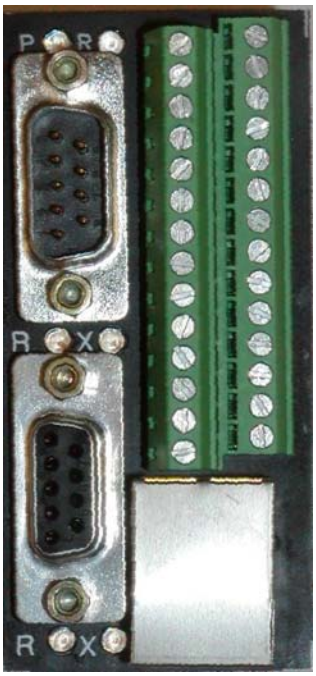
AGM Data Controller (DC), Series ( ) 5018-1, 5018-3

Manual Rev 21

User Manual

DC



AGM Data Controller

AGM Data Controller (DC) User Manual

CONTENTS

CONTENTS

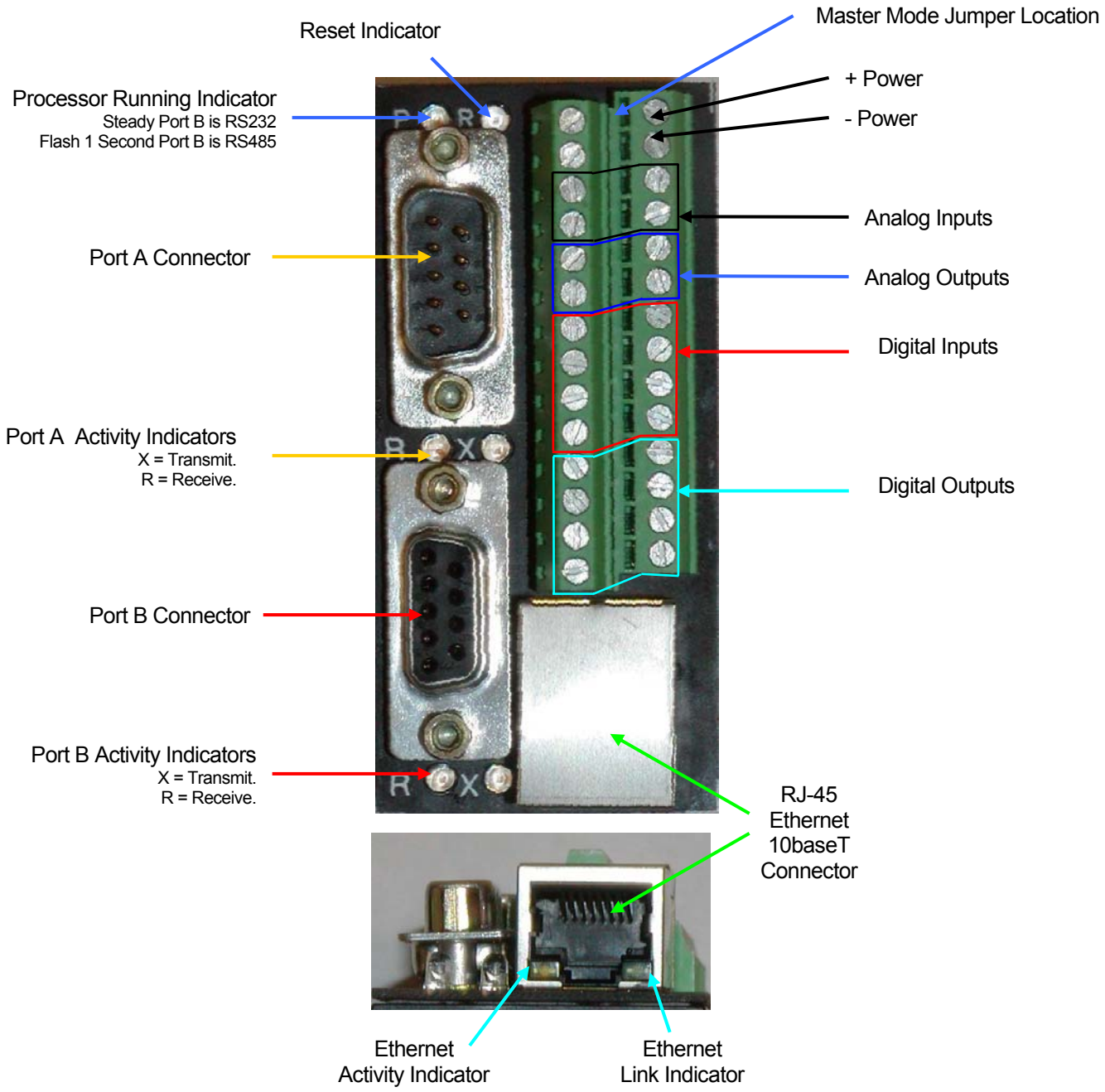
CONTENTS

CONTENTS

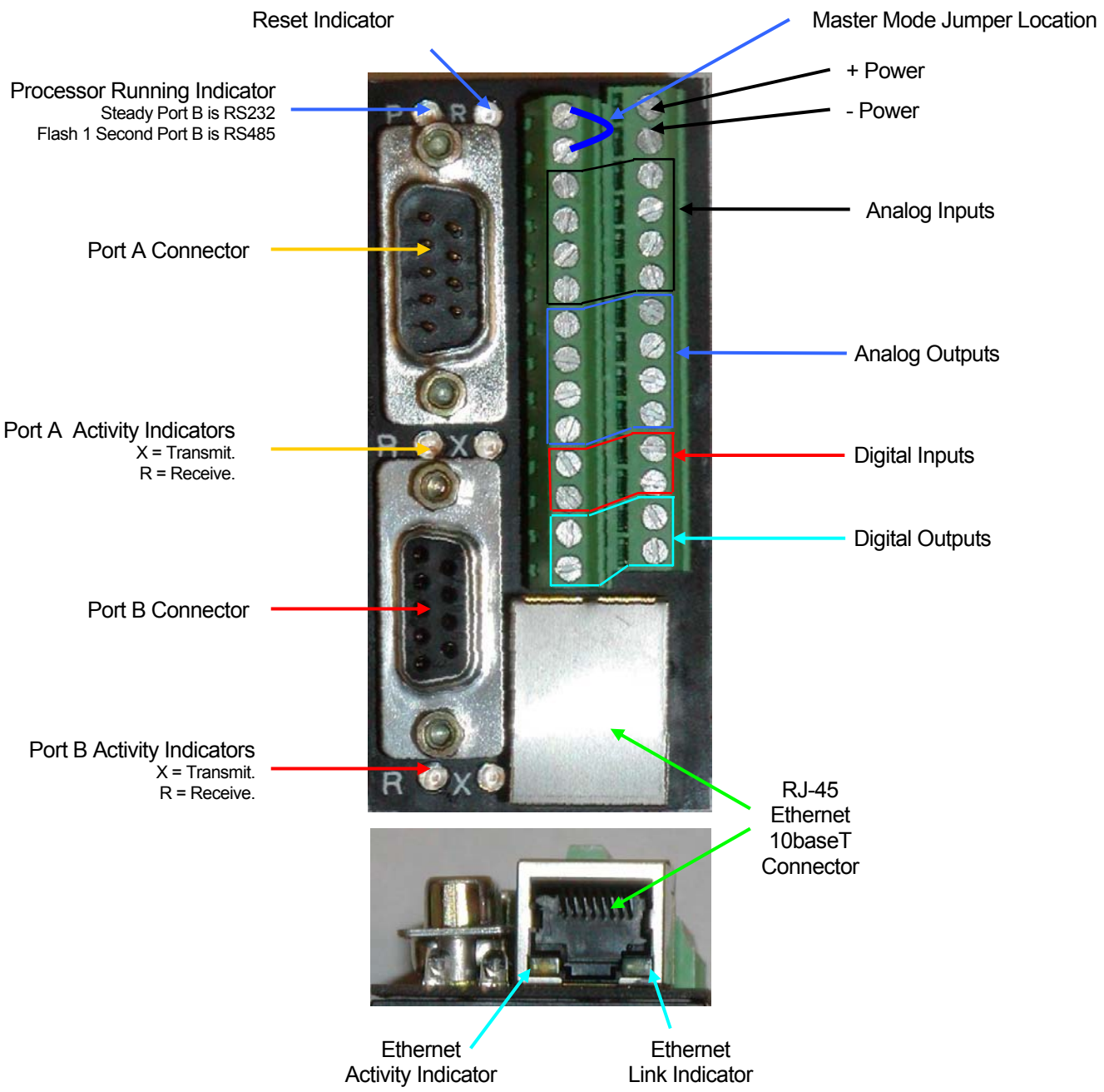
Introduction

Thank you for purchasing the AGM Data Controller (DC). The AGM Data Controller provides a variety of cost effective data acquisition and control configuration possibilities. This manual covers installation and setup of the more commonly used configurations.

Two models of the DC are available. Both models are functionally equivalent except for the available I/O. Model 5018-1 has 2 analog I/O and 4 digital I/O. Model 5018-3 has 4 analog I/O and 2 digital I/O.



DC Connections 5018-1



DC Connections 5018-3

Overview

The AGM Series 5018 Data Controller (DC) is a communications tool for collecting and transferring field data from one location to another.

The DC translates standard device interface protocols like ASCII ModBus, RTU ModBus, and TCP/IP ModBus. For the ModBus protocols the DC will perform as either a Master or Slave device. The DC will also perform as a slave device for the DF1 Half Duplex, DNP3, and Ethernet-IP protocols.

It includes an addressable mini-server that "serves" WEB pages. These web pages are currently dedicated for configuring the DC but future releases will allow custom web pages and sending E-Mails.

Theory of Operation and Construction

The heart of the DC is an industrial hardened micro-controller with a built-in server.

Built-in configuration menu simplifies field setup and changes.

The hermetically sealed assembly minimizes installation costs.

The DC contains Analog and Digital I/O which is continuously monitored and made available to any device communicating with DC using one of the supported slave protocols. The DC will optionally perform as a master and transfer field data from one DC to another or from DC to PLC.

The DC uses two tables to configure the transfer of data. The first table defines the sites where field data is stored or where field data is to be written. The second table defines what field data needs to be transferred. The DC may transfer data from itself to any connected device; from any connected device to any other connected device; or from one internal location to another internal location.

The DC can optionally record Input and Output data in flash memory and send E-Mail or text messages on either a specified interval or change of state.

General Specifications

Analog Inputs – (2 each on 5018-1 or 4 each on 5018-3)
Nominal range: 4 to 20 mA across 250 ohm resistor.
Maximum range: 0 to 6 V.
Accuracy: 12 Bits.

Analog Outputs – (2 each on 5018-1 or 4 each on 5018-3)
Nominal range: 4 to 20 mA.
Maximum range: 0 to 25 mA.
Accuracy: 12 Bits.

Digital Inputs – Contact closure. Internally pulled up to +5V (4 each on 5018-1 or 2 each on 5018-3)

Digital Outputs – NO Relay contacts. Max 5 A @ 24V (4 each on 5018-1 or 2 each on 5018-3)

Ports – 1 Dedicated RS232C, 1 RS232/RS485, 1 10baseT

Baud Rate - RS232C/RS485 - up to 19200 pbs

Clock - Yes

Protocols –Ethernet, HTTP, FTP, Telnet; ModBus Slave/Master (ASCII/Binary/TCP/IP), Ethernet/IP, AB-DF1 Half-Duplex Slave/Master, AGM ICS Protocol, AGM DH Protocol, DNP3 Protocol, ASCII text

Connections – ModBus and Allen-Bradley PLC's, Dial-up/Cell phone system, PC, fixed frequency/spread spectrum radio modem, cable, satellite, fiber optics, serial ASCII printer.

Status Indicators - 8

Operating Temperature Range, -20/80 deg C

Adjustments - Operator configurable locally from a PC

Power - 12/24 VDC +/- 10%, nominal 3 Watts

Physical – 2 x 3 X 1.4 inches not including connectors or DIN clip.

Maximum number of entries in site table: 256

Maximum number of entries in routing table: 1000

Maximum number of unique Device ID or Device address supported: Slave Protocols, 1 per communications port. Master Protocols, 256 or maximum number of valid device addresses supported by the protocol whichever is lower.

Data Recording: Approximate number of records at minimum size allocation is 1000 records. At maximum size allocation is 150000 records. Actual number of records will vary according to the number of data points recorded per record.

E-Mail or Text Messaging: Up to 20 E-Mail or Text Messaging recipients may be entered. Messaging requires SMTP E-Mail provider in addition to a connection to the Internet. Text Messaging to cell phones will use the E-Mail to text messaging gateways provided by most cell phone network providers.

ModBus Specifications

Supported Modes: ASCII (Master/Slave)
RTU or Binary (Master/Slave)
TCP/IP (Master/Slave)

Supported Registers:			
	Coils	00001 - 09999	Read / Write
	Discreet Inputs	10001 - 19999	Read Only.
	Input Registers	30001 - 39999	Read Only.
	Holding Registers	40001 - 49999	Read / Write

Supported Data Types: 16 bit Integer
32 bit Long Integer

NOTE 1: ModBus only specifies 16 bit integer data registers. Long Integer is supported by combining 2 sequential data registers. The first register will contain the least significant word. The second register will contain the most significant word. Internally the DC uses long integers for all registers.

NOTE 2: To preserve data integrity both registers must be written within the same command.

Supported Commands:

Code (Hex)	**Description**
01	Read Coil Status
02	Read Discreet Inputs
03	Read Holding Register
04	Read Input Register
05	Force Single Coil
06	Preset Single Register
0F	Force Multiple Coils
10	Preset Multiple Registers

DF1 Specifications

Supported Modes: Half-Duplex Slave using BCC
Half-Duplex Slave using CRC

Supported Registers:			
	Coils	O0:00/x	Read / Write
	Discreet Inputs	I1:00/x	Read Only.
	Analog Inputs	I1:02-I1:05	Read Only.
	Analog Outputs	O0:02-O0:05	Read / Write

NOTE: The DC uses Allen-Bradley's PLC-5 style of Logical Binary Addressing.

Supported Data Types 16 bit Integer
32 bit Long Integer

NOTE 1: DF1 I/O registers only specifies 16 bit integer data registers. Long Integer is supported by combining 2 sequential I/O registers. The first register will contain the least significant word. The second register will contain the most significant word. Internally the DC uses long integers for all registers.

NOTE 2: To preserve data integrity both registers must be written within the same command.

Supported Commands:

Cmd (Hex)	**Fnc(Hex)**	**Description**
0F	A1, A2	Logical Read
0F	A9, AA, AB	Logical Write
0F	01	Word Range Read
0F	00	Word Range Write

Ethernet/IP Specifications

Supported Modes:	Unconnected Message Manager Explicit Messaging (Class 2 & 3)	
Supported UDP Classes:	Identity	0x01
	Assembly	0x04
	Digital Inputs	0x08
	Digital Outputs	0x09
	Analog Inputs	0x0A
	Analog Outputs	0x0B
Supported TCP Classes:	Identity	0x01
	Assembly	0x04
	Connection Manager	0x06
	Digital Inputs	0x08
	Digital Outputs	0x09
	Analog Inputs	0x0A
	PCCC	0x67
	TCP/IP	0xF5
	Ethernet	0xF6

Note 1: See appendix M for details on each of the Ethernet/IP classes.

Note 2: To protect the integrity of the DC setting the IP address and other network settings via the TCP/IP or Ethernet classes is not supported. IP and other network parameters can only be set via the configuration web pages. .

Note 3: Only the software sections of the Ethernet/IP specification are supported. The hardware section is optional to meet the commercial section.

Note 4: The DC has implemented the PCCC (0x67) class used by some legacy Allen-Bradley PLC's such as the PLC-5 and SLC-5. **The PCCC class is not documented by Allen-Bradley and therefore not supported by AGM Electronics Inc. technical support or warranty.** If at your own risk you wish to use the DC with these Allen-Bradley PLC's, see Appendix L for the addresses used. The PCCC class typically encapsulated the DF1 protocol so your PLC may or may not communicate with the DC.

DNP3 Specifications

NOTE: See Appendix N for conformance documentation.

Communications Type:	Serial Only.
Function Codes Supported:	Confirm Read. Write. Time and restart bit only. Select. Analog and Digital Outputs. Operate. Analog and Digital Outputs. Direct Operate. Analog and Digital Outputs. Direct Operate, No Ack, Analog and Digital Outputs. Immediate Freeze. Analog Inputs and Counters. Immediate Freeze, No Ack. Analog Inputs and Counters. Freeze & Clear. Counters. Freeze & Clear, No Ack. Counters. Freeze With Time. Analog Inputs and Counters. Freeze With Time, No Ack. Analog Inputs and Counters. Cold Restart. Perform full reset of DC. Warm Restart. Performs full reset of DC. Delay Measurement.
Highest DNP Level Supported:	
For Requests:	Level 1.
For Responses:	Level 1.
Device Function:	Slave Only.
Maximum Data Link Frame Size:	
Transmitted:	292
Received:	292
Maximum Application Fragment Size:	
Transmitted:	292
Received:	292
Maximum Retries:	
Data Link:	None
Application:	None
Requires Confirmation:	
Data Link:	Never
Application:	Only after Class 1, 2, or 3 requests. Events will be cleared when confirmation occurs.

Timeouts:	Timeout between Select and Operate for control of Digital and Analog Outputs may be configured or disabled.
Control Operations:	
Analog Outputs:	Select / Operate. Direct Operate. Direct Operate No Ack.
Digital Outputs:	Select / Operate. Direct Operate. Direct Operate No Ack. Count > 1 Pulse On Pulse Off Latch On Latch Off
Queue:	Queue flag may be used to repeat a single operation. Only one operation may be queued.
Digital Input Events:	
Event:	Configurable: On to Off, Off to On or Change of State.
Class:	Configurable: Class1, Class 2, or Class 3.
Maximum Number:	16 Events total over all classes. Events share same event buffer.
Unsolicited Responses:	Not supported.
Binary Counters:	Counters configurable to increment on a Digital Input change.
Rolls Over At:	32 bits. No rollover status reported.
Multi-Fragment Support:	None.
File Support:	None.

Hardware Installation

The DC is available pre-configured to your application using up to 2 operating modes. When pre-configured the DC is ready for use and you only need to connect your equipment and select the operating mode by installing or removing the jumper between pins 2 and 4 of the screw terminal connector. With a jumper installed the pre-configured “Master” configuration will be used. With the jumper removed the pre-configured “Slave” configuration will be used. For a simple DC to DC connection all you need to do is install the jumper on one DC and leave the jumper off the second DC.

Other pre-configured options are available from the factory.

If not pre-configured or if you need to modify the configuration you will need to connect the DC to either your Ethernet network or to a computer containing a Ethernet card and a web browser. See below for instructions on connecting the DC to your computer.

The DC is available in two hardware models, the 5018-1 and 5018-3. See Appendix D for a listing of the screw terminal connections for each model.

Power Connections

1. You will need a 12 to 24 VDC power supply that is capable of supplying a minimum 300 mA in addition to any other connected equipment.

2. Make sure your power supply is turned off or disconnected from line. Do not make any connections with power applied to the DC or devices connected to the DC.

3. Connect the negative lead of your 12 to 24 VDC power supply to pin 3 on the screw terminal connector.

4. Connect the positive lead of your 12 to 24 VDC power supply to pin 1 of the screw terminal connector.

5. After all connections are made apply power and observe the green “P” light. After approximately 15 to 20 seconds the light will turn on and depending on the operating mode will start to flash. The red “R” light should only briefly flash on when power is applied. If the red “R” light remains on, either the DC has insufficient power or an internal failure has occurred.

I/O Connections

Analog Inputs

NOTE: The DC analog inputs are designed to measure a 4 to 20 milliamp signal using an external 250 ohm resistor. The inputs are not isolated and share a common negative input. If isolation or other signal conditioning is required then contact AGM Electronics Inc. for suggested isolation and signal conditioning modules. AGM Electronics Inc. manufactures a wide range of signal conditioning and isolation products available in the same case style and size as the DC.

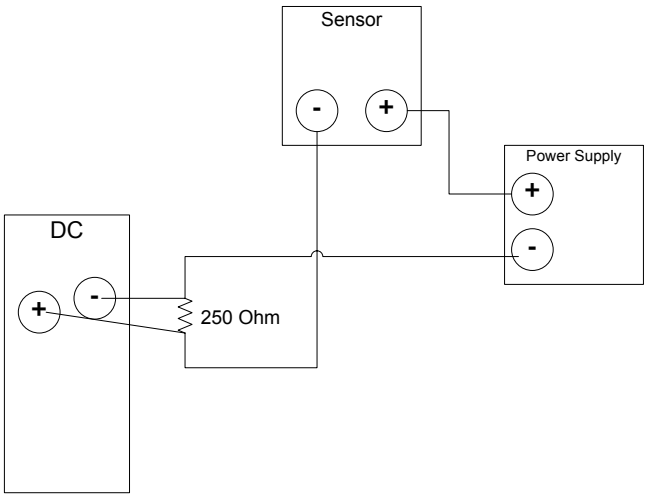
Current Inputs

1. Place a 250 ohm resistor across the analog input pins of the screw terminal I/O connector. This resistor will convert the 4/20 mA signal to a voltage which will be measured by the DC.

2. Connect the negative lead of your sensor to the Analog Input (+) screw terminal on the DC for each of the desired analog inputs. See Appendix D for screw terminal.

3. Connect the negative lead of the power supply supplying the loop current power to the Analog Input (-) screw terminal on the DC. See Appendix D for screw terminal.

4. Connect the positive lead of your sensor to the power supply providing the 4/20 mA loop current.



Analog Outputs

NOTE: The DC analog outputs are designed to produce a 0 to 25 mA output and are not isolated. The outputs share a common negative supply. If isolation is required then contact AGM Electronics Inc. for suggested isolation modules.

Current Outputs

1. Connect the positive signal input to your PLC, chart recorder or other 4/20 mA device to the Analog Output (+) screw terminal on the DC for the desired Analog Output. See Appendix D for screw terminal.

2. Connected the negative input from your device to the Analog Output (-) screw terminal on the DC. See Appendix D for screw terminal.

Voltage Outputs

1. Place a 250 ohm resistor across pins the analog output of the screw terminal I/O connector. This resistor will convert the 4/20 mA signal provided by the DC to a 1/5 VDC. Other resistor values may be used to produce different voltage outputs up to 2 volts below the supply voltage. 10 volts for 12 volt supply and 22 volts for 24 volt supply.

2. Connect the positive lead of your PLC, chart recorder or other device to the Analog Output (+) screw terminal on the DC for the first output. See Appendix D for screw terminal.

3. Connected the negative input from your device to the Analog Output (-) screw terminal on the DC. See Appendix D for screw terminal.

Digital Inputs

NOTE: The DC digital inputs are designed for a dry contact closure from a switch or relay contact. The inputs are not isolated. If isolation is required then contact AGM Electronics Inc. for suggested isolation modules. The odd numbered screw terminals are common to the DC supply. The even numbered screw terminals are pulled up to 5VDC using a 10 kΩ resistor.

1. Connect one side of your switch or relay contact to one of the even numbered Digital Input screw terminals. See Appendix D for screw terminal.

2. Connect the other side of your switch or relay contact to one of the odd numbered Digital Inputs screw terminals. See Appendix D for screw terminal

Digital Outputs

NOTE: The DC digital outputs are dry contacts from a relay. The outputs are isolated. Contact rating: 0.3A @ 125 VAC, 0.5A @ 30 VDC.

1. Connect one side of device to one of the Digital Output screw terminals. See Appendix D for screw terminal.

2. Connect other side of device to the Digital Output screw terminals. See Appendix D for screw terminal.

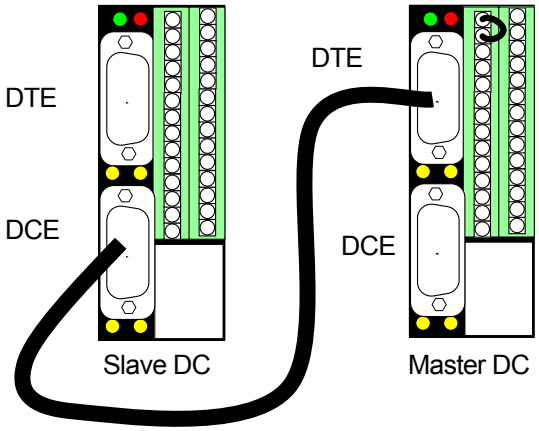
Connecting DC to DC

The DC has several options for connecting one DC to another DC depending on the media desired for communications. To simplify connections the DC has both a 9 pin female DCE (Data Circuit-terminating Equipment) and a 9 pin male DTE (Data Terminal Equipment) RS232 ports. It also has a RS485 port which is shared with the 9 pin female DCE connector. See Appendix J for more details on the pin outs of each port.

RS-232 Connections

Direct connect

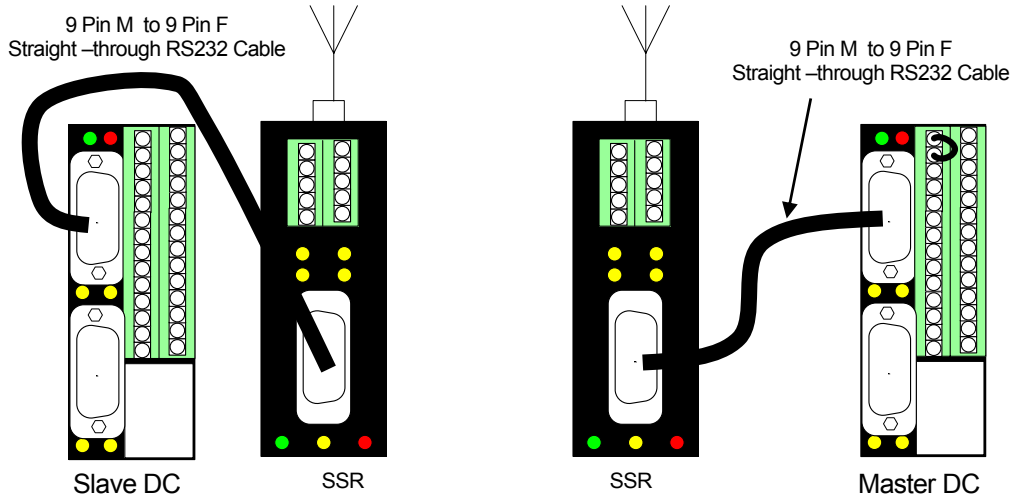
Connect a 9 pin male to 9 pin female straight through cable from the top Male 9 pin connector on the master DC to the bottom Female 9 pin connector on the slave DC. The master DC is the DC with a jumper installed between pins 2 and 4. If correctly installed and configured the two middle “R” and “X” on the master DC will be flashing and the two bottom “R” and “X” lights on the slave DC will flash.



9 Pin M to 9 Pin F
Straight –through RS232 Cable

Radio, Leased Line, or Dial Up Modem

Connect a 9 pin female straight through cable from the top Male 9 pin connector on each DC to the Female connector located on the modem. The modem may have either a 9 or 25 pin connector, use a RS232 cable designed to connect between your computer and external modem. Below is an illustration of the DC used with AGM Electronics Inc. Spread Spectrum Radio (SSR). Other modem will use similar connections.

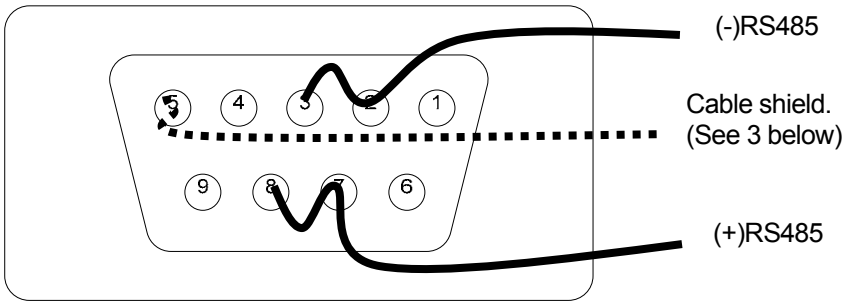


RS-485 Connections

For long runs from over 100 feet to 4000 feet RS485 is recommended over RS232. RS485 may also be used for connecting multiple DC or other devices together over a common communications buss. RS232 and RS485 share the lower female D connector and a custom cable is required to make the connections. To make a connection you will need a male 9 pin D connector for each DC and shielded twisted pair cable.

1. Jumper pins 2 and 3 on the D connector and attach to one of the signal wires in your RS485 cable. This will be the minus side of the RS485 signal.

2. Jumper pins 7 and 8 on the D connector and attach to one of the signal wires in your RS485 cable. This will be the plus side of the RS485 signal.

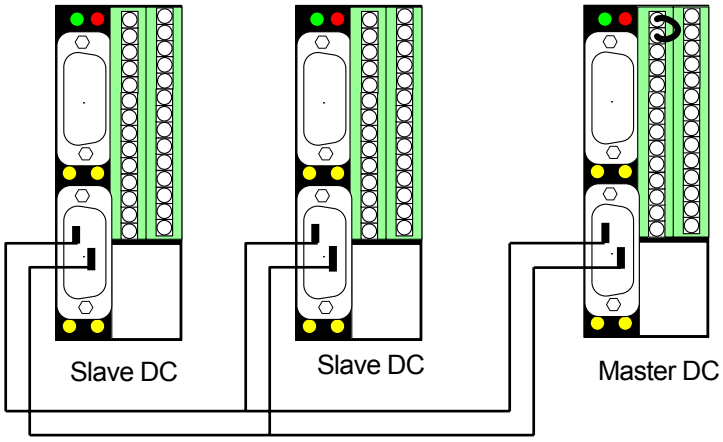


3. If the DC or other connected devices do not share a common power supply and the minus power of the power supplies are not connected elsewhere, connect the shield of the RS485 cable to pin 5 of the D connector for all devices. This connection may not always be required but will prevent failure due to common mode voltage differences between the two devices. If the power supply is shared or the minus power supplies are connected connect the shield to pin 5 of only one D connector.

4. Repeat the above steps for each device in the RS485 chain. RS485 devices should be wired in a continuous buss from one DC or RS485 device to another.

5. A 150 ohm termination resistor at each end of the RS485 buss may be required for some installation. This resistor is used to reduce reflections on the RS485 buss. At the baud rates used by the DC and over shorter runs this resistor is not required.

6. When the cable is assembled plug the 9 pin connectors with the RS485 wiring into the lower Female 9 Pin D connector port.



NOTE: Selection of RS232 or RS485 is done through the DC configuration. Normally the DC will be set up to auto detect a RS232 connection. When in this mode and a RS232 connection is not detected the lower connector (Port B) will be in RS485 mode.

Connecting DC to your PLC

The DC may be connected to any PLC with a serial port and supported communications protocol. The DC may operate as either a slave or master device.

To simplify connections the DC has both a 9 pin female DCE (Data Circuit-terminating Equipment) and a 9 pin male DTE (Data Terminal Equipment) RS232 ports. It also has a RS485 port which is shared with the 9 pin female DCE connector. See Appendix J for more details on the pin outs of each port.

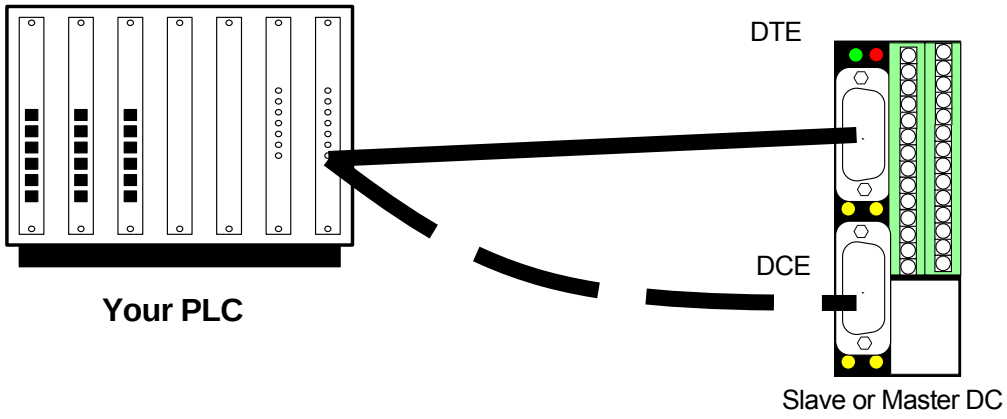
RS-232 Connections

First determine which type of connection you have on your PLC. Your PLC may be wired either as a DTE or DCE device.

If you normally plug your PLC directly into your computer without any Null-Modem adapters your PLC is a DCE device and you can plug into the top 9 pin connector. The top 9 pin D connector is wired the same as a personal computer.

If you normally plug your PLC into a modem or require a Null-Modem adapter when connecting to your computer, you may plug your PLC into the bottom 9 pin connector your PLC is a DTE device and you may plug into the bottom 9 pin connector without the use of a Null-Modem. The bottom 9 pin D connector is wired the same as a modem.

See Appendix J for more details on the pin outs of both connectors.



RS-485 Connections

On the DC, RS232 and RS485 share the lower female D connector and a custom cable is required to make the connections. To make a connection you will need a male 9 pin D connector for each DC and shielded twisted pair cable.

1. Jumper pins 2 and 3 on the D connector and attach to one of the signal wires in your RS485 cable. This will be the non-inverting or plus side of the RS485 signal.

2. Jumper pins 7 and 8 on the D connector and attach to one of the signal wires in your RS485 cable. This will be the inverting or minus side of the RS485 signal.

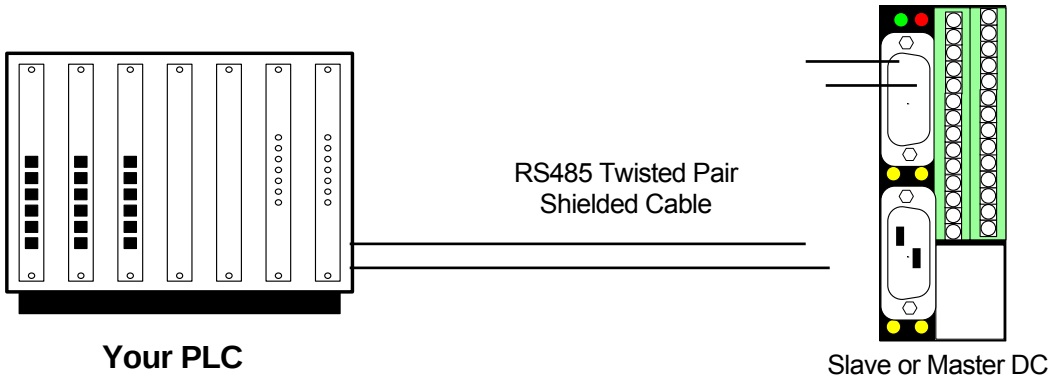
3. If the DC or other connected devices do not share a common power supply and the minus power of the power supplies are not connected elsewhere, connect the shield of the RS485 cable to pin 5 of the D connector for all devices. This connection may not always be required but will prevent failure due to common mode voltage differences between the two devices. If the power supply is shared or the minus power supplies are connected connect the shield to pin 5 of only one D connector.

4. Repeat the above steps for each device in the RS485 chain. RS485 devices should be wired in a continuous buss from one DC or RS485 device to another.

5. A 150 ohm termination resistor at each end of the RS485 buss may be required for some installation. This resistor is used to reduce reflections on the RS485 buss. At the baud rates used by the DC and over shorter runs this resistor is not required.

6. When the cable is assembled plug the 9 pin connectors with the RS485 wiring into the lower Female 9 Pin D connector port.

7. Consult with your PLC documentation on how to connect your PLC to a RS485 buss.

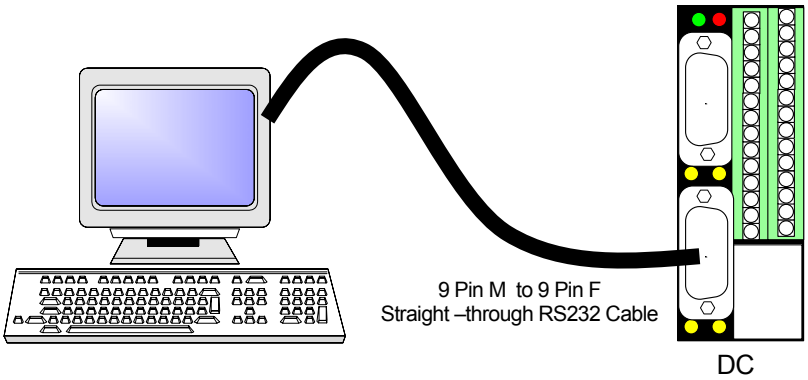


Connecting DC to Computer

The DC may be either connected to your computer for use by AGM Electronics Inc. TakeCharge or other 3rd party SCADA packages via the computers serial port or Ethernet port.

RS-232 Serial Port Connections

Connect a 9 pin male to 9 pin female straight through cable from your computers serial communications port to the bottom Female 9 pin connector on the DC.



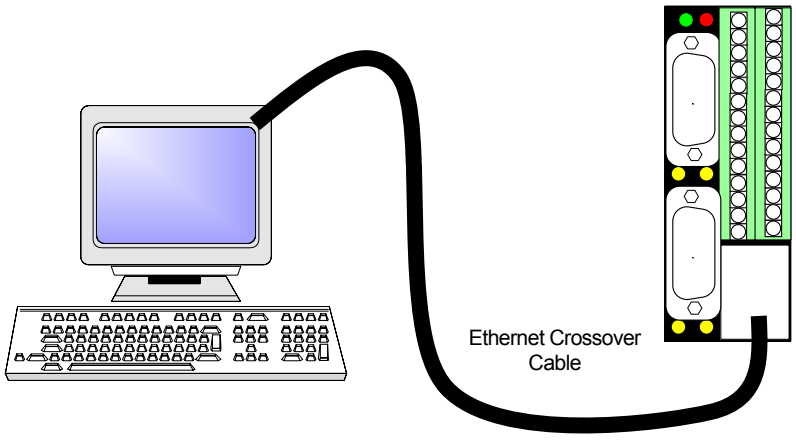
Direct Ethernet Connection:

If you will not be connecting the DC to your Ethernet network you may connect the DC directly to your computer provided your computer is equipped with a 10baseT Ethernet card. This type of connection is required to configure the DC.

1. Plug a crossover Cat 3 or Cat 5 Ethernet patch cable into the RJ-45 Ethernet Jack located on the top of the DC. Connect the other end of this patch to the Ethernet controller on your Computer.

2. Power up the DC and observe the green light located on RJ-45 connector. After approximately 10 to 20 seconds this light should turn on. The yellow light on the RJ-45 connector may also flash indicating network activity.

3. If equipped, check the Link light on your Ethernet controller card. Both the green light on the RJ-45 connector and Link light on your Ethernet card should be on.



Connect through the Internet/Intranet via 10baseT Ethernet

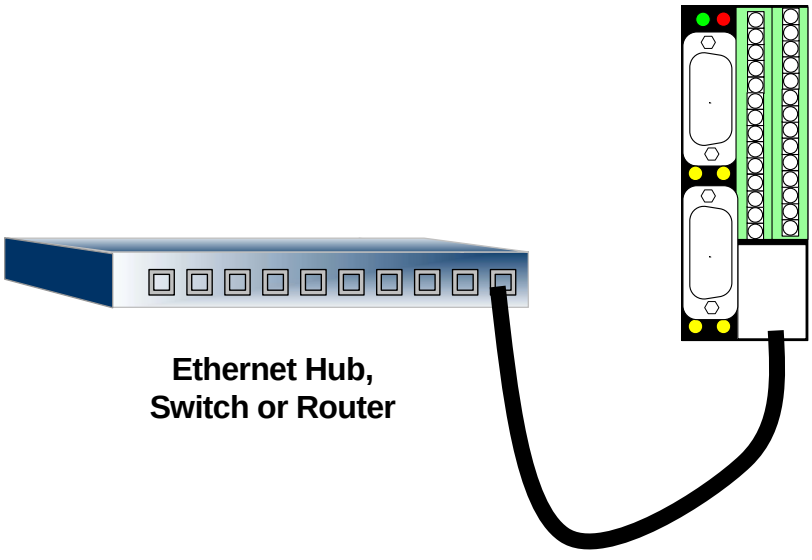
NOTE: When shipped from the factory the IP address is set for 192.168.0.251. Check with your network administrator to determine if this is valid address before connecting the DC to a working network. If this IP address is unavailable connect the DC directly to your computer using a crossover cable for initial configuration. After initial configuration the DC will operate on the IP address you specify.

Connecting to a 10/100baseT Ethernet Hub or Switch

1. Plug a standard Cat 3 or Cat 5 Ethernet patch cable into the RJ-45 Ethernet Jack located on the top of the DC. Connect the other end of this patch cable to an unused RJ-45 jack on your Ethernet hub.

2. Power up the DC and observe the green light located on the RJ-45 Ethernet Jack. After approximately 10 to 20 seconds this light should turn on. The yellow light may also flash indicting network activity.

3. If equipped, check the Link light on your Hub or Switch. Both the green light on the RJ-45 connector and Link light on your hub or switch should be on. Hubs or switches that support the faster 100baseT or 1000baseT may contain additional indicator lights used only for the faster connections. Typically these lights will not be lit when connected to a 10baseT device such as the DC. Consult with your Hub or Switch documentation for the meaning of any status lights.



Getting Started

The DC is available preconfigured from the factory. When preconfigured your DC should be ready to use after you have made all hardware connections. This existing configuration may be backed up via the procedure outlined in Appendix C. You may also obtain the configuration files from AGM Electronics Inc. technical support.

In addition to the standard application designed for transferring data. Other application specific firmware is available from the factory. Application specific firmware adds additional software features to the standard DC application. When working with application specific firmware the configuration screens may have additional settings specific to the application.

If your DC has not been preconfigured or the configuration needs to be modified connect the DC to power and your computer or network using the Ethernet port. Then follow instructions in Setup section to set all required operating parameters. The Setup section does not show all possibilities for more detailed information go to the Software Setup section.

The factory defaults for the DC are:

IP Address:	192.168.0.251
Netmask	255.255.255.0
Communication Port "A":	9600 baud, 8 data bits, 1 stop bit, no parity.
Communication Port "B":	9600 baud, 8 data bits, 1 stop bit, no parity. Auto detect of RS232 or RS485.

Setup

General information for all installations

To setup and use the DC the following will be required:

1. Working knowledge of TCP/IP networks.
2. Static IP address that may be used on your network. See your network administrator for this number.

   If connecting directly to your computer via a crossover cable you may use the default address of 192.168.0.251. Set your computer to an address within this address block, typically 192.168.0.1.
3. Computer with Ethernet 10baseT or 10/100baseT network card.
4. Internet browser installed on your computer. The DC has been tested with Microsoft Explorer and Netscape Navigator. Although not tested other browsers that support HTML forms will work.
5. Crossover cable or Ethernet hub.
6. 12 to 24 volt power supply. The DC typically draws 200 to 300 mA when operating. Recommended 350 mA supply or greater depending on any additional devices connected to the DC.
7. The Data Controller(s) (DC).

The following instructions assume you are familiar with Ethernet and TCP/IP networks. The computer used for setting up the DC must already have the correct TCP/IP and other network drivers installed prior to installation of the DC.

The DC is configured through an Ethernet 10baseT connection using HTML web pages and your Internet Browser.

Before the DC can be configured you must connect the DC to a 10baseT network or to a PC using a crossover cable. See the Hardware Installation section.

The default IP address of 192.168.0.251 is in a block of IP addresses reserved for local area networks. If installing in an existing network, check with your network administrator to determine if you may use addresses within this block or if this address is already in use.

If you are unable to use this address or are having problems contacting the DC use a crossover cable and connect directly to the DC with your computer. See Appendix B, Setting your computer to access the DC for instruction on modifying your computer's network settings to work with the DC default settings.

1. With the DC connected and powered up load your Internet browser and enter the following address:

   http://192.168.0.251/DCDefault.htm

   If all your connections are correct you will see the Default Home page. This page contains the following information:

   1. Site, Location, and Description as entered in the Titles section of the configuration.

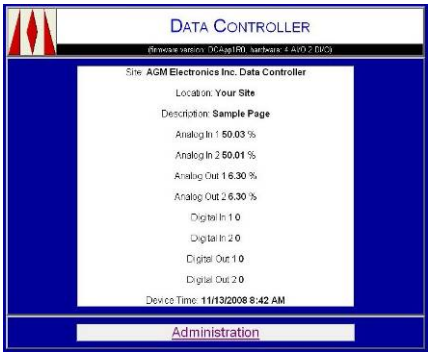
   2. Current date and time of the real time clock within the DC.

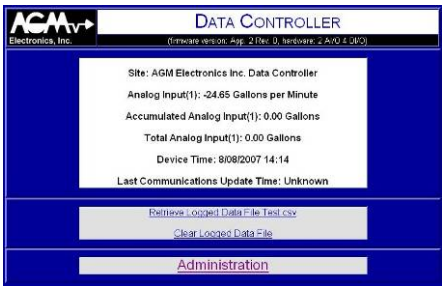
   3. Current status of the local Analog and Digital I/O. Actual data displayed will depend on the version of the Data Controller and it's configuration.

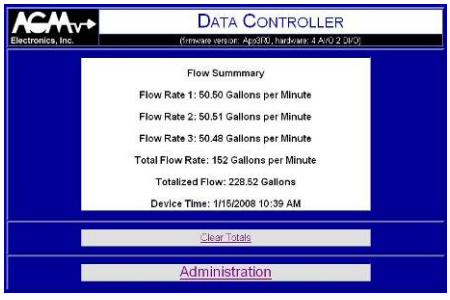
   4. Date and time the data was last updated. If data has not been updated then "Unknown" will be displayed. When operating as a Master this time will be the last time a successful transfer occurred. If operating as a slave then this will be the last time the DC received a valid read.

   5. Link to the Administration pages.

   6. Application specific firmware will have additional information displayed specific to the application. There may also be additional applications specific links such as for downloading logged data files or clearing accumulated totals.

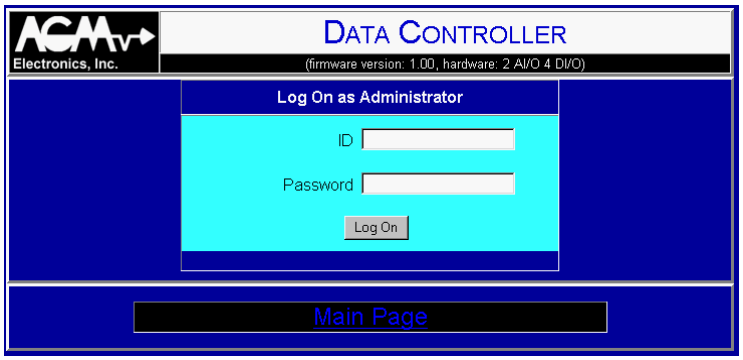






Default Home Pages

2. Click on the Administration link located at the bottom of the Default Home page. This will bring up the Log On page.



Log On Page

3. Enter your ID and Password.

When shipped then ID and password is as follows:

ID: Admin
Password: password

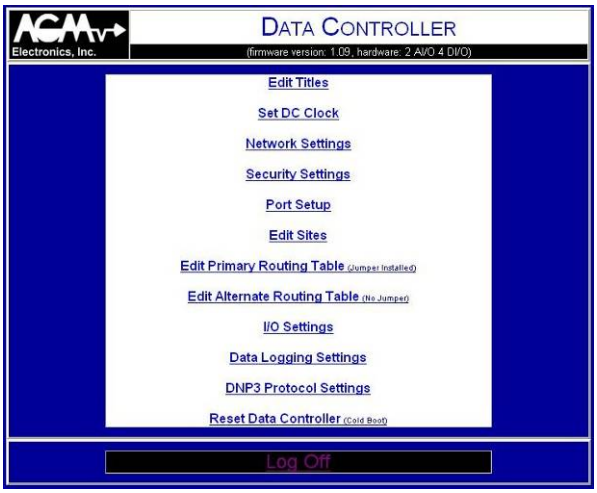
The ID is not case sensitive and may be entered in either upper or lower case. The password however is case sensitive and must be entered as shown.

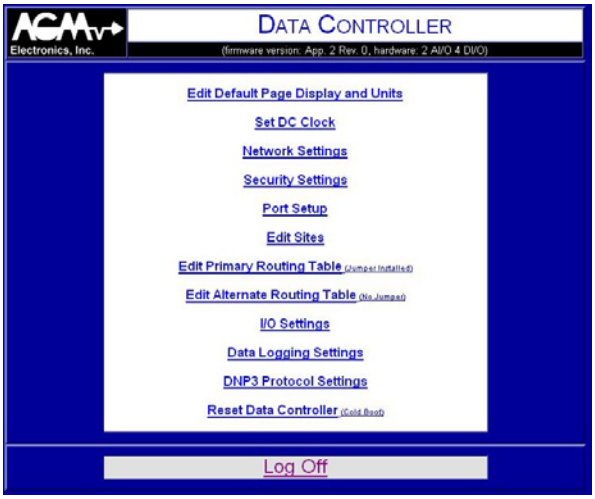
4. Click on the Log On button when both the ID and password are entered. You will either get the Administration page if the ID and password were correct. If you are returned to the Log On page then reenter the ID and password.

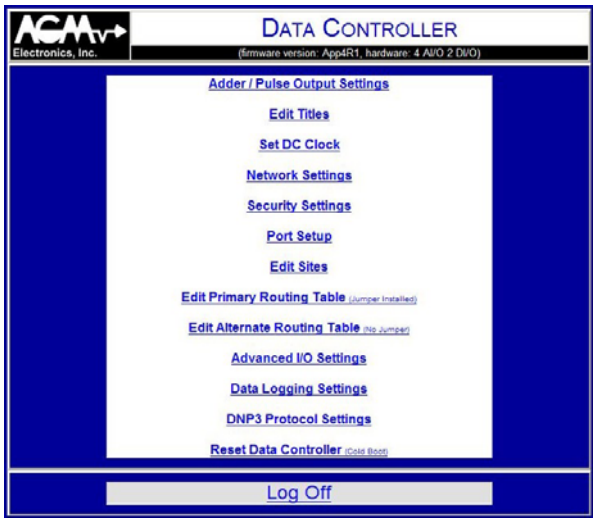
   To protect the integrity of the DC all configuration pages have a time limit and check to determine if the page was linked from another configuration page. If any pages are idle for more than the interval or if you refresh or click on the go back button on your browser you will be required to reenter the user name and password before continuing. Do not use the go back button or bookmarks when reconfiguring the DC or you may loose modifications you have just entered.

   The default time limit is 15 minutes but may be set via the Security page.

5. After you have logged on you will see the Administration menu as shown below. From this menu you can select the various configuration sections in the DC. This menu will vary depending on the Data Controller firmware version.







Administration Page

The following sections contain the instructions for setting up each common feature of the DC. Only the common settings required to get your DC functional are covered. See the Software Configuration section for more detailed information about each configuration screen.

The first section below will lead your through setting up communications settings. Communications settings will depend on how you are connecting your DC(s). Only the common combinations are described. More combinations are possible than what can be shown in this document. Use the following sections as a guide for setting up more complex installations.

The section following the Communications Settings will show you how to set up data recording and messaging. Data Recording and Messaging is only available only on some versions of firmware.

Instructions for setting up the applications specific features of Applications 1, Application 2, Application 3, and Application 4 follow the sections on setting up the DC Messaging.

Communications Settings

DC to DC(s)

Settings on the Port Setup page must be selected before defining the Sites or Routing Tables. The settings on this page determine the basic communications parameters of each port used. Most of the settings will be the same whether you are using RS232 or RS485.

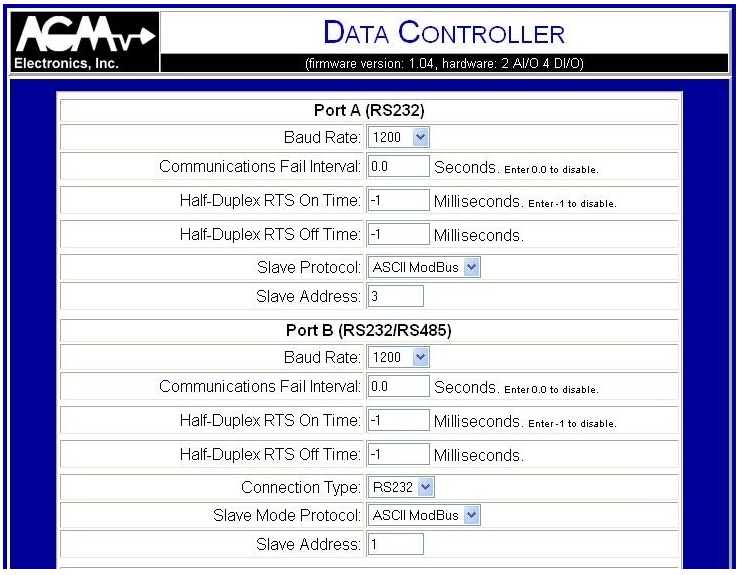
NOTE 1: When using only 2 DC's, both DC's may be set up to act as either a master and a slave by adding or removing the jumper between pins 2 and 4 on the screw terminal connector. Keeping the configuration identical in both DCs will allow the devices to be interchanged with the final configuration option, the jumper, to be configured in the field. This will simplify field installation and repair.

When using multiple DCs you can not set up all DCs so they are interchangeable like you can with a simple DC to DC transfer. When using multiple DC's, each DC must have it's own unique address.

NOTE 2: When using serial connections set both port A and B to identical settings. For the slave DC this will allow you to switch ports without reconfiguring. This may be important in some field installations where you my find yourself with the wrong combinations of RS232 cables.

Port Setup

1. Select Port Setup. This will open the page used to set up the communications ports. Port A is the top Male 9 pin connector. The pin out of this port is the same as a PC. Port B is the bottom female 9 pin connector. The pin of this port is the same as a modem. Ports C, D, and E are the Ethernet ports and use the Ethernet RJ45 jack.



DC Communications Port Setup

2. For the serial ports, use the drop down list to select the baud rate you will be using. The default is 9600 baud, however 300, 1200, and 19200 baud is available. This baud rate must be the same for both DCs and must match any interconnecting devices such as modems or radio modems.

3. For Ethernet, set the TCP Port Number. The reserved port number for Modbus is 502. You may enter any valid port number, however using the reserved ports is recommended. When working with a Gateway or Firewall you may need to use port numbers other than the registered port numbers.

4. Select the Slave Protocol you will be using. For a DC to DC connection select either of the Modbus protocols. The current version supports both ASCII and RTU Modbus for serial connections. Other protocols listed are available but not covered in this section. For Ethernet connections there is only one Modbus protocol, select that protocol when connecting two DC's over a Ethernet connection.

   ASCII Modbus is recommended for radio modem or other installations where timing or noise may be a problem. RTU Modbus will give slightly better performance but may not work 100% of the time if the radio modem or other device breaks up the RTU Modbus packets. For most applications you can use either protocol, provided the same protocol is used in both DCs.

   NOTE: You may set a slave protocol even if the DC is being used as a master. When used as a master the master protocol will override the slave protocol settings.

5. For serial connections set the Slave Address. For a single DC to DC connection we recommend setting the Slave Address to 1. For multiple DC to DC connections you need to use a unique number for each DC.

6. Port B will normally auto select the type of interface, either RS232 or RS485. This auto selection requires the RS232 signal DTR to be available. In some cases such as using a 3 wire cable the auto selection will not work. You may bypass the auto selection by selecting RS232 or RS485 in the Connection Type drop down list box.

   You can determine when Port B is in the RS485 or RS232 mode by observing the "P" light. If the "P" light is flashing at a approximate 1 Hz rate then Port B is in the RS485 mode. If on steady then Port B is set for RS232 either through auto detect or this configuration option.

7. For most installations leave the Communications Fail Interval to 0.0. This will set the Communications Fail Interval to the default time based on the protocol. Unless you are communicating through multiple repeaters or other installations that delay the communications the default Communications Fail Interval will work.

8. Unless you are using Half-Duplex communications that require RTS control leave the Half-Duplex On Time and Half-Duplex Off Time to -1. Typical devices that may require this type of control are leased line Bell 202 Modems and some of the more primitive radio modems. Spread Spectrum radio modems such as AGM Electronics Inc. SSR do not require Half-Duplex control.

   If your device requires Half-Duplex control, set the Half-Duplex On Time to the time in milliseconds your modem requires to stabilize before the first character is transmitted. Set the Half-Duplex Off Time to the time in milliseconds your modem may require RTS to be active after the last character is transmitted.

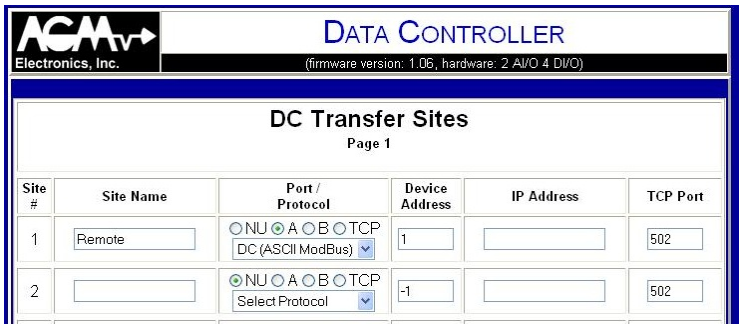
   If used Half-Duplex On Time and Half-Duplex Off Time must be the same for all DC's and other devices connected using the Half-Duplex modems. Half-Duplex On Time must also be equal to or greater than the Half-Duplex Off time.

9. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

10. From the Administration Page you must click on the Log Off link before the DCs will start transferring data. Transferring of data will stop when the first transfer related setting is saved and will not resume until you Log Off; the automatic log off interval has elapsed; or power is cycled to the DC. By default the DC will automatically log the administration off and resume transferring after 15 minutes.

Edit Sites

1. Select Edit Sites. This will open the page used to define all the remote sites the Master DC will be connected to. Even though you may be connecting 1 DC to another DC you will need at least 1 entry in this table.



DC Transfer Sites Table

2. Enter an identifying text name in the box under Site Name. The name entered here will be used in the Routing Tables to identify the site. The name entered here defines the name of the remote site. For the purposes of these instructions “Remote” will be used but you may use any meaningful name. When using multiple DC’s, or other devices, each DC must have it’s own unique name.

   DO NOT USE “Local” as a site name. “Local” is a reserved name identifying the local DC.

3. Select the port that will be used to communicate to the remote device. “A” is the top male D connector and “B” is the bottom female D connector. TCP is for a Ethernet connection. “NU” indicates the site is not currently used.

4. Enter the device address in the text box under Device Address. The device address much match the device address programmed in the Slave DC. Normally when configuring a simple DC to DC transfer the Device Address should be set to 1.

5. If using an Ethernet connection, fill in the IP address and TCP port number of the remote DC. The TCP port number in most cases should be the registered Modbus port number of 502. The IP and TCP port number must match the IP and TCP port numbers defined in the slave DC.

   If using a remote Gateway or Firewall, the IP address will not be the same as programmed in the remote DC. The TCP Port Number may also be different depending on how the remote Gateway or Firewall is configured. Typically, you will need to enter the IP address of the remote Gateway or Firewall for the IP address and the TCP Port number used by the remote Gateway or Firewall to connect to the DC.

6. For a simple DC to DC transfer you only need to fill in the first row. IP Address and TCP Port are not used in firmware version 1.00.

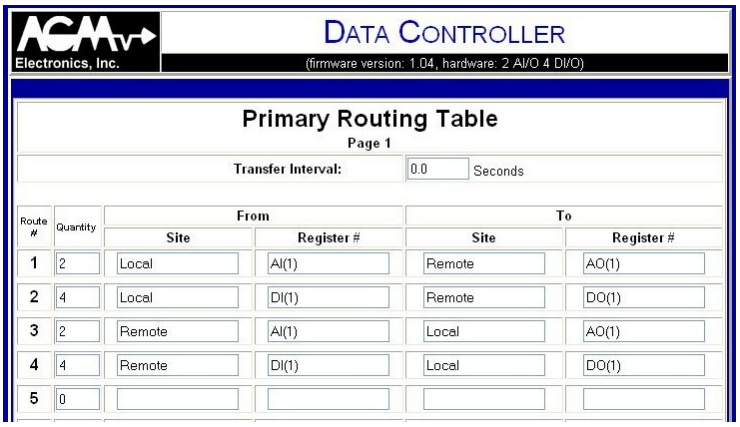
7. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

Edit Routing Table

Two routing tables are available in the DC. The Primary Routing Table is used when a jumper is installed between pins 2 and 4 on the screw terminal. The Alternate Routing Table is used when there is no jumper installed. For DC to DC connections use only the Primary Routing Table and leave the Alternate Routing table blank.

1. Select Edit Primary Routing Table. This will open the page used to define how data will be transferred between the two DCs.

   The illustration below shows a typical DC to DC routing table. Use it when simply transferring data from one DC to another.



DC Primary Routing Table Setup

2. Leave the Transfer Interval set to 0. This will allow the DCs to communicate at the maximum throughput.

3. Starting with the first row fill in each row of the table.

   The illustration above shows the setup for transferring 2 analog I/O and 4 digital I/O into and out of two DCs. This is typical for a 5018-1 DC.

4. In the Quantity column enter the number of continuous data points to transfer. In the case of a full transfer of all I/O, 4 rows will be required. For a 5018-1 you will need to transfer 2 analog signals out of the local DC; 4 digital signals out of the local DC; 2 analog signals from a remote DC; and 4 digital signals from a remote DC. For a 5018-3 you will need to transfer 4 analog signals out of the local DC; 2 digital signals out of the local DC; 4 analog signals from a remote DC; and 2 digital signals from a remote DC.

5. The remaining 4 columns represent the From and To location of the data points you will be transferring. The two columns under “From” define the source of the data point and the two columns under “To” define the destination of the data points.

6. In the Site columns enter either “Local” for the local DC or a name form the Site Transfer Table set up previously. The local DC represents the I/O of the DC you are currently configuring. In the case of the above illustration “Remote” represents the remote DC.

7. In the Register # column enter the first DC register you will be transferring. The following table shows register names you may use. Additional registers will be added in future firmware versions.

Register	Description	Register	Description
AI(1)	Analog Input 1.	AI(2)	Analog Input 2.
AI(3)	Analog Input 3. (5018-3 Only)	AI(4)	Analog Input 4. (5018-3 Only)
AO(1)	Analog Output 1.	AO(2)	Analog Output 2.
AO(3)	Analog Output 3. (5018-3 Only)	AO(4)	Analog Output 4. (5018-3 Only)
CNT(1)	Counter 1.	CNT(2)	Counter 2.
CNT(3)	Counter 3. (5018-1 Only)	CNT(4)	Counter 4. (5018-1 Only)
VAR(1)	Internal Variable 1.	VAR(2)	Internal Variable 2.
VAR(3)	Internal Variable 3.	VAR(4)	Internal Variable 4.
VAR(5)	Internal Variable 5.	VAR(6)	Internal Variable 6.
VAR(7)	Internal Variable 7.	VAR(8)	Internal Variable 8.
DI(1)	Digital Input 1.	DI(2)	Digital Input 2.
DI(3)	Digital Input 3. (5018-1 Only)	DI(4)	Digital Input 4. (5018-1 Only)
DO(1)	Digital Output 1.	DO(2)	Digital Output 2.
DO(3)	Digital Output 3. (5018-1 Only)	DO(4)	Digital Output 4. (5018-1 Only)
BIT(1)	Internal Bit Variable 1.	BIT(2)	Internal Bit Variable2.
BIT(3)	Internal Bit Variable 3.	BIT(4)	Internal Bit Variable 4.
BIT(5)	Internal Bit Variable 5.	BIT(6)	Internal Bit Variable 6.
BIT(7)	Internal Bit Variable 7.	BIT(8)	Internal Bit Variable 8.

DC I/O Registers

8. When done In the Register # column enter the DC register you will be transferring. The above table shows register names you may use. Additional registers will be added in future firmware versions.

9. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

10. From the Administration Page you must click on the Log Off link before the DCs will start transferring data. Transferring of data will stop when the first transfer related setting is saved and will not resume until you Log Off; the automatic log off interval has elapsed; or power is cycled to the DC. By default the DC will automatically log the administration off and resume transferring after 15 minutes.

DC to Modbus PLC

The DC is designed to communicate with Programmable Logic Controllers (PLC), Remote Terminal Units (RTU), Human Machine Interfaces (HMI) and other devices that use the Modbus Protocol. See the following sections for DF1 and Ethernet/IP. Other protocols such as DNP3 are in the planning stages.

The DC may be set up to act either as a Master or Slave device. Setting up the DC to work with your PLC is very similar to a DC to DC connection. For a Slave device you only need to configure the settings on the Port Setup page. Site and Routing Table pages can remain empty.

Settings on the Port Setup page must be selected before defining the Sites or Routing Tables. The settings on this page determine the basic communications parameters of each port used. Most of the settings will be the same whether you are using RS232 or RS485.

NOTE 1: When using TCP/IP Modbus you may use the same settings for all DCs. In TCP/IP Modbus the IP address which is set via the Network Settings page is used to select the device address of the DC.

NOTE 2: You may set both port A and B to identical settings. For the slave DC this will allow you to switch ports without reconfiguring. This may be important in some field installations where you my find yourself with the wrong combinations of RS232 cables.

NOTE 3: The DC supports a sub set of the Modbus protocol. See the Modbus specifications section for a list of supported Modbus commands. All the commands required to transfer data are supported. Diagnostic and other commands are not supported in the current version.

NOTE 4: The DC stores data as long (32 bit) integers. Modbus Input and Holding registers are only 16 bit registers. To support this difference register pairs are used to hold the integer data. The odd register will be the lower 16 bits of the long integer and the even register will be the upper 16 bits of the integer.

The current version uses only 12 bits for the Analog I/O. When reading analog inputs you may read only the odd register as the even register will read 0. When writing analog outputs you may write only the odd register. Even analog output registers should be 0.

NOTE 5: The Data Controller has built in scaling and calibration and reports analog inputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

NOTE 6: The Data Controller has built in scaling and calibration and reports analog outputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

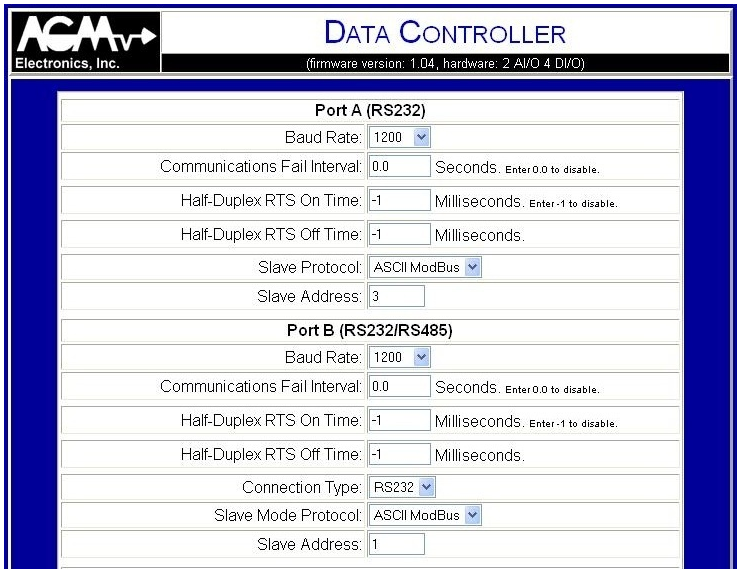
Modbus Registers

The following lists the Modbus Registers and how they are used. Registers not listed below are reserved for future expansion and should not be used.

Register	Description	Register	Description
00001	Digital Output 1	00002	Digital Output 2
00003	Digital Output 3 (5018-1 Only)	00004	Digital Output 4 (5018-1 Only)
10001	Digital Input 1	10002	Digital Input 2
10003	Digital Input 3 (5018-1 Only)	10004	Digital Input 4 (5018-1 Only)
30001	Analog Input 1 (lower 16 bits) (see NOTE 5)	30002	Analog Input 1 (upper 16 bits) (May read 0 or -1, see NOTE 5)
30003	Analog Input 2 (lower 16 bits) (see NOTE 5)	30004	Analog Input 2 (upper 16 bits) (May read 0 or -1, see NOTE 5)
30005	Analog Input 3 (lower 16 bits) (see NOTE 5) (5018-3 Only)	30006	Analog Input 3 (upper 16 bits) (May read 0 or -1, see NOTE 5) (5018-3 Only)
30007	Analog Input 4 (lower 16 bits) (see NOTE 5) (5018-3 Only)	30008	Analog Input 4 (upper 16 bits) (May read 0 or -1, see NOTE 5) (5018-3 Only)
40001	Analog Output 1 (lower 16 bits) (see NOTE 6)	40002	Analog Output 1 (upper 16 bits) (see NOTE 6)
40003	Analog Output 2 (lower 16 bits) (see NOTE 6)	40004	Analog Output 2 (upper 16 bits) (see NOTE 6)
40001	Analog Output 3 (lower 16 bits) (see NOTE 6) (5018-3 Only)	40002	Analog Output 3 (upper 16 bits) (see NOTE 6) (5018-3 Only)
40003	Analog Output 4 (lower 16 bits) (see NOTE 6) (5018-3 Only)	40004	Analog Output 4 (upper 16 bits) (see NOTE 6) (5018-3 Only)

Port Setup

1. Select Port Setup. This will open the page used to set up the communications ports. Port A is the top Male 9 pin connector. The pin out of this port is the same as a PC. Port B is the bottom female 9 pin connector. The pin of this port is the same as a modem. Ports C, D, and E are the Ethernet ports and use the Ethernet RJ45 jack.



DC Communications Port Setup

2. For the serial ports, use the drop down list to select the baud rate you will be using. The default is 9600 baud, however 300, 1200, and 19200 baud is available. This baud rate must be the same for all devices.

3. For Ethernet, set the TCP Port Number. The reserved port number for Modbus is 502. You may enter any valid port number, however using the reserved ports is recommended. When working with a Gateway or Firewall you may need to use port numbers other than the registered port numbers.

4. Select the Slave Protocol you will be using. For serial ports both ASCII and RTU Modbus are supported as well as additional protocols. The Ethernet ports have only one Modbus protocol. You may also select Not Used to indicate the communications port is not being used for slave communications.

   ASCII Modbus is recommended for radio modem or other installations where timing or noise may be a problem. RTU Modbus will give slightly better performance but may not work 100% of the time if the radio modem or other device breaks up the RTU Modbus packets. For most applications you can use either protocol, provided the same protocol is used for all devices.

   NOTE: You may set a slave protocol even if the DC is being used as a master. When used as a master the master protocol will override the slave protocol settings.

5. Set the Slave Address. For most installations this number must be unique.

6. Port B will normally auto select the type of interface, either RS232 or RS485. This auto selection requires the RS232 signal DTR to be available. In some cases such as using a 3 wire cable the auto selection will not work. You may bypass the auto selection by selecting RS232 or RS485 in the Connection Type drop down list box.

   You can determine when Port B is in the RS485 or RS232 mode by observing the "P" light. If the "P" light is flashing at a approximate 1 Hz rate then Port B is in the RS485 mode. If on steady then Port B is set for RS232 either through auto detect or this configuration option.

6. For most installations leave the Communications Fail Interval to 0.0. This will set the Communications Fail Interval to the default time based on the protocol. Unless you are communicating through multiple repeaters or other installations that delay the communications the default Communications Fail Interval will work.

7. Unless you are using Half-Duplex communications that require RTS control leave the Half-Duplex On Time and Half-Duplex Off Time to -1. Typical devices that may require this type of control are leased line Bell 202 Modems and some of the more primitive radio modems. Spread Spectrum radio modems such as AGM Electronics Inc. SSR do not require Half-Duplex control.

   If your device requires Half-Duplex control, set the Half-Duplex On Time to the time in milliseconds your modem requires to stabilize before the first character is transmitted. Set the Half-Duplex Off Time to the time in milliseconds your modem may require RTS to be active after the last character is transmitted.

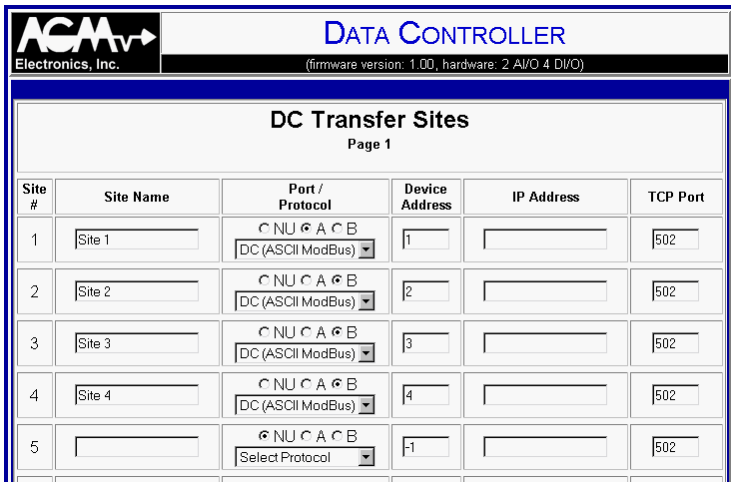
   If used Half-Duplex On Time and Half-Duplex Off Time must be the same for all DC's and other devices connected using the Half-Duplex modems. Half-Duplex On Time must also be equal to or greater than the Half-Duplex Off time.

8. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

9. If the DC will be used as a slave device only, you are done with the configuration. If you want to configure your DC to act as master continue with this section.

Edit Sites

1. Select Edit Sites. This will open the page used to define all the remote sites the Master DC will be connected to. You need 1 entry per slave device connected.



DC Transfer Sites Table

2. Enter an identifying text name in the box under Site Name. The name entered here will be used in the Routing Tables to identify the site. The name entered here defines the name of the remote site. For the purposes of these instructions 4 sites have been defined, “Site 1” through “Site 4”. You may use any meaningful name to name your sites.

   DO NOT USE “Local” as a site name. “Local” is a reserved name identifying the local DC.

3. Select the port that will be used to communicate to the remote device. “A” is the top male D connector and “B” is the bottom female D connector. TCP is for a Ethernet connection using Modbus TCP. “NU” indicates the site is not currently used.

4. Enter the device address in the text box under Device Address. The device address much match the device address programmed in the Slave device.

5. If using an Ethernet connection, fill in the IP address and TCP port number of the remote DC. The TCP port number in most cases should be the registered Modbus port number of 502. The IP and TCP port number must match the IP and TCP port numbers defined in the slave DC.

6. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

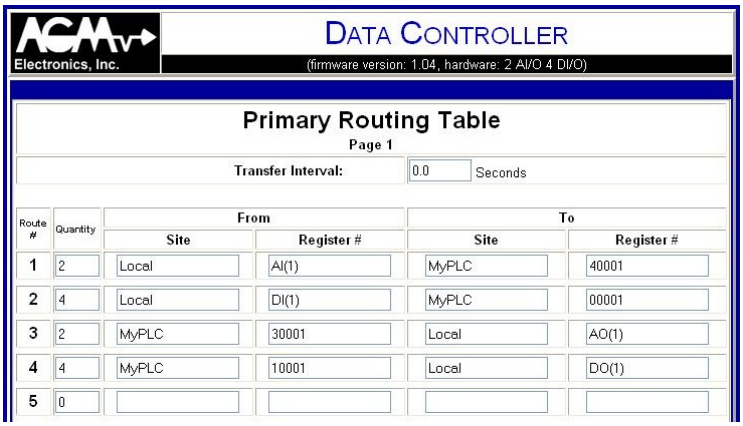
Edit Routing Table

Two routing tables are available in the DC. The Primary Routing Table is used when a jumper is installed between pins 2 and 4 on the screw terminal. The Alternate Routing Table is used when there is no jumper installed. For purposes of these instructions only the Primary Routing Table is used.

1. Select Edit Primary Routing Table. This will open the page used to define how data will be transferred between the two DCs.

   The illustration below shows a typical DC routing table. Your table will vary according to the number of sites you are using and where you will be transferring data.

   NOTE: In the example below the DC shows 4 registers being transferred for the Analog I/O. This is due to the size differences between a DC register and a Modbus register. The sample below is transferring the both Analog Inputs to registers 40001 through 40004. Registers 30001 through 30004 are being transferred to the Analog outputs.



DC Primary Routing Table Setup

2. Unless you need to slow down the transfer of data, leave the Transfer Interval set to 0.

3. Starting with the first row fill in each row of the table.

   The illustration above shows the setup for transferring both Digital and Analog I/O to and from your PLC.

4. In the Quantity column enter the number of continuous data points to transfer. When working with Modbus registers the quantity represents the number of Modbus registers.

5. The remaining 4 columns represent the From and To location of the data points you will be transferring. The two columns under “From” define the source of the data point and the two columns under “To” define the destination of the data points.

6. In the Site columns enter either “Local” for the local DC or a name form the Site Transfer Table set up previously. The local DC represents the I/O of the DC you are currently configuring. In the case of the above illustration “My PLC” represents your remote PLC.

7. In the Register # column enter the first DC register you will be transferring. The following table shows register names you may use. Additional registers will be added in future firmware versions.

Register	Description	Register	Description
AI(1)	Analog Input 1.	AI(2)	Analog Input 2.
AI(3)	Analog Input 3. (5018-3 Only)	AI(4)	Analog Input 4. (5018-3 Only)
AO(1)	Analog Output 1.	AO(2)	Analog Output 2.
AO(3)	Analog Output 3. (5018-3 Only)	AO(4)	Analog Output 4. (5018-3 Only)
CNT(1)	Counter 1.	CNT(2)	Counter 2.
CNT(3)	Counter 3. (5018-1 Only)	CNT(4)	Counter 4. (5018-1 Only)
VAR(1)	Internal Variable 1.	VAR(2)	Internal Variable 2.
VAR(3)	Internal Variable 3.	VAR(4)	Internal Variable 4.
VAR(5)	Internal Variable 5.	VAR(6)	Internal Variable 6.
VAR(7)	Internal Variable 7.	VAR(8)	Internal Variable 8.
DI(1)	Digital Input 1.	DI(2)	Digital Input 2.
DI(3)	Digital Input 3. (5018-1 Only)	DI(4)	Digital Input 4. (5018-1 Only)
DO(1)	Digital Output 1.	DO(2)	Digital Output 2.
DO(3)	Digital Output 3. (5018-1 Only)	DO(4)	Digital Output 4. (5018-1 Only)
BIT(1)	Internal Bit Variable 1.	BIT(2)	Internal Bit Variable2.
BIT(3)	Internal Bit Variable 3.	BIT(4)	Internal Bit Variable 4.
BIT(5)	Internal Bit Variable 5.	BIT(6)	Internal Bit Variable 6.
BIT(7)	Internal Bit Variable 7.	BIT(8)	Internal Bit Variable 8.

DC I/O Registers

8. When done In the From Register # column enter the DC or Modbus register you will be transferring in the To Register # column.

9. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

10. From the Administration Page you must click on the Log Off link before the DCs will start transferring data. Transferring of data will stop when the first transfer related setting is saved and will not resume until you Log Off; the automatic log off interval has elapsed; or power is cycled to the DC. By default the DC will automatically log the administration off and resume transferring after 15 minutes.

DC to DF1 Half-Duplex Slave PLC

The DC is designed to communicate with Programmable Logic Controllers (PLC), Remote Terminal Units (RTU), Human Machine Interfaces (HMI) and other devices that use the DF1 Half-Duplex Slave Protocol.

When used with DF1 the DC can only be set up to act as a Slave device. For a Slave device you only need to configure the settings on the Port Setup page. Site and Routing Table are not used for DF1 and may remain empty.

NOTE 1: You may set both port A and B to identical settings. For the slave DC this will allow you to switch ports without reconfiguring. This may be important in some field installations where you my find yourself with the wrong combinations of RS232 cables.

NOTE 2: The DC supports a sub set of the DF-1 protocol. See the DF-1 specifications section for a list of supported DF-1 commands. All the commands required to transfer data are supported. Diagnostic and other commands are not supported in the current version.

NOTE 3: The DC stores data as long (32 bit) integers. DF1 I/O registers are only 16 bit registers. To support this difference register pairs are used to hold the integer data. The even register will be the lower 16 bits of the long integer and the odd register will be the upper 16 bits of the integer.

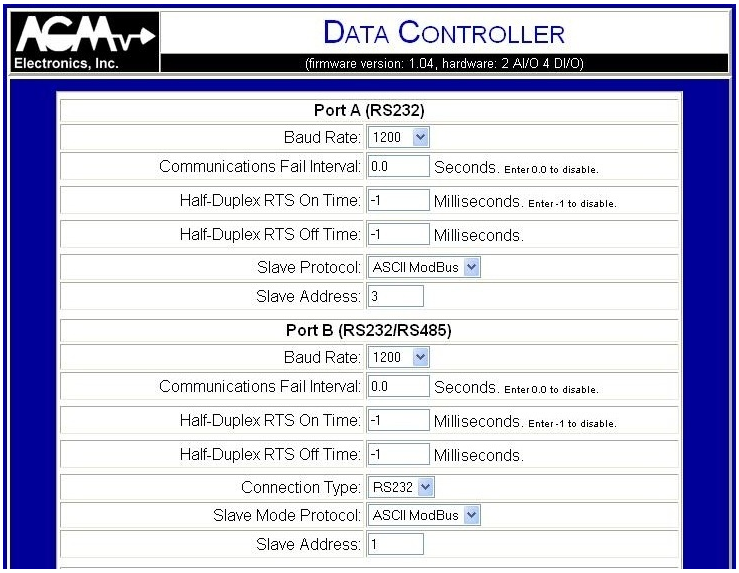
DF1 Registers

The following lists the DF1 Registers and how they are used. Registers not listed below are reserved for future expansion and should not be used.

Register	Description	Register	Description
O0:00/1	Digital Output 1	O0:00/3	Digital Output 2
O0:00/2	Digital Output 3 (5018-1 Only)	O0:00/4	Digital Output 4 (5018-1 Only)
I1:00/1	Digital Input 1	I1:00/3	Digital Input 2
I1:00/2	Digital Input 3 (5018-1 Only)	I1:00/4	Digital Input 4 (5018-1 Only)
I1:02	Analog Input 1 (lower 16 bits)	I1:03	Analog Input 1 (upper 16 bits)
I1:04	Analog Input 2 (lower 16 bits)	I1:05	Analog Input 2 (upper 16 bits)
I1:06	Analog Input 3 (lower 16 bits) (5018-3 Only)	I1:07	Analog Input 3 (upper 16 bits) (5018-3 Only)
I1:08	Analog Input 4 (lower 16 bits) (5018-3 Only)	I1:09	Analog Input 4 (upper 16 bits) (5018-3 Only)
O0:02	Analog Output 1 (lower 16 bits)	O0:03	Analog Output 1 (upper 16 bits)
O0:04	Analog Output 2 (lower 16 bits)	O0:05	Analog Output 2 (upper 16 bits)
O0:06	Analog Output 3 (lower 16 bits) (5018-3 Only)	O0:07	Analog Output 3 (upper 16 bits) (5018-3 Only)
O0:08	Analog Output 4 (lower 16 bits) (5018-3 Only)	O0:09	Analog Output 4 (upper 16 bits) (5018-3 Only)

Port Setup

1. Select Port Setup. This will open the page used to set up the communications ports. Port A is the top Male 9 pin connector. The pin out of this port is the same as a PC. Port B is the bottom female 9 pin connector. The pin of this port is the same as a modem.



DC Communications Port Setup

2. Use the drop down list to select the baud rate you will be using. The default is 9600 baud, however 300, 1200, and 19200 baud is available. This baud rate must be the same for all devices.

3. Select the Slave Protocol you will be using. DF1 Half-Duplex has two versions of error checking, BCC and CRC. Select the version that matches the error detection used by your PLD.

4. Set the Slave Address to the device address for this DC. This is the address you will program into your Master device to connect to the DC.

5. Port B will normally auto select the type of interface, either RS232 or RS485. This auto selection requires the RS232 signal DTR to be available. In some cases such as using a 3 wire cable the auto selection will not work. You may bypass the auto selection by selecting RS232 or RS485 in the Connection Type drop down list box.

6. You can determine when Port B is in the RS485 or RS232 mode by observing the “P” light. If the “P” light is flashing at a approximate 1 Hz rate then Port B is in the RS485 mode. If on steady then Port B is set for RS232 either through auto detect or this configuration option.

7. Leave the Communications Fail Interval to 0.0. Communications Fail is only used when the DC is a master device.

8. Unless you are using Half-Duplex communications that require RTS control leave the Half-Duplex On Time and Half-Duplex Off Time to -1. Typical devices that may require this type of control are leased line Bell 202 Modems and some of the more primitive radio modems. Spread Spectrum radio modems such as AGM Electronics Inc. SSR do not require Half-Duplex control.

9. If your device requires Half-Duplex control, set the Half-Duplex On Time to the time in milliseconds your modem requires to stabilize before the first character is transmitted. Set the Half-Duplex Off Time to the time in milliseconds your modem may require RTS to be active after the last character is transmitted.

10. If used Half-Duplex On Time and Half-Duplex Off Time must be the same for all DC's and other devices connected using the Half-Duplex modems. Half-Duplex On Time must also be equal to or greater than the Half-Duplex Off time.

11. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

DF1 is supported for slave devices only. You have completed all settings required to use the DC with DF1 protocol.

DC to Ethernet/IP PLC

The DC is designed to communicate with Programmable Logic Controllers (PLC), Remote Terminal Units (RTU), Human Machine Interfaces (HMI) and other devices that use the Ethernet/IP Protocol.

When used with Ethernet/IP the DC can only be set up to act as a Slave or Server device. For a Slave device you only need to configure the settings on the Port Setup page. Site and Routing Table are not used for Ethernet/IP and may remain empty.

Ethernet/IP Classes

The following lists a subset of the Ethernet/IP classes. See Appendix M for a complete list.

Class	Instances	Description
Assembly 0x04	100, 101	Analog Inputs
	108 , 109	Analog Outputs
	116 - 119	Digital Inputs
	124 - 127	Digital Outputs
Digital Inputs 0x08	1 - 4 (5018-1) 1 - 2 (5018-3)	Digital Inputs
Digital Outputs 0x09	1 - 4 (5018-1) 1 - 2 (5018-3)	Digital Outputs
Analog Inputs 0x0A	1 - 2 (5018-1) 1 - 4 (5018-3)	Analog Inputs
Analog Outputs 0x0B	1 - 2 (5018-1) 1 - 4 (5018-3)	Analog Outputs

DC to DNP3

The DC is designed to communicate with Programmable Logic Controllers (PLC), Remote Terminal Units (RTU), Human Machine Interfaces (HMI) and other devices that use serial DNP3 Protocol.

When used with DNP3 the DC can only be set up to act as a Slave only. You will need to configure the settings on the Port Setup and Edit DNP3 Protocol / IO Settings pages. Site and Routing Table are not used for DNP3 and may remain empty.

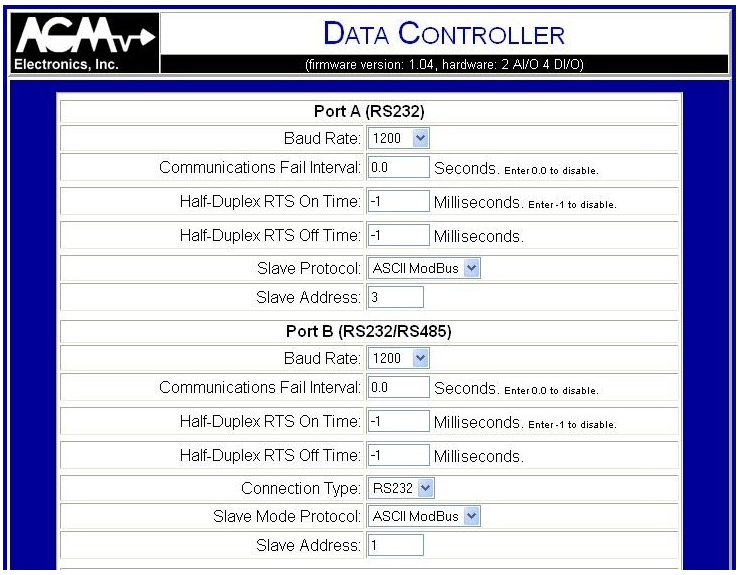
DNP3 Objects

The following table lists the DNP3 objects used by the Data Controller.

Object	Variation	Description
Binary Input 1	1	Digital Inputs.
Binary Input Event 2	2	Digital Input change with time. Reported only on a Class 1, Class 2, or Class 3 request.
Binary Output Status 10	1	Digital Outputs. The actual digital output status is reported and not the output data points. If using a trip/close pair each output of the pair will be reported as separate bits.
Control Relay Output Block 12	1	Digital Output Control Block. Can control Digital Output type, and pulse on and off times.
Counter 20	5	32 Bit Counter without flag.
Frozen Counter 21	5	32 Bit Counter with time of freeze.
Analog Input 30	3	32 Bit Analog Input without flag.
Frozen Analog Input 31	3	32 Bit Analog Input with time of freeze.
Analog Output Status 40	1	32 Bit Analog Output status.
Analog Output Block 41	1	32 Bit Analog Output control block.
Static Class 60	1	Static I/O. Analog and Digital Inputs always reported. Counters, Frozen Inputs and Output Status can be configured.
Event Classes 60	2, 3, 4	Digital Input Events. Digital Inputs may be configured as to the event class generated.

Port Setup

1. Select Port Setup. This will open the page used to set up the communications ports. Port A is the top Male 9 pin connector. The pin out of this port is the same as a PC. Port B is the bottom female 9 pin connector. The pin of this port is the same as a modem.



DC Communications Port Setup

2. Use the drop down list to select the baud rate you will be using. The default is 9600 baud, however 300, 1200, and 19200 baud is available. This baud rate must be the same for all devices.

3. Select DNP3 from the Slave Protocol drop down list.

4. Set the Slave Address to the device address for this DC. This is the address you will program into your Master device to connect to the DC.

5. Port B will normally auto select the type of interface, either RS232 or RS485. This auto selection requires the RS232 signal DTR to be available. In some cases such as using a 3 wire cable the auto selection will not work. You may bypass the auto selection by selecting RS232 or RS485 in the Connection Type drop down list box.

6. You can determine when Port B is in the RS485 or RS232 mode by observing the “P” light. If the “P” light is flashing at a approximate 1 Hz rate then Port B is in the RS485 mode. If on steady then Port B is set for RS232 either through auto detect or this configuration option.

7. Leave the Communications Fail Interval to 0.0. This setting is not used for DNP3 protocol.

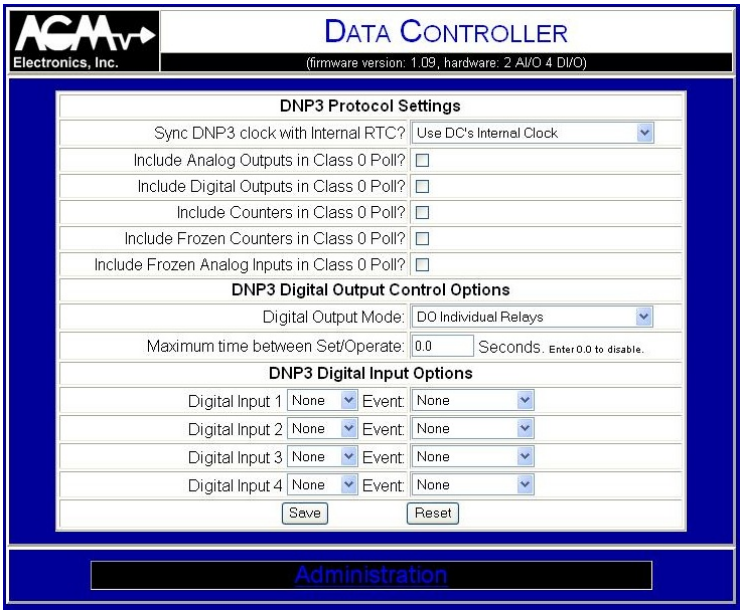
8. Unless you are using Half-Duplex communications that require RTS control leave the Half-Duplex On Time and Half-Duplex Off Time to -1. Typical devices that may require this type of control are leased line Bell 202 Modems and some of the more primitive radio modems. Spread Spectrum radio modems such as AGM Electronics Inc. SSR do not require Half-Duplex control.

9. If your device requires Half-Duplex control, set the Half-Duplex On Time to the time in milliseconds your modem requires to stabilize before the first character is transmitted. Set the Half-Duplex Off Time to the time in milliseconds your modem may require RTS to be active after the last character is transmitted.

10. If used Half-Duplex On Time and Half-Duplex Off Time must be the same for all DC's and other devices connected using the Half-Duplex modems. Half-Duplex On Time must also be equal to or greater than the Half-Duplex Off time.

11. Click on the Save button to save any changes you have made. Once the settings have been saved a Saved confirmation page will be displayed. Click on the Continue link to return to the Administration page.

12. From the Administration Page click on the "Edit DNP3 Protocol / IO Settings. This will bring up a page that will allow you to set some specific to the DNP3 protocol. Review the settings on this page. The settings on this page allow you to set optional settings which control the data that is reported to your DNP3 master device. See the "DNP3 Protocols and I/O Settings" section in the Software Configuration section below for more details on the settings on this page.

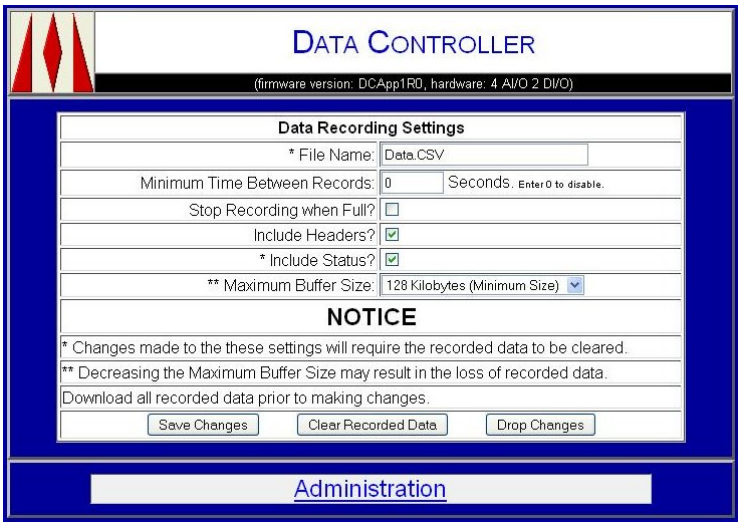


DC DNP3 Protocol and I/O Settings Setup

13. When done reviewing, your DC is ready to communicate with your DNP3 Master device.

Data Recording, Application 1 and Application 0

1. Select Data Recording Settings from the Administration menu. This will open the web page used to set up the basic settings for data recording. This page will include the file name for the comma delimited (.CSV) file and other settings required for recording data.



Data Recording Settings

2. Enter a file name in the text box. Maximum file name is 26 characters not including the ".CSV" extension. The name must consist of alphanumeric characters only. You do not need to enter the ".CSV" extension. The extension of ".CSV" will be automatically appended if not supplied.

3. The "Minimum Time Between Records" is used to prevent multiple alarm events from creating multiple record entries on a single event. For most applications leave this setting to 0.

4. When the DC recorded data buffer fills up you have two options on handling the full buffer and loss of data. When the "Stop Recording when Full" box is checked the DC will stop recording data when the buffer fills up. This will preserve the oldest recorded data in the buffer. Any new data will be discarded. If the box is unchecked then the oldest data will be discarded to make room for new recorded data.

5. Depending on how you will be processing the recorded data file you may or may not want to include headers on the .CSV file. When the “Include Headers” check box is checked the first line of the .CSV file will contain text names of each of the .CSV data columns. These column names will make it easier to identify the data, and may be required when converting to a database table. When some operations to the data file such as simply concatenating the .CSV files together the header information could create invalid data in the table.

   The “Include Headers” option may be changed without losing data. When you first set up the DC for recording included the headers in the .CSV file. You may later uncheck the box to retrieve the .CSV file without headers.

6. The “Include Status” checkbox when checked includes a status field between the Data and Time field and other data fields in the .CSV file. The status field is used to indicate when the DC has been reset.

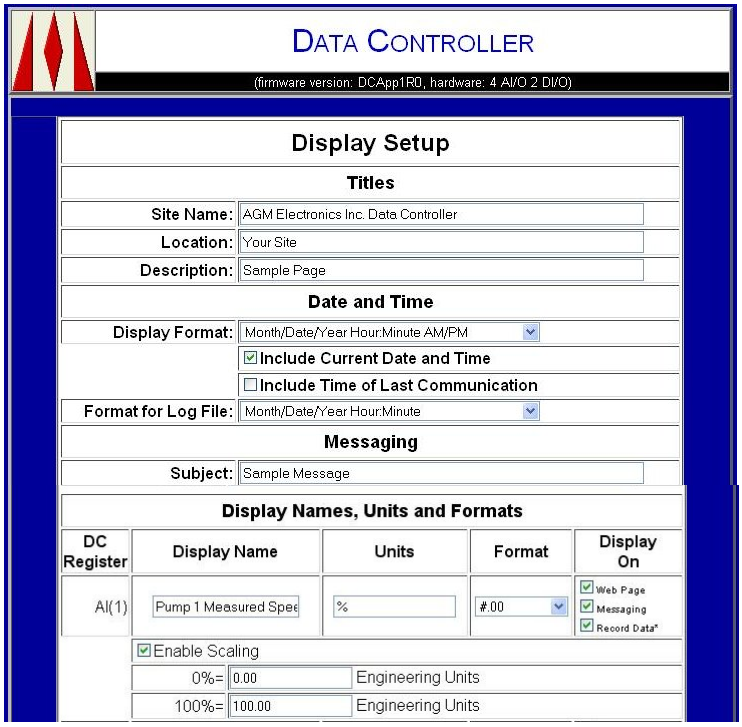
7. The “Maximum Buffer Size” drop down box sets the amount of the DC flash memory that will be set aside for data recording. The number of data records stored will depend on the amount of data to record and the formats for the recorded data. Typically the DC can store 1000 records at the minimum settings and 150000 at the maximum settings.

8. Click on the “Save Changes” button or “Clear Recorded Data” buttons to save the settings. Clicking on the “Clear Log” button will also clear all recorded data.

9. Depending on the changes made you may see a warning message indicating that all recorded data will be cleared. Click the “Yes” button to continue. When you get the Saved page click on the “Continue” link to return to the Administration menu.

Clear Recorded Data Warning Message

10. From the Administration menu select “Display Settings”. The Display Setup page is used to control how various data registers are displayed on the default web page, in text messages, and recorded data files. From this page you will select which data points to record and define the header text for the .CSV file.



Display Setup

11. Check the “Record Data” check boxes on each of the DC Registers you wish to included in the recorded data file.

12. Enter a descriptive name in the “Display Name” column for each of the registers you will be recording. The text name entered will be used for the header of the .CSV file if enabled.

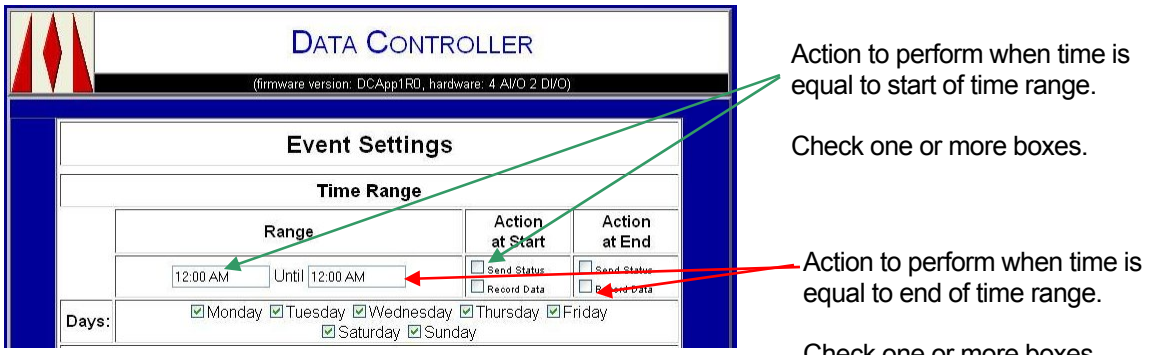
    NOTE: When using headers and you will be importing the .CSV file into another program make sure you only use characters in the Display Name that are valid for the other program. To prevent problems, limit the Display Names to alphanumeric characters only.

13. Other options on this page control how the value will be displayed in messaging and on the default web page. See the Software Configuration section for more details on the options not covered here.

14. Click on the “Save Changes” button to save the settings. If you changed the registers included you will need to clear all recorded data. The Clear Recorded Data Warning Message as shown previously will be displayed if the file needs to be cleared.

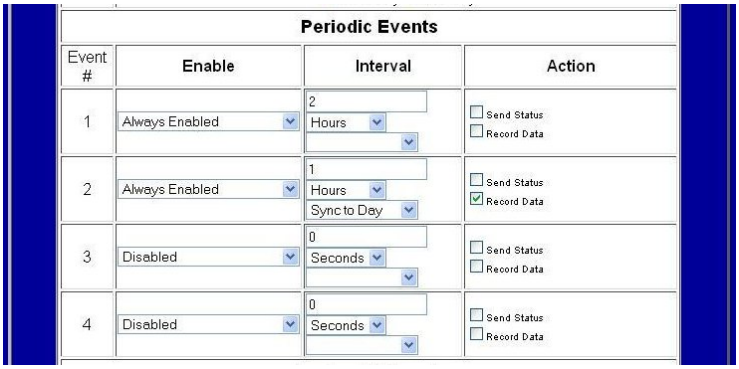
15. From the Administration menu select “Events”. The Events page is used to define the conditions that will initiate a message or data recording. Four types of settings are available.

16. The first Event condition is a time range. This event is used to set up a time window for enabling or disabling other events however it may also be used to produce a daily recording at a specific time. To use enter the time range and check one or both of the “Record Data” check boxes.



Event Settings, Time Range

17. The second set of Event conditions is for periodic events for use where data needs to be recorded at a periodic interval. Up to four periodic events may be specified.



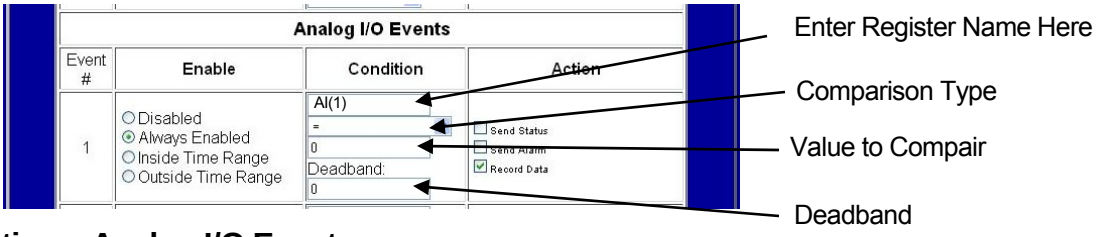
Event Settings, Periodic Events

18. Set the value in the drop down list box under the “Enable” column to “Always Enabled” or one of the other options to enable a specific event. The other options will allow for periodic recording only when within the specified time range or when another analog or digital alarm condition is true.

19. Enter the interval for when data will be recorded in the first text box in the “Interval” column. You may enter the interval in seconds, minutes, or hours by setting the drop down list box to the appropriate units. You may also select when the interval will start with the second drop down list box.

20. Check the “Record Data” box to enable data recording at the interval you just specified.

21. The third set of Event conditions are analog tests, typically used to generate a recording when alarm condition exists.



Event Settings, Analog I/O Events

22. Select “Always Enabled” or one of the other conditions under the “Enable” column to enable the event test.

23. Enter the name of a Data Controller register in the first text box in the “Condition” column. You may enter any valid DC I/O register name.

Register	Description	Register	Description
AI(1)	Analog Input 1.	AI(2)	Analog Input 2.
AI(3)	Analog Input 3. (5018-3 Only)	AI(4)	Analog Input 4. (5018-3 Only)
AO(1)	Analog Output 1.	AO(2)	Analog Output 2.
AO(3)	Analog Output 3. (5018-3 Only)	AO(4)	Analog Output 4. (5018-3 Only)
CNT(1)	Counter 1.	CNT(2)	Counter 2.
CNT(3)	Counter 3. (5018-1 Only)	CNT(4)	Counter 4. (5018-1 Only)
VAR(1)	Internal Variable 1.	VAR(2)	Internal Variable 2.
VAR(3)	Internal Variable 3.	VAR(4)	Internal Variable 4.
VAR(5)	Internal Variable 5.	VAR(6)	Internal Variable 6.
VAR(7)	Internal Variable 7.	VAR(8)	Internal Variable 8.
DI(1)	Digital Input 1.	DI(2)	Digital Input 2.
DI(3)	Digital Input 3. (5018-1 Only)	DI(4)	Digital Input 4. (5018-1 Only)
DO(1)	Digital Output 1.	DO(2)	Digital Output 2.
DO(3)	Digital Output 3. (5018-1 Only)	DO(4)	Digital Output 4. (5018-1 Only)
BIT(1)	Internal Bit Variable 1.	BIT(2)	Internal Bit Variable2.
BIT(3)	Internal Bit Variable 3.	BIT(4)	Internal Bit Variable 4.
BIT(5)	Internal Bit Variable 5.	BIT(6)	Internal Bit Variable 6.
BIT(7)	Internal Bit Variable 7.	BIT(8)	Internal Bit Variable 8.

DC I/O Registers

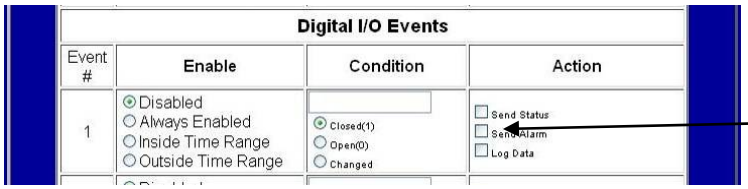
24. Select the compare condition from the drop down list box. In addition to the simple type of comparisons the following are also available:
    a. Change by a specified value.
    b. Increase by a specified value.
    c. Decrease by a specified value.
    d. When the minimum value is reached.
    e. When the maximum value is reached.
    f. When either the minimum or maximum values are reached. Peak test.

25. Enter the value to test for in the text box under the text conditions. All tests except the minimum, maximum and peak tests require an entry in this box.

26. Enter any dead band value used for the test condition. For simple comparisons the dead band value represents the magnitude the specified register value must change before the test resets to the false condition. For minimum, maximum and peak test values the dead band value is used to determine when the register value has reached its peak. Dead band is not used by the change by, increase, or decrease tests.

27. Check the “Record Data” box to enable data recording.

28. The forth set of Event conditions are digital tests. Digital tests are set up the same as the analog tests except there are fewer test options.



Event Settings, Digital I/O Events

29. Select one of the conditions under the “Enable” column to enable or disable a test.

30. Enter the name of a Data Controller register in the first text box in the “Condition” column. You may enter any valid DC I/O register name. Analog registers may be entered but their conditions will be tested for zero or non-zero.

31. Select one of the test conditions from the radio buttons.

32. Check the “Record Data” box to enable data recording.

33. Click on the “Save Changes” button to save the settings. Once you receive the “Saved” page you will be ready to start recording data.

34. To test, create a recording event or if periodic recording is enabled wait for a record to be recorded then retrieve and inspect the .CSV file. You may retrieve the file with either a FTP program or by requesting the data file through your web browser by entering “http://192.168.0.251/mydatafile.csv” on the address line. The “192.168.0.251” is the IP address of the DC and “mydatafile.csv” is the name of the data file you specified in the Data Recording Settings.

NOTE: Application 0 and Application 1 as well as some future applications the recording of data will be referred to as Data Recording. Other applications refer to the recording of data as Data Logging.

Data Recording, Other Firmware Applications

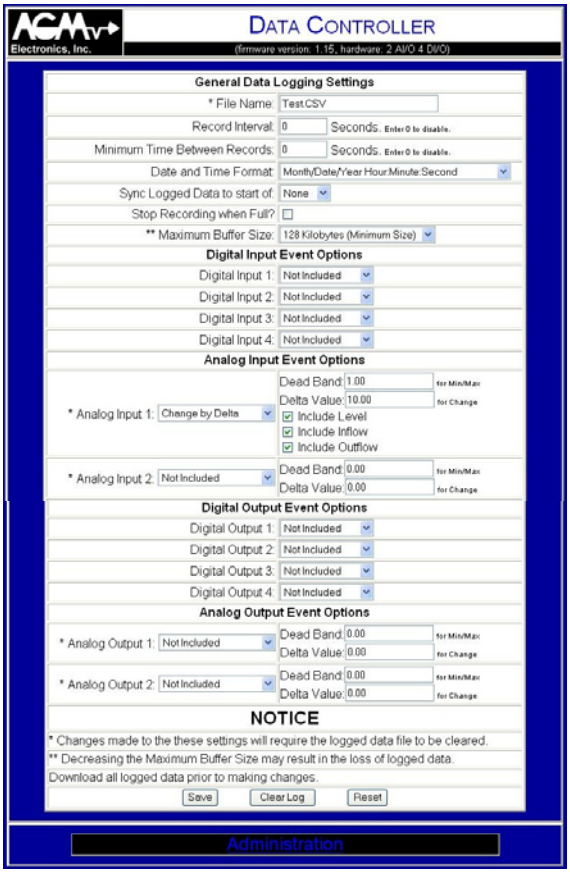
NOTE: On some firmware versions Data Recording is called Data Logging.

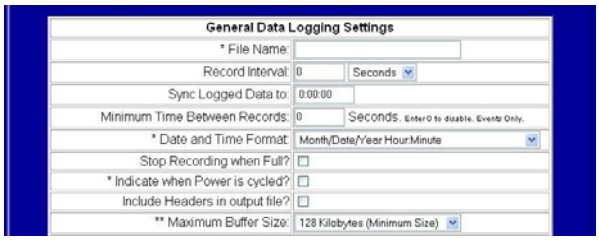
1. Determine the I/O you wish to log and the format for the data. The default settings display the Analog I/O in percentage of full scale with 2 decimal points. This may be changed to engineering units and up to 8 decimal points.

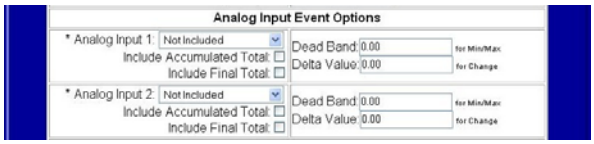
2. If you wish to use Engineering units go to the Administration Page and select I/O Settings. Enter the Engineering Units for both 0% and 100%, then set the decimal point for each of the Analog Inputs or Outputs you will be recording. See the Software Configuration section for more information. Save the settings when done.

3. Go to the Administration Page and select Data Logging Settings. This will bring up the Data Logging Settings Page.

4. Enter a name for the recorded data file to the right of File Name. This is the name that will appear in the directory when you are connected via FTP. If you omit the.CSV extension it will be added. The DC limits you to the 30 characters for the name. You may use any alphanumeric name. Spaces, dashes, and underlines are accepted. You may not use question marks, asterisks, or any other reserved characters that will not be accepted by your computers file system.







Data Logging Settings

5. If you wish to record data on a periodic interval enter your required interval to the right of Record Interval. Enter 0 if you will be recording on events only. If you are recording on events only you may want to consider using a bench mark recording at a periodic interval in addition to the events. For example you may want to record a record every hour regardless of detecting an event, just as a system test. In this case you would enter 3600, the seconds in a hour, for the Record Interval.

   Some versions have a drop down list next to the Record Interval text box. This list indicates the time units of the periodic interval entered. This allows the Record Interval to be specified in Minutes, Hours or Days as well as seconds.

6. For most applications you will leave the Minimum Time Between Records set to 0. You will only need to change this setting when your system may create multiple events and you wish to have only one or two events recorded to save space. If not set then each event can create its own recording.

7. Set the Date and Time Format to the date and time format you wish to use in the .CSV file. The Date and Time Format may be the same or different than the format used for displaying the date and time on the default web page.

8. Determine if you want to sync your periodic recorded data to the actual time and possibly external events and set the Sync Logged Data drop down list accordingly. With recording Intervals under a Minute, syncing does not make any sense and you will probably want to leave this settings set to None. If however your recording interval is 15 minutes or more you may want to sync the interval to the start of the hour. For example if you want to record data 15 minutes after the hour then you would set the Record Interval to 900 seconds and the Sync Logged Data to start of hour. This would produce recording at: 1:15; 1:30; 1:45; and 2:00. If you don't set the Sync the recordings will be just 15 minutes apart. Eg. 1:05; 1:20; 1:35; and 1:50. Where the starting time will be when the DC was last powered up.

   Some firmware versions have the drop down list box replaced with a text box where you may enter the Sync Time in the formation of hh:mm:ss where hh is the hours, mm is the minutes and ss is the seconds.

   This setting only applies to periodic recording. It will have no effect on event recordings.

9. Determine how you want the DC to handle the data file filling up and set the Stop Recording when Full check box accordingly. Checking the box will prevent the loss of old data but at the expense of more recent data. Checking the box will also require the logged data file to be periodically cleared when the data has been uploaded. Leaving the box unchecked will allow DC to continue logging when the data file fills up, but at the expense of the oldest data. When unchecked, clearing the data file is not required, however when retrieving the logged data old data will be included along with the new data. You may want to periodically delete the file to cut down on the retrieval time and prevent redundant records.

10. Determine how much of the Flash memory you want to allocate to the logged data buffer and set the Maximum Buffer Size. If you will not be using any custom web pages and want to maximize the amount of data stored, select the maximum size of 3 Megabytes. If you will be: automatically uploading the data; not manually deleting the recorded data; and wish to minimize the upload time set the Maximum Buffer Size to the minimum size 128 Kbytes or any of the values in between.

11. Select the Inputs and Outputs you will be recording and what condition if any will generate a new record. Set the drop down list boxes accordingly.

12. For Analog I/O signals that will generate an event recording, calculate the dead band or delta value and enter in the appropriate text boxes.

    The Dead Band is used Minimum and Maximum level detection and Flow Measurement only. The value entered should be large enough so any noise does not generate a recording. The Dead Band is entered in Engineering Units. The default is in percentage of full scale. On DC's with flow measurement, the Dead Band entered here is the same Dead Band used in making the flow calculation.

    The Delta Value is used for the "Change by" event recording options. If using one of these recording options enter the amount of change in Engineering Units for a recording to take place. The default is in percentage of full scale.

13. Save your changes by clicking on the Save or Clear Log buttons. Clear Log will save your settings and clear the logged data file. Save will only clear the logged data file if the changes require the file to be cleared.

14. Test your settings. If you are using periodic recording, leave the DC powered up for longer that the specified interval. If recording on events, create several events.

Retrieving Recorded Data

Once the DC has been operating and has had the opportunity to record data, it is time to retrieve the data from the Flash memory. For most firmware versions this is done via a FTP transfer. The following uses the FTP program available in Microsoft Windows. Other FTP programs are available and may be used.

Some firmware versions will also provide the recorded data via a link on the Default page. Instructions on retrieving the data from the default page will follow the FTP instructions described below.

In addition to the Microsoft Windows FTP program the DC has been tested with:

FireFTP. A freeware add-on for Mozilla Firefox.

WS_FTP Pro. A low cost FTP client available from IP Switch.

Communicator. A communication program available from AGM Electronics Inc. Communicator not only provides a simplified interface to the DC but the ability to communicate with other AGM equipment.

To retrieve the file using Microsoft Windows FTP program:

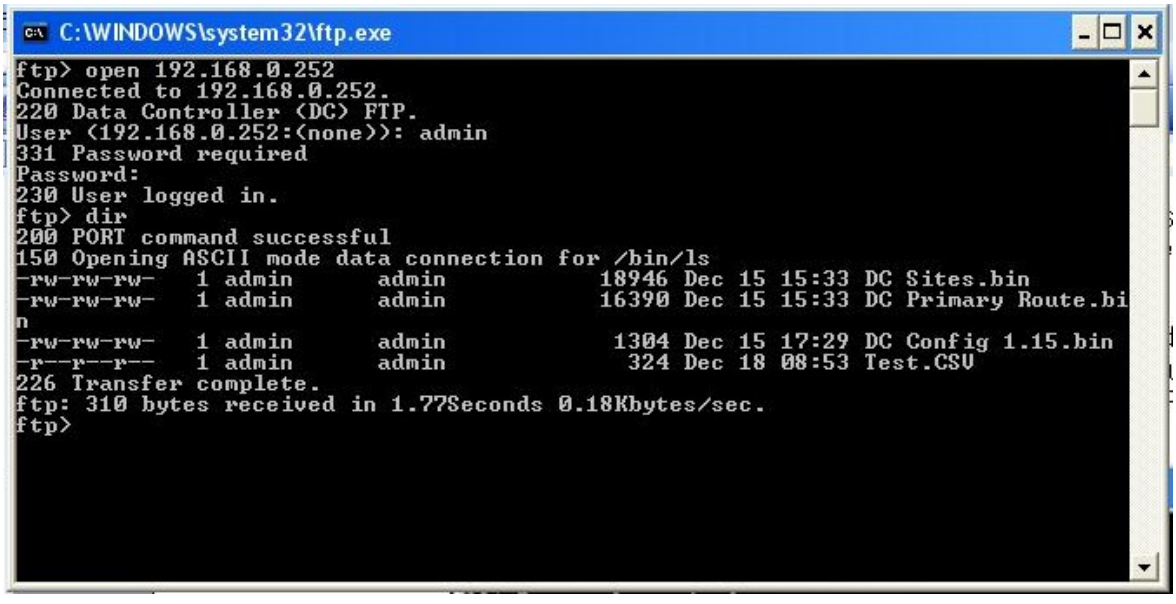
1. Go to the Start Menu then select Run. In the Run dialog box enter “FTP” without the quotes and click on the OK button.

2. Open the connection to the DC by entering “open” followed by the DC’s IP address. “open 192.168.0.251” If the FTP port number has been changed then the port number will follow the IP address. “open 192.168.0.251 50000”.

3. When you are requested for the User name, enter “admin” or any user name you have set up in the DC.

4. When the password is requested, enter “password” or the password that matches the user name. If you get the “User logged in” message you have successfully connected to the DC.

5. If you wish to determine if a data file has been recorded, enter “Dir”. This will display a directory of all files stored on the DC. These file include configuration files, custom web pages, and the logged data file. In the Example FTP Session below the data file is named “Test.CSV” The data file will always have the “.CSV” extension.



Example FTP Session

6. To retrieve the recorded data use the Get command. E.g. “Get Test.CSV C:\Data1.csv” to upload the data file “Test.CSV” on the DC to “C:\Data1.csv” on your computer.

7. To delete the file from the FTP program use the “Del” command. E.g. “Del Test.CSV”.

   NOTE: To protect your data only the data that has been uploaded during the FTP session the will be deleted. To delete all data, regardless of whether or not it has been uploaded use the delete command twice.

8. Use “Close” to close the connection without closing the FTP program or use “Bye” to close the connection and program.

9. Check your retrieved data. A “.CSV” file is a comma delimited text file. In addition to programs such as Microsoft Excel which can read a “.CSV” file a normal text editor such as Microsoft Windows Notepad can read the file.

To retrieve the file using a Web Browser, Application 0 and Application 1:

In Firmware Applications 0 and Applications 1 the recorded data file can be retrieved from a web browser by entering the IP address of the Data Controller followed by the name of the .CSV file. You may also put the link in a custom web page.

Example: Http://192.168.0.251/Data.csv

To retrieve the file using a Web Browser, Applications with Default Page Link:

Some versions of the DC firmware have the ability to send the Recorded Data via a web browser link. If your firmware version has this support you will see a Retrieve Logged Data File link on the default page. This link will only be displayed when the DC has been set up to record data and recorded data is available.

Example Web Page Link

1. To retrieve the recorded data right click on the Retrieve Logged Data File link. Then select “Save Target as …” or “Save Link as …” depending on your web browser version.

2. When the “Save as” dialog box is displayed, select the folder where you wish to save the file. You may also change the name of the recorded data file if required.

   For Microsoft Internet Explorer you must change the file name extension. Microsoft Internet Explorer tries to save the file as an “.HTM” file and not a “.CSV” file. For the file to be recognized by Microsoft Excel and other programs the saved file must have the extension of “.CSV”.

Some programs such as Mozilla Firefox will recognize the file as a ".CSV" file and save it with the correct extension. Firefox will also correctly handle the file if you click on the Retrieve Logged Data File link.

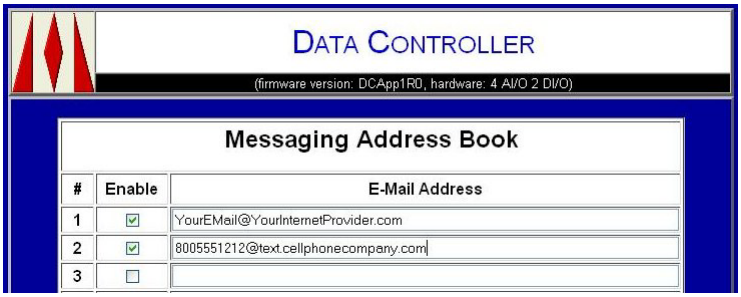
You may clear the recorded data by clicking on the Clear Logged Data File link. When the confirmation page is displayed, enter the user ID and Password then click on the Yes button.

Clear Logged Data Confirmation Page

Messaging

Messaging is only available in Application 0 and Application 1 firmware. The following steps will walk you through setting up a typical messaging application.

1. Select Address Book from the Administration Menu.



Messaging Address Book

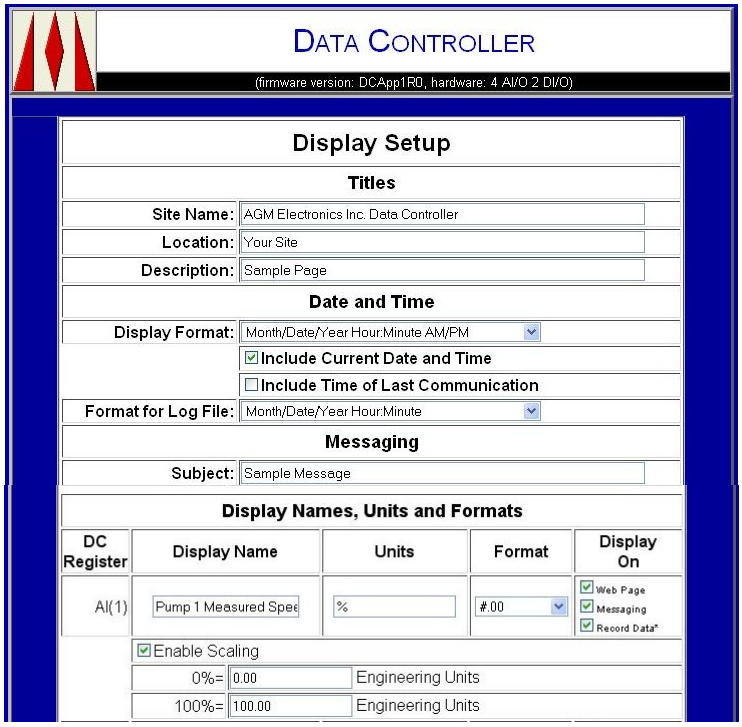
2. Enter from one to twenty E-Mail addresses in the E-Mail address column and check the box in the Enable column for at least one E-Mail address.

   NOTE: Text messages are sent to cell phones using the cell phone providers gateway. Check with your cell phone provider to determine the E-Mail address to use for sending text messages from the Internet to a phone on their network. Typical text messaging addresses the phone number followed by the gateway address.

   Sprint: [10 digit phone number]@messaging.sprintpcs.com
   Verizon: [10 digit phone number]@vtext.com
   AT&T: [10 digit phone number]@txt.att.net

3. Click on the “Save Changes” button to save the settings then click on the “Continue” link of the “Saved” page to return to the Administration menu.

4. From the Administration menu select “Display Settings”. The Display Setup page is used to control how various data registers are displayed on the default web page, in text messages, and recorded data files. From this page you will select the data points that will be included in the status message.



Display Setup

5. Check the “Messaging” check boxes on each of the DC Registers you wish to include in the status message.

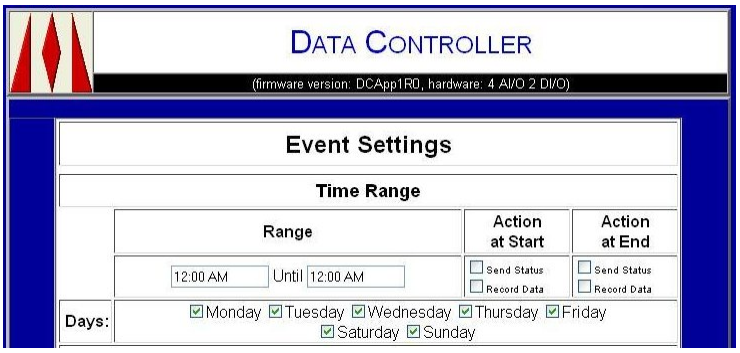
6. Enter a descriptive name in the “Display Name” column and if required “Units” for each of the registers you will be including. The text entered for “Display Name” will appear before the value and the text entered for “Units” will appear after the value.

7. Other options on this page control how the value will be displayed in messaging and on the default web page. See the Software Configuration section for more details on the options not covered here.

8. Click on the “Save Changes” button to save the settings.

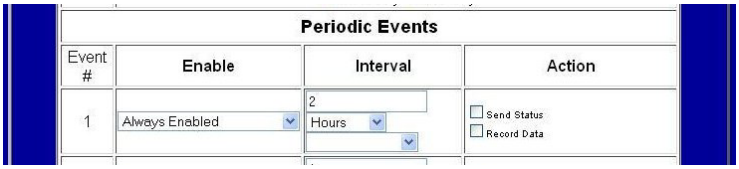
9. From the Administration menu select “Events”. The Events page is used to define the conditions that will initiate a message. Four types of settings are available.

10. The first Event condition is a time range. This event is used to set up a time window for enabling or disabling other events however it may also be used to produce to send a status message at a specific time. To use enter the time range and check one or both of the “Send Status” check boxes.



Event Settings, Part 1

11. The second set of Event conditions is for periodic events for use where status data needs to be sent at a periodic interval.



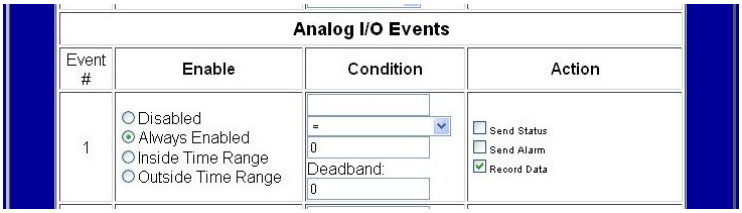
Event Settings, Part 2

12. Set the value in the drop down list box under the “Enable” column to “Always Enabled” or one of the other options to enable a specific event.

13. Enter the interval for when status messages should be sent in the first text box in the “Interval” column. You may enter the interval in seconds, minutes, or hours by setting the drop down list box to the appropriate units. You may also select when the interval will start with the second drop down list box.

14. Check the “Send Status” box to send a status message at the interval you just specified.

15. The third set of Event conditions are analog tests, typically used to send a message when an alarm condition occurs.



Event Settings, Part 3

16. Select one of the conditions under the "Enable" column to enable or disable a test.

17. Enter the name of a Data Controller register in the first text box in the "Condition" column. You may enter any valid DC I/O register name.

Register	Description	Register	Description
AI(1)	Analog Input 1.	AI(2)	Analog Input 2.
AI(3)	Analog Input 3. (5018-3 Only)	AI(4)	Analog Input 4. (5018-3 Only)
AO(1)	Analog Output 1.	AO(2)	Analog Output 2.
AO(3)	Analog Output 3. (5018-3 Only)	AO(4)	Analog Output 4. (5018-3 Only)
CNT(1)	Counter 1.	CNT(2)	Counter 2.
CNT(3)	Counter 3. (5018-1 Only)	CNT(4)	Counter 4. (5018-1 Only)
VAR(1)	Internal Variable 1.	VAR(2)	Internal Variable 2.
VAR(3)	Internal Variable 3.	VAR(4)	Internal Variable 4.
VAR(5)	Internal Variable 5.	VAR(6)	Internal Variable 6.
VAR(7)	Internal Variable 7.	VAR(8)	Internal Variable 8.
DI(1)	Digital Input 1.	DI(2)	Digital Input 2.
DI(3)	Digital Input 3. (5018-1 Only)	DI(4)	Digital Input 4. (5018-1 Only)
DO(1)	Digital Output 1.	DO(2)	Digital Output 2.
DO(3)	Digital Output 3. (5018-1 Only)	DO(4)	Digital Output 4. (5018-1 Only)
BIT(1)	Internal Bit Variable 1.	BIT(2)	Internal Bit Variable2.
BIT(3)	Internal Bit Variable 3.	BIT(4)	Internal Bit Variable 4.
BIT(5)	Internal Bit Variable 5.	BIT(6)	Internal Bit Variable 6.
BIT(7)	Internal Bit Variable 7.	BIT(8)	Internal Bit Variable 8.

DC I/O Registers

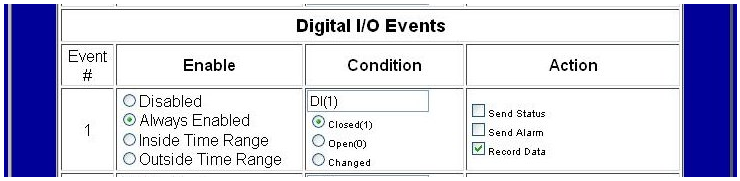
18. Select the compare condition from the drop down list box. In addition to the simple type of comparisons the following are also available:
    a. Change by a specified value.
    b. Increase by a specified value.
    c. Decrease by a specified value.
    d. When the minimum value is reached.
    e. When the maximum value is reached.
    f. When either the minimum or maximum values are reached. Peak test.

19. Enter the value to test for in the text box under the text conditions. All tests except the minimum, maximum and peak tests require an entry in this box.

20. Enter any dead band value used for the test condition. For simple comparisons the dead band value represents the magnitude the specified register value must change before the test resets to the false condition. For minimum, maximum and peak test values the dead band value is used to determine when the register value has reached its peak. Dead band is not used by the change by, increase, or decrease tests.

21. You have two types of messages available for Analog I/O Events. Check the "Send Status" box to send a status message. Status messages include all the data selected in the Display Settings page. Check the "Send Alarm" check box to only send the status of the register specified in the "Conditions" column.

22. The forth set of Event conditions are digital tests. Digital tests are set up the same as the analog tests except there are fewer test options.



Event Settings, Part 4

23. Select one of the conditions under the "Enable" column to enable or disable a test.

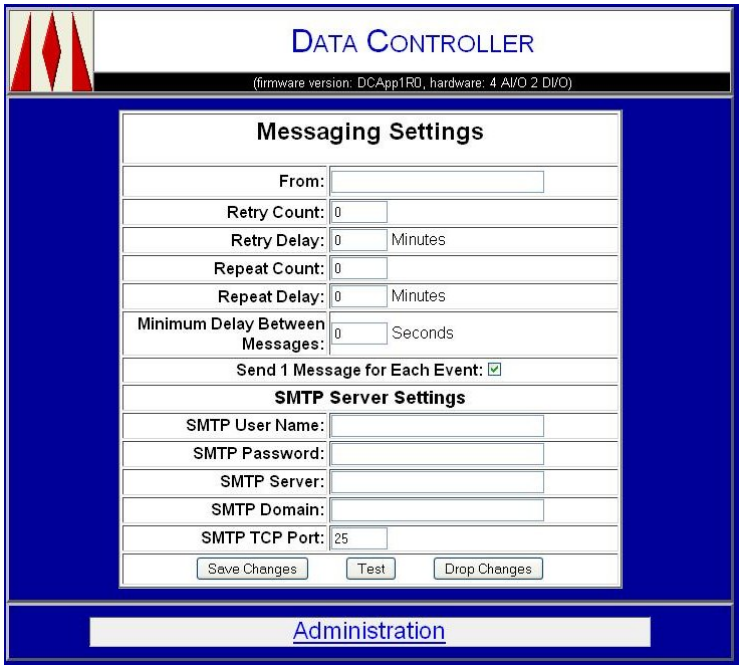
24. Enter the name of a Data Controller register in the first text box in the "Condition" column. You may enter any valid DC I/O register name. Analog registers may be entered but their conditions will be tested for zero or non-zero.

25. Select one of the test conditions from the radio buttons.

26. You have two types of messages available for Digital I/O Events. Check the "Send Status" box to send a status message. Status messages include all the data selected in the Display Settings page. Check the "Send Alarm" check box to only send the status of the register specified in the "Conditions" column.

27. Click on the "Save Changes" button to save the settings.

28. Select Messaging Settings from the Administration menu. This will open the web page used to set up the information required to connect to a SMTP mail server.



Messaging Settings

29. In the text box to the right of “From”, enter a valid E-Mail address. The E-Mail address entered will be used to report some types of errors such as invalid addresses or full mail box for the recipients.

30. Many mail servers require you to log onto their server with a user name and password to send messages through their server. You must have an E-Mail account on the server to send messages. Enter the user name for the account in the text box to the right of “SMTP User Name”. Enter the corresponding password in the text box to the right of “SMTP Password”.

    If you are using a SMTP server that does not require you to log in to send a message you may leave both the “SMTP User Name” and “SMTP Password” blank.

31. Enter the address of the SMTP mail server. SMTP mail servers are sometimes referred to as outgoing mail server when used as part of POP, POP3 or IMAP E-Mail service. Your E-Mail service provider can provide you with the name to used as a SMTP or outgoing server. Only mail servers using SMTP for sending mail are supported by the DC.

32. See the Software Configuration section for a description of these and other settings not covered in this section.

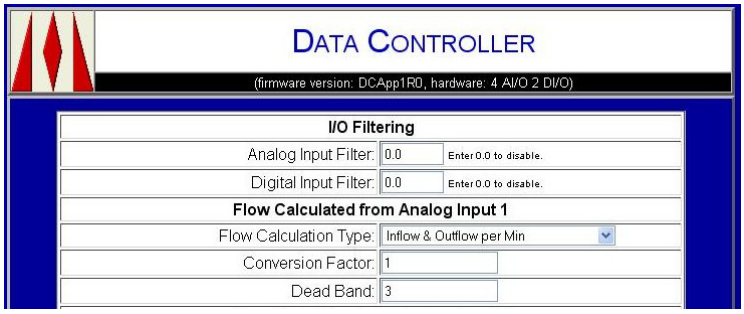
33. Click on the “Test” button to save the settings then send a test status message or click on “Save Changes” button just to save the settings. If you do not receive a message within a few minutes return to the Administration menu and click on “Display Message Log” to get a log of any errors encountered in sending the message.

DC Firmware Application 1

DC Firmware Application 1 is an application specific firmware version that is designed to calculate an estimated flow and pump capacity from changes in the amplitude read by an analog input. See the Calculating Flow section for more information on how the flow is calculated.

The following steps are use to set up the Application 1 firmware to perform this calculation.

1. Select I/O Settings from the Administration Menu. This will bring up the page for setting various I/O parameters including the settings for calculating flow.



I/O Settings

2. Select the type of flow to be calculated from the drop down list. You have the option of calculating:
   a. Inflow
   b. Outflow
   c. Pump Capacity
   d. Inflow and Outflow
   e. Inflow and Pump Capacity
   f. Outflow and Pump Capacity

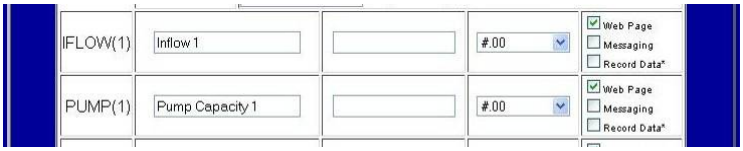
3. In the text box to the right of the Dead Band enter a value for dead band. Dead band will be in same units as the analog input. The dead band is the magnitude the analog input must change in the reverse direction before the flow calculation routine will determine a peak has been reached.

4. Click on the "Save Changes" button to save the settings.

NOTE: Application 1 has up to 6 additional registers available for display, data recording or event monitoring. The following registers are available in Application 1:

Register	Description	Register	Description
IFLOW(1)	Inflow from Analog Input 1.	IFLOW(2)	Inflow from Analog Input 2.
OFLOW(1)	Outflow from Analog Input 1.	OFLOW(2)	Outflow from Analog Input 2.
PUMP(1)	Pump Capacity from Analog Input 1.	PUMP(2)	Pump Capacity from Analog Input 2.

5. Select Display Settings from the Administration menu. When the flow calculations have been enabled up to four additional Display Settings will be shown. These settings will allow you to name the calculated flow registers, supply units for display, and select where the flow will be displayed. Web Page will include the flow on the default web page, Messaging will include the flow in the status message, and Record Data will include the flow in the recorded data file.



Display Settings for Flow Registers

DC Firmware Application 2

DC Firmware Application 2 is an application specific firmware version that is designed to totalize the analog input values to produce a total reading over a period of time.

For example an analog input scaled so 4 to 20 mA equals 0 to 100 Gallons per minute can be totalized to display the number of gallons in a hour or day.

The following steps will lead you through setting up the DC to perform this calculation.

1. Start by going to the Administration page and select Edit Default Page and Units link.

Administration Page for Application 2 Firmware

2. In the Units column of the Analog Inputs section fill in the units in the text box and use the drop down list box to indicate the time base for the analog input scaling. For example if the analog input is scaled for Gallons per minute, you will enter “Gallons” in the text box and select “per Minute” from the drop down list. You must select either “per Second”, “per Minute”, “per Hour”, or “per Day” for the total calculation to work correctly.

DC Default Page Display and Units Settings

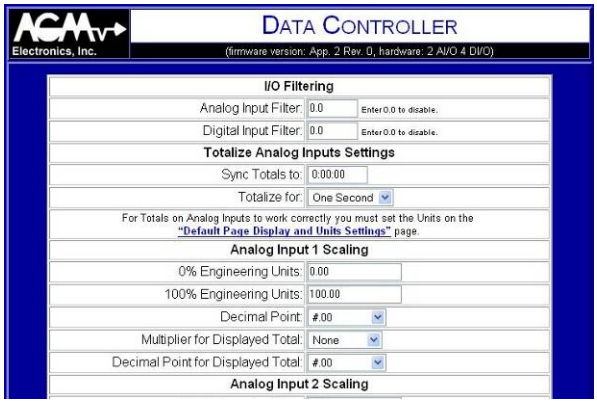
3. Select which calculations you wish to display on the default web page. You can display:

   a. Analog input rate. In the case of this example this would be the measured Gallons per Minute.

   b. The accumulated total. This is the current accumulated value updated every second. This accumulated total will be reset when the final total calculation is reset.

   c. The final total. This is the final accumulated total based on the interval set in the I/O Settings page. For example if the Totalize for is set for One Day the final total would be the accumulated total reached at the end of the day.

4. Click on the Save button when done then return to the Administration page and select I/O Settings.



I/O Settings

5. Under the Totalize Analog Input Settings select the time interval to use for calculating the final total and clearing the accumulated total. You can accumulate analog input data for One Second, One Minute, One Hour or One Day.

6. When totalizing long intervals you may wish to reset the totals at some other time than the beginning of the minute, hour or day. If you need to calculate the totals and reset at a time other than the beginning enter the time after Sync Totals to. The format for the Sync Totals is hh:mm:ss where hh represents the hour, mm represents the minutes, and ss represents the seconds.

   For example if you were calculating a daily total at 6 am you would set the Totalize for to One Day and enter 6:00:00 for Sync Totals to.

7. In the Analog Input Scaling section enter the value in engineering units for 0 percent or 4 mA in and for 100 percent or 20 mA in.

   For example if your analog input represent 0 to 50 Gallons per Minute for 4 to 20 mA. You will enter 0 for 0% Engineering Units and 50 for 100% Engineering Units.

   Using this example if the analog input was 50 percent or 25 Gallons per minute and it remained at that rate for a full day the final total will be 36,000 Gallons per day.

8. Optionally you may set the displayed decimal point for both the analog input and calculated total. You may also provide a multiplying factor to the calculated total. For example it your were measuring gallons per minute and wanted the display to read million gallons you would select a multiplier of x.000001. This would change the displayed value from 1000000 to 1.

9. Click on the Save button. The DC will now be totalizing the analog input value.

DC Firmware Application 3

DC Firmware Application 3 is an application specific firmware version that is designed to perform the following functions:

1. Sum the analog inputs to produce a total value. Sum may include one to all analog inputs.

2. Set the analog output to the sum of all the inputs.

3. Totalize the analog inputs. Total may be reset manually, allowed to overflow at 9999999999, or to reset automatically after a time interval. Total is available on each input as well as the summed inputs.

   The total is typically used for converting flows such as Gallons per Minute into Gallons. This allows the number of gallons used to be calculated from the flow. For example if an analog input scaled so 4 to 20 mA equals 0 to 100 Gallons per minute the number of Gallons used can be calculated.

4. Produce a pulse output representing the totalized input. Pulses may be produced on a single input or on the sum of the selected inputs.

   The pulse out will typically represent the number of Gallons used. Each pulse out will represent some number of Gallons used.

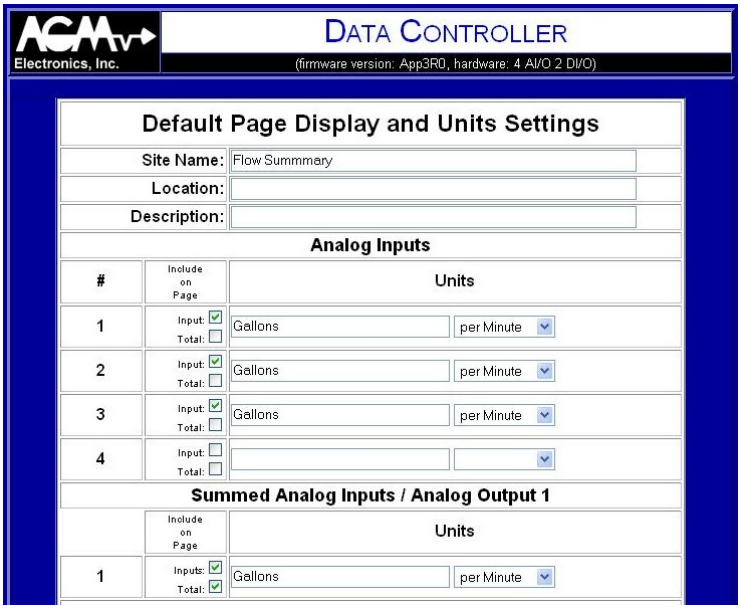
The following steps will lead you through typical Application 3 settings.

1. Start by going to the Administration page and select Edit Default Page and Units link.

Administration Page for DC with Application 3 Firmware

2. In the Units column of the Analog Inputs section fill in the units in the text box and use the drop down list box to indicate the time base for the analog input scaling. For example if the analog input is scaled for Gallons per minute, you will enter “Gallons” in the text box and select “per Minute” from the drop down list. You must select either “per Second”, “per Minute”, “per Hour”, or “per Day” for the total calculation to work correctly.

   In most cases the time base should be the same for all inputs as well as the summed inputs. If different time bases are used the DC will convert the flows to time base specified in the Summed Analog Inputs prior to calculating the sum.



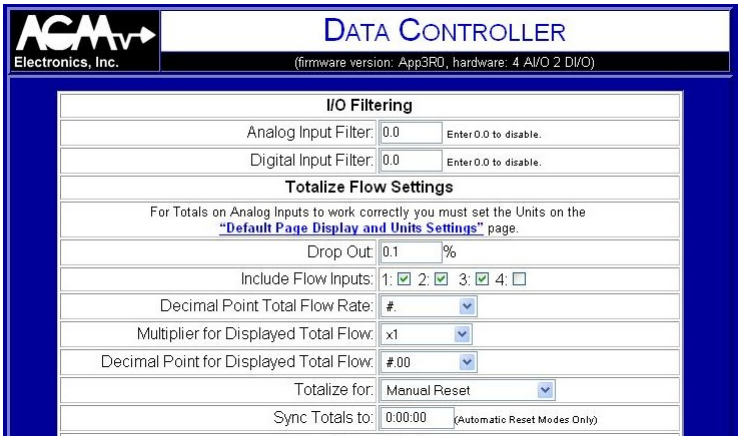
Default Page Display and Units Settings

3. Select which calculations you wish to display on the default web page. You can display:

   a. Analog input rate. In the case of this example this would be the measured Gallons per Minute.

   b. The total. This is the accumulated total based on the interval set in the I/O Settings page.

4. Click on the Save button when done then return to the Administration page and select I/O Settings.



Totalize Flow Settings

5. Under the Totalize Flow Settings, locate the Include Flow Inputs settings and select the analog inputs which will be included in sum of analog inputs. For example if you wish to add the flow rate from the first three analog inputs, check the 1, 2, and 3 box and leave box 4 unchecked.

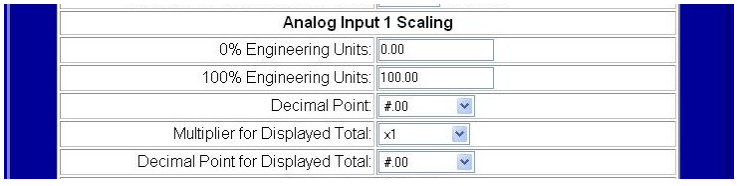
6. If required select the desired Decimal Point for the displayed Total Flow Rate and Total Flow. The Total Flow Rate is the sum of the selected analog inputs such as Gallons per Minute. The Total Flow is the calculated total such as Gallons.

7. If required enter the desired Drop Out. The Drop Out is the minimum total of from the total of the analog inputs that will be used for producing an analog output and for totalizing. The Drop Out is expressed as a percentage of the analog output.

8. For most applications you may leave the Multiplier for Displayed Total Flow set to x1. This will make the displayed total have the same units as the analog inputs. For example if the analog input units are Gallons per Minute the displayed total will be Gallons. If however you need to convert the units to some other range such as Thousand Gallons or Millions Gallons select the correct multiplier for the totals.

9. For most applications, Manual Reset should be selected for the Totalize for option. Other settings allow the total to be reset at a specified time interval. Sync Totals is only used for the automatic reset options.

10. Scroll down to the Analog Input Scaling section.



Analog Input Scaling

11. In the Analog Input Scaling section enter the value in engineering units for 0 percent or 4 mA in and for 100 percent or 20 mA in.

    For example if your analog input represent 0 to 50 Gallons per Minute for 4 to 20 mA. You will enter 0 for 0% Engineering Units and 50 for 100% Engineering Units.

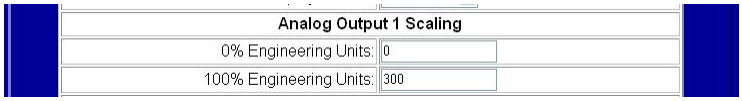
12. Optionally you may set the displayed decimal point for both the analog input and calculated total.

13. You may also provide a multiplying factor to the calculated total. For example it you are measuring gallons per minute and wanted the display to read million gallons you would select a multiplier of x.000001. This would change the displayed value from 1000000 to 1.

14. Scroll down to the Analog Output 1 Scaling and enter the engineering units representing 0 and 100 percent.

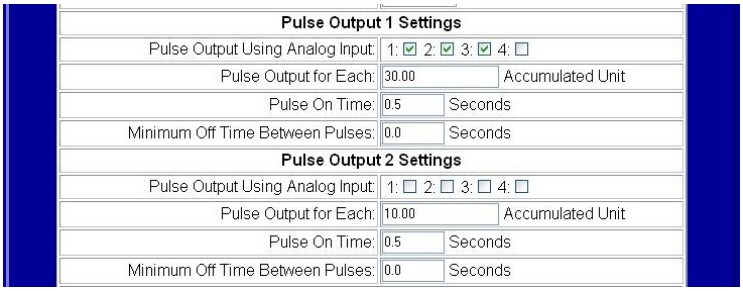
    Keep in mind that Analog Output 1 will be outputting the sum of the selected analog inputs. For most applications the 100 percent engineering units will be the sum of the 100 percent engineering units for the analog inputs. Other scaling may be used, however the Analog Output may over range and exceed 20 mA or may never reach full scale output of 20 mA depending on the scaling value.

    For example if the Analog Inputs are scaled for 0 to 100 Gallons per Minute and you are using 3 inputs, scaling the Analog Output to 0 to 300 will produce a full scale output of 20 mA when all three inputs are at full scale.



I/O Settings for Analog Output 1

15. For each analog input that will be used to produce a pulse scroll up to the Pulse Output Settings sections and check one or more of the boxes to the right of Pulse Output Using Analog Input. Checking more than one box will sum the analog inputs to produce the pulse.



I/O Settings for Pulse Outputs

16. Enter the value of accumulated input to produce a single pulse out to the right of Pulse Output in engineering units.

    For example if an analog input is set up to read gallons per minute, the value entered here would be the number of gallons per pulse output. An entry of 10 would produce a pulse out for every 10 gallons. If the analog input was reading a flow of 50 Gallons per minute, then with a setting of 10, an output rate of 5 pulses per minute would be generated.

17. Set the Pulse On Time to the desired pulse width. The output will be closed for the specified duration plus or minus 0.25 seconds. Recommended setting is 0.5 seconds or greater depending on the ability of the connected device to detect the contact closure.

18. If your equipment requires a minimum time between pulses set Minimum Off Time Between Pulses to the required interval. Setting to 0.0 will set the minimum time to approximately 0.25 seconds.

    NOTE: It is possible to set up the DC to produce pulses out even after the analog inputs have returned to 0. The DC produces outputs on the accumulated total and not the immediate input.

    For example if you were to set the analog input for 0 to 100 Gallons per Minute and the Pulse Output to 1 Gallon. Then if the analog input remained at 100 GPM for 1 minute

19. Click on the Save button. Your DC is now ready to Totalize the Inputs.

DC Firmware Application 4

NOTE: The following instructions are for revision 1 of the Application 4 program. For the previous version see AGM Data Controller (DC) Manual revision 16.

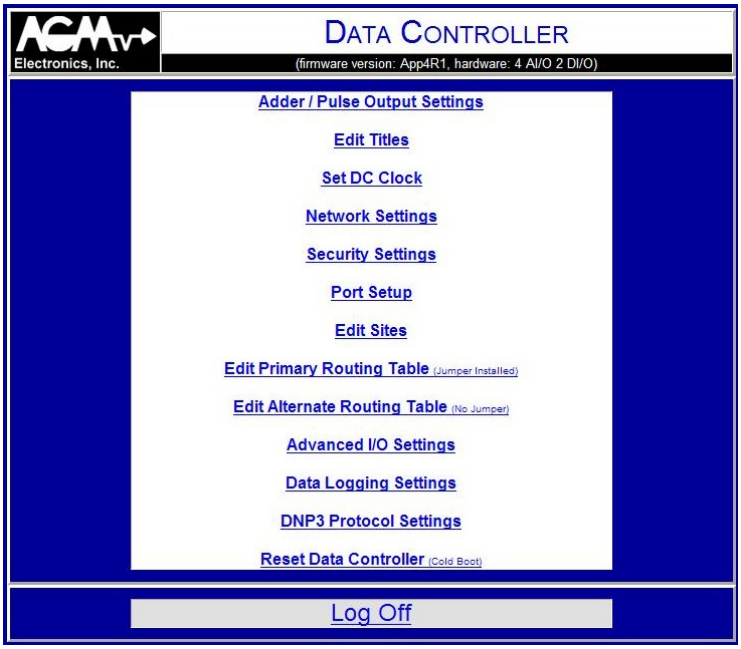
DC Firmware Application 4 is an application specific firmware version that is designed to perform the following functions:

1. Add up to four remote analog inputs together to produce an analog output.
2. To produce a analog output signal based on the sum of the remote analog inputs.
3. Produce a pulse output based on the sum of the analog inputs.
4. Optionally, Application 4 can be used to count pulses on a digital input then reproduce the number of pulses on the digital outputs.

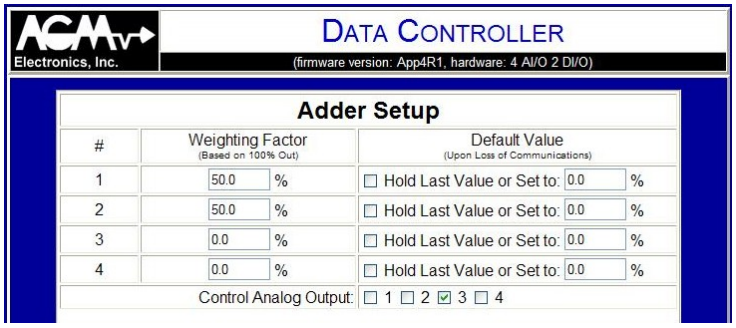
Adder / Pulse Output Settings

The following steps will lead you through typical Application 4 settings. With the exception of the counter settings described at the end of this section, the following steps only need to be performed on the DC producing the output pulses or analog signal.

1. Start by going to the Administration page and select Adder / Pulse Output Settings link.



Administration Page for DC with Application 4 Firmware



Adder / Pulse Output Settings, Adder Setup Section

2. The top left section of the Adder / Pulse Output Settings page sets how the analog inputs values will be weighted. Weighting is based on a 100% output signal. The Weighting Factor is what percentage of the 100% output will be added into the total.

   Example 1:

   Two analog inputs signals representing a 0 to 100 gallon per minute flow rate are to be added to produce a combined flow rate representing 0 to 200 gallons per minute.

   In this example the inputs are equal weighted to both would be set to 50 percent. To set up the Weighting Factor for this application you would enter 50 for #1 and #2 representing a 50 percent weighting factor for each input signal.

   Example 2:

   Two analog inputs signals are used. Once signal represents a 0 to 100 gallon per minute flow rate and the second represents a 0 to 10 gallon per minute flow rate. The output will represent a 0 to 110 gallons per minute flow rate.

   In this example the inputs are not equally weighted with one input being one tenth of the other input. In this case you would enter 10 for the 0 to 10 gallon per minute signal and 90 for the 0 to 100 gallon per minute signal.

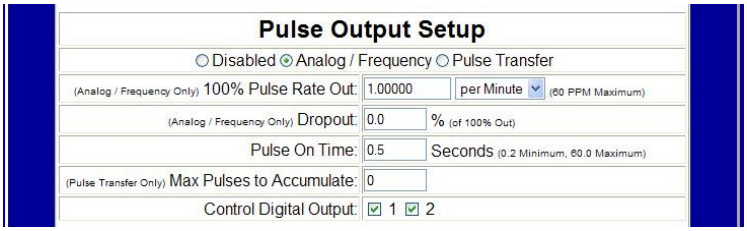
3. The top right section indicates the default values to be used on start up and after a communications failure.

   Checking the Hold Last Value check box will keep the last value transferred and has the effect of disabling the communications failure test for the selected input.

   Entering a value in the text box will force the input value used for the calculation to the specified value. The value entered is the percentage of the full scale input before the weighting factor is applied. For example if you were working with a 0 to 10 gallon per minute input signal and you wished for the analog input value to go to 5 gallons per minute on communications failure you would enter 50 representing 50 percent of the 0 to 10 gallon per minute input signal.

4. To select an analog output for the sum of the input signals, check one or more of the check boxes to the right of Control Analog Output. When checked the sum of the analog input values will be transferred to the selected analog output.

5. Scroll down to the Pulse Output Setup section to set up the pulse output section. The row of radio buttons are used to select the operating mode of the pulse output section. Pulse outputs may be disabled, creating by integrating an analog input signal, or by transferring a pulse count.



Adder / Pulse Output Settings, Pulse Output Section

6. When Analog / Frequency is Selected you must enter the 100% Pulse Rate Out. Enter the pulse rate output you expect when all inputs are at 100 percent in the text box to the right of 100 % Pulse Rate Out. This rate may be expressed in either pulse per minute or per hour depending on the setting of the drop down list box.

   The maximum setting is 60 pulses per minute and if exceeded will be forced to 60.

   If transferring pulses skip the following two steps.

   Example:

   Two analog inputs signals representing a 0 to 100 gallon per minute flow rate are to be added to produce a combined flow rate representing 0 to 200 gallons per minute and one pulse is to be generated for every 100 gallons. The 100% Pulse Rate Out settings would be 2 pulses per minute.

   Setting = Number of Gallons per Minute / Gallons per Pulse.

   2 = 200 Gallons per Minute / 100 Gallons per Pulse

7. Enter a dropout value for generating pulses. Dropout sets the minimum input signal in percentage that will be used for calculation. If any value is below the dropout value the input value will be forced to 0.

   Setting a dropout value prevents gradual accumulation of pulse output data and prevents a false pulse out due to this accumulation.

8. Set the Pulse On Time to the desired pulse width. The output will be closed for the specified duration plus or minus 0.25 seconds. Minimum setting is 0.2 seconds and the maximum is 60 seconds. Recommended setting is 0.5 seconds or greater depending on the ability of the connected device to detect the contact closure.

9. If setting up for Pulse Transfer you must enter a value for Max Pulses to Accumulate. If setting up for Analog / Frequency then skip this step.

   In transferring pulses the DC counting the pulses and the DC reproducing the pulses must remain in sync to insure the correct number of pulses is generated. The program in the DC calculates the number of pulses to output by comparing the contact closure counter in a remote DC with an internal count. The difference between the two counts determines how many pulse to output.

   To insure these counts remain in sync the DC producing the pulses will synchronize the counters without producing any pulses on the first successful communications after power up or a configuration change.

   There are conditions however where the two counts may get out of sync. The first is if a DC is replaced in the field without updating its Counter Value or if set to the incorrect Counter Value. The second is if the communications link is interrupted for a extended length of time. Either condition could cause the DC to output a continuous stream of pulses.

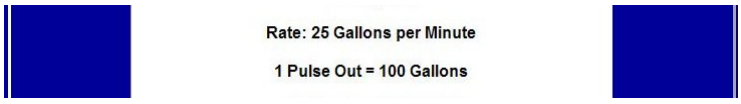
   As a failsafe the Max Number of Pulses to Accumulate should be set to limit the maximum number of pulses allowed to accumulate. This number should be set to a value large enough to accommodate any pulses accumulated during a brief interruption of communications.

10. Select the digital outputs to use by checking the boxes to the right of Control Digital Output. All selected outputs will be controlled together.

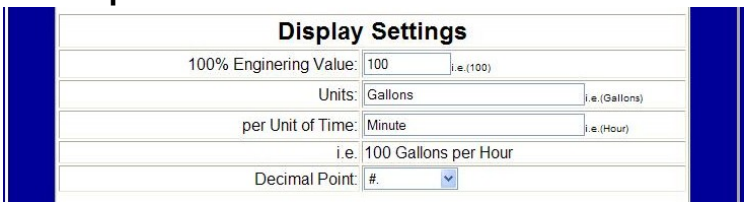
11. Under the Pulse Output Setup section is the Display Settings section. Settings in this section are optional and are used only to provide a status display on the default web page. Enter the value you wish to be displayed when output is at 100% in the text box to the right of 100% Engineering Value.

12. Enter any text you wish to display in the text boxes to the right of the Units and per Unit Of Time.

13. Set the decimal point for the displayed value in the drop down list box to the right of Decimal Point.



Sample Display for Pulse Output

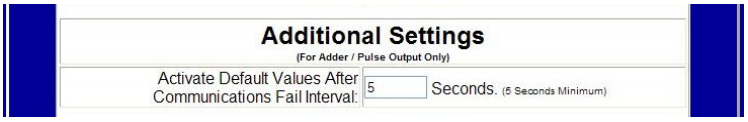


Adder / Pulse Output Settings, Display Setting Section

14. At the bottom of the page is the Additional Settings section. Enter the time in seconds that communications must be lost before the Default Settings defined in the Adder Setup section will be activated. The minimum time interval is 5 seconds which should be adequate for most systems. Systems transferring a large number of signals, or if long communications delays are inherent in the system the interval may need to be increased.

    NOTE 1: The Communications Fail interval set here is independent of the Communications Fail interval set in the Advanced IO Settings page. The communications failure set here only effects input signals to the adder.

    NOTE 2: As inputs for the adder may originate from up to 4 remote locations it is possible to have a communications failure from one location but not another. In this case the adder will continue to operate with the available signals substituting the Default Value for the value transferred.



Adder / Pulse Output Settings, Additional Settings Section

15. Click on the Save button to save your changes return to the Administration Menu. You have completed all settings required in the Adder / Pulse Output Settings Page however there are additional settings that need to be made before your DC is ready for use.

16. Click on the Save button to return to the Administration Menu. If all of the following conditions are true you are done configuring the DC and the DC is ready for use.

    - The DC is not required to count pulses for transfer.
    - The DC is a slave.
    - You have gone through the previous DC to DC(s) section.

Settings required for Master DC

To allow the Master DC to add analog input and counter values special registers are used which are used in place of or in addition to the normal registers used in a DC to DC transfer. Continue to the next steps to set up the Routing tables for use with these registers.

DC Register	Modbus Register	Description
CNT(1)	40017	Digital Input 1 Counter.
CNT(2)	40019	Digital Input 2 Counter.
CNT(3)	40021	Digital Input 3 Counter. (5018-1 Only)
CNT(4)	40023	Digital Input 4 Counter. (5018-1 Only)
ADD(1)	42121	Analog Input Signal 1 for adder.
ADD(2)	42123	Analog Input Signal 2 for adder.
ADD(3)	42125	Analog Input Signal 3 for adder.
ADD(4)	42127	Analog Input Signal 4 for adder.
PUL(1)	42113	Pulse Count 1 for pulse transfer.
PUL(2)	42115	Pulse Count 2 for pulse transfer.
PUL(3)	42117	Pulse Count 2 for pulse transfer.
PUL(4)	42119	Pulse Count 2 for pulse transfer.
TOT(1)	42057	Total of the analog input signals ADD(1) through ADD(4).
TOT(2)	42059	Total of the pulse input signals PUL(1) through PUL(4)

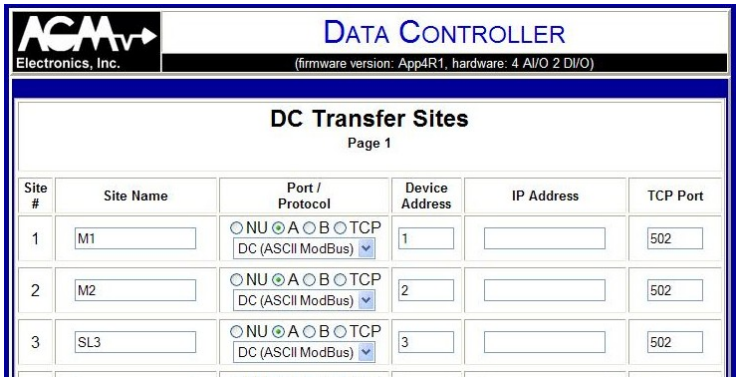
DC I/O Registers Specific to Application 4

The following steps set up a typical DC using Application 4 firmware. In this example 4 sites are used. M1, M2 and SL3 are all remote slave sites. The Local site in the routing table is the master site.

NOTE: The DC used for a master has the reserved name of “Local” for use within the routing tables. In the sample application used for this section, there are actually 4 DCs in use but only 3 are defined in the table. The master or Local DC does not require an entry in the DC Transfer Sites table.

17. Before setting up the routing table you must set up the DC Transfer Sites by clicking on the Edit Sites link from the Administration page. From this page you will: name each site; select the communication port used; select either the DC (ASCII ModBus) or DC (RTU ModBus) protocol; and select the device address.

    In the case of this example all sites are using radio communications so Port A is selected with the DC (ASCII ModBus) protocol. Each site is named and assigned the Device address of 1, 2 and 3 respectively.



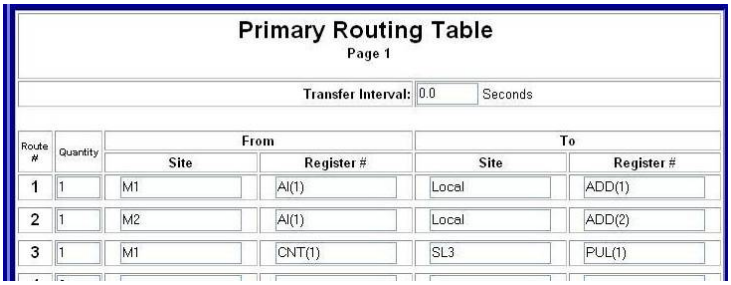
Example Site Settings for Application 4

18. Once the DC Transfer Sites table is completed click on the Save button then click on the continue link after the Save confirmation page is displayed.

19. From the Administration menu click on the Edit Primary Routing Table link. This is the routing table that will be used when a jumper is installed between terminals 2 and 4 on the DC. Alternately you may click on the Edit Alternate Routing Table. The Alternate Routing Table will be used when the jumper is not installed between terminals 2 and 4.

20. Fill in the routing table according to your applications then click on the Save button when done.

    As each application may be different the following section shows a sample Application 4 routing table and describes each entry on the routing table. You may use it as an example to fit your own specific application.



Example Routing Table for Application 4

Route #1 & 2 The first two entries show the analog input signals being transferred into the addition registers 1 and 2. The analog input signals when transferred will be added then optionally outputted to the selected analog or pulse output.

Route #3 This entry shows how to transfer a pulse count. In the case of this example the count of pulses from the remote site M1 is being transferred to the remote site SL3.

21. Once the routing table is complete click on the Save button. Once you get the Saved confirmation screen click on Continue to return to the Administration then click on the Log Off link.

    If the Primary Routing Table was used you will need to install a jumper between terminals 2 and 4.

    You will also need to log off the Administration pages or reset the DC before transferring of data will begin.

Settings required for Pulse Transfer, Slave DC

If transferring pulses you must set up a DC to count on a transition of a digital input signal. This setting must be done to the DC providing the pulse count. The following steps will lead you through setting up the DC to count pulses.

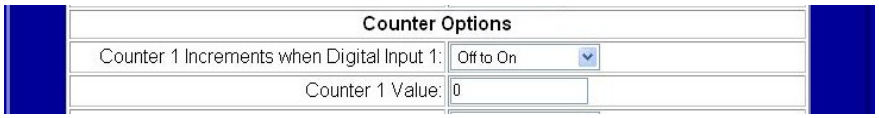
NOTE: Remote DC which used for counting pulses or providing Analog Input signals do not require Application 4 firmware. The counting of pulses and providing the analog input signal is a standard feature of the DCs. In order to produce pulses or add analog input signals Application 4 firmware is required.

22. Go to the Administration menu and select Advanced IO Settings. If not using Application 4 Revision 1 firmware select IO Settings from the Administration menu.

23. Scroll down the page until you reach the Counter Options.

24. To the right of Counter # Increments when Digital Input #: select the required option form the drop down list. You can increment the counter on a low to high transition; high to low transition; or a change of state.

25. Counter Value indicates the current count. Under normal conditions you should not change the Counter Value as changing the count could cause the local DC outputting the pulses to generate output pulses. If however you are replacing a DC, you should set the Counter Value to the new DC to the Counter Value of the old DC.



Counter Options

26. Click on the Save button. Once the Saved confirmation page is displayed your settings have been saved and the remote DC is ready to transfer pulses. Consult other sections of this manual for settings any additional settings that may be required for your application.

Software Configuration

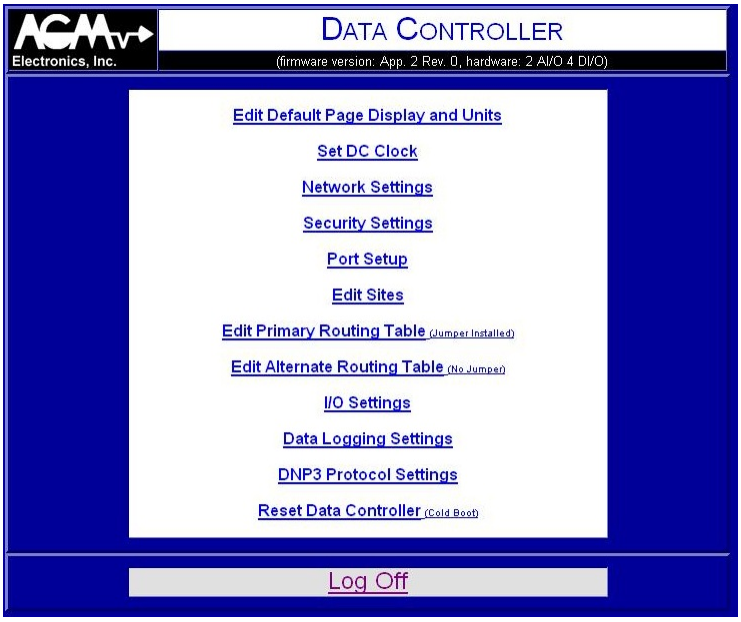
NOTE: The DC has several different firmware versions available. Not all firmware versions will contain the pages described in this section.

To configure or modify the DC settings you must first go to the Administration page from there select the menu option for the settings you wish to configure. The actual menu options may vary according to the available options in the DC's firmware.

Menu options are the hypertext links, underlined in blue. To select one of the menu options, click on the hyperlink to go to the selected configuration page.

Below are two examples of the Administration pages. The first example is for Application 1 and 2 the newest versions of the DC firmware. Options in this menu have been grouped into four areas. The first is general operating settings. These are the settings that will mostly likely require modification. The second group is for communications settings used to communicate with other devices. The third group is Installation settings. Installation settings will generally only be changed when setting up the DC. The third group is for diagnostics. Diagnostics include resetting the DC and displaying a text log of the last activity between the DC and SMTP E-Mail server.

Administration Page, Application 1 and 2

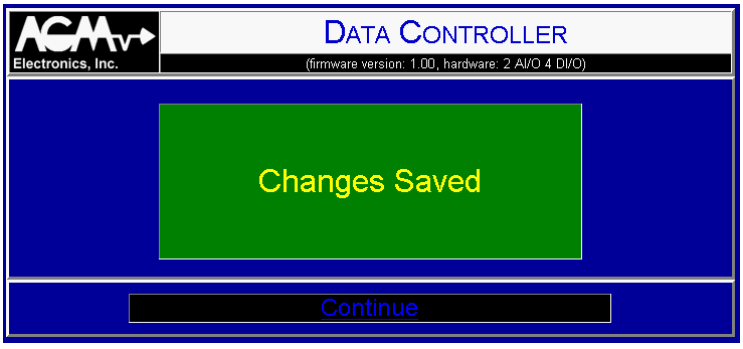


Administration Page, Typical for Other Firmware Applications

After selecting the menu options, make your changes then click on the Save button to save. Clicking on the Administration link at the bottom of each page will return you to the Administration page without modifying any settings.

For most settings you will be returned to the Administration page after the settings are saved. A Saved confirmation page will be displayed after each click of the Save button to show the changes have been successfully saved to non-volatile memory.

If some other action or confirmation needs to be done then the saved page will be replaced with a page indicating the action that needs to be completed.



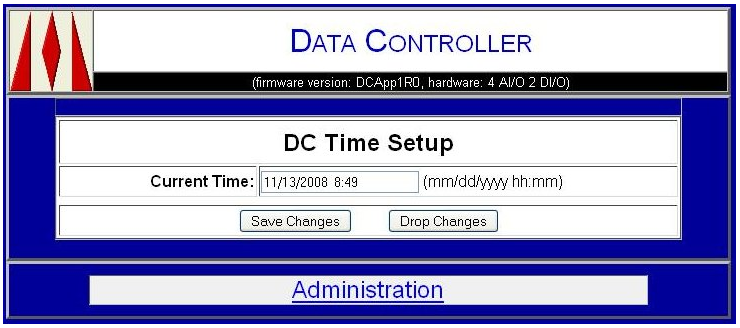
Saved Confirmation Page

DC Clock

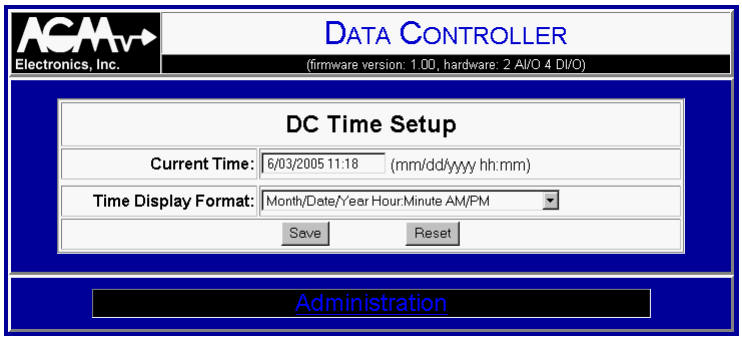
Clicking on the DC Clock link on the Administration page will bring up the DC Time Setup page. From this page you can set the time and date in the DC real time clock. For some firmware versions you can also define how the date and time will be displayed.

Regardless of the setting of the setting of the Time Display Format the Current Time must be entered as mm/dd/yyyy hh:mm or Month/Date/4 digit year Hour:Minute.

On firmware versions Application 0 and Application 1 the Time Display Format has been moved to the Display Settings page. For other firmware applications a drop down list will show all formats for displaying the date and time. The format selected here will affect the display of the date and time in all areas of the DC.



DC Time Setup Page, Application 0 and 1

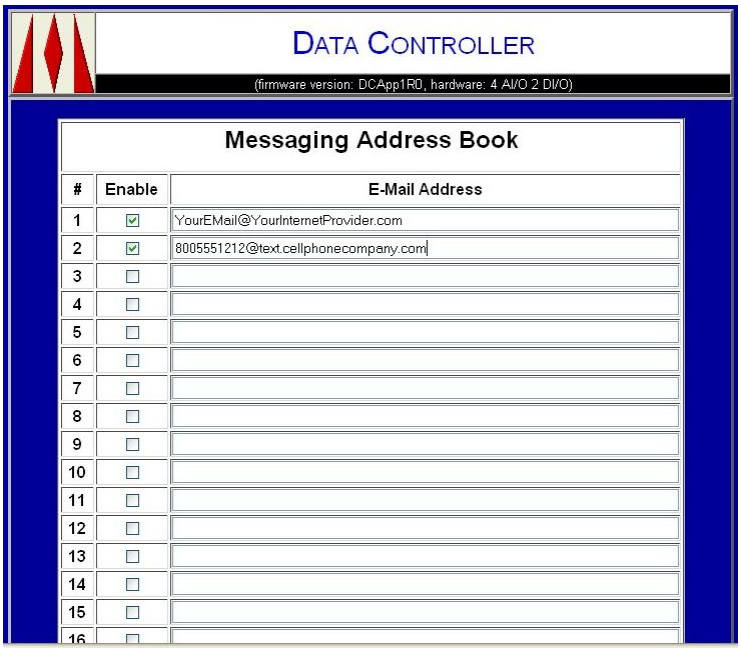


DC Time Setup Page, Other Applications

Address Book

Application 0 and 1 Only

Clicking on Address Book link will display the Messaging Address Book used for sending E-Mail and text messages by the DC.



Messaging Address Book

To use the address book enter the E-Mail addresses in the E-Mail Address column and check the box in the Enable column. You may enter up to 20 E-Mail addresses.

When the DC sends a message it will send message to all enabled recipients on the list. To temporarily disable sending a message to a recipient, uncheck the box in the Enable column.

For convenience in managing systems with multiple Data Controllers, Address Book information is saved in a standard comma delimited text file, “Address Book .CSV” which can be transferred between Data Controllers and edited with 3rd party software such as Microsoft Windows Notepad or Microsoft Excel.

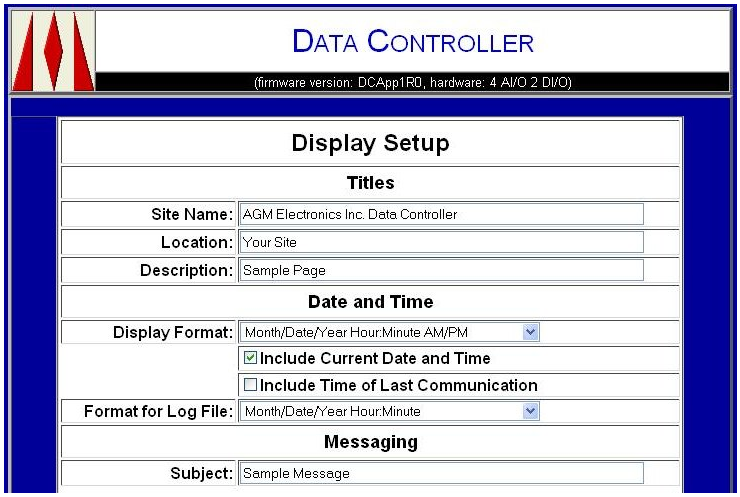
```
1,"YourEMail@YourInternetProvider.com"
1,"8005551212@text.cellphonecompany.com"
0,""
0,""
```

Sample “Address Book.CSV” file

Display Setup

Application 0 and 1 Only

Clicking on the Display Setup Administration Page will bring up the Display Setup page. This page is used to define the settings required for displaying values on the default web page, status message, and recorded data file.



Display Settings, Top section

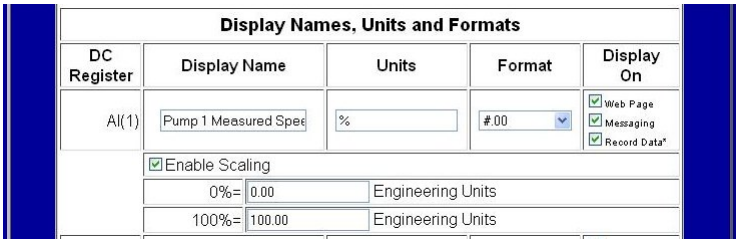
The first three text boxes on this page are used to set the Site Name, Location, and Description on the default web page. The Site name is also used for the title for all internal web pages. Leave the text box blank if not used. Each entry may be up to 64 characters long.

The drop down list to the right of Display Format sets how the current date and time will be displayed on web pages.

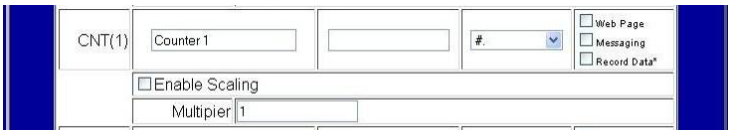
Include Current Data and Time and Include Time of Last Communications check boxes when checked enable the display of the current time and the display of the time of the last update via a communications port. Including the times on the default web page can be useful in diagnosing communications problems.

The drop down list to the right of Format for Recorded Data File sets how the date and time will be recorded in the .CSV file.

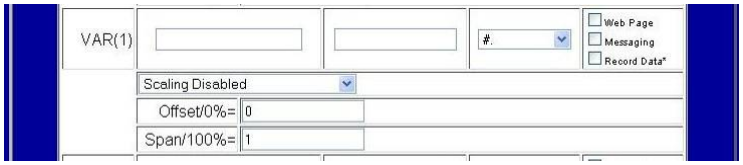
The Subject text box sets the subject for E-Mail messages. If blank the Subject will be “DC Status”.



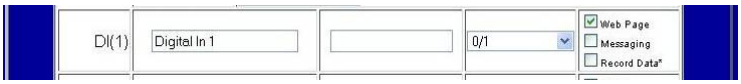
Display Settings, Analog I/O Register Settings



Display Settings, Counter Settings



Display Settings, Internal Variable Settings



Display Settings, Digital I/O Settings

Under the Display Names, Units, and Formats heading are settings used to determine how registers will be displayed on the default web page, in messages or in recorded data.

The text box in the Display Name column is used to name the register. This name will appear before the value on the default web page and in messages. For recorded data the name will be used for the header information if enabled.

The text box in the Units column is used to define the text that will appear after the value on web pages and in messages. Units are not used in the recorded data file.

The drop down list box in the Format column sets the format for the displayed value. For analog registers the list box selects the displayed decimal point for the value on web pages, messages and recorded data .CSV file. For digital registers the list box selects options to the standard 0 for false and 1 for true display. Alternate display options for digital registers are: On/Off; Open/Closed; and True/False.

The three check boxes under the Display On column set where the register will be displayed.

Analog Registers have additional settings that can be used for scaling the analog register into engineering units.

For the Analog I/O registers scaling is enabled by a check box and the engineering values for 0 and 100 percent are entered in the text boxes. The values entered will be the engineering units for when the analog I/O is at 0 and 100 percent. The DC is calibrated so 0 percent is equal to 1 V in or 4 mA out and 100 percent is equal to 5 V in or 20 mA out.

For the Counter registers scaling is enabled by a check box and Multiplier value is entered in the text box.

Internal variables contain data transferred from other Data Controllers or devices. When you enable scaling for these variables you must select the type data in the register and the type of scaling to be performed. Select one of the following from the drop down list box:

Scaling Disabled
: Scaling is disabled. The value as transferred will be displayed.

Scale Integer Using 0%/100%
: Enables scaling for integer values where 0% is 0 and 100% is 10000. Use this option when transferring Analog I/O registers from other Data Controllers.

Scale Integer Using Span/Offset
: Scales a transferred integer value using the formula:
  Display Value = (Register Value * Span) + Offset

Scale Float Using 0%/100%
: Enables scaling for floating point values where 0% is 0.0 and 100% is 100.0.

Scale Float Using Span/Offset
: Scales a transferred floating point value using the formula:
  Display Value = (Register Value * Span) + Offset

Click on the “Save Changes” button to save the changes. Clicking on the “Drop Changes” button will reset all text boxes, check boxes, and drop down lists to their initial values.

NOTE: When you have changed any of the Record Data check boxes you a confirmation page indicating the recorded data file needs to be cleared. To protect the integrity of the data file you should click on the “Yes” button. If you click on the “No” button the data at the beginning of the recorded data file will not match the selected new selections.

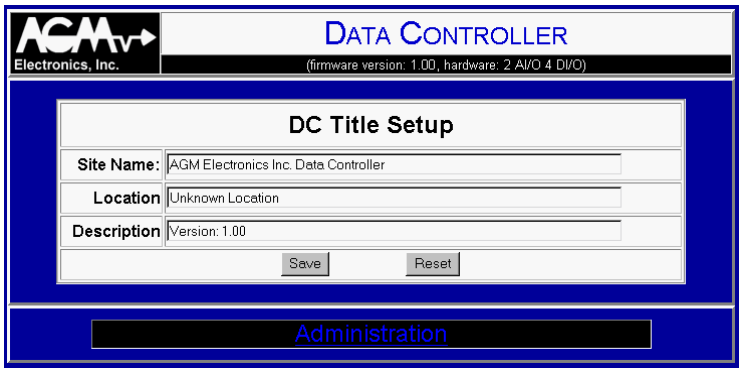
Edit Titles

Some firmware have a Title Setup page in place of the Display Setup page.

Clicking on the Edit Titles link on the Administration Page will bring up the DC Title Setup page. From this page you can define the Site, Location and Description that will appear on the Default Home page. On some firmware versions additional settings may be available. See below for a description of the alternate page for setting up titles.

NOTE: The Site name is also used for the title for all internal web pages.

Each entry in the DC Title Setup page may be up to 64 characters long.



DC Title Setup Page

Edit Default Page Display and Units

Application 2 and 3 Only

These applications have the Edit Titles link replaced with a Edit Default Page Display and Units link. Clicking on this link will bring up an enhanced version of the page used to set up the titles and the units required for totalization.

From this page you can define the following:

1. Titles used on the default page.
2. I/O to display.
3. Units of the displayed data. The text entered will be use on the default page as well as for headers of any recorded data.

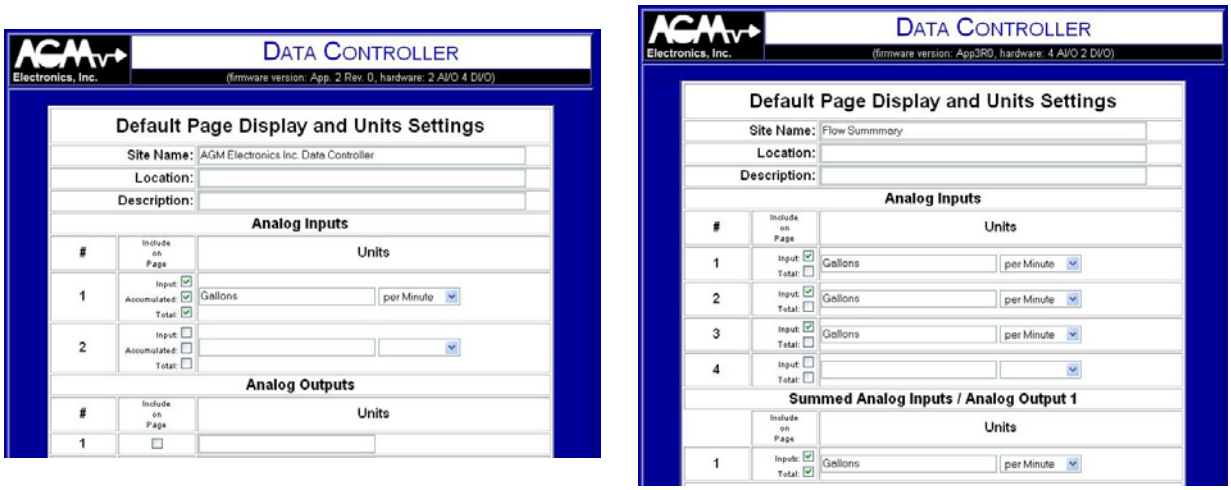
   On DC's with the ability to totalize, the drop down list after the text box sets the rate used to calculate the total.

   Example:

   Assuming the Totalize interval has been set for 1 hour and the input has been set to "Gallons per Second" by entering "Gallons" in the text box and select "per second" in the drop down list.

   When the DC calculates the total the DC will correctly calculate the total based on the "per Second" selection and the totalize interval. In this example if the DC analog input was reading a rate of 1 Gallon per Second then it will calculate the total after 1 hour as 3600 Gallons.

   If the drop down list was set to "per Minute" then the rate would be "Gallons per Minute" and the total would be only 60 Gallons after the 1 hour totalize interval.



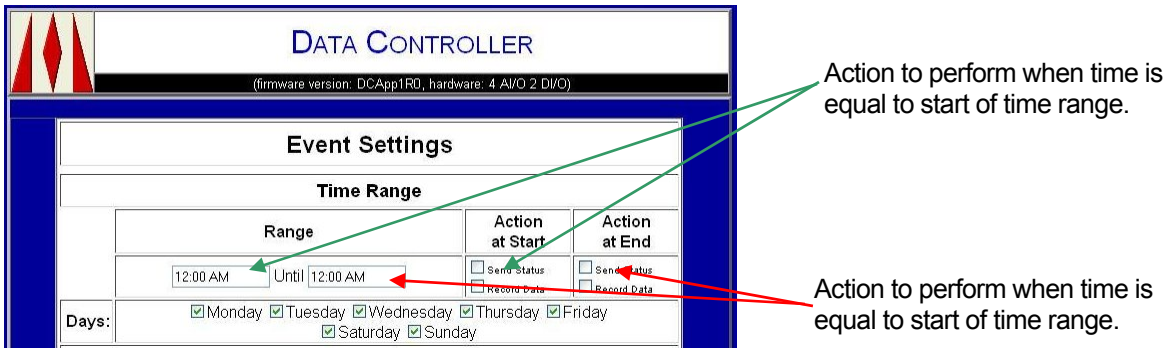
DC Default Page Display and Units Settings

Events

Application 0 and 1 Only

Clicking on the Events from the Administration Page will bring up the Events page. This page is used to define Events that will cause a message to be sent or data values to be recorded.

The Event Settings page is broken into 4 parts. Each part is described below.



Event Settings Page, Part 1 – Time Range Settings

The first part is the Time Range settings.

The main function of the Time Range settings is to define a time range which can be used to enable or disable other events. This will allow two different operating modes for sending messages or recording data based on the time of day and the day of the week.

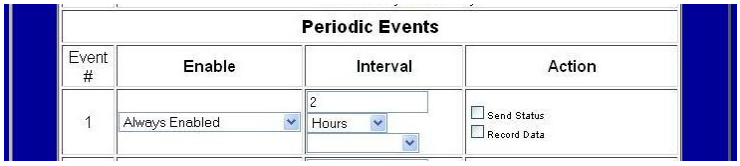
For example you can set the DC to only send messages after working hours by setting the time range from 8:00 AM to 5:00 PM, and checking only Monday through Friday. Then by enabling other events outside the time range you can only send messages after hours.

The Time Range can also produce a daily message or data recording when the time period starts or ends. If you do not need the time range feature, you can still use the time setting to produce a daily status report message or data record.

To set up the time range enter the time in the two text boxes in the Range column. The first text box contains the start time and the second text box contains the stop time. Time may be entered in either 24 or 12 hour format. If the stop time is before the start time then the stop time is assumed to be the next day.

The check boxes to the right of “Days” select the days of the week which will be within the time range. For example checking Monday through Friday check boxes will define the time range for a standard work week. Monday through Friday will be within the time range. All day Saturday and Sunday will be outside the time range.

The check boxes under the “Action at Start” select the actions that will occur at the defined start time. The check boxes under the “Action at End” select the actions that will occur at the defined stop time. A status message, data recording, or both may be generated at the selected start and stop times.



Event Settings Page, Part 2 – Periodic Events

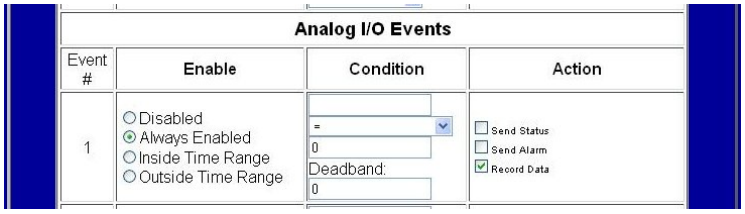
The second part is for setting periodic events. Up to four periodic events may be defined. A periodic event may send a status message, record data, or both.

To define a periodic event you must enable the periodic event from the drop down list box under the Enable column. Periodic events may be: always disabled; always enabled; enabled only within the defined time range; enabled only outside the defined time range; or based on the results from the Analog or Digital events.

Normally, you will set periodic events to be always enabled however if you had a condition where you needed to switch recording rates when something happened you would use one of the other options. For example, if you required the level of a tank to be recorded at some interval but only when a pump was running. You would first set up Digital Event #1 to monitor the digital output controlling the pump. Then you would set up the Periodic Event to be enabled only when "Digital Condition 1 True". This would cause the DC to only record data when the digital output was on.

Under the Interval column is one text box and two drop down lists. Enter the desired interval in the text box. Interval values can be in either seconds, minutes or hours depending on the units selected in the first drop down list box. The second drop down list box allows you to sync the periodic event to the beginning of the minute, hour or day. For example, if you needed to produce a data recording or message at hourly intervals on the hour, you would enter 1 in the text box; select "Hours" in the first text box; and "Sync to Day" in the second list box.

The check boxes under the Action select the actions that will occur at the defined periodic interval. A status message, data recording, or both may be generated at the selected interval.



Event Settings Page, Part 3 – Analog Events

The third part is for setting events based on the value of an Analog I/O or internal register. Up to ten analog events may be defined.

To define an analog event you must enable the event by checking one of the radios buttons under the Enable column. Analog events may be: always disabled; always enabled; enabled only within the defined time range; or enabled only outside the defined time range.

Under the Condition column are three text boxes and one drop down list box. The first text box is for the analog register, the second list box is for the test value, and the third text box is for specifying a dead band.

In the first text box enter the Register number which will be used for testing. Below is a listing of the available DC registers.

Register	Description	Register	Description
AI(1)	Analog Input 1.	AI(2)	Analog Input 2.
AI(3)	Analog Input 3. (5018-3 Only)	AI(4)	Analog Input 4. (5018-3 Only)
AO(1)	Analog Output 1.	AO(2)	Analog Output 2.
AO(3)	Analog Output 3. (5018-3 Only)	AO(4)	Analog Output 4. (5018-3 Only)
CNT(1)	Counter 1.	CNT(2)	Counter 2.
CNT(3)	Counter 3. (5018-1 Only)	CNT(4)	Counter 4. (5018-1 Only)
VAR(1)	Internal Variable 1.	VAR(2)	Internal Variable 2.
VAR(3)	Internal Variable 3.	VAR(4)	Internal Variable 4.
VAR(5)	Internal Variable 5.	VAR(6)	Internal Variable 6.
VAR(7)	Internal Variable 7.	VAR(8)	Internal Variable 8.

Analog Registers

Enter the value to test the register against in the second text box and if required a dead band value in the third text box.

The drop down list box contains all possible comparisons that can be made on the register. The following comparison tests are available:

= Equals
The register value is between the test value plus the dead band value and the text value minus the dead band value.

<> Not Equals
The register value is not between the test value plus the dead band value and the text value minus the dead band value.

> Greater Than
If the register value is above the test value the test condition will be true. The test condition will not turn false until the register value falls below the test value minus the dead band.

>= Greater Than or Equal
If the register value is above or equal to the test value the test condition will be true. The test condition will not turn false until the register value falls below the test value minus the dead band.

< Less Than
If the register value is below the test value the test condition will be true. The test condition will not turn false until the register value rises above the test value plus the dead band.

<= Less Than or Equal
If the register value is below or equal to the test value the test condition will be true. The test condition will not turn false until the register value rises above the test value plus the dead band.

Change By
If the register value has changed by the amount specified in test value the test condition will be true. The old value used for the test is reset when the test condition becomes true.

This is a one shot test which should not be used for enabling periodic events.

Increase By
If the register value has increased by the amount specified in test value the test condition will be true. The old value used for the test is reset when the test condition becomes true.

This is a one shot test which should not be used for enabling periodic events.

Decrease By
If the register value has decreased by the amount specified in test value the test condition will be true. The old value used for the test is reset when the test condition becomes true.

This is a one shot test which should not be used for enabling periodic events.

Maximum Reached
When the register value reaches its maximum amplitude and has started to decrease this test condition will be true. The maximum amplitude is detected when the amplitude drops by the value specified in the dead band. In order for this test to work correctly the dead band must be set to a value greater than 0.

This is a one shot test which should not be used for enabling periodic events.

Minimum Reached

When the register value reaches its minimum amplitude and has started to increase this test condition will be true. The minimum amplitude is detected when the amplitude rises by the value specified in the dead band. In order for this test to work correctly the dead band must be set to a value greater than 0.

This is a one shot test which should not be used for enabling periodic events.

Peak Reached

When the register value reaches its minimum or maximum amplitude and has started to increase or decrease this test condition will be true. The peaks are detected when the amplitude rises or falls by the value specified in the dead band. In order for this test to work correctly the dead band must be set to a value greater than 0.

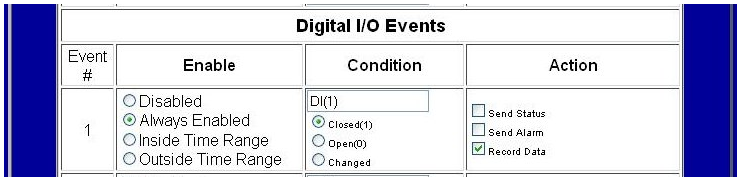
This is a one shot test which should not be used for enabling periodic events.

The check boxes under the Action select the actions that will occur when the event is true. Analog Events may generate any one of the following: status message; alarm message; or data recording.

Two types of event messaging are available with Analog Events.

Status messages contain the information selected in the Display Setup page. The register that created the alarm is not part of the message unless that register has the Messaging check box checked on the Display Setup page.

Alarm messages do not use the Display Setup page. An alarm message only contains the register that triggered the event. The Display Name, Units and Format settings will be used from the Display Setup page to format the message however you do not need to check the Messaging check box to send an alarm message.



Event Settings Page, Part 4 – Digital Events

The forth part is for setting events based on the value of a Digital I/O or internal register. Up to ten digital events may be defined.

To define an analog event you must enable the event by checking one of the radios buttons under the Enable column. Digital events may be: always disabled; always enabled; enabled only within the defined time range; or enabled only outside the defined time range.

Under the Condition column is one text box and three radio buttons. The text box is for the digital register and the radio buttons select the condition for the test.

Enter the Register number which will be used for testing in the text box. Below is a listing of the available DC registers.

Register	Description	Register	Description
DI(1)	Digital Input 1.	DI(2)	Digital Input 2.
DI(3)	Digital Input 3. (5018-1 Only)	DI(4)	Digital Input 4. (5018-1 Only)
DO(1)	Digital Output 1.	DO(2)	Digital Output 2.
DO(3)	Digital Output 3. (5018-1 Only)	DO(4)	Digital Output 4. (5018-1 Only)
BIT(1)	Internal Bit Variable 1.	BIT(2)	Internal Bit Variable2.
BIT(3)	Internal Bit Variable 3.	BIT(4)	Internal Bit Variable 4.
BIT(5)	Internal Bit Variable 5.	BIT(6)	Internal Bit Variable 6.
BIT(7)	Internal Bit Variable 7.	BIT(8)	Internal Bit Variable 8.

Digital Registers

Select one of the test conditions to enable the event. The following tests are available:

Closed(1)

The I/O register value is set to a 1. This represents a closed condition for the contact closure inputs or outputs.

Open(0)

The I/O register value is set to a 0. This represents a open condition for the contact closure inputs or outputs.

Changed

The value of the I/O register has changed from a 1 to a 0 or from a 0 to a 1.

This is a one shot test which should not be used for enabling periodic events.

The check boxes under the Action select the actions that will occur when the event is true. Digital Events may generate any one of the following: status message; alarm message; or data recording.

Two types of event messaging are available with Digital Events.

Status messages contain the information selected in the Display Setup page. The register that created the alarm is not part of the message unless that register has the Messaging check box checked on the Display Setup page.

Alarm messages do not use the Display Setup page. An alarm message only contains the register that triggered the event. The Display Name, Units and Format settings will be used from the Display Setup page to format the message however you do not need to check the Messaging check box to send an alarm message.

NOTE: You can enter any register for the Analog or Digital Event tests however not all tests will be meaningful. If you enter a Digital register in an Analog Event the only values you can test for are 1 and 0. If you enter a Analog register for a Digital Event the value will be converted to a binary value where 1 represents any non-zero value.

Network Settings

Clicking on the Network Settings link on the Administration page will bring up the DC Network Setup page. From this page you can set the IP address and subnet mask for the DC. You may also set the port numbers used for the HTTP server and FTP server functions of the DC.

The IP Address and Netmask must be set to values acceptable to your network. Consult with your network administrator for values for these two settings. For most local networks that are not connected to the Internet the first 3 digits of the IP Address will match the IP address set on other computers on the network. The 4th set of digits will be a unique number that is not duplicated on the network. The Netmask will typically be 255.255.255.0 for most small networks. This setting should match the other computers on the network.

Gateway and Domain Name Servers are required for messaging or for connecting to remote devices over the network. Consult with your network administrator for values for these two settings. Typically if you already have a computer connected to the Internet or local Intranet these values will be the same.

If used on the Internet you have two options:

1. If connected directly to the Internet you must use the IP address and Netmask assigned by your Internet Provider. Enter these values where provided.

2. If connected through a firewall, gateway, or other device that translates IP addresses. Set the IP address to be compatible with the local network. Set up your firewall or gateway to pass HTML request to the DC. The DC allows you to set the port addresses of to accommodate firewalls. Setting up the DC for this type of installation is beyond the scope of this manual. Consult your firewall or gateway documentation for instructions on setup up HTTP and other servers to be accessible from the Internet.

   In both cases you will need an IP address, assigned by your Internet provider. The difference between the two options above is that with the second option the Internet IP address will be shared by all devices on the local network.

The MAC (Media Access Control) Address is for informational purposes only. Depending on the configuration of your network, your network administrator may need this address.

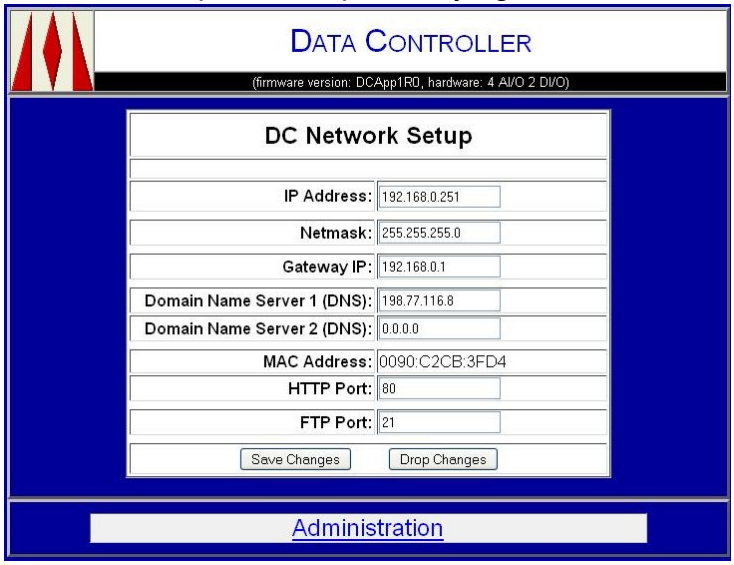
The HTTP Port and FTP Port are the TCP port numbers used by the HTTP and FTP server functions. When shipped the HTTP Port is set for 80 and FTP Port is set for 21. These port numbers are the standard port numbers recognized by most software. If used with a firewall you may need to change these port settings.

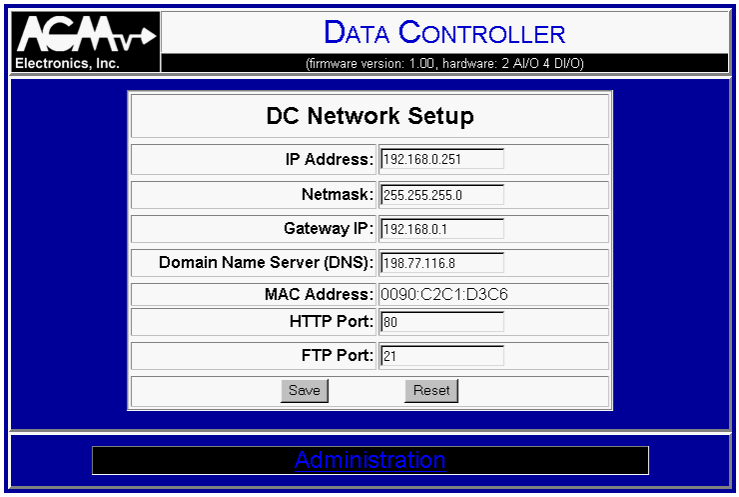
IMPORTANT: Unlike the other administration pages, Network Settings will not be immediately saved when you click on the Save button.

After changing the IP, NetMask or Ports you will have 5 minutes to return to the Administration page before the changes are saved. After 5 minutes the Network Settings will revert to their pervious settings. This is a failsafe delay designed to prevent setting an unreachable network configuration.

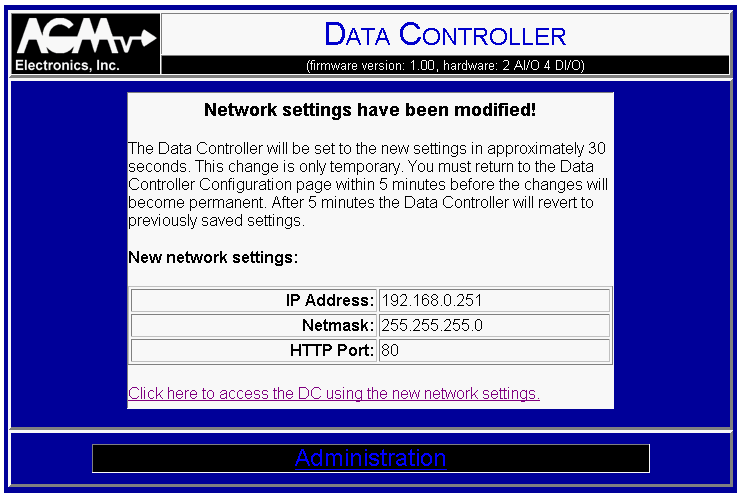
If you will be unable to return to the Data Controller Configuration page within 5 minutes, turn off the power to the DC until you can access the Data Controller Configuration page. The 5 minute timer will reset when you apply power.

Should you make a mistake in setting up the Network Configuration, wait 5 minutes with the DC powered up then try again.





Network Settings Page



Network Changed Page

NOTE: The link on the Network Change Confirmation Page will not work in some cases. If accessing the DC through a Firewall, Bridge, or other device that translates IP addresses the new address you entered will probably not be the address you need to contact the DC. You will not be able to contact the DC until the Firewall or other device is set up with the new address and you will need to use the IP address of the firewall and not the DC.

Security Settings

Clicking on the Security Settings link on the Administration page will bring up the DC Security Setup page. From this page you change the administrator's password and set up to 3 additional users. The Admin user is fixed and is always available.

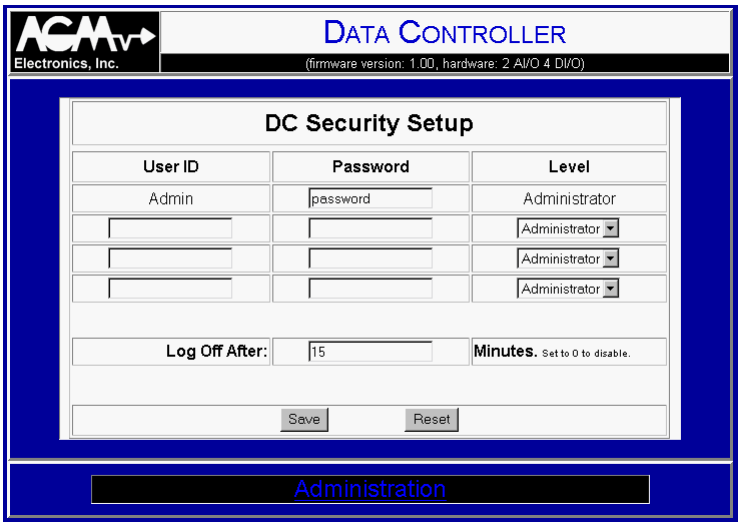
The Admin user will always have full access to the DC. Other users you define can be given either complete Administration level control or just Operator level control. Users with Administrator level access will have complete control over the DC. Operator level control is for planned expansion and is not fully implemented in firmware version 1.00.

If additional security is required, the DC must be operated behind a Firewall or Gateway that provides the additional security.

Unless the DC is installed on a secure network, we recommend you change the Admin password.

The User ID's and Passwords may be up to 30 characters long. User ID's are not case sensitive. Passwords are case sensitive, watch your Caps Lock key when entering passwords.

The Log Off After box sets the time in minutes before you will be automatically logged off the administration setup pages and the transferring of data will resume.



Security Settings Page

Port Setup

Clicking on the Port Setup link on the Administration page will bring up the DC Ports Setup page.

When used as a master or slave the baud rate and other settings will be set from this page.

When using the DC as a slave the slave protocol and device address will be set for each of the possible port.

There are 2 serial ports available in the DC. Each serial port is designated by one of the following letters:

A RS232 serial port. Top Male 9 pin connector.
B RS232/RS485 serial port. Bottom Female 9 Pin connector.

The Ethernet connection uses TCP/IP protocol, which uses 2 parts for addressing. The IP address which identifies the device and the TCP port number which indicates to the server how to process the connection. For example a TCP port of 80 is the default TCP port for a web server. When a server receives an Ethernet TCP/IP connection addressed to TCP port 80 the server knows a web page is being requested. The DC can use up to 3 of these TCP for communicating to other devices. This will allow up to 3 master devices to access the DC without waiting for the other master to disconnect.

Each available TCP port is designated by one of the following letters:

C First TCP port
D Second TCP port.
E Third TCP port.

NOTE: Ethernet/IP also uses UDP for some types of connections. The same port number is used for UDP as TCP.

Baud Rate is a drop down list on Ports A and B which includes all communications data rates supported by the DC. Supported data rates are: 300, 1200, 9600, 19200.

Communications Fail Interval is only used when the DC is operating as a master. The value entered here sets the maximum time interval between when a command is transmitted and a response is expected. For most applications set this value to 0 to select the default time delay based on the selected protocol.

Half-Duplex RTS On Time and Half-Duplex Off Time enable and set the communications port for use with Bell 202 modems and radio modems that require RTS. Half-Duplex RTS On Time sets the time in millisecond between when RTS is turned on and the first character is transmitted. Half-Duplex RTS Off Time sets the time in milliseconds between when the last character is transmitted and RTS is turned off.

Normally Half-Duplex RTS On Time and Half-Duplex RTS Off Time will be set to -1 to disable. If Half-Duplex is required then set the On Time must be set to a value that allows your modem to stabilize and become ready to transmit the first character. Half-Duplex Off Time should be set to a value that allows the last character to be completely transmitted. All devices using Half-Duplex should have the same On and Off times. The On Time must be equal to or greater than the Off time. If these parameters are not met it is possible for communications to fail due to the response from the remote device being lost due to a collision between the two modems.

Slave Protocol is a drop down list indicating all possible protocols for the specified port. Not all protocols may be available on all ports. Available protocols are:

Serial:
- Not Used
- ASCII ModBus
- RTU ModBus
- SPM9000
- DNP3
- DF1 Half-Duplex Slave, CRC error checking.
- DF1 Half-Duplex Slave, BCC error checking.

Ethernet:
- Not Used
- ModBus
- SPM9000
- Ethernet/IP

Slave Address indicates the Modbus or other protocol's Device Address for this Data Controller. This address is only used for the serial ports protocols. Ethernet protocols use the IP address.

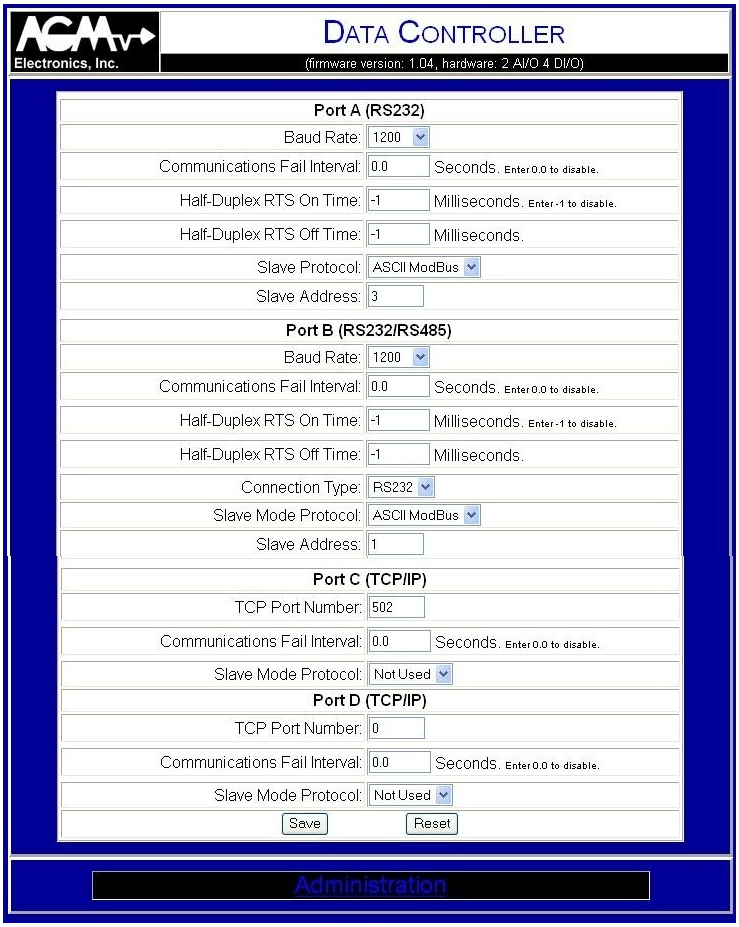
Connection Type is only available on Port B. This drop down list box selects which driver will be used.

Auto	Automatically selects the RS232 or RS485 driver depending on the presence of the DTR signal from a connected RS232 device. This setting will work for most connections.
RS232	Forces the DC to use the RS232 driver. Use this setting if your RS232 connection does not supply the required DTR signal. DTR is not available if using only 3 wires for RS232. DTR may also not be available when connected to some types of hardware.
RS485	Forces the DC to use the RS485 driver.

The TCP Port Number is only available for the Ethernet ports C, D and E. This is the TCP port that will be used by the Ethernet connection. The registered port for TCP/IP Modbus is 502 and the registered port for Ethernet/IP is 44818. However, any valid TCP port may be used to allow communications through a gateway or firewall.

For Ethernet/IP protocol, the same port numbers are used for UDP as for TCP.

Unlike the serial communications on ports A and B, up to 3 simultaneous connections may be made to the Ethernet ports provided all 3 TCP/IP ports are enabled and using the same protocol. Care must be taken when using multiple connections that only one connected device is controlling the outputs. For example, if you have two connected devices each trying to control Digital Output 1 the last message received will set the status of the Digital Output. This could cause the outputs to be unstable. Any number of devices may read the DC's Inputs or Outputs but only one device should control the Outputs.

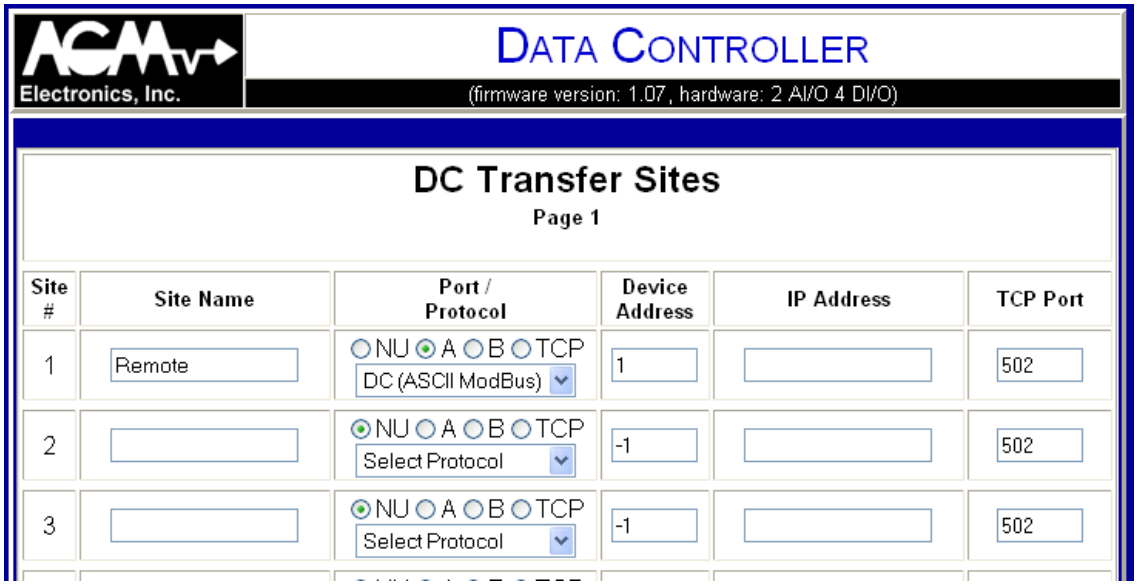


DC Communications Port Setup

Edit Sites

Edit Sites page is one of the key pages used to control how a Master DC transfers data to and from other Slave DC or other devices. With this page you will define each of the remote sites for use in the routing tables. If the DC will not be used only as a slave device you do not need to set up this table.

You may enter up to 256 sites. Each page has up to 20 sites for additional sites use the navigation buttons at the bottom of the page. See Appendix A for instruction on navigating between pages.



DC Sites Setup

The Site Name column is where you give each site a meaningful name. This may be as simple as “Remote” for a 2 DC connection. It may also be a number such as “Site 1”. You may also use names such as “Hilltop Tank”, “Main Street Well”, or “Pump House” depending on you specific requirements.

The Port / Protocol column define which of the ports will be used. Ports A and B are the serial ports. TCP is the TCP/IP Ethernet port. The “NU” button indicates that site is not currently used.

While the Serial Ports A and B may be used for only one connection, either as a slave or master, the TCP port is independent of the 3 slave TCP/IP ports C, D and E.

The drop down list box in the Port / Protocol column is used to select the communications protocol used. Currently 4 protocols are available.

DC (ASCII Modbus)	Indicates the site is connected to another DC using ASCII Modbus. The routing table will use the DC register names in place of Modbus register numbers.
DC (RTU Modbus)	Indicates the site is connected to another DC set up to use RTU Modbus. The routing table will use the DC register names in place of the Modbus register numbers.
ASCII Modbus	Indicates the site is connected to another device set up to use ASCII Modbus. Typically this will not be a DC.
RTU Modbus	Indicates the site is connected to another device set up to use RTU Modbus. Typically this will not be a DC.

When used with the TCP/IP port. ModBus over TCP/IP will be used. Select either “DC (ASCII Modbus)” or “DC (RTU) Modbus)” if connecting to another DC. Select either “ASCII Modbus” or “RTU Modbus” if connected to Modbus device other than a DC.

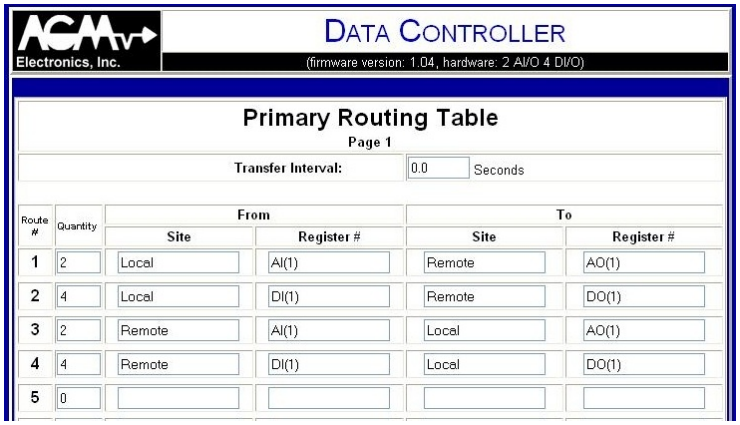
Device Address in the device address of the remote device. Used for serial protocols only. If using Ethernet TCP/IP then the device address is not used.

IP Address and TPC Port are used only for an Ethernet TCP/IP connection. Enter the IP address and TCP port of the remote Ethernet device.

Routing Tables

Clicking on the Edit Primary Routing Table or Edit Alternate Routing Table link on the Administration page will display one of the pages used for defining how data will be transferred between connected devices. The Primary Routing Table is used when a jumper is installed between pins 2 and 4 on the screw terminal. The Alternate Routing Table is used when pins 2 and 4 are open.

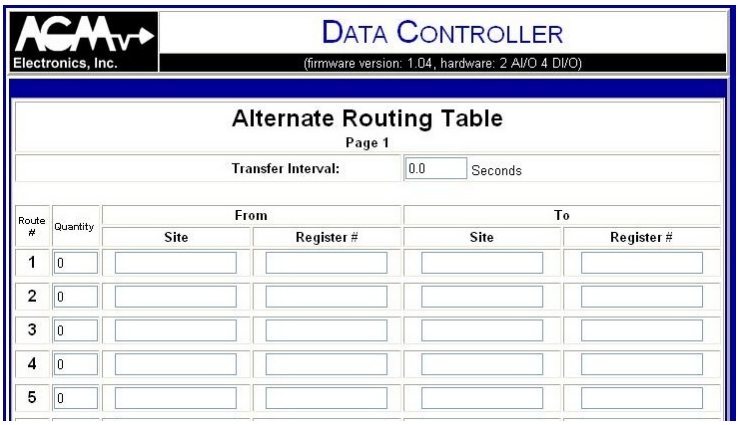
Adding the jumper is intended to allow all DC's to be configured the same but still allow for one of the DCs to be defined as the master for the system when it is installed in the field.



Primary Routing Table

The Alternate Routing Table is provided to allow for more advanced routing options and flexibility in setting up your DC. A typical use of the Alternate Routing Table would be when you are using multiple DCs to transfer data. For example if you needed to transfer 4 analog I/O and 8 digital I/O from one site to another over radio. You could connect 2 DCs at each site using Port B of the DC and connect the two sites using Port A. You would then set up the Primary Routing table to transfer the data between the two sites and the Alternate Routing Table to transfer the data between the two DCs located at each site. By having two Routing Tables rather than one you could configure all DCs with the same Routing tables and still allow you to select the master used to transfer data between via the jumper on the DC.

The Alternate Routing Table may be used for other applications as well. A second possibility would be to switch between a primary communications and a back up communications system. For example, you could use an Ethernet connection through a network as your primary communications media and dial up or radio modems as a backup in case the primary connection fails. You would then select which communication media you were using by connecting a switch between terminals 2 and 4.



Alternate Routing Table

Transfer Interval text box defines how often the Master DC will transfer data. When set to the default of 0.0 data transfer will be continuous. For most applications this is the setting you will use. If for some reason you need to slow communications down, such a duty cycle limitations or a radio modem or other device you may slow down the data transfer by entering the number of seconds between transfer cycles here. The time entered here will only effect the time the transfer cycle starts and not the time between records transferred.

The first column on this page is the routing number. This is for reference only. Data will be transferred in the order the entered in the routing table.

The Quantity column indicates how many registers will be transferred. When transferring data with mixed register sizes such as between a DC and PLC, the smaller register will be used.

The remaining 4 columns are divided into a To and From columns. The first set of Site and Register # columns define the source of the data, where the data will be obtained. The second set of Site and Register # columns define where the data will be sent.

The Site columns will contain either the word “Local” for the DC you are configuring or one of the names entered in the Site page.

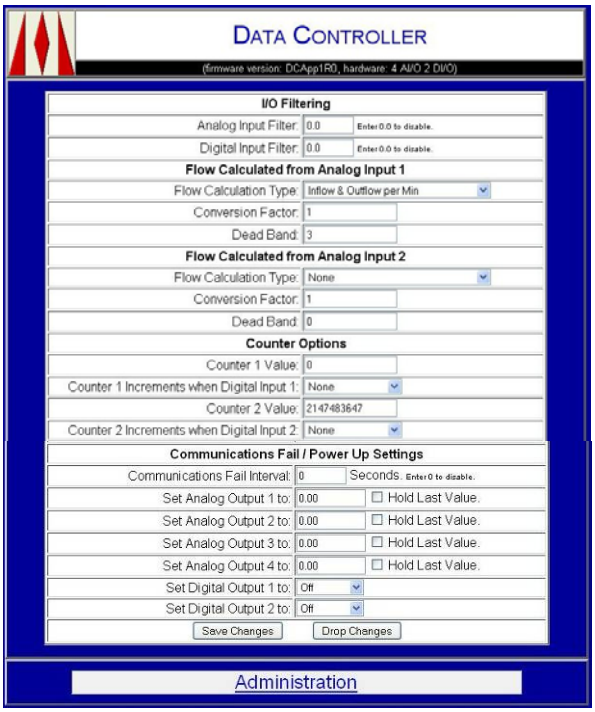
The Register # columns will contain the register number. This register number will depend on the protocol selected for the site.

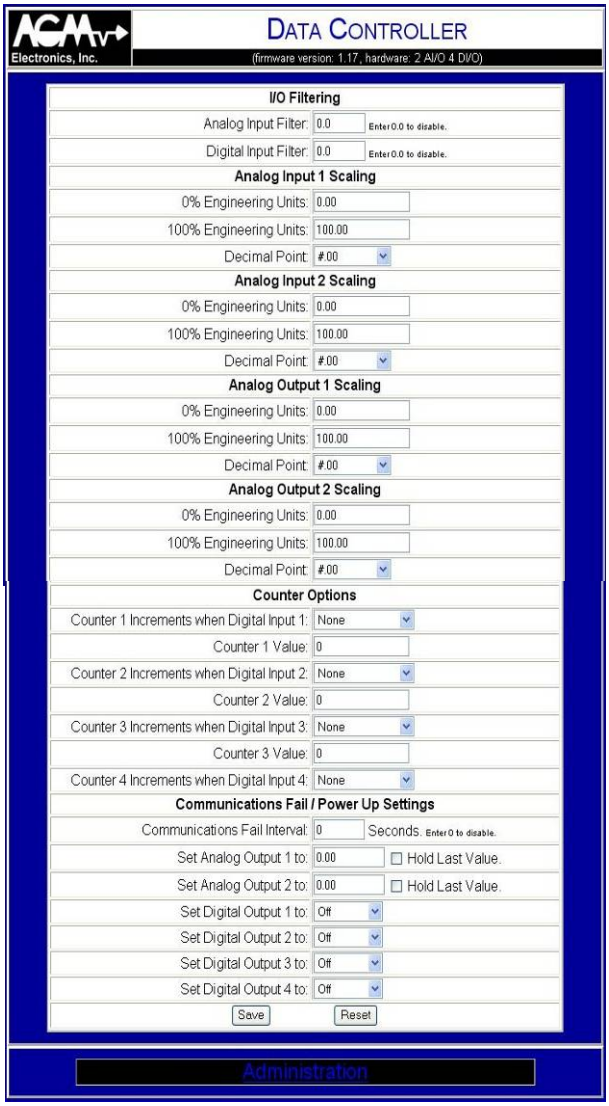
The DC can be configured to make up to 1000 transfers. The Routing Table is broken into 50 pages of 20 transfers each. See Appendix A for instructions on navigating between the pages.

I/O Settings

I/O Settings page is used to set some of the I/O features of the Data Controller.

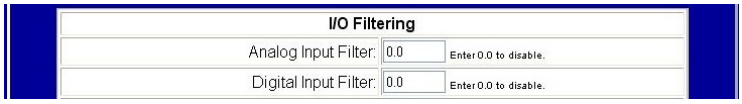
Some versions of the firmware also include flow estimation from a change in the analog input levels or totalizing the analog input values. Settings to control these features are also found here.





I/O Settings

I/O Filtering



I/O Filter Settings

Analog Input Filter

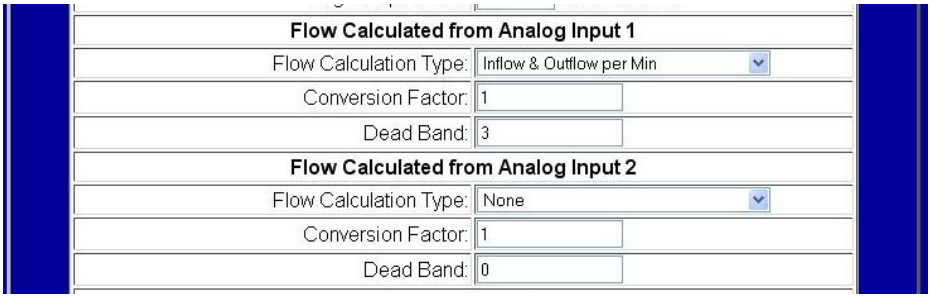
Enables and sets the filter delay for filtering the analog inputs. When set the analog input will be averaged over the specified time period.

Digital Input Filter

Enables and sets the filter delay for filtering the digital inputs. When set a digital input must remain in its current state for the specified interval before a change will be recognized.

Flow Calculations, Application 1

Application 1 includes the ability to calculate flow based on a change in the Analog Input. When available the following settings set up the flow calculation: Flow Calculation Type; Conversion Factor; Dead Band.



Flow Calculation Settings

Flow Calculation Type

Selects how the DC will estimate and calculate flow. The available options are:

1. Inflow per Min. Calculates the inflow from an increasing or rising input level. Calculation is performed from the minimum measured input to the maximum measured input and is displayed as engineering units per minute. The DC must detect a minimum and maximum level before this flow will be available. A minimum or maximum level is detected when a change in direction by the specified Dead Band is measured.

2. Outflow per Min. Same as the above Inflow calculation except the calculation is made between the maximum and minimum measured input level.

3. Inflow & Outflow per Min. Combination of the two above flow calculations.

4. Inflow per Sec; Outflow per Sec; Inflow & Outflow per Sec. Same as the above calculations except the calculated flow is displayed in engineering units per second.

5. Pump Up Cap per Min; Pump Down Cap per Min; Outflow & Pump Up Cap per Min; Inflow & Pump Down Cap per Min. Pump Up and Down capacities are variations of the Flow calculations. To calculate the pump capacity both the inflow and outflow are calculated. Pump Up capacity is the rising or Inflow plus the calculated outflow. Pump Down capacity is the falling or Outflow plus the calculated inflow.

6. Pump Up Cap per Sec; Pump Down Cap per Sec; Outflow & Pump Up Cap per Sec; Inflow & Pump Down Cap per Sec. Same as the Pump Capacity calculations described above except the units are per second rather than per minute.

Conversion Factor

The conversion factor is a multiplier that will allow you to convert from the engineering units for the analog input level into flow engineering units. The conversion factor is the amount of level change in engineering units that equals a corresponding change in volume.

Conversion factor = (Maximum Level – Minimum Level) / (Maximum Volume – Minimum Volume)

Example:

Using the default scaling of 0 to 100 percent where 4 mA in equals 0 percent and 20 mA in equals 100 percent. If a level of 0 percent equaled 10 gallons and a level of 100 percent equaled 20 gallons the conversion factor would be:

0.1 Gallons / Percent = (20 – 10 Gallons)/ (100 - 0 Percent)

With a level change of 0 to 50 percent per minute then the results would be:

5 gallons / minute = 50 percent * 0.1 gallons per percent.

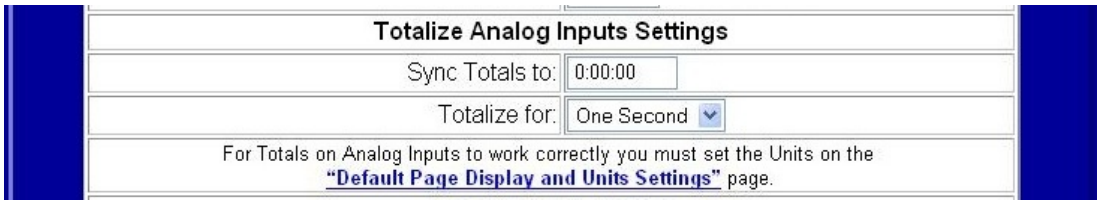
Dead Band

In order to calculate flow from the input signal the minimum and maximum values must be detected by the DC. A change in level by the specified Dead Band is used to determine when a maximum or minimum level has been reached. A minimum level is detected when the level has risen above the minimum measured level plus the Dead Band. A maximum level is detected when the level has fallen below the maximum measured level by the Dead Band.

Total Calculations, Application 2

Application 2 includes the ability to calculate a total based on an analog input that represents a flow rate. For example an analog input representing a flow rate of Gallons per Second can be used to calculate the number of Gallons per hour.

Firmware that supports this feature will have the following additions to the I/O setting page.



Totalize Settings

Sync Totals to:

Used to synchronize the total calculation to the time of day as stored in the internal real time clock.

When Totalize for is set to:

1. One Second. Sync Totals is ignored.
2. One Minute. Sets the second within the minute when the calculation will be performed. Enter "0:00:ss" where ss represents the second to perform the calculation.
3. One Hour. Sets the minute and second within the hour when the calculation will be performed. Enter "0:mm:ss" where mm represents the minute and ss represents the second to perform the calculation. Example: 0:30:00 would cause the total to be calculated 30 minutes after the top of the hour.
4. One Day. Sets the time of day when the total calculation will be performed.

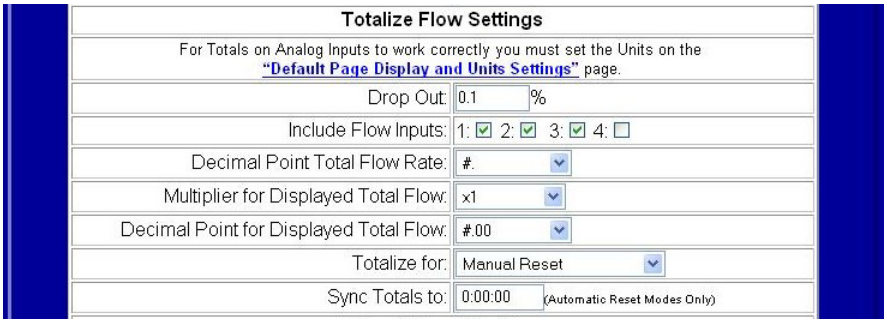
Totalize for:

Set how long the DC will accumulate the analog input before calculating the total. After the total is calculated the accumulation will be reset. The DC can totalize for: one second; one minute; one hour; or one day.

Total Calculations, Application 3

Application 3 includes the ability to sum the analog inputs then calculate a total based on either the sum or each individual analog input representing the flow rate.

Firmware that supports this feature will have the following additions to the I/O setting page.



Totalize Settings

Drop Out:
Sets the dropout used for the analog output, generating pulses and calculating totals. The dropout is based on the percentage of full scale of the analog output.

Include Flow Inputs:
Selects which analog inputs will be added together to produce the analog output signal and total flow rate calculation.

Decimal Point Total Flow Rate:
Decimal Point Displayed Total Flow:
Sets the decimal point used for the total rate or total flow rate display. Total flow rate is the sum of all selected analog inputs. Total flow is the calculated flow.

Multiplier for Displayed Total Flow:
Sets a multiplier used to display the calculated flow. For example a multiplier may be used to convert a calculated total in Gallons to Millions of Gallons.

Totalize for:
Set how the DC will calculate the total flow.

With Manual Reset the total flow will accumulate until it is manually reset or the total reaches 999999999. The automatic reset options will the analog input for the specified interval before calculating the total.

Sync Totals to:

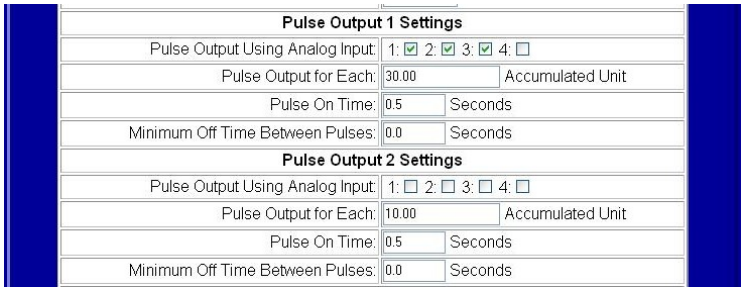
When Totalize for is set for one of the automatic reset options you may synchronize the automatic reset to the time of day as stored in the internal real time clock.

When Totalize for is set to:

5. One Second. Sync Totals is ignored.
6. One Minute. Sets the second within the minute when the calculation will be performed. Enter “0:00:ss” where ss represents the second to perform the calculation.
7. One Hour. Sets the minute and second within the hour when the calculation will be performed. Enter “0:mm:ss” where mm represents the minute and ss represents the second to perform the calculation. Example: 0:30:00 would cause the total to be calculated 30 minutes after the top of the hour.
8. One Day. Sets the time of day when the total calculation will be performed.

Pulse Output, Application 3

Application 3 includes the ability to output a pulse on accumulated flow from either a single input or the sum of multiple inputs.



Pulse Output Settings

Pulse Output Using Analog Input:
Selects the analog input or inputs which will be used to generate the pulse output.

Pulse Output for Each:
Sets the accumulated flow value used to generate a pulse output.

Pulse On Time:
Sets the time the digital output contact will remain closed. Accuracy of the pulse width output is value entered plus 0.25 seconds.

Minimum Off Time Between Pulses:
Sets the time the DC will delay before generating another output pulse. This setting may be left to 0.0. A setting of 0.0 will have a typical off delay of 0.25 seconds.

Analog Input or Output Scaling

The Data Controller has built in scaling and calibration and reports analog I/O as an integer value from 0 to 10000 which represent 0 to 100.00 %. For the protocols used for transferring data to and from another device such as a PLC, the scaling is fixed and can not be changed.

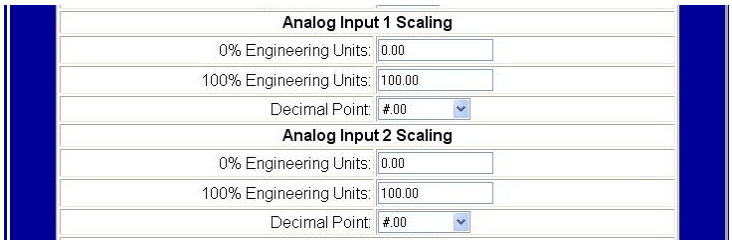
When used with the data logging or the web page features of the DC the Analog Inputs and Outputs may be converted from their 0 to 100% scaling into your choice of engineering units. Analog Input Scaling for Analog Input 1 or 2 consists of 3 entries: 0% Engineering Units; 100% Engineering Units; and Decimal Point.

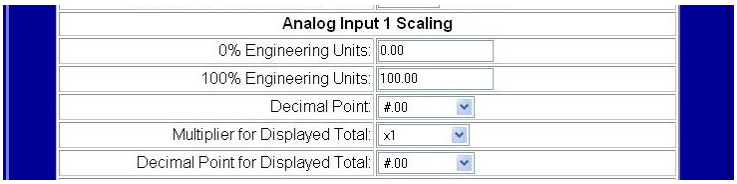
The Analog Inputs of the DC are calibrated for 4 to 20 mA across a 250 ohm resistor where 0% represents 4mA and 100% represents 20mA. Analog Outputs are calibrated for 4 to 20mA out where 0% represents 4mA and 100% represents 20mA. To scale either of the Analog Inputs or Analog Outputs place the corresponding engineering units in the text boxes.

The decimal point is set via the drop down list. You may adjust the decimal point from 0 to 8 digits to the right of the decimal point.

Data Controllers with firmware that allows the analog inputs to be totalizes will have two additional drop down lists. The Multiplier for Displayed Totals and Decimal Point for Displayed Total. Under normal conditions calculating the total will result in the final total to be in the same units as the analog input but with a different time interval. For example a Gallon per Second input over one day would result in a Gallons per Day total. This total could be a huge number. To reduce the magnitude of this number you can use the Multiplier and Decimal point to convert the large numeric total into a more manageable number such as converting from Gallons per Day to Million Gallons per Day.

NOTE: (Application 4) Do not use adjust the 0% and 100% Engineering units on the Analog Outputs when the Analog Output will be controlled by the Adder function. Leave 0% set to 0 and 100% set to 100.



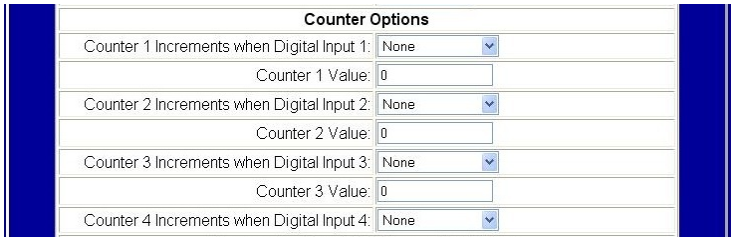


I/O Scaling Settings

Counters

The DC has internal counters that may be incremented when one of the Digital Inputs changes state. These internal counters are available in ModBus, DNP3 or for web pages. Counter Options indicate how the internal counters will be incremented. Counters may be incremented: off to on transition; on to off transition; or change of state.

Counters may be preset to any value by entering the new value in the text box.



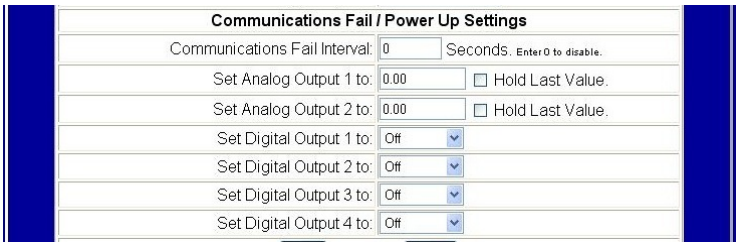
Counter Settings

Communications Fail / Power Up Settings

NOTE: (Application 4) When an Analog Output or Digital Output is controlled by the Adder or Pulse Output functions. The Communications Fail / Power Up Settings described below will not be used for the controlled Outputs. See Adder / Pulse Output section for more information.

When power is not applied to the DC or after initial power up all Digital Outputs will be open and all Analog Outputs will be set to 0 mA.

After the firmware in the DC has been initialized the Digital and Analog Outputs will be set to the state specified by the Communications Fail / Power Up Settings. If the Communications Fail Interval has been enabled, the Digital and Analog Outputs will also be set to the specified settings when the Analog or Digital Output has not been updated within the Communications Fail Interval.



Communications Fail / Power Up Settings

Communications Fail Interval

To enable the detection of a communications failure, enter the time in seconds in which the Digital or Analog Output must be updated. This interval must be longer than the maximum round robin time to update all DC's when operating normally. Setting the Communications Fail Interval to 0 will disable the communications fail detection but still allow the Outputs to be set to a known state on power up.

NOTE: Each Analog and Digital Output maintains it's own communications failure counter. When used with multiple sites, this allows the working sites to maintain control of the output and still set the failed site to a known state.

Set Analog Output # to:

Sets the value of the Analog Output in Engineering Units after power up or when communications has failed. To retain the current value after a communications fail or to restore the last value on power up, check the Hold Last Value check box.

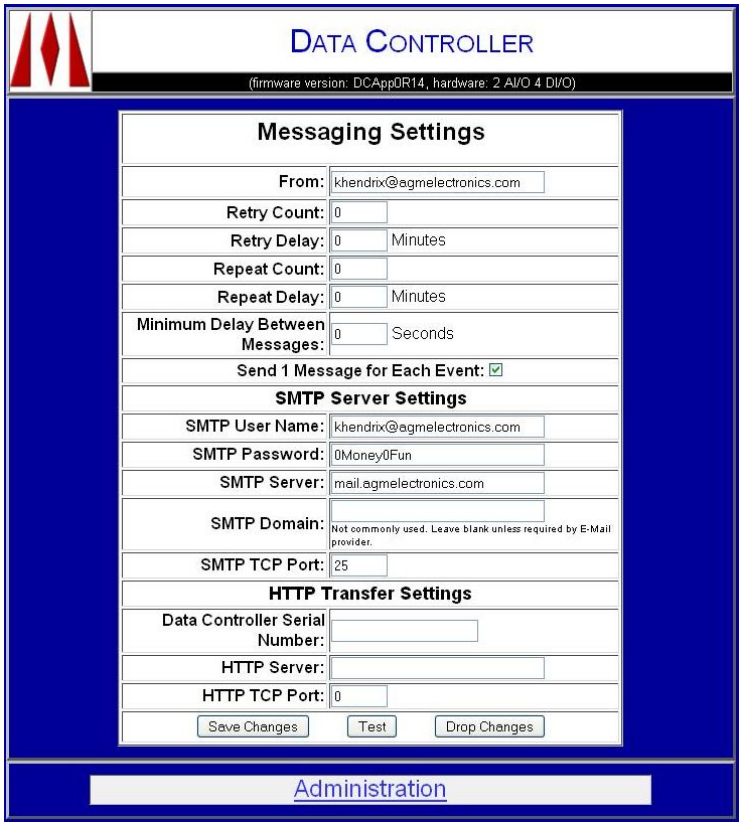
Set Digital Output # to:

Sets the state of the Digital Output after power up or when communications has failed. Possible Options are: Off; On; or Hold Last to retain the current value after a communications fail or power up.

Messaging Settings

Some DC firmware versions have the ability to send E-Mail or text messages periodically or as a result of some event. To use this feature you must have access to a SMTP server. A SMTP server is the sending or outgoing half of a POP, POP3 or IMAP E-Mail service. The SMTP server may be either a Internet server or local Intranet server set up as part of a local mail system. You will need to consult with your E-Mail provider or Systems Administrator for some of the settings required by the DC.

The Messaging Settings Page only provides settings used to communicate with the E-Mail server. See the Address Book page for setting the recipients. See Events Setup page for setting the conditions that create a message. See the Display Settings page for selecting values to display as part of the default messages.



Messaging Settings

From

Enter a valid E-Mail address where you would like error messages from the recipients mail service to be sent.

When a E-Mail message is sent only some error messages are reported immediately by the SMTP server. Other error messages such as an unknown address are reported back to the “From” address. For this reason you should use a real E-Mail address that you monitor regularly rather than a address no one checks.

Retry Count
Retry Delay

Sometimes the Data Controller may fail to connect to the E-Mail server. When this occurs the Data Controller can be set to retry sending the message. If you wish to enable this feature set the Retry Count to a value other than 0 and Retry Delay to the number of minutes the Data Controller should wait before retrying.

Repeat Count
Repeat Delay

The Data Controller can be set up to repeat a message regardless if the message received the SMTP server. If you wish to enable this feature set the Repeat Count to a value other than 0 and Repeat Delay to the number of minutes between message repeats.

NOTE: There is some latency between the time you send a E-Mail message and the time you actually receive the message. This latency time may vary from just a minute to many minutes depending on the time it takes for the outgoing SMTP server to forward the message to the recipients E-Mail server. If is possible that a message may take several hours if either server is off line.

Minimum Delay Between Messages

When the Data Controller is set up to send a message on multiple events it is possible that a series of related events can cause a large number of messages to be sent within a very short period of time. Setting the Minimum Delay Between Messages will cause the DC to send the first alarm message when it occurs but delay before sending any additional alarm messages. This will limit the number of messages sent to just 2 even when multiple alarm events occur within a short period of time.

Send 1 Message for Each Event

When this option is unchecked the DC will send all alarm events as a single message. When checked the DC will always send each alarm message separately even if they occurred at the same time.

SMTP User Name

If your SMTP server requires authentication, enter the user name for the E-Mail account here. Some E-Mail providers use your E-Mail address others may use just the user name for authentication. Check with your E-Mail provider for the user name to use. If authentication is not required leave SMTP User Name and SMTP Password blank.

SMTP Password

If your SMTP server requires authentication, enter the password for the E-Mail account here. If authentication is not required leave blank.

SMTP Server

Enter the address of the SMTP mail server here. SMTP mail servers are sometimes referred to as outgoing mail server when used as part of POP, POP3 or IMAP E-Mail service. Your E-Mail service provider can provide you with the name to used as a SMTP or outgoing server. Only mail servers using SMTP for sending mail are supported by the DC.

SMTP Domain

Leave blank for most E-Mail servers.

The SMTP Domain is for E-Mail providers that require the Domain Name of the sender for authentication. These E-Mail servers will compare the IP address of the sender with the Domain Name registered with a DNS server to determine if access is allowed. This type of authentication is rare and if required your E-Mail provider will give you the Domain name to use.

SMTP TCP Port

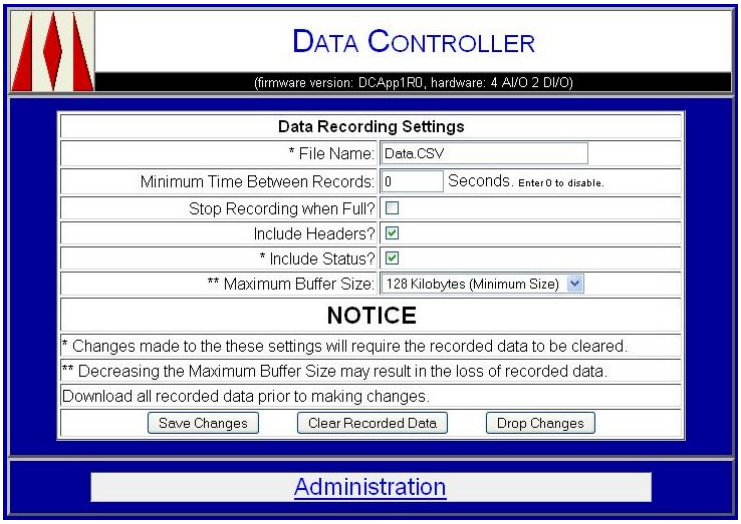
The standard TCP Port number used for sending SMTP mail is 25. Some E-Mail providers may use a different TCP port number. Your E-Mail provider will provide you with the TCP port number to use if a non-standard port number is used.

Data Controller Serial Number
HTTP Server
HTTP TCP Port

These three settings are used for pushing data into AGM Electronics web site. Contact AGM Electronics for availability of this service and the values to enter. Leave HTTP Server blank and HTTP TCP Port set to 0.

Data Recording Settings, Application 0 and Application 1

Data Recording Settings page along with the Display Settings and Events pages are used set up data recording. When data recording is set up the DC will record data based on Events defined in the Event Settings page. The recorded data may be uploaded from the DC via a FTP connection on by specifying the name of the .CSV file on the address bar of your web browser. E.g. http://192.168.0.251/data.csv



Data Recording Settings

File Name

Name of the recorded data file. File name is limited to 30 characters. The file will be uploaded as a comma delimited .CSV file. If not specified the .CSV extension will be added.

Minimum Time Between Records

When recording events it is possible for a series of events to happen in a sequence that results in multiple records being recorded. This could fill up the available memory at an accelerated rate. The Minimum Time Between Records is used to limit the number of records recorded by setting the minimum allowed time between records. When set to a value other than 0, The first event will be recorded in it's own record, but any following events will be recorded after the specified interval. This will allow you to detect the event that caused the recording of data but still allow you to conserve memory.

Stop Recording when Full

Indicates how the DC will handle the filling up of the recorded data file. When checked, all data recording will stop when the data file is full. This will protect old data but will result in the loss of any data after the file fills up. When unchecked the old data will be overwritten when the maximum data file size is reached. Old data will be discarded in favor of making room for the new records. As data recording uses Flash memory, discarding of the records will be done in 64K Byte blocks or approximately every 500 records. To prevent loss of data you will need to upload the data file prior to the filling up of the data file.

Include Headers

If checked the first line of the .CSV file will contain the names of the registers. Register names are entered on the display settings page. If unchecked then the first line will be the first record in the file.

Include Status

If checked the first field after the data and time will be a status indication which indicates when the DC has been reset.

Maximum Buffer Size

Maximum Buffer Size indicates the maximum size the DC allocates for the recorded data file. You may select: 128 Kilobytes; 1 Megabytes; 2 Megabytes; or 3 Megabytes.

NOTE: Data is recorded as a .CSV text file. Record sizes are estimates only. A typical record containing 4 analog signals and 2 digital signals will use about 60 characters per record. At 60 characters per record, 128 Kilobytes will allow approximately 2000 records to be stored. Three Megabytes will allow 50000 records to be stored.

Save Changes

Saves the changes you have made. Some changes may require the recorded data file to be cleared. The recorded data file will only be cleared if the changes require the file to be cleared.

Clear Recorded Data

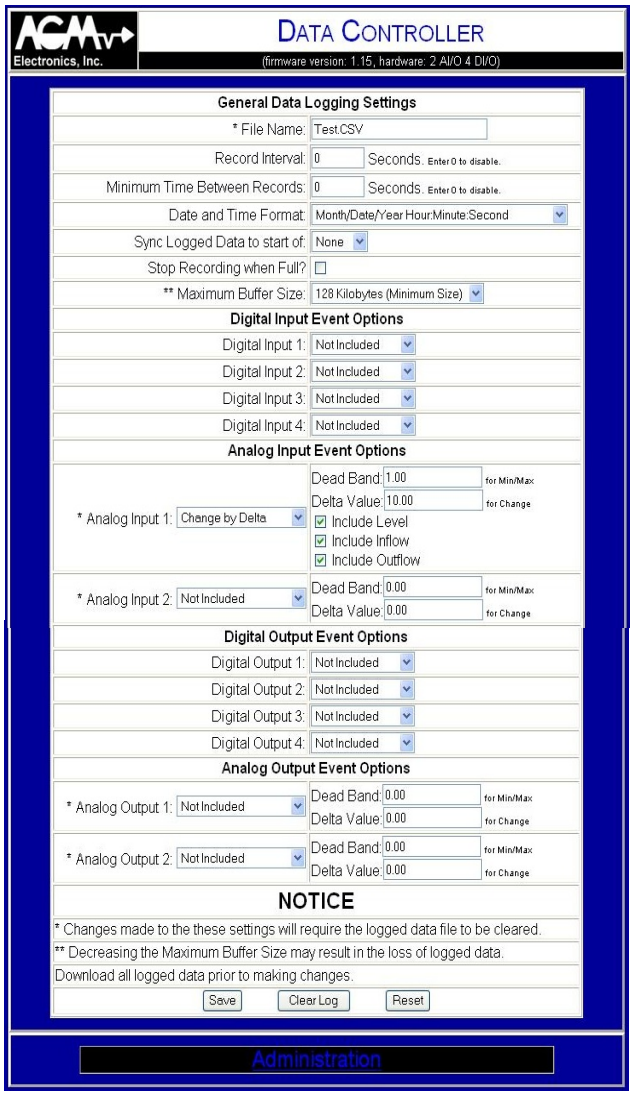
Saves the changes and clears the recorded file.

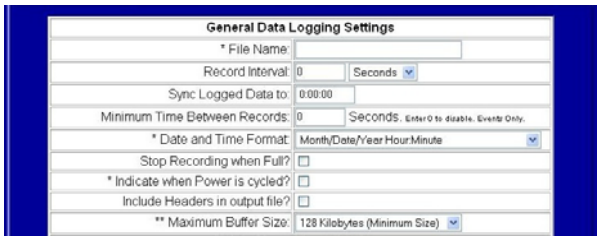
Data Logging File Warning

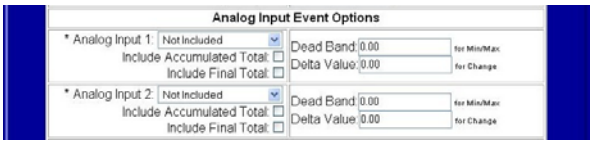
Data Logging Settings, Other Firmware Versions

Data Logging Settings page is used set up data logging. When data logging is set up the DC will periodically record data to its internal flash memory. The logged data may be uploaded from the DC via a FTP connection on in some firmware versions from the default web page.

The General Data Logging Settings page may vary depending on the firmware version. Some firmware versions have the ability to calculate flow based on the input and others have the ability to totalize the analog inputs. When working with these firmware versions additional settings will be available to accommodate the calculated flow or totals.







Data Logging Settings

General Data Logging Settings

File Name

Name of the logged data file as it will appear in the FTP directory. This file name is limited to 30 characters. The file will be uploaded as a comma delimited .CSV file. If not specified the .CSV extension will be added.

Record Interval

Data may be logged on either a periodic interval, on event or both. To enable periodic interval recording enter the time in seconds to record data. Setting to 0 will disable periodic recording.

Some firmware versions have a drop down list box specifying the time units for the value entered for the Record Interval. In these versions the value entered may be in either seconds, minutes, hours or days.

Minimum Time Between Recordings

When logging on events it is possible for a series of events to happen in a sequence that results in multiple records being recorded. This could fill up the available memory at an accelerated rate. The Minimum Time Between Records is used to limit the number of records recorded by setting the minimum allowed time between records. When set to a value other than 0, The first event will be recorded in it's own record, but any following events will be recorded after the specified interval. This will allow you to detect the event that caused the recording of data but still allow you to conserve memory.

Date and Time Format

The Date and Time Format sets the date and time format displayed as the first field in the comma delimited file. Setting the format will not have any effect on the amount of space used by each record, but only how the date and time is displayed in the data file.

NOTE: Some time formats list contain fractions of a second. These formats are useful for determining what sequence a series of events occurred but may be off by 0.3 seconds or more. The DC when not performing any other tasks reads the I/O approximately every 0.2 to 0.3 seconds. If performing any other tasks the time between readings will be longer. If modifying the configuration pages the reading of I/O may stop for several seconds as the configuration changes are stored.

Sync Logged Data to start of:

When periodically recording data longer than 1 second you may want to sync the recorded data to the real time clock, the Sync Logged Data to the start of allows you to set how the recorded intervals will be synced. You may sync to the start of the last minute, last hour or last day. For example if you wanted to record readings at 15 minute intervals after the hour you would set the Record Interval to 300 seconds and the Sync Logged Data to start of Hour. This would produce recording at :15, :30, :45, and :00.

In some firmware versions the Sync Logged Data to start of: has been replaced with the Sync Logged Data to: described below.

Sync Logged Data To

In some firmware versions a text box has replaced the drop down list box used for syncing the start of the logging intervals. The text box identified by Sync Logged Data To provides greater control. For example if data is to be recorded only once a day with the time of the recording to be done at 6:30 AM. You would set the Record Interval to 1 Day and the Sync Logged Data To to 6:30:00. This would produce one record each day at 6:30 AM.

Stop Recording when Full

Indicates how the DC will handle the filling up of the logged data file. When checked, all data logging will stop when the data file is full. This will protect old data but will result in the loss of any data after the file fills up. When unchecked the old data will be overwritten when the maximum data file size is reached. Old data will be discarded in favor of making room for the new records. As data recording uses Flash memory, discarding of the records will be done in 64K Byte blocks or approximately every 2000 records. To prevent loss of data you will need to upload the data file prior to the filling up of the data file.

Maximum Buffer Size

Maximum Buffer Size indicates the maximum size the DC allocates for the logged data file. You may select: 128 Kilobytes for 4000 records; 1 Megabytes for 32000 records; 2 Megabytes for 64000 records; or 3 Megabytes for 96000 records.

NOTE: Record sizes are estimates only. Typically a single record contains 16 bytes for overhead which includes the time and digital I/O status. Each Analog Input or Output used then adds 4 bytes to the record for a maximum record size of 32 bytes.

Digital Input Event Options

Digital Output Event Options

The Digital Input Event Options and Digital Output Event Options determine which Digital Inputs or Outputs will be included in the recorded data file and if a change of state will generate a record in the recorded data file. Available options are:

Selection	Description
Not Included	Digital I/O status will not be included in the recorded data.
On Interval	Digital I/O status will be included in the recorded data however a change of state will not trigger a new record.
Change of State	Digital I/O status will be included. Any change in state will trigger a new record.
Off to On	Digital I/O status will be included. A new record will be created when the Digital I/O closes.
On to Off	Digital I/O status will be included. A new record will be created when the Digital I/O opens.

Analog Input Event Options

Analog Output Event Options

The Analog Input Event Options and Analog Output Event Options determine which Analog Inputs or Outputs will be included in the recorded data file and if a change of state will generate a record in the recorded data file. Available options are:

Selection	Description
Not Included	Analog I/O status will not be included in the recorded data.
Include w/o Event	Analog I/O status will be included in the recorded data however a change of state will not trigger a new record.
Minimum & Maximum	A new record will be created when the Analog I/O has reached its minimum or maximum values.
Minimum	A new record will be created when the Analog I/O has reached its minimum value. Minimum value is detected and recorded when the input has risen by the specified Dead Band.
Maximum	A new record will be created when the Analog I/O has reached its maximum value. Maximum value is detected and recorded when the input has fallen by the specified Dead Band.
Change by Delta	A new record will be created when the Analog I/O has increased or decreased by the value specified in the Delta Value text box.
Increase by Delta	A new record will be created when the Analog I/O has increased by the value specified in the Delta value text box. No record will be created when the Analog I/O value has decreased.
Decrease by Delta	A new record will be created when the Analog I/O has decreased by the value specified in the Delta Value text box. No record will be created when the Analog I/O value has increased.

Dead Band

To prevent input noise from triggering false minimum or maximum recordings a Dead Band should be defined. A change in level by the specified Dead Band is used to determine when a maximum or minimum level has been reached. A minimum level is detected when the level has risen above the minimum measured level plus the Dead Band. A maximum level is detected when the level has fallen below the maximum measured level by the Dead Band. Dead Band is expressed in Engineering Units.

The Dead Band specified here is the same Dead Band used for calculating flow.

Delta Value

To record on a change in level, the amount of change must be specified. The values entered here only effects the Change by Delta settings.

Include Level
Include Inflow
Include Outflow

For DC's that contain the ability to estimate flow based on a change in level these three check boxes are supplied to indicate what analog input values will be recorded. You may record the measured level, calculated inflow and calculated outflow. Checking the box will include the specified value. You may include just one or all three values.

Include Accumulated Total
Include Final Total

For DC's that contain the ability to totalize the analog input readings these check boxes are supplied to indicate which calculated totals are to be included. Accumulated Total is the current accumulated total at the time of recording. Final Total is the maximum total reached before the accumulated total was reset. The Final Total will only be included in the recorded data when the final total is calculated.

Buttons

Save

The save button saves your changes. Some changes may require the logged data file to be cleared. The logged data file will only be cleared if the changes require the file to be cleared.

Clear Log

Saves the changes and clears the logged data file.

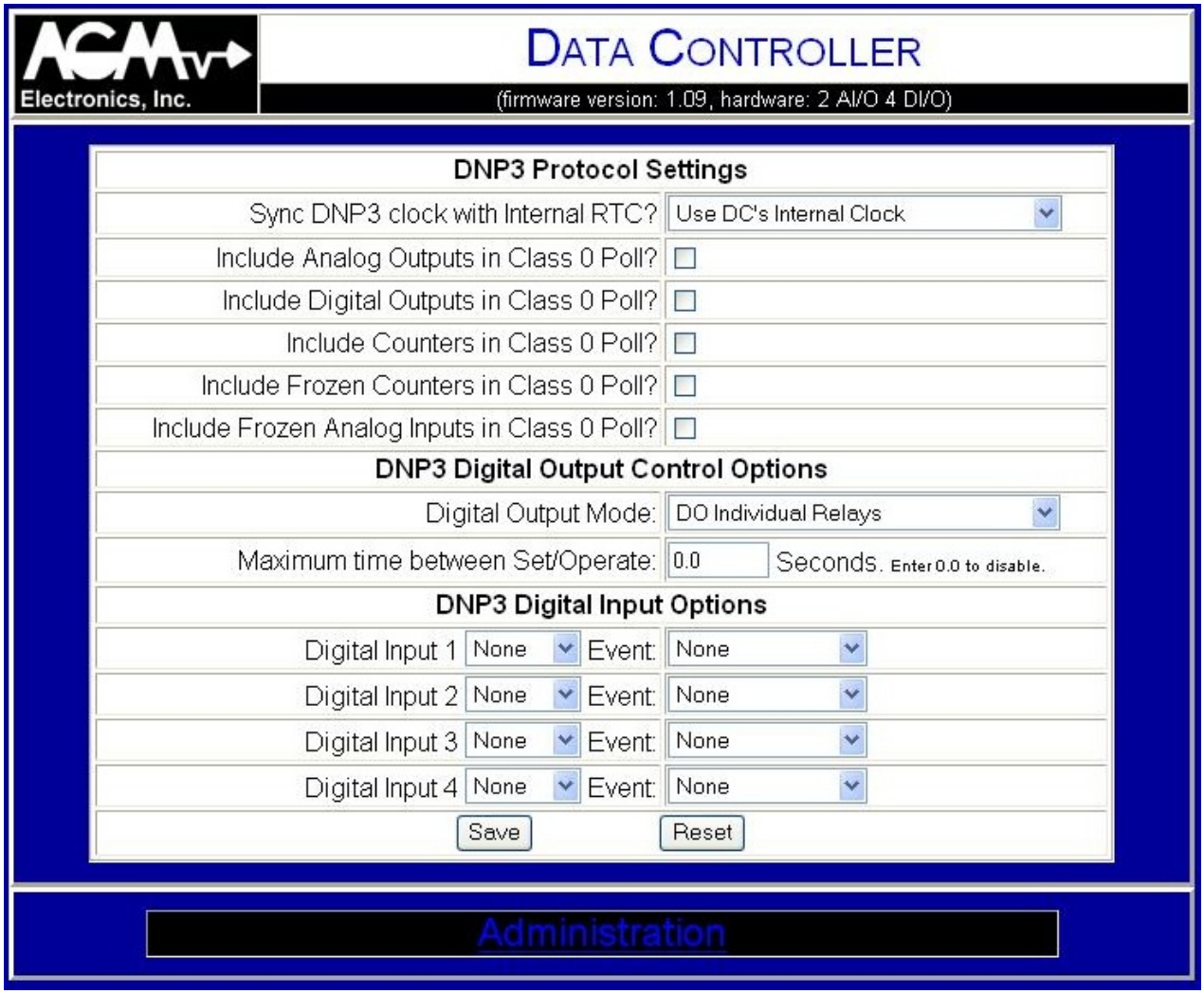
NOTE 1: Some settings can not be changed without clearing the recorded data due to changes in the size of the recorded data records. Before making any changes to the Logging Settings you should upload the recorded data file from the DC.

NOTE 2: Altering the Maximum Buffer Size to a smaller size could cause the loss of data.

Data Logging File Warning

DNP3 Protocol Settings

Edit DNP3 Protocol page is used to set protocols and I/O options specific to the DNP3 protocol.



DNP3 Protocol and I/O Settings

Sync DNP3 clock with internal RTC is used to determine how the DC will synchronize the date and time between the DC and a remote DNP3 master device.

In all cases the date and time of the internal Real Time Clock will be used for the initial date and time reading from the DC. The status of the Date and Time required flag in the DNP3's Internal Indicator Status and if the DC's internal clock can be modified by the Master device is controlled by this option. See the following table:

Setting	Sets Date & Time Required	Allows RTC to be Set
Use DC's Internal Clock	No	No
Get Time From Master	Yes	No
Allow Master to Write DC's Clock	No	Yes
Sync DC's Internal Clock with Master	Yes	Yes

DNP3 has a "Class 0" object that returns all data from a remote device. When a DC receives this command all Analog and Digital Inputs are reported along with some optional I/O status. The check boxes under DNP3 Protocol Settings select the optional data that will be reported. Optional Class 0 data is: Analog Output status; Digital Output status; Counters; Frozen Counters; and Frozen Analog Inputs.

DNP3 has several options for controlling the Digital Outputs. Digital Outputs may be either pulsed or latched, on or off. Digital Outputs may also be grouped in a "Trip/Close" relay pair where one control point controls two digital outputs. Pulsing and latching of the Digital Outputs is selected by the protocol, however for the "Trip/Close" option to work the Digital Output Mode must be set. The following table shows how the relays will be controlled with each option:

Setting	Control Point				Notes
	DO(1)	DO(2)	DO(3)	DO(4)	
DO Individual Relays	1	2	3	4	Normal operation
DO 1 & 2 Trip & Close, No Overlap	1 Trip	1 Close	2	3	DO(1) and DO(2) may not be on simultaneously.
DO Trip & Close, No Overlap	1 Trip	1 Close	2 Trip	2 Close	DO(1) and DO(2) may not be on simultaneously. DO(3) and DO(4) may not be on simultaneously.
DO 1 & 2 Trip & Close, Can Overlap	1 Trip	1 Close	2	3	All DO may be on simultaneously.
DO Trip & Close, Can Overlap	1 Trip	1 Close	2 Trip	2 Close	All DO may be on simultaneously.

DNP3 has an option where Outputs are selected before actually modifying the output signals. The maximum time allowed between the select and operate is set in the "Maximum time between Set/Operate" box. Setting this time to 0 will disable the time limit and allow the DC to wait forever between the select and operate commands. Otherwise the DC will require the operate command to be received within the specified time limit before modifying the outputs.

The DC supports DNP3's event logging for each of the Digital Inputs. The settings under DNP3 Digital Input Options indicate when an event log will occur and to which one of the 3 DNP3 classes the event will be reported as.

The drop down list box on the left sets the DNP3 event class to report a digital input transition. The "None" entry disables event reporting for the selected input.

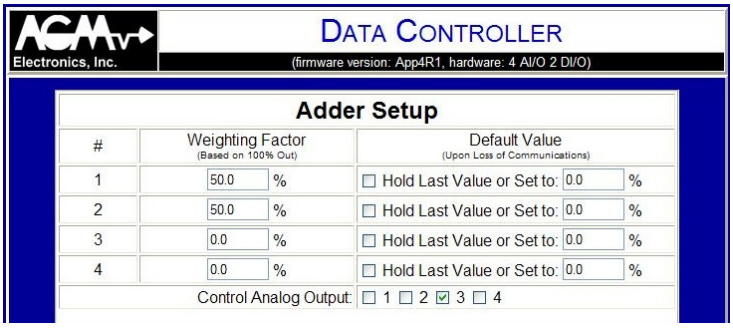
The drop down list box on the left sets the action that will log an event. Available options are:

None. Disables event logging for the selected input.
Off to On. Logs an event when the Digital Input closed.
On to Off. Logs an event when the Digital Input opens.
Change of State. Logs an event when the Digital Input changes state.

Adder / Pulse Output Settings (Application 4 Only)

The following section describes the I/O settings unique to Application 4. These settings are used to set up the DC to add analog input signals and to produce a pulse output. This page is divided into 4 sections. Adder Setup; Pulse Output Setup; Display Settings; and Additional Settings.

Adder Setup



Adder Setup

Weighting Factor Column

The weighting factor is a multiplier used to normalize analog inputs prior to adding. This allows analog inputs signals of different magnitudes to be correctly added.

Example 1:

Two analog inputs signals representing a 0 to 100 gallon per minute flow rate are to be added to produce a combined flow rate representing 0 to 200 gallons per minute.

In this example the inputs are equal weighted to both would be set to 50 percent. To set up the Weighting Factor for this application you would enter 50 for #1 and #2 representing a 50 percent weighting factor for each input signal.

Example 2:

Two analog inputs signals are used. Once signal represents a 0 to 100 gallon per minute flow rate and the second represents a 0 to 10 gallon per minute flow rate. The output will represent a 0 to 110 gallons per minute flow rate.

In this example the inputs are not equally weighted with one input being one tenth of the other input. In this case you would enter 10 for the 0 to 10 gallon per minute signal and 90 for the 0 to 100 gallon per minute signal.

Default Value Column

The settings in Default Value column indicate how the DC is to calculate the output during power up or communications failure. This setting affects the input values for the calculation. You have the option of either holding the last value transferred by checking the box or forcing the input value to a known value which you enter in the text box.

Checking the Hold Last Value check box will keep the last value transferred and has the effect of disabling the communications failure test for the selected input.

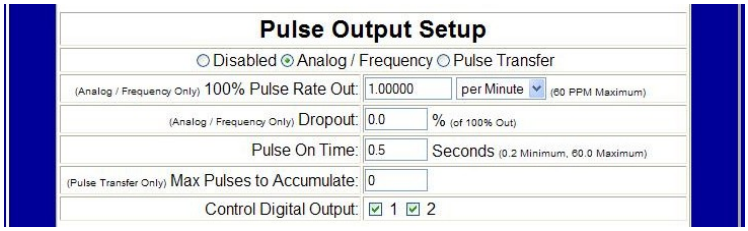
Entering a value in the text box will force the input value used for the calculation to the specified value. The value entered is the percentage of the full scale input before the weighting factor is applied. For example if you were working with a 0 to 10 gallon per minute input signal and you wished for the analog input value to go to 5 gallons per minute on communications failure you would enter 50 representing 50 percent of the 0 to 10 gallon per minute input signal.

Control Analog Output

Selects which if any analog outputs will output the sum of the analog inputs signals.

If the sum is not required as an Analog Output signal you may leave all boxes unchecked. The sum will still be calculated for use in the Pulse Output section.

Pulse Output Setup



Pulse Output Setup

Disabled; Analog / Frequency; Pulse Transfer

The first row of radio buttons selects the operating mode of the pulse output section. Pulse outputs may be disabled; creating by integrating an analog input; or be the result of a pulse count transfer.

100% Pulse Rate Out

(Analog / Frequency Mode Only)

The value entered here is used to calculate when a output pulse will be generated. This rate may be expressed in either pulse per minute or per hour depending on the setting of the drop down list box. Maximum setting is 60 Pulses per Minute.

You can calculate this setting by dividing the 100% Flow Rate by the number of gallons or other engineering units. See example below.

Example:

Two analog inputs signals representing a 0 to 100 gallon per minute flow rate are to be added to produce a combined flow rate representing 0 to 200 gallons per minute and one pulse is to be generated for every 100 gallons. The 100% Pulse Rate Out settings would be 2 pulses per minute.

Setting = Number of Gallons per Minute / Gallons per Pulse.

2 = 200 Gallons per Minute / 100 Gallons per Pulse

Dropout

(Analog / Frequency Mode Only)

Sets the minimum input signal in percentage that will be used for calculation. If any value is below the dropout value the input value will be forced to 0.

Setting a dropout value prevents gradual accumulation of pulse output data and prevents a false pulse out due to this accumulation.

Pulse On Time

Sets the time the digital output contact will remain closed. Accuracy of the pulse width output is value entered plus 0.25 seconds. Minimum setting is 0.2 seconds and the maximum is 60 seconds. Recommended setting is 0.5 seconds or greater depending on the ability of the connected device to detect the contact closure.

Max Number of Pulses to Accumulate:

(Pulse Transfer Mode Only)

Limits the maximum number of pulses allowed to be outputted at one time. The DC calculates the number of pulses to output based on the current counter value and the previous counter value. The DC will wait for two data transfers to complete to synchronize the two counts after power up or a configuration page is changed.

There are however two conditions that could put the DC's out of sync or generate a large number of output pulses. First, if a remote DC is replaced with an incorrect value for the counter without setting the counter. The DC outputting pulses could incorrectly determine that there are a large number of pulses to be outputted. Second is if there is a communications failure for an extended length of time. This will not generate false pulses but could create a continuous stream of pulses which do not represent the current status.

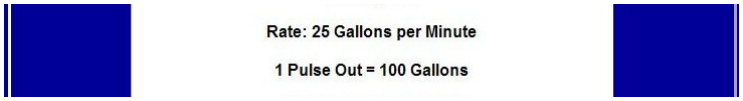
The value set for the Maxim Number of Pulses to Accumulate will limit the number of pulses outputted. This value should be set large enough to accommodate any valid pulses even after a brief communications break but should be small enough to prevent the DC from generating a continuous stream of pulses lasting minutes if not hours.

Control Digital Output

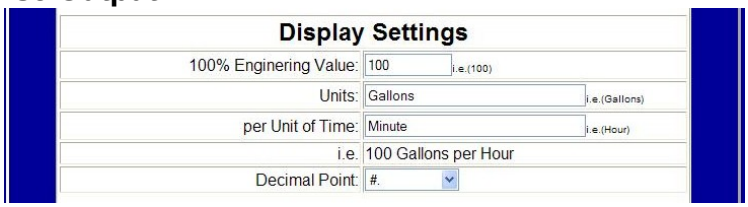
Selects which digital outputs will be pulsed. If multiple outputs are selected then each output will be pulsed closed at the same time.

Display Settings

The calculations performed within the DC are done as a percentage of 100% or full scale. This allows output values to be correctly calculated without knowing the actual engineering units. For diagnostic purposes the engineering units may be required for display. The settings within this section allow you to set up the display on the default web page.



Sample Display for Pulse Output



Adder / Pulse Output Settings, Display Setting Section

100% Engineering Value

This is the conversion factor required to convert 100% output into a meaningful flow rate. To set this value enter the expected output flow rate in engineering units when the output is at 100%.

Units

This is the text that will be displayed on the Default web page. You are limited to 30 characters otherwise any alphanumeric characters may be used.

For the display to work correctly the flow rate must be broken into Engineering Units and the per Units of Time. Typical units are “Gallons”; “Liters”; “Cubic Feet”; etc.

Per Unit of Time

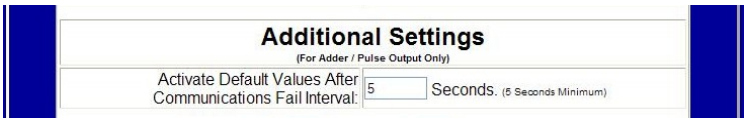
Like Units described above this is the text that will be displayed for the flow rate on the default web page. The text entered here will provide the “per Minute”; “per Hour”; “per Day”; etc. part of the flow rate display.

You do not need to include the “per” part of the units. “per” will be added automatically.

Decimal Point

Sets the resolution of the displayed value.

Additional Settings



Additional Settings Section

Activate Default Values After Communications Fail Interval

Sets the communications fail interval for the Adder section only. The time interval entered here determines when the Default Values entered in the Adder Setup section will be used in place of the transferred values. Does not directly affect other I/O.

The minimum time interval is 5 seconds which should be adequate for most systems. Systems transferring a large number of signals, or if long communications delays are inherent in the system the interval may need to be increased.

NOTE 1: The Communications Fail interval set here is independent of the Communications Fail interval set in the Advanced IO Settings page. The communications failure set here only effects input signals to the adder.

NOTE 2: As inputs for the adder may originate from up to 4 remote locations it is possible to have a communications failure from one location but not another. In this case the adder will continue to operate with the available signals substituting the Default Value for the value transferred.

Diagnostics

Indicator Lights

To assist you in diagnosing possible communications problems the DC is equipped with 8 indicator lights. The Red "R" Light, Green "P" Light and Yellow "X" and "R" lights are located on the top of the DC. The Green "Link" and Yellow "Act" light are located on the RJ45 Ethernet connector.

NOTE: There are 2 "X" and "R" yellow lights. The actions and interpretation of these lights is the same. The middle set of lights is for the port A the top Male 9 pin D connector port and the bottom lights are for port B the bottom Female 9 Pin D connector port.

Light	Action	Description.
(Red)R	Off	Normal Operation
(Red)R	On Steady	Supply voltage below minimum threshold of 10V. May also be caused by a internal failure of the DC.
(Red)R	Periodically flashing	Indicates a possible internal failure. May also be caused by unstable power supply.
(Red)R	Flashes once on power up.	Normal Operation.
(Green)P	On Steady	Normal operation. Port B is in the RS232 mode.
(Green)P	Flashing 1 Second rate.	Normal operation. Port B is in the RS485 mode or in the Auto detect mode with no RS232 cable connected.
(Green)P	Off	Normal for a few seconds after power up. If no other lights are on then check power connections. If the "X" lights are on steady then the DC may have an internal failure.
(Yellow)X	Off	The DC is not transmitting any data out the serial port.
(Yellow)X	On steady	After power up the X light may remain on until the processor is initialized. If the Red "R" light is also on see the description for the "(Red)R" light.
(Yellow)X	Flashing	Normal operation. The X light will flash with each character transmitted out the serial port. If the DC is the Master then the "R" light should also be flashing. If only the "X" light is flashing then you may have a connection or configuration problem between this Master DC and the remote device.
(Yellow)R	Off	Indicates the DC is not receiving any characters on the indicate port. This may indicate a connection problem with a connected device.
(Yellow)R	On Steady	Indicates a connection problem.
(Yellow)R	Flashing	Normal operation. When the DC is a Master then this light will flash after the "X" light. If the DC is a slave this light may flash before the "X" light. When acting as a slave with multiple devices an "R" flash without a "X" flash may be normal you will only get a "X" flash when the DC responds to a command.
(Green)Link	Off	Indicates the DC is not connected to a Ethernet Network.
(Green)Link	On steady	Normal operation. A network cable is connected to the DC.
(Yellow)Act	Off	Indicates there is no activity on the Ethernet connection.
(Yellow)Act	Flashing	Normal operation when connected to a Ethernet network. Indicates there is some form of activity on the Ethernet network. Even if the DC is not currently being accessed this light will flash.

Default Web Page

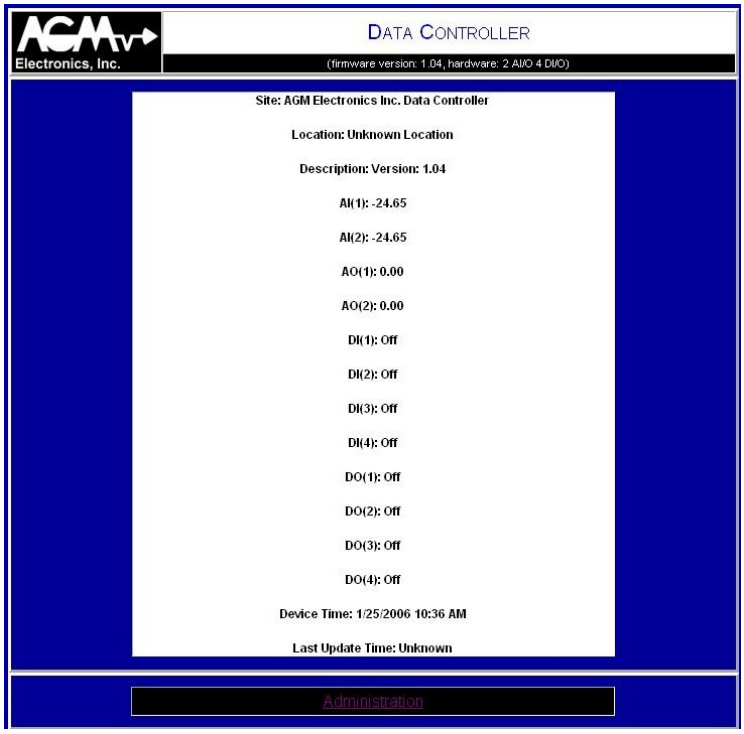
The default web page can be used to provide some diagnostic information. Information included on the default web page will depend on the firmware version. For firmware Application 0 and 1 the information included on the default web page is selected by the Display Settings page.

For other versions the following information is included:

Site, Location, and Description are text strings entered on the DC Titles Setup page. These strings are informational only and intended to provide a means to identify the DC.

AI(x), AO(x), DI(x), and DO(x) show the current state of each of the Analog and Digital I/O signals.

The Last Update Time when the DC is a master is the last date and time a successful transfer occurred. As a slave the last date and time is the last time the DC was accessed.

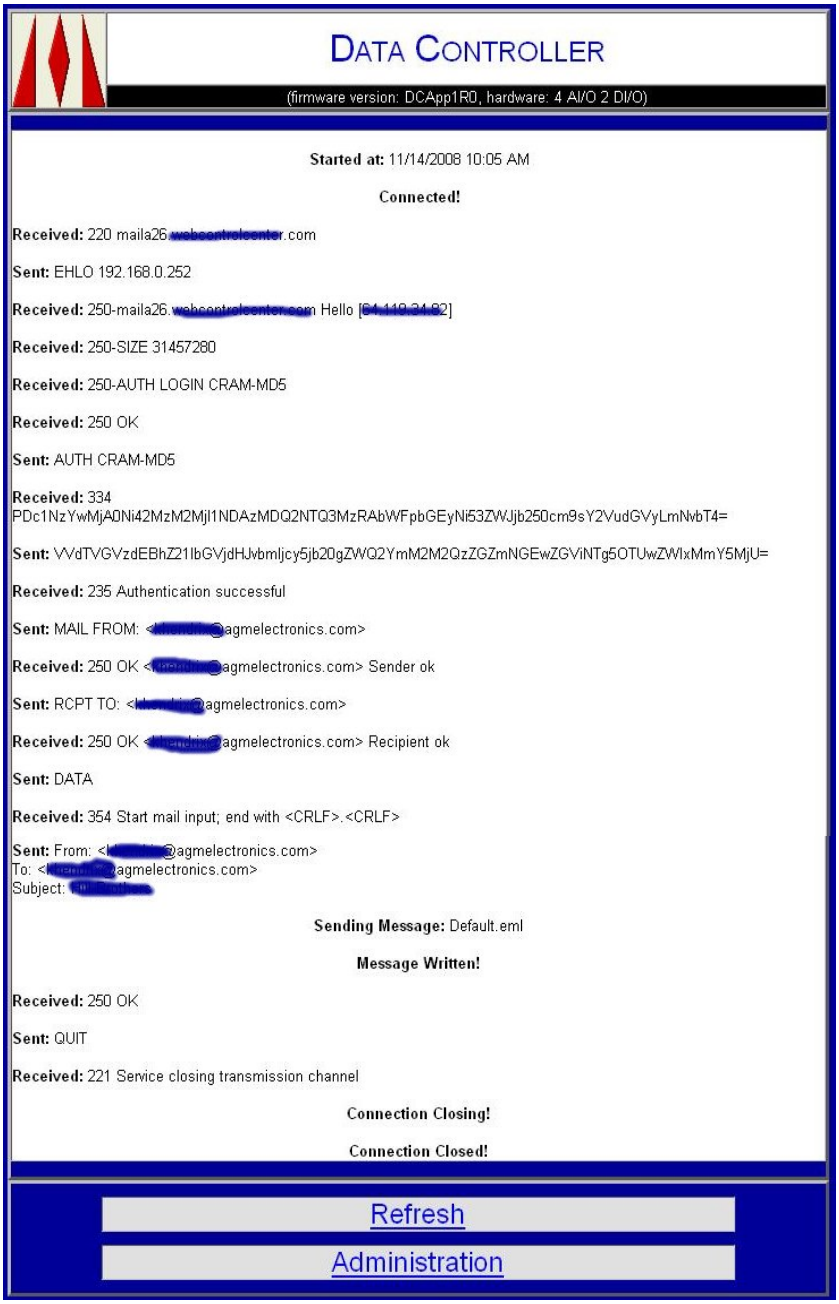


Default Web Page

Messaging Log

When sending messages a log is kept of the transaction between the DC and the SMPT mail server. This log file can help in diagnosing problems with sending messages. The message log may be displayed by clicking on the Display Message Log link on the Administration Menu. The file (DCMessaging.log) is also available via a FTP connection.

Below is a sample of a successful message send. Due to the variations in SMTP servers not all messages will be the same, but the below sample can be used as a reference. This sample uses one of the encrypted authentication.



Sample Messaging Log

Ethernet Connection Problem

Description of problem:

Due to the way computers and other devices operate when using an Ethernet and IP addresses a condition can occur which causes a temporary communications failure. Under normal conditions you will not see this problem but when troubleshooting a system this problem may occur.

If you are communicating with one DC or other communications device and swap that device with another Ethernet device with the same IP address, you may not be able to connect to the second device. But if you reconnect the first device, communications seems normal. This may lead to you thinking there is a problem with the second device. You may also think the second device is intermittent, as sometime you can make the swap without problems.

Example:

DC #1 has the default address of 192.168.0.251. You connect and configure the DC without any problems. As you will not be using the Ethernet connection except for configuration you do not change the IP address.

Next you disconnect DC #1 and replace it with DC #2. DC #2 is also set up at the default address of 192.168.0.251. You find that it suddenly takes longer for the default page to be displayed and when it does the time is the same as the last page displayed with DC #1. You also find that you can not get to the administration page.

Next, you give up and go get a cup of coffee. When you return you try again and now you can communicate with DC #2.

The Problem:

Caching.

If you have browsed the Internet at any length you are probably aware of how Microsoft's Internet Explorer and other web browsers cache web pages. If you attempt to connect to a site and a connection is not successful, the web browser may pull up the last page displayed from the site you were trying to access.

What is not obvious is that other information is cached. Specifically, in the case of Ethernet, a MAC (Media Access Control) address is cached. Ethernet uses the MAC address for transferring data and not the IP address. Ethernet uses the IP address to find the MAC address and once the MAC address is found, it is placed in a cache on your computer. Your computer then uses the MAC address from the cache to communicate with the remote device. The IP is not used again until the MAC address is flushed out of the cache.

The problem is not with the DC or any other Ethernet devices. It's with the devices being asked to do something that is abnormal. Caching was designed to make Ethernet more efferent and under normal conditions you would not see this problem.

The Fix:

To fix the problem you need to clear the cache. You can either wait until the cache expires and clears itself, or you can take actions to clear the cache. If using Windows XP you can clear the cache by opening your Ethernet connections and selecting repair. See your Windows help files for specific instructions. Older versions of Windows require restarting your computer. Other devices may also require restarting.

Calculating Flow

Application 1 has the ability to calculate an estimated flow rate and pump capacity from a change in the analog inputs. The flow rate is calculated from the change in magnitude and direction in analog input signal. The following is calculated and may be displayed either on the default or custom web page:

Inflow	Inflow is calculated by the change on the analog input in the upward or positive direction over time. The inflow is detected and measured between the minimum and maximum peak levels.
Outflow	Outflow is calculated by the change on the analog input in the downward or negative direction over time. The outflow is detected and measured between the maximum and minimum peak levels.
Pump Capacity	Pump Capacity is a variation of the Inflow or Outflow calculation. Pump Up capacity if for pumps that raise the level. Pump Up capacity first calculates the inflow and outflow then adds the outflow to the inflow resulting in the pump capacity. Pump Down capacity uses adds the inflow to the outflow.

In order to calculate the flow, several assumptions must be made:

1. Flow can be represented by a change in the analog input and the change is linear. For example if an inflow of 1 gallon creates a 1 inch increase in level within a tank and a inflow of 2 gallons create a 2 inch level increase the change is linear and flow may be calculated. If however a 1 gallon inflow creates a 2 inch increase when the tank is empty and a 1 inch increase when full, flow based on a level change can not be determined with a simple conversion factor and is not supported by the firmware in the DC.

2. Flow remains constant between the minimum and maximum values. If not constant then the average flow will be calculated.

3. Flow can only be detected when both a minimum and maximum peak are detected. A Dead Band and measurement of the peak values is used to determine when a tank or well is being emptied or filled up. A large dead band can effect the accuracy of the flow calculation. A too small of a dead band could cause a false minimum or maximum level to be detected and result in incorrect flow calculations.

4. When calculating Pump Capacity the pump is running the opposite flow remains constant.

E-Mail Messaging

The Data Controller has the ability to send an E-Mail or text message as the result of an event. Events may be either periodic events or as the result of some alarm condition. Events that generate a message are defined on the Events Setting page.

The message sent may be either one of the built in message or a custom message you create.

Default E-Mail Message

Two types of default messages are available. One type of message is a status message which can be sent either periodically or as a result of an alarm event. The second type of message is an alarm message which is only sent as a result of an alarm event.

The status message contains the values selected on the Display Settings page. Values selected for display are selected by checking the “Messaging” box. The current date and time will always be included at the end of the page.

The alarm message contains just the value that generated the alarm and the current date and time. You do not need to select the value on the Display Settings page. The value displayed will always be the value that generated the alarm message.

You select which one of the default messages will be used on the Event Settings page.

Indentifying text, units and display format are set on the Display Settings page. The same display settings used for displaying values on the default web page will be used for displaying values in messages.

Custom E-Mail Message

If more detail is required you may create custom messages. Creating a custom message is the same as creating a custom Web page except the file names will be different.

For E-Mail Messages use the following file names:

Message.eml Status message.

MessageA1.eml through
MessageA9.eml Messages for analog I/O events.

MessageD1.eml through
MessageD9.eml Messages for digital I/O events.

Message1.eml through
Message4.eml Messages for periodic events.

Custom Web and Messaging Pages

Creating a Web Page or custom E-Mail messages is optional when using the DC. The Default Home Page and Default Status messages can be used to display all I/O by selecting the variables to display in the Display Settings page. The DC supports customized web pages and messages for the users who want a more customized look. See Appendix O for a sample custom web page.

Creating a custom web page or message requires 3 steps: Creating your web page; downloading your web page to the DC; and then testing your web page. Creating and downloading your web pages are discussed below. Except as noted creating a message is the same as creating a web page.

Creating your Web Page

To create your web page you may use any Web Authoring tool. For messages which are typically text only you may use any text editor such as Windows Notepad. Designing a web page for the DC is no different from designing a web page for any other HTML server with the following exceptions:

1. The DC does not have the speed and throughput of a large server computer. Therefore, there are limitations on the size and number of files used. While the DC can handle large graphics you will not get the same performance as a faster computer.

2. With the exception of the server side includes (SSI) defined below, custom CGI or other routines are not supported. Java scripts that run on the client may be used.

To access the I/O and other information contained within the DC include the following in your HTML or E-Mail text file where the variable information is to be displayed.

General Commands

<!--#echo var="SiteTitle"-->
<!--#echo var="SiteLocation"-->
<!--#echo var="SiteDescription"-->

The above will include the Site information as entered on the Titles Setup page when you configured the DC.

<!--#exec cmd="Get_RTC"-->

The above will include the current DC time.

<!--#exec cmd="Get_Last_Update"-->

The above will include the date and time the DC received an update from a another DC or other connected device. Local I/O is updated continuously so this command will have no meaning on a stand alone DC.

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I/O Commands

<!--#exec cmd="AI(1)"-->
<!--#exec cmd="AI(2)"-->
<!--#exec cmd="AI(3)"-->
<!--#exec cmd="AI(4)"-->

The above will display the current values of the Analog Inputs. The value displayed will be formatted according to the I/O Settings configuration page. The default is to display in percentage of full scale with a 2 decimal points. Go to the Software Configuration, I/O Settings section for instructions on changing the decimal point or engineering units.

<!--#exec cmd="AO(1)"-->
<!--#exec cmd="AO(2)"-->
<!--#exec cmd="AO(3)"-->
<!--#exec cmd="AO(4)"-->

The above will display the current values of the Analog Outputs. Like the Analog Inputs the value displayed will be formatted according to the I/O Settings configuration page.

<!--#exec cmd="DI(1)"-->
<!--#exec cmd="DI(2)"-->
<!--#exec cmd="DI(3)"-->
<!--#exec cmd="DI(4)"-->

The above will display the current values of the Digital Inputs.

<!--#exec cmd="DO(1)"-->
<!--#exec cmd="DO(2)"-->
<!--#exec cmd="DO(3)"-->
<!--#exec cmd="DO(4)"-->

The above will display the current values of the Digital Outputs.

<!--#exec cmd="CNT(1)"-->
<!--#exec cmd="CNT(2)"-->
<!--#exec cmd="CNT(3)"-->
<!--#exec cmd="CNT(4)"-->

The above will display the current values of the Counters. Counters may be incremented on a change of state of the digital inputs. Go to the Software Configuration, I/O Settings section for instructions on setting up the counters.

Flow Commands

Some firmware versions have the ability to calculate an estimated flow rate from a change in the analog inputs. The following commands are available on those versions.

<!--#exec cmd="INFLOW(1)"-->
<!--#exec cmd="INFLOW(2)"-->
<!--#exec cmd="OUTFLOW(1)"-->
<!--#exec cmd="OUTFLOW(2)"-->
<!--#exec cmd="PUMP(1)"-->
<!--#exec cmd="PUMP(2)"-->

The above will display the calculated flows. Go to the Software Configuration, I/O Settings section for instructions on setting up the flow calculations.

The above will display the maximum calculated Pump Capacity. When used with a Pump Up system this reading will be the same as INFLOW(#) described above. In a Pump Down system this reading will be the same as OUTFLOW(#). The difference between the INFLOW(#), OUTFLOW(#) and PUMP(#) is the PUMP(#) will latch the maximum calculated Inflow or Outflow depending on the system.

Setting Outputs

The outputs and counters of the DC may be controlled via a HTML form. Appendix O contains a sample form. The following describes each line in the sample. Some of the tags have more options than displayed, consult with a HTML manual for more details on how to create forms and the options available with each form tag.

E-Mail messages can not control any of the outputs. Forms only work on HTML web pages and not text E-Mail messages.

<form action="change.cgi" method="post">

You must open your form section using the above tag. Use only “change.cgi” for the action and “post” for the method.

This tag must be the first tag in your from section. Only input tags between this tag and the </form> tag will be processed when the submit button is clicked.

<input type=”hidden” name="page" value="sample.htm">

This tag indicates what page will be displayed after the form is processed. If not provided then the default web page will be displayed.

<input type=”hidden” name="user" value="admin">
<input type=”hidden” name="pass" value="password">

Either these two tags or the tags below are required to process the form. If your form may be used by anyone you can use the above hidden input types to hide the required user ID and password. The values for “user” and “pass” must match one of the user ID’s and passwords defined in the DC Security pages.

<input type=”text” name="user">
<input type=”password” name="pass">

Either these two tags or the tags above are required to process the form. These two tags create text boxes for the required user ID and password. These should be used in place of the hidden text shown above when access to the form is required. The values entered for “user” and “pass” must match one of the user ID’s and passwords defined in the DC Security pages.

<input type="text" name="ao1" value="<!--#exec cmd="AO(1)"-->">
<input type="text" name="ao2" value="<!--#exec cmd="AO(2)"-->">
<input type="text" name="ao3" value="<!--#exec cmd="AO(3)"-->">
<input type="text" name="ao4" value="<!--#exec cmd="AO(4)"-->">

These tags show how an analog output can be changed via a text box. The tag after the “value=” is optional and used to place the current analog output in the text box.

<input type=radio value="0" checked name="do1">Off<input type=radio value="1" name="do1">On
<input type=radio value="0" checked name="do2">Off<input type=radio value="1" name="do2">On
<input type=radio value="0" checked name="do3">Off<input type=radio value="1" name="do3">On
<input type=radio value="0" checked name="do4">Off<input type=radio value="1" name="do4">On

These tags show how to control the digital outputs using radio buttons. Text boxes or list boxes may also be used but are not covered in this document. Check boxes can only be used to set a digital output. The current status of a digital output can not be displayed using radio or other button types. If current status is required use a text box and format your tag the same as the analog outputs or counters.

<input type="text" name="cnt1" value="<!--#exec cmd="CNT(1)"-->">
<input type="text" name="cnt2" value="<!--#exec cmd="CNT(2)"-->">
<input type="text" name="cnt3" value="<!--#exec cmd="CNT(3)"-->">
<input type="text" name="cnt4" value="<!--#exec cmd="CNT(4)"-->">

These tags show how counters can be changed via a text box.

<input type=”submit” value="Set" name="button">

This is the standard submit button. This tag creates the button that submits the form to the DC for processing. All submit buttons are processed the same by the DC. Value and name are ignored by the DC.

</form>

This tag indicates the end of the form section.

Downloading your Web Page or E-Mail Message

After you have created your web or E-Mail pages you will need to download them to the DC using a standard FTP program. Specifics for using the FTP program are not covered in this document due to the variations in programs.

The DC has been tested with: Microsoft Windows FTP program; FireFTP an add-on for Mozilla Firefox; and WS_FTP Pro a FTP client available from IP Switch.

Of the FTP programs tested:

Mozilla Firefox with FireFTP provides both the web browser and FTP client in one relatively easy to use package. FireFox and FireFTP are freeware available for downloading from the Internet.

Microsoft's FTP program is available on any version of Microsoft Windows but is more difficult to use and does not allow you to select passive or active FTP connections.

WS_FTP Pro is a full featured FTP program which is available from IP Switch for a charge.

DC Limitations:

1. Anonymous use is not supported. Before viewing or modifying the files within the DC you must log on with a User ID and password that has Administration level permissions.

   NOTE: While testing the DC we have found that some versions of Microsoft Internet Explorer will hang up if you attempt to access the UWS by the IP address only. You must us the syntax of admin@192.168.0.251 each and every time you access the web page. Other FTP programs do not have this problem.

2. Subdirectories are not supported. This limitation should also be kept in mind when designing your web pages.

3. The maximum file name is 30 characters.

4. Only copying to and from the DC or deleting a file is supported.

5. If the DC will not be used for logging data, up to 60 user files may be used provided the file size does not exceed 64K bytes. If over 64K bytes reduce the number of supported files by 1 for each 64K bytes exceeded. If data logging is enabled with the maximum size of 3 Megabytes reserved for logging then the maximum number of user files is 10. Data logging with the minimum size of 128 Kbytes reserved will leave room for 58 user files.

6. All web pages must have the extension of .htm or .html if they include any of the SSI links described above. E-Mail Messages must have the one of the reserved file names of Message##.eml as described in the Messaging section.

7. The Logged Data file has an extension of .CSV. This file can be uploaded from the DC but not downloaded.

Uploading or Downloading:

All files may be copied either to or from the DC using your FTP program. Old files may also be deleted.

NOTE: Other files such as: DC Config x.xx.bin; DC Primary Route.bin; DC Alternate Route.bin; and DC Sites.bin are used for configuring your DC. Do not delete. If logging data there will also be a file with a .CSV extension containing the logged data, if you delete this file, it will be recreated but you will loose any previously recorded data.

Setting the Default Page:

The name of the default DC web page is Index.htm. When you design your web pages, give this name to your default or home page.

For E-Mail Messages use one of the names described below:

Message.eml Status message.

MessageA1.eml through
MessageA9.eml Messages for analog I/O events.

MessageD1.eml through
MessageD9.eml Messages for digital I/O events.

Message1.eml through
Message4.eml Messages for periodic events.

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Frequently Asked Questions

Q. How can I read my DC network and security settings?

A. The DC network and security settings may be displayed by performing the following steps:

1. Turn off the power to the DC.
2. Connect up a computer to either Port A or B. Use a null-modem cable for Port A and a straight through cable for Port B. Port B must be configured for auto detect or RS232.
3. Load Hyperterminal or other terminal program and set the communications settings to 9600 baud, 8 data bits, 1 stop bit and no parity.
4. Turn on the power to the DC and enter “display settings” without the quotes and followed by the enter key. You must enter this within the first 10 seconds after the DCS has been powered up.
5. If successful, a message showing the networks and security settings will be displayed.

Q. How can I restore my DC configuration settings to factory defaults?

A. The DC may be restored to the factory defaults by performing the following steps:

NOTE: Following this procedure will erase all configuration data within the DC. It is intended to recover from problems where the configuration table has been corrupted and you are unable to communicate with the DC. Use only as a last resort.

1. Turn off the power to the DC.
2. Connect a computer to Port A using a null-modem cable or Port B with a straight through cable.
3. Load Hyperterminal or other terminal program and set the communications settings to 9600 baud, 8 data bits, 1 stop bit and no parity.
4. Turn on the power to the DC and enter “reset data controller” without the quotes and followed by the enter key. You must enter this within the first 10 seconds after the DC has been powered up.
5. When prompted enter “YES’ without the quotes to verify that you wish to reset.
6. If successful, a message indicating the data controller has been reset to factory defaults will be displayed.

7. If you have made a back up copy of your configuration continue with the following steps. If you do not have a back up copy, you will need to reconfigure the DC. If your DC was shipped pre-configured, you will need to contact Technical Support to obtain a copy of how the DC was configured at the factory.

   NOTE: Configuration files are version specific. Do not use a configuration file from a different version of firmware.

8. Start your FTP program and connect to the DC using the IP address of 192.168.0.251. See Appendix C.

9. Use “admin” as the user ID and “password” as the password to open the FTP connection to the DC.

10. Copy your back up configuration files to the DC.

11. End your FTP session.

12. Cycle the power to the DC.

13. Your DC will now be back to the same configuration as when you created your back up configuration file.

Q. How can I find out the current status of the Analog and Digital I/O?
A. The Default Web Page provides information that can be used to aid in troubleshooting the DC. On this page is the status of all I/O, the current date and time of the DC's Real Time Clock and the date and time of the last data transfer.

To use the Default Web Page for troubleshooting you will need to connect to the Ethernet port of the DC. The following steps lead you through some basic trouble shooting of the DC. The steps below are to aid in determining if the problem is with the input, output or communications.

1. Connect to the DC that is the source of the signal and go to the Default Web Page.

2. Check that the input signals are as expected. Analog Inputs are shown as a percentage of full scale. Digital Inputs are shown as being either On or Off. If the results do not match your expected values then you have a problem with the Input signals. Check the input terminals of the DC and the output from your sensor or other connected device.

3. Check the Last Update Time. If the DC is set up as a slave, then the Last Update Time will indicate when any of the I/O was last updated. If the DC is a master then the Last Update Time will indicate when it last successfully updated a remote slave. Normally the Last Update Time will be within a few seconds of the Device Time. The actual number of seconds will depend on the communications delays in the system. If the Last Update Time says Unknown, then the DC has not communicated since the last reset. A larger than expected time difference indicates communications problems in the system.

4. Connect to the destination DC and go to the Default Web Page.

5. Check that the output signals are correct. Analog Outputs are shown as a percentage of full scale. Digital Outputs are shown as being either On or Off. If the values match those from the source DC check the output terminals and connected devices. If the values do not match you have communications problems. If testing a system for the first time or after modifying the configuration in the DC you may have a problem with the configuration. If you have been modifying the configuration in the Master DC, make sure you Log Off from the Administration Page before testing.

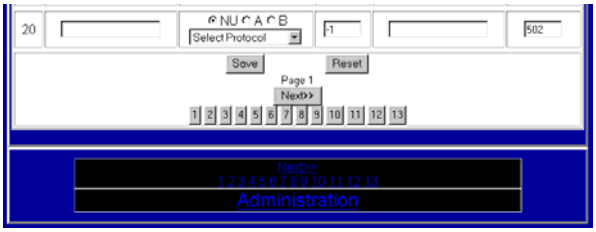
6. Check the Last Update Time. Like step 3 above if the Last Update Time is not within a few seconds of the Device Time, you may have communications problems.

Appendix A

Multi-Page Navigation

While most configuration settings are a single page. The Sites Setup and Routing Table pages require multiple pages.

At the bottom of these configurations pages are additional buttons and links. The buttons under the "Save" button are used for saving the current configuration and advancing to one of the other pages. The links at the bottom of the page above the "Administration" link are used to select a page without saving.



DC Navigation Buttons and Links

Save Button	Saves the current settings and returns to the Administration Home page.
Reset Button	Resets all settings to saved values.
Previous Button	Saves the current settings and goes to the previous page. If already on page 1 then page 1 will be displayed again.
Next Button	Saves the current settings and advances to the next page. If the last page is already displayed then the last page will be selected again.
Numeric Buttons	Saves the current setting and goes to the selected page.
Previous Link	Displays the previous page without saving any settings.
Next Link	Displays the next page without saving any settings.
Numeric Links	Displays the selected page without saving any settings.
Administration Link	Displays the Administration Home Page without saving any settings.

Appendix B

Setting your computer to access the DC

If you are having difficulty connecting to the DC, it may be possible the network settings on your computer are incorrect for the default address of the DC. To get around this problem or to access a DC when you can't put a DC on an existing network follow the steps outlined below:

1. If your computer is currently connected to a network temporarily disconnect it from the network and connect to the DC using a crossover cable.

2. Go to the Windows Control Panel and select the "Network" applet.

3. On the "Configuration" tab select the "TCP/IP" protocol that is attached to your network controller card then click on the "Properties" button.

4. Write down the current "IP address" and "Subnet Mask" settings.

5. On the "IP Address" tab, click on the "Specify an IP Address" button. Then enter the following for a "IP Address":

   192.168.0.1

   If using an existing network, check to see if this address is in use. If in use, you may substitute any IP address in the 192.168.0.xxx block except for IP address configured in the DC. The default address for the DC is 192.168.0.251.

6. For "Subnet Mask" enter the following:

   255.255.255.0

   When done, click on the "OK" button. Your computer may indicate your computer needs to be restarted. You will need to restart your computer before continuing with this configuration.

7. Try to connect to the DC. If successful, go to the Administration page and then the Network Settings page.

   If not successful, then check your connections and try again.

8. When you reach the Network Setting page, enter new IP and Netmask settings. These settings must be compatible with other devices on your network.

9. Restore the IP and Subnet mask setting on your computer then reconnect your computer to the network when done.

Appendix C

Backing Up or Cloning the DC Settings

After configuring your DC we recommend you back up your settings. You may also use this procedure to clone the settings in a DC. Cloning involves making a back up copy of the DC settings and restoring the settings files to a different DC.

The following procedure uses the Microsoft Windows FTP program. This program is available in most installations of Microsoft Windows 95. The procedure is written using Windows XP other versions of Windows may be slightly different. Other FTP programs may be used. If you use another FTP program use the following procedure as a guide.

To back up your DC Settings:

1. Connect your DC to the Ethernet.
2. Click on the "Start" button then "Run". Enter "FTP" in the "Open" text box then click the "OK" button. The FTP program will open in a window with a "ftp>" prompt.
3. Enter "open 192.168.0.251" followed by the enter key if the DC is set for the default IP address. If you have modified the IP address enter the correct address after the open. If you have modified the FTP Port number then you will need to enter the port number after the IP.

   ftp> open 192.168.0.251 21
   Connected to 192.168.0.251.
   220 Universal Web Station (UWS) FTP.

4. Enter the user name and password as required. Default user name "Admin", password is "password".

   User (192.168.0.251:(none)): admin
   331 Password required
   Password:
   230 User logged in.

5. Enter "Dir" to display the files currently stored in the DC.

   ftp> dir
   200 PORT command successful
   150 Opening ASCII mode data connection for /bin/ls
   -rw-rw-rw- 1 admin admin 857 Jun 9 15:49 DC Config 1.00.bin
   -rw-rw-rw- 1 admin admin 16394 Jun 9 11:46 DC Primary Route.bin
   -rw-rw-rw- 1 admin admin 18946 Jun 9 14:08 DC Sites.bin
   226 Transfer complete.
   ftp: 239 bytes received in 0.44Seconds 0.55Kbytes/sec.

6. If you are backing up the files within a DC copy them to your computer using the "Get" command.

   ftp> get "DC Config 1.00.bin" "C:\DC Config 1.00.bin"
   200 PORT command successful
   150 Opening BINARY mode data connection (857 bytes)
   226 Transfer complete.
   ftp: 857 bytes received in 0.17Seconds 4.98Kbytes/sec.

   The following is a list of the files you may want to back up. Not all files may be available. You will need to put the names in quotes. You may rename the files when copying to your computer. When restoring the files you must however use the exact file names.

   a. DC Config1 #.##.bin
      #.## is the firmware version number of the DC
   b. DC Sites. bin
      Contains the Site definition table.
   c. DC Primary Route. bin
      Contains the Primary Routing table.
   d. DC Alternate Route. bin
      Contains the Alternate Routing table.

   You may have additional files stored on the DC. These files are used for other features of the DC. Typically these files will be for custom web pages or messages.

7. If you are restoring or cloning a DC copy them from your computer using the "Put" command.

   ftp> put "C:\DC Config 1.00.bin" "DC Config 1.00.bin"
   200 PORT command successful
   150 Opening BINARY mode data connection.
   226 Transfer OK. Got 857 bytes
   ftp: 857 bytes sent in 0.00Seconds 857000.00Kbytes/sec.

8. You can also delete files with the "Delete" command. Deleting a configuration file will have the effect of restoring the data stored in the file to the DC default values.

   ftp> Delete "DC Sites.bin"
   250 OK

9. When done enter "Bye" to close the FTP program or if you will be working with another DC use the "Close" command to close the connection.

10. Cycle the power on your DC or perform a Cold Boot. See Appendix K for Cold Boot instructions.

11. If cloning a DC, go to the Network Settings page and enter a new and unique IP address.

NOTE 1: When restoring the configuration you must spell the configuration files exactly as stated above. Any misspelling will cause the DC not to recognize the new configuration file.

NOTE 2: The DC configuration is version specific. You can not mix configuration files between firmware versions of a DC.

NOTE 3: The "DC Config #.##.bin" file contains the network settings. If you are cloning a DC the clone will have the exact same IP address as the original. After copying the files you will need to set the IP address of each DC to a unique number before you may use them on the same network.

Appendix D

Screw Terminal Connections, 5018-1, 2 AI/O 4 DI/O

Terminal	Description
1	+ Power. 10 to 26 VDC
2	Mode Selection Jumper. Connect to Terminal 4 to enable Primary or Master routing table.
3	- Power.
4	Mode Selection Jumper. Connect to Terminal 2 to enable Primary or Master routing table. *
5	Analog Input 1 (-) *
6	Analog Input 1 (+)
7	Analog Input 2 (-) *
8	Analog Input 2 (+)
9	Analog Output 1 (-) *
10	Analog Output 1 (+)
11	Analog Output 2 (-) *
12	Analog Output 2 (+)
13	Digital Input 1 Dry Contact *
14	Digital Input 1 Dry Contact
15	Digital Input 2 Dry Contact *
16	Digital Input 2 Dry Contact
17	Digital Input 3 Dry Contact *
18	Digital Input 3 Dry Contact
19	Digital Input 4 Dry Contact *
20	Digital Input 4 Dry Contact
21	Digital Output 1 Dry Contact
22	Digital Output 1 Dry Contact
23	Digital Output 2 Dry Contact
24	Digital Output 2 Dry Contact
25	Digital Output 3 Dry Contact
26	Digital Output 3 Dry Contact
27	Digital Output 4 Dry Contact
28	Digital Output 4 Dry Contact

* Indicates terminals that are internally connected to – Power.

Screw Terminal Connections, 5018-3, 4 AI/O 2 DI/O

Terminal	Description
1	+ Power. 10 to 26 VDC
2	Mode Selection Jumper. Connect to Terminal 4 to enable Primary or Master routing table.
3	- Power.
4	Mode Selection Jumper. Connect to Terminal 2 to enable Primary or Master routing table. *
5	Analog Input 1 (-) *
6	Analog Input 1 (+)
7	Analog Input 2 (-) *
8	Analog Input 2 (+)
9	Analog Input 3 (-) *
10	Analog Input 3 (+)
11	Analog Input 4 (-) *
12	Analog Input 4 (+)
13	Analog Output 1 (-) *
14	Analog Output 1 (+)
15	Analog Output 2 (-) *
16	Analog Output 2 (+)
17	Analog Output 3 (-) *
18	Analog Output 3 (+)
19	Analog Output 4 (-) *
20	Analog Output 4 (+)
21	Digital Input 1 Dry Contact *
22	Digital Input 1 Dry Contact
23	Digital Input 2 Dry Contact *
24	Digital Input 2 Dry Contact
25	Digital Output 1 Dry Contact
26	Digital Output 1 Dry Contact
27	Digital Output 2 Dry Contact
28	Digital Output 2 Dry Contact

* Indicates terminals that are internally connected to – Power.

Appendix E

DC to Modbus Register Translation Table

Use the table below to translate between the register names used in the DC and their Modbus register numbers.

NOTE 1: The DC uses long integers (32 bit) while Modbus register use short integers (16 bit). Odd numbered 3xxxxx or 4xxxxx register are the lower 16 bits of the DC register and Even 3xxxx or 4xxxx registers are the upper 16bits.

NOTE 2: The DC has more registers than those listed in the table below. These registers are for future expansion. Do not write any register not listed below.

NOTE 3: The Data Controller has built in scaling and calibration and reports analog inputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

NOTE 4: The Data Controller has built in scaling and calibration and reports analog outputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

NOTE 5: The Data Controller has 512 general purpose transfer bits. All bits within a 16 bit block must be written before the bits may be successfully read. If less than 16 bits are used then the remaining bits must be padded to the next 16 bit boundary. Bits may be padded by adding a local transfer from the DC's inputs (DI) or outputs (DO) to the unused bits. Boundaries occur at: BIT(1); BIT(17); BIT(33); etc.

DC Register	Modbus Register(s)	Description
DO(1)	00001	Digital Output 1
DO(2)	00002	Digital Output 2
DO(3)	00003	Digital Output 3 (5018-1 Only)
DO(4)	00004	Digital Output 4 (5018-1 Only)
DI(1)	10001	Digital Input 1
DI(2)	10002	Digital Input 2
DI(3)	10003	Digital Input 3 (5018-1 Only)
DI(4)	10004	Digital Input 4 (5018-1 Only)
BIT(1)	00129	First General purpose Transfer Bits (See NOTE 5)
BIT(512)	00641	Last General purpose Transfer Bits (See NOTE 5)
AI(1)	30001 30002	Analog Input 1 (see NOTE 3) (Even register will read 0 or -1. see NOTE 1)
AI(2)	30003 30004	Analog Input 2 (see NOTE 3) (Even register will read 0 or -1. see NOTE 1)
AI(1)	30001 30002	Analog Input 3 (5018-3 Only) (see NOTE 3) (Even register will read 0 or -1. see NOTE 1)
AI(2)	30003 30004	Analog Input 4 (5018-3 Only) (see NOTE 3) (Even register will read 0 or -1. see NOTE 1)
AO(1)	40001 40002	Analog Output 1 (see NOTE 4) (Even register will read 0 or -1. see NOTE 1)
AO (2)	40003 40004	Analog Output 2 (see NOTE 4) (Even register will read 0 or -1. see NOTE 1)
AO(1)	40001 40002	Analog Output 3 (5018-3 Only) (see NOTE 4) (Even register will read 0 or -1. see NOTE 1)
AO (2)	40003 40004	Analog Output 4 (5018-3 Only) (see NOTE 4) (Even register will read 0 or -1. see NOTE 1)
CNT(1)	40017 40018	Counter 1 (see NOTE 1)
CNT (2)	40019 40020	Counter 2 (see NOTE 1)
CNT(3)	40021 40022	Counter 3 (5018-1 Only) (see NOTE 1)
CNT (4)	40023 40024	Counter 4 (5018-1 Only) (see NOTE 1)
VAR(1)	40129 40130	First General Purpose Transfer Variable (see NOTE 1)
VAR(512)	41153 41154	First General Purpose Transfer Variable (see NOTE 1)

Appendix F

DC Factory Defaults

As a Factory Default the DC is set up to transfer I/O from one DC to another using ASCII Modbus communicating at 9600 baud. The master is selected by installing a jumper between terminal 2 and 4 on the screw terminal block.

The table below shows the default settings for a DC. The settings are grouped according to the page where the settings are modified.

Description	Setting
DC Title Setup	
Site Name	AGM Electronics Inc. Data Controller
Location	
Description	
DC Time Setup	
Current Time	NOTE: Current Time is not effected by resetting the defaults. Should the DC internal Lithium battery fail the Current Time will revert to 1/1/1980.
Time Display Format	Month/Date/Year Hour:Minute
DC Network Setup	
IP Address	192.168.0.251
Netmask	255.255.255.0
Gateway IP	192.168.0.1
Domain Name Server (DNS)	198.77.116.8
HTTP Port	80
FTP Port	21
DC Security Setup	
User ID	All ID's are blank except for the fixed "Admin" ID.
Password	password
Log Off After	15 Minutes
Port Setup Port A(RS232)	
Baud Rate	9600
Communications Fail Interval	0.0 This sets the DC to the default interval of .5 seconds.
Slave Protocol	ASCII Modbus
Slave Address	1

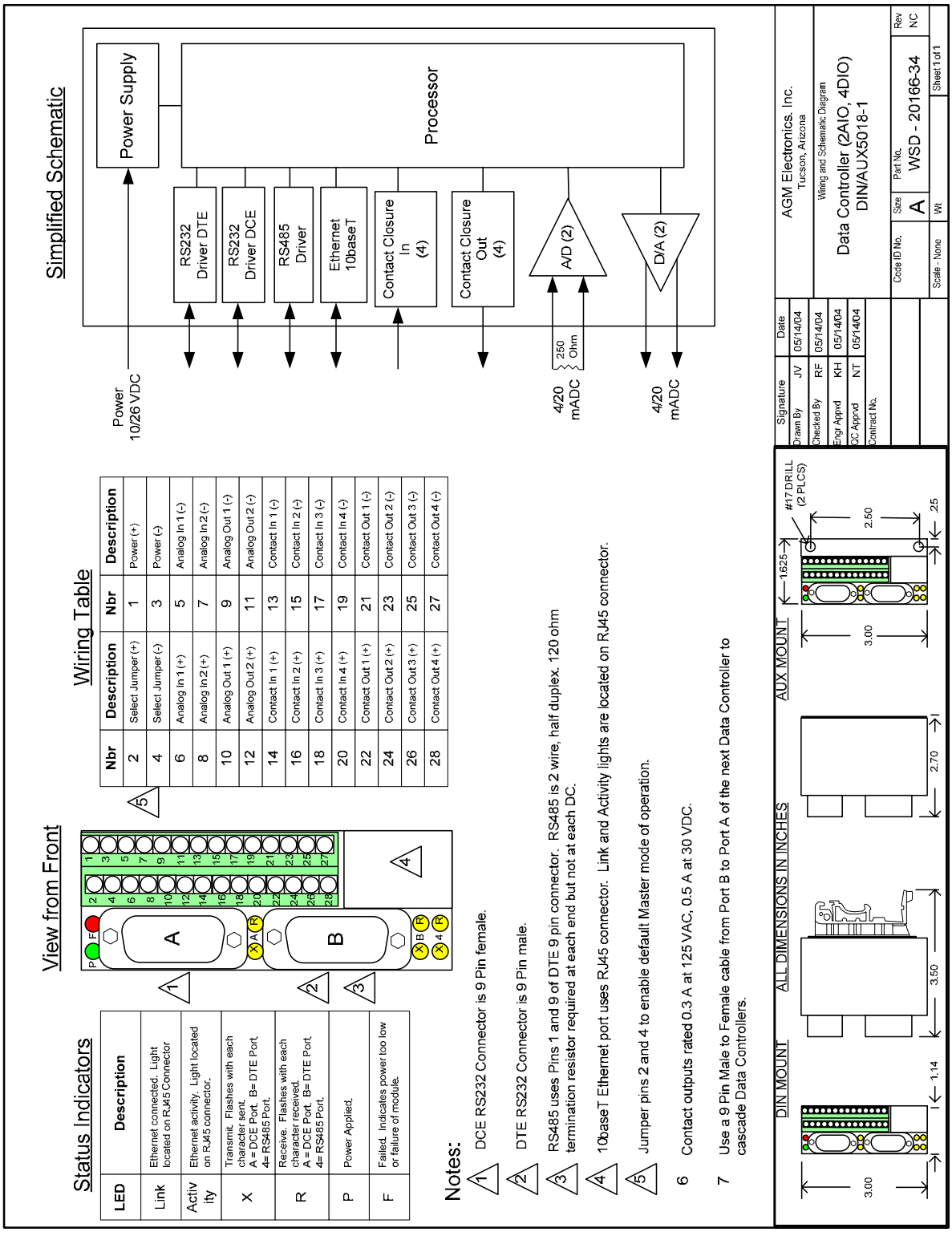
Port Setup Port B(RS232/RS485)	
Baud Rate	9600
Communications Fail Interval	0.0 This sets the DC to the default interval of .5 seconds.
Connection Type	Auto Port B will automatically detect the presence of a RS232 connection and switch from RS485 to RS232 mode when RS232 is connected. DTR must be provided by the connected device.
Slave Protocol	ASCII Modbus
Slave Address	1
Port Setup Port C(TCP/IP)	
TCP Port Number	502
Communications Fail Interval	0.0 This sets the DC to the default interval of .5 seconds.
Slave Protocol	Not used
Port Setup Port D(TCP/IP)	
TCP Port Number	0 TCP port is disabled.
Communications Fail Interval	0.0 This sets the DC to the default interval of .5 seconds.
Slave Protocol	Not used
DC Transfer Sites Site # 1	
Site Name	Remote
Port	A
Protocol	DC (ASCII Modbus)
Device Address	1
IP Address	Blank
TCP Port	502
DC Transfer Sites Remaining Sites	
Site Name	
Port	NU
Protocol	Select Protocol
Device Address	1
IP Address	
TCP Port	502

Primary Routing Table Route # 1	
Quantity	2 (5018-1) or 4 (5018-3)
From Site	Local
From Register #	AI(1)
To Site	Remote
To Register #	AO(1)
Primary Routing Table Route # 2	
Quantity	4 (5018-1) or 2 (5018-3)
From Site	Local
From Register #	DI(1)
To Site	Remote
To Register #	DO(1)
Primary Routing Table Route # 3	
Quantity	2 (5018-1) or 4 (5018-3)
From Site	Remote
From Register #	DI(1)
To Site	Local
To Register #	DO(1)
Primary Routing Table Route # 4	
Quantity	4 (5018-1) or 2 (5018-3)
From Site	Remote
From Register #	AI(1)
To Site	Local
To Register #	AO(1)
Primary Routing Table Remaining #	
Quantity	0
From Site	
From Register #	
To Site	
To Register #	

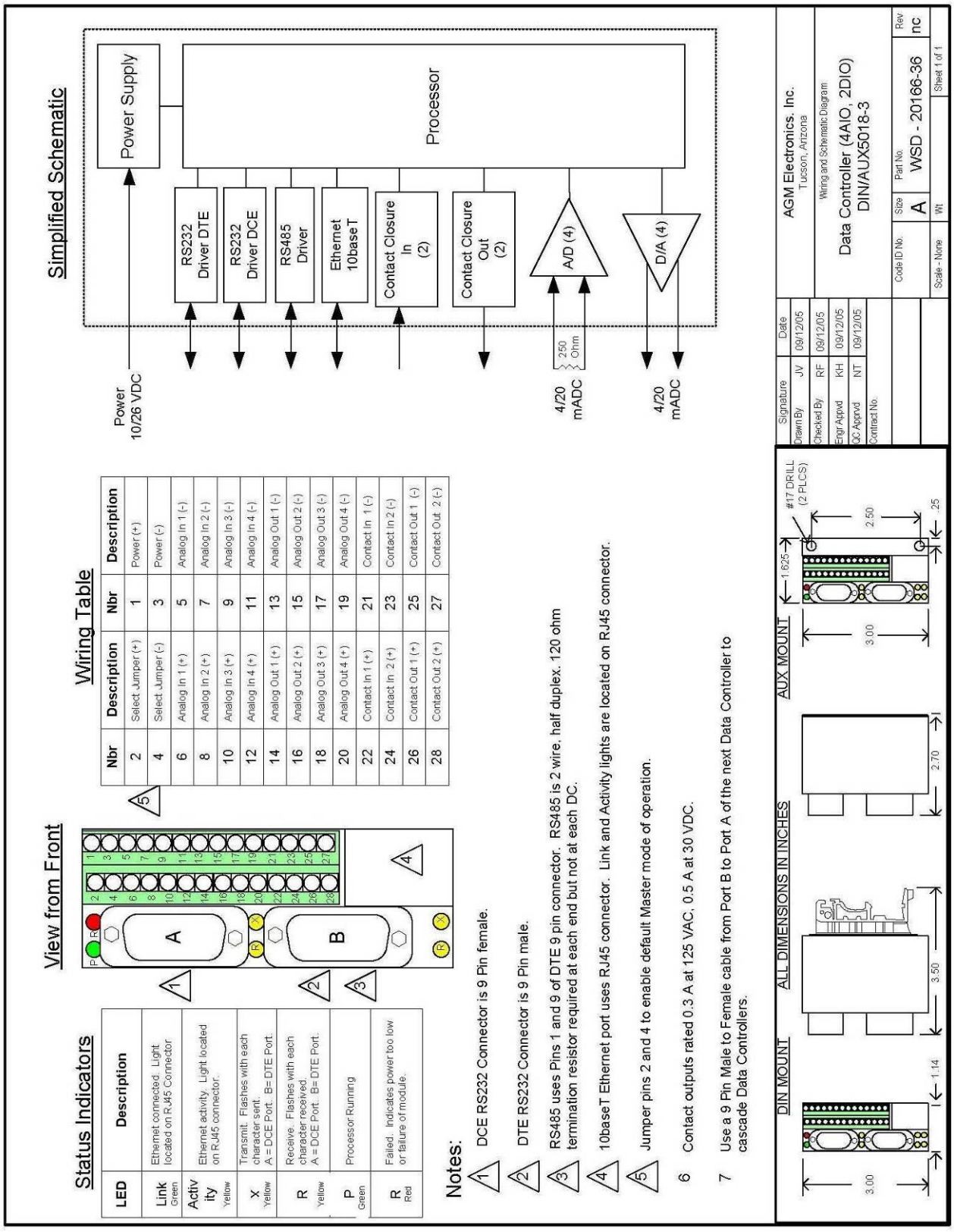
Alternate Routing Table All Route #	
Quantity	0
From Site	
From Register #	
To Site	
To Register #	

Appendix G

DC - Wiring and Simplified Diagram, 5018-1



DC - Wiring and Simplified Diagram, 5018-3



Nbr	Description	Nbr	Description
2	Select Jumper (+)	1	Power (+)
4	Select Jumper (-)	3	Power (-)
6	Analog In 1 (+)	5	Analog In 1 (-)
8	Analog In 2 (+)	7	Analog In 2 (-)
10	Analog In 3 (+)	9	Analog In 3 (-)
12	Analog In 4 (+)	11	Analog In 4 (-)
14	Analog Out 1 (+)	13	Analog Out 1 (-)
16	Analog Out 2 (+)	15	Analog Out 2 (-)
18	Analog Out 3 (+)	17	Analog Out 3 (-)
20	Analog Out 4 (+)	19	Analog Out 4 (-)
22	Contact In 1 (+)	21	Contact In 1 (-)
24	Contact In 2 (+)	23	Contact In 2 (-)
26	Contact Out 1 (+)	25	Contact Out 1 (-)
28	Contact Out 2 (+)	27	Contact Out 2 (-)

LED	Description
Link Green	Ethernet connected. Light located on RJ45 Connector
Activity Yellow	Ethernet activity. Light located on RJ45 connector.
X Yellow	Transmit. Flashes with each character sent. A = DCE Port. B= DTE Port.
R Yellow	Receive. Flashes with each character received. A = DCE Port. B= DTE Port.
P Green	Processor Running
R Red	Failed. Indicates power too low or failure of module.

1. DCE RS232 Connector is 9 Pin female.
2. DTE RS232 Connector is 9 Pin male.
3. RS485 uses Pins 1 and 9 of DTE 9 pin connector. RS485 is 2 wire, half duplex. 120 ohm termination resistor required at each end but not at each DC.
4. 10baseT Ethernet port uses RJ45 connector. Link and Activity lights are located on RJ45 connector.
5. Jumper pins 2 and 4 to enable default Master mode of operation.
6. Contact outputs rated 0.3 A at 125 VAC, 0.5 A at 30 VDC.
7. Use a 9 Pin Male to Female cable from Port B to Port A of the next Data Controller to cascade Data Controllers.

Appendix H

DC to SPM9000 (Data Handler) Register Translation Table

Use the table below to translate between the register names used in the DC and the register used in the Data Handlers.

The syntax used for communicating to the Data Handlers is: "$";device address; command; register address; delimiter ",", "d" or "x", "data"; "@"; checksum. The delimiter and data are only used for the write commands. The "@" and checksum are only required for RV and WV commands. See the example column below for examples of the commands and typical responses. All examples use the actual checksum, for testing you may use "FF" is place of the checksum. E.g. $1RV128@FF.

NOTE 1: Analog I/O registers can be read or written as a floating point number or integer. If read as an integer an implied decimal point of 2 digits is used. E.g. 100.00 will be displayed as 10000.

NOTE 2: The DC has more registers than those listed in the table below. These registers are for future expansion. Do not write any register not listed below.

NOTE 3: The Data Controller has built in scaling and calibration and reports analog inputs as an integer in from 0 to 10000 (0 to 100.00 floating point) which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 (100.00 floating point) is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

NOTE 4: The Data Controller has built in scaling and calibration and reports analog outputs as an integer in from 0 to 10000 (0 to 100.00 floating point) which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 (100.00 floating point) is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

NOTE 5: When setting up some AGM Electronics equipment such as the GPM the DH register number entered in the GPM is one higher that the DH Register number listed in the table.

DC Register	DH Register	Description	Example Command	Example Results
DI(1)	128	Digital Input 1	$1RV128d@10	$Y1@74
DI(2)	129	Digital Input 2	$1RV129d@12	$Y0@73
DI(3)	130	Digital Input 3 (5018-1 Only)	$1RV130d@04	$Y1@74
DI(4)	131	Digital Input 4 (5018-1 Only)	$1RV131d@06	$Y0@73
DO(1)	144	Digital Output 1	$1RV144d@10	$Y0@73
DO(2)	145	Digital Output 2	$1WV145d1@90	$Y
DO(3)	146	Digital Output 3 (5018-1 Only)	$1RV146d@14	$Y1@74
DO(4)	147	Digital Output 4 (5018-1 Only)	$1RV147d@16	$Y0@73
AI(1)	0	Analog Input 1 (see NOTE 3)	$1RV0@ED	$Y25.25@49
AI(2)	1	Analog Input 2 (see NOTE 3)	$1RV1@EE	$Y75.01@93
AI(3)	2	Analog Input 3 (see NOTE 3) (5018-3 Only)	$1RV2@EF	$Y25.25@49
AI(4)	3	Analog Input 4 (see NOTE 3) (5018-3 Only)	$1RV3@F0	$Y75.01@93
AO(1)	8	Analog Output 1 (see NOTE 4)	$1RV8@FF	$Y75.01@93
AO (2)	9	Analog Output 2 (see NOTE 4)	$1RV9@FF	$Y25.25@49
AO(3)	10	Analog Output 1 (see NOTE 4) (5018-3 Only)	$1RV10@FF	$Y75.01@93
AO (4)	11	Analog Output 2 (see NOTE 4) (5018-3 Only)	$1RV11@FF	$Y25.25@49
CNT(1)	16	Counter 1	$1RV16d@FF	$Y0@73
CNT (2)	17	Counter 2	$1WV17d1@FF	$Y
CNT (3)	18	Counter 3	$1RV18d@FF	$Y1@74
CNT (4)	19	Counter 4	$1RV19d@FF	$Y0@73
		Firmware Version	$-1VERS	DC 1.01
All		All I/O registers	$-1RD	

Appendix I

Communications Failure Detection

Communications Failure Detection is available for a DC operating as a master or slave.

For DC's operating as a master, two types of failure detection are available. One type is based on the time out of a single data transfer. The second type is based on an adjustable Communications Fail Interval is set in the I/O Settings section. The first option will provide faster detection of communications failure while the second option will provide more fault tolerance. The first option should only be used for wired connections as it will indicate an error on any communications timeout. The second option is recommended for radio systems.

For DC's operating as a slave an adjustable Communications Fail Interval is set in the I/O Settings section.

Communications status is indicated by internal status bits which may be transferred to Digital Outputs to indicate the communications status. The following table describes each of the status bits.

DC Register	Modbus Register	Description
TOUT(1)	00125	Indicates the communications interval specified by Communications Fail Interval in the I/O Settings section has timed out. 1 = Communications Failed, 0 = Communications Okay.
UPD(1)	00126	Indicates the DC is communicating and the communications interval has not timed out. This is the inverse of the TOUT(1) bit. 1 = Communications OK, 0 = Communications Failed.
COMOK(1)	00127	Master Only. Indicates the DC is communicating successfully with all sites. No errors detected.
COMERR(1)	00128	Master Only. Indicates at least one communications failure has been detected.
OK(#)	01281	Master Only. Indicates the DC is communicating successfully with the specified site. "#" is the Site Number.
FAIL(#)	01025	Master Only. Indicates a communications error has been detected with the specified site. "#" is the Site Number.

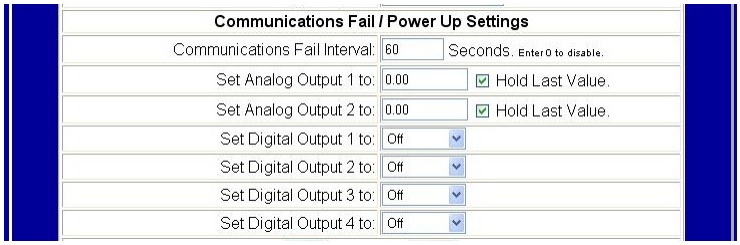
The following two examples show typical steps required to set up the DC's to detect communications failure. These are only two examples and other variations are possible depending on the system configuration.

Communications Fail Example 1

The following example shows a typically application using 2 DC's which indicate successfully communications by setting Digital Output 4 on when communicating successfully and off after 60 seconds of no communications activity.

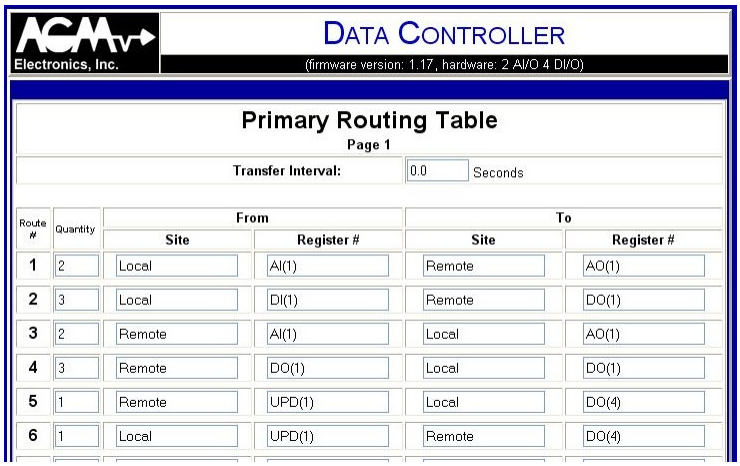
1. On both the master and slave DC the Communications Fail Interval is set to 60 seconds. This is required so both the master and slave can detect a communications failure. As the Digital Output 4 will be indicating successful communications it is set to turn off when the Communications Fail Interval has timed out.

   Other Digital Outputs and the Analog Outputs will be set to the state required when communications has failed. In the case of this example the Analog Outputs will retain their last values while the Digital Outputs will be turned off.



2. In the Master DC's routing table two items are added to the normal transfer.

   Route numbers 1 through 4 are the normal I/O transfers between the two sites. Note that only 3 Inputs are transferred to the Outputs. Output 4 will indicate the communications status so it should not be transferred.



Route #	Quantity	From Site	From Register #	To Site	To Register #
1	2	Local	AI(1)	Remote	AO(1)
2	3	Local	DI(1)	Remote	DO(1)
3	2	Remote	AI(1)	Local	AO(1)
4	3	Remote	DO(1)	Local	DO(1)
5	1	Remote	UPD(1)	Local	DO(4)
6	1	Local	UPD(1)	Remote	DO(4)

   Route number 5 and 6 transfer the communications status from one site to the others Digital Output 4. It is possible to use the local UPD(1) status and to indicate successful communications. Transferring the UPD(1) status is used as an additional check on the communications status. Without this check it would be possible for one site to indicate failed communications while the other site indicates successful communications.

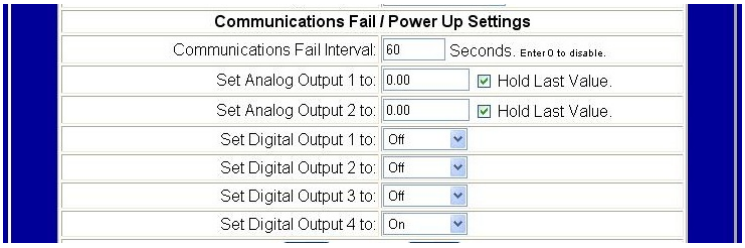
Communications Fail Example 2

The following example shows a typically application using 2 DC's. The Master DC will indicate a communications fail by setting Digital Output 4 when any errors in transferring data is detected. The Slave will indicate a communications error by setting Digital Output 4 when communications is interrupted for 60 seconds or more.

1. In the case of this example a communications fail is to be indicated on both the master and slave DC so on both the master and slave DC the Communications Fail Interval is set to 60 seconds. If only communications errors are to be indicated on the master DC then the Communications Fail Interval can be set to 0.

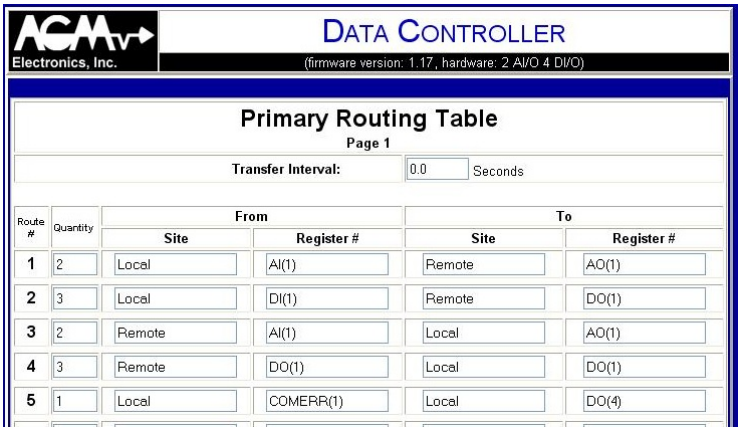
   Digital Output 4 must be set to turn on when the Communications Fail Interval times out.

   Other Digital Outputs and the Analog Outputs will be set to the state required when communications has been interrupted for 60 seconds on more. In the case of this example the Analog Outputs will retain their last values while the Digital Outputs will be turned off.



2. In the Master DC's routing table one item is added to the normal transfer.

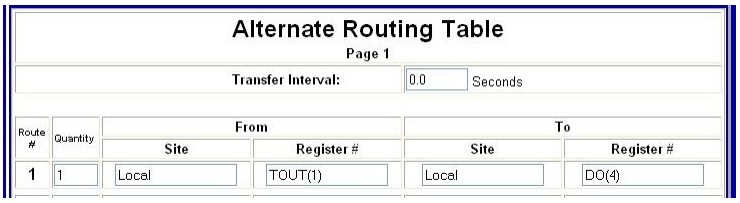
   Route numbers 1 through 4 are the normal I/O transfers between the two sites. Note that only 3 Inputs are transferred to the Outputs. Output 4 will indicate the communications status so it should not be transferred.



Route number 5 transfers the communications error status to Digital Output 4. COMERR(1) will be set when any transfer of data fails. COMERR(1) will indicate a failure even if the Communications Fail Interval is set to 0.

3. In the slave DC's a transfer between the local TOUT(1) and the local Digital Output 4 has been added. TOUT(1) is set when no communications has been received within the time set by the Communications Fail Interval. If a communications failure is not required on the slave DC then this transfer may be omitted.

   The Alternate Routing Table is enabled when the Select Jumper is not installed. (See Appendix G)



Alternate Routing Table

Page 1

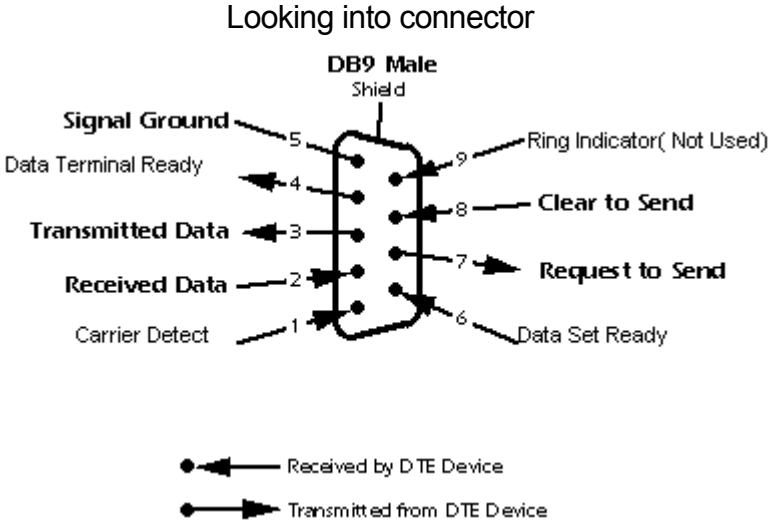
Transfer Interval: 0.0 Seconds

Route #	Quantity	From		To	
		Site	Register #	Site	Register #
1	1	Local	TOUT(1)	Local	DO(4)

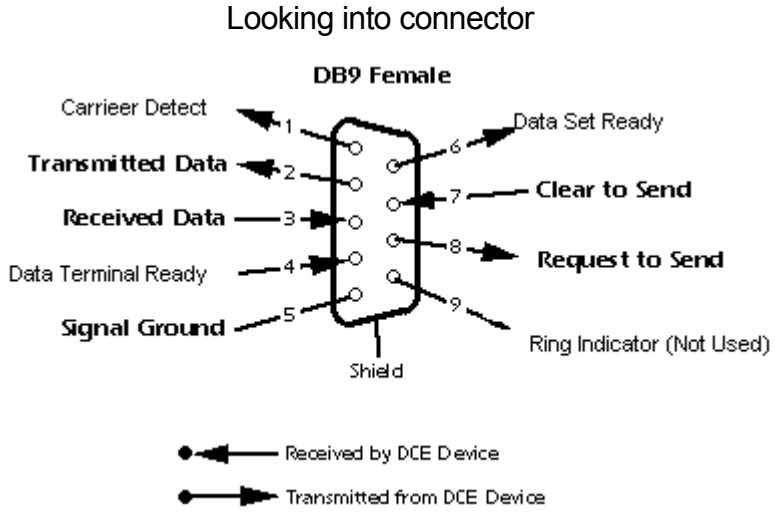
Appendix J

Connector Pin Outs

Top 9 Pin Connector, (DTE) Data Terminal Equipment

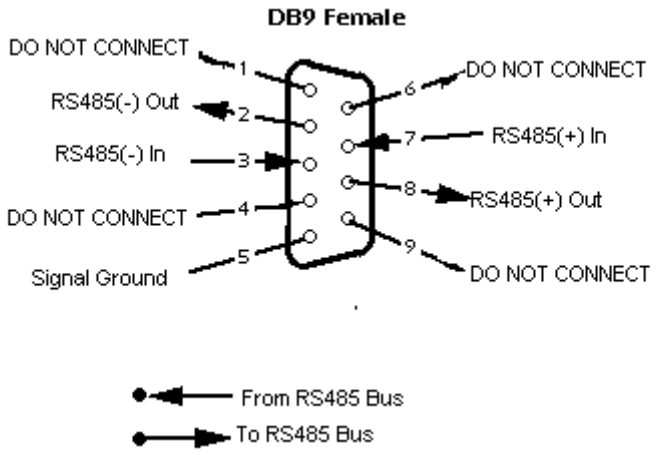


Bottom 9 Pin Connector, (DCE) Data Circuit-terminating Equipment



Bottom 9 Pin Connector, RS485 Mode

Looking into connector



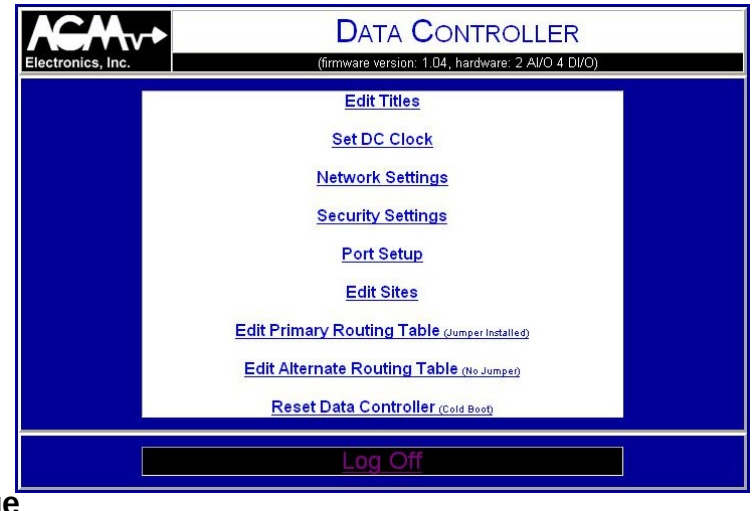
Appendix K

Remote Reset (Cold Boot)

When connected to a network the DC may be reset via the Administration Web page. This reset is a cold boot of the processor contained within the DC. All memory will be initialized and configuration files reloaded as if the power was cycled to the DC. This option is intended for diagnostics and for when new configuration files have been downloaded to the DC. See Appendix C for details on cloning a DC configuration files.

To reset the DC:

1. Go to the Administration Page.

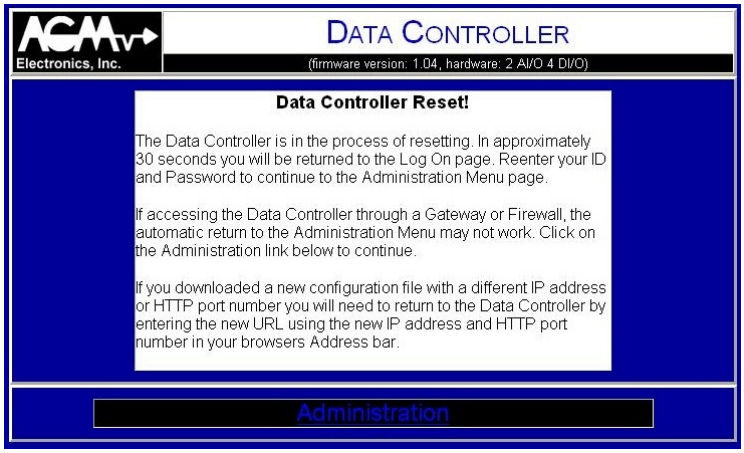


Administration Page

2. Click on the Reset Data Controller link. This will bring up the Reset Confirmation Page.

Reset Confirmation Page

3. If you wish to continue with the reset, click on the Yes button. This will bring up the Reset in Progress Page. When the DC has been reset you will automatically be returned to the Administration page. You will need to reenter your ID and Password to continue to the Administration Page.



Reset in Progress Page

WARNING: Resetting the DC will temporally suspend all communications and set all Analog and Digital Outputs to 0. The Analog and Digital Outputs will not change until communications has been reestablished. If resetting a slave device that is part of a larger system, the master may show a communications failure due to the suspension of communications. Communications will not become active again until the DC has been completely initialized. Typically, the reset will be complete in 30 seconds or less.

Appendix L

DC to DF1 Register Translation Table

Use the table below to translate between the register names used in the DC and their DF1 register numbers.

NOTE 1: The DC uses long integers (32 bit) while the DF1 I/O register use short integers (16 bit). Even numbered addresses O0:xx or I1:xx register are the lower 16 bits of the DC register and Odd O0:xx or I1:xx registers are the upper 16 bits.

NOTE 2: The DC has more registers than those listed in the table below. These registers are for future expansion. Do not write any register not listed below.

NOTE 3: The Data Controller has built in scaling and calibration and reports analog inputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

NOTE 4: The Data Controller has built in scaling and calibration and reports analog outputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

DC Register	DF1 Register(s)	Description
DO(1)	O0:00/0	Digital Output 1
DO(2)	O0:00/1	Digital Output 2
DO(3)	O0:00/2	Digital Output 3 (5018-1 Only)
DO(4)	O0:00/3	Digital Output 4 (5018-1 Only)
DI(1)	I1:00/0	Digital Input 1
DI(2)	I1:00/1	Digital Input 2
DI(3)	I1:00/2	Digital Input 3 (5018-1 Only)
DI(4)	I1:00/3	Digital Input 4 (5018-1 Only)
AI(1)	I1:02 I1:03	Analog Input 1 (see NOTE 3) (Odd register will read 0 or -1. see NOTE 1)
AI(2)	I1:04 I1:05	Analog Input 2 (see NOTE 3) (Odd register will read 0 or -1. see NOTE 1)
AI(1)	I1:06 I1:07	Analog Input 3 (5018-3 Only) (see NOTE 3) (Odd register will read 0 or -1. see NOTE 1)
AI(2)	I1:08 I1:09	Analog Input 4 (5018-3 Only) (see NOTE 3) (Odd register will read 0 or -1. see NOTE 1)
AO(1)	O0:02 O0:03	Analog Output 1 (see NOTE 4) (Odd register will read 0. see NOTE 1)
AO(2)	O0:04 O0:05	Analog Output 2 (see NOTE 4) (Odd register will read 0. see NOTE 1)
AO (3)	O0:06 O0:07	Analog Output 3 (5018-3 Only) (see NOTE 4) (Odd register will read 0. see NOTE 1)
AO (4)	O0:08 O0:09	Analog Output 4 (5018-3 Only) (see NOTE 4) (Odd register will read 0. see NOTE 1)

Appendix M

Ethernet/IP Classes, Service Codes, Attributes and Instances

Attributes

Class	Instance	Attribute	Service Codes	Name	Description
Identity 0x01	1	1	0x01, 0x0E	Vendor ID	AGM Electronics Inc. ODVA Register ID. 1002
		2	0x01, 0x0E	Device Type	DC is a ODVA Generic Device.
		3	0x01, 0x0E	Product Code	The product code is the same as the last 2 digits of the model number. Example: 5018-1 product code is 1.
		4	0x01, 0x0E	Revision	Firmware version number. Initial release for Ethernet/IP is 1.06.
		5	0x01, 0x0E	Status	Always 0.
		6	0x01, 0x0E	Serial Number	Unique Serial Number specific to Ethernet/IP. Number was derived from the Ethernet MAC. This is not the same serial number located on the Tag of the DC and is only used by Ethernet/IP.
		7	0x01, 0x0E	Product Name	Typically DC 5018-01. The number following the DC is the model number of the DC.
Assembly 0x04	0 (Class)	1	0x0E	Revision	Class revision number = 2
		2	0x0E	Max Instances	Maximum Number Instances = 32
		3	0x0E	Number Instances	Number of Instances = 32
	100	3	0x0E	AI(1)	Analog Input 1
	101	3	0x0E	AI(2)	Analog Input 2
	102	3	0x0E	AI(3)	Analog Input 3 (5018-3 Only)
	103	3	0x0E	AI(4)	Analog Input 4 (5018-3 Only)
	108	3	0x0E, 0x10	AO(1)	Analog Output 1
	109	3	0x0E, 0x10	AO(2)	Analog Output 2
	110	3	0x0E, 0x10	AO(3)	Analog Output 1 (5018-3 Only)
	111	3	0x0E, 0x10	AO(4)	Analog Output 2 (5018-3 Only)
	116	3	0x0E	DI(1)	Digital Input 1
	117	3	0x0E	DI(2)	Digital Input 2
	118	3	0x0E	DI(3)	Digital Input 3 (5018-1 Only)
	119	3	0x0E	DI(4)	Digital Input 4 (5018-1 Only)
	124	3	0x0E, 0x10	DO(1)	Digital Output 1
	125	3	0x0E, 0x10	DO(2)	Digital Output 2
	126	3	0x0E, 0x10	DO(3)	Digital Output 3 (5018-1 Only)
	127	3	0x0E, 0x10	DO(4)	Digital Output 4 (5018-1 Only)

Attributes (continued)

Class	Instance	Attribute	Service Codes	Name	Description
Digital Inputs 0x08	0 (Class)	1	0x0E	Revision	Class revision number = 2
		2	0x0E	Max Instances	Maximum Number of Instances = 8
		3	0x0E	Number Instances	Number of Instances = 8
	1	3	0x0E	DI(1)	Digital Input 1
	2	3	0x0E	DI(2)	Digital Input 2
	3	3	0x0E	DI(3)	Digital Input 3 (5018-1 Only)
	4	3	0x0E	DI(4)	Digital Input 4 (5018-1 Only)
Digital Outputs 0x09	0 (Class)	1	0x0E	Revision	Class revision number = 2
		2	0x0E	Max Instances	Maximum Number of Instances = 8
		3	0x0E	Number Instances	Number of Instances = 8
	1	3	0x0E, 0x10	DO(1)	Digital Output 1
	2	3	0x0E, 0x10	DO(2)	Digital Output 2
	3	3	0x0E, 0x10	DO(3)	Digital Output 3 (5018-1 Only)
	4	3	0x0E, 0x10	DO(4)	Digital Output 4 (5018-1 Only)
Analog Inputs 0x0A	0 (Class)	1	0x0E	Revision	Class revision number = 1
		2	0x0E	Max Instances	Maximum Number of Instances = 8
		3	0x0E	Number Instances	Number of Instances = 8
	1	3	0x0E	AI(1)	Analog Input 1 (see NOTE 1)
	2	3	0x0E	AI(2)	Analog Input 2 (see NOTE 1)
	3	3	0x0E	AI(3)	Analog Input 3 (5018-3 Only) see NOTE 1)
	4	3	0x0E	AI(4)	Analog Input 4 (5018-3 Only) (see NOTE 1)

NOTE 1: The Data Controller has built in scaling and calibration and reports analog inputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

Attributes (continued)

Class	Instance	Attribute	Service Codes	Name	Description
Analog Outputs 0x0B	0 (Class)	1	0x0E	Revision	Class revision number = 1
		2	0x0E	Max Instances	Maximum Number of Instances = 8
		3	0x0E	Number Instances	Number of Instances = 8
	1	3	0x0E, 0x10	AO(1)	Analog Output 1 (see NOTE 2)
	2	3	0x0E, 0x10	AO(2)	Analog Output 2 (see NOTE 2)
	3	3	0x0E, 0x10	AO(3)	Analog Output 3 (5018-3 Only) (see NOTE 2)
	4	3	0x0E, 0x10	AO(4)	Analog Output 4 (5018-3 Only) (see NOTE 2)
TCP/IP Interface 0xF5	1	1	0x0E	Status	TCP/IP can not be configured via Ethernet/IP. Status returned always 1.
		2	0x0E	Config. Capability	TCP/IP can not be configured via Ethernet/IP. Static IP and Port addresses used and configured via Web Page only. 0 always returned by this attribute.
		3	0x0E	Config. Control	TCP/IP can not be configured via Ethernet/IP. Static IP and Port addresses used and configured via Web Page only. 0 always returned by this attribute.
		4	0x0E	Physical Link	Path to Ethernet object. Always “20 F6 24 01”. (Values in Hex)
		5	0x0E	Interface Config.	TCP/IP can not be configured via Ethernet/IP. This attribute is read only. Values returned are the current IP address, Network Mask, Gateway Address, and Primary Name Server. Secondary Name Server is not used and will be 0.
		6	0x0E	Host Name	Not used. Attribute will always be 0.
Ethernet Link 0xF6	0 (Class)	1	0x0E	Revision	Class revision number = 2
	1	1	0x0E	Interface Speed	Only 10 Mbps is supported. 10 always returned for this attribute.
		2	0x0E	Interface Flags	Interface Status Flags.
		3	0x0E	Physical Address	MAC Address is returned for this attribute.

NOTE 2: The Data Controller has built in scaling and calibration and reports analog outputs as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or

write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

Service Codes

Class	Instance	Service Code	Name	Description
Identity 0x01	1	0x01	Get Attributes All	Returns all Identity class attributes.
		0x05	Reset	Setting to 0 or 1 will reset the DC as if power was cycled. Resetting to factory defaults via Ethernet/IP is not supported. After reset the DC will not be available for approximately 30 seconds.
		0x0E	Get Attributes Single	Reads the specified attribute. Setting attributes is not available for the Identity class.
Assembly 0x04	0, 100 - 131	0x0E	Get Attributes Single	Reads the specified attribute.
		0x10	Set Attribute Single	Sets the specified attribute.
Connection Manager 0x06	1	0x54	Forward Open	Opens Ethernet/IP connection.
		0x4E	Forward Close	Closes Ethernet/IP connection.
Digital Inputs 0x08	0, 1 - 8	0x0E	Get Attributes Single	Reads the specified attribute.
Digital Outputs 0x09	0, 1 - 8	0x0E	Get Attributes Single	Reads the specified attribute.
		0x10	Set Attribute Single	Sets the specified attribute.
Analog Inputs 0x09	0, 1 - 8	0x0E	Get Attributes Single	Reads the specified attribute.
Analog Outputs 0x0A	0, 1 - 8	0x0E	Get Attributes Single	Reads the specified attribute.
		0x10	Set Attribute Single	Sets the specified attribute.
TCP/IP Interface 0xF5	0, 1	0x0E	Get Attributes Single	Reads the specified attribute.
Ethernet Link 0xF6	0, 1	0x0E	Get Attributes Single	Reads the specified attribute.

Electronic Data Sheet

The following is the text from the Electronics Data Sheet DC1.eds used by Ethernet/IP configuration utilities for 5018-1.

```
[File]
        DescText = "AGM Electronics Data Controller";
        CreateDate = 03-30-2006;
        CreateTime = 14:50:00;
        ModDate = 03-31-2006
        ModTime = 10:52:00
        Revision = 1.2;

[Device]
        VendCode = 1002;
        VendName = "AGM Electronics Inc.";
        ProdType = 0;
        ProdTypeStr = "DC";
        ProdCode = 1;
        MajRev = 1;
        MinRev = 6;
        ProdName = "DC 5018-01";

[Device Classification]
        Class1 = EtherNetIP;
```

The following is the text from the Electronics Data Sheet DC3.eds used by Ethernet/IP configuration utilities for 5018-3.

```
[File]
        DescText = "AGM Electronics Data Controller";
        CreateDate = 03-30-2006;
        CreateTime = 14:50:00;
        ModDate = 03-31-2006
        ModTime = 10:52:00
        Revision = 1.2;

[Device]
        VendCode = 1002;
        VendName = "AGM Electronics Inc.";
        ProdType = 0;
        ProdTypeStr = "DC";
        ProdCode = 1;
        MajRev = 1;
        MinRev = 6;
        ProdName = "DC 5018-03";

[Device Classification]
        Class1 = EtherNetIP;
```

Appendix N

DNP3 Device Profile

The purpose of this appendix is to describe specific configuration and interoperability information for an implementation of the Distributed Network Protocol (DNP), Version 3.0 using AGM Electronics Inc. Data Controllers. This document, in conjunction with the DNP 3.0 Basic 4 Document Set, and the DNP Subset Definitions Document, provides complete information on how to communicate via the DNP 3.0 protocol.

This implementation of DNP 3.0 is targeted to be compliant with DNP 3.0 Subset Definition Level 1 with some functionality beyond Subset Level 1.

The following table provides a "Device Profile Document" in the standard format defined in the DNP 3.0 Subset Definitions Document.

<table>
<tr><td colspan="2">DNP V3.0
DEVICE PROFILE DOCUMENT</td></tr>
<tr><td colspan="2">Vendor Name: AGM Electronics Inc.</td></tr>
<tr><td colspan="2">Device Name: AGM Data Controller (DC), Series ( ) 5018-1</td></tr>
<tr><td>Highest DNP Level Supported:

For Requests: Level 1
For Responses: Level 1</td><td>Device Function:

☐ Master
☒ Slave</td></tr>
<tr><td colspan="2">Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported :

None.</td></tr>
<tr><td>Maximum Data Link Frame Size (octets):

Transmitted: 292
Received 292</td><td>Maximum Application Fragment Size (octets):

Transmitted: 292
Received 292</td></tr>
<tr><td>Maximum Data Link Re-tries:

☒ None
☐ Fixed
☐ Configurable from 0 to 255</td><td>Maximum Application Layer Re-tries:

☒ None
☐ Configurable</td></tr>
<tr><td colspan="2">Requires Data Link Layer Confirmation:

☒ Never
☐ Always
☐ Sometimes</td></tr>
</table>

DNP V3.0

DEVICE PROFILE DOCUMENT

Requires Application Layer Confirmation:

- ☐ **Never**
- ☐ Always
- ☒ When reporting Event Data (Slave devices only)
- ☐ When sending multi-fragment responses (Slave devices only)
- ☐ Sometimes

Timeouts while waiting for:

Data Link Confirm:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable.
Complete Appl. Fragment:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable
Application Confirm:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable**.**
Complete Appl. Response:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable

Sends/Executes Control Operations:

WRITE Binary Outputs	☒	Never	☐	Always	☐	Sometimes	☐	Configurable
SELECT/OPERATE	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
DIRECT OPERATE	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
DIRECT OPERATE – NO ACK	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Count > 1	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Pulse On	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Pulse Off	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Latch On	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Latch Off	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Queue	☐	Never	☒	Always	☐	Sometimes	☐	Configurable
Clear Queue	☐	Never	☒	Always	☐	Sometimes	☐	Configurable

Reports Binary Input Change Events when no specific variation requested:

- ☒ **Never**
- ☐ Only time-tagged
- ☐ Only non-time-tagged
- ☐ Configurable to send one or the other

Reports time-tagged Binary Input Change Events when no specific variation requested:

- ☐ **Never**
- ☒ Binary Input Change With Time
- ☐ Binary Input Change With Relative Time
- ☐ Configurable

Sends Unsolicited Responses:

- ☒ **Never**
- ☐ Configurable
- ☐ Only certain objects
- ☐ Sometimes (attach explanation)
- ☐ Enable/Disable Function Codes.

Sends Static Data in Unsolicited Responses:

- ☒ **Never**
- ☐ When Device Restarts
- ☐ When Status Flags Change

DNP V3.0

DEVICE PROFILE DOCUMENT

Default Counter Object/Variation:	Counters Roll Over at:
☐ No Counters Reported ☐ Configurable ☐ Default Object Default Variation: ☒ **Point-by-point list attached**	☐ No Counters Reported ☐ Configurable (attach explanation) ☐ 16 Bits ☒ **32 Bits** ☐ Other Value: _____ ☐ Point-by-point list attached

Sends Multi-Fragment Responses:

☐ Yes

☒ **No**

Sequential File Transfer Support:

Append File Mode	☐ Yes	☒ **No**
Custom Status Code Strings	☐ Yes	☒ **No**
Permissions Field	☐ Yes	☒ **No**
File Events Assigned to Class	☐ Yes	☒ **No**
File Events Send Immediately	☐ Yes	☒ **No**
Multiple Blocks in a Fragment	☐ Yes	☒ **No**
Max Number of Files Open	**0**	

DNP3 Implementation Table

The following table identifies which object variations, function codes, and qualifiers the AGM Electronics Inc. Data Controller supports in both request messages and in response messages.

In the table below, text shaded as 00 (start, stop) indicates supported functionality beyond Subset Level 1.

OBJECT			REQUEST (DC will parse)		RESPONSE (DC will respond with)	
Object Number	**Variation Number**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
1	0	Binary Input – Any Variation	1 (read)	06 (See Note 1)		
1	1	Binary Input			129 (response)	00 (start-stop)
2	2	Binary Input Change with Time			129 (response)	17 (index)
10	0	Binary Output Status – Any Variation	1 (read)	06 (See Note 1)		
10	2	Binary Output Status			129 (response)	00 (start-stop)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17 (index)	129 (response)	echo of request
20	0	Binary Counter – Any Variation	1 (read)	06 (See Note 1)		
20	5	32-Bit Binary Counter without Flag			129 (response)	00 (start-stop)
21	0	Frozen Counter – Any Variation	1 (read)	06 (See Note 1)		
21	5	32-Bit Frozen Counter with Time of Freeze			129 (response)	00 (start-stop)
30	0	Analog Input - Any Variation	1 (read)	06 (See Note 1)		
30	3	32-Bit Analog Input without Flag			129 (response)	00 (start-stop)
40	0	Analog Output Status - Any Variation	1 (read)	06 (See Note 1)		
40	1	32-Bit Analog Output Status			129 (response)	00 (start-stop)
41	1	32-Bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17 (index)	129 (response)	echo of request

OBJECT			REQUEST (DC will parse)		RESPONSE (DC will respond with)	
Object Number	**Variation Number**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
50	0	Time and Date	1 (read)	06		
50	1	Time and Date	2 (write)	07	129 (response)	07 (limited qty) (qty = 1)
52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
60	1	Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class 1 Data	1 (read)	06 (no range, or all)		
60	3	Class 2 Data	1 (read)	06 (no range, or all)		
60	4	Class 3 Data	1 (read)	06 (no range, or all)		
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			

Implementation Notes:

1. Only the 06 Qualifier Code is supported, however any Qualifier Code will be accepted. The DC will return all data regardless of the Qualifier Code specified.

2. Writes of Internal Indications are only supported for index 7 (Restart IIN1-7).

3. Cold restarts (command 13) and warm restarts (command 14) will cause the DC to go through a power on reset. The DC will remain unavailable for approximately 30 seconds after a restart. Cold and warm restarts will effect the entire operation of the DC and not just the DNP3 communications.

4. The DC model 5018-1 supports 4 Digital I/O, 4 counters, and 2 Analog I/O. Other models of the DC will have different I/O combinations.

5. Only the single octet qualifier codes 00 (start-stop) and 17 (index) are used. To remain compliant with Level 1, additional qualifier codes such as 01 (2 octet start-stop) and 28 (2 octet index) are supported however only the first octet is used.

6. Only a single frame or fragment is supported. All static I/O will be reported within the single frame and up to 16 events.

7. Each Event Class may have up to 16 events each of all types. Events and the classes used are configured through the DC's DNP3 Protocol Settings page

8. Outputs, Frozen Counters and Frozen Analog Inputs may be reported via a Class 0 poll. Selection of this option is done through the DC's DNP3 Protocol Settings page.

DNP3 Point List, 5018-1

The tables below identify all the data points provided by the implementation of the AGM Electronics Inc. Data Controller Model 5018-1 with the standard DNP3 application. Other Data Controller Models will have different combinations of data points.

Binary Input Points

The Data Controller Model 5018-1 has 4 binary contact closure inputs. The following table is for this model only.

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported: **1 (Binary Input without status)**
Change Event Variation: **2 (Binary Input Change with Time)**

Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0	Digital input 1. Contact closure.	Depends on configuration
1	Digital input 2. Contact closure.	Depends on configuration
2	Digital input 3. Contact closure.	Depends on configuration
3	Digital input 4. Contact closure.	Depends on configuration

Binary Output Status Points and Control Relay Output Blocks

Binary Output Status Points
Object Number: **10**
Request Function Codes supported: **1 (read)**
Default Variation reported: **2 (Binary Output Status)**
Control Relay Output Blocks
Object Number: **12**
Request Function Codes supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

Point Index	Name/Description	Supported Control Relay Output Block Fields
0	Relay Output 1	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.
1	Relay Output 2	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.
2	Relay Output 3	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.
3	Relay Output 4	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.

Counters

The Data Controller Model 5018-1 increments counters on either a on to off, off to on or change of state transition for the binary inputs therefore counter events are not implemented. The following table indicates the counters used.

Binary Counters Static (Steady-State) Object Number: **20** Request Function Codes supported: **1 (read)** Static Variation reported: **5 (32-Bit Binary Counter without Flag)**		
Point Index	**Name/Description**	**Change Event Assigned Class (1, 2, 3 or none)**
0	Incremented on change of state of Digital Input 1.	none
1	Incremented on change of state of Digital Input 2.	none
2	Incremented on change of state of Digital Input 3.	none
3	Incremented on change of state of Digital Input 4.	None

Frozen Counters

The Data Controller Model 5018-1 increments counters on either a on to off, off to on or change of state transition for the binary inputs therefore counter events are not implemented. The following table indicates the counters used.

Frozen Binary Counters Static (Steady-State) Object Number: **21** Request Function Codes supported: **1 (read)** Static Variation reported: **5 (32-Bit Frozen Counter with Time of Freeze)** Freeze Function Codes supported: **7 (Immediate Freeze)** **8 (Immediate Freeze, No Acknowledgement)** **9 (Freeze and Clear)** **10 (Freeze and Clear, No Acknowledgement)** **11 (Freeze with Time)** **12 (Freeze with Time, No Acknowledgement)**		
Point Index	**Name/Description**	**Change Event Assigned Class (1, 2, 3 or none)**
0	Incremented on change of state of Digital Input 1.	none
1	Incremented on change of state of Digital Input 2.	none
2	Incremented on change of state of Digital Input 3.	none
3	Incremented on change of state of Digital Input 4.	None

Analog Inputs

The following table lists Analog Inputs.

The Data Controller has built in scaling and calibration and reports analog I/O as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

Analog Inputs			
Static (Steady-State) Object Number:	**30**		
Change Event Object Number:	**32**		
Request Function Codes supported:	**1 (read)**		
Static Variation reported:	**3 (32-Bit Analog Input no flag)**		
Point Index	**Name/Description**	**Valid Range**	**Default Change Event Assigned Class (1, 2, 3 or none)**
0	Analog input 1	0 to 10000 (Calibrated)	none
1	Analog input 2	0 to 10000 (Calibrated)	none

Frozen Analog Inputs

Static (Steady-State) Object Number:	**31**		
Request Function Codes supported:	**1 (read)**		
Static Variation reported:	**3 (32-Bit Frozen Counter with Time of Freeze)**		
Freeze Function Codes supported:	**7 (Immediate Freeze)** **8 (Immediate Freeze, No Acknowledgement)** **9 (Freeze and Clear)** **10 (Freeze and Clear, No Acknowledgement)** **11 (Freeze with Time)** **12 (Freeze with Time, No Acknowledgement)**		
Point Index	**Name/Description**	**Valid Range**	**Default Change Event Assigned Class (1, 2, 3 or none)**
0	Analog input 1	0 to 10000 (Calibrated)	none
1	Analog input 2	0 to 10000 (Calibrated)	none

Analog Outputs

The following table lists both the Analog Output Status Points and the Analog Output Control Blocks.

The Data Controller has built in scaling and calibration and reports analog I/O as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

Analog Output Status Points	
Object Number:	**40**
Request Function Codes supported:	**1 (read)**
Default Variation reported:	**1 (32-Bit Analog Output Status)**
32-Bit Analog Output Blocks	
Object Number:	**41**
Request Function Codes supported:	**3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

Point Index	Name/Description	Valid Range
0	Analog Output 1.	0 to 10000 (Calibrated)
1	Analog Output 2.	0 to 10000 (Calibrated)

DNP3 Point List, 5018-3

The tables below identify all the data points provided by the implementation of the AGM Electronics Inc. Data Controller Model 5018-3 with the standard DNP3 application. Other Data Controller Models will have different combinations of data points.

Binary Input Points

The Data Controller Model 5018-1 has 4 binary contact closure inputs. The following table is for this model only.

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported: **1 (Binary Input without status)**
Change Event Variation: **2 (Binary Input Change with Time)**

Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0	Digital input 1. Contact closure.	Depends on configuration
1	Digital input 2. Contact closure.	Depends on configuration

Binary Output Status Points and Control Relay Output Blocks

Binary Output Status Points
Object Number: **10**
Request Function Codes supported: **1 (read)**
Default Variation reported: **2 (Binary Output Status)**
Control Relay Output Blocks
Object Number: **12**
Request Function Codes supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

Point Index	Name/Description	Supported Control Relay Output Block Fields
0	Relay Output 1	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.
1	Relay Output 2	Latch On, Latch Off. Pulse On, Pulse Off. Trip/Close or Individual Outputs. Action takes place on reception of operate command.

Counters

The Data Controller Model 5018-1 increments counters on either a on to off, off to on or change of state transition for the binary inputs therefore counter events are not implemented. The following table indicates the counters used.

Binary Counters Static (Steady-State) Object Number: **20** Request Function Codes supported: **1 (read)** Static Variation reported: **5 (32-Bit Binary Counter without Flag)**		
Point Index	**Name/Description**	**Change Event Assigned Class (1, 2, 3 or none)**
0	Incremented on change of state of Digital Input 1.	None
1	Incremented on change of state of Digital Input 2.	None

Frozen Counters

The Data Controller Model 5018-1 increments counters on either a on to off, off to on or change of state transition for the binary inputs therefore counter events are not implemented. The following table indicates the counters used.

Frozen Binary Counters Static (Steady-State) Object Number: **21** Request Function Codes supported: **1 (read)** Static Variation reported: **5 (32-Bit Frozen Counter with Time of Freeze)** Freeze Function Codes supported: **7 (Immediate Freeze)** **8 (Immediate Freeze, No Acknowledgement)** **9 (Freeze and Clear)** **10 (Freeze and Clear, No Acknowledgement)** **11 (Freeze with Time)** **12 (Freeze with Time, No Acknowledgement)**		
Point Index	**Name/Description**	**Change Event Assigned Class (1, 2, 3 or none)**
0	Incremented on change of state of Digital Input 1.	None
1	Incremented on change of state of Digital Input 2.	None

Analog Inputs

The following table lists Analog Inputs.

The Data Controller has built in scaling and calibration and reports analog I/O as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA in and 10000 is calibrated for 20 mA in across a 250 Ohm resistor. It is possible to read values above or below the calibrated range. Inputs below 4mA will read a negative value. Actual magnitude of value read positive or negative will depend on the limit of the analog input hardware.

Analog Inputs	
Static (Steady-State) Object Number:	**30**
Change Event Object Number:	**32**
Request Function Codes supported:	**1 (read)**
Static Variation reported:	**3 (32-Bit Analog Input no flag)**

Point Index	**Name/Description**	**Valid Range**	**Default Change Event Assigned Class (1, 2, 3 or none)**
0	Analog input 1	0 to 10000 (Calibrated)	none
1	Analog input 2	0 to 10000 (Calibrated)	none
2	Analog input 3	0 to 10000 (Calibrated)	none
3	Analog input 4	0 to 10000 (Calibrated)	none

Frozen Analog Inputs

Static (Steady-State) Object Number:	**31**
Request Function Codes supported:	**1 (read)**
Static Variation reported:	**3 (32-Bit Frozen Counter with Time of Freeze)**
Freeze Function Codes supported:	**7 (Immediate Freeze)** **8 (Immediate Freeze, No Acknowledgement)** **9 (Freeze and Clear)** **10 (Freeze and Clear, No Acknowledgement)** **11 (Freeze with Time)** **12 (Freeze with Time, No Acknowledgement)**

Point Index	**Name/Description**	**Valid Range**	**Default Change Event Assigned Class (1, 2, 3 or none)**
0	Analog input 1	0 to 10000 (Calibrated)	none
1	Analog input 2	0 to 10000 (Calibrated)	none
2	Analog input 3	0 to 10000 (Calibrated)	none
3	Analog input 4	0 to 10000 (Calibrated)	none

Analog Outputs

The following table lists both the Analog Output Status Points and the Analog Output Control Blocks.

The Data Controller has built in scaling and calibration and reports analog I/O as an integer in from 0 to 10000 which represent 0 to 100.00 percent. 0 is calibrated for 4 mA and 10000 is calibrated for 20 mA out. It is possible to read or write values above or below the calibrated range. Actual magnitude of output will depend on the limit of the analog output hardware.

Analog Output Status Points	
Object Number:	**40**
Request Function Codes supported:	**1 (read)**
Default Variation reported:	**1 (32-Bit Analog Output Status)**
32-Bit Analog Output Blocks	
Object Number:	**41**
Request Function Codes supported:	**3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

Point Index	Name/Description	Valid Range
0	Analog Output 1.	0 to 10000 (Calibrated)
1	Analog Output 2.	0 to 10000 (Calibrated)
2	Analog Output 3.	0 to 10000 (Calibrated)
3	Analog Output 4.	0 to 10000 (Calibrated)

Appendix O

Sample Custom Web Page with Output Control

Below is a sample of a HTML page.

```
<html><head><meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
<title> <!--#echo var="*SiteTitle"--></title></head>
<body>
<p>Site: <!--#echo var="SiteTitle"-->
<p>Location: <!--#echo var="SiteLocation"-->
<p>Description: <!--#echo var="SiteDescription"-->
<p>Analog Input(1): <!--#exec cmd="AI(1)"-->
<p>Analog Input(2): <!--#exec cmd="AI(2)"-->
<p>Analog Output(1): <!--#exec cmd="AO(1)"-->
<p>Analog Output(2): <!--#exec cmd="AO(2)"-->
<p>Digital Input(1): <!--#exec cmd="DI(1)"-->
<p>Digital Input(2): <!--#exec cmd="DI(2)"-->
<p>Digital Input(3): <!--#exec cmd="DI(3)"-->
<p>Digital Input(4): <!--#exec cmd="DI(4)"-->
<p>Digital Output(1): <!--#exec cmd="DO(1)"-->
<p>Digital Output(2): <!--#exec cmd="DO(2)"-->
<p>Digital Output(3): <!--#exec cmd="DO(3)"-->
<p>Digital Output(4): <!--#exec cmd="DO(4)"-->
<p>Counter(1): <!--#exec cmd="CNT(1)"-->
<p>Counter(2): <!--#exec cmd="CNT(2)"-->
<p>Counter(3): <!--#exec cmd="CNT(3)"-->
<p>Counter(4): <!--#exec cmd="CNT(4)"-->
<p>Device Time: <!--#exec cmd="Get_RTC"--></font>
<p>Last Communications Update Time: <!--#exec cmd="Get_Last_Update"-->
<form action="change.cgi" method="post">
<input type=hidden name="page" value="sample.htm">
<input type=hidden name="user" value="admin">
<input type=hidden name="pass" value="password">
<p>Analog Output 1:<input type="text" name="ao1" value="<!--#exec cmd="AO(1)"-->">
<p>Analog Output 2:<input type="text" name="ao2" value="<!--#exec cmd="AO(2)"-->">
<p>Digital Output 1:<input type=radio value="0" checked name="do1">Off<input type=radio value="1" name="do1">On
<p>Digital Output 2:<input type=radio value="0" checked name="do2">Off<input type=radio value="1" name="do2">On
<p>Digital Output 3:<input type=radio value="0" checked name="do3">Off<input type=radio value="1" name="do3">On
<p>Digital Output 4:<input type=radio value="0" checked name="do4">Off<input type=radio value="1" name="do4">On
<p>Counter 1:<input type="text" name="cnt1" value="<!--#exec cmd="CNT(1)"-->">
<p>Counter 2:<input type="text" name="cnt2" value="<!--#exec cmd="CNT(2)"-->">
<p>Counter 3:<input type="text" name="cnt3" value="<!--#exec cmd="CNT(3)"-->">
<p>Counter 4:<input type="text" name="cnt4" value="<!--#exec cmd="CNT(4)"-->">
<p><input type=SUBMIT value="Set" name="BUTTON">
</form>
</body>
```