

Instruction Manual

IN-OPERANDO SYSTEM

Model : VTEC-trans

Revisions :

Revision	Date	Initials	Comments
0.1	Feb 3, 2022	G.A KANG	First Draft
1.0	Jan 15, 2023	G.A KANG	Update comments and pictures
1.1	Feb 20, 2024	G.A KANG	Update the contents.

References :

Ref No.	Documents ID	Initials

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1. About the instruction manual

Thank you for purchasing a PDC Technology product.

This instruction manual informs you about the installation and the safe handling and use of the instrument. Make sure that the instruction manual is easily accessible to all personnel involved with the instrument. Pay special attention to the safety instructions and warnings in the manual and on the instrument.

Symbols in this Instruction Manual

This instruction manual features the following symbols:



Warning :

This symbol calls attention to **the risk of accidental injuries or damage to goods**. Do not proceed until the indicated conditions for averting this threat are fully understood and met.



Hot or Cold :

This symbol calls attention to **hazards** caused by **hot or cold parts** of the instrument. Do not proceed until the indicated conditions for averting this threat are fully understood and met.

2. Safety Instructions

- Read this instruction manual before using VTEC-trans.
- Follow all information and instructions contained in this instruction manual to ensure the correct use and safe functioning of VTEC-trans.

2.1 General safety instructions

2.1.1 Liability

- This instruction manual does not claim to address all safety issues associated with the use of the instrument and samples. It is your responsibility to establish health and safety practices and determine the applicability of regulatory limitations.
- Operates VTEC-trans with Combined Controller from PDC Technology only.
- PDC Technology only warrants the proper functioning of VTEC-trans if no adjustments have been made to the mechanics and electronics.
- Only use VTEC-trans for the purpose described in this instruction manual. PDC Technology is not liable for damages caused by incorrect use of VTEC-trans.

2.1.2 Installation and Use

- VTEC-trans is not an explosion-proof instrument and therefore must not be operated in areas with risk of explosion.
- VTEC-trans must not be used with hazardous (e.g. explosive or poisonous) gasses.
- The installation procedure should only be carried out by authorized personnel who are familiar with the installation instructions.
- It is the responsibility of the customer to provide all the set-up (tubings, valves,..) necessary for proper work with VTEC-trans.
- Do not use any accessories or wearing parts other than those supplied or approved by PDC Technology.
- Make sure all operators are trained to use the instrument safely and correctly before starting any applicable operations.
- In case of damage or malfunction, do not continue operating VTEC-trans. Do not operate the instrument under conditions which could result in damage to goods and/or injuries and loss of life.
- Check VTEC-trans, especially the sample mounted parts, for chemical resistance to the samples and cleaning agents.
- Check the battery within its specification when charging and discharging.
- Never over charge the battery.



Hot or Cold :

During operation and even after turning off the instrument, temperatures at the stage can reach up to 70°C or down to -10°C. Make sure that the stage is at room temperature before handling it.



Warning :

Overcharging may lead to fire and irreversible deformation of the batteries. In operando(charging-discharging) measurement should be handled with care.

2.1.3 Maintenance and Service

- The results delivered by VTEC-trans not only depend on the correct function of the instrument, but also on various other factors. We therefore recommend having the results checked (e.g. plausibility tested) by skilled personnel before consequential actions are taken based on the results.
- Service and repair procedures may only be carried out by authorized personnel or by PDC Technology.

2.1.4 Disposal

- Concerning the disposal of VTEC-trans, observe the legal requirements in your country.

2.1.5 Returns

- For repairs send the VTEC-trans (excluding consumable) unit to PDC Technology, Korea. If the instrument cannot be cleaned from residues, material safety data sheets for all contaminants must be sent together with the instrument.

2.1.6 Precautions for samples and Cleaning Agents

- Observe and adhere to your national safety regulations for handling the measured samples (e.g. use of safety goggles, gloves, respiratory protection etc.).
- Only store the minimum required amount of sample, cleaning agents and other inflammable materials near VTEC-trans.
- Do not spill sample/cleaning agents or leave their containers uncovered. Immediately remove spilled sample/cleaning agents.
- Make sure that the setup location is sufficiently ventilated. The environment of VTEC-trans must be kept free of inflammable gasses and vapors.
- Connect the controller to the mains via a safety switch located at a safe distance from the instrument. In an emergency, turn off the power using this switch instead of the power switch on the controller.
- Supply a fire extinguisher unit.
- Ensure sufficient supervision of VTEC-trans during operation.

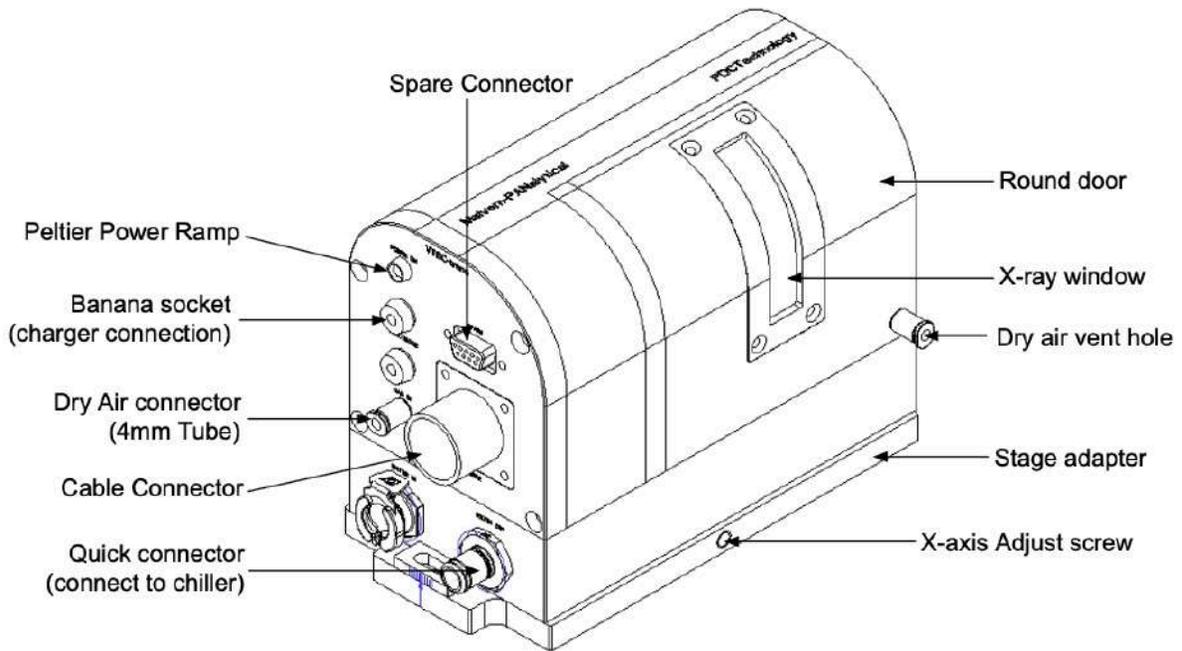
3. Overview

3.1 Purpose

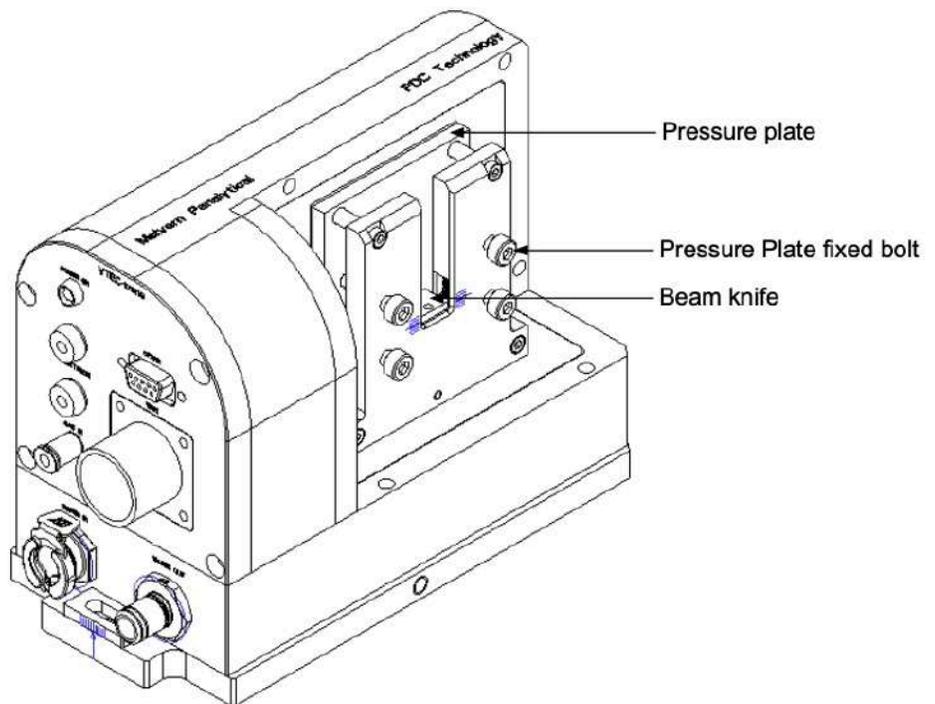
This is the In-operando Battery Test system developed to measure the electrode reactions which occur during charging and discharging with XRD.

3.2 Description

The size of the VTEC-trans is W105mm×D205mm×H136mm. This system is suitable for Research & Development. The VTEC-trans attachment is designed to mount on the Malvern Panalytical XRD System.



External view of VTEC-trans module



Internal view of Chamber module

4. Configuration

The standard configuration of the VTEC-trans consists of the following components.

4.1 Main Chamber

Dimension	W105mm×D205mm×H136mm
Chamber Internal Dimension	W35mm×D83mm×H108mm
Max. Sample Size	W60mm×D100mm×T9mm
Window Size (incident)	W5mm x H12mm
PI (Polyimide) Window	W5mm×D35mm×T20um
Z position for modular stage	around 21~25
Banana Socket	Ø4mm (2x)
Dry Air Tubing	Ø4mm Quick-fit
Spare Connector	Serial 9 pin

4.2 Round window

Dimension	W57mm×D118mm×H93mm
Window Size (detector)	W5mm x H54mm
PI (Polyimide) Window	W84mm×D35mm×T20um
Measurement Angle (2θ)	70°
Air Vent Tubing	Ø4mm Quick-fit

5. General specification

5.1 Main Chamber

Measurement Range	Transmission mode 2θ mode : Max. Measurement Angle 70°
Current Collector	Alligator Clip

Material of Insulator	Engineering plastic
Number of Poles	2 Poles
Temperature Range	-10°C ~ 70°C
Cooling Water Pressure	1 ~ 2 bar (Max. 2 bar)
Water Flow Rate	1~4 LPM (Max. 4 LPM)
Mass	3,850g

5.2 Controller

Input	Thermocouple (K)
Control Method	PID control with auto tuning or self tuning
Material of Insulator	The bigger one of $\pm 0.5\%$ of specified value or $\pm 0.9^\circ\text{C}$
Temperature Setting Range	-10°C ~ 70°C
Output Power	DC 24V $\pm 1\%$
Peltier Driving Capability	DC 24V 10A (maximum in regular time)
Operating Environment	Indoors
Operating Envir. Temp. Range	10°C ~ 40°C
Operating Envir. Humidity Range	85% or Less (No condensation)
Altitude	< 2000m
Storage Temp., Humidity	-10°C ~ 70°C, 10 ~ 80%
Ambient Pressure	1 HPA
Power Supply Voltage	7A / 115VA, 3.5A / 230VA
Power Consumption	115VAC or 230VAC $\pm 10\%$ (50/60Hz)
Controller Size	W435mm×D360mm×H177mm(4U)
Mass	10kg

6. Supplied Parts

VTEC-trans was tested and packed carefully before shipment. However, damage may occur during transport.

- Keep the packaging material (box, foam piece, transport protection) for possible returns or questions from the transport and insurance company.
- Check the delivery for completeness by comparing the supplied parts to those noted in the table below.
- If a part is missing or damaged, contact your local representative of the Malvern Panalytical in local or PDC Technology, Korea.
- If a part is damaged, contact the transport company and either the Malvern Panalytical in local or PDC Technology, Korea.

VIEW	Q'ty	DESCRIPTION
	1	<p>VTEC-trans module :</p> <ul style="list-style-type: none"> - Non-ambient chamber - Round cover
	1	<p>Stage adapter :</p> <ul style="list-style-type: none"> - The adapter for modular stage - Set screw : M6 x 15L - Set screw : M8 x 10L (2x) - Wrench bolt : M3 x 8L (4x) - Wrench bolt : M5 x 15L (2x) - Spring (2x)
	1	<p>Controller :</p> <ul style="list-style-type: none"> - Main controller - 19" Rack holder and Bolt

	<p>1</p>	<p>Cables :</p> <ul style="list-style-type: none"> - Power supply cable (5m) <p>Controller vs. VTEC-trans</p> <ul style="list-style-type: none"> - Liquid flow switch cable (5m) - USB/RS485 converter cable (1.5m) - USB extension cable (5m) - Power cable (1m)
	<p>1</p>	<p>Liquid flow switch :</p> <ul style="list-style-type: none"> - Liquid flow switch body - Ø8mm Quick-fit (2x) <p>(Already assembled on the body)</p>
	<p>1</p>	<p>Liquid regulator :</p> <ul style="list-style-type: none"> - Liquid regulator body - Ø8mm Quick-fit (2x) - Pressure Gauge - Bracket <p>(Assembly is needed)</p>
	<p>2</p>	<p>Divider T :</p> <ul style="list-style-type: none"> - ¼" T - Ø8mm Quick-fit - Ø13mm Barb fitting (2x) - Hose band (6x) <p>(Assembly is needed)</p>
	<p>1</p>	<p>Air flow meter :</p> <ul style="list-style-type: none"> - Air flow meter body - Ø6mm Quick-fit (2x) <p>(Already assembled on on the body)</p>

		<p>Coupling Connector :</p> <ul style="list-style-type: none"> - EU Standard Ø8mm Coupler - Quick-fit reducer : Ø8mm to Ø6mm
	<p>1</p>	<p>Ø8mm tube with one touch fitting :</p> <ul style="list-style-type: none"> - Ø8mm tube 10m (2x) - Male / Female quick connectors (Already assembled on on the Tube)
	<p>1</p>	<p>Accessories :</p> <ul style="list-style-type: none"> - Ball Wrench set - Ø4mm tube for air purge (10m) - Quick-fit reducer : Ø6mm to Ø4mm (2x) - Quick-fit plug : Ø4mm (2x) - USB/RS485 converter Driver CD - Wrench bolt : M3 x 10L (5x) - Manual <p>The accessories may be different from the pictures</p>

7. Installation

7.1 VTEC-trans Installation onto XRD stage.

Parts name :



'VTEC-trans body'



'Adapter'



'Set screw & Spring'



'controller'



'Power Supply Cable'



'RS485/USB converter Cable'



'Extension cable'

Before installing, please check the stage change procedure of the XRD equipment.

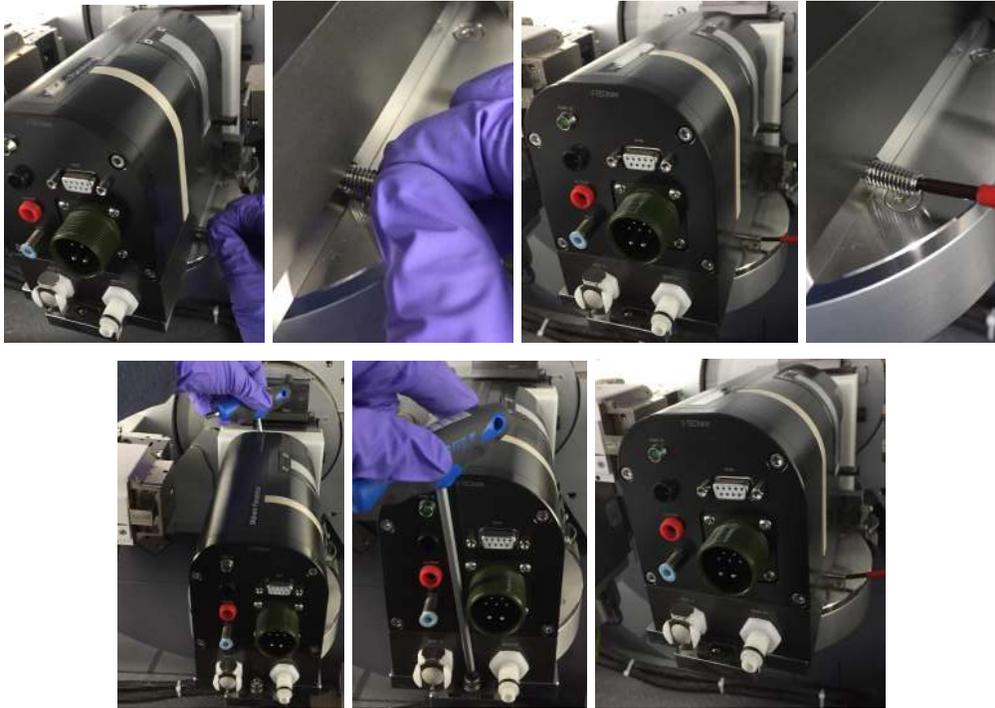
- a.** Mount the 'adapter' onto the XRD stage with 4 bolts(M3x10L).



- b.** Put the "VTEC-trans body' onto the 'adapter'. Insert the spring and fasten the set screw(M8x10L) onto the 'adapter'



- c.** Fasten the set screw(M6x15L) onto the 'adapter' and align the 'VTEC-trans body'. Fix the body 2 wrench bolts.(M5x15L)



- d.** Connect the 'VTEC-trans' and 'Controller' with the power supply cable.



- e.** Connect the 'controller' and 'computer' with 'RS485/USB converter Cable'.
If It is short, connect the extension cable.



7.2 Set up the Chiller System and Dry air for VTEC-trans.

Parts name :



'VTEC-trans body'



'Controller'



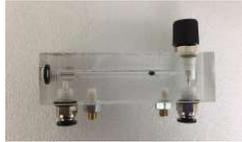
'Regulator'



'Flow switch'



'Extension cable
for Flow switch'



'Air flow meter'

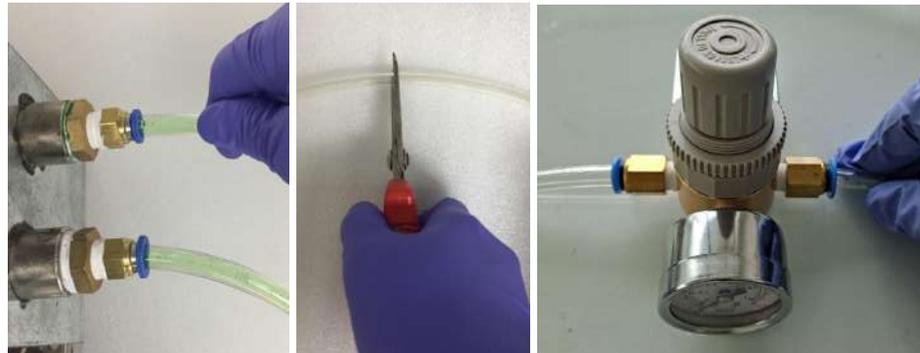


'Ø8mm tube'

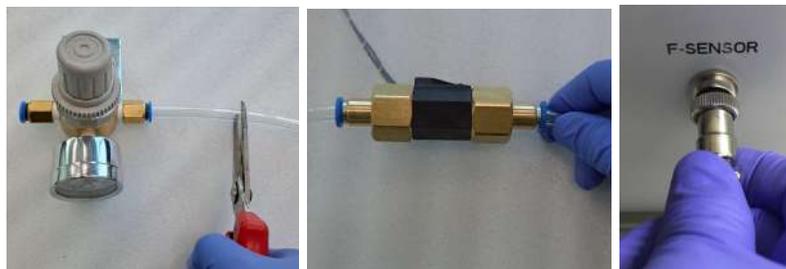


'Ø4mm tube'

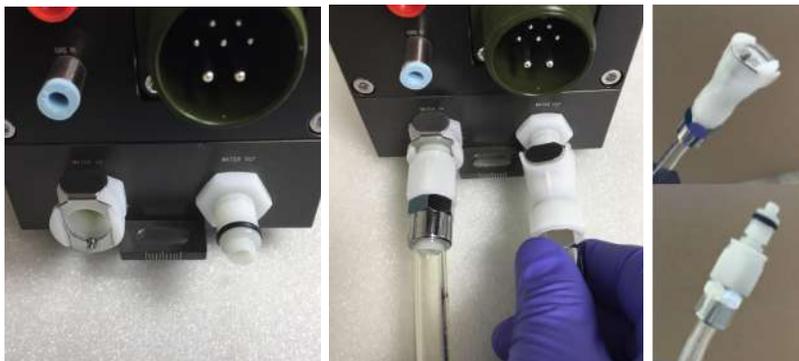
- a.** Connect a 'Chiller' and 'VTEC-trans' with a served 8mm Tube. Cut the supply line tube and connect the regulator on both sides of the cut tube.



- b.** Cut the line to the right side of the regulator and connect the flow switch on both sides of the cut tube. And connect the cable on the flow switch and controller. If It is short, connect the extension cable.



- c.** Connect the quick connectors to the VTEC-trans.

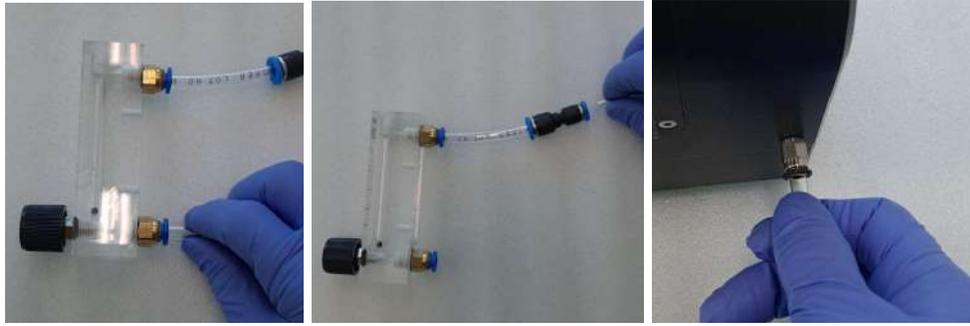


- d.** If you share the chiller with XRD source, use the divider T.

Caution :

- Pay attention to the flow direction of the switch.
- Place a chiller and the device at a minimum distance.
- Be sure to observe the following order (Supply line ⇒ regulator ⇒ flow switch ⇒ VTEC-trans ⇒ Return line).
- If use the divider T check the order below (Supply line ⇒ T splitter ⇒ regulator ⇒ flow switch ⇒ VTEC-trans ⇒ T splitter ⇒ Return line)

- e.** Connect the 'Dry air' and 'VTEC-trans' with the flow meter, Quick-reducer and the served 4mm Tube (It is needed when low temperature test).



7.2 Battery Cell Assembly



Hot or Cold :

During operation and even after turning off the instrument, temperatures at the stage can reach up to 70°C or down to -10°C. Make sure that the stage is at room temperature before handling it.

Before cell assembly or disassembly, please switch off the power supply of the temperature controller.

You need to prepare the pouch type sample. Its size should not exceed 60x100x5(thickness) mm(included leadtap).

Parts name :



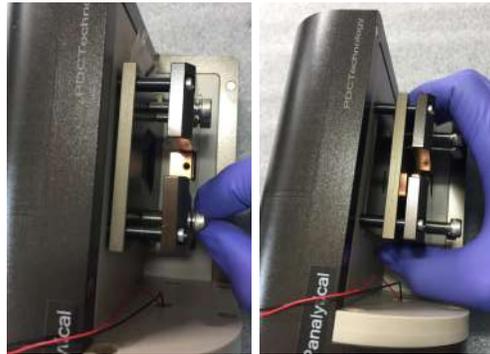
'VTEC-trans body'

'Pouch sample'

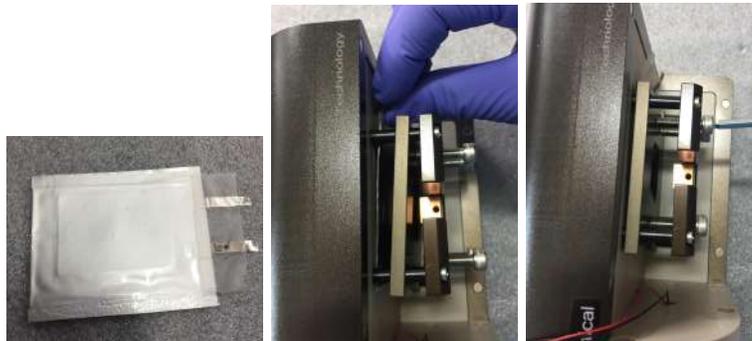
- a.** Open the cover. It is fixed with magnets.



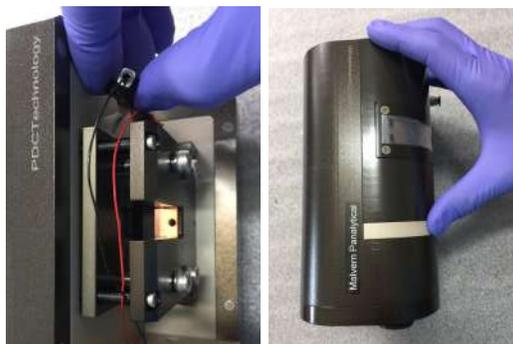
- b.** Loosen the 'pushed bolt'(X4) and open the 'push plate' to make space.



- c.** Insert the 'pouch sample' and fasten the 'pushed bolt'(X4)



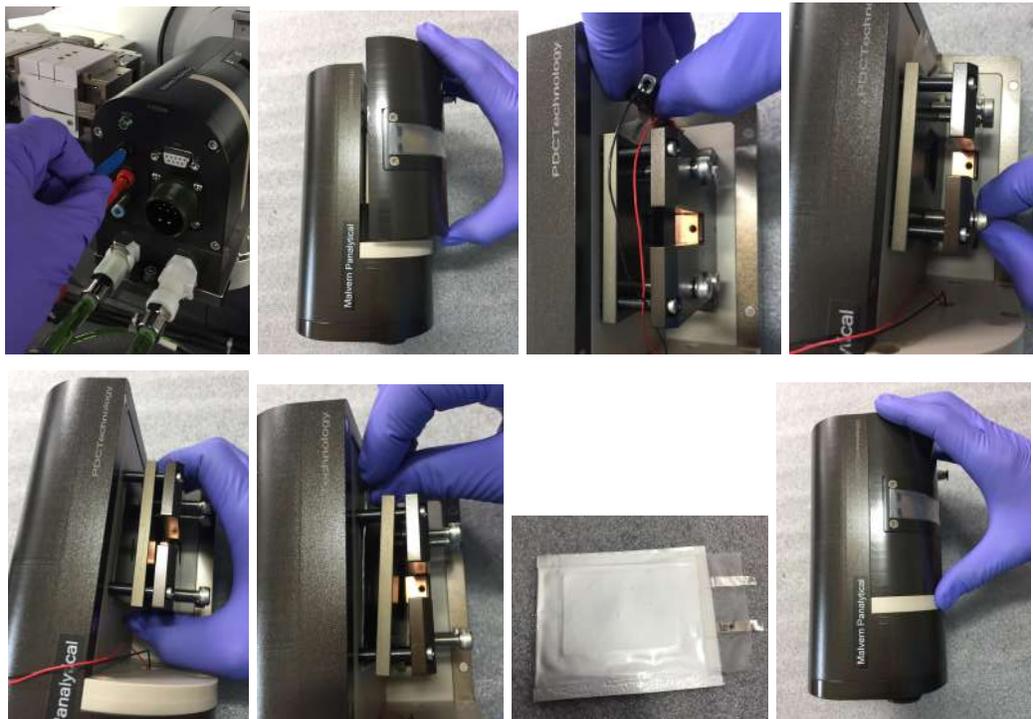
- d.** Connect the alligator clips to 'pouch sample' and close the cover.



- e.** Connect the banana plug which is the charge-discharge cable.



- f.** Disassembly is the reverse of assembly.



8. Operation

8.1 Chiller

- a.** Turn on the chiller. Push the switch on (The picture below is an example. It may vary depending on the chiller).



- b.** Set the temperature at 10°C using up/down keys.



- b.** Check the flow rate. It needs over 2 LPM. If the flow rate is low 2 LPM, the device doesn't work.



8.2 Dry air

This setting is for a low temperature test. If the test temperature is higher than ambient temperature, you don't need it.

- a.** Connect the air tube on the chamber (Ø4mm Quick-fit)



- b.** Remove the end cap.



- C.** Set the flow rate at 0.5 ~ 1 LPM.



8.3 Controller

This control device uses the P104, Eurotherm controller. For detailed controller uses, refer to the relevant manual.

8.3.1 Panel layout



- ← Measured Temperature (or Process Value 'PV')
- ← Target Temperature * (Setpoint 'SP')
- ← Output Power demand *

Beacons 1 2 3 4	
ALM	Alarm active (Red)
1	Lit when output 1 is ON (typically heating)
2	Lit when output 2 is ON (typically cooling)
3	Lit when output 3 is ON (P108 & P104 only)
4	Lit when output 4 is ON (typically alarm)
SPX	Alternative setpoint in use (SP2)
REM	Digital communications active (flashing)
MAN	Manual mode selected

Operator Buttons	
	Scroll button. Press to scroll forward through a list of parameters. Hold down to scroll continuously.
	Page button. Press to scroll back through a list of parameters. Hold down to select a different operating level. This button can be assigned a specific function - see 'P' code P73 section 5.2.18.
	Press to decrease a value.
	Press to increase a value.
Press and together to return to the operating display.	
F1	Function key 1
F2	Function key 2
These buttons are only available in P108 & P104. For functionality see section 5.2.18	

8.3.2 To set the target temperature

From the HOME display:-

Press to raise the setpoint

Press to lower the setpoint

The units (if configured *) are displayed briefly when either button is first pressed. If either button is pressed repeatedly the units are not displayed - it requires about 1 second between button presses for the units to be displayed again.

The new setpoint is entered when the button is released and is indicated by a brief flash of the display.

8.3.3 To start Auto-Tune

This device is set to Auto-tune when the chiller condition is 10°C / flow rate 2 LPM. If the above conditions change or the temperature control is not performed well, the 'Auto-tune' process of the controller should be performed. This process only needs to be performed the first time.

- a. Set the 'Tune Control Point(TCP)' that is below the formula.

$$TCP = \text{Initial PV} + 0.75 * (\text{Target Setpoint} - \text{Initial PV})$$
 Example : If Target Setpoint=70°C and Initial PV=20°C, then the TCP will be 57.5°C { $20 + 0.75 * (70 - 20) = 57.5$ }
- b. Select level 2.

Operation	Action	Indication	Notes
Select Level 2	<ol style="list-style-type: none"> 1. Press and hold until Goto is shown. 2. Press to choose LEu 2 (Level 2). 3. Press to enter. 		Choices are:- LEu 1 LEu 2 ConF
Enter the pass code (if configured)	<ol style="list-style-type: none"> 4. Press or to enter the correct pass code 5. Press to accept the value 6. The controller is now operating in Level 2 		The default pass code for level 2 is '2'. A special case exists if a security code has been configured as '0'. If this has been done it is not necessary to enter a code and the controller will enter the chosen level immediately.

c. Go to '**ALUn**' and set 'On'.

Press to scroll through a list of parameters. (Press to scroll back).

Press or to adjust the value of a selected parameter.

Press to accept the value

8.3.4 Manual Operation

a. Turn on the controller. Push the main power switch on. (The power of the controller is on, but the DC power for the poltier is not supplied)



b. Turn on the DC power. Turn clockwise the Peltier power switch on.



c. Set the target temperature.



9. Warranty

PDC Technology warrants its products to be free of defects in materials and workmanship, subject to the conditions set forth below, for a period of one year from the Date of Sale.

'Date of Sale' shall mean the date of the PDC Technology invoice issued on delivery of the product. The responsibility of PDC Technology in respect of this warranty is limited solely to product replacement or product repair at an authorized location only.

Determination of replacement or repair will be made by PDC Technology personnel or by personnel expressly authorized by PDC Technology for this purpose.

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