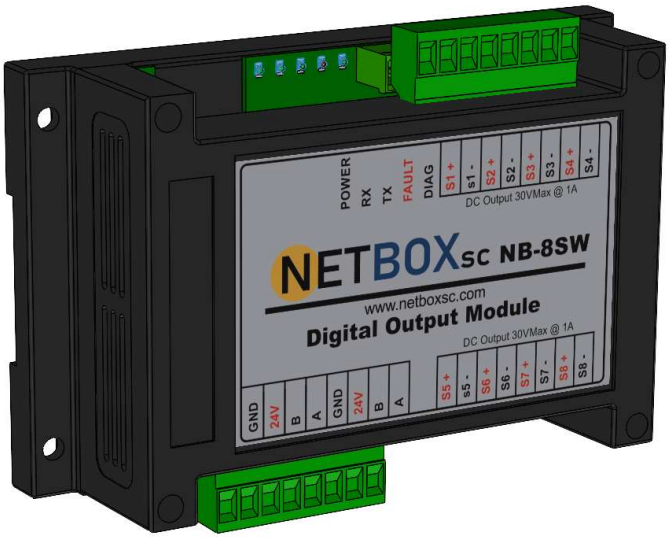
Digital Output Module

USER MANUAL



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1: About this Device

The Netbox NB-8DO Digital Output Module is a DIN rail mountable device which allows the user to associate Field Unit outputs — such as process variables, switch input values, and Field Unit status — to digital switch output.

Each of the Field Units' outputs is received by the Base Radio and is then routed to the NB-8DO Digital Output Module via a WIM RS-485 connection. This "assigned" variable is then converted to an industry standard digital output within the NB-8DO Digital Output Module and output on a user defined loop.

The NB-8DO Digital Output Module allows the user to select which Field Units and their respective variables are mapped to the device via the Accutech[1] Wireless Instrumentation Manager software.

The purpose of this manual is to help you install and maintain your NetBox Digital Output Module.

1.1: Compatibility

Accutech[1] analog and switch output modules are accessories to be used with the base radio module to provide analog 4-20mA and configurable switch output to any PLC using standard 4-20mA and digital inputs.

NOTE

The below figure shows the complete family with both Accutech[1] and NetboxSC Output Modules connected together. The NetboxSC NBHMI allows for local display of the alarms, values, and battery life of each field unit. In addition, the NBWIFI module enables wifi connectivity to allow for a user to access real-time sensor data from their smartphone.

The NetboxSC equivalent modules of the NB-4AO and the NB-8SW will fulfil the same role as the WI-4AO and the WI-8SW respectively; as a one-to-one drop-in replacement for, wired in series with, or independent of existing Accutech[1] modules. With compatible connectors, DIN mounting, and +24VDC input power, the NetboxSC module can be added to any existing WIM RS-485 daisy-chain network connected to a base radio module with no extra considerations for incompatible hardware.

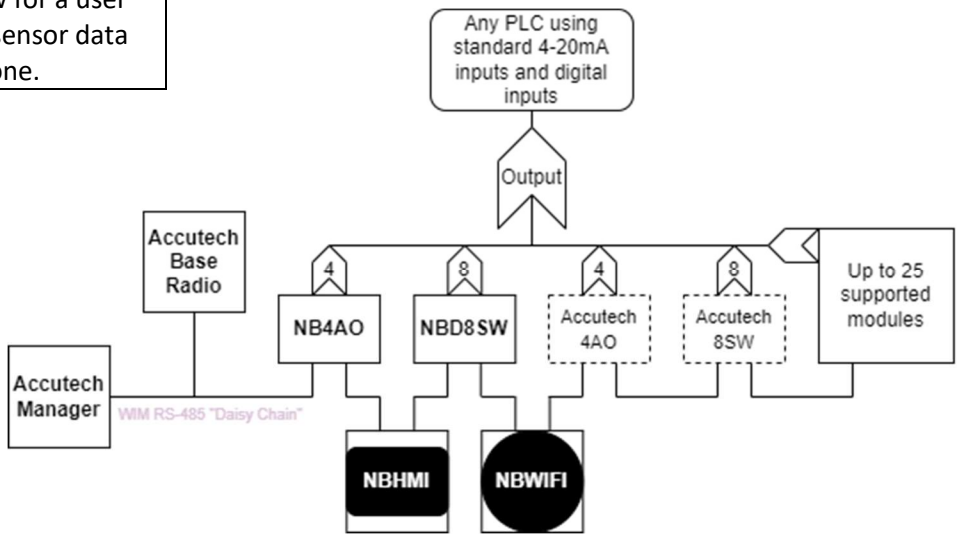

Fig. 1.1 System Block Diagram

[1]Accutech is a trademark of Schneider Electric

2: Quick Start

This section summarizes the steps that should be taken in order to get the device installed, configured, and in operation quickly.

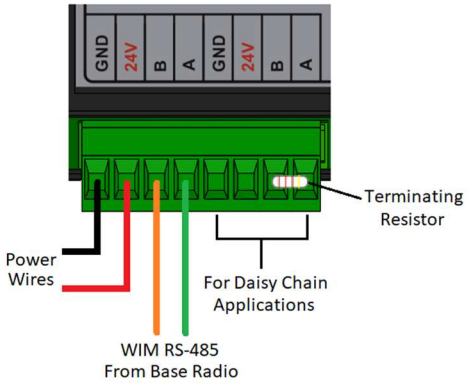

Fig. 2.1 Daisy-Chain Termination

1. Wire 24VDC power to the Output Module (See side Diagram)
2. Wire WIM RS-485 communications to the Module (See side Diagram)
3. Place terminating resistor in terminal only if Module will be used as an End Unit (see side Diagram)
4. With only one Output Module on the RS-485 network at a time, configure the RS-485 Address of each module via the Output Device Utility. (Only assign addresses between 3 and 32).
5. Once each module has been given a unique address, re-wire the modules in a daisy-chain with the Base Radio, making sure that the device with the terminating resistor (could be Base Radio) is in the End Unit location. (See Diagram below for daisy-chain wiring diagram).

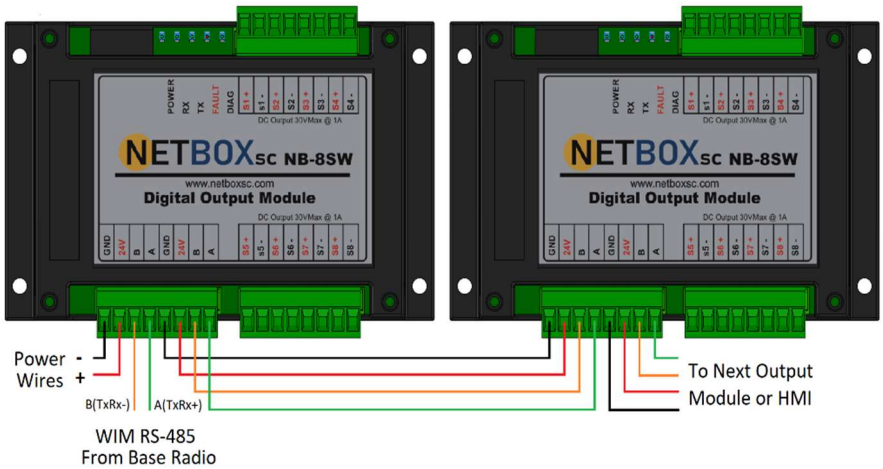

Fig. 2.2 Daisy-Chain Wiring Diagram

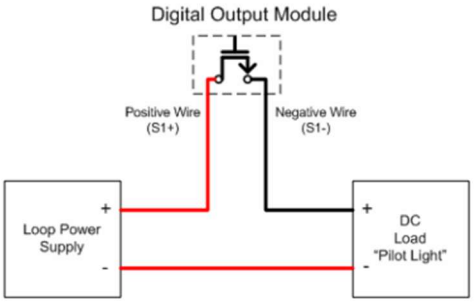

Fig. 2.3 Digital Connection Diagram

6. Wire digital outputs (S1…S8) (See side Diagram)
7. Using Wireless Instrumentation Manager software, configure Digital Output to monitor various Field Unit and Network parameters via the Properties of each Output Module

3: Electrical Installation

In this section wiring instructions are discussed for the various setup capabilities of the NB-8DO Digital Output Module. The subsections are as follows:

3.1: Electrical Specifications

- +24VDC Power Supply with 0.5 Amp minimum output Recommend 22AWG Power Supply wire
- 2 Wire WIM RS-485 Serial Communications Cable Recommend Belden 3105A shielded and protected 22AWG or equivalent
- All output loops are isolated and MUST be externally powered. Two or more channels can be wired to the same Loop Power.

3.2: Wiring Power and Communications

⚠ WARNING ⚠

Remember to turn off all power before hooking up power wires!

Once you have located power and communications terminal blocks shown in Figure 3.2.1, you can wire the Digital Output Module accordingly. The best way to wire the Module is to:

1. Remove the terminal blocks from the jacks on the NB-8DO Output Module
2. Secure the wire into the proper terminal blocks via the small standard screws located on the top of the terminal blocks.
3. Plug the terminal blocks back into the proper jacks on the Output Module.

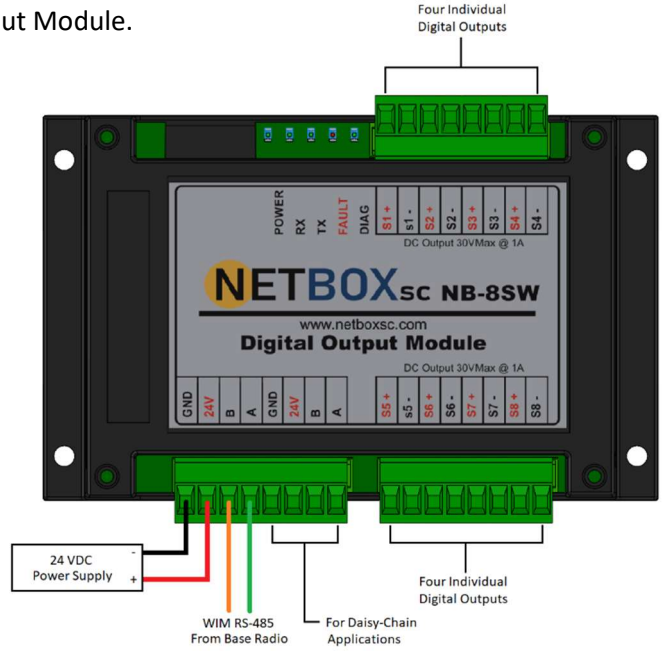

Fig. 3.2.1 Overall Wiring Diagram

3.3: "Daisy-Chaining" Multiple Output Modules

⚠ CAUTION ⚠

Make sure only ONE power supply is routed to an Output Module at any time! (Does not apply to Loop Power Supplies)

In order to allow the Accutech Base Radio to communicate to an NB-8DO Output Module the user MUST daisy chain the Accutech Base Radio to the Output Module

To do so, bring the WIM RS-485 wires from the Base Radio to the Output Module terminal block labeled "RS485 from Base Radio" shown in the Figure 3.2.1: Overall Wiring Diagram. Then simply attach the outbound WIM RS-485 communication cable to the A and B terminals of each module. Keep in mind that all A and B connections must be connected to their respective terminals. Failure to do so will result in faulty communications on the WIM RS-485 network.

Power may be supplied in daisy-chain form from a single power supply, but be sure not to power a module from two separate supplies in series. Doing so will supply the Output Module with 48VDC and destroy the unit! The two GND and 24V connectors on the module are connected internally and are used for daisy chaining modules together.

NOTE

If one of the Output Modules in the daisy-chain application is wired to the NB-BR converter cable, the A (Tx +) and B (Tx-) wires may need to be crossed for correct operation. Please see the converter's user manual for further instructions.

Shown in Figure 3.3.1, is a common daisy-chain network using three optional NetboxSC NB-4AO Analog Output or NB-8SW Digital Modules. In this setup the output from one Output Module is the daisy chained input to the next Output Module.

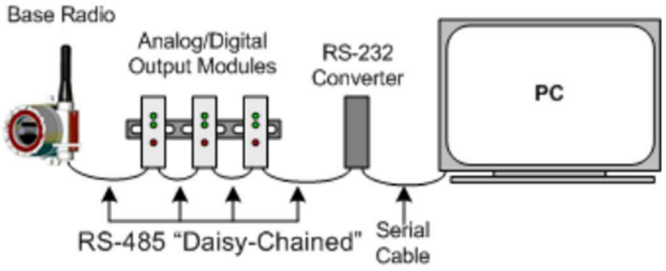

Fig. 3.3.1 Daisy-Chained Network

Shown below in Figure 3.3.2, is an example of how to wire the modules together when using a daisy-chain setup with multiple Digital Output Modules.

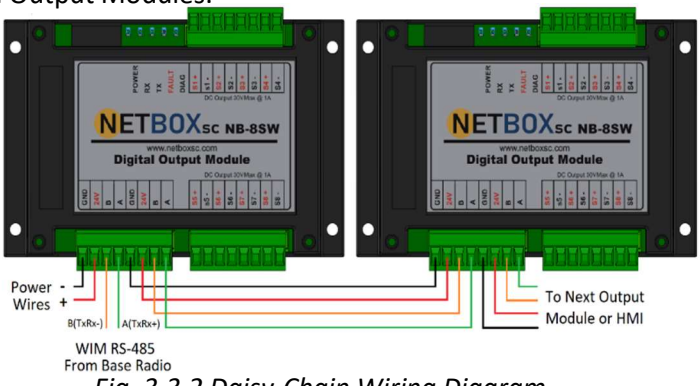

Fig. 3.3.2 Daisy-Chain Wiring Diagram

3.4: Terminating Output Modules

RS-485 is capable of maintaining communications over a maximum distance of approximately 3000 to 4000 feet. In most (and we recommend all) situations the unit that comprises an "end" of an RS-485 network should be terminated by a resistor wired across the A and B communication wires.

In the case of a daisy-chained application the end unit should be terminated. The end unit is the unit that is at the end of series of units. Note: a PC is also an end unit, but the termination for this end unit is done within the converter. In a multiple unit daisy-chain application the end unit is the RS-485 unit located farthest from the PC, as shown in Figure 3.4.1 below:

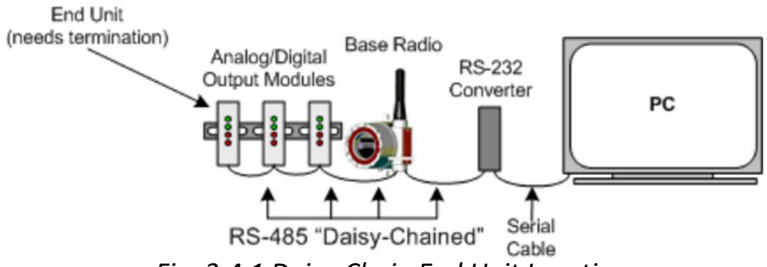

Fig. 3.4.1 Daisy-Chain End Unit Location

Termination of an end unit is done by placing a resistor across the A and B wires of the RS-485 cable. The value of this resistor should match the characteristic impedance (Zo) of the RS-485 cable. The characteristic impedance (Zo) is published by the manufacturer of the RS-485 cable you are using. The nominal value for the terminating resistor is 120Ω @ ¼ Watt.

To terminate an Output Module simply place one end of the resistor in the open terminal block's B slot and place the other end of the resistor in the open terminal block's A slot. Doing so will place the resistor across the A and B wires as needed. An example of this is shown below:

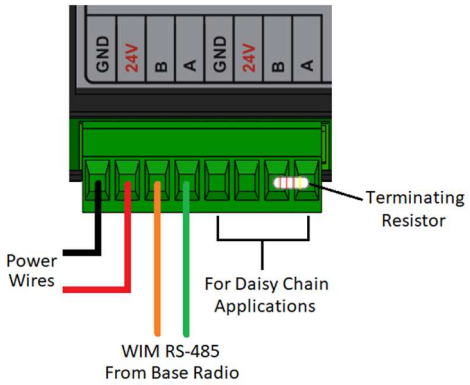

Fig. 3.4.2 Daisy-Chain Termination

3.5: Wiring Digital Outputs

NOTE

The de-energized state of all digital switches is NORMALLY OPEN. Consideration should be given, as in the event of power loss to the device, all switches will OPEN.

Because the Digital Module is simply a Normally Open semiconductor switch type operation, some excitation may need to be supplied to the digital circuit in order to determine the state of the digital circuit, as shown in Figure 3.5.1 below. The amount of power supplied to the loop is determined by the requirements of the device that is monitoring the state of the digital circuit. The power supply limits of the digital circuit are 30VDC and 1A each. Different loop power supplies may be implemented but a common ground must be maintained between them.

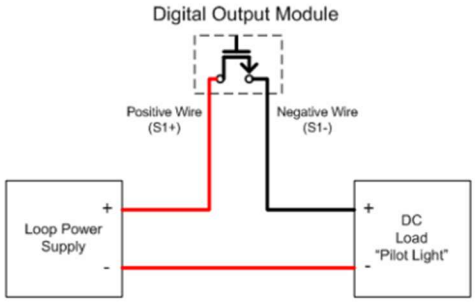

Fig. 3.5.1 Digital Loop Diagram

4: Configuring the RS-485 Address

Each Output Module has a WIM RS-485 address. These addresses must be set before the Output Modules can be used in service. Only one Output Module can be connected to the WIM RS-485 network at a time when doing address configuration.

NOTE

All Output Modules are given an RS-485 Address of 3 at the factory. Thus, if you have purchased more than one module, readdressing must be performed. Failure to do so will prevent Wireless Instrumentation Manager from properly communicating with these devices.

NOTE

Connect only the 24v power supply and communications connections A and B for address configuration

To set the WIM RS-485 address for the Output Module, follow the instructions below. The factory default for all Modules is Address 3:

1. Make sure Wireless Instrumentation Manager Software is installed on the PC.
2. Wire and connect an individual Digital Output Module to the PC via the RS-485 converter.
3. Run the Output Device Utility. You should see the following screen after performing these steps:

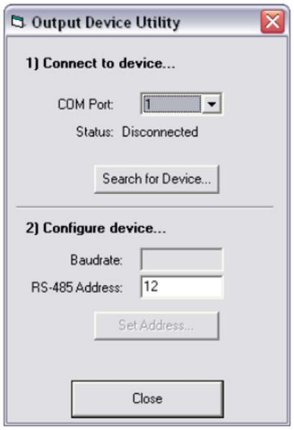

Fig. 4.1 Output Device Utility

Configuring the RS-485 Address cont.

NOTE

Programming the address only changes the module address and does not change any of the output trim or output configurations. If the user desires to change these settings, then it should be done through the Accutech Wireless Instrumentation Manager Software by using the trim and/or configuration functions or through a factory reset as described in section 6.

Once the Output Device Utility is open (Fig. 4.1), perform the following steps:

1. Select the COM Port that the module is connected (Usually COM 1)
2. Then click Search for Device
3. Once the device is found, its current Baud Rate and RS-485 Address will be displayed. Enter a new address from 3 to 32. (NOTE: Output Modules CANNOT share the same address if they reside on the same daisy-chain network)
4. Then click Set Address
5. Repeat all steps for subsequent devices. Note that all devices come factory configured to Address 3, and will conflict unless all are changed to different addresses.

5: Configuring the Digital Outputs

In this section software configuration instructions are discussed for the various setup capabilities of the Digital Output Module. The subsections are as follows:

NOTE

All loops must be externally powered as the Output Module does not supply the loop power. See section 3.5 for more wiring details.

There are eight possible digital outputs available on each NB-8DO Digital Output Module. Each individual loop is configured to a Field Unit RF ID number and variable within that Field Unit.

For example: If Switch 1 on the Digital Output Module has been selected to monitor Field Unit Status, then the Field Unit(s) that have been selected to be monitored will have their user selected status variables collectively output as specified on that switch.

The Module also has five indication lights:

- POWER — Indicates power is being supplied.
- RX — Flashes every time the Output Module receives an RS485 message from the Base Radio.
- TX — Flashes every time the Output Module transmits an RS485 message to the Base Radio.
- FAULT — Indicates loss of communication or sensor error with one of the four mapped inputs when lit.
- DIAG — Blinks error code patterns for diagnostics

5.1: Getting Started

Once you have properly wired up the Base Radio and the Digital Output Module(s), turn on the Field Units, Base Radio and Output Module. Make sure that the Field Unit(s) and Base Radio are communicating properly (see respective User Guides for more details). Then run the Accutech Wireless Instrumentation Manager (WIM) software.

Once you are connected to the WIM software, click on the Base & Output Devices icon in the left-hand VIEWS pane. The top half of the view will contain all Base Radios on your network. The bottom half of the view will contain every Output Module that is on the network. Each Module that is in the WIM RS-485 network should appear on the screen. This will include their address and type. If it does not there, there is an error in the setup that needs to be corrected.

If you have connected a Digital Output Module but do not see it being displayed, you may have to tell the software to look for new devices. The software performs a new device search upon start-up of the RF Server, however if devices are added after the RF Server is already running, they may not be detected. To manually perform a new device search click Discover Devices, which is found under the File menu. The software will inform the user when it is finished searching for devices via the Events Log.

5.2: Mapping Field Units to Digital Outputs

Any combination of Field Units and their respective inputs and outputs may be mapped or "linked" to the various digital outputs on the Digital Output Module. This is done in the Base & Output Devices view within the WIM software as shown below.

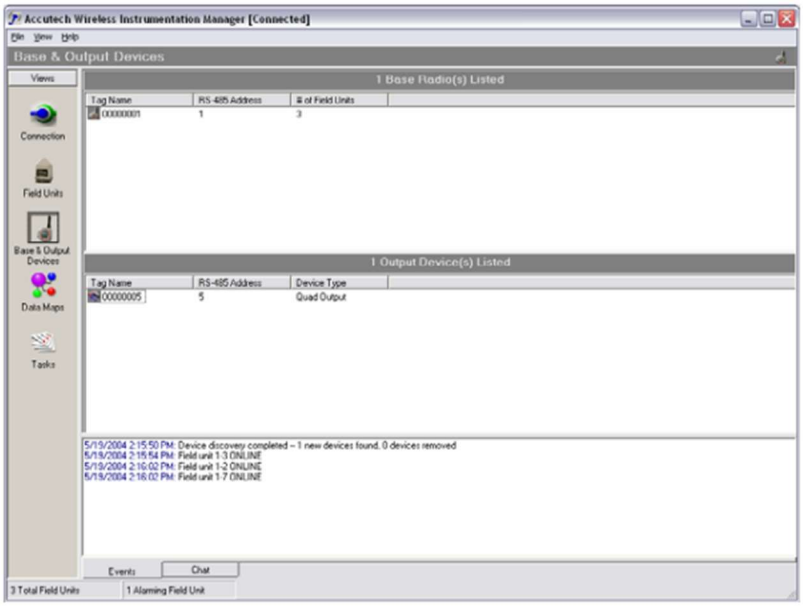

Fig. 5.2.1 Base and Output Devices

Mapping Field Units to Digital Outputs cont.

To map the Field Unit(s), double-click on the Output Module or right-click and select Properties. Doing so will open the Output Device Properties menu as shown below.

NOTE

The de-energized state of all digital loops is NORMALLY OPEN. Consideration should be given, as in the event of power loss to the device, all switches will OPEN.

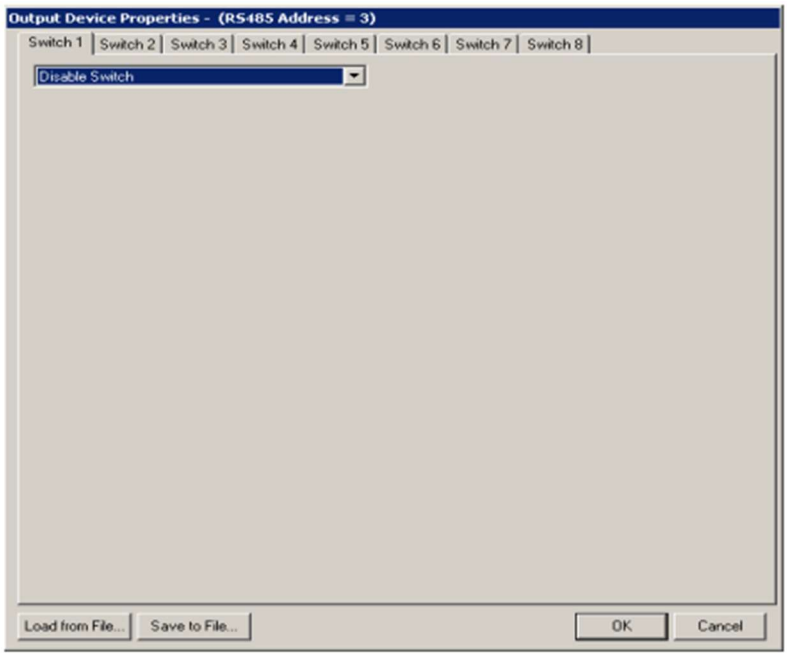

Fig. 5.2.2 Output Device Properties

As seen above, the switches all come in the disabled position from the factory. The disabled position is the normally open position. Because these switches are normally open, the device will revert to open position on all switches if a power loss occurs.

To enable a switch, select the intended mode for the switch in the respective drop box menu. Each of the switch modes available are outlined in the following section along with configuration instructions.

5.2.1: Monitoring Field Unit Process Values

The 'Monitor Field Unit Process Value' mode is used to open and close the switch output based on the value of the Field Unit's process variable. As shown in Figure 5.2.3, once the mode has been selected in the drop-down box, the menu shown on the next page will appear:

Monitoring Field Unit Process Values cont

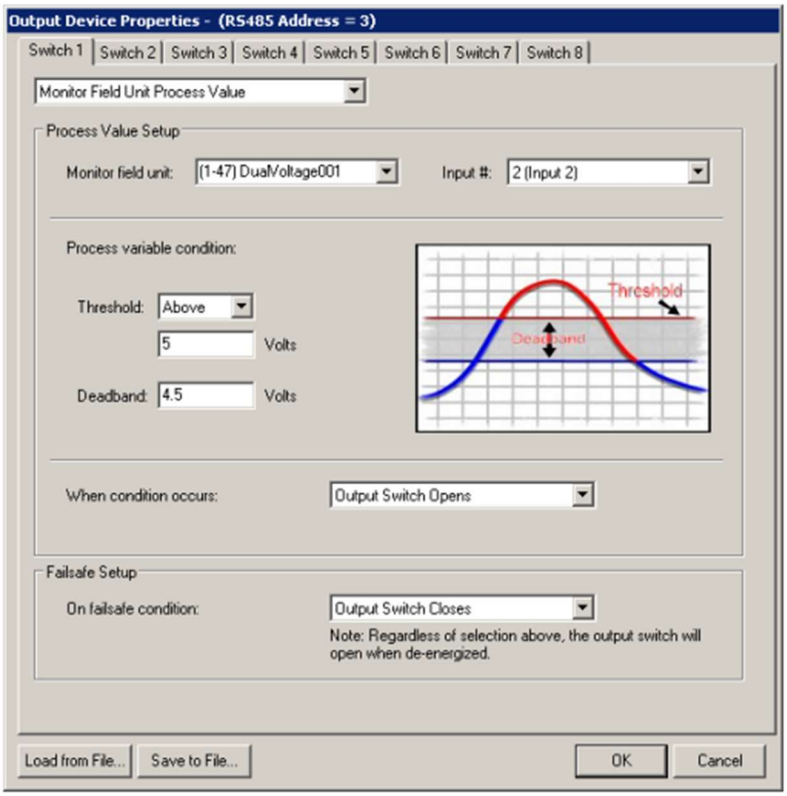

Fig. 5.2.3 Monitor Field Unit Process Value

NOTE

Once a switch has been enabled to operate in a certain mode, a Failsafe Setup box will be displayed on the bottom of Output Device Properties screen, as shown in Figure 5.3.

The failsafe condition setting indicates which state the switch will be set to, in the event of a failsafe condition such as loss of communications with the Base Radio. However, if the Output Device loses power the switch will be in an OPEN state.

In the above example Switch 1 (S1+, S1-) is being setup to monitor the process variable of the Field Unit with RF ID 47 and a Tag Name of DualVoltage001. The Field Unit's number two, or secondary process variable has been set to be monitored via the Input # drop box. Since the unit being monitored is a Multi-Input Field Unit, the Threshold and Deadband values are in whichever units the device has been configured to; in this case volts.

The Threshold setting is the set point that if exceeded, the state of the switch will change to state selected in the When condition occurs drop box; in this case the switch has been set to open when the threshold is exceeded.

The Deadband setting is an additional margin about the threshold at which the switch will be allowed revert to its original state. The value entered in the Deadband box is the width of this deadband, and NOT a set point. For example, with the above settings Switch number one would open when the [second] input variable of Field Unit RF ID 47 is above 5 Volts. Say this open switch turns on a discharging device of some sort and the voltage begins to fall from the 5 Volts it reached to 4 Volts. The switch will remain in the open state, and the discharging device will remain on, even though the measured voltage has fallen below the threshold. This is due to the deadband that was set. In this case the switch will not close and

Monitoring Field Unit Process Values cont

turn off the discharging device until the voltage reaches 0.5 Volts. Once the voltage falls below 0.5 Volts, it must climb back above the 5 Volt threshold to open the switch again.

5.2.2: Monitoring Field Input Switches

The 'Monitor Field Unit Input Switches' mode is used to open and close the switch output based on the current state of the switch input being monitored by a Field Unit(s). As shown in Figure 5.2.4 once the Monitoring of a Field Unit's Input Switches mode has been selected in the dropdown box, the following menu will appear:

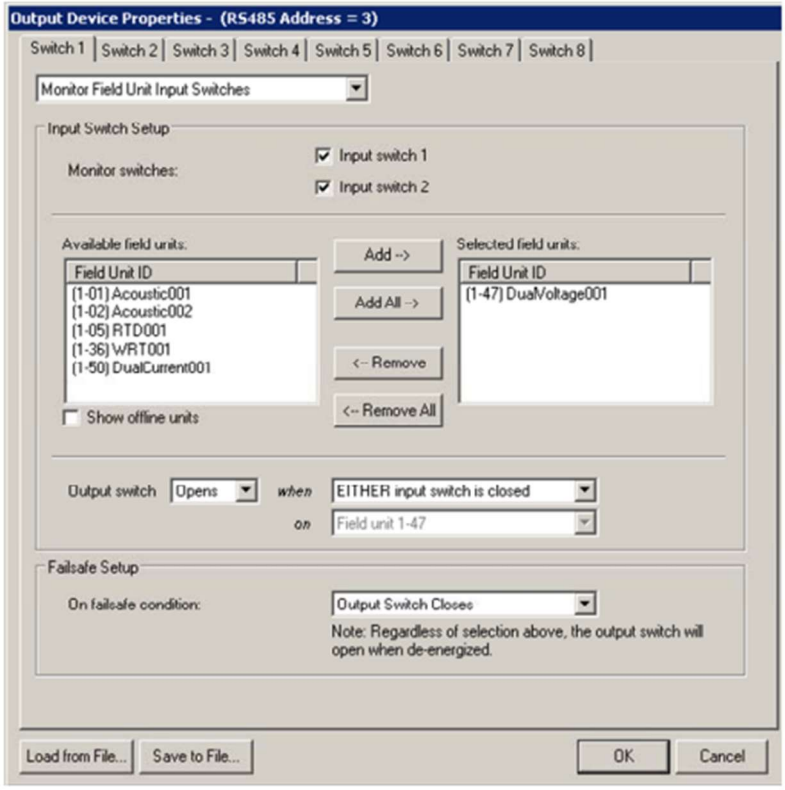

Fig 5.2.4 Monitor Field Unit Input Switches

In the above example Switch 1 (S1+, S1-) is being set up to monitor the switch inputs of the Field Unit with RF IDs 47 and Tag Name DualVoltage001. The Field Unit's Input Switch 1 and Input Switch 2 have been set to be monitored via the respective check boxes. Note that in the list of Available Field Units only online Field Units are displayed. If it is desired to have all possible Field Units displayed, check the "Show offline units" box.

Since we have chosen to monitor both input switches of the two Field Units, we are allowed to enter two rules which will determine the state of the output switch (Switch 1 on the Digital Output Module in this case). The first rule pertains to the two input switches on EACH Field Unit. The rule is asking whether the output

Monitoring Field Input Switches cont.

switch (on the Digital Output Module) should open/close (depending on the user setting) when EITHER input switch closes on a Field Unit or if the output switch should open/close only when BOTH input switches on a Field Unit close.

The second rule pertains to Field Unit(s) that are listed in the Selected Field Units box. The rule is asking if the output switch should open/close when ANY Field Unit meets the first rule or if the output switch should open/close only if ALL Field Units meet the first rule. (In Figure 6.4 we are only monitoring one Field Unit so that is the only available rule).

If we had chosen only to monitor Input Switch 1 OR Input Switch 2 and not both, the first rule would have been unavailable. This means that only the second rule would apply to respective monitored input switch.

5.2.3: Monitoring Field Unit Stations

The monitoring of a Field Unit's status mode is used to open and close the switch output based on the current status of a Field Unit(s). Once this mode has been selected in the dropdown box, the menu in Figure 5.2.5 (on the next page) will appear.

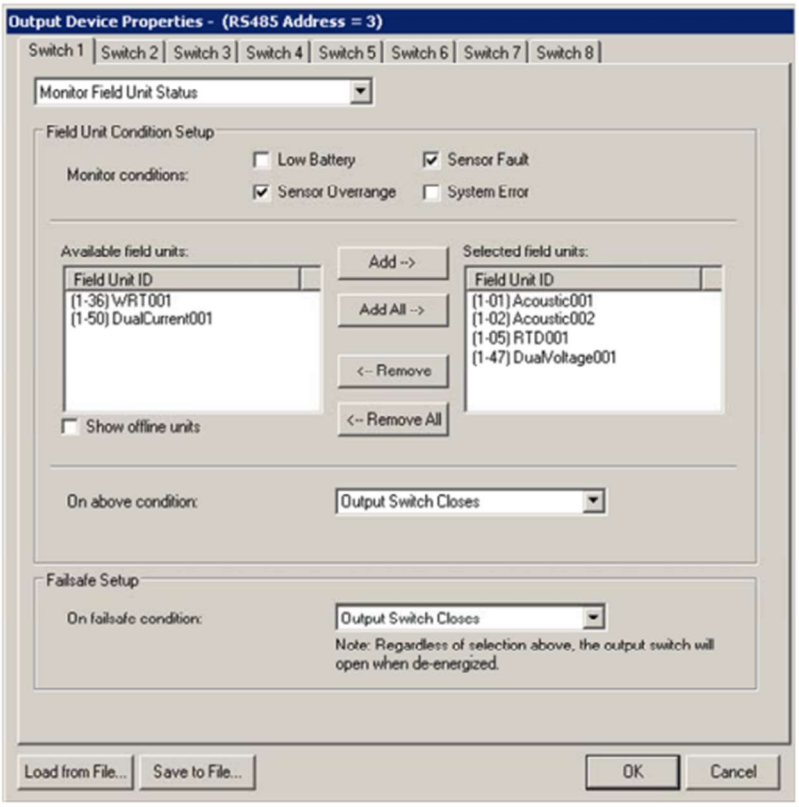

Fig. 5.2.5 Monitor Field Unit Status

Monitoring Field Unit Stations cont.

In the example on the previous page, Switch 1 (S1+, S1-) is being set up to monitor the status of the Field Units' with RF IDs 1, 2, 5 and 47. The Field Units' Low Battery and Sensor Fault have been set to be monitored via the respective check boxes.

If for any reason one of the selected conditions become true for ANY of the Field Units that are listed in the Selected Field Units box, the output switch will open/close. The user must determine whether the output switch should open or close based on the previous parameters. This is selected via the "On above condition" drop box.

5.2.4: Monitoring Base Radio Status

The monitoring Base Radio status mode is used to open and close the switch output based on the detection of a fault condition with the Base Radio communications.

In this mode, the switch will open/close if for any reason the Base Radio stops communicating on the RS-485 network to the Digital Output Module. The user must determine whether the output switch should open or close based on the previous parameter. This is selected via the drop box.

6: Factory Reset and Diagnostics

The NB-8DO has two built in features for preforming a factory reset and internal diagnostics. There are two jumpers or DIP Switches located on the printed circuit board of the NB-8DO. To access these jumpers or switches the top cover of the module must be removed. This is done by removing the four screws located in each corner of the module. Once the cover is removed, locate the JP jumpers or the DIP switches located in the upper lefthand side of the board. JP1 or DIP switch 1 is used to perform a factory reset. JP2 is used to test each of the outputs.

6.1: Factory Reset

⚠ CAUTION ⚠

ALL previous values and setting are lost.

To perform a factory reset, install a jumper or turn on DIP switch 1. Remove all output connections to the NB-8DO. This is to prevent unwanted signals from appearing on the receiving input device such as a PLC. Apply power to the NB-8DO module. Press the Reset button located in the upper lefthand side of the NB-8DO module. The green power light should be on and the green diagnostic light should flash one time. Doing this operation will reset the address of the module to 3, clear all outputs to a factory setting and disable all configurations. Remove power from the NB-8DO module and remover the JP1 jumper or turn DIP switch 1 off. After this operation has been performed, the user should do the following:

1. Set the module address to the desired value (see section 4).

Factory Reset cont.

2. Set the Mapping of each Field Unit to a Digital Output of each channel using the Accutech Wireless Instrumentation Manager software. (section 5.3)

This operation should only be done if a complete reset of the NB-8DO module is desired.

6.2: Diagnostic Output

The NB-8DO has a diagnostic switch output mode. In this mode the NB-8DO will output switch signals that can be used to check it for proper operation. In this mode, each output is opened and closed in sequence.

To place the NB-8DO outputs in this diagnostic mode, install jumper JP2 or turn on DIP switch 2. Remove the output connections to the NB-8DO. This also prevents unwanted signals from appearing on the input device such as a PLC. Apply power to the NB-8DO module. Press the Reset button located in the upper lefthand side of the NB-8DO) module. The green power light should be on as well as the red fault LED. This is followed by the alternating green diagnostic LED then the red fault LED approximately 2 seconds apart. This indicates the module is in diagnostic mode. Each output will now change with each change of the LEDs. This pattern will continue until the power is removed and the JP2 jumper removed or the DIP switch 2 is set to off. Putting the module in diagnostic mode does not change any of the previous setting made by the user. Once the use of this mode is completed, restore the module and wiring to its original condition for normal operation.

7: Technical Specifications

Operating Characteristics:

- 10-30 VDC
- 0°F to 175 °F (-17 °C to 79 °C)

Digital Output Characteristics:

- Switch closure outputs are individually isolated and rated for 5- 30 VDC and 1 Amp Max.

Physical Characteristics:

- DIN Rail mounted
- 3.6” high X 5.7” wide X 1.2” deep

Fault (Fail-Safe) Condition:

- Each output goes into fail safe in the event of a sensor failure, missing sensor, NO RF condition, RS-485 link down, field unit powered down
- The Digital Output Module displays a fault indication if any enabled output goes into a fail-safe condition

User Programmable Options:

- Range (lower value range and upper value range) each output using Wireless Instrumentation Manager (WIM)
- Enable or disable failsafe for each output
- Select RS-485 address with the Configuration Utility Program