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Data sheet 6ES7146-6HF00-0BB0



SIMATIC ET 200eco PN, AI 6x U/I + AIQ 2x U/I, M12-L, 8x M12, 16-bit resolution, channel diagnostics for wire break and short-circuit, shared device with 2 controllers, prioritized startup, MSI, MSO, MRP, S2 redundancy, I&M0...3, multi-fieldbus, PN IO, Ethernet IP, Modbus TCP, degree of protection IP67 / IP69K

General information	
HW functional status	FS02
Firmware version	V5.1.x
● FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	0306H
Manufacturer ID according to ODVA (VendorID)	04E3H
Device ID according to ODVA (Product code)	0FABH
Product function	
● I&M data	Yes; I&M0 to I&M3
● Isochronous mode	No
● IRT	Yes
● Prioritized startup	Yes
Engineering with	
● STEP 7 TIA Portal configurable/integrated from version	STEP 7 V18 or higher with HSP 0391
● PROFINET from GSD version/GSD revision	GSDML V2.4.x
● Multi Fieldbus Configuration Tool (MFCT)	V1.5 or higher
Operating mode	
● MSI	Yes
● MSO	Yes
CiR - Configuration in RUN	
Calibration possible in RUN	Yes
Supply voltage	
power supply according to NEC Class 2 required	No
Load voltage 1L+	
● Rated value (DC)	24 V
● permissible range, lower limit (DC)	20.4 V
● permissible range, upper limit (DC)	28.8 V
● Reverse polarity protection	Yes; against destruction
Input current	
Current consumption (rated value)	110 mA; without load
from load voltage 1L+ (unswitched voltage)	12 A; Maximum value
from load voltage 2L+, max.	12 A; Maximum value
Encoder supply	
Number of outputs	8
24 V encoder supply	
● Short-circuit protection	Yes; per channel, electronic
● Output current, max.	0.5 A; total current for encoder and actuator supply: 2 A
Actuator supply	
Number of outputs	2

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Short-circuit protection	Yes; per channel, electronic
Output current	
● Rated value	0.5 A; total current for encoder and actuator supply: 2 A
Power loss	
Power loss, typ.	6.9 W
Address area	
Address space per module	
● Inputs	16 byte; + 2 bytes for QI information
● Outputs	4 byte
Hardware configuration	
Submodules	
● Number of configurable submodules, max.	2
Analog inputs	
Number of analog inputs	8; 6 AI fixed, 2 AIQ can be parameterized
● For current measurement	8
● For voltage measurement	8
permissible input voltage for voltage input (destruction limit), max.	30 V
permissible input current for current input (destruction limit), max.	protective shutoff as of 32 mA (typical)
Cycle time (all channels), min.	sum of the basic conversion times
Input ranges (rated values), voltages	
● 0 to +10 V	Yes
— Input resistance (0 to 10 V)	100 kΩ
● 1 V to 5 V	Yes
— Input resistance (1 V to 5 V)	100 kΩ
● -10 V to +10 V	Yes
— Input resistance (-10 V to +10 V)	100 kΩ
Input ranges (rated values), currents	
● 0 to 20 mA	Yes; 17 V for 2-wire transformers
— Input resistance (0 to 20 mA)	75 Ω
● -20 mA to +20 mA	Yes; 17 V for 2-wire transformers
— Input resistance (-20 mA to +20 mA)	75 Ω
● 4 mA to 20 mA	Yes; 17 V for 2-wire transformers
— Input resistance (4 mA to 20 mA)	75 Ω
Cable length	
● shielded, max.	30 m
Analog outputs	
Number of analog outputs	2; AIQ can be parameterized
Voltage output, short-circuit protection	Yes
Voltage output, short-circuit current, max.	40 mA
Current output, no-load voltage, max.	19 V
Cycle time (all channels) max.	1 ms
Output ranges, voltage	
● 0 to 10 V	Yes
● 1 V to 5 V	Yes
● -10 V to +10 V	Yes
Output ranges, current	
● 0 to 20 mA	Yes
● -20 mA to +20 mA	Yes
● 4 mA to 20 mA	Yes
Connection of actuators	
● for voltage output two-wire connection	Yes
● for voltage output four-wire connection	Yes
● for current output two-wire connection	Yes
● for current output four-wire connection	Yes
Load impedance (in rated range of output)	
● with voltage outputs, min.	1 kΩ
● with voltage outputs, capacitive load, max.	1 µF
● with current outputs, max.	600 Ω
● with current outputs, inductive load, max.	1 mH

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Destruction limits against externally applied voltages and currents	
● Voltages at the outputs towards MANA	30 V; to reference potential 1M
Cable length	
● shielded, max.	30 m
Analog value generation for the inputs	
Analog value display	SIMATIC S7 format
Measurement principle	integrating
Integration and conversion time/resolution per channel	
● Resolution with overrange (bit including sign), max.	16 bit
● Integration time, parameterizable	Yes; channel by channel
● Integration time (ms)	0.84 / 16.7 (50) / 20 (60) / 60 (180)
● Basic conversion time, including integration time (ms)	4.50 / 21.5 (54) / 24 (64) / 64 (184)
● Interference voltage suppression for interference frequency f1 in Hz	none / 60 / 50 / 16.7
Smoothing of measured values	
● parameterizable	Yes
● Step: None	Yes; 1x cycle time
● Step: low	Yes; 4x cycle time
● Step: Medium	Yes; 16x cycle time
● Step: High	Yes; 32x cycle time
Analog value generation for the outputs	
Integration and conversion time/resolution per channel	
● Resolution with overrange (bit including sign), max.	16 bit
Settling time	
● for resistive load	1 ms
● for capacitive load	1 ms
● for inductive load	1 ms
Encoder	
Connection of signal encoders	
● for voltage measurement	Yes
● for current measurement as 2-wire transducer	Yes
● for current measurement as 4-wire transducer	Yes
Errors/accuracies	
Linearity error (relative to input range), (+/-)	0.01 %
Temperature error (relative to input range), (+/-)	0.006 %/K
Crosstalk between the inputs, max.	-70 dB
Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)	0.008 %
Output ripple (relative to output range, bandwidth 0 to 50 kHz), (+/-)	0.02 %
Linearity error (relative to output range), (+/-)	0.02 %
Temperature error (relative to output range), (+/-)	0.002 %/K
Crosstalk between the outputs, max.	-70 dB
Repeat accuracy in steady state at 25 °C (relative to output range), (+/-)	0.008 %
Operational error limit in overall temperature range	
● Voltage, relative to input range, (+/-)	0.15 %
● Current, relative to input range, (+/-)	0.2 %
● Voltage, relative to output range, (+/-)	0.1 %
● Current, relative to output range, (+/-)	0.15 %
Basic error limit (operational limit at 25 °C)	
● Voltage, relative to input range, (+/-)	0.1 %
● Current, relative to input range, (+/-)	0.1 %
● Voltage, relative to output range, (+/-)	0.08 %
● Current, relative to output range, (+/-)	0.1 %
Interference voltage suppression for f = n x (f1 +/- 0.5 %), f1 = interference frequency	
● Series mode interference (peak value of interference < rated value of input range), min.	46 dB
Interfaces	
Number of PROFINET interfaces	1
1. Interface	
Interface type	PROFINET with 100 Mbit/s full duplex (100BASE-TX)

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Interface types	
● M12 port	Yes; 2x M12, 4-pin, D-coded
● Number of ports	2
● integrated switch	Yes
Protocols	
● PROFINET IO Device	Yes
● Open IE communication	Yes
PROFINET IO Device	
Services	
— IRT	Yes; 250 µs to 4 ms in 125 µs frame
— Prioritized startup	Yes
— Shared device	Yes
— Number of IO Controllers with shared device, max.	2
Interface types	
M12 port	
● Autonegotiation	Yes
● Autocrossing	Yes
● Transmission rate, max.	100 Mbit/s
Protocols	
Supports protocol for PROFINET IO	Yes
PROFIsafe	No
EtherNet/IP	Yes
Modbus TCP	Yes
Redundancy mode	
● PROFINET system redundancy (S2)	Yes
— on S7-1500R/H	Yes
— on S7-400H	Yes
● PROFINET system redundancy (R1)	No
● H-Sync forwarding	Yes
Media redundancy	
— MRP	Yes
EtherNet/IP	
Services	
— CIP Implicit Messaging	Yes
— CIP Explicit Messaging	Yes
— CIP Safety	No
— Shared device	Yes; 2x EtherNet/IP Scanner
— Number of scanners with shared device, max.	2
Updating times	
— Requested Packet Interval (RPI)	2 ms
Redundancy mode	
— DLR (Device Level Ring)	No
Address area	
— Address space per module, max.	48 byte; of which 44 bytes for inputs and 4 bytes for outputs
— LargeForwardOpen (Class3)	No
Modbus TCP	
Services	
— read coils (code=1)	Yes
— read discrete inputs (code=2)	Yes
— Read Holding Registers (Code=3)	Yes
— write single coil (code=5)	Yes
— write multiple coils (code=15)	Yes
— Write Multiple Registers (Code=16)	Yes
— Parameter change by master	No
— Modbus TCP Security Protocol	No
Address space per station	
— Address space per station, max.	48 byte; of which 44 bytes for inputs and 4 bytes for outputs
— Access-consistent address space	2 byte
Updating time	
— I/O request interval	2 ms
Connections	

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— number of connections per device	12
Open IE communication	
● TCP/IP	Yes; (only EtherNet/IP or Modbus TCP)
● SNMP	Yes
● LLDP	Yes
● ARP	Yes
Interrupts/diagnostics/status information	
Substitute values connectable	Yes; channel by channel, parameterizable
Alarms	
● Diagnostic alarm	Yes; Parameterizable
● Maintenance interrupt	Yes; Parameterizable
● Limit value alarm	Yes; two upper and two lower limit values in each case
Diagnoses	
● Diagnostic information readable	Yes
● Monitoring the supply voltage	Yes
— parameterizable	Yes
● Wire-break	Yes; at 4 mA to 20 mA and 1 V to 5 V
● Short-circuit	Yes; encoder and actuator supply module to ground, for output type voltage; channel by channel
● Overflow/underflow	Yes
Diagnostics indication LED	
● RUN LED	Yes; green LED
● ERROR LED	Yes; red LED
● MAINT LED	Yes; Yellow LED
● NS LED	Yes; green/red LED
● MS LED	Yes; green/red LED
● IO LED	Yes; red/green/yellow LEDs
● Channel status display	Yes; green LED
● for channel diagnostics	Yes; red LED
● Connection display LINK TX/RX	Yes; green LED, only link
Potential separation	
between the load voltages	Yes
between Ethernet and electronics	Yes
Potential separation channels	
● between the channels	No
● between the channels and the power supply of the electronics	No
Permissible potential difference	
Between the inputs and MANA (UCM)	AC 10 Vpp to reference potential 1M
Isolation	
tested with	
● 24 V DC circuits	707 V DC (type test)
● Test voltage for interface, rms value [Vrms]	1 500 V; According to IEEE 802.3
Degree and class of protection	
IP degree of protection	IP65/67/69K
Standards, approvals, certificates	
Suitable for safety-related tripping of standard modules	Yes; from FS01
Highest safety class achievable for safety-related tripping of standard modules	
● Performance level according to ISO 13849-1	PL d
● Category according to ISO 13849-1	Cat. 3
● SIL acc. to IEC 62061	SIL 2
● remark on safety-oriented shutdown	https://support.industry.siemens.com/cs/de/en/view/39198632
Use in hazardous areas	
● Explosion protection category for gas	ATEX, UKEX, IECEx, CCCEx for Zone 2
● Explosion protection category for dust	ATEX, UKEX, IECEx, CCCEx for Zone 22
product functions / security / header	
signed firmware update	Yes
safely removing data	Yes
Ambient conditions	
Ambient temperature during operation	
● min.	-40 °C

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• max.	60 °C
Altitude during operation relating to sea level	
• Ambient air temperature-barometric pressure-altitude	Up to max. 5 000 m, at installation height > 2 000 m additional restrictions
connection method	
Design of electrical connection	4/5-pin M12 circular connectors
Design of electrical connection for the inputs and outputs	M12, 5-pin, A-coded
Design of electrical connection for supply voltage	M12, 4-pin, L-coded
Dimensions	
Width	45 mm
Height	200 mm
Depth	48 mm
Weights	
Weight, approx.	795 g

Classifications

	Version	Classification
eClass	14	27-24-26-01
eClass	12	27-24-26-01
eClass	9.1	27-24-26-01
eClass	9	27-24-26-01
eClass	8	27-24-26-01
eClass	7.1	27-24-26-01
eClass	6	27-24-26-01
ETIM	10	EC001596
ETIM	9	EC001596
ETIM	8	EC001596
ETIM	7	EC001596

Approvals / Certificates

General Product Approval

For use in hazardous locations

Miscellaneous

CCC-Ex

For use in hazardous locations

Maritime application

Miscellaneous

Maritime application

Food, Pharmaceutical, Medical

NK / Nippon Kaiji Kyokai

CCS (China Classification Society)

Confirmation

Environment

Industrial Communication

PROFINET

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