

## ENCORE® 700 DIAPHRAGM METERING PUMP



The Encore® 700 Diaphragm Metering Pump combines the robustness of hydraulic diaphragm pumps with the unparalleled economy, simplicity, and serviceability of a mechanical pump. The Encore 700 can handle industrial and municipal metering applications in water and wastewater treatment, swimming pools, food processing, chemical processing, brewing and distillation, and agriculture.

- Handles capacities to 634 gph (2400 l/h), back pressures to 175 psi (12 bar).
- Non-loss-motion (amplitude modulation) variable eccentric stroke adjust mechanism renders efficiency, longevity, and reliability, as well as a smooth discharge pattern.
- Flexibility of two field convertible drives: direct coupled or pulley coupled, for an additional 4:1 turndown on stroke frequency with a standard induction motor.
- Precision-engineered liquid ends meter mild solutions, aggressive chemicals, high-viscosity polymers, and slurries with greater efficiency than conventional liquid ends.
- Integral clear PVC cartridge valves for fast service with no piping disturbances and built-in visual indication of operation.
- Premium composite diaphragm design ensures high metering accuracy, even at varying discharge pressures.

# ENCORE® 700

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### FEATURES

#### Full Mechanical Movement

Unlike solenoid pumps or loss-of-motion pumps, the Encore 700 diaphragm is driven by a rotating crankshaft in which the eccentricity is smoothly adjusted during operation. There are no return springs, and the diaphragm moves with simple harmonic motion. The fluid velocity profile is sinusoidal at all stroke lengths; adjusting stroke length simply alters the amplitude of the sine wave. The graph below shows the velocity profiles for each pump type. For any given output, the areas circumscribed by each curve are identical.

#### Solenoid Pumps

The most simple and economical type of pump, these provide a pulsed flow with huge pressure spikes, considerable noise and wear.

#### Lost-Motion Pumps

These motor-driven pumps are higher in capacity than solenoid pumps, but also give rapid acceleration to the liquid at rest in the pump head due to non-continuous diaphragm motion.

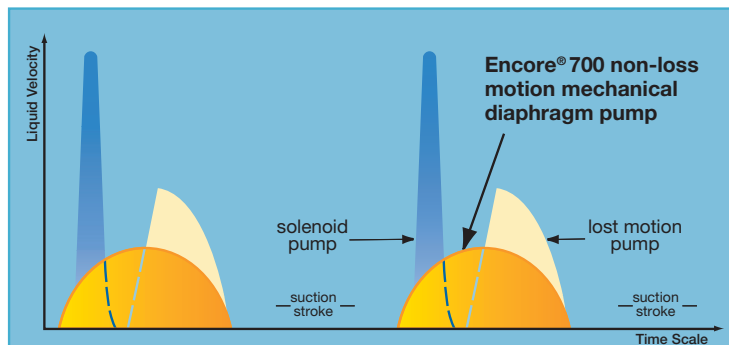
#### Non-Loss-Motion Pumps

The diaphragm is driven by a rotating crankshaft, where the eccentricity can be smoothly adjusted during operation. There are no return springs, and the diaphragm moves with simple harmonic motion. The fluid velocity profile is sinusoidal at all stroke lengths; adjusting stroke length simply alters the amplitude of the sine wave. This design provides reliability and longevity, and pump valves operate with far greater efficiency and minimal system vibration.

**Short suction and discharge porting** minimizes friction losses and cavitation, improving hydraulic characteristics and providing far more efficient fluid metering than conventional liquid end designs.

**Our premium composite diaphragm** is manufactured to stringent specifications to ensure long life even under the most demanding applications. The design incorporates Teflon®-facing, for the highest degree of chemical resistance, and nylon reinforcements, all bonded to a pre-formed elastomeric support. We've added convolutions for unconstrained rolling action, a steel backing plate to assure volumetric accuracy even at varying discharge pressures, and an O-ring groove in the head's diaphragm cavity for complete sealing.

A secondary diaphragm seal completely separates the pump head from the drive unit. This **double diaphragm isolating design** eliminates the risk of cross-contaminating gearbox lubricant and process fluid.



*This graph shows the velocity profiles for each pump type. For any given output, the areas circumscribed by each curve are identical. Note the difference in non-loss-motion designs.*

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High-precision-guided ball-and-seat clear PVC cartridge valves are available up to 180 GPH to provide built-in sight flow indication and fast, foolproof service. The patented design includes wide flow paths and four-point guides to control ball rise and assure proper seating. The valve housing is compression-sealed to the pump head and pipe connectors by O-rings and removes easily for service or replacement without disturbing the external piping.

Available with **standard induction, variable speed, or inverter duty motors** for wider operating ranges and automatic process control.

This patented **robust mechanical assembly** features liberal use of heavy-duty parts, including an epoxy-painted cast iron gearbox for superior corrosion resistance, stainless steel fasteners, load-absorbing tapered roller bearings, robust gears, and steel and nodular iron drive components.

An optional **diaphragm leak detection system** senses the early stages of diaphragm failure. The system consists of a solid-state, electro-optic sensor that mounts to the liquid end and a NEMA 4X control box. This box, which can be mounted at the pump, or up to 100 feet remote, can monitor two liquid ends. LED's and a relay provide both local and remote indication of failure.

Obtain precise and highly repeatable feed rate settings with a **10-turn, micrometer-type stroke length adjuster**. A percent scale and vernier indicate stroke length in 0.25%

Patented drive and control mechanism with precision liquid end design offer superior metering and process control performance—Patent Nos. 5957,669; 6068,450; and 6354,819.

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Available in two compact drive arrangements: direct drive or pulley drive for an additional 4:1 rangeability on stroke frequency with a standard induction motor. When the pulley drive arrangement is combined with a DC variable speed motor, total operating turndown can be as high as 800:1!



With double simplex capability, two drive units, each with independent capacity control, can be multiplexed for blending applications or future process expansion.



### MANUAL AND AUTOMATIC STROKE LENGTH CONTROL

The Encore® 700 metering pump can be controlled by varying the stroke length or stroke frequency. The following control schemes are available:

- Manual or Remote Manual Control
- Start-Stop Control where the motor is wired into the circuit of a transfer pump, switch, timer, or controller
- Flow Proportional Control from a single process variable
- Residual, Compound Loop, or Setpoint Control using one or two process variables



### MANUAL STROKE LENGTH CONTROL

A 10-turn micrometer gives continuous feed rate adjustment over a 10:1 range. A percent scale and vernier indicate stroke length setting to 1 part in 400. Each revolution of the knob changes feed rate by 10%. Stroke length is infinitely adjustable from 0 to 100%. The stroke control mechanism provides positive positioning and locking of the stroke mechanism, eliminating the need for external manual locks.



### AUTOMATIC STROKE LENGTH CONTROL

For automatic capacity control via stroke length, our NEMA 4X actuator is used in conjunction with either of two process-variable controllers. The compact, field-retrofitable actuator easily installs on the pump and features local manual override and a window for clear indication of stroke length. Two new microprocessor-based controllers are available.

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### DIRECT mA INPUT

For remote or automatic control, the optional stroke length controller accepts a direct 4-20 mA control signal, typically from a SCADA or centralized control system. Plug position is linear and proportional to the mA input. See TI 40.050 UA for more details.

### SCU, SIGNAL CONDITIONING UNIT

The economical SCU gives automatic process control in response to one process variable, typically flow rate. Housed in a NEMA 4X enclosure, the SCU features an eight-character, alphanumeric LCD display with six-button keypad and menu-driven operator prompts for simple operation, setup, and calibration. Input flow scaling and output dosage adjustment allow independent scaling from 10 to 400%.

See publication TI 40.100 UA for more details.



### VARIABLE SPEED OR VARIABLE FREQUENCY CONTROL

For precise and accurate feed rate control via stroking speed, an SCR Drive Unit varies the speed of a DC pump motor. AC variable frequency drives and inverter motors are also available for speed control. Stroke frequency can be regulated manually by potentiometer setting, or automatically via a 4-20 mA process variable input signal (optional). Closed-loop speed regulation provides feed rate control accurate to 1% of full scale. With continuous adjustment over a 20:1 range, total operating turndown with water-like solutions is 200:1 on direct drive units, 800:1 on pulley drives. Dosing or scaling of a process variable can be accomplished by means of an SCU (Signal Conditioning Unit) used in conjunction with an SCR drive or VFD.

For more complex control, a PCU (Process Control Unit) can be used to provide setpoint control in response to two process variables, such as plant flow and chlorine residual.

### PCU, PROCESS CONTROL UNIT

The PCU is a full-feature setpoint controller. It provides automatic process control in response to two process inputs, typically flow rate and chlorine residual. The PCU can operate in any of four different control modes, including residual feedback, compound loop, dual signal feed forward (for dechlorination), and flow proportional. In addition, the PCU can be configured for “center-zero” operation in compound loop mode when a DEOX/2000® Dechlorination Analyzer is used. Housed in a NEMA 4X enclosure, the PCU features a large alphanumeric display, an LED bar graph to indicate flow input or actuator position in 5% increments, a six-button keypad, and menu-driven operator prompts for simple operation, setup, and calibration.

For more information request publication TI 40.200 UA.



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### TECHNICAL INFORMATION

#### Accuracy

Repeatable metering accuracy is ± 2% of full scale, at constant hydraulic conditions, over a 10:1 operating range.

#### Stroke Length

*Liquid End Size 1 and 2:* 0.188" (4.8mm).  
*Liquid Ends Size 3, 4, 5, and 6½:* 0.375" (9.6mm).

#### Feed Rate Adjustment

Feed rate is infinitely adjustable from 0 through 100%. A percent scale and vernier indicate stroke length setting in 0.25% increments. Each revolution of the knob changes stroke length by 10%.

#### Operating Range

##### *Direct Drive Arrangement:*

Stroke length is adjustable over a 10:1 range; stroke frequency is adjustable over a 20:1 range (using an optional variable speed drive). Total combined maximum operating turndown can be as high as 200:1. Above 100:1 continuous turndown, total available operating range should be evaluated against specific chemicals being metered.

##### *Pulley Drive Arrangement:*

Stroke length is adjustable over a 10:1 range; stroke frequency is adjustable over an 80:1 range (using an optional variable speed drive). Total combined maximum operating turndown can be as high as 800:1. Above 100:1 continuous turndown, total available operating range should be evaluated against specific chemicals being metered.

#### Speed of Response

Automatic stroke length control response time is 100 seconds from 0 to 100%.

Variable speed control response time is under three seconds from 0 to 100%.

#### Suction Lift

The pump will self-prime with a 10-foot-of-water suction lift (wetted valves, zero back pressure, full stroke and speed, water-like solutions). Once primed, the

pump will operate with a 10-foot-of-water suction lift.

Flooded suction is recommended.

#### Weight and Shipping Weight

*Single simplex 110 lb:* 127 lb (50 kg; 58 kg); *double simplex 160 lb:* 184 lb (73 kg; 84 kg). For arrangements with automatic stroke length control add 12 lb; 16 lb (5.5 kg; 7.3 kg).

CAPACITIES AND DISCHARGE PRESSURES											
Diaphragm Size Inches	Stroke Frequency Stroke/min.	Capacity*		Stroke Frequency Stroke/min.	Capacity*		Pulley Step**	Maximum Discharge Pressure (psi)			Connections NPT (Tubing)
		gph	lph		gph	lph		Motor Horsepower @ 1725 RPM Induction (Variable Speed)			
								1/4 (1/2)	1/2 (3/4)	3/4 (1)	
1-3/8	36	1.3	4.7	30	1.0	3.9	1	175	-	-	1/2" (1/4"IDx 3/8"OD)
	72	2.5	9.5	60	2.1	7.9	1	175	-	-	
	144	5.0	18.9	120	4.2	15.8	1	175	-	-	
	-	-	-	144	5.0	18.9	1	175	-	-	
2	36	6.0	22.7	30	5.0	18.9	1	175	-	-	1/2" (1/4"IDx 3/8"OD)
	72	12.0	45.4	60	10.0	37.9	1	175	-	-	
	144	24.0	90.8	120	20.0	75.7	1	175	-	-	
	-	-	-	144	24	90.8	1	175	-	-	
3	36	11.3	42.6	30	9.4	35.5	1	150	-	-	1/2"
	72	22.5	85.2	60	18.8	71	1	100	150	-	
	144	45.0	170.3	120	37.5	141.9	1	50	120	150	
	-	-	-	144	45.0	170.3	1	50	120	150	
4	36	19.3	72.9	30	16.0	60.7	1	130	-	-	3/4"
	72	38.5	145.7	60	32.1	121.4	1	75	130	-	
	144	77.0	291.4	120	64.2	242.9	1	30	75	130	
	-	-	-	144	77.0	291.4	1	30	75	130	
5	36	45.0	170.3	30	37.5	141.9	1	75	-	-	1"
	72	90.0	340.7	60	75.0	283.9	1	40	75	-	
	144	180.0	681.3	120	150.0	567.8	1	20	40	75	
	-	-	-	144	180.0	681.3	1	20	40	75	
6-1/2	36	79.0	299.0	30	66.0	249.0	1	45	-	-	1-1/2"
	72	158.0	598.0	60	132.0	498.0	1	25	45	-	
	144	317.0	1200.0	120	264.0	1000.0	1	15	25	45	
	-	-	-	144	317.0	1200.0	1	15	25	45	

\*Reflects simplex capacity, double-simplex arrangements must be configured with same stroke-frequency on both liquid ends.

\*\*For pulley drive arrangements, capacities listed are for pulley step 1. Capacities for steps 2, 3, and 4 are 75%, 50%, and 25%, respectively.

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### Temperature Limits

*With PVC liquid end:* ambient temperatures from 35-125°F (2-52°C), process fluid temperatures up to 125°F (52°C).

*With Kynar® liquid end:* process fluid temperatures up to 180°F (62°C).

### Electrical Requirements

Standard induction motor arrangement is 1725 rpm, 115/230 Volts, 50/60 Hz, single phase, TEFC, UL Listed, CSA Approved. Motors with other electrical characteristics are available as an option. Diaphragm leak detector requires 115/230 Volts. Relay rating 5 Amps @ 250 Volts, 30 VDC. NEMA 4X enclosure. Variable speed drive control unit requires 115/230 Volts, 50/60 Hz, single phase, 200 mA (115V, 100 mA (230V). Variable Frequency Drive requires 230 or 460 Volt, 3-phase power. Automatic stroke length actuator - three alarm contacts (high, low, actuator disengaged) N.O., rated 5 Amps @ 250 Volts.

### Materials of Construction

*Gear box and liquid end adapter:* epoxy painted, cast iron

*Actuator enclosure:* epoxy painted, cast aluminum

*Pump head:* PVC, Kynar, or Stainless Steel

*Suction and discharge valve housings:* clear PVC, gray PVC, Kynar, or Stainless Steel

*Valve balls:* 316 stainless, TFE, ceramic, glass, and polyurethane (for slurry service)

*Valve seals:* Hypalon®, Viton®, and EPDM  
*Diaphragm:* TFE-faced, fabric reinforced, elastomer backed, with a steel backing plate

*Mounting base:* Optional with single simplex pumps; standard with double simplex pumps

The pump is UV resistant.

### Polymer and Slurry Handling Capabilities

Polymer solutions at viscosities up to 5,000 cps at 144 spm. Viscosities measured with a Brookfield Viscometer with No. 2 spindle at 3 rpm.

Hydrated lime slurries up to 3.8 pounds per gallon of water; activated carbon slurries up to 1.1 pounds per gallon of water; diatomaceous earth slurries up to 1.7 pounds per gallon of water.

### Chemical Metering Integrated Skid System

To simply liquid feed system design, installation, and startup, integrated pump skid packages are available from stock components. All systems are laid out on an easily accessible and opened frame design with a small foot print. Skid systems also include standard metering pump control panels that are pre-tested and fully integrated with the liquid feed system. They are pre-piped and include many installation accessories, such as back pressure and relief valves, pulsation dampeners, and calibration chambers. Multiple sizes provide a unit tailored to meet a wide range of flows and pressures. For more information see publication TI 410.440 UA.



# ENCORE® 700 DIAPHRAGM METERING PUMP

## ACCESSORIES

### Metering Pump Control Panel

A metering pump control panel is available that is specifically designed for control of Encore 700 metering pumps. The panel utilizes variable speed AC or DC controllers housed in a NEMA 4X enclosure. The panel includes pilot lights for indication of pump status, a digital speed indicator, and a standard disconnect switch. For more information see publication TI 410.100 UA



### Auto Degas Valve

An optional auto degas valve is available for metering liquids, such as sodium hypochlorite, that tend to outgas especially at low chemical feed rates and/or start-stop operation. With the auto degas valve installed, the pump can be restarted under high back pressure conditions without the need for manually priming the liquid end. This can be a major advantage especially for unmanned stations. The valve has a PVDF housing, Viton and EPDM O-rings, a PTFE diaphragm, and a Hastelloy® C spring.



### Diaphragm Leak Detector

An optional diaphragm leak detector system is available. It senses the early stages of diaphragm failure. The system contains an electro-optic sensor mounted to the liquid end and a NEMA 4X control box. It can monitor two liquid ends and it includes a relay for remote indication of diaphragm failure.



### Optional Installation Accessories

Available accessories include back pressure valves, pressure relief valves, antisiphon valves, main connections, suction line strainers, pulsation dampeners, calibration columns, solution tanks, mixers, and level switches.

To find out more about how to put USFilter to work for you, contact us at

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