ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Coherent / Molectron Opti-Mum 4001* at our website: ***Click HERE***

MOLECTRON DETECTOR OPTI-MUM™ 4001

4-CHANNEL JOULEMETER RATIOMETER

Operator Manual
March, 1991

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOLECTRON DETECTOR MODEL OPTI-MUM™ 4001
4-CHANNEL JOULEMETER RATIOMETER

TABLE OF CONTENTS

I. GENERAL INFORMATION 5

Introduction 5

II. INSTALLATION 6

Unpacking and Inspection 6
Power Supply 6
Safety Precautions 6
Selecting Line Voltage 7

III. FRONT PANEL USER INTERFACE 8

General Information 8
Annunciators 8
Menu Path Line 8
System Info 10
Data Display 10
Keys 10
The Live Display (LIVE>) 10
Annunciators Area 10
RCV/XMT 10
BATCH Mode 12
LOGGER 12
TRIGGER 12
CHANNEL A,B,C,D 13
System Info Area 13
Display Control Keys 13
Clock/Calendar 13
Keys Area 13
RANGE 13
UNITS 14
0.STATS 14
+DISPLAY 14
SETUP 14
The Setup Menus (LIVE> SETUP> ...) 14
CHANNEL> Ch SETUP 15
CHANNEL> PROBES> 16
DISPLAYS> LAYOUT> 17
SYSTEM> CONFIGURE 18
SYSTEM> COMM 18

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SYSTEM> STATS 18
OUTPUTS> LOGGER 18
OUTPUTS> SYNCER 19
OUTPUTS> SENDER 20
OUTPUTS> PRINTER 20

IV. COMPUTER INTERFACE WITH THE OPTI-MUM™ 4001 21

General Information 21
1. Statistics 23
0.LEVEL 23
0.STATS 23
STATS 23
HOLD 23
REPEAT 23
2. Channel Setup 24
CH 24
EXT 24
INT 24
TRIG. 24
RANGE 25
JOULES 25
VOLTS 25
LEVEL 25
MULT 26
3. Sync Mode 26
BURST 26
FIRE 26
HALT 26
HZ 27
SEC 27
SYNC.ON 27
SYNC.OFF 27
4. Instrument Control 27
?STATUS 27
DISPLAY 28
LOCK 28
UNLOCK 28
STATUS 28
ECHO 29
5. Logger and Sender Setup 29
LOGGER 29
LOG:...;LOG 29
REC/FILE 30
INIT.LOG 30
LOG 30

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

FILE # 30
?LOG 31
SENDER 31
SEND:...;SEND 31
SENDER. 32
6. Status Commands 32
?BURST 32
?CH 32
?DISPLAY 33
?DUTY 33
?LEVEL 33
?LOCK 33
?MULT 33
?RANGE 34
?TRIG 34
?TRIGMODE 34
?UNITS 34
7. Data Formats 34
SHORT 35
LONG 35
ASCII 36
STATUS 37

V. LIMITED WARRANTY 39

LIST OF FIGURES

Figure 1. Live Display Area 9

Figure 2. Typical Live Display (4-Channel) 11

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

I. GENERAL INFORMATION

Introduction

Congratulations! You have chosen the most powerful and advanced multichannel Joulemeter/Ratiometer available today, the Molectron **OPTI-MUM™ 4001.**

This new microprocessor-based instrument is capable of simultaneously reading four pyroelectric joulemeter probes at a repetition rate of 1,000 Hz. A variety of statistical and other calculations may also be performed in real time, with the results stored in the built-in LOGGER memory, ported to a computer via RS-232 or GPIB and/or displayed on the high-resolution supertwist LCD front panel using predefined or user-generated formats. The transparent touchscreen display allows easy control of all instrument functions, and a computer may be interfaced to automate operation as desired.

In this manual, we have attempted to provide all the information you will need to get the most out of this innovative instrument. First-time users may wish to follow the tutorial "Getting Started" in the Appendix in order to have a guided tour of some of the features of the **OPTI-MUM™ 4001** after scanning through the "Front Panel User Interface" section. Of course, if you find yourself getting stuck, you're welcome to call our toll free number (800-366-4340) for assistance.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

II. INSTALLATION

Unpacking and Inspection

The equipment described in this manual was delivered to the carrier in good condition and properly packed. When the shipment of equipment is received, it should be inspected immediately for lost or damaged components; check the case for cracks, loose hardware, etc. Flip switches to insure none are broken. All the boxes comprising the shipment should be opened and unpacked carefully. Contents of the boxes are listed on the packing slip.

If loss or damage is to be claimed:

1. Notify the carrier or their agent for inspection of the loss or damage claimed. File claims with the carrier.

2. Save all shipping boxes and cartons for carrier's inspection until claim is settled.

3. If you require replacement for the parts damaged in shipment, please send us your purchase order. The amount shown in the replacement part invoice may then be collected from the carrier.

Power Supply

Safety Precautions

This instrument may be damaged if operated with the LINE VOLTAGE SELECTOR set for the wrong applied AC input-source voltage or if the wrong fuse is installed.

The **OPTI-MUM™ 4001** has a detachable, three wire power cord with a three-contact plug for connection to both the power source and protective ground. The protective ground contact connects to the accessible metal parts of the instrument. To prevent electrical shock, always use a power source outlet that has a properly grounded protective-ground contact.

OPERATE WITH COVERS IN PLACE! To avoid injury, do not remove the product covers or panels. Do not operate the product without all covers and panels in place.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Selecting Line Voltage

The **OPTI-MUM™ 4001** operates from a 100V, 120V, 220V or 240V nominal AC power source having a line frequency of 50 or 60 Hz. Before connecting the power cord to a power source, verify that the LINE VOLTAGE SELECTOR card, located in the rear panel fuse holder, is set so that the correct AC input voltage value is visible.

Conversion to other AC input voltages requires a change in the fuse holder card position and fuse value. Disconnect the power cord, open the fuse holder cover door and rotate the fuse-pull lever to remove the fuse. Remove the small printed circuit board and select the operating voltage by orienting the printed circuit board to position the desired voltage to be visible when pushed firmly into its slot. Rotate the fuse-pull lever back into its slot. Rotate the fuse-pull lever back into its normal position and insert the correct fuse into the fuse holder.

Verify that the correct line fuse is installed before connecting the line cord. For 100V and 120V, use a 1/2 Amp fuse and for 220V and 240V, use a 1/4 Amp fuse.

Artisan Technology Group - Quality Instrumentation ..: Guaranteed | (888) 88-SOURCE | www.artisantg.com

III. FRONT PANEL USER INTERFACE

General Information

The **OPTI-MUM™ 4001** front panel is an integrated assembly of a liquid crystal display (LCD) and a transparent touchscreen keyboard. In addition to the normal display information of letters and numbers, the instrument creates rectangular button areas which can be pressed to implement the function named within the box. In this way the instrument can easily present a variety of menus to the user, showing current configuration settings and simplifying the process of inputting new settings. The "feel" of the buttons created by the software of the **OPTI-MUM 4001** is somewhat different than the touch panel buttons you may be used to on a microwave oven, for example. The **OPTI-MUM 4001** will respond easily if you press gently in the middle of the box you want to activate, holding your finger down for about a quarter of a second. Pressing forcefully is never necessary, and remember that if your finger overlaps two active buttons at once, there will be no response.

There are two types of screens displayed on the front panel, either the "Live Display" or one of the "SETUP" menus. The Live Display is used during all measurements, so it provides a flexible display of data and several controls which directly affect the measurement status. The setup menus are logically organized into a tree structure, similar to the directories used in computer systems. The notation we use to specify a menu is to give its menu path line. The menu path line tells you what sequence of keys to press to reach a given menu, and it is always displayed on the screen as a reference point. A typical menu path line would be (Live> Setup> Channels> Ch SETUP).

The setup menus provide access to the less frequently needed information and controls of the **OPTI-MUM 4001**. The screen is divided into five distinct areas in either live or setup modes, as shown in figure 1. These areas and their functions are as follows:

Annunciators

Displays instrument status. In the live mode, there are seven buttons in this area for status control. In the setup menus, user prompts are displayed here to show the choices available for the parameter currently being programmed.

Menu Path Line

Indicates the current position in the menu tree structure at all times. In the Live Display this line adds a fast analog bargraph of the currently selected channel (A, B, C, or D) as a laser tuning or optical alignment aid.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

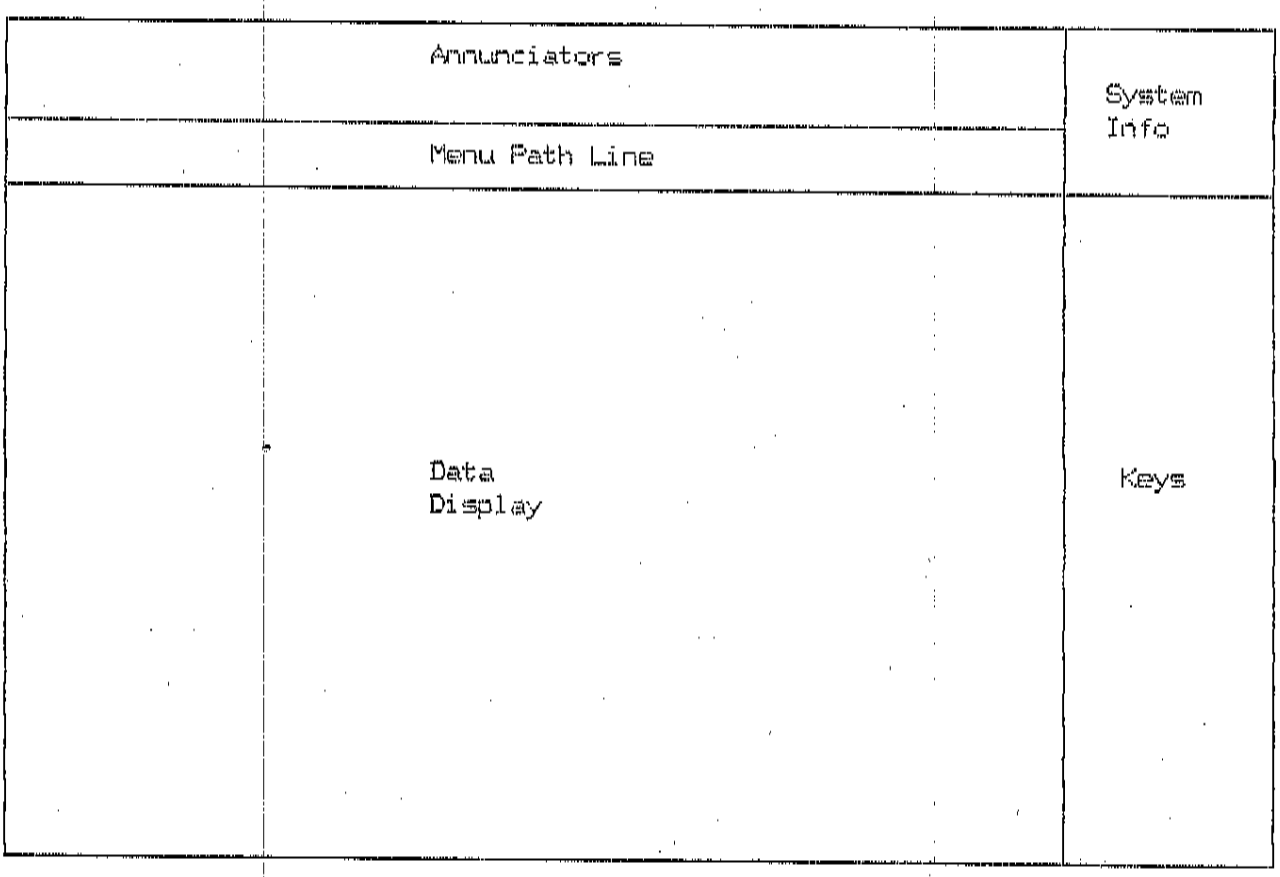


Figure 1. Live Display Areas

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

System Info

Displays date and time and contains controls for display contrast adjustment. Also contains a control to toggle the LCD display between "blue on white" and "white on blue" modes of display. This area is blank in the setup menus.

Data Display

In the live mode, data can be displayed in a variety of formats here. Quantities such as Joules, mean, ratios, frequency, etc. may be arranged in various layouts. One of the built-in display formats also includes a live strip chart display. In the setup menus, the selectable parameters and the values in that menu are shown in this area.

Keys

Displays five keys which are used to make various selections. In the Live Display, four of these are used as controls and the fifth (SETUP) is used to enter the setup menu structure.

The Live Display (Live>)

An example of the Live Display is shown in Figure 2. This is one of the four predefined display formats, in this case showing the reading, mean and standard deviation for each channel in the Data Display area. The other four screen areas in the Live Display always have the same functions regardless of the selected Data Display format. A detailed description of each area and function in the live display is as follows:

Annunciators Area

RCV / XMT

A dot momentarily appears to the right of the RCV annunciator whenever the instrument receives a message from the host computer over the communications link, either RS-232 or IEEE-488. A dot momentarily appears to the right of the XMT annunciator whenever the instrument transmits a message to the host computer over the active communications link. The active link is the one which most recently received a command; no other action is necessary to switch between RS-232 and GPIB. Touching this box has no effect.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

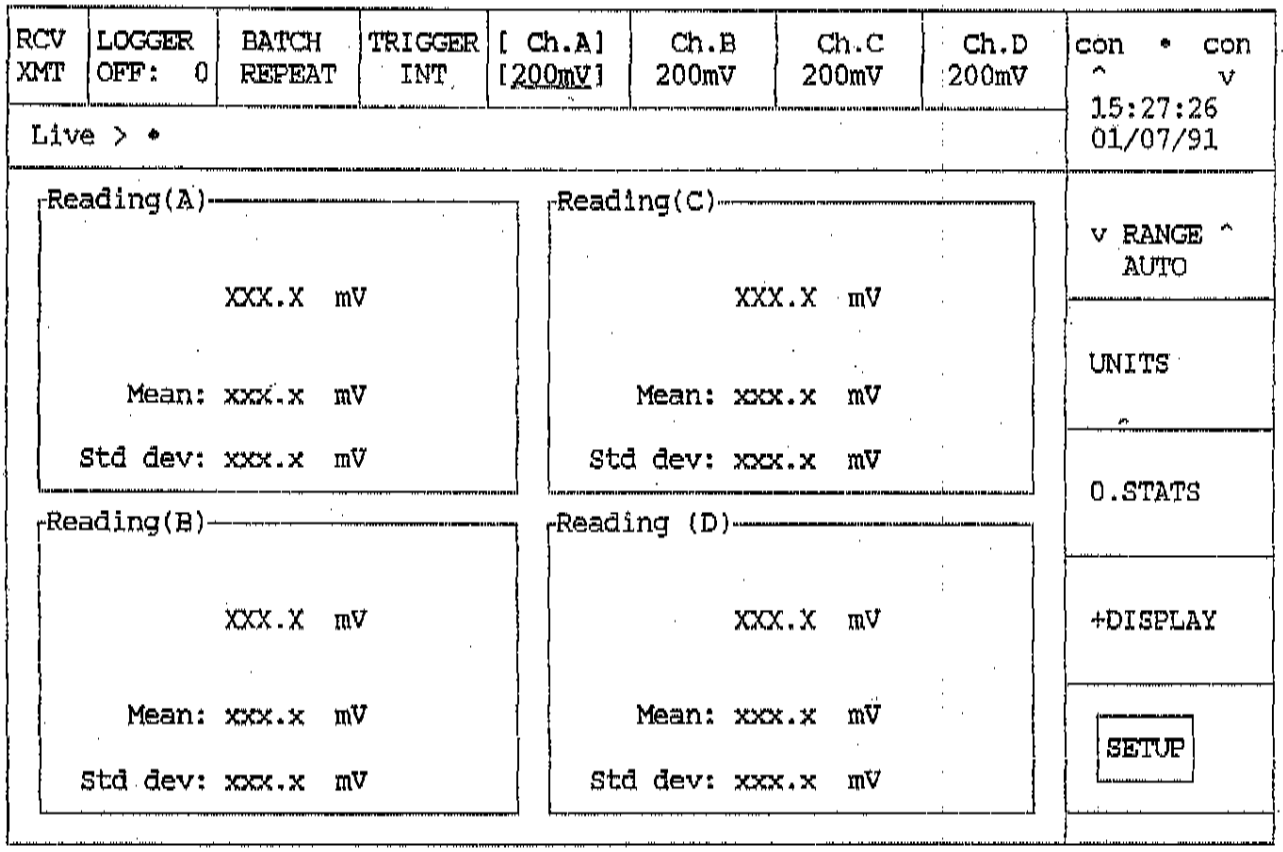


Figure 2. Typical Live Display (4-channel)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

BATCH Mode

Touching this box toggles between the two statistics modes, REPEAT and HOLD. When HOLD is selected, the OM 4001 will accept a number of triggers equal to the batch size selected in (Live> Setup> System> Stats), and then stop, so that results for a particular group of pulses can be displayed. Pressing the 0.STATS box in the keys area will then take a new set of data when desired. In REPEAT mode, triggers are always accepted, and the display will be continuously updated.

LOGGER

Displays status of the 128 Kbyte built-in data logger. The contents of the data logger may be sent to a computer via the comm link, while the format of the logged data is selected in (Live> Setup> Outputs> Logger). The bottom part of this box initially shows " OFF : 0". Touching this box will begin data logging and display either HLD or RPT, depending on the sampling mode (hold or repeat) selected in (Live> Setup> Outputs> Logger). With HLD selected, logging will automatically turn OFF after collecting one file, and the number displayed after the colon will increase by one to show the total number of files collected. In RPT mode, logging will continue until the box is touched to turn logging off; there will be no missing data between the end of one file and the beginning of the next even at high rep rates when RPT is used. When there is no longer enough room in Logger memory to hold another complete file, the HLD/RPT annunciator is replaced with "FUL".

TRIGGER

This displays and selects the trigger source, which may be EXT, INT, or one of the channels. EXT is the "trigger in" BNC connector on the OM 4001 back panel. INT will take a trigger from any of the four channels, except for any which may have " Trigger : disabled" selected in (Live> Setup> Channel> Ch Setup), and of course if a specific channel is selected, then only an input to that channel will trigger the instrument. To achieve a trigger from a given channel input, the applied signal must be greater than the percentage of full scale for that channel selected under "Trigger Level" in (Live> Setup> Channel> Ch Setup). The precise trigger threshold obtained will vary slightly depending on the risetime of the probe in use.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CHANNEL A,B,C,D

Four boxes which display the full-scale range and units for display of each channel. One channel is highlighted to indicate the "selected channel"; touch a box to select the desired channel. The selected channel will be the one affected by range or units changes, and in some data display formats, the data shown will change to represent the selected channel; for instance, on the built-in format with one large window which displays reading, mean, std dev, min, max, pulses, and period, these quantities will apply to the selected channel. You are reminded of this by the channel letter in parentheses after the word "reading", such as "Reading (A)", in the data display.

System Info Area

Display Control Keys

The up-and down-arrows labeled "CON" adjust the LCD contrast. The best contrast setting depends somewhat on room temperature and viewing angle. Pressing the dot between the "CON" labels switches the display mode between blue-on-white and white-on-blue, depending on your preference.

Clock/Calendar

Displays the current date and time. Battery backup will maintain the correct time even when power is switched off.

Keys Area

RANGE

Touching the up- or down-arrow in this box ranges the gain of the selected channel up or down. The "*" symbol labeled "auto" will set automatic range scaling for the selected channel, and "AUTO" will appear in the channel annunciator instead of a specific full scale value. If a single channel trigger source is selected, then autoranging is not allowed for that particular channel. If "INT" is selected for the trigger source, then autoranging is not allowed for any channel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

UNITS

Touching this key changes the display units for the selected channel between Volts and Joules. The voltage reading is always absolutely calibrated, while the relation of Joules to Volts is determined by the probe responsivity entered in (Live> Setup> Channel> Probes>) and the channel multiplier (which is available to accommodate attenuators) entered in (Live> Setup> Channel> Ch Setup)

0.STATS

Touching this key clears all statistics, and initiates collection of a data set when in BATCH HOLD mode. When operating in BATCH REPEAT mode, a 0.STATS is automatically generated each time the number of pulses equal to the batch size (set in Live> Setup> System> Stats) have been received. Pressing 0.STATS will interrupt the current batch and start from zero in either HOLD or REPEAT mode.

+DISPLAY

Touching this key cycles through the display formats. There are four predefined formats and three user-generated formats available. The predefined formats cannot be altered, while the user-defined formats may be freely created, stored, and edited in (Live> Setup> Displays>).

SETUP

Touching this key exits the Live Display and enters the setup menus, which are discussed in the following sections.

The Setup Menus (Live> Setup> ...)

Touching the SETUP key exits the Live Display and enters the menu structure. This is a tree structure of menus that allows you to perform a variety of setup operations. There are 9 setup menus grouped into four main headings (channel, displays, system, and outputs). These four headings and "DONE" are shown as keys when "SETUP" is pressed from the live display. "DONE" is always available to move the displayed screen up the menu tree toward the Live Display, while the other keys move toward specific setup screens. In some cases, there is a "SAVE" key that must be pressed if you wish to enter your changes before pressing "DONE".

When a setup screen has been reached, one of the parameters available in that menu will be highlighted; the highlight indicates which parameter is ready to be changed. To change the highlighted parameter, press the "NEXT CHOICE" key. This will either scroll that parameter's value through the possible values listed in the top annunciators area, or else an alphanumeric keypad will pop up to allow

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

input of the desired value. To move the highlight to a different parameter, press the "NEXT FIELD" key, and/or the "NEXT CHANNEL" key if that is listed. Some menus which list the four channels also include settings which apply to all the channels at once, in which case an "ALL CHAN" key is used to reach these settings. Once in the "ALL CHAN" area, the "ALL CHAN" key will become a "CHANNELS" key to allow return to the individual channel settings area. The ten setup menus have the following menu path lines:

```
LIVE> SETUP> CHANNEL  > Ch SETUP
             CHANNEL  > PROBES
             DISPLAYS > LAYOUT
             SYSTEM   > CONFIGURE
             SYSTEM   > COMM
             SYSTEM   > STATS
             OUTPUTS  > SYNCER
             OUTPUTS  > LOGGER
             OUTPUTS  > SENDER
             OUTPUTS  > PRINTER
```

The use and significance of each setup menu is discussed below in detail. The menus are covered in the same sequence as in the above list. The LIVE> SETUP> portion of the menu path line is common to all, and will be omitted for clarity here.

CHANNEL> Ch SETUP

This is primarily used to specify what probe is connected to each channel. With the highlight on the Probe type/ Serial Number area, the serial numbers of the available probes (which must have been previously entered through the CHANNEL> PROBES> menu) are listed as choices on the top annunciator line; use "NEXT CHOICE" to reach the correct probes. Having the correct probe entered for each channel is not only important for maintaining the correct calibration for display of energy units, but also the correct termination impedance and risetime setting is needed for a valid measurement of peak voltage from the probe.

The MULTIPLIER parameter is useful when an attenuator is employed with a joulemeter probe. If the transmission of the attenuator is entered in the MULTIPLIER field, the JOULES reading for that channel will be divided by the MULTIPLIER value (perhaps divider would be a better term), so that the same energy reading is obtained as would occur without the attenuator in place and a MULTIPLIER value of 1.000.

The TRIGGER ENABLED/DISABLED field determines whether that channel can cause a trigger when the trigger mode (shown in Live Display) is set to INT.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CH ON/OFF may be used to disable all readings on a channel with no probe connected. Turning a channel off will slightly enhance performance speed on the other channels, but it is generally not necessary to turn off any channels on account of performance. The response (Rv), rise time, and termination of the probe selected for each channel are displayed in this menu for convenience, but these values may be changed only at the time a new probe is entered.

Finally, the trigger level is selected in the "ALL CHAN" area; this is expressed as a percentage of the full scale reading needed to be input to cause a trigger on any channel selected as a trigger source. If an active trigger channel is operating on the most sensitive range scale, a low trigger level may cause susceptibility to false triggering on noise, particularly with high impedance probes. The 0.STATS command causes a reset of the analog front end which can also cause a false trigger in the extreme case of highest sensitivity, high impedance probe, and low trigger threshold. If this occurs, simply raise the trigger threshold or disable triggering on the offending channel.

CHANNEL> PROBES

This menu is used to add and delete specific probes from the list maintained in the **OPTI-MUM 4001** memory. A probe must be entered here before it can be selected for a channel in CHANNEL> Ch SETUP. When this menu is entered, pressing "NEXT CHOICE" allows you to review all the probes currently entered into memory. The probe serial numbers are listed on the top annunciator line, and all information for the highlighted probe is given in the data display area. The highlighted probe may be deleted by pressing "DEL PROBE" (caution: be careful not to leave your finger down too long or the auto key repeat will begin to delete the next probes as well!).

There is room for 20 probes in memory, including the "NULL" probe which cannot be deleted. The "NULL" probe has 1 megohm impedance and fast risetime. Press "NEW PROBE" to enter a new probe. First select the Molectron probe Model Number from the list on the annunciator line (or "USER" if you are connecting a non-standard probe) using the "NEXT CHOICE" key. Move the highlight to "SERIAL #" with the "NEXT FIELD" key and press "NEXT CHOICE" to obtain a pop-up keypad for entering the serial number or any other identifier that you find convenient; press "DONE" after typing the desired characters. Finally, enter the responsivity of the probe (listed on the probe body) in Volts/Joule. Risetime and impedance will already be correct based on the model number. You must then press "SAVE" to enter the probe into memory, and then press "DONE" to move on.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DISPLAYS> LAYOUT

This menu allows you to create, edit, and save custom data display formats. Before pressing "LAYOUT", use the "NEXT FORMAT" key to select which of the three user formats you wish to work with, then press "LAYOUT" to begin.

The strategy is to first create the desired arrangement of windows for the display, and then fill the windows with selected items of interest. There are four window sizes: the full screen, then that size divided in half vertically (half size), then that size divided in half horizontally (quarter size), then that size divided in half again horizontally (eighth size).

The numbers of data items a window can hold is as follows: full: 7 items; half: 5 items; quarter, 3 items; and eighth: 1 item. One window is listed as the "current window"; change the current window by pressing "NEXT WINDOW". Pressing "SPLIT" will divide the current window in two if that is possible, while "MERGE" will combine with an adjacent window into a larger one if possible. In this way, a large variety window arrangements can be obtained. Press "FUNCTIONS" to add or change data items displayed in the windows (to return to window arrangement after beginning "FUNCTIONS", press "NO FUNCTIONS", "DONE", "LAYOUT").

Of the 16 functions available for each channel, only 7 primary functions can be placed in the top position of any window. The top position item is in larger numbers than the other items, and the channel for the top position item will be the channel for other items in that window. The primary functions are: Reading, Mean, Std Dev, and Ratio of Reading / A, B, C, or D.

"Reading" is the channel selected by pressing the "CHANNEL" button. Use "NEXT CHOICE" to select the desired function for the highlighted area, and the "NEXT FIELD" key to move the highlighted area within the window. In addition to the primary functions, the following data items may also be placed in the lower window positions: Min, Max, Filter, Exposure, Power, Pulses, Misses, Period, Frequency. Min and Max show the extreme readings obtained since the last 0.STATS. Filter is a running average which includes the last 2,4,8, or 16 pulses as selected in System> Stats. Exposure is the sum of readings (whether Volts or Joules) since the last 0.STATS. Power, period, and frequency are calculated on a pulse-to-pulse basis by measuring the time interval from the previous pulse. Pulses counts the number of triggers since 0.STATS, while Misses shows how many of these were below the percentage of full scale selected for the missing shot limit in System> Stats. When the desired window arrangement and functions have been entered, press "DONE" once, and be sure to press "SAVE" next to enter that user format into memory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SYSTEM> CONFIGURE

This menu shows the PROM version running on your **OPTI-MUM™ 4001**, allows you to turn the audio key click on or off, and provides for setting the time and date in the display.

SYSTEM> COMM

The settings needed for GPIB and RS-232 are entered here. For GPIB, you need to set only the Bus Address (1-15). RS-232 communications require selection of Baud Rate (110 to 19,200), Data Bits (7 or 8), Stop Bits (1 or 2), and Parity (even, odd, or none). The appropriate values for the communications parameters are determined entirely by the equipment being connected to the **OPTI-MUM™ 4001.**

SYSTEM> STATS

Certain statistical settings are made here. The start delay allows you to bypass the selected number of pulses after issuing 0.STATS before using the incoming data for calculations. BATCH SIZE is the number of pulses used for calculation of mean, std dev, min, and max. MISSING SHOT LIMIT is used for calculating misses, which are taken to be any pulse smaller than the percentage of full scale selected. The smoothing filter is a running average displayed as "FILTER" which covers the last 2,4,8, or 16 pulses.

OUTPUTS> LOGGER

The logger provides an effective way of storing considerable information (128 Kbytes) in the internal memory of the **OPTI-MUM™ 4001.** A computer interface must be used to read this information once it has been collected. In the "ALL CHANNELS" area, the MODE can be selected as BATCH or PULSE. When PULSE mode is selected, the reading on any or all of the channels may be logged for every pulse; select "OFF" or "READING" for each channel as desired, and a record will be produced on each pulse. In BATCH mode, only statistical functions may be recorded, namely mean, std dev, max, and min, for each channel as desired. The batch size selected in System> Stats will determine how many pulses are processed to obtain each BATCH mode record. The FORMAT may be SHORT or LONG; short uses 2 bytes per item and long uses 3 (see 7. Data Format in Computer Interfacing section). The FORMAT cannot be changed without erasing the logger contents. The file size sets how many records constitute one file.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting SAMPLING MODE to HOLD means that logging will stop after filling a file until LOGGER: ON is pressed in the Live Display or sent over the computer link. If SAMPLING MODE is REPEAT, then a new file will begin to fill as soon as the previous one has filled. When Logger cannot hold another file, "FUL" will be displayed on the front panel, and no further logging will be possible until the memory is flushed with INITIALIZE. Any data you wish to save should be shipped to your PC prior to INITIALIZE.

The data storage requirement is 2 bytes per item in short format or 3 bytes per item long format, with a 6 byte per file overhead for specifying starting and stopping times. The maximum number of files which can be stored at once is (1024 x 128)/(6 + 2 * DataItems * FileSize) for SHORT, or (1024 x 128)/(6 + 3 * DataItems * FilesSize) for LONG. DataItems is the number of quantities logged in each record; it ranges from 1 to 4 in PULSE mode, and from 1 to 16 in BATCH mode. The SAMPLE RATE parameter allows you to store only every Nth record, where N is the SAMPLE RATE; a value of 1 skips nothing. Increasing the SAMPLE RATE allows you to sample the data at regular intervals, but fills the logger memory more slowly.

OUTPUTS> SYNCER

The syncer provides a facility for triggering a laser from the **OPTI-MUM™ 4001** with a variety of options. When SYNC: DISABLED is selected, a pulse is sent from the "sync out" BNC on the back panel each time a channel trigger occurs. When SYNC: ENABLED is selected, pulses are sent according to the other parameters in this menu. Note that the **OPTI-MUM™ 4001** does not trigger to read a laser pulse just because a trigger is issued from "sync out". You must either tee "sync out" into "trig in" on the **OPTI-MUM™ 4001** back panel and select TRIG: EXT, or set the **OPTI-MUM™ 4001** to trigger on one of the probe inputs.

The pulse repetition rate generated by SYNCER is set either by frequency or period; a value may be entered into either one and the other will take on its corresponding value. The period must be a multiple of one millisecond; attempts to enter other values will be rounded so that the displayed value will be accurate.

The MODE for the SYNCER may have three values, SINGLE BURST, BURST, or CONTINUOUS. The MODE value cannot be changed directly (you can't put the highlight on it), instead, its value is determined by the DUTY CYCLE. If Duty cycle is set to 0, no more pulses will be issued after the first burst until the SYNCER is again fired, thus, SINGLE BURST. If Duty Cycle is set to 100, then pulses will be issued CONTINUOUSly until

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SYNCER is halted. Duty cycles between 1 and 99 will result BURSTs of pulses being issued with sufficient off time between groups to achieve the selected duty cycle. The #_of_shots parameter sets the number of pulses in each burst. Whenever SYNC: ENABLED is selected, the "UNITS" key on the Live Display is replaced by a "SYNC: ON/OFF" key. Pressing this key will fire or halt the syncer. Note that computer control of the syncer permits flexible control of laser firing by your PC software.

OUTPUTS> SENDER

The sender facility is used to transmit data in real time to a connected computer after the computer issues a SENDER.ON command. Like LOGGER, the mode may be either BATCH or PULSE. However, the sender mode may be switched freely from PULSE to BATCH, and the channel settings for each mode will be remembered. In PULSE mode, the reading from any or all channels may be sent. In BATCH mode, only statistical data (mean, std dev, min, max) is sent. The items to be sent are set for each channel individually. The FORMAT type (SHORT, LONG, or ASCII) determines how the transmitted data is arranged; see 7. Data Formats in Computer Interfacing chapter for details. The SAMPLE RATE parameter allows you to transmit only every Nth pulse or batch, where N is the SAMPLE RATE.

OUTPUTS> PRINTER

In this screen, pressing the "DUMP STATS" key will generate a printout of date/time, plus reading, min, max, mean, and std dev for each channel. For this function, you need to connect a printer with a parallel-type cable.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

IV. COMPUTER INTERFACE WITH THE OPTI-MUM™ 4001

General Information

Digital communication with the **OPTI-MUM™ 4001** is made possible by the Communication Command Language (**CCL**) which is built into the **OPTI-MUM™ 4001** operating software. The **CCL** allows a computer or terminal to control the instrument data collection parameters, logging functions, and to request transmission of desired data. The syntax for the **CCL** commands is relatively simple, and is the same whether the RS-232 or GPIB communication link is employed.

All commands must start with "%" and be terminated by a carriage return character. While the presence of blank spaces is usually not important, it is advisable to use the exact command format as given here. The "^" character is used to indicate a required space. Because the CCL commands are capable of programming the **OPTI-MUM™ 4001** at a fundamental level, it can rarely happen that sending an improperly formatted command may cause the **OPTI-MUM™ 4001** to "freeze up" or exhibit erratic behavior. Usually, an improper command will simply be rejected, resulting in sending back an error code and giving an instrument reset. However, if an error condition occurs which cannot be handled by a reset (equivalent to turning the power off and on once), then it is necessary to reboot out of PROM. This can be frustrating, since it results in the loss of probe information and other data the user has entered into the **OPTI-MUM™ 4001,** but it is guaranteed to restore normal operation of the **OPTI-MUM™ 4001** in a worst-case scenario. A reboot from PROM is performed by cycling the power switch twice (off-on-off-on) leaving it on for only about one second the first time.

The **OPTI-MUM™ 4001** responds to successfully interpreted commands lines by returning "ok". If you have entered the setup menus by using the front panel keys, the **OPTI-MUM™ 4001** will not transmit any replies or data until you return to the Live Display. Commands sent to the **OPTI-MUM™ 4001** while in a setup menu will be remembered and processed after returning to Live Display. If an error occurs, the **OPTI-MUM™ 4001** will send "?" and an error code. The meanings for the error code are:

?	-	unidentified command or improper number
??	-	unidentified command or improper number
?1	-	not enough or improper parameters
?2	-	parameter out of range
?3	-	channel parameter missing
?4	-	improper channel parameter
?5	-	incorrect data format
?6	-	incorrect mode
?7	-	invalid function for current mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The CCL commands are grouped into six categories. These categories and their associated commands are as follows:

1. Statistics

0.LEVEL, 0.STATS, STATS, HOLD, REPEAT

2. Channel Setup

CH, EXT, INT, TRIG, RANGE, JOULES, VOLTS, LEVEL, MULT

3. Sync Mode

BURST, FIRE, HALT, HZ, SEC, SYNC

4. Instrument Control

?STATUS, DISPLAY, LOCK, UNLOCK, STATUS, ECHO

5. Logger and Sender Setup

LOGGER, LOG:...;LOG, REC/FILE, INIT.LOG, LOG., FILE#, ?LOG, SENDER, SEND:...;SEND, SENDER.

6. Status Commands

?BURST, ?CH, ?DISPLAY, ?DUTY, ?LEVEL, ?LOCK, ?MULT, ?RANGE, ?TRIG, ?TRIGMODE, ?UNITS

Data Formats (description)

SHORT, LONG, ASCII

The commands are discussed in more detail below in the same order as the above list, followed by a description of the types of data formats available. The effect of setting many of the control parameters on the instrument is identical whether issued via CCL or entered through the instrument front panel; in such cases a reference to the Front Panel User Interface chapter is provided for descriptive information. Only those aspects unique to the CCL are described fully in this chapter.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1. Statistics

0.LEVEL

Sets the missing shot threshold in percent of full scale. See (SYSTEM> STATS).

Format: %^n^0.LEVEL <cr>

Where: n = 1 to 100; no decimal point

0.STATS

Resets the statistical variables, and in HOLD mode, restarts sampling for one batch. See (SYSTEM> STATS and Live Display).

Format: %^0.STATS <cr>

STATS

Sets the instrument's batch statistical functions. See (SYSTEM> STATS).

Format: %^delay^batch.size^STATS <cr>

Where: delay = 0 to 10,000; no decimal point is the number of shots to delay after a 0.STATS before taking data.

batch.size = 10 to 10,000 is the number of samples to average.

HOLD

Sets the hold mode. The instrument will take one statistics batch and stop. The instrument is restarted with 0.STATS. See (Live Display).

Format: %^HOLD <cr>

REPEAT

Sets the continuous sample mode. A batch may be interrupted and reset by entering 0.STATS. See (Live Display).

Format: %^REPEAT <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2. Channel Setup

These commands allow control of channel gain, trigger level, trigger mode, and units. New probe identification is done most conveniently at the front panel and is currently not supported by the CCL.

CH

Sets the current CCL channel. All channel commands which refer to an individual channel will apply to the currently defined channel.

Format: %^n^CH <cr>

Where: n = A, B, C, or D will be the current channel.

Please note that the CCL current channel is independent from the front panel current channel selected by pressing the channel annunciators. CCL commands will affect the CCL current channel, while controls pressed on the front panel will affect the displayed current channel. The purpose of this is to make it less likely that front panel input would disrupt an ongoing automated process.

EXT

Sets the instrument in the external trigger mode. This applies to all channels. See (Live Display).

Format: %^EXT <cr>

INT

Sets the instrument in the internal trigger mode. All channels with triggers on will be used (OR'd) as trigger sources. See (Live Display).

Format: %^INT <cr>

TRIG.

Sets the trigger status for the current CCL channel. See (CHANNEL> Ch SETUP).

Format: %^TRIG.mode <cr>

Where: mode = ON or OFF

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

RANGE

Sets the full-scale range for the current channel. Zero represents the lowest value and four the highest. See (Live Display).

Format: %∧n∧RANGE <cr>

Where: n = 0, 1, 2, 3, 4

In the VOLTS mode: 0 is the 2 mV range
4 is the 20 V range.

In the JOULES mode, the actual range is dependent on the probe responsivity and channel multiplier factor.

JOULES

Sets the units of the current channel to Joules. See (Live Display).

Format: %∧JOULES <cr>

VOLTS

Sets the units of the current CCL channel to volts. See (Live Display).

Format: %∧VOLTS <cr>

LEVEL

Sets the trigger level in percent of full scale. See (CHANNEL> Ch SETUP).

Format: %∧n∧LEVEL <cr>

Where: n = 1 to 100 percent; no decimal point

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MULT

Sets the scale factor for the current channel. This may be used to account for beamsplitters, filters, and/or preamps. See (CHANNEL> Ch SETUP).

Format: % a.aaaE n MULT <cr>

Where: a.aaaE+x = 1.000E-9 to 9.999E 9; no spaces within the number, do not use "+" sign for positive exponents

3. Sync Mode

The SYNCER provides the ability to program the **OPTI-MUM™ 4001** to output trigger pulses for a laser in a predefined sequence.

BURST

Sets the number of shots per burst and duty-cycle for the FIRE command. See (OUTPUTS> SYNCER).

Format: %^shots^dutycycle^BURST <cr>

Where: shots = 1 to 10,000 is the number of shots per burst.

dutycycle = 0 to 100; no decimal point
is the on/off duty-cycle in percent. A value of 0 indicates a single burst for each FIRE command.

FIRE

Starts the generation of trigger pulses by the internal sync generator at the current rep rate and duty-cycle. See (OUTPUTS> SYNCER).

Format: %^FIRE <cr>

HALT

Stops the generation of trigger pulses by the internal sync generator. see (OUTPUTS> SYNCER).

Format: %^HALT <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HZ

Sets the repetition rate for the FIRE command. For slower repetition rates use the **SEC** command. The timing resolution is 1 millisecond, so there will be large gaps at the higher frequencies (i.e., only 1,000, 500, 333.3, 250, etc. Hz are possible). The timing precision is better than 100 microseconds. See (OUTPUTS> SYNCER).

Format: %^x^HZ <cr>

Where: x = .01 to 1000. ; use decimal point

SEC

Sets the repetition period for the FIRE command. For faster repetition rates use the **HZ** command. The period must be a multiple of one millisecond. See (OUTPUTS> SYNCER).

Format: %^x^SEC <cr>

Where: x = .01 to 1000. ; use decimal point

SYNC.ON

Turns the sync mode on, so the sync output will be controlled by the fire command. See (OUTPUTS> SYNCER).

Format: %^SYNC.ON <cr>

SYNC.OFF

Turn the sync mode off, so the sync output is controlled by the channel trigger. See (OUTPUTS> SYNCER).

Format: %^SYNC.OFF <cr>

4. Instrument Control

?STATUS

Returns the status word. See data format section 7. below for the structure of the status word.

Format: %^?STATUS <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DISPLAY

Turns display on or off. When the display is off no data is displayed. The usual keys are also replaced by F-key labels; see lock.

Format: %^DISPLAY.mode <cr>

Where: mode = ON, OFF

LOCK

Locks the touch screen to inhibit local control of the instrument. The status message will indicate when a button has been pressed. When the display is locked the usual keys are replaced by F-key labels. This allows the host computer to use the touch screen for input from the user.

Format: %^LOCK <cr>

Menu Format:

-- F1 -- (returns keys 34, 35, or 36)
-- F2 -- (returns keys 52, 53, or 54)
-- F3 -- (returns keys 70, 71, or 72)
-- F4 -- (returns keys 88, 89, or 90)
-- F5 -- (returns keys 106, 107, or 108)

UNLOCK

Unlocks the touchscreens allowing local operation of the instrument.

Format: %^UNLOCK <cr>

STATUS

Controls the sending of status information over the communications port. STATUS.ON intersperses the status word with the transmitted data whenever a key is pressed on the **OPTI-MUM™ 4001** front panel. STATUS.OFF causes status words to be transmitted only when ?STATUS command is issued. See data format section for status format. Note that by monitoring the key presses, the **OPTI-MUM 4001** may be used to enter data to the host computer.

Format: %^STATUS.mode <cr>

Where: mode = ON, OFF

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ECHO

When ON, returns the last command sent along with "ok" upon successful interpretation. The **OPTI-MUM™ 4001** will power up with ECHO.ON set.

Format: %^ECHO.mode <cr>
Where: mode = ON or OFF

5. Logger and Sender Setup

These commands initialize and control the **data logging and** data communication functions.

LOGGER

Sets the LOGGER format and sampling mode. See (OUTPUTS> LOGGER).

Format: % datatype mode samplerate LOGGER <cr>

Where: datatype = ASCII, LONG, or SHORT
mode = PULSE or BATCH
samplerate = 1 to 10,000

LOG:...;LOG

This command is used to define the parameters to be logged. When a new log is defined the logging area is cleared and INIT.LOG should also be issued. See (OUTPUTS> LOGGER) for the list of functions.

Format: %^LOG:^... list ...,^;LOG <cr>

Where: list is the list of parameters by channel.
;LOG ends the logging format command.

In PULSE mode, "ENERGY" is the only parameter available; this actually gives volts as well if volts are selected for that channel. In BATCH mode, you may select any or all of mean, Sdev, min, or max for each channel. If no parameters are entered for a channel, then no data will be stored from that channel. Example: to store Channel A min and max, Channel B mean, and Channel D standard deviation, send

%^LOG:^A^CH^MIN^,^A^CH^MAX^,^
B^CH^MEAN^,^D^CH^SDEV^,^;LOG <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

You should send LOGGER before this command, and INIT.LOG afterwards.

Note: When sending commands over IEEE 488, the **OPTI-MUM™ 4001** may have problems processing command strings over about 26 characters. For longer messages (such as the above example), you should arrange to send the command in smaller segments, sending <cr> only at the end of the last segment.

REC/FILE

Sets the number of records per file in logger. A record is one pulse or one batch.

Format: %^n^REC/FILE <cr>

Where: n=1 to 1024; use no decimal

INIT.LOG

Resets and zeros the data log. Use this command after changing the LOGGER format to assure data integrity. See (OUTPUTS> LOGGER).

Format: %^INIT.LOG <cr>

LOG

Turns data logging on or off. See (OUTPUTS> LOGGER).

Format: %^LOG.mode <cr>

Where: mode = ON, OFF

FILE#

Sets the current file number. Subsequent queries with ?LOG will send data from this file. See (OUTPUTS> LOGGER).

Format: %^n^FILE# <cr>

Where: n=0 to highest current file; no decimal point

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

?LOG

Sends one record of data from the current file number in LOGGER memory. If the stored format was SHORT, then the transmitted data will be SHORT format also. If the stored format was LONG, then the transmitted data may be ASCII or LONG, depending on the LOGGER format.

Format: %^n^?LOG <cr>

Where: n = 1 to File Size; use no decimal

SENDER

Sets the SENDER format and sampling mode. See (OUTPUTS> SENDER).

Format: %^datatype^mode^samplerate^SENDER <cr>

Where: datatype = ASCII, LONG or SHORT
mode = PULSE or BATCH
samplerate = 1 to 10,000; use no decimal

SEND:...;SEND

This command is used to define the functions to be sent over the communication line in real time. Two lists are maintained, one for the pulse mode and one for the batch mode. SEND: defines a list for the current mode. See (OUTPUTS> SENDER).

Format: %^SEND:^... list ...^;SEND <cr>

Where: list is the list of parameters by channel.
;SEND ends the SENDER format command.

In PULSE mode, "ENERGY" is the only parameter available; if the selected channel units are "VOLTS", then "ENERGY" will return the reading in VOLTS. In BATCH mode, you may select any or all of MEAN, SDEV, MIN, or MAX for each channel. If no parameters are entered for a channel, then no data will be sent for that channel. Example: to send readings from Channel A and Channel C, send

%^SEND:^A^CH^ENERGY^,^C^CH^ENERGY^,^;SEND <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

You should send the SENDER command to set the data type and mode before using SEND:;SEND. Use SENDER.ON and SENDER.OFF to initiate and halt real time data transmission.

Note: When sending commands over IEEE 488, the **OPTI-MUM™ 4001** may have problems processing command strings over about 26 characters. For longer messages (such as the above example), you should arrange to send the command in smaller segments, sending <cr> only at the end of the last segment.

SENDER.

Turns data communications on or off.

Format: %∧SENDER.mode <cr>

Where: mode = ON, OFF

6. Status Commands

The following commands cause the **OPTI-MUM™ 4001** to return a string indicating the status of various instrument functions. There must not be a space between the question mark and the letters in these commands.

?BURST

Returns the number of shots set for the sync burst.

Range: 1-10,000

Format: %∧?BURST∧<cr>

?CH

Returns the current I/O data channel. This is the channel referred to by all CCL channel commands and is not necessarily the display channel.

Range: **A**, **B**, **C**, or **D**

Format: %∧?CH <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

?DISPLAY

Returns status of display.

Range: **ON, OFF**

Format: %^?DISPLAY <cr>

?DUTY

Returns the sync duty cycle in percent. 0 is single shot or single burst and 100 is continuous. See (OUTPUTS> SYNCER).

Range: 0-100

Format: %^?DUTY <CR>

?LEVEL

Returns the trigger level in percent of full scale. See (CHANNELS> Ch SETUP).

Range: 1-100

Format: %^?LEVEL <cr>

?LOCK

Returns the status of the keyboard.

Range: **ON, OFF**

Format: %^?LOCK <cr>

?MULT

Returns scale factor for current channel. See (CHANNELS> Ch SETUP).

Range: x.xxxEnn

Format: %^?MULT <cr>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

?RANGE

Returns the range for the current channel.

Range: 0-4

Format: %^?RANGE <cr>

?TRIG

Returns the trigger enable status of the current channel. see (CHANNELS> Ch SETUP).

Range: **ENABLED, DISABLED**

Format: %^?TRIG <cr>

?TRIGMODE

Returns the system trigger mode. See (Live Display).

Range: **A, B, C, D, INT,** or **EXT**

Format: %^?TRIGMODE <cr>

?UNITS

Returns units for current channel. See (Live Display).

Range: **J** or **V**

Format: %^?UNITS <cr>

7. Data Formats

The **OPTI-MUM 4001** supports a number of data types for both the **LOGGER** function and **SENDER** function. The short format is used to maximize data storage capability and data I/O transfer rate. The long and ASCII formats provide more information, but also require more memory per data item and limit the transmission speed of the instrument. The short and long data formats may be sent with or without a status word included, see the **STATUS** command.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SHORT

The SHORT data type sends or logs only a 12 bit binary mantissa plus four status bits for each data item (2 bytes total). In other words, the exponent on 10 (expressing the number in scientific notation) is not recorded. If the exponent is known and is the same for all data in a batch, then no information is lost while making a significant gain in storage efficiency. By requesting or setting the channel ranges once before data transmission, there will be no ambiguity as long as autoranging is not selected.

Data Format:		Oabc dddd dddd dddd
Where:	O	indicates data item (i.e., not STATUS word)
	a	indicates one or more pulses were skipped, which may occur if the pulse rate exceeds the capabilities of the communications channel when using SENDER.
	b	indicates last data of stream.
	c	indicates a status change has occurred.
dddd dddd dddd		0-2999, overrange = 4095

LONG

The LONG data type adds an 8 bit signed 2's complement exponent to the SHORT data type.

Data Format:		Oabc dddd dddd dddd eeee eeee
Where:	O	indicates data item
	a	indicates one or more pulses were skipped, which may occur if the pulse rate exceeds the capabilities of the communications channel when using SENDER.
	b	indicates last data of stream.
	c	indicates a status change has occurred.
dddd dddd dddd		0-2999, overrange = 4095
eeee eeee		-99 - +99

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ASCII

The ASCII mode provides the same information as the LONG format but the information is formatted and sent as a ASCII string. This format is useful when using a terminal to monitor the output of the **OPTI-MUM 4001**, or when the highest data transmission rates are not required.

Format:
Ch:Aab
data1
data2
...
Ch:Bab
data1
...
Ch:Cab
...
...

Where: a is an "s" if pulses were skipped due to a bottleneck in the communications link. Otherwise it is a blank.

b is an "o" if an overrange has occurred, otherwise it is blank.

dataN>> is the data as specified in the **LOG:** or **SEND:** commands, or entered via the front panel in (OUTPUTS> SENDER) or (OUTPUTS> LOGGER).

Data Format: d.dddExx

Where:
d.ddd >> 0 to 9.999
xx >> -99 to +99

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

STATUS

The status word provides information concerning changes to the instruments state (eg. range or unit changes) as well as touch screen input key numbers. This allows the **OPTI-MUM 4001** to be used as an input device for integrated test sets. The channel number is always sent as "A" for events which are not channel specific, while gain and unit changes will specify the correct channel.

SHORT & LONG FORM
Status Format: 1ubi dbcc bnnn nnnn

Where:

1 : indicates status word (i.e., not data item).

u : indicates a unit (V or J) change has occurred.

i : indicates the gain has increased.

d : indicates the gain has decreased.

b : spare bit.

cc: indicates the channel number affected.

00	Ch.A
01	Ch.B
10	Ch.C
11	Ch.D

nnn nnnn = is the key number pressed.

0 : no key pressed.

1-1101100 : key # starting in upper (1-108) left corner and progressing along the top left to right.

ASCII FORM
Status Format: SuidNXXX

Where:

S : indicates status word.

u : indicates a unit (V or J) change has occurred.

i : indicates the gain has increased.

d : indicates the gain has decreased.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

N : indicates the channel letter affected (A, B, C, or D)

XXX : is the key number pressed.

000 : no key pressed.

(1-108) key# starting in upper left corner and progressing along the top left to right.

Note: In ASCII form, the status word is sent as 8 ASCII characters (= 8 bytes).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

V. LIMITED WARRANTY

Molectron Detector, Inc. warrants the **OPTI-MUM™ 4001** 4-Channel Joulemeter Ratiometer to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment when properly installed, maintained, and used for its intended purpose. This warranty applies only to the original purchaser of the equipment, and only so long as the equipment is used in the country to which it was originally shipped by Molectron Detector, Inc.

This warranty is null and void if the user attempts to service the equipment himself (other than performing the maintenance described in the Operator Manual), or if service is performed by persons who are neither trained nor authorized to do so by Molectron Detector, Inc. If, after examination by a Molectron Service Representative, the unit is found to be defective within the period specified above, and Molectron Detector, Inc. is satisfied that the failure was due to defective materials and/or workmanship, Molectron Detector, Inc. will, at its option, repair or replace the defective parts without charge. Molectron Detector, Inc. reserves the right to make the necessary repair/replacement in its own factory, at any authorized repair station, or at the facilities of the purchaser of the instrument. Any shipping charges incurred shall be paid by the purchaser.

The Express Warranty above is the sole warranty obligation of Molectron Detector, Inc. and the remedy provided above is in lieu of any and all other remedies. There are no other agreements, guarantees or warranties--oral or written, express or implied--including, without limitation, warranty of merchantability or fitness for a particular purpose. Molectron Detector, Inc. shall have no liability whatsoever for any incidental or consequential damages arising out of any defect, improper use or unauthorized service or repair.

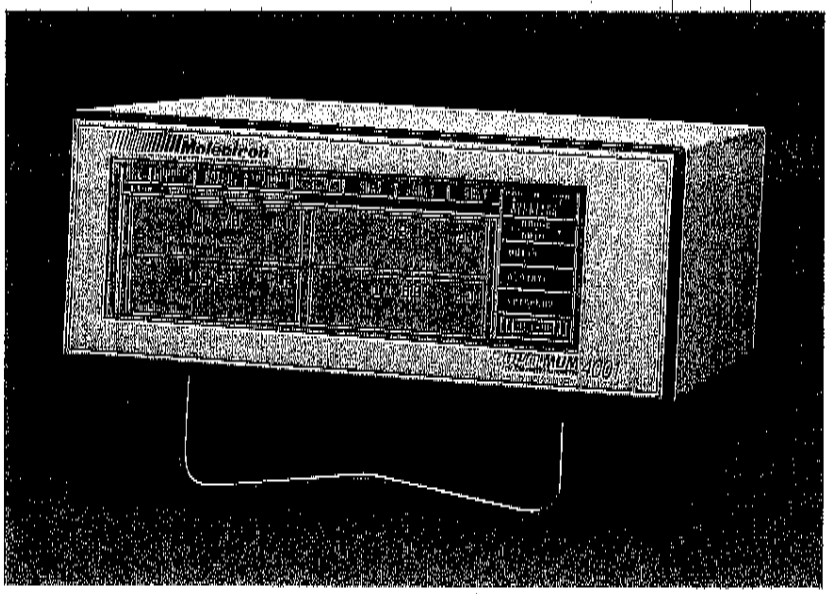
Prior to return of a unit, or any portion thereof, the Molectron Detector Service Department must be consulted to avoid unnecessary shipping. If return of the equipment is deemed necessary, a Return Material Authorization (RMA) number will be assigned. This number must be recorded on the outside of the shipping container.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Features

OM4001 4CH
Joulemeter/Ratiometer/ Laser Controller/Data Logger

- **Pulse detection to 1000 pps**
- **4 channel inputs**
- **Wide dynamic range pJ to J, μV to V**
- **High-resolution LCD and touch screen display**
- **Powerful 16-bit microprocessor**
- **Flexible menu driven**
- **Ratio any 2 channels**
- **Auto range and baseline correction**
- **Auto or external trigger**
- **RS-232 and IEEE-488 interfaces**
- **Centronic parallel printer output**
- **Programmable sync output**



Functions

- *Pulse energy*
- *Mean and standard deviation*
- *Minimum and maximum*
- *Pulse rep rate and period*
- *Missing pulse count*
- *Ratios*
- *Graphics - strip chart*

Applications

- *Pulsed laser energy*
- *Pulsed flashlamp energy*
- *Multi-probe laser test station*
- *Multi-probe laser spectroscopy*
- *Raman spectroscopy*
- *Optics testing... %A, %T, %R*
- *Non-linear optics*
- *Laser beam divergence*
- *Laser production burn-in test set*
- *Multi-channel LIDAR*

NOW AVAILABLE

LabVIEW® Drivers

Description

The OPTI-MUM™ 4001 brings the best of analog/digital electronics, a 16-bit microprocessor, and LCD display technology together for the first time in a versatile, fast, and intelligent electro-optical instrument. By combining a large supertwist dot matrix, backlit LCD display, transparent touch screen and high-speed microprocessor with Molectron's fast analog peak detect electronics, we have created the OPTIMUM 4-channel laboratory pulse diagnostic system.

With our selection of calibrated Silicon and Pyroelectric Joulemeter probes, you can measure from femtojoules to joules, UV to FAR IR, picoseconds to milliseconds, and a single pulse to 1000 pps. Display pulse energy, period, min/max, pulse count, and other statistics for one to four channels or an energy strip chart using one of our four default screens or customize the displayed data using our intuitive menu-driven software.

The flexibility of the OM4001 is limited only by your specific measurement needs.

For convenient data transmission and/or remote control of the OM4001, it includes both RS-232 and IEEE-488 computer I/O ports. Use its Centronic printer port if you simply want to dump the data, or if your computer is busy controlling other instruments, you can use our DATA LOGGER function to capture up to 64,000 energy readings and transmit them on call.

And finally our SYNCER function allows you to control the triggering of your pulsed laser and, therefore, the entire research or test setup! Set the pulse period and choose continuous triggering or a specific duty cycle (burst mode).

The versatile OPTI-MUM 4001 is four instruments in one... Joulemeter/Ratiometer/Data Logger/Laser Controller. Precision, speed, versatility, and value... it's OPTIMUM!

Molectron
DETECTOR, INCORPORATED

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OM4001 4CH

Joulemeter/Ratiometer/Laser Controller/Data Logger

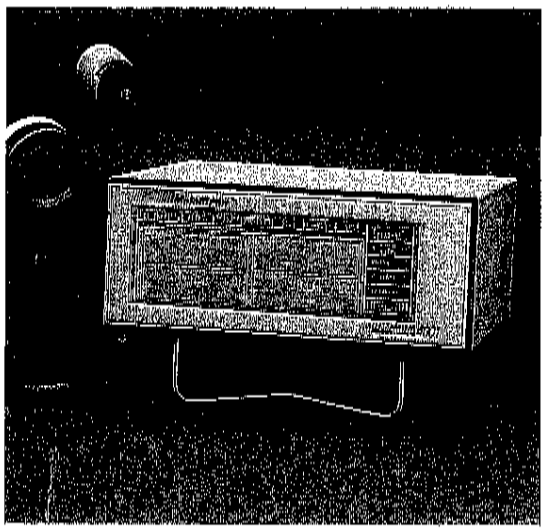


Figure 1. OM4001 setup with our J25 and J4-09 Joulemeter probes.

Versatile Touchscreen Control

The beauty of the matrix touch screen overlayed on the 640 X 200 dot-matrix LCD display is its incredible versatility. It has allowed us to create a number of intuitive displays that guarantee simplicity of operation. There is a single key for every function. No dual-function keys like so many other software-driven push-button instruments.

As you can see in Figures 5-14, we have placed most of the function keys on the right-hand side of the display and several, like channel selection, at the top. All important annunciators are also located along the top for easy viewing. When it's time to enter probe calibration data or serial numbers, you can easily access a full alpha numeric keypad to type it in.

Figures 5-14 represent a sampling of some of the 18 screens that are available for setup and control of the OM4001. You will be amazed at how easy it is to use the OPTI-MUM 4001 at first touch!

Extensive Application Engineering Support

In the final judgement, the true value of the laser test instrumentation you acquire is based not only on its price and performance, but also your ability to get insight and guidance from the Manufacturer's Sales/Customer Service Organization.

We at Molectron Detector, Inc. pride ourselves on our in-depth, continuous technical support. Our team of experienced Engineers and Laser Scientist will help you select the right Joulemeter probe and accessories to guarantee a solution to your pulsed measurement requirement.

We will use the OM4001, Joulemeter probes, computer and laser resources that are dedicated to our Applications Lab to work out every last technical uncertainty of your application. Your success rests on our shoulders, and we guarantee success!

Please call our Applications Engineers with any technical questions... dial **(800) 366-4340**.

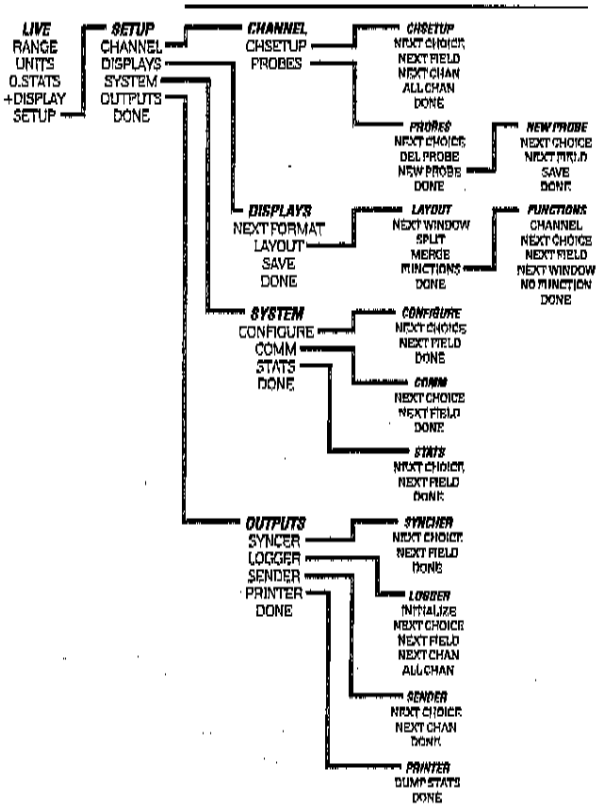


Figure 2. The OM4001 Menu Tree shows the intuitive organization of the function and setup screens (18 in all).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 CH Joulemeter/Ratiometer

The OM4001 is equipped with a powerful 16-bit microprocessor which allows simultaneous energy measurements with up to four joulemeter probes from a single pulse to 1000 pps. It acquires peak voltages from the attached probes and accounts for their individual calibration factors to obtain the absolute energy in real time. The baseline prior to the pulse is also measured to compensate for baseline droop. External triggering may be supplied to a BNC jack on the back panel, or internal triggering may be selected from any or all channels. The statistical batch size may be selected by the user from 10 to 10,000 pulses.

When running in BATCH mode, the OM4001 will stop at the end of a batch. While in repeat mode it will run continuously, updating statistical variables as each batch goes by. Many statistical quantities may be selected for display, such as mean, std dev, ratio, avg power, pulse count, pulse period, and more.

Custom display formats are easily created which show the quantities of interest in data windows on the front panel. One display mode even includes a live strip chart display with a handy 10X zoom-in capability. Automatic range selection is also possible for any channel not used as an internal trigger source.

Powerful Laser Controller

The OM4001 incorporates a digital SYNC pulse generator which allows easy control of your laser's repetition rate and firing sequence. You can select rep rates from 0.001 Hz up to 1 KHz, and a variety of on/off sequences are possible. When you consider that all the SYNCER functions are remotely controllable with a simple computer interface, it is clear that the OM4001 incorporates a very useful laser control function as well as its primary role for pulse energy measurement.

The SYNCER batch size, duty cycle, and of course, rep rate or period can each be programmed. When **FIRE** is issued (remotely or from front panel), a batch of pulses are output. At 100% duty cycle, pulses are continuous; at 0% exactly one batch will be output; and between 1% and 99%, pulse batches are issued with quiet time between to obtain the selected duty cycle.

Data Logger

To augment the powerful data processing capability of the OM4001, the LOGGER function provides data storage in a large 128 KByte RAM memory (up to 64,000 shots). This can allow your lab computer to control other functions and instruments during a run while the OM4001 acquires and stores data independently. Afterward, any or all of LOGGER memory can be rapidly transferred to the computer for further analysis.

If desired, the LOGGER contents may also be viewed on the OM4001 front panel without the use of a computer. The LOGGER memory can also act as a buffer in the case of measuring high rep rate lasers where the real-time data rate may exceed the capabilities of the I/O link on the computer. The LOGGER can be programmed to store individual pulse energies or statistical information, and high-resolution pulse timing with sub-microsecond accuracy is also available as an option.

Computer Control

The OM4001 is equipped with GPIB and RS-232 digital interfaces for instrument control and data transfer. Configuring the RS-232 and GPIB ports is easily done on the OM4001 touch panel screen. There are no jumpers to change inside the case. The RS-232 port will run up to 19.2 KBaud. Either interface may be used at any time. The OM4001 will send its response over the interface which most recently received a command.

The OM4001 can send data in standard ASCII format or in binary format. The ASCII format is easiest to use for most purposes, but in performance-critical applications, the binary modes can substantially increase data transmission and storage efficiency.

There is also a special mode that replaces 5 keys on the front panel with buttons **F1** through **F5**. These can be pressed to send user-defined input to a computer directly from the OM4001 front panel without interrupting any ongoing processing. This can be useful in automated test systems.

CCL Codes

The Command and Control Language (CCL) for the OM4001 allows remote control of almost all functions available from the front panel, and includes additional features not used on the front panel. After each received command, the OM4001 will send **OK** if the command can be successfully processed; otherwise an error code will be returned. All commands begin with **%** (percent sign), then the command mnemonic and numeric data, and end with a carriage return terminator.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

For example, to have the OM4001 send pulse energies for channels A and C, issue the command **% SEND: A CH ENERGY, C CH ENERGY, ;SEND <cr>.** Then issue **% SENDER.ON <cr>** and the OM4001 will continuously send A and C channel energies until **% SENDER.OFF <cr>** is sent.

If the command **% STATUS.ON** is issued, then the OM4001 will automatically send the computer a status byte whenever a setting is changed from the front panel by the user.

Other commands can reconfigure the front panel, start and stop data acquisition, and control many other functions.

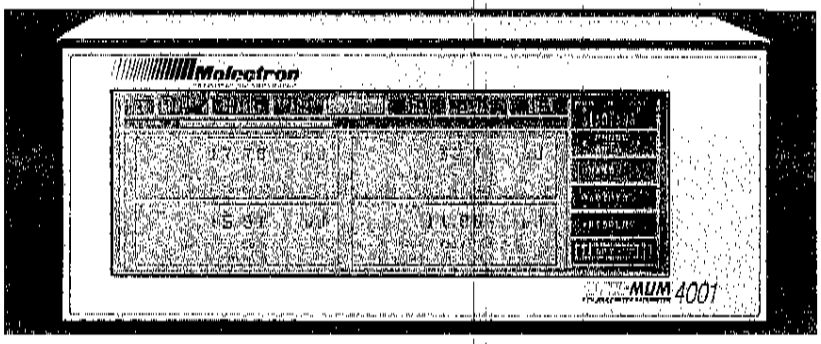


Figure 3. Front panel of OM4001 4CH Joulemeter/Ratiometer/Laser Controller/Data Logger

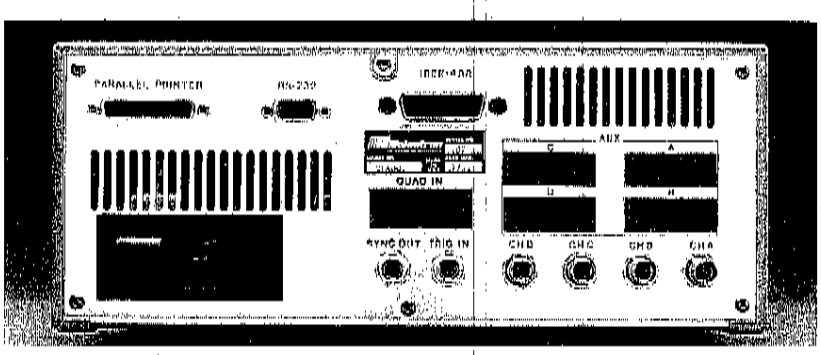


Figure 4. Rear panel of OM4001 4CH Joulemeter/Ratiometer/Laser Controller/Data Logger

Controls and Connectors

FRONT PANEL

SET-UP:
Exits the live display and accesses the primary setup menus. There are four main headings under the setup menu:

Channel
Allows the user to enter probe calibration and performance data, allocate any probe to any channel, and select the internal trigger level threshold.

Displays
Allows the operator to create, edit, and save custom display formats.

System
Allows the operator to set up the computer interface parameters and select various statistical functions.

Outputs
Enables the operator to configure the functions of the computer output ports, printer port, sync output pulse generator, and internal data storage.

+ DISPLAY:
Cycles the display through four predefined and two user-generated data formats.

0.STATS:
Clears all the statistics and initiates collection of a data set when in BATCH HOLD mode.

UNITS:
Changes the display units for the selected channel between Volts and Joules.

RANGE:
The arrow keys in this cell range the gain of the selected channel up or down. The "*" symbol labeled "AUTO" will set automatic range scaling for the selected channel.

SYSTEM INFO:
The arrows keys in this cell adjust the contrast of the LCD. Pressing the square between arrows switches the display between blue on white and white on blue. There is also a clock and calendar display.

CHANNELS A,B,C,D:
Display the full scale range of each channel. The operating channel is selected by touching the appropriate channel cell. The current operating channel is denoted by a highlighted background.

TRIGGER:
Displays and sets the trigger source and selects between internal, external, or a specific channel as a trigger source.

BATCH:
Toggles between the two statistics modes, REPEAT, and HOLD.

LOGGER:
Begins data logging into the 128 Kbyte of internal memory. The status of the logger is displayed in this area. It can be off, in repeat, or batch hold modes of data storage. The number of logger files is also displayed.

RCV/XMT:
Shows the status of the computer interface ports. When the small box appears adjacent to RCV, the instrument is in listen mode for IEEE-488 and receive for RS-232. When the box is next to XMT, the instrument is in talk mode for IEEE-488 and transmit for RS-232.

MENU PATH LINE / ANALOG BAR GRAPH:
This line across the top of the display area indicates the current position in the menu tree structure. In the live display, this line becomes a fast analog bar graph of the currently selected channel.

BACK PANEL

POWER:
The two-position switch next to the power cable port turns the OM4001 on and off.

PARALLEL PRINTER:
This port is designed to accept a parallel type printer cable. It can be used to dump statistical information directly to Centronic compatible printers.

RS-232:
Data collection and function control serial computer interface port.

IEEE-488:
Data collection and function control parallel computer interface port.

SYNC OUT:
BNC-type connector for sending a user-controlled trigger signal to sync/trigger input of lasers or other associated equipment.

TRIG IN:
BNC-type connector for accepting external trigger pulses.

CHANNELS A,B,C,D INPUTS:
BNC-type connectors for input signal from Joulemeter probes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Touchscreen Controls

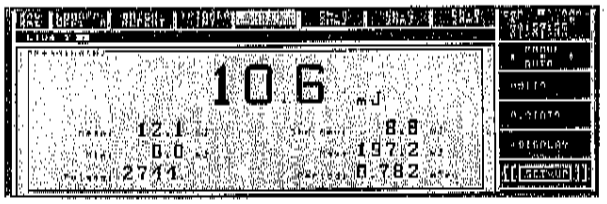


Figure 5. Single channel default screen with CHA displayed. Note: Pulse Statistics Mean, STD DEV., etc.

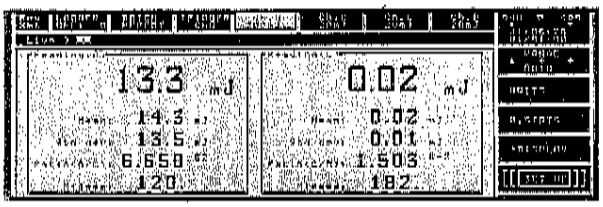


Figure 6. Dual channel default screen with CHA and CHC displayed. Note: Ratio and missing pulses, etc.

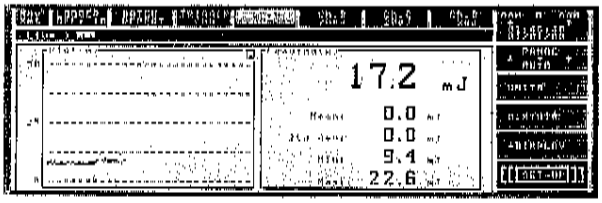


Figure 7. Single channel with strip chart default screen. Strip chart includes zoom feature to expand the scale!

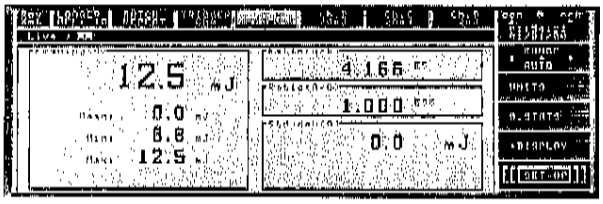


Figure 8. Custom user defined 4-window display. You select up to 8 windows and pick the data displayed. You can create up to 3 screens.



Figure 9. Channel setup screen. Displays probe calibration data and allows you to add or delete Joulemeter probes.

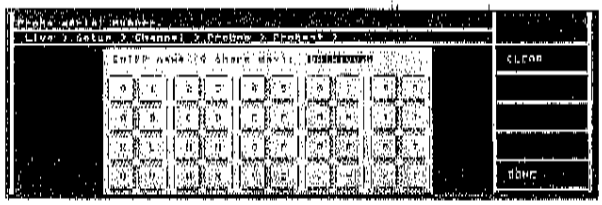


Figure 10. Full alpha numeric keypad displayed when adding probe calibration data in New Probe Menu.

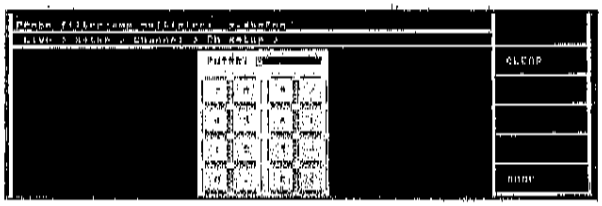


Figure 11. Numeric keypad displayed when changing data in Channel Setup Menu.



Figure 12. Displays Logger Menu for selection of data type to be logged for each channel.

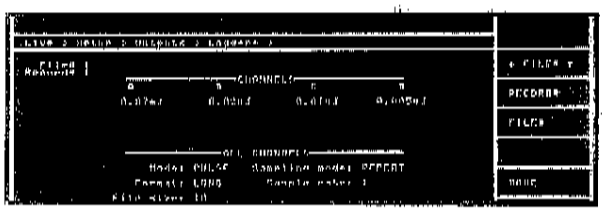


Figure 13. Shows view data screen for Logger mode. Displays test data for each channel, identified by file and record number.



Figure 14. This is the Syncer setup screen used to select pulse period, no. of shots, duty cycle, and continuous or burst mode of triggering.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Specifications:

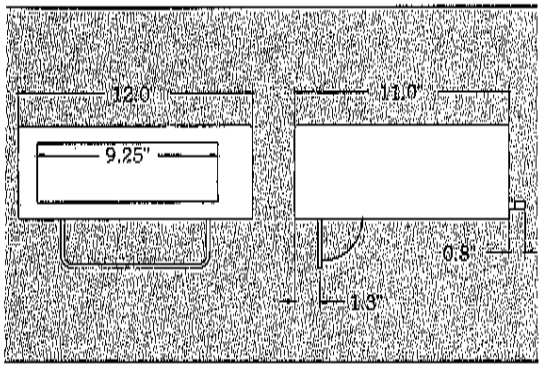


Figure 15. OM4001 package outline showing the front and side views.

Mechanical Specifications

Package:
12 x 5 x 11 inches
30 x 13 x 28 mm

Power Requirement:
120/240 VAC ±10%, 50/60 Hz,
25 W Switch Selectable

Rack Mount:
19 x 6 inches
48 x 15 mm

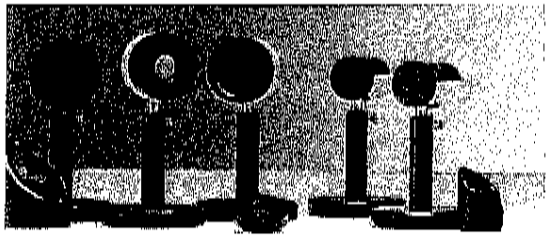


Figure 16. Joulemeter probes and accessories.

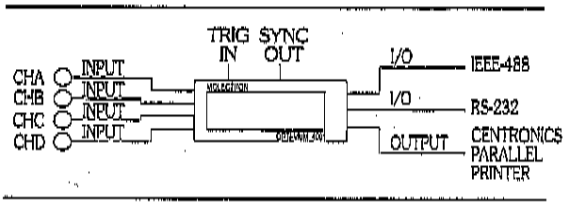


Figure 17. OM4001 system schematic.

Range (Full Scale):
Joules 0.2 pJ to 0.2 µJ (J3S Series)
2 µJ to 20 mJ (J3 Series)
2 mJ to 20 J (J25/J50)
Volts 2 mV to 20 V (All Probes)

N.E.J. (Typical):
8.0 fJ (J3S Series)
3.0 nJ (J3/J4 Series)
4.0 nJ (J25 Series)
16 µJ (J50 Series)

N.E.V. (Typical): 32 µV

Maximum Rep Rate: 1000 pps

Linearity: ± 1% of Full Scale

Digital Resolution: 11 bits

Ratio Accuracy: ±2%

Averaging: 2 to 10,000 pulses

Auto Triggering: 5% Typical (Adjustable 1 to 20%)

External Triggering Input: TTL Compatible (1V, 1mΩ)

Sync Output: TTL Compatible

Display: 640 x 200 Dot Matrix Supertwist LCD with Coldcathode Fluorescent Backlight

Comm Ports: RS-232 and IEEE-488

OM4001 Joulemeter Probe Performance

Probe Model Responsivity Range (in Joules)	J3S-05 4kV/J	J3S-10 2kV/J	J3-02 10V/mJ	J3-05 / J4-05 2.5V/mJ	J3-09 / J4-09 1V/mJ	J25 / J25HR / J25LP 40V/J	J50 / J50HR 2V/J	J50 / J50LP 50mV/J
20	-	-	-	-	-	2.5x10⁻³	5x10⁻³	2.5x10⁻⁴
2	2.5x10⁻⁴	5x10⁻⁴	1x10⁻³	4x10⁻⁴	1x10⁻³	2.5x10⁻⁴	5x10⁻⁴	2.5x10⁻⁵
.2	2.5x10⁻⁵	5x10⁻⁵	1x10⁻⁴	4x10⁻⁵	1x10⁻⁴	2.5x10⁻⁵	5x10⁻⁵	2.5x10⁻⁶
.02	2.5x10⁻⁶	5x10⁻⁶	1x10⁻⁵	4x10⁻⁶	1x10⁻⁵	2.5x10⁻⁶	5x10⁻⁶	2.5x10⁻⁷
.002	1.6x10⁻⁷	3.2x10⁻⁷	6.4x10⁻⁷	2.6x10⁻⁷	6.4x10⁻⁷	1.6x10⁻⁷	3.2x10⁻⁷	1.6x10⁻⁸

Table 1. Minimum detectable energy in joules for standard Joulemeter probes, determined by the N.E.V. of the OM4001 or assumed to be 0.5% of Full Scale.

Joulemeter Probe Compatibility

The OM4001 is designed to work with all of Molectron's Silicon and Pyroelectric Joulemeter Probes:

- J3-02, J3-05, J3-09
- J4-05, J4-09
- J3S-05, J3S-10
- J9LP-1
- J25, J25HR, J25LP
- J50, J50HR, J50LP

Measure from fJ to J, pS to mS, 1 to 1000 pps in the UV to Far IR with NIST traceable accuracy.

Accessories

We have several accessories that might make it easier to use and/or transport our OM4001.

Model RM-2000 Rack Mount is the hardware necessary to mount the OM4001 into a 19 inch instrumentation rack.

Model JC-20 Carrying Case is a foam lined, impact resistant plastic carrying suitcase for the OM4001.

OM-APPS Application Software is a custom program designed for remote control of the OM4001 over the RS-232 interface.

Molectron
DETECTOR, INCORPORATED
7470 S.W. Bridgeport Road
Portland, Oregon 97224
(800) 366-4340 (503) 620-9069 FAX (503) 620-8964

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP