LUDLUM MODEL 4612
12-CHANNEL COUNTER

November 2019

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12 CHANNEL COUNTER

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LUDLUM MEASUREMENTS, INC.
501 OAK STREET, P.O. BOX 810
SWEETWATER, TEXAS 79556
325-235-5494, FAX: 325-235-4672

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DESIGNER AND MANUFACTURER OF
Scientific and Industrial Instruments

27 October 2017

Model 4612 Counter Addendum

Model 4612AB Update

Beginning with version 2.3.0 of the Model 4612 Counter software, dual channel alpha/beta is supported. This can be enabled in Tools/Options by checking the Alpha/Beta Configuration.

When enabled, the channel labels are changed from Channel 1-12 to Det 1-6 β and α. Since the alpha detector board shares the high voltage with its corresponding beta detector board, the high voltage parameters cannot be adjusted.

The High Voltage Plateau shows in parenthesis the alpha counts when performing a beta plateau and the beta counts while performing the alpha plateau and automatically calculates the crosstalk percentage.

Table of Contents

Section 1

Introduction

The Ludlum Model 4612 Counter is a 12-detector SCA (single channel analyzer) with PC control of all necessary operating parameters. Up to 12 detectors may be connected to the counter each with independent high voltage, threshold or sensitivity, and window settings.

The counter is configured with a host board and up to 12 slave boards. The host board collects the counts from each slave board and communicates with the computer. The host board has an RS-232 connector for communicating with a computer or other device capable of serial communication, a power connector, and a reset button. The reset button performs the same function as cycling the power. The slave boards are responsible for powering the detector and sending the count data to the host board.

The counter host board recalls all parameters from its built-in flash memory and configures the slave boards during the power-up sequence. The parameters include High Voltage, Upper Level Discriminator (ULD), Lower Level Discriminator (LLD), GM Mode, and Window Mode. Because the host board sends the parameters over to the slaves during power-up, a slave board may be replaced while still keeping the same operating parameters as the previous slave board.

When using GM detectors, the GM Mode should be activated to prevent double pulsing and longer dead times. The Window Mode determines if the ULD is enabled. The ULD may be disabled by disabling the Window Mode.

Typically a computer is used to collect and display the data, send parameters, and to start and stop counts. The Model 4612 Counter software (supplied) monitors the activity of the counter. The software allows the user to control and log data from individual channels or groups of channels. The software also allows the user to modify the parameters if each slave board.

The software receives a data stream every 50 milliseconds from the 4612 counter that contains the total counts for each of the 12 channels for the previous 50 millisecond period. These counts are displayed in the "Counts 50 mSec" column on the main screen. When a channel is counting, the accumulated count for each channel is stored in the "Accumulated Count" column on the main screen. The "Last Count" stores the last completed count. The Rate Meter column shows the current count rate in a user-defined unit of measure (cps, cpm, R/hr, Sv/hr). When the user starts counting on a particular channel (or a group of channels simultaneously), the software starts accumulating 50 millisecond counts until the count time has completed.

A count may be started on a single channel or a group of channels. To start counting on a single channel, click on the "Count" button. The count is started immediately and when the count is complete, the result is saved to a file. Clicking on the "Start Counts" button will allow the user to select which channels to group in this count and select the count time. A group number is assigned to provide a means to differentiate each count group.

Counts may be set to start again automatically. If the "Recycle" check box is selected when the "Count" button is clicked, the count will automatically restart after a count is complete. Once in the recycle mode, the count must be stopped manually by clicking on the "Cancel" or "Stop All Counts" button.

After a count is complete, the data is saved to a comma separated value (.CSV) file suitable for loading into a spreadsheet or database program for further processing. This serial number, group number, channel, count time, count, rate meter reading, HV, LLD, ULD, efficiency, and date are saved to the file. The file name is in the format of YYYYMMDD.CSV where "YYYY" is the current year, "MM" is the current month, and "DD" is the current day. A new file is created when the date changes.

In addition to the counting functions, the 4612 counter software also stores alarm points for each of the 12 channels. If a timed count is running and the accumulated count value exceeds the alarm set point, the "Accumulated Count" background will turn red, indicating an alarm condition. The software also has an optional audible alarm (which can be changed to any .wav file) to indicate an alarm condition.

The software features an easy to use "Wizard" to calibrate each channel's various calibration constants. These constants are: HV Actual Cal, HV Read Back Cal, LLD Actual Cal, and ULD Actual Cal.

Finally, the 4612 Counter software has a function known as HV Plateau. This function is used to determine the correct operating voltage (or HV) for

an individual or group of detectors. The HV Plateau function will take background counts at different HV intervals (set by the user) for a single detector or multiple detectors. After the background counts have completed, the software will take source counts on each detector. When the source counting is completed on each detector, the net count in counts per minute (CPM) and the detector efficiency will then be calculated and displayed. When the plateau is complete, the user has the option to save or print the plateau results.

Section 2

Software Installation

SYSTEM REQUIREMENTS

The Ludlum Model 4612 Counter software is a Windows ™ program, intended to run on a IBM-compatible personal computer (PC) running Windows ™ XP or later.

HARDWARE REQUIREMENTS

A Windows ™ based PC with an RS-232 Serial Port. A USB to Serial adapter may be required if the computer does not have an RS-232 Serial Port.

MINIMUM PC REQUIREMENTS

1.5 GHz processor or greater

512 MB of memory (1024 MB recommended)

High capacity hard drive for storing the database

SVGA monitor capable of a resolution of 800 x 600 or greater

INSTALLATION

Note:

Before installing any LMI software, read the Software License Agreement at the end of this section.

Insert the Model 4612 Counter CD (LMI Part # 1370-081) into your CD-ROM drive. If the installation does not start automatically, double-click on "setup.exe" to start installation. After the installation is complete, a group will be created under the Start Menu called "Ludlum Measurements, Inc" with the Model 46xx Counter shortcut.

Connecting a Computer

Connect the Model 4612 Counter to the computer with the supplied RS-232 cable. Connect the cables from the detectors to the slave boards. The calibration paperwork will identify which detector should be connected to each channel. Connect the A/C power adapter to the host board. An internal jumper determines if the counter powers up automatically or if it waits for the DTR signal. Remove the channel 12 board or cover plate to access this jumper. If the Jumper is closed, the Counter will power up automatically.

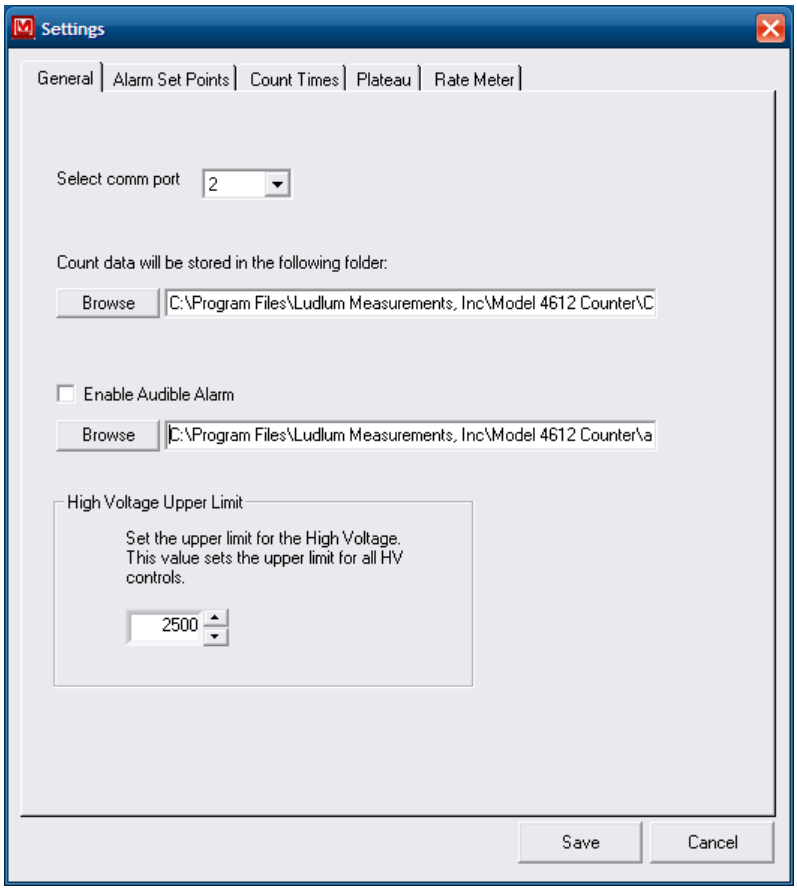
Starting Software

Click on this shortcut to start the software. The software will default to looking for the Counter on COMM Port 1. If the COMM Port is a different value, the correct port number must be selected from the Settings screen.

Settings

The Settings screen is accessed from the Tools\Settings menu and is used to configure the options that affect how the software operates.

General



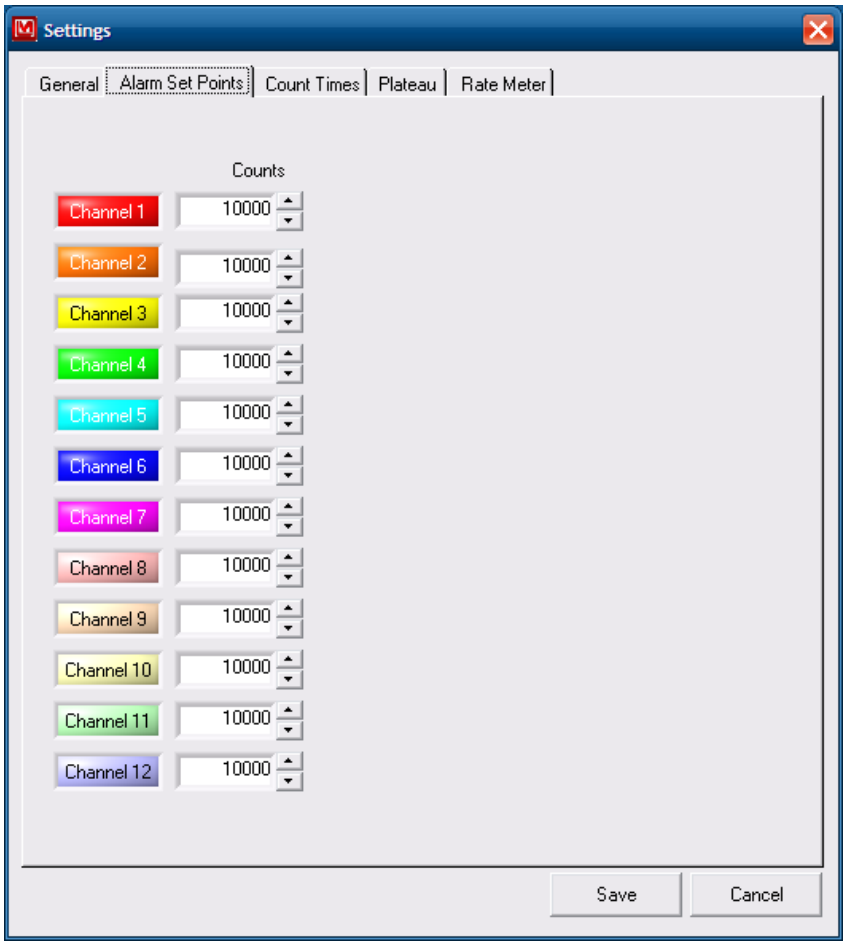
Comm Port: the RS-232 serial port used to communicate with the Counter. This list box displays all available communication ports on the computer. If a USB to serial adapter is used, consult the documentation that came with it for instructions on installing any drivers and configuring the port. The software will only work with communication port numbers that are between 1 and 16. If the port number is higher than this, it must be reconfigured to a lower number.

Data Folder: the folder where the count data is saved.

Enable Audible Alarm: If checked, an audible alert will be sounded when the accumulated count exceeds the alarm set point for that channel.

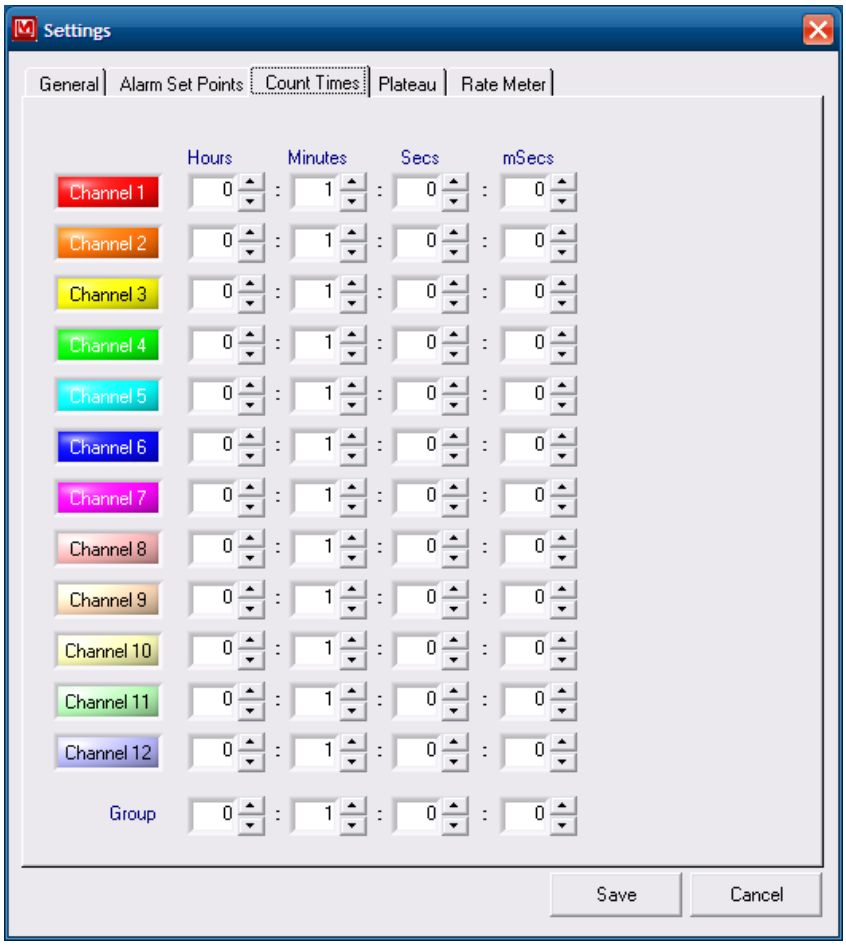
Audible Alarm File: Wav file that is played when alarm occurs.

Alarm Set Points



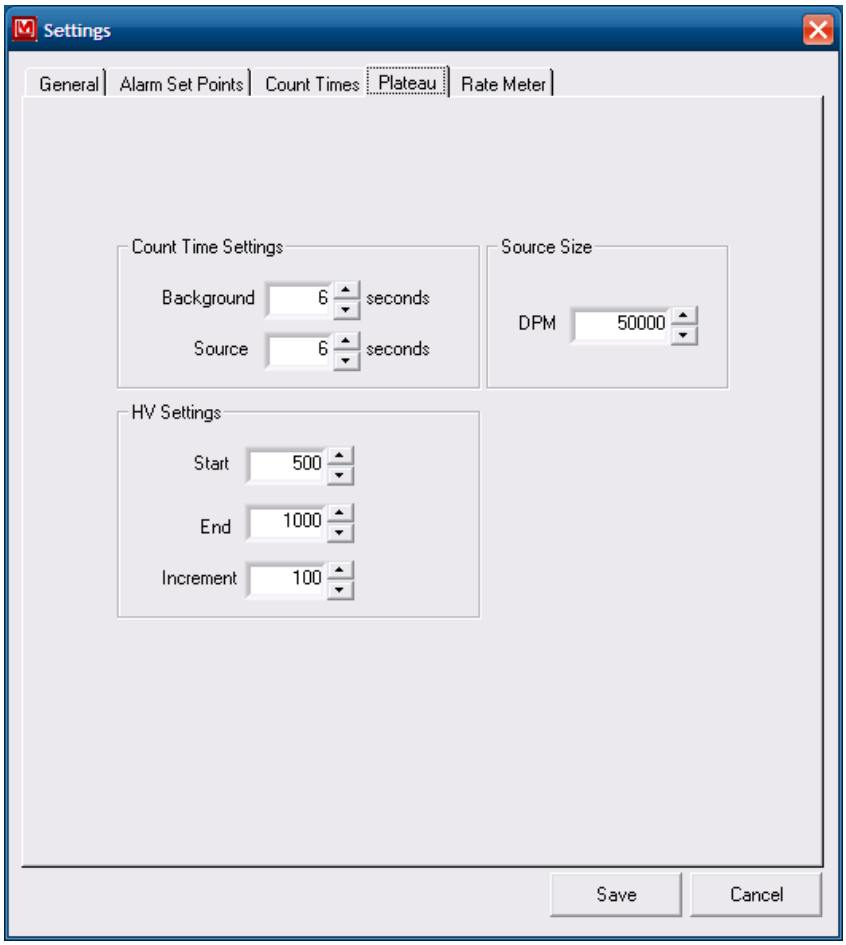
Individual alarm set points can be defined for each channel. During a timed count, if the accumulated value exceeds this set point, the background of the field will turn red and an audible alert will be played (if enabled).

Count Time



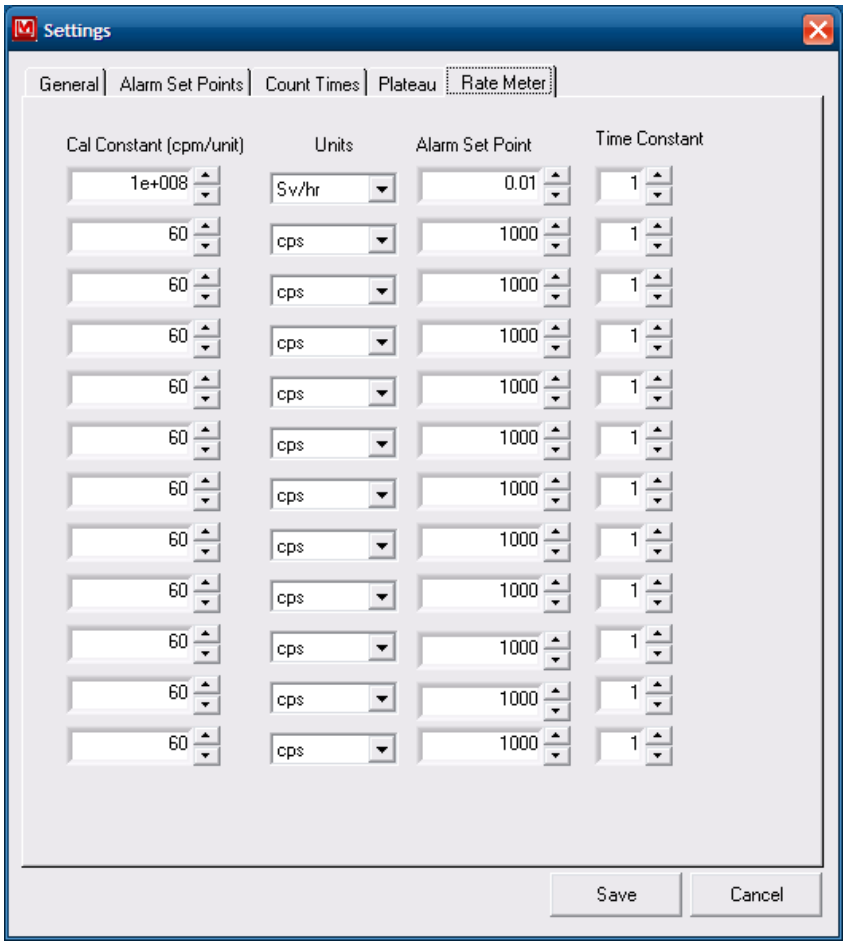
The values here determine the default counts times for each channel. These are just default values and can be changed at any time from the main screen.

Plateau



The plateau settings determine the default values used when running a plateau. These values can also be changed directly on the HV Plateau screen.

Rate Meter



The rate meter settings configure the rate meter display on the main screen. The rate meter can be set to display in cps, cpm, R/hr, and Sv/hr. The calibration constant must be correctly set to display the rate meter reading correctly. For instance, set the cal constant to 60 for cps and set the cal contant to 1 for cpm. Calibration constants for R/hr and Sv/hr will depend on the type of detector connected. The time constant affects the response time of the rate meter reading. A lower time constant give a faster response time while a higher time constant gives a slower response time.

Each channel has an individual rate meter alarm that can be set. When the current rate meter reading exceeds the set point, the background for the channel turns red and an audible alert will sound (if enabled). The default alarm set point is 1000 cps. During a timed count, the rate meter will display the highest reading. At the end of the count the highest reading will be logged to the .CSV file.

End User License Agreement

LUDLUM MEASUREMENTS, INC.
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Software License Agreement

Rev. (number) 1.0
Written by (or Revised by): Richard Brooks **Date:** 20 Jan 06
Approved by: Ed Ludlum **Date:** 20 JAN 06

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Section

3

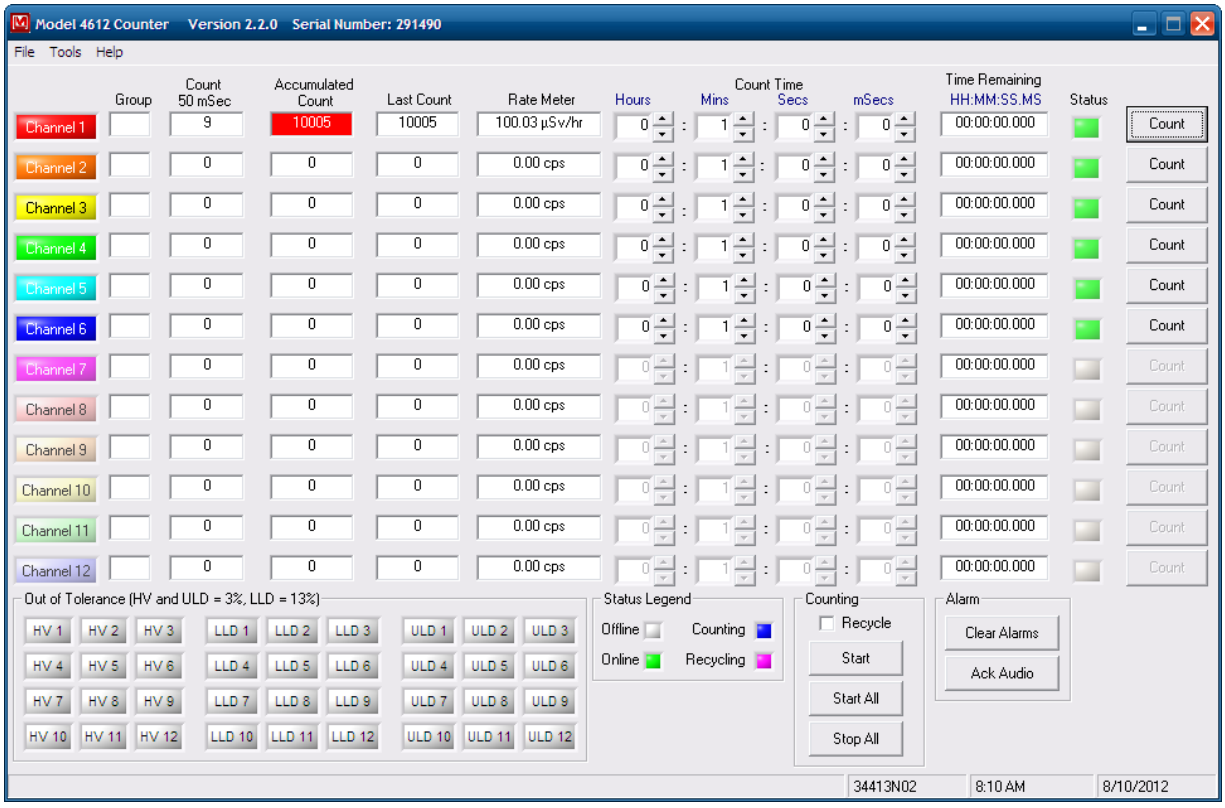
Software Features

The Model 4612 software has the following features, which will be detailed in depth in this section:

- Asynchronous counting on any channel with the ability to start/stop individual channels, as well as a group of channels
- Automatically store finished count data for groups as well as individual channels in a text file, in a folder chosen by the user
- Set the high voltage (HV), lower level discriminator (LLD), upper level discriminator(ULD), efficiency, gamma mode, and window mode on each channel
- Set the alarm set points, as well as an optional audio alarm. The software comes with a .wav file for the audio alarm; however, the user can change the audio alarm to any .wav file on the system.
- HV Plateau for a single channel or all channels
- Calibration Wizard that guides the user through the steps necessary to calibrate the counter
- User-definable color for each channel indicator

Counting

There are two types of counting – individual channel counting and group channel counting. Both types of counts can be started from the main screen, an example of which is shown in the following graphic.



The main screen displays the following information: Group Number, current 50 millisecond count, Accumulated Count, Last Count, Count Time, Remaining Time, Status, and Out of Tolerance.

The count time can be changed by clicking on the up or down arrows next to each field or by simply typing in a new value. The count time can only be changed when the channel is not counting.

The status of the channel is displayed as a colored indicator next to the count button.

- Gray: indicates the channel if offline. A channel may be offline if the channel does not exist or if there is a problem with the channel.
- Green: indicates the channel is online and ready to start counting.

- Blue: indicates the channel is counting. When the count time expires, the count is stopped.

- Violet: indicates the channel is counting in the recycle mode. When the count time expires, the count will automatically restart.

When the accumulated count exceeds the alarm set point, the background color will change from white to red on that channel. An audible alert will sound if enabled. Clicking the "Clear Alarms" button will silence the audio and return the background color for all alarming channels to white. Clicking on the "Ack Audio" button will silence the audio.

The "Stop" button will stop all counting channels.

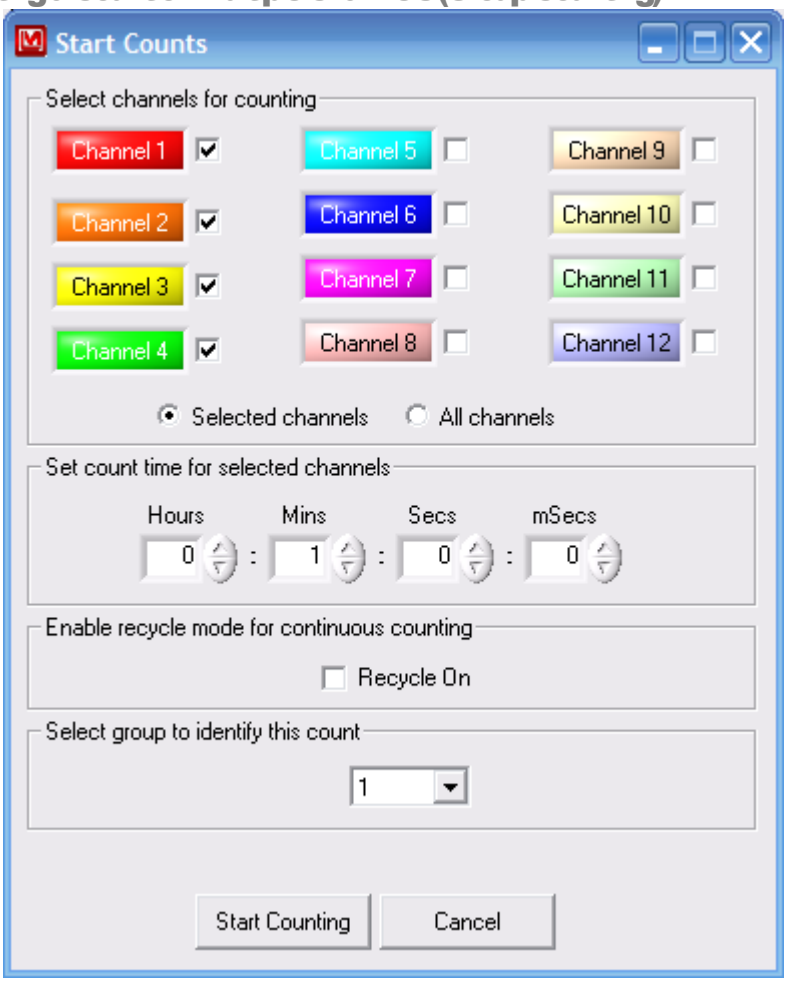
Out-of-tolerance indicators in the lower, left corner of the screen change to red if these parameters fall out of tolerance. The HV and ULD are out of tolerance if they are not within 3% of their set points. The LLD is out of tolerance if it is not within 13% of the set point.

Starting a Count on a Single Channel

An individual count may be started by clicking on the "Count" button located on the right side of the screen. When this button is clicked, a count on that channel is started immediately. If the Recycle checkbox is checked, then this count will automatically restart a new count as soon as the current count is complete. If it is not checked, the count will stop as soon as the count time expires. To stop a count that is in progress, click on the "Cancel" button. Once the count has completed, the data will be saved to the .CSV file.

Additionally, clicking the "Start All" button will start a count on all active channels that are not currently counting.

Starting a Count on Multiple Channels (Group Counting)

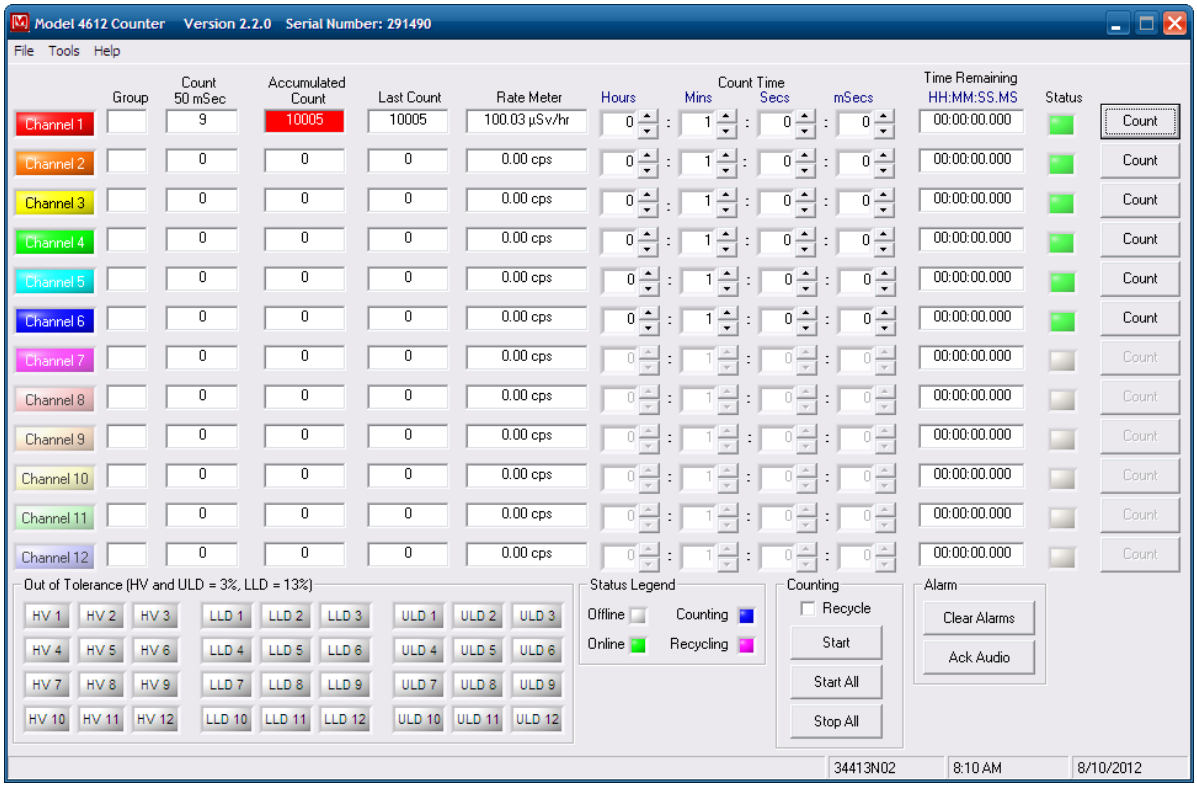


To start counting on a group of channels, click on the "Start" button. From this screen the user can start all channels counting simultaneously or individually select a group of channels. To select an individual channel make sure the "Selected channels" radio button is selected, and then click on either the check box or channel indicator.

Set the count time for this group by using the up/down buttons or entering in the count time for hours, minutes, seconds, and milliseconds.

If continuous counting is desired, place a check in the "Recycled On" checkbox. With this checked, once the count time expires, this group of channels will automatically restart counting.

The group number is used to identify each group of channels. This group number is displayed on the main screen and also saved to the .CSV file.



Count Data Text Files

When a count has finished, the data is automatically saved to a text file. The file is saved in a comma separated value (.CSV) format. This is a text file where each value is separated by the comma character and is suitable for loading into a spreadsheet or database file for further processing, graphing, etc. This file contains the Serial Number, Group Number, Channel, Count Time, Count, HV, LLD, ULD, Efficiency, and Date.

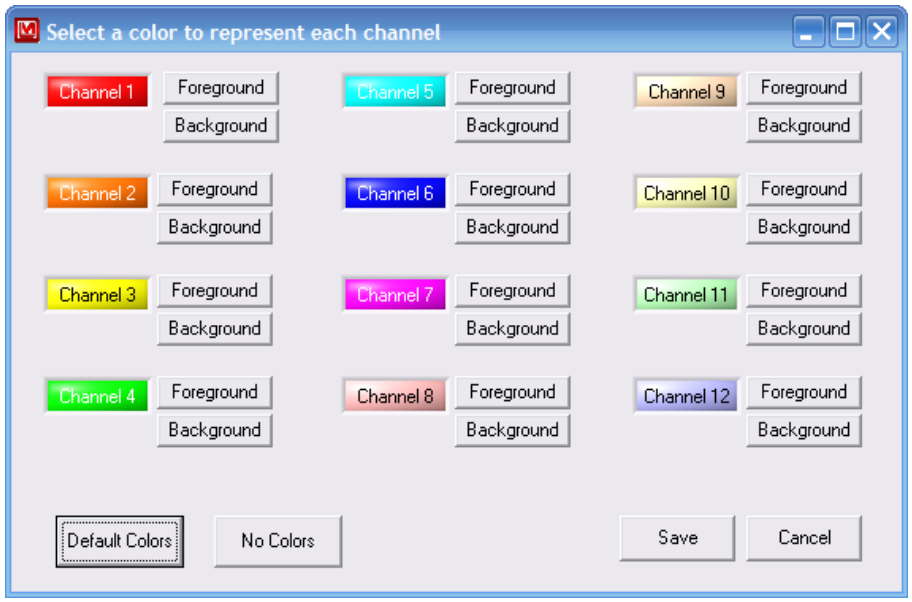
Channel, Total Count, Elapsed Count Time, HV, LLD, ULD

Example:

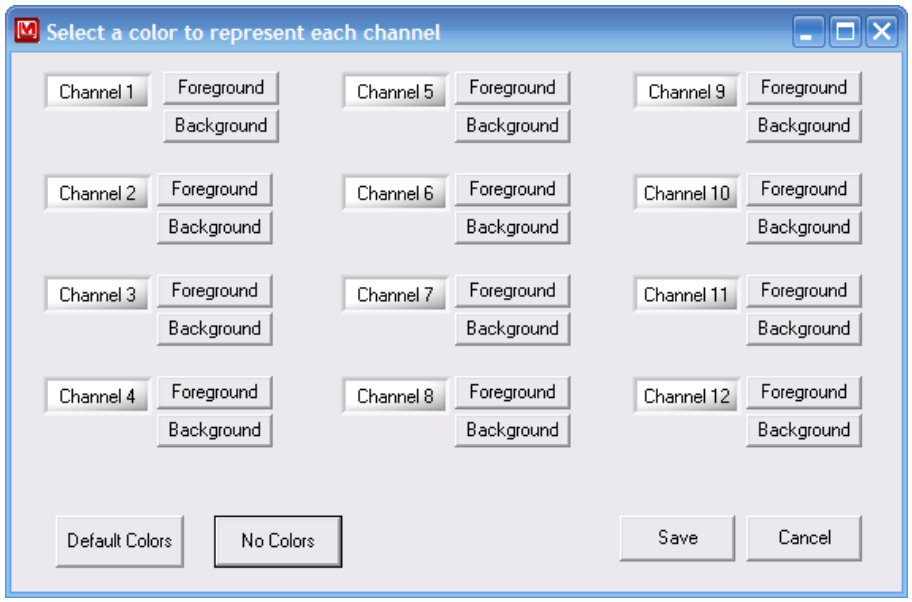
```
SerialNumber,Group,Channel,CountTime,Count,HV,LLD,ULD,Efficiency,Date
240600,00,01,00:00:06.000,3984,1001,0101,3001,01.1,11/30/2007 13:52:29
240600,00,01,00:00:06.000,3985,1001,0101,3001,01.1,11/30/2007 13:52:43
```

Channel Colors

A color can be defined to help distinguish each channel. The channel indicators on all screens will be displayed with these colors.



The foreground and background can be defined for each channel. Clicking on the "Default Colors" button will set each channel to a different default color. Clicking on the "No Colors" button will set all channels to white.

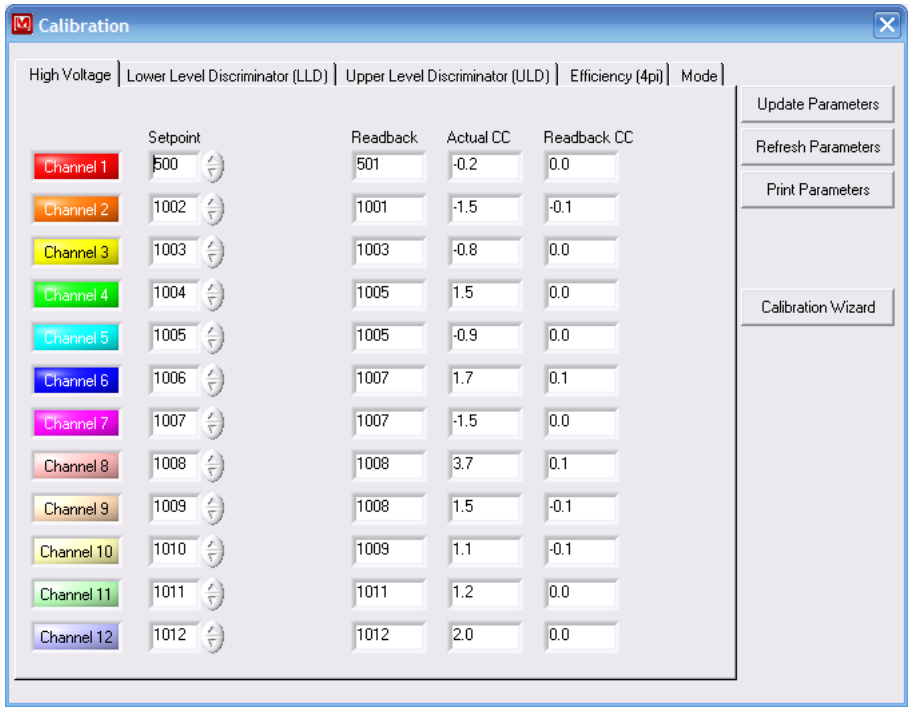


Calibration

The calibration screen allows the user to set the HV, LLD, ULD, Efficiency, and Modes for each channel. After changing a single or multiple values, click on the "Update Parameters" button to send the parameters to the Counter. To reload the parameters from the Counter, click on the Refresh Parameters button. The "Print" button will print a list of all parameters. The Calibration Wizard will guide the user through calibrating the various calibration constants for each channel. Only channels that are online are available for parameter changes.

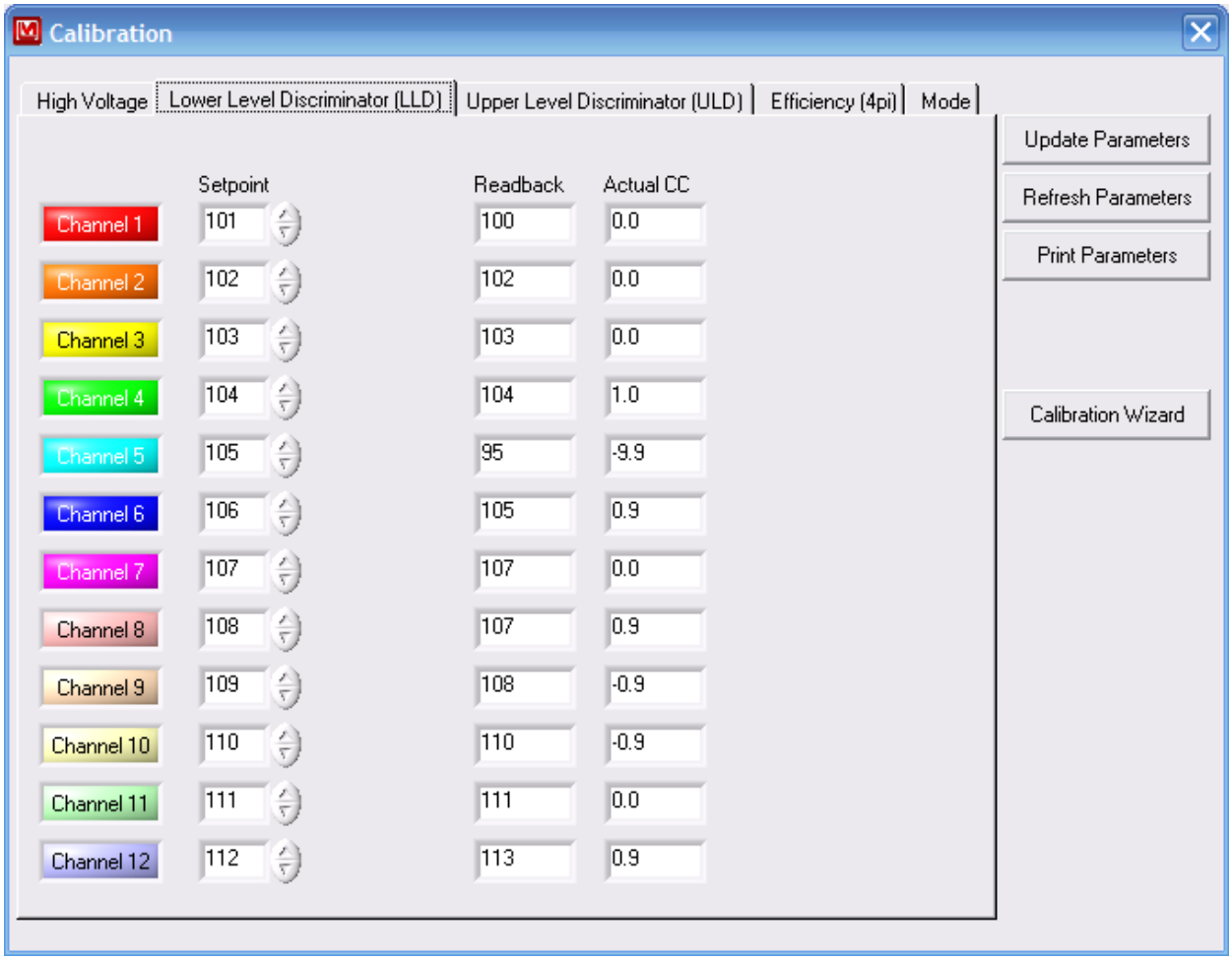
High Voltage

The High Voltage tab shows the current high-voltage set point, read-back voltage, actual calibration constant, and read-back calibration constant. The high voltage is adjustable from 0 to 1400 V. The only value on this tab that can be changed is the high voltage set point. All other values must be changed through the calibration wizard.



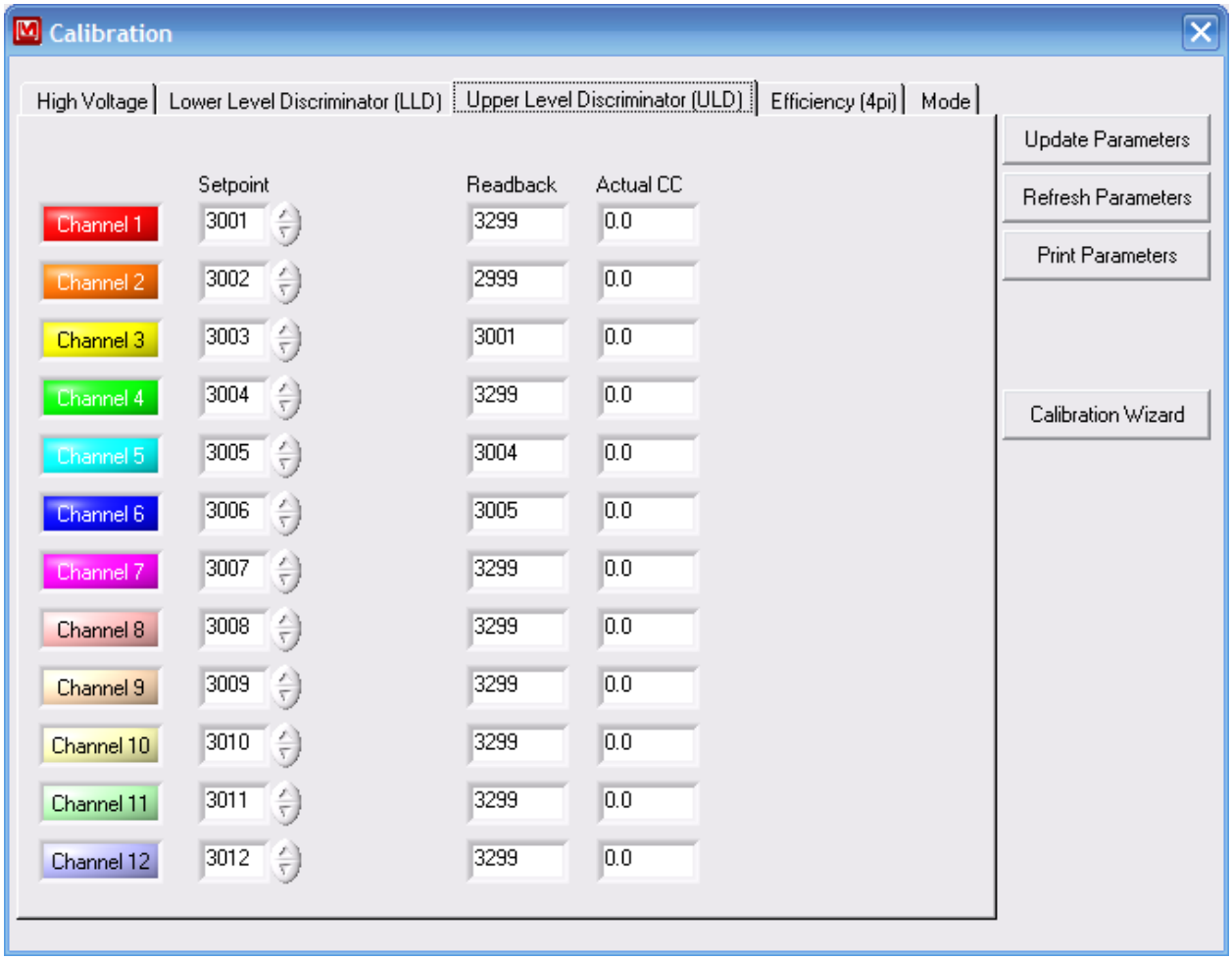
Lower Level Discriminator

The Lower Level Discriminator tab shows the current LLD set point, read-back voltage, and actual calibration constant. The LLD is adjustable from 0 to 3300 mV.



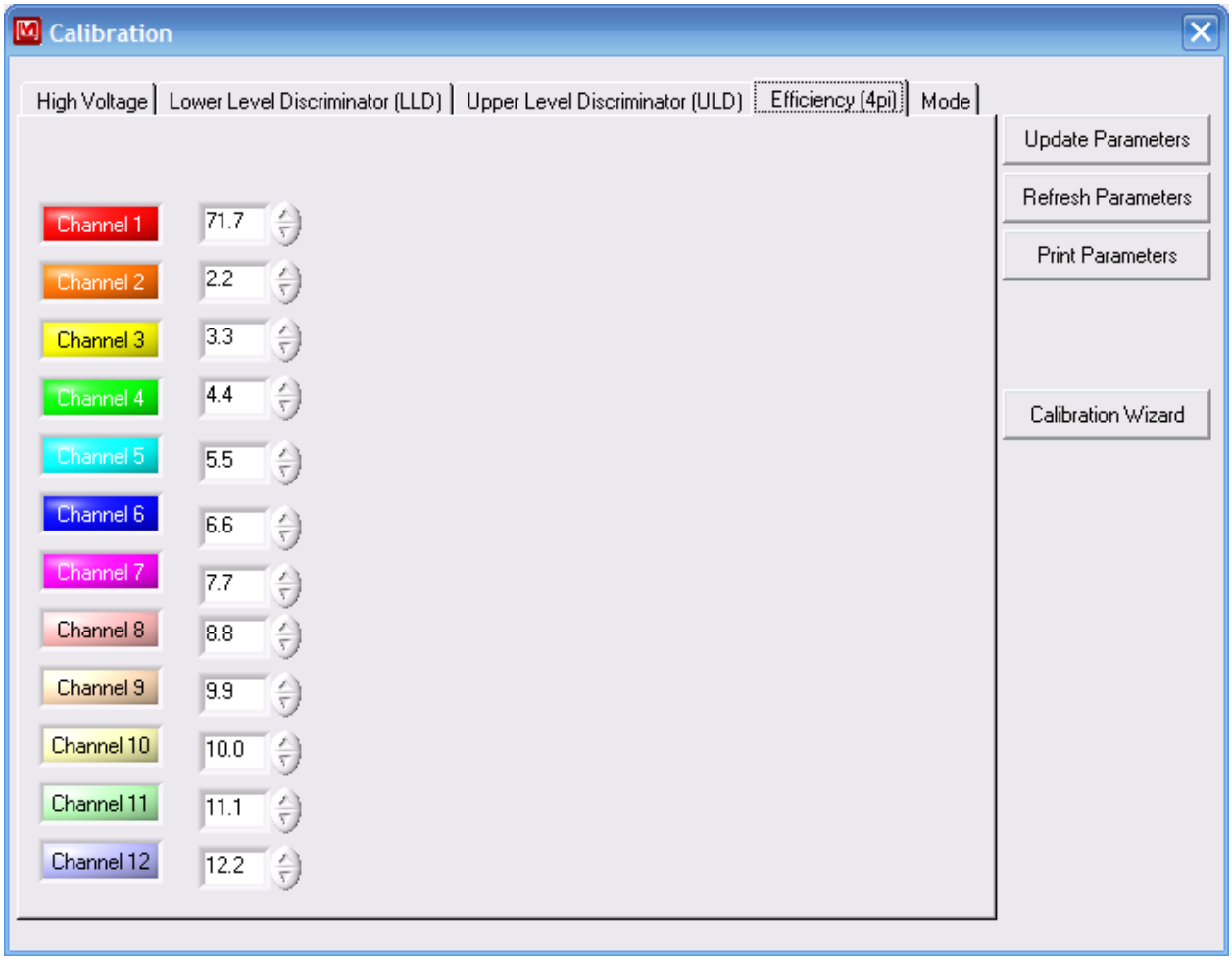
Upper Level Discriminator

The Upper Level Discriminator tab shows the current ULD set point, read-back voltage, and actual calibration constant. The ULD is adjustable from 0 to 3300 mV.



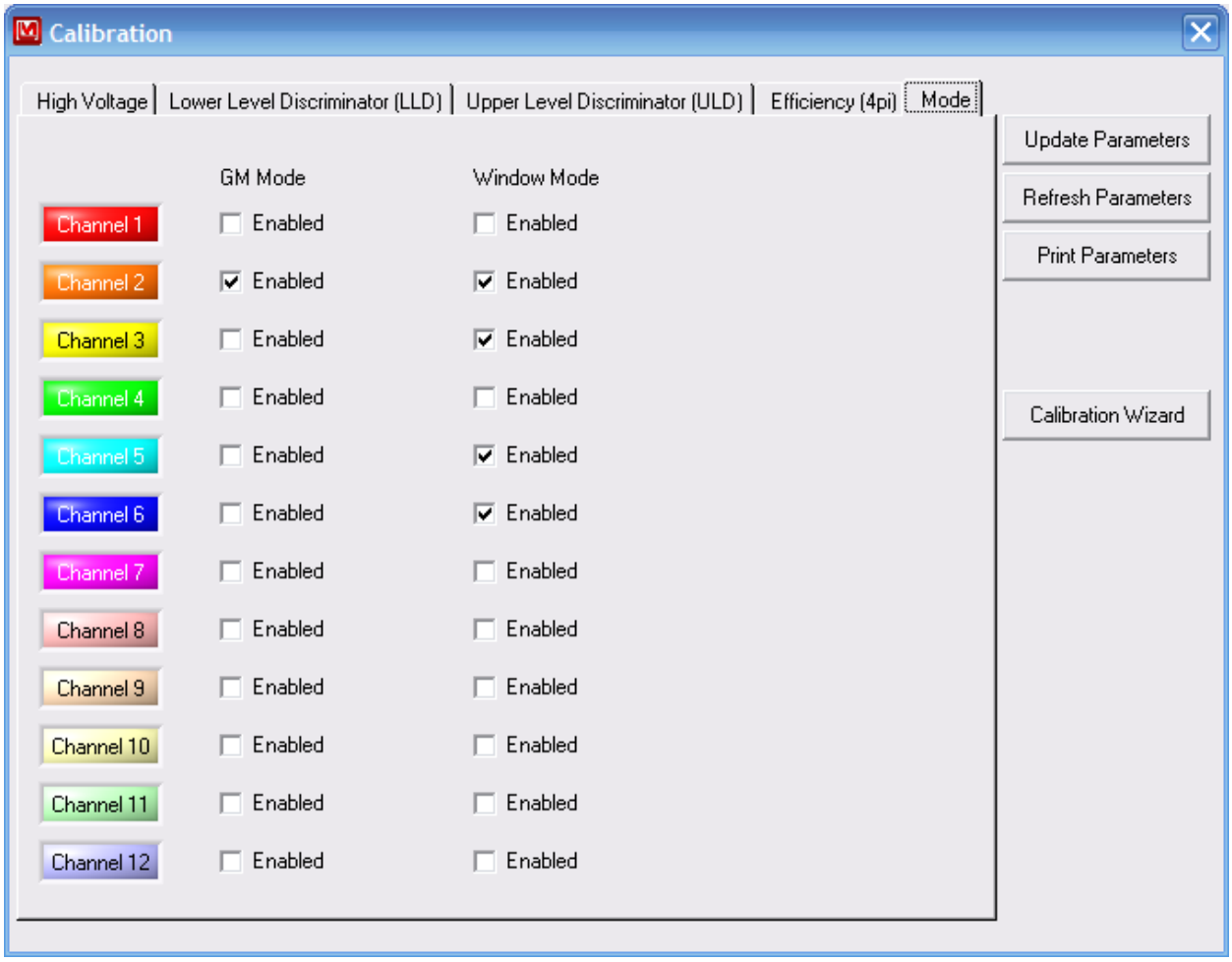
Efficiency

This is the efficiency that was calculated for the high voltage, which was set when the plateau was run. It is not used for any calculations and is for informational purposes only.



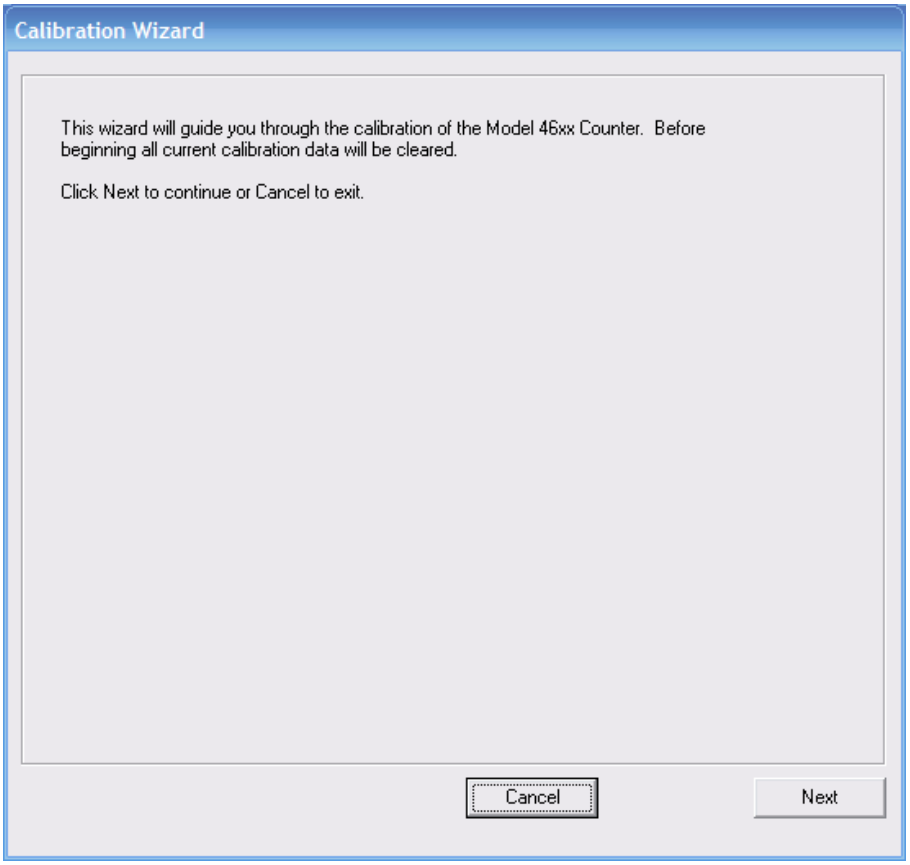
Mode

The GM and Window mode can be set individually for each channel. When the GM Mode is checked, the slave board is configured for use with GM detectors to eliminate double pulsing and long dead times. When the Window Mode is unchecked, the slave board's ULD set point is ignored.



Calibration Wizard

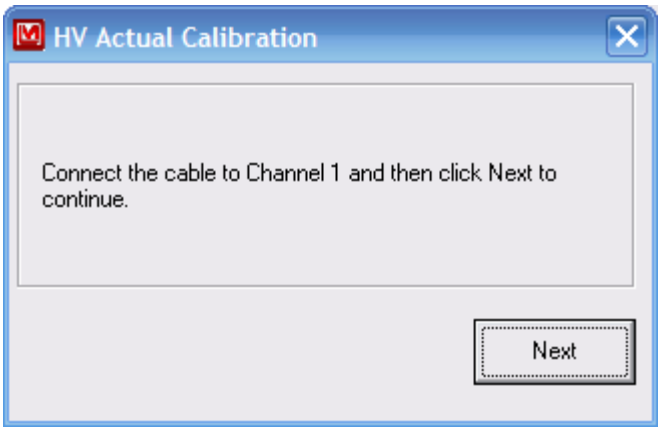
The calibration wizard guides the user through the process of setting the calibration constants for each online channel. The following parameters will be set by the wizard: HV actual calibration constant, HV read-back calibration constant, LLD actual calibration constant, and ULD actual calibration constant. The wizard automatically calculates the calibration constant based on the measurements entered in for each channel. All calibration constants are zeroed out at the beginning. Calibration requires a Model 500 Pulser with a high-voltage readout or a high-impedance voltmeter with at least 1000 Megohm meter input resistance.

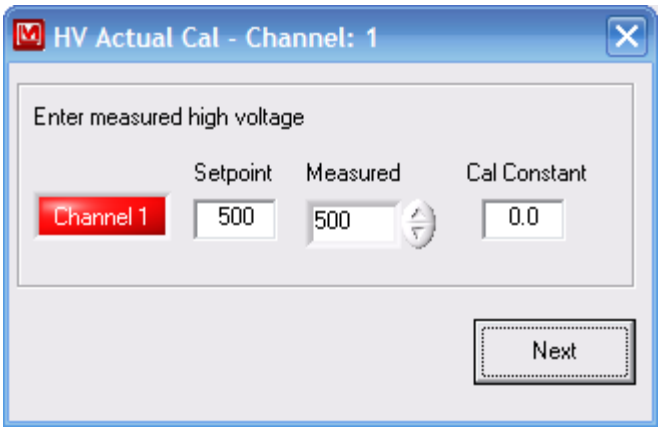


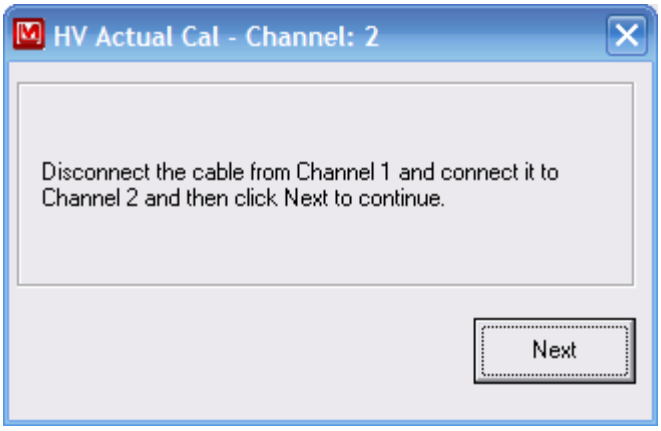
HV Actual Calibration Constant

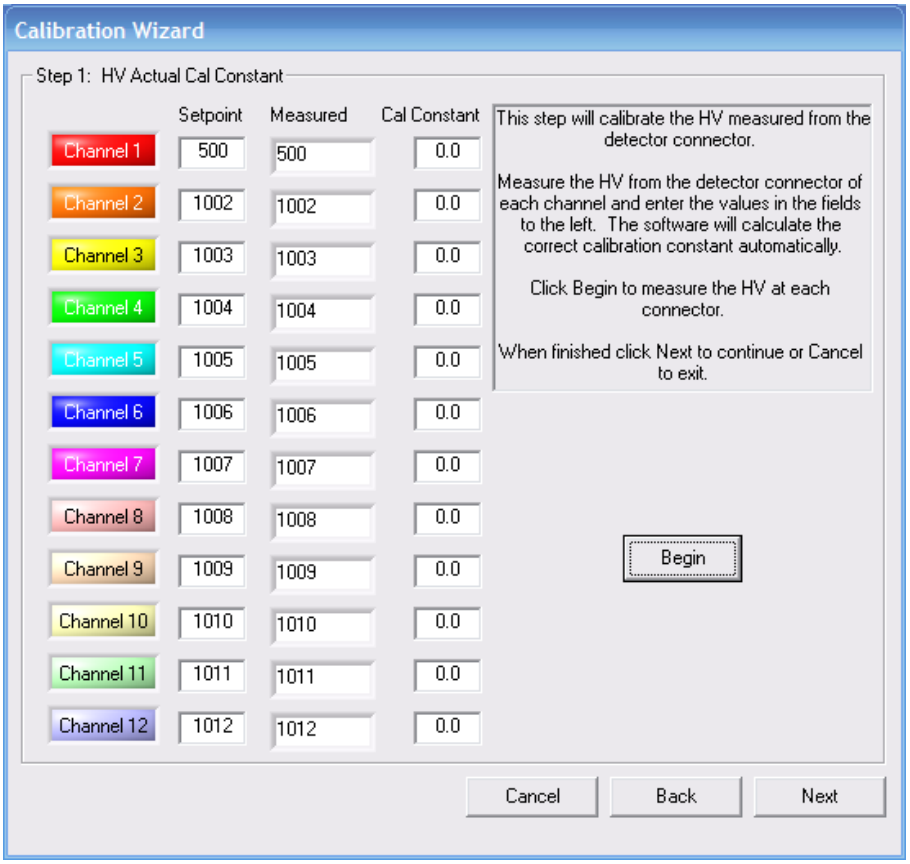
Click the "Begin" button to start the process of calibrating the HV actual calibration constant. The HV actual calibration constant is calculated automatically by entering the high voltage measured at the detector connector. The wizard will set the high voltage of all channels to zero and then prompt for the cable to be connected to the first channel.

After connecting the cable and clicking Next, the high voltage will be restored to the set point. Enter the measured high voltage and click Next. This process continues until all online channels are completed. Click Done and then click Next to go to the HV Read Back calibration.



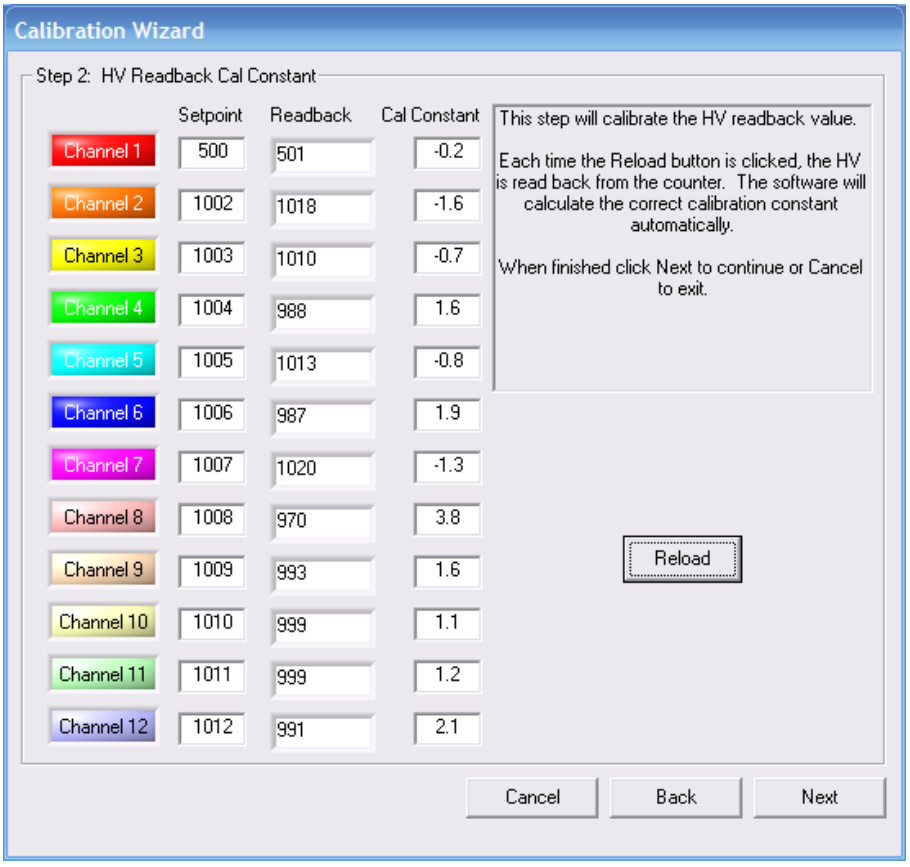





Calibration Wizard
Step 1: HV Actual Cal Constant
Setpoint
Measured
Cal Constant
Channel 1
500
500
0.0
Channel 2
1002
1002
0.0
Channel 3
1003
1003
0.0
Channel 4
1004
1004
0.0
Channel 5
1005
1005
0.0
Channel 6
1006
1006
0.0
Channel 7
1007
1007
0.0
Channel 8
1008
1008
0.0
Channel 9
1009
1009
0.0
Channel 10
1010
1010
0.0
Channel 11
1011
1011
0.0
Channel 12
1012
1012
0.0
This step will calibrate the HV measured from the detector connector.
Measure the HV from the detector connector of each channel and enter the values in the fields to the left. The software will calculate the correct calibration constant automatically.
Click Begin to measure the HV at each connector.
When finished click Next to continue or Cancel to exit.
Begin
Cancel
Back
Next

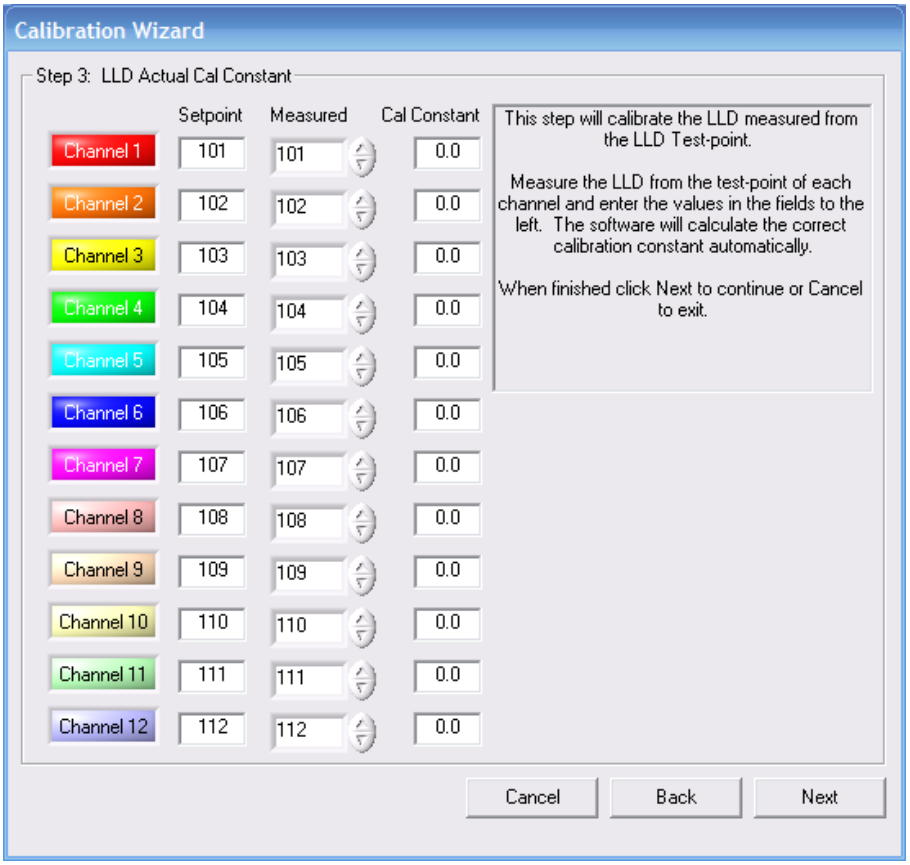
HV Read Back Calibration Constant

The HV Read Back calibration constant is more or less automatic. Simply click on the Reload button to view the read-back high voltage from the counter. If the returned values are consistent, click Next.



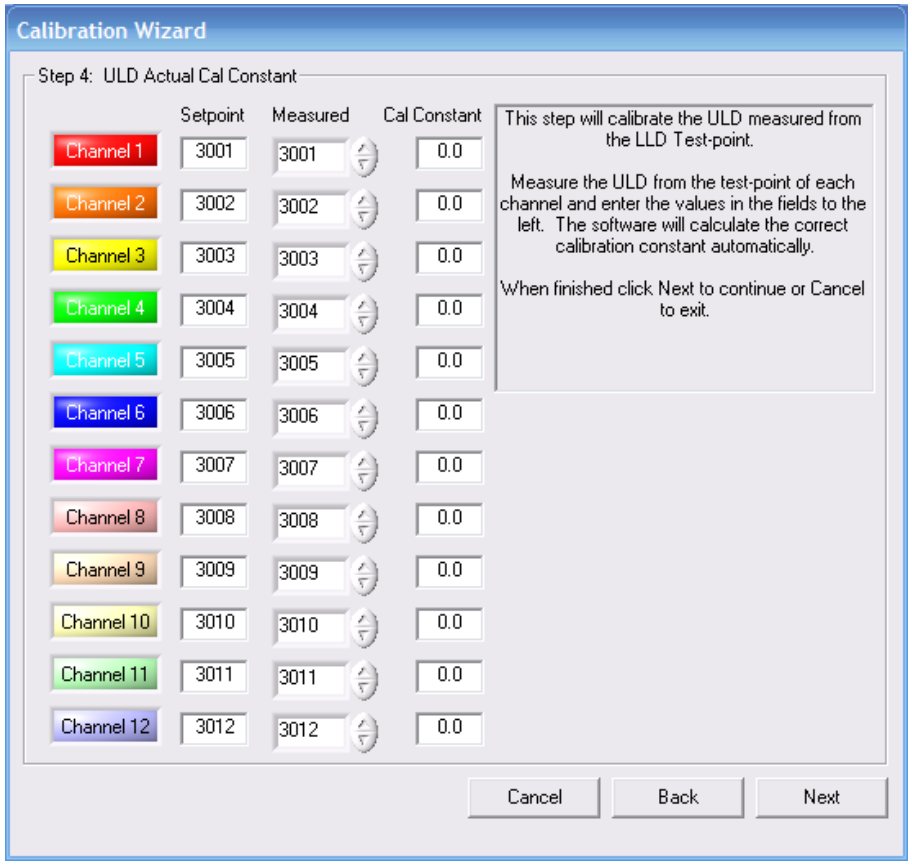
LLD Actual Calibration Constant

The LLD actual calibration constant is obtained by measuring the LLD from the test point on each channel and entering the measured reading in the appropriate fields. This can be accomplished by entering the number directly or using the up and down buttons to reach the desired value. When complete, click the Next button.



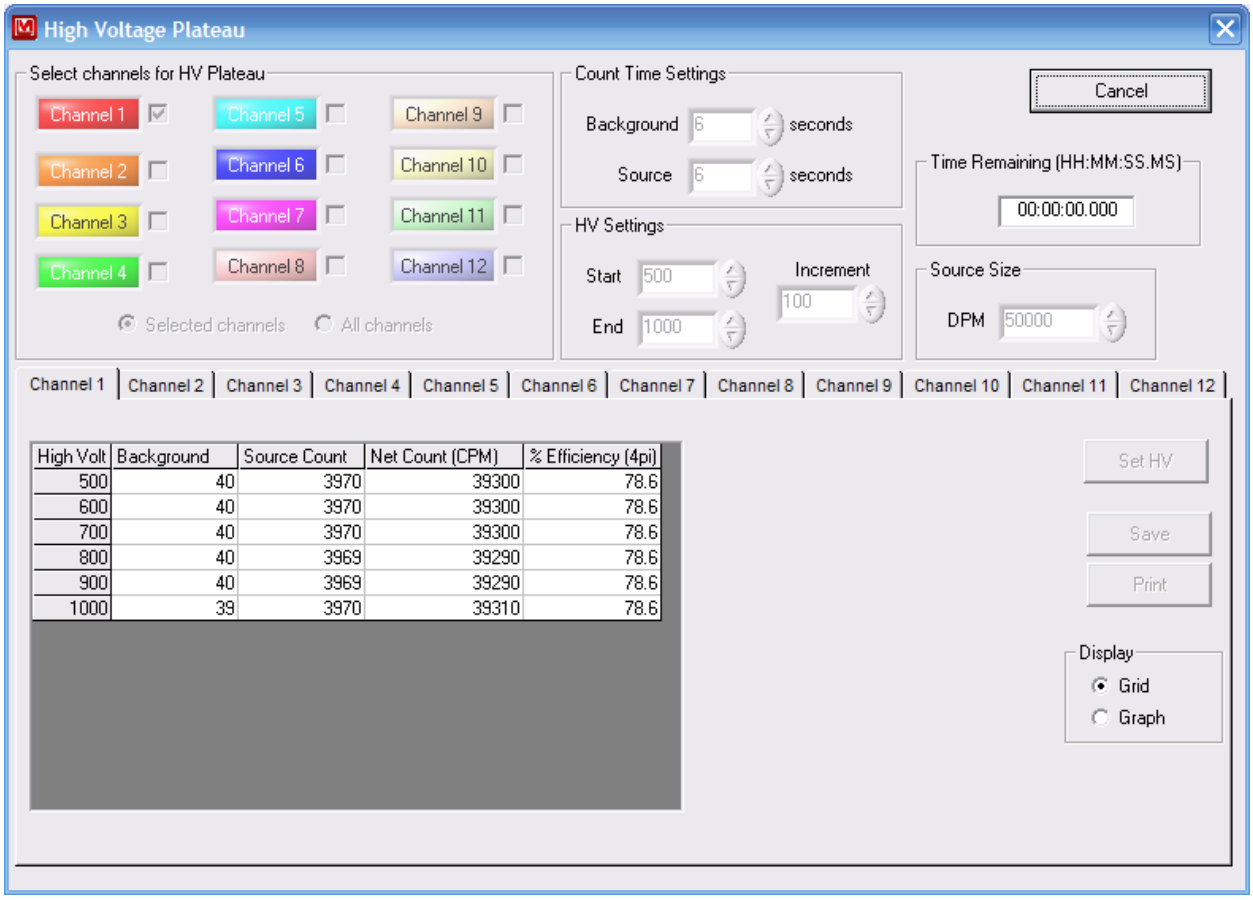
ULD Actual Calibration Constant

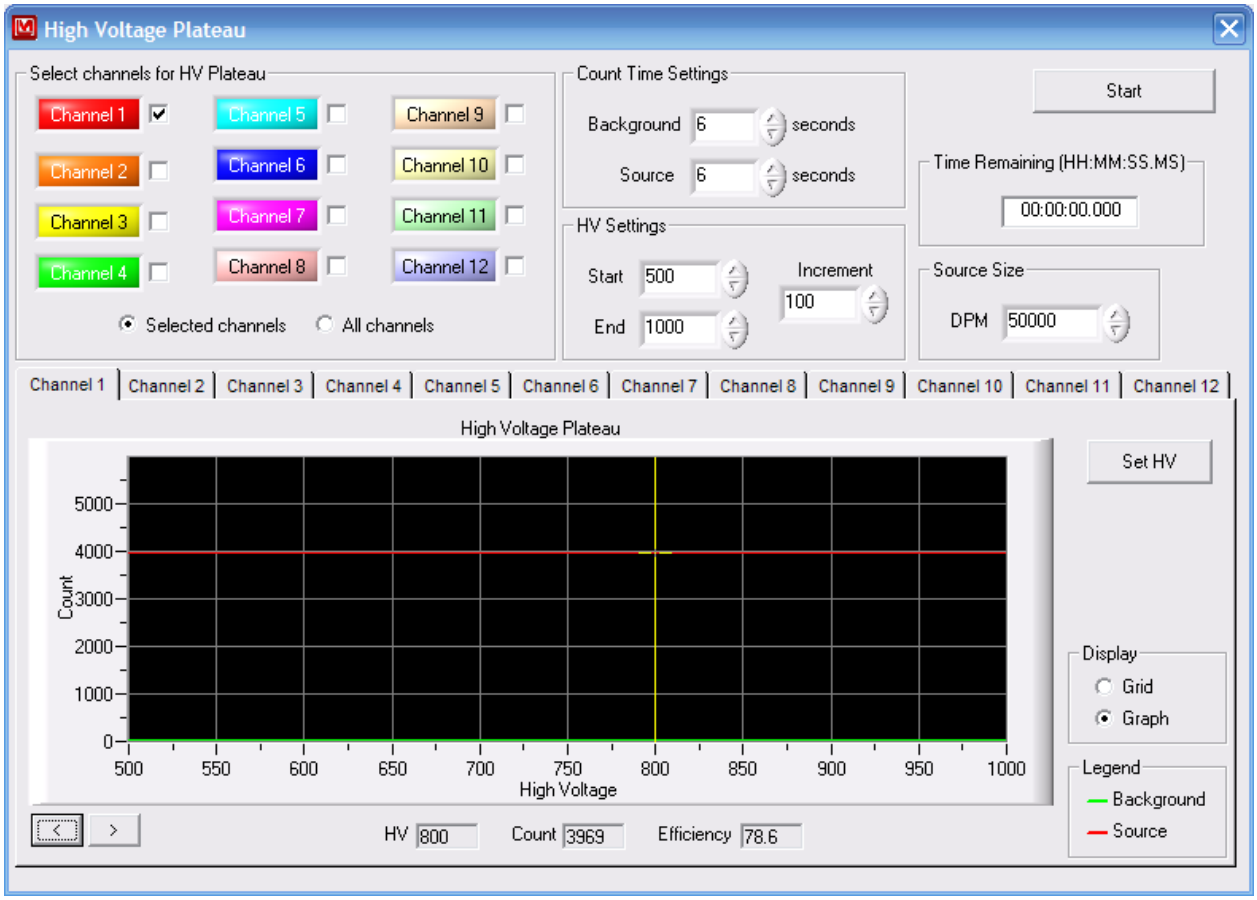
The LLD actual calibration constant is obtained by measuring the LLD from the test point on each channel and entering the measured reading in the appropriate fields. This can be accomplished by entering the number directly or using the up and down buttons to reach the desired value. When complete, click the Next button.



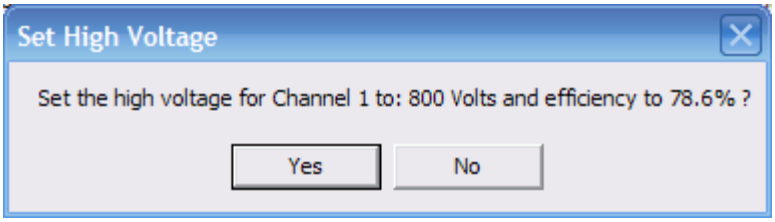
HV Plateau

The HV Plateau provides the ability to plateau individual or all channels simultaneously. Before beginning, select which channels will be included in the plateau, background and source count times, start and ending high voltage, high voltage increment, and the source size in DPM. Clicking on the Start button will begin the plateau. The background plateau is run on all enabled channels simultaneously. After the background plateau is finished, the user will be prompted to place the source on the first detector. The user will then be prompted to place the source on the remaining detectors in sequence until all detectors have been plateaued.





Once the plateau is complete, clicking on the Set HV button will set the high voltage and efficiency for the channel. Select the appropriate high voltage and efficiency by highlighting the row on the grid or by selecting a point on the graph with the cursor. On the graph view, the cursor can be moved by dragging it around the plot with the mouse or by using the Cursor Left and Cursor Right buttons, which are located at the bottom, left corner of the graph.



Section 4

Electronics Specifications

Power: 7.5 to 36 Vdc at 3 W maximum

Amplifier Gain: adjustable from 1 to 15 V/V

Amplifier Range: 0 to approximately 3 V

Input Sensitivity: adjustable from 5 to 3300 mV

High Voltage: adjustable from 0 to 1500 Vdc (optional 0-2500 Vdc)

Window: adjustable from 5 to 3300 mV (can be enabled or disabled)

Connectors: four BNC-type connectors (MHV also available)

Finish: beige powder-coat finish

Size: 10.9 x 29.2 x 10.7 cm (4.3 x 11.5 x 4.2 in.) (H x W x L)

Weight: 1.2 kg (2.7 lb)

Section 5

Description of Controls and Functions

Input: voltage input; minimum 7.5 to maximum 36 Vdc, center pin is positive

RS-232: used in connecting the instrument to a computer, 8-N-1 19.2 k bps, no handshaking

Detectors 1-12: up to 12 detectors may be connected

Test Points: Each slave board has test point for Upper Level Discriminator (ULD), Lower Level Discriminator (LLD) and HV Read-Back Voltage (HR).

Amplifier Output: Each slave board has an SMB type coaxial output for amplifier out. Use LMI part # 8303-632 (BNC to SMB).

Power LED: red LED on front panel indicating unit power is on. Note: Port connection and DTR must be high to activate this LED.

GN: gain adjustment for each slave board. Note: At a normal gain setting of 10, 500 mV on the LLD test point is equal to a 50 mV detector sensitivity.

Section

6

Drawings and Diagrams

HOST -843 BOARD, Drawing 344 × 417 (3 sheets)

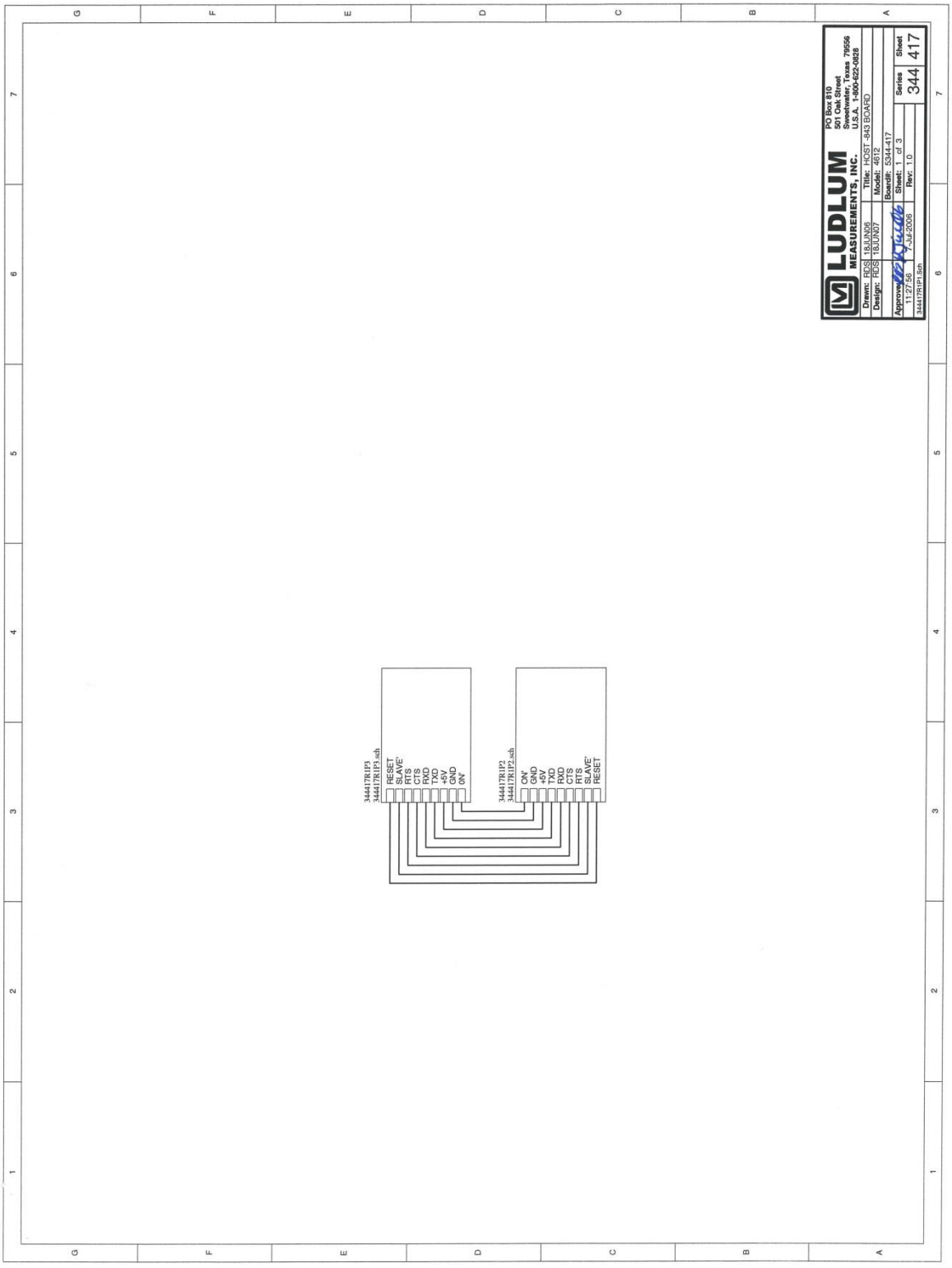
HOST -843 BOARD LAYOUT, Drawing 344 × 418A (2 sheets)

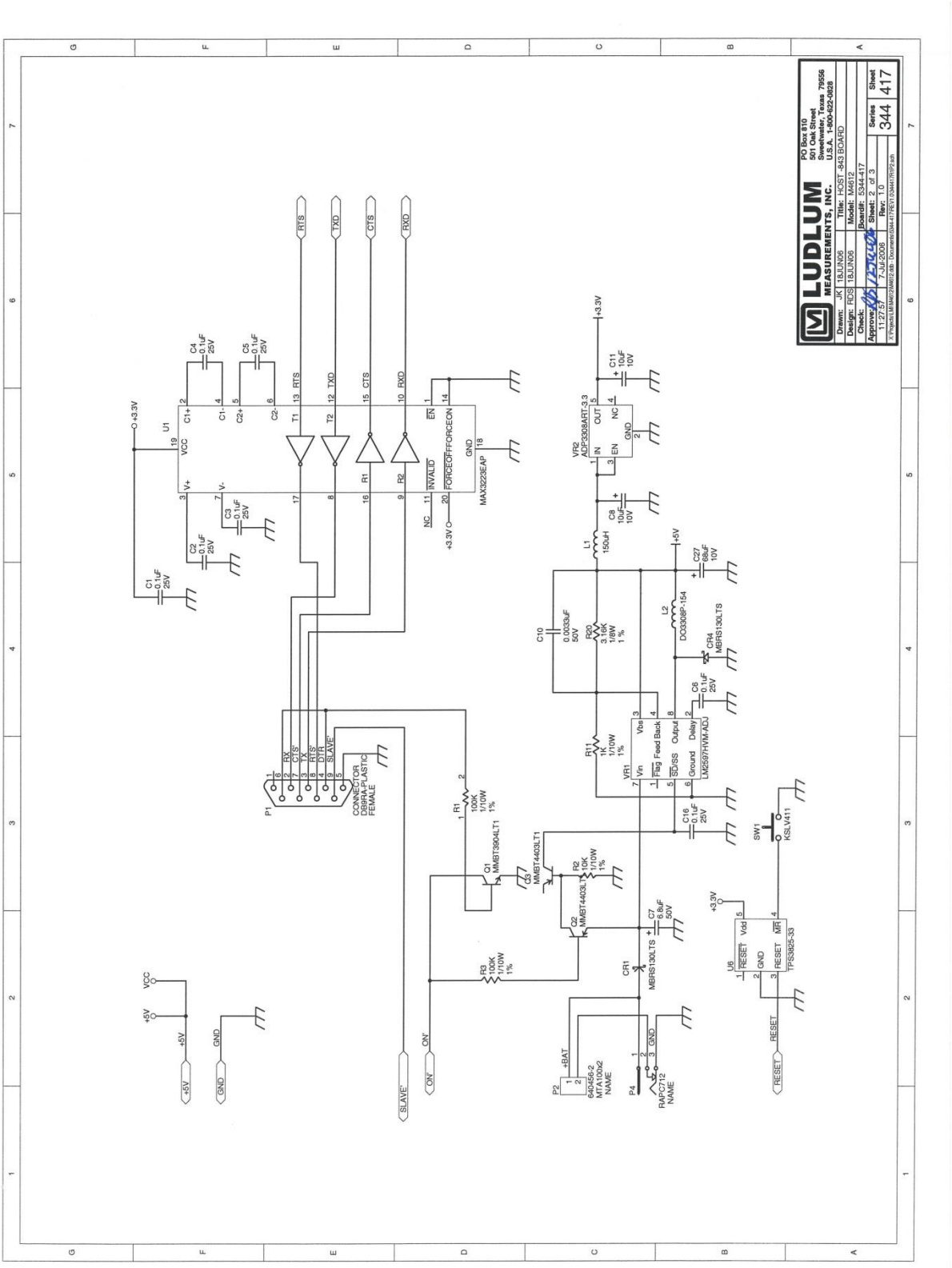
SLAVE BOARD, Drawing 344 × 289 (3 sheets)

SLAVE AMP BOARD LAYOUT, Drawing 344 × 290A (2 sheets)

BACKPLANE BOARD, Drawing 344 x 201

BACKPLANE BOARD LAYOUT, Drawing 344 x 202 (2 sheets)


LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828
Drawn: RDS 18JUN06
Design: RDS 18JUN07
Title: HOST 843 BOARD
Model: 4612
Boardfi: 5344-417
Sheet: 1 of 3
Rev: 1.0
Approved: 7-Jul-2006
Series 344
Sheet 417
11:27:56
5344417R1P1.Sch
344417R1P3
344417R1P3.sch
RESET
SLAVE'
RTS
CTS
RXD
TXD
+6V
GND
0N'
344417R1P2
344417R1P2.sch
ON'
GND
+6V
TXD
RXD
CTS
RTS
SLAVE'
RESET


LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828
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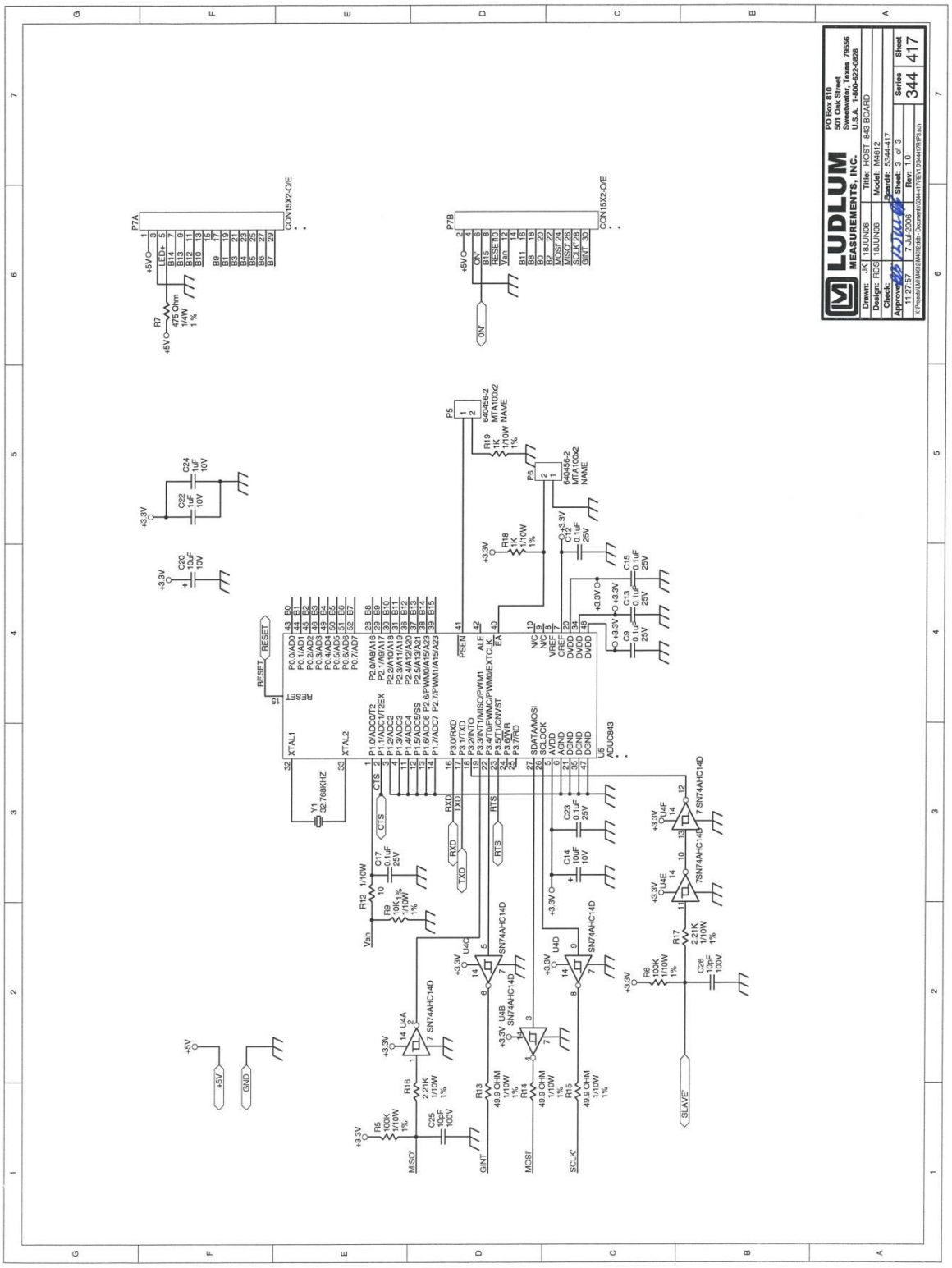
Design: RDS 18JUN06
Check:
Approver: 11:27:57 7-Jul-2006
Title: HOST -843 BOARD
Model: M4612
Board#: 5344-417
Sheet: 2 of 3
Rev: 1.0
Series 344
Sheet 417
U1
MAX3223EAP
U6
TPS3825-33
VR1
LM2597HVM-ADJ
VR2
ADP3308ART-3.3
P1
CONNECTOR DB9F PLASTIC FEMALE
P2
640456-2 M7AA1002 NAME
P4
RAPC712 NAME
SW1
KSL0411
RTS
TXD
CTS
RXD
SLAVE
ON
+3.3V
+5V
VCC
GND
+BAT
RESET


LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 915-235-5494
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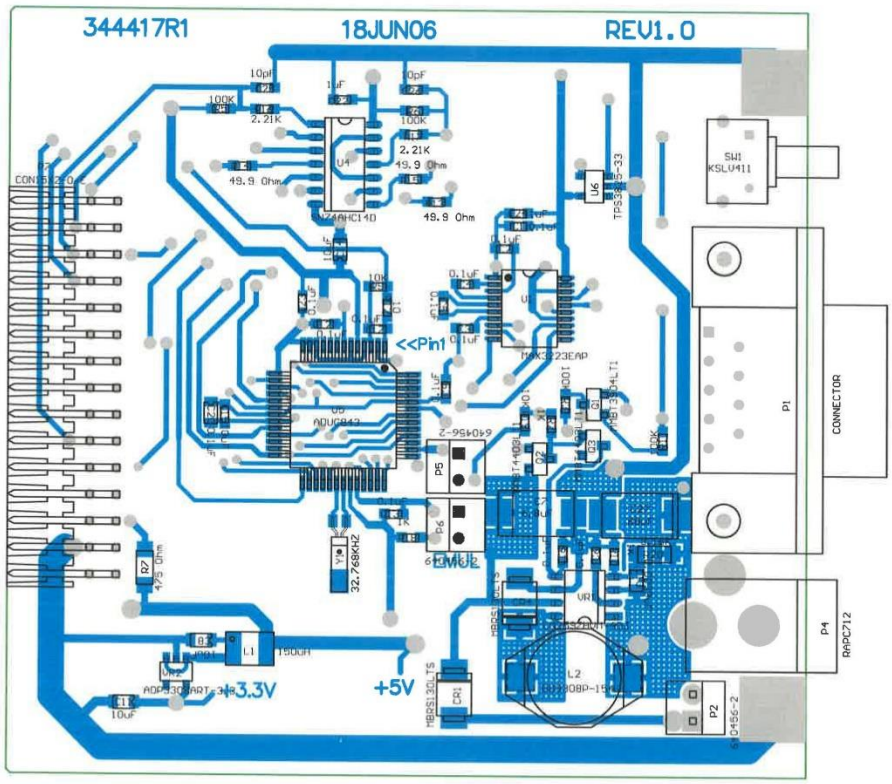
Design: RDS 18JUN06
Check:
Approved: 11:27:57 7-Jul-2006
Title: HOST -#43 BOARD
Model: M4612
Specif: 5344-417
Sheet: 3 of 3
Rev: 1.0
Series 344
Sheet 417
X:\Projects\JM\M4612\M4612.sdb - Document\5344417REV1.0\5344417RP3.sch
P7A
P7B
CON15X2-O/E
R7 475 Ohm 1/4W 1%
P5
P6
640456-2 MTA100x2
R19 1K 1/10W 1%
R18 1K 1/10W 1%
C24 1uF 10V
C22 1uF 10V
C20 10uF 10V
C1-C3 0.1uF 25V
C9 C13 C15 0.1uF 25V
U5 ADUC843
Y1 32.768KHZ
C17 0.1uF 25V
C23 0.1uF 25V
C14 10uF 10V
R12 1/10W 10
R9 10K 1/10W 1%
U4A U4B U4C U4D U4E SN74AHC14D
R16 2.21K 1/10W 1%
R13 R14 R15 49.9 OHM 1/10W 1%
R5 100K 1/10W 1%
C25 10pF 100V
R17 2.21K 1/10W 1%
R6 100K 1/10W 1%
C26 10pF 100V
MISO
GINT
MOSI
SCLK
SLAVE
RESET
RXD
TXD
CTS
RTS
+5V
GND
+3.3V
Van



LUDLUM MEASUREMENTS, INC.	PO Box 810, 501 Oak Street, Sweetwater, TX 79556 U.S.A. 1-800-622-0828		
Title: HOST-843 BOARD			
Drawn: JK	06/18/2006	Model: 4612	
Design: RDS	06/18/2006	Board#: 5344-417	
Approve: RDS 14MAR19		Rev: 1	
Print Date: 3/14/2019 10:46:19 AM		SCALE: 1.08 Top Overlay	Series 344 / Sheet 418 A
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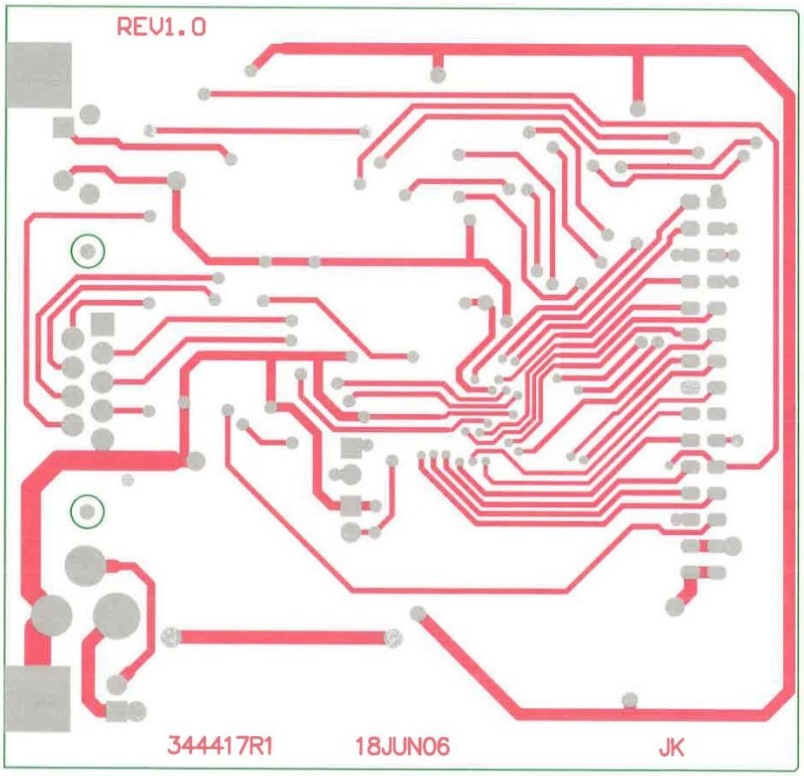

LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
Title: HOST-843 BOARD			
Drawn: JK	06/18/2006	**Model:** 4612	
Design: RDS	06/18/2006	**Board#:** 5344-417	
Approve: RDS	14 Mar 19	**Rev:** 1	
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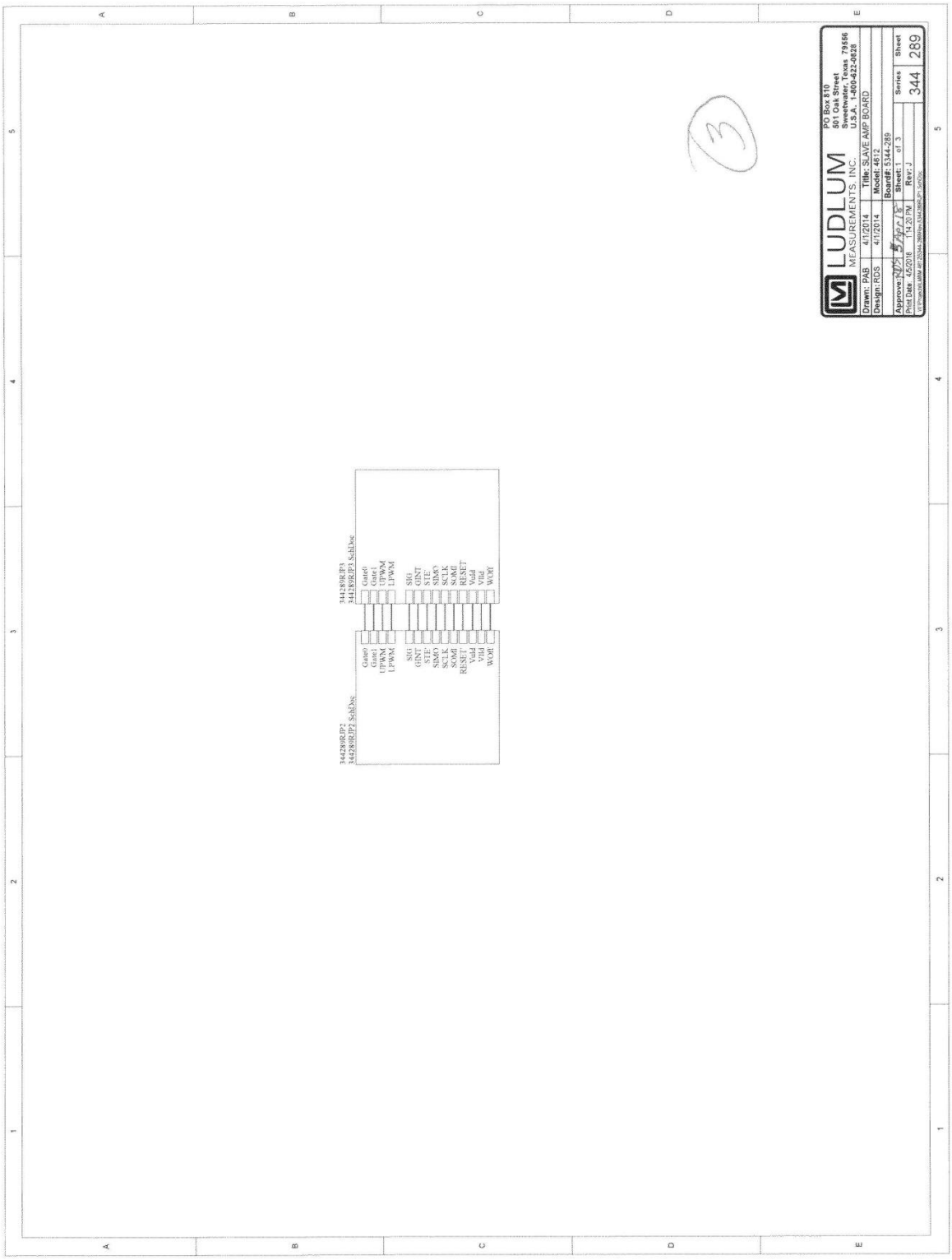
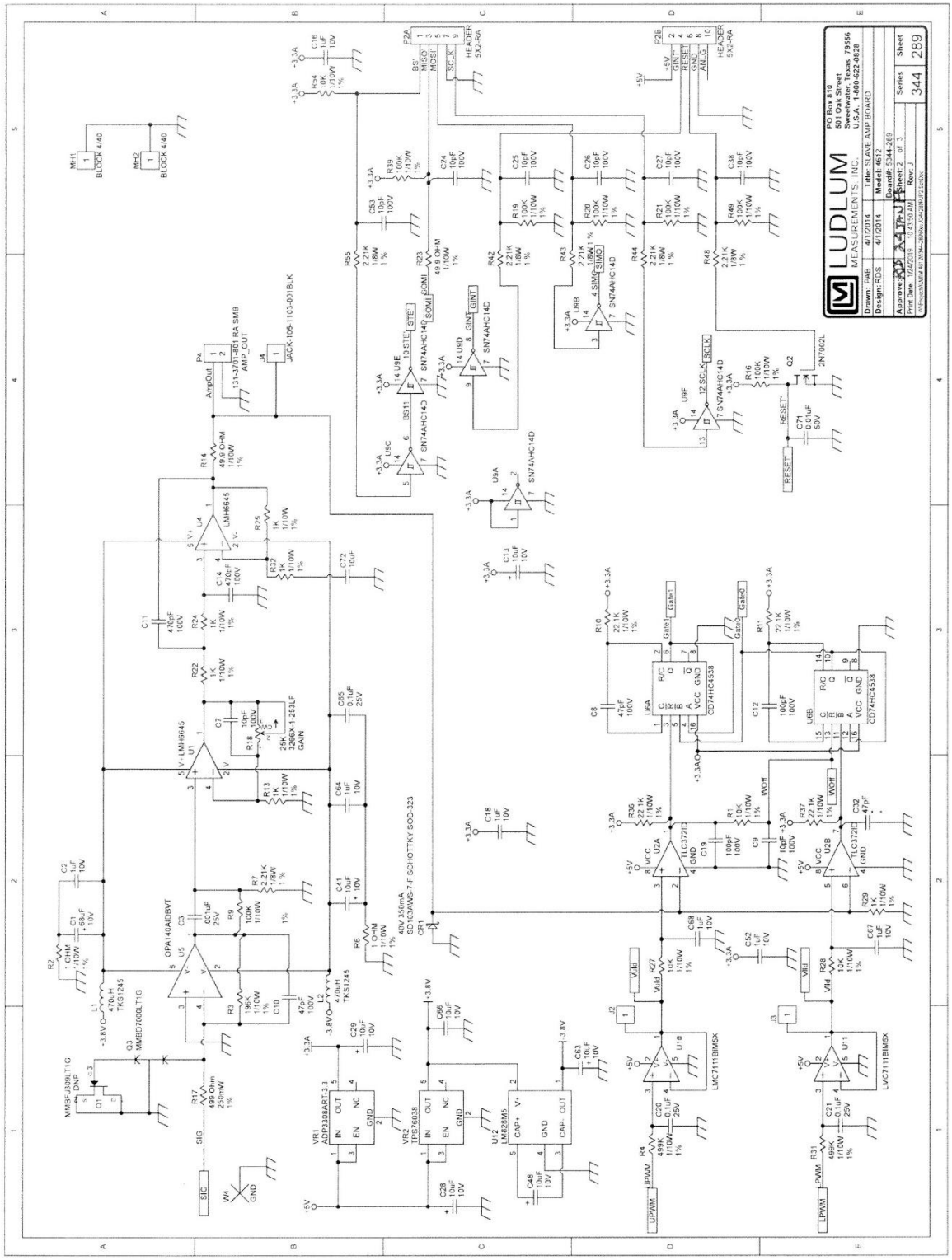
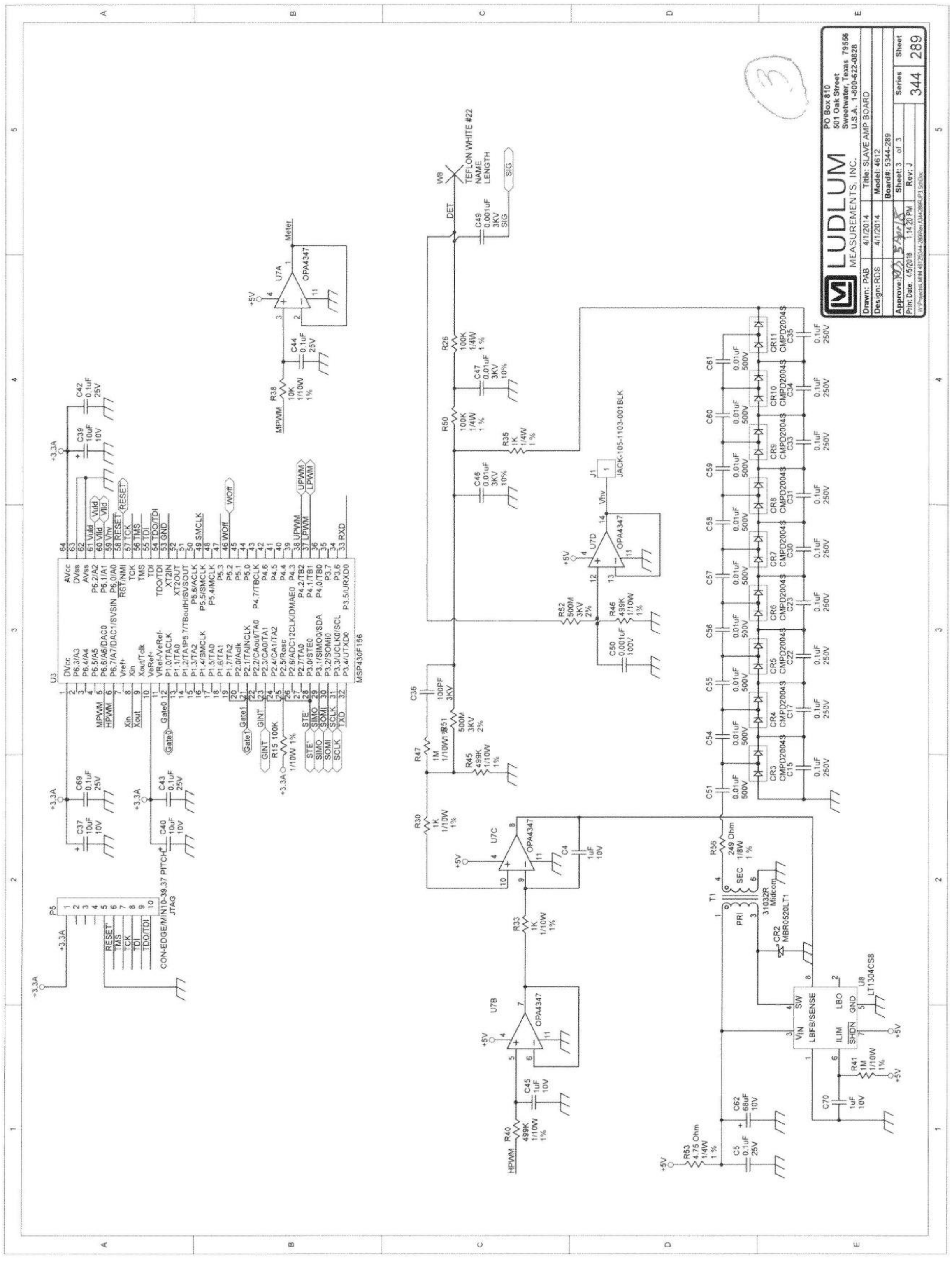
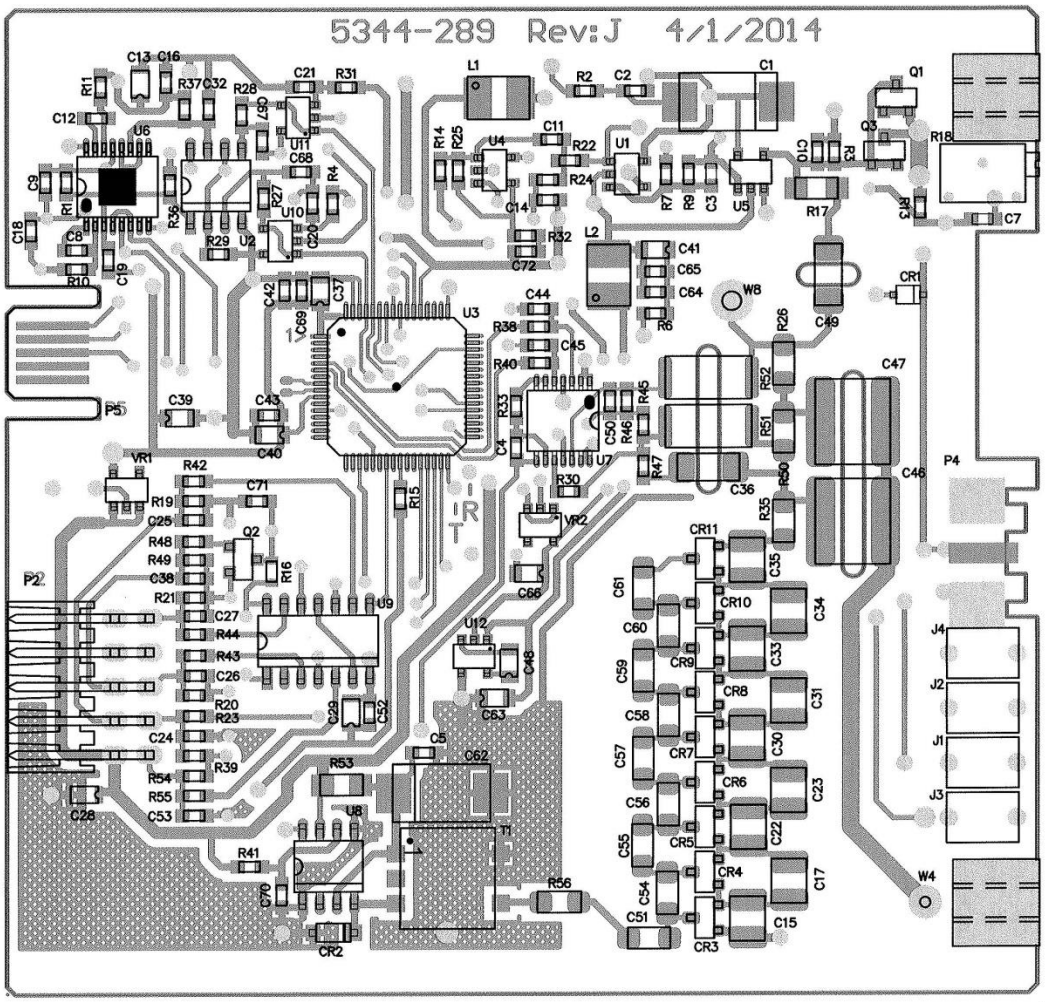

LUDLUM
MEASUREMENTS, INC.
P.O. Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-422-0828
Drawn: PAB 4/7/2014
Design: RDS 4/7/2014
Title: SLAVE AMP BOARD
Model: 4612
Board#: 5344-289
Sheet: 1 of 3
Rev: J
Series
Sheet
344 289
Print Date: 4/6/2018 1:42:07 PM
344289RP3
344289RP3 SchDoc
Gate6
Gate1
UPWM
LPWM
SIG
GINT
STE
SMO
SCLK
SOMI
RESET
Vdd
Vdd
WOff
344289RP2
344289RP2 SchDoc
Gate0
Gate1
UPWM
LPWM
SIG
GINT
STE
SMO
SCLK
SOMI
RESET
Vdd
Vdd
WOff




LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828
Title: SLAVE AMP BOARD
Model: 4612
Board#: 5344-289
Series 344
Sheet 289

DO NOT PLACE Q1



LUDLUM MEASUREMENTS, INC.		PO Box 810, 501 Oak Street, Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
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Drawn: PAB	4/1/2014	Model: 4612	
Design: RDS	4/1/2014	Board#: 5344-289	
Approve: RDS	5 Apr 18	Rev: J	
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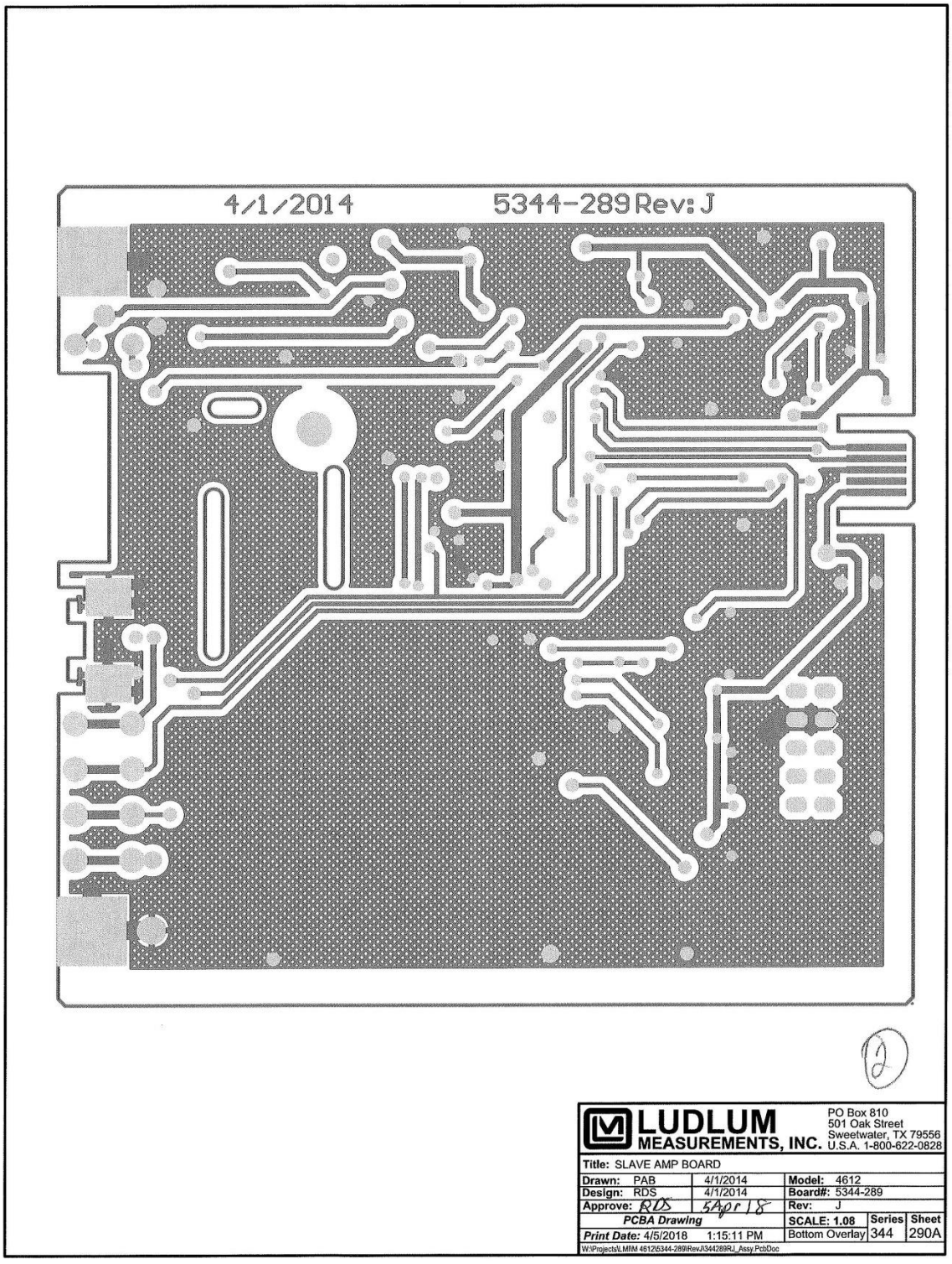
4/1/2014
5344-289 Rev: J
LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, TX 79556
U.S.A. 1-800-622-0828
Title: SLAVE AMP BOARD
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Approve: RDS 5Apr18
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Rev: J
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Series 344
Sheet 290A
Bottom Overlay
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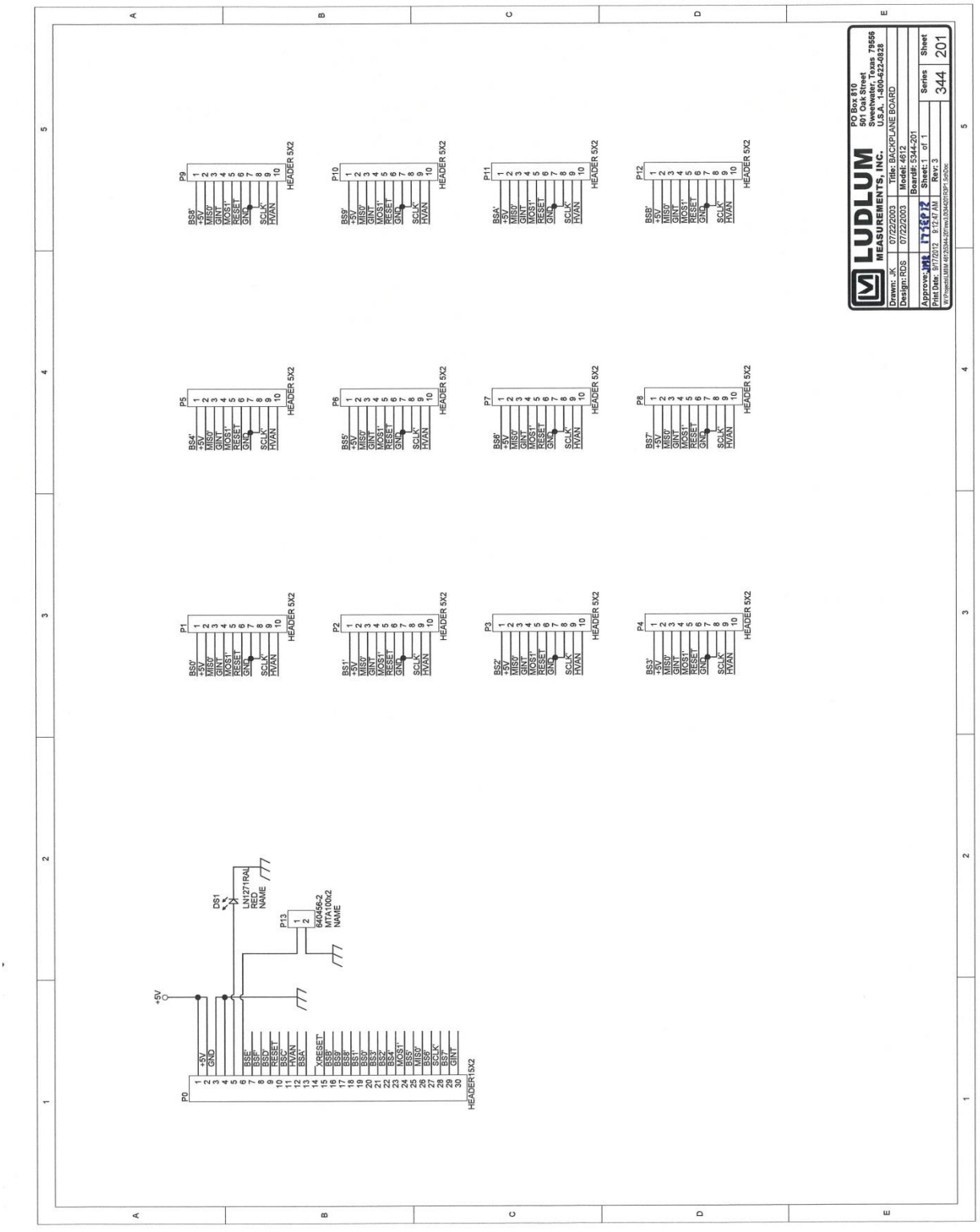
LUDLUM
MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. (325) 235-5494 1-800-622-0828
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Design: RDS 07/22/2003
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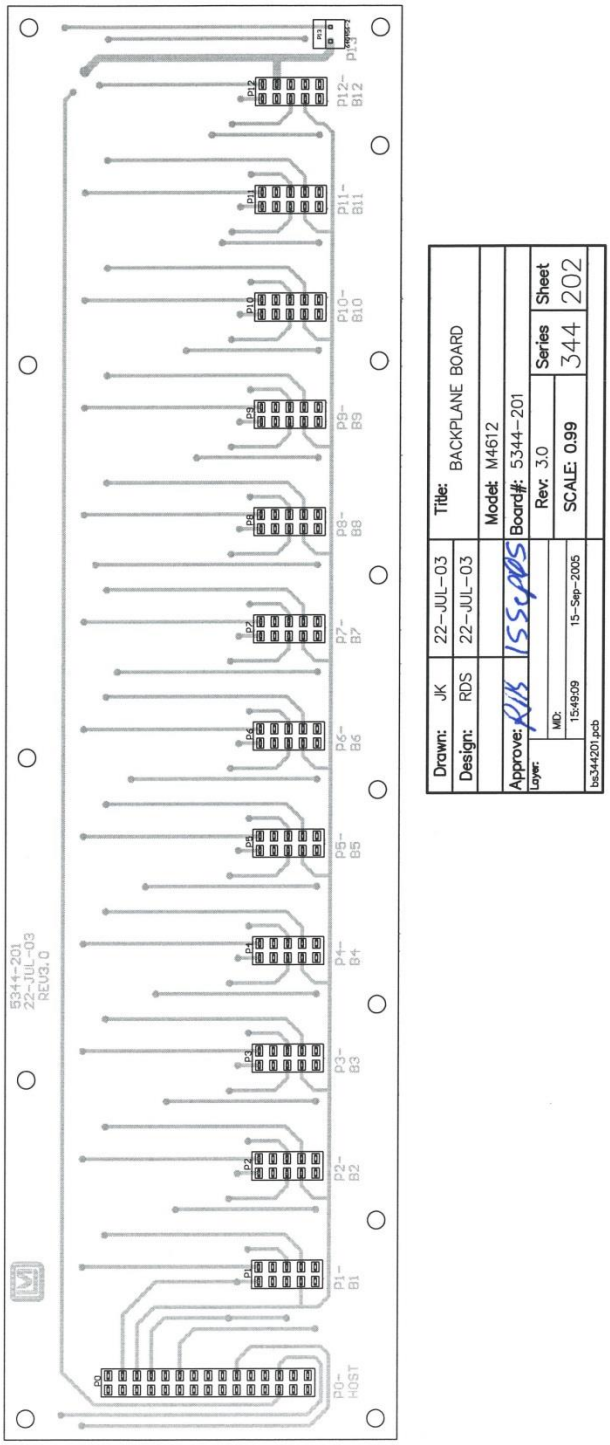
Model: 4612
Board#: 5344-201
Approved: 17662
Plot Date: 9:21:47 AM
Sheet: 1 of 1
Rev: 3
Series
Sheet
344 201
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
HEADER 5X2
HEADER15X2
DS1
LN1271RAU
RED
NAME
640456-2
MTA100x2
+5V
GND
XRESET
BSE'
BSF'
BSG'
BSH'
BSA'
BSB'
BSC'
BSD'
HVAN
MOSI'
MISO'
SCLK'
GINT'
RESET'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22-JUL-03
REV3.0
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HOST
P1-
B1
P2-
B2
P3-
B3
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B4
P5-
B5
P6-
B6
P7-
B7
P8-
B8
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P10-
B10
P11-
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B12
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Design: RDS 22-JUL-03
Approve: RJS ISSCADS
Layer:
MD:
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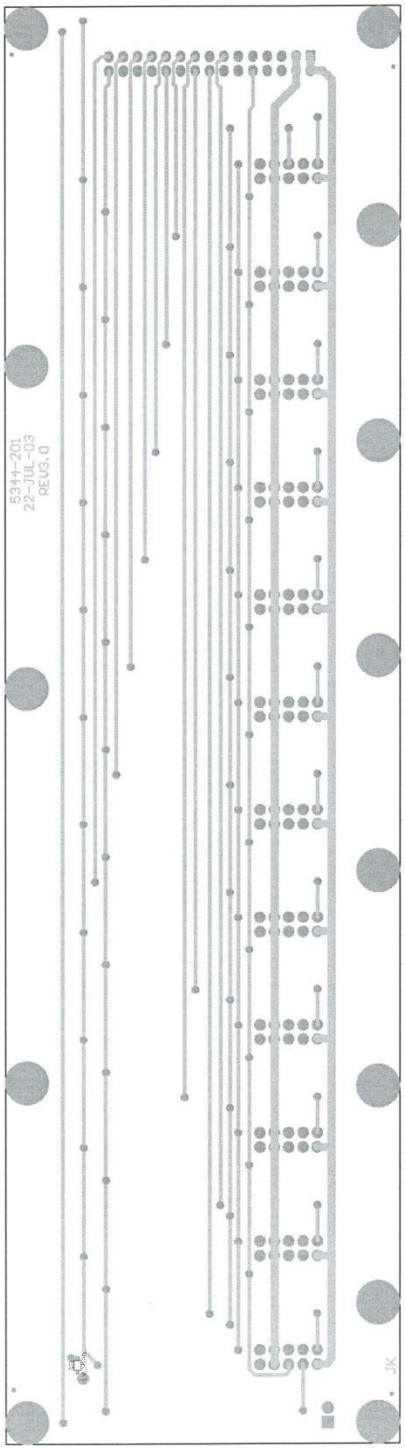
Board#: 5344-201
Rev: 3.0
SCALE: 0.99
Series
344
Sheet
202



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		Model: M4612	
Approve: RDS 15Sep05		Board#: 5344-201	
Layer: Mech.1 Mech.2 Mech.3 Mech.4	MD: 15:46:05	Rev: 3.0	Series 344
	15-Sep-2005	SCALE: 0.99	Sheet 202
bs344201.pcb			

Section 7

Hardware Calibration

A Ludlum Model 500 Pulser or equivalent is required. If the pulser does not have a high-voltage readout, use a high impedance voltmeter with at least 1000 megohm input resistance to measure the detector voltage. Remove the cover of the Model 4612.

1. Connect the Model 500 Pulser to the Model 4612 Channel #1, using an appropriate cable.

2. Adjust the pulser for 40,000 cpm and set the pulse amplitude to -10 mV (negative amplitude).

3. Start the Counter.exe program and "connect" to the Model 4612.

4. Observe the Model 500 HV readout (or connect the high-impedance meter). Using your PC and the Model 4612 Counter software, set the HV control to 900 Vdc. Check for an actual high voltage reading of 900 V ±4 V and adjust, if necessary, the potentiometer on top of the slave board (#1) and closest to front panel for a reading of 900 Vdc on the voltmeter or pulser. Connect the voltmeter between the HVR test point (+) on the rear panel of Slave #1 and ground (the screw head (-) located just to the right of the LMI logo on the panel). Adjust the HVR pot located closest to the rear panel for a meter reading of 0.900 Vdc ±0.004 Vdc.

5. Set the HV to 500 and finally to 1200 Vdc and confirm that the reading of the HV meter corresponds to the external voltmeter within ±5% of each reading.

6. Set the LLD for all channels to 100 and set the ULD to 200. Note: This results in a calibration level of 10 mV threshold and 10 mV window.

7. Connect the voltmeter between the LLD test point (+) on the rear panel of Slave #1 and ground (-) (the screw head located just to the right of the LMI logo on the panel). Check that the voltage here is 100 mVdc ±5%.

8. Connect the voltmeter between the ULD test point (+) on the rear panel of Slave #1 and ground (-) (the screw head located just to the right of the LMI logo on the panel). Check that the voltage is 200 mVdc ±5%.

9. Observe the count rate for Channel #1. With an output time of 0.50 sec, the count rate should show a value of 333 ±2. With an output time of 50 msec, the count rate should show a value of 33 ±2. Adjust the gain control (GN) clockwise (located on the rear panel of the slave board) to obtain the 333 ±2 (or 33 ±2) reading, then adjust the control counter-clockwise to the point where the counts just cease (less than 10 counts observed).

10. With the LLD = 100 and ULD = 200 for all channels, observe the count rate for Channel #1. With an output time of 0.50 sec, the count rate should show a value of 333 ±2 with the pulser amplitude set to -15mV. With an output time of 50 msec, the count rate should show a value of 33 ±2. Adjust the pulser amplitude toward -20 mV and confirm that the reading drops to 0 (less than 10 counts) at -20 mV ±0.5 mV.

11. Repeat steps 7 thru 10 above for all remaining channels.

Section 8

RS-232 Communication

The Model 4612 Counter operates at the following RS-232 parameters:

- 19200 baud
- 8 data bits
- No parity
- 1 stop bit

After power-up, the counter will begin sending a 50-byte data message every 50 milliseconds. This message contains the count data for each channel and the status of each channel. The message is terminated with a carriage return and line feed character. The count data is the number of counts received in the previous 50 milliseconds.

Byte 01 – Channel 01
Byte 02 – Channel 01
Byte 03 – Channel 01
Byte 04 – Channel 02
Byte 05 – Channel 02
Byte 06 – Channel 02
Byte 07 – Channel 03
Byte 08 – Channel 03
Byte 09 – Channel 03
Byte 10 – Channel 04
Byte 11 – Channel 04
Byte 12 – Channel 04
Byte 13 – Channel 05
Byte 14 – Channel 05
Byte 15 – Channel 05
Byte 16 – Channel 06
Byte 17 – Channel 06
Byte 18 – Channel 06

Byte 19 – Channel 07
Byte 20 – Channel 07
Byte 21 – Channel 07
Byte 22 – Channel 08
Byte 23 – Channel 08
Byte 24 – Channel 08
Byte 25 – Channel 09
Byte 26 – Channel 09
Byte 27 – Channel 09
Byte 28 – Channel 10
Byte 29 – Channel 10
Byte 30 – Channel 10
Byte 31 – Channel 11
Byte 32 – Channel 11
Byte 33 – Channel 11
Byte 34 – Channel 12
Byte 35 – Channel 12
Byte 36 – Channel 12
Byte 37 – Channel 01 Status
Byte 38 – Channel 02 Status
Byte 39 – Channel 03 Status
Byte 40 – Channel 04 Status
Byte 41 – Channel 05 Status
Byte 42 – Channel 06 Status
Byte 43 – Channel 07 Status
Byte 44 – Channel 08 Status
Byte 45 – Channel 09 Status
Byte 46 – Channel 10 Status
Byte 47 – Channel 11 Status
Byte 48 – Channel 12 Status
Byte 49 – Carriage Return (\r)
Byte 50 – Line Feed (\n)

The count for each channel is stored in three bytes. To convert the bytes into the count, multiply each byte as follows:

(Byte 1 * 65536) + (Byte 2 * 256) + Byte 3

The Status byte is configured as:

Bit 0: Slave counting status (0=counting, 1=not counting).

Bit 1: Overload status. Currently not used.

Bit 2: HV out of tolerance by 3% (0=OK, 1=OOT).

Bit 3: LLD out of tolerance by 13% (0=OK, 1=OOT).

Bit 4: ULD out of tolerance by 3% (0=OK, 1=OOT).

Bit 5: Not used

Bit 6: Not used

Bit 7: Slave online/offline status (0=offline, 1=online).

RS-232 Commands

All commands must be in upper-case letters and terminated with a line feed (/n) character. Channels are designated as 0, 1, 2, 3 4, 5, 6, 7, 8, 9, A, B, which correspond to channels 1–12. When sending commands to set and read parameters, the data output must be stopped using the "SO" command.

Stop Data Output – SOn

Stops/starts the 50 millisecond data output. A "1" starts the data output, and a "0" stops the data output.

Read Firmware Version – F

Reads the firmware version of the host board.

Read GM Mode – RGn

Reads the GM mode of the specified channel. A "1" is returned if the GM mode is enabled, a "0" if disabled.

Set GM Mode – SGnx

Sets the GM mode of the specified channel. A "1" enables the GM mode, and a "0" disables the GM mode.

Read Window Mode – RWn

Reads the Window mode of the specified channel. A "1" is returned if the Window mode is enabled, a "0" if disabled.

Set Window Mode – SWnx

Sets the Window mode of the specified channel. A "1" enables the Window mode, and a "0" disabled the Window mode.

Read Efficiency – REn

Reads the efficiency of the specified channel. The value returned is formatted as "nn.n."

Set Efficiency – SEnxx

Sets the efficiency for the specified channel. The efficiency is set using the format of "nnn." Do not send the decimal point. The value must be formatted to three digits and is adjustable from 000 to 999.

Save Slave Flash Parameters – SF

Saves all calibration constants to flash on all slave boards. The calibration constants will revert to the last saved values if the counter is reset without saving.

Read High Voltage – RHn

Reads the high voltage set point and read-back value from the specified channel. The return format is "HVnnnnnnnn." The first four characters are the set point; the last 4 characters are the read-back voltage.

Set High Voltage – SHnxxxx

Sets the high voltage set point for the specified channel. The value must be formatted to four digits and is adjustable from 0000 to 1500.

Read High Voltage Actual Cal – RHACn

Reads the high-voltage actual calibration constant for the specified channel. The return format is "±n.n."

Set High Voltage Actual Cal – SHACnxxx

Sets the high voltage actual calibration constant for the specified channel. The value must be formatted as "±nn." Do not include the decimal place. The range is -99 to +99. After setting any calibration constant, the "SF" command must be sent to save the values into flash.

Read High Voltage Read Back Cal – RHRCn

Reads the high-voltage read-back calibration constant for the specified channel. The return format is "±n.n."

Set High Voltage Read Back Cal – SHRCnxxx

Sets the high-voltage read-back calibration constant for the specified channel. The value must be formatted as "±nn." Do not include the decimal

place. The range is -99 to +99. After setting any calibration constant, the "SF" command must be sent to save the values into flash.

Read LLD – RLn

Reads the lower level discriminator set point and read-back value from the specified channel. The return format is "LDnnnnnnnn." The first four characters are the set point; the last four characters are the read-back voltage.

Set LLD – SLnxxxx

Sets the lower level discriminator set point for the specified channel. The value must be formatted to four digits and is adjustable from 0000 to 3300.

Read LLD Actual Cal – RLCnxxx

Reads the lower level discriminator actual calibration constant for the specified channel. The return format is "±n.n."

Set LLD Actual Cal – SLCnxxx

Sets the lower level discriminator actual calibration constant for the specified channel. The value must be formatted as "±nn." Do not include the decimal place. The range is -99 to +99. After setting any calibration constant, the "SF" command must be sent to save the values into flash.

Read ULD – RUn

Reads the upper level discriminator set point and read-back value from the specified channel. The return format is "UDnnnnnnnn." The first four characters are the set point; the last 4 characters are the read-back voltage.

Set ULD – SUnxxxx

Set the upper level discriminator set point for the specified channel. The value must be formatted to four digits and is adjustable from 0000 to 3300.

Read ULD Actual Cal – RUCnxxx

Reads the upper level discriminator actual calibration constant for the specified channel. The return format is "±n.n."

Set ULD Actual Cal – SUCnxxx

Sets the upper level discriminator actual calibration constant for the specified channel. The value must be formatted as "±nn." Do not include the decimal place. The range is -99 to +99. After setting any calibration constant, the "SF" command must be sent to save the values into flash.