Micro-Nano Technology Sol-Gel Corrosion Monitoring System

Getting Started Guide

Prime Sponsor: Army Corps of Engineers

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Introduction

All materials to some degree are susceptible to deterioration by their environment. Demanding environmental conditions can lead to the degradation of even advanced structural material. Corrosion is one of that multibillion dollar cost to modern society. A major challenge to all engineers employing metals in their designs is to prevent corrosion attacks.

In order to overcome the problems as mentioned above, a full-proof and reliable inspection system is designed to continuously monitor the corrosion on the Army Bridge. This system would ensure that corrosion related bridge health is continuously monitored and hence prevent any possible danger.

This guide is intended as a reference for those working with IPFW established Corrosion Monitoring System for the first time. It explains step by step unpacking and setup of equipment, testing communication link and startup of automatic monitoring software program.

Project Team

Project Sponsor: Richard Lampo and Michael McInerney
Principal Investigator: Max Shing-Chung Yen
Co-PIs: Paul I-Hai Lin and Dong Chen
Graduate Students: Robert Timbery, MengWei Li, Muhammad Mansur
Undergraduate EE Student: Steve Groff

Part 1: Set up of the Corrosion Monitoring System

Identify Kit Components

Carefully unpack and verify the contents of your kit. Your kit should include the following:

Description	Quantity
Embedded Computer Server Unit Box with power supplies and sockets	X 1
Sensor Electronics Box	X 6
6 pin Sensor Box Connection Wire with socket	X 6
RJ-45 Ethernet Connection Wire with socket	X 1
Uninterruptible Power Supply	X 1
Temperature Sensor	X 1
Coal-tar epoxy coated Sol-Gel Sensor mounted on ceramic plate, with wire and connector	X 2
Sol-Gel Sensor mounted on ceramic plate, with wire and connector	X 2
Coal-tar epoxy coated cylindrical sensor with wire and connector (316 stainless steel)	X 1
Coal-tar epoxy coated Cylindrical Sensor with wire and connector (A36 carbon steel)	X 1

Below are snapshots of all above mentioned equipment's

Embedded Computer Server Unit Box (dimension: width-length-height 16 in x 16 in x 6 in)

Figure 1: Embedded Computer Server Unit Box

Sensor Electronic Box with Socket for Sensor Connection; and Socket for Power Supplies and RS485 Communication Lines

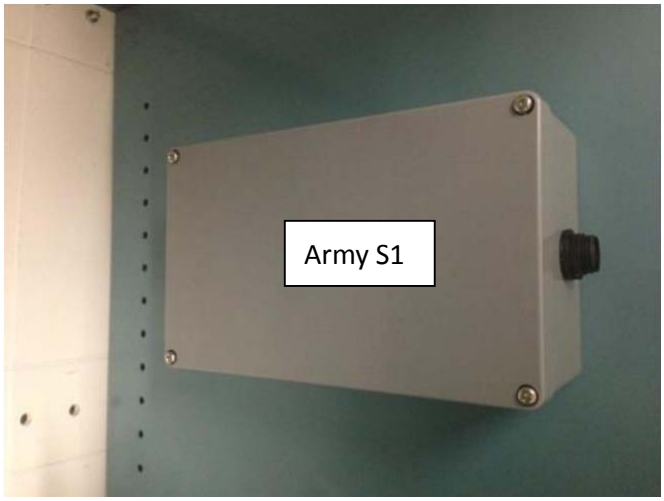


Figure 2: Mounted sensor box with Army S1 to S6 Labels on all Sides

Figure 3: Inside view of Sensor Electronics Box

Currently, there are 3 different types of sensors in the package sent. There numberings and desired installed locations are as below:

1. Coal-tar epoxy coated sol-gel sensor (installed at a lower level of the bridge).
2. Coal-tar epoxy coated sol-gel sensor (installed at a higher level of the bridge).
3. Sol-gel sensor (installed at a lower level of the bridge).
4. Sol-gel sensor (installed at a higher level of the bridge).
5. Coal-tar coated cylindrical dummy sensor (all made of 316 stainless steel).
6. Coal-tar epoxy coated cylindrical corrosion sensor (the center is made of A36 carbon steel).

Figure 4: Coal-tar epoxy coated Sol-Gel Sensor1 and Sensor Box Army S1

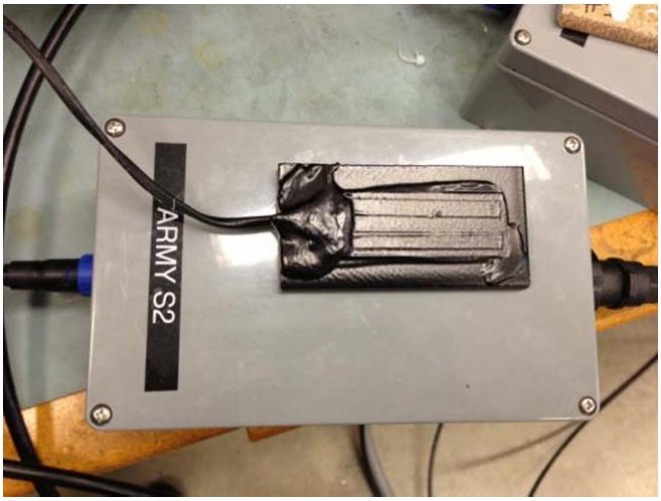


Figure 5: Coal-ta epoxy coated Sol-Gel Sensor2 and Sensor Box S2

Figure 6: Sol-Gel Sensor3 and Sensor Box S3

Figure 7: Sol-Gel Sensor4 and Sensor Box S4

Figure 8: Coal-tar epoxy coated Cylindrical Sensor5 and Sensor Box S5

Figure 9: Tar-Coated Cylindrical Sensor6 and Sensor Box S6

Wiring Details

The Corrosion monitoring system wiring diagram is shown in Figure 10.

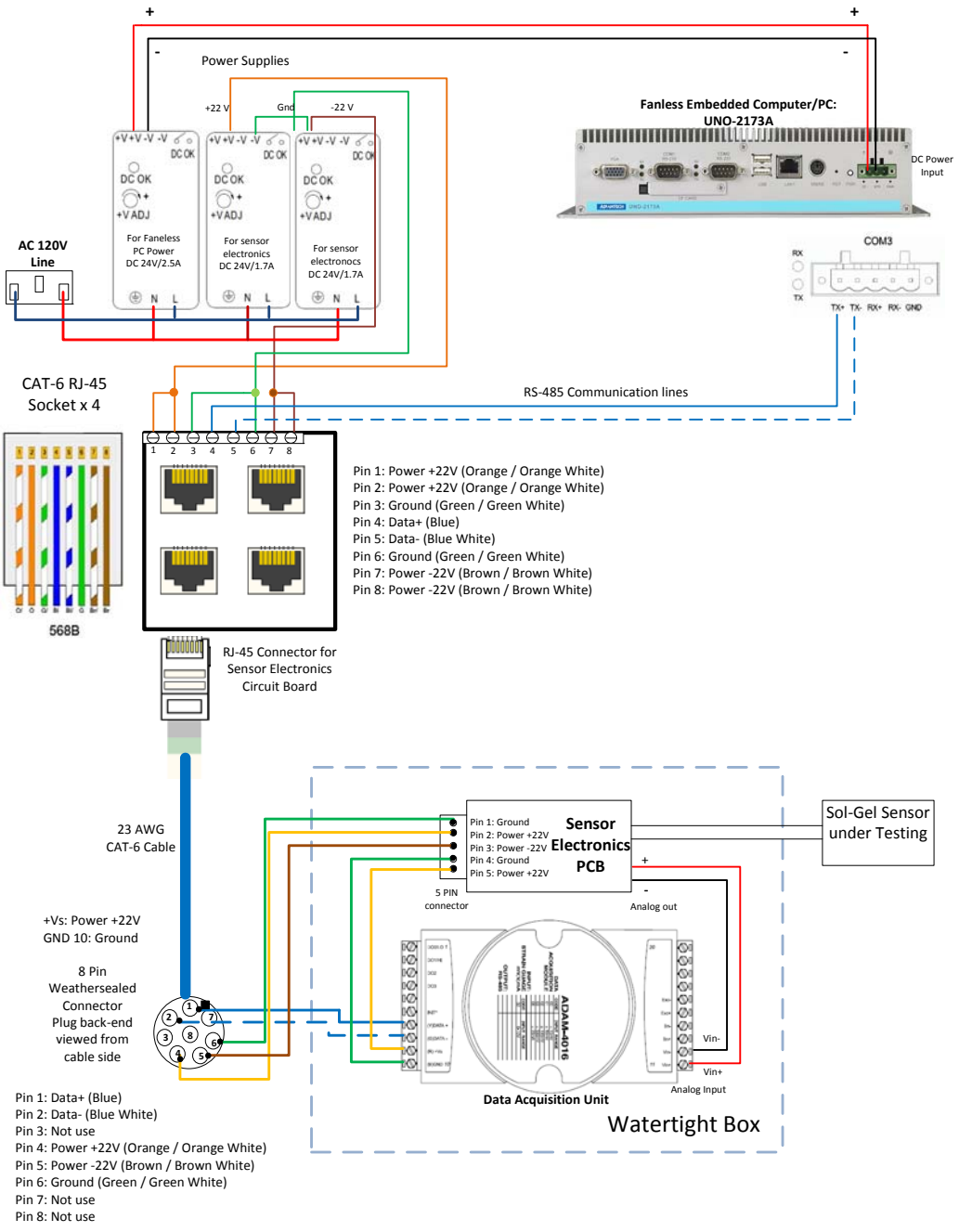


Figure 10: Corrosion Monitoring System Wiring Diagram

Some of the wiring details with associated snapshots are as below

Figure 11: 6 pin Sensor Box Connection Wire for Power Supply and RS485 Communication Lines

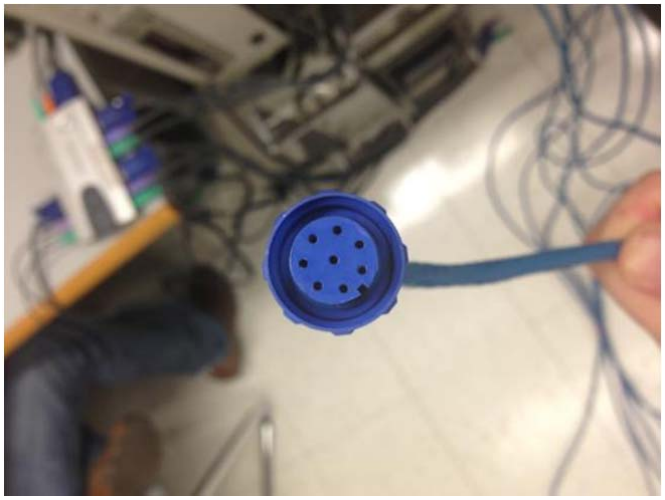
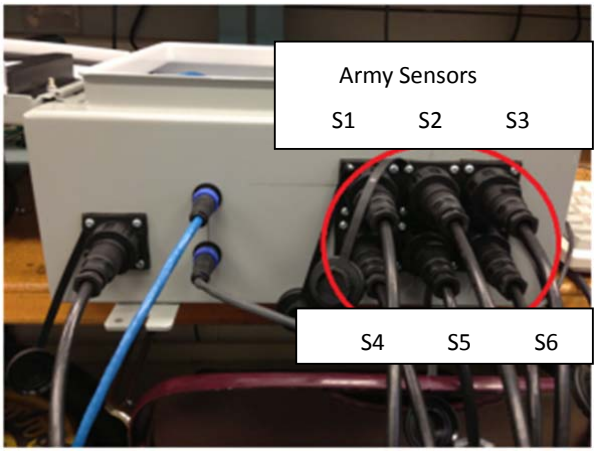


Figure 12: RJ-45 Ethernet Connection Wire for Connection Embedded Server Unit Box to Internet

Assemble the Corrosion Monitoring System Kit

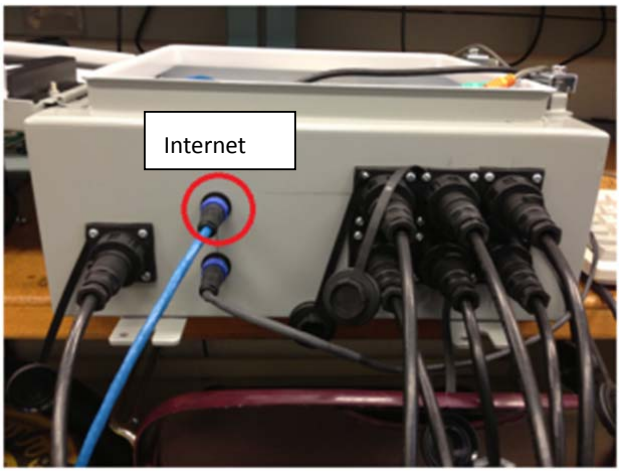
To assemble the Corrosion Monitoring System, perform the following steps:

1. Connect the sensor boxes to the Server Unit Box.

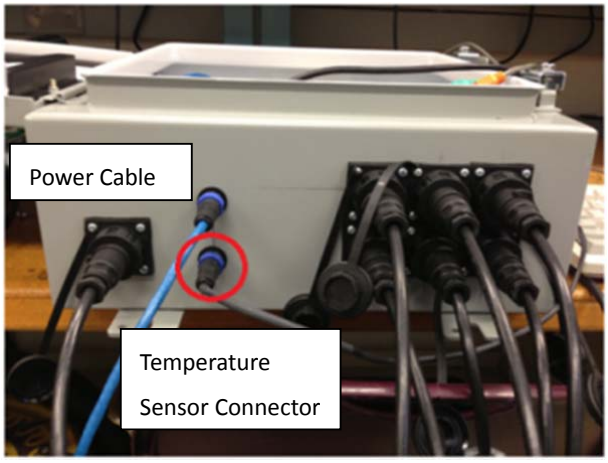


2. Connect the Sensor Electronics boxes to the Embedded Server Box.

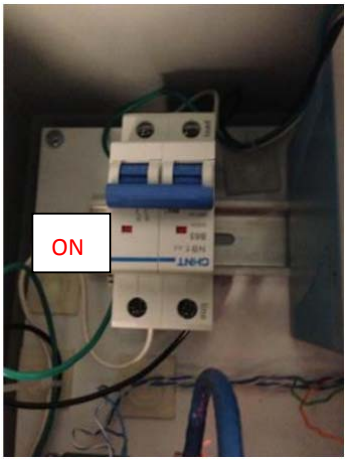
3. Connect RJ-45 Ethernet cable to the Server Unit Box.



4. Plug in the temperature sensor cable to the Server Unit Box.



5. Plug the power cable to the outlet.
6. Turn on the main power switch inside the Embedded Computer Server unit box.



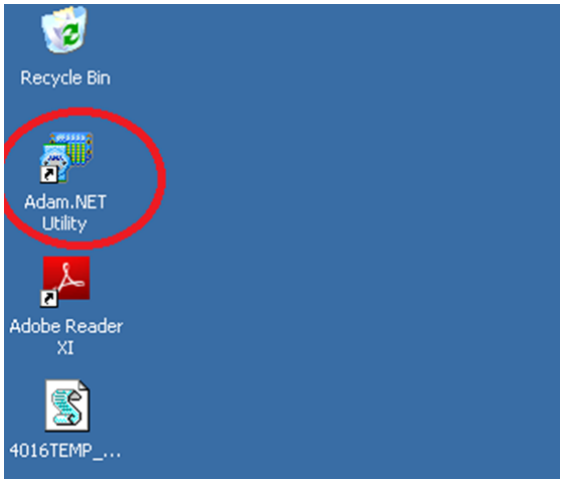
7. Embedded Computer Reset Button with DC power wires connected (used if needed to Cold boot the computer).

You are now ready to run the ADAM .NET utility software or VBscript for corrosion sensor data acquisition.

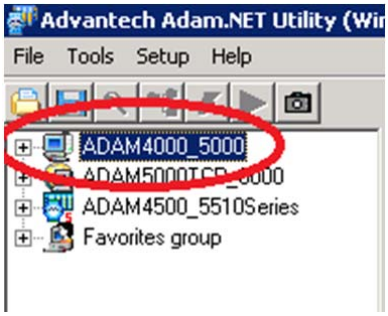
Part 2: Test Communications Link

The present sensor boxes are pre-configured with RS communication device addresses. In case additional sensor boxes are to be added in the future, they will need to be configured using the following steps:

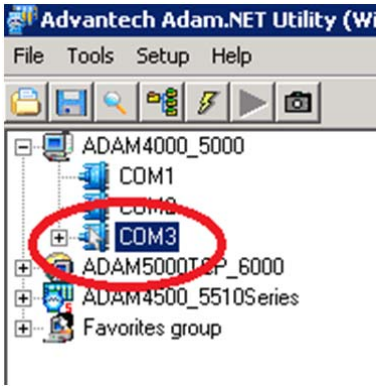
1. Double-click the ADAM .NET utility shortcut on the desktop.



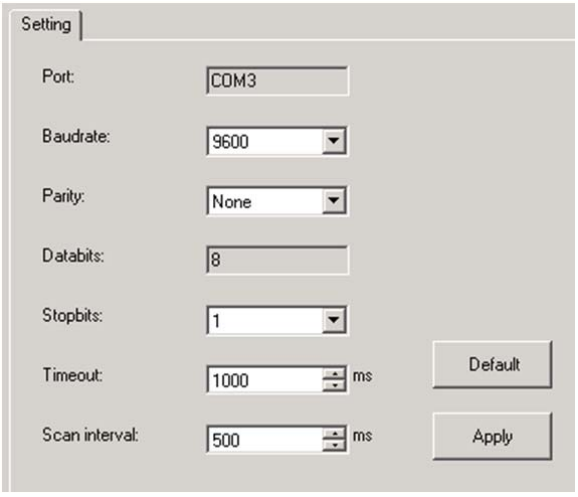
2. Double click ADAM4000_5000.



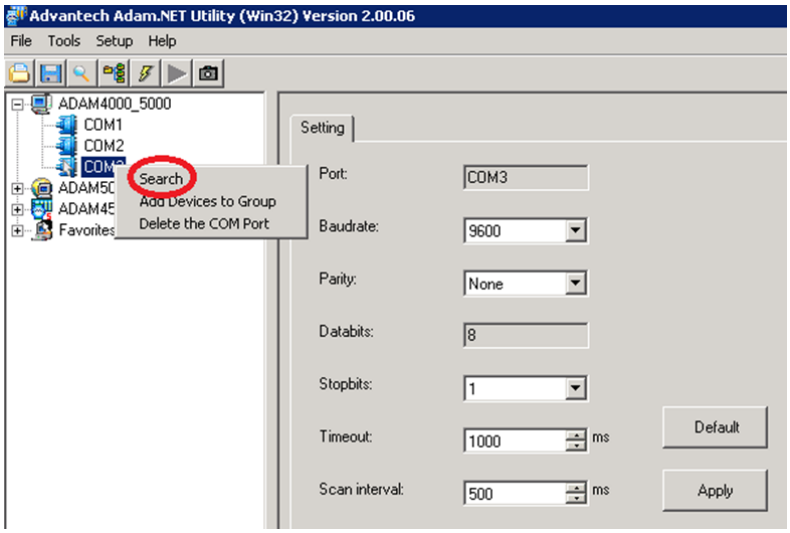
3. Select the COM3 port.



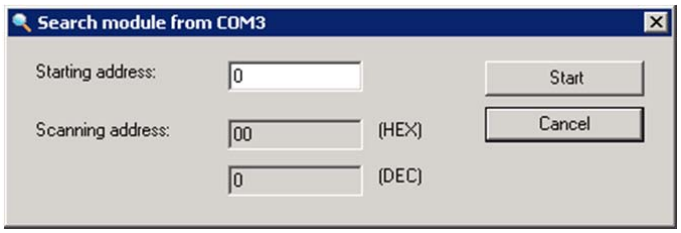
4. Verify that the baud rate and data settings match the internal settings of the devices:
   - Port: COM3
   - Baud Rate: 9600
   - Parity: NONE
   - Data Bits: 8
   - Stop Bits: 1



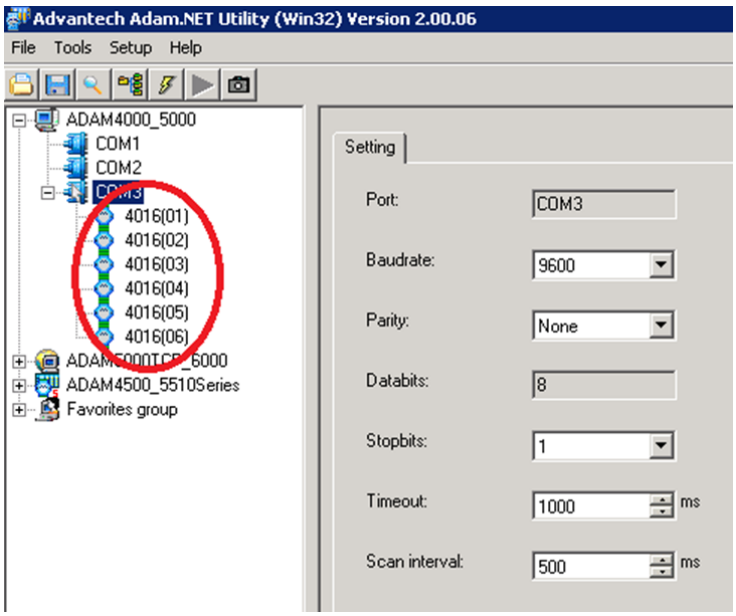
5. Right click COM3 and select Search.



6. Click start to search the sensor boxes

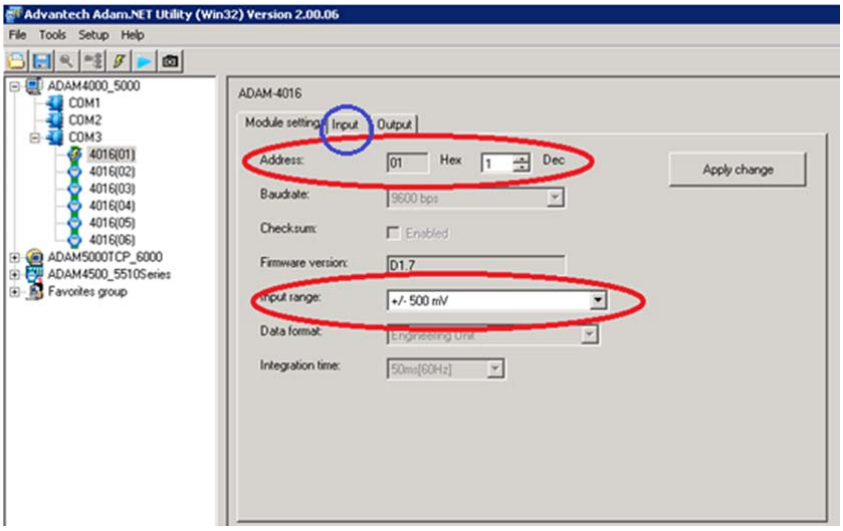


All the sensor boxes connected to the Server Unit Box should be found. Once that is completed click cancel to stop search

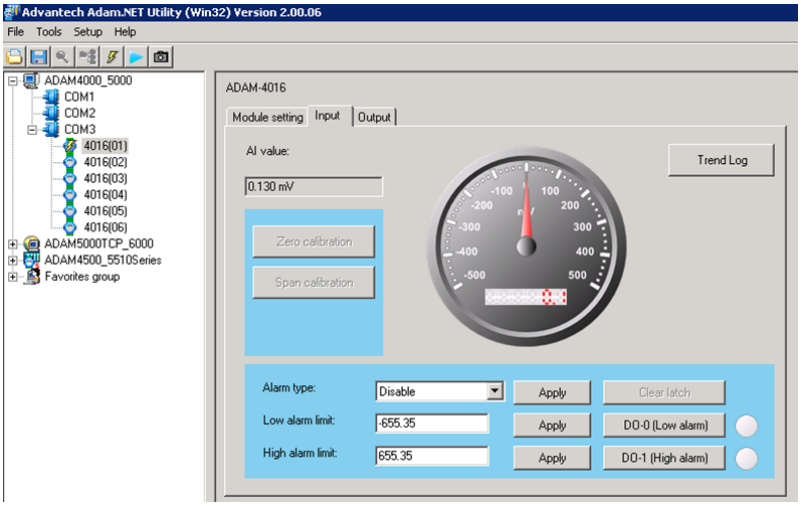


7. Now each individual module is ready to be selected

8. Click the module setting, assign a new address for the sensor box, set the input range to +/- 500mV



9. Click the input tab, you should be able to see the current sensor reading

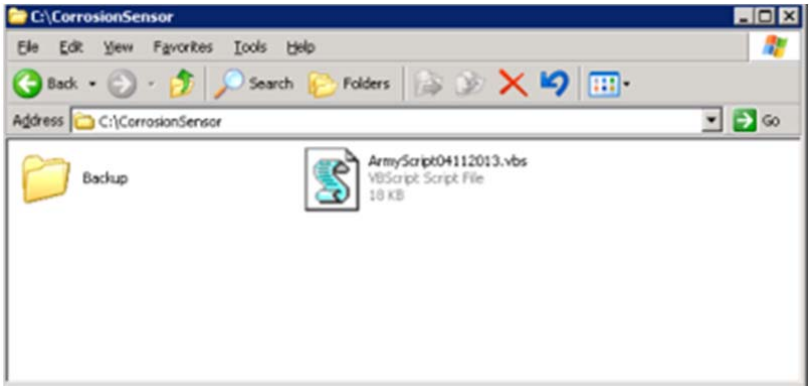


This completes the testing and confirms that the setup has been properly done.

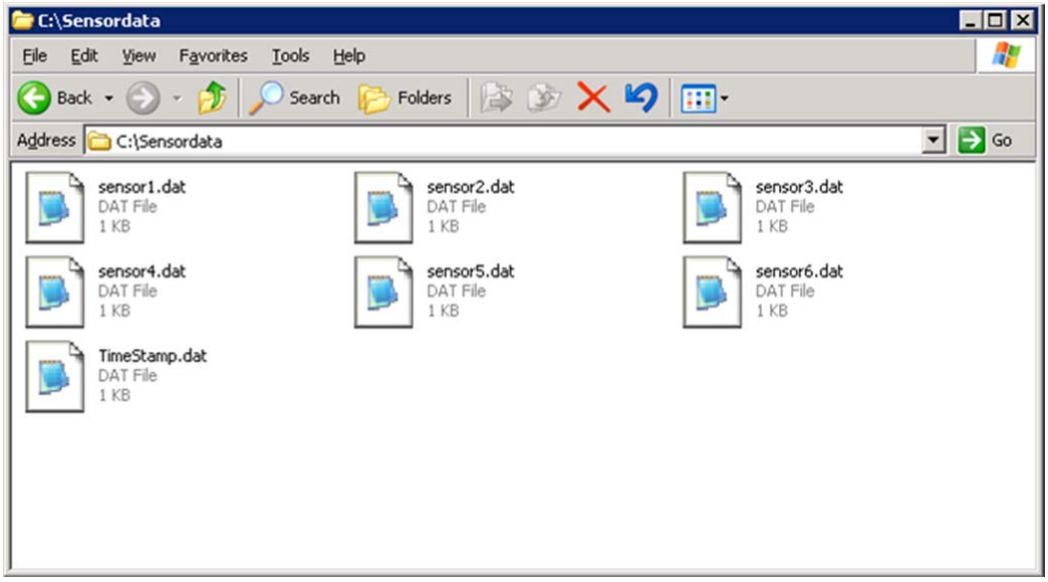
Part 3: Automation through VBscript

Running VBscript

The VBscript is used to get data from the sensor automatically and put the data into the database. The executable file ArmyScript04112013.vbs is located under C:\CorrosionSensor\ ArmyScript04112013.vbs

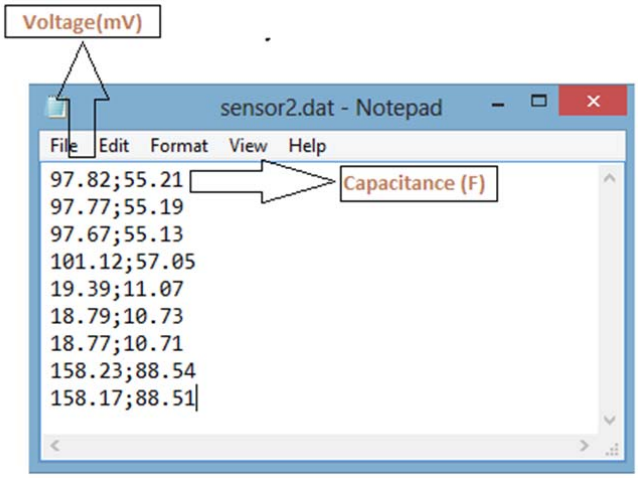


The VBscript code is preconfigured to run by itself. Data gets written onto a file, one for each sensor, after approximately 30 minutes intervals. The data output is a .dat file for each sensor from sensor1 to sensor6 which are located at C:\Sensordata. A separate time stamp file is also generated. Please note that these files will appear once the script is running.

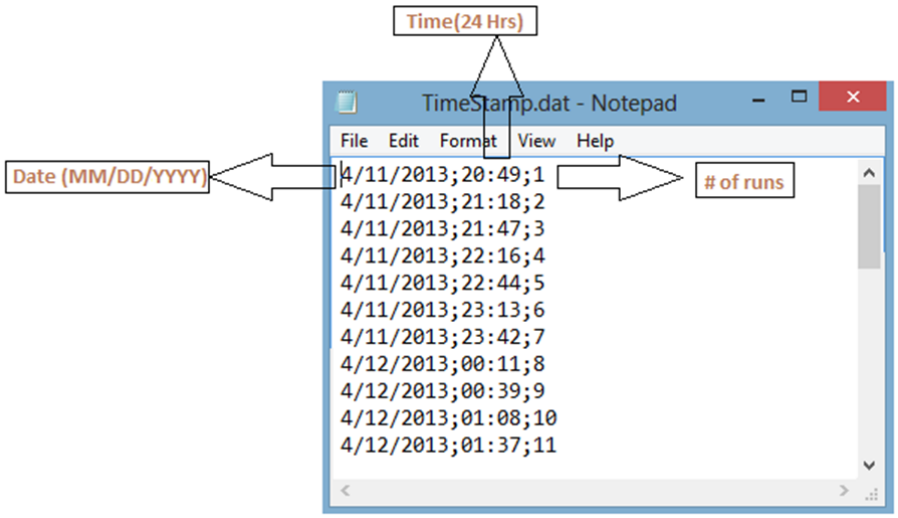


Field description of data files

The detail of the sensor (1-6).dat data files is as below. Fields are separated by a semicolon.



There will be one common timestamp file which has the below details;

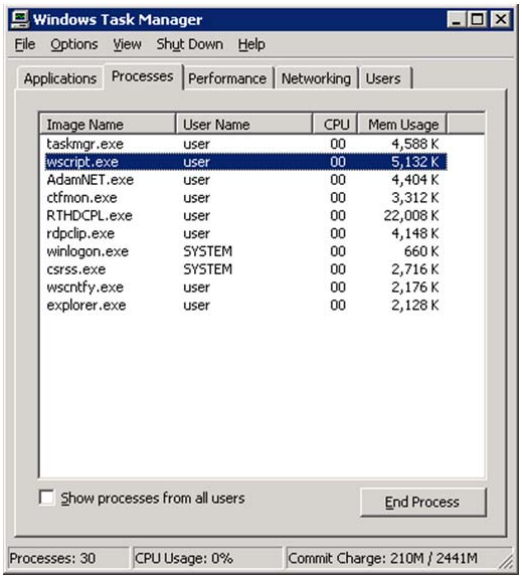


Please note, both ADAM .NET utility and VBscript code are using the same COM port (COM 3). Therefore only one program can be operated at a time. If both are running at the same time, the one started last will have error or might display wrong readings.

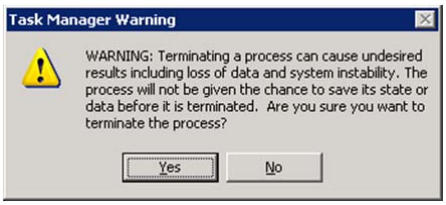
Stopping VBscript Automation

The VBscript is designed to run 24/7 to collect measurements from sensors S1 through S6 automatically. However, if there is any reason that the program has to be stopped, it has to be done with the following steps.

1. Hit Ctrl + Alt + Delete to call out the task manager (Ctrl + Alt + End for remote session)
2. Click on the Process tab



3. Select wscript.exe and click End Process
4. A warning will pop out, click Yes to end process.



Part 4: Remote Configuration

The server is accessible through the windows remote desktop. The current IP address setting is listed in Appendix A. Once the Server is setup at the new location, the new IP address will have to be provided in order to allow the users to use the remote login session.

There are two administration log-in passwords setup for accessing the Embedded Computer Server Box unit.

To remotely connect to the server from windows, perform the following steps:

1. Click start
2. Under Accessories, click Remote Desktop Connection
3. Enter the IP address provided
4. Hit connect to connect to the server
5. Enter the user name and password

Appendix A

Current Setting in IPFW

Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\user>ipconfig /all

Windows IP Configuration

Host Name . . . . . : research-30debe
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : ipfw.edu

Ethernet adapter Local Area Connection:

Connection-specific DNS Suffix . : ipfw.edu
Description . . . . . : Realtek RTL8168C(P)/8111C(P) PCI-E G
igabit Ethernet NIC
Physical Address. . . . . : 00-D0-C9-D4-04-FE
Dhcp Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IP Address. . . . . : 149.164.39.237
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 149.164.39.254
DHCP Server . . . . . : 149.164.30.11
DNS Servers . . . . . : 149.164.1.1
149.164.4.127
149.164.1.13
Primary WINS Server . . . . . : 149.164.187.6
Lease Obtained. . . . . : Friday, April 12, 2013 1:06:04 PM
Lease Expires . . . . . : Friday, April 12, 2013 5:06:04 PM

Appendix B

Dimension of Sensor Electronic Box