

Product Data Sheet

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Damcos P-NET[®] Controlled LPU System



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EMERSON
Process Management

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Introduction

The P-NET controlled LPU is specially developed to be integrated in complete MTM (Marine Tank Management) systems, which includes:

- Valve control and operation.
- Pump control and operation.
- Tank contents gauging and calculation.
- Draft, trim and heel measurement and calculation.
- Interface to loading/stability computer.
- Interface to ISC (Integrated Ship Control) system.

The P-NET controlled LPU is fitted with a P-NET fieldbus, enabling interconnection of the LPU with other P-NET units, such as IO modules, display units, controllers and work-stations for the shared fieldbus P-NET.

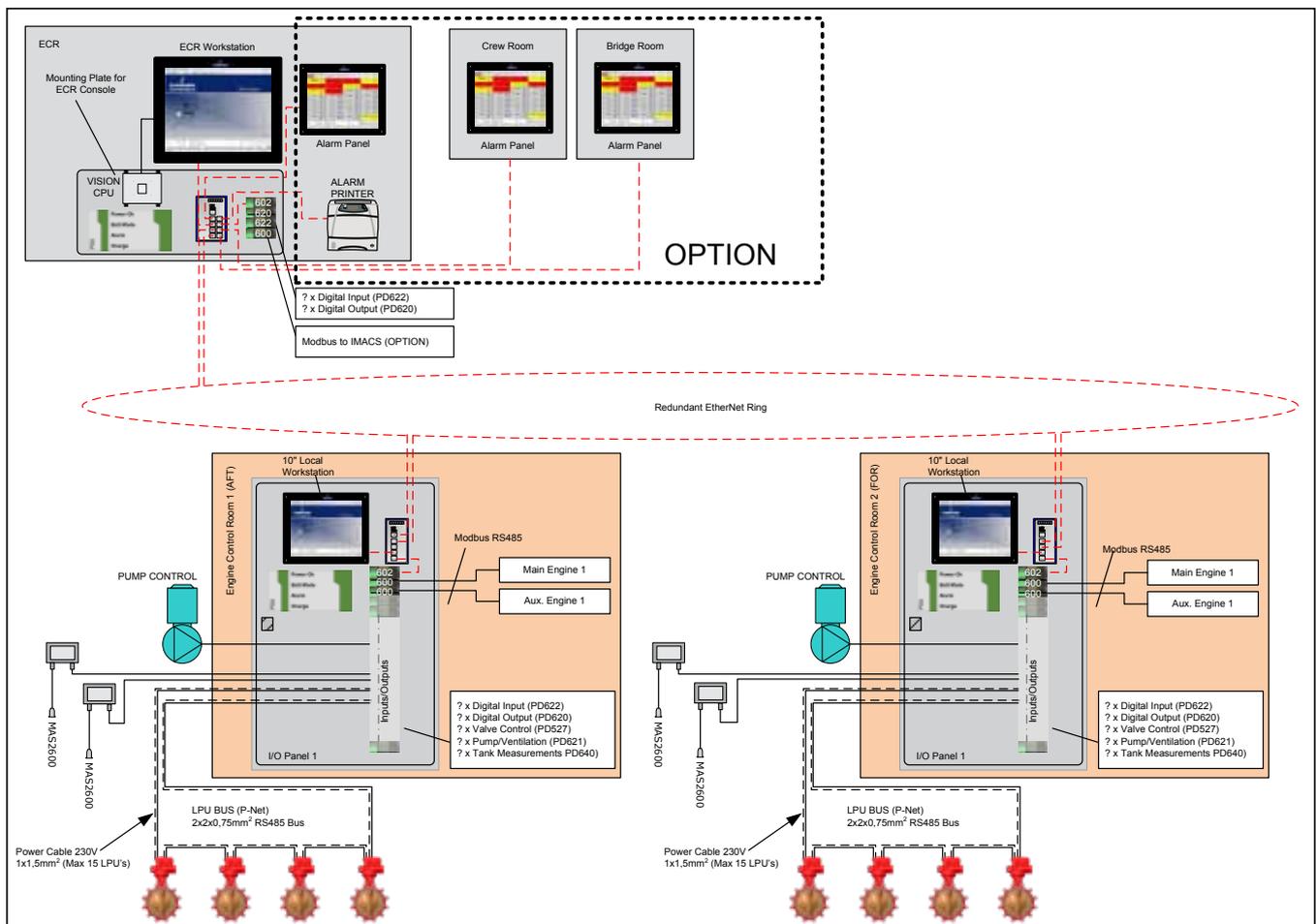
The P-NET LPU is equipped with 2 optocoupler inputs for controlling the valve, and 2 relay outputs and an analogue output for position feedback signals.

The P-NET controlled LPU can be used as a stand-alone unit without being connected to P-NET. In this case it is controlled from external inputs/outputs connected to simple push-buttons, lamps or e.g. a PLC (Programmable Logic Controller).

The LPU has built-in internal push-buttons and LEDs to be used for commissioning/test of the unit.

Whether the LPU is controlled by the P-NET or by external inputs/outputs, the built-in microprocessor controls and manages the actual control. This ensures an optimal control of the LPU, which is never overloaded.

MTM system layout



General description

Complete MTM systems can be designed on the basis of the P-NET LPU. The MTM systems are designed to match needs and requirements of each individual ship with respect to LPU location, cable installation, safety, control of other machinery, data acquisition and control of other measuring points, operation facilities centralised and decentralised. Each P-NET LPU is connected to a combined communication/24 VDC supply cable (4-Wire P-NET) and an AC supply cable. This offers the user the possibility of viewing status from LPU, should the AC supply fail.

This provides a very flexible installation in which both 4-Wire P-NET and VAC supplies are separated in suitable numbers of segments irrespectively of the ship's layout, LPU location and the required safety. Galvanic separation of 4-Wire P-NET bus segments is possible by means of P-NET repeaters, each with 3 galvanically separated P-NET. The 3 P-NET could be used e.g. in connection with a small section at starboard/port-side and in connection with a superior network. This means that a partial failure will not affect the remaining network. The separation of the AC supply can e.g. be done by connecting each segment via a separate fuse.

Supervision/operation of the LPU can take place from a P-NET master, i.e. a controller or workstation. These units can be installed on the P-NET wherever operation is needed, e.g. on the bridge, in the cargo control room, engine control room or locally in interface panels.

The connected controllers/workstations can be configured to be redundant in relation to each other. This feature being an additional safety for the crew should any unit fail.

Interlocks for the connected controllers/work

stations can be implemented. In this way a certain group of LPUs and attached equipment are operated from one location only, and simultaneous operation from more locations is prevented.

An on-line connection can be established to the vessel's ISC system for transfer of commands, status, alarms etc.

The LPU built-in microprocessor intensively monitors the unit, including the following errors/alarms:

- Program/RAM/EEPROM storage errors.
- Watch dog run out (P-NET communication has stopped).
- Pressure switch error.
- Invalid position transmitter system.
- Position (differs significantly from set point).
- Low AC power.
- Max run time (Motor and pump protection).
- Motor overload (Motor and pump protection).
- Max time (Valve moves too slowly).
- Min time (Valve moves too fast).
- Pressure (Hydraulic pressure not achieved, or has fallen).

The following are measured and displayed:

- Actual position analog feedback 0-100%.
- On/Off feedback 0% (closed), 50 % (middle), 100 % (open).
- Motor status (stopped, opening, closing).
- Operation mode (P-NET®, Voltage input, Internal pushbuttons).
- AC voltage.
- DC voltage.

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The LPU can be controlled from a master in two ways:

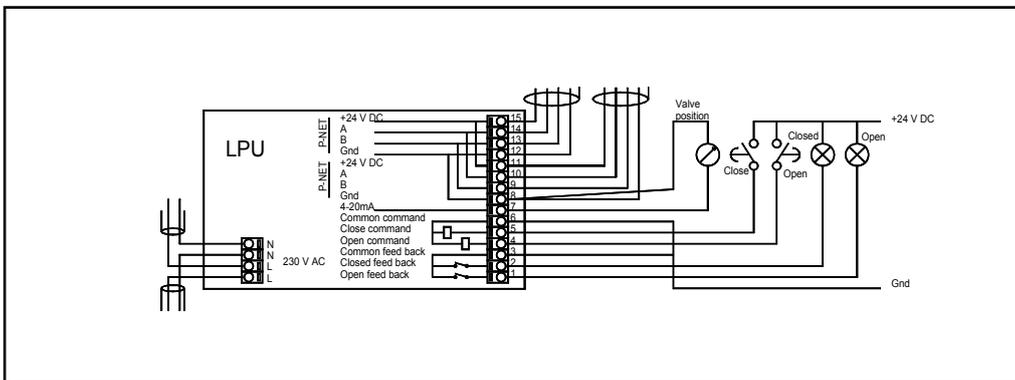
- Through transfer of a setpoint to the LPU, which takes over the actual control of the motor and stops when the wanted setpoint has been reached.
- Direct control: open/close/stop.

Another safety feature, "Block Setpoint" blocks the LPU so the Setpoint cannot be

changed from P-NET. This is especially used for protecting automated procedures.

Apart from being P-NET controlled, the LPU can simultaneously be controlled locally from e.g. an emergency control. From the connected controllers/workstations it is possible to check whether the LPU is locally operated either by internal or by the external pushbuttons. It is possible to have an alarm indication activated when the LPU is locally operated.

PCB diagram for local control



Features

- 100% protection and control of the LPU.
- One circuit board only for LPU-S and LPU-D, analog and ON/OFF feedback, P-NET and hard wire voltage input controlled.
- Being a P-NET slave the P-NET LPU is an independent unit to be controlled directly from e.g. a workstation.
- All LPUs can operate simultaneously with a suitable dimensioning of AC power supply.
- Random delay restart of the LPU-S after an AC voltage drop to prevent all LPUs from starting at the same time, thus avoiding drawing high starting current in the system.
- From the P-NET indication can be given how the LPU was operated the last time; internal/external pushbuttons or from the P-NET.
- From the P-NET change of Setpoint can be blocked.
- "AutoCorrection" option (the LPU retakes its position, and re-establishes pressure if it drops in open position on the LPU-S). This feature can be disabled when no P-NET communication is present, in order to allow emergency operation of the LPU if the P-NET fails.
- Measurement of 24 VDC and VAC power supplies.
- The unit is monitored even if the VAC supply falls out.
- The presence of 24 VDC is displayed on the internal LEDs.
- Prepared for future oil level gauging in the tank.
- Good service/starting up facilities as the LPU.:
- Can be operated directly from internal pushbuttons. One-touch pushbuttons for opening or closing valves.
- Has got indication on internal LEDs of position (Open, Closed, Intermediate) and alarm state if any.
- If the pushbutton is not released, the signal is ignored.
- Can be used as PLC/power controlled with separate VAC power supply and 24VDC control input/output, and ON/OFF and analogue position feedback.

Description

Apart from being controlled by the P-NET the LPU can be used as a stand-alone unit without P-NET but controlled by hardwired inputs/outputs (24 VDC supply must be connected). 24 V DC I/O can be used directly i.e. from PLC. P-NET is applied in connection with end testing, for configuration and test only. Control follows by means of voltage inputs. Position feedback signal from relay outputs or a 4-20 mA transmitter.

There are 4 possible controlling methods for the LPU control inputs:

- PulseMode (only a pulse is needed either for opening or closing the valve).
- ActiveMode (LPU only moves while a continuous high signal for opening or closing is given, and automatically stops in end position).

In "DirectionMode" the LPU position (fully open or fully closed) can be controlled from one 24 VDC input, while the other input is used for enabling the valve movement. The relay outputs are for ON/OFF position indication. When the valve is < 3% open, the closed output is high. When the valve is > 97% open, the Open output is high. In intermediate positions, both inputs are low.

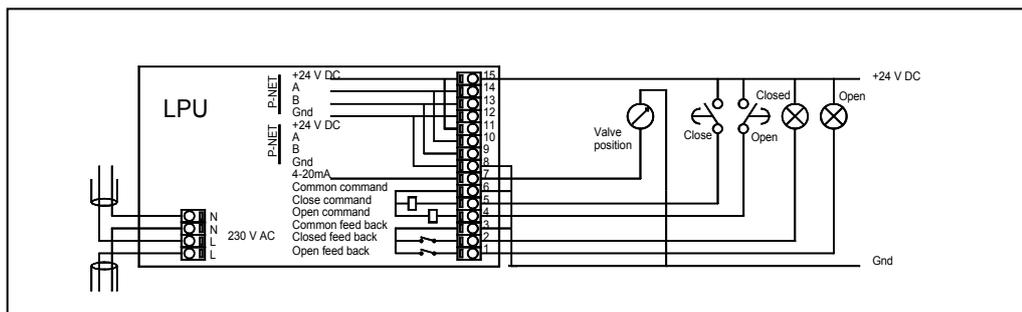
Also when hardwire controlled, a 100 % protection of the LPU is achieved just as if it was controlled from P-NET, as the control and supervision functions are carried out by the built in microprocessor.

A galvanic separation of the position signals from the DC supply can be established (except for the 4-20 mA output). Due to the separate AC supply all signal transfers lie on 24 VDC level.

- DirectionModeOpen (a continuous high signal is given on only one input to select valve open).
- DirectionModeClose (a continuous high signal is given on only one input to select valve closed).

In case of a position indicator error (or if the 24V supply to the PCB (Printed Circuit Board) has fallen out), both outputs are high. The analogue 4-20 mA output is connected to the 0 from the 24V DC supply. The 4 mA corresponds to 0% open, and 20 mA corresponds to 100% open. Position indicator error is indicated by an output current of 0 mA.

PCB diagram for stand alone unit



Features

The following features can be added to the Hardwire controlled P-NET LPU:

- LPU is controlled by using one or two control inputs (open/close) and two feedback outputs (open/closed), and/or one analogue 4-20mA position feedback output.
- AutoCorrection option for hardwire controlled LPU also.

- Has galvanic separation between control input and output and the 24VDC supply, except for 4-20 mA output which is to be connected to minus on the 24 VDC.
- Is fitted with its own relays. Control inputs (open/close) can directly be connected to the PLC (24 VDC).

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P-NET® Fieldbus

The P-NET Fieldbus, first developed in 1983 and since then applied on more than 10,000 installations became 1996 European standard EN50170 Vol. 1 and in 2000 International standard IEC 61158 Part 4. P-NET is based on the electric standard RS485 with a 2-wire twisted shielded cable. Today a 4-wire twisted shielded cable, including both communication and 24 VDC supply can be used as well. Each single P-NET segment can be up to 1,200 meter long. More P-NET segments can be linked

together by controllers with two P-NET ports.

The P-NET is a multi master network. To each segment totally up to 125 nodes (P-NET LPU, Interface modules, controllers and workstations) can be connected, hereof max. 32 masters (Controllers, Workstations).

The P-NET Baud rate is 76.8 k corresponding to 300 transactions (questions and answer) per second.

Test and configuration tools

Test and configuration of the P-NET LPU to meet the customers specifications takes place when the unit is end tested in the factory with the valve.

This ensures a correct setup of the LPU, hereunder actuator type1, indicator type2, max./min. time3, run on4, calibration of feedback5 etc.

Fieldbus controlled

The programme "Project" is used for set-up of complete MTM systems, including all hardware and software modules. From this programme there is free access to all units connected to the P-NET fieldbus. Therefore, it is also possible to change all data settings in the LPUs and have them tested via

the P-NET fieldbus.

All data settings from the test incl. order number, new-building number, yard, valve number etc. are stored in a shared database. Data from one single order can be exported to an order specific database and applied for further test/configuration on board. Settings for a specific valve are stored, and may be restored into spare LPU PCB.

Hardwire controlled

The programme used for end test of a unit in the factory can be applied on board for test/configuration of the P-NET LPU.

Position indication input signals

The position indicator is built into the pump block with internal wiring from position indicator to the circuit board mounted in the LPU electrical encapsulation (except for KFR). Potentiometer for analogue

position indication or 2 micro-switches for end-position indication are available.

The P-NET LPU is to be configured either to position indicator type ON/OFF or analogue.

LPU with LED Postion Indicator

The LED indicator is powered from the 24VDC supply for the LPU electronics, via the internal position indicator output relays in LPU circuit board. LED indicator can be used with either ON/OFF or ANALOG position indicator as desired.

With analog position indicator, the LED will change status over at 3% open valve and 97% open valve.

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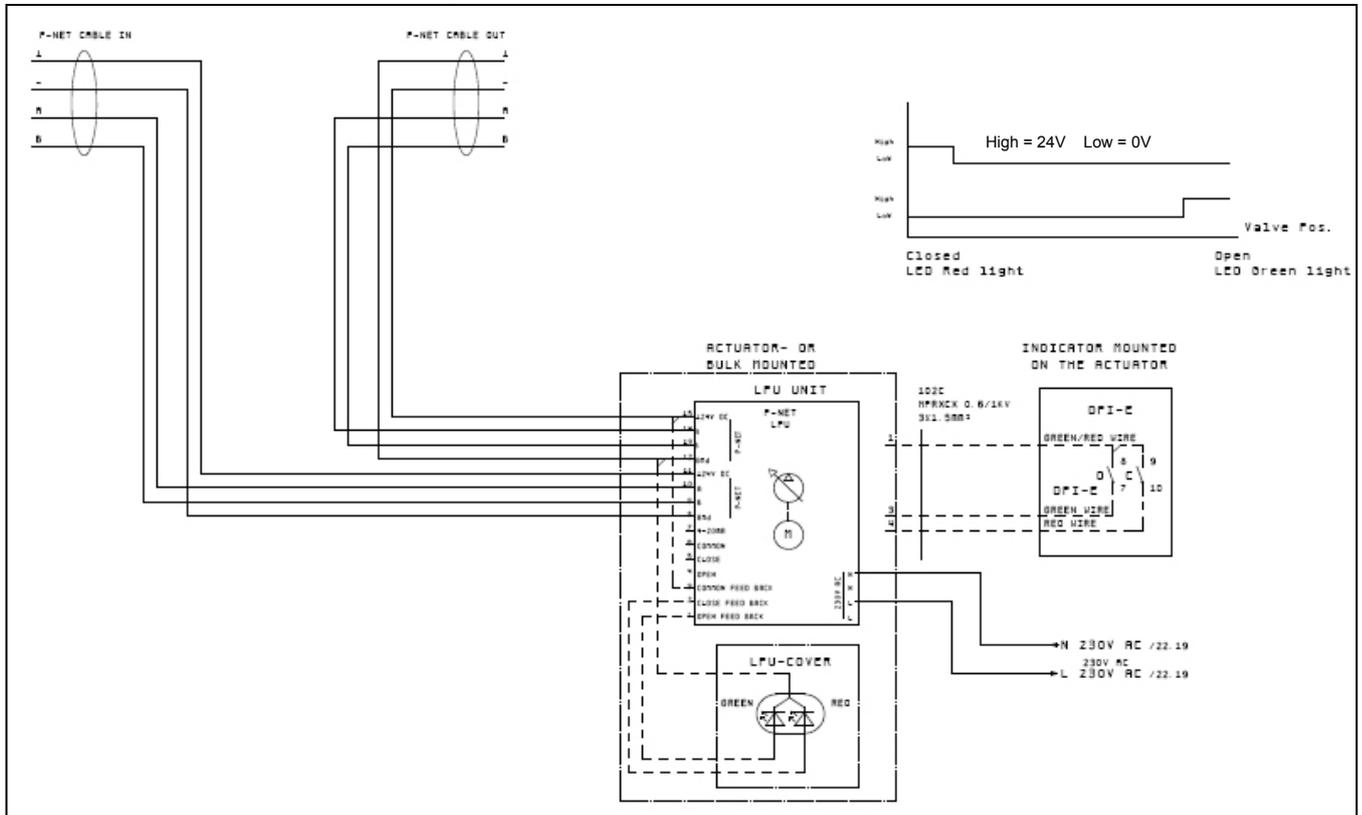
SD 1506-2E04

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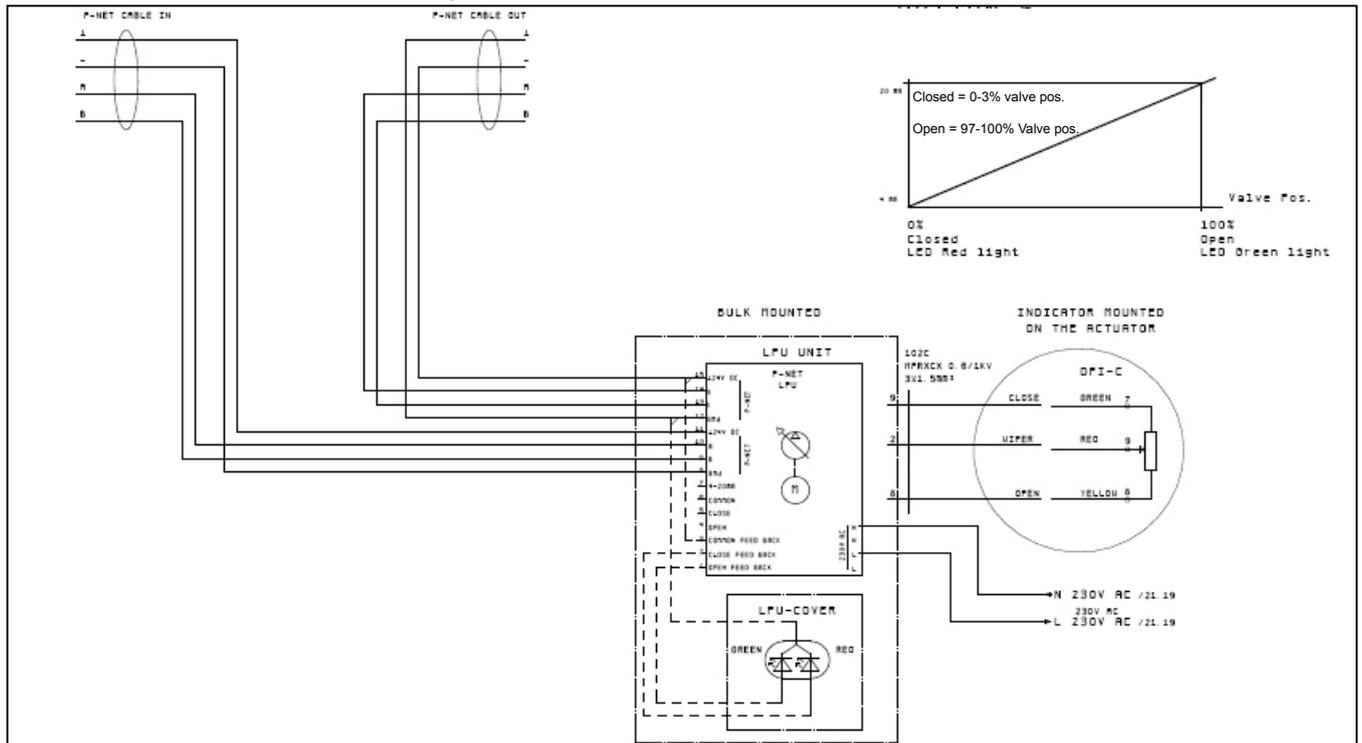
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Digrams for LPU with LED Position Indicator

LPU P-NET with LED Indication - Option 1



LPU P-NET with LED Indication - Option 2



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Electrical specification

AC power supply:	
Voltage Nom.	220-230 V AC 50 or 60 Hz + 10% - 15%
Current	1.4 A (max. 4.0 A)
Interface:	
	4-wire P-NET
DC voltage:	
Min.	12 V DC
Nom.	24 V DC
Max.	35 V DC
Power supply:	
Min.	25 mA 12 V DC
Idle max.	70 mA 12 V DC
Max.	140 mA 12 V DC (incl. 20 mA output)
Min.	25 mA 24 V DC
Idle max.	70 mA 24 V DC
Max.	115 mA 24 V DC (incl. 20 mA output)
Min.	25 mA 35 V DC
Idle max.	70 mA 35 V DC
Max.	100 mA 35 V DC (incl. 20 mA output)
Inputs, 24 V (galvanic separation with opto-couplers):	
V in Off	< 1.4 V DC
V in On	> 10.0 V DC
V in max.	45 V DC
Ri	10 k Ω
Outputs, galvanically isolated relays:	
Imax.	1 A 30 V DC or 0.5 A 125 V DC
Analogue output, external 4 -20 mA:	
Resolution	100 uA
Accuracy	2.5%
Output voltage	Vin/2-1 V
Update freq.	32 Hz
Duty/cycle:	
Max.	30% for 10 minutes
Max. running time	5 minutes at 20°C

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