kdScientific

Model 100 Series
User's Manual

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General Safety Summary

Please read the following safety precautions to ensure proper use of your syringe pump. To avoid potential hazards and product damage, use this product only as instructed in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

To Prevent Hazard or Injury:

Avoid Exposed Circuitry

Do not touch any electronic circuitry inside of the product.

Avoid Pinch Hazard

A pinch hazard may exist between the Pusher Block and the End Blocks. Avoid placing fingers between these points while the pump is running.

Do Not Operate with Suspected Failures

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making any connections to the input or output terminals of the product, ensure that the product is properly grounded.

Make Proper Connections

Make sure all connections are made properly and securely.

General Safety Summary

Observe all Terminal Ratings

Review the operating manual to learn the ratings on all connections.

Orient Equipment Properly

Do not position the equipment such that it is difficult to reach the disconnecting device.

Place Product in Proper Environment

Review the operating manual for guidelines for proper operating environments.

Use Proper Fuse

Use only specified fuses with product.

Use Proper Line Cord

Use only the line cord shipped with the product and make sure the line cord is certified for the country of use.

Observe all Warning Labels on Product

Read all labels on product to ensure proper usage.

CAUTION
Refer to Manual

Protective
Ground Terminal

CAUTION: **This pump is not registered with the FDA and is not for clinical use on human or veterinary patients. It is intended for research use only.**

Technical Specifications

100 Series, Including KDS100, 101 and 120	
Syringe Size	10 microliter - 60 milliliter
Electrical Rating	Model 115V ~, 0.1A
	CE model 230V ~, 0.06A
Fuse	5 x 20 mm, 250V ~, slow blow, 0.1A
Voltage Operating Range	Model 100-120V ~, 50/60Hz
	CE model 200-240V ~, 50/60Hz
Drive Mechanism	Microprocessor controlled stepper gearmotor (½ microstepping), driving a leadscrew through a belt and pulley drive mechanism
Pusher Advance per Half Step	~ 0.529 micron or 2.083×10^{-5} in (KDS100)
	~ 0.088 micron (KDS101)
Linear Travel	
KDS100, KDS120	Min 0.00635 cm/hr; Max 76.18 cm/hr
KDS101	Min 0.00106 cm/hr; Max 12.2 cm/hr
Step Rate	
Min	One ½ step in 30 seconds - may vary depending on syringe size
Max	400 ½ steps / second
Speed Range	12000:1
Flowrate Range	0.1 µl/hr (10 µl syringe) - 426 ml/hr (60 ml syringe)

Technical Specifications

Linear Force	20 lb min (9 Kg)
Dimensions, W x D x H	9 x 6 x 5 in (23 x 15.25 x 13 cm)
Weight	4.5 lb (2 Kg)
Atmospheric Specs	
Temperature	4˚ C - 40˚ C (40˚ F - 104˚ F)
Humidity	20% - 80% RH, non-condensing
Mode of Operation	Continuous
Classification	Class I
Pollution Degree	2
Installation Category	II
Output	N/A
Physiological Effects	N/A
Cooling Conditions	No special considerations
Mechanical Stability	No special considerations
Protective Packaging	No special considerations
Earth Terminals	No External connections required
Removable Protective Means	N/A
Supplier Name	KD Scientific Inc.
Address	84 October Hill Road, Holliston, MA 01746

Features

The Model 100 series are simple, accurate and cost effective syringe pumps designed to hold glass or plastic syringes, of any make, from 10 microliter - 60 milliliter for the KDS100; 10 µl - 15 ml for the KDS120; and 10 µl - 10 ml for the KDS101.

The models KDS100 and KDS101 are infusion only pumps. The flow rates of the KDS101 are six times slower than that of the KDS100 and the units of flow rate are suitably adjusted. The KDS120 is a push-pull simultaneous infusion/withdrawal pump.

Setup and pump operation for all of the 100 series pumps are similar and extremely simple. A menu, displayed on an alphanumeric LCD "prompts" the operator to make the necessary selections using the keypad for choice of features and numerical entries.

The internal diameter of the syringe is used by the control program to calibrate the pump and deliver the volume and flowrate selected. For simplicity the syringe diameter is also used to set automatically the volume and flowrate units.

The syringe diameter can be entered directly or the syringe can be identified from a table of syringes held in memory. When the syringe is selected from the table the diameter is entered automatically.

Two dispense modes are available:

    a.   Dispense volume mode, in which the pump keeps track of the volume dispensed and automatically stops the pump when a set target volume is reached.

    b.   Run mode, where the pump runs at the set flowrate until manually stopped.

In the event of a power interruption during operation, the pump can be programmed to either resume operation or remain stopped when power is returned.

For convenience, all pump settings are stored in non-volatile memory to minimize the number of setting changes required.

Keypad Functions

↙   This key has two functions:

     a.   Moves the display to the left.

     b.   Causes the numerical entry to decrease. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.

     This key has two functions.

↗   a.   Moves the display to the right.

     b.   Causes the numerical entry to increase. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.

select   This key has three functions:

     a.   Return to main menu when pressed repeatedly.

     b.   Selects the pulsing or "highlighted" feature of the main menu display.

     c.   Enter numerical values.

run/stop

     a.   Turns the motor on and off.

     b.   Acts as a "pause" during a dispense.

DISPLAY

After the pump is programmed an arrow on the right side of the display indicates the direction of operation. This arrow pulses when the pump is running.

Operating Instructions

POWER SWITCH

The power switch is located at the right, rear corner of the pump. When the power is turned on the LCD will display the Volume or Rate setting. Press the **select** key to return to the main menu.

MAIN MENU

Pressing **select** repeatedly will always return the display to the main menu. The main menu consists of five variables, three of which are displayed at all times. The center variable pulses to indicate that this option can be reviewed or changed. The menu acts as a continuous loop and the arrow keys, ↙ ↗ are used to move around the loop. The variable to be changed can be selected with the **select** key.

←→	dia	←→	table	←→	rate	←→	vol	←→	pwr up	←→
	direct entry		syr dia		flowrate		dispense vol		run/stop	
	syr dia (mm)		mfr, size		µl or ml/h		µl or ml			

SYRINGE DIAMETER ENTRY

Syringe diameter must be entered for automatic internal calibration. Once the diameter is entered, it is retained in non-volatile memory and need not be entered again unless the syringe being used is changed. When a syringe diameter is changed the Volume and Rate settings are set to zero.

There are two methods of diameter entry.

    a.   **Internal Library**

Select **TABLE** from the main line menu. The table of syringes is organized by manufacturer, then by glass or plastic, and then by size. Use the **arrow** keys to scroll through the table and the **select** key to enter the correct setting.

First, scroll through the manufacturers and select the manufacturer of the syringe used. The menu will next display either syringe type or syringe size.

Again, use the **arrow** keys to move through the table until the correct size is displayed. Press the **select** key when the correct syringe size is displayed. This automatically enters the internal syringe diameter.

See Table of Syringe Diameters for the syringe library.

    b.   **Direct Entry**

From the main menu select **DIA**. The display will read "xx.xx mm". Use the **arrow** keys to display the measured internal diameter of the syringe in millimeters and enter with the **select** key.

Changing the diameter clears the Volume and Rate settings, and the display will now prompt for the new Volume setting.

Operating Instructions

VOLUME ENTRY

The volume setting mode is selected from the main menu or is displayed automatically after changing the diameter.

Display reads: xx.xx µl (Units displayed in µl or ml depend on syringe diameter entered)

1. Use the **arrow** keys to enter the dispense volume required.

2. When the correct dispense volume is displayed save this number with the select key.

Note: If no target dispense volume is required, enter volume = 0.0. The pump will run at the set flowrate until stopped manually or a stall occurs.

3. After setting a volume the menu prompts for the flowrate setting. When the pump runs, the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.

FLOWRATE ENTRY

RATE can be selected from the main menu or will be displayed automatically after the volume setting.

The display reads: Rate: X.X µl/h or X.X ml/h

Rate units are µl/h or ml/h, microliter or milliliter/hour and are selected automatically according to the syringe diameter.

1. Use the arrow keys to display the flowrate required.

2. Enter the rate with the select key.

3. If the rate entered is out of range, a message is displayed:

   "Max Rate XX ml/h"

   To continue, enter a lower rate or select a larger syringe.

Note:
a. *If a dispense volume was set then the display will now change to "Volume : 0.0" ,that is, in automatic dispense mode.*

   When the pump runs, the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.
b. *If no dispense volume is set, the LCD displays the set flowrate and, when running, the directional indicator arrow will pulse.*

Operating Instructions

START THE PUMP

a.   Press the **run/stop** key to start the pump. A second press will stop the pump.

b.   If the pump is stopped during a dispense, the volume accumulator is not cleared - the dispense is <u>paused</u>. Restarting the pump with a second press of the **run/stop** key continues the dispense to the target volume.

POWER FAILURE MODE

If there is a temporary power interruption, <u>when no dispense volume is selected</u>, the **Power Up run/stop** option allows the pump to either resume the dispense when the power returns, or remain stopped but display a message warning of the power failure.

1.   Move the main menu to the right and select PWR UP.

2.   The display will read Power Up Run (or STOP). Use the arrow keys to change display and select the required option.

Run   After power is returned, the pump resumes normal operation. The display flashes PowerFailed to acknowledge a power interruption. Press Select to display the Rate.

STOP   Pump does not run when power returns. The LCD displays the rate setting.

<u>If a dispense volume is entered</u> the power interruption stops the pump, clears the volume accumulator and returns the volume to the setpoint. Only if the power failure setting is "run" will the power failure warning be displayed.

Operating Instructions

CHANGE OR REVIEW VOLUME SETTING WHILE RUNNING

While the pump is running it is possible to look at the volume and flowrate settings without interrupting the operation of the pump. If required, the volume and flowrate settings can be changed while the pump continues to run. When the changes are entered the pump immediately changes to the new settings.

1. While operating, press **select** to return to the main menu.

2. Select Volume to display the set dispense volume. If no change is required press **select**.

3. For a volume change use the arrow keys and enter with the **select** key.

4. The display moves to RATE, permitting a change if required. Press **select** if no change is required, or use the **arrow** keys to change the setting. The **select** key immediately changes to the new flowrate and the volume display continues to increment, uninterrupted to the new dispense setting.

*Note: If the VOLUME is changed to a setting **smaller** than the volume already accumulated then the pump stops when the new, smaller dispense volume is selected.*

CHANGE OR REVIEW RATE SETTING WHILE RUNNING

1. Press **select** to change the volume accumulator display to the main menu.

2. Select RATE.

3. Make rate changes, if required, and press **select**.

The pump immediately changes to the new flow rate and displays the continuing volume accumulation uninterrupted by the change in flowrate.

FAST FORWARD

Press the **run** and the **→** keys simultaneously to actuate the fast forward mode. The pump travels at its maximum rate while both keys are pressed simultaneously.

Loading the Syringe

KDS100 AND KDS101
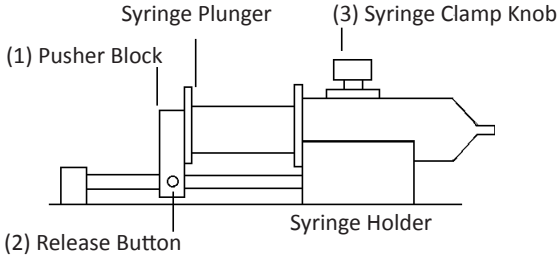
To facilitate loading, the pusher block (1) can be released from the leadscrew and manually moved along the guide rods to accommodate the syringe.

Press the bronze release button (2) on the side of the black pusher block (1) to release the block from the leadscrew.

Raise the spring loaded retaining clamp knob (3) and rotate away from the syringe barrel.

Place the syringe barrel in the V of the syringe holder, making sure that the flange of the syringe barrel is pressed against the side of the syringe holder.

Rotate and release the syringe clamp to hold the syringe in place.

Press in release button (2) and move the pusher block back along the guide rods to make contact with the syringe plunger.

GLASS SYRINGES

With some glass syringes the corners of the flange of the syringe barrel are rounded and can cause a tendency for the syringe barrel to ride up out of the syringe holder.

To give a more secure, flatter surface to clamp against, an O-ring or metal collar can be placed over the barrel and pressed against the flange.

Loading the Syringe

KDS120 PUSH-PULL PUMP

Travel Direction

Withdraw Clamp   Syringe Clamp

Withdraw Bracket Clamp   Release Button   Syringe Rest
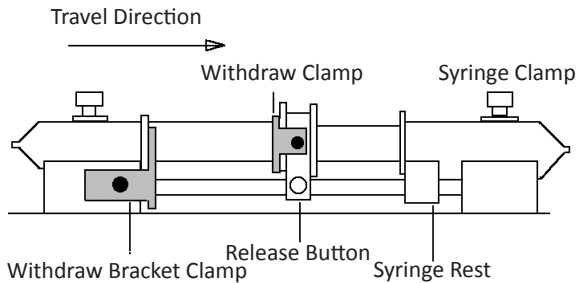
To facilitate loading, the pusher block can be released from the leadscrew by pressing the bronze release button and can be manually moved along the guide rods to accommodate the syringes.

First place the withdraw syringe in the withdraw syringe holder, using the spring loaded retaining clamp to retain the syringe barrel in the V of the syringe holder.

Make sure the barrel flange is held firmly by the withdraw clamp and that the adjusting screws on the withdraw clamp are firmly tightened.

While keeping the button pressed firmly "in" slide the block along the guide rods so that the syringe plunger flange can be retained by the clamp on the pusher block. Tighten the locking screws on the adjusted syringe clamp.

Loosen the locking screw on the Adjustable syringe rest and position the rest so that the plunger of the loaded syringe is pressed firmly against the pusher block and the syringe barrel flange is pressed up to the syringe rest.

The barrel of the loaded, infusion syringe should be clamped in the V of the syringe holder with the spring loaded clamp.

Tighten the screw on the syringe rest to lock the rest in place on the guide rod.

Manual Stall Setting and Microliter Syringes

A movable collar, located on the rear guide rod, can be set to restrict travel of the pusher block. The block moves until stalling against the collar. Stalling does no permanent damage but may result in increased wear on the drive mechanism and should not be used routinely but only as a "fail safe" device.

Microliter syringes with fine wire plungers can be damaged if the plunger is forced into the end of the syringe barrel; the collar can be adjusted to prevent this occurrence.

NV Ram Failure

If the settings in the non-volatile memory become corrupted the display will read "NV Ram Failure" and the pump will not operate.

To recover from this condition, the pump must be powered down and then turned on again. The pump will be re-initialized to the default settings and can now be programmed as normal.

A second method of clearing the "NV Ram Failure" is to press select and then enter a changed rate setting.

Fuses

The fuses are located in the power entry module on the rear panel. The linecord must be first removed to gain access to the fuse holder.

Fuses   5x20mm, 250V~ slow blow, 0.1A

Voltage Selector

If it is necessary to change the input voltage selection, disconnect the line cord from the entry module on the rear panel. Use a flat bladed screwdriver to open the Fuse Holder access door. Remove the Fuse Holder, flip over, and reinstall. Close the access door. The new input voltage selection should be visible through the door window. Install a proper line cord certified for the country of use.

Fuse Holder ────────
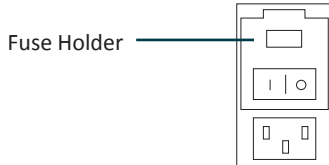
Maintenance

Maintenance is required only for the moving mechanical parts, which should be kept clean and lubricated. Occasionally, a small amount of light machine oil should be applied to the guide rods and a small amount of grease or oil to the leadscrew.

Solvents of any type should never be used to clean the pump. A mild detergent solution may be used to clean the keypad.

Standard Table
of Syringe Diameters

"Air-Tite" All Plastic	
1 cc	4.70 mm
2.5	9.70
5.0	12.48
10	15.89
20	20.00
30	22.50
50	28.90

Becton Dickson Glass - all types	
0.5 cc	4.64 mm
1	4.64
2.5	8.66
5	11.86
10	14.34
20	19.13
30	22.70
60	28.60

Becton Dickinson Interim, WW design, Plastipak	
1 cc	4.70 mm
3	8.59
5	11.99
10	14.48
20	19.05
30	21.59
60	26.60

Cadence Science, Inc. Formerly Popper & Sons, Inc. Perfektum glass	
0.25	3.45 mm
0.5	3.45
1	4.50
2	8.92
3	8.99
5	11.70
10	14.70
20	19.58
30	22.70
50	29.00

Hamilton 1000-Series Gastight	
10 µl	0.46 mm
25	0.73
50	1.03
100	1.46
250	2.30
500	3.26
1 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57
25	23.03
50	32.57

Ranfac	
2 cc	9.12 mm
5	12.34
10	14.55
20	19.86
30	23.20
50	27.60

Scientific Glass Engineering SGE	
25 µl	0.73 mm
50	1.03
100	1.46
250	2.30
500	3.26
1 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57

Sherwood - Monojet Plastic	
1 cc	4.674 mm
3	8.865
6	12.600
12	15.621
20	20.142
35	23.571
60	26.568

Terumo	
1 cc	4.73 mm
3	9.00
5	13.04
10	15.79
20	20.18
30	23.36
60	29.45

Unimetrics Series 9000	
10 µl	0.46 mm
25	0.73
50	1.03
100	1.46
250	2.30
500	3.26
1000	4.61

Japanese Table
of Syringe Diameters (available in Japanese Models)

"Air-Tite" All Plastic	
1 cc	4.70 mm
2.5	9.70
5.0	12.48
10	15.89
20	20.00
30	22.50
50	28.90

Becton Dickson Glass - all types	
0.5 cc	4.64 mm
1	4.64
2.5	8.66
5	11.86
10	14.34
20	19.13
30	22.70
60	28.60

Becton Dickinson Interim, WW design, Plastipak	
1 cc	4.70 mm
3	8.59
5	11.99
10	14.48
20	19.05
30	21.59
60	26.60

Top	
1 ml	4.70 mm
2	6.40
3	9.30
6	13.10
12	15.40
25	21.00
30	23.00
50	29.00

Hamilton 1000-Series Gastight	
10 µl	0.46 mm
25	0.73
50	1.03
100	1.46
250	2.30
500	3.26
1 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57
25	23.03
50	32.57

Hoshi	
1 ml sm	4.80 mm
1 ml lg	6.70
2 ml sm	6.70
2 ml lg	9.20
3	10.30
5	12.20
10	15.00
20	19.00
30	22.50
50	25.50
100	34.00

JMC Air-Tite pls	
1 ml	4.66 mm
2	6.90
2.5	9.10
5	12.62
10	14.34
20	19.68
30	22.44
50	28.80
100	36.68

Natsume	
0.25 ml	2.60 mm
0.50	3.20
1	4.30
2	6.30
3	7.30
5	9.50

Nipro	
1 ml short	6.61 mm
1 ml long	4.75
3	9.53
5	12.96
10	15.78
20	20.07
30	23.17
50	29.13

Terumo	
1 ml	4.73 mm
3	9.00
5	13.04
10	15.79
20	20.18
30	23.36
60	29.45

Terumo Japan	
1 ml sm	4.73 mm
1 ml lg	6.50
3	8.95
5	13.00
10	15.80
20	20.15
30	23.10
50	29.10

Standard Minimum & Maximum Flowrates

MODEL KDS 100		
Syringe size	**Minimum**	**Maximum**
10 µl	0.1 µl/h	126 µl/h
25 µl	0.1 µl/h	318 µl/h
50 µl	0.2 µl/h	625 µl/h
100 µl	1.0 µl/h	1274 µl/h
250 µl	2.0 µl/h	3164 µl/h
500 µl	3.0 µl/h	6359 µl/h
1 ml	0.01 ml/h	13.2 ml/h
2.5 ml	0.02 ml/h	31.7 ml/h
3 ml	0.02 ml/h	44.9 ml/h
5 ml	0.03 ml/h	87.0 ml/h
10 ml	0.1 ml/h	125 ml/h
20 ml	0.1 ml/h	219 ml/h
30 ml	0.1 ml/h	282 ml/h
60 ml	0.2 ml/h	426 ml/h

MODEL KDS 101		
Syringe size	**Minimum**	**Maximum**
10 µl	0.001 µl/m	0.382 µl/m
25 µl	0.001 µl/m	1.010 µl/m
50 µl	0.001 µl/m	1.762 µl/m
100 µl	0.001 µl/m	3.542 µl/m
250 µl	0.01 µl/m	8.78 µl/m
500 µl	0.01 µl/m	17.65 µl/m
1 ml	0.1 µl/m	35.2 µl/m
2.5 ml	0.1 µl/m	88.0 µl/m
3 ml	0.1 µl/m	122.5 µl/m
5 ml	0.1 µl/m	176.2 µl/m
10 ml	0.001 ml/m	0.351 ml/m

MODEL KDS 120		
Syringe size	**Minimum**	**Maximum**
10 µl	0.1 µl/h	126 µl/h
25 µl	0.1 µl/h	318 µl/h
50 µl	0.2 µl/h	625 µl/h
100 µl	1.0 µl/h	1274 µl/h
250 µl	2.0 µl/h	3164 µl/h
500 µl	3.0 µl/h	6359 µl/h
1 ml	0.01 ml/h	13.2 ml/h
2.5 ml	0.02 ml/h	31.7 ml/h
3 ml	0.02 ml/h	44.9 ml/h
5 ml	0.03 ml/h	87.0 ml/h
10 ml	0.1 ml/h	125 ml/h

Model Numbers

Legacy Model	KDS 100	KDS 101	KDS 120
Order Code 110 VAC	78-0100	78-0101	78-0120
Order Code 220 VAC with CE Mark	78-9100	78-9101	78-9120

Notes:
KDS 100 Y suffix: Integrated footswitch capability.
KDS 100 ZZ suffix: LED option with end of run alarm.
All part numbers subject to change; please contact KD Scientific for additional information.

Limited Warranty

KD Scientific Inc. warrants to the first consumer purchaser, for a period of one year from the date of purchase that this unit, when shipped in its original container, will be free from defective workmanship and materials and agree that it will, at its option, either repair or replace the defective unit.

This warranty does not extend to misuse, neglect or abuse, normal wear and tear, accident, modification or unauthorized repair.

KD Scientific will not be liable or in any way responsible for any incidental or consequential economic or property damage. Some States do not allow the exclusion of incidental or consequential damages, so the above exclusion may not apply to you.

There are no implied warranties of merchantability, or fitness for a particular use, or of any other nature. Some states do not allow this limitation on implied warranty, so the above limitation may not apply to you.

If a defect arises within the warranty period contact KD Scientific Inc. (see address below).

The customer is responsible for shipping charges and must first obtain a Return Material Authorization number (RMA) before the unit will be accepted. If a replacement unit is issued it is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

Note: This pump is not registered with the FDA and is not for clinical use on patients.

Syringe pumps are manufactured by:

KD Scientific Inc.

84 October Hill Road

Holliston, MA 01746

phone: 508.429.6809 | fax: 508.893.0160

email: info@kdscientific.com

www.kdscientific.com

kdScientific
Declaration of Conformity

Manufacturer:

KD Scientific Inc.
84 October Hill Rd.
Holliston, MA 01746-1388 U.S.A.
Phone: (508) 429-6809

We herewith declare that the following product:

Product Name: *Model 100 Series Syringe Pump*

Model Numbers: *KD100, KD101, KD120*

To which this declaration relates, is in conformity with the applicable
EC Directives, harmonized standards, and other normative requirements:

**Application of
Council Directive(s):** *2006/95/EC, 89/336/EEC*

**Standard(s) to which
Conformity is Declared:**

  Safety: *IEC 61010-1:2012 Ed. 3*

  Emissions/Immunity: *EN 61326:1997 w/ A1:1998 and A2: 2001*

                                  EN 61000-4-2:1995

                                  EN 61000-4-3:1995

                                  EN 61000-4-4:1995

                                  EN 61000-4-5:1995

                                  EN 61000-4-6:1996

                                  EN 61000-4-11:1994

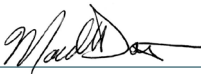   *EN 61000-3-2:2001 w/ A.14*

                                  EN 61000-3-3:1995

EMC and Safety compliance were evaluated by Intertek/ETL Semko

Reference test report file numbers: *3086793 .Box.001 & .Box.002 and 101450664 .Box.003*

Signature: _____ **Date:** 7/30/14

Mark Davis, Director, Global MPE