

# Flowmeters Paddle Wheel

## Flowmeter Systems

Sensors, monitors, controllers, and installation fittings—the guide at right can direct you to a full array of components that are designed to work seamlessly in any custom arrangement that you choose. The example (below right) highlights a common system application for numerous industries. This is only the beginning, there are an infinite number of component combinations to match your needs.

Reference the table below for suitable flow ranges of each sensor type. The guide at right lists the location of additional components to complete a system. As always, please feel free to contact an Application Specialist for additional technical support.

**Flow Ranges** for flow sensors on page 647.

Pipe ID	Flow range (GPM)		
	Low-flow Rotor-X™	Standard Rotor-X™	Metalex™
½"	0.3 to 19	1 to 19	1.6 to 19
¾"	0.5 to 34	1.7 to 34	2.7 to 34
1"	0.8 to 54	2.7 to 54	4.4 to 54
1¼"	1.4 to 94	4.7 to 94	7.4 to 94
1½"	1.9 to 127	6.4 to 127	10.1 to 127
2"	3.2 to 210	10.6 to 210	16.8 to 210
2½"	4.5 to 300	15 to 300	24 to 300
3"	7 to 461	24 to 461	37 to 461
4"	12 to 794	40 to 794	63 to 794
5"	19 to 1247	63 to 1247	100 to 1247
6"	27 to 1801	91 to 1801	144 to 1801
8"	47 to 3119	156 to 3119	250 to 3119
10"	74 to 4915	246 to 4915	393 to 4915
12"	105 to 6977	349 to 6977	559 to 6977

### REQUIRED SYSTEM Components

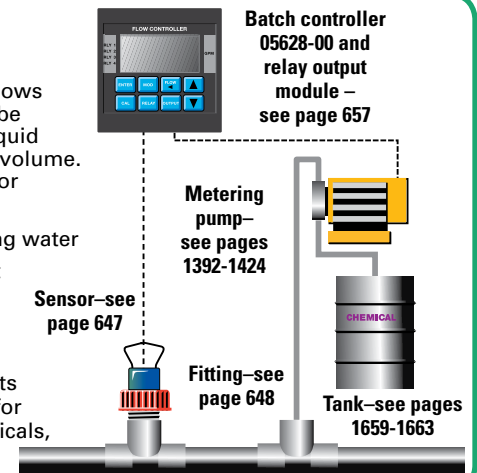
- 1 Flow sensor ..... 647
- 2 Installation fitting..... 648
- 3 Monitor or controller..... 657



### Example of a chemical proportioning system using these Flow Systems

**Chemical Proportioning System** allows for an accurate volumetric ratio to be maintained between the process liquid volume and the chemical injection volume. Real applications include injection or introduction of:

- Vitamins into farm animal drinking water
- Sodium hypochlorite disinfectant into water
- Fertilizer into irrigation water
- Bio-engineered organisms into liquids for manufacturing products such as man-made snow, soaps for large laundries, defoaming chemicals, and insecticides.

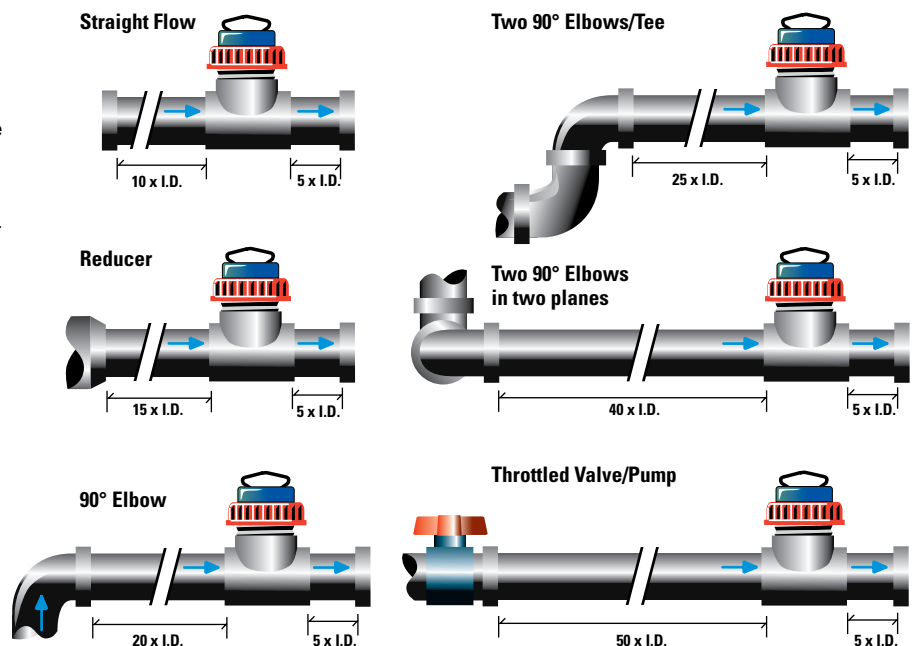
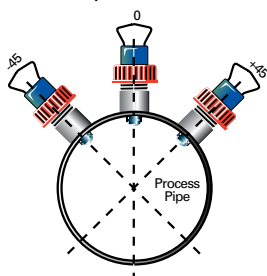


### Installing Your Flow Sensor

For best results, allow a straight run of pipe before and after the sensor after any bends, valves, or flow restrictions.

Stated accuracy is not guaranteed unless the Signet installation fittings on page 648 are used. The installation fitting ensures proper paddle depth and orientation.

In horizontal pipe runs with no air pockets or sediments present, mount the sensor/fitting in the 12 o'clock or 6 o'clock position. If sediment or air pockets are present, tilt the sensor/fitting at a maximum angle of 45° to avoid these obstacles. Vertical runs require upward flow. Pipes must be full.





**Low-Flow Rotor-X™ Sensors**

**Measure low flow rates with better resolution**

Measure a wider flow range with these high-quality designs. The rotor has an open core design to eliminate cavitation, to reduce drag on the paddle and to minimize pressure drop within the system. Less refined products in the market will use solid paddlewheels that can produce a non-linear and non-repeatable signal.

The design is suitable for measuring flow from 0.3 to 20 feet/second. Unlike basic paddle designs, this sensor includes a magnet in each paddle—4 total—for much higher resolution throughout the linear measuring range. Without amplification, the output signal can be transmitted up to 1000 feet.

This sensor is offered in materials to resist most chemicals. Select from glass-filled polypropylene or natural PVDF. All sensors have a PVDF rotor and Viton® O-ring. An integrated 25-foot signal cable is included for wiring the sensor into most systems.

These sensors may be mounted in any pipe that is compatible with the installation fittings on the following page. Rotor-X low-flow sensors are compatible with all of the line-powered displays, totalizers and controllers listed on page 657.



32500-00

**Rotor-X™ Sensors**

**Economical version of a proven design**

This sensor's rotor has an open core design to eliminate cavitation, to reduce drag on the paddle, and to minimize pressure drop within the system. Less refined products in the market will use solid paddlewheels that can produce a nonlinear and nonrepeatable signal.

The design is suitable for measuring flow from 1 to 20 feet/second. This paddle design includes a magnet in two opposite paddles for good resolution throughout the measuring range. Without amplification, the output signal can be transmitted up to 200 feet. As an FM-approved device, this sensor may be installed in hazardous locations.

This sensor is offered in materials to resist most chemicals. Select from glass-filled polypropylene or natural PVDF. All sensors have a PVDF rotor and Viton® O-ring. An integrated 25-foot signal cable is included for wiring the sensor into most systems.

These sensors may be mounted in any pipe that is compatible with the installation fittings on the following page. Rotor-X sensors are compatible with all of the line-powered displays, totalizers and controllers listed on page 657.



05618-10

**Specifications**



**Flow velocity:** 0.3 to 20 ft/sec (0.1 to 6 m/sec)

**Output:** open collector, sinking

**Linearity:** ±1% full-scale

**Repeatability:** ±0.5% full-scale

**Max temp:** 185°F (85°C) at 25 psi

**Max pressure (at 68°F/20°C)**

PP body: 180 psi (12.4 bar)

PVDF body: 200 psi (13.8 bar)

**Input power:** 3.3 to 24 VDC (supplied by a flow monitor/controller)



Catalog number	Pipe ID	Sensor length	Price
<b>Sensors with polypropylene body; titanium shaft</b>			
TW-32500-00	½" to 4"	4½"	
TW-32500-02	5" to 8"	5¾"	
<b>Sensors with PVDF body; Hastelloy C® shaft</b>			
TW-32500-10	½" to 4"	4½"	

**Specifications**



**Flow velocity:** 1 to 20 ft/sec (0.3 to 6 m/sec)

**Output:** 1 V peak-to-peak per ft/sec; 8 kΩ source impedance, nominal frequency of 6 Hz per ft/sec

**Linearity:** ±1% full-scale

**Repeatability:** ±0.5% full-scale

**Max temp**

PP body: 194°F (90°C)

PVDF body: 212°F (100°C)

**Max pressure (at 68°F/20°C)**

PP body: 180 psi (12.4 bar)

PVDF body: 200 psi (13.8 bar)



Catalog number	Pipe ID	Sensor length	Price
<b>Sensors with polypropylene body; titanium shaft</b>			
TW-05618-10	½" to 4"	4½"	
TW-05618-11	5" to 8"	5¾"	
<b>Sensors with PVDF body; Hastelloy C® shaft</b>			
TW-05618-13	½" to 4"	4½"	

**Metalex™ Sensors**

**Stainless steel body withstands high pressures and temperatures**

This design was specifically developed to handle aggressive flow applications such as liquid ammonia and steam condensate. Like all +GF+® Signet designs, the rotor has an open core design to eliminate cavitation, to reduce drag on the paddle and to minimize pressure drop within the system.

The design is suitable for measuring flow from 1.6 to 20 feet/second. Without amplification, the output signal can be transmitted up to 200 feet. As an FM-Approved device, this sensor may be installed in hazardous locations.

The sensor body is 316 SS. Other components are a CD4MCu SS rotor, Fluoroloy B® rotor bearing and KLINGER®sil O-ring. An integrated 25-foot signal cable is included for wiring the sensor into most systems.

These sensors may be mounted in any pipe that is compatible with the Metalex-specific installation fittings on the following page. Metalex sensors are compatible with all of the line-powered displays, totalizers and controllers listed on page 657.



05618-64

**Specifications**



**Flow velocity:** 1.6 to 20 ft/sec (0.5 to 6 m/sec)

**Output:** sine wave, 12k Ω source impedance; nominal frequency of 12 Hz per ft/second

**Linearity:** ±1% full-scale

**Repeatability:** ±0.5% full-scale

**Max temp**

Mini-tap fitting: 300°F (149°C)

Saddle fitting: 150°F (66°C)

**Max pressure**

Mini-tap fitting: 1500 psi (103 bar)

Saddle fitting: 300 psi (20.7 bar)



Catalog number	Pipe ID	Sensor length	Price
<b>Use with mini-tap fitting</b>			
TW-05618-60	½" to 1"	1½"	
TW-05618-64	1¼" to 12"	2½"	
<b>Use with saddle fitting</b>			
TW-05618-80	2" to 12"	4½"	

**MORE info!**

Mounting is critical to flow measurement accuracy. The fitting places the sensor at the proper height in the flow stream to achieve the maximum accuracy. To ensure proper paddle-wheel alignment, order an installation fitting from the next page.



# Flowmeters Paddle Wheel

## Installation Fittings

Fittings are precision crafted to ensure proper sensor insertion depth and accurate flow measurement. Pipe fitting sizes range from 1/2" to 12" in diameter. See our chemical resistance charts (go to [www.coleparmer.com/techinfo](http://www.coleparmer.com/techinfo)) to select a fitting material compatible with your fluid. Order dummy plugs (key letter **J**) to use in pipelines while sensors are removed.

- A PVDF Tees** with true union socket connectors. For pipes up to 2" in diameter.
- B Polypropylene Tees** for pipes up to 2" in diameter. True union socket connectors.
- C PVC Tees** for PVC 80 pipes up to 4" in diameter and CPVC 80 pipes up to 1 1/2" in diameter. Slip on ends (no threads).
- D Metal Tees** for copper, 316 stainless steel (SS), carbon steel (CS), and galvanized iron (schedule 40) pipes up to 2" in diameter. SS, CS, and galvanized iron fittings include PVDF insert for all sizes and NPT(F) threads at each end. Copper tee fittings include PVDF insert for pipe ID over 1" and feature sweat-on ends.
- E 316 SS Socket-Weld Mini-Tap Fittings** for Metalex™ sensors only. Includes cap kit.

- F 316 SS Weld-On Mini-Tap Fittings** for Metalex sensors only. Include a cap kit.
- G PVC Saddles** for PVC 40 pipes from 2" to 4" in diameter; PVC 80 pipes from 6" to 8" in diameter. Specify schedule of pipe when ordering.
- H Galvanized Iron (Schedule 80) Saddles** for pipes from 2 1/2" to 4" in diameter. Specify schedule of pipe when ordering.
- I Weldolet Fittings** weld directly onto hole cut in pipe. For stainless steel and carbon steel pipes 2 1/2" to 12" in diameter. Specify schedule of pipe when ordering.
- J Dummy Plug.** Insert a plug in place of the sensor when it has been removed for inspection or service. **Note:** Not for use with Metalex sensors.

**TW-05614-29 Polypropylene dummy plug**

Fitting type	Pipe ID	Material	Catalog number	Price
A	1/2"	PVDF	<a href="#">TW-05619-51</a>	
B		Polypropylene	<a href="#">TW-05619-61</a>	
C		PVC 80	<a href="#">TW-05620-21</a>	
D		CPVC 80	<a href="#">TW-05620-31</a>	
D		316 SS	<a href="#">TW-05620-41</a>	
D		Copper	<a href="#">TW-05620-71</a>	
E		316 SS socketTW-weld	<a href="#">TW-05618-61</a>	
A	3/4"	PVDF	<a href="#">TW-05619-52</a>	
B		Polypropylene	<a href="#">TW-05619-62</a>	
C		PVC 80	<a href="#">TW-05620-22</a>	
D		CPVC 80	<a href="#">TW-05620-32</a>	
D		316 SS	<a href="#">TW-05620-42</a>	
D		Copper	<a href="#">TW-05620-72</a>	
E		316 SS socketTW-weld	<a href="#">TW-05618-62</a>	
C	1"	PVC 80	<a href="#">TW-05620-23</a>	
D		CPVC 80	<a href="#">TW-05620-33</a>	
D		Galvanized iron (40)	<a href="#">TW-05620-53</a>	
D		316 SS	<a href="#">TW-05620-43</a>	
D		Copper	<a href="#">TW-05620-73</a>	
E		316 SS socketTW-weld	<a href="#">TW-05618-63</a>	
A	1 1/4"	PVDF	<a href="#">TW-05619-53</a>	
A		PVDF	<a href="#">TW-05619-54</a>	
B		Polypropylene	<a href="#">TW-05619-64</a>	
C		PVC 80	<a href="#">TW-05620-24</a>	
D		CPVC 80	<a href="#">TW-05620-34</a>	
D		Galvanized iron (40)	<a href="#">TW-05620-54</a>	
D		316 SS	<a href="#">TW-05620-44</a>	
D		Copper	<a href="#">TW-05620-74</a>	
R		316 SS weld-on	<a href="#">TW-05618-65</a>	
A	1 1/2"	PVDF	<a href="#">TW-05619-55</a>	
B		Polypropylene	<a href="#">TW-05619-65</a>	
C		PVC 80	<a href="#">TW-05620-25</a>	
D		CPVC 80	<a href="#">TW-05620-35</a>	
D		Galvanized iron (40)	<a href="#">TW-05620-55</a>	
D		316 SS	<a href="#">TW-05620-45</a>	
D		Copper	<a href="#">TW-05620-75</a>	
F		316 SS weld-on	<a href="#">TW-05618-66</a>	

\*Fittings are metric size with a 32 mm (1.2598") pipe ID, not 1 1/4".



**A**



**B**



**C**



**D**

Fitting type	Pipe ID	Material	Catalog number	Price
A	2"	PVDF	<a href="#">TW-05619-56</a>	
B		Polypropylene	<a href="#">TW-05619-66</a>	
C		PVC 80	<a href="#">TW-05620-26</a>	
D		Galvanized iron (40)	<a href="#">TW-05620-56</a>	
D		316 SS	<a href="#">TW-05620-46</a>	
D		Copper	<a href="#">TW-05620-76</a>	
G		PVC 40	<a href="#">TW-05620-16</a>	
F		316 SS weld-on	<a href="#">TW-05618-70</a>	
C	2 1/2"	PVC 80	<a href="#">TW-05620-27</a>	
G		PVC 40	<a href="#">TW-05620-17</a>	
H	3"	Galvanized iron (80)	<a href="#">TW-05620-57</a>	
C		PVC 80	<a href="#">TW-05620-28</a>	
G		PVC 40	<a href="#">TW-05620-18</a>	
H	4"	Galvanized iron (80)	<a href="#">TW-05620-58</a>	
I		Carbon steel	<a href="#">TW-05615-23</a>	
I		316 SS	<a href="#">TW-05620-48</a>	
F		316 SS weld-on	<a href="#">TW-05618-72</a>	
C		PVC 80	<a href="#">TW-05620-29</a>	
G		PVC 40	<a href="#">TW-05620-19</a>	
H	6"	Galvanized iron (80)	<a href="#">TW-05620-59</a>	
I		Carbon steel	<a href="#">TW-05615-24</a>	
F		316 SS weld-on	<a href="#">TW-05618-73</a>	
G	8"	PVC 80	<a href="#">TW-05620-83</a>	
I		Carbon steel	<a href="#">TW-05615-26</a>	
F		316 SS weld-on	<a href="#">TW-05618-75</a>	
G	10"	PVC 80	<a href="#">TW-05620-84</a>	
I		Carbon steel	<a href="#">TW-05615-27</a>	
I	12"	Carbon steel	<a href="#">TW-05615-28</a>	
I		Carbon steel	<a href="#">TW-05615-29</a>	



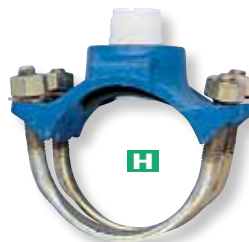
**E**



**F**



**G**



**H**



**I**



**J**





## Low-Flow Impeller Sensors and Controllers

### Impeller design minimizes wear for long sensor life

Each flow sensor uses a rotating turbine and a magnetic Hall-effect sensor to generate an electronic pulse proportional to flow rate. The controller converts these pulses into flow units. These low-flow sensors measure flow rates in pipe sizes from 3/8" to 1" NPT(F). Sensors generate a square wave pulse output that can be sent to flow controllers 33110-60 or -70 to display flow rate and total; batch controller 33112-52, which provides batch output control to multiple devices; or rate/total display 33112-50, which is a battery-operated two-line display.

Choose from polypropylene (PP), TFE, 316 stainless steel (SS), or brass sensors. Select PP sensors for general-purpose applications. Use TFE sensors for high-purity, high-temperature applications. The 316 SS sensors should be used in applications such as chemical batching and injection, fertilizer injection, or proportioning of spray chemicals. Brass sensor should be used in applications using clean water. For best results, install sensors within a straight run of tubing or pipe (five pipe diameters long on the inlet side). Sensors can be mounted in any orientation. All models include an 18-ft (5.5-m) L cable with stripped ends.



33125-10

### Specifications

<b>Viscosity range:</b> 30 cp max	<b>Max pressure</b>	<b>Output signal</b>
<b>Accuracy:</b> ±1% full-scale	PP and TFE: 150 psi (10.3 bar)	PP, TFE, and SS: current
<b>Linearity:</b> ±1% full-scale	SS: 500 psi (34.5 bar)	sinking pulse,
<b>Repeatability:</b> ±0.5% full-scale	Brass: 175 psi (12 bar)	6 to 24 VDC
<b>Max operating temperature</b>	<b>Input power</b>	Brass: square wave pulse,
PP and TFE: 160°F (71°C)	PP, TFE, and SS:	5 to 30 VDC
SS: 200°F (93°C)	5 to 24 VDC, 2 mA min	<b>Cable length:</b> 18 ft
Brass: 185°F (85°C)	Brass: 5 to 30 VDC current	
	sinking pulse	



Wetted materials	PP	TFE	316 SS	Brass
Body	PP	TFE	316 SS	Nickel-plated brass
Rotor	PVDF	PVDF	PVDF	Thermoplastic
Shaft	Tungsten carbide	Ceramic	Tungsten carbide	Tungsten carbide
Bearings	Ruby	Ruby	Ruby	Sapphire, graphic
O-ring	EPDM	Viton®	Viton	Viton
Cover	Acrylic	TFE	316 SS	Thermoplastic

Flow range (GPM)	Connection NPT(F)	Pressure drop at max flow	PP sensors		TFE sensors		SS sensors		Brass sensors	
			Cat. no.	Price	Cat. no.	Price	Cat. no.	Price	Cat. no.	Price
0.07 to 5	3/8"	15 psi	<a href="#">TW-33110-00</a>	—	<a href="#">TW-33110-05</a>	—	—	—	—	—
0.1 to 10	1/2"	15 psi	<a href="#">TW-33110-10</a>	—	<a href="#">TW-33110-15</a>	—	<a href="#">TW-33125-10</a>	—	—	—
0.2 to 10	1/2"	14 psi	—	—	—	—	—	—	<a href="#">TW-33125-00</a>	—
0.2 to 15	3/4"	14 psi	—	—	—	—	<a href="#">TW-33125-15</a>	—	—	—
0.2 to 18	3/4"	14 psi	—	—	—	—	—	—	<a href="#">TW-33125-05</a>	—
0.2 to 20	3/4"	24 psi	<a href="#">TW-33110-20</a>	—	<a href="#">TW-33110-25</a>	—	—	—	—	—
0.5 to 25	1"	15 psi	—	—	—	—	<a href="#">TW-33125-20</a>	—	—	—
0.5 to 40	1"	24 psi	<a href="#">TW-33110-30</a>	—	<a href="#">TW-33110-35</a>	—	—	—	—	—

### Flow Rate/Totalizer Display

Battery-operated flow rate/totalizer display has a three to five year battery life. The two-line LCD provides 6-digit rate and 8-digit total display simultaneously—units are user-selectable. Flow display has simple, three-button operation: enter the R-factor, pulse output scaling, and the decimal point. Includes a wall-mountable NEMA 4X enclosure.



33112-50

### Specifications



<b>Sensor input:</b> square wave, 20 mV to 6 V peak to peak
<b>Output:</b> 0.1 second open collector pulse, scalable 0.1 to 200,000 units/pulse
<b>Operating temperature:</b> 32 to 158°F (0 to 70°C)
<b>Power:</b> lithium C cell battery, 3 V
<b>Dimensions (W x H x D):</b> 3 3/8" x 3 3/8" x 2 1/8" (9.8 x 9.8 x 7.3 cm)

Cat. no.	Description	Price
<a href="#">TW-33112-50</a>	Flow rate/totalizer display	

### Batch Controller

Controller provides batch output control through two relays for controlling multiple devices. Dual pulse outputs allow proportional feed with pulse-responsive metering pumps. Features backlit 5-digit flow rate and 8-digit totalizer displays—volume and time units are user-selectable. NEMA 4X enclosure can be wall or panel mounted.



### Specifications

<b>Sensor input:</b> open collector current sink; 1000 Hz max
<b>Output power, sensor:</b> 12 VDC, 10 mA
<b>Relay output:</b> two SPDT relay, 115 VAC, 5 A max, NO or NC
<b>Pulse output:</b> two, 100 mA at 60 VDC, max
<b>Analog output:</b> 4 to 20 mA, 0 to 10 VDC, or 0 to 5 VDC
<b>Operating temperature:</b> 32 to 130°F (0 to 55°C)
<b>Input power:</b> 115/220 VAC, 50/60 Hz or 12 to 24 VDC
<b>Auxiliary input:</b> batch start/stop/resume
<b>Dimensions (W x H x D):</b> 6 1/16" x 6 7/16" x 4 7/8" (16.3 x 16.3 x 11.8 cm)

Cat. no.	Description	Price
<a href="#">TW-33112-52</a>	Batch controller	

### Flow Controllers

Controllers display flow rate and total (resettable) simultaneously on a two-line 8-digit LCD. The 4 to 20 mA output lets you send data to a recorder or data logger. Nonvolatile memory stores flow total in the event of power failure.

Panel-mount model 33110-60 features a gasketed front panel, membrane switches, and NEMA 12 (IP52) enclosure. Wall-mount model 33110-70 has a clear cover and splashproof NEMA 4X (IP56) enclosure. Both models include a 2 1/2-ft (0.8-m) L cable with stripped ends.

### Specifications



<b>Input signal:</b> pulse frequency 5 VDC 200 Hz max
<b>Output signal:</b> 4 to 20 mA (loop) scaled pulse, open collector; sensor pulse pass through high/low alarm (through pulse output)
<b>Operating temperature:</b> 32 to 158°F (0 to 80°C)
<b>Input power:</b> 12 or 32 VDC, 4 mA loop powered
<b>Display type:</b> two-line, 8-digit LCD, 7/16"H
<b>Panel cutout:</b> 3 1/16"W x 3 3/16"H x 2"D
<b>Dimensions (W x H x D)</b>
Panel-mount model: 3 3/4" x 3 3/4" x 2" (9.5 x 9.5 x 5.1 cm)
Wall-mount model: 3 7/8" x 3 7/8" x 2 1/8" (9.8 x 9.8 x 7.3 cm)

Cat. no.	Description	Price
<a href="#">TW-33110-60</a>	Panel mount	
<a href="#">TW-33110-70</a>	Wall mount	