



User Manual

VMM-T1 Shutter Driver Timer

14-0020

Version 2.00

2013

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Version 2.00

2013

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Warranty

LIMITED PRODUCT WARRANTY: All Products manufactured by VINCENT ASSOCIATES® (MANUFACTURER) are warranted to meet published specifications and to be free of defects in materials and workmanship as defined in the specifications for 365 days - one year - (WARRANTY PERIOD) from the date of original shipment of the product. DSS series shutters are additionally warranted to achieve two million cycles within the WARRANTY PERIOD (as defined in the CYCLE WARRANTY CRITERION). MANUFACTURER will, at its own option within the WARRANTY PERIOD, repair or replace without charge any listed item discovered to be defective excepting transportation charges. Burned out or otherwise damaged actuator coils are not covered under this warranty. Any defective product returned to the MANUFACTURER must follow the RETURN MATERIAL AUTHORIZATION PROCEDURE as defined below. This warranty does not extend to cover damage resulting from alteration, misuse, negligence, abuse, normal wear and tear, or accident. The MANUFACTURER will consider the return of unused equipment if returned within 30 days from the original date of shipment, subject to a 20% restocking charge. This offer does not apply to used or damaged equipment. This warranty extends only to the original purchase and is not available to any third party, including any purchaser assemblies or other Products of which the goods may become component equipment.

CYCLE WARRANTY CRITERION: One "cycle" is considered one open and one closure of the shutter. DSS Shutter must be operated with the ED12DSS driver or equivalent H-Bridge type shutter driver circuit at +10.7VDC across the actuator coil for the specified duration. DSS Shutter must be operated within the defined environmental, electrical and mechanical specifications as listed on the device's data sheet. After one year (WARRANTY PERIOD), the cycle warranty is null and void. If returned, the device must be accompanied by a written statement indicating the approximate number of cycles contained on the device, include all parameters to which the shutter was operated and follow the RETURN MATERIAL AUTHORIZATION PROCEDURE as defined below.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified.

Only qualified personnel should perform service procedures.

Injury Precautions

- **Use proper Power Cord** – To avoid fire hazard and risk of personal injury use only the power cord supplied with this product.
- **Avoid Electric Overload** – To avoid electrical shock or fire hazard do not apply a voltage to a terminal that is outside the range specified for that terminal.
- **Avoid Electric Shock** – To avoid injury or loss of life, do not connect or disconnect line cord while it is connected to the line voltage.
- **Ground the Product** – This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, the grounding connector must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded. **DO NOT DEFEAT THE GROUND CONNECTION ON THE SUPPLIED LINE CORD.**
- **Access to On/Off Switch** – Due to the location of the unit's On/Off switch on the rear panel, ***do not*** position the unit such that the On/Off switch is difficult to access and operate while installed and in use.
- **Do Not Operate Without Covers** – To avoid electric shock or fire hazard, do not operate this product with case or panels removed.
- **Use Proper Fuse** – To avoid fire hazard, use only the fuse type and rating specified for this product.
- **Do Not operate in Wet/Damp Conditions** – To avoid electric shock, do not operate this product in wet or damp conditions.
- **Do Not Operate in an Explosive Atmosphere** – To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

- **Use Proper Power Source** – Do not operate this product from a power source that applies more than the voltage specified.

- **Provide Proper Ventilation** – To prevent product overheating, provide proper ventilation.
- **Do Not Operate with Suspected Failures** – If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

These terms appear in this manual

WARNING

Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION

Caution statements identify conditions or practices that could result in damage to this product or other property.

Preface

This Manual provides information for the **VMM-T1 Shutter Driver/Timer**. The manual contains the following chapters:

- *Getting Started* contains a brief product description, information needed to power on the driver and a brief procedure to verify that it functions.
- *Operator Controls* provide an outline of the panel control functions and locations at the front and rear panels. This also includes the location and function of the input/output signals.
- *Operating Basics* gives further details to the operational features of the controllers.
- *Specifications* are described for all input/output levels as well as timing accuracy of the **VMM-T1 Shutter Driver/Timer** including other pertinent details and information required for the RS-232 interface.
- *Index* contains a full index.

*What follows is the complete operator's manual for the **UNIBLITZ**[®] VMM-T1 Shutter Driver/Timer. Please read this manual completely before operating your unit. Due to the construction of this unit, we recommend that the unit be returned to the manufacturer for repair, no user-serviceable parts inside.*

Getting Started

Features

The **VMM-T1 Shutter Driver/Timer** replaces the T132 controller. The **VMM-T1** contains nearly all of the features of the T132 plus some new features which enhance the unit's capability in even more demanding applications.

These new features include:

- An addressable RS-232 input. Eight units can be daisy-chained together via the RS-232 input connector (DB-9 female) and the user can select an address for each unit at the rear panel through the use of the ADDRESS switch.
- Switching capability on all BNC input jacks to provide either an active-high or active-low logic trigger level.
- An Auxiliary (AUX) output that is the DELAY timer output, on a three-pin terminal located on the rear panel. This terminal also includes pins for +5VDC and Ground.
- A GATE INPUT which allows the user to select a single or multiple trigger signals from a stream of trigger signals.
- An EXPOSURE PRESET (EXP PRESET) control which combines the functions of the NORM/CONT switch of the previous Model T132 and an exposure counter. The user can pre-select a number of exposures per trigger signal from 1 to 99. By selecting the EXP PRESET to 00 the unit will re-trigger continuously.
- A user-configurable AC input module. This AC input module includes the AC power cord input receptacle, power switch, dual 3AG, 0.5A time-lag (slo-blo) line fuses (For 115 VAC operation), line voltage change-over fuse block, and line filter. Dual 3AG, 0.25A time-lag (slo-blo) line fuses for 230 VAC operation are supplied.

Introduction

The **UNIBLITZ VMM-T1** is capable of controlling all shutter types in the **UNIBLITZ** product line. The **VMM-T1** incorporates two precise timers to control shutter exposure and delay intervals. Each timer has a range from 0.1msec to 9999 seconds. Four-digit pushwheel switches provide exceptional resolution for use in a multitude of shutter applications, ranging from holography to microscopy. The **VMM-T1** incorporates a state of the art shutter driver and relies on the user's input signal to determine exposure and frequency.

Another feature of the **VMM-T1** is the PRE or POST exposure delay. The PRE/POST toggle switch allows the user to actuate the shutter immediately upon receipt of a trigger signal or delay the EXPOSURE for a predetermined period. The period of the DELAY interval is determined from the front panel DELAY TIME SELECT. The DELAY signal is provided to the AUX output terminal located at the rear panel. In addition to the PRE/POST DELAY, the **VMM-T1** can re-trigger itself continuously to provide low level chopper control. By selecting the EXP PRESET pushwheel switch to "00", the DELAY interval control acts as the recycle interval to determine the exposure frequency. The unit will run continuously until reset. By selecting any value between 01 and 99 the shutter will trigger for the number of exposures selected.

The **VMM-T1** contains an addressable RS-232C input. By using the Model 910RSDC daisy-chain cable, multiple controllers can be connected and controlled. Eight separate addresses are available which allows up to eight units to be individually controlled by a single computer serial port.

The patented driver design of the VMM-T1 allows the controller to operate all shutter types in the UNIBLITZ product line.

A Model 710C, 7-pin female to 7-pin male (3 meter length), shutter interconnect cable is also included with each unit.

Start Up

After unpacking the unit, inspect for any obvious defects and that all manufacturer supplied materials are present.

If a problem is found or a part (or parts) is missing, please contact Vincent Associates immediately for problem resolution. Do not attempt to connect the unit if defects or damage are noted until Vincent Associates has been contacted and the problem resolved.

After the initial inspection the unit is ready to use. To properly install and power on the **VMM-T1**, please follow the procedure below.

1. Check for proper electrical connections. Please note the label covering the AC input module. It is there as a reminder to re-configure the AC input module if the unit requires operation at 230VAC. The **VMM-T1** is shipped with the proper fuses for 115 VAC operation installed (two 3AG, 0.5A time-lag (slo-blo)). See "**Voltage Change**" instructions elsewhere in this manual.

CAUTION

*This label must be removed prior to inserting the power cord into the AC input receptacle regardless of which AC voltage level is used.
Caution statements identify conditions or practices that could result in*

2. *Remove the label before proceeding.*
3. Check the line fuses to be sure they are the proper rating. For 230 VAC operation, change the two line fuses to two 3AG, 0.25A time-lag (supplied). See “**Line Fuse Replacement**” instructions elsewhere in this manual.
4. Be sure the AC module power switch is toggled to the “0” position and the line cord is NOT connected to the AC line.
5. Connect the supplied line cord to the rear panel AC module receptacle. Be sure the cord is inserted completely into the AC module receptacle.
6. Connect the line cord to the AC line.
7. *Please Note: The VMM-T1 power switch is located on the rear of the case. Please be sure that it is readily accessible at all times when in use.*
8. Power ON the unit by toggling the AC module power switch to the “1” position. Power LED indicator will illuminate.

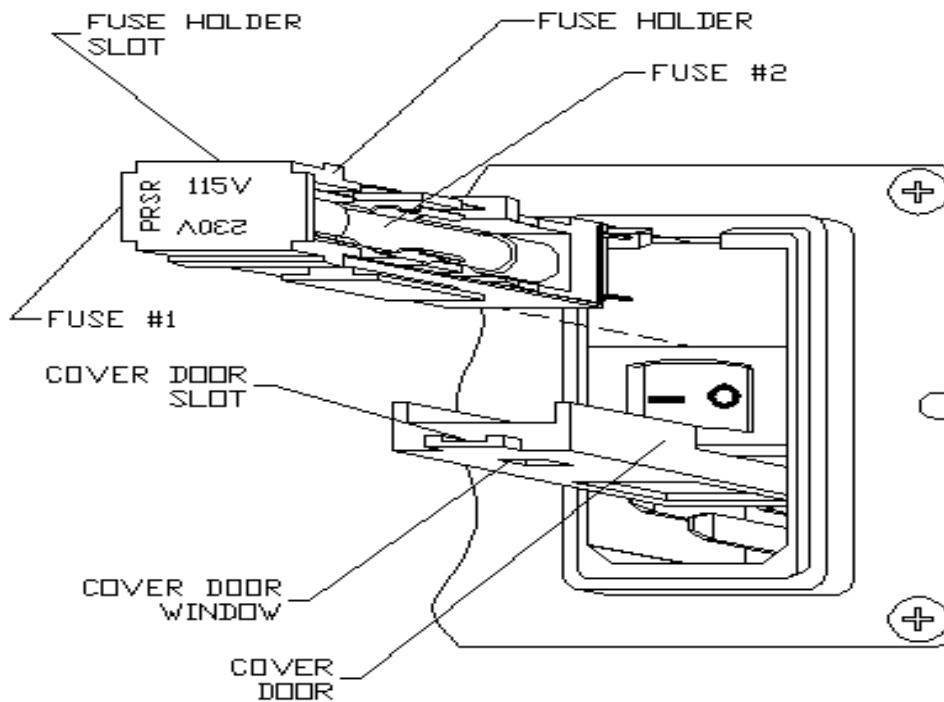
Line Fuse Replacement

WARNING

To avoid injury or death, unplug the line cord from the line voltage power source before continuing.

1. A small flat-bladed screwdriver or similar tool is needed to complete this procedure. Please refer to Figure 1.
2. **BE SURE THE LINE CORD IS DISCONNECTED FROM THE LINE VOLTAGE POWER SOURCE. DO NOT CONTINUE WITH THIS PROCEDURE WITHOUT REMOVING THE LINE CORD FROM THE VMM-T1.**
3. Unplug the line cord from the AC module receptacle of the **VMM-T1**.
4. Position the **VMM-T1** unit so that the rear panel is facing.
5. Please refer to Figure 1. Using the small flat-bladed screwdriver or similar tool, insert the tool into the cover door slot, gently pry open cover door.
6. Insert the tool into the fuse holder slot and gently pry out the fuse holder block.
7. Remove defective fuse(s); replace with new fuse(s).
8. Replace fuse holder into housing.
9. Close the cover door.

Figure #1 - AC Input Module



Voltage Change

WARNING

To avoid injury or death, unplug the line cord from the line voltage power source before continuing.

1. Please refer to Figure #1.
2. Repeat steps 1 – 6 in “**Line Fuse Replacement**” instructions.
3. To change from 115 VAC to 230 VAC, rotate the fuse holder block 180°.
4. Remove the two 3AG, 0.5A time-lag fuses and replace with two 3AG, 0.25A time-lag fuses.
(*Note: Be sure to change fuses back to 3AG, 0.5A time-lag fuses when changing back to 115VAC operation.*)
5. Replace fuse holder block and close the cover door. The desired line voltage will be indicated in the cover door window.

Shutter Fuse Replacement

1. Please refer to Figure 2 for VMM-T1 front panel layout.
2. A medium flat-bladed screwdriver or similar tool is needed to complete this procedure.
3. Power the unit OFF and disconnect the line cord from the line voltage power source.
4. Position the VMM-T1 unit such that the front panel is facing you. If necessary, disconnect the shutter cable from the respective 7-pin SHUTTER connector on the rear panel.

5. Using the screwdriver, or similar, insert the tool into the slot on the SHUTTER FUSE cap, apply slight inward pressure and rotate the cap 1/8 turn, counterclockwise. The fuse cap will pop out slightly.
6. Remove the fuse cap and fuse.
7. Replace the fuse with a known good one. Shutter fuse is a 0.6A, 5 x 20 mm, time-lag (slo-blo) type.
8. Reverse the procedure to re-install the fuse cap, reconnect all cables and power the unit back up.

Initial Operation and Testing

WARNING

WARNING: Be sure power switch is in the off position before connecting the power cord to line. Attach line cord to the unit first before plugging into the AC power source.

1. The **VMM-T1** is manually selectable to operate from 115 VAC or 230 VAC (50-60Hz). **PLEASE BE SURE THAT THE UNIT IS PROPERLY SET UP FOR THE LINE VOLTAGE TO BE USED.** Refer to the “**Voltage Change**” section of this manual for further information and procedures.
2. Once the line cord has been attached to unit and connected to properly grounded wall receptacle, the unit may be energized. See “**Start Up**” section.
3. Insert the 7-pin male connector of shutter interconnect cable into 7- pin female receptacle at rear of unit labeled SHUTTER.
4. Connect the 7-pin female connector of the shutter interconnect cable to 7-pin male connector on shutter to be driven.
5. Place **VMM-T1** POWER switch to the ON “1” position, the POWER LED will illuminate.
6. Place the N.O./N.C. switch into the N.O. position. The shutter will open and remain open until the switch is returned to the N.C. position. The DRIVER ACTIVE LED will illuminate when this switch is in the N.O. position.
7. All **UNIBLITZ** drivers provide the circuitry necessary to support shutters equipped with the Solid State Synchronization option. Simply plug the shutter interconnect cable into the driver. If the shutter is equipped with the Solid State Synchronization option, the green LED labeled SYNC ACTIVE will illuminate when the shutter is in the open position. In addition, the SYNC Output BNC will change to the active state when the shutter is open. The absence of the solid state synchronization option will inhibit the operation of the SYNC output and SYNC ACTIVE LED. The remainder of the **VMM-T1** systems will not be affected.
8. See specifications and operator controls for additional operational information concerning other features of the **VMM-T1**
9. Should the shutter and/or controller not respond as described previously, be sure line cord is installed into the receptacle and connections to the shutter are properly made. Note that the shutter output is also fused. The fuse is located on the front panel and is a 0.6A, 5 x 20 mm,

time-lag. Check this fuse for failure. Please refer to the SHUTTER FUSE REPLACEMENT section of this manual.

10. Be advised, a visual inspection of a fuse is usually NOT an adequate test to determine if a fuse has failed. Use a DMM (Digital Multi-Meter) or equivalent test device to determine fuse continuity.

CAUTION

Turn off the unit and remove the plug from the AC source before checking for blown fuses

11. Additionally, please note that particular shutter units respond to different minimum pulse widths. For example, a standard VS25 shutter has a minimum exposure pulse of 6 msec. If the timing is set for an exposure pulse width less than 6 msec, the shutter may not open fully.
12. If the unit still does not operate properly, turn off and disconnect the unit. Please notify Vincent Associates immediately. There are no user-serviceable parts outside or inside of the unit.

Operator Controls

VMM-T1 Front Panel Operator Controls

Please refer to Figure 2.

1. **DELAY TIMER Select:**

Four pushwheel switches that determine the DELAY timing range. The total delay interval will be the product of the DELAY TIMER SELECT and DELAY MULTIPLIER. Each depression of the (+) key increases each digit by one, the (-) key decreases each digit by one.

2. **DELAY LED Indicator:**

Green LED indicates when DELAY timer is active.

3. **EXPOSURE TIMER Select:**

Four pushwheel switches that determine the EXPOSURE timing range. The total exposure interval will be the product of the EXPOSURE TIMER SELECT and EXPOSURE MULTIPLIER. Each depression of the (+) key increases each digit by one, the (-) key decreases each digit by one.

4. **EXPOSURE LED Indicator:**

Green LED indicates when EXPOSURE timer is active.

5. **EXPOSURE MULTIPLIER Switch:**

A 5-position rotary switch. Clockwise rotation increases the magnitude of the EXPOSURE interval by a factor of 10.

6. **EXP. PRESET Select:**

Two pushwheel switches that determine the number of exposure cycles the unit will count up to per trigger input. A setting of "00" allows the unit to run continuously until reset. In the "00" or continuous setting, the time between exposures is determined by the DELAY time interval.

7. **SYNC. ACTIVE Indicator:**

Green LED indicates the status of the Solid State Synchronization system. LED is illuminated when the shutter's electronic SYNC sensor is active. This LED functions only if the shutter used is equipped with the Solid State Synchronization system.

8. **DRIVER ACTIVE Indicator:**

Red LED indicates when the internal shutter driver circuit input has an active signal present.

9. **ACTUATE Switch:**

Depressing this momentary pushbutton switch triggers the **VMM-T1** EXPOSURE and DELAY timers from the front panel.

10. **RESET Switch:**

A momentary pushbutton switch that inhibits all functions of the unit. Depress this switch to reset both the EXPOSURE and DELAY timers, and return all outputs to their original state. Shutter state will be returned to the status set by the N.O./N.C. switch.

Please note if an OPEN command is sent to the RS-232C input a RESET command will not clear the RS-232C output and the shutter will not close. A CLOSE command must be sent to allow the shutter to close. If it is desired to have the shutter close with a RESET command or the RESET switch the shutter must be opened with a TRIGGER command. In this case the shutter will either close, upon reset, or return to the state as set by the N.O./N.C. switch.

11. PRE/POST Toggle Switch:

Position of this switch determines if DELAY interval occurs before (PRE) or after (POST) the EXPOSURE interval.

- a. PRE mode: Delays the start of the shutter EXPOSURE interval until the end of the DELAY interval.
- b. POST mode: The DELAY timer is triggered at the conclusion of the EXPOSURE interval.
- c. In PRE or POST the DELAY (AUX) output will go high for the duration of the DELAY interval when the DELAY timer is active.

12. POWER LED Indicator:

Red LED, when lit indicates the unit is powered.

13. SHUTTER FUSE.

Replace with 5 x 20 mm, 0.6A time-lag (slo-blo) fuse.

Please note: This fuse may fail if the shutter is operated at an excessive frequency and duty cycle to protect the coil from premature failure. If the operation of the shutter used is causing “nuisance blowing” of this fuse, please contact technical support to discuss your application.

14. N.O./N.C. Toggle switch:

The N.O./N.C. switch acts to invert the shutter operation. The position of this switch determines shutter status before a trigger signal is received by the VMM-T1.

- a. N.C. (Normally Closed): The shutter will be closed and commanded to open by an input pulse signal.
- b. N.O. (Normally Open): The shutter will be open and activated to close by an input pulse signal.
- c. Any RESET command will return the shutter to the position determined by the N.O./N.C. switch.
- d. *Please note if an OPEN command is sent to the RS-232C input, a RESET command will not clear the RS-232C output and the shutter will not close. A CLOSE command must be sent to allow the shutter to close. If it is desired close the shutter or return it to the state set by the N.O./N.C. switch with a RESET command or by the RESET switch, the shutter must be opened with a trigger command.)*

15. DELAY MULTIPLIER switch:

A 5-position rotary switch. Clockwise rotation increases the magnitude of the DELAY interval by a factor of 10.

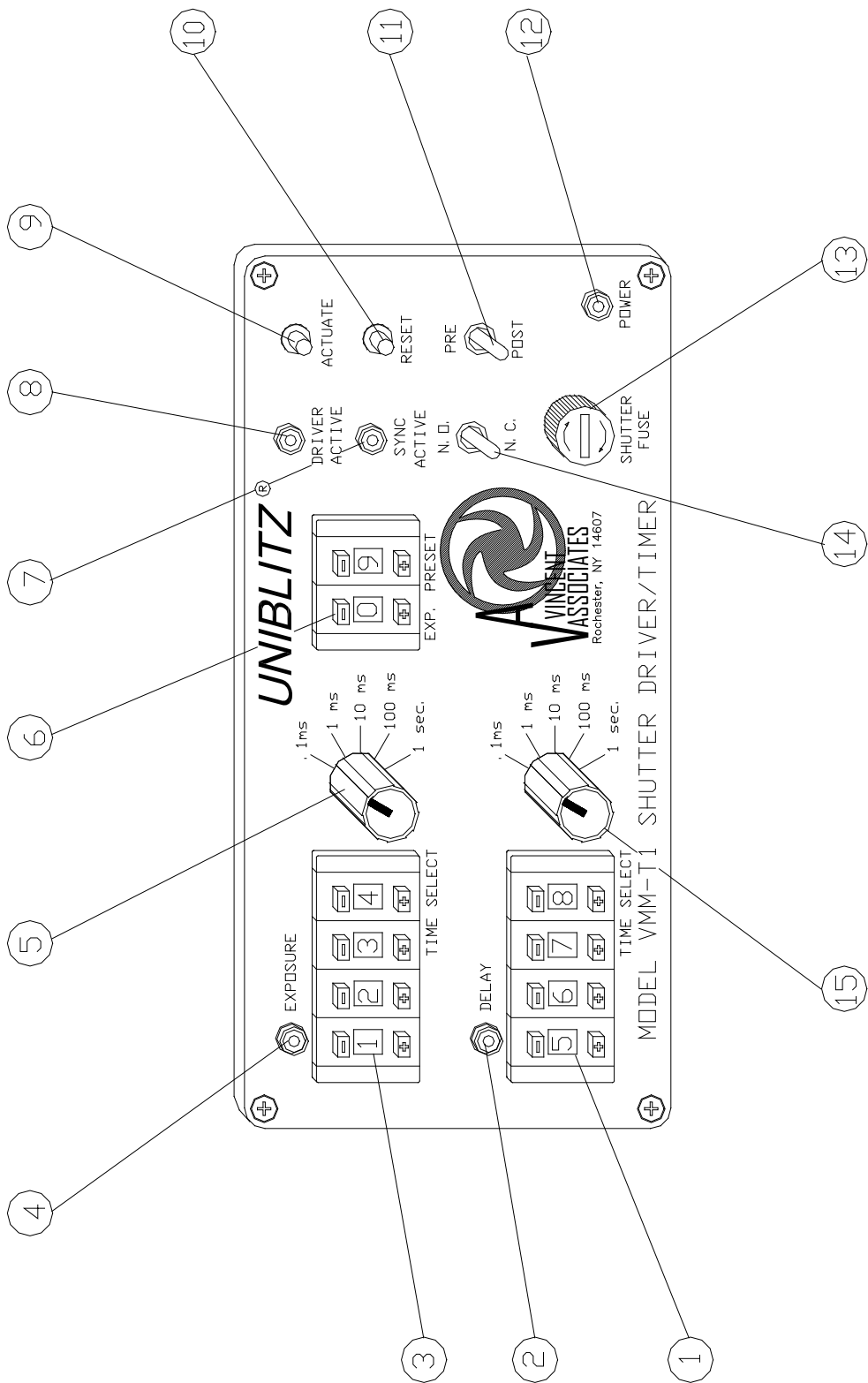


Figure 2 – VMM-T1 Front Panel Operator Controls

Notes

VMM-T1 Rear Panel Operator Controls

Please refer to Figure 3.

1. **ADDRESS SELECT** switch:

Rotation of the 8-position octal rotary switch selects the active RS-232C address of the unit. See **ADDRESS SELECT** under **GENERAL CHARACTERISTICS**.

2. **PULSE OUTPUT** BNC.

- a. Active-low output.
- b. The duration of this pulse is equal to the duration of the shutter exposure pulse.
- c. This output can be used to daisy-chain **VMM-T1** units together.
- d. A TTL exposure pulse input to the PULSE INPUT BNC will appear at the PULSE OUTPUT BNC.
- e. *Note toggling the N.O./N.C. switch will **not** change the state of the PULSE OUTPUT.*

3. **RS-232C** DB-9 female connector.

Provides access to the VMM-T1 RS-232C interface allowing the user to control input functions via a computer RS-232C serial port. See **RS-232C DB-9 female** under **EXTERNAL INPUT SPECIFICATIONS**.

4. **TRIGGER INPUT** BNC:

- a. Opens the shutter on the first pulse trigger edge.
- b. Closes the shutter on the next trigger edge.
- c. Pulse starts EXPOSURE and DELAY interval sequence.
- d. This input operates in conjunction with the GATE INPUT BNC.
- e. When the GATE INPUT is active (default selection) the TRIGGER INPUT will be enabled.
- f. This input can be set active-high or active-low by FUNCTION switch A. See “**FUNCTION SELECT**” under **GENERAL CHARACTERISTICS**.

5. **RESET INPUT** BNC:

Inhibits **VMM-T1** timing functions and both the DELAY and EXPOSURE timers are RESET.

Please note if an open command is sent to the RS-232C input, a RESET command will not clear the RS-232C output and the shutter will not close. A CLOSE command must be sent to force the shutter to close. If it is desired to have the shutter close or return to the state as set by the N.O./N.C. switch with a RESET command the shutter must be opened with a trigger command.

This input can be set active-high or active-low by FUNCTION switch C. See “**FUNCTION SELECT**” under **GENERAL CHARACTERISTICS**.

6. **GATE INPUT** BNC:

- a. An active signal present at this input will enable trigger signals presented to the TRIGGER INPUT BNC. (An unused GATE INPUT is in the active state.)

- b. When the applied signal goes inactive, the TRIGGER INPUT will disable. In this way, the user can effectively “gate” a stream of trigger pulses and allow one or more to be received, as determined by the user.
 - c. This input can be used to “pick” a pulse or pulses from a series of trigger pulses presented to the TRIGGER INPUT.
 - d. This input must be used in conjunction with the TRIGGER INPUT BNC.
 - e. This input can be set active-high or active-low by FUNCTION switch D. See “FUNCTION Select” under GENERAL CHARACTERISTICS.
7. **SHUTTER** Output 7-pin Connector.
- A 7-pin female connector to mate with 7-pin male plug of the Model 710C interconnect cable included with the unit. Pin-out as follows:
- a. Pin A - Shutter Actuator Coil Drive Send
 - b. Pin B - Shutter Actuator Coil Drive Return
 - c. Pin C - Sync Emitter Diode Source
 - d. Pin D - Sync Ground
 - e. Pin E - Sync. Detector Transistor Output
 - f. Pin F - +6.75 VDC Sync Power Source
 - g. Pin H - Shutter Ground
8. **115 VAC 60Hz. /230 VAC 50Hz** Input Module.
- Mates with female IEC plug on supplied line cord. Includes the following additional functions:
- a. Power switch – “0” is off, “1” is on.
 - b. Power fuses: 3AG, 0.5A, time lag (slo-blo) for 115 VAC 60Hz (2 required), 3AG, 0.25A, time lag (slo-blo) for 230 VAC 50Hz (2 required). See “LINE FUSE REPLACEMENT” instructions.
 - c. Voltage change switchover block. See “VOLTAGE CHANGE” instructions.
 - d. 3Amp line filter. (Internal, not user accessible)
9. **AUX/GND/+5V** Auxiliary Terminal:
- a. A 3-pin pluggable terminal block connector.
 - b. Both +5.0 VDC and Ground are available in addition to an AUX DELAY signal.
 - c. The **VMM-T1** AUX output is now the DELAY timer output signal.
 - d. An active-high pulse is delivered to this output equal to the length of the DELAY timer setting. See “DELAY Out (AUX Pin 1)” under EXTERNAL OUTPUT CHARACTERISTICS.
10. **FUNCTION** switches:
- Five sub-miniature slide switches.
- a. Switches **A – D** are used to select the active states of each of the four input BNC connectors.

- b. Switch **E** is used to select the proper pulse energy for the shutter being driven. Switch to the **HIGH** (up) position for 35mm and larger aperture types, switch to the **LOW** (down) position for all other shutter types.

11. **SYNC. OUTPUT BNC.**

- a. Active-low output
- b. Output for shutters equipped with the **SOLID STATE SYNCHRONIZATION SYSTEM** option.
- c. The shutter's internal synchronization circuit sets the BNC to an active level when the synchronization circuit becomes energized.
- d. The output goes active when the shutter reaches 80% of full open, and goes to the non-active state when the shutter reaches 20% closed.
- e. The front panel **SYNC. ACTIVE LED** illuminates when the synchronization sensor is active.

12. **PULSE INPUT BNC:**

Allows control of the shutter exposure and frequency from a TTL signal source.

- a. The pulse duration determines the shutter exposure interval.
- b. The frequency of the signal presented to this input determines the frequency of shutter exposures.
- c. This input can be set active-high or active-low by **FUNCTION** switch B. See "**FUNCTION SELECT**" under **GENERAL CHARACTERISTICS**.

Operating Basics

Please refer to the section describing the “**Initial Operation and Testing**” for initial preparation to put the VMM-T1 into operation.

Function Switches

There are 5 sub-miniature slide switches located on the Rear Panel and labeled “FUNCTION”.

1. Switches **A** – **D** allow the user to select the active state of the four BNC inputs.
 - a. When the switch actuators are in the DOWN position the corresponding BNC input will be TTL active-low. This indicates that a logic “0” (0 volts) will activate the selected input. *The switches must be in the active-low position to activate the inputs from a remote activate cable such as the 710R (handheld) or the 710R/F (foot activated).*
 - b. In the UP position the selected BNC input will become TTL active-high. This indicates that logic “1” (+5 volts) will activate the selected input.
2. Switch **E** selects HIGH/LOW pulse energy.

CAUTION

*The **HIGH** energy setting must be used for only 35 mm and larger aperture shutters. Use the **LOW** setting for all other UNIBLITZ shutters. Use of the **HIGH** position for shutter apertures smaller than 35mm could cause irreparable damage to the shutter used and will void the shutter’s warranty.*

- a. HIGH energy is required to operate 35mm and larger aperture shutters.
- b. In the DOWN position the pulse energy is selected LOW.
- c. When the switch actuator is in the UP position the pulse energy is selected HIGH.

Gate Input

The GATE INPUT BNC is used in conjunction with the TRIGGER INPUT BNC. This allows the user to select one or a finite number of trigger pulses to trigger the controller from a continuous stream of pulses presented at the TRIGGER INPUT. Please see Figure 4. The following description assumes the GATE INPUT is selected active-high (FUNCTION switch “D” in the UP position) and the TRIGGER INPUT is selected to the active-low state (FUNCTION switch “A” in the DOWN position).

When a stream of trigger pulses is sent to the TRIGGER INPUT and the GATE INPUT is in the HIGH state (TTL logic “1”, +5V), the VMM-T1 will operate as described in the “OPERATOR CONTROLS” section.

Once the GATE INPUT changes to the TTL LOW state (TTL logic “0”, 0V), all trigger signals being sent to the TRIGGER INPUT are disabled.

A single TTL HIGH pulse at the GATE INPUT equal to the trigger period will allow one trigger signal from the trigger stream to be enabled. (See Figure 4A)

If a single TTL HIGH pulse arrives at the GATE INPUT and is equal to twice the trigger period, two trigger signals from the trigger stream will be enabled. (See Figure 4B) Therefore, the number of trigger pulses input (or GATE INPUT duration) is equal to the trigger period times the number of exposures desired.

Please note: The VMM-T1 TRIGGER INPUT triggers the internal timers. The EXP PRESET will determine the number of cycles which is the combination of EXPOSURE and DELAY time.

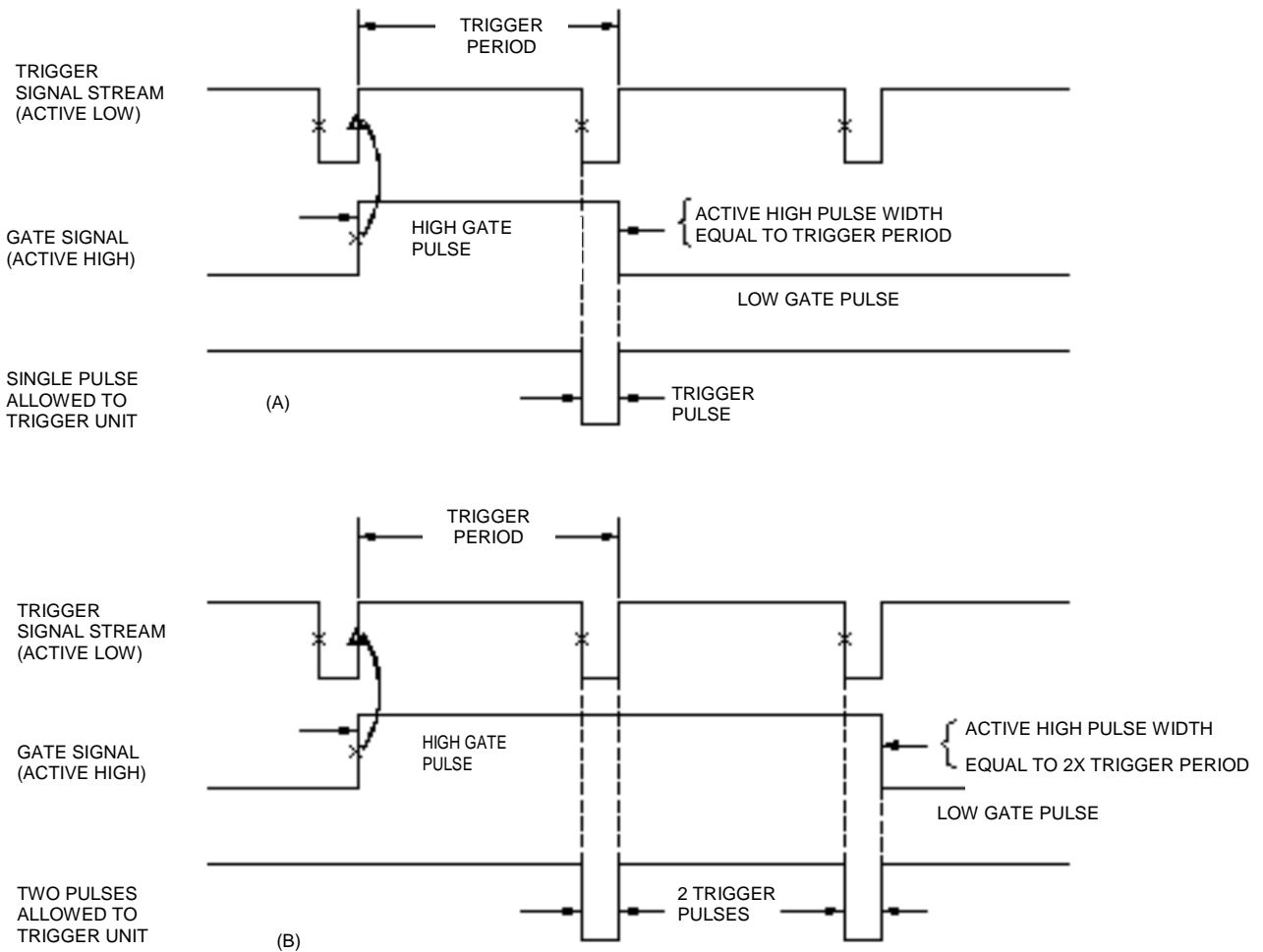


Figure 4A & 4B: Gate Input Timing Diagram

RS-232C Operation

The **VMM-T1** inputs can be controlled via an RS-232C computer serial signal (COM port). From the computer's RS-232C serial port, connect a cable such as the Model **910RS** (not supplied), the **910RSDC** (not supplied), a null modem cable, or a user-constructed cable (with connections as enumerated in the INPUT SPECIFICATIONS) to the unit's RS-232C interface.

Connect the Tx (transmit) from the host to the Rx (receive) on the **VMM-T1** control unit. All other lines are not used except for the ground connection. If the host contains a 25-Pin D-Sub or an 8-Pin Mini-DIN, check the computer's user manual to find the proper corresponding pin-outs. In most cases the corresponding 25-Pin D-Sub pin-out and MAC 8-Pin Mini-DIN are as follows:

Function		VMM DB-9F	IBM DB-9M	IBM DB-25M	MAC Mini-DIN-8F	VCM RJ45
Rx	Receive Data	2	2	3	5	5
Tx	Transmit Data	3	3	2	3	6
GND	Signal Ground	5	5	7	4	4

General Pin-Outs for 25-Pin D-Sub and MAC 8-Pin Mini-DIN

All other pins not used. Be sure to connect the Tx pin, Pin 3, from the IBM 9-Pin D-Sub (or Pin 2 from the 25-Pin D-Sub) male connector to the Rx pin, Pin 2, of the **VMM-T1** 9-pin D-SUB female connector, located on the rear panel, for proper operation. Connect all other functions by type as indicated above. By sending the proper commands the unit will respond by activating the proper functions.

The **RS-232C Test Program** listed elsewhere in this manual will allow operation of the VMM-T1 from the computer keyboard.

Activation of the EXPOSURE and DELAY times with a TRIGGER command through the RS-232C interface can be de-activated as follows:

- a. RESET command from the control unit's front panel
- b. Through the RESET INPUT BNC on the rear panel
- c. Reset command through the RS-232C

*When an open command is sent to the **VMM-T1** controller, a RESET command will **not** close the shutter. The shutter must be closed with a CLOSE command. The **VMM-T1** controller trigger command from the RS-232C is utilized to trigger the built in timers.*

Up to eight **VMM-T1** controllers can be daisy-chained together (connected through the same serial port) using the **910RSDC** cable. One cable is required for each controller in the chain.

Figure 5 illustrates connecting two controllers from a single serial port. Once connected, each unit will require a unique address in the chain. This is accomplished by adjusting the octal switch beneath the 9-pin D-SUB connector on the rear panel to the desired command range. See “ADDRESS SELECT” under GENERAL CHARACTERISTICS in the SPECIFICATIONS section for a complete listing of the command range for each octal switch position. The specific command range set will decode commands sent via the serial port. A set of “ALL” commands is also available to simultaneously control all units connected to the serial port.

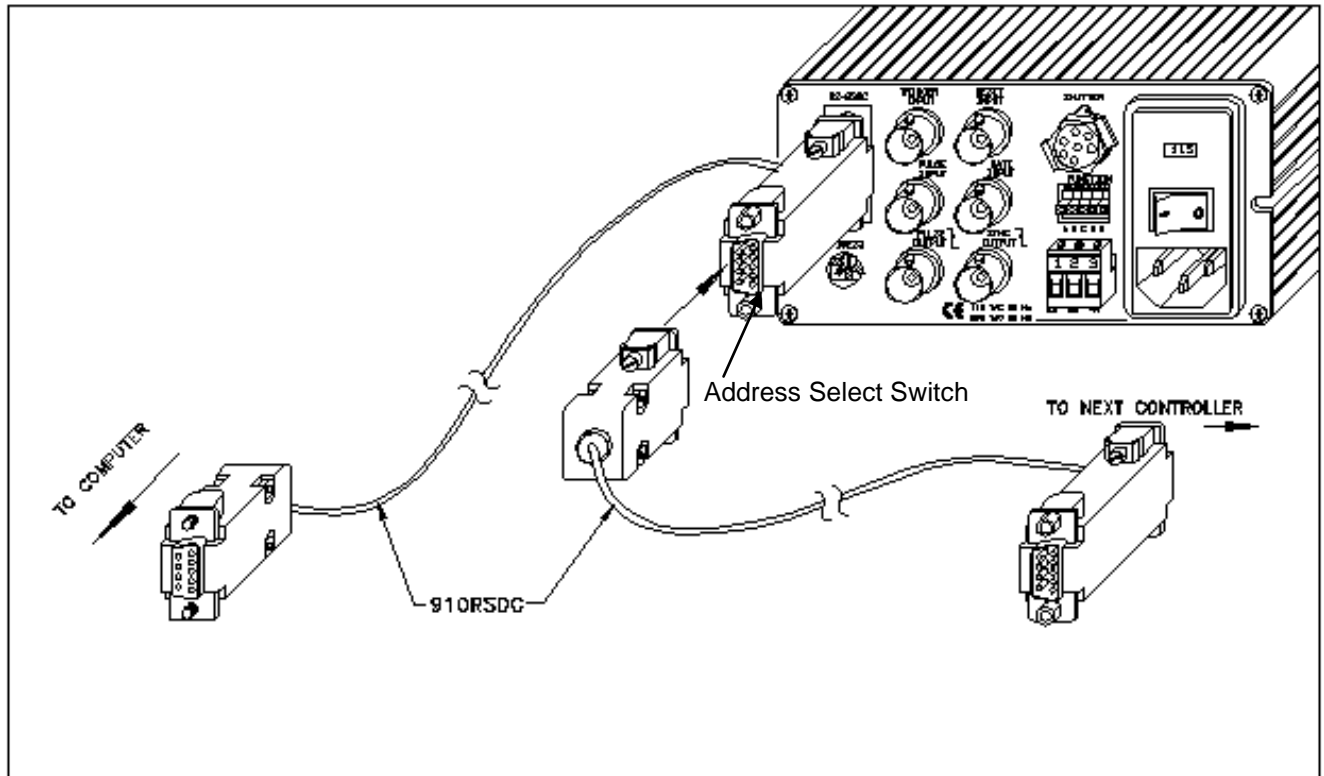


Figure 5: VMM-T1 Daisy-Chain Cable Configuration

RS-232C Test Program

The following is a test program written to test the input commands to the RS-232 interface of the **VMM-T1** controller. This program and LabView programs (not listed) are available by contacting Vincent Associates at our web site (www.uniblitz.com), via e-mail (vincentassociates@uniblitz.com), or calling (800) 828-6972. Other programs may be available, please contact technical support for further information.

```
REM PROGRAM TO SEND COMMAND PULSES TO RS232C INTERFACE AND VMM-T1
REM WRITTEN BY STEVE PASQUARELLA, VINCENT ASSOCIATES.
REM LAST REVISION 7/29/99 BY RICHARD ST.LOUIS
REM COMPUTER LANGUAGE USED – Microsoft Quick Basic ver. 4.0
```

```
CLS 0
K = -1
WHILE K
    OPEN "COM1:9600,N,8,1,CS0,DS0" FOR RANDOM AS #1
    J = 64
    C$ = "X"
```

```
MENU:    PRINT
          PRINT
          PRINT
          PRINT "WAITING FOR KEYSTROKE COMMAND "
          PRINT "TYPE:"
          PRINT "    VMM-T1          "
          PRINT "    -----          "
          PRINT "    O - OPEN Shutter      "
          PRINT "    C - CLOSE Shutter    "
          PRINT "    T - TRIGGER Control  "
          PRINT "    R - RESET Control    "
          PRINT "    G - OPEN Aux-Out     "
          PRINT "    F - CLOSE Aux-Out    "
          PRINT
          PRINT "    S - SET Octal Switch Address "
          PRINT "        (Current Starting Decimal # = "; J; ")"
          PRINT "        (Current Octal Address Value = "; C$; ")"
          PRINT
          PRINT "    Q - QUIT Program      "
          PRINT
          PRINT
```

```
START: A$ = INKEY$
      IF A$ = "O" OR A$ = "o" THEN
          PRINT #1, CHR$(J);
          PRINT "SHUTTER OPEN COMMAND SENT"
```

```

GOSUB TIMEOUT
GOTO MENU
ELSEIF A$ = "C" OR A$ = "c" THEN
    PRINT #1, CHR$(J + 1);
    PRINT "SHUTTER CLOSE COMMAND SENT"
    GOSUB TIMEOUT
    GOTO MENU
ELSEIF A$ = "T" OR A$ = "t" THEN
    PRINT #1, CHR$(J + 2);
    PRINT "CONTROL TRIGGER COMMAND SENT"
    GOSUB TIMEOUT
    GOTO MENU
ELSEIF A$ = "R" OR A$ = "r" THEN
    PRINT #1, CHR$(J + 3);
    PRINT "CONTROL RESET COMMAND SENT"
    GOSUB TIMEOUT
    GOTO MENU
ELSEIF A$ = "G" OR A$ = "g" THEN
    PRINT #1, CHR$(J + 4);
    PRINT "AUX OPEN COMMAND SENT"
    GOSUB TIMEOUT
    GOTO MENU
ELSEIF A$ = "LF" OR A$ = "f" THEN
    PRINT #1, CHR$(J + 5);
    PRINT "AUX CLOSE COMMAND SENT"
    GOSUB TIMEOUT
    GOTO MENU
ELSEIF A$ = "Q" OR A$ = "q" THEN
    K = 0
    PRINT "PROGRAM TERMINATED"
ELSEIF A$ = "S" OR A$ = "s" THEN
    INPUT "ENTER OCTAL ADDRESS 0 - 7 or X: ", B$
    GOSUB ADDRESS
    GOTO MENU
ELSE GOTO START
END IF

```

```

WEND
END

```

```

TIMEOUT:   FOR I = 1 TO 100: NEXT I
           CLS 0
           RETURN

```

```

ADDRESS:   IF B$ = "X" OR B$ = "x" THEN
           J = 64
           C$ = "X"
           ELSEIF B$ = "0" THEN

```

```
J = 128
C$ = "0"
ELSEIF B$ = "1" THEN
J = 144
C$ = "1"
ELSEIF B$ = "2" THEN
J = 160
C$ = "2"
ELSEIF B$ = "3" THEN
J = 176
C$ = "3"
ELSEIF B$ = "4" THEN
J = 192
C$ = "4"
ELSEIF B$ = "5" THEN
J = 208
C$ = "5"
ELSEIF B$ = "6" THEN
J = 224
C$ = "6"
ELSEIF B$ = "7" THEN
J = 240
C$ = "7"
ELSE J = 64
      C$ = "X"
END IF
PRINT "STARTING ASCII DECIMAL # = ", J
GOSUB TIMEOUT
CLS 0
RETURN
```

Shutter Frequency of Operation

The repeat exposure specification as listed in this manual is specified at 35 ms. This is an optimum value to ensure enough pulse energy to open any **UNIBLITZ** shutter. However, the **VMM-T1** is capable of operating each Vincent shutter to its maximum frequency with a slight sacrifice in shutter opening speed. This is due to the drive circuit, which allows the pulse voltage to drop with an increase in frequency to compensate for the heat that is developed in the shutter coil. See graphs Figure 6 and 7.

Contact the factory for specific information concerning shutter and/or drive modifications that may be necessary for operating shutters at their maximum frequency.

Please note that fuse blowing problems, specifically shutter fuses, may be due to high frequency operation without proper fuse selection. Due to the large number of different frequencies and duty cycles in which the shutter is used please contact the factory for further details regarding specific fuse selection.

Trigger Cautions and Trouble Shooting Tips

The **VMM-T1** system's capability can be greatly enhanced by external control as described previously, however, extreme care must be taken to ensure that high voltages (see SPECIFICATIONS) are not inadvertently switched into external control inputs. Also note that large negative voltages can cause irreparable damage to the unit's internal circuitry. *Exercise extreme caution.*

Visual inspection of a fuse is NOT an adequate test to determine if a fuse failure has occurred. Use a DMM (Digital Multi-Meter) or equivalent test device to determine fuse continuity.

Particular shutter units respond to different minimum pulse widths. For example, a standard VS25 shutter with Teflon coated shutter blades has a minimum exposure pulse of 6 msec. If the timing or pulse width is set for an exposure pulse width less than 6 msec the shutter may not open fully. If the unit still does not operate properly, when using the proper pulse width, please contact Vincent Associates immediately.

Please note that if a Vincent Model **910RS** RS-232C interface cable is not being used, a standard RS-232C cable will ***not*** work with these controls. A "**NULL MODEM**" type interface cable must be used in this situation.

When operating shutters with apertures larger than 25 mm, please be sure that the FUNCTION slide switch "E" is set to the upper position. Failure to make this change may result in incomplete shutter opening and causing immediate shutter close resulting in probable loss of capture.

When operating shutters with a 25 mm aperture or smaller, please be sure that the FUNCTION slide switch "E" is set to the lower position. Failure to observe this setting is likely to cause damage to the shutter, thereby voiding the shutter warranty.

The shutter may be shipped with a small circular white plastic protective ring around the male connector contacts. This ring protects the male connector's contacts during shipping. It is held on by friction and must be removed prior to attaching the female end of the Model 710C cable to the shutter. This ring can be removed by gently pulling up off the top of the connector. No tools are required.

Pulse Voltage Graphs

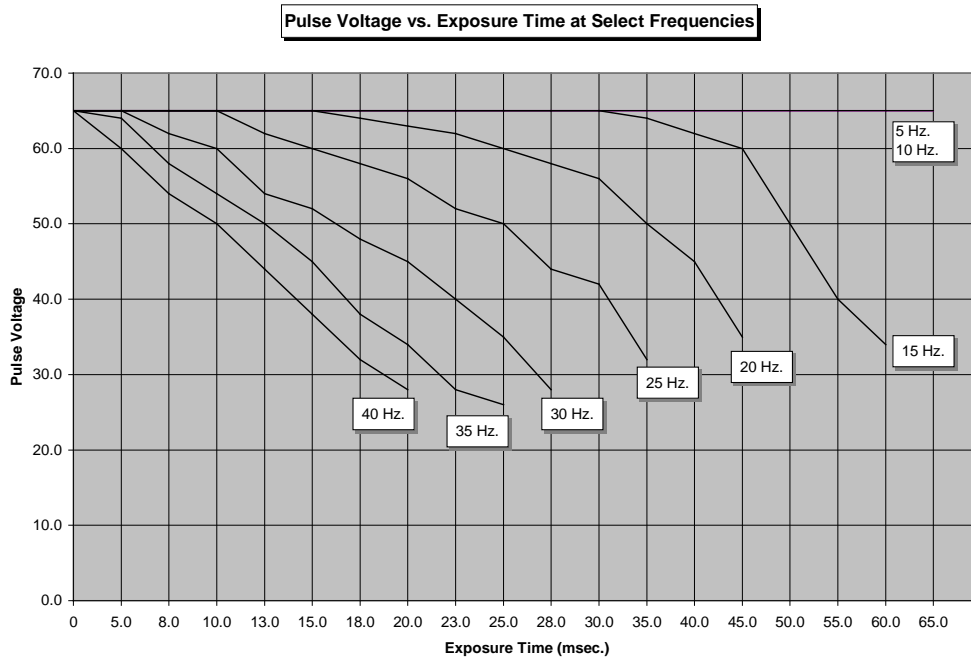


Figure 6: Pulse Voltage vs. Exposure Time

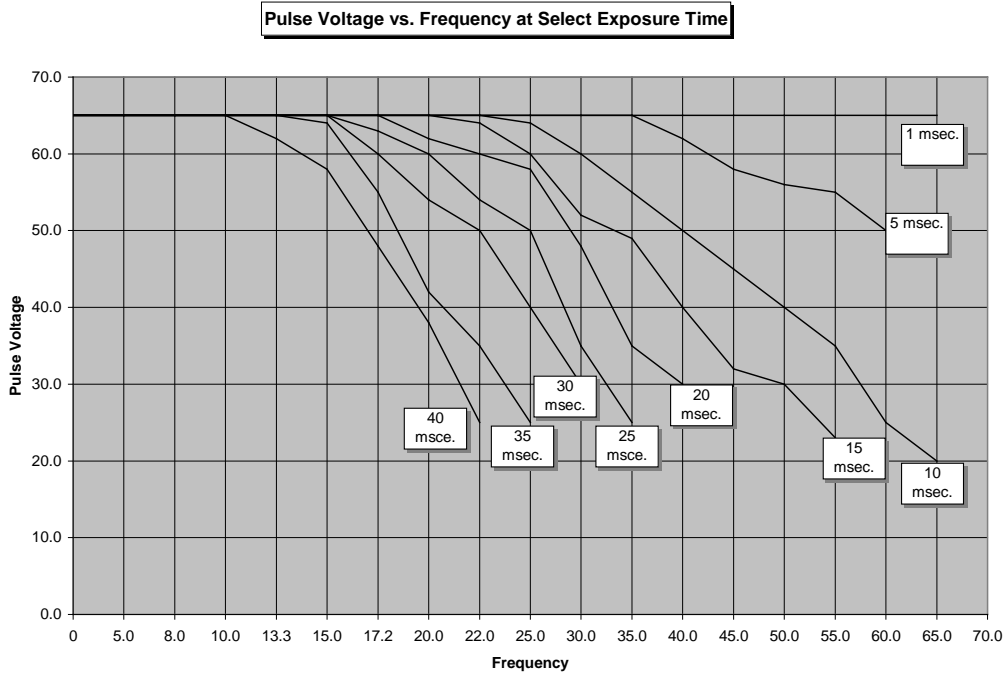


Figure 7: Pulse Voltage vs. Frequency

Dimensions

The overall dimensions of the VMM-T1 are shown in Figure 8.

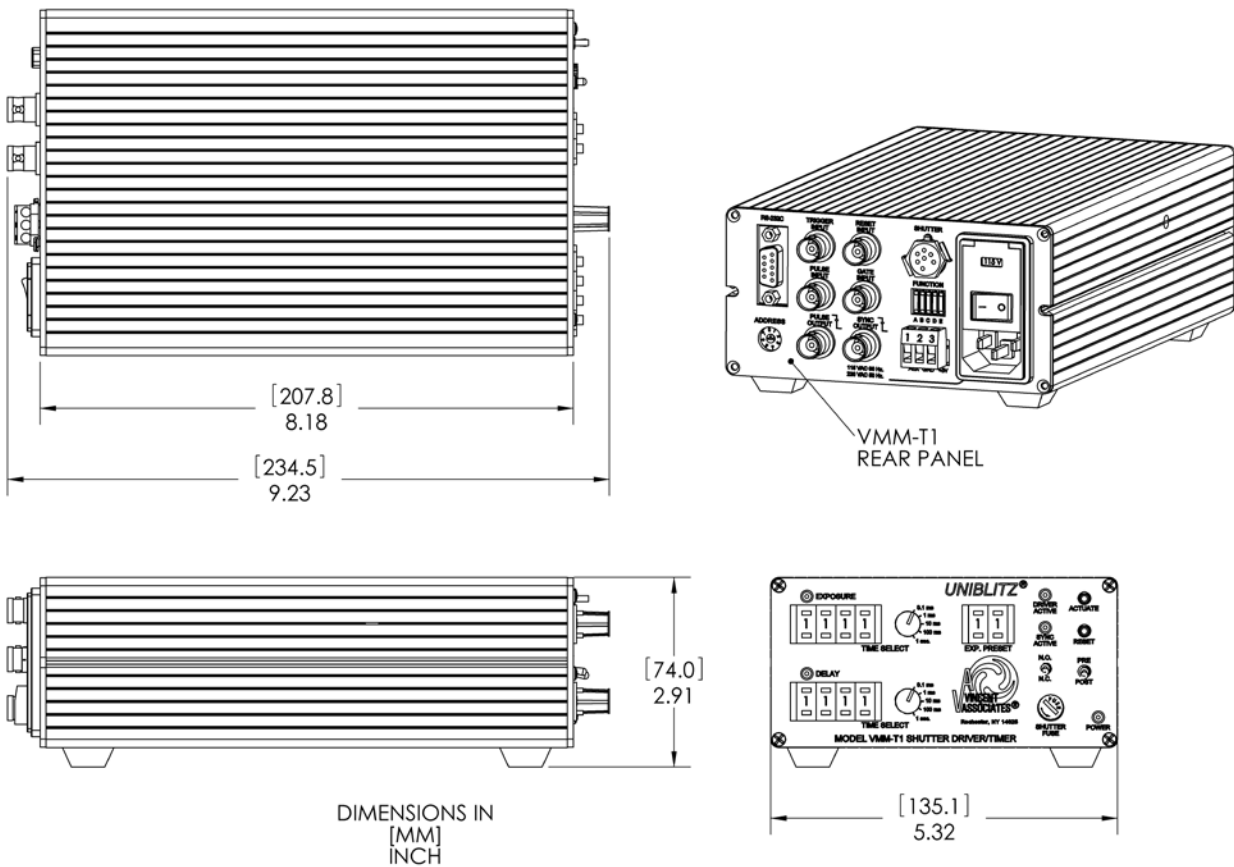


Figure 8: Overall VMM-T1 Dimensions

Maintenance

Proper care and maintenance of the unit should be taken as with any electronic instrument.

With the exception of line and shutter fuse replacement, there are no user-serviceable parts outside or inside of the **VMM-T1**.

There is no service to be performed by the user other than exterior inspection for visible damage of the case and line cord and exterior cleaning.

The only user service that can be performed is **Fuse Replacement** or **Line Voltage Change** procedures.

Although the stability of the drive voltage is checked and calibrated prior to shipment, it may become necessary to make some minor adjustments to the operating systems of the **VMM-T1** over time.

It is highly recommended that if a problem is suspected that the unit be returned to the factory for checkout, adjustment and calibration. Failure to do this may damage the unit's circuitry and/or functionality.

General Care

Perform routine inspection of the **VMM-T1** on a regular basis.

Inspect the outer case for any signs of visible damage

Pay particular attention to the condition of the AC line cord. If there are any signs of damage or deterioration, replace it immediately with an approved line cord.

Follow the **Exterior inspection and Cleaning Procedures** elsewhere in this manual.

Inspection and Cleaning

Inspection – Exterior

Inspect the outside of the **VMM-T1** for damage, wear, and missing parts. A device that appears to have been dropped or shows other signs of exterior damage should be checked thoroughly to verify correct operation and performance. If damage is suspected, please return the unit to the factory for repair – there are no user-serviceable parts.

Cleaning Procedure – Exterior

To prevent getting moisture inside the unit during external cleaning, use only enough liquid to dampen the cloth or applicator.

CAUTION

1. Remove loose dust on the outside of the **VMM-T1** with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.

Inspection – Interior

*Do not attempt to open the case of the **VMM-T1** under any circumstances. There are no user-serviceable parts inside the case.*

Cleaning Procedure – Interior

*Do not attempt to open the case of the **VMM-T1** under any circumstances. There are no user-serviceable parts inside the case.*

Specifications

System Characteristics

Name	Description
Exposure Interval	<ul style="list-style-type: none"> • 0.1 msec (100 μS) to 9999 sec (2.8 hrs) in five decade ranges • Variable within each decade with 4-digit pushwheel switches.
Delay interval	<ul style="list-style-type: none"> • 0.1 msec (100 μS) to 9999 Sec (2.8 hrs) in five decade ranges • Variable within each decade with 4-digit pushwheel switches.
Repeat Exposure	<ul style="list-style-type: none"> • 01 to 99 exposures variable or continuous (00) selectable with EXP. PRESET 2-digit pushwheel switches • 35 msec minimum between exposures (100 msec minimum for 35 mm and larger aperture shutters).
Accuracy	<ul style="list-style-type: none"> • Exposure and Delay $\pm 0.5\%$ all ranges (crystal time base) • Maximum 20 μS propagation delay from application of trigger to pulse applied to driver • Typical 5 - 7 μS delay.
Shutter Drive	<ul style="list-style-type: none"> • Continuously variable frequency of exposures from DC to the shutter's maximum rate • Maximum peak pulse power 400 W • Pulse voltage 70 VDC • Pulse current 5.7 A (test conditions: VS35 shutter, standard 5 Volt, 12 ohm coil cycled with 20 ms exposure at 5 Hz).

External Input Characteristics

Name	Description
TRIGGER INPUT (BNC) Rear Panel	<ul style="list-style-type: none"> • Input impedance 50K ohms • Source current 100 μA • Active-low or active-high selectable with FUNCTION slide-switch A • Minimum pulse width required to ensure triggering: 100 μS • TTL compatible: <ul style="list-style-type: none"> - Minimum high-level +2.0 VDC - Maximum low-level +0.8 VDC - Sink current 1.0 μA
RESET INPUT (BNC) Rear Panel	<ul style="list-style-type: none"> • Input impedance 50K ohms • Source current 100 μA • Active-low or active-high selectable with FUNCTION slide-switch C • Minimum pulse width required to ensure reset: 100 μs • TTL compatible <ul style="list-style-type: none"> - Minimum high-level +2.0 VDC - Maximum low-level +0.8 VDC. - Sink current 1.0 μA
GATE INPUT (BNC) Rear Panel	<ul style="list-style-type: none"> • Input impedance 50K ohms • Source current 100 μA • Active-low or active-high selectable with FUNCTION slide-switch D • Minimum pulse width determined by period of signal applied to TRIGGER Input • Maximum pulse width determined by multiple of TRIGGER signal period • TTL compatible <ul style="list-style-type: none"> - Minimum high-level +2.0 VDC - Maximum low-level +0.8 VDC - Sink current 1.0 μA

Name	Description				
PULSE INPUT (BNC)	<ul style="list-style-type: none"> • Input impedance 50K ohms • Source current 100 μA • Active-low or active-high selectable with FUNCTION slide-switch B • Minimum pulse width determined by applicable shutter • Maximum pulse width unlimited • TTL compatible <ul style="list-style-type: none"> - Minimum high-level +2.0 VDC - Maximum low-level +0.8 VDC - Sink current 1.0 μA 				
RS-232C Input (DB-9 Female)	<ul style="list-style-type: none"> • "Null Modem" type input • Baud rate 9600 • 8 Data bits • 1 Stop bit • No parity • No flow control • Command transmission time: 0.94 msec • 4 commands available • 1 global address location for commands • 8 local address locations for commands (see "ADDRESS SELECT" specification for switch settings of local address locations). Also see RS-232 Test Program. 				
Global Address Codes					
RS232C Commands	<u>Decimal</u>	<u>HEX</u>	<u>Octal</u>	<u>Binary</u>	<u>ASCII</u>
Open	64	40	100	01000000	@
Close	65	41	101	01000001	A
Trigger	66	42	102	01000010	B
Reset	67	43	103	01000011	C

External Output Characteristics

Name	Description
PULSE OUTPUT (BNC) Rear Panel	<ul style="list-style-type: none"> • Active-low only • Source impedance: 1K ohms • Maximum source current: 5.0 mA • Maximum sink current: 100 mA • Maximum (low-level) output voltage: 0.5 VDC • Minimum high level: +4.5 VDC • Duration time determined by width of active pulse applied to PULSE Input or Exposure Time setting
SYNC. OUTPUT (BNC) Rear Panel	<ul style="list-style-type: none"> • Active-low only • Source impedance: 1K ohms • Maximum source current: 6.8 mA • Maximum sink current: 25.0 mA • Maximum (low-level) output voltage 0.5 VDC • Minimum High Level: +4.5 VDC • This output provided for shutters equipped with the Electronic Synchronization (SYNC) option.
Delay Out (AUX Pin 1) Rear Panel	<ul style="list-style-type: none"> • Active-high only • Source impedance: 1K ohms • Maximum source current: 5.0 mA • Maximum sink current: 100 mA • Maximum (high-level) output voltage: +5.0 VDC. • Duration time determined by Delay Time setting. (Delay interval can be set before exposure or after with PRE/POST toggle switch.)
+5V (AUX Pin 3) Rear Panel	<ul style="list-style-type: none"> • +5.0 volt DC regulated output provided for use in remote switching and/or control circuits.
GND (AUX Pin 2) Rear Panel	<ul style="list-style-type: none"> • 0 VDC ground reference provided for AUX output pins (located on rear panel).

General Characteristics

Name	Description
------	-------------

POWER Indicator Front Panel	<ul style="list-style-type: none"> Red 3mm LED indicates when unit is powered. 																																																		
	<ul style="list-style-type: none"> 																																																		
DRIVER ACTIVE Indicator Front Panel	<ul style="list-style-type: none"> Red 3mm LED indicates when the shutter driver circuit is active. LED will illuminate with or without the load of a shutter's actuator coil. 																																																		
SYNC. ACTIVE Indicator Front Panel	<ul style="list-style-type: none"> Green 3mm LED indicates when a shutter's Electronic Synchronization (SYNC) circuit is active. SYNC. OUTPUT will be low when this LED is on. Indicator will only operate if the shutter used is equipped with the solid-state sync. sensor. 																																																		
EXPOSURE Indicator Front Panel	<ul style="list-style-type: none"> Green 3mm LED indicates when EXPOSURE time base is active. 																																																		
DELAY Indicator Front Panel	<ul style="list-style-type: none"> Green 3mm LED indicates when DELAY time base is active. 																																																		
	<ul style="list-style-type: none"> 																																																		
<p style="text-align: center;">ADDRESS Select (Octal Rotary Switch)</p> <p style="text-align: center;"><u>RS232 Commands</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">X</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">1</td> <td style="width: 10%; text-align: center;">2</td> <td style="width: 10%; text-align: center;">3</td> <td style="width: 10%; text-align: center;">4</td> <td style="width: 10%; text-align: center;">5</td> <td style="width: 10%; text-align: center;">6</td> <td style="width: 10%; text-align: center;">7</td> </tr> <tr> <td style="text-align: right;">Open</td> <td>64</td> <td>128</td> <td>144</td> <td>160</td> <td>176</td> <td>192</td> <td>208</td> <td>224</td> <td>240 (Decimal)</td> </tr> <tr> <td style="text-align: right;">Close</td> <td>65</td> <td>129</td> <td>145</td> <td>161</td> <td>177</td> <td>193</td> <td>209</td> <td>225</td> <td>241 (Decimal)</td> </tr> <tr> <td style="text-align: right;">Trigger</td> <td>66</td> <td>130</td> <td>146</td> <td>162</td> <td>178</td> <td>194</td> <td>210</td> <td>226</td> <td>242 (Decimal)</td> </tr> <tr> <td style="text-align: right;">Reset</td> <td>67</td> <td>131</td> <td>147</td> <td>163</td> <td>179</td> <td>195</td> <td>211</td> <td>227</td> <td>243 (Decimal)</td> </tr> </table>		X	0	1	2	3	4	5	6	7	Open	64	128	144	160	176	192	208	224	240 (Decimal)	Close	65	129	145	161	177	193	209	225	241 (Decimal)	Trigger	66	130	146	162	178	194	210	226	242 (Decimal)	Reset	67	131	147	163	179	195	211	227	243 (Decimal)	<p>Allows selection of individual (local) address locations of commands sent by a PC's serial port. ADDRESS Switch Positions (x = don't care or global)</p>
	X	0	1	2	3	4	5	6	7																																										
Open	64	128	144	160	176	192	208	224	240 (Decimal)																																										
Close	65	129	145	161	177	193	209	225	241 (Decimal)																																										
Trigger	66	130	146	162	178	194	210	226	242 (Decimal)																																										
Reset	67	131	147	163	179	195	211	227	243 (Decimal)																																										
<p style="text-align: center;">FUNCTION Select Rear panel</p>	<ul style="list-style-type: none"> Slide-switches A, B, C, and D allow selection of active-low or active-high states for the four BNC inputs and outputs Slide-switch E allows the selection of additional pulse energy for 35 mm and larger shutters. These 5 switches are banked together. 																																																		

Name	Description		
	Position		
Function	Slide Switch	Lower	Upper
TRIGGER INPUT	A	active-low	active-high
PULSE INPUT	B	active-low	active-high
RESET INPUT	C	active-low	active-high
GATE INPUT	D	active-low	active-high
PULSE ENERGY	E	25mm & smaller	35mm & larger
Power Requirements	<ul style="list-style-type: none"> • 115 VAC $\pm 5\%$, 60 Hz or 230 VAC $\pm 5\%$, 50 Hz., 60 watts • Selected manually by rotating the fuse holder of the AC power entry module. See "Voltage Change" instructions. 		
Fuse Requirements	<ul style="list-style-type: none"> • Two 0.5 Amp, "T" slow blow, 3AG for 115 VAC line • Two 0.25 Amp, "T" slow blow, 3AG for 230 VAC line • One 0.6 Amp, "T", slow blow, 5 x 20 mm for Shutter actuator coil • See "LINE FUSE REPLACEMENT" instructions for AC power fuse change 		
Operating Temperature	<ul style="list-style-type: none"> • +5° C to +40° C (+41° F to +104° F) 		
Storage Temperature	<ul style="list-style-type: none"> • -20° C to +55° C (-4° F to +131° F) 		
Size (HWD)	<ul style="list-style-type: none"> • 2.638" x 5.354" x 8.186" (67.0 x 136.0 x 207.9 mm) 		
Weight	<ul style="list-style-type: none"> • 3.50 lbs (1.59 kg) 		
Relative Humidity	<ul style="list-style-type: none"> • 80% at +31° C (+88 ° F) ambient decreasing linearly to 50% at +40 ° C (104 °F) 		
Pollution	<ul style="list-style-type: none"> • Degree 2 		
Overvoltage	<ul style="list-style-type: none"> • Category II 		

Name	Description
Supplied Accessories	<ul style="list-style-type: none"> • Interconnect Cable Model 710C, 3 meters • AC Line Cord, IEC Type, North America • Two 0.25 Amp, 3AG, 230 VAC line fuses • User Manual • Checklist
Optional Accessories (Not Supplied)	<ul style="list-style-type: none"> • Model 710R Remote handheld trigger cable for use with active-low BNC • Model 710R/F Remote footswitch trigger cable for use with active-low BNC • Model 910RSDC RS-232C interconnect cable for daisy-chain applications (One (1) cable required per unit in the chain) • Model 910RS RS232C interconnect cable for serial port

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