

OPERATING AND SERVICE MANUAL

DSA E-SCAN

Dissolved Solids Analyzer Refractometer

Designed and Manufactured by

THE ELECTRON MACHINE CORPORATION

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Introduction

The Electron Machine Corporation DSA E-SCAN

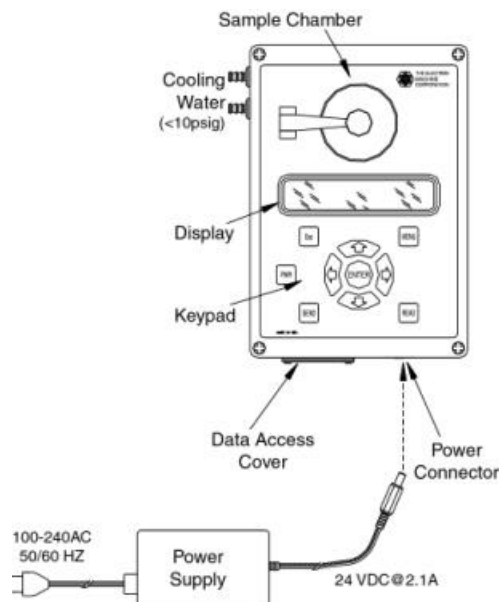
The DSA E-Scan is an automatic, bench-top critical angle refractometer with a digital readout. It measures the critical angle of refraction of sample fluids, which can be directly correlated to various measurements; i.e. dissolved solids, Brix, refractive index, etc.

The DSA E-Scan is equipped with a menu-driven user interface. It is calibrated before leaving the factory and should not need re-calibration. Calibration procedures are available to change system parameters and allow the refractometer to measure different sample fluids if so desired.

Extensive literature is available for various industries listing the correlation between refractive index, °Brix, or % solids and specific process parameters. Please contact the service department for more information on your particular application.

Important DSA E-Scan components are:

- Sample Chamber
- Display
- Keypad
- Power Supply
- Power Connector
- Cooling Water Fittings
- Data Access Cover



DSA E-Scan Overview

Important Manual Information

The Chapter title is at the top of each page for quick reference through the manual.

Important points, reminders, and warning messages are printed in bordered boxes as:

NOTE: Box indicates important messages.

This is a general use manual. Additional information is available for specific applications.

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1. Installation

1.1 Site Selection

The DSA E-Scan is to be operated in an industrial laboratory environment. Select an area where the instrument will be protected from shock and vibration to avoid damage to the optics. The console is sealed from the environment. However, care should be taken to avoid temperature extremes and exposure to moisture.

1.2 Power Requirements

A.C. power to the external power supply can be 90-250 VAC at 50/60 Hertz. The appropriate cord will be supplied according to the customer's requested plug type. The output of the external power supply is 24 VDC at 2.1A and the connector should be plugged into the power connector located on the bottom right side of the console.

1.3 Interconnection

The DSA E-Scan offers some options for external device connections to satisfy a wide range of requirements. The data access cover located on the bottom left side can be used to bring wires and cables into and out of the instrument. The bottom cover will need to be removed to connect external devices to the PC card by loosening the screws located underneath the silicone plugs at each corner of the instrument.

1.3.1 Voltage Outputs

The DSA E-Scan supports voltage outputs for both the measurement and the temperature readings. Output for these readings is a 0 to 5V range with connections on the TB1 terminal block. Terminal 1 is measurement, Terminal 2 is temperature, and Terminal 3 is common ground.

1.3.2 Serial Ports

The DSA E-Scan offers two serial interface ports at J5 and J1 on the electronics card. The connectors are male and female DB9 with the standard personal computer pin out for IBM PC/AT compatible devices. This feature allows interfacing the DSA E-Scan with a computer or printer. The cables should be routed through the data access hole located to the left of the power connector on the enclosure. The data access cover should be re-installed and the integrity of the seal should be verified before operating the instrument. Refer to the Operation section for more information.

1.3.3 Parallel Port

A parallel printer port is supplied at J2 on the electronics card and allows an external parallel Centronics-compatible printer or other device to be used. The cables should be routed through the data access hole located to the left of the power connector on the enclosure. The data access cover should be re-installed and the integrity of the seal should be verified before operating the instrument. Please refer to the Operation section for more information.

1.3.4 Optional Temperature Controlled Coolant Circulation

If a precision reading of a sample at ambient temperature or below is desired, a temperature controlled external coolant source will need to be connected to the fittings located on the left side of the instrument. The fittings are for 1/4" inside diameter tubing and should only be connected to a low-pressure coolant source of less than 10 psig. Commercial circulators with cooling and heating capabilities are available from instrument supply dealers or contact Electron Machine for a suggested model with prices and delivery information.

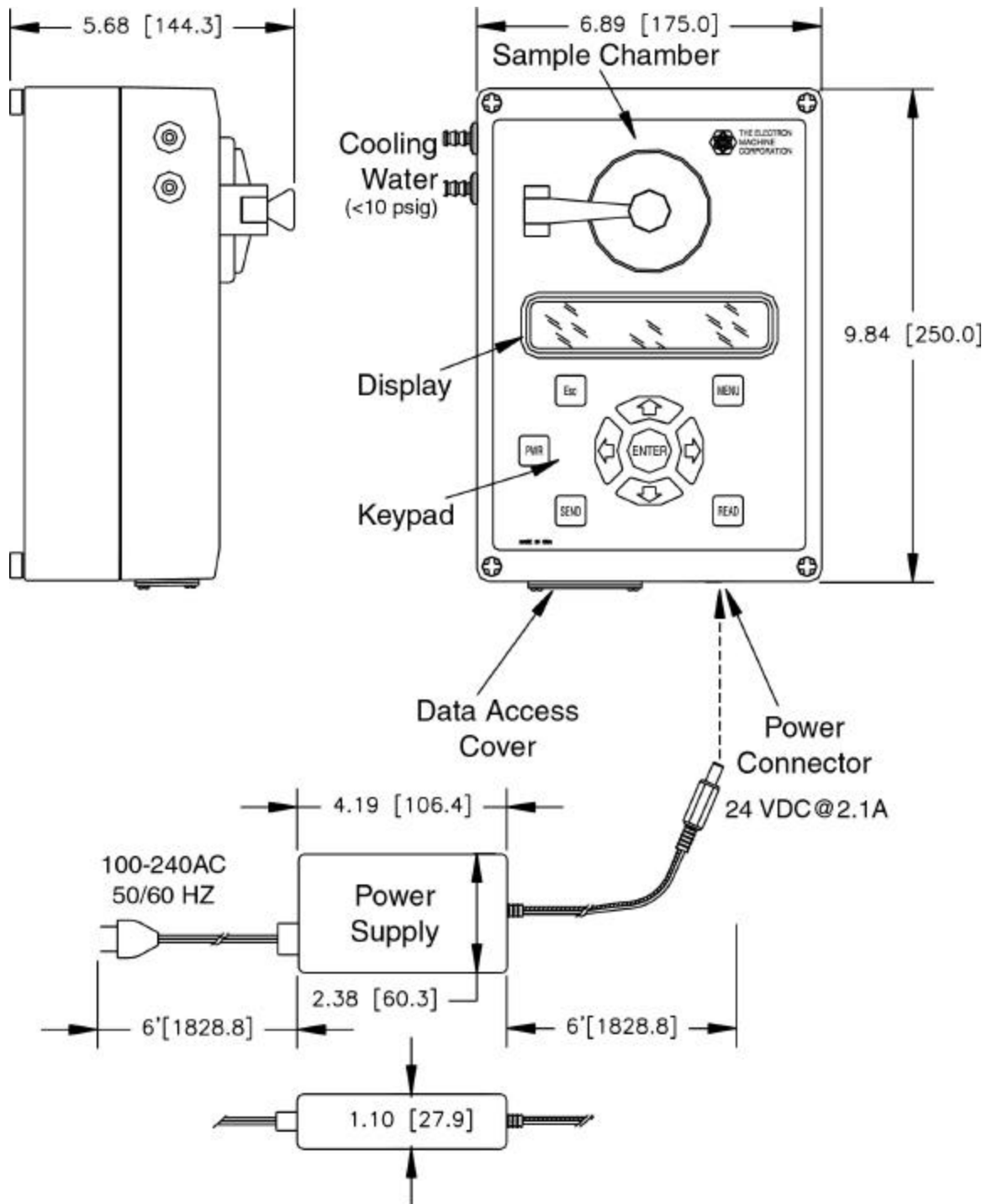
Damage will result if the pressure of the cooling water exceeds 5 psig.

Only use a coolant circulation system with the DSA E-Scan.

Do not connect the instrument to a domestic water supply.

Care should be taken to avoid condensation on the optical surfaces when cooling near or below the dew point. Desiccant and purging systems can be provided. Contact the service department for more information.

1.4 Outline Drawing



- NOTES-

2. System Information

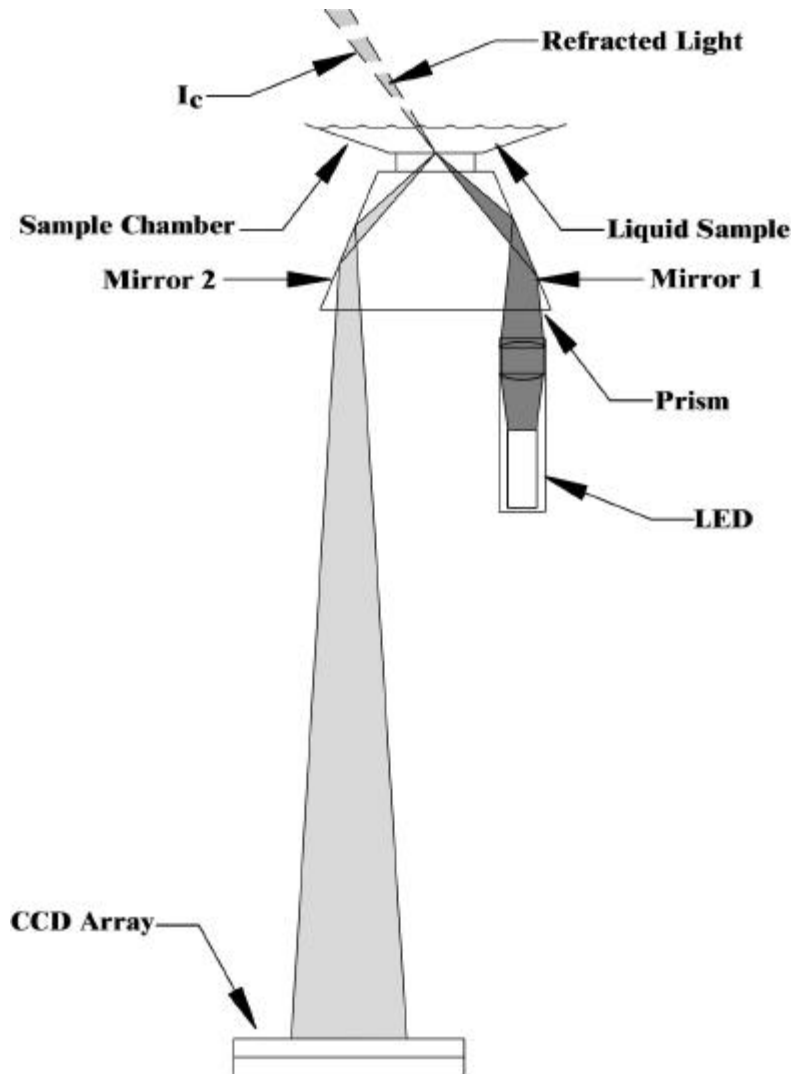
2.1 Technical Description

2.1.1 Measurement Sensing

The DSA E-Scan uses an LED as an energy source and utilizes a CCD (charge coupled device) to accomplish scanning the reflected energy returned from the prism.

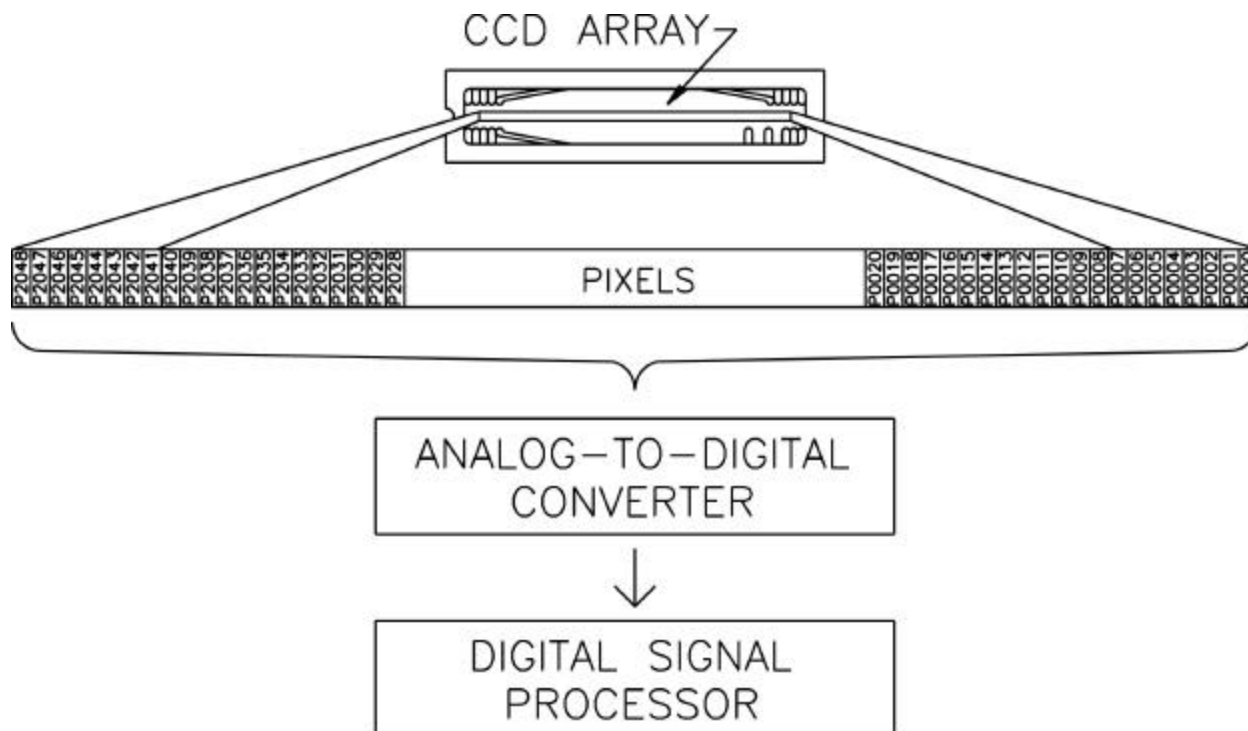
2.1.1.1 Optics

Light energy radiating from a light emitting diode (LED) passes through the prism surface and reflects off mirror 1 to the prism-to-sample interface. The energy reaching this interface intersects at angles chosen to include critical angle for the sample being measured. The light intersecting at an angle greater than critical angle is refracted into the solution. Light intersecting at less than the critical angle is reflected to mirror 2 and is measured by the CCD linear array.



2.1.1.2 CCD Linear Array

The Charged Coupled Device (CCD) linear array used in the DSA E-Scan includes 2048 individual photo sites. Each of these photo-diodes independently measures the incident radiation between scan intervals and stores an electrical charge, which reflects the measured intensity. The measured intensity is then converted to a digital value using a high-speed analog-to-digital converter. The processor manipulates the digital value using the appropriate calculations for the measurement scale chosen based on the calibration of the instrument. Thus, the DSA E-Scan's signal is completely digital allowing for greater measurement span and greater accuracy.



2.1.2 Enclosure

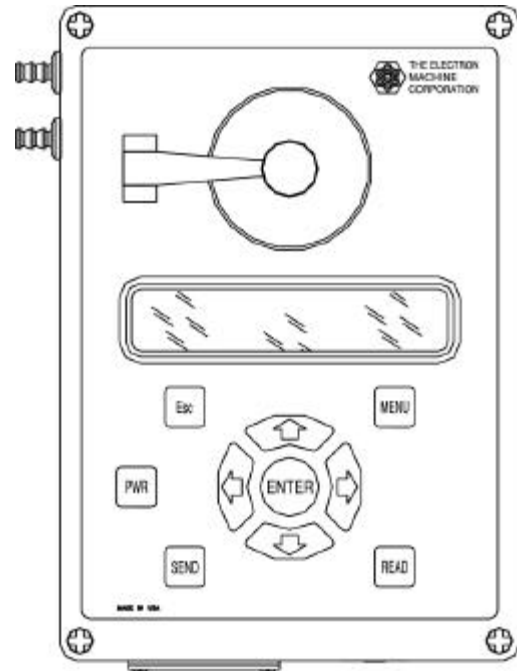
The enclosure is constructed of impact-resistant Polycarbonate material to give protection against temperature and chemicals. A Polycarbonate “LEXAN®” glass window is incorporated into the enclosure to provide scratch and temperature resistant viewing of the display.

2.1.3 Display

The LCD (liquid crystal display) has a single line of 16 characters with a 120mm x 23mm viewing area. The display incorporates a yellow-green LED backlight for viewing in low light levels.

2.1.4 Switch Matrix Overlay

The switch matrix overlay is located on the outside of the enclosure and allows the operator to make modifications and changes to the operating conditions of the instrument. The operation of this switch matrix is explained in the Operation section of the manual. The overlay itself is made of a polyester material for chemical resistance.



Enclosure, Display and Switch Matrix Overlay

2.1.5 Cable Entry

The DSA E-Scan has a data access port to allow data communications with external peripherals. The cover should be installed at all times to prevent liquid intrusion. The supplied gaskets should be used with any wires or cables securely sandwiched between the gaskets and the data access cover using the supplied hardware. The integrity of the seal should be verified on a regular basis to ensure that the seal is secure.

2.1.6 Interface for External Connections

There are several options for external devices to interface with the DSA E-Scan. The 0-5V measurement and temperature outputs can be used to drive a chart recorder or other similar device. The connections for this output are located on the top right side of the electronics card at TB1 and the connections are labeled. A parallel printer output is supplied at J2 on the left side of the electronics card. Serial outputs are located at J1 and J5 on the top left side of the electronics card and can be used for communications with another computer or serial printer. Please see Electronics Card section for more information.

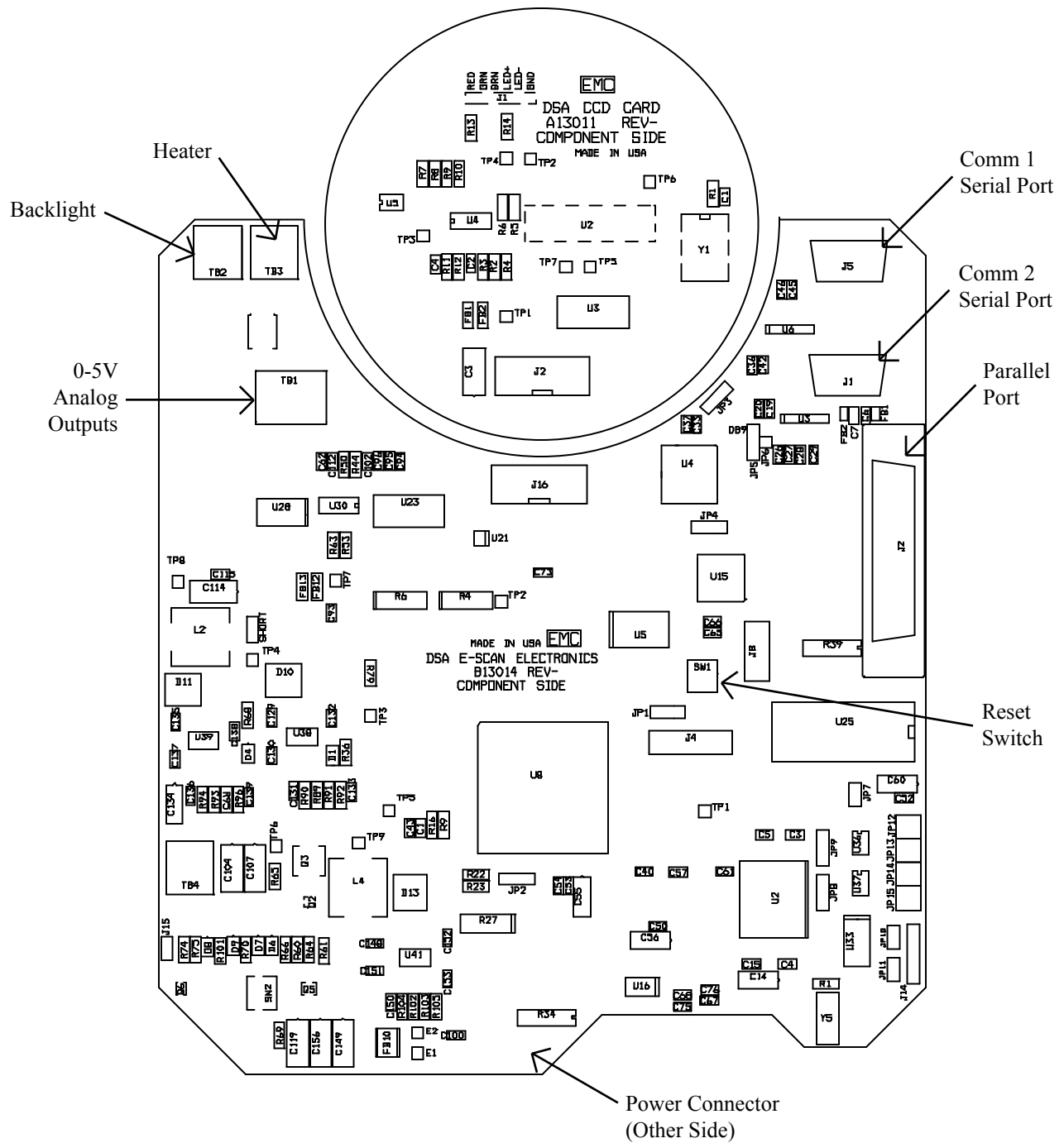
2.1.7 Power Supply

The supplied power source for the DSA E-Scan is a desktop power supply selected for its high power rating (51W). The power supply delivers 24VDC at 2.1A to the instrument through the sealed power connector on the enclosure. The power supply accepts inputs from 90-265VAC and 47-63Hz. Both American and European power cords are available to connect to the power supply's IEC 320-2P AC receptacle. The device has safety approvals from UL, cUL, TUV, Tmark, Nemco, and CE for worldwide acceptance.

NOTE: Only the power supply provided with the DSA E-Scan should be used. DO NOT USE any other power supply, as it may not meet the application requirements.

2.1.8 Electronics Card

The DSA E-Scan incorporates all functions onto two multi-layered surface mount printed circuit cards, with components on both sides. The following diagram shows the layout of major components, integrated circuits, switches, and connections.



DSA Electronics Cards Component Identification

2.2 Refractometer Specifications

The precision and accuracy of refractive index measurements is dependent on operator skill, the environment, temperature control, the accuracy of calibration standards, chemical stability of the sample, and the concentration of the sample. A product demonstration is suggested to validate the true precision and accuracy of the instrument in a specific application.

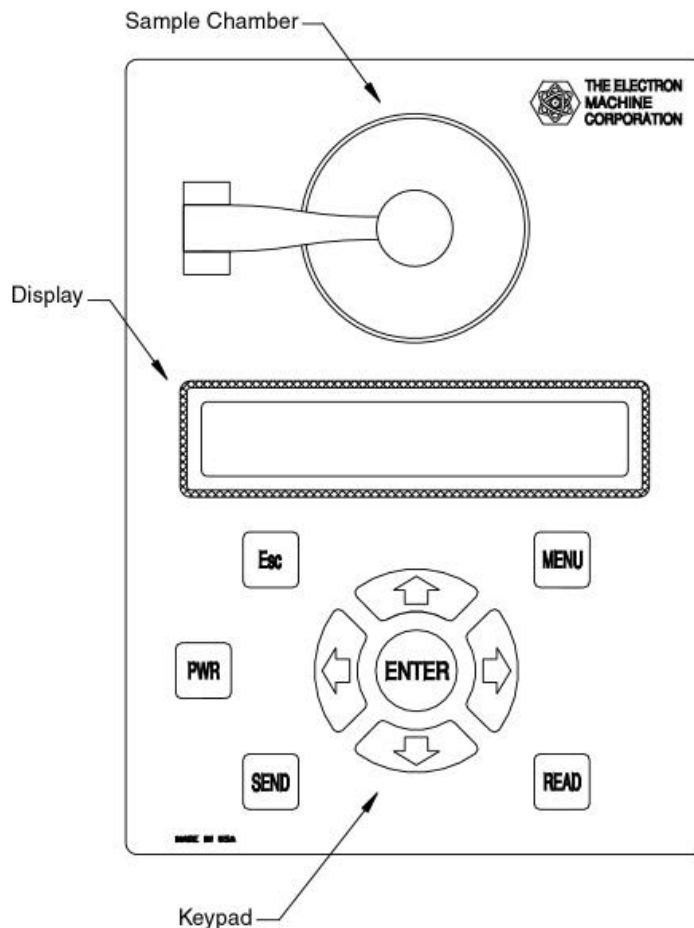
Accuracy:	± 0.000075 R.I. or ± 0.05 Brix, whichever is greater, or $\pm 0.1\%$ Black Liquor Dissolved Solids
Range:	1.329 – 1.539 R.I. or 0 – 85% Black Liquor Dissolved Solids
Stability:	No recorded drift per 24-hour period.
Sample temperature:	10°C to 85°C
Ambient temperature:	0°C to 50°C
Processor:	Analog Devices SHARC floating-point Digital Signal Processor
Display:	120x23mm, 16 character 1 line, LCD w/LED backlight
Calibration:	1.329 – 1.539, see calibration print-out for individual units
Sample chamber materials:	316 SS, synthetic Sapphire, sealed with chemical-resistant epoxy and Peak [®] materials
Outputs:	0-5VDC Measurement/Temperature 9600 Baud Serial Parallel Printer

3. Operation

This instrument is designed for continuous operation and may be left ON for extended periods of time.

3.1 The User Interface

The user's interface consists of the sample chamber, the display, and the 10-button keypad overlay. The majority of all interactions with the instrument take place using these three elements. Refer to the figure below.





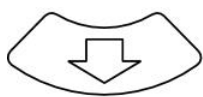







3.1.1 The Sample Chamber

The sample chamber is located on the top of the instrument, underneath the black lid assembly that rotates up and to the left for access to the well. It consists of recessed stainless steel area with the sapphire prism surface in the center upon which samples are placed for measurement. It is important that the sample covers the prism for an accurate reading. The lid should be kept in the closed position to prevent light contamination when reading a sample.

The sample chamber should be kept clean when not in use. The sample may be removed with a paper towel and the prism cleaned with water, methanol, or alcohol, depending on the application. Dry with a clean cloth or paper towel. Some liquids may necessitate a second cleaning to prevent cross-contamination of samples.

NOTE: Do not use Lacquer Thinner or other related solvents to clean the sample chamber. Damage to the display window may result from inadvertent contact.

3.1.2 Button Touch Pad Function Chart

	<p>“Up” allows changing between measurement and temperature readings (°F and °C) in normal mode. It is also used to scroll through options after pressing “menu” and increments the value when user input is prompted.</p>
	<p>“Right” allows changing between displayed units of measurement in normal mode. Scrolls cursor horizontally to the right when user input is prompted.</p>
	<p>“Down” allows changing between measurement and temperature readings (°F and °C) in normal mode. Used to scroll through options after pressing “menu” and decrements the value when user input is prompted.</p>
	<p>“Left” allows changing between displayed units of measurement in normal mode. Scrolls cursor horizontally to the left when user input is prompted.</p>
	<p>“Enter” accepts information displayed for user input.</p>
	<p>“Menu” allows user to change the operating mode by adjusting various parameters.</p>
	<p>“Read” prompts the instrument to display an average of the current measurement over the time period specified in the “sample time” menu selection after the “read delay” time has completed.</p>
	<p>“Send” transmits data through the serial and parallel ports when connected.</p>
	<p>“Escape” returns to the previous display selection.</p>
	<p>“Power” turns the instrument on and off. To turn the instrument ON, press the button momentarily and then release. To turn OFF the instrument, press and hold the button until the display clears and then release.</p>

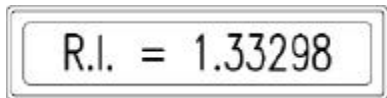
3.2 Set-Up

When the instrument is first turned on the display will briefly show **ELECTRON MACHINE Dissolved Solids Analyzer Phone (352) 669-3101 DSA E-SCAN**. The instrument will then default to the normal display mode discussed in the next section. A warm-up period of about 15 minutes should be given to allow the optics to thermally stabilize. The instrument will be factory calibrated and should be ready for normal operation. A few measurements on known samples should be taken to verify the instrument’s accuracy. If the instrument appears to be functioning incorrectly, perform a single point calibration as referenced in section 3.4.2. Contact the Electron Machine Corporation Technical Service department as described in the Service section of the manual if any problems are experienced.

3.3 Normal Mode

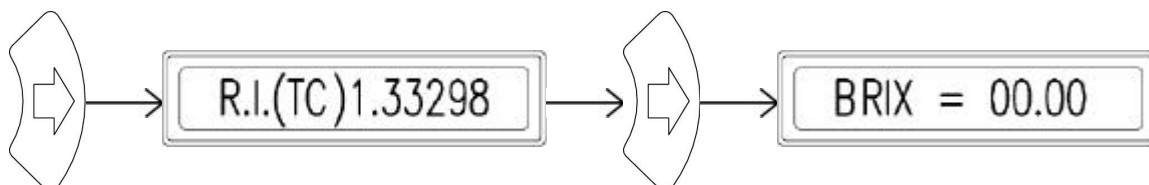
The default mode for the DSA E-Scan displays the reading according to the selected measurement units. The **“LEFT”** arrow and **“RIGHT”** arrow keys change the measurement units and the **“UP”** arrow and **“DOWN”** arrow keys display the temperature in °C and °F. The **“READ”** button initiates a reading of an averaged measurement of the displayed reading for a pre-determined amount of time after the time set by the “read delay” adjustment has completed. Please refer to the Menu Selections section on Sample Time and Read Delay for more information.

After the reading has been completed, the instrument will display the result until another key is pressed. Pressing **“READ”** at this time takes another reading while pressing the **“SEND”** key sends the held value to the output. Pressing any other key returns the display to normal operation. The **“MENU”** key allows the user to adjust the operating parameters of the instrument. Please refer to the Menu Selections section for more information.



Refractive Index (R.I.) display

The **“RIGHT”** and **“LEFT”** arrow buttons in the normal mode display allow changing between measurement scales. As an example, if the instrument is set up for sucrose solutions and is displaying refractive index (R.I.), pressing the **“RIGHT”** arrow button produces the temperature compensated (TC) R.I. display. This display references the current measurement and temperature to 20°C based on stored temperature correction data. Pressing the **“RIGHT”** arrow again shows the degree brix display. This can be for sucrose, black liquor, or a custom solution. Please refer to the Solution Type menu for more information. Pressing the **“RIGHT”** arrow again will return to the R.I. display. This sequence is shown below and can also be accomplished in the reverse order by using the **“LEFT”** arrow button.



3.4 Menu Selections

Pressing the “MENU” key allows the user to scroll with the “UP” and “DOWN” key through a series of menus that allow adjusting the operation of the instrument. Pressing the “ENTER” key selects the parameter to be adjusted. Pressing the “ESC” key at any time will return to the previous display, and pressing the “READ” key at any time reads the current sample and returns to the measurement display.

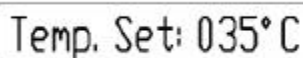
NOTE: If ESC or READ is pressed before pressing the ENTER button, the modified selection will not be stored.

The following sections describe the menu options displayed after pressing the “MENU” button and pressing the “UP” button sequentially.

3.4.1 Heater Control

A rectangular display box with a double-line border containing the text "Heater Control".

The heater control menu allows the user to enter the desired temperature that the sample chamber should maintain, in either °C or °F. If the selected temperature is above the current temperature, a heater at the base of the sample chamber will be activated. The temperature will then be maintained automatically. This is a useful feature when measuring thick liquids that solidify at room temperature, such as concentrated black liquor. When the temperature set point is below 10°C the heater is turned completely off regardless of the current temperature of the sample chamber.

A rectangular display box with a double-line border containing the text "Temp. Set: 035°C".

Use the “RIGHT” and “LEFT” arrows to move the cursor and the “UP” and “DOWN” arrows to adjust the units. After “ENTER” is pressed, the cursor will move to allow the temperature scale to be changed using the “UP” and “DOWN” arrows. Pressing “ENTER” again will complete the process, “Set!” will briefly appear, and the heater will adjust accordingly. The maximum allowable temperature is 82°C or 180°F.

WARNING: When temperature set point is near or above approximately 125°F, do not touch the sample chamber.

3.4.2 Single Point Calibration



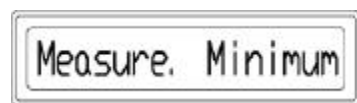
The single point calibration is designed to easily calibrate the instrument with either a water sample or a known refractive index sample, or a sample with known brix, solids, or specific gravity value. This feature should be used if the instrument does not accurately read a sample. This procedure will effectively shift the stored calibration curve to match the current reading (zero shift) without affecting the saved calibration data. Before performing this procedure, the sample chamber should be thoroughly cleaned and sufficient time should be given to allow the sample's temperature to stabilize in the sample well. If a water sample is used, distilled water is recommended. If a sample other than water is used, the sample's refractive index (R.I.) value must be known for the "Known R.I." option, or degrees brix, percent solids, or specific gravity value must be known for the "Measurement Offset" option.

3.4.3 Measurement Offset



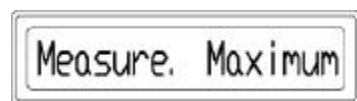
The measurement offset is used to mathematically shift the current reading. It is entered in units of degree brix, percent solids, or specific gravity, depending on which solution type is in use. Measurement offset can also be calculated automatically by the Dissolved Solids Analyzer through the "Measurement Offset" option under "Single Point Calibration."

3.4.4 Measurement Minimum



When using the 0-5V measurement output, this option allows a minimum measurement reading to be correlated to the 0V output. This parameter has nothing to do with the instrument's calibration and is only used for adjusting the scale of the measurement output.

3.4.5 Measurement Maximum



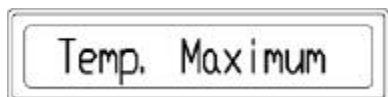
When using the 0-5V measurement output, this option allows a maximum measurement reading to be correlated to the 5V output. This parameter has nothing to do with the instrument's calibration and is only used for adjusting the scale of the measurement output.

3.4.6 Temperature Minimum



When using the 0-5V temperature output, this option allows a minimum temperature reading to be correlated to the 0V output. This parameter has nothing to do with the instrument's calibration and is only for adjusting the scale of the temperature output.

3.4.7 Temperature Maximum



When using the 0-5V temperature output, this option allows a maximum temperature reading to be correlated to the 5V output. This parameter has nothing to do with the instrument's calibration and is only for adjusting the scale of the temperature output.

3.4.8 Backlight Adjustment



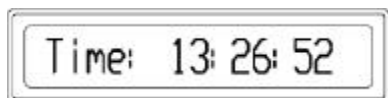
This parameter allows the user to adjust the intensity of the backlit display from completely off to full on. Use the “**RIGHT**” and “**LEFT**” arrows to increase and decrease the intensity. A bar graph on the display shows the relative level. Press the “**ENTER**” button to store the setting.

3.4.9 Contrast Adjustment



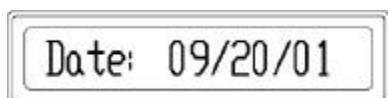
This parameter allows the user to adjust the contrast of the display to match the lighting conditions and user's preferences. Use the “**RIGHT**” and “**LEFT**” arrows to increase and decrease the level according to the displayed bar graph. Press the “**ENTER**” button to store the setting.

3.4.10 Time Adjustment



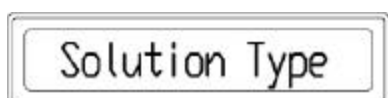
Use the “**RIGHT**” and “**LEFT**” arrow buttons to move the cursor and the “**UP**” and “**DOWN**” arrows to change the appropriate digit. Press “**ENTER**” to save the changes and to continue normal clock operation.

3.4.11 Date Adjustment



Use the “**RIGHT**” and “**LEFT**” arrow buttons to move the cursor and the “**UP**” and “**DOWN**” arrows to change the appropriate digit. Press “**ENTER**” to save the changes and to continue normal operation.

3.4.12 Solution Type



The instrument has stored calibration data for sucrose and black liquor solutions. These calibrations feature precise algorithmic calculations that optimize the accuracy of the instrument. Use the “**UP**” and “**DOWN**” buttons to select either of these applications. If a product other than these is desired, select either Custom Solution Solids or Custom Solution Specific Gravity and proceed to the Custom Calibration menu to set-up the appropriate calibration.

The stored data in the sucrose and black liquor calibration uses the ICUMSA table for temperature compensation through 40°C. Temperature compensation data above 40°C is extrapolated from the ICUMSA table and gathered data.

3.4.13 Read Delay



The read delay parameter controls the amount of time before a sample is actually measured after the “**Read**” button is pressed. This time can be adjusted depending on the accuracy desired and the temperature differential between the sample and the sample chamber and allows for more consistent results of sample measurements. The arrow buttons are used to change the digits to the desired time in seconds.

3.4.14 Sample Time



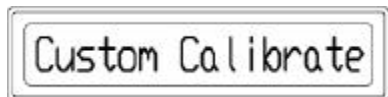
The sample time controls the time interval in which a sample is read after the “**READ**” button is pressed. This setting effectively determines the number of readings taken before averaging and displaying the measured value. The time can be selected from 2,5,10, or 20 seconds.

3.4.15 Black Liquor Scale Factor



The black liquor scale factor menu is to be used when the black liquor solution type has been selected and allows the user to adjust the scale of the factory stored black liquor calibration data. This should be used to compensate for the slight deviations from industry standards that exist due to small amounts of un-dissolved solids in a process. The appropriate scale factor is calculated by dividing the sample’s known value by the DSA E-Scan’s measurement reading of the same sample.

3.4.16 Custom Calibration



The custom calibration menu is used in conjunction with the custom solution selection of the solution type menu. This allows for an application other than black liquor or sucrose to be calibrated for and measured with the instrument. For maximum precision, the instrument should be connected to an external temperature-controlled coolant circulation source to help stabilize the sample chamber to a constant temperature (usually 20°C). Starting with the low sample, the liquid should be placed in the sample chamber and given an adequate amount of time for the temperature to stabilize. The value of the sample should then be entered using the arrow keys with the “**ENTER**” button saving the current reading to that value. The sample chamber should then be thoroughly cleaned before placing the next higher value sample in the sample chamber. This process is repeated for all samples in the desired measurement range. To end the calibration table, a value of 0.00000 R.I. (or equivalent) should be entered after the highest sample has been entered. This tells the instrument that the preceding value is the last relevant point on the refractive index curve. It will accept 0.00000 on first sample.

3.4.17 Custom Temperature Compensation



This parameter is to be used when a custom solution type is selected and allows an application other than black liquor or sucrose to be compensated for throughout the desired temperature range. A value of refractive index change per degree C of the solution to be measure should be entered. The DSA E-Scan corrects the measured readings based on the sample's temperature and the value entered.

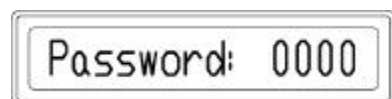
3.4.18 Test Mode



The test mode allows a variety of operating parameters to be viewed to allow easier troubleshooting and diagnosis. Using the **“UP”** and **“DOWN”** arrows allows scrolling between these parameters. A brief explanation is below for the various displays:

- Vtemp Voltage received from the temperature thermistor
- Vled Voltage being applied to the LED light source used in the optical assembly
- +24V Voltage of the 24V power source used for the sample chamber heater
- +8V Voltage of the 8V power source used to drive the display backlight
- +3.3V Voltage of the 3.3V power source used to power some integrated circuits
- Vcc Voltage of the 5V power source used to power some integrated circuits
- +5.0V Pre-regulated 5V source
- Pdark Average level of defined dark pixels detected on the linear array CCD array
- Pmin Average level of minimum CCD output pixels detecting light on the CCD array
- Pmax Average level of maximum CCD output pixels detecting light on the CCD array
- Heat% Current percentage of heater output being applied to the sample chamber
- sw rev. Software revision currently loaded into the instrument
-

3.4.19 Password Entry



To access calibration, temperature compensation, heater PID, and initialization selections, a password must be correctly entered. Digits can be changed using the **“UP”** and **“DOWN”** arrows and the **“LEFT”** and **“RIGHT”** arrow keys to move the cursor. **“Accepted”** will appear after pressing **“ENTER”** with the correct password. The remaining menus can then be accessed using the **“UP”** arrow key. If an incorrect password is entered, **“Denied”** will be briefly displayed and the instrument will return to the Heater Control menu.

3.5 External Communications

The DSA E-Scan is equipped with standard features that allow the instrument to be integrated into a process control environment. These features are accessed via dual serial communication ports as well as through a parallel port and allow the instrument to print reports of samples read at specific times and dates as well as communicate with external computers. An external computer communicating with the instrument can view and adjust operating parameters as well as record sample measurement data. Refer to the Installation section for more information on connecting to these ports.

NOTE: This portion of the manual is written assuming a certain level of computer knowledge is known. If you have questions regarding external communications that are not addressed in this manual please contact the Technical Services department as described in the Servicing section.

3.5.1 Serial Ports

The two serial port connections are located on the electronics card at J5 and J1. Comm 1 uses the J5 connector and operates in conjunction with the “SEND” button to transmit a sample reading to a serial receiver such as a dumb terminal or serial printer. Comm 2 uses the J1 connector and is used for communication with an external computer. Through Comm 2 the operating parameters of the instrument can be viewed and adjusted as well as recording of sample measurement data.

3.5.1.1 Comm 1

When the “**SEND**” button is pressed, the DSA E-Scan transmits date, time, measurement reading, and temperature data through the Comm 1 serial port. The following is a sample illustrating the format used:

```
01/10/02 15:24:02  
BRIX = 01.37  
TEMP = 26.6C 079.9F
```

3.5.1.2 Comm 2

The Comm 2 serial port is used for communication with an external computer. This port is configured to receive at all times when the DSA E-Scan is on and will transmit requested information when prompted to with the appropriate command. The following list shows the defined serial commands that can be used with the DSA E-Scan.

NOTE: Information typed in THIS FONT STYLE represents a command that is to be used as shown to evoke the response described.

Transmit commands- use the following commands to instruct the DSA E-Scan to transmit the associated information to the external computer.

- >TCSM transmits current system measurement
- >TCST transmits current system temperature
- >TAML transmits current analog measurement low value
- >TAMH transmits current analog measurement high value
- >TATL transmits current analog temperature low value
- >TATH transmits current analog temperature high value
- >TMUN transmits current measurement units
- >THSP transmits current heater set-point
- >TCTC transmits current custom temperature compensation coefficient
- >TTIM transmits current system time
- >TDTE transmits current system date
- >TCAL transmits system calibration data
- >TCCL transmits custom calibration data
- >TSPC transmits single point offset data
- >TTCD transmits temperature compensation data
- >TSRT transmits current sample time
- >TSOL transmits current solution type
- >TTST transmits current test mode information
- >TPID transmits stored heater proportional/integral/derivative information
- >TCCD transmits CCD frame value
- >TTOS transmits stored temperature offset value
- >TSSN transmits serial number
- >TLVL transmits stored threshold level value

- >TPCA transmits stored PMAX compensation attenuation factor
- >TPCO transmits stored PMAX compensation offset factor

Receive commands- use the following commands immediately followed by an acceptable value to change the associated information from an external computer.

- >RAML followed by 1 . 23456 for R.I. and R.I. (TC) or 12 . 34 for Brix and Solids measurement units: receives analog measurement low value
- >RAMH followed by 1 . 23456 for R.I. and R.I. (TC) or 12 . 34 for Brix and Solids measurement units: receives analog measurement high value
- >RATL followed by 123 in °C: receives analog temperature low value
- >RATH followed by 123 in °C: receives analog temperature high value
- >RMUN followed by 0 for R.I., 1 for R.I. (TC), 2 for Brix, and 3 for Solids: receives measurement units
- >RHSP followed by 123 and C or F: receives heater set-point value
- >RCTC followed by 1 . 23 in °C: receives custom temperature compensation coefficient
- >RTIM followed by 12 : 34 in 24 hour format: receives time information
- >RDTE followed by 12 / 31 / 56 in Month/Day/Year format: receives date information
- >RSRT followed by 0 for 2 seconds, 1 for 5 seconds, 2 for 10 seconds, and 3 for 20 seconds: receives sample time value
- >RSOL followed by 0 for sucrose, 1 for black liquor, and 2 for custom: receives solution type information
- >RTOS followed by 123 in °C: receives temperature offset value
- >RLVL followed by 1234: receives threshold level value
- >RPCA followed by 1234: receives PMAX attenuation factor for un-dissolved solids compensation
- >RPCO followed by 1234: receives PMAX offset factor for un-dissolved solids compensation

Start commands- use of the following commands start the applicable procedures.

- >SSPC starts single-point calibration procedure
- >SCCL starts custom calibration procedure
- >SSCL starts standard calibration procedure
- >SSTC starts system temperature calibration procedure

NOTE: >SSCL and >SSTC commands will erase the stored calibration and temperature data. Only use these commands if you intend to re-calibrate and temperature compensate the instrument.

3.5.2 Parallel Port

When the “**SEND**” button is pressed, the DSA E-Scan transmits date, time, measurement reading, and temperature data through the parallel port. The following is a sample illustrating the format used.

```
01/10/02 15:24:02  
BRIX = 01.37  
TEMP = 26.6C 079.9F
```

A form feed signal is sent after 15 transmissions. Thus, the printer will only print the information after the “**SEND**” button has been pressed 15 consecutive times. Then, all 15 transmissions will be printed on a single sheet of paper. For the printer to print the sent information sooner than that, the form feed button on the printer will need to be pressed. Refer to your printer’s manual for more information on form feeding.

- NOTES -

4. Servicing

4.1 Warranty

The Electron Machine Corporation warrants that the equipment manufactured by EMC is free of defects in material and workmanship. Should such fault appear within one year of date of shipment from our factory, the Electron Machine Corporation will repair or replace the defective part upon its prepaid return to Umatilla, Florida USA. (This warranty does not apply to equipment which has been tampered with or abused).

The DSA is not to be used as the only measurement device for process control. It is not a substitute for a controlled environment certified laboratory measurement. It should only be used as a fast/easy supplement to laboratory readings.

4.2 Return of Defective Parts

No return authorization is necessary. Pack defective parts carefully to avoid damage in transit. The shipper will be liable if, in the opinion of the carrier, insufficient packing was used. Attach a letter stating the nature of the difficulty encountered, the reason for failure (if known), the date of delivery of original equipment, and the approximate number of hours of operation.

Please include model number and serial number in all correspondence.

All return shipments must be prepaid and addressed to:

**Electron Machine Corporation
15824 CR 450 West
Umatilla, FL 32784
USA**

4.3 Technical Assistance

For technical assistance please contact the service department:

**Technical Services
Electron Machine Corporation
P O Box 2349
Umatilla, FL 32784-2349
service@electronmachine.com
(352) 669-3101
(352) 669-1373 fax**

4.4 Preventive Maintenance

The DSA E-Scan requires very little maintenance, but should be checked periodically for proper calibration. The most important factor in maintaining accuracy is the cleanliness of the sample chamber and the surrounding surfaces.

- NOTES -