

P-NET® Controlled LPU System



The P-NET® controlled LPU is designed to be used in a linked or looped bus ring and connected to the complete ICMS (Integrated Control and Monitoring System).

The P-NET® Controlled LPU system features:

- Local protection and control of the LPU
- One circuit board only for LPU-S and LPU-D, analog and ON/OFF feedback, P-NET®
- 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® 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). The feature is automatically 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
- Good service/starting up facilities as the LPU:
 - can be operated directly with magnets
 - has got indication on LED of position (Open, Closed, Intermediate)

Introduction

The P-NET[®] controlled LPU is specifically developed to be integrated in a complete ICMS (Integrated Control and Monitoring System), which includes:

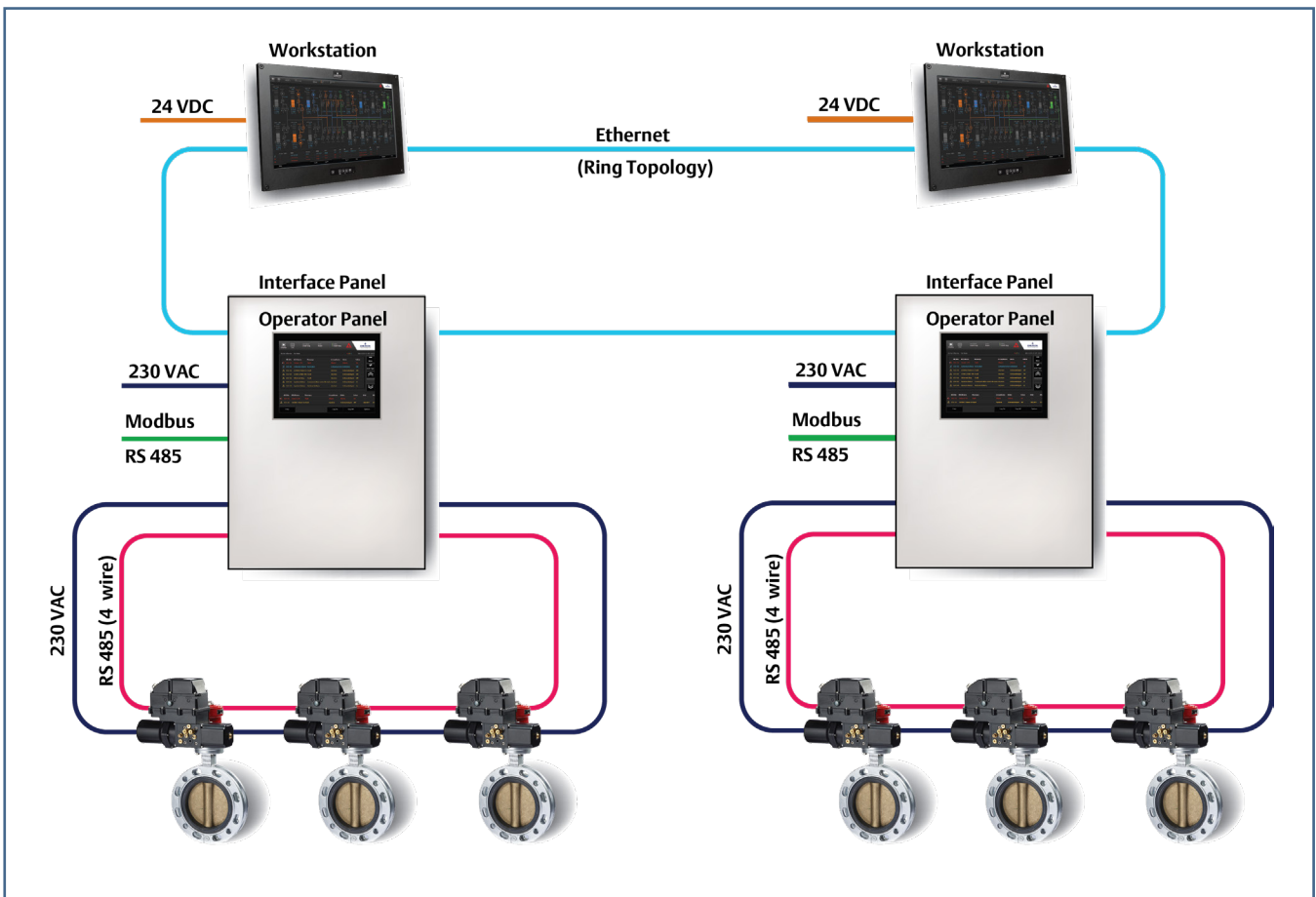
- Valve control and operation
- Pump control and operation
- Tank contents gauging and calculation
- Draft, trim and heel measurement and calculation
- Fuel Oil consumption calculation
- Bunkering control and operation
- MRV monitoring and reporting
- Interface to loading/stability computer
- Interface 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 I/O modules, operator panels, controllers and workstations for the shared fieldbus P-NET[®].

The LPU has built-in magnet control and LED to be used for local operation and commissioning/test of the unit.

In the P-NET[®] controlled LPU the built-in microprocessor control is managing the actual control. This ensures an optimal control of the LPU, which will never be overloaded.

LPU P-NET[®] System Layout



General Description

Complete Integrated Control and Monitoring System (ICMS) systems can be designed on the basis of the P-NET® LPU. The Integrated Control and Monitoring System is 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 centralized and decentralized.

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 in consideration 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® Controllers (PD600). 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 workstation. The workstations can be installed on the Ethernet LAN (Local Area Network) 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 workstations 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/alarm:

- 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 voltage
- 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 main functions are measured and displayed:

- Actual position analog feedback 0-100%
- On/Off feedback 0% (closed), 50 % (middle), 100 (open)
- LPU status (stopped, opening, closing)
- Operation mode (P-NET®, Magnet control)
- AC voltage
- DC voltage

The P-NET® 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 valve 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 by the magnet input. It is possible to have an alarm indication activated when the LPU is locally operated.

P-NET® RS 485 Fieldbus

The P-NET® Fieldbus, first developed in 1983 and 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 should be used.

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 P-NET® LPU, hereunder actuator type, indicator type, max./min. time, run on, calibration of feedback etc.

Fieldbus Controlled

The tool "Project" is used for set-up of complete Integrated Control and Monitoring Systems, including all hardware (IO modules, Controllers and Workstations) and software modules. From this tool there is access to all units connected to the P-NET®

RS485 fieldbus or Ethernet LAN. Therefore, it is also possible to change all data settings in the LPUs and have them tested via the P-NET® RS485 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.

Position Indication Input Signals

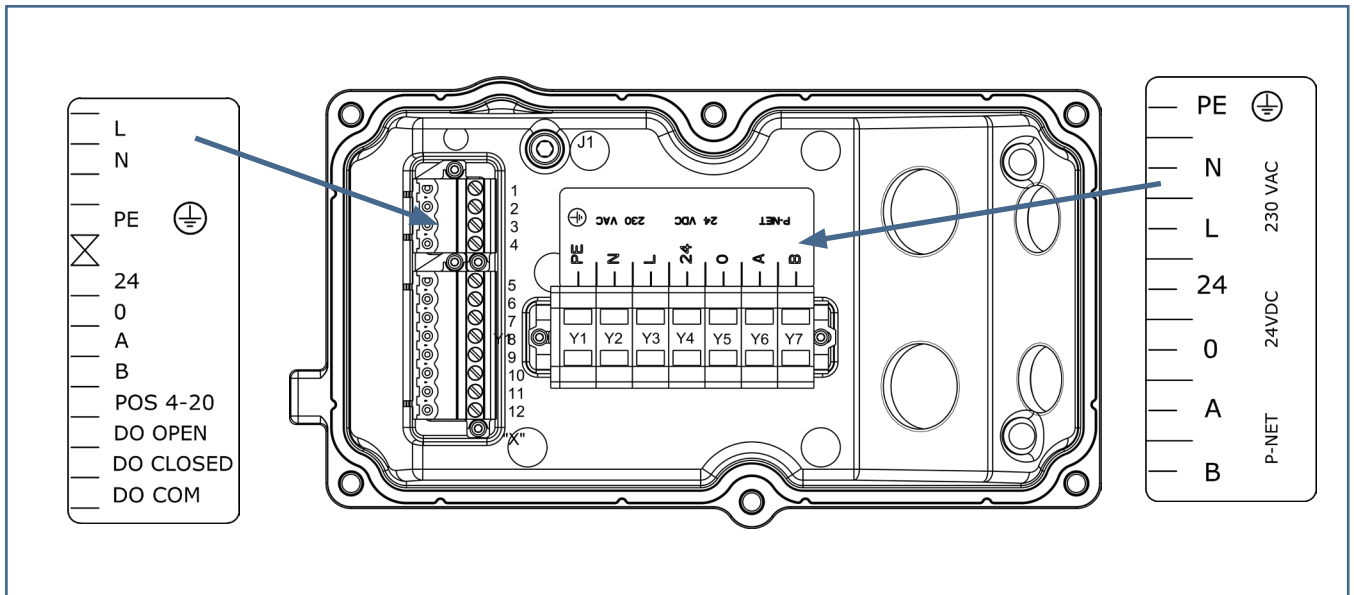
The position indicator is built into the main block with internal wiring from position indicator to the circuit board mounted in the LPU electrical encapsulation. Potentiometer for analogue position indication or 2 micro-switches for end-position indication are available.

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

Local LED and Magnet Control

It is possible to control the P-NET® LPU locally by means of a magnet. The LED is red when the valve is closed and green when the valve is open.

Connections Overview



The LPU has all the electrical wires in the Cable Connection Cover with fixed connectors fitting respective connectors on the top of the encapsulation. The cover comes completely off and electrical wiring can be done away from the LPU. The cover is then easily fitted back in place ensuring a safe installation with no risk of electrical shocks even in the most difficult mounting areas.

The labels above shows the LPU electrical control input and output.

Electrical Specification

Damcos P-NET® Controlled LPU System	
AC Power Supply	
Voltage Nom.	220-230 V AC 50 or 60 Hz +10% /-20%
Current Maximum	8.2 A RMS
Current Nominal	3 A RMS - Large Motor :3.2A, Small Motor: 1.7A
Interface	4-wire P-NET®
DC Voltage	
Minimum	12 V DC
Nominal	24 V DC
Maximum	35 V DC
Minimum	25 mA 12 V DC
Idle maximum	70 mA 12 V DC
Maximum	140 mA 12 V DC (incl. 20 mA output)
Minimum	25 mA 24 V DC
Idle maximum	70 mA 24 V DC
Maximum	115 mA 24 V DC (incl. 20 mA output)
Minimum	25 mA 35 V DC
Nominal	70 mA 35 V DC
Maximum	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} maximum	45 V DC
R_i	10 k Ω
Analogue out, external 4 - 20 mA	
Resolution	100 μ A
Accuracy	2.5 %
Output voltage	$(V_{in}/2) - 1$ V
Update frequency	32 Hz
Duty/Cycle	
Maximum	25% at 25°C ambient 10% at 70°C ambient
Maximum running time	Large motor: 8 minutes single stroke Small motor: 5 minutes single stroke

Classification

Meets the requirements from the major classification and approval authorities like:

- Det Norske Veritas / Germanischer Lloyd
- Lloyd's Register of Shipping
- American Bureau of Shipping
- Bureau Veritas
- China Classification Society

©2020 Emerson. All rights reserved.

The Emerson logo is a trademark and service mark of Emerson Electric Co. Damcos and the Damcos logotype are trademarks of Damcos A/S. Damcos is a member of the Emerson family of companies. All other marks are the property of their respective owners.

Emerson Automation Solutions

Damcos A/S
Aaderupvej 41
DK-4700 Naestved
T +45 5578 7200
F +45 5578 7272

www.Emerson.com/marine

The contents of this publication are presented for information purposes only, and while effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, expressed or implied, regarding the products or services described herein or their use or applicability. Standard Terms and Conditions of Sale can be issued by contacting Damcos A/S. We reserve the right to modify or improve the designs and specifications of our products at any time without notice. Damcos A/S accepts no responsibility for any errors that may appear in this publication.