



Valco Instruments Co. Inc.

VICI Metronics Dynacalibrator® Model 120 Instruction Manual

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Introduction

Unpacking

Every Dynacalibrator® is completely calibrated, tested, inspected, and carefully packed prior to shipment from the VICI Metronics Inc. plant. Upon receipt of your unit, inspect the packages for visible evidence of damage to the shipment or its containers. Damaged shipments must remain with the original packaging for freight company inspection.

Check the packing list to make sure that the number of cartons received tallies with the packing list. The shipment should include the following:

- Dynacalibrator Model 120
- manual
- power cord
- forceps
- permeation device holder
- power inverter for operation from a 12-volt source

Permeation devices, if ordered, will ship separately. The permeation device shipping tubes, complete with the charcoal and desiccant packets, should be kept for storing the devices when they are not in service. If a device will not be used for at least a week and its total useful life is less than a year, leave it packaged and place it in cold storage to prolong its useful lifetime.

General Description

The Dynacalibrator Model 120 is a completely portable instrument for generating precise ppm or ppb concentrations of chemical compounds in a gas stream, using permeation devices as the trace gas source. It is designed for use as a reference for the calibration of instruments in the field of gas chromatography, verifying the accuracy of analytical data generated from air pollution monitoring, industrial hygiene surveys, odor survey programs, and tracer studies, and in other instruments that measure gas concentrations.

Since the Model 120 can be operated by its rechargeable lead-acid battery, by the 12 volt power inverter, or by any 110 VAC power source (220 VAC optional), it is suitable for field or laboratory use. The battery will power the instrument for up to 24 hours of continuous use (at lower temperatures) and can be fully charged in 12 hours.

The Model 120 contains an insulated, constant temperature permeation chamber which holds one or more permeation devices or one diffusion vial. (A schematic is shown in **Figure 1**, on the next page.) The chamber temperature, which controls the permeation or diffusion rate of the trace gas, is set and maintained by the digital temperature controller located on the front panel.

An internal pump generates an air stream which travels through an activated charcoal scrubber to create “zero” air for dilution. The flow of this dilution stream is regulated by the flow control knob and indicated by the dilution flowmeter. As the air enters the permeation chamber, it picks up and mixes with the permeant trace gas. The output mode control valve selects the exit route for the resulting mixture: (1) the span outlet alone, (2) the overflow vent alone, or (3) both the span outlet and the overflow vent. Calibration gas exiting the overflow vent is scrubbed via an external scrubber before being recycled into the environment.

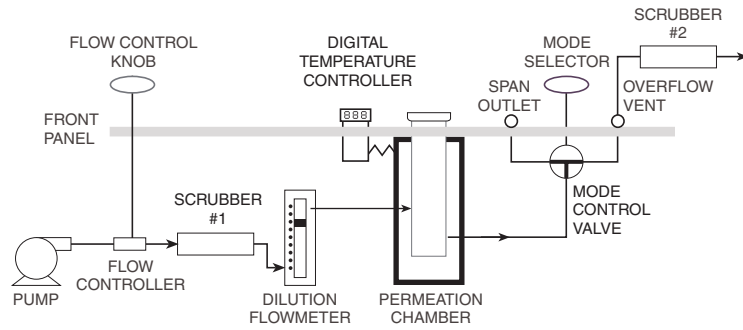


Figure 1: Dynacalibrator Model 120 schematic

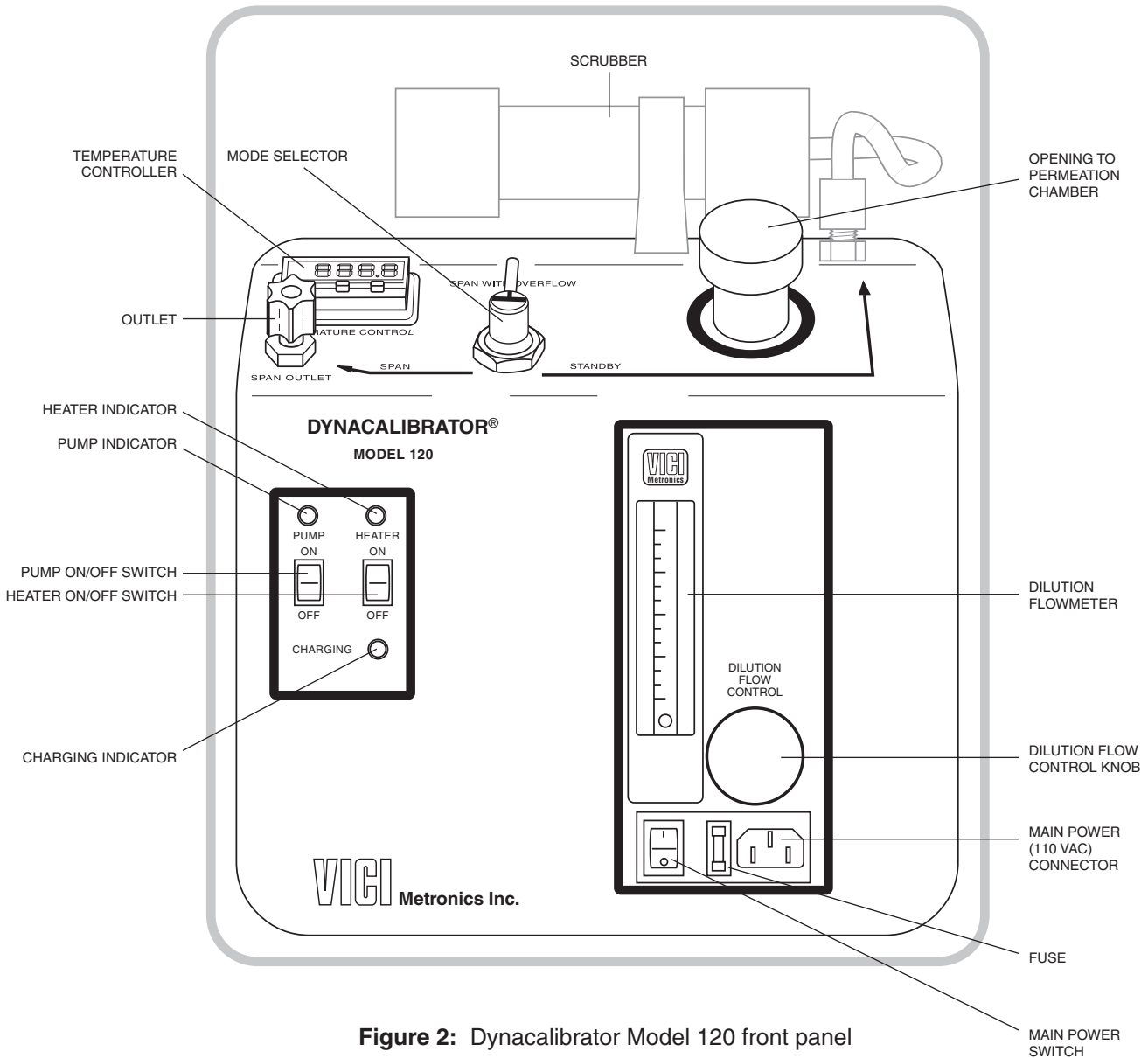


Figure 2: Dynacalibrator Model 120 front panel

Getting Started

Battery Information

The unit arrives with a fully charged battery. A red charging indicator indicates that the battery needs to be charged.

Charging the Battery

Plug the power cable into the main power connector on the front panel of the calibrator and into a 110 VAC power source (220 VAC with the Model 120-C), or into the power inverter plugged into a 12 VDC source.

A green charging indicator confirms charging activity. A fully discharged battery will take about 12 hours to be completely charged. The Dynacalibrator can be used while the battery is charging.

Enhancing Battery Charge Duration

At low temperatures, the battery can power the instrument for as long as 24 hours. At 100°C, the battery will power the instrument for about 4 hours. To increase battery life at 100°C operation:

1. Set a very low flow rate (~500 cc/min) when heating the system to its operating temperature. This will minimize the cooling effect of the air flow on the permeation chamber.
2. Preheat the system with the Dynacalibrator plugged into an AC power source. When the AC power cord is unplugged, the unit will automatically switch to battery operation.

Battery Maintenance

To maintain the battery in good condition, keep the unit fully charged or leave it charging continuously. The lead-acid battery does not exhibit the “memory effect” characteristic of nickel-cadmium batteries, and requires no further maintenance for optimum performance.

Output Modes

SPAN WITH OVERFLOW



Standby or equilibration mode

The span outlet is cut off; the total flow from the permeation chamber exits through the overflow vent to the scrubber.

SPAN WITH OVERFLOW



Monitors with sample pumps

The flow from the permeation chamber is routed to a tee, exiting through the span outlet *and* overflow vent.

SPAN WITH OVERFLOW



Passive monitors (those without sample pumps)

The overflow vent is cut off; the total flow from the permeation chamber exits through the span outlet.

Initial Equilibration

Refer to **Figure 2** as required.

1. With the battery fully charged or with the power cable connected to 110 VAC or 12 VDC source, turn on the main power at the main power switch. The temperature controller display will light up.
2. Turn on the pump and heater. The indicators will light up, indicating proper operation.
3. Use the mode selector to select STANDBY, forcing all the calibration gas to the overflow scrubber.
4. Use the dilution flow control knob to set the dilution flow to the lowest float setting on the flowmeter.
5. Use the UP and DOWN buttons under the display on the temperature controller to input the desired temperature (30° - 100°C). Keeping the button depressed will make the display change faster.



Make sure that the selected temperature is compatible with the permeation device that will be in use.

6. Place the permeation device in the permeation chamber, using the forceps if necessary. If you are using a wafer-type device, refer to the information on page 8.
7. Allow 30 minutes for the permeation chamber to equilibrate.

Calibration Connections

Passive Monitors (*without sample pump*)

If the sensor to be calibrated does not have a sample pump which will draw the calibration gas from the span outlet:

1. Connect a sample line from the span outlet to the monitor.
2. Switch the mode selector to SPAN, forcing all the calibration gas to exit at the span outlet.



An exhaust port must be provided downstream of the sensor so that there is no backpressure on the calibrator.

Fixed Sample Flow Monitors (*with sample pump*)

1. Connect a sample line from the span outlet to the monitor.
2. Switch the mode selector to SPAN WITH OVERFLOW, so that the calibration gas exits at the span outlet and at the scrubbed overflow vent.

Calculating the Concentration

A calibrated Dynacalibrator flow rate table is included in the certification documents shipped with the instrument. Use this flow rate and your device's permeation rate to calculate output concentration.

Concentration of the permeant compound in the span outlet stream is inversely proportional to the carrier flow rate through the chamber. It is determined using the following equation:

$$\text{Concentration (ppm)} = \frac{K * P}{F}$$

Where: K = 24.45 / molecular weight of gas
 P = permeation rate in ng/min (information included with the permeation device documentation)
 F = Chamber carrier flow (ml/min)

If the permeation rate is known for some reference temperature, the rate at a second temperature can be estimated as follows:

$$\log P = \log P_o + 0.034 (T - T_o)$$

Where: P_o = Permeation rate at reference temperature T_o
 P = New permeation rate at temperature T

Certified devices should be used only at the temperature specified on the certificate.



Using any permeation device beyond its recommended temperature range could result in the destruction of the device by explosion and/or changes in the membrane characteristics. If in doubt, contact VICI Metronics with the part number of the device to determine its maximum temperature limit.

Flow Correction Factor

When using the portable calibrator in an environment other than standard conditions, the flow must be corrected to standard temperature and pressure using the following formula:

$$\text{Flow} = (0.6262) F_c * \sqrt{(P / T)}$$

Where: Flow = indicated flow corrected to standard temperature and pressure. This corrects the flow to standard conditions when the flowmeter is at a different temperature and pressure.
 P = ambient pressure in mm Hg
 T = Flowmeter temperature in °Kelvin (273+C)
 F_c = Calibrated flow when the flowmeter is at standard conditions.

The following flow correction factor table can be used if the elevation is known. Find the elevation and temperature of your operational environment on this table and multiply this factor to the published calibrated flow. The calibrated flow is included in the certification documents shipped with the instrument.

Elevation	Temperature (°C)								
	0	5	10	15	20	25	30	35	40
-1000'	1.064	1.054	1.045	1.036	1.027	1.018	1.010	1.002	0.994
sea level	1.045	1.035	1.026	1.017	1.009	1.000	0.992	0.984	0.976
1000'	1.026	1.017	1.008	0.999	0.990	0.982	0.974	0.966	0.958
2000'	1.007	0.998	0.989	0.981	0.972	0.964	0.956	0.948	0.941
3000'	0.989	0.980	0.971	0.963	0.955	0.947	0.939	0.931	0.924
4000'	0.971	0.962	0.954	0.945	0.937	0.929	0.922	0.914	0.907
5000'	0.953	0.944	0.936	0.928	0.920	0.912	0.905	0.897	0.890

Figure 3: Flow correction factor table

Sample Calculation

Given:

Permeation rate: 21,000 ng/min Cl₂ @ 30°C

Flow: 1100 cc/min (from Flowmeter Table)

Ambient temperature: 15°C

Ambient pressure: (unknown), elevation = 2000'

Correct the flow per table above:

$$F = (0.981)(1100) = 1079 \text{ cc/min}$$

Then:

$$\begin{aligned} \text{Concentration (ppm)} &= \frac{K * P}{F} \\ &= \frac{(0.346)(21,000)}{1079} = \mathbf{6.75 \text{ ppm}} \end{aligned}$$

For zero reference measurement, remove the permeation device from the chamber.

Standby and Shutdown Procedures

Standby

1. When the Dynacalibrator is not in use, switch the mode control selector to the STANDBY position. This will divert all flow through the overflow vent and scrubber to atmosphere. The scrubber will filter the permeant gas so that no concentration of the permeant will escape out into environment.
2. Turn the flow control knob counterclockwise to set the pump at a minimum flow setting
3. Leave the permeation device in the permeation chamber to maintain equilibrium until you are ready to use the Model 120 again.

Shutdown

1. Remove the permeation device from the chamber and place it in the shipping tube with the charcoal packets. If the device will not be used for over 1 week and its total useful life is under 1 year, it is recommended that the device be placed in cold storage to prolong its useful life.
2. Recharge the battery if required.

Factory Repair Service

VICI provides complete repair and calibration services for Dynacalibrators. If service is required, contact the facility indicated below for authorization and repair specifics prior to returning your unit.

*North America, South America, and
Australia/Oceania*

VICI Metronics Inc.
tel: (877) 737-1887
fax: (360) 697-6682
metronics@vici.com

Europe, Asia, and Africa

VICI AG International
tel: Int + 41 41 925-6200
fax: Int + 41 41 925-6201
info@vici.ch

Equipment should be shipped in the original or equivalent packing materials, prepaid and insured. Include a complete written description of symptoms, problems, or calibration requirements, as well as the name and phone number of the person to contact for discussion of the required service. Upon receipt, VICI will inspect the equipment and advise the contact person of any unusual repair time or cost factors prior to starting the work. Repaired equipment will be returned with an invoice for any costs not covered by warranty.



Remove all permeation tubes from the chamber before packaging and shipping the Dynacalibrator

A Note on Wafer Devices

Wafer devices have only a small permeable window, or wafer, so permeation rates are typically an order of magnitude lower than rates for tubular devices. The Model 120 is supplied with a 1/4" ID x 3.5 cm length of PTFE tubing to be used as a spacer with VICI Metronics wafer devices. The spacer fits on the non-permeating end of the stainless steel wafer device body and lifts the device off the bottom of the permeation chamber and into the region of most accurate temperature control.

Wafer devices should be inserted spacer end first, with the wafer side facing up to allow the permeant gas to be released into the carrier flow downstream of the wafer body.

If you're using a wafer device in a Dynacalibrator with a Teflon chamber, you may find it difficult to remove the device from the chamber. In that situation, a useful trick is to invert the Dynacalibrator and allow the device to slide out by itself. This will not damage the device nor the Dynacalibrator.



CAUTION: Wafer devices are heavy and can damage a glass permeation chamber if they are carelessly dropped into the chamber. Use the forceps provided for careful placement of the wafer device in the chamber.

Warranty

This Limited Warranty gives the Buyer specific legal rights, and a Buyer may also have other rights that vary from state to state. For a period of 90 calendar days from the date of shipment, VICI Metronics Inc. (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace at Seller's option defective and/or nonconforming goods or parts (exclusions noted below) without charge for material or labor, subject to inspection FOB VICI Metronics Inc. factory. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or for consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods

This Limited Warranty does not cover:

- lamps or fuses
- damage due to improper shipping
- damage due to improper use
- damage due to modifications or alterations
- damage due to improper maintenance.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is VOID when repairs are performed by a nonauthorized service center or representative.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

This Limited Warranty supercedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.