# MPR E-SCAN

# MICROPROCESSOR REFRACTOMETER

# OPERATING AND SERVICE MANUAL

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# MPR E-Scan

## Introduction

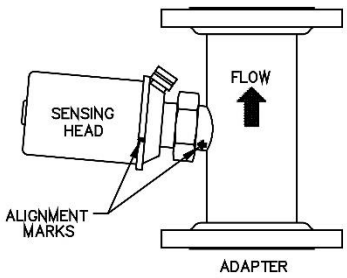
The MPR E-Scan is a microprocessor driven critical angle refractometer. It is used to measure the refractive index of process fluids which directly correlate with customer request for dissolved solids, Brix or other meaningful measurement. The E-Scan may be used as an error indicator or an integral part of a complete process control system.

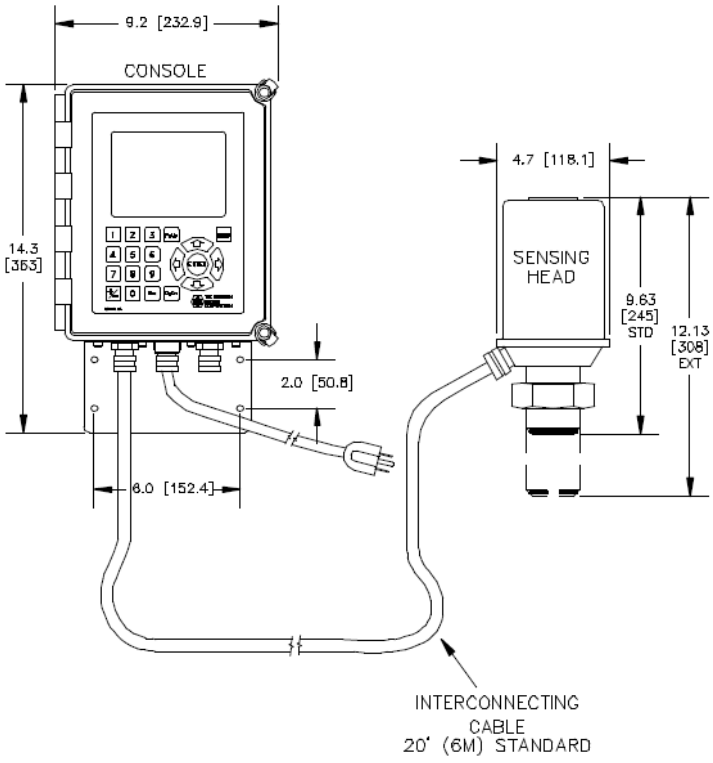
The MPR E-Scan is equipped with a broad range of diagnostics to aid in fault isolation without the use of special test equipment. The instrument is calibrated before leaving the factory and should not need recalibration unless some modification is made to the sensing head. Calibration procedures are available to change system parameters and allow the refractometer to measure different process fluids.

Extensive literature is available for various industries listing the correlation between refractive index, degrees Brix, or % solids and specific process parameters.

The MPR E-Scan consists of:

- **Console**
- **Interconnecting Cable**
- **Sensing Head**
- **Pipeline Adapter**



# 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**.

## CAUTION

**When removing the sensing head from an operating line, *do not assume that the line is empty or that the isolation or bypass means is working properly*. If an EMC isolation valve is used, be sure its travel is not limited by any external attachments or other interference and that the valve is closed tightly. No pressure should be felt on the head as the mounting nut is being removed.**

**ANY PRESSURE FELT WHEN THE NUT IS LOOSENED MUST BE INVESTIGATED BEFORE PROCEEDING. Steam should be turned off before attempting to remove the head if clean purge equipped.**

**Use facility approved and mandated PPE, as well as protective clothing.**

**Stand to the side when removing the sensing head.**

**Clean all process liquid residue from the spud-piece on the adapter prior to re-insertion of sensing head. Check to ensure the old O-ring has been removed. The O-ring seal should be replaced before re-installation.**

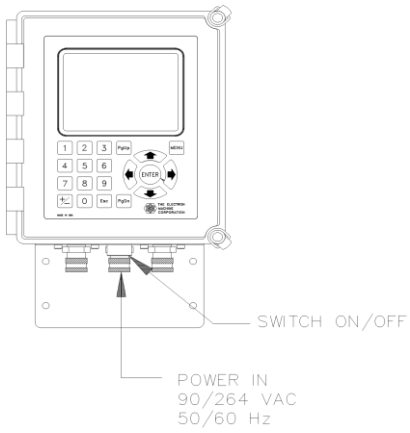
# Contents

# 1 MPR E-Scan Installation

## 1.1 Site Selection

The E-Scan console must be mounted in a non-hazardous "safe" environment where ambient conditions allow personnel to remain for extended periods. The cabinets are NEMA4X rated and should be kept closed. Do not mount or install the Console or the sensing head in a location that interferes with or impairs the use of disconnect equipment, instrument access panels or EMO controls of other equipment.

Environmental conditions of up to 2000m (6562 Feet) altitude, maximum relative humidity 80% for temperatures up to 50 degrees C (122 degrees F), decreasing linearly to 50%, and relative humidity at 40 degrees C (104 degrees F). Pollution Degree 3 is recommended for the normal operation of the MPR E-Scan I/S Console and Barrier Box, the Sensing Head is capable of normal operations at Pollution Degree 3. All values indicated have a tolerance of +/-10%. The MPR E-Scan can be used in outdoor conditions. An optional VORTEX Cooler is offered by EMC for cabinets housing MPR E-Scan Consoles.




The MPR E-Scan console must be secured to prevent unauthorized personnel from accessing the consoles interior. Optional console door latches are available for installation; however, the responsibility of securing these latches with a padlock or other safety lock are the responsibility of the end user. Additionally, the mounting of the MPR E-Scan console should be made to a strong wall surface. In the event the mounting of the console should be on gypsum board/sheetrock/drywall, Electron Machine Corporation recommends first mounting a plywood backer panel, securing the plywood to the wall's underlying studs or support structure; then mounting the console to the plywood. Electron Machine offers an optional mounting bracket set for additional support to the top of the console.

Protective earthing must be made between the MPR E-Scan console's mounting bracket and earth ground. This can be achieved by securing a ground strap from the mounting bracket to an earth ground lug or post nearby.

## 1.2 Power Requirements

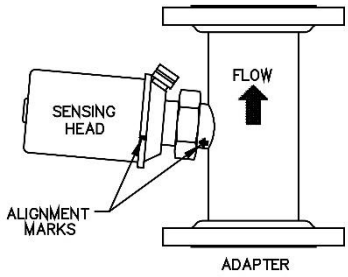
The A.C. power should be supplied from a line which is not subjected to power interruptions or heavy inductive loads. The power supply used by the MPR E-Scan is self-switching and can accept the following power inputs. A.C. power can be 90-264 VAC at 50 or 60 Hertz, 2.0A. The label on the console concerning AC power simplifies power to 100-240 VAC at 50 or 60 Hz, 2.0A which is most standard.

## 1.3 Installation of Sensing Heads

**NOTE: Prior to shipment of an MPR E-Scan system, each sensing head is matched to the specific console and factory calibrated**. DO NOT ATTEMPT TO CALIBRATE!

The sensing heads are attached to the process line by custom pipeline/tank adapters, with a minimum of three times the diameter of the line in which the sensing heads are to be installed, from any elbow, bend, injection point or valve.

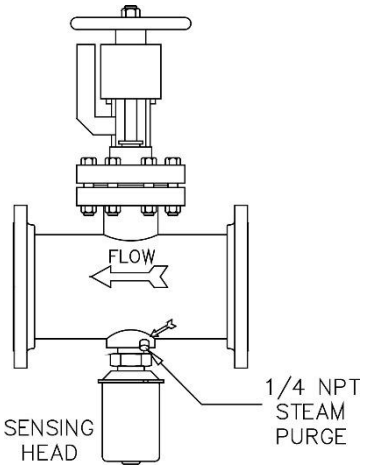
The adapter can be carbon steel, stainless steel (316) or a material specified by the customer.




This adapter must not be placed in an area where vibration is severe or excessive.

If the sensing head is to be mounted on a vertical pipe, the fluid flow should be upward. The arrow on the adapter should point in the direction of fluid flow. (See Head to Adapter Positioning.) The probe end of the sensing head has a groove for an interface O-ring.

**NOTE: The adapter should be oriented to place the sensing head in a horizontal plane to assure that deposit buildup and air pocket/foam creation will be minimal.**




**This O-ring must be in place prior to installing the head into the adapter to prevent the process fluid from leaking out.**

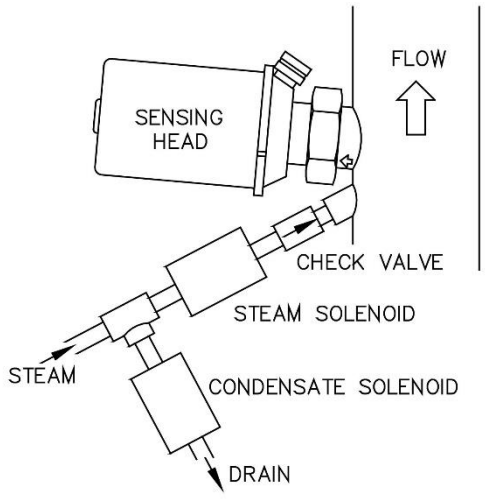
The head is attached to the adapter by a 2-inch sanitary nut.

The sensing head houses optical components, which are susceptible to the effects of moisture. The cover is moisture proof and contains a small amount of desiccant to absorb any moisture remaining in the head after assembly.

**NOTE: The sensing head mounting nut should be tightened with a wrench, supplied by EMC, to a maximum of 50 FT-lbs of torque (68 Newton-Metre). Alignment marks are provided to ensure the thermistor probe will not be in a direct line with the steam blast. (See sensing head to adapter positioning illustration).**

## 1.4 Steam Purge Attachment

Steam Purge Attachment- for liquids which exhibit a tendency to "coat"




The steam purge valve must be similarly mounted to the adapter with a minimum of 6" and a maximum of 18" from the steam port on an adapter preferably with 1/4" tubing.

Steam pressure must be at least 50 psi (3.44 bar) above process pressure but no more than 175 psi max steam pressure with adequate condensation drainage at the steam valve in order to ensure hot

steam for cleaning the prism. Trial and error must, of necessity, be employed in determining the minimum steam time necessary for proper steam cleaning of the prism due to variables from application to application.

**NOTE: It is essential that NO LEAKS be present in this line that could allow evaporation of liquids, thereby plugging the purge line**.

**NOTE: To avoid excessive prism deterioration, keep the intervals between the purge times at maximum, which may vary from minutes to 120 minutes, and the prism clean time at a minimum of approximately 5 seconds. IMPORTANT: A major cause of refractometer trouble is the prism clean process.**

## 1.5 Cooling System Requirements

When supplied with a vortex cooler a clean and dry air supply of the proper pressure (approximately 90 PSI at 8 cubic ft/min.) is required. If equipped with the cooling fan option the console must be mounted in a controlled environment.

## 1.6 Start-Up

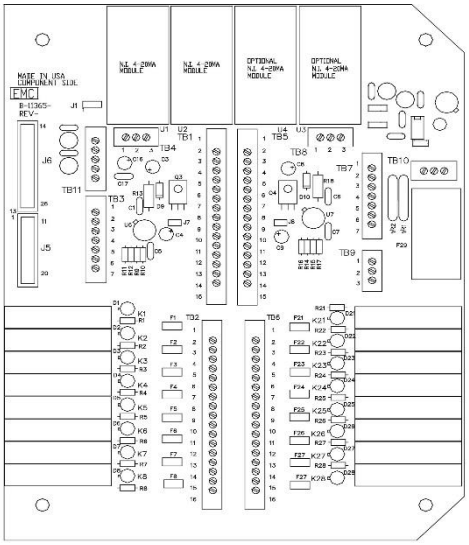
**Note: Important! Prior to shipment the sensing head is matched to the console and factory calibrated. DO NOT ATTEMPT TO RE-CALIBRATE**

Turn power ON. Allow sufficient time for the sensing head to stabilize at the process temperature. It is recommended that no adjustments be made for at least 15 minutes after start-up.

Compare the reading against a sample taken from the process line close to where the unit is installed and at the process operating temperature. If the sample does not equal the displayed reading, adjust the Analog Zero per the Operation/Calibration section.

# 2 Outputs

## 2.1 Analog Outputs



In addition to voltage outputs, the E-Scan also offers current outputs for the measurement and temperature (optional). The measurement is a standard output and temperature is an option. Output for these readings is a 4 to 20 mA signal that is referenced to ground (non-isolated) so that any device that is connected to these outputs must have a floating (or isolated) input. Isolated current output modules are available as an option.

The output for the measurement reading is found on TB 3 terminals 1 and 2. Terminal 1 is the positive output for both the isolated output option and the standard non isolated output module. The (optional) output for the temperature is located on TB 3 terminals 3 and 4, 3 being the positive output in this case.

The modules on the top of the interface board represent the output modules. The one on the left U1 is the output module for the measurement. U2 is the output module for the temperature. The other modules (U3 and U4) are for optional features and are explained in the optional addendums to this manual. It is an easy process to change from a non-isolated module to an isolated output module. You must first remove the power supply, then unplug the non-isolated module and replace it with the isolated module. The isolated modules are blue potted modules while the non-isolated modules are bare board modules. If a 0-10 voltage output is desired, then TB 4 terminal 1 is the measurement output and terminal 2 is the temperature output. Terminal 3 is the common for both outputs.

## 2.2 Relays

The MPR E-Scan can support up to 8 configurable relays. The typical setup includes 2 input relays, and 6 output relays. These relays are controlled by the integrated logic of the MPR E-Scan to serve such functions as prism clean, alarms, lightbars, horns, valves, etc.

The Interface Board (located in the console, and containing the relays), provides 120/240Vac power source via TB1 and TB5, terminals 14 and 15. Power ratings for these terminals are fused at 1.0A each.

# 3 MPR E-Scan Operation

**Note: This equipment is designed for continuous operation and is to be left on for extended periods of time.**

## 3.1 Operation Panel

The Operator's Panel or Front Panel consists of a display and a 20-button touch pad, which form the interface between the operator and the instrument. The display consists of a 640 x 480 pixel LCD screen, which provides the operator with various messages. The 20-button touch pad allows the operator to make entries and execute commands.


The three basic types of messages displayed are:

**Variable:**

These information lines contain either set points that may be altered by the operator, or measurement variables that are updated by the CPU.

**Alternate Action:**

Works much like a two-position switch and is used to select various menu options. The operator is able to alternate between two states, such as ON and OFF.

**Error Display:**

Flashes continuously to attract operator's attention to an error condition.

## 3..1 Button Touch Pad Function Chart

Scrolls cursor horizontally to the left and also used to initiate editing of calibration voltages in the calibration table, and temperature values in the compensation table.

Scrolls cursor horizontally to the right and also used to initiate editing of all system parameters excluding those accessed by the LEFT ARROW.

Scrolls cursor vertically in the "Up" direction.

Scrolls cursor vertically in the "Down" direction.

| | |
|---|---|
| ENTER | Used to select all cursor items and to save edited data. |
| Esc | Used to abort to previous operation without saving edited data. |
| Menu | Used to immediately display the normal mode of operation without saving information or main menu selections if already in normal mode. |
| PgUp | Displays previous screen of information or mode of operation and is applicable when indicated on the screen. |
| PgDn | Displays next screen of information or mode of operation and is applicable when indicated on the screen. |
| + / – | Allows data fields to be either positive or negative. Also used to create calibration table end, to toggle diagnostic options, and to record sample readings used for Analog Zero adjustment. |
| 0 – 9 | Numeric characters used to input data. |

## 3..2 Measurement Signal Graphing for the MPR E-Scan


Graph Mode Screen

The MPR E-Scan offers a graphical mode display, which can be accessed from the normal mode of operation via the PgDn button on the front panel switch matrix. PgUp will then return to the normal mode display. The graphical mode display comes equipped with all the essential information including the current product, error status, and measurement reading, in addition to the graph span and time.

The graph span limits are derived from the analog low and high limits in calibration and are drawn on the display at the top and bottom of the graph area as dotted lines.

The graph time can range from 5 minutes to 9999 minutes and can be accessed via the ➡ button on the front panel switch matrix.

The calibration alarm limits are also displayed graphically within the graph area and are drawn as red dashed lines to differentiate them from the graph span limits. The alarm limit lines are drawn 20 pixels apart horizontally, which gives the added feature of breaking the graph time into 20 equal parts. Thus, if the graph time were 20 hours, each alarm limit segment would represent 1 hour.

Finally, the measurement signal itself is drawn in the graph area and can be recognized as a single continuous stream of information that is 2 pixels thick. The measurement graph offers a high-quality display with 574 pixels of horizontal and 295 pixels of vertical resolution.

## 3.2 Normal Mode

### 3..3 What Normal Mode Does

In normal mode the system displays the following information:

System status indicators:

- System Status Indicators
- Name of the current product being measured along with an associated unit number.
- Software version number.
- Current time and date.
- On-line SOLIDS measurement.
- On-line temperature in Degrees Fahrenheit and Centigrade.
- Alarm points for measurement.
- Error status for system measurement, communication, and voltage levels.
- Graphics menu to allow access to other MPR E-Scan system features.

**Note: In normal mode set points cannot be changed or adjustments made.**

### 3..4 System Indicators

**C** Isolation valve is closed. The MPR E-Scan will not initiate a prism clean.

**T** Below minimum purge temp setting. No prism clean allowed.

**H** Measurement Hold. Current readings and analog outputs are maintained until complete. Indicates a cleaning cycle is in progress by a purge message, as well as a current measurement voltage display while in normal mode.

**P** Purge failed. This means the previous purge cycle did not properly clean the prism.

**O** Measurement over range. Current reading above last calibration point for MPR E-Scan in the calibration table.

**U** Measurement under range. Current reading below first calibration point for MPR E-Scan in the calibration table.

**S** Measurement sample reading has been recorded as the reference for Analog Zero adjustment.

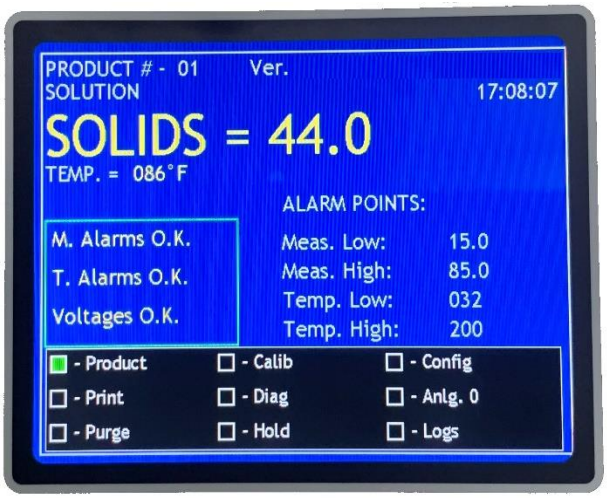
## 3..5 The Menu Options in Normal Mode

Normal mode is entered by default, upon power up. To gain access to other system features select the MENU button on the Front Panel Touch Pad.

**Note: The screen names and set points below are just an example, they will vary from application to application**.

When the **MENU** button is selected, six menu options are displayed on the normal mode screen:

### 3..5.1 Overview of Menu Options




1. **PRODUCT** option allows the operator to select a product from a list of previously calibrated products. When a new product is chosen, all operating parameters are automatically loaded so that the E Scan can immediately be ready to measure the "new" product selected. This menu option also allows the operator to enter actual product names which are attached to associated product numbers. In addition, this option enables the operator to create new products by storing product information into unused product numbers.

2. **CALIB -** option allows the operator to enter calibration set points. This consists of calibration limits, and analog zero adjustment. Since a complete calibration is performed in advance by EMC, it would be a rare condition for the operator to access calibration measurement. However, system limits may be changed more frequently if the operator chooses to change the alarm limits, analog output limits, alarm delays, purge cycle information, or other limits. An analog zero adjustment is provided to "zero in" the instrument to match lab samples or reach a target measurement if needed.

3. **CONFIG -** option allows the operator to configure the E-Scan to perform various functions. Such configurations would include: purge/hold interface, smart cleaning, measurement and temperature alarms, 232 output and associated baud rates, measurement title, and displayed reading decimal format. Other options are selected in advance by EMC and would not normally be changed by the operator. Thus, access to system configurations is gained only by entering a correct password.

**4. PRINT -** option allows the operator to print all system calibration and configuration settings.

**5. DIAG -** option provides the operator with data that can be used to test and troubleshoot system problems. The operator can display all voltages from the sensing head, test relays on the interface board, output min., mid., and max., analog data to test and calibrate analog output, and enter system time and date in cases of battery failure.

**6. Anlg. 0:** option allows the operator direct access to the analog zero adjustment which is used to correct for any shifts in the measurement voltage. After calibration and before compensation, an analog zero adjustment may be needed to "zero in" the measurement reading due to measurement voltage shifts that could occur when going from room temperature to the process base temperature used for the temperature compensation run. Analog zero adjustment may also be needed after installation to make instrument readings agree with normal testing methods.

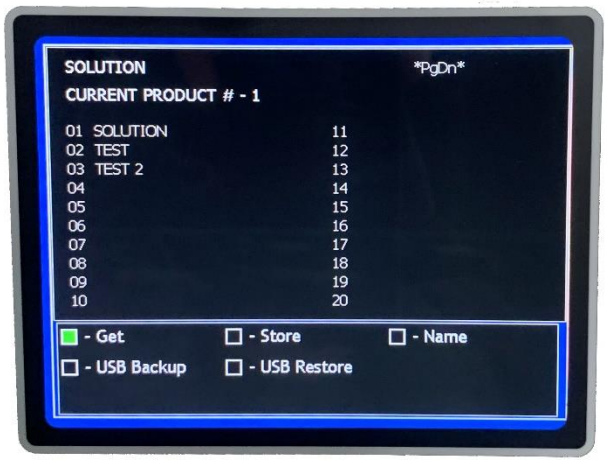
**7. PURGE**: option allows the operator to initiate a purge from normal mode in addition to the automatic purge cycle timing setup in calibration limits. The purge function cleans the sensing head prism and since configured for intelligent cleaning will automatically start another purge cycle if the previous purge was unsuccessful. Purge can be aborted using the Front Panel ESC button.

**8. HOLD:** option allows the operator to initiate a hold condition from normal mode, which will freeze system information. This freezes both displayed readings as well as analog output. Hold can be aborted using the Front Panel ESC button.

**9. LOGS:** Option allows the operator to view historical data pertaining to system errors and warnings, purge logs, clear logs, and export.

## 3..6 Product Selection

The product selection menu contains five menu options:




**1. Get** - This option allows the operator to choose a specific product, provided this product has been previously calibrated and configured for on demand use.

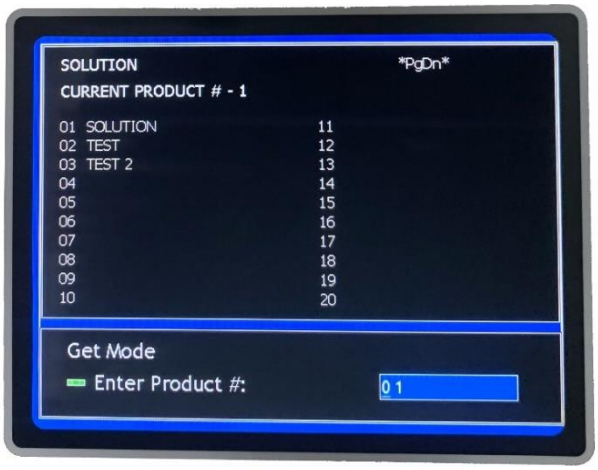
**2. Store**. - This option allows the operator to create a new product by selecting a product number that will be the destination for the current product calibration and configuration information.

**3. Name** – This option allows the operator to store a name for the product.

**4. USB Backup** – Backup to USB for EMC technician use.

**5. USB Restore** – Restores previously stored product from USB for EMC technician use.

### 3..6.1 Product Get Selection




Using the Front Panel buttons the operator can enter a product number and then "**Get**" that product.

The operator can only "**Get**" products that are available which are identified by a product name.

### 3..6.2 Product Store Selection


The product menu options have been replaced by the **"Store Mode"** and **"Enter Product #:"** messages.

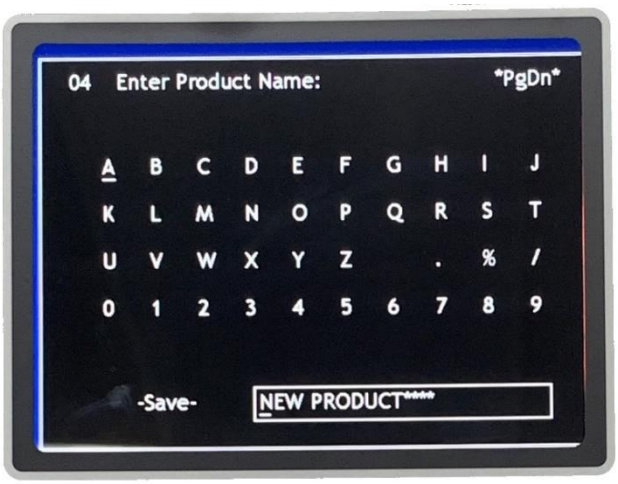
Using the Front Panel buttons, the operator can select a product number that will be the destination of the current calibration and configuration. In this example, all of product 01 information will be copied to product 04 thus creating a new product.

### 3..6.3 Product Store Name

The next step would be to assign a meaningful name to the newly created product which can be accomplished by selecting the third product menu option, "**Name**".

**Name Mode Alphabet Screen**

This is the product name mode alphabet menu. It displays the current product selected in the upper left corner, the alphabetic characters available for assigning a product name in the center, and the product name at the bottom which is updated as characters are selected.

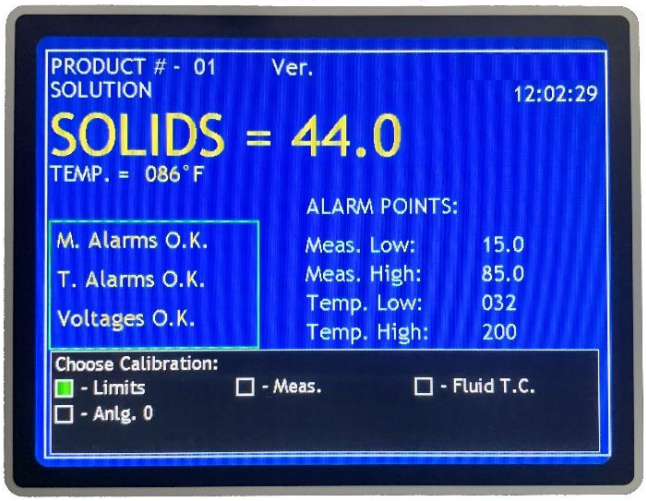



Using the Front Panel **ARROWS** and the **ENTER** button a product name can be selected and then saved. The "**PgDn**" and "**PgUp**" messages at the top right indicate the status of the editing mode. Toggling between these modes allows the operator to move the edit cursor to a desired position either in the alphabet or the product name. When the **"-Save-"** option is selected the product name is saved.

**Note:** Up to 99 products are available. The operator can use the **"PgDn"** and **"PgUp"** buttons to view a set of 20 products per page.

## 3..7 Calibration Menu Selection

The calibration menu contains four menu options:



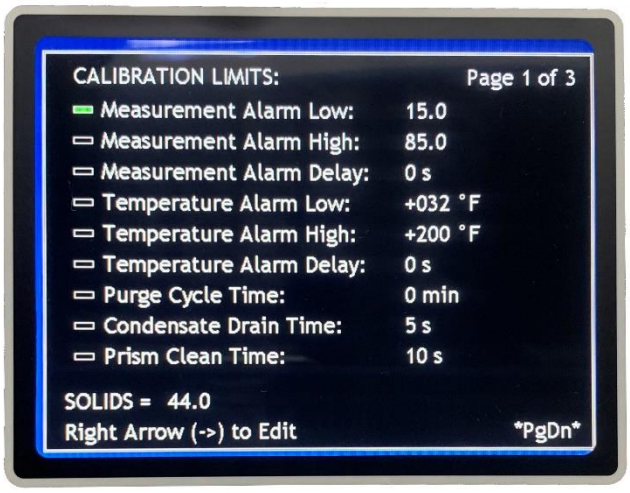

**1. Limits** - This option contains the system limits for alarms, divert point, purge cycle, analog output and filter weight.

**2. Meas**. - This option allows entry to the calibration measurement routine. This is used to calibrate the process measurement so that a linear interpolation can be made to get the Refractive Index based on the current measurement voltage.

**3.Fluid T.C.**- This option allows entry to the calibration temperature compensation routines. This is used to compensate the process measurement changes that are caused by temperature changes.

**4. Anlg. 0 (Analog Zero)** - This option is used to adjust or "zero in" or fine adjust the instrument to match a target value.

### 3..7.1 Calibration Limits Screen




The calibration limits screen contains three pages of options. Press the PgUp or PgDn buttons on the keypad to switch between these pages. Using the Front Panel buttons, the operator can highlight and then select the specified calibration menu options. Selecting the "**Limits**" menu option would generate the shown display:

Using the Front Panel arrow buttons, the operator can scroll through and edit selected system limits. In this example, Measurement Alarm Low can now be changed using the **RIGHT ARROW** button.

**Measurement Alarm Low:** If the measurement falls below this limit, a system alarm is activated. An error message will appear in the status window in normal mode, and the low measurement alarm relay will be turned on.

**Measurement Alarm High:** If the measurement exceeds this limit, a system alarm is activated. An error message will appear in the status window in normal mode, and the high measurement alarm relay will be turned on.

**Measurement Alarm Delay:** (0-1) This is the alarm delay time in seconds for the process measurement that must expire while a limit is exceeded before an error is activated.

**Temperature Alarm Low:** If the temperature falls below this limit, a system alarm is activated. An error message will appear in the status window in normal mode, and the low temperature alarm relay will be turned on.

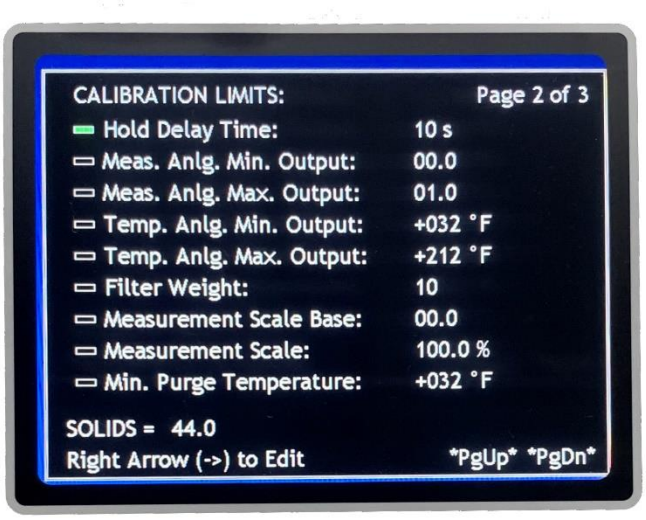
**Temperature Alarm High:** If the temperature exceeds this limit, a system alarm is activated. An error message will appear in the status window in normal mode, and the high temperature alarm relay will be turned on.

**Temperature Alarm Delay:** This is the alarm delay time in seconds for the process temperature that must expire while a limit is exceeded before an error is activated.

**Purge Cycle Time:** (0-120 min) This is the time interval in minutes between automatic purging. During purging, all system readings and analog outputs are frozen. A "0" setting disables automatic purging.

**Condensate Drain Time:** (0-30 Sec) When the purge cycle is activated, this is the time in seconds that elapse before a prism clean occurs. During this time the condensate drain relay is activated and condensation is allowed to drain before steam cleaning.

**Prism Clean Time:** (0-30 Sec) This is the time in seconds during which cleaning of the prism occurs and the prism clean relay is activated.




**Hold Delay Time:** (1-30 Sec) This is the time in seconds that elapse after a prism clean occurs. This time allows a delay to occur before resuming normal process measurement. Readings are held constant during the period.

**Meas. Anlg. Min. Output:** This is the minimum measurement reading that will produce a 4 ma or 0-volt output.

**Meas. Anlg. Max. Output:** This is the maximum measurement reading that will produce a 20 ma or 10-volt output.

**Temp. Anlg. Min. Output:** This is the minimum temp reading that will produce a 4 ma or 0-volt output.

**Temp. Anlg. Max. Output:** This is the maximum temp reading that will produce a 20 ma or 10-volt output.

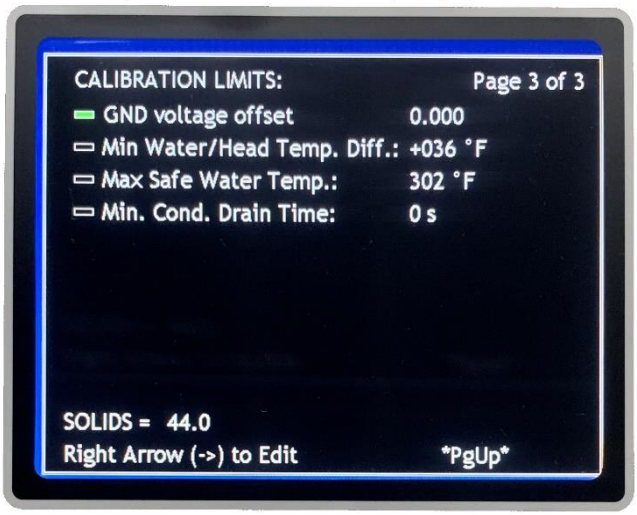
**Filter Weight:** (0-20, Standard 10) This is a value that controls system response time to process measurement changes. The larger the value the slower the response time. The filter weight divided by 10 will give approximate response time in seconds to achieve 63% output of a step input change.

**Measurement Scale Base:** This is a base value for the measurement scale. If set to zero, the measurement will be scaled from the calibration table or else from the given base.

**Measurement Scale:** This is a scale for the process measurement that allows fine tuning so that the reading can be adjusted to match lab samples. The default is 100%. The formula for scaling is as follows: **NEW MEAS = (((Current Meas. - Base) * Scale) + Base)**

**Min. Purge Temperature:** This value determines the point below which a steam purge will not be allowed.

**Note: These following min/max calibration limits require optional hardware and enabling High Temp Cond. Drain**.



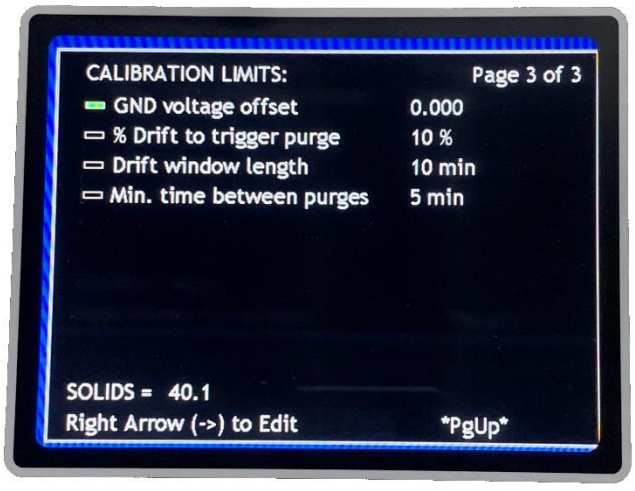

**GND voltage offset:** This value adjusts the reference voltage for the Temperature output.

**Min Water/Head Temp. Diff.:** This is the minimum difference between process temperature and purge water temperature required to switch from drain cycle to purge cycle. This will trigger a visual alarm and relay when purge water temp does not reach target at end of condensate drain time.

**Max Safe Water Temp.:** This will trigger a visual alarm and relay when purge water temp goes above.

**Min. Cond. Drain Time:** When the purge cycle is activated, this is the time in seconds that elapse before meeting Min Water/Head Temp. Diff. During this time the condensate drain relay is activated and condensation is allowed to drain before prism wash.

**Note: These following calibration limits require enabling Drift based purge**

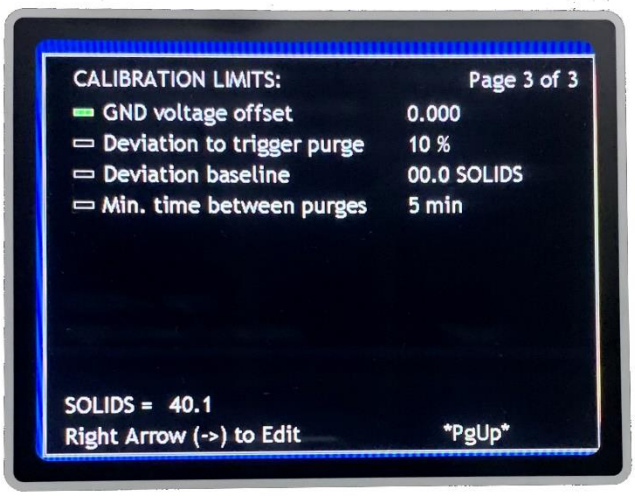



**% Drift to trigger purge:** This option triggers the purge function based upon % drift from the nominal or mean measurement value

**Drift window length:** This option allows the drift duration to be set for the % Drift to trigger purge function.

**Min. time between purges:** This option sets the minimum time for purge to take place regardless of % Drift or Drift Window Length.

**Note: These following calibration limits require enabling Deviation-triggered purge.**



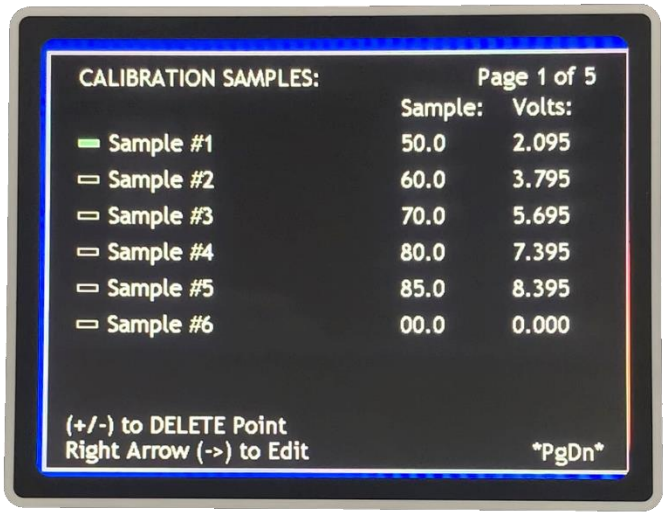

**Deviation to trigger purge:** This option triggers the purge function based upon deviation from the baseline value.

**Deviation baseline:** This option establishes the baseline from which the deviation trigger activates the purge function.

**Min. time between purges:** This option sets the minimum time for purge to take place regardless of deviation.

### 3..7.2 Calibration Measurement Selection

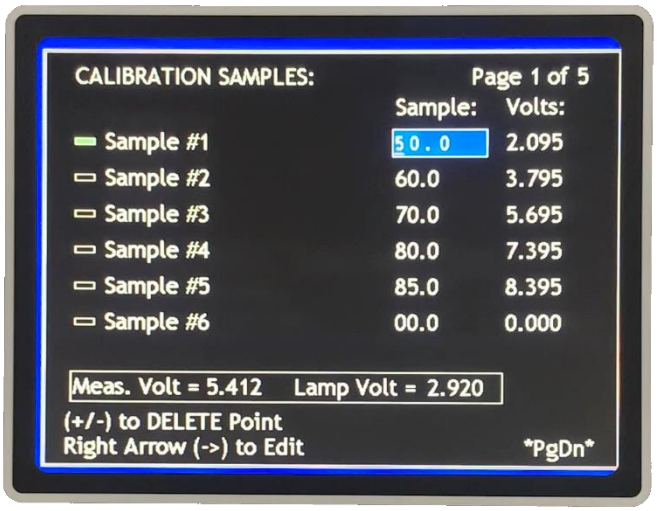
**Selecting the "Meas." option from the calibration menu results in the following display:**




The calibration measurement table is created when you place actual solution samples to be measured on the sensing head and then save the desired measurement reading for that sample along with the current measurement voltage. This table is graphically equivalent to approximating a measurement curve with a series of straight lines. Calibration data is only entered here during factory setup or exchanging the sensor in the field. **ONLY ENTER DATA IN THESE FIELDS AT THE GUIDANCE OF QUALIFIED PERSONNEL.**

Use the **RIGHT ARROW** button on the Front Panel to edit the sample value and **ENTER** to capture the measurement voltage. To give the operator more flexibility, the voltages can also be edited by using the **LEFT ARROW** button. Select the **ENTER** button to permanently save calibration.

Calibration Sample Example Screen



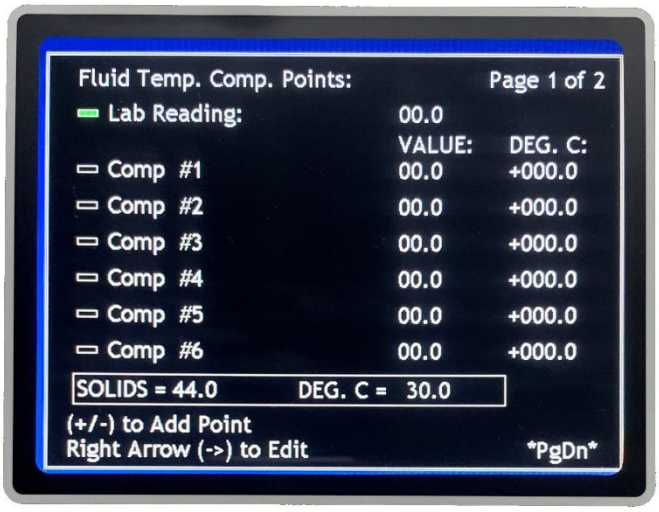

**Example: what is displayed while calibrating Sample #1 shown:**

At this point, sample #1 should be on the sensing head, and a sample value should be entered. When the **ENTER** button is selected, the measurement voltage displayed at the bottom is put in the table as the measurement voltage for the current sample. This measurement voltage is a raw voltage without analog 0 or temperature compensation adjustment.

**Note: Calibration cup required, contact EMC for part # and additional directives on process.**

### 3..7.3 Calibration Fluid T.C. Selection

**Selecting the "Fluid T.C." option from the calibration menu results in the following display:**




(Circulation bath with temperature adjustment and pump is needed for temperature compensation.)

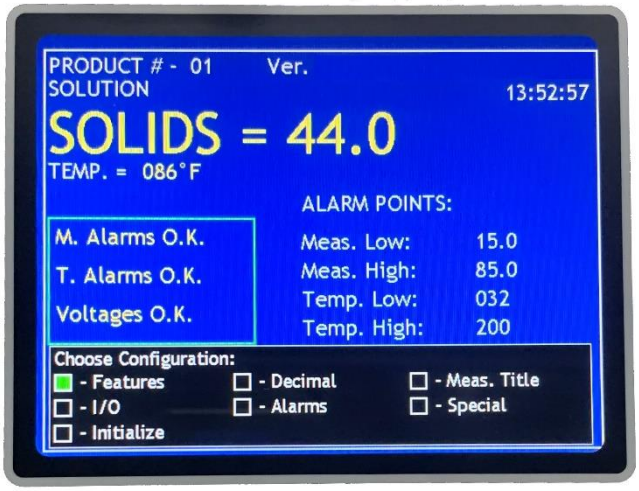
This is the temperature compensation table. The "**VALUE**" column represents the compensation values, and the "**DEG. C**" column represents the temperatures at which those compensations occurred.

Using the Front Panel buttons, both columns of data can be edited and saved. Since these values are generated by an actual temperature run, **any changes made should be done with extreme caution, and with the guidance of qualified personnel.**

### 3..7.4 Calibration Analog 0 Selection

The final option of the calibration menu is "Anlg. 0". See section 3.5.7 for details on this process.

## 3..8 Configuration Menu Display




**1. Features** - This contains system feature options that can be configured by the operator such as purge/hold and smart cleaning.

**2. Decimal** - This option allows the measurement readout to be displayed in various resolutions by selecting a decimal place format.

**3. Meas. Title -** This option allows the operator to assign a meaningful title to the measurement readout such as **Brix, Solids, R.I., Scale ...**

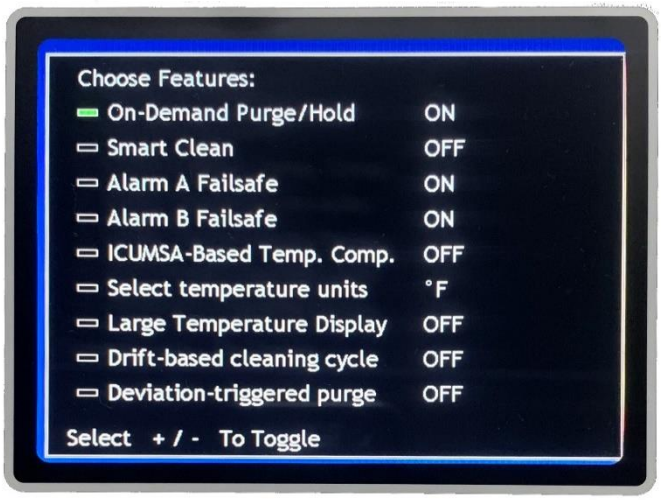
**4. I/O** - This option is used to configure all RS-232 / 422 communications.

**5. Alarms** - This allows the operator to choose the type of alarms for both measurement and temperature readings such as High/Low, Low/Low, or High/High.

**6. Special** - This option allows custom features to be added to the standard system features and is password protected for EMC technician access only.

**7. Initialize –** This is used for system initialization and is password protected for EMC technician access only.

### 3..8.1 Configuration Features Selection




The first configuration option, "**Features"** activates the following display:

**On-Demand Purge/Hold:** allows the system to work with a purge interface and also allows all readings to be frozen or placed on hold. Both menu options can be selected from normal mode. The purge option can also be activated by the automatic purging cycle defined by the purge cycle time in the system limits calibration.

Either the purge or hold option can also be activated remotely by the configuration of a system input. EMC must be notified in all cases that require custom configuration.

**Smart Clean:** option activates an intelligent prism clean process. This will cause the system to automatically initiate another cleaning cycle if the previous cleaning was unsuccessful. After three unsuccessful attempts, purging will be aborted, and a **"P"** system indicator will appear in the normal mode display.

**Alarm A and Alarm B Fail-safes:** invert the standard relay configuration. Thus, the relay will be activated during normal operation and deactivated in the event of an alarm or loss of power condition.

**ICUMSA-Based Temp. Comp.:** International Commission for Uniform Methods of Sugar Analysis table overrides the custom temperature compensation achieved in the Electron Machine Corporation test laboratory for each specific Sensing Head.

**Select Temperature units:** This feature allows selection of Fahrenheit or Celsius

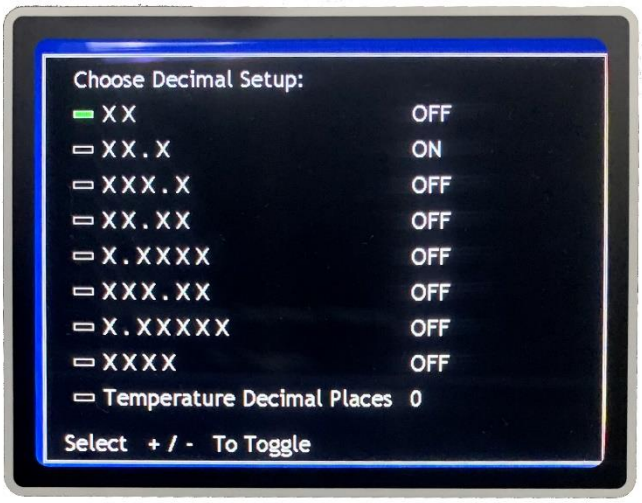
**Large Temperature Display:** This option defines the size of the font displaying temperature

**Drift-based cleaning cycle:** This option triggers the purge function based upon drift criteria from the nominal or mean measurement value

**Deviation-triggered purge:** This option triggers the purge function based upon deviation criteria from the nominal or mean measurement value

### 3..8.2 Configuration Decimal Selection

The next available configuration menu option "**Decimal"** activates the following display:



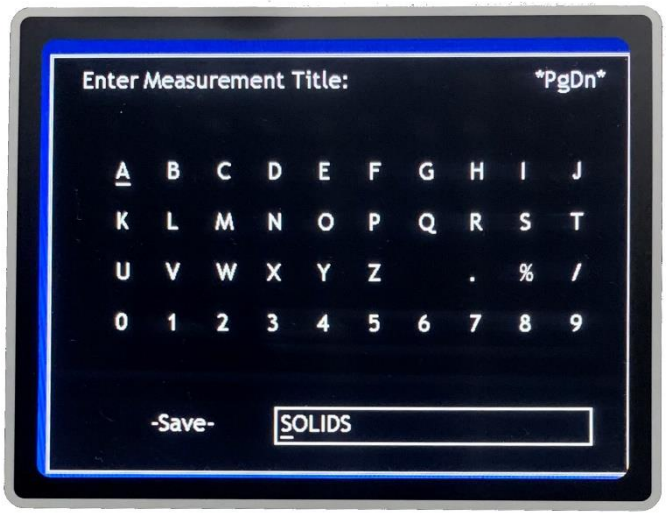

The decimal place option allows the operator to configure various measurement readout formats. When selected, all measurement readings as well as calibration limits will reflect the chosen format. The format chosen will depend on the resolution desired by the operator.

**NOTE:** The decimal format affects displayed readings only. Maximum resolution is still maintained internally for accurate output.

### 3..8.3 Configuration Meas. Title Selection

Choosing the **"Meas. Title"** configuration option will activate the following display:

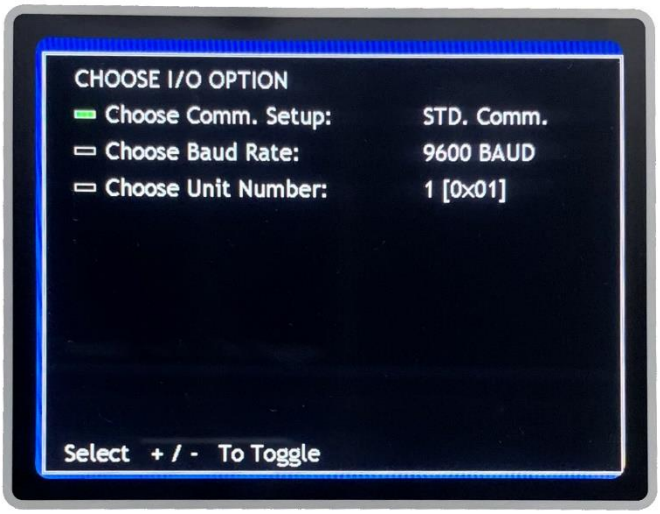
This is the measurement title alphabet menu. It displays the alphabetic characters available for designating a title, and the measurement title itself at the bottom which is updated as characters are selected.




Using the Front Panel **ARROW** and **ENTER** buttons a measurement title can be selected and then saved. The "**PgDn**" and "**PgUp**" messages at the top right indicate the status of the editing mode. Toggling between these modes allows the operator to move the edit cursor to a desired position either in the alphabet or the measurement title. When the "**-Save-**" option is selected, all characters from the edit cursor position in the measurement title onward are erased, thus saving only the measurement title characters that precede the edit cursor position.

### 3..8.4 Configuration I/O Selection

The next available configuration option is "**I/O**" which produces the following display:




There are three "**I/O**" options available.

1. **Comm. Setup** - This allows the operator to specify RS-232/422 options.

**STD. Comm.** option activates a continuous 232 output stream which includes the product number, the process measurement, and temperature. The format is as follows: **[01 35.13, 43.6]**
For this example, 01 is the product number, 35.13 is the process measurement, and 43.6 is the temperature.

**PC Comm.** option allows communication with a remote PC. This option requires a remote PC

with EMC software installed to establish communications. The PC software is a statistical analysis package that can be used to monitor up to 4 on-line MPR E-Scan units.

2. **Baud Rate** - Is the selectable transmission rate for the communications.

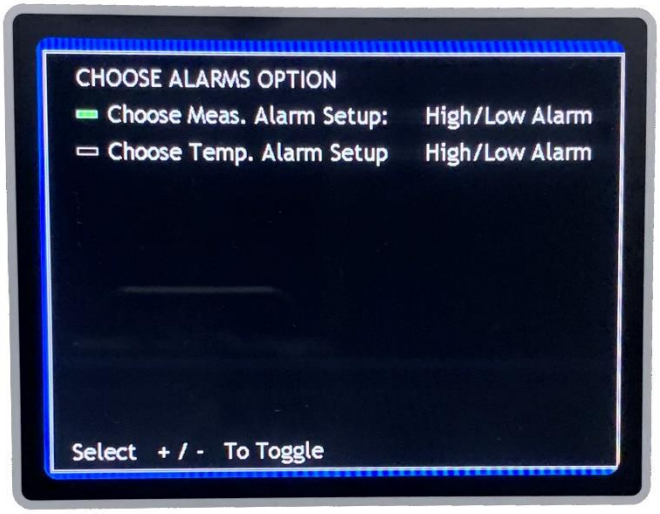
The 232/422 is preset to a default setting displayed. However, the baud rate is user selectable and is used for all communications configured in the "**Comm. Setup**" option.

3. **Unit Num** - This is used to identify the instrument by a number when configured for PC communications. This option is used to identify the MPR E-Scan when configured for PC communication. Each MPR connected to the remote PC would have a designated unit number. The PC software will communicate with up to four on-line MPR E-Scan units.

In cases where a remote protocol interface is used in place of the PC communications software from EMC, each MPR being addressed can have a designated unit number in the range of 1-255. In addition, the decimal base 10 unit number is converted to support ASCII hex protocol to comply with standard fieldbus applications. The ASCII hex equivalent is displayed in parenthesis above. (See RS-232/422 Protocol addendum.)

### 3..8.5 Configuration Alarms Selection

The next available configuration menu option is "**Alarms**". When selected, it activates the following display:




1. **Meas. Alr. -** The process measurement alarms can be configured as High/Low, Low/Low, High/High, Deviation/Setpoint, and No Meas. Alarms.

**High/Low Alarm** - An error occurs if the process measurement falls below a low limit or exceeds a high limit.

**Low/Low Alarm** - An error occurs if the process measurement falls below a low limit. An additional error occurs below a low-low limit.

**High/High Alarm** - An error occurs if the process measurement exceeds a high limit. An additional error occurs beyond a high-high limit.

**Dev/Setpt Meas. Alarm -** An error occurs when the process measurement exceeds above or below a setpoint by a fixed amount.

The deviation is applied to both sides of the setpoint equally. The setpoint can be remotely changed using the Remote Display Panel option. This also is the setpoint used in the PID Controller option and can be remotely changed using the Remote Display Panel.

2. **Temp. Alr.** - The process temperature alarms can be configured as High/Low, Low/Low, High/High, No Temp. Alarms and Head Temp Alarm

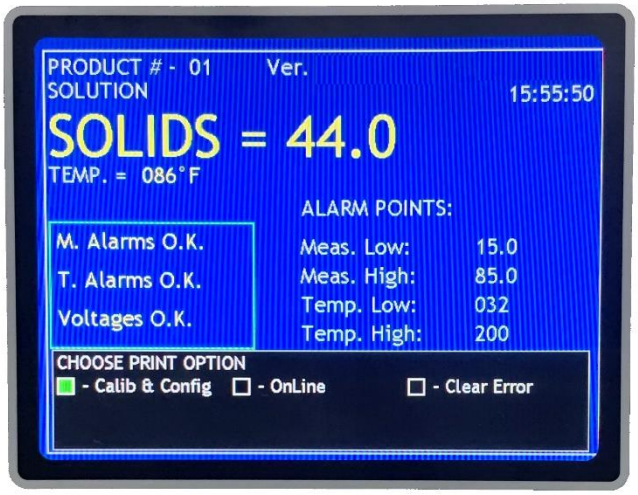
**High/Low Alarm** - An error occurs if the process temperature falls below a low limit or exceeds a high limit.

**Low/Low Alarm** - An error occurs if the process temperature falls below a low limit. An additional error occurs below a low-low limit.

**High/High Alarm** - An error occurs if the process temperature exceeds a high limit. An additional error occurs beyond a high-high limit.

**Head Temp Alarm –** An error occurs if internal head temp exceeds a high limit. Requires optional hardware.

### 3..8.6 Print Selection




**Prints all System Calibration and Configuration Settings. FOR EMC TECHNICIAN USE**

**(Printer must be attached for this function to work)**

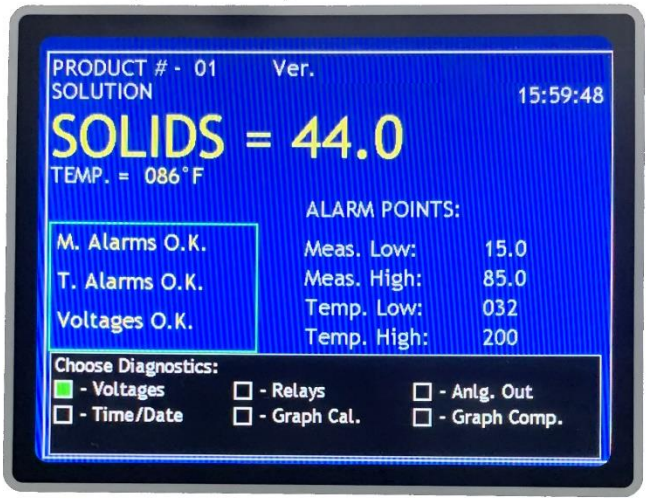
**Calib & Config:** Function Disabled

**OnLine:** This option allows a data stream to be communicated as a continuous output with the addition of an additional PCB.

**Clear Error:** Clears any print errors that may occur.

## 3..9 Diagnostic Selection

The Diagnostics menu contains the following options:




**1. Voltages -** This displays all pertinent system voltages such as: measurement voltage, temperature voltage, and lamp voltage.

**2. Relays -** This allows the operator to toggle system relays for testing or troubleshooting purposes. The toggled relays can be visually checked by examining the relay LEDS on the interface board. This option also allows the operator to test custom inputs.

**3. Anlg. Out -** This option enables the operator to test system output as well as calibrate the output to work with various analog loads.

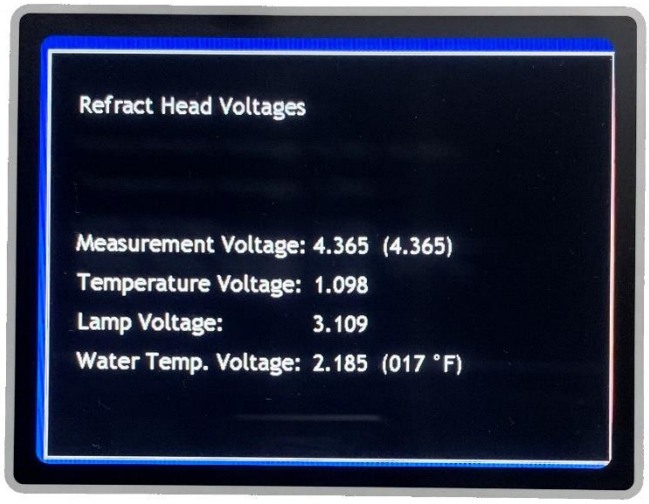
**4. Time/Date -** This option enables the operator to reset the system clock with a valid time and date. Such adjustments may be necessary as a result of time zone differences or when the system clock batteries fail.

**5. Graph Cal –** This option provides the operator with a visual display of calibration voltages

**6. Graph Comp –** This option provides the operator with a visual display of temperature compensation voltages if used.

### 3..9.1 Diagnostics Voltages Screen

The **"Voltages"** option results in the following display:




**Measurement Voltage:** The voltage produced when measuring a sample. The first voltage displayed is the raw sensing head voltage. The voltage in brackets is the compensated voltage. Range is (0-10 volts). See also Analog O menu.

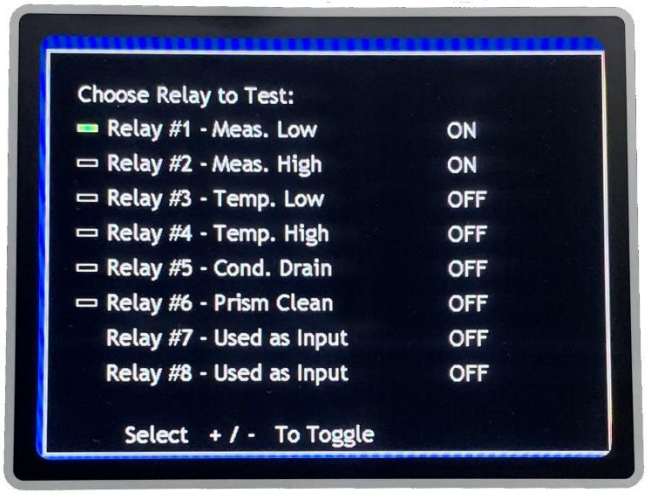
**Temperature Voltage:** A voltage that produces the process temperature readout as follows: (Voltage - .5v) * 50 = Deg. C.

**Lamp Voltage:** A nominal voltage needed to maintain a signal of proper amplitude.

**Water Temp. Voltage:** This is the water temperature voltage, communicated by a secondary RTD; used in the High Temp. Cond Drain process.

### 3..9.2 Diagnostics Relay Screen

The **"Relays"** option activates the following display:




**WARNING: Changing values on this page while process is in operation is not advised!**

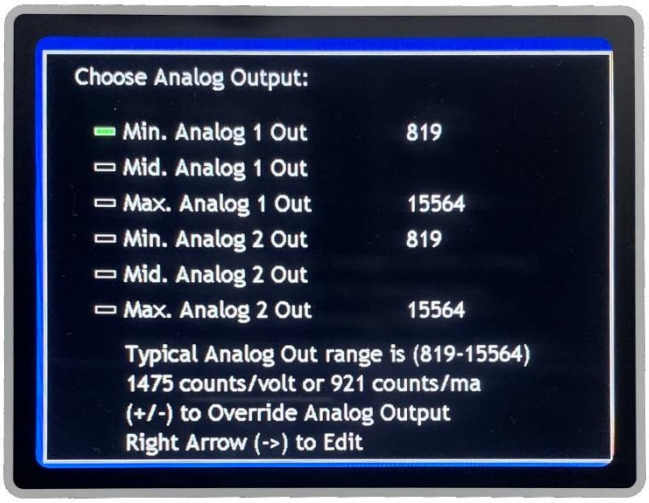
There are eight total relays available on request, two of which are used as inputs (unless system configured for **High Temp Cond. Drain)**. The other six relays are activated when either measurement alarms are occurring or when purging.

Using the Front Panel buttons, all relays except the input relays can be tested by toggling the

output conditions and visually checked by examining the relay LEDS on the interface board. Also, by supplying an external voltage, the operator can test the custom input relays.

### 3..9.3 Diagnostics Analog Output Screen

The **"Anlg. Out"** diagnostic option activates the following display




**WARNING: Entering this page will change instrument output! Editing any values on this page will change instrument output.**

**There are two standard outputs that produce a 0 - 10 volt and 4-20 mA signal and are used for process measurement and temperature. They are displayed as Analog 1 Out and Analog 2 Out respectively.**

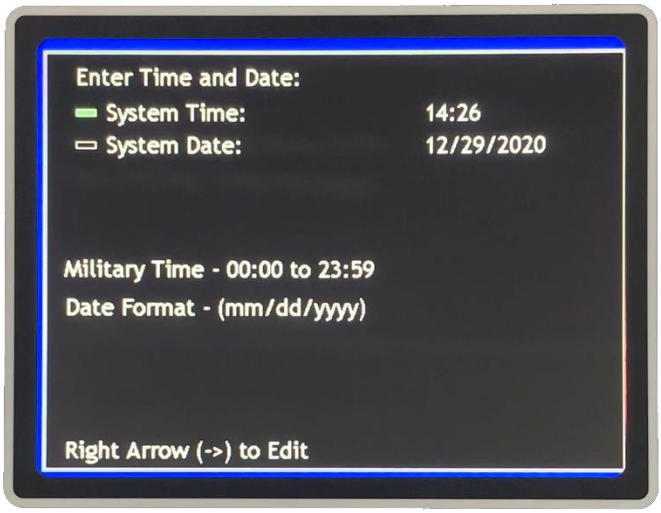
**The 4-20mA and 0-10v outputs are dynamic (self-powered). Do not attempt to power with a 24v input.**

Using the Front Panel buttons, the operator can test the outputs in min., mid., and max., value conditions. Also, by editing the min. and max. values, the operator can even calibrate the output to work more accurately with various analog loads.

**Note: The information displayed at the bottom gives the operator the output resolution, which is useful when editing the output values for analog load calibration.**

### 3..9.4 Diagnostics Time / Date Screen

The **"Time/Date"** diagnostic option activates the following display:




This menu enables the operator to set the system time and date.

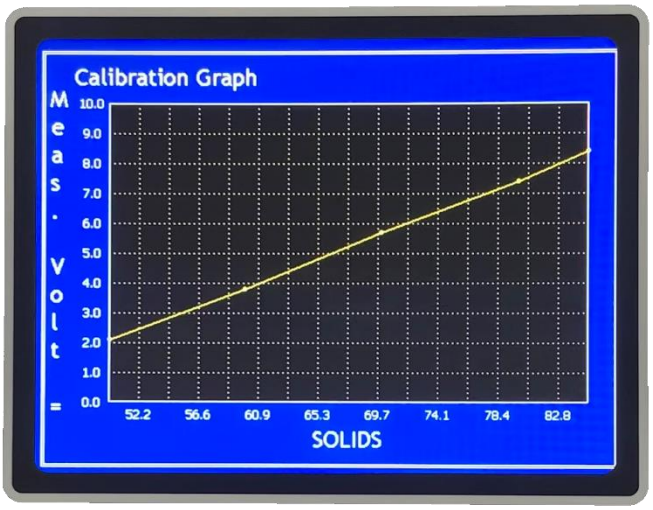
**System Time:** This is the time displayed in military format in normal mode.

**System Date:** This is the date displayed in normal mode.

### 3..9.5 Diagnostics Graph Cal Selection

The **"Graph Cal"** diagnostic option activates the following display:

This function allows you to view the calibration of the unit. The Measurement Voltage and Solids plot presents two factors:




1) The anticipated voltage necessary to display a specific % Solids on the Console Display.

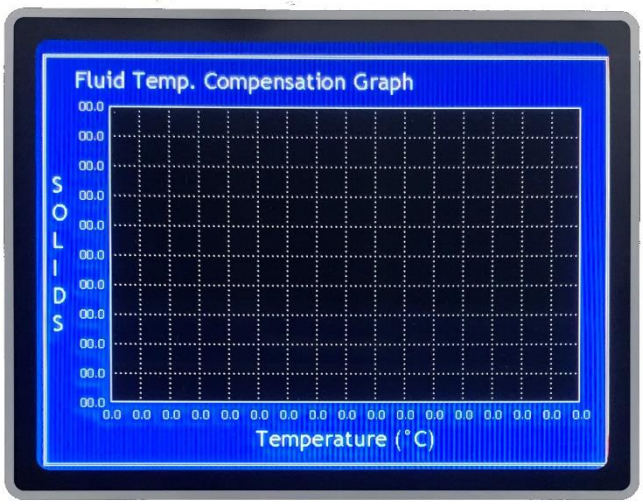
2) Identifies any errant data points seen while calibrating the Sensing Head.

The data line should be relatively linear, with some materials displaying a slight bow to the data line. Most materials generate a line of a uniform slope. Any data points that disrupt a smooth plot are to be examined closely, as the reading supplied by the Measurement Voltage will display an incorrect value on the Console Display.

### 3..9.6 Diagnostics Graph Comp Selection

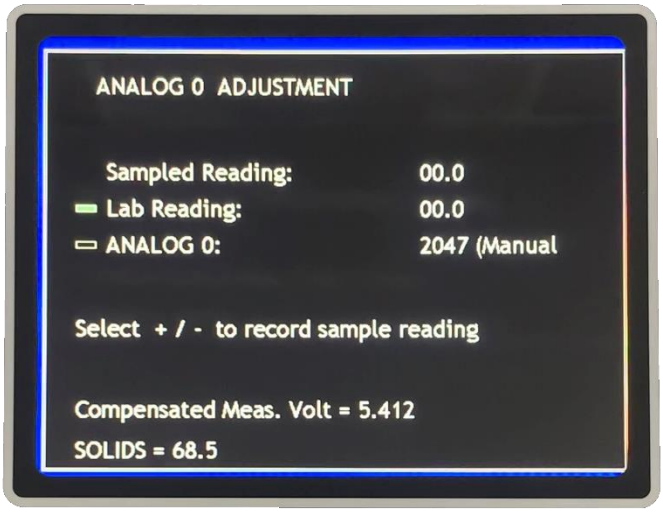
The **"Graph Comp"** diagnostic option activates the following display:

This function allows you to view the Fluid Temp. Compensation of the unit.




1) If a Temperature Compensation chart is created for a particular process liquid, the results of the Temperature Compensation's table inputs will be displayed on this chart. This option is seldom used as the vast majority of Sensing Heads are Temperature Compensated using the hardware available in the Sensing Head.

### 3..9.7 Analog Zero Adjustment




The analog zero adjustment is used to correct for any shifts in the measurement voltage. After calibration and before compensation, an analog zero adjustment may be needed to "zero in" the measurement reading due to measurement voltage shifts that could occur when going from room temperature to the process base temperature used for the temperature compensation run. Analog zero adjustment may also be needed after installation to make instrument readings agree with normal testing methods.

The measurement voltage displayed contains both analog zero and temperature compensation adjustment. This is the voltage used to obtain calculated value from the calibration table that will reflect an accurate displayed reading in Solids... (Range is 0-10 volts.)

The analog adjustment value ranges from 0 to 4095, with 2048 representing the zero voltage point. Therefore, any value above 2048 results in a positive voltage adjustment and any value below 2048 results in a negative voltage adjustment. The maximum manual adjustment allowed in either the positive or negative direction is 1.5 volts, so there are 614 counts for a 1.5 volt span or 41 counts for a .1 volt shift. The remainder of the resolution beyond +/- 1.5 volts is used for temperature compensation.

**Auto Adjustment**

To perform automatic analog zero adjustment, the current measurement reading should be recorded in the E-Scan when the sample is taken from the process. This can be accomplished in normal mode of operation using the +/- button on the front panel. An "S" character is displayed on the normal mode screen to indicate that the sampled reading has been recorded. The sampled reading can also be recorded via the analog zero adjustment screen shown previously.

The final part of automatic adjustment consists of entering the lab reading of the sample taken. Using the previously recorded sampled reading and the lab reading, the software will automatically determine the amount of analog offset needed to "zero" the instrument. The newly calculated analog zero value is displayed as a digital number in the range of 1434-2662.

**Note: If the process measurement changes after the sampled reading is recorded then the final adjusted reading will not reflect the lab reading. However, since the adjustment is calculated from the recorded sampled reading, the final reading will be accurate and will not require further manual adjustment. Thus, the lab reading should only be thought of as the desired reading if the process is stable. In all other cases, the lab reading simply provides a means of calculating an error adjustment from a previously recorded reference point.**

**Manual Adjustment**

The operator should proceed with caution when adjusting analog zero manually since this will change the output of the instrument. To reduce the likelihood of manual adjustment error, it is suggested that the default least significant digit be altered first so the operator can observe the effects on the measurement reading. Pressing the up or down arrow buttons will output the altered analog zero adjustment.

### 3..9.8 Purge Selection


Selecting the **"Purge"** option from normal mode adds purge information to the current display. When purging, the **'H'** system indicator (measurement hold) is displayed to the far right of the displayed reading, and the measurement voltage as well as the current purge mode is displayed at the bottom. The timing information for purging is set in the calibration limits menu.

**During the purge process, all readings and analog output are "on hold" or frozen.**

Each purge operation mode can be aborted before the selected time expiration by selecting the **ESC** button from the Front Panel at which time the system will resume normal operation. Following the termination of the purge cycle, the **'H'** indicator and the information at the bottom is removed. Successive purge cycles will be started if the previous purge was unsuccessful and/or terminated if smart clean is enabled. This will continue for three entire purge cycles; at which time a **'P'** system indicator is displayed if all purges were unsuccessful.

The purging consists of three internal modes:

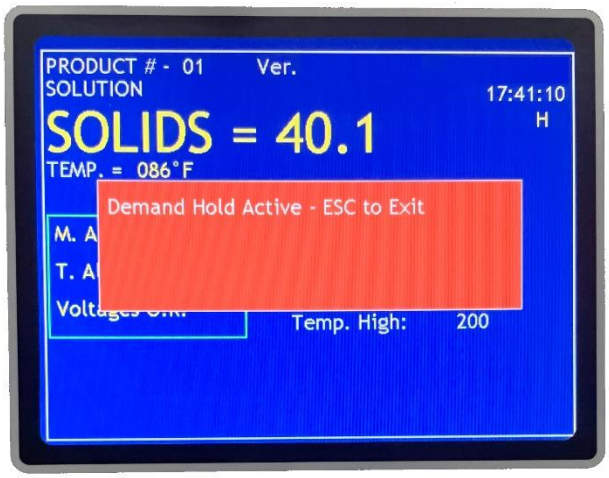
**1. Condensate Drain Time:** This time allows any condensation to drain before steam cleaning if steam is being used as the cleaning agent.

**2. Prism Clean Time:** This is the actual time during which cleaning of the prism occurs.

**3. Hold Delay Time:** This time allows a delay to occur before resuming normal operation.

NOTE: **Purging can be automatically initiated by setting up a purge cycle time in the calibration limits.**

### 3..9.9 Hold

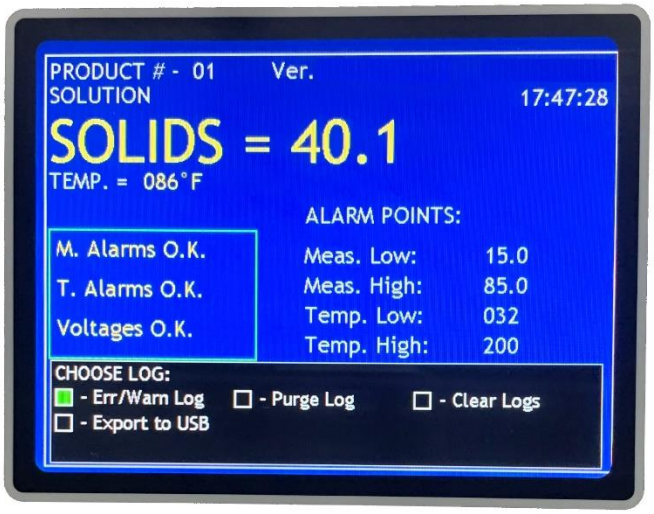



Selecting the "**Hold**" option is selected from normal mode, the "**H**" system indicator is added to the right of the displayed reading. This option allows the operator to freeze system readings and analog output at any time using the Front Panel buttons. Selecting the **ESC** button terminates the hold condition.

**NOTE:** The hold condition can also be activated on demand remotely by using a custom input.

### 3..9.10 Log Menu Selection

The logs menu contains four menu options:




1. Err/Warn log

This option allows the operator to view a log containing a history of system errors and warnings. Each log entry contains the error/warning message along with a time and date stamp.

2. Purge log

This option allows the operator to view a log containing a purge history. This log will enable the operator to see how many seconds of steam cleaning were required to successfully clean the MPR E-Scan prisms during each purge cycle

3. Clear Logs

This option allows the operator to clear all the logs.

4. Export to USB

For EMC technician use only

# 4 Problem Analysis / Troubleshooting

## 4.1 Problem Analysis

The following analysis procedures are meant to aid in isolating failures down to the board level. Board or device replacement with a fast turnaround is available from EMC.

These abbreviations are used:

| | | |
|---|---|---|
| I/O | **I/O Board** | **Conditions analog voltages for digital microprocessor.** |
| CPU | **CPU Card** | **Microprocessor, plugs into the I/O board.** |
| IB | **Interface Board** | **Most external connections are made to this board.** |

Before any troubleshooting, always check that all cards are properly plugged in, ribbon cables are properly socketed and that correct power is supplied.

**Typical display ranges for voltages in test mode are:**

**LED voltage** 2.5 - 4.0V (Varies slightly with temperature and cable length.)
***(Normal Range 2.8~3.8 Volts)***

**Measure voltage** Varies with process 0-10V range with 2-8 Vdc nominal.

**Temperature voltage** 0 to 5 Vdc = -25 to 225°C

### 4..1 Trouble Shooting Chart

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| No display, failsafe LED off. | Fuse blown. |
| No display, backlighting | Power supply failure, check +15vdc and +5vdc. |
| | |

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| No display and failsafe LED on. | Display failure.<br><br>Video cable failure. |
| Display on but is garbled | CPU card failing. |
| Buttons do not respond properly. | Connector from overlay to I/O board not, or improperly mated with J5.<br><br>Front panel overlay defective.<br><br>Defective I/O board (keyboard section). |
| E-Scan does not appear to take calibration | Replace CPU card. |
| "NO TEMP. VOLTAGE" flashing on display | If voltage between TB1-3 and TB1-10 on the IB is less than 0.2 volt and the process temperature is above 25° C, check 2.5-volt regulator VR-1 in the head.<br><br>Sensing head failed.<br><br>I/O card failed. |
| "NO MEAS. VOLTAGE" flashing on display | If positive voltage does not exist between TB1-12 and TB1-3 on the IB, check for process flow across prism.<br><br>Sensing head failed.<br><br>I/O card failed. |
| Measurement incorrect. | Check display for O, U, or T indicators.<br><br>Check for large digital offset value. |

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| | Rezero using analog zero (in software).<br><br>Rezero head using zero pot in sensing head. |
| "NO LAMP VOLTAGE" flashing on display | Sensing head failed.<br><br>Check for AGC voltage on LED.<br><br>Preamp card failed.<br><br>I/O card failed. |

# 5 Technical Information

## 5.1 Console Technical Description

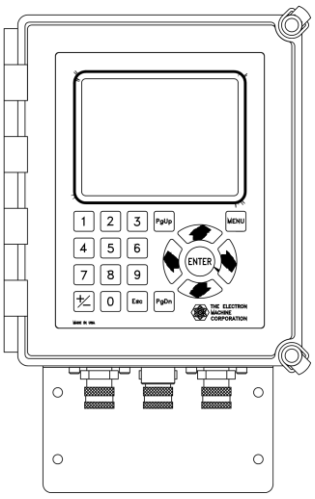
The console is constructed of molded fiberglass polyester to give protection in harsh environments.

**Display**

**The display has a pixel count of 640 by 480 to give very sharp resolution. The display is suitable for both graphics and text information.**

**Switch Matrix**

The switch matrix is located on the outside of the console and allows the operator to make modifications and changes to the operating conditions of the instrument. The operation of this switch matrix is further explained in the operations section of this manual.




DISPLAY AND SWITCH MATRIX

### 5.1.1 Console Cards

**Interface Board for external connection**

The interface board is located on the back wall of the console. Most external connections are made to connectors that plug into this board. The only exceptions are optional features that require connections to optional available connectors located on the side of the console.

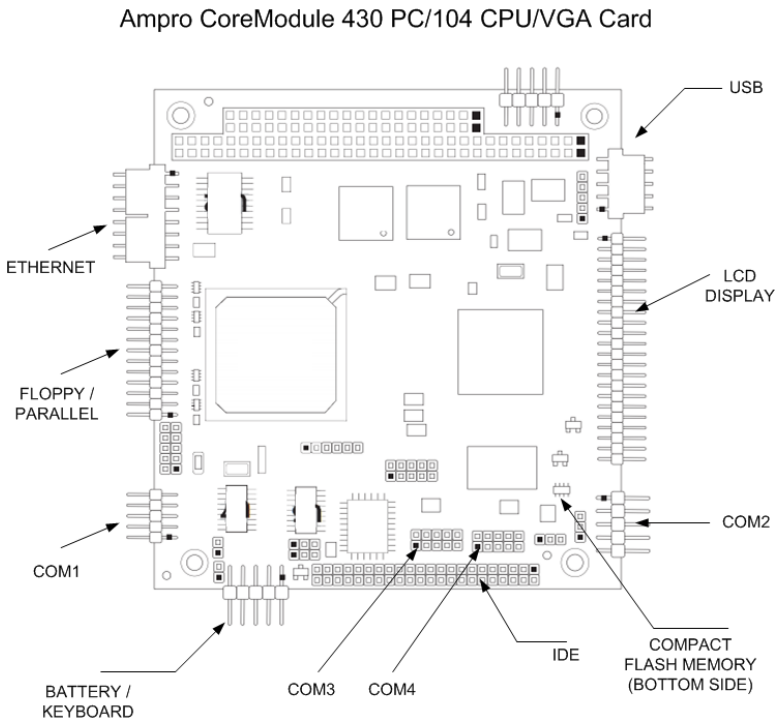
**Power supply**

The power supply is in the top of the console and serves as a hold down clamp for the analog output modules. The power supply supplies power to both the I/O card and also the IB. The voltages supplied are +5 vdc and +/- 15 vdc.

**I/O card**

The I/O card handles most of the signal inputs and outputs from the instrument. Three ribbon cables from this card route the signals from the IB to the I/O card and power is supplied through a power cable to the I/O card from the power supply.

**CPU card**




The CPU card is found plugged into the PC/104 bus connectors of the I/O card.

The CPU card operates with a microprocessor. The CPU card has a built-in flash hard disk drive, which contains the operating software, parameters and calibration points for the system. The processing power of the MPR E-Scan is performed by the microprocessor on the CPU core module. The layout for this card, with standard cable connections, is shown on the above figure for the CPU card layout. When the Comm/LPT card connection board is supplied, cables also run between the parallel printer port and the connector board. The optional Com ports cable also connects to the CPU core module card, as shown in the RS232 Terminal Block Mounting Kit addendum.

**This card is always installed on the I/O board and additional cards such as the 422 optional card are then installed above the CPU card.**

The CPU card is supplied with a Compact Flash memory card that plugs into the socket on the bottom side of the CPU card.

### 5.1.2 Additional Cards

Additional cards may be used for special features and options.

### 5.1.3 Console Specifications

| | |
|---|---|
| **Ambient temperature** | Up to 125°F (52°C) |
| **Console** | – 32°F to 120°F (0°C to 50°C) |
| **Processor** | Ampro Core Module 430, 133mhz |

### 5.1.4 Features

- Intelligent Purge Cycle
    - The measurement voltage is monitored in order to determine if the preceding prism wash was successful. If unsuccessful another purge cycle will be automatically initiated. In the case of three unsuccessful purge attempts, a purge error indicator is activated. In addition, the intelligent purge will terminate as soon as the prism is clean, thus protecting the prism from unnecessary purge action.

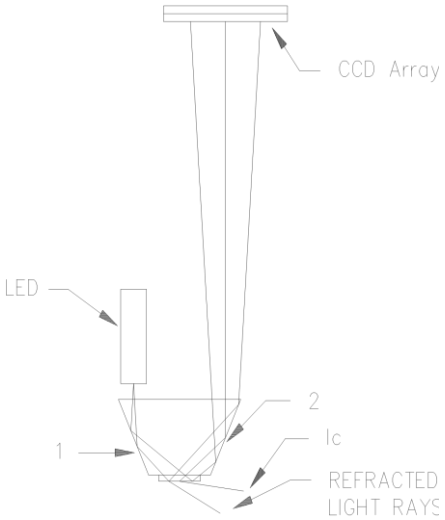
### 5.1.5 Sensing Head

The MPR E-Scan uses an LED as a light source and utilizes state of the art CCD (charge coupled device) technology to accomplish scanning the reflected light returned from the prism.

### 5.1.6 Optics

Light radiated from the LED passes through the prism surface to be reflected off mirror 1 to the prism-to-process interface. The light reaching this interface intersects the same interface over a series of angles chosen to include critical angle for the process being measured. Light intersecting the interface at an angle greater than critical angle is refracted into the solution, (1c). Light intersecting the interface at less than critical angle is reflected up to mirror 2 and out of the prism up to the CCD linear array to be scanned.

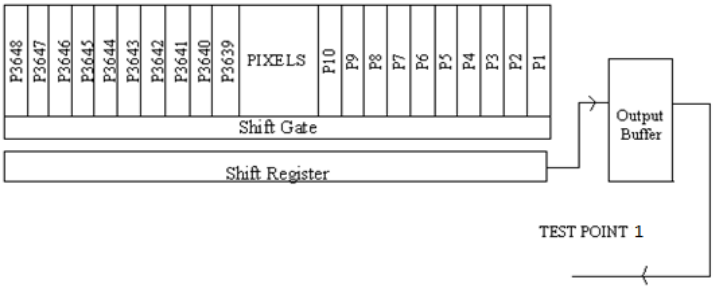
OPTICAL PATH



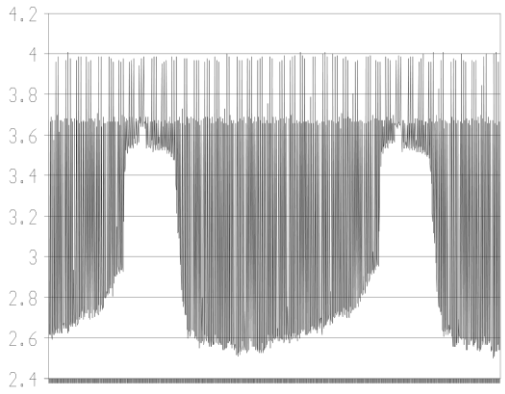

### 5.1.7 CCD Linear Array

The linear array used in the E-Scan includes 3648 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. At the end of this interval the shift gate is activated, and the charges are simultaneously transferred into the shift register. The charges are transferred out of the shift register in "bucket brigade" fashion through the signal output buffer.

The output is an analog voltage representative of the charge per pixel (photo site) and is reset to ground between each transfer.



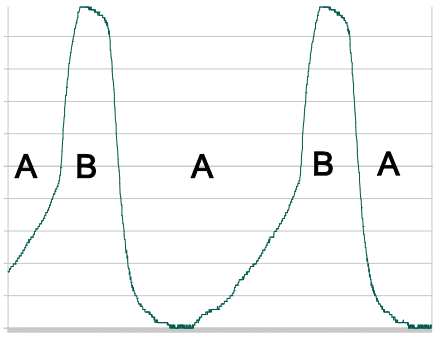
## 5.1.8 Signal




**CCD Signal**

To further increase resolution the signal is rectified and averaged as shown in the figure. This signal is used to control the LED current to eliminate the effects of process color changes, suspended solids, entrained air and other problems associated with non-scanning refractometers. The refractive index information is also contained in this signal in the form of the ratio of A to B.

The signal is passed through circuitry to develop a DC voltage, which is related to the ratio of the time of A to B. This voltage is sent to the console to be processed by the microprocessor and displayed in the customers preferred units of measurement.




A to B = reflected to refracted light.


Filtered CCD Signal

## 5.2 Refractometer Specifications

| | |
|---|---|
| **Accuracy** | **+/-0.0002 R.I. min (typ. 0.1% by weight) to 0.000075 R.I. max** |
| **Span** | **0.0015 R.I. minimum (1 Brix)** |
| | **0.214 R.I. maximum (100 Brix)** |
| **Repeatability** | **Corresponds to accuracy** |
| **Sensitivity** | **Corresponds to accuracy** |
| **Stability** | **No recorded drift /24 hour period.** |
| **Response time** | |
| **Console** | **250m.s. to 15 min.** |
| **Head** | **<500m.s. for .0015 R.I. change with 90% recovery on .015R.I. span.** |
| **Process temperature** | **-40° F to 300° F (-40° C to 150°C)** |
| **Ambient temperature** | **-40° F to 125°F (-40° C to 52°C)** |
| **Console** | **- 4°F to 120°F (-20°C to 49°C)** |
| **Calibration** | **See Engineering Order Sheet (EOS)** |

**Sensing head wetted materials of construction: 2205 Duplex SS, sapphire, PEEK, Teflon (other alloys and elastomers available)**

| | |
|---|---|
| **Outputs** | **4-20mA non-isolated** |
| | **0 – 10Vdc non- isolated** |

## 5.3 Available Options

| Optional E-Scan Outputs | Optional E-Scan Features |
|---|---|
| Isolated 4-20 mA output for measurement | High Temp Condensate Drain Function |
| Isolated or non-isolated 4-20mA output for temperature | Different alloys & elastomers for sensing head wetted materials |
| | Multirange Calibrations as requested |
| | Spanish, Chinese & Japanese Languages |

# 6 Service

## 6.1 EMC 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 two years 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).**

## 6.2 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.**

## 6.3 Service in the Field

**Services of factory trained field engineers are available at standard rates upon request.**

**Please contact EMC at service@electronmachine.com, by phone at (352) 669-3101 or by mail at:**

**Technical Services Department**
**The Electron-Machine Corporation**
**15824 CR 450 West**
**Umatilla, FL 32784-2349**

**For afterhours emergency technical service please call 352-669-3101 to obtain the Technical Service phone number.**

## 6.4 Spare Parts

### 6.4.1 How to Order Parts

**Orders for parts should be addressed to EMC Parts at sales@electronmachine.com, or can be ordered by phone at (352) 669-3101 or by mail at:**

**Technical Sales Department**
**The Electron-Machine Corporation**
**15824 CR 450 West**
**Umatilla, FL 32784-2349**

**Note: Purchase orders should include the model number and the serial number of the equipment that the part is to be used with, in addition to the part number or drawing number and the chassis number.**

**If the part number or the drawing number is not known, give a detailed description including a sketch, if possible. All orders will receive prompt attention.**

**Phone: (352)-669-3101 Fax: (352)-669-1373 E-Mail: sales@electronmachine.com**

### 6.4.2 Recommended Spare Parts

| EMC Number | Description |
|---|---|
| | |
| 511010 | MPR E-Scan Door Assembly w/electronics |
| | |
| 511002 | Sensing Head E-Scan |
| | |
| 187496 | Power Supply PS-40 |
| | |
| 596407 | O-ring 17-030 Teflon (pkg of 10) |
| | |
| 46601 | Fuse Pico 5 amp LittelFuse (pkg of 5) |
| | |
| 45801 | Fuse 1 amp Slo Blo LittelFuse (pkg of 5) |
| | |

## 6.5 Maintenance

### 6.5.1 Lamp Adjustment Procedure

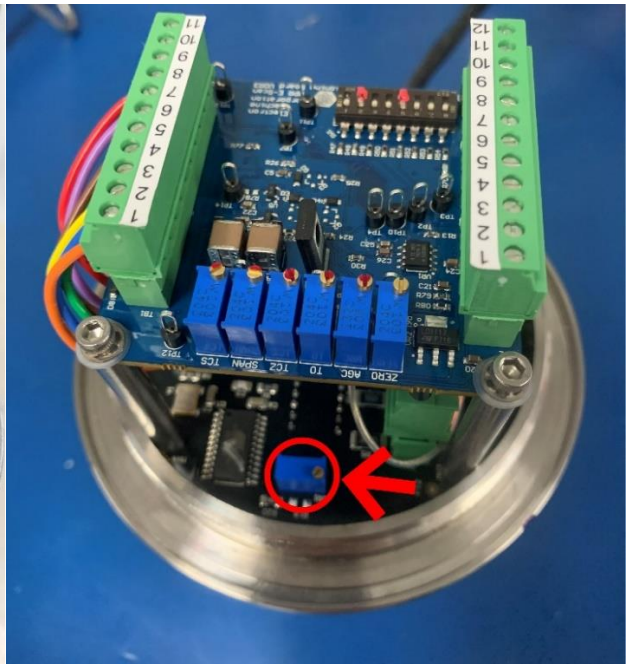
The lamp voltage operates between 2.8vdc at room temperature and up to 4vdc at operating temperature. If lamp voltage is below 3.5vdc when measured no adjustment is necessary however, at 4vdc will give Check Lamp Alarm. If the alarm is activated the Lamp Voltage needs to be adjusted.

**"These adjustments are meant to be made at operating temperatures."**

1. Ensure the steam cleaning is operational and properly cleaning the sensing head. (Dirty Optics can cause a High Lamp Voltage). Also ensure there is product in the line.

2. Remove the sensing head COVER and adjust P1 (see image below) on the CCD Board for 3.2vdc as seen in Diagnostics Voltages or with a voltmeter across TB1 (3gnd & 9 lamp) on original Analog Board or TB1 (2gnd & 6 lamp) on Universal Analog Board.

**Note: The optics is sensitive to exterior light, it may be necessary to shield the sensing head from any light when adjusting.**



### 6.5.2 Sensing Head Replacement

(Refer to www.electronmachine.com for an online video demonstration)

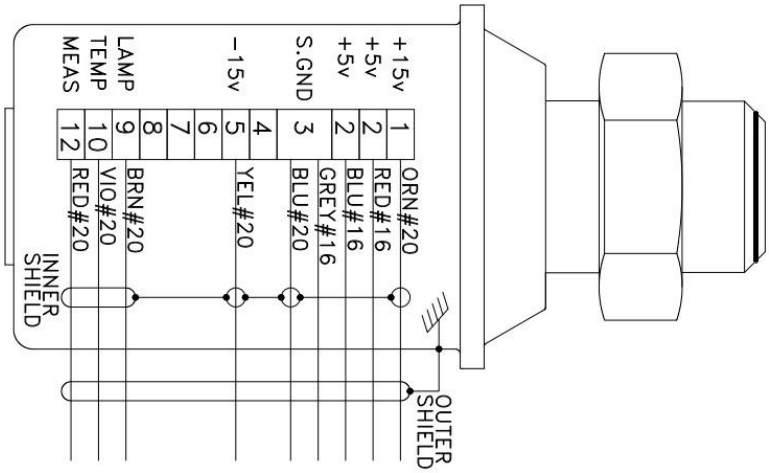
1. Remove Sensing head from pipeline adapter**. (See Head Removal Procedure)**

**** Before Removing****

- **Ensure no pressure is felt on installed sensing head.**
- **Ensure pipeline level is drained.**
- **Install maintenance plug any time sensing head is removed from pipeline adapter.**
- **Always use PPE when removing sensing head.**
- **Use Head Removal Safety Tool – If Available**

**3.** Turn-off power to entire MPR E-Scan System

**4.** If head is equipped with quick disconnect clipper connector, simply twist connector loose and skip to step 9. If no quick disconnect, remove sensing head cover by unscrewing.




**5.** Take note of wiring color/label wire location/ refer to I/C Drawing

**6.** Loosen/Remove wires from terminal strip.

**7.** Loosen squeeze fitting cap.

**8.** Remove cable from sensing head.

9. Re-install sensing head cover before returning head for repair.

10. Check for EOS Sheet attached to replacement sensing head to ensure proper range for installation application.

11. If head is equipped with quick disconnect, simply reconnect and skip to step 17, or remove head cover from replacement head.

12. Hold on to the calibration info sheet (EOS) that is attached to replacement head. (You will need to enter this information into the console in later steps)

13. Insert Cable and connect wires to proper position on terminal strip. **** Refer to drawing B-11415 E-Scan Systems Interconnect Diagram ****

**Note: previous E-Scan versions utilized a Green #16 and Yellow #16 gauge wires in the TB1 #4 position, these are no longer required and can be clipped back on both ends to save time and confusion.**

14. Note the two #2 positions wire colors and gauge size.

15. Tighten wires in terminal strip.

16. Install sensing head cover.

17. Tighten squeeze fitting.

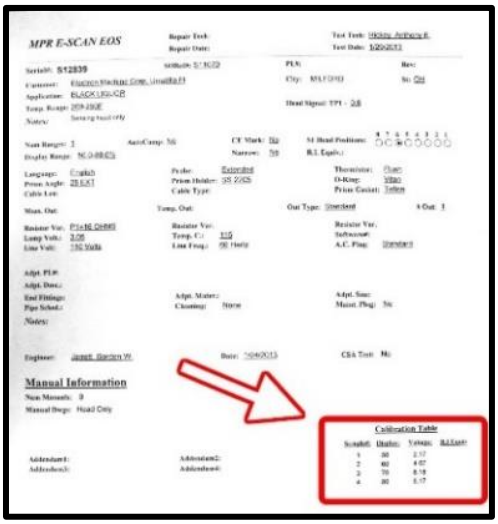
18. Remove shipping tape from O-Ring on end of sensing head. Ensure O-Ring is properly seated.

19. Install sensing head into pipeline and turn on power
    ****Note proper orientation, tighten to proper torque with supplied wrench****

20. Enter Calibration
    ****See Console Measurement Calibration Procedure Sheet****

### 6.5.3 Console Measurement Calibration Procedure

(Refer to www.electronmachine.com for an online video demonstration)




1. Refer to MPR E-Scan EOS sheet calibration table for input values.
2. Power on Console

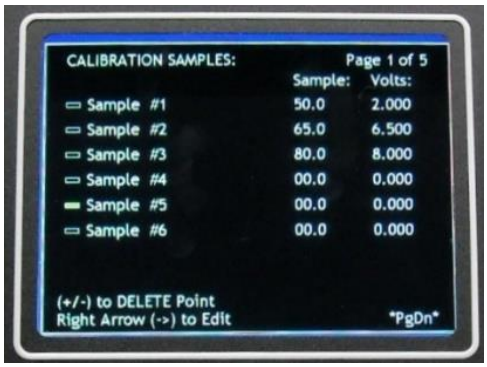
**(Allow time for console to boot up)**


3. Push the MENU button.
4. User Arrow keys to select "Calib."
5. Push ENTER

**( Password will be required.)**


**Default Password is "0000"**

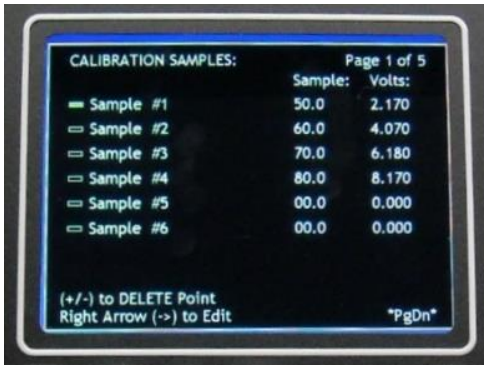
6. Right arrow to "Meas."
7. Push ENTER




**8.** Check that console's "Sample" values match calibration table on EOS sheet. (To edit console "sample" values: RIGHT arrow to highlight sample value. Key in EOS sample values. Push ENTER **(***allow voltage to stabilize***).**

**9.** Edit console "Volts" to match EOS sheet provided with replacement sensing head. Start with Sample 1 (To edit console "volts" values. LEFT arrow to highlight "volts". Key in EOS values for highlighted sample. Push ENTER.).

**10. *Step 10A for Color MPR **Step 10B for Non-Color MPR Doors ***Step 10C for Refractometer**




**10A.** After all values entered Push ENTER. Using ARROWS key in password **"0000"** then highlight Save. Push ENTER.

**10B. (For Non-Colored Doors)** After all values entered go to line after last sample. Push Right Arrow then ± Key Then ENTER.

**10C.** After all values entered press ENTER.


**11.** Push MENU to return console to normal operation.

**12.** For new door installation refer to Console Limit Calibration Sheet

## 6.5.4 Safely Removing Sensing Head

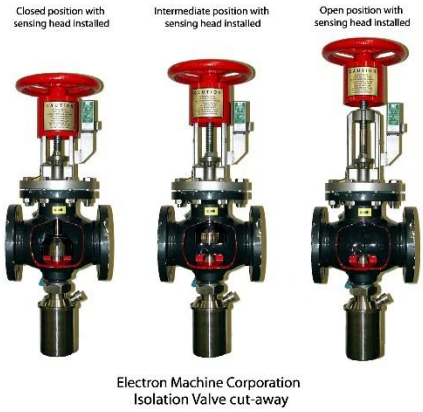
**Always wear appropriate Personal Protective Equipment (P.P.E.) as required by your company's safety procedures.**

**Please refer to www.electronmachine.com for an online demonstration.**

Disable steam purging on the sensing head being removed.

1. Close isolation valve by turning red hand-wheel clockwise to a hard full stop. "Rock" hand-wheel shut several times to ensure clean closure.

2. Verify the bottom of hand-wheel is in the "closed" position as indicated on the bonnet casting.



Electron Machine Corporation
Isolation Valve cut-away

3. Do not over-tighten or use leverage increasing tools (cheater bars, etc)
.
4. If hand-wheel does not fully close, **STOP!! DO NOT REMOVE THE SENSING HEAD OR MAINTENANCE PLUG.**


5. If Isolating a sensing head used with System: Confirm offline status of refractometer on system display.

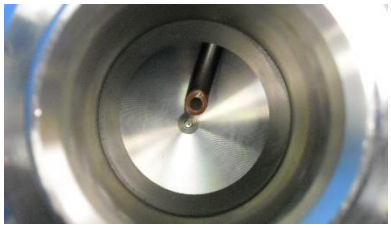
6. **Suggested to Install Isolation Valve Adapter Safeguard Tool**

7. Loosen sensing head or maintenance plug mounting nut one (1) complete turn
.
8. Relieve trapped pressure on the sensing head or maintenance plug before proceeding. Push and pull the sensing head in and out between the mounting nut and the adapter. You should be able to move the sensing head about ¼" (6mm). Continue the movement until liquor drains from the adapter and no pressure is felt on the sensing head. (The liquor is under pressure until it is drained.)

# STOP!!

**IF THERE IS A RESISTANCE AGAINST THE SENSING HEAD RETIGHTEN THE MOUNTING NUT. DO NOT REMOVE THE SENSING HEAD OR MAINTENANCE PLUG.**

**9.** When there is no sign of pressure felt, standing to one side, completely remove the mounting nut.



**10.** After removing the sensing head, flush all liquor from the adapter for easy installation next time.

**11.** Inspect steam purge tube for damage. If you have a spare sensing head skip to step 15.

**12.** Before installing maintenance plug check the O-ring for damage and to ensure it is in place.

**13.** Install maintenance plug with O-ring and tighten to 50 foot-pounds of torque (68 Newton-Meter) using supplied wrench.

**14.** Leave isolation valve in closed position and tag appropriately as required by your company's safety procedures.

**15.** Install Spare Sensing head with o-ring. Note proper alignment of sensing head. (Alignment mark with steam purge fitting and interconnecting cable squeeze fitting downstream).


4" Isolation Valve in open position with E-Scan sensing head installed

**16.** Tighten to 50 foot-pounds of torque (68 Newton-Meter) using supplied wrench.

**17.** Open Isolation valve slowly while checking for any possible indications for leaks.

**18.** Hand-wheel should be turned counter-clockwise to the fully opened position by hand for normal operation.

**19.** Enable Steam Purging on the installed sensing head.

### 6.5.5 Door Replacement Procedure

**(Refer to www.electronmachine.com for an online video demonstration)**

1. Write down console measurement calibrations

**2.** Power Down and open MPR E-Scan console
**3.** Remove lower grounding strap (Blue Arrow)
**4.** Loosen power supply wires (Red Arrow)
***Note wire color and location***
**5.** Remove power wire retaining screw (Yellow Arrow) and power wires from door

**6.** Remove ribbon cables from console.

**7.** Remove hinge pin rod.
**8.** Remove door and package for repair.
**9.** Install new door using existing hinge pin rod

**10.** Secure lower grounding strap (Blue Arrow)
**11.** Secure power wire retaining screw (Yellow Arrow)
**12.** Connect and secure power wires (Red Arrow)
**13.** Connect ribbon cables.
**14.** Securely latch door shut and power on console.
**15.** Refer to Console Measurement Calibration sheet

## 6.6 Caution

**CAUTION**

**When removing the sensing head from an operating line**, *do not assume that the line is empty or that the isolation or bypass means is working properly*. **If an EMC isolation valve is used, be sure its travel is not limited by any external attachments or other interference and the valve is closed tightly. No pressure should be felt on the head as the mounting nut is being removed.**

ANY PRESSURE FELT WHEN THE NUT IS LOOSENED MUST BE INVESTIGATED BEFORE PROCEEDING. **Steam should be turned off before attempting to remove head.**

**Use facility approved PPE and protective clothing. Stand to the side when removing the sensing head.**

**Clean all product residue from spud-piece on adapter prior to re-insertion of sensing head.**

**Check to ensure the old O-ring has been removed. The O-ring seal should be replaced before re-installation.**

**CAUTION**

Close off isolation valve or remove the sensing head and replace with maintenance plug prior to steam cleaning process lines to prevent prism breakage.

**Notes:**

## 6.7 Drawings List

| Drawing # | Rev | Description |
|---|---|---|
| A-13101 | | Outline MPR E-Scan System |
| B-11859 | G | Isometric, Low Power MPR E-Scan Sensing Head |
| B-11487-1 | | Parts Identification., Single/Dual Head, Color Display |
| A-12208 | A | Block Diagram – MPR E-Scan |
| B-11415 | K | E-Scan Systems Interconnect Diagram |
| B-11365 | H | Assembly MPR E-Scan Interface Board |
| B-11366 | C | Schematic E-Scan Interface Board |
| B-12699 | H | Assembly MPR E-Scan I/O CPLD Card **(Two Sheets)** |
| A-12698 | H | Schematic Diagram MPR E-Scan I/O CPLD Card **(Six Sheets)** |
| B-13024 | A | Assembly, Analog Conditioning Board |
| B-13025 | A | Schematic Diagram, Analog Conditioning Board |
| A-11792 | K | Assembly Low Power CCD Sensor Board |
| A-11794 | I | Low Power CCD Sensor Board |
| B-11423 | A | Interconnecting Cable Console to Head, E-Scan |