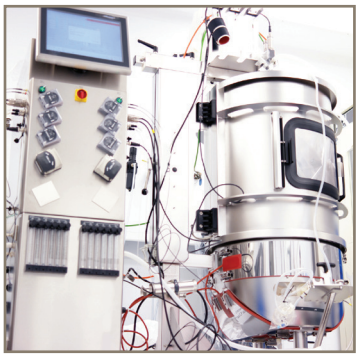


BTX-Connect

Miniature Diaphragm Pump

ENGINEERING YOUR SUCCESS.

Innovative solutions for health care success

ENGINEERING YOUR SUCCESS.

When you partner with the global leader in motion and control technologies, expect to move your business and the world forward. From miniature solenoid valves to highly integrated automation systems, our innovations are critical to life-saving medical devices and scientific instruments used for drug discovery and pathogen detection. Not to mention, critical to decreasing time to market and lowering your overall cost of ownership. So partner with Parker, and get ready to move, well, anything.

Parker

www.parker.com/precisionfluidics 1 603 595-1500

BTX-Connect Miniature Diaphragm Pump

Up to 10 LPM Free Flow

Parker's BTX-Connect pump product line combines best in class diaphragm pump design, innovative 'connected' brushless motor technology, ultra-low vibration, and advanced manufacturing techniques to bring a next-generation solution to next-generation device needs. The BTX-Connect Pump is designed to provide high performance with superior quality and reliability. The options for Motor Control, Single Head, Dual Head, Pressure only, Vacuum only, and Pressure/Vacuum configurations offer a wide range of solutions with the support of Parker's Global Teams.

Applications

- Point of Care Diagnostics
- Negative Pressure Wound Therapy
- Compression Therapy
- Medical Simulation
- Scent Dispersion

Features

- "Connected" brushless motor design with digital communication control and monitoring available
- Fail-safe design with over-current, stall, and over-temperature shut-down
- Optimized pump balancing for ultra-low vibration
- RoHS, REACH, and CE compliant

Product Specifications

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)

Storage Environment:
-4 to 212°F (-20 to 100°C)

Media:
Air, Nitrogen, Oxygen, and other non-reacting gases

Humidity:
0 - 80% Relative Humidity
Non-condensing

Noise Level[2]:
As low as 45 dB @ 12 in (30 cm)
Muffler recommended for additional noise reduction (see accessories)

Pump Assembly Rated Life[3]:
Brushless Motor - 15,000 Hours

Weight:
Compact BLDC Single Head
4.4 oz (125 g)
Compact BLDC Dual Head
5.8 oz (165 g)
Slotless BLDC Dual Head
8.4 oz (240 g)

Electrical

Motor Type (DC):
Brushless Slotted, Brushless Slotless

Nominal Motor Voltages[4]:
12 or 24 VDC
Other voltages available upon request

Electrical Termination:
Mating Connector: JST PAP-06V-S
Pin 1: Tachometer Speed (Blue)
Pin 2: PWM or 0-5V Input (White)
Pin 3: +DC Voltage Input (Red)
Pin 4: -Ground (Black)
Pin 5: Digital UART Rx (Brown)
Pin 6: Digital UART Tx (Purple)
On/Off only, PWM input, and 0-5Vdc are factory set, see ordering table.
Standard on/off configuration only requires DC power and Ground.

Pneumatic

Maximum Unrestricted Flow:
Single Head: Up to 6 LPM
Dual Head: Up to 10 LPM

Pressure Range:
Continuous Duty:
Up to 30 PSIg (2 Bar)

Vacuum Range:
Continuous Duty:
Up to -22 inHg (-558 mmHg)

Filtration:
40 microns - recommended

Connect Features

Speed Control Options:
On/Off Control, with Factory Set Speed
PWM
0-5V Analog
Serial UART

Current Limit Shut Down:
Compact BLDC 12V - 1 Amp
Compact BLDC 24V - 0.5 Amp
Slotless BLDC 12V - 2 Amp
Slotless BLDC 24V - 1 Amp

Temperature Limit Shut Down:
Compact BLDC: 90°C
Slotless BLDC: 90°C
Time before shut down: 2 Seconds

UART Serial Comm:
Pump speed measurement: ±200 RPM
Internal Motor Temp: ±10°C
Current Measurement: ±50mA

Wetted Materials

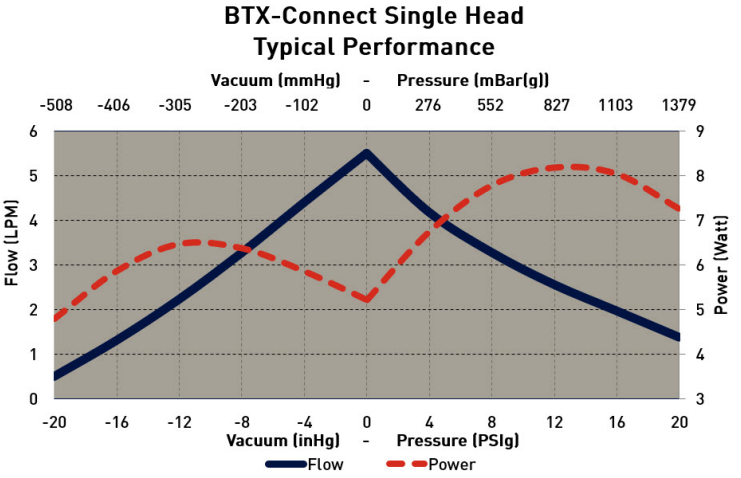
Diaphragm:
Long Life - Advanced EPDM

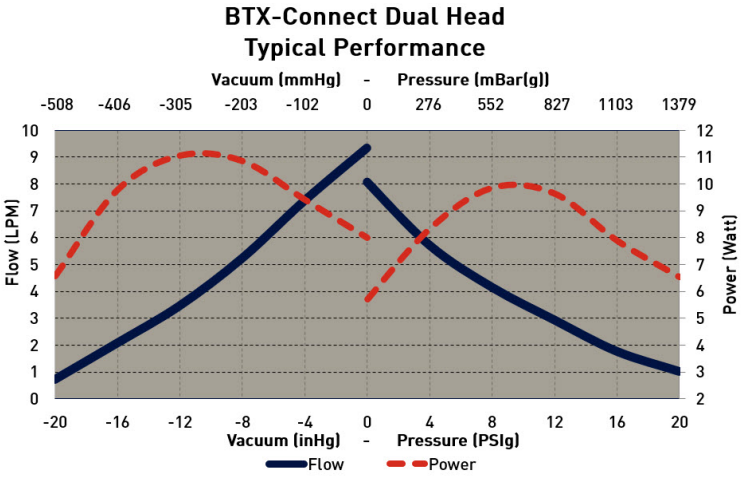
Valves:
EPDM, Advanced EPDM

Pump Head:
PBT

Other materials available upon request

BTX-Connect Miniature Diaphragm Pump
Typical Flow Curve





- **Dual head performance shown with pump heads connected in parallel**
- **Curve shows maximum flow capability with a 0.090" pump offset, which are vacuum or pressure only. Pumps capable of alternating pressure and vacuum are available with 0.050" pump offset or less. See ordering table below for a list of available standard options**
- **Detailed performance specification sheets are available for each part number**
- **Contact Parker Precision Fluidics Applications Engineering team for other performance options.**

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from a Parker or its subsidiaries or authorized distributor.

The above graphs represent an example of performance for the pump series handling air at 800 feet (244 m) above sea level at 75 degree F (24 C). Performance will vary depending on barometric pressure and media temperature. A variety of configurations can be accommodated to meet application requirements.

Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

BTX-Connect Miniature Diaphragm Pump
Sizing and Selection

BTX-Connect Dual Head
Compact BLDC Motor
B2C

BTX-Connect Dual Head
Slotless BLDC Motor
B2S

BTX-Connect Single Head
Compact BLDC Motor
B1C

Efficiency	Better	Best
Life	Best - 15,000 Hours	Best - 15,000 Hours
Control	On/Off, Digital, PWM, 0-5V	On/Off, Digital, PWM, 0-5V
Protection	Reverse Polarity, Temp, Current	Reverse Polarity, Temp, Current
Cost	Better	Good

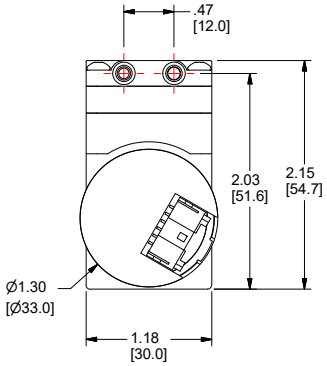
Mounting Guidelines:

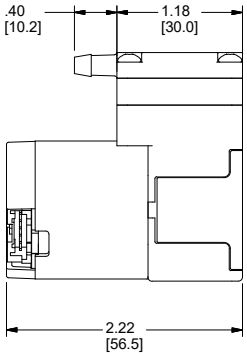
- Bracket options available for mounting consideration (*See EZ Mount catalog pages).*
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement torque to 4 in-lbs (0.45 N-m).

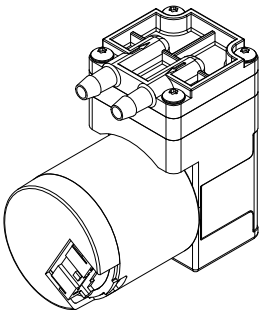
Port Connections:

- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

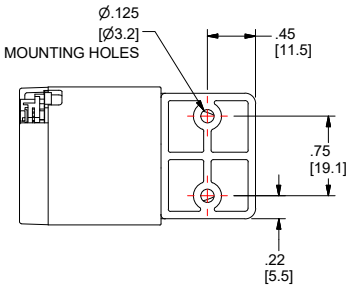
BTX-Connect Miniature Diaphragm Pump
Mechanical Drawings



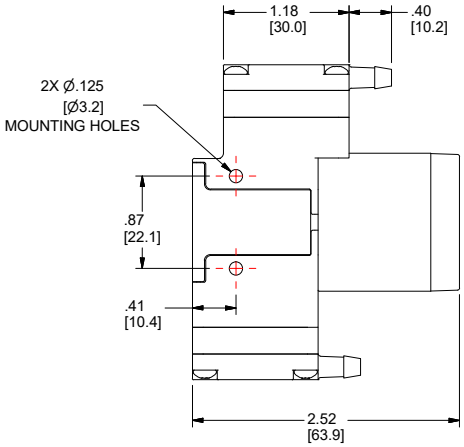


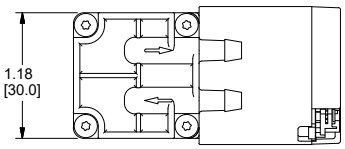


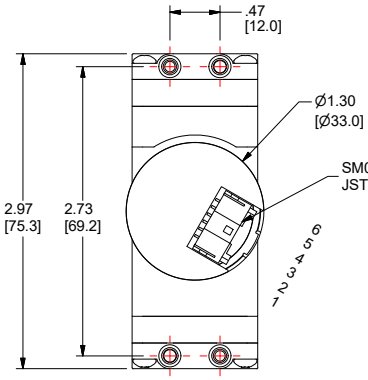
NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

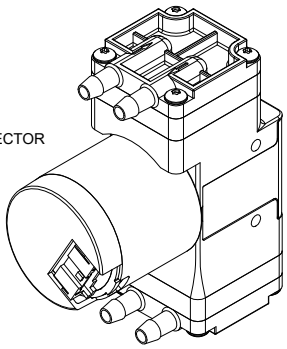


UNITS
IN [mm]









UNITS
IN [mm]

	PIN OUT
1	TACH
2	PWM / EVC
3	V+
4	GROUND
5	UART
6	UART

NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

BTX-Connect Miniature Diaphragm Pump
Electrical Integration and Motor Control

Motor Electrical Connection

Intregrated Electrical Connector	Male pin JST PAP-06V-S
Recommended Mating Connector	Manufacturer: JST Housing Part Number: PAP-06V-S Terminal Part Number: SPHD-001T-P0.5
Recommended Wire	22 AWM Stranded Wire

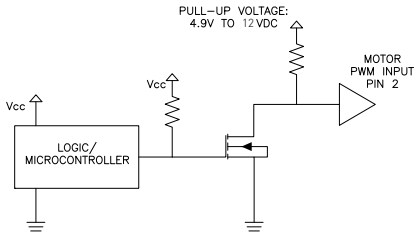
BTX-Connect Motor Control Options

The motor control feature is factory selected in 4 speed control modes: On/Off control, PWM input, 0-5Vdc input or UART Serial port mode. These modes are described in detail in the Application Notes section. The Tachometer signal is always enabled.

PWM Control Electrical Details

On Board Motor Circuit	1kΩ to +5VDC weak pull-up enabled on micro-controller 5.1VDC Zener diode limits voltage to micro-controller
User Control Circuit	User must pull the 5 VDC signal to ground, 0.8 VDC low threshold. MOSFET transistor circuit is recommended as shown in the example below

User PWM Control Circuit Example



0-5VDC Control Electrical Details

On Board Motor Circuit	1kΩ to +5VDC weak pull-up enabled on micro-controller 5.1VDC Zener diode limits voltage to micro-controller If the input is disconnected (floating input) it is normal for the pump to operate very slowly, less than 100 RPM or completely off.
User Control Circuit	User must supply 0 to 5 VDC analog signal for control

Tachometer Electrical Details

Speed Signal Outupt	The feature is always on, regardless of speed control mode
Compact BLDC Signal	4 Pulses per rotation of the pump
Slotless BLDC Signal	1 Pulse per rotation of the pump
On Board Motor Circuit	0 to 5 VDC square wave signal Low signal will be < 0.6VDC, High will be > 4.3VDC

UART Electrical Details

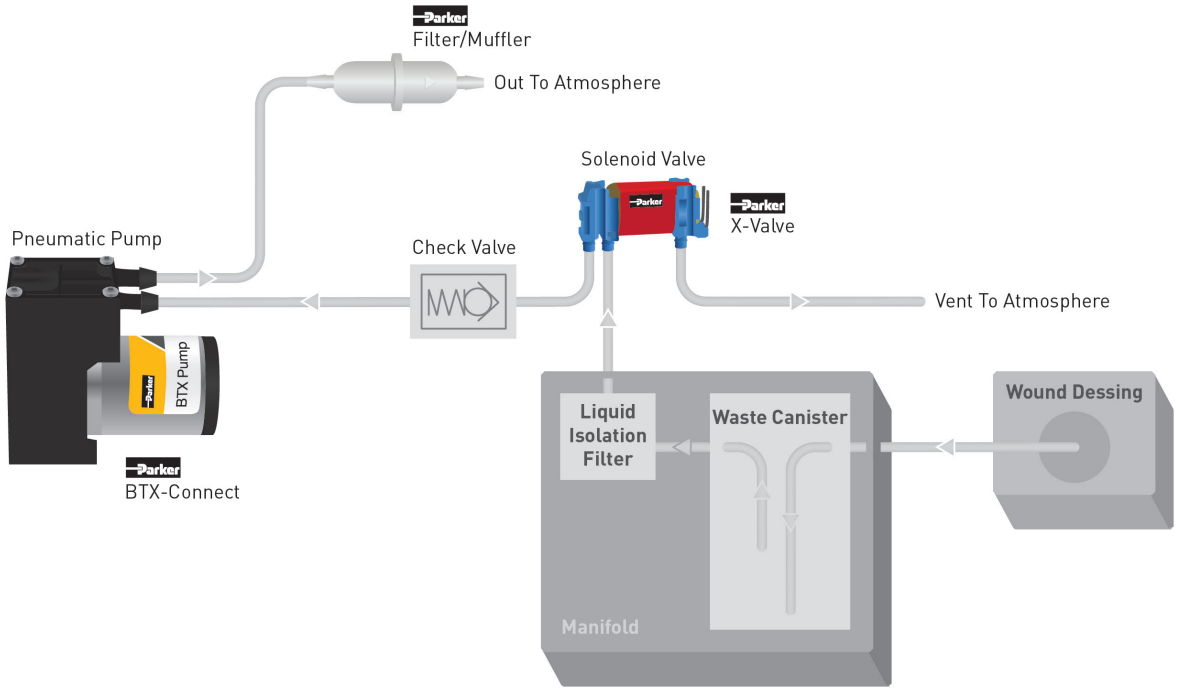
UART Voltage	5Vdc TTL UART Voltage
On Board Motor Circuit	UART Connection to PIC18F micro-controller
User Control Circuit	Recommended to use isolation, such as optocouplers to isolate motor electronics from user electronics. Parker uses a Microchip MCP2200 UART to USB transceiver IC and confirms it is compatible with the BTX-Connect motor

Do not connect motor electrical connector harness while power is applied (Hot Plugging). Arching in the connector may damage UART electronics.

BTX-Connect Miniature Diaphragm Pump

Typical Flow Diagrams

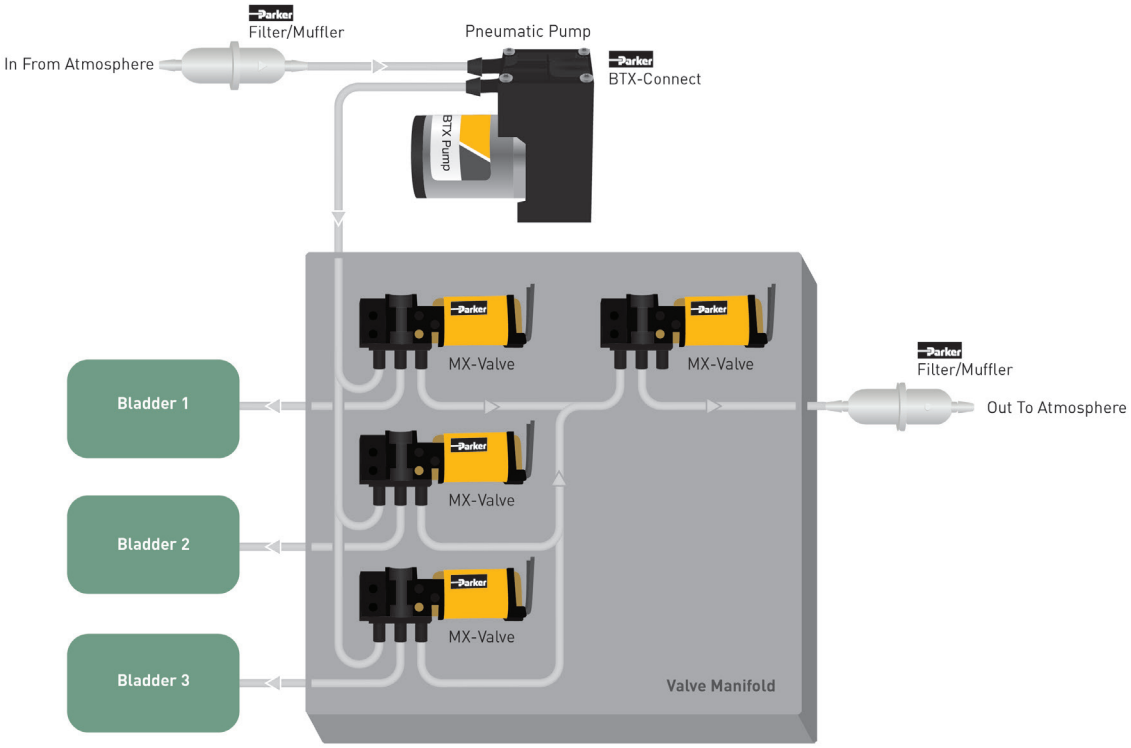
Negative Pressure Wound Therapy (NPWT)



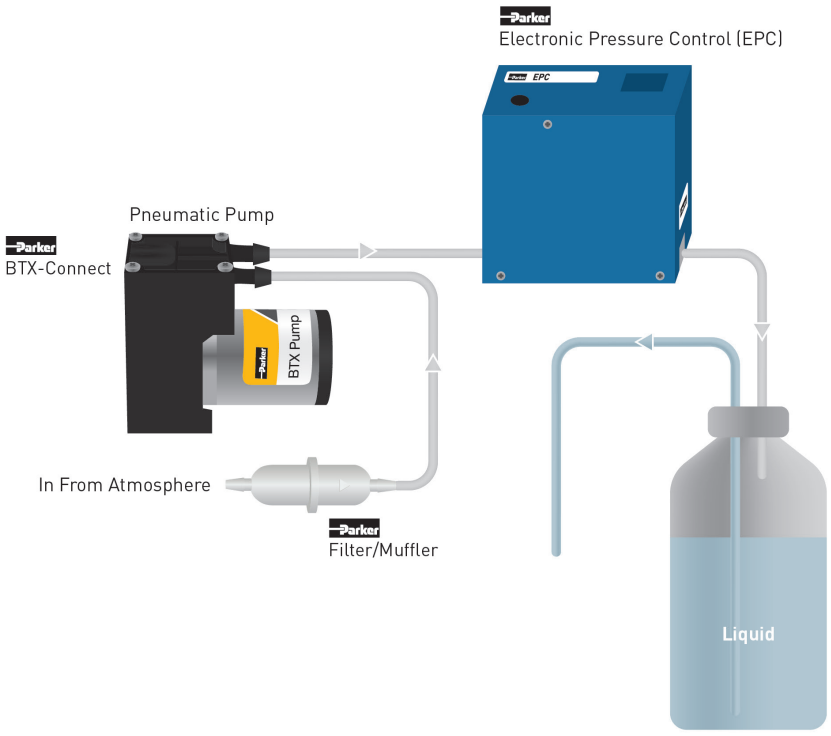
BTX-Connect Miniature Diaphragm Pump

Typical Flow Diagram

Compression Therapy Prevention (DVT)



Air-Over-Liquid Flow Control



BTX-Connect Miniature Diaphragm Pump

Application Notes

Connect Features and Instructions

The BTX-Connect offers many methods to control the pump, this is configured by the factory. However, in any configuration, the serial UART port can be accessed for pump information.

Speed Control Methods

Stored Speed Setting	With this configuartion, the pump speed is factory set, only ground and input voltage must be supplied. The speed can only be adjusted using UART command with this mode
PWM Input	A PWM signal is provided on the speed input to change pump speed, the motor has an internal pull-up, so only an open-collector or open-drain signal is required by the user When using this mode, the pump is set to 100% speed if the input is floating
Analog 0-5Vdc Control	0-5 Volt DC signal is applied to control speed. When using this mode, the pump is set to 0% speed if the input is floating
UART Control	The user will activate the pump and adjust the speed of the pump using the UART serial port channel, the pump will be off until the host sends a UART speed command

Serial UART Details

The BTX with Connect technology includes a UART Serial port that is available regardless of speed control mode. Communication with the pump allows a user to monitor pump performance and pump health. This provides more detail to the hosts system for more integrated pump management and error handling.

UART Syntax

1 Byte	4 bytes	1 byte	4 bytes	1 byte
$	GETS	,	TACH	#
Starting Flag	Command Type	Comma seperator	Command	Ending Flag

1 Byte	4 bytes	1 byte	4 bytes	1 byte	1 - 5 bytes	1 byte
$	CMDS	,	PWMS	,	75	#
Starting Flag	Command Type	Comma seperator	Parameter Name	Comma seperator	Input Parameter	Ending Flag

UART Configuration

Electrical Signal	5Vdc TTL Level*
Baud Rate	9600 bps
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None
Timing	Allow >20ms delay between messages

*For integration with RS232 or USB, a transeiver/converter is required

UART Command Set	**Command Sent to Motor**	**Response from Motor**	**Description**
Pump Heartbeat Message	No Command Required	$HB#	Pump will report a heartbeat message over UART every 20 seconds
Invalid Message Response	Incorrect Command or Sytax	$CMD:Error#	Response if an incompatible or incomplete message is sent to the pump

Control Commands	**Command Sent to Motor**	**Response from Motor**	**Description**
Set Pump Speed	$CMDS,PWMS,50#	$ACK,PWMS,50#	Set PWM Duty Cycle, <1 - 100 %>
Stop Pump	$CMDS,MSTP#	$ACK,MSTP#	Motor will stop
Restart Pump	$CMDS,MRST#	$ACK,MRST#	Pump will restart, will allow restart from fault

Status Commands	**Command Sent to Motor**	**Response from Motor**	**Description**
Read Approx. Current	$GETS,CURR#	$STAT,CURR,1100#	Pump reports approximate average motor current, reported in mA
Read Approx. Temp.	$GETS,TEMP#	$STAT,TEMP,50#	Pump reports approximate temperature on motor controller, reported in Celcius
Read Pump Speed	$GETS,TACH#	$STAT,TACH,3200#	Pump reports approximate pump speed in RPM
Read Set PWM Duty	$GETS,SDTY#	$STAT,SDTY,50#	Motor will restart
Read Pump Health	$GETS,HLTH#	$STAT,HLTH,Normal#	Motor will report "Normal" if no fault has occurred
		$STAT,HLTH,OverCurrent#	Motor will report "Over Current" if preset current limit has been reached and pump has stopped
		#STAT,HLTH,OverTemperature#	Motor will report "OverTemperature" if preset temperature limit has been reached and pump has stopped

BTX-Connect Miniature Diaphragm Pump

Application Notes

Chemical Compatibility Chart*

BTX-Connect	Chemical Compatibility of Wetted Path Materials	
Chemical	AEPDM	PBT
Air	1	1
Ozone (1000 ppm)	1	1
Oxygen	1	1
Ethylene (Ethene)	1	1
Methane	4	2
Nitrogen	1	1
Carbon Dioxide	2	1
Acetone (Vapor/Cleaning)	1	1(5%), 3(100%)

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. LIMITED
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Pulse Width Modulation (PWM)

Pulse-width modulation is a commonly used technique for controlling DC motors.

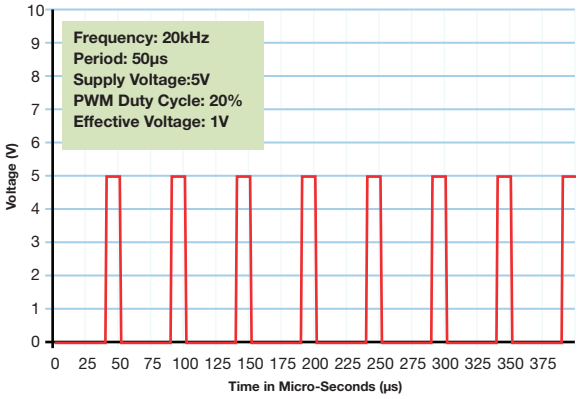
The average value of the voltage fed to the motor is controlled by turning a switch between the voltage supply and the motor on-and-off at a fast pace. The longer the switch is on compared to the off time, the higher the power supplied to the motor.

The PWM switching frequency varies for different types of devices, and is selected based on how it affects the device. For example, some applications require a faster switching frequency to prevent audible noise or electrical noise.

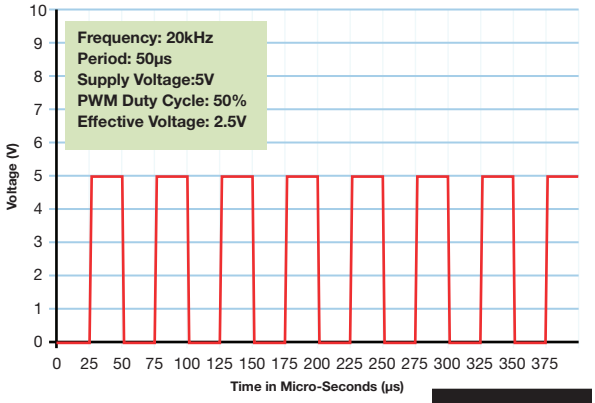
The term duty cycle describes the ratio of on-time to the period (one complete on-and-off cycle). Duty cycle is normally expressed as a percentage of on-time, 100% being full-power and 50% being half-power.

The advantage of PWM is the reduction of power-loss due to switching versus other control methods. Parker Hannifin recommends controlling the pump using 15kHz - 20 kHz frequency range.

20% PWM Example



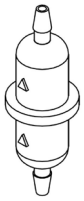
50% PWM Example



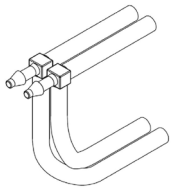
BTX-Connect Miniature Diaphragm Pump

Accessories Information

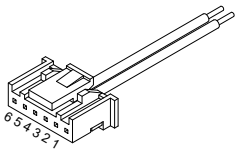
A Filter-Muffler is always recommended in the air inlet or outlet to reduce noise and risk of debris that may affect pump performance.
Parker recommends 40 micron or better filtration to be used with this pump series.



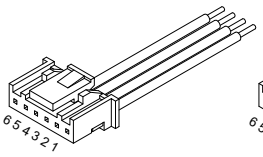
P/N: 00492-15
(10 micron Filter)



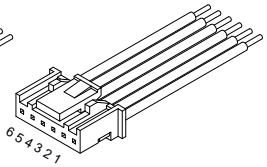
P/N: 01881-KT
(Parallel Tubing)



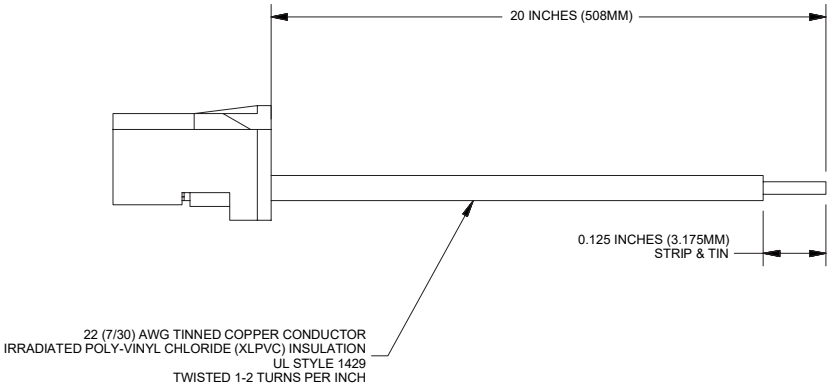
P/N: 02040-10
(2-Wire Harness)



P/N: 02042-10
(4-Wire Harness)



P/N: 02043-10
(6-Wire Harness)

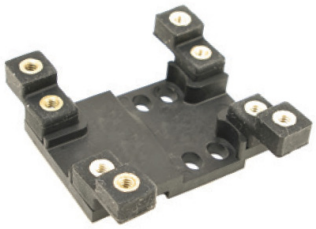


Connector Pin-out

	Color	Function
1	Blue	Tachometer
2	White	Speed Input
3	Red	Power V+
4	Black	Ground V-
5	Brown	UART Rx
6	Violet	UART Tx

BTX-Connect Miniature Diaphragm Pump

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic BTX Family of diaphragm pumps.

Features

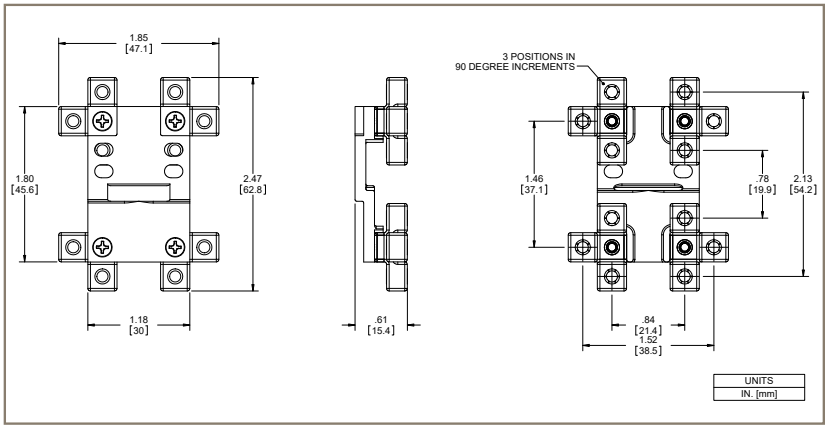
- Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.
- EZ Mount was designed to minimize weight added to the pump assembly. Approximate weight is: 0.63 oz (18 g).
- Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.
- Designed to keep height and size to a minimum.

Physical Properties

Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

- EZ Mount kits include all necessary hardware and detailed instructions.
- Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only) hardware and can be mounted in any of three ninety-degree planes.

Dimensions



EZ Mount for BTX with Compact Motor Single and Dual Head

Part Number	Style	Description
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

BTX-Connect Miniature Diaphragm Pump

Ordering Information

Configuration	Voltage	Motor Control	Speed at Free Flow	Part Number	-16 inHg -406 mmHg	-12 inHg -305 mmHg	-8 inHg -203 mmHg	-4 inHg -102 mmHg	0 Free Flow	4 PSIg 276 mbar	8 PSIg 552 mbar	12 PSIg 827 mbar	16 PSIg 1103 mbar	16 PSIg 1103 mbar
B1C BTX- Connect Single Head with Compact BLDC 	12	On/Off	3900	**B1C-050F12AN-00**	0.3	1.0	1.6	2.3	3.0	2.3	1.8	1.4	0.9	0.4
	24	On/Off	3900	**B1C-050F24AN-00**	0.4	1.0	1.6	2.3	3.1	2.3	1.8	1.4	1.0	0.5
	12	On/Off	4200	**B1C-090P12AN-00**	-	-	-	-	5.7	4.5	3.7	3.0	2.4	1.9
	12	PWM Input	4200	**B1C-090P12AN-03**	-	-	-	-	5.7	4.5	3.7	3.0	2.4	1.9
	12	On/Off	4200	**B1C-090V12AN-00**	1.5	2.5	3.5	4.7	5.8	-	-	-	-	-
	12	PWM Input	4200	**B1C-090V12AN-03**	1.5	2.5	3.5	4.7	5.8	-	-	-	-	-
	24	On/Off	4000	**B1C-090V24AN-00**	1.4	2.3	3.3	4.7	5.5	-	-	-	-	-
	24	On/Off	4000	**B1C-090P24AN-00**	-	-	-	-	5.5	4.3	3.4	2.6	2.1	1.7
B2C BTX- Connect Dual Head with Compact BLDC 	12	On/Off	4000	**B2C-050F12AN-00**	0.7	2.0	3.1	4.6	6.4	4.6	3.5	2.5	1.6	1.0
	24	On/Off	4000	**B2C-050F24AN-00**	0.7	1.9	3.0	4.4	6.2	4.6	3.5	2.5	1.6	1.0
	12	On/Off	3800	**B2C-070P12AN-00**	-	-	-	-	8.6	5.9	4.1	2.9	2.0	1.1
	12	On/Off	4000	**B2C-090V12AN-00**	2.2	3.6	5.4	7.7	9.8	-	-	-	-	-
	12	PWM Input	4000	**B2C-090V12AN-03**	2.2	3.6	5.4	7.7	9.8	-	-	-	-	-

Part Number Description

B	**1**	**C**	-	**090**	**P**	**12**	**A**	**N**	-	**00**
Model	**Pump Heads**	**Motor Type**		**Pump Offset**	**Diaphragm Configuration**	**Voltage**	**Materials**	**Tubing**		**Special**
B - BTX	1 - Single Head	C - Compact		050 - 0.050" Offset	F - Universal Pressure and Vacuum	12 - 12 Vdc	A - 80D AEPDM Diaphragm & low noise valves	N - None		00 - Factory set speed
	2 - Dual Head	S - Slotless		070 - 0.070" Offset	P - Pressure Only	24 - 24 Vdc	B - 80D AEPDM Diaphragm & 80D Valves	P - Parellel (dual head only)		01 - Digital UART speed control
				090 - 0.090" Offset	V - Vacuum Only					02 - Analog 0-5Vdc 03 - PWM speed control

Accessories Ordering Table

Part No.	Description	Comments
02040-10	2 Pin Wire Harness 20" (508mm) Long	2 Pin wire harness for on/off control only
02042-10	4 Pin Wire Harness 20" (508mm) Long	4 Pin wire harness for speed control and tachometer output
02043-10	6 Pin Wire Harness 20" (508mm) Long	6 Pin wire harness required for UART
00492-15	Filter-Muffler	Filter to 10 microns. Not included with pump
01881-KT	Tubing Assembly	As needed for parallel flow. Not included with pump

BTX-Connect Miniature Diaphragm Pump

Ordering Information

Please refer to sizing and selection chart for identifying which one will fit your application

Please click on the Order On-line button below (or go to www.parker.com/precisionfluidics/BTX-Connect) to configure your BTX-Connect Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory

2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

3. Life rating can vary depending on application and operating conditions.

4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

6. Inductance is an indicator of induced voltage with change in current and it is a key parameter to enable customers' low energy intrinsic safety systems

7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

BTX-Connect Miniature Diaphragm Pump

Serving a broad spectrum of life science, air quality, and process instrumentation OEM fluidic needs

Providing Pressure and Vacuum:
Broad range of diaphragm pumps for Gas and Liquid

Gas Flow Control:
High to Low Flow Proportional Valves

On/Off & Channel Selection Capabilities:
Gas and Liquid Solenoid Valves

High Precision Thermal Flow Control:
Mass Flow Controllers and Meters

BTX-Connect Miniature Diaphragm Pump

Learn More at: solutions.parker.com/BTX-Connect

Below are some common specifications that are helpful to have on hand to accelerate your product selection:

- Gas Type
- Maximum Flow Rate
- Inlet and Outlet Pressures
- Operating Temperature
- Standard Reference Conditions
- Process Connection Size and Type
- Set Point Signal
- Digital Communication Protocol Preferences

For more information call **+1 603 595 1500** or email **ppfinfo@parker.com**

Visit **www.parker.com/precisionfluidics**

Recommendations on application design and material selection are based on available technical data and are offered as suggestions only. Each user should conduct their own tests to determine the suitability for their own use. Parker offers no express or implied warranties concerning the form, fit, or function of a product in any application.

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