

IOTA ONE



SAFETY PRECAUTIONS

MANUAL – Before attempting to install or operate the unit, read and familiarize yourself with all of the safety, installation, and operational instructions in this manual. This manual contains valuable safety, operational, and troubleshooting information and should be maintained for future reference.

WARNINGS – For personal safety and to insure correct operation of the unit, know and follow all warnings. In particular, this instrument produces high voltage spikes. Do not operate the instrument without a valve attached to the instrument through the supplied cable. Do not connect or disconnect valve or valve cable while the instrument is operating.

POWER SOURCES – Use only power sources that are within the specified limits and which are capable of providing the specified power outputs for this unit.

GROUNDING – Make certain that the power source is properly grounded.

DISASSEMBLY – DO NOT attempt to disassemble the unit beyond what is described in the User's Manual. Disassembly will expose high voltages that could cause severe electrical shock.

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SECTION 1 GENERAL INFORMATION

1.1 SCOPE

This manual describes the operation of the IOTA ONE[®] valve driver instrument, Parker part number 060-0010-900. This instrument is similar in operation and performance to the Parker part number 060-0001-900 instrument, but with electronic displays, increased timing accuracy, and remote operation capability. For those users familiar with the older 0001 version, Appendix A describes the major differences between the two.

1.2 PURPOSE OF EQUIPMENT

The IOTA ONE[®] 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. The instrument is capable of repetition rates up to 250 Hz; however, the valve may not operate correctly at higher rates. The unit can be triggered both internally or externally and has “one shot” capability. Both input and output logic-level (TTL) signals are through the front panel BNC jacks.

1.3 DESCRIPTION OF INSTRUMENT

The front panel of the IOTA ONE[®] is depicted in Figure 1.1. Following is a description of the controls, indicators, and connectors on the front panel:

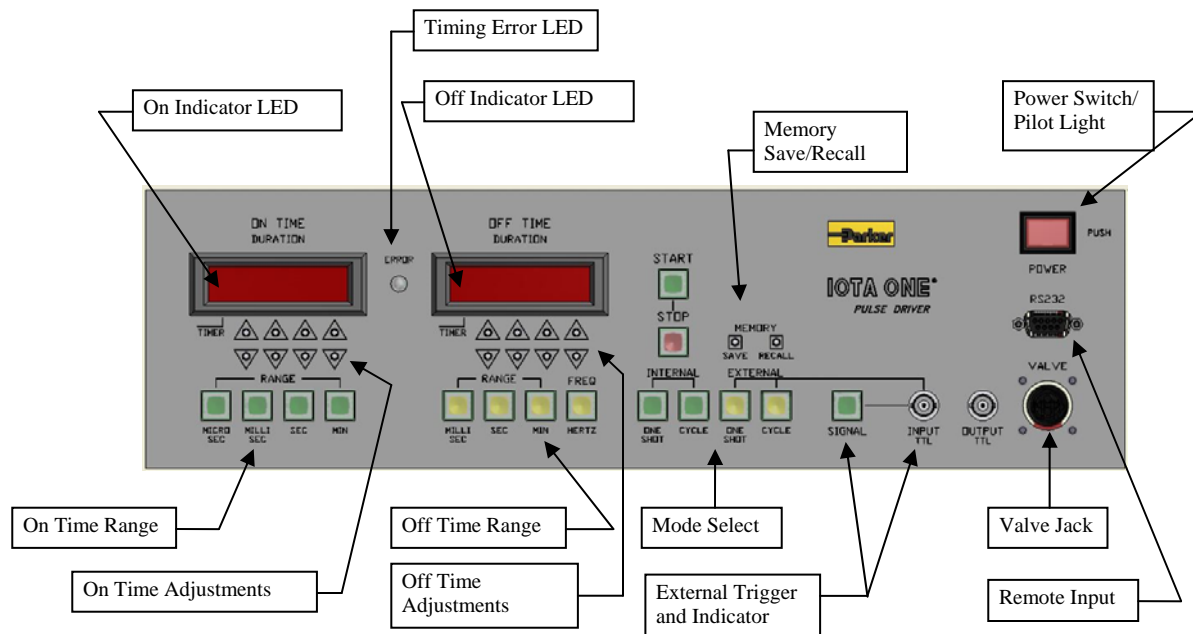


Figure 1.1 View of Front Panel Showing Controls, Indicators, and Connectors

“ON-TIME” Section

1. INDICATOR – A red 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 is actually illuminated a few milliseconds longer than the valve is open so that it can be seen. Because of persistence of vision, the LED may appear to remain on for high repetition rates.

2. DURATION – A four-digit digital display indicates the “ON” (open) time of the valve reading from 0001 to 9999. Up and down push-button switches below the display permit the user to increment and decrement the value of each digit. Note that the display automatically carries over to the next digit(s) when incrementing past 9 and decrementing past 0.

3. RANGE – Four-position momentary switch/indicators determine the time range for the “ON-TIME DURATION” switch: microseconds, milliseconds, seconds, or minutes.

“OFF-TIME” Section

4. INDICATOR – A red LED that lights whenever the valve is closed. 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 off-time durations. Likewise, for very high repetition rates, the LED may appear to remain on.

5. DURATION – A four-digit digital display indicates the “OFF” (closed) time of the valve reading from 000.0 to 999.9. Up and down push-button switches below

the display permit the user to increment and decrement the value of each digit. Note that the display automatically carries over to the next digit(s) when incrementing past 9 and decrementing past 0.

6. RANGE – Four-position momentary switch/indicators determine the time range (milliseconds, seconds, or minutes) or selects frequency mode for the “OFF-TIME DURATION” switch.

OTHER CONTROLS, INDICATORS, AND CONNECTORS

7. ERROR – A red LED that lights when the operating parameters are set outside allowable limits.

8. START -- This momentary contact push button switch starts action in the INTERNAL mode by triggering a single pulse (ONE SHOT) or starting a series of pulses (CYCLE).

9. STOP - This momentary contact push button switch stops any timing that may be active and restores the valve to the OFF condition. If the instrument is operating in a mode that is independent of timing (EXTERNAL CYCLE MODE), this control will have no effect.

10. INTERNAL/EXTERNAL – These four momentary switch/indicators select the operating mode and signal sources for the system.

11. 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.

12. SIGNAL – This green push button/LED serves two functions. As an indicator, it illuminates to show a logic high on the external signal source. As a control, it serves as an input that is active as a signal source. It is active when depressed.

13. OUTPUT (TTL) – A logic high (TTL) output is provided at this BNC jack whenever the valve driving circuit is active in any operating mode.

14. POWER – A retained action switch to control the AC power to the unit. The face of this switch will illuminate when depressed if proper AC voltage is present and the fuses are functional.

15. VALVE – This jack is the connection to the valve through the supplied valve cable.

16. RS-232 – This jack is the RS-232 connection for remote monitoring and control.

17. SAVE -- This momentary push button saves the current settings of the instrument to non-volatile memory. Upon power up, the instrument loads the most recent SAVE settings.

18. RECALL – This momentary push button restores the most recent SAVE settings to the instrument.

On the rear panel of the IOTA ONE[®] is a power input module with a standard IEC detachable cord socket for the AC power cord. In addition this module contains a drawer above the socket that houses the two 5 X 20 mm AC fuses.

AC power requirements as well as fuse size appear on the rear panel as well as in section 1.4 (Specifications).

1.4 SPECIFICATIONS

Size: Standard 19-inch relay rack, 3U high by 10" deep excluding handles.

Weight: 11pounds.

Voltage input: 90 – 250 VAC, 47 – 63 Hz,

Power consumption: 160VA max.

Fuses (Qty 2): 5 x 20 mm glass cartridge, 2.0 A, 250 V

Power factor: 0.93 min

Operating temperature: 0 to +40 degrees C

Storage temperature: -20 to +60 degrees C

Humidity: 20 – 90 %, non-condensing

Shock and Vibration: As incurred in bench handling.

Logic-Level (TTL) output: one TTL unit load.

Logic-Level (TTL) input: compatible with standard TTL logic.

Valve Burst: 300 V max

Timing accuracy: 250 nanoseconds or 0.001%, whichever is greater.

Timing uncertainty (with respect to external trigger): 250 nanoseconds.

1.5 EQUIPMENT SUPPLIED

The IOTA ONE[®] instrument is supplied with the following:

- Power cord

- Valve cable

- IOTA ONE[®] remote software for PC

- This operator's manual

1.6 ACCESSORIES REQUIRED BUT NOT SUPPLIED

To operate the IOTA ONE[®] instrument, a Parker valve must be ordered separately. No additional equipment is required.

In the event of abnormal operation, the instrument should be put into the hands of a qualified technician to troubleshoot the problem.

1.7 OPTIONAL TEST EQUIPMENT

In order to use the external logic-level (TTL) input, an external pulse generator or push-button switch will be required. If an automated test setup is to be used, this input can be exercised directly from a computer-controlled logic source.

In order to use the external logic-level (TTL) output, an oscilloscope or other monitoring equipment will be required. If an automated test setup is to be used, this output can be monitored directly through a computer-controlled logic input or a data logging device.

In order to use the remote monitor and control feature, a PC with a COM port will be required. If an automated test setup is to be used, the remote monitor and control functions can be accessed through an RS-232 port implemented in the automated equipment. A standard DTE/DCE RS-232 cable is required to connect the instrument to the remote equipment.

SECTION 2 INSTALLATION

2.1 UNPACKING

Before unpacking the IOTA ONE[®], examine the packing container and notify the shipping carrier of any damage. Unpack the contents of the container carefully and take inventory of the contents. Save the container and the packing material in the event that the instrument needs to be returned to the factory for servicing. The following items should be inventoried:

- IOTA ONE[®] instrument
- Power cord
- Valve cable
- IOTA ONE[®] remote software for PC
- This operator's manual

In addition to these items, a valve will be included in the packing container if one was ordered with the instrument.

2.2 INSTALLATION

The IOTA ONE[®] instrument is designed to operate in a bench-top environment or mounted in a standard 19" relay rack. Rack mounting flanges with standard-spaced holes are provided for rack-mounting. To mount the instrument in a rack, use standard rack hardware. Rear support of the instrument is not required.

2.3 DRIVER SETTINGS

The IOTA ONE[®] embodies a high performance valve driver that reduces the turn-on time of the valve by applying a short high voltage burst to overcome the inductance inherent in the valve coil. Following the high voltage burst, the driver reduces the voltage to the valve to a value that is lower than the rated voltage of the valve, but is sufficient to hold it open. This reduces valve heating and improves closing response time. Both the time of the burst and the hold in voltage can be set by the user using the following procedure:

2.3.1 Turn the unit off and disconnect the power cord to insure that no dangerous voltages are present inside the instrument.

2.3.2 Remove the top cover by taking out the two screws on the back panel and sliding the cover to the rear.

2.3.3 The instrument is factory set for a burst pulse length of 180 microseconds. To change the burst pulse length, find the 8-position DIP switch as designated on Figure 2.1. 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 # (microseconds)	Value
1	100
2	100
3	100
4	80
5	40
6	20
7	10
8	5

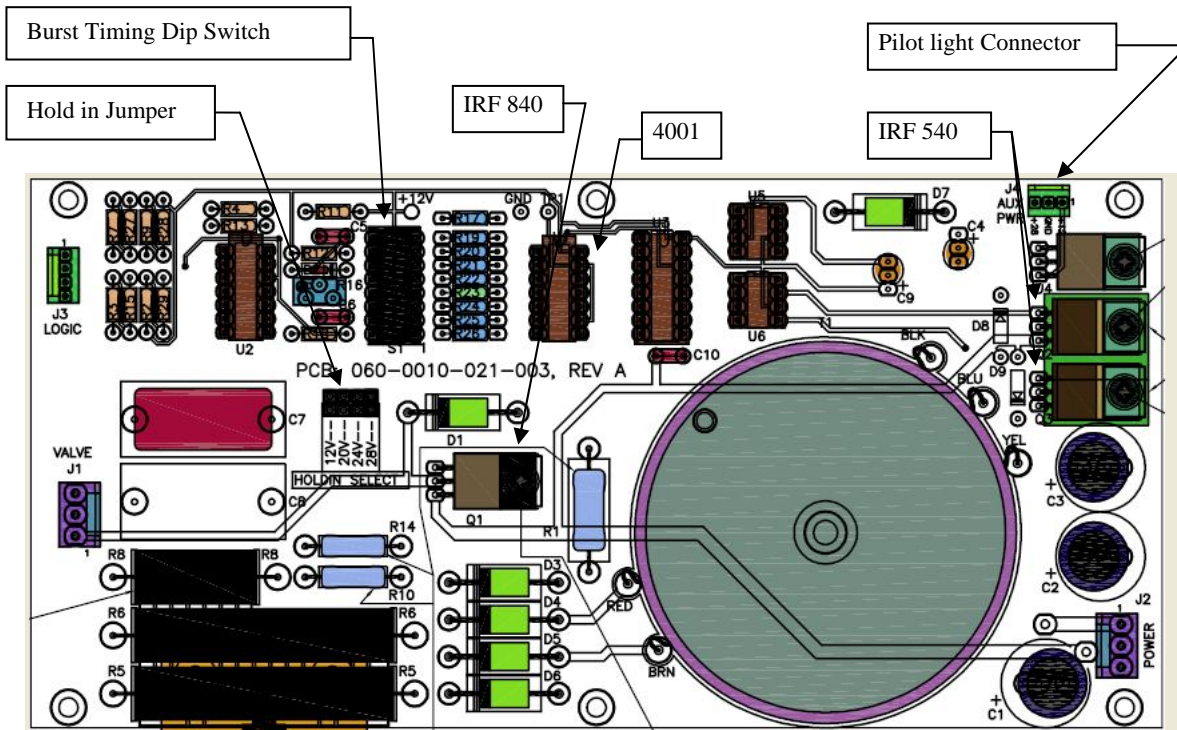


Figure 2.1
Locations of Burst Timing DIP Switch and Hold In Jumper on Driver Board

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

2.3.4 The holding voltage for the valve is also set on the driver PC board with a 4-position jumper as depicted in Figure 2.1. It is marked for 12-, 20-, 24-, and 28-volt valves. The standard factory setting is the 28 volt position. 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.

2.3.5 After making required adjustments to the driver board, replace the cover before reconnecting it to AC power.

DANGER

Do not attempt to apply power to the instrument with the cover removed, as high voltages are exposed that could cause severe electrical shock

2.4 CONNECTIONS

Attach one end of the supplied valve cable to the valve and the other end to 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.

DANGER

When the unit is in operation, the driver triggers the valve with a pulse of approximately 275 volts (Direct Current). DO NOT operate the instrument without a valve properly attached.

2.5 CHECKOUT

2.5.1 With the instrument connected as in section 2.4, depress the power switch in the upper right corner of the front panel. The button should illuminate as well as the panel displays indicating that power is present. If the button and displays do not illuminate, check that the instrument is connected to a live AC source with the proper voltage. Once that is verified, disconnect the power and remove the fuse holder tray on the rear panel. Replace the fuses with the correct size and type as specified in section 1.4. Reconnect the power and repeat this paragraph.

If the power indicator still fails to illuminate, place the instrument into the hands of a qualified technician to troubleshoot the problem.

2.5.2 Referring to section 1.3 as required, set the instrument to the following state:

ON TIME 0040 Milliseconds
OFF TIME 040.0 Milliseconds
MODE Internal Cycle

Depress the START button. The ON TIME and OFF TIME indicators should alternately flash and the valve should emit an audible sound at a 12.5 Hz rate. Depress the STOP button to shut down the cycling. To more completely verify the instrument and to familiarize yourself with its operation, refer to section 3.2.

SECTION 3 OPERATION

3.1 FRONT PANEL CONTROLS AND INDICATORS

The front panel controls, indicators, and connectors of the IOTA ONE[®] are described in section 1.3 and are depicted in Figure 1.1.

3.2 OPERATING MODES

The IOTA ONE[®] Pulse Driver unit has four operating modes selected by depressing one of the four buttons below the START and STOP buttons just right of center on the front panel. The selected mode will be indicated by the associated button illuminating.

3.2.1 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. Note that START button debounce circuits are implemented to produce exactly one pulse in INTERNAL ONE SHOT mode if depressed and released quickly. To produce a single pulse, the button must be depressed and released within 400 milliseconds. Holding the button down will produce a repeated retriggering at 400 millisecond intervals. Timing between successive pulses cannot be less than 400 milliseconds using this mode. If such timing is required, INTERNAL CYCLE or one of the EXTERNAL modes can be used. In this mode, the OFF TIME is not used and the OFF TIME display is dimmed.

3.2.2 INTERNAL CYCLE – A train of pulses will be started when the START button is pressed and aborted when the STOP button is pressed. There are two ways to set up the INTERNAL CYCLE mode, ON/OFF and FREQUENCY.

3.2.2.1 INTERNAL CYCLE, ON/OFF – If the OFF TIME RANGE selected is milliseconds, seconds, or minutes, the ON TIME section determines the open time of the valve, and the OFF TIME section determines the interval between valve actuations. The period of the cycle is the combined times and the frequency is (1 / period).

3.2.2.2 INTERNAL CYCLE, FREQUENCY – If the OFF TIME RANGE selected is FREQ, the ON TIME section determines the open time of the valve, and the OFF TIME section determines the frequency. In this mode of operation, there may be a small error in the actual frequency due to the granularity of the OFF timers. The instrument calculates the period and subtracts the ON TIME to determine the nearest OFF TIME to achieve a frequency close to the frequency entered.

3.2.3 EXTERNAL ONE SHOT – When the EXT INPUT TTL is high or the SIGNAL button is depressed, the OFF TIMER will be triggered. When the OFF TIMER times out, the ON TIMER will be triggered. If the OFF TIMER is set to 000.0 or if FREQ mode is selected, there will be no delay between the trigger and the ON TIMER trigger. The EXTERNAL input is level triggered, not edge triggered, so that the trigger pulse width must be less than the OFF TIMER setting. The START button does not function in this mode; however, the STOP button can be used to abort the timers after they have been triggered.

3.2.4 EXTERNAL CYCLE – In this mode the valve will open whenever the EXT INPUT TTL is high or the SIGNAL button is depressed. Likewise, it will close whenever a logic low is applied to the INPUT jack and the SIGNAL button is not depressed. The START and STOP buttons do not function and all pulse parameters are controlled by the external signal source. In this mode, the ON TIME and OFF TIME functions are not used and the displays are dimmed.

3.3 MEMORY SAVE/RECALL

SAVE -- This momentary push button will save the current settings of the instrument to non-volatile memory. Upon power up, the instrument will load the most recent SAVE settings.

RECALL – This momentary push button will restore the most recent SAVE settings to the instrument.

The SAVE function can be used to establish a temporary default setting that can be restored at any time or upon power up.

3.4 REMOTE OPERATION

The IOTA ONE[®] has the capability of remote operation over an RS-232 data link. The protocol for the link is described in Appendix B, and a GUI application for PC is supplied with the instrument. A Windows[®] -based PC with a COM port and a standard DB-9 DTE/DCE cable are required to operate the instrument remotely using the supplied GUI application. A PC that has no COM port can also be used with a standard USB/serial interface adapter.

To operate the IOTA ONE[®] remotely, install the supplied application on the PC and connect the PC COM port to the RS-232 connector on the instrument with a DB-9 cable. Launch the application to see the GUI interface, which resembles the front panel of the instrument, with a few additions. See Figure 3.1 for a screen shot of the GUI as it should appear.

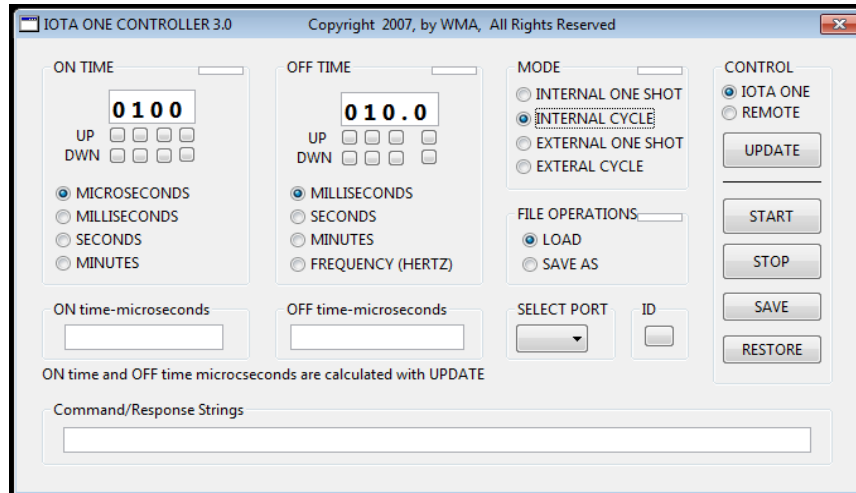


Figure 3.1 Screen shot of GUI Application for Remote Operation

The fields in the GUI labeled ON TIME, OFF TIME, MODE, START, STOP, SAVE, and RESTORE are similar to the same fields on the front panel of the instrument and are described in section 3. (Note that RESTORE on the GUI is equivalent to the RECALL button on the instrument.) The remaining parts of the GUI are described below.

The SELECT PORT pull-down menu is used to select the COM port of the PC to which the instrument is connected. The correct COM port must be selected before any communications with the instrument can be established.

The GUI can be used to either control the instrument or to monitor it. These two basic modes are selected with the Radio Buttons in the CONTROL group: When IOTA ONE is selected, the GUI is in the monitor mode and clicking on the UPDATE button will update the GUI screen to match the front panel of the instrument. When REMOTE is selected, the control mode is selected and clicking on the UPDATE button will update the front panel of the instrument to match the GUI screen. Note that the START, STOP, SAVE, and RESTORE buttons are active regardless of which CONTROL button is selected.

The ID push button initiates an Identify command to the instrument. The instrument will respond with a response string of “{AIWMA091}e”. This command provides a means of checking communications integrity.

The FILE OPERATIONS permit the user to SAVE and LOAD instrument settings to the PC hard drive. These operations use the GUI display as the source for SAVE operations and the destination for the LOAD operations, so the following procedures must be followed to save/load a file from/to the instrument:

SAVE INSTRUMENT SETTING TO FILE	LOAD SETTING TO INSTRUMENT FROM FILE
Select IOTA ONE from the Control group Click on UPDATE Click on SAVE to get a pop-up window Select the desired destination folder Enter a file name Click on OK	Click on LOAD to get a pop-up window Select the folder of the file to load Select the file to load Click on OK Select REMOTE from the Control group Click on UPDATE

The ON time—microseconds and OFF time—microseconds text fields display the ON and OFF times respectively, calculated from the settings on the GUI display. These are provided as a reference check and may be useful in determining granularity errors in FREQ mode.

The Command/Response Strings text field displays the actual strings of characters sent to and received from the instrument. This information can be useful as a guide when setting up automated testing. For an explanation of these strings, refer to Appendix B.

3.5 OPERATIONAL NOTES AND LIMITS

The various modes of the Iota One make use of the ON and OFF timers differently. When modes are selected that do not make use of a timer, the display for the associated timer is dimmed, indicating that the display has no function in that mode. A description of the modes follows:

1. INTERNAL ONE SHOT: ON timer only is used, triggered by START button.
2. INTERNAL CYCLE: ON and OFF timers are used, ON timer is triggered by START button.
3. EXTERNAL ONE SHOT: ON and OFF timers are used, OFF timer is triggered by EXT button or positive level on TTL INPUT, ON timer is triggered at the end of the OFF time.
4. EXTERNAL CYCLE: Neither timer is used, valve driver is actuated by EXT button or high logic level on TTL INPUT.

EXT button will illuminate whenever it is depressed or whenever a positive signal is present on the TTL INPUT.

The TTL OUTPUT will have a logic high signal present whenever the valve is driven (open).

The UP and DOWN buttons for the digits are debounced with a 300 millisecond timer. Holding a button down continuously will result in multiple commands, repeated at 300 millisecond intervals. Each of the two four-digit displays is equipped with logic that automatically carries to and borrows from the digit to its left when a 0/9 roll-over occurs. This function is carried for successive digits throughout the display, such that incrementing a 9999 display results in a display of 0000. Likewise, decrementing a display of 0000 by one results in a display of 9999.

The START button debounce circuits are implemented to produce exactly one pulse in INTERNAL ONE SHOT mode if depressed and released quickly. To produce a single pulse, the button must be depressed and released within 400 milliseconds. Holding the button down will produce a repeated retriggering at 400 millisecond intervals. Timing between the start of successive pulses cannot be less than 400 milliseconds using this mode. If such timing is required, INTERNAL CYCLE or one of the EXTERNAL modes can be used.

The EXTERNAL input is not debounced to permit full use of that input for the EXTERNAL CYCLE mode. In the EXTERNAL ONE SHOT mode, the length of the external input has some restrictions for deterministic results:

1. If the OFF time (delay) is not set to zero, the length of the EXTERNAL input must be less than the OFF time.
2. If the OFF time (delay) is set to zero, the length of the EXTERNAL input must be less than the ON time.

When using the EXTERNAL ONE SHOT mode with a manual input and short pulses, the OFF time should be set for several hundred milliseconds or greater so that it will serve a debounce function. As long as the input pulse is less than the OFF time, the ON time will have no restriction.

The following conditions will cause the ERROR LED on the panel to illuminate:

1. A zero ON time for INTERNAL ONE SHOT, INTERNAL CYCLE, and EXTERNAL ONE SHOT modes.
2. A zero FREQUENCY input in INTERNAL CYCLE mode.
3. A value of ON time greater than the period when the FREQUENCY range is selected in INTERNAL CYCLE mode.
4. Any set of conditions in INTERNAL CYCLE mode that will result in a frequency greater than 250 pulses per second.
5. A zero off time in INTERNAL CYCLE mode.

The ON TIME indicator is illuminated a few milliseconds longer than the pulse duration so that extremely short ON times can be seen.

APPENDIX A

DIFFERENCES BETWEEN IOTA ONE® VERSIONS

The IOTA ONE® valve driver instrument (known today as Parker part number 060-0001-900) was first introduced in the 1980s and has been in production since its introduction with minor changes. The most notable change was a redesign in the driver board in 1993, but very little has been done to affect the user interface. In 2015, a revised controller was introduced (Parker part number 060-0010-900), which is similar in operation and performance to the original instrument, but with electronic displays. This section describes the major differences between the two versions of the controller as it affects the user.

Original Version	Electronic Display Version
<p>All mechanical switches for numerical entry assure power up parameters to be the same as those prior to power down.</p>	<p>SAVE button must be used to establish power up conditions.</p>
<p>Microprocessor timing incurs latency in timing and limits timing accuracy.</p>	<p>Programmable logic running at a higher clock rate has no latency and yields triggering stability within 250 nanoseconds.</p>
<p>Duty cycle of internal cycle mode is limited to 50%. Two error indicators are used.</p>	<p>There is no limit on duty cycle. One error indicator is used with slightly different criteria. See section 3.3.</p>
<p>STOP button is required to reload timer parameters when changing modes.</p>	<p>No reset is required when changing modes.</p>
<p>ON TIME indicator does not show short pulses.</p>	<p>ON TIME indication is extended a few milliseconds to show short pulses.</p>
	<p>Numerical entry embodies a feature that permits borrowing and carrying to preceding digits.</p>
	<p>START button and EXT inputs have debounce circuits that differ from original version. See section 3.3.</p>
	<p>Remote monitor and control capability are provided, permitting automated operation and saving of test setup parameters to a PC.</p>

APPENDIX B

REMOTE INTERFACE COMMUNICATIONS PROTOCOL

GENERAL

The communications standard is RS-232 interface, compatible with the COM port on a PC.

BAUD 19200 ONE START BIT ONE STOP BIT	8 DATA BITS NO FLOW CONTROL NO PARITY
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All communications to the instrument are in the form of a command sent by the host controller, followed by a response from the IOTA ONE[®]. All characters in both the command and the response strings are defined as ASCII printable, shown as bold characters. The command and response structures are the same and are shown below.

{ @ + command character + data string + } + checksum

The command character is always echoed in the response string. The data string will differ for the command and response strings. The command characters and data strings for both command and response are listed under COMMAND DEFINITIONS below.

The checksum is calculated from ascii values of the string of characters prior to the checksum as follows:

- Subtract 32 from the ascii value of each character and add the results.
- Perform modulo 95 on the resultant sum.
- Add 32 to the results of the modulo operation.
- This is the checksum byte and will always be an ascii printable character.

COMMAND DEFINITIONS

Numbers in parentheses are decimal values of ASCII characters.

(73): Device Identifier "I". The command data field will be null. The response data field will consist of six ASCII characters. This data field is: "WMA091" This command has no effect on the operation of the IOTA ONE[®].

(70): Full Control "F". The command data field will contain 11 bytes in the order defined below. The response data field will be in the same format as the command data field. The command will change the operating parameters of the IOTA ONE[®] to match those of the command string.

BYTE LIMITS	MEANING
1 (48) – (57)	First digit (MSD) of On Time
2 (48) – (57)	Second digit of On Time

3	(48) – (57)	Third digit of On Time
4	(48) – (57)	Fourth digit (LSD) of On Time
5	(48) – (51)	Range of On Time, in numerical order as shown on panel
6	(48) – (57)	First digit (MSD) of Off Time
7	(48) – (57)	Second digit of Off Time
8	(48) – (57)	Third digit of Off Time
9	(48) – (57)	Fourth digit (LSD) of Off Time
10	(48) – (51)	Range of Off Time, in numerical order as shown on panel
11	(48) – (51)	Mode, in numerical order as shown on panel.

(71): Start "G". This command performs the same function as the START button on the panel of the IOTA ONE[®]. The command data field will be null. The response data field will be in the same format as the Full Control command data field.

(72): Stop "H". This command performs the same function as the STOP button on the panel of the IOTA ONE[®]. The command data field will be null. The response data field will be in the same format as the Full Control command data field.

(87): Write to NV "W". This command writes the current operating parameters of the IOTA ONE[®] to the non-volatile memory. The command data field will be null. The response data field will be in the same format as the Full Control command data field.

(92): Restore from NV "R". This command recalls the data stored in non-volatile memory to the IOTA ONE[®]. The command data field will be null. The response data field will be in the same format as the Full Control command data field.

(83): Status "S". The command data field will be null. The response data field will be in the same format as the Full Control command data field. This command has no effect on the operation of the IOTA ONE[®].