustment).

Opto-BERO with IQ-Sense, K 80 design

■ Functions

Diffuse sensors (energetic sensors)

The light from the emitter falls on an object and is reflected in a diffuse pattern. Part of this reflected light reaches the receiver located in the same device. If the intensity of the received light is sufficient, the output is switched.

The sensing range depends on the size and color of the object involved as well as its surface texture. The sensing range can be varied within a wide range by means of the built-in potentiometer. The "energetic sensor" can therefore also be used to detect different colors.

Diffuse sensor with background suppression

Diffuse sensors with background suppression can detect objects up to a specific sensing range. All objects beyond this range are suppressed. The focus level can be adjusted. The background is suppressed due to the geometric constellation between the emitter and the receiver.

Retroreflective sensors

The light from the emitter diode is focused through a lens and directed via a polarization filter to a reflector (principle of a 3-way mirror). Part of the reflected light passes through another polarization filter and reaches the receiver. The filters are selected and aligned in such a way that only the light reflected from the reflector reaches the receiver and not the light reflected from other objects within the beam range.

An object that interrupts the light beam from the emitter through the reflector to the receiver causes the output to switch.

IQ-Sense

IQ-Sense photoelectric sensors

Technical specifications

Design		C40 IQ-Sense	K80 IQ-Sense
Diffuse sensors (energetic sensors)			
Sensing range	m	0.7	2
Standard target	mm	200 × 200 (white)	
Emitter (type of light)	nm	660 (red LED)	880 (IR LED)
Current input	mA	50	
Response time	ms	1	
LEDs		Switching display (yellow), surplus light (green)	
Enclosure material		ABS + PBTP	PBTP
Degree of protection		IP67	
Dimensions	mm	40 × 40 × 53	83 × 65 × 25
Diffuse sensor with background suppression			
Sensing range	m	–	0.2 ... 1
Standard target	mm	–	200 × 200 (white)
Emitter (type of light)	nm	–	880 (IR LED)
Current input	mA	–	50
Response time	ms	–	2
LEDs		–	Switching display (yellow), surplus light (green)
Enclosure material		–	PBTP
Degree of protection		–	IP67
Dimensions	mm	–	83 × 65 × 25
Retroreflective sensor			
Sensing range	m	6	8
Reflector		Type D84, 3RX7916	
Emitter (type of light)	nm	660 (red LED, polarized)	
Current input	mA	50	
Response time	ms	1	
LEDs		Switching display (yellow), surplus light (green)	
Enclosure material		ABS + PBTP	PBTP
Degree of protection		IP67	
Dimensions	mm	40 × 40 × 53	83 × 65 × 25

Selection and ordering data

Design	Design	Operating mode	DT	Order No.	PS	Approx. weight per PU
						kg
Photoelectric sensors for connection to the 4 IQ-Sense sensor module	C40 IQ-Sense	Diffuse sensor	►	**3SF7 240-3JQ00**	1 unit	0.985
		Retroreflective sensor	►	**3SF7 241-3JQ00**	1 unit	0.985
	K80 IQ-Sense	Diffuse sensor	►	**3SF7 210-3JQ00**	1 unit	0.123
		Diffuse sensor with background suppression	C	**3SF7 214-3JQ00**	1 unit	0.126
		Retroreflective sensor	►	**3SF7 211-3JQ00**	1 unit	0.118

Overview

The Sonar-BEROs of the M 18 IQ compact range are all-in-one units ready for connection, and have a cylindrical M 18 enclosure for connection to the S7-300/ET 200M IQ-Sense module SM338, 8×IQ-Sense

- 5 operating modes:
  - Measuring sensor ("analog signal")
  - Sensor with background suppression
  - Sensor with large differential travel
  - Sensor with foreground and background suppression
  - Reflex sensor
- Static setting of parameters using STEP7
- Dynamic setting of parameters using an S7 function block
- Measured distance from object is always transmitted
- Synchronization capability, multiplex operation
- Temperature compensation
- M12 connector
- Non-polarized two-wire system (protected against polarity reversal)
- Channel-specific system diagnostics (e.g. wire break, short-circuit, parameterization faults).

Design

The devices of the M 18 IQ compact range are always supplied with permanently installed sensors.

Functions

The devices are suitable for various operating modes. The operating mode is statically parameterizable using the S7 Manager. The following are possible:

- Switching signal deactivated; only transmission of the analog value (distance)
- Switching signal: sensor with background suppression + analog value
- Switching signal: sensor with large differential travel + analog value
- Switching signal: sensor with foreground and background suppression + analog value
- Switching signal: retroreflective sensor + analog value

The sensor cyclically transmits the distance (analog value) to the module.

Furthermore, the following static parameters can be set:

- Differential travel (1 % / 5 % / 8 % / 10 %)
- Temperature compensation
- Mean value
- Attenuation
- Time function and time value
- Sync mode (multiplex/synchronization)
- Setting of switching points (teach-in/parameterization)
- Sensor ID.

The following dynamic parameters are available:

- Start and end of switching range (using teach-in/parameterization).

Various data/information can be read out from the sensor during operation:

- Sensor identification (manufacturer, Order No., version, sensor ID, set parameters etc.)
- Diagnostics.

Following enabling of the local teach-in, the beginning and end of the switching range can be set using the built-in potentiometer. The found value is then available as a dynamic parameter.

Technical specifications

Type		3SF62 32–3JA00	3SF62 33–3JA00
Sensing range			
• Rated value	cm	5 ... 30	15 ... 100
• Maximum value	cm	5 ... 50	15 ... 150
Standard target	mm	10 × 10	20 × 20
Differential travel H (adjustable)	mm	3 ... 30	10 ... 100
Repeat accuracy R	mm	1	2
Operational voltage (DC)		From IQ-Sense	
Rated operational current I_e		From IQ-Sense	
No-load supply current I_0		From IQ-Sense	
Adjustment/parameterization		Start and end of the switching range using IQ-Sense (IntelliTeach) or local teach-in using potentiometer	
Ultrasonic frequency	kHz	400	200
Switching frequency f	Hz	8	4
Response time	ms	100	120
Power-up delay	ms	280	
Status display		Yellow LED	
Enclosure material		Nickel-plated brass, CRASTIN converter cover, epoxy resin converter surface	
Degree of protection		IP67	
Ambient temperature			
• Operation	°C	–25 ... +70	
• Storage	°C	–40 ... +85	

Selection and ordering data

Design	Design	Sensing range	DT	Order No.	PS	Approx. weight per PU
		mm				kg
Ultrasonic sensors for connection to IQ-Sense	M 18 IQ-Sense	5 ... 30	X	**3SF62 32–3JA00**	1 unit	0.087
		15 ... 100	X	**3SF62 33–3JA00**	1 unit	0.087

Start of delivery at beginning of 2004.

IQ-Sense

■ Overview

4 IQ-Sense module for ET 200S

- The 4 IQ-Sense module is an intelligent 4-channel electronics module for the ET 200S distributed I/O station in the PROFIBUS DP networking system. It is used to connect photoelectric sensors with IQ-Sense technology.

- The 8×IQ-Sense sensor module is an intelligent 8-channel I/O module for SIMATIC S7-300 and ET 200M, and is used to connect photoelectric and ultrasonic sensors with IQ-Sense technology. Mixing of different sensor types on one module is possible.

Standard function blocks are available for simplified handling on a SIMATIC S7. Conventional sensors cannot be used on these modules.

Main applications of the IQ-Sense system are plants and machines

- with high availability demands,
- with a high probability of mutual influencing of the sensors,
- with high flexibility and dynamic modification requirements for the sensor parameters.

■ Functions

- Connection of up to 4 or 8 IQ-Sense sensors
- Low wiring overhead (2 wires, polarity-independent)
- Rapid commissioning thanks to IntelliTeach:
  - Presetting of sensor parameters, or copying of parameters set by teach-in onto other modules/sensors
  - Dynamic modification of parameters (e.g. range setting) using PLC program
  - Integral alignment support using LED display
- High plant availability due to:
  - Signals and displays for preventive maintenance (e.g. warning of surplus light in case of contamination or maladjustment of optical sensors)
  - No mutual influencing of sensors (anti-interference function)
- Channel-specific system diagnostics (e.g. open-circuit, short-circuit, module/sensor failure etc.)
- Fast replacement of sensors due to sautomatic re-parameterization without renewed teach-in (alignment)

Additionally with ET 200S:

- Hot swapping of modules possible
- Can be plugged onto TM-E terminal module with automatic coding.

Additionally with ET 200M:

- Reading of vendor-specific and sensor-specific data (e.g. manufacturer, Order No., release version etc.) directly out of the sensor.

■ Technical specifications

SYSTEM	ET 200 S	S7-300 / ET 200M
Type	4 IQ-Sense	8×IQ-Sense
Number of inputs	4	8
Cable length		
• Unshielded	Max. 50 m	
• Shielded	Max. 50 m	
Voltages, currents, potentials		
Rated supply voltage (from power module)	DC 24 V	
• Reverse polarity protection	yes	
Electrical isolation		
• Between the channels	no	
• Between the channels and back-plane bus	yes	
Permissible potential difference		
• Between different circuits	DC 75 V, AC 60 V	
Insulation tested at	DC 500 V	
Current input		
• From power supply	Max. 0.3 A	Max. 1 A
• From backplane bus	–	150 mA
Module power loss	Typ. 0.85 W	–
Status, alarms, diagnostics		
Status display	Green LED per channel	
Diagnostics functions		
• Group fault	Red LED "SF"	
• Reading of diagnostics information	yes	
Data for selection of a sensor		
Connectable sensors	Photoelectric sensors with IQ-Sense	Photoelectric and ultrasonic sensors with IQ-Sense
Response times		
Cycle time	Max. 3.24 ms	Max. 6 ms
Design		
• Dimensions W × H × D (mm)	15 × 81 × 52	40 × 125 × 120
• Weight	Approx. 0.035 kg	Approx. 0.250 kg

■ Selection and ordering data

Design	DT	Order No.	PS	Approx. weight per PU
				kg
4 IQ-Sense modules	X	**6ES7 138-4GA00-0AB0**	1 unit	0.201
8×IQ-Sense modules	X	**6ES7 338-7XF00-0AB0**	1 unit	0.250

8×IQ-Sense module: start of delivery at beginning of 2004