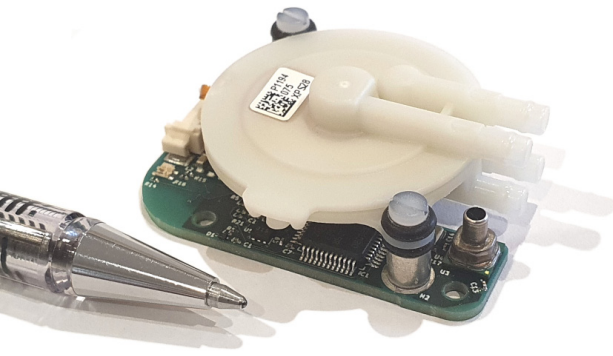


SPM-041 - SMART PUMP MODULE

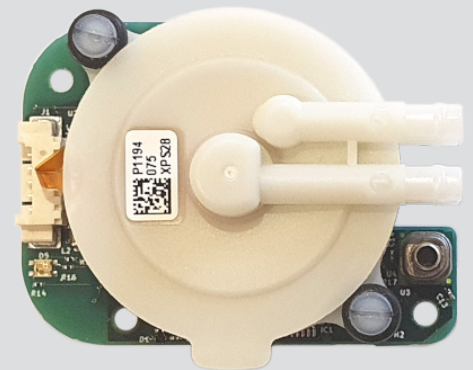


The SPM-041 Smart Pump Module combines our award-winning micropump, Disc Pump, with drive electronics and pressure sensing in a tightly-integrated package. It is controlled via a simple interface, with UART and I2C variants, and configurable control via analog input, providing maximum flexibility.

The module offers exceptional closed-loop pressure and vacuum regulation, benefiting from the high-precision control, pulsation-free output, wide dynamic range and rapid response speed of the pump. The module can be fitted with any of our BL, XP, LT and HP Series pumps.

Module Features

- Up to **600 mBar** pressure, **-400 mBar** vacuum or **2 L/min** flow depending on pump choice²
- Closed-loop pressure/vacuum regulation
- Compact and lightweight (**11g**)
- Simple five-wire interface
- Digital and analog control options
- No set up required: plug and play operation



Technology Features

- High-precision control
- Pulsation-free output
- Silent, vibration-free operation
- Millisecond response speed
- Durable, long-life operation

Operational

- Temperature range See relevant pump datasheet
- Humidity range⁴ 0 to 95% RH
- Pumping medium⁵ Air
- Noise level⁶ <10 dB (phon)
- Turn-down ratio⁷ Near infinite

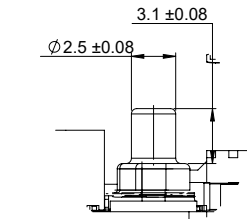
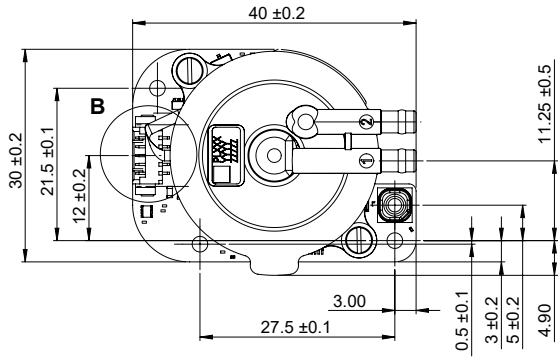
Control Interfaces

- UART or I2C³
- 0-3.3 V analog input
- Compatible with Ventus Pump Control App

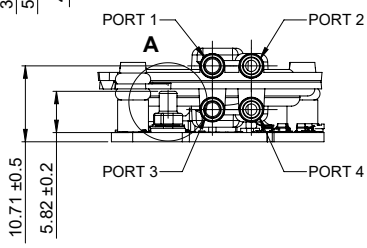
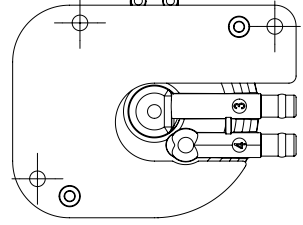
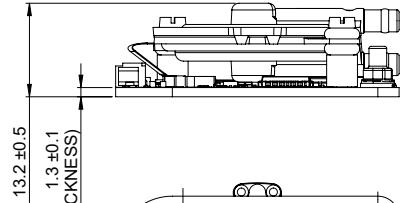
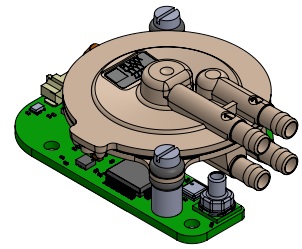
Control modes

- Power control
- Closed-loop pressure/vacuum control
- Bang-bang pressure control

MODULES FITTED WITH BL, XP OR LT SERIES PUMPS:



**DETAIL A
PRESSURE SENSOR PORT
SCALE 5 : 1**

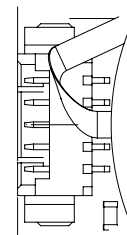


PORT CONFIGURATION

- FOR SERIES CONFIGURATION PUMPS:
 - LINK PORTS 2 AND 4
 - PORT 3 IS INLET AND PORT 1 IS DISCHARGE

- FOR PARALLEL CONFIGURATION PUMPS:
 - PORT 2 AND 4 ARE COMMON INLET
 - PORT 1 AND 3 ARE COMMON DISCHARGE

MOLEX PART # 532610571
1.25MM PITCH, PICOBLADE PCB HEADER,
SINGLE ROW, RIGHT-ANGLE, SURFACE
MOUNT, TIN (SN) PLATING, FRICTION LOCK,
5 CIRCUITS

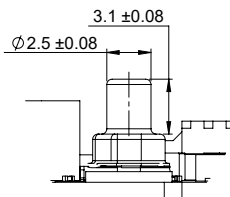
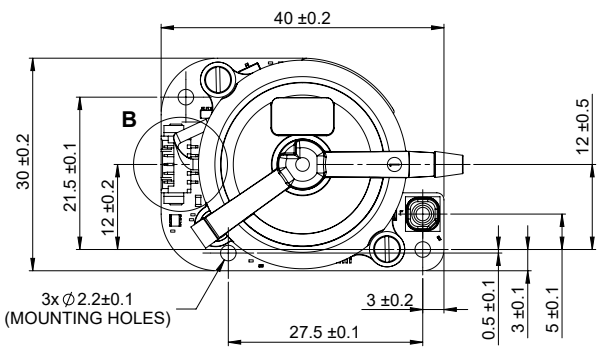


**DETAIL B
SCALE 5 : 1**

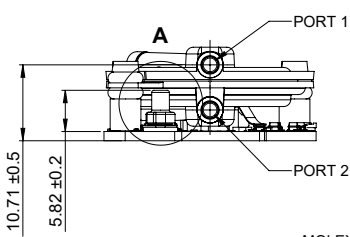
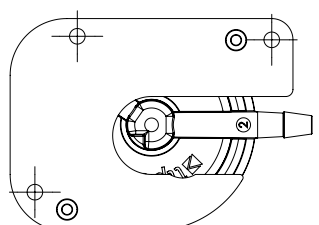
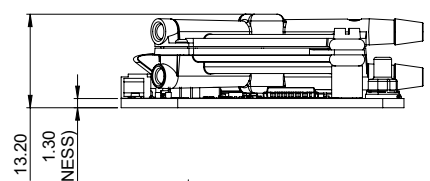
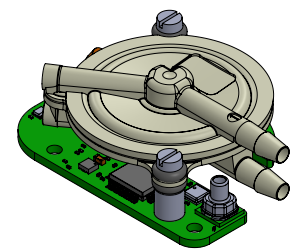
MOUNTING GUIDANCE

MOUNT IN ANY ORIENTATION
IF USING 3x MOUNTING HOLES ON PCB, IT IS
RECOMMENDED TO USE 3x NYLON M2 SCREWS.
NYLON WASHER OR STANDOFFS ARE RECOMMENDED TO
MAINTAIN A CLEARANCE TO THE UNDERSIDE OF THE PCB.
THIS MOUNTING SCHEME ISOLATES HIGH-FREQUENCY
VIBRATION AND PREVENTS AUDIBLE NOISE

MODULES FITTED WITH HP SERIES PUMPS:



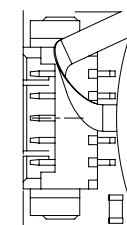
**DETAIL A
PRESSURE SENSOR PORT
SCALE 5 : 1**



PORT CONFIGURATION

- PORT 1 IS DISCHARGE
- PORT 2 IS INLET

MOLEX PART # 532610571
1.25MM PITCH, PICOBLADE PCB HEADER,
SINGLE ROW, RIGHT-ANGLE, SURFACE
MOUNT, TIN (SN) PLATING, FRICTION LOCK,
5 CIRCUITS



**DETAIL B
SCALE 5 : 1**

MOUNTING GUIDANCE

MOUNT IN ANY ORIENTATION
IF USING 3x MOUNTING HOLES ON PCB, IT IS
RECOMMENDED TO USE 3x NYLON M2 SCREWS.
NYLON WASHER OR STANDOFFS ARE RECOMMENDED TO
MAINTAIN A CLEARANCE TO THE UNDERSIDE OF THE PCB.
THIS MOUNTING SCHEME ISOLATES HIGH-FREQUENCY
VIBRATION AND PREVENTS AUDIBLE NOISE

MOUNTING GUIDANCE:

IF USING 3x MOUNTING HOLES ON PCB, IT IS RECOMMENDED TO USE 3x NYLON M2 SCREWS. NYLON WASHER OR STAND-OFFS ARE RECOMMENDED TO MAINTAIN A CLEARANCE TO THE UNDERSIDE OF THE PCB. THIS MOUNTING SCHEME ISOLATES HIGH-FREQUENCY VIBRATION AND PREVENTS AUDIBLE NOISE.

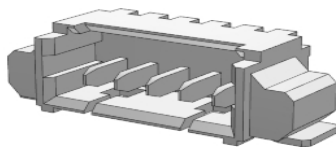
FILTRATION:

TTP VENTUS RECOMMENDS THE USE OF AN INLET FILTER WITH A PORE SIZE OF 3µm OR LESS IN ORDER TO PREVENT THE INGRESS OF PARTICULATES THAT MIGHT OTHERWISE LIMIT THE LIFETIME OF THE PUMP.

Electrical

- 5-wire interface:

1. VCC - 3.5 to 5.5 V supply
2. UART RX or I2C SDA (3.3 V)
3. UART TX or I2C SCL (3.3 V)
4. Ground
5. 0 to 3.3 V Analog In



Molex 53261-0571

For mating cable assemblies see:
<https://bit.ly/3mtVPh0>

- The integrated pump drive electronics provide an AC drive waveform of 20-22 kHz at 0 to 60 V peak. Power is limited between 0 and 1 W into pump (continuous operation) and up to 1.4 W (intermittent operation). Drive electronics also perform drive frequency optimisation. Drive efficiency depends on operating use case.

PUMP SELECTION

The table below summarises the peak performance across multiple models within each product line. Consult the individual datasheets for each product line to select the appropriate model for your application.

Product Line	Summary	Peak Pressure	Peak Flow	Peak Vacuum
BL Series	Entry-level pumps striking a balance between performance and cost.	> 300 mBar	> 1.65 L/min	> 200 mBar
XP Series	Highest performance and widest temperature range of -25 to +55 °C	> 400 mBar	> 2.00 L/min	> 300 mBar
LT Series	Long life models offering 5000+ hours' continuous operation.	> 270 mBar	> 1.20 L/min	> 220 mBar
HP Series	High differential pressure models.	> 600 mBar	> 0.10 L/min	> 400 mBar

ORDERING GUIDE

- When requesting a quote or placing an order, please specify the module product code and required pump model, e.g.

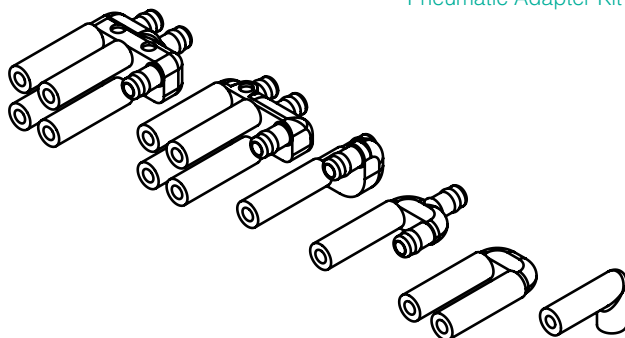
SPM-041 Smart Pump Module

XP-S2-028 XP Series Disc Pump

Optional extras

- **EK-01-0046 USB Power and Communication Cable** enables connection between the module and a host PC, providing power and enabling configuration, control and data-logging via the TTP Ventus Pump Control App.
- **EK-01-0006 USB Flash Drive** with Pump Control App, SPM manual, technical notes. and mechanical files. Note that items included on the flash drive can be downloaded from the TTP Ventus website.
- **EK-03-0052 SPM Prototype Pneumatic Adapter Kit** enables convenient connection between the pump and on-board pressure sensor. Note that the adapters are made via SLA / rapid prototyping, and are intended for prototyping and development purposes; they are not suitable for use in end products.

EK-03-0052 SPM Prototype
Pneumatic Adapter Kit



Notes

1. The SPM-041 module is not available for use in certain specific applications. Please discuss your application with us during the quotation stage.
2. See individual pump datasheets for pump performance.
3. Auto-detection function enables selection between I2C and UART. See User Manual for more information on auto-detection.
4. Non-condensing gases only; ingress of liquid-phase water will halt pump operation.
5. Liquid may be pumped indirectly in a "pressure-driven flow" / "air displacement" regime. Other gases / gaseous mixtures may be pumped. Contact TTP Ventus to discuss.
6. Per ISO 226:2003 and related studies, 30 cm measurement distance.
7. Disc Pump's piezoelectric drive actuator has no stall speed. The pump can be controlled continuously between 0 and 100% maximum output.
8. TTP Ventus recommends the use of an inlet filter with a pore size of 3µm or less in order to prevent the ingress of particulates that might otherwise limit the lifetime of the pump.

The information presented herein is based on engineering data and test results of nominal module prototype units. It is believed to be accurate and reliable and is offered as an aid to guide in the selection of TTP Ventus pump products and module prototypes. It is the responsibility of the customer to determine the suitability of the pump products and module prototypes for the intended use and the customer assumes all risk and liability whatsoever in connection therewith. TTP Ventus does not warrant, guarantee or assume any obligation or liability in connection with this information. Specifications may change without notice.