



## IOTA ONE<sup>®</sup>

The IOTA ONE<sup>®</sup> is a complete system for driving molecular beam pulsed sources for laser spectroscopy experiments. Supersonic carrier gas pulses for Helium, Argon, etc. can be controlled in place of “CW”, thus reducing the size and cost of high vacuum systems. Synchronizing the gas pulse with the laser pulse reduces the pumping size, increases the signal to noise ratio and lowers the temperature. Molecules are cooled without changing to liquid and therefore, higher peak intensities can be achieved due to the simpler spectra of cold molecules. Less sample is used.

The IOTA ONE can be rack mounted or used on a bench. Pulse duration ranges in microseconds, milliseconds or minutes can be selected. Both ON TIME and OFF TIME settings can be changed while running. Repetition rates up to 250 Hz are standard. The unit can be triggered both internally or externally and has “one shot” capability. Both input and output TTL signals are through the front panel BNC's. Also included: Shielded cable with the appropriate connectors.

# IOTA ONE<sup>®</sup>

## **OPERATING MANUAL AND SETUP INSTRUCTIONS**

*Please Read this Instruction  
Manual COMPLETELY Before  
Operating the System*



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## WARNING

Observe the following safety precautions.

1. **DO NOT** operate this unit with the top removed. Dangerously high voltage is present when Driver is active.
2. **DO NOT** connect or disconnect the valve cable at either end while the driver unit is turned “ON.”
3. **DO NOT** place any objects in front of the “VALVE” jack if the cable is not connected; there may be **250 VOLTS** present on the pins.

## EQUIPMENT/ACCESSORIES

1. General Valve Series 9 or 99 Flange Mount Pulse Valve
2. Driver Unit
3. 10 - foot connecting cable

## SET UP INSTRUCTIONS

Mount the pulse valve in the desired location. Position the driver unit within reach of the cable and attach it between the valve and the front panel jack labeled “VALVE.” Note that the cable is polarized at both ends and therefore can only be attached one way.

Once the driver and valve are connected, attach the AC line cord to the rear of the unit and plug into electrical current with the proper voltage.

When the unit is in operation, the driver triggers the valve with a pulse of approximately 275 volts (Direct Current).

## REPLACEMENT PARTS

### GV P/N

009-0997-100-001	O-Ring, Viton, Internal
009-0070-100-001	O-Ring, Kalrez, Internal
001-0044-020-001	O-Ring, Viton, External
001-0045-020-001	O-Ring, Kalrez, External
009-0280-050-2	Coil Assembly (Regular, 12 VDC)
009-0199-050-2	Coil Assembly (Regular, 24 VDC)
009-0181-050-2	Coil Assembly (Regular, 28 VDC)
009-0279-050-2	Coil Assembly (High Temperature)
007-0001-102-001	Spring (buffer)
007-0002-064-001	Spring (inside armature)

### For Valves with up to .50” Orifice (1.2 mm)

003-0023-050-002	Teflon Poppet
009-0185-020-002	Kel-F Poppet
099-0025-040-002	PPS Poppet
009-0595-020-002	Vespel Poppet
009-0181-031-2	Armature (plunger)

### For Valves with .060” to .078” Orifice (1.5 to 2 mm)

009-0440-030-002	Teflon Poppet
009-0441-030-002	Kel-F Poppet
009-0596-020-002	Vespel Poppet
009-0292-031-2	Armature (plunger)

The standard setting has switches 1, 6, and 7 OFF for a total pulse length of 180 microseconds. Ideally, the setting should be as short as possible while still yielding consistent results. The maximum setting should not exceed 320 microseconds.

The holding voltage for the valve is also set on the driver PC board with a 4-position jumper located at the front left. It is marked for 12, 20, 24, and 28 volt valves. Normally the jumper would be set for the coil voltage of the valve, but some valves meeting the conditions set forth above may require that the jumper be set for a lower voltage to prevent the valve from closing at the end of the high voltage pulse.

Instructions for opening the driver to obtain access to the holding voltage jumper and the DIP switch are on page 12 of the manual. For additional questions on changing these settings, or the circumstances under which changes might be necessary, please contact the factory at (800) 482-8258 or (973) 575-4844.

## REPLACEMENT PARTS

The replacement part numbers on the following page are the standards. All of the coil assemblies listed have ¼ inch compression fittings as the inlet to the valve. If your valve has a different fitting on the inlet or you would like to check the parts for a particular valve please call customer service at (973) 575-4844.

## LINE VOLTAGE

The IOTA ONE<sup>®</sup> Pulse Driver can be operated on four different AC line voltages:

- 100 VAC 50-60 Hz
- 115-120 VAC 50-60 Hz
- 220 VAC 50-60 Hz
- 230-240 VAC 50-60 Hz

This unit was adjusted for operation on 115-120 VAC unless otherwise specified. If you need to operate the unit on another voltage, follow the steps outlined in section *Voltage Adjustment*.

## VOLTAGE ADJUSTMENT

1. Turn unit off and remove plug from wall socket.
2. Remove electric cord from the AC input Module on the rear panel.
3. Slide window of fuse housing to the left to expose fuse and selector card.
4. Pull the lever marked “FUSE PULL” and remove the fuse from the unit. Leave the lever in the extreme left position to allow removal of the selector card.
5. Place a small screwdriver or other small tool in the hole visible in the center of the selector card (or CAREFULLY grasp the card with a pair of needle-nose pliers). Move the selector card from side to side as you work it out of the unit.

6. Position the card with the desired voltage selection right side up (facing you) and replace it in the unit.
7. Push the “FUSE PULL” lever all the way to the right (flush with the rear of the selector unit); then install the proper size 1 ¼” x ¼” fuse as follows:
 

• <b>100</b>	<b>VAC</b>	<b>1 ½ AMP</b>
• <b>115-120</b>	<b>VAC</b>	<b>1 ½ AMP</b>
• <b>220</b>	<b>VAC</b>	<b>¾ AMP</b>
• <b>230-240</b>	<b>VAC</b>	<b>¾ AMP</b>
8. Slide the window back to the right and replace the line cord.

## OPERATING INSTRUCTIONS (*Front Panel*)

### “ON-TIME” Section

1. INDICATOR – A green LED that lights whenever the valve is open. Note that the human eye may not respond to light pulses that are less than 3 milliseconds. The LED, therefore, may appear to be off during short pulses.
2. ERROR – A red LED that lights when the operating parameters are set outside allowable limits.
3. DURATION – A four-digit pushbutton digital switch that sets the “ON” (open) time of the valve reading from 0001 to 9999.
4. RANGE – A four-position pushbutton switch (ONE BUTTON MUST ALWAYS BE IN), which establishes the time range for the “DURATION” switch above: microseconds, milliseconds, seconds or minutes.

6. Reattach the power cord. The 28-volt supply has an automatic fold back current limit in the event of an overload on or through the driver board. Should this occur, the pilot light will go out, but the pulse LED’s will continue to function. To reset the power supply, turn the power switch off, correct the fault, then turn the power back on. (If the unit functions, but the pilot light does not illuminate, the bulb may be blown). The new driver board will provide virtually identical valve performance to the original.

## PULSE DRIVER SYSTEM SETTINGS FOR SPECIAL VALVES

The standard setting for the maximum length of the high voltage pulse is 180 microseconds. This setting has been found to be sufficient to operate most pulse valves consistently. Valves having an orifice larger than 1.0 mm and/or operating at higher pressure differentials (greater than 100 PSIG) may require a longer high voltage pulse to operate correctly. Units shipped after January 1, 1993 have an 8-position DIP switch on the driver PC board (on the right side of the chassis) that sets the length of this pulse. The base (minimum) length is 50 microseconds. Setting one or more of the DIP switches OFF adds to this base time setting. The values of the switches are as follows:

Switch #	Value (microseconds)
1	100
2	100
3	100
4	80
5	40
6	20
7	10
8	5

5. Remove fuse and replace with one of the proper size fuses (see page 4).
6. Slide window back to the right and replace line cord.

## DRIVER BOARD

This unit is equipped with a redesigned Driver Board. All DC power supplies are now referenced to chassis ground instead of floating. The high voltage for the initial pulse is now being generated on demand from the 28 volt supply rather than being drawn from a separate high voltage supply. Consequently, the high voltage (250-300 V DC) is not present in the unit or on the valve jack except during the initial firing pulse currently set for a maximum of 180 microseconds. The remainder of the pulse width selected, if any, is at a reduced holding voltage. The value of this holding voltage is dependent on the voltage rating of the valve. A jumper on the driver board should be positioned to match the valve rating. For units sold with a valve, this has already been done. Otherwise, it will be set for a 28 volt valve. If the valve to be used with the unit has a different voltage rating, then the jumper should be repositioned accordingly. To change this jumper, proceed as follows:

1. Turn the unit off and disconnect the power cord.
2. Remove the top cover by taking out the two screws on the back panel and sliding the cover to the rear.
3. The jumper block is on the front left-hand corner of the driver board. Move the jumper to the desired setting (they are labeled).
4. For reference, the settings from the front to the back are 12 V, 20 V, 24 V and 28 V.
5. Slide the cover back on and replace the retaining screws.

## “OFF TIME” Section

1. ERROR – A red LED that lights when the operating parameters are set outside of allowable limits.
2. INDICATOR – A yellow LED that lights when the valve is closed in the “ONE SHOT” mode and during the off interval in the “CYCLE” mode.
3. DURATION – A four-digit pushbutton digital switch that sets the off time (interval) of the valve or the frequency of oscillation in the INTERNAL CYCLE mode. **Please note that this switch contains a decimal point in the second position. Therefore, it reads 000.1 to 999.9.**
4. RANGE/FREQ. – A four position pushbutton switch (ONE BUTTON MUST ALWAYS BE IN) that determines the time range (milliseconds, seconds or minutes) or selects the frequency mode for the DURATION switch in #3 above.

## OTHER CONTROLS

1. START - This momentary contact pushbutton switch starts action in the INTERNAL mode by triggering a single pulse (ONE SHOT) or starting a series of pulses (CYCLE).
2. STOP - This momentary contact pushbutton switch stops action in the INTERNAL mode. In addition, it causes the program to “read” all of the control settings (DURATION SWITCHES, RANGE AND MODE SWITCHES).
3. INTERNAL/EXTERNAL – These four pushbuttons select the operating mode and signal sources for the system.

4. INPUT (TTL) – This BNC jack allows the unit to be triggered from an external source. The input signal should be low (0 volts) for off and high (+5 volts) for on.
5. SIGNAL – This green LED will flash in time with the external signal source.
6. OUTPUT (TTL) – A + 5 volt output is provided at this BNC jack whenever the valve driving circuit is active in any operating mode.
7. REMOTE – This jack allows attachment of an optional remote start and stop pushbutton.
8. POWER – A retained action switch to control the AC power to the unit. The face of this switch will light if proper AC voltage is present and the fuse is functional.

## OPERATING MODES

The IOTA ONE® Pulse Driver unit has four operating modes selected by depressing one of the four pushbuttons below the START and STOP buttons in the center of the front panel. One of these four buttons MUST always be depressed for the unit to operate; otherwise both ERROR lights will come on.

1. INTERNAL, ONE SHOT – One activating pulse whose length is determined by the ON TIME section will be directed to the external pulse valve each time the START button is pressed. Longer pulses may be aborted by pressing the STOP button.

2. FREQUENCY: As supplied, frequency can be set up to 250 Hertz. If you try to set the frequency in the OFF TIME section to more than 250 Hertz, or set the total period (ON and OFF TIME) to less than 4 milliseconds, an error condition results and both ERROR lights will come on.

When using the EXTERNAL ONE SHOT mode, it is important to remember that the “OFF TIME” section will function as a delay for the valve (relative to the rising edge of the input signal) if one of the three range buttons is depressed. A duration setting of 0000 will result in an OFF TIME error under these conditions. If no delay is desired, the “FREQ” button should be depressed.

## FUSES AND FUSE REPLACEMENT

### *AC Fuse*

If the “POWER” switch does not light when depressed and the unit is not working, then you should check to see if the proper voltage is available to the unit (line cord plugged into a live AC socket). If AC power is present and the unit still does not work, then check and, if necessary, replace the AC fuse as follows:

1. Turn unit off and remove plug from wall socket.
2. Remove line cord from socket on back of unit.
3. Slide window of fuse housing to left to expose fuse and voltage selector board.
4. Pull the lever marked FUSE PULL out to pop out fuse, then return lever to its original position.

## ERROR LIGHTS

ON TIME ERROR ONLY – All four duration digits are set to zero, or none of the range switches are depressed, or limit error.

OFF TIME ERROR ONLY – All four digits are set to zero, or none of the range switches are depressed, or limit error.

BOTH ERROR LIGHTS – None of the mode switches are depressed, or the time settings yield a duty cycle greater than 50 percent, or the time settings yield a frequency greater than 250 Hertz (LIMIT ERRORS).

Note: One or both of the error lights may come on when making changes to the time settings. If the resulting setting is within the operating limitations, then they will go out again.

## OPERATING NOTES

When setting up the ON TIME/OFF TIME parameters in the INTERNAL CYCLE mode, the following should be considered:

1. DUTY CYCLE: The ON TIME portion of the duty cycle can be up to 50 percent. The ON TIME may not exceed the OFF TIME. This is true whether you are setting an OFF TIME or an oscillating frequency. For example, if you set the ON TIME section for 100 milliseconds and the OFF TIME section for 99 milliseconds (or less) it would be more than 50 percent duty cycle and both ERROR lights would come on.

Similarly, if you set the ON TIME for 50 milliseconds and the frequency for 10.1 Hertz (or more), an ERROR condition would result.

2. INTERNAL, CYCLE – A train of pulses will be started when the START button is pressed and aborted when the STOP button is pressed. The ON TIME section will determine the open time of the valve, and the OFF TIME section will determine the interval between valve actuations.
3. EXTERNAL, ONE SHOT – A single pulse whose length is determined by the ON TIME section will be triggered EACH TIME a low (0 volts) to high (+5 volts) transition is applied to the External INPUT BNC jack and the FREQ button is depressed. Control of all but the ON TIME of the valve passes to the external signal source. If one of the OFF TIME range buttons is depressed instead of the FREQ button, then the setting on the OFF TIME thumbwheel switch will be read as a DELAY to triggering of the valve each time a signal is received (MINIMUM DELAY IS 1.0 MILLISECONDS). The START and STOP buttons do not function in this mode.
4. EXTERNAL CYCLE – In this mode the valve will open whenever +5 volts DC is applied to the INPUT jack, opening on the low-to-high transition and closing on the high-to-low transition. The START and STOP buttons do not function and all pulse parameters are controlled by the external signal source.

After switching from External Cycle mode to either internal mode, you must press the STOP button to reload the ON and OFF time settings, otherwise the START button will not function.

## DRIVER OPERATION

Turn the unit on. If AC voltage is present and the fuse is working, then the indicator on the face of the switch will light. One or both of the ERROR lights may come on if switch settings fall outside the limitations explained on the following pages, or if one switch in each bank is not depressed. Setting the ON TIME, OFF TIME, and the operation mode will cause those lights to go out.

Setting the ON TIME is accomplished by depressing an appropriate range switch button until it locks (THE REMAINING THREE SHOULD BE OUT WITH A BLACK FACE WHILE THE SELECTED BUTTON SHOULD HAVE A GREEN FACE). Then, set the desired time on the four-digit DURATION switch by pressing the button below a digit to add one, or the button above a digit to subtract one. Pressing the top button when a “0” appears in the window will result in a “9” appearing because the rotation of the switch is continuous. Each digit must be set individually to the desired number. The available ranges are as follows:

- **Microsecond**            **0005 to 9999**
- **Millisecond**            **0001 to 9999**
- **Second**                **0001 to 9999**
- **Minute**                **0001 to 9999**

Settings in the microsecond range below 5 will yield an electrical pulse of 5 microseconds.

If the ON TIME is set for 0000 or none of the range switches are depressed, the ERROR light will remain on and the START button will not function.

Maximum error in the electrical pulse is + 2 microseconds or .001 percent, whichever is greater.

Setting the OFF TIME is similar to setting the ON TIME. In this instance, the ranges are as follows:

- **Milliseconds**            **000.1 to 999.9**
- **Seconds**                **000.1 to 999.9**
- **Minutes**                **000.1 to 999.9**
- **Frequency**              **000.1 to 250.0 (HERTZ)**

One of these buttons must be fully depressed, or else the ERROR light will come on and the START button will not function. This will be true in the first three operating modes. Each range will show a yellow face when depressed and the FREQ switch will show a white face. Otherwise, the switch faces should be black. The four-digit DURATION switch is set just as in the ON TIME section, except that a decimal exists between the third and fourth digits (see range listing above).

In general, changes may be made in the ON and OFF time settings even while the unit is running in the internal cycle mode. However, doing so will generate an erratic pulse during or immediately after the change. You may set up the operating time and mode with or without the valve cable attached. However, **DO NOT ALLOW ANYTHING TO BE PLACED IMMEDIATELY IN FRONT OF THE “VALVE” JACK IF THE CABLE IS NOT CONNECTED**, as there may be 250 volts present on the pins. The OUTPUT BNC jack provides a square wave output identical in length to the drive signal with an amplitude of + 5 volts.