

# IPS 4000 | INTEGRATED PUMPING SYSTEM FOR VARIABLE PRIMARY APPLICATION | SUBMITTAL

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**Date:** NEW

Job: \_\_\_\_\_ Representative: \_\_\_\_\_

Ordered by: \_\_\_\_\_ Date: \_\_\_\_\_

Engineer: \_\_\_\_\_ Submitted by: \_\_\_\_\_ Date: \_\_\_\_\_

Contractor: \_\_\_\_\_ Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

## CONFIGURATION

SYSTEM EQUIPMENT QUANTITY		
PRIMARY PUMPS	CHILLER(S) OR BOILER(S)*	ZONES
<input type="checkbox"/> 1	<input type="checkbox"/> 1 <input type="checkbox"/> 2	—
<input type="checkbox"/> 2		
<input type="checkbox"/> 3		
<b>IPS 4501W</b>		(Specify 1 to 3)
<input type="checkbox"/> 4	<input type="checkbox"/> 3 <input type="checkbox"/> 4	—
<b>IPS 4502W</b>		(Specify 1 to 6)
<input type="checkbox"/> 5	<input type="checkbox"/> 4 <input type="checkbox"/> 5	—
<input type="checkbox"/> 6	<input type="checkbox"/> 5 <input type="checkbox"/> 6	
<b>IPS 4503W</b>		(Specify 1 to 12)
<input type="checkbox"/> 7	<input type="checkbox"/> 6 <input type="checkbox"/> 7	—
<input type="checkbox"/> 8	<input type="checkbox"/> 7 <input type="checkbox"/> 8	
<b>IPS 4504W</b>		(Specify 1 to 16)

\* Dedicated or headered configuration are allowed.

PRIMARY PUMP SPEED CONTROL	FOR ZONE(S)
<input type="checkbox"/> Sensorless*	1
<input type="checkbox"/> Hybrid: Sensorless* + critical zone sensor(s)	2 to 16
<input type="checkbox"/> Zone differential pressure sensor(s) <input type="checkbox"/> and/or Zone return temperature sensor(s)	1 to 16

\* Only available with Armstrong Design Envelope pump(s).

## STANDARD FUNCTIONALITY AND CONSTRUCTION

The Armstrong IPS 4000 is a pre-programmed multi-zone pump set controller for primary heated or chilled water systems, designed for the automation of multi-primary pumps installed in a variable speed dedicated or headered configuration. It is supplied with all hardware, software and programming required to control up to eight variable speed primary pumps including the following features:

## STANDARD CONSTRUCTION

- Multi-color 4.3" back-lit touch-screen (Not to be directly exposed to sunlight)
- Internal circuit breaker protection
- Secure front cabinet door with lock and key
- IP54 rated panel

## STANDARD FUNCTIONALITY

- Remote or local start/stop mode of operation
- Two-level (field and factory) password security
- Selectable on-screen languages : English, Spanish, French, Portuguese and Simplified Chinese
- Hand-Off-Automatic (H-O-A) control
- On-screen menu driven operator interface with :
  - Detailed view of the system of primary pumps and sensitive equipment (Chiller or Boiler) quantity, mode and status, system flow, dynamic minimum and maximum flow, bypass valve % opening, deviation from the control curve (sensorless mode) or from the active zone (with zone sensors)
  - System zones overview with setpoint, status and active zone deviation
  - Zone (1 to 16) setup with one dP (differential pressure) or Temperature sensor per zone used to determine the active zone and pump speed
  - Pump overview (1 to 8) with their mode, status, speed (% and rpm) and total run time
  - Detailed view of each pump with actual run hours, hand speed % and power consumption, and Hand-Off-Automatic (H-O-A) control
  - Pump setup to configure the number of duty pumps (with option for up to one stand-by pump), lead pump switch & minimum running time and drive settings
  - Pump speed setup with minimum, maximum and default speed, pump rated rpm and speed ramping
  - Sensorless overview (sensorless technology only available with Armstrong Design Envelope pumps) completing the pump overview with individual and system flow and head

- Sensorless setup for flow and head at Best Efficiency Point (BEP), dead band, flow and head design, zero flow head.
  - PID setup for the pump speed control based on selected cooling or heating mode
  - Temperature control overview monitoring the valve position (%), the temperature sensor setpoint & present values, and sensor status (not available on IPS 4501W)
  - Temperature control setup with adjusting the P/I control parameters, the valve output type (0-10V or 2-10V), temperature sensor zero and range (4-20mA output as reference), valve maximum allowable opening (%) and PID action (not available on IPS 4501W)
  - Bypass valve overview monitoring the valve position (%), actual system flow (from flow meter or sensorless readout) and Chiller/Boiler minimum & maximum flow rates dynamically based on number of equipment enabled.
  - Bypass valve setup adjusting the P/I control parameters, the valve output type (0-10V or 2-10V), the valve minimum and maximum positions and ramp time setting (second)
  - Optional BAS (Building Automation System) communication setup with protocol, address, BAUD rate and parity selection
  - System valves control setup, if enabled, to maintain the position of the most open system valve at the optimum opening setpoint by adjusting the active zone setpoint
  - VFD readout setup to scale values read from VFD
  - Flow setup, obtained from a sensor or by sensorless reading, flow range and min/max flow rate from BAS or per sensitive equipment in local source.
  - Current alarm list and alarm history
  - PLC diagnostic with current state and information of the PLC, HMI, and BAS protocol
- Up to eight (8) analog outputs (AO), one per pump, for speed reference signal
  - Up to eight (8) digital outputs (DO), one per pump, for start signal
  - One DO for general system alarm
  - One DI for emergency stop
  - Up to eight (8) DI's, one per pump, for run feedback
  - One AI for system flow meter
  - One DO for bypass valve
  - Standard Communication between IPS and VFD's through serial Modbus protocol (Analog/Digital Input/Outputs available for hardwired control of VFD's )
  - Optional communication port for interfacing with a BMS
  - One terminal block for power supply 100V-240V AC/ 50-60 Hz

#### ▪ General sequence of operation

The IPS controller:

#### ▪ Input/output:

Complete point schedule provided detailing analogue and digital input and output point description, functions and types. Accepting and processing signals (Differential Pressure, Temperature, or Flow) for the following dedicated terminal blocks:

- Up to sixteen (16) analog inputs (AI) for zone differential pressure or zone temperature signals (4-20 mA)
- Up to eight (8) digital inputs (DI), one per Chiller/Boiler status
- One DI for remote connection for start/stop
- Up to eight (8) DI's, one per pump, for fault signal (not available on IPS 4501W)
- Determines the most efficient combination of operating pumps, and pump operating speed based on the zone differential pressure/temperature sensor signals and/or Parallel Sensorless™ as per the field adjustable configuration.
- The control system shall continuously monitor all zone signals to determine an active control zone. Use of a multiplexer for multiple sensor inputs is not acceptable.
- Responds to an increase in demand by increasing either: the number of operating pumps or the pump speed.
- If demand decreases, the IPS controller responds by decreasing either: the number of operating pumps (or) the pump speed to optimize the energy efficiency of the pumping operation while meeting system demand.
- The control system shall automatically disable any zone differential pressure or temperature signals that are not within limits and alert the operator of a possible transmitter failure. If system found all differential pressure/temperature sensors failure in the building, the pump speed will default to a pre-defined percent of full speed (factory default loaded as 95% of full speed).
- The pump set controller shall include a modulating valve control capability based on one of the zone temperature inputs of the pump set controller. The valve position is controlled by PID through the pump set controller to maintain the temperature at a set point specified by the user. The valve output shall be selectable between 0-10 VDC and 2-10 VDC.
- Rotates the pumps based on a field adjustable interval of operating hours with a 'bump-less' transfer algorithm.
- Incorporates embedded logic to prevent hunting, pump flow surge, and motor overloading.

- If any vFD/pump unit fails, the unit is locked out in alarm and the appropriate alarm signal is activated. In place of the failed assembly, the next available vFD/pump unit is operated.
- Modulates the bypass valve to maintain the minimum flow required by the operating equipment (Chillers or Boilers).
- Either determines the minimum and maximum flow rate of all enabled Chillers/Boilers or directly obtain the values from the BAS; adjusts the pump number, speed and/or bypass valve position in order to maintain the flow between those limits.
- The pump set controller shall provide End-of-Curve (EOC) protection based on Parallel Sensorless™ (sensorless pumps) or pump operating speed (non-sensorless pumps).
- Manual operation mode (for commissioning): When the IPS is switched to the manual operation mode by the operator, there is no automatic operation or sequencing of any pump, and operation of chilled water distribution pumps can be manually set. When operation mode is switched back to auto, the automatic operation mode is restarted.

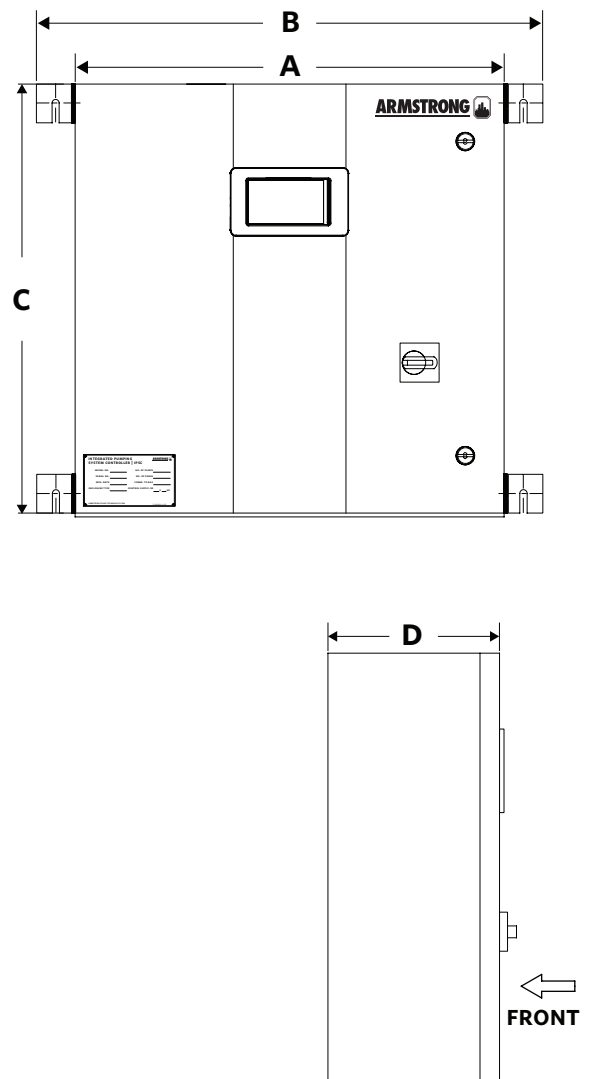
**OPTIONAL FEATURES AND DIMENSIONS**

ENCLOSURE	DIMENSIONS AND WEIGHTS				
	WIDTH		HEIGHT	DEPTH	WEIGHT
IP54	A	B	C	D	
IPS 4501W	550 (21.65)	650 (25.59)	550 (21.56)	220 (8.66)	21.0 (45)
IPS 4502W	600 (23.62)	700 (27.56)	550 (21.56)	220 (8.66)	22.0 (47)
IPS 4503W	650 (25.59)	750 (29.53)	700 (27.56)	220 (8.66)	23.0 (50)
IPS 4504W	650 (25.59)	750 (29.53)	700 (27.56)	220 (8.66)	23.0 (50)

ENCLOSURE	DIMENSIONS AND WEIGHTS				
	WIDTH		HEIGHT	DEPTH	WEIGHT
IP55	A	B	C	D	
IPS 4501W	600 (23.62)	700 (27.56)	700 (27.56)	350 (13.78)	21.0 (45)
IPS 4502W	650 (25.59)	750 (29.53)	700 (27.56)	350 (13.78)	22.0 (47)
IPS 4503W	700 (27.56)	800 (31.50)	850 (33.46)	350 (13.78)	23.0 (50)
IPS 4504W	700 (27.56)	800 (31.50)	850 (33.46)	350 (13.78)	23.0 (50)

**Notes:**

- Dimensions in mm (inches) Weights in kg (lbs)
- Weights are approximate



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INSTRUMENTATION	TOTAL QUANTITY	PRIMARY PUMP SPEED CONTROL OPTIONS		
		SENSORLESS*	HYBRID*	ZONE DP OR T
<input type="checkbox"/> Zone dP sensors	—	N/A	Σ= qty of critical zones	Σ = qty of zones
<input type="checkbox"/> Zone return temperature sensors	—	N/A		
<input type="checkbox"/> System flow sensor	—	Option**		<input type="checkbox"/> 1 flow sensor

\* With Armstrong Design Envelope pumps only

\*\* Flow sensor is optional if 'sensorless reading' is available

**BAS COMMUNICATION**

- Not required\*
- Modbus RTU
- BACnet™ MS/TP
- BACnet™ IP

\*If there are no communication between the IPS and BMS, the IPS must have the chiller/boiler isolation valves status wired to the digital inputs of the IPS, to ensure min/max rates are maintained.

**OTHER OPTIONS**

- Export crating
- Controller assembly: enclosed or rack mounted IPS and drives (please consult the factory)

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