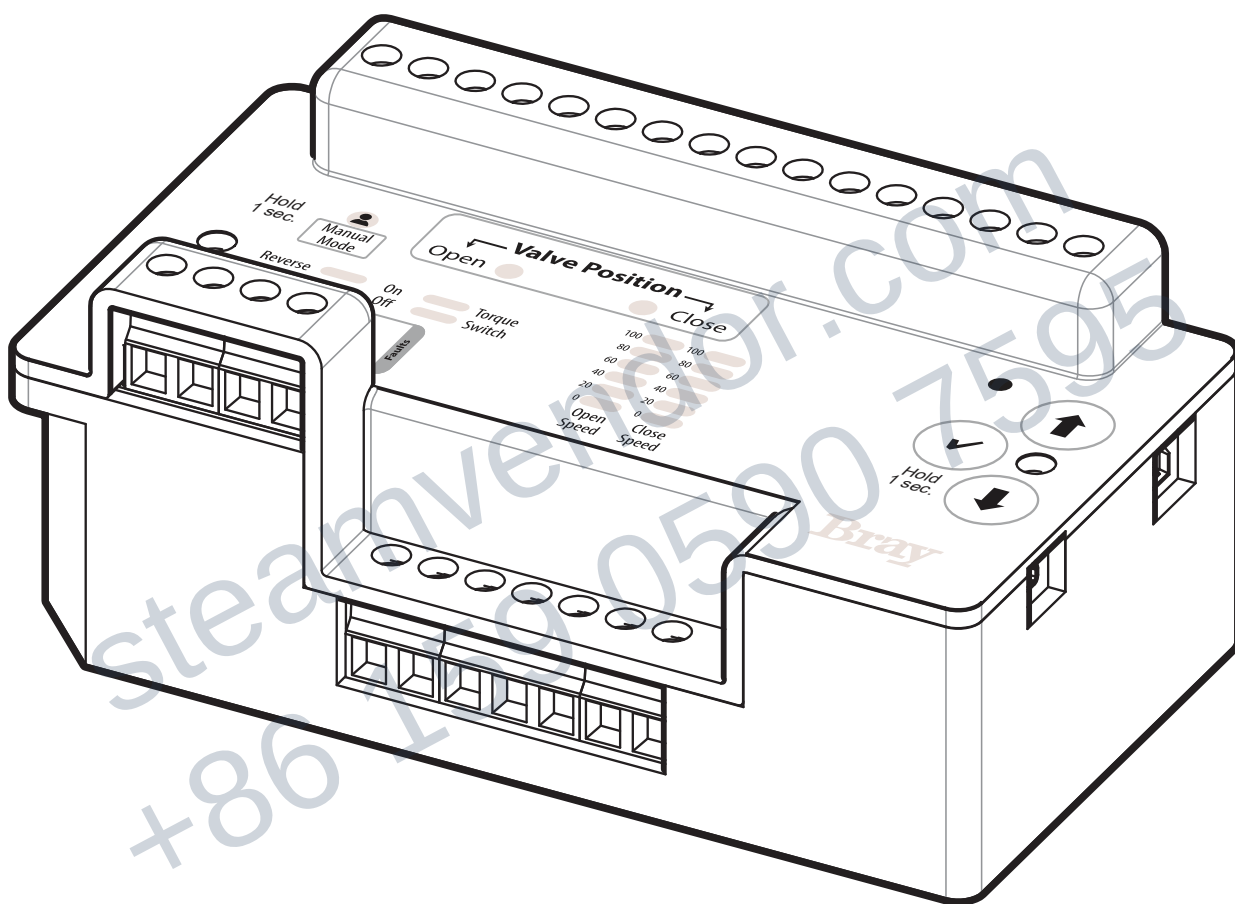

SERIES 70

24V ON/OFF NXT CONTROLLER

Installation, Operation, and Maintenance Manual



 **Bray**®

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**READ AND FOLLOW THESE INSTRUCTIONS CAREFULLY.
SAVE THIS MANUAL FOR FUTURE USE.**

0.0 DEFINITION OF TERMS

All information within this manual is relevant to the safe operation and proper care of your Bray valve. Please understand the following examples of information used throughout this manual.

0.0 IDENTIFIES CHAPTER HEADING

0.00 Identifies and explains sequential procedure to be performed.

NOTE: Provides important information related to a procedure.

SAFETY STATEMENTS: To prevent unwanted consequences.
Standard symbols and classifications are:



DANGER

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE

Used without the safety alert symbol, indicates a potential situation which, if not avoided, may result in an undesirable result or state, including property damage.

Additional **product information** (such as application data, engineering specifications, actuator selection, etc.) is available from your local Bray distributor or sales representative, or online at **BRAY.COM**

For complete details on the latest product **certifications**, visit **BRAY.COM/Certifications**.

1.0 SAFETY

1.1 Hazard-Free Use

This device left the factory in proper condition to be safely installed and operated in a hazard-free manner. The notes and warnings in this document must be observed by the user to ensure hazard-free operation of this device.

All necessary precautions need to be taken to prevent damage due to rough handling, impact, or improper storage. Do not use abrasive compounds to clean the device, or scrape its surfaces with any objects.

Configuration and setup procedures for this device are described in this manual. Proper configuration and setup are required for the safe operation of this device.

The control system in which this device is installed must have proper safeguards to prevent injury to personnel, or damage to equipment, should a failure of system components occur.



WARNING

Equipment controlled by the device can generate large mechanical forces during normal operation.

1.2 Qualified Personnel



WARNING

The device must only be installed, commissioned, operated and repaired by qualified personnel.

Installation, commissioning, operation and maintenance of the device must be performed under strict observation of all applicable codes, standards and safety regulations.

As per this document, a qualified person is one who is trained in:

- > The operation and maintenance of electric equipment and systems in accordance with established safety practices.
- > Procedures to energize, de-energize, ground, tag and lock electrical circuits and equipment in accordance with established safety practices.
- > The proper use and care of personal protective equipment (PPE) in accordance with established safety practices.
- > First aid.

2.0 DESCRIPTION OF OPERATION

The Bray Series 70 On/Off NXT provides Open/Close valve control and monitoring of the Bray Series 70 Electric Actuator. The basic function of the On/Off NXT is to position the S70 Actuator in response to a command signal from a process controller. The process controller contains a desired process set point entered by the user, and continually monitors the process variable (such as flow rate, tank level, etc.) through some type of sensor. Switching the command signal to the On/Off NXT will cause the actuator to change position, which will move the associated valve open or closed to modify the process variable. The process controller continually calculates and transmits the appropriate command signal to the On/Off NXT to maintain the process in the desired state of operation.

The command signal to the On/Off NXT can be 24VAC, 50/60 Hz, +/-10% or 24VDC -10 to +30%. Optional actuator auxiliary limit switches provide a discrete contact closure for actuator position feedback. Specific operating modes are enabled by a simple-to-use configuration menu.

The 24V On/Off Controller offers 3-wire control for the actuator. To drive the actuator in the open direction, 24V power must be applied between the "Open" and "Common" terminals of the controller. Similarly, to drive the actuator in the close direction, 24V power must be applied between the 'Close' and 'Common' terminals of the controller. The same power type (AC or DC) must be used for both directions of travel.

When the command signal is first applied, the Controller will wait for 1 second before powering the actuator motor. This delay is necessary to prevent a simultaneous reversal of the motor if an abrupt change in command signal direction occurs (instant reverse delay).

When the actuator reaches end of a travel direction (open or closed limit switch) the On/Off NXT will stop motor function to prevent damage to the actuator or valve. The system integrator may elect to continue to apply control power to the On/Off NXT to keep internal electronics and the optional internal space heater powered.

3.0 USER INTERFACE

The On/Off NXT features a rich, LED-based menu that displays both configurable settings and operational status. Indicators are grouped together based on function, shown by their respective label(s).

Without any user interaction, the On/Off NXT will display the factory default product settings, in addition to mode of operation, valve position, and fault status.

3.1 Product Setting

The product settings determine how the On/Off NXT will respond to commands from the process controller. These must be defined and verified before operation begins. The settings that can be adjusted on the On/Off NXT are, in clockwise order:

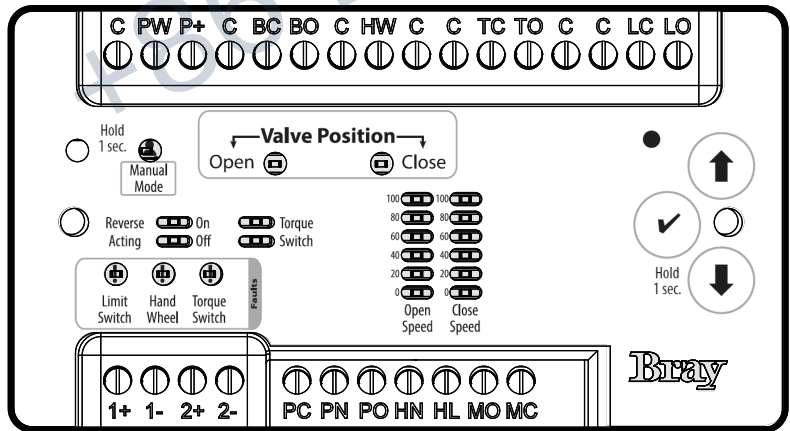
- > Close Speed - Close Speed Control
- > Open Speed - Open Speed Control
- > Torque Switch - Torque Switch Detection
- > Reverse Acting - Reverse Acting Mode

All units ship with default settings from the factory.

Table 1: On/Off NXT default settings

Feature	Setting
Open Speed Control	100%
Close Speed Control	100%
Torque Switch Detection	Off
Reverse Acting Mode	Off

Figure 1: On/Off NXT Menu



3.2 Changing Settings

Settings can be changed locally by utilizing the keypad on the On/Off NXT. The keypad is located on the right side of the unit, and the keys are labelled based on the operation performed.

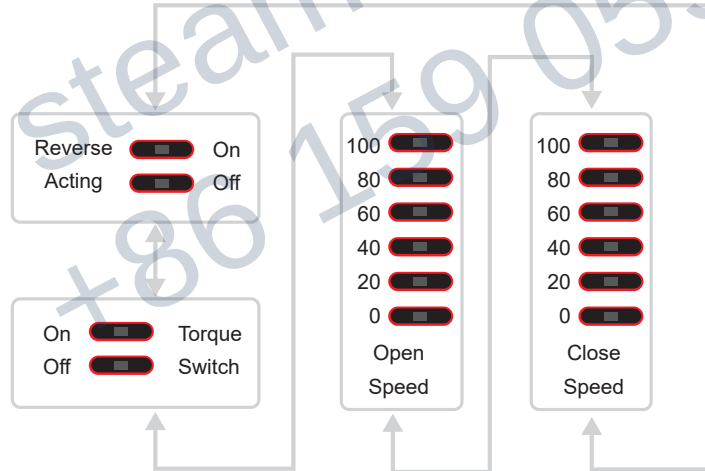
See **Figure 1: On/Off NXT Menu**

- > **Up arrow** - Cycles the cursor (see below) in a counter-clockwise direction
- > **Down arrow** - Cycles the cursor in a clockwise direction
- > **Check mark** - Activates the selected setting (if applicable) and saves the current configuration

Settings are changed using the cursor, visualized by a flashing indicator. To produce the cursor, the up or down arrow key must be pressed, causing one of the setting indicators to flash. Pressing or holding the Up or Down Arrow will move the cursor in the respective direction, as illustrated in **Figure 2: On/Off NXT Input Settings**. Producing the cursor does not alter any settings without further user input, and the cursor will automatically timeout if the keypad is not used.

Once the cursor has been positioned over a desired setting, pressing and holding the check mark for 1 second or more will activate the selected setting. Attempting to activate a setting that is already active will have no additional effect.

Figure 2: On/Off NXT Input Settings



3.3 Description of Settings

See **Figure 1:** On/Off NXT Menu

3.3.1 Input Signal Type

Input signals position the valve under control, based on the applied signal. During normal operation, 24V applied to the close input will move the valve to the closed position and 24V applied to the Open input will move the valve to the Open position.

Reverse Acting Mode inverts this relationship (Close input = Open position, Open input = Close position). Only one input signal can be active at a time. If both open and close inputs are active at the same time, the On/Off NXT will only respond to the close input and will move towards the Close position if not already closed.

3.3.2 Open Speed Control

Open Speed Control determines how quickly the On/Off NXT operates the actuator in the open direction. This value is a percentage of the full speed. The illuminated indicators act as a level gauge: activating a speed setting illuminates all lower speed setting indicators. Maximum speed illuminates all indicators, while minimum speed illuminates only one. This setting is independent of Close Speed Control. See **Figure 3: Open speed control range.**

Table 2: On/Off NXT Open Speed Setting

Open Speed Setting	Description
0% - 100% (default) Step size: 20%	Actuator open speed as a percentage of full speed

3.3.3 Close Speed Control

Close Speed Control determines how quickly the On/Off NXT operates the actuator in the close direction. This value is a percentage of the full speed. The illuminated indicators act as a level gauge: activating a speed setting illuminates all lower speed setting indicators. Maximum speed illuminates all indicators, while minimum speed illuminates only one. This setting is independent of Open Speed Control.

Figure 3: Open speed control range

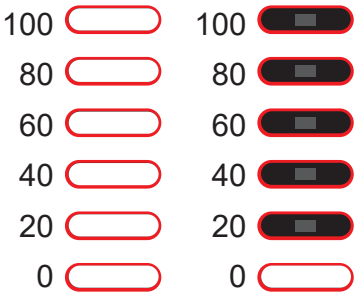


Table 3: On/Off NXT Close Speed Setting

Open Speed Setting	Description
0% - 100% (default) Step size: 20%	Actuator open speed as a percentage of full speed

3.3.4 Torque Switch Detection

Torque Switch Detection determines whether the On/Off NXT is responding to input from the torque switch assembly. When ON is selected, the On/Off NXT will stop actuator motor operation if an over torque condition occurs in the commanded direction of travel. The actuator may still be motor operated in the opposite direction of travel permitting review and correction of the over torque condition. When the actuator is moved in the opposite direction of the over torque condition, the torque switch will reset permitting motor operation in the original direction.

This setting should only be activated only if torque switches are connected to the On/Off NXT.

Table 4: On/Off NXT Torque Switch Settings

Torque Switch Setting	Description
OFF (default)	On/Off NXT does not monitor torque switch input for over torque conditions. Responds normally to input commands
ON	Actuator movement stopped if over torque condition occurs in the commanded direction of travel.

3.3.5 Reverse Acting Mode

Reverse Acting Mode determines how the On/Off NXT responds to input commands. When Reverse Acting is ON, the On/Off NXT will operate inversely to how it operates normally, treating the open input signal as the close command and the close input signal as the open command. On/Off NXT controller limit switch settings are not changed when this option is selected. Ensure that the field wiring to the auxiliary limit switches aligns with the desired acting mode.

Table 5: On/Off NXT Reverse Acting Mode Settings

Reverse Acting Setting	Description
OFF (default)	On/Off NXT responds normally to input commands
ON	On/Off NXT responds inversely to input commands

3.3.6 Operating Modes

3.3.7 Remote Mode

By default, the operating mode of the On/Off NXT is remote mode, where the valve is positioned based on input signals. Exiting another mode of operation generally results in the On/Off NXT returning to remote mode.

3.3.8 Local Mode

Local Mode is entered if a connection is made to the Control Box terminals and a command signal is present. See **Figure 6: Internal actuator connections**. This allows the On/Off NXT to be controlled by a local control box, mounted to or near the actuator. See **section 5.1 Control Station** for more information.

3.3.9 Manual Mode

This operating mode allows for the actuator to be controlled directly from the user interface on the On/Off NXT. By utilizing the keypad, the user can change the position of the valve with a single button press. See **Figure 1: On/Off NXT Menu**

Manual mode is exited in the same way it is entered: by pressing and holding the manual mode button for 1 second. While in manual mode, the indicator next to the manual mode button remains lit. Manual mode can only be entered during remote operation.

Up arrow - Energizes the actuator in the open direction. The actuator will operate until it reaches the end of travel or the user presses the check mark key.

Down arrow - Energizes the actuator in the close direction. The actuator will operate until it reaches the end of travel or the user presses the check mark key.

Check mark - Sets the current actuator position as the command position. If the actuator is energized when the button is pressed, then it stops in place.

3.3.10 Status Indication

These are all indicators that report key information on the operation and functional status of the On/Off NXT and actuator. See **Figure 1: On/Off NXT Menu**

3.3.11 Valve Position

These two indicators provide position information of the valve under control. See **Figure 1: On/Off NXT Menu**. In addition, if the actuator is operating the valve, then it also indicates the current command position and direction of travel.

Direction indicators – The Open (green) and Close (red) indicators show the current direction of travel. When the actuator is energized, the corresponding indicator will flash to indicate travel. The green indicator will be lit if the open travel limit is reached. The red indicator will remain lit if the close travel limit is reached.

3.3.12 Fault Status

These indicators in the lower left of the user interface illuminate in the event of a fault. See **Figure 1: On/Off NXT Menu**. The occurrence of a fault generally indicates that user intervention is required to restore operation, and these indicators attempt to provide the diagnostic information needed to accomplish this.

The **Fault Status** indicators are, from left to right:

Limit Switch – Both travel limit switches have been engaged, preventing the actuator from operating, or the travel limit switches are not correctly wired to the On/Off NXT.

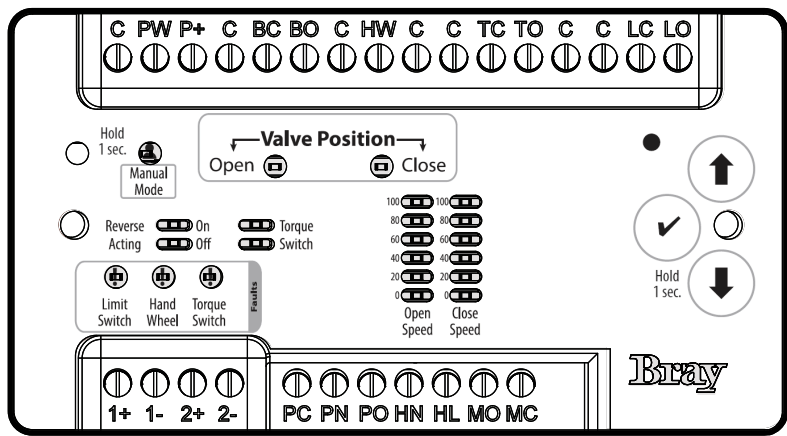
Hand Wheel – The actuator hand wheel has been engaged (pulled out), or the hand wheel switch is not correctly wired to the On/Off NXT.

Torque Switch – A torque switch has been engaged, or the torque switches are not correctly wired to the On/Off NXT.

3.3.1 Bray Logo

The Bray logo in the lower right of the user interface serves as status indicator or heartbeat for the On/Off NXT. No matter what operation is performed, the Bray logo should continuously flash. If they do not, refer to **Section 7.0 Troubleshooting Guide**.

Figure 4: On/Off NXT Status Indicators



4.0 HARDWARE DESCRIPTION

See **Figures 5 & 6** for reference

4.1 Terminal Connections



WARNING

Turn off all power and lockout/tag out service panel before installing or modifying any electrical wiring.

Terminals are provided on the unit for the landing of stripped wires, connecting the On/Off NXT to the external sources and signals needed for it to successfully operate. These terminals are positioned on the unit based on physical location of the connecting components and the voltages expected at the connection. There are two categories that the terminal connections fall into: high/low voltage and customer/actuator connection. Connections of differing voltage levels are differentiated by their height on the On/Off NXT, with higher voltage connections being near the bottom of the unit and lower voltage connections being near the top. Similarly, the customer and actuator connections are positioned such that they are easily accessible once the On/Off NXT is installed in an actuator. Actuator connections are generally made at the factory, and should not require any customer adjustment. All connections required for proper operation are **bolded** below.

Table 6: Terminal Connection Categories

	Customer Connection	Actuator Connection
Voltage (> 15V)	Power and Control Signal	Heater, Motor
Voltage (< 15V)	Auxiliary Limit Switch	Control Box, Hand Wheel, Torque Switch, Limit Switch



NOTICE

Refer to the actuator wiring diagram for wire gauge, torque, voltage, and temperature limits of the terminal blocks. All actuator connections should match the actuator wiring diagram.

On/Off NXT Module Terminal Strip: 14-24 AWG, Tightening torque 3.5 in-lbs

Other Terminal Strip: 14-22 AWG, Tightening torque 8 in-lbs

4.2 Power

Power connection that energizes the On/Off NXT and powers the actuator under control. The voltage supplied should be based on the actuator nameplate voltage and the voltage listed on the On/Off NXT label.

Verify that the actuator nameplate voltage and the On/Off NXT label voltage match before providing power to the unit.

The On/Off NXT has two onboard fuses that are in-line with the input power connections. Therefore, the power supply connected to the input power connection should be rated to provide at least this much current to each On/Off NXT.

4.3 Heater

If the actuator has an internal heater, then the heater wires are terminated at this connection. The heater will be powered by the input power connection. Only Bray supplied heaters should be connected to the On/Off NXT.

4.4 Motor

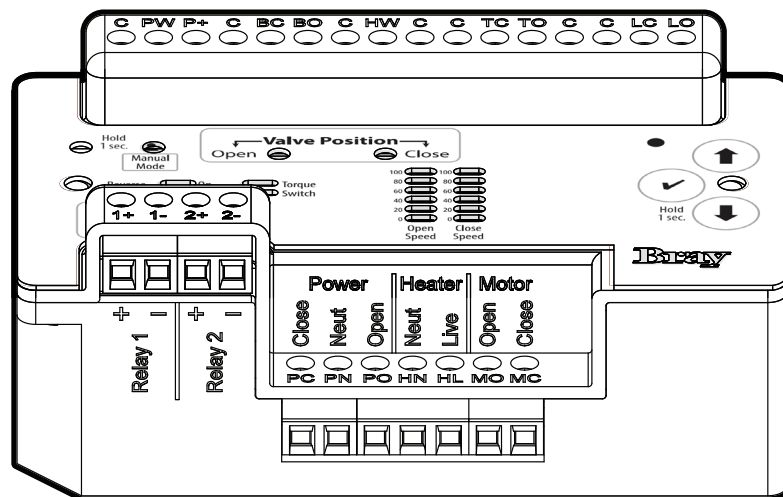
Connections for the motor that operates the actuator. Refer to the actuator manual for more information on the motor.

These terminal connections are not used. Do not attach wires to these terminal points

4.5 Relays 1 & 2

These terminal connections are not used. Do not attach wires to these terminal points

Figure 5: Power Connections



4.6 FB Pot

These terminal connections are not used. Do not attach wires to these terminal points

4.7 Control Box

The On/Off NXT provides a logic level voltage at the Open and Close terminals of this connection. If a switch connects either of the terminals to the COM terminal, this pin will be pulled to 0V, signaling the On/Off NXT to enter local mode. The On/Off NXT will not exit local mode until the Open and Close terminals return to their original voltage level. Once in local mode, the On/Off NXT will ignore input commands until remote operation resumes.

4.8 Hand Wheel

Connections for the handwheel override switch. When the actuator handwheel is engaged (pulled out), this switch prevents the actuator from operating until the handwheel is disengaged. The On/Off NXT provides a logic level voltage at the HW terminal of this connection. If the handwheel is engaged (pulled out), this pin will get pulled to 0V, signaling the On/Off NXT and resulting in a fault.

4.9 Torque Switch

Connections for the torque switch assembly, if present, which alert the On/Off NXT to the presence of excessive torque applied to the actuator.

The On/Off NXT provides a logic level voltage at the Open and Close terminals of this connection. If the actuator torque increases above the rated torque, the switch at the applicable connection will pull this pin to 0V, signaling the On/Off NXT to enter a fault condition.

4.10 Limit Switch

Connections for the travel limit switches, which indicate to the On/Off NXT when an end of travel set point has been reached.

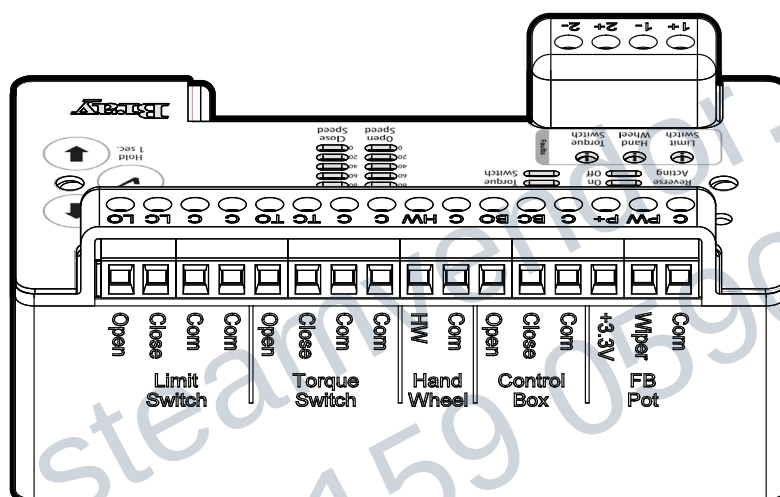
The On/Off NXT provides a logic level voltage at the Open and Close terminals of this connection. Once one of the travel limit switches is engaged, the switch at the applicable connection will engage and pull this pin to 0V, signaling the On/Off NXT to end travel.

For proper operation, both travel limit switches should not be engaged at the same time. This would prevent the On/Off NXT from operating the actuator, and results in a fault condition.

Low voltage actuator connections are powered by the On/Off NXT. An external source should never be connected to these terminals

Refer to the actuator manual for more information.

Figure 6: Internal actuator connections



5.0 ACCESSORY CONTROL METHODS

5.1 Control Station (Optional)

Figure 7: Control Station



The optional control station permits the operator to select different modes of operation for the actuator. The control station contains a 3 position control selector switch, 2 indicating lights (red and green) and an open, stop, close selector switch for use in local operation.

The Local/ Off/ Close selector switch lets the operator choose between the following three modes of operation:

Local - In this mode, using switch 2 the operator can drive the actuator to open or close position, or stop the actuator; overriding any control signal from the process controller.

Off - In this mode, the actuator can only be operated manually.

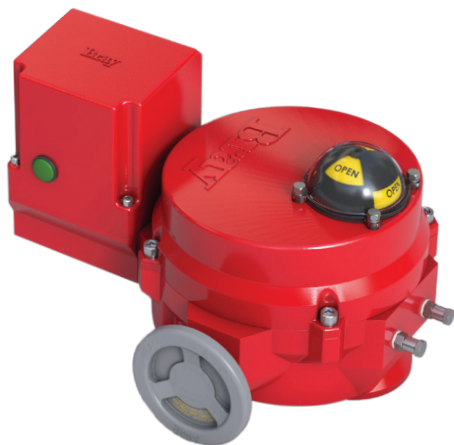
Remote - In this mode, the actuator is controlled remotely from a process controller using a 24 VDC or 24 VAC signal

NOTE:

Control Station requires a dedicated set of auxiliary switches. These switches are required for turning on or off the lights on the control station to locally indicate actuator position. Control Station does not contain terminal strips. All wiring is done directly to the switches and lights via 2 x 3/4" NPT holes in the bottom of the control station housing. Wire the process controller to the control station in accordance to the provided wiring diagram.

Control Station can also be ordered with key lockable switches. Ordering the Control Station with optional pin connector receptacles will eliminate the necessity of field wiring

5.2 Battery Backup Unit (BBU) Control Station (Optional)

Figure 8: Battery Backup Unit

To meet requirements of fail-safe operation in the event of a main power supply interruption, an optional battery backup unit is available for use with the On/Off NXT Controller. The BBU is compatible with 24V AC and DC powered actuators. During normal actuator operation, the BBU monitors the actuator main power supply and maintains a battery charge while keeping the batteries in ready reserve for fail-safe operation. If the main power is interrupted for more than 5 seconds, the BBU apply the stored battery power to move the actuator to the predetermined fail-safe Open or Close position.

The BBU fail-safe position is configured as either Open or Close on loss of main power. The actuator will remain at the fail-safe position until main power is restored and normal actuator operation resumes. At this time, the BBU will be recharge the battery to be made ready for the next fail-safe operation event.

The Battery Backup Unit (BBU) specifications:

- > Self monitoring battery health
- > Visual indication (LED) of BBU status
- > Dry contact for remote indication
- > Two 12V 1.4Ah rechargeable sealed lead acid batteries
- > Requires dedicated Class 2 transformer rated at 100VA
- > Operating Temperature -4°F to 122°F (-20°C to 50°C)
- > The BBU 24-27V AC or 30-38V DC (the minimum voltage is required to provide proper battery charging) Use dedicated Class 2 non-bonded transformer rated 100VA per BBU.

Refer to the Series 70 Battery Backup Unit Installation and Maintenance Manual for additional information.

7.0 TROUBLESHOOTING GUIDE

Refer to the actuator manual before adjusting or replacing any actuator components. Before testing or acting on any possible issues, check for any active faults.



WARNING

Turn off all power and lockout/tag out service panel before installing or modifying any electrical wiring

Table 7: Troubleshooting Guide

Issue	Possible Causes	Possible Solutions
On/Off NXT does not turn on when power is applied	Fuse is blown	Verify and replace
	On/Off NXT is incorrectly wired	Verify wire connections against the wiring diagram
	On/Off NXT is not receiving power	Test the Input Power connection with a multimeter or oscilloscope
	Power is not correct	Check the provided power against the voltage listed for the On/Off NXT and actuator
On/Off NXT not responding to command signal	On/Off NXT in Local Mode	If local control is being used, ensure the local control station is not active or is set to remote mode. If local control is not being used, test the voltage on the Control Box Open and Close pins relative to the COM pins. Greater than 3V should be measured.
	On/Off NXT in Manual Mode	Check the indicators for manual mode
	On/Off NXT is incorrectly wired	Verify wire connections against the wiring diagram
Actuator only runs in one direction	Wiring is incorrect	Correct field wiring
	Incorrect control signal	Check/correct the control signal wire
Limit Switch Fault	Both limit switches are engaged	Adjust actuator cams
	On/Off NXT is incorrectly wired	Verify wire connections against the wiring diagram
	Travel limit switch failure	Test the switches to ensure that they are changing states when engaged.
Torque Switch Fault	Torque Switch setting enabled with no torque switches connected	Disable torque switch setting
	Torque switch(es) engaged	Check the valve and/or actuator for obstructions.
	On/Off NXT is incorrectly wired	Verify wire connections against the wiring diagram
	Torque Switch failure	Test the switches to ensure that they are changing states when engaged.
Hand Wheel Fault	Hand Wheel is engaged	Disengage (push in) hand wheel
	On/Off NXT is incorrectly wired	Verify wire connections against the wiring diagram
	Hand wheel switch failure	Test the switch to ensure that it is changing states when engaged.

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