A.V.C.
SPECIALISTS, INC.

PRECIPITATOR SUPERVISORY SYSTEM

PSS^{tm}

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Notices

Danger

During normal operation of this device, hazardous voltages are present which can cause severe injury or death. High voltages are present on the terminal blocks, circuit boards, power distribution and control devices. These voltages are present beyond the control enclosure in which this equipment is installed.

Limitation of Liability

A.V.C. Specialists, Inc. reserves the right to make changes in the devices or the device specifications identified in this Installation and Operating Manual without notice. A.V.C. Specialists advises customers to obtain the latest versions of device specification and operating firmware before installing this equipment.

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The information contained in this document is believed to be accurate at the time of publication, however, A.V.C. Specialists, Inc. assumes no responsibility for any errors that may appear here and reserves the right to make changes without notice.

Installation and Maintenance Considerations

Installation and maintenance of the *POWERCON*[tm] control and auxiliary equipment should only be performed by qualified, competent personnel that have appropriate training and experience with high-voltage and current devices. Every effort has been made to ensure the installation instructions presented in this document are clear and easy to understand; however, if you are not sure how to perform any of the instruction provided, DO NOT CONTINUE THE INSTALLATION, OPERATION OR REPAIR of this equipment.

Warning

Failure to observe the following information may result in severe injury or death.

During normal operation of this device, hazardous voltages are present on the terminal strips, circuit boards, auxiliary equipment and external circuits. Follow standard safety precautions while performing any installation or service work.

Warning

This equipment should be installed in a switchgear cabinet or similar enclosure to ensure that the equipment is not accessible to non-qualified personnel.

Do not use this device for primary protection functions. These include applications where the device performs energy limiting functions or provides protection of people from injury. Primary protective equipment includes but is not limited to circuit breakers, ground fault interrupters, fuses, etc. The *POWERCON*[tm] control may be used to provide secondary protection functions.

Do not HIPOT/Dielectric test this equipment.

Do not remove or install any circuit board with power applied to the control.

The field devices operated by this equipment are often attached to equipment that operates at very high-voltages. Proper grounding of field devices is essential to provide protection of this equipment and service personnel.

II. WHAT IS THE *PSS™*?

The *Precipitator Supervisory System™* (or *PSS™*) is a PC-based HMI that communicates with all power controllers (*POWERCON™*) and rapper controllers (*RAPPERCON™*) in a facility. This user-friendly and intuitive supervisor system allows operators to monitor and control the performance of the T/R controllers (*POWERCON™*):

- track status of voltage, current and power
- modify parameters to improve operation
- provide alarm and warning notification
- log specified status parameters to meet regulatory agency controls

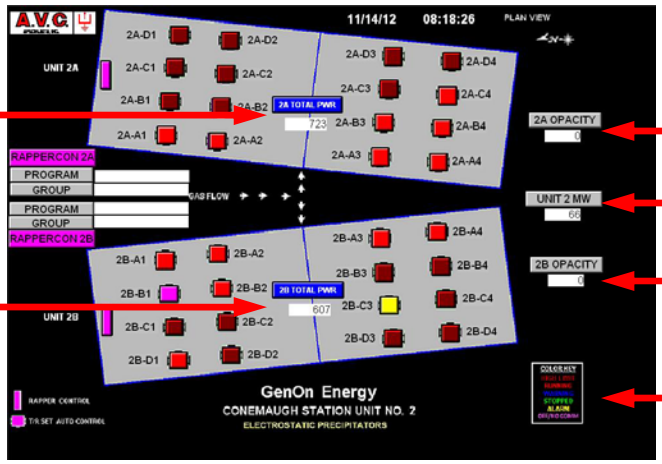
In addition the rapper controllers (*RAPPERCON™*) attached to the network are monitored and controlled:

- display existing rapper operation
- display rapper programs
- change active program to vary rapper operation as conditions vary
- track fault issues

III. STARTUP AND MAIN DISPLAY SCREEN

The Main operator screen of the *PSS™* displays an overview of the precipitator(s) with all controllers identified. In operation this screen will highlight all *Powercon*s and *Rappercon*s by color to designate operating status as well as with text to advise special modes (Manual or Remote operation).

A sample Main screen is shown in Figure 1. In this example the PSS controls two precipitators, identified as 1A and 1B. Each precipitator has sixteen T/R set power controllers, or Powercons, and one hundred forty-four rappers (not displayed on this screen) controlled by a single Rappercon.



Sum Of Unit controller Power

Sum Of Unit Controller Power

Unit Opacity Value

Total MWatt Power

Unit Opacity Value

Color code

Fig 1

The RAPPERCON 2A and 2B programs and groups are displayed while in operation.

In this figure Powercons are shown in operation. Powercons running at High Limits  are displayed as dark red.

Powercons displayed in bright red are running in normal range. 

Additional colors include green  signifying that the controller is OK but not running,
yellow  signifying a fault condition, dark blue  if in Power Off
Rapping or pink  if off or not communicating.

The Rappercons also conform to a color code convention to make it easy for the operator to identify current status of each controller and know which rapper(s) is active.

IV. *POWERCON™* AND *RAPPERCON™* MONITOR SCREENS

Click on any T/R set  in either unit and the screen will display a detailed view of the selected precipitator unit. This new view adds specific active rappers and includes the unit opacity, MWatt output and the total sum of the units voltage controller output power.

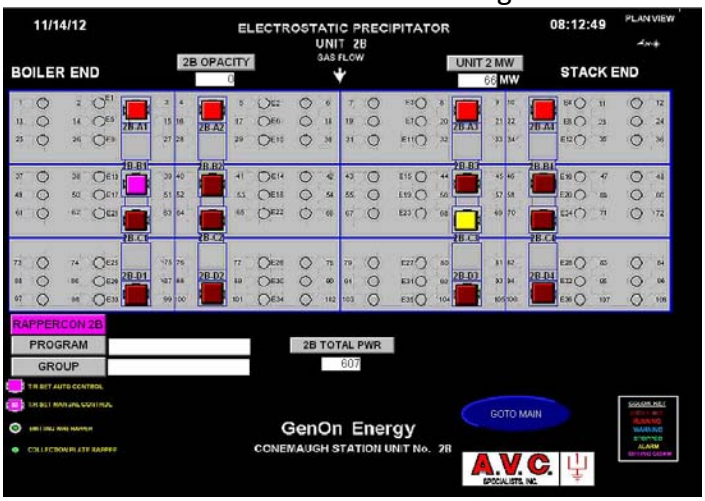


Fig 2

This is a very informative screen in that it displays the active state of every component of the precipitator. *Powercon™* voltage controllers, Rappercon(s), and individual rapper(s) are displayed to allow instant status recognition by the operator. Rappers are normally green if not actively rapping, red if active and yellow if in a fault condition.

In our example the sixteen T/R Sets (*Powercon™* voltage controllers) in Unit 2B are shown. Each T/R Set and its controller are identified, operational status is shown by color code and a text identifier to show if the Powercons are in Manual mode (M) or Remote mode (R).

Other conditions that appear are yellow, if the *POWERCON*^{tm} is faulted for any reason, and blue if the *POWERCON*^{tm} is currently running in Power Off Rapping. The complete color code is shown in the lower right corner of the screen.

V. *POWERCON*^{tm} (T/R SET) STATUS DISPLAY AND CONTROL

Once the individual precipitator unit is displayed, click on the T/R set icon () to pop up the status display, and edit screens, for the selected *POWERCON*^{tm} voltage controller.

The main *POWERCON*^{tm} screen for each Field is shown in Figure 4. This screen shows the instantaneous status values for the most important data as well as the High Limit settings, Lower Limit settings, TR Nameplate data, 6 Minute Average data and the current status of the *POWERCON*^{tm} and any alarm that might be active.

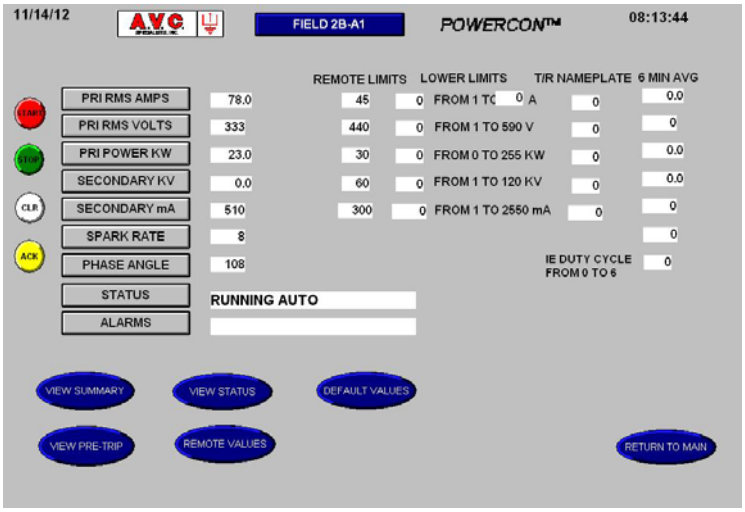


Fig 4

In addition, pushbuttons down the left side allow the operator to Start or Stop the controller, Clear or Ack(knowledge) warnings or alarms.

Five blue pushbuttons across the bottom access additional screens that allow the:

- Display and editing of Default Parameters
- Display and editing of Remote Parameters
- View the 6 Minute Averaged variable data
- View pre-trip data
- View overall status of the *POWERCON*^{tm}
- View and edit limits
- View a summary of the status variables

A. DISPLAY DEFAULT  VALUES

Selecting this button will pop-up a screen that shows all the Default Parameters for the *POWERCON*^{tm} voltage controller.

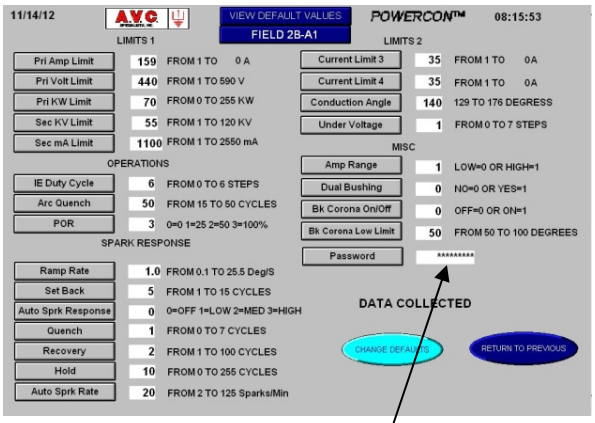


Fig 5

The Default Parameters are stored in non-volatile memory in the *POWERCON*^{tm} controller. The PSS reads these status variables when the Default Values button is pressed.

B. EDITING DEFAULT VALUES

To modify Default Parameters in the *POWERCON*^{tm} voltage controller:

a) Click on the Password data field, a data entry window will pop-up.
b) Enter 5318900 and click on the CHANGE DEFAULTS button.

All data fields on the screen are now editable.

c) Click on a field to be modified (ex-the 159 of PRI AMP LIMIT). The data entry window will pop-up to allow typing of new data.
d) Type in new value and click OK. The new value will be written to the screen field.

Continue to make any changes needed.

e) When finished click on the +WRITE THIS DATA button. This will set the value to write to the *POWERCON*^{tm} controller.

f) Click on RETURN TO PREVIOUS and then click on RETURN TO PREVIOUS again until you return to the original FIELD screen. The red SET DEFAULT button should be displayed.
g) Click on SET DEFAULT. This will write the data to the *POWERCON*^{tm} controller. When the write is complete the button will disappear.

C. DISPLAY OR EDIT REMOTE VALUES

Remote Mode of operation is a useful tool for testing different operating parameters to accommodate differing conditions (changes in atmosphere, boiler fuels or operating temperatures, etc). The Remote Mode parameters are stored in the PSS and are downloaded to the *POWERCON™* when Remote Mode is activated. When active, an R is displayed in the T/R Set icon.

When the REMOTE VALUES button is pressed the Remote parameters and limits are displayed:

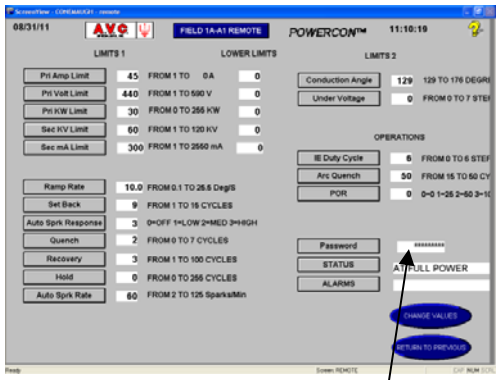


Fig 6

These parameters can be modified manually by:

- Click on the Password field (*********). A password entry window will pop-up. The operator/engineer must enter the correct password in order to modify any values.

  The default password for Remote parameter modification is “4170005”.

- Once the password is entered click on OK. The keypad will disappear.

- Click on CHANGE VALUES and the screen will change to appear as shown in Figure 7.

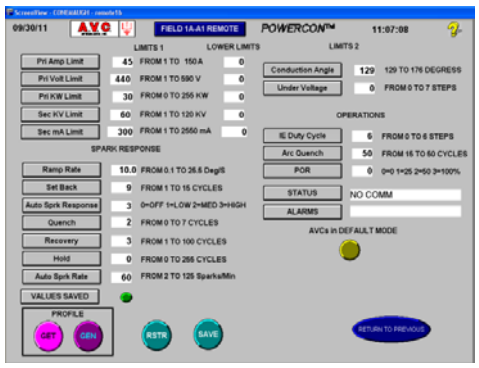


Fig 7

There are three different primary functions that are accessed by this screen.

- The *POWERCON*^{tm} can be run with the stored Remote variables by clicking on the Default/Remote button.
- Individual Remote parameters can be modified and saved to disk or saved to the *POWERCON*^{tm}.
- A *POWERCON*^{tm} operating "Profile" can be created and saved and recalled.

a. Selecting Default or Remote Operation

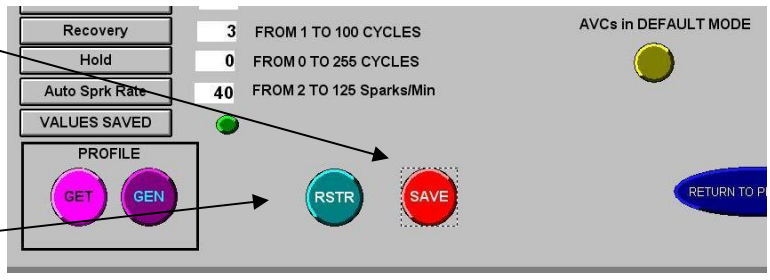
At power-on the *PSS*^{tm} assumes Default mode. Accessing the Remote Mode edit screen displays the Default/Remote button, which, based on which mode is active, will appear as follows:

Pressing the **AVC in Default Mode** will cause the *PSS*^{TM} to activate Remote Mode and download the Remote parameters to the *POWERCON*^{tm} controller (these values are stored on the *PSS*^{TM}).

If the controller is running in remote mode and the button is red press on it to switch back to Default Mode. The Default parameters will be re-activated in the *POWERCON*^{tm} controller.

b. Editing Individual Parameters and Saving them

1. Clicking/pressing the value field of the parameter that you wish to modify will activate its edit mode.
2. The keypad will pop-up.
3. Type the desired value and press OK.
4. Press the SAVE button. It will turn red for a couple of seconds while it saves the data.
5. After making all changes press the RSTR (Restore) button to download to the *POWERCON*^{tm} controller.

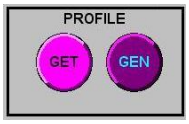


Notice that the green VALUES SAVED light illuminates when values are successfully saved.

c. Creating an Operating Profile and Recalling Stored Profiles

The *POWERCON*^{tm} is capable of automatically generating an operating profile for the T/R Set. For complete details on how this is done refer to the *POWERCON 900*^{tm} Manual.

The PSS has two buttons in the Remote Mode Edit screen that activate the function in the *POWERCON*^{tm}: GET PROFILE and GEN(ERATE) PROFILE.



- GET Profile will retrieve a stored profile.
- GEN Profile will create a new profile.

D. VIEW STATUS

Press View Status to switch the screen to display a three-column list of Status and Settings, Alarms and Communications Status flags. The system time and date is shown as well.

This screen displays a color based round button next to any state that is true. If an alarm or fault occurs the operator can quickly view which was the cause.

Fig 10

E. VIEW PRE-TRIP

If a *POWERCON*^{tm} should trip, for any reason, the values just prior to the trip are stored into registers for viewing and troubleshooting.

The data set includes Primary Volts and Amps, Primary Power, Secondary kV and ma, Spark Rate and Phase Angle. In addition

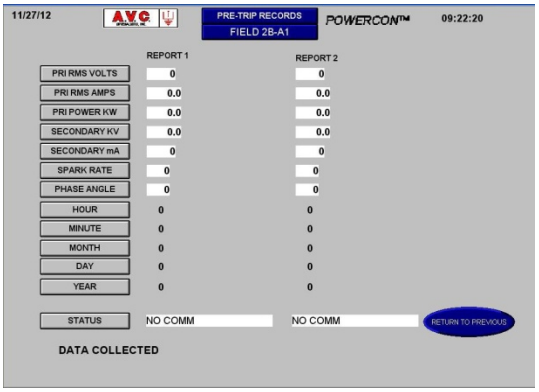


Fig 11

F. VIEW SUMMARY

The Summary screen displays key instantaneous values for all *POWERCON*^{tm} controllers in the precipitator unit.

Values are either summed or averaged, depending on the nature of the data, across the bottom of the screen.

The default display is in a “parallel” format.

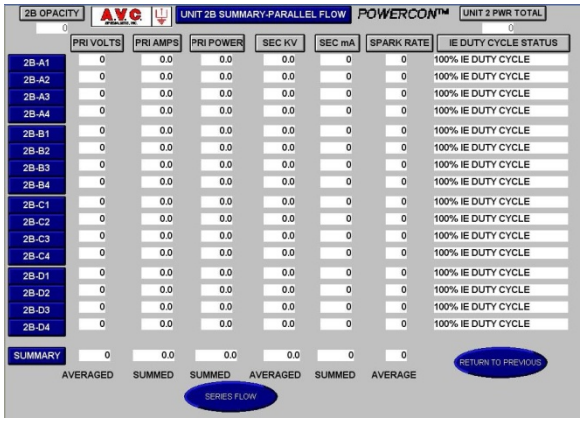


Fig 12

Click on SERIAL FLOW to display in series gas flow arrayed order.

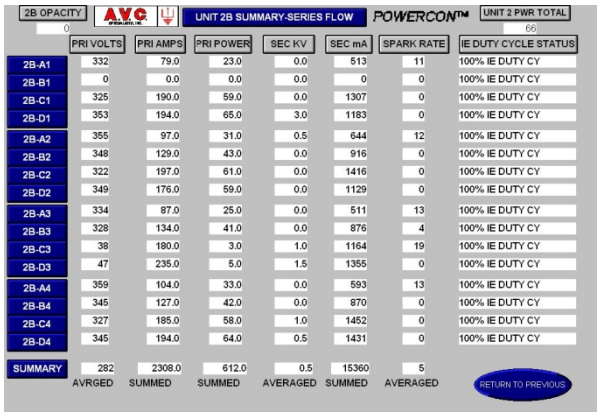


Fig 13

VI. *RAPPERCON™* STATUS DISPLAY AND CONTROL

If a *RAPPERCON™* is operating as part of the precipitator control system there will be a pushbutton identified with the name of the *RAPPERCON™* on the main screen. In this example the main screen displays dual precipitators, Unit 1A and Unit 1B.

On the left side of the screen note that there are two *RAPPERCON™* controllers, identified as RAPPERCON 1A and RAPPERCON 1B.

Click on either red button to display the operator monitor and control screen for the selected *RAPPERCON™*.

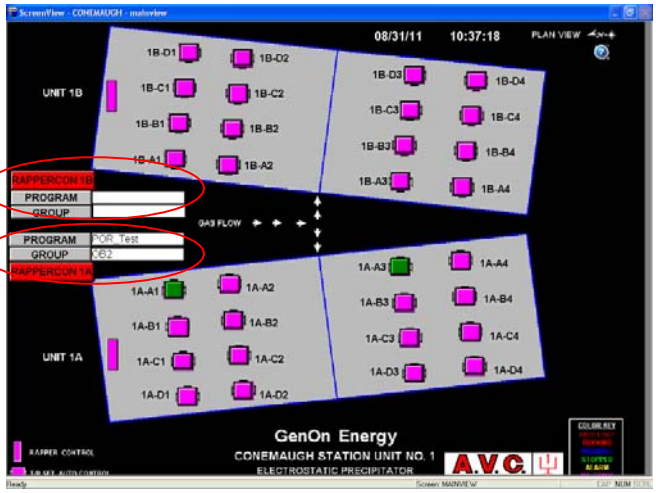


Fig 14

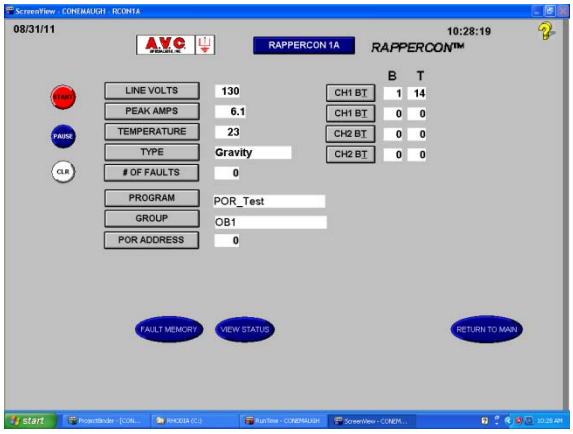


Fig 15

Clicking on either will cause the PSS to display the *RAPPERCON™* operator screen, shown in Figure 15

The *RAPPERCON™* main screen displays all the key information about the operation of the rappers connected to it.

The buttons on the left side of the screen allow the operator to START running the currently selected Program (shown on this screen along with the active Group and the Board and Terminal address for the active rapper(s).

Additionally, pressing the PAUSE button will cause the *RAPPERCON™* to stop rapping for 12 minutes. If no keyboard activity for this period the *RAPPERCON™* will return to operation and continue rapping from where it was paused.

If the CLR clear button is pressed after a change of program the new program will begin. If no new program has been selected the current program will start over from the beginning.

A. CHANGE OPERATING PROGRAM

From the *RAPPERCON*^{tm} main screen shown in Figure 15 click on VIEW STATUS.

This will cause the STATUS screen to be displayed:

This screen displays the current status of the *RAPPERCON*^{tm} as well as available programs and any alarms or warning messages may exist.

1. Notice that there are six resident programs possible.

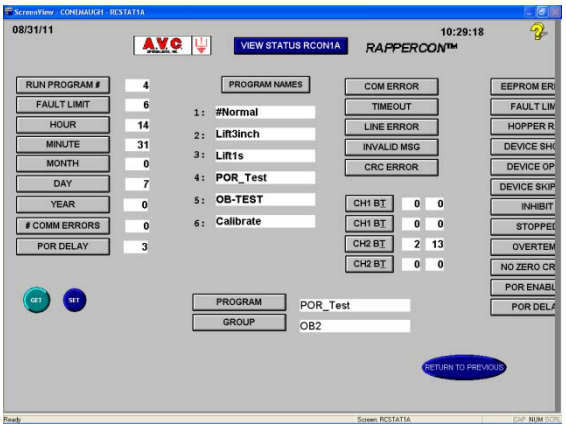


Fig 16

2. Click on the field labeled RUN PROGRAM #, note that in this example the current program is #4, which you will note in the center section under PROGRAM NAMES, is POR_Test. Use the keyboard to change it to the number that represents the program to run next (ex: 5 to run OB-TEST).
3. Click on SET.
4. Click on RETURN TO PREVIOUS
5. Click the STOP button and then the CLR button.

The new program will be loaded and begin running.

B. MONITORING ACTIVE RAPPER

Note the CH1 and CH2 Board and Terminal values. As the *RAPPERCON*^{tm} runs a program the display will show the currently active rappers.

On the Unit screen (shown in Figure 17) the active rappers will be displayed in red. Inactive rappers will be shown in green. A faulted rapper will be shown in yellow.

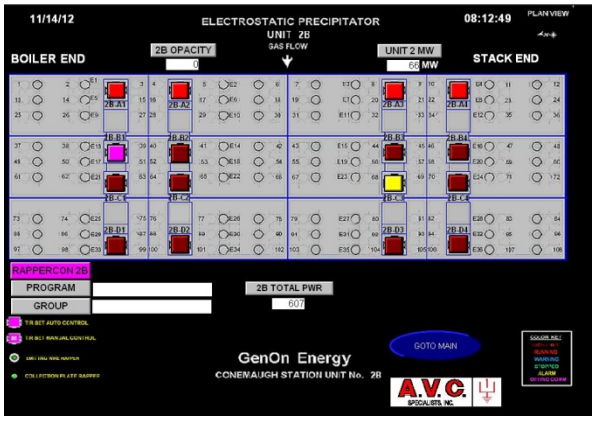
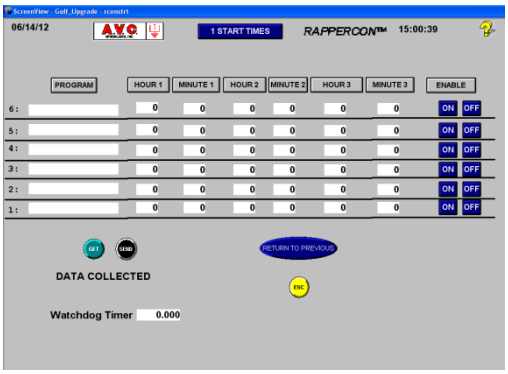


Fig 17

C. PROGRAMMING START TIMES

The *RAPPERCON*^{tm} will allow the operator to schedule automatic program operation, ideal for Power Off Rapping at convenient times of the day.

From the *RAPPERCON*^{tm} screen click on the START TIMES button. This will display the START TIMES setting screen.



The PSS will read the Start Times program memory in the *RAPPERCON*^{tm} and display them in the left column.

Select programs that are to be automatically run using this function and click on the ENABLE ON button for that program. A light will be illuminated to let you know that the program is enabled to run in automatic mode.

There are three possible start times for each program, per day. These are shown as HOUR 1 and MINUTE 1, HOUR 2 and MINUTE 2 and HOUR 3 and MINUTE 3. This allows the operator to specify to the minute when a program will start and end.

On the program that is enabled set HOUR 1 to the time the program is to start. This is based on a 24 hour clock. Any value other than 0:00 can be programmed. Example: 12:01AM will be designated with HOUR 1=0 and MINUTE 1=1.

A program will run until a different program starts. When programming POR be sure to set the start time for the POR program as well as the start time for the normal program to run again. Example: the POR program is set to start at HOUR 1 = 3 (3AM) and the NORMAL program is set to start at HOUR 1 = 5 (5AM). With this configuration the NORMAL program will run from 5AM until 3AM the next day, when the POR program will start running for two hours. At 5AM the NORMAL program will again begin running.

Once the desired schedule is set on the screen click on the SET button. It will turn blue while writing the data to the *RAPPERCON*^{tm} and then turn black again.

To update the *RAPPERCON*^{tm} with the new data the operator must go to the *RAPPERCON*^{tm} and press the 8 key on the keyboard (*RAPPERCON*^{tm} *800)* to popup the Start Times screen. This will read the new data into active memory. Press ESC once the new schedule is displayed.

This completes the programming of START TIMES function.

VII. POWERCON STATUS LOGS

Every 6 minutes the PSS logs status values for each attached POWERCON controller. This data includes:

- IE DUTY CYCLE
- PRIMARY VOLTAGE
- PRIMARY AMPERAGE
- PRIMARY POWER
- SECONDARY KV
- SECONDARY Ma
- SPARK RATE

Each day, at 12AM, a new log is started. The file is named for the current date (12162012=Dec 16, 2012).

The logfile is updated every 6 minutes with the above referenced data in “csv” format for easy importing into spreadsheets, with each entry date and time stamped.

The data is the average for the previous six minute period.

An example of a section of a log (PSS #1) is shown below:

5/30/2012 7:57	FIELD NAME	IE Duty Cycle	Primary Volts	Primary Amps	Primary Power	Secondary KV	Secondary mA	Spark Rate
	FIELD 1A-A1	6	148	13	1	25.5	34	16
	FIELD 1A-A2	6	236	21.6	4.7	38.5	118	20
	FIELD 1A-A3	6	346	61.2	20.4	51.5	320	4
	FIELD 1A-A4	6	396	20.9	6	60	96	0
	FIELD 1A-B1	6	371	17	5	59.5	91	0
	FIELD 1A-B2	6	312	20.2	5.9	59.5	86	0
	FIELD 1A-B3	6	108	5.8	0.7	23	15	29
	FIELD 1A-B4	6	145	12.2	0.9	25	31	15
	FIELD 1A-C1	6	264	37.2	8.7	38	180	2
	FIELD 1A-C2	6	148	13	1	25.5	34	16
	FIELD 1A-C3	6	236	21.6	4.7	38.5	118	20
	FIELD 1A-C4	6	346	61.2	20.4	51.5	320	4
	FIELD 1A-D1	6	148	13	1	25.5	34	16
	FIELD 1A-D2	6	236	21.6	4.7	38.5	118	20
	FIELD 1A-D3	6	346	61.2	20.4	51.5	320	4
	FIELD 1A-D4	6	312	20.2	5.9	59.5	86	0
5/30/2012 8:03	FIELD NAME	IE Duty Cycle	Primary Volts	Primary Amps	Primary Power	Secondary KV	Secondary mA	Spark Rate
	FIELD 1A-A1	6	206	20.8	3.9	36.5	90	20
	FIELD 1A-A2	6	239	22.1	4.9	39	121	20
	FIELD 1A-A3	6	339	59.2	19.2	50.5	307	10
	FIELD 1A-A4	6	107	5.6	0.6	23	14	29
	FIELD 1A-B1	6	146	12.4	0.9	25	32	16
	FIELD 1A-B2	6	265	37.5	8.8	38	181	1
	FIELD 1A-B3	6	396	20.8	6.1	60	96	0
	FIELD 1A-B4	6	371	17	5	59.5	91	0
	FIELD 1A-C1	6	239	22.1	4.9	39	121	20
	FIELD 1A-C2	6	339	59.2	19.2	50.5	307	10
	FIELD 1A-C3	6	107	5.6	0.6	23	14	29

Important note: The DATALOG directory will continue to grow indefinitely unless files are moved to another holding location.

APPENDIX A - Modification to Registry for *PSS*^{tm} Operation

This applies only if the *PSS*^{tm} computer is replaced.

Part of the functionality of the *PSS*^{tm} is the use of “common variables” for Default Parameters, 6 Minute Average values, etc. Standard Think n Do does not allow for this, requiring a unique variable for each I/O address. Think n Do added this feature for AVC Specialists, and is therefore not present on a "standard install" of Think & Do. **In order to use this feature, a registry key and registry value must be created.**

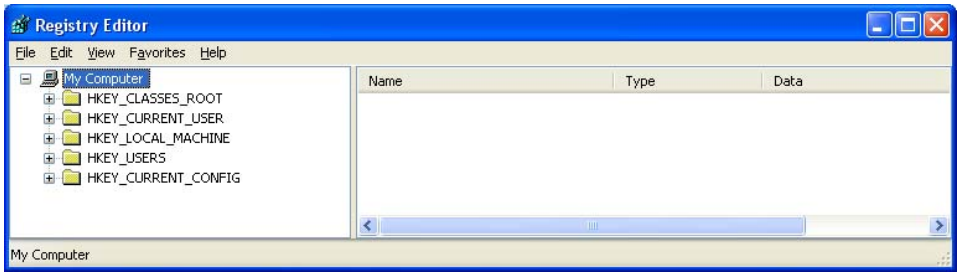
NOTE: Always create a Windows "System Restore Point" and back up registry prior to making changes. Improper registry entries can render your system unusable.

1 - From the desktop of the PC, access the Registry Editor by clicking on the START button,
2 - Click on RUN and type REGEDIT in the RUN window

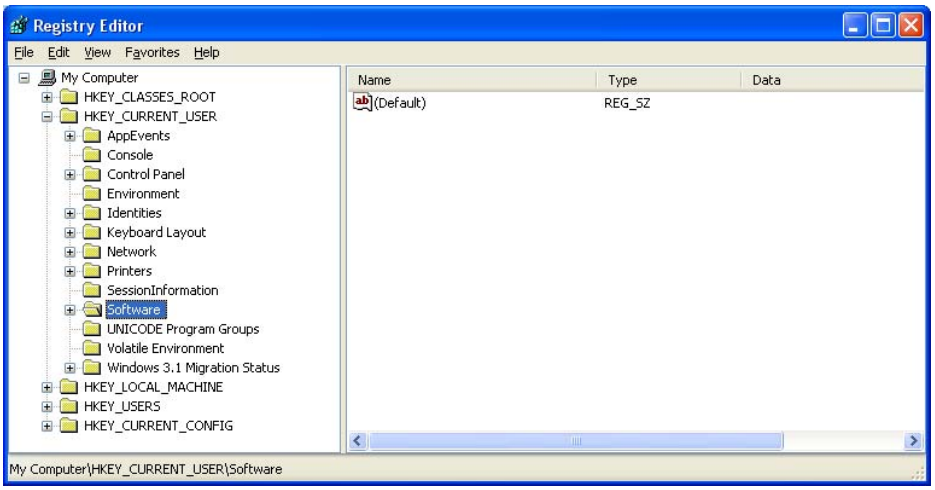
3 - Click OK

This will startup the Registry Editor that will allow you to create these registry entries.

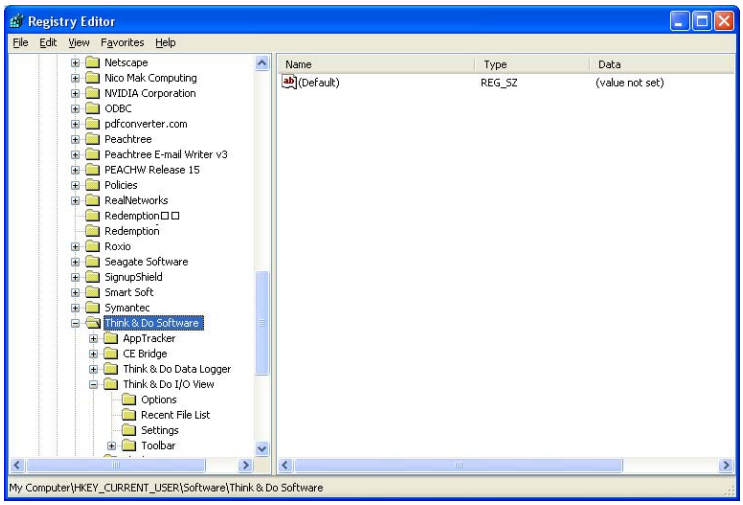
The Registry tree will be displayed:



4 – Click on the ‘+’ to the left of ‘HKEY_CURRENT_USER’ to open up the sub folders



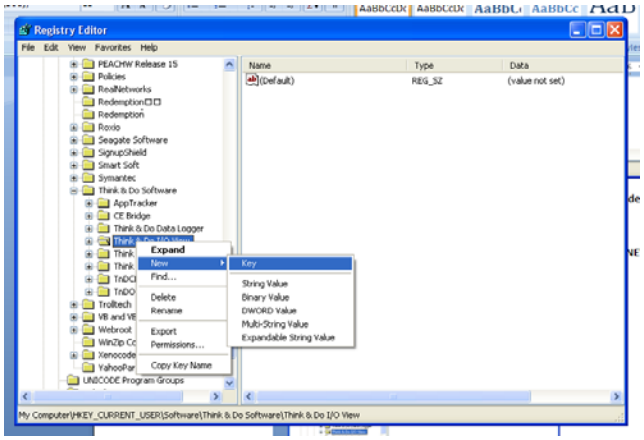
5 – Click on the '+' to the left of 'Software' to open up its sub-folders



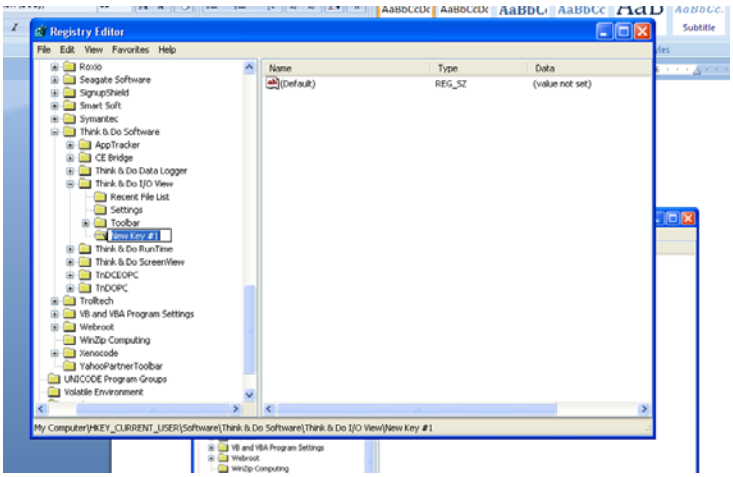
6 – Scroll down to 'Think & Do Software' and click on the '+' to the left. This opens up the sub-folders.

7 – Click on the '+' next to 'Think & Do I/O View' to open up its sub-folders.

8 – Click on 'Think & Do I/O View' to highlight the folder and then click on the EDIT menu, then NEW and then KEY.

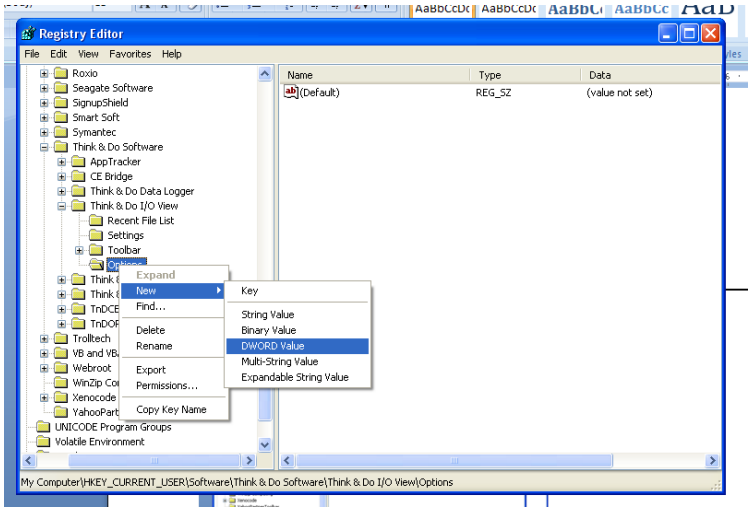


A new sub-folder under Think & Do I/O View will be created.



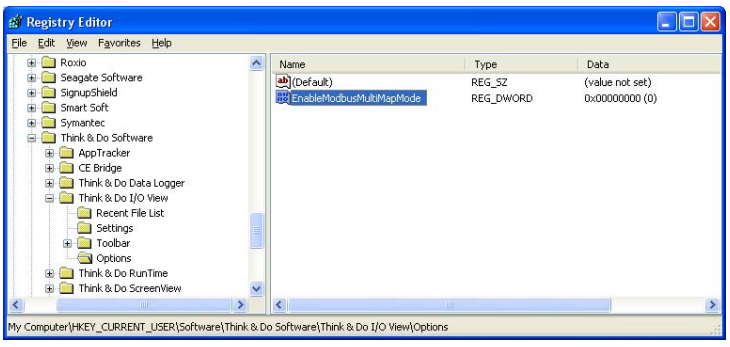
9 – Name the new folder ‘OPTIONS’

10 – Right click on the ‘Options’ folder and click on NEW and DWORD Value

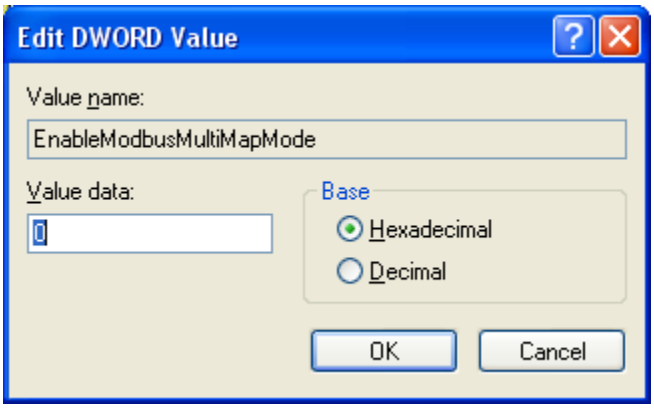


A new item will be displayed in the Options folder.

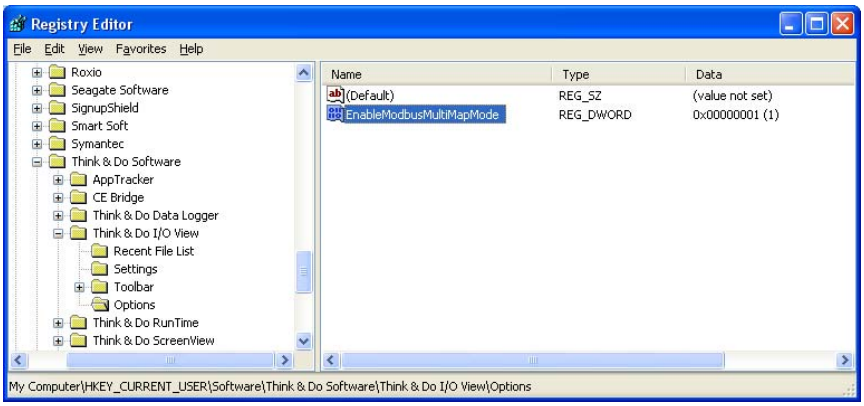
11 - Name this new item ‘EnableModbusMultiMapMode’ (without the quotes)



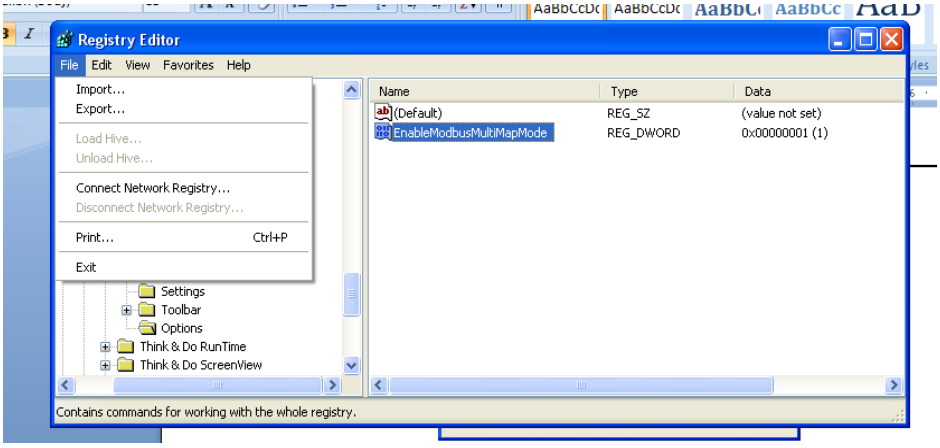
12 – Double click on this item to open a new window. Set the value for this new item to '1'.



13 – Enter a '1' in the Value data field and click OK. The added data item value will be updated in the Registry.

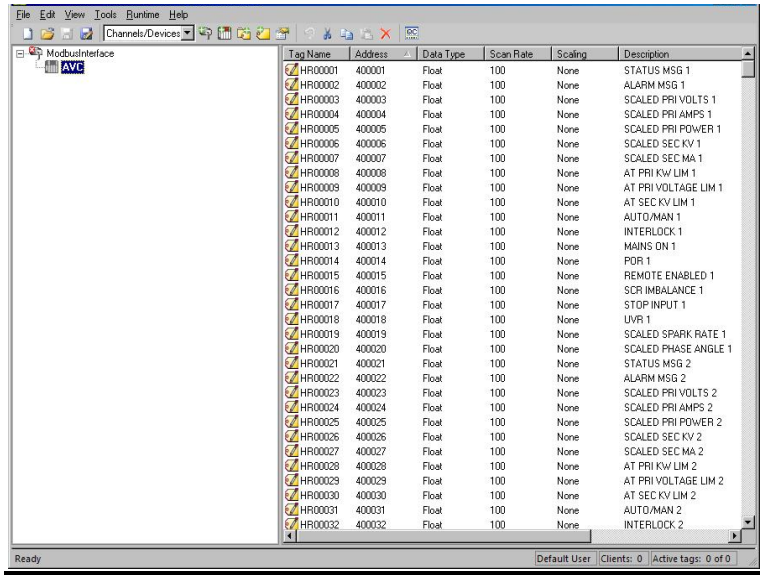


14 - You have successfully modified the Registry to support the new feature. Click on File and Exit to return to the desktop.

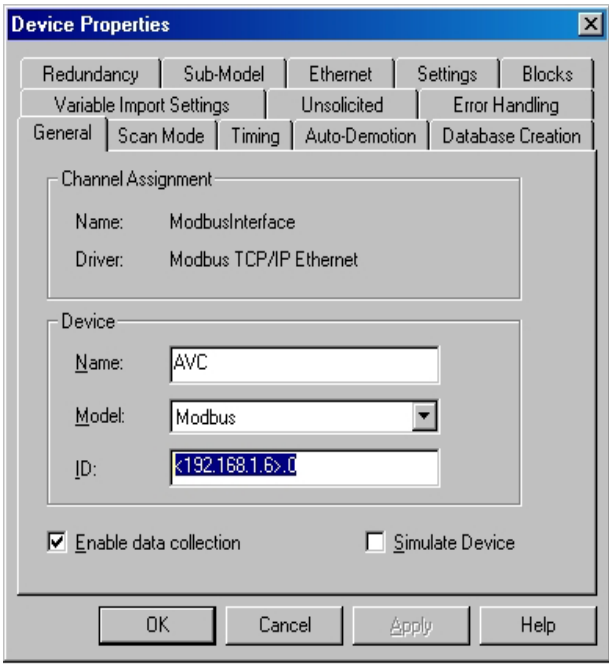


APPENDIX B - DCS COMMUNICATIONS

Startup the Kepware



Right click AVC in the left window and then select Properties. The following window will appear:

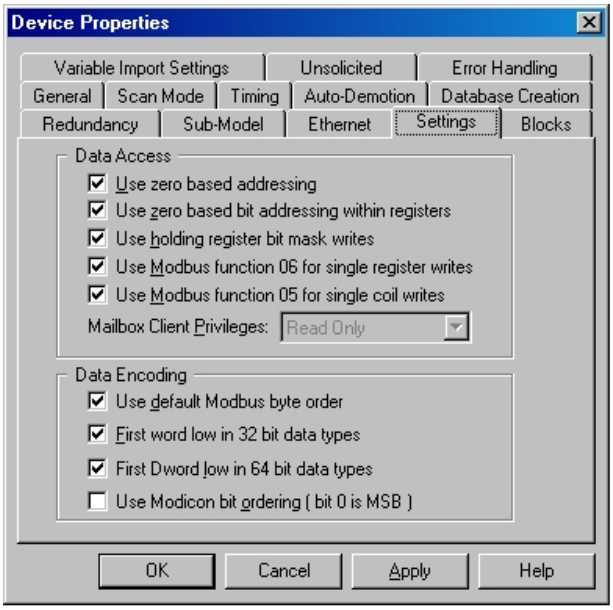


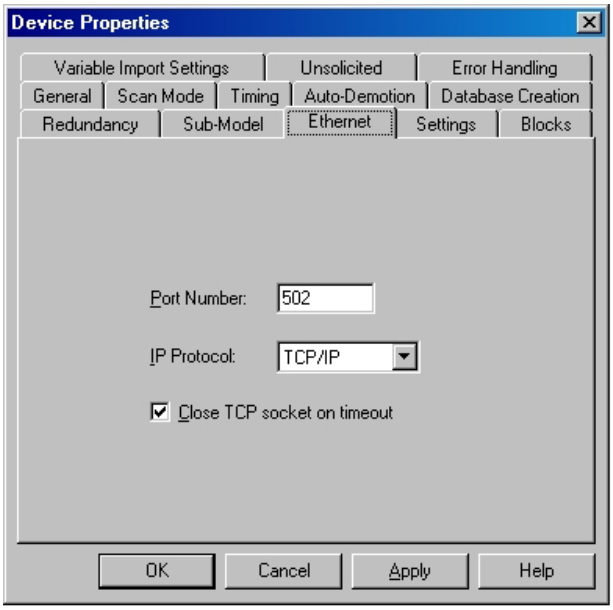
The General tab should be displayed by default. If it does not click on the tab to bring it to front.

The Device Name is AVC.
The Model is Modbus.
The IP address must be changed to a valid address in your domain.

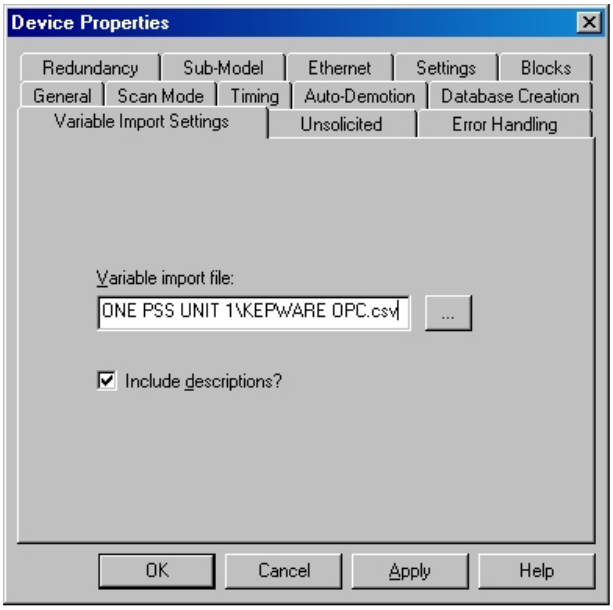
Once the correct IP address is setup you should verify these other tabs, although there should be no reason for them to have been changed.

Most do not matter but be certain that the following settings are as shown:





After verifying these settings click Apply and OK to return to the main screen.



At this point the host should be able to access the Tag database on the Kepware system. The Tagnames are, by default, H00001 with properties and description in columns to the left.

APPENDIX C – SCHEMATICS