SPECTRON

SE1450 DASH
STROKE GENERATOR

OPERATING AND MAINTENANCE MANUAL
(Version - 073004)

Spectron Engineering, Inc.
Denver, Colorado

Caution

Ensure that all cables are properly attached and secured before turning on power.

Do not remove the covers on the SE1450 DASH Stroke Generator except for Power Supply removal/replacement as described within. Removal of these covers will necessitate factory recalibration and may cause damage.

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Chapter One

OVERVIEW

SE1450 DASH
STROKE GENERATOR

Spectron Engineering's high-performance SE1450 DASH Stroke Generator (SE1450 DASH) has been designed to display very accurate cursive images on a Head Up Display (HUD). This is a vital prerequisite to accurately and objectively measuring HUD image performance parameters.

SE1450 DASH Stroke Generator Front View

The SE1450 DASH is designed to generate a linear ramp at the both slow and fast HUD specified writing speeds. The linearity of the ramp defines the brightness uniformity along the length of the stroke line. A HUD specified failed writing speed can also be generated and used to test the phosphor protect circuitry of the HUD.

The SE1450 DASH is also designed to very accurately position stroke written lines on the HUD. Horizontal lines are positioned vertically, and vertical lines are positioned horizontally, to a 16 bit accuracy. This 16 bit accuracy is actively calibrated through appropriate use of the *ADJust* Command (see, Manual, *Spectron Control Language Commands, SE1450 Stroke Generator)* to compensate for the loading of each individual HUD and its associated interconnections. The accuracy of the SE1450 DASH is NIST traceable

The SE1450 DASH can be programmed to combine a series of user defined lines. There are horizontal and vertical lines available in three line lengths as well as preprogrammed patterns for a crosshair and a raster patch. The crosshair is a single control language command that combines a vertical and horizontal line intersecting on a user defined center position. The raster patch is also a single command language call. It combines 33 horizontal lines or 33 vertical lines with a user defined center position and center-to-center line spacing. The raster patch is a convenient image for Resolution, Contrast and Modulation Factor testing. The lines, crosshairs and raster patches can be combined to form more complex test patterns.

The SE1450 DASH has an extensive Built-In-Test (BIT), is able to communicate both RS232 and IEEE488 and is capable of diagnosing Input functionality of the necessary HUD generated signals (DU Busy and Symbol Command) as well as the other HUD required signals (modified RS170 and Symbol Mode).

Chapter Two

INITIAL SETUP and CONNECTIONS

SE1450 DASH
STROKE GENERATOR

The SE1450 DASH is composed of one module and associated cabling. In addition to the cables, the only field replaceable part of the SE1450 DASH is the Power Supply as described below in *Chapter 4, Maintenance and Repair*.

Typically, the SE1450 DASH is operated in association with an automated display measurement system such as the Spectron SE1420 DASH Display Measurement System to objectively measure and characterize the performance parameters of the resultant HUD image. It is this configuration and operation that will be described in this manual, however, with proper input and cabling, the SE1450 DASH could operate independently of the measuring system.

Typical System Components and Cables

Table 2-1

Main Module and Replaceable Part	*Part Number*
DASH Stroke Generator	SE1450
Power Supply	SE3022-01D

Associated Cables	*Part Number*
HUD/Test Station Connect cable	Customer Supplied
External Sync Cable	OMS-3430
Standard IEEE488 Cable	Customer Supplied
Standard RS232 Standard Cable	Customer Supplied
120 VAC Power Cord	WAC4

Setup Procedures

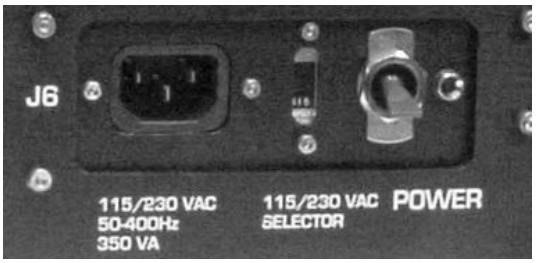
Carefully remove the SE1450 DASH and associated cabling from their shipping cartons and begin the setup procedures described below. Locate the SE1450 DASH in a secure location near the Controlling Computer, the SE1420 DASH Display Measurement System (if used), and the HUD.

Typical SE1450 DASH Stroke Generator Rear View

Communication and Data Connections

1. Determine that the power switch/circuit breaker on the back of the SE1450 DASH is OFF (See Power Connection, directly below).
2. Connect the HUD/Test Station Connect Cable from Connector J5 on the back of the SE1450 DASH to the appropriate Connectors on the Test Station and HUD.
3. Connect the External Sync Cable from Connector J2 on the back of the SE1450 DASH to the External Sync In on the Display Measurement System (Normally Connector J2 on the back panel of the SE1420 DASH Display Measurement System Controller.)
4. Connect the RS232 Cable and/or the IEEE488 Cable for communication from Connector J4 and/or the IEEE488 Connector respectively on the back panel of the SE1450 DASH and to the appropriate port(s) on the Controlling Computer.

Power Connection



Power Section - SE1450 DASH Stroke Generator Back Panel

1. Determine that the power switch/circuit breaker on the back of the SE1450 DASH is in the OFF (down) position and that the 115/230 VAC selector switch is in the correct position for the power source to be used.
2. Connect the 120 VAC Power cord to the back of the SE1450 DASH, Connector J6, and plug into the power outlet.
3. The system is powered up by turning on the power switch/circuit breaker on the back of the Controller and operated according to the procedures in *Chapter 3, Operations* of this manual.

RS232 Connection and Protocol

User supplied and initiated RS232 Communications with the SE1450 DASH system are described in *Chapter 3, Operations*. The following information is supplied as an aid in initiating proper communications through the RS232 port.

The RS232 connector is a DB9 male connector located on the SE1450 DASH Back Panel (J4). Only five of the nine pins are used in accordance with the pin out specifications in table 2-1, below.

Table 2-1

1450 DASH Connection		***Terminal Connection***
Pin 2	RD Receive Data	TRANSMIT
Pin 3	TD Transmit Data	RECEIVE
Pin 5	GND Ground	GROUND
Pin 7	RTS Request to Send	CLEAR TO SEND
Pin 8	CTS Clear to Send	REQUEST TO SEND

Complete instructions for using the RS232 port are contained in *Chapter 3, Operations*.

The RS232 protocol follows an IBM 9-pin “DTE” standard, which is an ASCII system. The serial protocol for this system is:

- 1 start bit
- 1 stop bit
- 8 data bits
- 9600 baud
- Hardware Flow Control

Chapter Three

OPERATIONS

SE1450 DASH
STROKE GENERATOR

The SE1450 DASH is operated by issuing Spectron Control Language Commands (SCL), (see, Manual, *Spectron Control Language Commands, SE1450 Stroke Generator),* either through RS232 or IEEE488 communications from a Controlling Computer. The commands may be entered in, 1) automatic mode, with command and data information controlled by user or Spectron Engineering, Inc. created software, or 2) command mode, with SCL Commands directly entered by the operator.

Whether operations are performed automatically or manually, the precisely generated image appears on the HUD and may be viewed and characterized using an independent measuring system such as the Spectron SE1420 DASH Display Measurement System to objectively determine HUD performance parameters.

This chapter will primarily describe the operation and testing procedures for manual operation using Spectron Control Language Commands. Automatic testing may be accomplished by software that sends sequential Spectron Control Language Commands, and captures the resulting data as it is generated, according to specific test procedures for the HUD UUT (Unit Under Test).

Preliminary Check – Before Power Up

At a minimum, the HUD/Test Station Connect Cable, the External Sync Cable, the 120VAC Power Cord, and either the RS232 Cable or the IEEE488 Cable must be connected as described in *Chapter 2, Initial Setup and Connections,* prior to commencing operations as described below.

Other connections, particularly those required to power up the UUT and any Display Measurement System used to measure and characterize the resulting image, may be made prior to power on, but are beyond the scope of this manual and are not necessary for a successful BIT (Built In Test) to be completed during power up.

The operator should become completely familiar with the **IST** and **TST** Commands, (see, Manual, *Spectron Control Language Commands, SE1450 Stroke Generator)* to view the results of the BIT and/or the status of the UUT prior to commencing further operations.

Initial Power Up

Built In Test (BIT) (For BIT Logic and Troubleshooting, see *Appendix B)*

The power switch/circuit breaker is located on the back panel of the SE1450 DASH near the AC power cord connector. **After all Setup and Connect procedures described in *Chapter 2, Initial Setup and Connections* have been completed,** the power switch may be turned on. This will initiate a system reset and the BIT will run.

The BIT will be accomplished each time the system is turned on or reset. It tests the electronic circuitry and function of the SE1450 DASH and tests for the presence of the HUD functions necessary to the generation of a precise and calibrated image on the UUT.

Use the **IST** and **TST** Commands, above, to determine the status of the SE1450 DASH and the necessary external circuitry.

Warm Up Recommendation

In order to allow all components to reach a consistent operating temperature, the SE1450 DASH should be turned on approximately 30 minutes prior to use

On-Site Alignment and Calibration

The SE1450 DASH is precisely calibrated at the Factory to NIST Standards and 16 bit accuracy. In order to obtain full Factory Specifications in the field, however, it is necessary for the Operator to fully understand and execute the ADJust command for each individual UUT. This is necessary for the SE1450 DASH to compensate for the actual loading of the UUT and its associated interconnections.

Other commands will allow the Operator to accurately position the precision images generated by the SE1450 DASH on the UUT according to user defined requirements for a particular test procedure.

Automatic Operations

The SE1450 DASH system is capable of generating a precise image by responding and replying to all Spectron Control Language Commands (see, Manual, *Spectron Control Language Commands, SE1450 Stroke Generator)* via the IEEE488 bus or RS232 port. Automatic routines for generating a series of specific test patterns are not included with the SE1450 DASH, however, they may be created by the user of the system or separately contracted from Spectron on an optional basis.

Manual Operations

To perform manual operations, connect a controlling computer to the RS232 port on the SE1450 DASH. Alternatively, a properly configured computer can communicate with the SE1450 DASH through the IEEE488 bus connection. Use of the IEEE488 bus will effectively override and disable the RS232 port. This section will describe the necessary communications relationship between the controlling computer and the SE1450 DASH for successful operation of the system.

RS232 Communications

All of the Pattern Generating, Design and System commands described in the Manual, *Spectron Control Language Commands, SE1450 Stroke Generator* can be performed via the RS232 port using a Controlling Computer.

Important Note

All SCL Commands in Serial (RS232) operation must be preceded with a colon (:) to indicate "Command Mode" to the SE1450 DASH (see, *General Command Format Notes, below).*

Caution: Failure to precede a SCL Command with a colon (:) in Serial Operation may lead to unpredictable results, including having to reset the System before proceeding.

Note
To perform a Hardware Reset, power down the system, then re-start it or Press the recessed Red RESET Button on the SE1450 DASH Back Panel.

All transmissions between the SE1450 DASH system and the controlling computer are in ASCII code. Commands that are sent via the RS232 interface return data in their own distinct format. All SCL Commands, and any associated parameters, must be followed by a Carriage Return and a Line Feed.

After entry of a colon (**:**), any ASCII input of the first 3 significant characters corresponding with a valid SCL command will cause the appropriate function to be implemented.

Complete description of the RS232 port, wiring information, and protocols are provided in *Chapter 2, Initial Setup and Connections,* above.

IEEE488 Communications

IEEE488 (GPIB) operations are commenced by properly connecting a Controlling Computer to the SE1450 DASH and sending ASCII character strings to the SE1450 DASH using the GPIB interface software on the computer. Once in GPIB Mode, RS232 Communication is disabled and the SE1450 DASH functions as a "slave" to the Controlling Computer until such time as GPIB control is relinquished.

The exact method of controlling SE1450 DASH operations will vary according to the GPIB interface being used, however, VALID Spectron Control Language commands as described in Manual, *Spectron Control Language Commands, SE1450 Stroke Generator*, must be sent as string data to the SE1450 DASH by the GPIB interface software. **Under GPIB control, the SCL Command MUST NOT be preceded by a colon (:).** All character strings sent to the SE1450 DASH will provide a report for that string. The GPIB interface software must request and interpret this reported data for proper interactive operation.

General Command Format Notes

Whether operating in Automatic or Manual mode, it is essential for the Operator to have a complete understanding of the format and function of all commands in the Manual, *Spectron Control Language Commands, SE1450 Stroke Generator*. The format rules from that Manual are repeated here for clarity of operation:

1. **Serial Operation vs. IEEE488 Operation -** Spectron Control Language Commands (SCL Commands) are entered directly as specified below during IEEE488 operation. If the SE 1450 Stroke Generator is being controlled through the Serial Port, however, the "Command Mode" must be entered by preceding each Command with a colon (**:**); i.e. READ is a valid command in IEEE488 Operation, **:**READ is valid in Serial Operation.

   Caution: Failure to precede a SCL Command with a colon (:) in Serial Operation may lead to unpredictable results, including having to reset the System before proceding.

2. **Only the First 3 Characters of a Command are Significant -** The READ command above will be recognized as valid if the user types REA, READ, REAxxx in IEEE488 Operation, or if the user types **:**REA, **:**READ, **:**REAxxx in Serial Operation. If the first 3 characters of a command are not recognized as valid; i.e. the user types REED, a "BAD COMMAND" response will be generated and no futher action will be taken by the System.

3. **Separate a Valid Command from the Parameters associated with the Command with One or More Spaces <sp>. Likewise, Separate Multiple Parameters with One or More Spaces <sp> -** The CENTER command requires two parameters representing the X and Y offset voltages (see *Summary*, below), and would be entered as follows: CENTER<sp>-.532<sp>1.217.

4. **Multiple Commands MAY NOT be Entered on the Same Line, However, Multiple Pattern Generating Commands may be Created, Viewed, Edited, Saved, and Recalled Through Appropriate use of the ADD, READ, EDIT, SAVE, and LOAD Commands and with a Working Understanding of how the Current Work Area, Described Directly Below, Functions.**

5. **The Current Work Area Allows Complicated Images to be Created, Edited, Saved and Recalled by Storing a Series (31 maximum) of SLINE, SCROSS and SPATCH Commands -** Directly entering a pattern generating command, such as SLINE, SCROSS, or SPATCH, will clear the Current Work Area and create a Line 1 in the Area reflecting the command entered. Further enhancements to the image pattern are generated using the ADD command which, with appropriate parameters, will add Line 2, Line 3, … Line 40 to the Current Work Area.

   Caution: Inadvertently issuing a pattern generating command directly at this point, rather than using the ADD command consistently, will clear the Current Work Area, as above described, and will result in the loss of the previously created elements of the final image pattern.

   The series of pattern generating commands in the Current Work Area can be viewed using the READ command, changed by using EDIT, deleted with the DELETE command, and permanently stored (in EEPROM) in one of 20 numbered locations using the SAVE command. The command series can later be retrieved into the Current Work Area with the LOAD command.

   The SE 1450 Stroke Generator generates a live image based on the contents of the Current Work Area.

   Caution: If the complete series of pattern generating commands in the current work area cannot be displayed due to the constraints of the time slot allocated for display generation, the 'IMAGE TRUNCATED, IN SYMBOL MODE' or the [IMAGE TRUNCATED, IN W/RASTER MODE] message will be generated as the last report line of the READ command. If the complete series of pattern generating commands is displayed, the 'IMAGE COMPLETE. IN SYMBOL MODE' or the 'IMAGE COMPLETE, IN W/RASTER MODE' message will be generated as the last report line of the READ command.

Chapter Four

MAINTENANCE and REPAIR

SE1450 DASH
STROKE GENERATOR

The SE1450 DASH is designed to make maintenance and repair as simple as possible. Each time the system is turned on or reset, it performs a self-diagnostic test called a BIT (Built In Test) that checks the electronic circuitry and connections in the SE1450 DASH (see, *Chapter 3, Operations)*, above.

Maintenance

No routine maintenance procedures by the operator are required for the SE1450 DASH as long as the unit passes the BIT.

Repair

No repair of the SE1450 DASH system is permitted by the user of the system other than the removal and replacement of the Power Supply as described below. User initiated repairs will void the factory warranty and invalidate the factory calibration. In no event should the user attempt to remove factory installed covers and access the internal parts (other than to replace the Power Supply Module). Should it appear that repairs are required, contact Spectron Engineering, Inc. as specified below.

Removal and Replacement of the Power Supply

The procedure for removal and replacement of the Power Supply is as follows:

1 Disconnect the power cord from the ***SE1450 DASH***.
2 Remove the top cover of the ***SE1450 DASH***.
3 Disconnect the 4 latched cable connectors from the Power Supply.
4 Remove the nylon cable tie that anchors the latched cables to the Power Supply angle strut.
5 Disconnect the in-line connector in the green chassis ground wire that connects to the transformer mounting screw. Note: The transformer mounting screw does NOT need to be removed.

6 Remove the #6-32 x ½" socket head cap screws (5 ea.) that attach the Power Supply to the lower right area of the ***SE1450 DASH*** back panel.
7 Carefully remove the Power Supply from the ***SE1450 DASH***.
8 Reverse these directions to install the new Power Supply.

Troubleshooting

If any of the modules fail the BIT, follow these general troubleshooting steps **after power is turned off:**

1. Check to ensure that all cables are properly seated and connected. The most common reason for BIT failure is the improper connection of the SE1420 DASH system cables.
2. Check the proper functionality of all units connecting to the SE1450 Dash to include the Controlling Computer and the UUT.
3. Turn the power on and carefully monitor and record the results of the BIT with the IST and TST commands. Note the exact "fail" indications from these commands and follow the specific troubleshooting directions found in *Appendix B, BIT Logic and Troubleshooting*.
4. If the procedures in *Appendix B* do not resolve the problem, contact Spectron Engineering, Inc., as specified below, with the specific circumstances and failure indications reported by the BIT for further instruction and safe troubleshooting steps for the error condition encountered.

Replaceable Modules

In the SE1450 DASH system, a module is defined as a minimum replaceable component. Other than the SE1450 DASH itself, there is one internal module (Power Supply), three cables and a power cord that can be replaced (see, *Chapter 2, Initial Setup and Connections, Typical System Components and Cables*).

Factory Contact

If the user of the SE1450 DASH encounters problems that cannot be solved by the above procedures, or if any other problems exist, contact Spectron Engineering, Inc. as follows:

Spectron Engineering, Inc.
255 Yuma Court
Denver, CO 80223

Telephone (303) 733-1060
Fax (303) 733-2432
E-mail (se1450support@spectronengineering.com).

APPENDIX A

SPECIFICATIONS

SE1450 Stroke Generator for T-50 HUD

For Definition, Specification and System Interaction of the Stroke Generation Requirements, refer to the following BAE SYSTEMS, AVIONIC SYSTEMS Document:

INTERFACE CONTROL DOCUMENT (ICD)
FOR THE
T-50 PRODUCTION INVESTMENT (PI)
HEAD UP DISPLAY (HUD) SYSTEM

Stroke Generator Specific Signals

Signal Label:	XDEF
Signal Name:	X Symbol Deflection
Signal Type:	Analog
Source:	Stroke Generator
Destination:	PDU (T-50 HUD)
Voltage Range:	-12 to +12 Volts DC Differential Line to Line
Parameter Range:	± 18 Degrees, 36 Degree Total Field of View
Scale Factor:	1.5 Degree per Differential Volt
Accuracy:	± 0.010 Volts at 0.0 Volts
	± 0.025 Volts at ±4.0 Volts Differential
	± 0.028 Volts at ±6.6 Volts Differential

Signal Label:	YDEF
Signal Name:	Y Symbol Deflection
Signal Type:	Analog
Source:	Stroke Generator
Destination:	PDU (T-50 HUD)
Voltage Range:	-10 to +10 Volts DC Differential Line to Line
Parameter Range:	± 15 Degrees, 30 Degree Total Field of View
Scale Factor:	1.5 Degree per Differential Volt
Accuracy:	± 0.010 Volts at 0.0 Volts
	± 0.025 Volts at ±4.0 Volts Differential
	± 0.028 Volts at ±6.6 Volts Differential

Writing Speed X & Y Deflection	Rate	Accuracy
Slow Cursive	1.221 ms per 30 degrees	± 5%
Fast Cursive	111 µs per 30 degrees	± 5%
Fail Rate	7.995 degrees per 1 ms	± 5%

Discrete – Standard Low Level Complementary Signal Types
From Stroke Generator to PDU (T-50 HUD)

Signal Label	Signal Name
IMDCBUSY	IMDC Busy
BU	Bright Up

Discrete – Standard Low Level Complementary Signal Types
From PDU (T-50 HUD) to Stroke Generator

Signal Label	Signal Name
DUBUSY	PDU Busy
SYMCMD	Symbol Command

Discrete – Standard Low Level Complementary Signal Type
From Test Station to Stroke Generator

Signal Label	Signal Name
SYMODE	Symbol Mode

Video - Modified RS170
From Test Station to Stroke Generator

Signal Label	Signal Name
SELVID	Selected Video

For X & Y Symbol Deflection waveform requirements refer to APPENDIX B, HEAD UP DISPLAY AIRCRAFT SYSTEM INTERACTION in the ICD defined above.

The Stroke Generator and DASH Measurement System passed-through metrology verification are defined in *Appendix C, NIST Traceability of the SE1420 DASH and SE1450 DASH.*

A Synchronization Pulse (stripped from the Test Station supplied RS170 video) is available as an output from the SE1450 Stroke Generator Sync Connector. This TTL pulse supplies the HUD External Sync to the SE1420 DASH Display Measurement System.

APPENDIX B

BIT Logic and Troubleshooting

1. No Answer - using IEEE 488 (GPIB) or RS232 communication.

   A. Physically go to the back panel of the Display Measurement Controller. Check for the proper connection of the GPIB (IEEE488) and/or the RS232 Cables at both ends.

   B. While at the back panel, check to see if the red LED (Power ON Indication) is on.

      1) If the LED is off, check the Power On Switch, A/C Power Cord connections at both ends and the A/C Source. If these actions do not light the LED, replace Power Supply Module.

      2) If the LED is on, first check to see if the Stroke Generator to BAE Station Cable is connected at both ends. Next, measure the Stroke Generator Power Supply Reference Signals at the BAE Station. If these values are within specification, replace/repair the Stroke Generator. If these numbers are out of specification, replace the Power Supply.

2. Failure Reports

   A. From STA(tus) Report = 61' STATUS FAIL - XPORT; RERUN ISTEST BEFORE REPAIR -or- 62' STATUS FAIL - CAMERA; RERUN ISTEST BEFORE REPAIR -or- 63' STATUS FAIL - CONTROLLER; RERUN ISTEST BEFORE REPAIR -or- 64' STATUS FAIL - POWER SUPPLY; RERUN ISTEST BEFORE REPAIR. Rerun the ISTEST and then request status report with a STATUS. If the same report is received, the Module specified in the report should be repaired/replaced.

   B. From AST(atus) Reports

      1). Failure report = 51' ASTATUS FAIL - CHECK ACCESSORY & RERUN ALIGN BEFORE REPAIR. This failure report will occur if the accessory cable is not properly connected to the HUD Simulator or HUD Holding Fixture or if the EEPROM can not be read/written. First, verify that the appropriate accessory being used in the ALIGN is either an T-50 EDU Holding Fixture or an T-50 HUD Simulator. Then check to see if the accessory cable is properly attached at both ends -- one to the accessory and the other to the Transport. Next, rerun the ALIGN procedure. If the failure report is number 51, repair or replace the accessory (and/or accessory cable). If available, a different accessory and/or accessory cable can be used to break the uncertainty between accessory failure and accessory cable failure.

      2). Failure Report = 52' ASTATUS FAIL - CAMERA, RERUN ISTEST & ALIGN BEFORE REPAIR. This failure report will occur if there is a camera shutter malfunction or no camera EOF (End Of Frame) or no VSync for camera timing. Check to see that all cables are properly connected and then run the Internal Self Test using an ISTEST command. Request a status report with a STATUS command. If there is a failure report, refer to 2. A. above. If there is no failure report from the STATUS report, check the accessory for light path obstructions and that the lenses on the

collimators and camera are clean. Insure that any ambient light is blocked from the camera and that the shroud is properly employed. Then rerun the ALIGN procedure. If the failure report is number 52, the Camera Module should be repaired/replaced.

3). Failure Report = 53' ASTATUS FAIL - SYSTEM, RERUN ISTEST & ALIGN BEFORE FACTORY RECALIBRATION. This failure report will occur when the system does not attain specified positional accuracy. Check to see that all cables are properly connected and then run the Internal Self Test using an ISTEST command. Request a status report with a STATUS command. If there is a failure report, refer to 2. A. above. If there is no failure report from the STATUS report, check the accessory for light path obstructions and that the lenses on the collimators and camera are clean. Ensure that any ambient light is blocked from the camera and the shroud is properly employed. Then rerun the ALIGN procedure. If the failure report is number 53, the entire Display Measurement System should be repaired/recalibrated.

4). Failure Report = 54' ASTATUS FAIL - SYSTEM, RERUN ISTEST & ALIGN BEFORE LUMINANCE RECALIBRATION. This failure report will occur when the system does not attain specified luminance accuracy. Check to see that all cables are properly connected and then run the Internal Self Test using an ISTEST command. Request a status report with a STATUS command. If there is a failure report, refer to 2. A. above. If there is no failure report from the STATUS report, check the accessory for light path obstructions (and are the lenses on all of the collimators and camera clean?) and insure that any ambient light is blocked from the camera (shroud properly employed). Then rerun the ALIGN procedure. If the failure report is number 54, the entire Display Measurement System should be recalibrated by the customer for luminance.

5). Failure Report = 55' ASTATUS FAIL - ALIGN NOT RUN, NO STATUS. This failure report will occur when a standard (non- 7 parameter) ALIGN has not be run since Power On. Run a standard ALIGN procedure (using an ALIGN command without any attributes) and then request status report with ASTATUS.

APPENDIX C

NIST Traceability Of The SE1420 DASH and SE1450 DASH

The Power Supplies in both the SE1420 DASH (Display Measurement System) and the SE1450 DASH (Stroke Generator) contain three shared references that are used as transfer standards. These references are available to the user on the cable coming from the Stroke Generator. If they are measured by the user with a NIST traceable measuring instrument and both the user measurement and the two Spectron units measurements are within specification (defined below), the Spectron systems are still in calibration as compared to a NIST Traceable instrument

In regards to the definition of signals on pins 18 - 29 on Spectron Drawing Number 3382-001 "P2/J1 of Cable W4, ITA to HUD Test Bench", *Appendix D*, SE1450 DASH – J5 Pinout Definition, this Manual:

VOLTAGE REFERENCES

Pin Nos.	Name	Long Name
18	Cont V Ref Rtrn	Display Measurement Controller Voltage Reference Return
19	Cont V Ref	Display Measurement Controller Voltage Reference
24	Stroke V Ref Rtrn	Stroke Generator Voltage Reference Return
25	Stroke V Ref Rtrn	Stroke Generator Voltage Reference

Definition (pins 18,19 and 24,25) - These twisted pairs will output +4.096 volts DC ± 0.5 %. This voltage should be measured with a DVM (Digital Volt Meter) high input impedance of approximately 10 Gigohms or greater.

PRIMARY FREQUENCY REFERENCES

Pin Nos.	Name	Long Name
22	Cont Unipolar Rtrn	Display Measurement Controller Unipolar Frequency Reference Return
23	Cont Unipolar Freq	Display Measurement Controller Unipolar Frequency Reference
28	Stroke Unipolar Rtrn	Stroke Generator Unipolar Frequency Reference Return
29	Stroke Unipolar Freq	Stroke Generator Unipolar Frequency Reference

Definition (pins 22,23 and 28,29) - These twisted pairs will output a square wave with a frequency of 75 Hertz ± 0.02%. The positive plateau is +3 to +5 volts and the negative plateau is -0.5 to +0.5 volts, both ranges including ripple. If no GPIB response is received from the Display Measurement Controller or the Stroke Generator and either or both of these voltages from the same unit are outside of the defined range, the power supply is suspect and should be replaced.

SECONDARY FREQUENCY REFERENCES

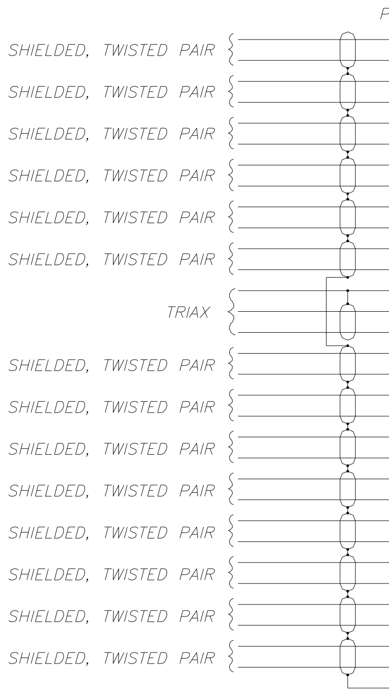
Pin Nos.	Name	Long Name
20	Cont Bipolar Rtrn	Display Measurement Controller Bipolar Frequency Reference Return
21	Cont Bipolar Freq	Display Measurement Controller Bipolar Frequency Reference
26	Stroke Bipolar Rtrn	Stroke Generator Bipolar Frequency Reference Return
27	Stroke Bipolar Freq	Stroke Generator Bipolar Frequency Reference

Definition (pins 20,21 and 26,27) - These twisted pairs will output a square wave with a frequency of 75 Hertz ± 0.02%. The positive plateau is +3 to +5 volts and the negative plateau is -3 to -5 volts, both ranges including ripple. If no GPIB response is received from the Display Measurement Controller or the Stroke Generator and either or both of these voltages from the same unit are outside of the defined range, the power supply is suspect and should be replaced.

APPENDIX D

SE1450 DASH - J5 Pinout Definition

REVISIONS			
REV	DESCRIPTION	DATE	APPVD
1	INITIAL DRAFT	5/13/2002	frc
2	CHANGE PIN NUMBERS TO LETTERS	6/11/2002	



A	1	BRIGHTUP COMP
B	2	BRIGHTUP TRUE
C	3	Y SYMBOL COMP
D	4	Y SYMBOL TRUE
E	5	X SYMBOL COMP
F	6	X SYMBOL TRUE
G	7	SYMBOL COMMAND COMP
H	8	SYMBOL COMMAND TRUE
J	9	EU BUSY COMP
K	10	EU BUSY TRUE
L	11	DU BUSY COMP
M	12	DU BUSY TRUE
N	13	SELECT VIDEO SCRN
P	14	SELECT VIDEO RETURN
R	15	SELECT VIDEO
S	16	SYMBOL MODE COMP
T	17	SYMBOL MODE TRUE
U	18	CONT V REF RTRN
V	19	CONT V REF
W	20	CONT BIPOLAR RTRN
X	21	CONT BIPOLAR FREQ
Y	22	CONT UNIPOLAR RTRN
Z	23	CONT UNIPOLAR FREQ
a	24	STROKE V REF RTRN
b	25	STROKE V REF
c	26	STROKE BIPOLAR RTRN
d	27	STROKE BIPOLAR FREQ
e	28	STROKE UNIPOLAR RTRN
f	29	STROKE UNIPOLAR FREQ
g	30	AVAILABLE
h	31	AVAILABLE
j	32	SHIELDS

CONNECTOR: Amphenol PT Series. MIL–C–26482, Series 1

Cable end, Pins, Solder pot, w/ Strain relief PT06A–18–32P–SR (ref. Allied 2001 catalog pg. 425)
or
Cable end, Pins, Crimp, w/ Strain relief AIPT06A18–32P(SR) and Pins 10–627173–272 (ref. Allied 2001 catalog pg. 427)

Bulkhead, Sockets, Solder pot, PT02A–18–32S (ref. Allied 2001 catalog pg. 425)

or
Bulkhead, Sockets, Crimp, AIPT02A18–32S and Pins 10–567448–272 (ref. Allied 2001 catalog pg. 427)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES ± 1° DECIMALS .XX ± .01 .XXX ± .005	PROJECT NO. D 6643	SPECTRON ENGINEERING 255 YUMA COURT DENVER, CO 80223 303/733–1060	
APPROVALS	DATE	TITLE P2/J1 OF CABLE W4 ITA TO HUD TEST BENCH	
DRAWN CLAYPOOL	5/13/2002		
CHECKED		SIZE C	DWG. NO. 3382–001 REV. 2
LAST EDIT CLAYPOOL	6/11/2002		
FILE NAME 3382001.DWG		SCALE –	SHEET 1 OF 1