

MASTERflex® Pumps & Tubing



Masterflex® L/S®
Digital Pump Drive
page 17



**Expert product
assistance**

Charles, Application Specialist

Research



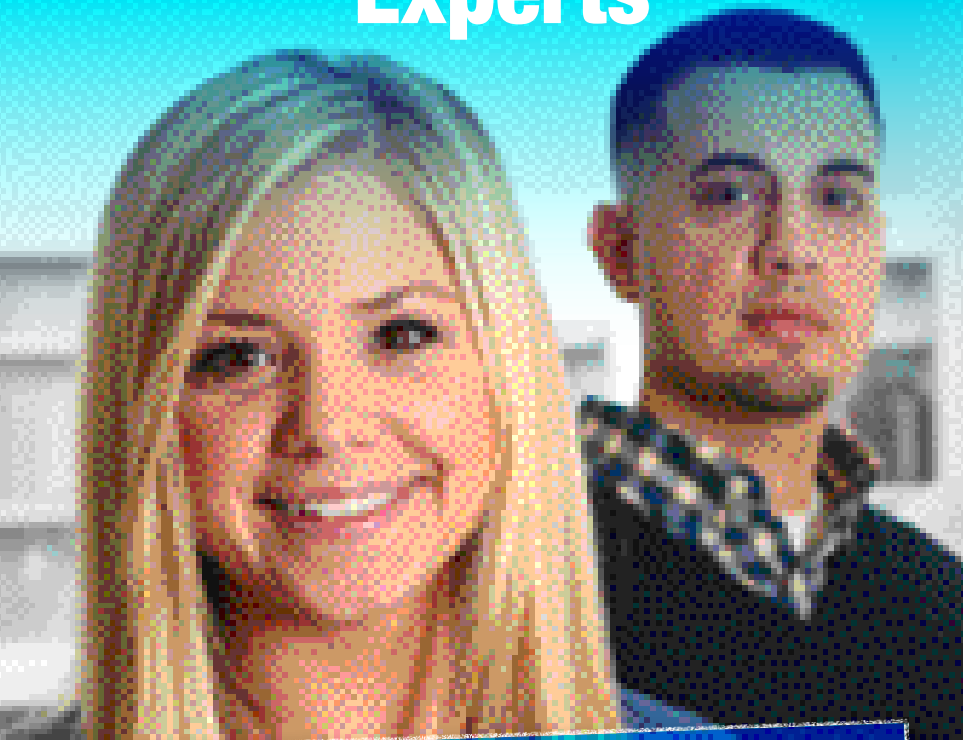
Process



Manufacturing



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Why *MASTERflex*[®] Peristaltic Pumps?

1 Easy

- Quick installation
- Low maintenance
- Easy tubing changeover

2 Durable

- Trusted for over 45 years
- Broad chemical compatibility

3 Versatile

- From research to process
- Handles just about any fluid
- Multichannel capabilities

4 Customizable

- Configurable systems
- Many tubing options
- Easy scale-up

5 Accurate

- Flow ranges from 0.0006 mL/min to 42 L/min
- Rigorous design and testing standards
- Tubing is custom manufactured to precise tolerances

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Masterflex peristaltic pump systems provide flexibility based on your needs and requirements. Use the chart below to help select the right system for you, then select the right head, tubing, and drive to match your exact needs. The best part: Masterflex pumps can be configured as your needs change—just switch out the pump head and the tubing to match your new requirements!



Selecting a **Masterflex®** Pump: As Easy As

Application Requirements

- What is my required flow rate?
- What chemical am I pumping?
- Do conditions such as viscosity or back pressure play an important role in my decision?

Base a Pump Series on Your Flow Rate

- Use the table below to find the pump series that best fits your flow rate needs

Complete Your System

- L/S and I/P pump series are divided into three components—pump head, tubing, and drive
- Select the three components from the same series or choose a complete preconfigured system

Masterflex pump series	Features	Flow range	Speed		Remote control capability	Multichannel capabilities	Page(s)
			Fixed	Variable			
C/L®	Compact, low-flow pump that easily fits on benchtop or mounts within a panel	0.002 to 43 mL/min		✓	Yes	Yes	4
L/S®	High-accuracy drives for precise flow control and dispensing	0.0006 to 3400 mL/min	✓	✓	Yes	Yes	5–20
I/P®	Powerful systems that provide better protection from possible hazards such as dust and water	0.012 to 19 LPM	✓	✓	Yes	Yes	21–28
B/T®	Highest flow rates—ideal for large batch fluid transfer with excellent hazard protection	0.3 to 42 LPM	✓	✓	Yes	Yes	29–30

Custom **OEM** Pump Systems

When an off-the-shelf pump just won't cut it, you need a solution custom-built for your requirements

With more than 100 years of combined experience, our design engineers will partner with you to create the exact pump you need. Contact our Application Specialists to get started!

Still not sure what to choose?

Let our expert Application Specialists find the right pump for your application.
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C/L® Variable-Speed Compact Pumps

Pump in even the tightest spaces!

- Pump fluids in either direction—easily switchable reversing motor
- Stop/start remotely via contact closure
- MAX button quickly primes or purges tubing
- Both pumps include 5 ft (1.5 m) of 0.89-mm ID Tygon® E-LFL tubing.

A. C/L Single-Channel Pumps

- Quick and easy tubing changes—open cover and release occlusion bed in one motion
- Pump from 0.002 to 43 mL/min
- Pump head made from polyphenylene sulfide, acetal, and copolyester; stainless steel rollers

B. C/L Dual-Channel Pumps

- Pump from 0.002 to 12.3 mL/min per channel, depending on drive and tubing
- Pump head made of polyphenylene sulfide and stainless steel; rollers made of acetal co-polymer



FEATURES

- ✓ Flow range: 0.002 to 43 mL/min
- ✓ ¼-DIN housing is perfect for panel mounting
- ✓ Reversible pumping
- ✓ Stop/start remote control capabilities

Power supplies are:

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rpm	Speed control (repeatability)	Number of channels	Number of rollers	Reversible motor	IP rating	Dimensions—¼ DIN (L x W x H)	Power		Catalog number	Price	
							VAC, Hz	Amps			
A. C/L single-channel compact pumps											
1.7 to 10	±5%	1	4	Yes	IP22	7" x 3¾" x 3½" (17.8 x 9.5 x 8.9 cm)	90 to 260, 50/60 12 VDC†	110 mA at 115 VAC —	XF-77122-04 XF-77122-06		
13 to 80							90 to 260, 50/60 12 VDC†	175 mA at 115 VAC —	XF-77122-14 XF-77122-16		
50 to 300							90 to 260, 50/60 12 VDC†	400 mA at 115 VAC —	XF-77122-24 XF-77122-26		
B. C/L dual-channel compact pumps											
1 to 6	±5%	2	6	Yes	IP22	7½" x 3¾" x 3½" (19 x 9.5 x 8.9 cm)	90 to 260, 50/60 12 VDC†	110 mA at 115 VAC —	XF-77120-32 XF-77120-52		
10 to 60							90 to 260, 50/60 12 VDC†	175 mA at 115 VAC —	XF-77120-42 XF-77120-62		

†Power supply not included with 12 VDC models.

[XF-77120-03](#) Brackets for panel mounting.
Set of 2

[XF-77200-07](#) Replacement power supply,
100 to 240 VAC, for pump 77122-24

[XF-77120-11](#) Replacement power supply,
100 to 240 VAC, for pumps 77122-04, -14;
77120-32 and -42

Microbore Pump Tubing Ordering Information

Tube ID (mm)	Tygon® E-Lab	Silicone (platinum-cured)	Silicone (peroxide-cured)	PharMed® BPT	Tygon E-LFL (long flex life)	Viton®	Puri-Flex™	C-Flex®	Solvent/hydrocarbon
	NEW				NEW				
0.19	XF-06460-10	—	—	—	—	—	XF-96418-10	XF-95718-10	XF-95712-10
0.25	XF-06460-12	—	—	XF-95809-12	—	—	XF-96418-12	XF-95718-12	XF-95712-12
0.51	XF-06460-18	XF-95590-18	—	XF-95809-18	XF-06449-18	—	XF-96418-18	XF-95718-18	XF-95712-18
0.89	XF-06460-26	XF-95590-26	XF-07625-26	XF-95809-26	XF-06449-26	XF-97632-26	XF-96418-26	XF-95718-26	XF-95712-26
1.14	XF-06460-30	XF-95590-30	XF-07625-30	XF-95809-30	XF-06449-30	XF-97632-30	XF-96418-30	XF-95718-30	XF-95712-30
1.42	XF-06460-34	XF-95590-34	XF-07625-34	XF-95809-34	XF-06449-34	XF-97632-34	XF-96418-34	XF-95718-34	XF-95712-34
2.06	XF-06460-42	XF-95590-42	XF-07625-42	XF-95809-42	XF-06449-42	XF-97632-42	XF-96418-42	XF-95718-42	XF-95712-42
2.79	XF-06460-48	XF-95590-48	XF-07625-48	XF-95809-48	XF-06449-48	XF-97632-48	XF-96418-48	XF-95718-48	XF-95712-48
Quantity/pack	100 ft (30.4 m)	50 ft (15.2 m)	50 ft (15.2 m)	100 ft (30.4 m)	100 ft (30.4 m)	50 ft (15.2 m)	50 ft (15.2 m)	50 ft (15.2 m)	50 ft (15.2 m)
Price/pk									

Flow Rates in mL/min

rpm	Microbore pump tubing size (ID)							
	0.19 mm	0.25 mm	0.51 mm	0.89 mm	1.14 mm	1.42 mm	2.06 mm	2.79 mm
1 to 6	0.002 to 0.013	0.0028 to 0.017	0.012 to 0.07	0.036 to 0.20	0.057 to 0.34	0.08 to 0.49	0.15 to 0.88	0.22 to 1.3
1.7 to 10	0.002 to 0.013	0.004 to 0.022	0.015 to 0.087	0.041 to 0.25	0.064 to 0.39	0.09 to 0.57	0.18 to 1.05	0.28 to 1.65
10 to 60	0.02 to 0.13	0.03 to 0.18	0.12 to 0.70	0.36 to 2.1	0.55 to 3.3	0.8 to 4.9	1.5 to 8.9	2.1 to 12.3
13 to 80	0.017 to 0.10	0.03 to 0.18	0.12 to 0.70	0.33 to 2.0	0.52 to 3.1	0.75 to 4.5	1.4 to 8.5	1.8 to 11.0
50 to 300	0.06 to 0.38	0.11 to 0.67	0.43 to 2.6	1.2 to 7.4	1.9 to 11.5	2.8 to 17.0	5.3 to 32	7.2 to 43

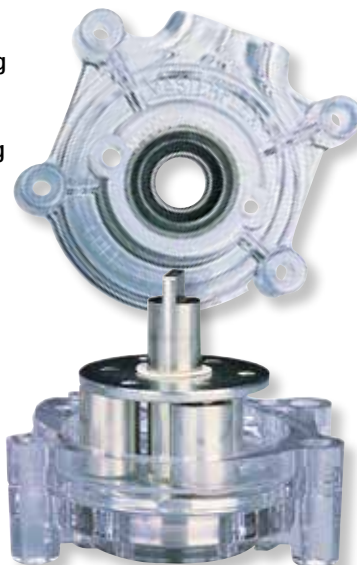
L/S® Pump Heads Selection Guide

Description	Flow rates (mL/min)	Multichannel or stackable	Special features	Page number
Standard				
	0.001 to 2900 mL/min	Yes, stack up to 4 heads	✓ Highest precision, yet economical ✓ Accurate, repeatable fluid transfer ✓ Each head dedicated to one tubing size	5
Easy-Load® II				
	0.001 to 2900 mL/min	Yes, stack up to 4 heads	✓ Easy tubing changes ✓ Automatic retention ✓ Adjustable occlusion	6
Easy-Load® 3				
	0.001 to 2900 mL/min	Yes, stack up to 4 heads	✓ Easy tubing changes ✓ Automatic retention ✓ Same side tubing entry/exit ✓ Install and stack without tools or hardware	7
Easy-Load®				
	0.001 to 2300 mL/min	Yes, stack up to 4 heads	✓ Load or change multiple tubing sizes quickly and easily ✓ Low maintenance ✓ Models available for ATEX Zone 2 applications	7
High-Performance				
	0.006 to 3400 mL/min	No	✓ Highest flow rate of any L/S pump head ✓ Up to 100 psi with L/S HP (High-Pressure) pump tubing ✓ ATEX Zone 2 applications model available	8
PTFE-Tubing				
	0.001 to 65 mL/min	No	✓ Uses rigid PTFE-tubing ✓ Pressures up to 150 psi ✓ Transfer aggressive solvents ✓ High purity	ColeParmer.com
Multichannel				
	0.00005 to 2300 mL/min (per channel)	Yes, stack up to 32 channels	✓ Synchronous flow from up to 32 channels without cartridges ✓ Two-stop tubing sets are easy to load with no adjustment needed	9
Multichannel Cartridge				
	0.00001 to 1700 mL/min (per channel)	Yes, 1 to 12 channels	✓ Synchronous flow rates ✓ Run up to 12 channels on a single pump head ✓ Easy tubing changes ✓ Holds tubing securely in place	ColeParmer.com
PTFE-Diaphragm				
	10.0 to 800 mL/min	No	✓ PTFE and borosilicate glass are the only wetted parts ✓ Up to 100 psi (6.9 bar) ✓ Accurate metering ✓ Handles aggressive fluids	ColeParmer.com

L/S® Standard Pump Heads

Ideal for accurate and repeatable fluid transfer applications

- Available with PC housing with CRS or SS rotor, or PPS housing with SS rotor
- PC housing allows you to see pump in operation; PPS housing and SS rotors have excellent chemical resistance



FEATURES

- ✓ Best overall pump head performance
- ✓ Designed and optimized for one tubing size
- ✓ Stack up to four heads

A. Standard Pump Heads for Precision Tubing

- Flow rates: 0.001 to 2300 mL/min
- Perfect for common fluid transfer applications
- Select a pump head for one of the following precision tubing sizes: L/S 13, L/S 14, L/S 16, L/S 17, L/S 18

B. Standard Pump Heads for High-Performance Precision Tubing

- Flow rates: 0.033 to 2900 mL/min
- Accepts our high-performance precision tubing—choose these pump heads for better pressure generation, suction lift, viscous fluid transfer, and longer tubing life
- Select a pump head for one of the following high-performance tubing sizes: L/S 15, L/S 24, L/S 35, L/S 36

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Pump tubing size	mL per rev	Flow rates in mL/min		Catalog number††		
		0.02 to 100 rpm	6 to 600 rpm	PC housing		PPS housing
				CRS rotor	SS rotor	SS rotor
A. Standard pump heads for precision pump tubing						
L/S 13	0.06	0.001 to 6	0.36 to 36	XF-07013-20	XF-07013-21	XF-07013-52
L/S 14	0.21	0.004 to 21	1.3 to 130	XF-07014-20	XF-07014-21	XF-07014-52
L/S 16	0.8	0.016 to 80	4.8 to 480	XF-07016-20	XF-07016-21	XF-07016-52
L/S 17	2.8	0.059 to 280	17 to 1700	XF-07017-20	XF-07017-21	XF-07017-52
L/S 18	3.8	0.077 to 380	23 to 2300	XF-07018-20	XF-07018-21	XF-07018-52
Price						
B. Standard pump heads for high-performance precision pump tubing						
L/S 15	1.7	0.033 to 170	10 to 1000	XF-07015-20	XF-07015-21	XF-07015-52
L/S 24	2.8	0.057 to 280	17 to 1700	XF-07024-20	XF-07024-21	XF-07024-52
L/S 35	3.8	0.077 to 380	23 to 2300	XF-07035-20	XF-07035-21	—
Price						
L/S 36	4.8	0.096 to 480	29 to 2900	XF-07036-30	XF-07036-31	—
Price						

†PC = polycarbonate PPS = polyphenylene sulfide
CRS = cold-rolled steel SS = stainless steel

††Maximum system pressure = L/S 13, L/S 14, L/S 15, L/S 16, L/S 24: 40 psi (2.7 bar); L/S 17, L/S 36: 20 psi (1.4 bar); L/S 18: 15 psi (1.0 bar); L/S 35: 35 psi (2.4 bar)

Mounting Hardware

Stack up to four L/S Standard pump heads on one drive (see drive specifications for recommended number of heads). Hardware is stainless steel.

Heads to be mounted	Catalog number	Price/st
Hardware for Standard Heads L/S 13 to 35		
One	XF-07013-04	
Two	XF-07013-05	
Three	XF-07013-08	
Four	XF-07013-09	
Hardware for Standard Heads L/S 36		
One	XF-07036-01	
Two	XF-07036-02	

L/S® Easy-Load® II Pump Heads

No more slipping of tubing—automatic retention holds it securely in place

- Reduced pulsation and improved pressure performance and mechanical stability with standard four-roller rotor
- Pump heads made of durable PPS housing
- Choice of rotors—economical CRS rotors or SS rotors for better chemical resistance and durability
- Don't let pressure get to you. Choose models with adjustable occlusion—tighten for higher pressure, loosen for longer tubing life

A. Pump Heads for Precision Pump Tubing (not shown)

- Wide flow range for wider range of applications from 0.06 to 2300 mL/min

B. Pump Heads for High-Performance Precision Pump Tubing

- Pump viscous liquids and get better pressure generation and suction lift

C. Two-Channel Pump Heads for Precision Pump Tubing

- No need to stack heads, get two channels in one head!

What's included: single-channel mounting hardware and a 15" (38-cm) length of silicone pump tubing. Pump head comes ready to mount to drive. Hardware for mounting two or more heads is available below.



C



B

FEATURES

- ✓ Load tubing easily
- ✓ Accepts several tubing sizes for a wide flow range
- ✓ Stack up to four heads

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Pump tubing size accepted	mL per rev	Flow rates in mL/min		Maximum system pressure† psi (bar)	Catalog number‡					
		1 to 100 rpm	6 to 600 rpm		Fixed occlusion				Adjustable occlusion	
					CRS rotor		SS rotor		SS rotor	
					Cat. no.	Price	Cat. no.	Price	Cat. no.	Price
A. Easy-Load II pump heads for precision pump tubing (not shown)										
L/S 13	0.06	0.06 to 6	0.36 to 36	40 (2.7)	XF-77200-50		XF-77200-60		XF-77201-60	
L/S 14	0.21	0.21 to 21	1.3 to 130	40 (2.7)						
L/S 16	0.8	0.8 to 80	4.8 to 480	40 (2.7)						
L/S 25	1.7	1.7 to 170	10 to 1000	35 (2.4)						
L/S 17	2.8	2.8 to 280	17 to 1700	20 (1.4)						
L/S 18	3.8	3.8 to 380	23 to 2300	15 (1.0)						
B. Easy-Load II pump heads for high-performance precision pump tubing										
L/S 15	1.7	1.7 to 170	10 to 1000	40 (2.7)	XF-77200-52		XF-77200-62		XF-77201-62	
L/S 24	2.8	2.8 to 280	17 to 1700	40 (2.7)						
L/S 35	3.8	3.8 to 380	23 to 2300	35 (2.4)						
L/S 36	4.8	4.8 to 480	29 to 2900	20 (1.4)						
C. Two-channel Easy-Load II pump heads for precision pump tubing										
L/S 13	0.06	0.06 to 6	0.36 to 36	40 (2.7)	XF-77202-50		XF-77202-60		—	—
L/S 14	0.21	0.21 to 21	1.3 to 130	40 (2.7)						
L/S 16	0.8	0.8 to 80	4.8 to 480	40 (2.7)						
L/S 25	1.7	1.7 to 170	10 to 1000	35 (2.4)						

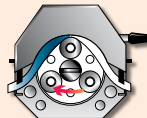
†Actual performance varies depending on pump tubing formulation—values shown are for firm pump tubing.

†CRS = cold-rolled steel SS = stainless steel

Teky's Tips

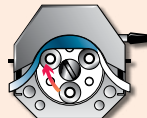
How Masterflex Pump Heads Work

1



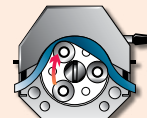
Tubing is placed in the tubing bed—between the rotor and housing—where it is occluded (squeezed).

2



The rollers on the rotor move across the tubing, pushing the fluid. The tubing behind the rollers recovers its shape, creates a vacuum, and draws fluid in behind it.

3



A "pillow" of fluid is formed between the rollers. This is specific to the ID of the tubing and the geometry of the rotor. Flow rate is determined by multiplying speed by the size of the pillow. This pillow stays fairly constant except with extremely viscous fluids.



Mounting Hardware for Easy-Load II Heads

Mount up to four L/S Easy-Load II pump heads on a single drive; see individual drive specifications for maximum number of heads to be mounted. Mounting hardware is stainless steel.

Heads to be mounted	Catalog number	Price/st
One	XF-77200-01	
Two	XF-77200-02	
Three	XF-77200-03	
Four	XF-77200-04	

L/S® Easy-Load® 3 Pump Heads

No tools or hardware needed

- Mount and stack heads in seconds with twist-lock mounting feature
- CRS rotor is more economical while SS offers greater durability and chemical resistance
- Mount up to four pump heads without tools or hardware when using mounting plate
- Included mounting plate adapts Easy-Load 3 pump heads to L/S drives

FEATURES

- ✓ Same side tubing entry/exit for space-limited applications
- ✓ Automatic tubing retention
- ✓ Stack up to four heads

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Pump tubing sizes accepted	mL per rev	Flow rates in mL/min		Maximum system pressure† psi (bar)	Catalog number‡	
		1 to 100 rpm	6 to 600 rpm		CRS rotor	SS rotor
Easy-Load 3 pump heads for precision pump tubing						
L/S 13	0.06	0.06 to 6	0.36 to 36	40 (2.7)	XF-77800-50	
L/S 14	0.22	0.22 to 22	1.3 to 130	40 (2.7)		
L/S 16	0.8	0.8 to 80	4.8 to 480	40 (2.7)		
L/S 25	1.7	1.7 to 170	10 to 1000	35 (2.4)		
L/S 17	2.8	2.8 to 280	17 to 1700	20 (1.4)		
L/S 18	3.8	3.8 to 380	23 to 2300	15 (1.0)		
Easy-Load 3 pump heads for high-performance precision pump tubing						
L/S 15	1.7	1.7 to 170	10 to 1000	30 (2.0)	XF-77800-52	
L/S 24	2.8	2.8 to 280	17 to 1700	30 (2.0)		
L/S 35	3.8	3.8 to 380	23 to 2300	25 (1.7)		
L/S 36	4.8	4.8 to 480	29 to 2900	20 (1.4)		
				Price		

†Actual performance varies depending on pump tubing formulation—values shown are for firm pump tubing.

‡CRS = cold-rolled steel SS = stainless steel

XF-77800-00 Replacement mounting kit, for mounting Easy-Load 3 pump head to Masterflex L/S pump drives. Includes mounting plate and four screws



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product specs
you need!

L/S® Easy-Load® Pump Heads

Save time with fast tubing changes and reduced maintenance

- No need to remove head to change tubing
- PPS housing offers improved chemical resistance; SS rotor offers increased durability and chemical resistance
- Get four separate pumping channels by mounting up to four heads on one drive
- ATEX Zone 2 approved models rated to EEx II 3 G c II C T6
- Ready to use—include single-channel mounting hardware and 15" (38 cm) of silicone tubing

FEATURES

- ✓ Fixed occlusion averaged for several tubing sizes
- ✓ Stack up to four heads
- ✓ ATEX Zone 2 rated models available

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ATEX
Zone 2



Pump tubing sizes accepted	mL per rev	Flow rates in mL/min		Maximum system pressure psi (bar)	Catalog number‡			
		1 to 100 rpm	6 to 600 rpm		White PPS housing		Black PPS housing	ATEX-approved PPS housing
					CRS rotor	SS rotor	SS rotor	SS rotor
Easy-Load pump heads for precision pump tubing								
L/S 13	0.06	0.06 to 6	0.36 to 36	40 (2.7)	XF-07516-00	XF-07516-10	XF-07518-60	XF-07516-40
L/S 14	0.21	0.21 to 21	1.3 to 130	40 (2.7)				
L/S 16	0.8	0.8 to 80	4.8 to 480	40 (2.7)				
L/S 25	1.7	1.7 to 170	10 to 1000	35 (2.4)				
L/S 17	2.8	2.8 to 280	17 to 1700	20 (1.4)				
L/S 18	3.8	3.8 to 380	23 to 2300	15 (1.0)				
Easy-Load pump heads for high-performance precision pump tubing								
L/S 15	1.7	1.7 to 170	10 to 1000	40 (2.7)	XF-07516-02	XF-07516-12	XF-07518-62	XF-07516-42
L/S 24	2.8	2.8 to 280	17 to 1700	40 (2.7)				
				Price				

†PSF = polysulfone PPS = polyphenylene sulfide CRS = cold-rolled steel SS = stainless steel



Mounting Hardware

for Easy-Load Heads

Stack up to four L/S Easy-Load pump heads on one drive. Order mounting hardware based on number of mounted pump heads. Hardware is stainless steel.

Heads to be mounted	Catalog number	Price/st
One	XF-07013-04	
Two	XF-07013-05	
Three	XF-07013-08	
Four	XF-07013-09	

L/S® High-Performance Pump Heads

Highest flow rate and pressure generation of any L/S pump head

- Offers better suction lift, viscous fluid transfer, and long tubing life—at pressures up to 150 psi (10.2 bar)
- Mount pump head upright or on its side—design allows tubing to enter/exit the same side of the pump head
- Rollers, bearings, rotor plates, and rotor shaft are made of stainless steel (SS); occlusion bed is made from polyphenylene sulfide (PPS) for excellent chemical resistance
- Compatible with all L/S drives listed in this catalog that accept two or more pump heads
- Accepts high-performance precision pump tubing sizes: L/S 15, L/S 24, L/S 35, L/S 36, and our high-pressure pump tubing: L/S 14HP, L/S 15HP, L/S 16HP and L/S 24HP
- Tubing enters/exits the same side of high-performance pump head 77250-62 for easy connection to tubing inlet and outlet
- ATEX Zone 2 approved model 77250-82; rated to EEx II 3 G c II C T6

What's included: mounting hardware and a 15" (38-cm) length of L/S 35 pump tubing.



FEATURES

- ✓ Load high-performance precision tubing easily
- ✓ Pressures up to 150 psi with L/S HP tubing
- ✓ Not stackable
- ✓ ATEX Zone 2 rated models available

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ATEX

Zone 2
77250-82



Pump tubing size	mL per rev	Flow rates in mL/min		Maximum system pressure psi (bar)	High-Performance pump head		ATEX-approved High-Performance pump head	
		0.02 to 100 rpm	6 to 600 rpm		Catalog number	Price	Catalog number	Price
L/S 14HP†	0.3	0.006 to 30	Not recommended	150 (10.2)	XF-77250-62		XF-77250-82	
L/S 16HP†	0.9	0.018 to 90	Not recommended	125 (8.5)				
L/S 15HP†	1.7	0.033 to 170	Not recommended	100 (6.8)				
L/S 24HP†	2.4	0.048 to 240	Not recommended	80 (5.5)				
L/S 15	1.8	0.036 to 180	11 to 1100	40 (2.7)				
L/S 24	3.0	0.060 to 300	18 to 1800	40 (2.7)				
L/S 35	4.3	0.086 to 430	26 to 2600	35 (2.4)				
L/S 36	5.8	0.116 to 580	34 to 3400	20 (1.4)				

†L/S 14HP, L/S 15HP, L/S 16HP and L/S 24HP pump tubing is for use only with the L/S High-Performance pump head mounted on any L/S 100 rpm drive capable of running two or more pump heads. **Note:** High-Performance pump heads are not stackable.

L/S High-Pressure Pump Tubing Ordering Information

Pump tubing formulation	L/S 14HP	L/S 16HP	L/S 15HP	L/S 24HP
PharMed® BPT	XF-95664-14 /25 ft (7.6 m)	XF-95664-16 /25 ft (7.6 m)	XF-95664-15 /25 ft (7.6 m)	XF-95664-24 /25 ft (7.6 m)
Norprene®	—	XF-06504-16 /25 ft (7.6 m)	XF-06504-15 /25 ft (7.6 m)	—



Teky's Tips

Loading the High-Performance Pump Head

Rotate tubing retainer knob counterclockwise to release retainer, then lift latch to open.



Insert tubing into occlusion bed so that the tubing ends extend out of the tubing entrance as shown.



Snap the latch closed. Pull the tubing snug around the rotor, close the cover, and rotate the tubing retainer knob clockwise to secure tubing.



Mounted upright

L/S® Multichannel Pump Heads

Get low-pulsation synchronous flow in multiple channels without cartridges

- Load the tubing, latch the occlusion bed, and run the pump—two-stop tubing gives you optimal tension with no adjustment
- Stackable two-, four-, or eight-channel heads for up to 24 channels
- Six roller heads deliver low-pulsation flow; three-roller heads offer higher flow rates
- Machined stainless steel (SS) and anodized aluminum with SS rotor, bearings, and rollers for reliable, continuous-duty operation
- Flow range: 0.045 to 2300 mL/min per channel depending on drive rpm and tubing size
- Heads for L/S precision pump tubing accept two-stop tubing set sizes L/S 13, L/S 14, and L/S 16; heads for L/S high-performance precision pump tubing accept two-stop tubing set sizes L/S 15, L/S 24, and L/S 35
- Compatible with L/S drives that accept two or more pump heads; 1/10 hp min



FEATURES

- ✓ Stackable for up to 24 synchronous flow channels
- ✓ Models for L/S two-stop tubing sets available
- ✓ Durable stainless steel and anodized aluminum construction



Stack heads for even more channels!

What's included: mounting hardware and hex key tool

ISO 9001:2008
CERTIFIED SUPPLIER



Number of channels	Number of rollers	Max channels with stacked heads†		Catalog number	Price
		100 rpm drive	600 rpm drive		
A. L/S Multichannel pump heads for precision pump tubing, sizes L/S 13, L/S 14, L/S 16					
4	6	24	12	XF-07535-04	
8				XF-07535-08	
B. L/S Multichannel pump heads for high-performance precision pump tubing, sizes L/S 15, L/S 24, L/S 35					
2	3	12	6	XF-07536-02	
4				XF-07536-04	

†Maximum channel capacity depends on drive torque capability and tubing formulation used.

L/S Two-Stop Precision Tubing Sets Ordering Information for 07535- and 07536-series pump heads

Pump tubing formulation	L/S Precision pump tubing			L/S High-performance precision pump tubing		
	L/S 13	L/S 14	L/S 16	L/S 15	L/S 24	L/S 35
Tygon® E-LFL	XF-06447-13 /pk of 8	XF-06447-14 /pk of 8	XF-06447-16 /pk of 8	XF-06447-15 /pk of 4	XF-06447-24 /pk of 4	XF-06447-35 /pk of 4
Silicone (platinum-cured)	XF-06421-13 /pk of 8	XF-06421-14 /pk of 8	XF-06421-16 /pk of 8	XF-06421-15 /pk of 4	XF-06421-24 /pk of 4	XF-06421-35 /pk of 4
BioPharm Plus Silicone (platinum-cured)	XF-96116-13 /pk of 8	XF-96116-14 /pk of 8	XF-96116-16 /pk of 8	XF-96116-15 /pk of 4	XF-96116-24 /pk of 4	XF-96116-35 /pk of 4
PharMed® BPT	XF-96114-13 /pk of 8	XF-96114-14 /pk of 8	XF-96114-16 /pk of 8	XF-96114-15 /pk of 4	XF-96114-24 /pk of 4	XF-96114-35 /pk of 4
Chem-Durance® Bio	XF-96117-13 /pk of 8	XF-96117-14 /pk of 8	XF-96117-16 /pk of 8	XF-96117-15 /pk of 4	XF-96117-24 /pk of 4	XF-96117-35 /pk of 4
Viton®	XF-96428-13 /pk of 8	XF-96428-14 /pk of 8	XF-96428-16 /pk of 8	XF-96428-15 /pk of 4	XF-96428-24 /pk of 4	XF-96428-35 /pk of 4

Flow Rates per Channel in mL/min with L/S Two-Stop Precision Pump Tubing Sets above

Drive rpm	Precision pump tubing			High-performance precision pump tubing		
	L/S 13	L/S 14	L/S 16	L/S 15	L/S 24	L/S 35
1 to 100	0.045 to 4.5	0.16 to 16	0.47 to 47	1.6 to 160	2.8 to 280	3.8 to 380
6 to 600	0.27 to 27	0.96 to 96	2.8 to 280	10 to 1000	17 to 1700	23 to 2300

L/S® Precision Pump Tubing

Ensure optimal performance from your Masterflex pump

- Custom extruded to fit Masterflex pumps
- Engineered for long life in peristaltic pump applications

– Custom extruded to fit Masterflex pumps			Tubing size		L/S 13	L/S 14	L/S 16	L/S 25	L/S 17	L/S 18
– Engineered for long life in peristaltic pump applications			Inner diameter		0.8 mm (0.03")	1.6 mm (0.06")	3.1 mm (0.12")	4.8 mm (0.19")	6.4 mm (0.25")	7.9 mm (0.31")
			Hose barb size		1.6 mm (1/16")	1.6 mm (1/16")	3.2 mm (1/8")	4.8 mm (3/16")	6.4 mm (1/4")	9.5 mm (3/8")
			Flow range (approximate)†		0.06 to 36 mL/min	0.21 to 130 mL/min	0.8 to 480 mL/min	1.7 to 1000 mL/min	2.8 to 1700 mL/min	3.8 to 2300 mL/min
Pump tubing formulation	Description	Compatible pump head								
Silicone (platinum-cured) 	– Complies with USP Class V, EP, FDA, REACH, RoHS, ADCF – Low protein binding, fungus resistant, phthalate and latex-free – Accommodates a wide temperature range	✓ Standard ✓ Easy-Load® ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96410-13	XF-96410-14	XF-96410-16	XF-96410-25	XF-96410-17	XF-96410-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Silicone (peroxide-cured) 	– Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADCF – Greater physical compression capability – Economical, longer tubing life	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96400-13	XF-96400-14	XF-96400-16	XF-96400-25	XF-96400-17	XF-96400-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Silicone (platinum-cured) 	– Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADCF – Low absorption; excellent biocompatibility – Very low extractable; weather, ozone, corona, radiation resistant	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96420-13	XF-96420-14	XF-96420-16	XF-96420-25	XF-96420-17	XF-96420-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Plus Silicone (platinum-cured) 	– Complies with USP Class VI, EP, FDA, REACH, RoHS, ADCF – Ultra-smooth—minimizes particle entrapment – Very low extractable—ideal for lab, biotech, and pharmaceutical applications	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96440-13	XF-96440-14	XF-96440-16	XF-96440-25	XF-96440-17	XF-96440-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Puri-Flex™ 	– Complies with USP Class VI, FDA, 3A, REACH, RoHS, ADCF – Heat sealable, weldable, and economical – Long pump life when compared to silicone or many other TPE tubings	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96419-13	XF-96419-14	XF-96419-16	XF-96419-25	XF-96419-17	XF-96419-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® 	– Complies with USP Class VI, EP, REACH, RoHS, ADCF – Heat sealable, weldable, economical – Better resistance to pH fluctuations	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06424-13	XF-06424-14	XF-06424-16	XF-06424-25	XF-06424-17	XF-06424-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® ULTRA 	– Complies with USP Class VI, EP, REACH, RoHS, ADCF – Longest life of any C-Flex formulation – Lowest spallation and reduced residue	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	—	XF-06434-14	XF-06434-16	XF-06434-25	XF-06434-17	XF-06434-18		
			—	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharMed® BPT 	– Complies with USP Class VI, EP, FDA, NSF, REACH, RoHS – >10,000 hours of tubing life; sealable, weldable – Ideal for tissue and cell culture work	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06508-13	XF-06508-14	XF-06508-16	XF-06508-25	XF-06508-17	XF-06508-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharmaPure® 	– Complies with USP Class VI, EP, FDA, REACH, RoHS – Nontoxic and nonhemolytic biocompatible – Long life even under pressure with VERY low spallation	✓ Easy-Load ✓ Easy-Load II	XF-06435-13	XF-06435-14	XF-06435-16	XF-06435-25	XF-06435-17	XF-06435-18		
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk

†Determined under the following conditions: Using a 1 to 600 rpm drive; 0 psi at inlet, 0.5 psi at outlet; water temperature at 22°C (72°F).

Benchtop Tubing Cutter

Steel blade makes right-angle cuts in several sizes of Masterflex tubing:

C/L® 2.06 mm, 2.79 mm OD
L/S® sizes 13, 14, 15, 16, 17, 18, 24, 25, 35, 36
I/P® sizes 26, 73

[XF-06438-10](#) Benchtop tubing cutter



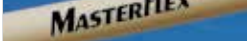
Tubing size	L/S 13	L/S 14	L/S 16	L/S 25	L/S 17	L/S 18
Inner diameter	0.8 mm (0.03")	1.6 mm (0.06")	3.1 mm (0.12")	4.8 mm (0.19")	6.4 mm (0.25")	7.9 mm (0.31")
Hose barb size	1.6 mm (1/16")	1.6 mm (1/16")	3.2 mm (1/8")	4.8 mm (3/16")	6.4 mm (1/4")	9.5 mm (3/8")
Flow range (approximate)†	0.06 to 36 mL/min	0.21 to 130 mL/min	0.8 to 480 mL/min	1.7 to 1000 mL/min	2.8 to 1700 mL/min	3.8 to 2300 mL/min

Pump tubing formulation	Description	Compatible pump head						
Chem-Durance® Bio 	- Complies: USP Class VI, FDA, REACH, RoHS - Excellent chemical compatibility and biocompatibility - Excellent pump life and durability under pressure	✓ Easy-Load ✓ Easy-Load II	XF-06442-13	XF-06442-14	XF-06442-16	XF-06442-25	XF-06442-17	XF-06442-18
Solve-Flex® 	- Complies with USP Class VI - Excellent chemical resistance, especially with solvents - Low spallation - Fluoropolymer lined tubing	✓ Easy-Load ✓ Easy-Load II	—	—	—	—	XF-96446-17 3.6 m (12 ft)/pk	—
Tygon® E-LFL 	- Complies with USP Class VI, EP, FDA, EU Food, REACH, RoHS, ADCF - Longest life of all Tygon formulations - Broad chemical resistance	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06440-13	XF-06440-14	XF-06440-16	XF-06440-25	XF-06440-17	XF-06440-18
Tygon E-Food (B-44-4X) 	- Complies with FDA, EU Food, NSF, 3A, REACH, RoHS, ADCF - Smooth inner surface unaffected by commercial sanitizers - Nontoxic; will not affect taste or odor	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06418-13	XF-06418-14	XF-06418-16	XF-06418-25	XF-06418-17	XF-06418-18
Tygon E-Lab (E-3603) 	- Complies with USP Class VI, FDA, EU Food, NSF, REACH, RoHS, ADCF - Ideal for general transfer applications - Nonaging, nonoxidizing, low gas permeability	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06509-13	XF-06509-14	XF-06509-16	XF-06509-25	XF-06509-17	XF-06509-18
Tygon Fuel & Lubricant (F-4040-A) 	- Complies with REACH, RoHS, ADCF - Specially formulated to transport hydrocarbons, petroleum products, and distillates - Low gas permeability	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06401-13	XF-06401-14	XF-06401-16	XF-06401-25	XF-06401-17	XF-06401-18
Tygon Chemical (2001) 	- Complies with FDA 21 CFR 175.300, REACH, RoHS, ADCF - Best chemical resistance of Tygon formulations - Plasticizer-free with low gas permeability	✓ Easy-Load ✓ Easy-Load II	XF-06475-13	XF-06475-14	XF-06475-16	XF-06475-25	XF-06475-17	XF-06475-18
Norprene® (A-60 G) 	- Complies with NSF, REACH, RoHS - Up to 10,000 hours of tubing life - Excellent choice for pressure/vacuum applications	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06404-13	XF-06404-14	XF-06404-16	XF-06404-25	XF-06404-17	XF-06404-18
Norprene Food (A 60 F) 	- Complies with FDA, 3A, NSF, REACH, RoHS - Ideal for high-temperature food applications - Resists heat, ozone, acids, and alkalis	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-06402-13	XF-06402-14	XF-06402-16	XF-06402-25	XF-06402-17	XF-06402-18
Viton® 	- Complies with FDA, ADCF - Perfect for applications where FDA and chemical compatibility is needed - Resists corrosives, solvents, and oils at elevated temperatures	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ Multichannel cartridge	XF-96412-13	XF-96412-14	XF-96412-16	XF-96412-25	XF-96412-17	XF-96412-18

L/S® High-Performance Precision Pump Tubing

Thicker wall compared to our Precision pump tubing

- Best choice for applications involving pressure, suction lift, viscous fluids, or long tubing life

- Best choice for applications involving pressure, suction lift, viscous fluids, or long tubing life		Tubing size	L/S 15	L/S 24	L/S 35	L/S 36
		Inner diameter	4.8 mm (0.19")	6.4 mm (0.25")	7.9 mm (0.31")	9.7 mm (0.38")
		Hose barb size	4.8 mm (3/16")	6.4 mm (1/4")	9.5 mm (3/8")	9.5 mm (3/8")
		Flow range (approximate)†	1.7 to 1000 mL/min (1.8 to 1100 mL/min)	2.8 to 1700 mL/min (3.0 to 1800 mL/min)	3.8 to 2300 mL/min (4.3 to 2600 mL/min)	4.8 to 2900 mL/min (5.8 to 3400 mL/min)
Pump tubing formulation	Description	Compatible pump head				
Silicone (platinum-cured) 	- Complies with USP Class V, EP, FDA, REACH, RoHS, ADFC - Low protein binding, fungus resistant, phthalate and latex-free - Accommodates a wide temperature range	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96410-15	XF-96410-24	XF-96410-35	XF-96410-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Silicone (peroxide-cured) 	- Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADFC - Greater physical compression capability - Economical, longer tubing life	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96400-15	XF-96400-24	XF-96400-35	XF-96400-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Silicone (platinum-cured) 	- Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADFC - Low absorption; excellent biocompatibility - Very low extractable; weather, ozone, corona, radiation resistant	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96420-15	XF-96420-24	XF-96420-35	XF-96420-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Plus Silicone (platinum-cured) 	- Complies with USP Class VI, EP, FDA, REACH, RoHS, ADFC - Ultra-smooth—minimizes particle entrapment - Very low extractable—ideal for lab, biotech, and pharmaceutical applications	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96440-15	XF-96440-24	XF-96440-35	XF-96440-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Puri-Flex™ 	- Complies with USP Class VI, FDA, 3A, REACH, RoHS, ADFC - Heat sealable, weldable, and economical - Long pump life when compared to silicone or many other TPE tubings	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96419-15	XF-96419-24	XF-96419-35	XF-96419-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® 	- Complies with USP Class VI, EP, REACH, RoHS, ADFC - Heat sealable, weldable, economical - Better resistance to pH fluctuations	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06424-15	XF-06424-24	XF-06424-35	XF-06424-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® ULTRA 	- Complies with USP Class VI, EP, REACH, RoHS, ADFC - Longest life of any C-Flex formulation - Lowest spallation and reduced residue	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06434-15	XF-06434-24	XF-06434-35	XF-06434-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharMed® BPT 	- Complies with USP Class VI, EP, FDA, NSF, REACH, RoHS >10,000 hours of tubing life; sealable, weldable - Ideal for tissue and cell culture work	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06508-15	XF-06508-24	XF-06508-35	XF-06508-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharmaPure® 	- Complies with USP Class VI, EP, FDA, REACH, RoHS - Nontoxic and nonhemolytic biocompatible - Long life even under pressure with VERY low spallation	✓ Easy-Load ✓ Easy-Load II	XF-06435-15	XF-06435-24	—	—
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	—	—

†Value in () obtained by High-Performance pump head. Flow range determined under the following conditions: Using a 1 to 600 rpm drive; 0 psi at inlet, 0.5 psi at outlet; water temperature at 22°C (72°F).

Tubing size	L/S 15	L/S 24	L/S 35	L/S 36
Inner diameter	4.8 mm (0.19")	6.4 mm (0.25")	7.9 mm (0.31")	9.7 mm (0.38")
Hose barb size	4.8 mm (3/16")	6.4 mm (1/4")	9.5 mm (3/8")	9.5 mm (3/8")
Flow range (approximate)†	1.7 to 1000 mL/min (1.8 to 1100 mL/min)	2.8 to 1700 mL/min (3.0 to 1800 mL/min)	3.8 to 2300 mL/min (4.3 to 2600 mL/min)	4.8 to 2900 mL/min (5.8 to 3400 mL/min)

Pump tubing formulation	Description	Compatible pump head				
Chem-Durance® Bio 	- Complies: USP Class VI, FDA, REACH, RoHS - Excellent chemical compatibility and biocompatibility - Excellent pump life and durability under pressure	✓ Easy-Load ✓ Easy-Load II	XF-06442-15	XF-06442-24	XF-06442-35	XF-06442-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Solve-Flex® 	- Complies with USP Class VI - Excellent chemical resistance, especially with solvents - Low spallation - Fluoropolymer lined tubing	✓ Easy-Load ✓ Easy-Load II	—	XF-96446-24	—	—
			—	3.6 m (12 ft)/pk	—	—
Tygon® E-LFL 	- Complies with USP Class VI, EP, FDA, REACH, RoHS, AECF - Longest life of all Tygon formulations - Broad chemical resistance	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06440-15	XF-06440-24	XF-06440-35	XF-06440-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Tygon E-Food (B-44-4X) 	- Complies with FDA, NSF, 3A, and EU Food regulations (10/2011) - Smooth inner surface unaffected by common commercial sanitizers - Nontoxic	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06418-15	XF-06418-24	XF-06418-35	XF-06418-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Tygon E-Lab (E-3603) 	- Complies with USP Class V, EP, FDA, REACH, RoHS, AECF - Ideal for general transfer applications - Clear for easy monitoring - Nontoxic, nonaging, nonoxidizing	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06509-15	XF-06509-24	XF-06509-35	XF-06509-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Tygon Fuel & Lubricant (F-4040-A) 	- Complies with USP Class V, EP, FDA, REACH, RoHS, AECF - Ideal for transferring hydrocarbons, gasoline, kerosene, and heating oil - Very low gas permeability	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06401-15	XF-06401-24	XF-06401-35	XF-06401-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Tygon Chemical (2001) 	- Complies with USP Class V, EP, FDA, REACH, RoHS, AECF - Best chemical resistance of Tygon formulations - Plasticizer-free with low gas permeability	✓ Easy-Load ✓ Easy-Load II	XF-06475-15	XF-06475-24	—	—
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	—	—
Norprene® (A-60 G) 	- Complies with NSF, REACH, RoHS - Up to 10,000 hours of tubing life - Excellent choice for pressure/vacuum applications	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06404-15	XF-06404-24	XF-06404-35	XF-06404-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Norprene Food (A 60 F) 	- Complies with FDA, 3A, NSF, REACH, RoHS - Ideal for high-temperature food applications - Resists heat, ozone, acids, and alkalis	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-06402-15	XF-06402-24	XF-06402-35	XF-06402-36
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk
Viton® 	- Complies with FDA, AECF - Perfect for applications where FDA and chemical compatibility is needed - Resists corrosives, solvents, and oils at elevated temperatures	✓ Standard ✓ Easy-Load ✓ Easy-Load II ✓ Easy-Load 3 ✓ High-Performance	XF-96412-15	XF-96412-24	XF-96412-35	XF-96412-36
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk

L/S® Drives Selection Guide

Description	Flow rates (mL/min)	Special features	Page number
Fixed-Speed			
	Lowest: 0.06 Highest: 290	✓ Consistent repeatable flow rates ✓ Economical and compact ✓ UL, cUL, and CE listed models	14
Variable-Speed Economy Console			
	Lowest: 0.06 Highest: 2900	✓ Economical variable flow ✓ Simple speed control ✓ UL, cUL, and CE listed models ✓ Accept stacked pump heads for multiple channels	ColeParmer.com
Precision Modular			
	Lowest: 0.06 Highest: 3400	✓ Separate motor and controller up to 15 ft (4.6 m) ✓ Models available with IP66-rated wall-mount controllers ✓ Pump heads can be stacked	15
Precision Variable-Speed Console			
	Lowest: 0.06 Highest: 3400	✓ Economical variable flow ✓ Simple speed control ✓ ETL and CE listed ✓ Accept stacked pump heads for multiple channels ✓ Drives are stackable	16
Variable-Speed Digital and Computer Compatible			
	Lowest: 0.001 Highest: 3400	✓ Four-line graphical LCD with menu-driven programming ✓ Maintenance-free brushless motor ✓ PWM speed control with 6000:1 turndown ✓ Tachometer feedback for ±0.1% speed control ✓ Calibration capability	17-18
Digital Process			
	Lowest: 0.006 Highest: 3400	✓ Four-line graphical LCD with menu-driven programming ✓ Sealed housing; IP66 and NEMA 4X rated for washdown ✓ Maintenance-free brushless motor; PWM speed control ✓ Dispensing features include delay interval and cumulative volume ✓ Remote control capability	19
Digital Modular Dispensers			
	Lowest: 0.001 Highest: 3400	✓ Maintenance-free brushless motor ✓ Precise repetitive dispensing with antidrip ✓ Precise PWM speed control ✓ Quiet operation ✓ Tachometer feedback for ±0.1% speed control ✓ Available with washdown wall-mount controller ✓ Calibration capability	20

L/S® Fixed-Speed Drives

Get consistent, repeatable flow rates

- Stackable drives are ideal for field or lab use
- Lighted power switch on front of drive lets you know that pump is running
- Accept five different pump head types: Standard, Easy-Load®, Easy-Load II, Easy-Load 3, and Cartridge



Drive 07540-01 shown with Easy-Load II pump head 77200-62

What's included: 6-ft (1.8-m) line cord. 115 VAC models: US standard plug; 230 VAC models: European plug.

FEATURES

- ✓ Flow rates: 0.06 to 290 mL/min
- ✓ General, intermittent-duty fluid transfer applications

Flow Rates in mL/min^{††}

rpm	Precision pump tubing					
	L/S 13	L/S 14	L/S 16	L/S 25	L/S 17	L/S 18
	Standard [†] , Easy-Load, Easy-Load II, Easy-Load 3					
	Cartridge [‡]					
1	0.06	0.21	0.8	1.7	2.8	3.8
2	0.12	0.42	1.6	3.4	5.6	7.6
6	0.36	1.3	4.8	10	17	23
12	0.72	2.5	9.6	20	34	46
20	1.2	4.2	16	34	56	76
30	1.8	6.3	24	50	84	110
60	3.6	13	48	100	170	230

rpm	High-performance precision pump tubing			
	L/S 15	L/S 24	L/S 35	L/S 36
	Standard, Easy-Load II, Easy-Load 3			
	Easy-Load			
1	1.7	2.8	3.8	4.8
2	3.4	5.6	7.6	9.6
6	10	17	23	29
12	20	34	46	58
20	34	56	76	96
30	50	84	110	140
60	100	170	230	290

[†]Standard pump head is not available for L/S 25.

[‡]Cartridge heads are available for microbore tubing.

^{††}Motor rpm and flow rates for the 230 VAC, 50 Hz economy drives are approximately % of values shown.



rpm	Speed control	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Catalog number	Price
115 VAC/60 Hz models							
1	None††	2	Sub-fractional (<1⁄25 hp)†††	IP22	6" x 5 1⁄4" x 4 3⁄8" (15.2 x 13.4 x 11.9 cm)	XF-07540-01	
2						XF-07540-02	
6						XF-07540-06	
12						XF-07540-12	
20	None††	2				XF-07540-20	
30						XF-07540-30	
60						XF-07540-60	
230 VAC/50 Hz models							
1	None††	2	Sub-fractional (<1⁄25 hp)†††	IP22	6" x 5 1⁄4" x 4 3⁄8" (15.2 x 13.4 x 11.9 cm)	XF-07542-01	
2						XF-07542-02	
5						XF-07542-06	
10						XF-07542-12	
17	None††	2				XF-07542-20	
25						XF-07542-30	
50						XF-07542-60	

^{††}Drive speed may vary ±15%, subject to fluctuations in line voltage and frequency.

^{†††}Maximum power required is 70 W or less.

L/S® Precision Variable-Speed Modular Drives

Place where convenient—ideal for limited spaces, hoods, or isolation chambers

- Three-digit LED display shows motor rpm—confirm speed setting at a glance
- Remote control capabilities: speed, direction, and start/stop
- $\pm 0.25\%$ speed control for precise flow regulation—ideal for metering applications

A. Modular Drives with Benchtop Controller

- Splash-resistant ABS plastic controller housing is IP33 rated; drive housing is epoxy finished steel, IP33 rated
- Remote control capabilities via a DB9 female connector on back of controller

B. Washdown Modular Drives with Wall-Mount Controller

- Wall-mount controller housing is powder-coated aluminum, IP66 / NEMA 4X rated for washdown; powder-coated steel drive housing is IP66 / NEMA 4X rated for washdown
- Remote control capabilities via weather-resistant connection on controller



A

FEATURES

- ✓ Flow rates: 0.06 to 3400 mL/min
- ✓ Easy up-front control of speed, direction, and start/stop
- ✓ Reversible motor—purge tubing before or after pumping; pump fluid in either direction



B

Models 07557-60 and -70 include wall-mount controller



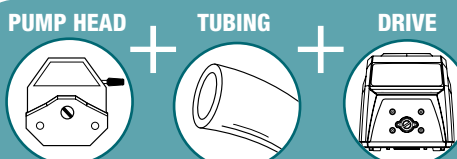
rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
A. Precision modular drives with benchtop controller									
6 to 600	±0.25% (1 rpm at 600 rpm;	2	1/10 hp (75 W)	IP33	Controller: 10½" x 8¼" x 5" Drive: 10¾" x 4⅝" x 4½"	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07557-00	
1 to 100	0.1 rpm at 100 rpm)	4						XF-07557-10	
B. Precision washdown modular drives with washdown wall-mount controller									
6 to 600	±0.25% (1 rpm at 600 rpm;	2	1/10 hp (75 W)	IP66	Controller: 9" x 11¼" x 4½" Drive: 15⅝" x 7" x 6"	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07557-60	
1 to 100	0.1 rpm at 100 rpm)	4						XF-07557-70	

[XF-07557-51](#) Extension cable, 9 ft (2.7 m); extend distance between motor and controller

[XF-07595-47](#) Cable assembly, for benchtop modular drives; DB9 male connector and 25 ft (7.9 m) cable with stripped wire terminal ends. Use for remote control

[XF-77300-32](#) Cable assembly, for washdown modular drives; 18-pin round connector and 25 ft (7.9 m) cable with stripped wire terminal ends. Use for remote control

[XF-17050-01](#) NIST-traceable calibration with data for peristaltic pump drive



Choose a Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	4.8 to 480 mL/min	Easy-Load® 3 77800-60	C-Flex® ULTRA L/S 16 tubing 06434-16 10 ft (3 m)	Modular drive 07557-00 6 to 600 rpm	90 to 260, 50/60	XF-77913-60	
	17 to 1700 mL/min	Easy-Load II 77200-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Modular drive 07557-00 6 to 600 rpm	90 to 260, 50/60	XF-77913-70	
	17 to 1700 mL/min	Easy-Load II 77200-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Modular drive 07557-60 6 to 600 rpm	90 to 260, 50/60	XF-77913-80	

L/S® Precision Variable-Speed Console Drives

Don't lose control of your metering applications—digital display gives you precise control

- Accurate and repeatable settings with 3-digit LED display of rpm
- Pump fluid in either direction with reversible motor—perfect for purging tubing
- Save space and increase productivity by stacking 2 or 4 pump heads on the same drive to create a multichannel pump system
- Maximize processes in a minimal footprint by stacking splash-resistant, IP33-rated drives
- Two ways to control speed, direction, and start/stop—use either the membrane keypad or remote control capabilities
- Customize for your application—drives accept nine pump head types: Standard, Easy-Load®, Easy-Load® II, Easy-Load® 3, Multichannel, High-Performance, Cartridge, PTFE-Tubing, and PTFE-Diaphragm

FEATURES

- ✓ Flow rates: 0.06 to 3400 mL/min
- ✓ Variable speed from 1 to 600 rpm
- ✓ Reversible motor accepts up to four pump heads



Stack up to 4 heads to maximize productivity in less space

Flow Rates in mL/min (flow rates in parentheses can only be obtained with the High-Performance pump head—at ColeParmer.com)

rpm	Precision pump tubing						High-performance precision pump tubing			
	L/S 13	L/S 14	L/S 16	L/S 25	L/S 17	L/S 18	L/S 15	L/S 24	L/S 35	L/S 36
	Standard†, Easy-Load, Easy-Load II, Easy-Load 3						Multichannel†, Standard†, Easy-Load II, Easy-Load 3, High-Performance			
	Cartridge, Multichannel			Cartridge			Easy-Load			
6 to 600	0.36 to 36	1.3 to 130	4.8 to 480	10 to 1000	17 to 1700	23 to 2300	10 to 1000 (11 to 1100)	17 to 1700 (18 to 1800)	23 to 2300 (26 to 2600)	29 to 2900 (34 to 3400)
1 to 100	0.06 to 6	0.21 to 21	0.8 to 80	1.7 to 170	2.8 to 280	3.8 to 380	1.7 to 170 (1.8 to 180)	2.8 to 280 (3.0 to 300)	3.8 to 380 (4.3 to 430)	4.8 to 480 (5.8 to 580)

†The Standard pump head is not available for L/S 25. ‡Multichannel head is not available for L/S 36. Multichannel and Cartridge heads are available for microbore tubing.

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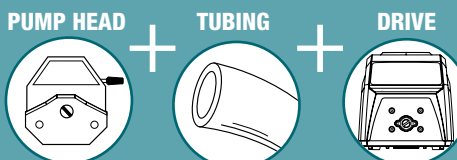
rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H) (25.4 x 21.6 x 21.6 cm)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
6 to 600	±0.25% (1 rpm at 600 rpm; 0.1 rpm at 100 rpm)	2	1/10 hp (75 W)	IP33		90 to 260	1.8 at 115 VAC, 1.2 at 230 VAC	XF-07528-10	
3 to 300		2						XF-07528-20	
1 to 100		4						XF-07528-30	

Accessories

[XF-07595-45](#) Connector, DB9 male. Use for 4 to 20 mA remote control
[XF-07595-47](#) Cable assembly, DB9 male connector and 25-ft (7.9-m) cable with stripped wire terminal ends. Use for remote control
[XF-77595-35](#) Foot switch, DB9 male

[XF-07528-80](#) Handheld remote controller; for remote control of start/stop, route tubing through handle for dispensing into containers
[XF-17050-01](#) NIST-traceable calibration with data for peristaltic pump drive

Choose a Complete System
One catalog number includes all 3!



System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	4.8 to 480 mL/min	Easy-Load® 3 77800-60	C-Flex® ULTRA L/S 16 tubing 06434-16 10 ft (3 m)	Precision console drive 07528-10 6 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77916-10	
	17 to 1700 mL/min	Easy-Load II 77200-62	C-Flex® ULTRA L/S 24 tubing 06434-24 10 ft (3 m)			XF-77916-20	

L/S® Variable-Speed Digital Drives

Versatile, worry-free operation

- Brushless, maintenance-free motor provides $\pm 0.1\%$ speed control accuracy with 6000:1 turndown ratio
- Bright graphical LCD offers easy programming, four operating modes, and seven languages
- Get more accurate dispensing with preprogrammed calibration
- Change based on your needs—drives accept all L/S pump heads for more pumping versatility
- Choose how you want to dispense: volume, copy cycles, or time
- Operate remotely via DB25 female connector

FEATURES

- ✓ Flow rates: 0.001 to 3400 mL/min
- ✓ Variable speed from 0.02 to 600 rpm
- ✓ Programmable, reversible motor accepts up to four pump heads
- ✓ Ensure dispensing accuracy with antidrip function
- ✓ Hands-free dispensing via time interval dispense cycles

Four operating modes for more functionality: continuous run, time dispense, copy dispense, and volume dispense



Flow Rates in mL/min (flow rates in parentheses can only be obtained with the High-Performance pump head—at ColeParmer.com)

rpm	Precision pump tubing						High-performance precision pump tubing			
	L/S 13	L/S 14	L/S 16	L/S 25	L/S 17	L/S 18	L/S 15	L/S 24	L/S 35	L/S 36
	Standard†, Easy-Load, Easy-Load II, Easy-Load 3						Multichannel‡, Standard, Easy-Load II, Easy-Load 3, High-Performance			
	Cartridge, Multichannel		Cartridge				Easy-Load			
0.1 to 600	0.006 to 36	0.021 to 130	0.08 to 480	0.17 to 1000	0.28 to 1700	0.38 to 2300	0.17 to 1000 (0.18 to 1100)	0.28 to 1700 (0.30 to 1800)	0.38 to 2300 (0.43 to 2600)	0.48 to 2900 (0.57 to 3400)
0.02 to 100	0.001 to 6	0.004 to 21	0.016 to 80	0.033 to 170	0.057 to 280	0.077 to 380	0.033 to 170 (0.036 to 183)	0.057 to 280 (0.057 to 300)	0.077 to 380 (0.086 to 433)	0.096 to 480 (0.113 to 566)

†The Standard pump head is not available for L/S® 25.

‡Multichannel head is not available for L/S 36. Multichannel and Cartridge heads are available for microbore tubing.

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rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
0.1 to 600	$\pm 0.1\%$ (0.1 rpm at 600 rpm; 0.01 rpm at 100 rpm)	2	1/10 hp (75 W)	IP33	10" x 8.5" x 8.5" (25.4 x 21.6 x 21.6 cm)	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07522-20	
0.02 to 100		4						XF-07522-30	

Accessories

[XF-07523-92](#) Foot switch, momentary start/stop; 6-ft (1.8-m) cable

[XF-07523-94](#) DB25 male connector. Use to create your own cable

[XF-07523-95](#) Cable assembly, DB25 male connector and 25 ft (7.9 m) cable with stripped wire ends for remote control

[XF-07523-97](#) Handheld remote controller; route tubing through handle for dispensing into containers

[XF-17050-01](#) NIST-traceable calibration with data for peristaltic pump drive

PUMP HEAD



TUBING



DRIVE



Choose a
Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.08 to 480 mL/min	Easy-Load® 3 77800-60	C-Flex® ULTRA L/S 16 tubing 06434-16 10 ft (3 m)	Digital drive 07522-20 0.1 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77921-65	
	0.28 to 1700 mL/min	Easy-Load II 77200-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)			XF-77921-75	

L/S® Computer-Compatible Digital Drives

Automate your process by interfacing drives with a computer

- Flow rate: 0.001 to 3400 mL/min with L/S tubing
- Interface drive to your PC via DB9 serial or USB connector
- Graphical LCD shows four operating modes: continuous run, time dispense, copy dispense, and volume dispense. View pump performance continually
- Antidrip function ensures dispensing accuracy
- Remote control capabilities via DB25 female connector on drive
- Menu driven interface—select one of seven languages for programming and operation

Drives offer analog remote control options and simple programming—ideal for automated process applications. Precise PWM speed control ($\pm 0.1\%$) maximizes accuracy and efficiency while the brushless motor gives you quiet, maintenance-free reliability.

What's included: 6-ft (1.8-m) line cord with IEC 320/EE22 socket. Shipped with country-specific plug/cord set; please specify ultimate destination when ordering.

FEATURES

- ✓ Flow rates: 0.001 to 3400 mL/min
- ✓ Variable speed from 0.02 to 600 rpm
- ✓ Programmable, reversible motor accepts up to four pump heads
- ✓ Remote functionality



Drive 07551-20 shown with L/S High-Performance pump head 77250-62

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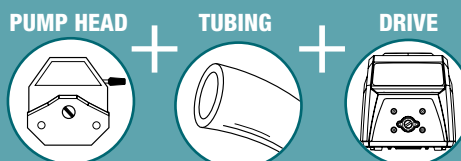


rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H) (25.4 x 21.6 x 21.6 cm)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
0.1 to 600	$\pm 0.1\%$ (0.1 rpm at 600 rpm; 0.01 rpm at 100 rpm)	2	$\frac{1}{4}$ hp (75 W)	IP33		90 to 260 VAC	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07551-20	
0.02 to 100		4						XF-07551-30	

[XF-07523-92](#) Foot switch, momentary start/stop; 6-ft (1.8-m) cable
[XF-07523-94](#) DB25 male connector. Use to create your own cable
[XF-07523-95](#) Cable assembly, DB25 male connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

[XF-07523-98](#) Tilt bail, use to securely elevate front of drive
[XF-07523-97](#) Handheld remote controller, DB9; for on/off control; route tubing through handle for filling and dispensing applications
[XF-17050-01](#) NIST-traceable calibration with data for peristaltic pump drive

Choose a Complete System
One catalog number includes all 3!



System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.08 to 480 mL/min	Easy-Load® 3 77800-60	C-Flex® ULTRA L/S 16 tubing 06434-16 10 ft (3 m)	Computer-compatible drive 07551-20 0.1 to 600 rpm	115/230 VAC, 50/60 Hz	XF-77924-55	
	0.28 to 1700 mL/min	Easy-Load II 77200-62	C-Flex® ULTRA L/S 24 tubing 06434-24 10 ft (3 m)			XF-77924-65	

L/S® Digital Console Process Drives

Transfer, dispense, and meter in lab, process and washdown environments

- IP66 and NEMA 4X rated. Sealed housing and sealed keypad are protected from dust, water, and chemicals in the wash-down environment—simply hose down to clean.
- Available with either a 316 SS or a powder-coat steel housing
- Flow rate: 0.006 to 3400 mL/min with L/S tubing
- Graphical LCD shows six different parameters: motor rpm, flow rate, dispense volume, cumulative volume, dispense interval time, and copy number.
- Brushless, maintenance-free motor with $\pm 0.1\%$ speed control accuracy and a 6000 to 1 turndown ratio
- Dispense by: volume—in milliliters (0.001 to 99,999), liters, and gallons; copy—1 to 99,999 dispense cycles. Set time interval of on/off cycles; 1 sec to 99 hr, 59 min, 59 sec.
- Remote control capabilities via 31-pin circular waterproof connection

FEATURES

- ✓ Flow rates: 0.006 to 3400 mL/min
- ✓ Variable speed from 0.1 to 600 rpm
- ✓ IP66 and NEMA 4X rated
- ✓ Programmable, reversible motor accepts up to two pump heads and offers remote functionality



Drive 07575-30 shown with L/S High-Performance pump head 77250-62

What's included: 6-ft (1.8-m) line cord—features IEC 320/CEE 22 connector coupler; watertight cord connection. Please specify destination country when ordering; drive is shipped with country-specific plug/cord set.

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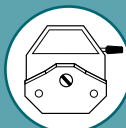
rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
Digital process drive with 316 stainless steel housing									
0.1 to 600	±0.1%	2	1/10 hp (75 W)	IP66	12" x 9" x 9 5/16" (30.5 x 22.9 x 23.6 cm)	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07575-30	
Digital process drive with powder-coat steel housing									
0.1 to 600	±0.1%	2	1/10 hp (75 W)	IP66	12" x 9" x 9 5/16" (30.5 x 22.9 x 23.6 cm)	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-07575-40	

[XF-07575-84](#) Washdown foot switch, momentary start/stop; 6-ft (1.8-m) cable

[XF-17050-01](#) NIST-traceable calibration with data for peristaltic pump drive

[XF-07575-80](#) Cable assembly, 31-pin round connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

PUMP HEAD



TUBING



DRIVE



Choose a Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.28 to 1700 mL/min	Easy-Load® II 77200-62	C-Flex® ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Digital console process drive with 316 SS housing 07575-30 0.1 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77975-25	
	0.28 to 1800 mL/min	High-Performance 77250-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)			XF-77975-35	
	0.28 to 1700 mL/min	Easy-Load II 77200-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Digital console process drive with powder-coat steel housing 07575-40 0.1 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77975-45	

L/S® Digital Modular Dispensing Drives

Three dispensing modes and precision low-maintenance motor

- Graphical LCD shows four operating modes: continuous run, timed dispense, copy dispense, volume dispense
- Dispense by mL—volume in mL of each dispense, 0.001 to 9999 mL; Copy—1 to 9,999 dispense cycles; or SEC—time interval between each dispense cycle (1 to 9,999 secs)
- Antidrip function ensures dispense accuracy
- Brushless, maintenance-free motor offers $\pm 0.1\%$ speed control accuracy and a 6000 to 1 turndown ratio
- Remote control capabilities: speed, direction, start/stop/prime, and tach output

What's included: 6-ft (1.8-m) cable to connect drive and controller and 6-ft (1.8-m) line cord with IEC 320/CEE22 socket. Shipped with country-specific plug/cord set; please specify destination when ordering.

A. Modular Drive with Benchtop Controller

- Stackable, splash-resistant ABS plastic controller housing is IP33 rated; drive housing is epoxy finished steel, IP33 rated
- Remote control via a DB25 female connector on back of controller

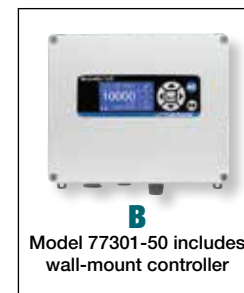
B. Washdown Modular Drive with Wall-Mount Controller

- Wall-mount controller housing is powder-coated aluminum, IP66 / NEMA4X rated for washdown; powder-coated steel drive housing is IP66 / NEMA4X rated for washdown
- Remote control via weather-resistant connection on controller



FEATURES

- ✓ Flow rates: 0.006 to 3400 mL/min
- ✓ Variable speed from 0.1 to 600 rpm
- ✓ Programmable, reversible motor accepts up to two pump heads and offers remote functionality



B
Model 77301-50 includes wall-mount controller



rpm	Speed control	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
A. Digital modular drive with benchtop controller									
0.1 to 600	±0.1% (0.1 rpm at 600 rpm; 0.01 rpm at 100 rpm)	2	1/10 hp (75 W)	IP33	Controller: 10½" x 8¼" x 5" (26.7 x 21 x 12.7 cm) Drive: 10½" x 3⅜" x 4⅝" (26.7 x 9.7 x 11.7 cm)	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-77301-40	
B. Digital washdown modular drive with washdown, wall-mount controller									
0.1 to 600	±0.1% (0.1 rpm at 600 rpm; 0.01 rpm at 100 rpm)	2	1/10 hp (75 W)	IP66	Controller: 9" x 11¾" x 4½" (23 x 30 x 11.4 cm) Drive: 15⅝" x 7" x 6" (39.5 x 17.8 x 15.2 cm)	90 to 260	2.2 at 115 VAC, 1.1 at 230 VAC	XF-77301-50	

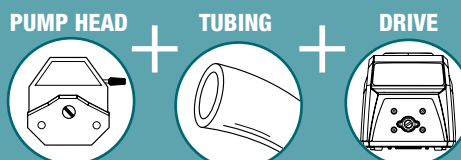
[XF-07523-95](#) Cable assembly, for benchtop modular drive 77301-40; DB25 male connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

[XF-77301-82](#) Extension cable, 9 ft (2.7 m) extends distance between motor and controller

[XF-07575-80](#) Remote control cable for washdown modular drive 77301-50; wire to controller/PLC; 25-ft (8.3-m) length

[XF-17050-01](#) NIST-traceable calibration for peristaltic pump drive

Choose a Complete System
One catalog number includes all 3!



System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.28 to 1700 mL/min	Easy-Load® II 77200-62	C-Flex® ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Digital modular drive 77301-40 0.1 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77923-80	
	0.28 to 1700 mL/min	Easy-Load II 77200-62	C-Flex ULTRA L/S 24 tubing 06434-24 10 ft (3 m)	Digital modular drive 77301-50 0.1 to 600 rpm	90 to 260 VAC, 50/60 Hz	XF-77923-90	

I/P® Easy-Load® Pump Heads

Minimize downtime with faster tubing changes

- Optimize pressure capabilities and tubing life with adjustable occlusion
- Less maintenance and quieter operation with included tang boot
- No more loose pump heads—five-screw mounting for more secure attachment
- Adjust flow rate to your needs—can pump from 0.6 to 13 LPM
- PSF housing with CRS or SS rotor, or PPS housing with SS rotor available. PPS has better chemical resistance than PSF. CRS rotors have sealed bearings; SS rotors have PTFE-sealed bearings



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ATEX
Zone 2
77601-80



Pump tubing sizes accepted	mL per rev	Flow rates (LPM) at indicated rpm			Maximum system psi (bar)	Catalog number†			
		100	540	20 to 650		PSF housing, CRS rotor	PSF housing, SS rotor	PPS housing, SS rotor	ATEX-approved; PSF housing, SS rotor
I/P 26	6.15	0.6	3.2	0.12 to 4	40 (2.7)	XF-77601-00	XF-77601-10	XF-77601-60	XF-77601-80
I/P 73	12.3	1.2	6.8	0.2 to 8					
I/P 82	20.0	2.0	11.0	0.4 to 13	20 (1.4)				
Price									

†PSF = polysulfone PPS = polyphenylene sulfide CRS = cold-rolled steel SS = stainless steel

[XF-77601-96](#) Dual-channel mounting hardware for two pump heads, stainless steel

FEATURES

- ✓ Load tubing without removing pump head from drive
- ✓ Automatic tubing retention
- ✓ Stack up to two pump heads
- ✓ ATEX Zone 2 rated model available

I/P® High-Performance Pump Heads

Get higher flow rates and pressure ratings

- Easily transfer viscous fluids
- Pump up to 19 LPM for higher volume processing
- Durable design for longer life—made of stainless steel rollers, bearings, rotor plates, and rotor shaft. Occlusion bed is made of thermoset polyester
- Compatible with I/P drives that accept two or more pump heads; pump head is not stackable



ISO9001:2008
CERTIFIED SUPPLIER

ATEX
Zone 2
77600-82



Pump tubing sizes accepted	mL per rev	Flow rates (LPM) at 20 to 650 rpm	Maximum system psi (bar)	Catalog number†	
				Polyester and SS housing, SS rotor	ATEX-approved; polyester and SS housing, SS rotor
I/P 70	12.3	0.26 to 8	40 (2.7)		
I/P 88	26.2	0.4 to 17	35 (2.4)	XF-77600-62	XF-77600-82
I/P 89	29.2	0.52 to 19	20 (1.4)		
Price					

†SS = stainless steel

FEATURES

- ✓ Easy to load tubing
- ✓ Adjustable tubing retention
- ✓ "C"-shaped design—tubing enters/exits the same side
- ✓ ATEX Zone 2 rated model available

Wait!

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ColeParmer.com

Browse **100,000+** products plus find
Technical Resources to help you choose

I/P® Precision Pump Tubing

Engineered for long life in peristaltic pumps

- Ensure optimal Masterflex® pump performance
- Custom extruded to fit Masterflex pumps
- Lot-to-lot consistency for superior accuracy and repeatability

		Tubing size	I/P 26	I/P 73	I/P 82
		Inner diameter	6.4 mm (0.25")	9.5 mm (0.37")	12.7 mm (0.5")
		Hose barb size	6.4 mm (¼")	9.5 mm (⅜")	12.7 mm (½")
		Flow range (approximate)†	0.01 to 4 LPM 0.002 to 1.1 GPM	0.01 to 8 LPM 0.002 to 2.1 GPM	0.02 to 13 LPM 0.005 to 3.5 GPM
Pump tubing formulation	Description	Compatible pump head			
Silicone (platinum-cured) 	– Complies with USP Class V, EP, FDA, REACH, RoHS, ADF – Fungus-resistant; phthalate- and latex-free – Accommodates a wide temperature range	✓ Standard ✓ Easy-Load®	XF-96410-26	XF-96410-73	XF-96410-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Silicone (peroxide-cured) 	– Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADF – Greater physical compression capability – Economical, longer tubing life	✓ Standard ✓ Easy-Load	XF-96400-26	XF-96400-73	XF-96400-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Silicone (platinum-cured) 	– Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADF – Lower absorption; excellent biocompatibility – Very low extractable and weather, ozone, corona, radiation resistant	✓ Standard ✓ Easy-Load	XF-96420-26	XF-96420-73	XF-96420-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
BioPharm Plus Silicone (platinum-cured) 	– Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADF – Ultra-smooth—minimizes particle entrapment – Very low extractable—ideal for lab, biotech pharma applications	✓ Standard ✓ Easy-Load	XF-96440-26	XF-96440-73	XF-96440-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Puri-Flex™ 	– Complies with USP Class VI, EP, REACH, RoHS, ADF – Heat sealable, weldable, and economical – Long pump life when compared to silicone or many other TPE tubings	✓ Standard ✓ Easy-Load	XF-96419-26	XF-96419-73	XF-96419-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® 	– Complies with USP Class VI, EP, REACH, RoHS, ADF – Heat sealable, weldable, economical – Better resistance to pH fluctuations	✓ Standard ✓ Easy-Load	XF-06424-26	XF-06424-73	XF-06424-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
C-Flex® ULTRA 	– Complies with USP Class VI, EP, REACH, RoHS, ADF – Longest life of any C-Flex formulation – Lowest spallation and reduced residue	✓ Standard ✓ Easy-Load	XF-06434-26	XF-06434-73	XF-06434-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharMed® BPT 	– Complies: USP Class VI, EP, FDA, NSF, REACH, RoHS – Over 10,000 hours of tubing life, sealable, weldable – Ideal for tissue and cell culture work	✓ Standard ✓ Easy-Load	XF-06508-26	XF-06508-73	XF-06508-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
PharmaPure® 	– Complies with USP Class VI, EP, FDA, REACH, RoHS – Nontoxic and nonhemolytic biocompatible – Long life even under pressure with VERY low spallation		XF-06435-26	XF-06435-73	XF-06435-82
			7.6 m (25 ft)/pk	7.6 m (25 ft)/pk	7.6 m (25 ft)/pk
Chem-Durance® Bio 	– Complies: USP Class VI, FDA, REACH, RoHS – Excellent chemical compatibility and biocompatibility – Excellent pump life, durable under pressure	✓ Easy-Load	XF-06442-26	XF-06442-73	XF-06442-82
			15.2 m (50 ft)/pk	15.2 m (50 ft)/pk	15.2 m (50 ft)/pk

Benchtop Tubing Cutter

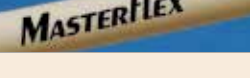
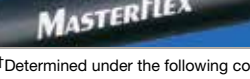
Steel blade makes right-angle cuts in several sizes of Masterflex tubing:

C/L® 2.06 mm, 2.79 mm OD
L/S® sizes 13, 14, 15, 16, 17, 18, 24, 25, 35, 36
I/P® sizes 26, 73

[XF-06438-10](#) Benchtop tubing cutter



Tubing size	I/P 26	I/P 73	I/P 82
Inner diameter	6.4 mm (0.25")	9.5 mm (0.37")	12.7 mm (0.5")
Hose barb size	6.4 mm (¼")	9.5 mm (⅜")	12.7 mm (½")
Flow range (approximate)†	0.01 to 4 LPM 0.002 to 1.1 GPM	0.01 to 8 LPM 0.002 to 2.1 GPM	0.02 to 13 LPM 0.005 to 3.5 GPM

Pump tubing formulation	Description	Compatible pump head			
Tygon® E-LFL 	- Complies with USP Class VI, EP, FDA, EU Food, REACH, RoHS, ALCF - Longest life of all Tygon formulations - Broad chemical resistance	✓ Standard ✓ Easy-Load®	 XF-06440-26 7.6 m (25 ft)/pk	 XF-06440-73 7.6 m (25 ft)/pk	 XF-06440-82 7.6 m (25 ft)/pk
Tygon E-Food (B-44-4X) 	- Complies with FDA, EU Food, NSF, 3A, REACH, RoHS, ALCF - Smooth inner surface unaffected by commercial sanitizers - Nontoxic, will not affect taste or odor	✓ Easy-Load	XF-06418-26 15.2 m (50 ft)/pk	XF-06418-73 15.2 m (50 ft)/pk	XF-06418-82 15.2 m (50 ft)/pk
Tygon E-Lab (E-3603) 	- Complies with USP Class VI, FDA, EU Food, NSF, REACH, RoHS, ALCF - Ideal for general transfer applications - Nonaging, nonoxidizing, low gas permeability	✓ Standard ✓ Easy-Load	XF-06509-26 15.2 m (50 ft)/pk	XF-06509-73 15.2 m (50 ft)/pk	XF-06509-82 15.2 m (50 ft)/pk
Tygon Fuel & Lubricant (F-4040-A) 	- Complies with REACH, RoHS, ALCF - Specially formulated to transport hydrocarbons, petroleum products, distillates - Very low gas permeability	✓ Easy-Load	—	XF-06401-73 15.2 m (50 ft)/pk	XF-06401-82 15.2 m (50 ft)/pk
Tygon Chemical (2001) 	- Complies with FDA 21 CFR 175.300, REACH, RoHS, ALCF - Best chemical resistance of any Tygon formulation - Plasticizer-free and low gas permeability	✓ Easy-Load	XF-06475-26 15.2 m (50 ft)/pk	XF-06475-73 15.2 m (50 ft)/pk	XF-06475-82 15.2 m (50 ft)/pk
Norprene® (A-60 G) 	- Complies with NSF, REACH, RoHS - Up to 10,000 hours of tubing life - Best choice for pressure/vacuum applications	✓ Standard ✓ Easy-Load	XF-06404-26 15.2 m (50 ft)/pk	XF-06404-73 15.2 m (50 ft)/pk	XF-06404-82 15.2 m (50 ft)/pk
Norprene Food (A 60 F) 	- Complies with FDA, 3A, NSF, REACH, RoHS - Ideal for high-temperature food applications - Resists heat, ozone, acids, and alkalis	✓ Standard ✓ Easy-Load	XF-06402-26 15.2 m (50 ft)/pk	XF-06402-73 15.2 m (50 ft)/pk	XF-06402-82 15.2 m (50 ft)/pk
Viton® 	- Complies with FDA, ALCF - Perfect where FDA and chemical compatibility are needed - Resists corrosives, solvents, and oils at elevated temperatures	✓ Standard ✓ Easy-Load	XF-96412-26 7.6 m (25 ft)/pk	XF-96412-73 7.6 m (25 ft)/pk	—

†Determined under the following conditions: Using a 1 to 650 rpm drive; 0 psi at inlet, 0.5 psi at outlet; water temperature at 22°C (72°F).

Overlook Filler/Dispensing Nozzles

- Maximize the speed, precision, and accuracy of dispensing and filling applications
- Minimize splashing and dripping when dispensing into narrow- or wide-mouth containers
- Dimensional tolerances of ±0.05% for assured repeatability

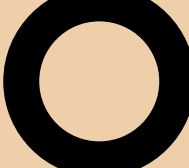
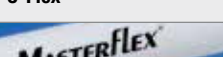
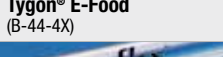
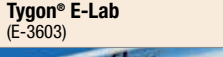
Tubing ID	Catalog number	Price
1/32"	XF-30619-06	
1/16"	XF-30619-01	
1/8"	XF-30619-07	
3/16"	XF-30619-02	
1/4"	XF-30619-08	
5/16"	XF-30619-03	
3/8"	XF-30619-09	
1/2"	XF-30619-04	
5/8"	XF-30619-10	
3/4"	XF-30619-05	



I/P® High-Performance Precision Pump Tubing

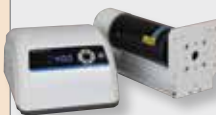
Thicker wall compared to our Precision pump tubing

- Best choice for applications involving pressure, suction lift, viscous fluids, or long tubing life

		Tubing size	I/P 70	I/P 88	I/P 89
		Inner diameter	9.5 mm (0.37")	12.7 mm (0.5")	15.88 mm (0.62")
		Hose barb size	9.5 mm (3/8")	12.7 mm (1/2")	15.88 mm (5/8")
		Flow range (approximate) [†]	0.01 to 8 LPM 0.002 to 2.1 GPM	0.02 to 17 LPM 0.005 to 4.5 GPM	0.03 to 19 LPM 0.007 to 5.0 GPM
Pump tubing formulation	Description	Compatible pump head			
Silicone (platinum-cured) 	- Complies: USP Class V, EP, FDA, REACH, RoHS, ADCF - Fungus-resistant; phthalate- and latex-free - Accommodates a wide temperature range	✓ High-Performance	XF-96510-70 3 m (10 ft)/pk	XF-96510-88 3 m (10 ft)/pk	XF-96510-89 3 m (10 ft)/pk
BioPharm Silicone (platinum-cured) 	- Complies with USP Class VI, EP, FDA, 3A, REACH, RoHS, ADCF - Lower absorption; excellent biocompatibility	✓ High-Performance	XF-96421-70 3 m (10 ft)/pk	XF-96421-88 3 m (10 ft)/pk	XF-96421-89 3 m (10 ft)/pk
BioPharm Plus Silicone (platinum-cured) 	- Complies: USP Class VI, EP, FDA, 3A, REACH, RoHS, ADCF - Ultra-smooth—minimizes particle entrapment	✓ High-Performance	XF-96441-70 3 m (10 ft)/pk	XF-96441-88 3 m (10 ft)/pk	XF-96441-89 3 m (10 ft)/pk
Puri-Flex™ 	- Complies: USP Class VI, FDA, REACH, RoHS, ADCF - Heat sealable, weldable, and economical - Long pump life when compared to silicone	✓ High-Performance	XF-96419-70 3 m (10 ft)/pk	XF-96419-88 3 m (10 ft)/pk	XF-96419-89 3 m (10 ft)/pk
C-Flex® 	- Complies: USP Class VI, EP, REACH, RoHS, ADCF - Heat sealable, weldable, economical - Better resistance to pH fluctuations	✓ High-Performance	XF-06424-70 3 m (10 ft)/pk	XF-06424-88 3 m (10 ft)/pk	XF-06424-89 3 m (10 ft)/pk
PharMed® BPT 	- Complies: USP Class VI, EP, FDA, NSF, REACH, RoHS >10,000 hours of tubing life, sealable, weldable - Ideal for tissue and cell culture work	✓ High-Performance	XF-06508-70 7.6 m (25 ft)/pk	XF-06508-88 7.6 m (25 ft)/pk	— —
Chem-Durance® Bio 	- Complies: USP Class VI, FDA, REACH, RoHS - Excellent biocompatibility, chemical compatibility - Excellent pump life, durable under pressure	✓ High-Performance	XF-06442-70 15.2 m (50 ft)/pk	XF-06442-88 7.6 m (25 ft)/pk	XF-06442-89 7.6 m (25 ft)/pk
Tygon® E-LFL 	- Complies with USP Class VI, EP, FDA, EU Food, REACH, RoHS, ABCF - Longest life of all Tygon formulations	✓ High-Performance	XF-06440-70 7.6 m (25 ft)/pk	XF-06440-88 7.6 m (25 ft)/pk	XF-06440-89 7.6 m (25 ft)/pk
Tygon® E-Food (B-44-4X) 	- Complies: FDA, EU Food, NSF, 3A, REACH, RoHS, ABCF - Smooth inner surface unaffected by commercial sanitizers; will not affect taste or odor	✓ High-Performance	XF-06418-70 15.2 m (50 ft)/pk	XF-06418-88 15.2 m (50 ft)/pk	XF-06418-89 15.2 m (50 ft)/pk
Tygon® E-Lab (E-3603) 	- Complies with USP Class VI, FDA, EU Food, NSF, REACH, RoHS, ABCF - Ideal for general transfer applications; nonaging, nonoxidizing, low gas permeability	✓ High-Performance	XF-06509-70 15.2 m (50 ft)/pk	XF-06509-88 15.2 m (50 ft)/pk	XF-06509-89 15.2 m (50 ft)/pk
Norprene® (A-60 G) 	- Complies with NSF, REACH, RoHS - Up to 10,000 hours of tubing life - Best choice for pressure/vacuum applications	✓ High-Performance	XF-06404-70 7.6 m (25 ft)/pk	XF-06404-88 7.6 m (25 ft)/pk	XF-06404-89 7.6 m (25 ft)/pk
Norprene Food (A-60 F) 	- Complies with FDA, 3A, NSF, REACH, RoHS - Ideal for high-temperature food applications - Resists heat, ozone, acids, and alkalis	✓ High-Performance	— —	XF-06402-88 7.6 m (25 ft)/pk	XF-06402-89 7.6 m (25 ft)/pk

†Determined under the following conditions: Using a 1 to 650 rpm drive; 0 psi at inlet, 0.5 psi at outlet; water temperature at 22°C (72°F).

I/P® Drives Selection Guide

Description	Special features	Page number
Brushless Process		
	✓ Compact and powerful ✓ Maintenance-free brushless motor ✓ IP55 rated	25
Precision Variable-Speed Modular		
	✓ Separate motor and controller for convenient setup ✓ Model available with wall-mount controller and IP66 protection	26
Variable-Speed Modular Digital Dispensing		
	✓ Digital dispensing with calibration ✓ Separate motor and controller for convenient setup ✓ Model available with wall-mount controller and IP66 protection	27
Digital Brushless Process		
	✓ Digital dispensing with calibration ✓ Sealed housing; IP66 and NEMA 4X rated for washdown ✓ Maintenance-free brushless motor	28

I/P® Brushless Process Drives

Powerful, low-maintenance drives keep you pumping

- Don't worry about moisture, chemicals, or dust—IP55-rated nonchip epoxy-coated steel housing
- Goes where you need it—compact and light enough to carry with one hand, powerful enough to drive two pump heads
- Get up to speed quickly—easy to adjust speed knob and LED display for improved repeatability



FEATURES

- ✓ Flow rates: 0.2 to 19 LPM
- ✓ Accuracy of $\pm 0.25\%$ speed control
- ✓ LED display
- ✓ Reversible motor and remote control capabilities
- ✓ Accept up to 2 pump heads

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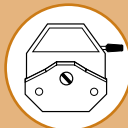


Motor speed (rpm)	Speed control (repeatability)	Pump heads accepted	Motor size	Power (50/60 Hz)		Catalog number	Price
				VAC	Amps		
Variable-speed brushless process drive; 14"L x 10"W x 9"H (35.6 x 25.4 x 22.9 cm)							
33 to 650	±0.25% (2% of max rpm)	2	1/3 hp (0.25 kW)	90 to 260	4.5 at 115 VAC, 2.6 at 230 VAC	XF-77410-10	
Variable-speed brushless process drive with remote input/output; 14"L x 10"W x 9"H (35.6 x 25.4 x 22.9 cm)							
33 to 650	±0.25% (2% of max rpm)	2	1/3 hp (0.25 kW)	90 to 260	4.5 at 115 VAC, 2.6 at 230 VAC	XF-77411-00	

[XF-07595-43](#) Washdown foot switch for model 77411-00

[XF-77300-32](#) Remote cable kit. Required for model 77411-00 to operate the remote inputs and outputs

PUMP HEAD



TUBING



DRIVE



Choose a
Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.4 to 8 LPM	Easy-Load® 77601-10	C-Flex® ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Brushless process drive 77410-10 33 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77963-10	
	0.7 to 17 LPM	High-Performance 77600-62	Tygon® E-LFL I/P 88 tubing 06440-88 3 ft (1 m)	Brushless process drive 77410-10 33 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77963-20	

I/P® Precision Variable-Speed Modular Drives

Place motor and controller where convenient with modular design

- Easy control of speed, direction, and start/stop with membrane keypad
- Ideal for metering and critical transfer applications

A. Modular Drive with Benchtop Controller

- Splash-resistant ABS plastic controller housing is IP33 rated; drive housing is epoxy finished steel, IP33 rated
- 6-ft (1.8-m) cable connects drive and controller; optional extension cable is available
- Remote control via DB9 female connector on controller

B. Washdown Modular Drive with Wall-Mount Controller

- Wall-mount controller housing is powder-coated aluminum, IP66 / NEMA 4X rated for washdown; powder-coated steel drive housing is IP66 / NEMA 4X rated for washdown
- 6-ft (1.8-m) cable connects drive and controller; optional extension cable is available
- Remote control via weather-resistant connection on controller

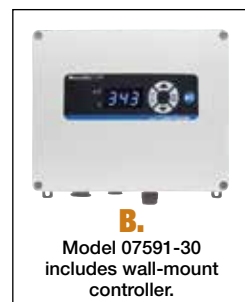
What's included: 6-ft (1.8-m) line cord with IEC 320/CEE22 socket. These models are shipped with country-specific plug/cord set; please specify ultimate destination when ordering.



A.
07591-20

FEATURES

- ✓ Flow rates: 0.036 to 19 LPM
- ✓ Accuracy of $\pm 0.25\%$ speed control
- ✓ LED display
- ✓ Reversible motor
- ✓ Remote control capabilities
- ✓ Accept up to 2 pump heads



B.
Model 07591-30
includes wall-mount
controller.

ISO9001:2008
CERTIFIED SUPPLIER



IP 66
07591-30



rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
A. Precision modular drive with benchtop controller									
6 to 650	±0.25% (1 rpm at 650 rpm)	2†	1⁄5 hp (149 W)	IP33	Controller: 10⅜" x 8⅜" x 5½" Drive: 13⅞" x 5½" x 6⅛"	90 to 260	4.4 at 115 VAC, 2.2 at 230 VAC	XF-07591-20	
B. Precision washdown modular drive with wall-mount controller									
6 to 650	±0.25% (1 rpm at 650 rpm)	2†	1⁄5 hp (149 W)	IP66	Controller: 10⅞" x 11" x 4¾" Drive: 14¼" x 7" x 6½"	90 to 260	4.4 at 115 VAC, 2.2 at 230 VAC	XF-07591-30	

†Drive accepts two pump heads when loaded with silicone or C-Flex® tubing.

[XF-07557-51](#) Extension cable, 9 ft (2.7 m); extend distance between motor and controller

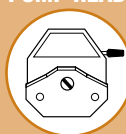
[XF-07595-47](#) Cable assembly for benchtop drive 07591-20; DB9 male connector and 25-ft (7.9-m) cable with stripped wire terminal ends. Use for remote control

[XF-77300-32](#) Cable assembly for washdown drive 07591-30; 18-pin round connector and 25-ft (7.9-m) cable with stripped wire terminal ends. Use for remote control

[XF-17050-01](#) NIST-traceable calibration for peristaltic pump drive

Choose a
Complete System
One catalog number includes all 3!

PUMP HEAD



TUBING



DRIVE



System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.06 to 8 LPM	Easy-Load® 77601-10	C-Flex® ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Modular drive 07591-20 6 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77962-20	
	0.06 to 8 LPM	Easy-Load 77601-10	C-Flex ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Modular drive 07591-30 6 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77962-30	

I/P® Variable-Speed Modular Digital Dispensing Drives

Get precise digital dispensing with virtually no maintenance

- Graphical LCD shows four operating modes: continuous run, timed dispense, copy dispense, and volume dispense
- Programmable dispense interval lets you set the delay between dispense cycles for convenient, automated dispensing by time or by volume
- Brushless motor gives you quiet, maintenance-free reliability

A. Modular Drive with Benchtop Controller

- Splash-resistant ABS plastic controller housing is IP33 rated; drive housing is epoxy finished steel, IP33 rated
- 6-ft (1.8-m) cable connects drive and controller; optional extension cable is available
- Remote control capabilities via a DB25 female connector on controller

B. Washdown Modular Drive with Wall-Mount Controller

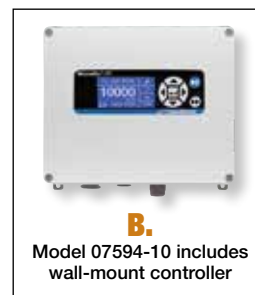
- Wall-mount controller housing is powder-coated aluminum, IP66 / NEMA 4X rated for washdown; powder-coated steel drive housing is IP66 / NEMA 4X rated for washdown
- 6-ft (1.8-m) cable connects drive and controller; optional extension cable is available
- Remote control capabilities via weather-resistant 31-pin round connection on controller



A.
07594-00

FEATURES

- ✓ Flow rates: 0.0006 to 19 LPM
- ✓ Accuracy of $\pm 0.1\%$ speed control
- ✓ Four-line graphical display
- ✓ Antidrip, reversible motor
- ✓ Remote control capabilities
- ✓ Accept up to 2 pump heads



B.
Model 07594-10 includes wall-mount controller

What's included: 6-ft (1.8-m) line cord with IEC 320/CEE22 socket. These models are shipped with country-specific plug/cord set; please specify ultimate destination when ordering.



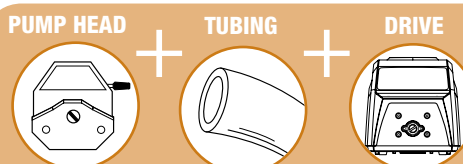
rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
A. Digital modular dispensing drive with benchtop controller									
0.1 to 650	±0.1% (0.1 rpm at 650 rpm)	2	¾ hp (280 W)	IP33	Controller: 10½" x 8¼" x 5" Drive: 15⅙" x 7" x 6"	90 to 260	4.5 at 115 VAC, 2.5 at 230 VAC	XF-07594-00	
B. Digital washdown modular dispensing drive with wall-mount controller									
0.1 to 650	±0.1% (0.1 rpm at 650 rpm)	2	¾ hp (280 W)	IP66	Controller: 9" x 11¼" x 4½" Drive: 15⅙" x 7" x 6"	90 to 260	4.5 at 115 VAC, 2.5 at 230 VAC	XF-07594-10	

[XF-77301-82](#) Extension cable, 9 ft (2.7 m); extend distance between motor and controller

[XF-07523-95](#) Cable assembly for benchtop drive 07594-00; DB25 male connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

[XF-07575-80](#) Cable assembly for washdown drive 07594-10; 31-pin round connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

[XF-17050-01](#) NIST-traceable calibration for peristaltic pump drive



Choose a Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.001 to 8 LPM	Easy-Load® 77601-10	C-Flex® ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Digital dispensing drive 07594-00 0.1 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77970-40	
	0.001 to 8 LPM	Easy-Load 77601-10	C-Flex ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Digital dispensing drive 07594-10 0.1 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77970-50	

I/P® Digital Console Process Drives

Maintenance-free drives built for process applications

- Graphical LCD shows four operating modes: continuous run, timed dispense, copy dispense, volume dispense
- Dispense by mL—volume in mL of each dispense, 0.001 to 9999 mL; Copy—1 to 9,999 dispense cycles; or SEC—time interval of on/off cycles (1 sec to 99 hr, 59 min, 59 sec per cycle)

Model 77420-10 features a 316 stainless steel housing with an anodized aluminum base. Ideal for pharmaceutical, dairy, biotech, and food and beverage applications.

Model 77420-20 features a powder-coated steel housing with anodized aluminum base. Use in process, manufacturing, and water-treatment applications where stainless steel is not a critical requirement.

What's included: 6-ft (1.8-m) line cord with IEC 320/CEE22 socket. These models are shipped with country-specific plug/cord set; please specify ultimate destination when ordering.



FEATURES

- ✓ Flow rates: 0.0006 to 19 LPM
- ✓ Accuracy of ±0.1% speed control
- ✓ Four-line graphical display
- ✓ Antidrip, reversible motor
- ✓ IP66-rated for easy washdown
- ✓ Accept up to 2 pump heads

77420-10 shown with I/P High-Performance pump head 77600-62

ISO9001:2008
CERTIFIED SUPPLIER



rpm	Speed control (resolution)	Pump heads accepted	Motor size	IP rating	Dimensions (L x W x H)	Power (50/60 Hz)		Catalog number	Price
						VAC	Amps		
Digital process drive with 316 stainless steel housing									
0.1 to 650	±0.1%	2	¾ hp (280 W)	IP66	16 ¹¹ / ₁₆ " x 11 ¹ / ₈ " x 12 ⁷ / ₈ "	90 to 260	4.5 at 115 VAC, 2.5 at 230 VAC	XF-77420-10	
Digital process drive with powder-coat steel housing									
0.1 to 650	±0.1%	2	¾ hp (280 W)	IP66	16 ¹¹ / ₁₆ " x 11 ¹ / ₈ " x 12 ⁷ / ₈ "	90 to 260	4.5 at 115 VAC, 2.5 at 230 VAC	XF-77420-20	

Accessories

[XF-07575-84](#) Washdown foot switch, momentary start/stop; 6-ft (1.8-m) cable

[XF-07575-80](#) Cable assembly, 31-pin round connector and 25-ft (7.9-m) cable with stripped wire ends for remote control

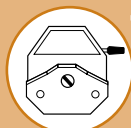
[XF-17050-01](#) NIST-traceable calibration for peristaltic pump drive

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There's More at
ColeParmer.com

Find all the
product specs
you need!

PUMP HEAD



TUBING



DRIVE



Choose a
Complete System
One catalog number includes all 3!

System	Flow range	What's included			Power	Catalog number	Price
		Pump head	Tubing	Drive			
	0.001 to 8.0 LPM	Easy-Load® 77601-10	C-Flex® ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Digital process drive 77420-10 0.1 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77964-20	
	0.001 to 8.0 LPM	Easy-Load 77601-10	C-Flex® ULTRA I/P 73 tubing 06434-73 10 ft (3 m)	Digital process drive 77420-20 0.1 to 650 rpm	90 to 260 VAC, 50/60 Hz	XF-77964-30	

B/T® Fixed- and Variable-Speed Pumps

Achieve the highest flow rates of any Masterflex pump—up to 42 LPM (11.1 GPM)

Fixed-Speed Pumps

- Economical and easy to operate
- Reversible motor: purge before or after pumping, pump fluid in either direction
- IP55-rated motor—wash off dirt and debris

Air-Powered Pump

- Use in locations where electricity is unsafe or impractical
- Includes pressure regulator—control your compressor air to match pump requirements
- 24 cfm (0.68 m³), 100 psi (6.9 bar) minimum air required, supply your own compressor to power pump
- IP56-rated motor protects against dust and strong water jets
- Rated for ATEX Zone 2 EEx II 3 G c IIC T6; NEC Class 1, Division 2, Groups A, B, C, D, T6

Variable-Speed Modular Pump

- Place washdown controller wherever it's convenient
- Controller with 16-ft (4.9-m) cord mounts on pump or wall
- IP56-rated motor protects against dust and strong water jets
- Reversible motor: purge before or after pumping, pump fluid in either direction

Variable-Speed Modular Digital Pump

- High-volume, high-accuracy dispensing
- Dispense by volume or time, or pump continuously
- Separate motor and controller by up to 6 feet (1.8 m) for convenient operation
- IP56-rated controller and motor protect against dust and water

What's included: a Rapid-Load® pump head, 3 ft (1 m) of Tygon® E-LFL B/T 91 pump tubing, and a 6-ft (1.8-m) power cord (115 VAC: US standard plug; 230 VAC: European plug).



Fixed-speed pump
77111-60



Variable-speed
modular digital pump
77111-40

FEATURES

- ✓ Flow rates up to 42 LPM
- ✓ Interlock switch shuts off power when pump head is opened
- ✓ Washdown pumps handle the toughest process and production applications, then clean up with ease
- ✓ Gentle peristaltic action is ideal for pumping shear-sensitive or viscous fluids (up to 10,000 cps)
- ✓ Rotor and occlusion bed design allow easier tube loading and prevent "tubing roll" during operation

Flow Rates in LPM (GPM)

rpm	PerfectPosition™ pump tubing	
	B/T 87	B/T 91
321	18.9 (5.0)	42 (11.1)
271	16.0 (4.2)	35 (9.4)
35 to 321	1.9 to 17.7 (0.5 to 4.7)	4.0 to 37 (1.06 to 9.8)
12 to 321	0.71 to 18.9 (0.19 to 5.0)	1.4 to 42 (0.4 to 11.1)

Motor type	Motor size	rpm	IP rating	Mounting type	Dimensions (L x W x H)	Power		Catalog number	Price
						VAC (Hz)	Amps		
Fixed-speed	1 hp (0.75 kW)	321	IP55	Direct-drive	27" x 15.8" x 15.1" (68.6 x 40 x 38.4 cm)	115 (60)	12.6	XF-77111-30	
		271				220 (50)	6.3	XF-77111-37	
Variable-speed, air powered	¾ hp (0.56 kW)	35 to 321	IP56	Direct-drive	27" x 15.8" x 15.1" (68.6 x 40 x 38.4 cm)	Requires 24 cfm (0.68 m³) 100 psi (6.9 bar) minimum		XF-77111-80	
Variable-speed (±5%)	½ hp (0.37 kW)	12 to 321	Controller: IP56 Drive: IP56	Direct-drive	27" x 15.8" x 17.4" (68.6 x 40 x 44.2 cm)	115 (50/60)	6.5	XF-77111-60	
						230 (50/60)	3.3	XF-77111-67	
Variable-speed (±0.3%)	½ hp (0.37 kW)	12 to 321		Direct-drive	Controller: 9" x 11" x 4½" (22.9 x 27.9 x 11.4 cm) Drive: 27" x 15¾" x 15" (68.6 x 40.0 x 38.4 cm)	90 to 130 (50/60)	6.5	XF-77111-40	
						190 to 260 (50/60)	3.3	XF-77111-47	

[XF-77300-32](#) Remote cable, required for remote control operation of models 77111-40 and -47; 25 ft (7.6 m)

[XF-77111-90](#) Bracket for digital controller on models 77111-40 and -47

B/T® PerfectPosition™ Pump Tubing

Easily place tubing with printed retention marks

- Optimized for use in B/T pumps to provide the performance you expect

Tubing size	B/T 87	B/T 91
Inner diameter	12.7 mm (0.5")	19.0 mm (0.75")
Hose barb size	12.7 mm (½")	19.0 mm (¾")

Pump tubing formulation	Description		
Silicone (platinum-cured) 	– Smooth surface; low protein binding levels – Fungus-resistant; phthalate- and latex-free – Accommodates a wide temperature range	XF-96510-87 3 m (10 ft)/pk	XF-96510-91 3 m (10 ft)/pk
Silicone (peroxide-cured) 	– Smooth surface for minimal particle entrapment – Very low extractables, with documented biocompatibility for sensitive applications	XF-96400-87 3 m (10 ft)/pk	XF-96400-91 3 m (10 ft)/pk
BioPharm Plus Silicone (platinum-cured) 	– Very low extractable; biocompatible for sensitive applications – Longest tubing life of any silicone pump tubing – Lower spallation than regular silicone	XF-96445-87 3 m (10 ft)/pk	XF-96445-91 3 m (10 ft)/pk
Puri-Flex™ 	– Heat sealable, weldable, and economical – Long pump life when compared to silicone or many other TPE tubings	XF-96419-87 3 m (10 ft)/pk	XF-96419-91 3 m (10 ft)/pk
C-Flex® 	– Heat sealable, weldable, economical – Longest life of any C-Flex formulation – Better resistance to pH fluctuations	XF-06424-87 3 m (10 ft)/pk	XF-06424-91 3 m (10 ft)/pk
PharMed® BPT 	– Over 10,000 hours of tubing life – Resists ozone and UV radiation – Ideal for tissue and cell culture work	XF-06507-87 3 m (10 ft)/pk	XF-06507-91 3 m (10 ft)/pk
PharmaPure® 	– Nontoxic and nonhemolytic – Great for tissue and cell work – Low extractables and gas permeability	XF-06437-87 3 m (10 ft)/pk	XF-06437-91 3 m (10 ft)/pk
Chem-Durance® Bio 	– Excellent chemical resistance – Plasticizer-free inner liner – Excellent biocompatibility	XF-06443-87 3 m (10 ft)/pk	XF-06443-91 3 m (10 ft)/pk
Tygon® E-LFL 	– Longest life of all Tygon formulations – USP Class VI, EU Pharmacopoeia 3.2.9, FDA 21	XF-06440-87 3 m (10 ft)/pk	XF-06440-91 3 m (10 ft)/pk
Tygon® E-Food (B-44-4X) 	– Complies with FDA, NSF, 3A, and EU food regulations – Smooth inner surface unaffected by common commercial sanitizers	XF-06418-87 3 m (10 ft)/pk	XF-06418-91 3 m (10 ft)/pk
Norprene® Food (A-60-F) 	– Ideal for high-temperature food applications – Resists heat, ozone, acids, and alkalies – Complies with FDA and NSF food regulations	XF-06399-87 3 m (10 ft)/pk	XF-06399-91 3 m (10 ft)/pk

Find even more online!
Go to ColeParmer.com to see full product details.

Masterflex® Barbed Fittings

Designed to tight tolerances and made from virgin materials

Size	Use with Masterflex® tubing sizes			HDPE		Polypropylene		Kynar® PVDF	
	L/S®	I/P®	B/T®	Catalog number	Price/ pk of 10	Catalog number	Price/ pk of 10	Catalog number	Price/ pk of 10
A. Straight barbs									
1/16"	13, 14	—	—	XF-30612-01		XF-30612-43		XF-30612-04	
1/8"	16	—	—	XF-30612-05		XF-30612-47		XF-30612-08	
3/16"	15, 25	—	—	XF-30612-09		XF-30612-51		XF-30612-12	
1/4"	17, 24	26	—	XF-30612-13		XF-30612-55		XF-30612-16	
3/8"	18, 35, 36	70, 73	86	XF-30612-17		XF-30612-59		XF-30612-20	
1/2"	—	82, 88	87	XF-30612-21		XF-30612-63		XF-30612-24	
5/8"	—	89	—	XF-30612-25		XF-30612-67		XF-30612-28	
3/4"	—	—	91	XF-30612-29		XF-30612-71		XF-30612-32	
1"	—	—	92	XF-30612-33		XF-30612-75		XF-30612-36	
B. Tee connectors (equal leg)									
1/16"	13, 14	—	—	XF-30613-01		XF-30613-43		XF-30613-04	
1/8"	16	—	—	XF-30613-05		XF-30613-47		XF-30613-08	
3/16"	15, 25	—	—	XF-30613-09		XF-30613-51		XF-30613-12	
1/4"	17, 24	26	—	XF-30613-13		XF-30613-55		XF-30613-16	
3/8"	18, 35, 36	70, 73	86	XF-30613-17		XF-30613-59		XF-30613-20	
1/2"	—	82, 88	87	XF-30613-21		XF-30613-63		XF-30613-24	
5/8"	—	89	—	XF-30613-25		XF-30613-67		XF-30613-28	
3/4"	—	—	91	XF-30613-29		XF-30613-71		XF-30613-32	
1"	—	—	92	XF-30613-33		XF-30613-75		XF-30613-36	
C. Y-connectors (equal leg)									
1/16"	13, 14	—	—	XF-30614-01		XF-30614-43		XF-30614-04	
1/8"	16	—	—	XF-30614-05		XF-30614-47		XF-30614-08	
3/16"	15, 25	—	—	XF-30614-09		XF-30614-51		XF-30614-12	
1/4"	17, 24	26	—	XF-30614-13		XF-30614-55		XF-30614-16	
3/8"	18, 35, 36	70, 73	86	XF-30614-17		XF-30614-59		XF-30614-20	
1/2"	—	82, 88	87	XF-30614-21		XF-30614-63		XF-30614-24	



A
Straight barb



B
Tee connector



C
"Y" connector

Cole-Parmer® Solenoid Two-Way Pinch Valves

Specifically designed for Masterflex® pump tubing

- Use with tubing that has durometer rating of 50 or less such as C-Flex® or silicone—7.25 psi max
- Excellent for clean processes—fluid stays contained within tubing
- Use for on/off flow control applications



98306-02

98306-16

Cole-Parmer

Tube size	Response time	Watts	12 VDC valves		24 VDC valves	
			Catalog number	Price	Catalog number	Price
Normally closed						
L/S® 14	30 to 50 msec	10	XF-98306-00		XF-98306-02	
L/S 16			XF-98306-08		XF-98306-10	
L/S 25			XF-98306-16		XF-98306-18	
L/S 17			XF-98306-24		XF-98306-26	
Normally open						
L/S 14	30 to 50 msec	10	XF-98306-04		XF-98306-06	
L/S 16			XF-98306-12		XF-98306-14	
L/S 25			XF-98306-20		XF-98306-22	
L/S 17			XF-98306-28		XF-98306-30	

Tubing Weights

Keep tubing in place during dispense cycles

Flow-through PTFE weights fit Masterflex L/S® tubing sizes noted.



Description	Catalog number	Price
Weight for L/S 16, 15, and 25	XF-78226-81	
Weight for L/S 17, 18, 24, 35, 36	XF-78226-82	
Set of two; one each of 78226-81 and 78226-82	XF-77310-03	

Pure-Fit® Tru Valve

Easy implementation in your system

- Reusable for multiple cycles and applications

The valve's butterfly design allows easy installation to existing lines; purity is maintained because the valve goes around the exterior of the tubing and never comes in contact with process fluid.

Simple threaded handle and calibrated scale ensure accurate control of flow and can also be written into validation protocols. The valve also features lockout positioning for use in steam-in-place (SIP) cycles. Withstands autoclaving or gamma irradiation. Accommodates any flexible tubing up to 17.8 mm (0.700") in outer diameter.



Fits Masterflex® tubing sizes	Material	Catalog number	Price
L/S® 13, 14, 15, 16, 17, 18, 24, 25, 35, 36; I/P® 26, 73	Glass-reinforced nylon	XF-20002-00	



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Highest flow rates
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