

LPU Plus and Elite Controlled System



The LPU Plus and Elite controlled system contains dedicated PCB matching the customer needs and requirements designed to be used within the complete Aperio ICMS (Integrated Control and Monitoring System).

The LPU Plus and Elite controlled system features:

- Local Intelligence, moved from the interface layer into the unit enabling safe handling and unit protection
- Ruggedized with supervising of AC voltage, DC voltage and power usage to protect the unit hardware and minimizing software down time (Elite model offers extended supervision with additionally sensors including options such as reading data from a cellphone using a dedicated APP)
- Automatic functions developed to ease setup and commissioning with no need for internal access, including:
 - Self-Learn; automatically detecting the scope of the product – minimizing time spent on setup and eliminating the need of tools
 - Feedback adjust; offering assistance to feedback adjustment – minimizing time spent on setup / exchange of indicator
 - Time setting; offering assistance to set customer specific ExtraTime and calibration of other time settings after a speed adjustment e.g. warning limits (standard time is setup by Self-Learn)
- Features that can be activated in the Plus and Elite PCB if selected:
 - Good service/starting-up facilities as the LPU:
 - can be operated directly with magnets
 - has got LED indication of position (Open, Closed, Intermediate)
 - has got warning indication (LED) and status text (APP)
 - Good service supervision and maintenance facilities as the LPU can display:
 - data to an APP by means of Bluetooth
 - data as sent to Aperio ICMS
 - instruction and guide on the APP
 - historical data and maintenance recommendations
 - Good operational safety as the LPU has options for:
 - AutoCorrection of the position
 - Low Oil Level detection with optional oil tank (accessories)
 - pressure keep and reset function

Description

The Plus or Elite controlled LPU is specifically developed to be integrated in a complete ICMS Aperio (Integrated Control and Monitoring System), which includes:

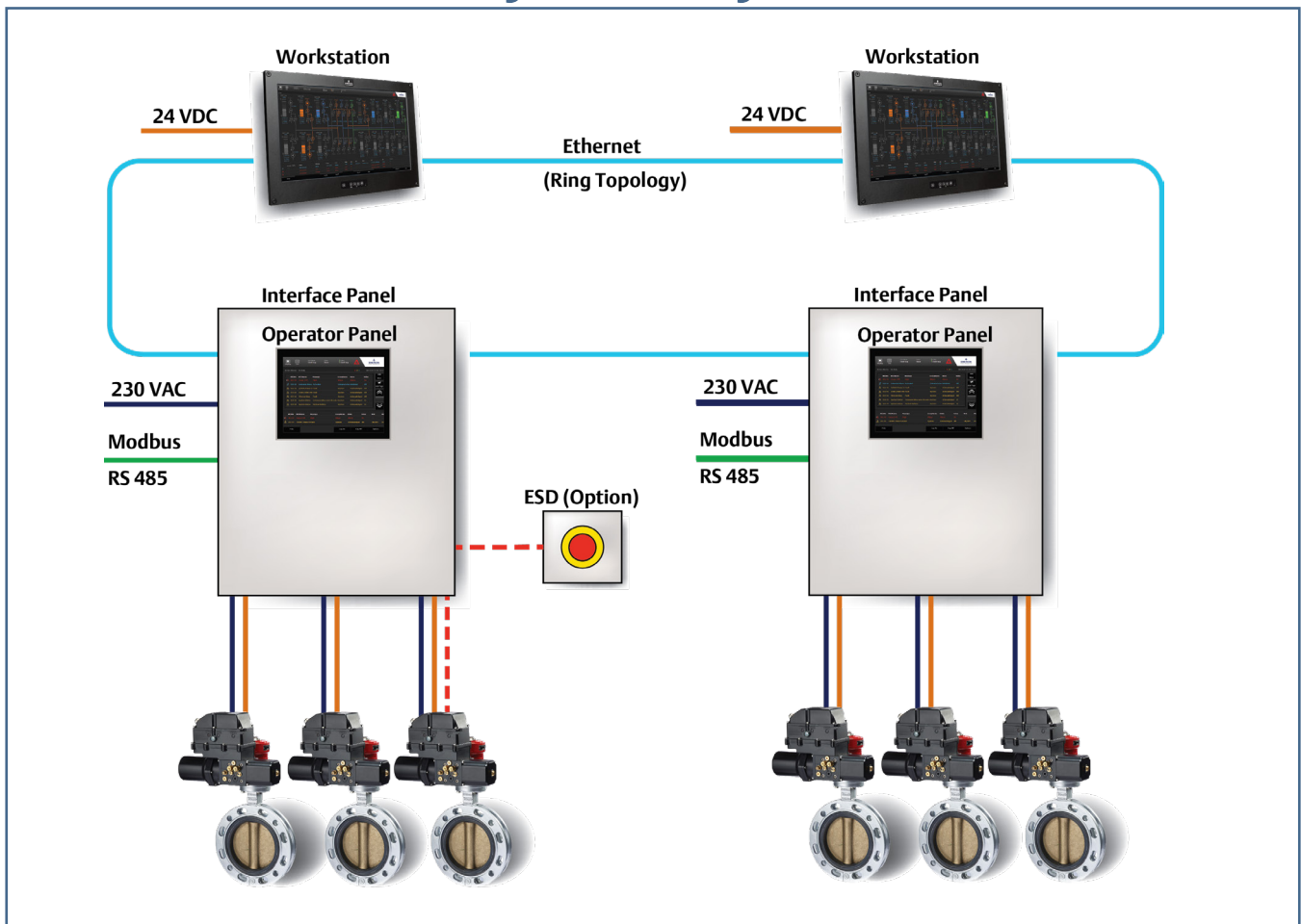
- Valve control and operation
- Pump control and operation
- Tank contents gauging and calculation
- Draft, trim and heel measurement and calculation
- Fuel Oil consumption calculation
- Bunkering control and operation
- MRV monitoring and reporting
- Interface to loading/stability computer
- Interface to ISC (Integrated Ship Control) system

The LPU is equipped with inputs for controlling the valve and feedback output for position signals and additional AUX In/Out options making ESD, Safe lock and Blocking possible as well as different options for control input signals; Pulse, Active, Direction Mode, 4-20mA if selected.

The LPU platform has, if selected and ordered, built-in magnet control and LED to be used for local operation and ease commissioning and test of the unit.

In the LPU Plus and Elite the built-in microprocessor, automatic functions and local Intelligence enables safe handling and unit protection. This ruggedness, is enabled by supervision of the AC voltage, DC voltage and power usage to protect unit and lowering down time (the Elite model offers additionally sensors including options to read data from an app).

Plus and Elite LPU System Layout (Overall)



RECOMMENDED USAGE										
Remote Control and Feedback	Plus PCB	Elite PCB	I/O Required (Aperio)	Minimum Yard wiring	Platform Functions LPU v3	AUX In & Out Signal	Local Ctrl & Feedback fnc	Software Configuration	Mechanical Option	Overall Hydraulic Function
Conventional and cost optimized										
Remote control (Pulse) On/Off feedback	✓		DO 2 + DI 2	2 + PE power 2 x 24VDC 4 wire signal	Standard safety features ⁽¹⁾	NA	NA	Standard safety features	NA	LPU-D (Small pump)
Remote control (Pulse) On/Off feedback	✓		DO 2 + DI 2	2 + PE power 2 x 24VDC 3 wire signal						LPU-S (Large pump)
Remote control (Active) Analog feedback		✓	DO 2 + AI 1	2 + PE power 2 x 24VDC 3 wire signal						LPU-D/S (Small/ Large pump)
Core / Improved customer experience (Default)										
Remote control (Pulse) On/Off feedback	✓		DO 2 + DI 3	2 + PE power 2 x 24VDC 5 wire signal	Standard safety features ⁽¹⁾ Local control + LED	AUX In => ESD Stay AUX Out => ESD Local	Yes	Standard safety + Auto-Correction (LPU-S = Enable)	Safety lock cover Pressure function Tank w/ switch	LPU-D/S (Small/ Large pump)
Remote control (Active) Analog feedback		✓	DO 2 + DI 1 + AI 1	2 + PE power 2 x 24VDC 4 wire signal	Local Padlock Local ESD stay (in) Local ESD/Local (out) Oil Level Switch					
Premium functionality (Default)										
Remote control (Pulse) On/Off feedback		✓	DO 2 + DI 3	2 + PE power 2 x 24VDC 5 wire signal	Standard safety features ⁽¹⁾ Local control + LED	AUX In => ESD Stay AUX Out => ESD Local	Yes	Standard safety + Auto-Correction (LPU-S = Enable)	Safety lock cover Pressure function Tank w/ switch	LPU-D/S (Small/ Large pump)
Remote control (Active) Analog feedback		✓	DO 2 + DI 1 + AI 1	2 + PE power 2 x 24VDC 4 wire signal	Local Padlock Local ESD stay (in) Local ESD/Local (out) Oil Level Switch App Connection					

1) Standard safety features: Local LPU logic, Feedback Adjust, Learn setup, Time setup, Unit warning

Data for LPU Basic is found in the PDS for "LPU Basic Controlled System" SD 1508-2Exx.

PLATFORM SOFTWARE FUNCTIONS			
Software Functions (LPU V3)	Background (based on earlier versions and experiences)	Solution	Benefit
Local Intelligence	Dependent on dedicated I/O or valve control module.	Local intelligence, protection and warning handling within the unit itself.	Increased safety handling and unit protection.
Ruggedness	Risk of false operation or remote control.	Ruggedness is achieved by having internal sensors enabling the firmware to predict and protect the unit from self-destruct.	Lowering downtime.
Self-Learn	Dependent on tools and specialist skills.	Self-learn, enabling startup and component exchange without need of special tools or PC software.	Fast and easy exchange of component lowering downtime.
Feedback Adjust	Need of disassembly, tools and specialist skills.	Feedback Adjust, enable (DPI) to be mounted and adjusted using only the LED and an 8 mm Allen key.	Saving time and lowering down time.

For more details please refer to the manual.

Device Control and Connections

Pulse Mode

A pulse (pulse width always minimum 0.5 seconds) on DI OPEN input causes the LPU to open the valve, build up full hydraulic working pressure if applicable, and stop.

A pulse on DI CLOSE input causes LPU to close the valve, build up full hydraulic working pressure if applicable, and stop. Also, the LPU can be stopped and reversed while in operation, for more information please refer to the User manual.

Active Mode

While DI OPEN is activated, LPU will move the valve towards OPEN. When the input goes low, LPU will stop the valve and stay in position. When the valve reaches OPEN position, LPU will (even if the input goes low) build up full hydraulic working pressure if applicable and stop.

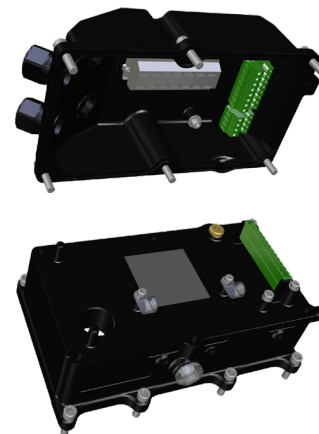
While DI CLOSE is activated, LPU will move the valve towards CLOSE. When the input goes low, LPU will stop the valve and stay in position. When the valve reaches CLOSED position, LPU will (even if the input goes low) build up full hydraulic working pressure if applicable, and stop.

AUX In / Out

Default when DI AUX is high, LPU is stopped, and blocked from external and local control. LED output is 75% blue, and 25% reflecting the current valve position.

AUX Output is per default high when AUX IN is high and if LPU is in Local Mode, set by magnets.

For other Modes like DirectionMode Open/Close, Analog Control Mode and additional option selection of the AUX In/Out, please refer to the User Manual.

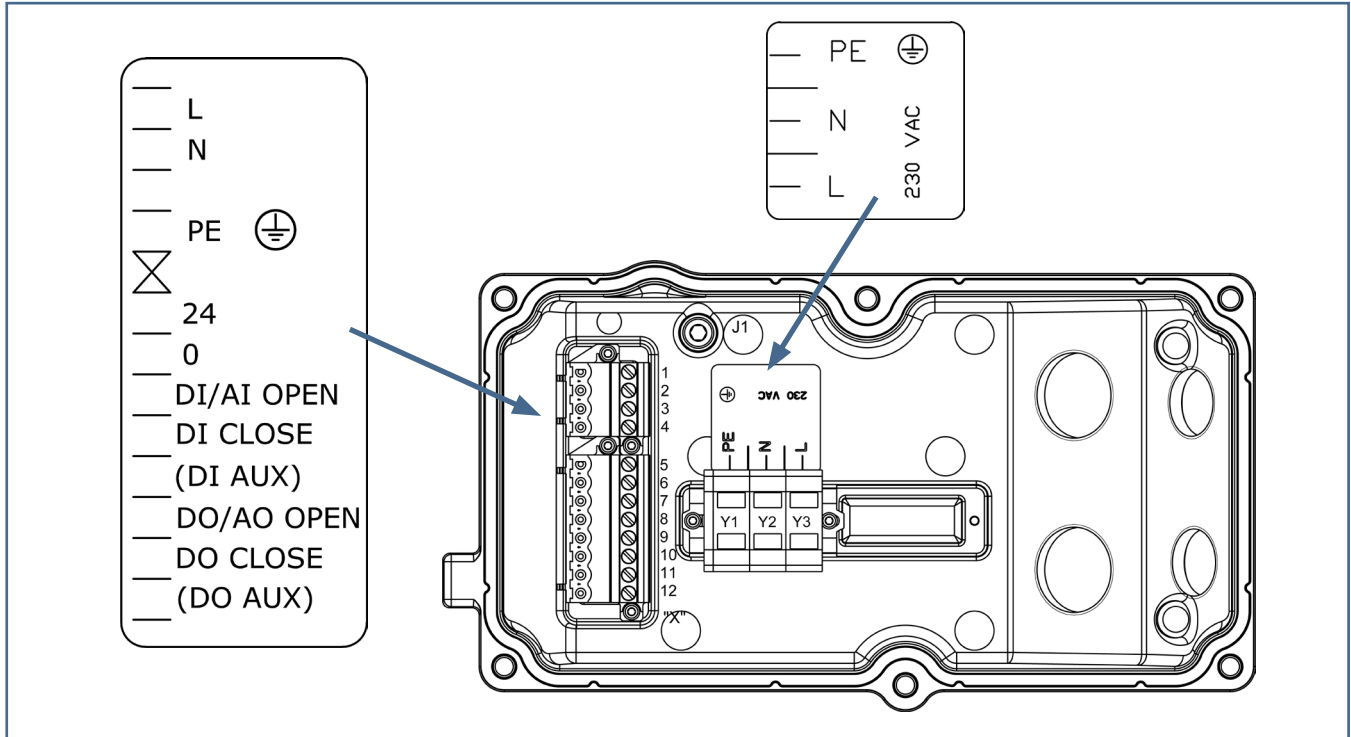


Recommended usage "Default"	LPU Control Mode	Control Terminals	LPU Feedback	Feedback Terminal Marking	Remark
LPU On/Off Valve operation	Pulse Mode (H2/H4)	DI/AI Open + DI Close	Digital	DO/AO Open + DO Close	Pulse width > 0,5 seconds
LPU Continuous valve operation	Active Mode (H4)	DI/AI Open + DI Close	4 - 20 mA	DO/AO Open	Resolution 1% of full scale / Error 12 mA ¹⁾
LPU Safe Lock-down of valve (ESD, or Padlock)	Active Signal (S1, H4)	DI AUX	Digital or 4 - 20 mA	DO AUX	AUX is optional selection

1) Error indication on LED and AUX OUT if this output is configured to show errors.

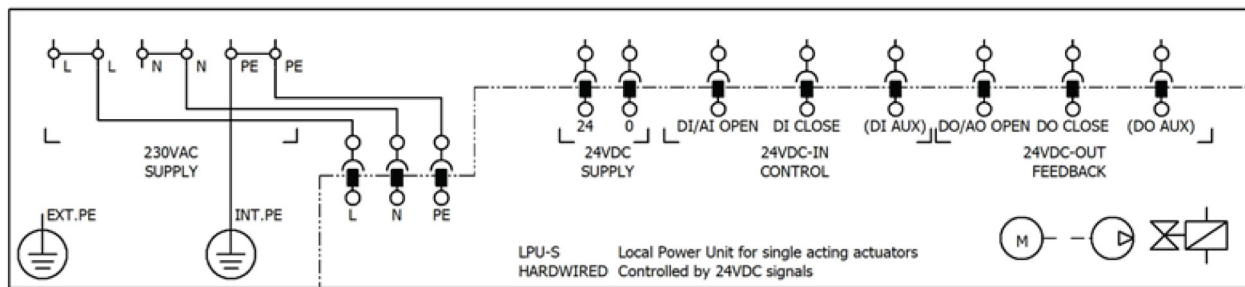
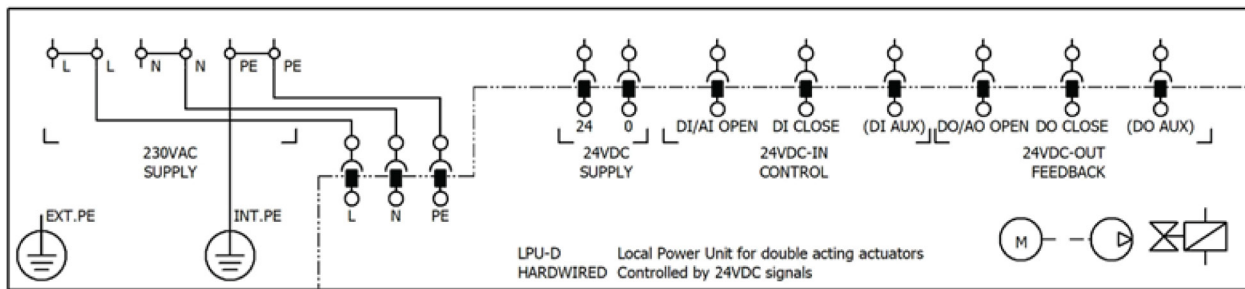
For more details please refer to the manual.

Connections Overview



Connection Layout

The connection layout for Plus and Elite are the same as is for both double and single acting valve:



Cable and Gland Connection

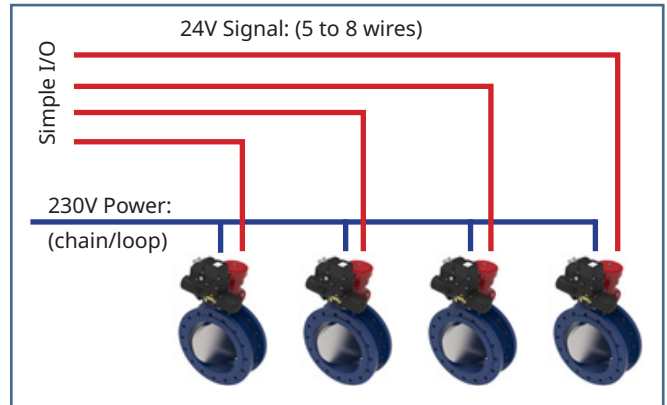
Recommended Usage "Default"	Recommended Cable	Recommended Gland	Recommended Cable Diameter
230 VAC Power L1 + L2 + PE	3 x 1.5 mm ²	M20	8 to 15 mm
24 VDC including signal wires	8 x 0.75 / 1.5 mm ²	M20	8 to 15 mm

Note!

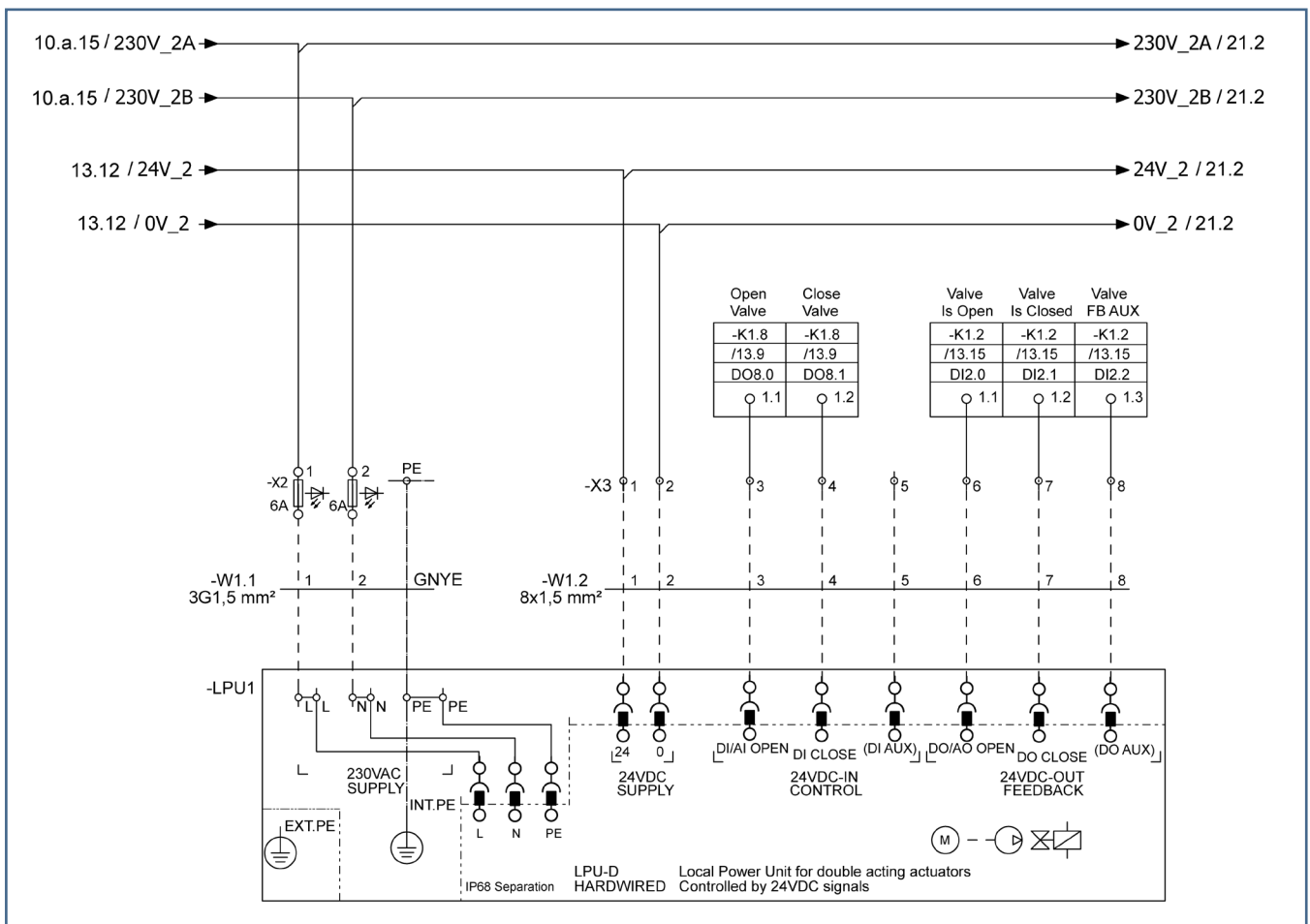
Connection Cover has 2 x M20 and 2 x M25 holes, these are plugged as standard. (Cable Gland to be agreed case by case).

Note!

Possibility to connect the device by one cable or chained/ looped power supply from unit to unit as illustrated in the example to the right.



Example of a connection diagram for LPU-D controlled with 24 VDC signal (Core/Improved customer experience (default))



Electrical Specifications

Plus and Elite LPU System	
AC Power Supply	
Supply Voltage	220-230 V AC +10%/-20% ,50 or 60 Hz
Current Maximum (starting current) @ 20 °C	8.2 A RMS
Current Nominal @ 20 °C	Large motor: 3.2 A, Small Motor: 2.4 A (RMS) LPU-S solenoid valve consumes: 0.07A (Holding current) LPU-D solenoid valve consumes: 0.21A (Holding current)
DC Power Input	
Minimum	18 VDC (10 VDC capable)
Nominal	24 VDC
Maximum	32 VDC
DC Power Current	
Minimum (Digital Control)	40 mA DC (10 VDC - 32 VDC)
Maximum	110 mA DC (10 VDC - 32 VDC)
Maximum (Digital Control Max DO current)	400 mA DC (10 VDC - 32 VDC)
Elite: Minimum /(4 - 20 mA Control)	44 mA DC (32 VDC - 10 VDC)
Elite: Maximum /(4 - 20 mA Control)	130 mA DC (32 VDC - 10 VDC)
Digital Inputs, 24 V (galvanic separation with opto-couplers)	
V_{in} Off	< 3 VDC
V_{in} On	> 5 VDC
V_{in} maximum	37 VDC
R_{in}	1.2 k Ω
Interface	Digital / 4-20 mA
Output	
I_{max}	The DC-Power @ 100 mA (polyfused)
Elite: Analogue out, external 4 - 20 mA	
Resolution	18.33 μ A
Accuracy	0.015 %
Output voltage	Up to DC Power input 2V @ 20 mA
Output Current	3 mA to 23 mA, Namur NE-43

Plus and Elite LPU System - Cont...	
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
Environmental	
Operating temperature	-5°C to +70°C
Humidity	< 50% - 100% RH
Vibration testing	4 g, 2Hz - 100 Hz 0.7 g, 2Hz - 100 Hz (if bulkhead mounted)

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
- Korean Register

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