INSTRUCTION MANUAL

Mini-Star™
Miniature DC Peristaltic Pump

CONTENTS

ABOUT THIS MANUAL

The following symbols are used in this guide:

This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.

INTRODUCTION

A peristaltic pump is a type of positive displacement pump used for delivering a variety of fluids, especially clean, sterile or corrosive fluids. The fluid makes contact only with the interior of the flexible tubing and thus cannot contaminate or damage the pump. WPI's MiniStar™ peristaltic pump is easy to maintain and clean. It is compact and lightweight and can conveniently fit into almost any experimental setup. Its flowrate runs between 0.06 mL/min to 14.0 mL/min. The pump can be controlled by either a hand-held remote, an analog signal or via the RS485 communication port.

Typically, the flow rate of a peristaltic pump is determined by the diameter of the tubing and the rotation speed of the rotors (pump speed). It is advisable to use only the recommended peristaltic pump tubing that came with the unit. In general, silicone tubing has the longest durability thereby increasing the service lifetime. Silicone also has good chemical compatibility with aqueous and many organic solvents. On the other hand, fluoroelastomer tubing should be used when pumping halogenated solvents. Vinyl tubing should be used with known chemically compatibility solvents.

Notes and Warnings

CAUTION: Although the pump controller cable uses USB-like connectors, the circuitry for them is NOT USB. Do not plug the controller cable into a computer USB port or any other USB device — doing so may result in electrical damage to computer and/or pump, fire, personal injury, and will consequently void the factory warranty.

WARNING: CERTAIN SOLVENTS, SUCH AS STRONG DETERGENTS AND ACIDS, CAN PERMANENTLY DAMAGE THE PUMP. THE FOLLOWING PRACTICES MUST BE ADHERED TO IN ORDER TO AVOID LEAKAGE WHEN RUNNING THE PERISTALTIC PUMP.

- Always follow GLP safety rules when handling aggressive solvents.

- Pull a fresh section of tubing into the tubing fixtures regularly – once weekly if use is heavy. Change tubing immediately if it is visibly worn.

- Be sure the tubing used is compatible with the solution being pumped.

- A fresh section of tubing should be pulled through the pump rollers before the pump is left unattended.

- Switch off the power and unplug the power cord before changing the tubing.

WARNING: THERE ARE NO USER-SERVICEABLE PARTS INSIDE THE PUMP. UNAUTHORIZED MODIFICATION OR REPAIR WILL VOID THE WARRANTY.

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 11 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. For further details, please read the section entitled "Claims and Returns" on page 11 of this manual.

INSTRUMENT DESCRIPTION

The Mini-Star is a compact pump that can be used as a standalone device or mounted on a post. The pump is powered by a 12 V DC adapter that is connected to a jack on the rear panel. The pump can be controlled either with a handheld remote or with an analog signal from a computer.

⚠ **CAUTION**: Although the pump controller cable uses USB-like connectors, the circuitry for them is NOT USB. Do not plug the controller cable into a computer USB port or any other USB device — doing so may result in electrical damage to computer and/or pump, fire, personal injury, and will consequently void the factory warranty.

A DB15 socket in the rear panel provides the interface for the analog control module and for RS485 communication. The connection between the device and the DB15 socket has a higher priority over the handheld controller if both are present.
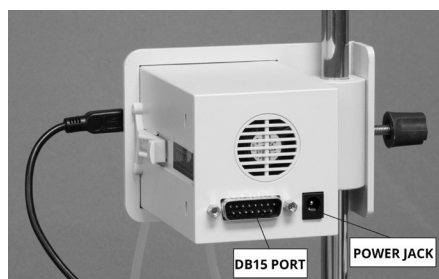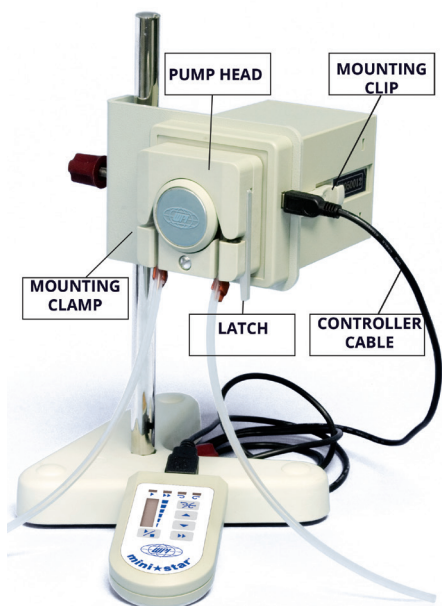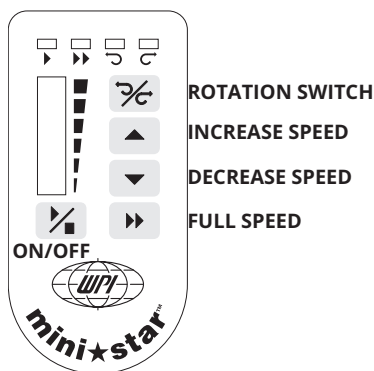
Tubing Installation

The maximum tubing outside diameter (OD) is 4.8 mm. As shown at right, pull up the latch to open the pump head. Pull the tubing through the tubing channel at the bottom of the pump head. Position the tubing in the middle of the rotor. Pull the tubing snugly against the rotor and move the tubing stops against the tubing channel openings. Push back the latch to close the pump head. The pump is now ready for operation.
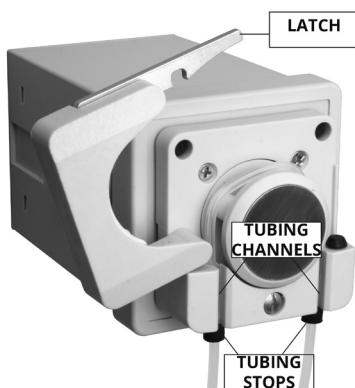
Handheld Controller

The handheld remote controller has five membrane function keys. Depress a key to activate each function as defined. There are also five status indicators. The On/Off Switch [⏯] turns the pump on or off as indicated by the top left LED. The Rotation Switch changes the direction of the rotor as indicated by LEDs above it. The pump speed is controlled by the keys for "Increase Speed" [▲] and "Decrease Speed" [▼]. Each key press will increase or decrease rotation by approximately 1 RPM. The LED array indicates the progression or regression of the speed, with each LED representing approximately 5 RPM. When the "Full Speed" key [⏩] is depressed, the pump runs at full speed as indicated by the LED with two arrows [⏩]. The other four function keys will not respond when depressed while in FULL SPEED mode. To reactivate those four keys again, just depress the "Full Speed" [⏩] key again once to stop the pump. The "Full Speed" provides a convenient way to purge the liquid and return to the pump to its original mode after purge.

Analog Control (Optional)

The analog input control provides precise control over the pump without using the technically advanced RS485 communication. WPI offers an external control module supporting analog signals of 0~5V. The pin connections in the module are enumerated below.

1. Rotation Speed Control: connect to an analog input (0~5V is the maximum rotation speed). Use analog ground (pin 4) for this.

2. "On/Off" Control: connect to a logical input. Low level (0 V) is "On" and high level (5 V) is "Off".

3. Rotation Direction Control: connect to a logical input. Low level is clockwise and high level is counterclockwise.

4. Analog Ground. For Pin 1 control (0~5V).

5. Logical Ground for pins 2 and 3. Do not connect logical ground to the analog ground.
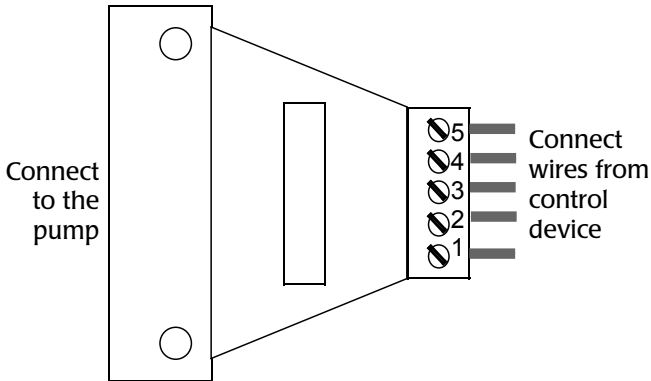
Computer Control (Optional)

The pump supports the technically advanced RS485 communication protocol through a DB15 plug. The communication protocol for the pump is given in the Appendix (see page 6). Users proficient in creating software applications (with LabView, C++ or similar tools) may wish to write their own control programs, but WPI does not provide support for this activity.

OPERATING INSTRUCTIONS

Appendix: RS485 Protocol

The number is in hexadecimal format.

1. DB15 hardware interface: DB15-3 = 485-A, DB15-2 = 485-B, ground = pins 9, 11

2. Communication format: start + command data + parity + stop
   - start: 1 bit, initiator
   - data: the command code
   - parity: 1 bit, data parity
   - stop: 1 bit, stopper
   - Speed: 1200bps

3. Command format: flag + addr + len + pdu + fcs
   - flag: E9H,

When sending data, all E8H is replaced with E8H 00H and all E9H is replaced with E8H 01H

When receiving data, E8H 00H is replaced back to E8H and E8H 01H is replaced back to E9H.

- · addr: one byte, the pump address (1-30). 31 is the broadcast address.
- · len: one byte, the length of pdu
- · pdu: command code
- · fcs: one byte, NOT OR of addr, len, pdu.

4. pdu format: command code
   · Set the rotation speed (RPM):

| Call | WJ | RPM, 2 byte | Full Speed, Start/Stop, 1 byte | Rotation Direction, 1 byte |

| Reply | WJ |

where WJ is the ASCII of the number 57H 4AH. The addr can be any pump address (0-30) or the broadcast address 31. When the broadcast address 31 is use, all pumps set the same and there is no reply.

Example: set a MiniStar pump (addr: 01) to clockwise rotation with speed 50.0 rpm. The command code is:

    E9 01 06 57 4A 01 F4 01 01 EF

where

    flag: E9H
    addr: 01H
    len: 06H

pdu: 57H 4AH 00H E8H 01H 01H (57H=W, 4AH=J, 01 F4H = 500, 01H = running, 01H = clockwise)

    fcs: EFH
    · Read the rotation speed (RPM):

| Call | RJ |

| Reply | RJ | RPM, 2 byte | Full Speed, Start/Stop, 1 byte | Rotation Direction, 1 Byte |

where RJ is the ASCII of the number 52H 4AH and addr can only be one of the pump address (1-30).
   · Set pump addr:

| Call | | WID | New addr, 1 byte |

| Reply | | WID |

where WID is the ASCII of the number 57H 49H 44H. The addr can be any pump address (0-30) or the broadcast address 31. When the broadcast address 31 is used, all pumps set the same and there is no reply.

•   Read pump addr:

Call	RID

Reply	RID

where RID is the ASCII of the number 52H 49H 44H and addr can only be one of the pump address (1-30).

5.   Settings
  •   Rotation speed is in the unit of 0.1 rpm. The maximum speed is 50.0 rpm (i.e., 01 F4H = 500)
  •   Full Speed, Start/Stop:

Low bit: 1 = start, 0 = stop

High bit: 1 = full speed, 0 = normal

Example: 01H = normal running
  •   Rotation Direction:

Low bit: 1 = clockwise, 0 = counter clockwise
  •   Default addr: 1.

Microbore Tubing

Tubing Sizes		1×1	2.4x0.8
Tubing Cross Sections (1:1)		●	○
Wall Thickness (mm)		1	0.8
Inner Diameter (mm)		1	2.4
Maximum Pressure (Mpa)	Continuous	0.1	
	Intermittent	0.1	

Flow Rates
1x1:   0.06 to 2.6 mL/min.
2.4x0.8:   0.35 to 14.0 mL/min.

MAINTENANCE

•   Loosen the tubing when pump is idle. The tubing can be deformed and subsequently lose elasticity if compressed for a prolonged period.

•   Keep the tubing and rotors clean. If any solvent (including water) spills on any parts of the pump or remote control, stop the pump and clean the solvent immediately.

ACCESSORIES

Part Number	Description
503121	Silicone Tubing with Stops, 2.4 mm ID x 0.8 mm wall x 1 m (5-pack)
503122	Silicone Tubing with Stops, 1 mm ID x 1 mm wall x 1 m (5-pack)

TROUBLESHOOTING

Issue	Possible Cause	Solution
Can not turn pump on. Fan not running.	Power line is not connected.	Check the power connections and plug in adapter to pump and AC outlet.
Pump is on, but no solution flows.	Tubing may be loose or damaged.	Pull to tighten the tubing. Make sure the Tubing Stop is tight against the tubing channel. Or replace the tubing.
Tubing moves or shifts around the head.	Tubing is not mounted properly.	Check the tubing size. Tighten the tubing if the tubing size is correct.
Pump suddenly stops.	Too much load.	Turn off immediately. Check to see if anything is stuck in the rotor. Try again after removing the blockage.

(!) CAUTION: Before servicing pump, replacing tubing or cleaning the pump, please ensure that the pump is switched off and unplugged from the power adapter.

NOTE: If you have a problem/issue with that falls outside the definitions of this troubleshooting section, contact the WPI Technical Support team at 941.371.1003 or technicalsupport@wpiinc.com.

SPECIFICATIONS

This unit conforms to the following specifications:

Number of Rollers	4
Number of Channels	1
Rotor Rotation	Clockwise or counterclockwise
Rotor Speed Range	1-50 rpm
Rotor Speed Resolution	0.1 rpm with RS485, 1 rpm otherwise
Tubing	OD < 4.8 mm. Wall Thickness 0.8~1.0 mm
Flow Rate Range	0.06-14.0 mL/min
Control	Manual, Analog or Computer (RS485, 1200 bps)
Work Environment	0-45°C, humility <80%
Power	12V DC (110/220 VAC adapter), < 10 W
Dimension	135x72x72 mm
Shipping Weight	0.5 kg (1 lb)

DECLARATION OF CONFORMITY

WORLD PRECISION INSTRUMENTS, INC.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258 USA
Telephone: (941) 371-1003 Fax: (941) 377-5428
e-mail wpi@wpiinc.com

DECLARATION OF CONFORMITY

We:

World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota FL 34240-9258
USA

as distributor of the apparatus listed, declare that the product:

Title: MINISTAR Peristaltic Pump

to which this declaration relates is in conformity with the following standards or other normative documents:

Safety: EN61010-1:2001

EMC: EN61326-1:2006
EN61326-2-3:2006

and therefore conforms with the protection requirements of Council Directive 2004/108/EC relating to electromagnetic compatibility and Council Directive 2006/95/EC relating to safety requirements.

Issued on: July 28, 2009

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Vice President of Manufacturing
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WARRANTY

WPI (World Precision Instruments) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. In some instances, photographic documentation may be required. Some items are time-sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.