

Conspec Controls, Inc.

P2621-NO2/VC

Nitrogen Dioxide Ventilation Fan Controller

Operations Manual

I) SYSTEM DESCRIPTION

Conspec's P2621-NO2/VC Nitrogen Dioxide (NO2) Monitor / Ventilation Controller is designed for use where ventilation fans are installed to prevent the accumulation of dangerous levels of Nitrogen Dioxide. Nitrogen Dioxide is a toxic byproduct of combustion and is contained in the exhaust of internal combustion engines. The P2621-NO2/VC utilizes a programmable micro-Controller combined with a high-quality electro-chemical Nitrogen Dioxide sensor to measure the NO2 level from 0-20ppm. The P2621-NO2/VC displays the NO2 level on the built-in LCD display, and activates a fan relay to ventilate the area when elevated concentrations (1 ppm) of NO2 are detected. The P2621-NO2/VC's audible alarm sounds if the NO2 level remains at an elevated level (3 ppm) for more than 15 minutes to signal nearby persons to leave the area. The P2621-NO2/VC continually self-tests the internal electronic circuitry and the sensor, and signals if a fault is detected. Front-panel LED indicators are provided for "Power", "Fan (ON)", "Alarm", and "Fail". The P2621-NO2/VC is factory tested and calibrated prior to shipment. Field calibrations are possible with the optional P1879-NO2 Calibration Kit and P2621-H handheld programmer module. The P2621-NO2/VC operate on 24VAC power and consumes less than .15W max.

The **P2621-NO2/VC's "Fan" relay** is operated in the failsafe mode where the relay coil is energized whenever the P2621-NO2/VC is in a non-alarm condition and the normally-open contact (terminal connections K1 & K2) is held closed. When any fault occurs the "Fan" relay is de-energized and the normally-open contact (terminal connections K1 & K2) falls open. The "Fan" relay is de-energized at start-up, when the NO2 level rises above 1ppm, when the internal diagnostics program detects a fault or when AC power to the unit is lost. The "Fan" relay is re-energized when the fault is cleared. The P2621-NO2/VC's programming holds the "Fan" relay de-energized for a minimum of three minutes once activated to prevent short-cycling of the exhaust fans.

The **P2621-NO2/VC's optional "Alarm" relay** (terminal connections K3 & K4) operates on the same principle as the internal audible alarm. The **audible alarm** is activated only after the NO2 level has exceeded 3ppm for 15 minutes. The audible alarm (and optional "Alarm" relay) deactivate when the NO2 level drops below 3ppm.

II) POWER REQUIREMENTS

Warning: The use of the P2621-NO2/VC unit with higher or lower voltages can damage the unit and cause improper operation or a hazardous condition.

The P2621-NO2/VC was engineered to be used with 24VAC power supply and a 24 VAC relay control circuit. The relay contacts are rated 5A@ 24VAC for use with an inductive load. If the installation requires a higher voltage or greater load capacity, replace the relay unit with an appropriately rated relay (or use a second relay between the control relay and the load). Power requirements for each P2621-NO2/VC are 24 VAC at 0.5 amps.

III) LOCATION & MOUNTING

The P2621-NO2/VC can be used to monitor up to 10,000 square feet of undivided area. It can be used as a self-contained, stand-alone control or as part of a multi sensor Control system. If the airflow is not uniform or if the area to be monitored is unusual, then the area by each unit should be appropriately reduced.

Select an appropriate mounting location in an area of heavy traffic flow, away from drafts and where the vent holes on the bottom of the unit will not be blocked. Mount the unit with four (4) screws using the external mounting feet provided. The unit should be at a convenient height, typically five (5) feet above the floor.

IV) INSTALLATION & WIRING

After mounting the unit(s) as described above, connect the power and relay wires as shown in INSTALLATION DIAGRAM page 9 of this manual. The power circuit and Control circuit of the unit(s) must be wired with 18 AWG or heavier copper wire. A multiple sensor installation requires only a simple series Connection of the fan Control relays. This feature allows for maximum flexibility in system design and installation. Zoned systems are easily created when several sets of fans need to be controlled independently.

1. Be sure to turn OFF power to fan Control system and 24 VAC power supply before wiring and Connections are made.
2. Open the enclosure using the provided hex-key. The Control card is mounted on the inside of the enclosure door. A terminal block for electrical Connections is located on the back panel of the monitor. The terminals are marked for power input and relay Connections.
3. The wiring must enter the P2621-NO2/VC enclosure through the two (2) electrical openings provided on the unit with conduit fittings.
4. Connect 24 VAC power supply to terminals T1 and T2 of the terminal block. Each P2621 unit requires 12 watts of power for proper operation.
5. Connect the relay (Control) Contacts K1 and K2 in series with the coil of the ventilation fan control, intermediate relay, or K1 and K2 of the next unit (for multiple units configuration). **NOTE: the P2621-NO2/VC must be wired so that the fans are ON when the relay contacts K1 and K2 are open.**
6. OPTIONAL ALARM RELAY- Connect the optional relay (alarm relay) Contacts K3 and K4, if so equipped, as shown in Installation Diagram page 9 of this manual.
7. Verify that the wiring to each unit is correct.

V) POWER UP & TESTING

1. Close the enclosure door and secure screws on the front panel.
2. Make sure power supply to the fan Control system is OFF. Turn ON the 24 VAC power to the P2621-NO2/VC unit.
3. The green POWER light should turn ON. The word –FAN- should appear in the LCD display. After several minutes the LCD display will display the current Nitrogen Dioxide (NO₂) reading in parts per million (ppm).

NOTE: After the P2621-NO₂/VC has been OFF, when power is restored to the unit, -FAN- will appear in the LCD display and the unit will run ventilation fan for several minutes to clear the air of accumulated Nitrogen Dioxide (NO₂) and then return to normal operation.

4. Turn OFF the power to the P2621-NO₂/VC. Turn ON the power to the ventilation fan Control system. Then turn on the power to the P2621-NO₂/VC. The green POWER light should turn ON. The word –FAN- should appear in the LCD display. After several minutes, the LCD will display the current Nitrogen Dioxide (NO₂) reading in ppm.

VI) Regular Maintenance

To ensure the sensor is operating correctly and performing proper gas detection, it is extremely important for the user to verify the sensor is responding correctly to the NO₂ gas at a regular interval. Conspec stipulates a gas injection into the sensor and verify the response of the sensor for every THREE MONTHS of operation.

To perform an actual gas verification, simply inject a known concentration of certified NO₂ test gas (recommended 10 PPM of NO₂ gas balance with Air) into the sensor. After injecting the test gas into the sensor for FOUR minutes, verify the reading displayed on the 3-digit LCD. If the reading displayed on the LCD is within 2% of the NO₂ gas injected (if 10 PPM of NO₂ Gas is used, then the reading should read between 8 to 12 PPM), then the sensor is operating correctly and no further calibration will be required. The user can also verify that the Controller is performing its Control function correctly by noticing the ventilation fan is turned ON when the gas reading exceeds 1 PPM. (If the 10 PPM NO₂ test gas is maintained into the sensor for more than 15 minutes, an audible piezo horn will be sounded). At the end of verification, if the user wishes to clear the alarm NO₂ condition faster, zero gas can be injected into the sensor for 2 minutes to purge the sensor.

At the end of four minutes after the test gas was injected into the sensor, if the reading on the 3-digit LCD deviates from the actual concentration of the test gas by more than 2%, then proper calibration of the sensor will be required. The user can purchase a calibration

kit (P1879-NO2/VC) from Conspec and follow the instructions to perform a calibration. The user may also send the unit to the distributor or directly to the factory for calibration.

VII) CALIBRATION PROCEDURE

NOTE: All Conspec Smart Gas Monitors are fully tested and calibrated before shipment. Calibration is the process of setting two distinct points for the Nitrogen Dioxide monitor to reference. All NO₂ readings are derived from these two reference points. The first reference point is referred to as “ZERO GAS” representing a total absence of NO₂ and is obtained by injecting zero air into the sensor. The seNO₂nd reference point is referred to as “SCALED GAS” and can be either half-scaled (½ of full range or 10ppm) or full scaled (full range or 20ppm) NO₂ and is obtained by injecting a known concentration of NO₂ into the sensor. The proper application of the calibration gases is essential to the correct operation of the P2621-NO2/VC.

Place the strap of the P1879-NO₂ Calibration Kit over the P2621-NO₂/VC so that the case hangs below the monitor. Use the supplied hex-key to loosen the tamper-proof screw in the lower left-hand corner of the P2621-NO₂/VC’s door. Use a standard flat blade screwdriver to loosen the remaining three door retaining screws. Open the door of the P2621-NO₂/VC and locate the 20 header-pin Connector marked “J2” in the middle of the left edge of the P2065 Smart Monitor Card. Plug the P2621-P programmer into the “J2” Connector on the P2065 card so that the “J2” graphic on the P2621-P plug is located uppermost. Open the top half-door of the P1879-NO₂ calibration kit and locate the P3013 calibration adapter. Insert the P3013 calibration adapter into the bottom of the P2057 NO₂ sensor by pushing upward while twisting. Install a 0.5 liter per minute regulator on each gas cylinder. Connect a 3’ section of flexible tubing onto the barb of each regulator. Follow instructions under “Manual Calibration.”

MANUAL CALIBRATION (This is Function “011” in CONFIGure Mode).

NOTE: DO NOT ENTER FUNCTION 11 UNLESS A GAS CALIBRATION IS TO BE PERFORMED. STEPPING THROUGH FUNCTION 11 WITHOUT APPLYING THE CALIBRATION GASES WILL ERASE THE PREVIOUS CALIBRATION SETTINGS RENDERING THE MONITOR INOPERATIVE UNTIL A PROPER CALIBRATION IS PERFORMED.

1. Depress the “CONFIG/4” Key for 2 seNO₂nds. The message “ENTER ACCESS CODE” will scroll across the 3 digit LCD .Press Key “4” once to remove the prompt. *The LCD will read “000”* (Waiting for operator to key in access CODE).
2. Press Key 3 once. *The LCD will read “001”* (Access CODE factory set.)
3. Press Key “4” twice to enter the Access CODE of “001”.*The message “CONSPEC Ver#” will scroll across the LCD* (Software Version Number).

4. Press Key "4" once to remove the prompt. *The LCD will read "000"* (Waiting for operator to key in function number to go to).
5. Press Key "2" once and Key "3" once. *The LCD will read "011"* (function number 11, Manual Calibration).
6. Press Key "4" twice to enter function 11. *The message "ZERO INPUT" will scroll across the 3 digit LCD.*
7. Press Key "4" once to remove the prompt.

**The LCD of the P2621-NO2/VC Monitor will display the 3 digit Analog to Digital NO2unt (ADC). The ADC has a possible range of 0 - 999 with typical values of "050" with ZERO AIR applied, "400 - 500" with 250ppm (Half-scale) NO2 GAS applied, or "800-999" with 500ppm (full scale) NO2 gas applied.*

8. Inject ZERO-AIR into the sensor. Wait approximately 2 minutes. The ADC should read approximately "050" with ZERO AIR flowing through the sensor. Press Key "4" once to accept the **ZERO GAS** calibration. *(If the reading on LCD is outside the range of 25 – 100, the monitor should be sent back to the factory for in-house calibration)*

The message "SCALED INPUT" will scroll across the LCD followed by the message "FULL SCALE INPUT".

9. Press the Key "CONFIG/4" once WHILE either message is scrolling depending on whether you are using Full (20ppm) or Scaled (10ppm) NO2 Cal-Gas.

**The LCD of the P2621-NO2/VC Monitor will display the 3 digit Analog to Digital Count (ADC).*

10. Remove the ZERO AIR and inject the NO2 CAL-GAS into the sensor. The ADC should climb as the sensor responds to the Cal-Gas (typically ~ 450 with 10ppm, or ~ 850 with 20ppm, if the reading is differed by more than 50%, sent the monitor back to the factory for in-house calibration). Wait approximately 2 minutes for the ADC to stabilize.

11. Press Key "4" once to accept the SCALED GAS calibration.

**The message "CONSPEC Ver#" will scroll across the LCD (Software Version Number).*

12. Press Key "4" once to remove the prompt.

**The LCD will read "000" (Waiting for operator to key in function number to go to).*

NOTE: If the operator wishes to check the alarms, leave NO₂ calibration gas flowing into the sensor, otherwise turn off the flow of NO₂ calibration gas and inject Zero Air into the sensor for 1 minute to purge the sensor of NO₂ before proceeding.

13. Press Key "3" once to enter function number "001" (Exit CONFIG mode). *The LCD will read "001".*

14. Press Key "4" twice to NO₂ confirm function 1 (Exit CONFIG mode).

15. The P2621-NO₂/VC returns to "Gas Monitoring Mode" with the LCD displaying the current NO₂ concentration.

VIII) SENSOR REPLACEMENT

The P2057 NO₂ sensor should be replaced when the displayed readings on the P2621-NO₂/VC become erratic or the unit can no longer be calibrated. Conspec recommends replacing all P2057 NO₂ sensors in service for 5 years as their continued operation is no longer assured. Use the supplied hex-key to loosen the tamper-proof screw in the lower left-hand corner of the P2621-NO₂/VC's door. Use a standard flat blade screwdriver to loosen the remaining three door retaining screws. Open the door of the P2621-NO₂/VC and unplug the P2057's 4-wire cable from the "J4" Connector on the P2065 Smart Monitor Card. Clip the wire tie securing the cable to the lower left-hand corner of the P2065 Smart Monitor Card and discard. Grasp the ring protruding from the bottom of the P2621-NO₂/VC and twist counter clockwise (as viewed from below) while holding the body of the P2057 inside the enclosure. Unscrew the outer ring (Note: the outer ring holds the dust screen in place inside the diffusion tube. When the outer ring is removed care should be taken to retain the dust screen if the P2057 is to be returned for sensor replacement) and remove the P2057 NO₂ sensor from the P2621-NO₂/VC enclosure. Installation of a new P2057 NO₂ sensor is accomplished in the reverse order.

NOTE: When a new P2057 NO₂ sensor is installed allow 10 minutes for the sensor to warm up.

IX) TROUBLE SHOOTING

1. No Lights On The Front Panel

Turn OFF the power to the P2621-NO₂/VC and to the fan Control system. Open the enclosure and check that the 24 VAC power supply wiring is securely attached to the terminals T1 and T2, and that the wiring from the Connector terminals to the circuit board is securely attached. Turn ON the 24 VAC power to the P2621-NO₂/VC. If the power light is OFF, using a voltmeter, measure the voltage between T1 and T2. The voltage should read close to 24 VAC. If it does not, the problem is in the power supply and not in the P2621-NO₂/VC. If there is 24 VAC across the T1 and T2 terminals and

the power light is off, return the P2621-NO2/VC to your supplier or CONSPEC factory for repair or replacement.

2. The Fan Does Not Operate When Fan Light (yellow light) is ON or
The Fan Does Not Turn OFF When The Fan Light (yellow light) is OFF

Turn OFF the power to the P2621 and to the fan Control system. Check that the field installed relay in the fan motor circuit is a (NC~ Normally Closed type.) Open the enclosure and check that the ventilation fan wiring is securely attached to the terminals K1 and K2, and that the wiring from the Connector terminals to the circuit board is securely attached. Disconnect the ventilation fan wiring from terminals K1 and K2. Using an ohmmeter, measure the resistance between terminals K1 and K2. The circuit should be open (high resistance). If the circuit is not open, return the P2621 to your supplier or CONSPEC for repair or replacement. Turn on the 24 VAC power to the P2621-NO2/VC and wait for -FAN- to appear in the display using an ohmmeter, measure the resistance between terminals K1 and K2. The circuit should be open (high resistance). If the circuit is not open, return the P2621 to your supplier or to CONSPEC for repair or replacement. With the 24VAC power to the P2621-NO2/VC turned OFF, wait for - FAN- to disappear from the display. Using an ohmmeter, measure the resistance between terminals K1 and K2. The circuit should be closed (low or zero resistance). If the circuit is not closed, return the P2621-NO2/VC to your supplier or CONSPEC for repair or replacement. If the above resistance checks between terminals K1 and K2 are fine, turn OFF the 24 VAC power to the P2621-NO2/VC and reconnect the fan Control wiring. Turn ON the 24 VAC power to the unit and fan Control system. Check the fan operation. If the fan does not operate properly the problem is in the ventilation fan Control system or the Connecting wiring.

3. Fault Light Is ON

Turn OFF the 24 VAC power to the P2621-NO2/VC then turn it ON. If power cycling does not remove the fault condition turn OFF the 24 VAC power and power to the ventilation fan Control system. Open the enclosure and check that the connector from the sensor is attached to the main board. Turn ON the 24 VAC power to the P2621-NO2/VC. If the above steps do not remove the fault condition, turn OFF the 24 VAC power to the P2621-NO2/VC and return the unit to your supplier or Conspec for repair or replacement. The sensor is factory calibrated and the P2621-NO2/VC is ready to install and use. An optional field calibration kit is available when local regulations require periodic calibration checks of the sensor. When the sensor is about to fail, the red fail LED will light intermittently and will light steadily when the sensor fails. If the sensor is not replaced the P2621 will turn on the fans and go into the fail mode. The plug-in sensor module must be replaced before the unit can be reset.

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VII) FIELD WIRING DIAGRAM

Analog Output (Optional)

Common ----- TB1 (COM) ----- P2065 (J5 COM)
4-20mA Signal ----- TB1 (SIG) ----- P2065 (J5 SIG)
15-30VDC ----- TB1 (+V) ----- P2065 (J5 +V)

NOTE: The standard Configuration for the P2065-1 includes a 110VAC power supply with an output of .7A @ 15VDC to power the monitor and options. The positive terminal of the power supply is Connected to TB1(+) and the negative terminal to TB1(NO2M).

The installer is not required to Connect an outside power source to TB1 on monitors NO2ntaining a power supply. The Analog Output is a 4-20mA Current Source.

Control Outputs (Optional)

Strobe (+) ----- TB1 (+V)
Strobe (-) ----- P2065 J3 (OUT 4) / **First Alarm**
Piezo (+) ----- TB1 (+V)
Piezo (-) ----- P2065 J3 (OUT 3) / **Second Alarm**

NOTE:

The Control Outputs are open-collector transistors limited to 100mA @ 30VDC. In use, the load's positive terminal is connected to the P2065-1's V+ terminal and the load's negative terminal is Connected to the J3 Connector on the P2065 card (OUT 4 for the First Alarm or OUT 3 for the Second Alarm). When the P2065-1 is in a normal condition the open collector transistors are turned off and the load is inactive. When the programmed alarm level is reached the open collector transistor is turned on providing a path to common, activating the load.

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