Armstrong®

BrainScan® Digital Hot Water System Monitoring

Installation, Operation, and Maintenance Manual
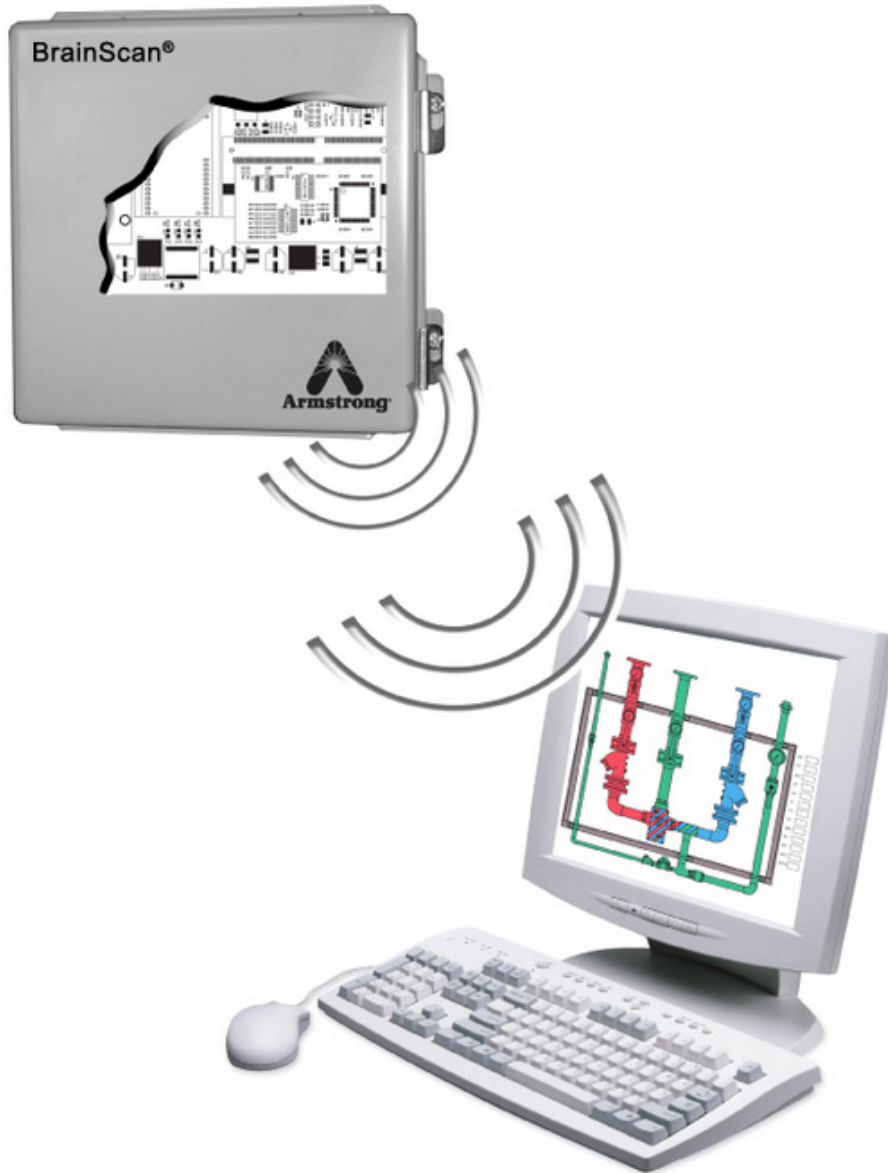
Retain this manual for future reference.

BrainScan® has been supplied for this application based upon information provided to Armstrong at the time the order was placed.

BrainScan has been specifically configured for this application based upon the information provided.

For further assistance please call our technical department Toll Free at 1-888-468-4673.

Model Number: _____

Serial Number: _____

Ship Date: _____

Armstrong

Contents

Disclaimer

Armstrong does not assume any liability arising from the use of this product. BrainScan® is capable of monitoring hot water system temperatures, pressures and flows and communicate the standard alarm conditions and error messages available with Armstrong's Model DRV "The Brain".

Armstrong does not assume any liability or responsibility for the failure to monitor the hot water system or communicate any information which may result in personal injury, death or property damage.

Installation

BrainScan® is a Digital Hot Water Management System console optionally supplied with DRV Digital Recirculating Valves and DRV based Digital Mixing Centers and DRV based Digital-Flo water heater packages.

BrainScan is factory configured to monitor system measurements with a built-in web browser graphical interface server.

BrainScan can also communicate with an external Building Automation System (BAS) or Human Machine Interface (HMI) using Modbus RTU or optional BACnet MSTP, BACnet IP, Metasys N2, Modbus TCP/IP, and LonWorks protocols with the appropriate Protocessor.

All of the standard alarm conditions and error messages available through the DRV are also available through BrainScan.

BrainScan
Includes remote hot water supply, cold/recirculation water supply and blended water outlet temperature readings from the DRV's internal thermistors. BrainScan also provides the ability to remotely change blended water outlet temperature set point. Included with BrainScan are several valve/system graphics.

BrainScan includes connections for eleven 4-20 mA inputs and two 8-bit counter inputs for pulse-type flow meters. COM ports include: one RS-485 port for communication with the DRV (labeled ST5), and one DB9 Modbus RTU port (CN1). A ProtoCessor communication module socket (MOD2), modem socket (MOD1), RJ-11 port (JK2), RJ-45 ethernet port (JK1), and SD/MMC card slot (SOK2 MMC) are also included.

BrainScan field sensor data is stored in a Microsoft Excel compatible XML formatted log on the SD card. Users can monitor sensor readings and control the valve using the built-in web browser graphical interface or with an external system communicating with BrainScan using Modbus, Metasys N2, BACnet or LonWorks protocol.

Hardware

An overview of the BrainScan board is shown in Figure 2-1.

Power

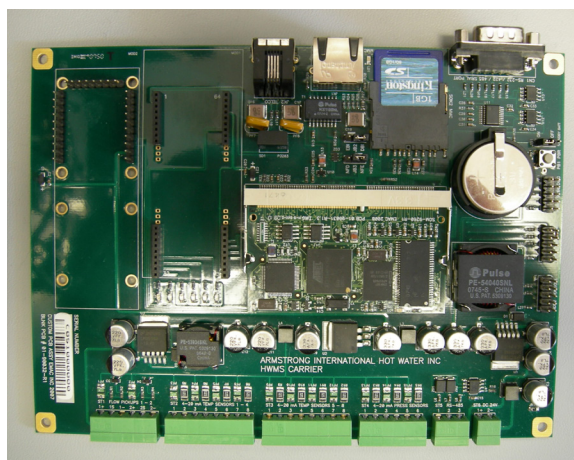BrainScan is supplied completely pre-wired to a 85-264VAC 50-60Hz switching 24VDC power supply.

Figure 2-1. BrainScan™ Board (Top View)

SD Card

The BrainScan® board provides an MMC/SD card slot for data storage. Standard SD and MMC cards can be used in this slot. If the SD card is missing, corrupted, or read-only, BrainScan will not function properly.

Standby Battery

A 3V standby battery is provided on the BrainScan board to provide power to the real-time clock. This allows the system to hold the date and time when the board is not connected to external power. The standby battery is connected through a jumper JB1 which allows battery backup to be disconnected from the circuit. If the system is in storage with the battery installed, setting this jumper to the OFF position will extend battery life. JB1 is sent out from the factory in the OFF position. Figure 3-1 shows the standby battery jumper JB1 in the ON position.

Protocessor Socket

A socket is provided on the board for a Protocessor module which enables communication with BACnet, LonWorks, and Metasys N2. If the software is configured properly to use the Protocessor module, simply plug the Protocessor into the male header on MOD2 with the BrainScan powered off. Failing to remove power from the BrainScan before installing the ProtoCessor may result in product damage. The socket for the Protocessor is shown in Figure 3-2.

Figure 3-1. Standby Battery Jumper JB1

Modem Socket

A modem socket is also available on the board at location MOD1. This can be seen in Figure 3-2. If used, a multitech modem can be inserted into this socket to provide dialout networking communications through the telecommunications port on the board, JK2.

Ethernet

The BrainScan board uses Ethernet to access the local network. This interface is capable of connecting to 10BASE-T or 100BASE-TX networks.

Figure 3-2. Protocessor and Modem Sockets

Sensor and Valve Connections

For DRV interface, the BrainScan carrier board must be connected to the DRV PCB via the ST5 port. Removable screw terminals are provided for these connections.

Figure 3-3 shows the locations of the field sensor connections: two (2) pulse-type flow meter connections labeled ST1, eight (8) 4-20mA temperature sensor connections labeled ST2 and ST3 and three (3) 4-20mA pressure transducer connections labeled ST4. As a result, some of the sensor inputs may not be used. **Reference Figure 7-1 for wiring schematic.**
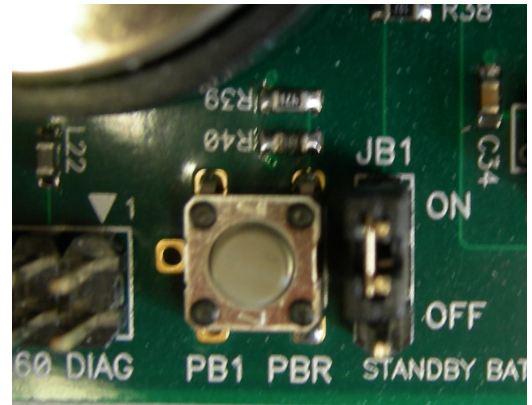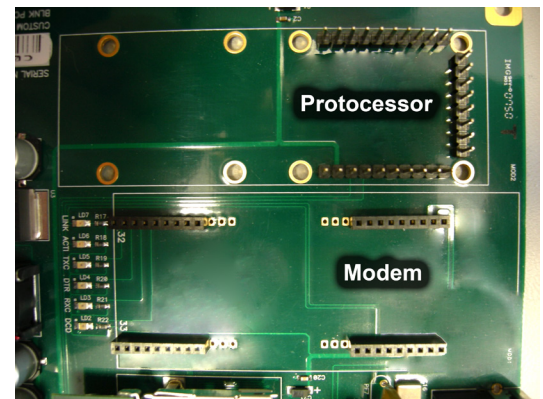

Figure 3-3. Sensor and Valve Connection Terminals

BrainScan® Control Wiring

Figure 4-1.

ST1 Flow Pickups	ST2 Temp Sensors	ST3 Temp Sensors	ST4 Press Sensors	ST5 RS-485	ST6 DC 24V
1+ 1S 1- 2+ 2S 2-	1+ 2- 3+ 4- 5+ 6- 7+ 8-	1+ 2- 3+ 4- 5+ 6- 7+ 8-	1+ 2- 3+ 4- 5+ 6-	1+ 2- 3⏚	1+ 2-

ST1: Mixed Flow, Recirc Flow

ST2: Downstream Mixed Temp, Hot Temp, Cold Temp, Recirc Temp

ST3: IBTV1, IBTV2, BSPTV1, BSPTV2

ST4: Hot Press, Cold Press, Mixed Press

ST5: DRV80

+ = White
- = Red
⏚ = Black

ST6: From Power Supply (Factory Wired)
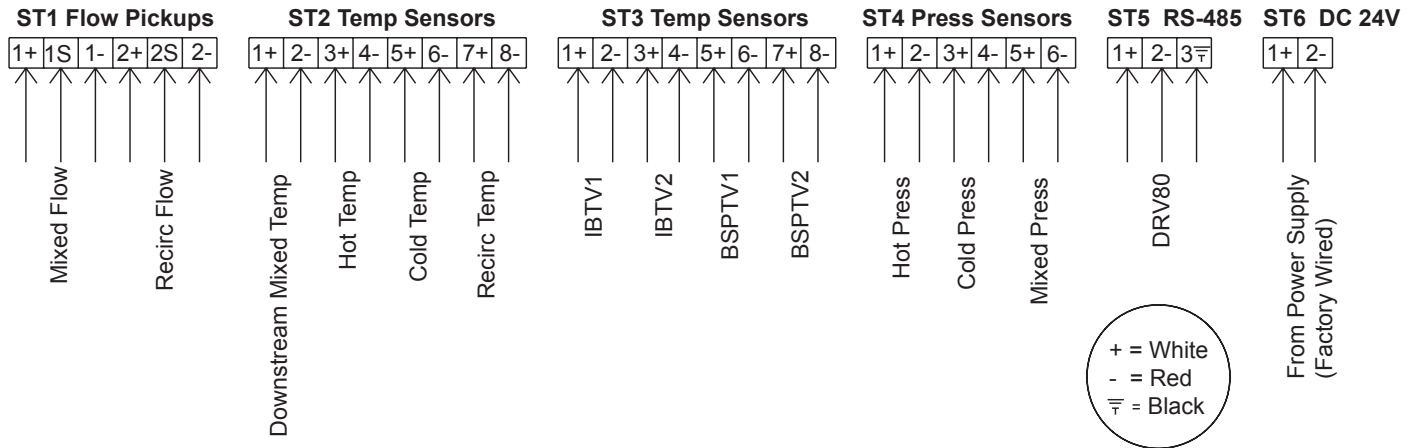
Six removable screw terminals are provided with the BrainScan board. Each connector should be inserted into one of the ports above that matches the number of connections on the pluggable terminal. Be careful when inserting and removing the screw terminal plugs. Never pull directly on the wires connected to a plug. To insert a wire into a connector, use a screwdriver to loosen the screw on the terminal, insert the wire, and hand tighten the screw.

Note: The DRV data cable is provided with BrainScan designed specifically for direct connection to the dedicated RS-485 connection to the DRV PCB.

Pin 1: RS-485 A (the white wire on DRV data cable).
Pin 2: RS-485 B (the red wire on DRV data cable).
Pin 3: Ground, the black wire on DRV data cable.

BrainScan® (configuration, monitoring and data collection using web browser interface)

A standard computer web browser is used to configure BrainScan and the DRV valve(s). The web browser interface also provides a real-time graphical measurement display, 24-hour data summary and access to XML log data.

Login Page

The login page is the index page for the web server. Users are required to login through this page before they will be allowed to access any other pages in the BrainScan web interface. A screenshot of this page is shown in Figure 5-1. The default username is armstrong, password brainscan.

To login, connect a computer's Ethernet port to the BrainScan's Ethernet port with a cross-over cable. Set your computer's network settings to the following:

IP: 172.16.31.200
Subnet: 255.255.0.0
Gateway: 172.16.254.1

In a web browser, access
https://172.16.31.201
To login, the default admin-level access is
username: armstrong
password: brainscan

BrainScan's Factory Default IP Settings:
Static IP: 172.16.31.201
Subnet Mask: 255.255.0.0
Gateway: 172.16.254.1
Primary DNS: 172.16.8.66
Secondary DNS: 172.16.8.67

Figure 5-1.
BrainScan Login

Administration Configuration Page

The administrative configuration page is accessed using the web browser interface at the following address: https://172.16.31.201/admin/config.php. This page is password protected.
Username: ahwgdrv80
Password: choffma

Depending on the software version loaded, it may also be accessed by https://172.16.31.201/cgi-bin/admin_config.php

This page is used to set the time zone, system date and time, add, delete, or edit usernames, passwords, and access level, configure the modbus settings, configure the Protocessor, change RTD settings, and set flow meter K-Factors.

A screenshot of the page is shown in Figure 6-1.

Step 1: Change time zone (if needed)
- Select your time zone
- Press "set time zone" button
Note: If time zone is changed, you must reboot BrainScan by turning the power off and then back on prior to setting date and time in step 2.

Figure 6-1.
Administrative Configuration Page

Step 2: Set current date and time (if needed)
- select time and date parameters
- press "set time" button

Step 3: HWMS user configuration
- Access levels
     - admin (read/write)
     - user (read only)
- To delete a current user, enter the username, change the action to delete and press submit. When the page refreshes the username will no longer be listed as a valid user.
- To add or edit a current user, enter the username, password and access level, set the action to add/edit and press submit.
     - If a user exists with same username, the password and access level will be set for that user.
     - If the username is not found, a new user will be created with the access level and password.

Step 4: Modbus Configuration
- Protocessor Port: Turn the port on or off, change the baud rate (default - 38400), parity (default - even) and the slave ID (default - 1) of the Protocessor. This is NOT the node ID of the Protocessor.
- Protocessor Settings
     -Type: BACnet, Lonworks, Metasys N2.
     - MAC address of the Protocessor (BACnet and Metasys N2 only)
     -Node ID of the Protocessor (BACnet and Metasys N2 only)
     -Modbus TCP ID
- Temperature Sensors: for modifying the slope of the RTD
- Custom K Factors: Set the K-factor for mixed and return flow meters where K is in pulses/gallon.
- Set Valve Address (on newer software): Only one valve may be connected at a time to set the valve address. If using a two-valve set up, connect the RS-485 cable of the valve which will be addressed. Press the "Valve Off" button, select the desired address, then the submit button. Press the "Valve On" button before leaving the page.

It is recommended to restart the device after submitting the Time Zone, Current Time, or ProtoCessor Settings.
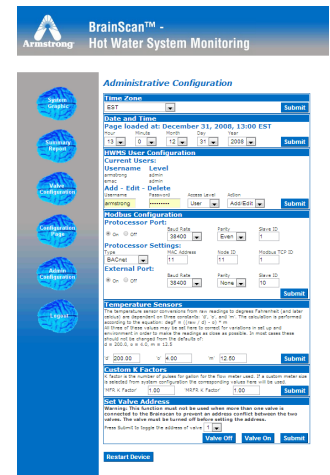
System Graphic

After logging in, the 'System Graphic' page is loaded. This page provides a real-time look at the DRV temperature readings as well as the temperature, pressure, and flow sensor readings that are monitored through BrainScan®.

These values are updated every ten seconds. An image of the specific Brain DRV or DMC model is shown as well. The image can be changed in the Configuration Page. On the left hand menu are links to the other functions in the BrainScan web browser interface referred to as the 'Navigation Bar'. A screenshot of the system graphic page is shown in Figure 7-1.

Summary Report Page

The 'Summary Report' page can be accessed through the corresponding link on the BrainScan Navigation Bar. This page provides a 24-hour summary of the readings stored in the XML data log, as well as a method of clearing the current data log and downloading the log file. Data log entries are stored every 15 minutes.

A screenshot of the 'Summary Report' is shown in Figure 7-2.The table displayed shows the last 24-hours of data collected by the BrainScan. To download the complete XML file and access all stored data, click on the 'Download XML Data Log' and the file will open in Microsoft® Excel.

To clear the data log, click on the 'Clear Data Log' button at the top of the page. This will permanently erase all information stored in the current XML data file. The log file is stored on the SD memory card. If free space on the SD card becomes critically low, the data log will begin to overwrite the oldest data logged with standard configuration settings.

The main application also has email client functionality. When configured, an email will be sent to the configured recipients if an error is detected with the valve(s) or if the SD card memory becomes critically low. See the "Configuration Page" for more details.
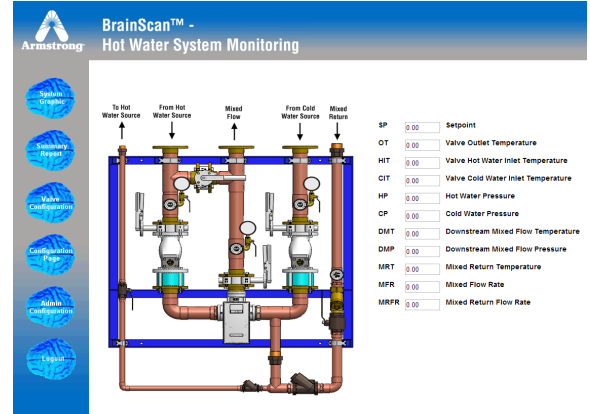
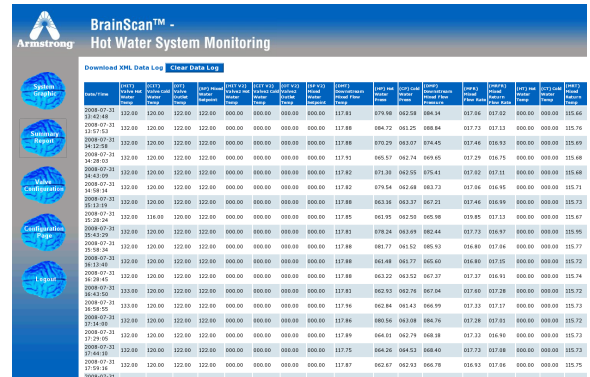**Figure 7-1. System Graphic (DMC1 Model)**

Figure 7-2. Summary Report

Valve Configuration Page

The valve configuration page is a menu for all DRV80 configuration settings:

- setpoint temperatures
- valve information
- disinfection
- engineering
- service data

Click on the corresponding button to access the desired setting.
A screenshot of the valve configuration page is shown in Figure 8-1.

All of the pages under this section access the valve. Users with "admin" access will be able to change the valve configuration. Users with "user" access will only be able to read the current configuration; any "write" buttons will be visible but disabled.

Note: Before making any configuration changes, the DRV80 must be first turned OFF to "write" the change and then ON to record the change. The only exception is the Current Setpoint, which can be changed without turning the valve off.

If any command to read or write to the valve encounters an error, a message will be displayed to inform the user. The error log can be viewed from the Service Data configuration page. All pages have the ability to turn the valve off and on through a button on the bottom of the page.

If the valve is currently on, the button will display the text "Valve Off" and pressing it will send a command to the valve to switch off. If the valve is currently off the button will read "Valve On" and pressing it will send a command to switch the valve on.

Note that the valve must be turned off for many configuration settings to be written to the valve. It will take several seconds for the DRV to respond to commands after switching the valve off and then back on.

The "Read" button at the bottom of each page will force the values to be re-read from the valve.
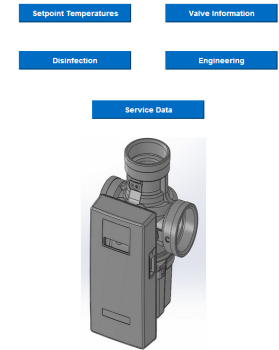
Figure 8-1. Valve Configuration

Setpoint Temperatures Configuration

The "Setpoint Temperatures" configuration page allows the current, maximum, default, and minimum setpoint temperatures to be viewed and written to the valve along with the valve alarm configuration. A screenshot of the page is shown in Figure 8-2.

Press the "Write" button at the bottom of the page to save the current values to the valve. The "Set to Default" button will set the current setpoint to the stored default setpoint.
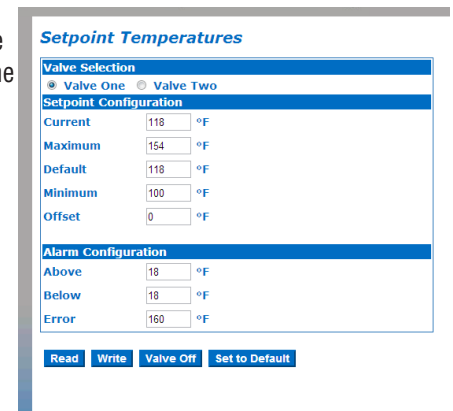
Figure 8-2.
Setpoint Temperature Configuration

Valve Information Configuration

The Valve Information configuration page is a read-only page that shows the serial number of the valve, date and time of manufacture, firmware type, and firmware version. A screenshot of the Valve Information page is shown in Figure 8-3.

Figure 8-3.
Valve Information Configuration

Valve Disinfection Configuration

The valve disinfection configuration page allows the user to put the valve into disinfection mode.

******REFER TO DRV MANUAL FOR DETAILS/PRECAUTIONS BEFORE USING DISINFECTION MODE!******

As a safety precaution, disinfection can only be triggered when enabled in the BrainScan software. This setting is located on the Engineering web page. If disinfection is disabled, the "Arm" button will be disabled, and the status box next to the "Arm" button will read "Disabled" rather than "Ready."
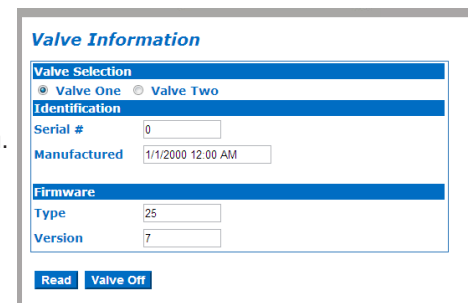
Figure 9-1 shows the valve disinfection page in its initial state when disinfection is enabled in the BrainScan software.

There are several steps to initiate disinfection. First, press the "Arm" button. This will send a command to the valve to arm it for disinfection. The text on the button will change to "Trigger" and the status box will change from "Ready" to "Armed." Pressing the "Trigger" button will send the valve a command to trigger disinfection. The status box will change to "Triggered" and a countdown message will be displayed showing that full-hot will be supplied in 10 seconds.

The button text will change to "Cool Down" and a message will be displayed following the countdown that reads "When disinfection is complete click 'Cool Down' to return the valve to the previous temperature."

Pressing the "Cool Down" button will disable disinfection mode and send the valve into cool down mode.

Note: "Cool down" mode is a mechanical function which resets the valves internal proportioning mechanism to achieve pre-disinfection set point. The plumbing system will only cool down in accordance with the systems natural heat loss characteristics. This may be a lengthy process. To ensure system safety a "system dump" may be required to accelerate the cool down process.

Press the "Set Disinfection Date" button to set the last disinfection date to the current date/time and save the user id for the disinfection to the value entered on the form.
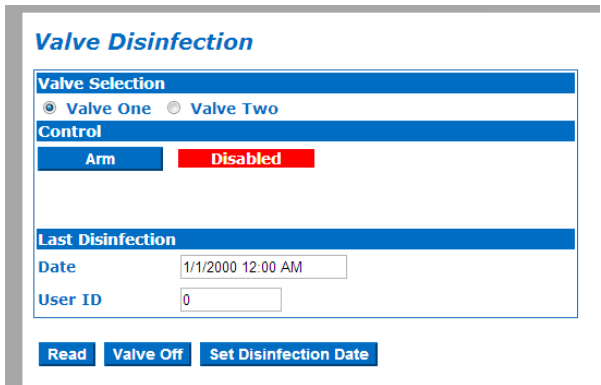
Figure 9-1. Valve Disinfection

Engineering Configuration

The Engineering Configuration page is used to set the units, location, commission information, disinfection enable and timeout, and motor calibration number of the DRV. A screenshot of this page is shown in Figure 9-2 below.

The location is an ASCII string of up to 16 characters that is stored in the valve. Pressing the "Set Commission Date" button will set the commission date to the current date and time. The "Write" button will save all other settings to the valve.
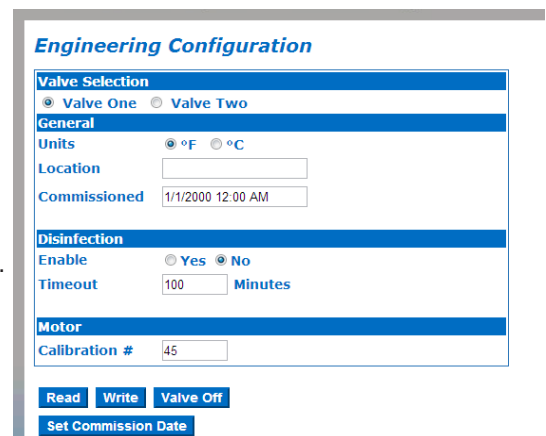
Figure 9-2. Engineering Configuration

Service Data Configuration

The Service Data configuration page displays any errors that have been logged by the BrainScan software and allows the date/time and user id to be set for the last valve service performed. A screenshot of this page is shown below in Figure 10-1.

If any errors have been detected when communicating with the valve, they will be logged along with a time stamp and description in the "Error Log" section of this page. To clear the error log, press the "Clear Errors" button. To set the service date and time to the current date and time press the "Set Service Data" button. The user id entered in the form will also be saved as the service user id in the DRV.

Configuration Page

The Configuration Page link on the main BrainScan menu can be used to configure the TCP/IP settings, Email notification settings, Web server settings, and other BrainScan specific settings. A screenshot of this page is shown in Figure 10-2.

Under the TCP/IP Configuration section, the Set TCP/IP Configuration option allows the user to specify DHCP or static IP configuration. If "set TCP/IP configuration" is set to "Yes", a static IP address, subnet mask, gateway, DNS, and domain suffix may be specified. If "set TCP/IP configuration" is set to "No", DHCP will be used to determine network settings when the BrainScan is powered up or the network connection is re-established.

Note: The hostname must be entered in both cases. Default hostname is brainscan1.

To send email notifications when error conditions are detected, set "Enable Email Notifications" to "Yes". A valid mail server name will need to be entered as well as a "From" address that is configured on the given mail server. Up to three recipient email addresses can be added to the "Notify List for Alerts" section.

Note: BrainScan is not an e-mail server. E-mail notifications must be configured on the facilities e-mail server. Contact the facility's IT department to enable this function.

By default, the web server listens on the standard HTTPS port 443. This can be changed to any open port as required by the host network.

The BrainScan configuration section can be used to specify the display and log temperature units, the device type, and the size of the attached flow meters. The device type selection determines the data layout, the appropriate system graphic, and the XML file format. If used, the flow meter sizes must be set correctly (1", 1.5", 2" or enter custom) for proper flow rate (gpm) calculation.

Figure 10-1. Service Data Configuration

Figure 10-2. Configuration

When all configuration information is entered correctly, press the "Save Changes" button to store these valves.

After pressing "Save Changes", a new page will be shown with a button labeled "Restart Device." You must press "Restart Device", wait approximately 45 seconds and login again to activate the changes.
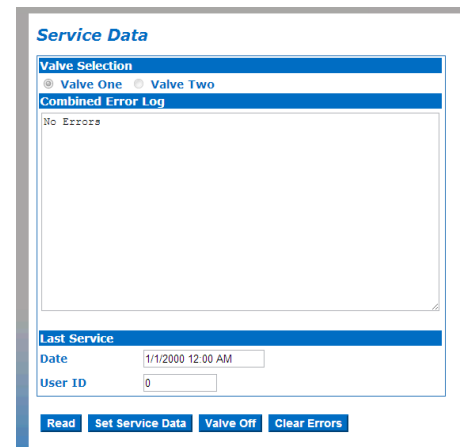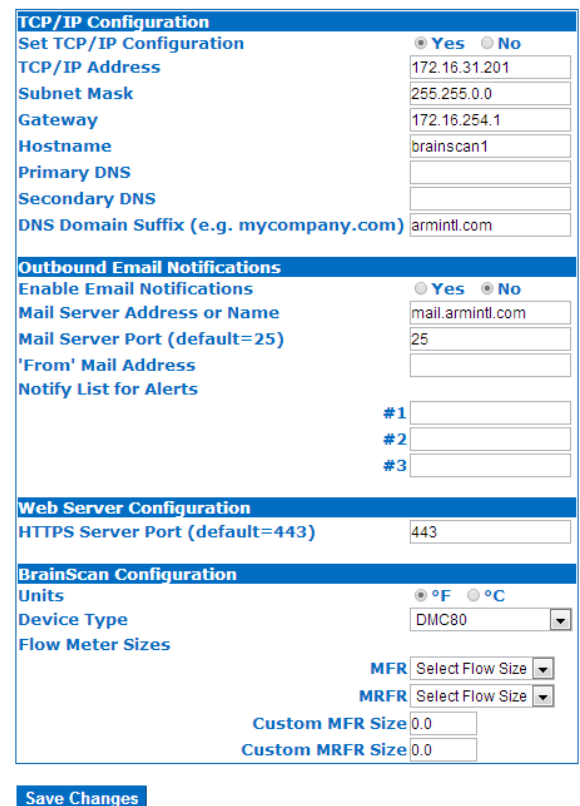
Logout

To logout of the system, press the "Logout" link on the left menu. You will then be returned to the login page.

Building Automation System Connections

The BrainScan provides several options for Building Automation Systems (BAS) interface. These options may be Armstrong factory configured based on specific customer requirements given at the time of order. The options are enabled by the installation of a specific Protocessor. Protocessors are not sent with the BrainScan unless the Installation Detail Form (IDF) has been provided to Armstrong at the time of order. If a Protocessor is needed but was not provided, please contact your local factory representative.

Two different types of Protocessors are available. Refer to Table 11-1 for the protocols provided by each.

The Protocessor plugs into the MOD2 socket on the BrainScan circuit board. This socket is shown in Figure 3-2 on page 3.

Protocessor Module	Supported Protocols
FPC-ED2	BACnet IP, BACnet MSTP, Modbus TCP, Metasys N2
FPC-F04	LonWorks

Table 11-1 BAS Protocols Provided by Protocessor Modules

The required network connection(s) for each device are described below.

Modbus

Modbus is a standard protocol for process control and building automation systems. The physical connection uses the CN1 DB9 connector which is a configurable RS-232/422/485 serial port.

The default mode is RS-232, and configuration is controlled in the configuration software. CN1 is used for the Modbus interface when configured in the software. In this case, it will automatically be placed in RS-422/485 mode. See Table 11-2 for connections to an external RS-422/485 network. To use the device in two-wire RS-485 mode, jumper 422 TX+ to 422RX+ and jumper 422TX- to 422RX.

Note: There are no jumper terminating resistors or pullup resistors in this port. Depending on the network used, terminating or pull-up resistors may need to be installed externally.

Pin	Name
1	422TX-/485A
2	232RX/422TX+/485B
3	232TX/422RX+
4	422RX-
5	GND
6	NC
7	232RTS
8	232CTS
9	NC

Table 11-2 CN1 DB9 Pin-Out
For RS-485 mode, jump pins 1 to 4 and pins 2 to 3.

Terminating resistors of 120 W are recommended only on the two end nodes of a multi-drop RS-422/485 network between the positive and negative differential pairs. Pull-up resistors may be used on some nodes as well to keep the data lines at a neutral state when the drivers on the network are in a high impendence state. Armstrong recommends using 560 W resistors to pull the positive data lines to 5 volts and same value to pull the negative data lines to the common ground.

    120 W between 1 - 2 and between 3 - 4
    560 W between 1 - 5 and between 4 - 5
    560 W between 2 - 5 and between 3 - 5

The baud rate, slave id, and parity for the CN1 DB9 port are selectable through the Admin Configuration page under "External Port".

A register map of the Modbus interface is shown on pages 12-13. These registers must be configured in the customer's system as "Holding" registers not as "Input" registers.

Modbus Register Map

Register	Name	Type	Description	Read / Write Access
0	update	integer	force refresh of valve configuration data	Write Only
1	ret_code	integer	return code of last valve command (See Fig 14-1 for more information)	Read Only
2	spv1	integer	valve 1 setpoint	Read Only
3	hitv1	integer	valve 1 hot inlet temp	Read Only
4	citv1	integer	valve 1 cold inlet temp	Read Only
5	otv1	integer	valve 1 outlet temp	Read Only
6	spv2	integer	valve 2 setpoint	Read Only
7	hitv2	integer	valve 2 hot inlet temp	Read Only
8	citv2	integer	valve 2 cold inlet temp	Read Only
9	otv2	integer	valve 2 outlet temp	Read Only
10*	mfr	integer	mixed flow rate	Read Only
11*	mrfr	integer	mixed return flow rate	Read Only
12*	dmt	integer	downstream mixed temp	Read Only
13*	ht	integer	hot water temp	Read Only
14*	ct	integer	cold water temp	Read Only
15*	mrt	integer	mixed return temp	Read Only
16*	ibtv1	integer	valve 1 inlet blended temp	Read Only
17*	ibtv2	integer	valve 2 inlet blended temp	Read Only
18*	bsptv1	integer	valve 1 blended setpoint	Read Only
19*	bsptv2	integer	valve 2 blended setpoint	Read Only
20*	hp	integer	hot water pressure	Read Only
21*	cp	integer	cold water pressure	Read Only
22*	dmp	integer	downstream mixed pressure	Read Only
23	v_select	integer	current valve selection	Read/write
24	v_state	integer	state of selected valve	Read/write
25	curr_sp	integer	current setpoint	Read/write
26	max_sp	integer	maximum setpoint	Read/write
27	def_sp	integer	default setpoint	Read/write
28	min_sp	integer	minimum setpoint	Read/write
29	al_above	integer	above temperature alarm	Read/write
30	al_below	integer	below temperature alarm	Read/write
31	al_error	integer	error temperature alarm	Read/write
32	serialno	integer	valve serial number	Read Only
33				
34	man_time	integer	valve manufacture time and date in seconds from the Unix epoch	Read Only
35				
36	fw_type	integer	valve firmware type	Read Only
37	fw_id	integer	valve firmware id	Read Only
38	units	integer	valve units	Read/write

* field sensors not installed by Armstrong International.

Register	Name	Type	Description	Read / Write Access
39	location	ASCII String	valve location represented as an ASCII string that is not necessarily null-terminated	Read/write
40				
41				
42				
43				
44				
45				
46				
47	dis_enable	integer	enable disinfection at the BrainScan level	Read/write
48	dis_timeout	integer	disinfection timeout in minutes	Read/write
49				
50	calib_num	integer	calibration number	Read/write
51	comm_time	integer	valve commission time and date in seconds from the Unix epoch	Read/write
52				
53	dis_on	integer	arm and trigger disinfection mode	Write Only
54	dis_cooldown	integer	set disinfection cooldown mode	Write Only
55	dis_id	integer	user id for last disinfection	Read/write
56	dis_time	integer	time and date of last disinfection in seconds from the Unix epoch	Read/write
57				
58	service_id	integer	user id for last service	Read/write
59	service_time	integer	time and date of last service in seconds from the Unix epoch	Read/write
60				
61	bs_units	integer	units for BrainScan system	Read/write
62	dev_type	integer	valve type for BrainScan operation	Read/write
63*	mfr_size	integer	mixed flow sensor size	Read/write
64*	mrfr_size	integer	mixed return flow sensor size	Read/write

* field sensors not installed by Armstrong International.

On the first read of the Modbus interface, all values are read from the sensors and the valve. On subsequent reads, only the valve prime data and sensor readings are updated. Valve configuration data such as the serial number, location, setpoint configuration, etc. are cached. When a write command is received for the update register, all values are re-read from the valve and updated. The actual value of the update register will not change with a write, and it does not matter what value is actually written to the register. If a configuration change is made to the valve from the Modbus interface, that particular section of values is automatically refreshed from the valve following the write command.

The return_code register holds the value of the return code from the previous write or read command from the DRV. Zero indicates normal operation. The value of the return code is defined by the actual error codes returned from the DRV. All possible values are given in Figure 14-1.

Times and dates such as manufacture, commission, service, and disinfection date/time are represented by a 32-bit integer storing the number of seconds elapsed since midnight on January 1, 1970. Writing any value to a date/time register will cause that field to be set to the current date/time. The only exception to this is the manufacture date/time register which has read only access.

The DRV and the BrainScan software can be set to use Fahrenheit or Celsius temperature units. Fahrenheit is represented by a 1, Celsius is represented by a 0 value. This is currently set in two separate registers. The units register controls the units setting in the DRV. This will only change the read out on the DRV LCD display. The bs_units register controls the units used by the BrainScan board and will be used for temperatures in all Modbus registers. To avoid confusion, make sure that the 'bs_units' and 'units' match.

The size of the flow meters is a configuration option specific to the BrainScan software.

The baud rate, slave id, and parity for the CN1 DB9 port are selectable through the configuration page.

BACnet

BACnet MSTP uses an RS-485 signaling interface. BACnet IP uses an ethernet network. The FPC-ED2 ProtoCessor module can provide both BACnet IP and BACnet MSTP as well as Modbus TCP at the same time.

Connect an Ethernet cable to the Ethernet port on the Protocessor module and connect this to the network to access BACnet IP and Modbus TCP. Connect the 3-wire RS-485 port on the Protocessor to the BACnet MSTP network to access the BACnet MSTP interface.

BACnet uses a node ID for each device. This must be unique on the network. Currently, the default node ID for BACnet interfaces is:

BACnet MSTP: 12
BACnet IP: 11

The BACnet MAC address is factory set to 11. The default baud rate for the BACnet MSTP interface is 38400.

If these values need to be changed for a particular application, the ProtoCessor module can be configured in the Admin Configuration page.

The Modbus TCP interface uses the same register map used for the Modbus RTU interface.as the service user id in the DRV.

Error Code	Description
0	OK
1	General OK value
2	Range error for analog to digital converter
3	Difference error
4	Comparator feedback error
5	Basic analog to digital converter error
6	Analog to digital converter timeout
7	Over temperature error
8	RAM checksum error
16	EE RAM error
32	Flash memory error
35	Welded contact
36	Open contact relay fault
37	General algorithm fault
40	General controller fault
41	Battery fault
45	General outlet error
50	Flow turbine error
60	Motor stuck error
70	Motor calibration error
80	Stack overrun error
90	Incorrect schedule phase
91	Incomplete message was received from controller
92	Invalid message was received from controller
93	A bad checksum was detected by the controller
94	A bad checksum was received from the controller
96	A timeout occurred contacting the valve

Figure 14-1. Error Code Description

LonWorks

LonWorks is a BAS protocol designed by Echelon Corporation.

The physical connection used by the Protocessor module is FT-10. It uses a 2-wire polarity-insensitive connection. The Ethernet port on the Lonworks Protocessor is used for configuration of the device, but does not need to be connected after the device has been configured.

Connect the FT-10 port on the module to the LonWorks network.

With LonWorks, each device must be commissioned using LonWorks control software before it may be used in a LonWorks network. This will configure the device's subnet, domain, and other parameters.

Note that each LonWorks device has a unique 'neuron id'. This 'neuron id' is discoverable and and does not need to be set in the configuration file. The LonWorks XIF file is available to download at http://www.armstronginternational.com/brainscan under the Download Center.

Commissioning a LonWorks Protocessor Using LonMaker

This section describes the process of commissioning a LonWorks Protocessor using LonMaker. This software is available from Echelon Corporation. The edition used in the examples below is Standard TURBO Edition SR-A Release 3.2. A USB adapter is used to connect the PC to the FT-10 port on the Protocessor.

To begin, start LonMaker and open an existing network or open a new one using the network wizard. Connect the computer to the FT-10 port using a USB adapter and power up the BrainScan. Allow a few minutes for the ProtoCessor to boot. A new network is shown in Figure 15-1.

To commission the Protocessor, drag a new LonWorks device from the left of the screen onto the new network drawing. This will start the New Device Wizard. Follow the instructions below to complete the device wizard.

The first screen of the wizard will allow you to name the device. Enter a name for the device and select create new device template. Set the channel to auto-detect. This screen is shown in Figure 15-2.

Figure 15-1. LonMaker Blank Network

The second screen sets the source for the external interface definition. This must be uploaded from the device. This screen is shown in Figure 15-3.

The third screen sets an optional description for the device as well as the ping interval. Pinging is not necessary and can be set to any value. This screen is shown in Figure 15-4.

The fourth screen is used to set the device identification method. This should be set to service pin. This screen is shown in Figure 15-5.
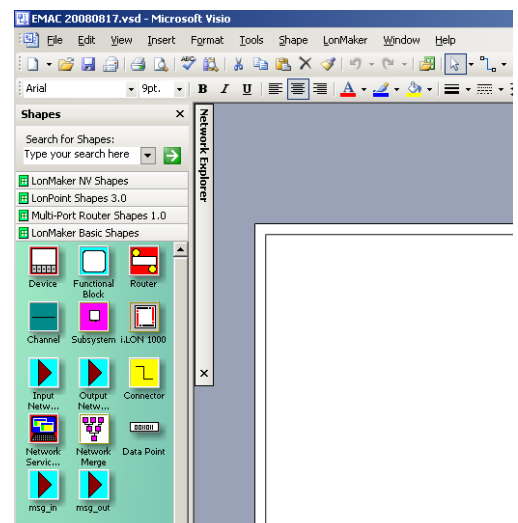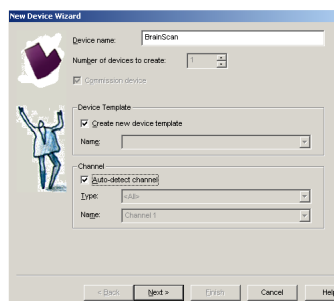

Figure 15-2.
Device Wizard Screen 1
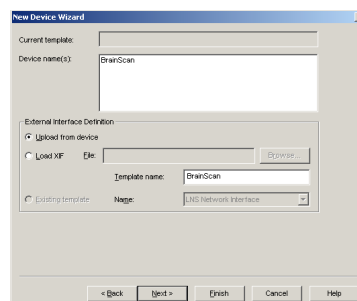
Figure 15-3.
Device Wizard Screen 2
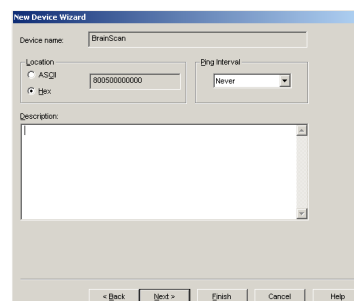
Figure 15-4.
Device Wizard Screen 3
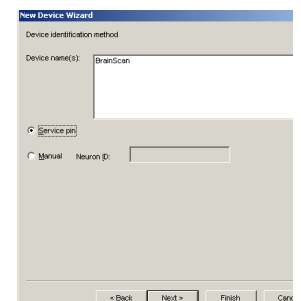
Figure 15-5.
Device Wizard Screen 4

The fifth screen is used to set the application image. This should not be loaded. This screen is shown in Figure 18-1.

The sixth screen is used set the initial state of the device. The device should be set to Online. This screen is shown in Figure 18-2.

The wizard is finished after the sixth screen. The wizard will now prompt for the service pin to be pressed on the Protocessor. To ensure that the device is detected properly, select Display data from service pin before pressing the service pin (located next to the FT-10 port on the Protocessor). This screen is shown in Figure 18-3.

After pressing the service pin on the Protocessor, the device data screen will be displayed as shown in Figure 18-4.

Press OK to let LonMaker commission the device. Once this is complete, the device has been commissioned and can be managed using LonMaker and added to the network.

Figure 16-1.
Device Wizard Screen 5

Figure 16-2.
Device Wizard Screen 6

Figure 16-3.
Service Pin Prompt

Figure 16-4.
Service Pin Data

After successfully commissioning the device, a new functional block can be added to the network and associated with BrainScan

Input and output variables can then be added manually as needed or all variables can be added to the new functional block automatically.

A functional block with all variables added is shown in Figure 18-5.

Figure 16-5. LonMaker BrainScan Functional Block

References

[1] http://en.wikipedia.org/wiki/POSIX_Threads

[2] http://freemodbus.berlios.de/

[3] http://www.lighttpd.net

[4] http://www.openssl.org

[5] http://www.protocessor.com

[6] http://en.wikipedia.org/wiki/BACnet

[7] http://en.wikipedia.org/wiki/LonWorks

Notes

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Notes

Limited Warranty and Remedy

Armstrong Hot Water, Inc. ("Armstrong") warrants to the original user that **BrainScan** is covered by a 1-year warranty against defects in materials or workmanship from the date of purchase/shipment . Armstrong reserves the rights to replace either the complete product, certain components of the product and/or replacement internal operating parts. This warranty does not extend to any product that has been subject to misuse, neglect or alteration after shipment from the Armstrong factory. Except as may be expressly provided in a written agreement between Armstrong and the user, which is signed by both parties, Armstrong **DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

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