i500 — Pump Ready!

No challenge is too great or single application too small. From industrial plants to OEMs to municipal water and wastewater treatment facilities, Lenze i500 pump solutions are hard at work. Versatile and robust, our industrial drives are cost effective and low maintenance. Our focus is on variable speed flow and pressure control so whatever your specific application requires, Lenze has the drive to match form, fit and function.

i500 drives are available in IP20, NEMA 1 as well as NEMA 4X versions ready to mount where you need them. NEMA 4X models also feature an optional, lockable disconnect switch to service the motor right at the pump.

The i500 features PID control with Sleep and Rinse functions so pressure, temperature, flowrate, and dosing applications can all easily be controlled.

With a wide range of communication options, i500 is also ready to integrate into your choice of upper level controls vendor:

- CANopen
- EtherCAT
- EtherNet/IP
- IO-Link
- Modbus
- PROFIBUS
- PROFINET
- ModbusTCP/IP
- POWERLINK

Input Voltage/Power:

- 120 V • 230 V • 400/480 V • 600 V
- 0.33 hp (0.25 kW) to 175 hp (132 kW)

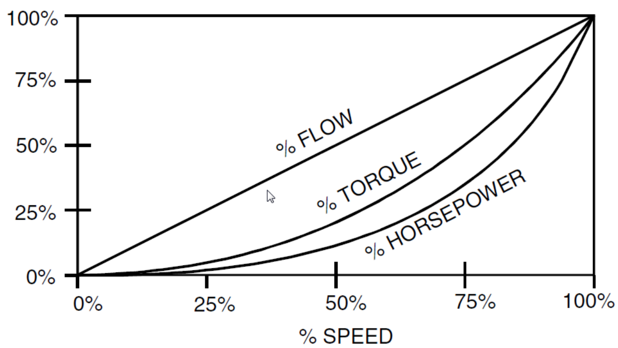
Features:

- Programmability
- Sequencer mode
- Parameters grouped by function
- Hassle-free installation
- Quick commissioning
- Diagnostics
- Quick reset to default or OEM settings

Lenze

Centrifugal pumps

Centrifugal pumps are used in a wide range of commercial, industrial, and municipal applications. Pumps are sized for the maximum flow condition however, most of the time a process will not require 100% of the system's capacity. Significant energy savings can be accomplished by simply taking advantage of the affinity laws.

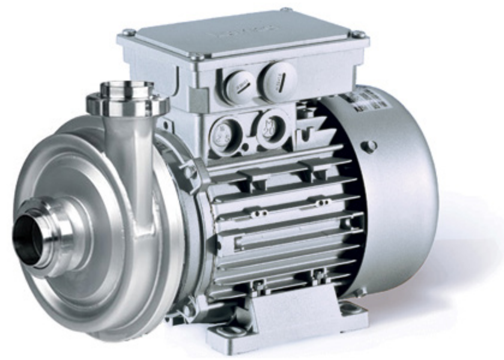


To do this, i500 drives can use a quadratic V/Hz profile to reduce the voltage supplied to the motor as a function of speed following the curve defined by the affinity law (following the torque curve). Throttling valves are another common flow control method. Compared to a throttling valve, the lower power requirements of the i500 VFD provide a greater energy savings. Following the affinity laws, operating at 75% flow reduces power demand by over 50% with an i500 Drive, while a throttling valve requires about 90%.

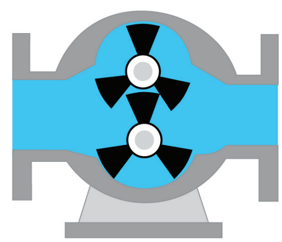
Typical applications:

- Chilled and hot water pumps
- Condenser water pumps
- Booster pumps
- Potable water pumps
- Chemical pumps

The i500 can minimize shock from water hammer / pipe fill by programming longer acceleration and deceleration times.



In centrifugal pump applications, the i500 can have its motor overload programmed to fault the drive in the event of a pump Runout/Open Flow condition. Additionally, loss of load detection (for fixed duty point) or an external sensor can be utilized to detect a loss of Net Positive Suction Head to prevent pump cavitation.



Positive Displacement (PD) Pumps require precise speed regulation to control the flow rate and high-starting torque to overcome the initial load, or to handle pseudoplastic fluids. The i500 Series offers 200% starting torque and 0.3% speed accuracy open loop in vector mode (or 0.01% closed loop with addition of an encoder). As a result, you can decrease the size of the motor you are using, simplify the system controls, and thus reduce the cost of the application.

Typical applications:

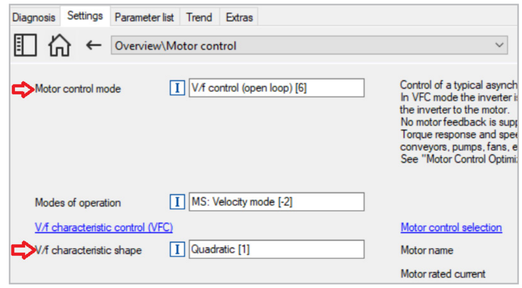
- Metering pumps
- Dosing pumps
- Gentle fluid handling
- Pumping highly viscous fluids or highly frictional loads

Pressure limitation for protection of the piping system in Positive displacement pump applications can be achieved by setting the drive's maximum motor current.

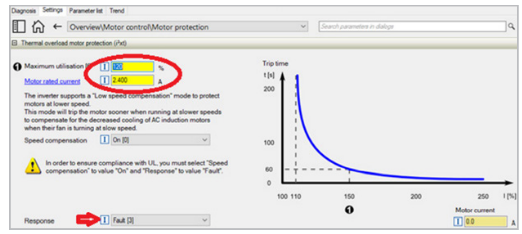
Motor Control mode for the type of pump utilized:

In the Lenze i500 set the “Motor control mode” (P300.000) = “V/f control (open loop) [6]” and also set “V/f characteristic shape” (P302.000) = “Quadratic [1]” to take full advantage of the energy savings for centrifugal pumps.

For Positive displacement pumps “Motor control mode (P300:000)” should be set to “Sensorless Vector (SLVC) [4]” for the most accurate flow control and to get optimum starting torque for most applications.



<u>To trigger a fault for a pump runout/ open flow condition</u>
set the “Maximum utilization (60s) (P308:001)” = 120%.
Set the “Motor rated current (P323:000)” to match the motor’s nameplate data.
Finally set the “Response (P308:003)” = “Fault [3].”

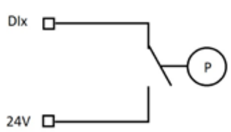


To minimize water hammer or to soften pipe fill:

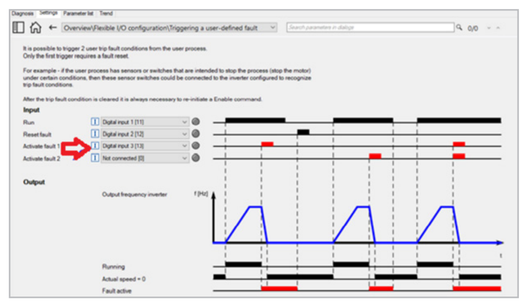
- For applications not using PID, use longer times for both “Acceleration time 1 (P220:000)” and “Deceleration time 1 (P221:000).”
- For applications utilizing PID, additionally use longer times for “PID setpoint ramp (P604:000),” “Accel time of activation (P607:001),” and Decel time for masking out (P607:002).”

To prevent cavitation:

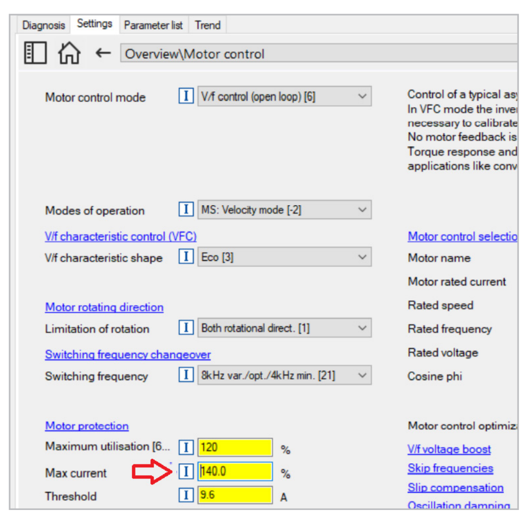
If a pressure switch will be used to check for loss of prime/ or loss of Net Positive Suction Head (NPSH) to prevent cavitation wire the switch between “24V” and one of the drive’s digital inputs (i.e. DI3).



Then assign that DI as the trigger to either “Activate fault 1 (P400:043)” or “Activate fault 2 (P400:044)” to fault the drive with either “User-defined fault 1” or “User-defined fault 2.”



<u>To limit pressure in positive displacement pump applications</u>
set “Max current (P324:000)” to a value limiting the available motor current/torque to a value suitable for the application.



Basic PID Setup:

PID applications are either “normal acting” or “reverse acting.” If an increase in the speed of the pump results in an increase in the monitored process variable (such as direct pressure), then the PID application is “normal acting.” If an increase in the speed of the pump results in a decrease in the process variable (such as a pump supplying coolant to a process monitoring temperature), then the process is “reverse acting.” Set the “Operating mode (P600:001)” for either “Normal operation [1]” or “Reverse operation [2]” as appropriate for the application. Next we need to program which drive analog input will be used as the monitored process variable. Set “PID process variable (P600:002)” either equal to “Analog input 1 [1]” and wire the monitored analog signal to AI1.

Next set “Default set point source (P201:002)” to “PID preset 1 [11]” and also program that desired set point value in “Preset 1 (P451.001).”

Program AI1 for the range of the monitored signal both the “Min PID value (P430:004)” and the “Max PID value (P430:005)” to match the signal range of the analog sensor used to monitor the process variable. Enter this value in PID units (so if the sensor was 0-10VDC = 20-100PSI, set P43x:004 = 20.0 and P43x:005 = 100).

The PID loop must then be tuned on the running system for the application. A common approach to PID tuning is the following:

1. Set the reset time for the I component to 6000 ms in “PID I-component (P602.000)” to deactivate the I component. With this setting and the default setting of “PID D-component (P603.000),” the process controller operates as P controller.
2. Increase gain of the P component step by step in “PID P-component (P601.000)” until the system becomes unstable (oscillates).
3. Reduce the gain again until the system is stable again (stops oscillating).
4. Reduce the gain by another 15 %.
5. Set reset time for the I component in “PID I-component (P602.000).” With this setting it should be noted that a too-low reset time may cause overshoots, especially in case of high steps of the system deviation.

For more detailed Pump application notes please see the “i500 Pump Application Guide”.