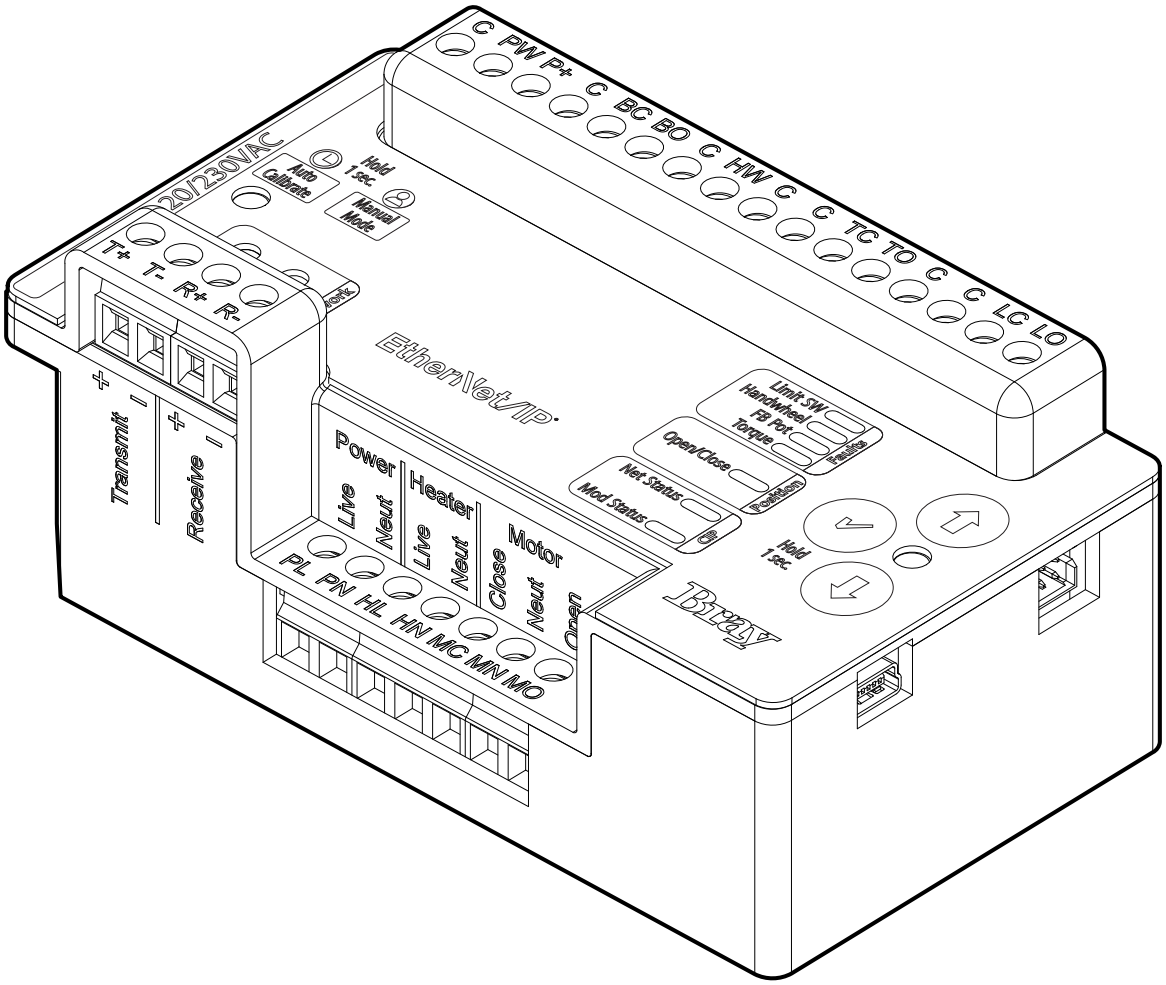
SERIES 70

SERVO NXT - ETHERNET/IP

Installation, Operation, and Maintenance Manual



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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 Indentifies and explains sequential procedure to be performed.

NOTE: Provides important information related to a procedure.

SAFETY STATEMENTS: To prevent unwanted consequences. Standard symbols and classsifications 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.

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1.0 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.

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.

2.0 QUALIFIED PERSONNEL

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

Installation, commissioning, operation and maintenance 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.

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1.0 INTRODUCTION

The S70 Servo NXT EtherNet/IP controller is an EtherNet/IP adapter that provides complete control and monitoring of the Bray S70 Electric Valve Actuator. The basic function of the S70 Servo NXT EtherNet/IP is to position the S70 Actuator in response to commands from an EtherNet/IP scanner. The scanner generates the desired process setpoint, in this case valve position, and continually monitors the process variables generated by the adapters. Varying commands to the S70 Servo NXT EtherNet/IP will change the S70 Actuator position, which in turn moves the underlying control valve to create a change in the process variable. The scanner calculates and transmits the appropriate commands to the S70 Servo NXT EtherNet/IP to establish and maintain the desired process setpoint.

NOTICE
The cover of the S70 Actuator will always be in place during operation except for maintenance by authorized personnel.

DEFINITION OF TERMS

- **Servo NXT EIP** – Bray EtherNet/IP-based controller, primarily intended for use in the Series 70 electric actuator. It is assumed that any actuator is connected to a rotary valve.
- **Scanner** – Opens connections with EtherNet/IP adapters, like the Servo NXT EIP, and initiates data transfers.

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2.0 DESCRIPTION OF OPERATION

The primary function of the Servo NXT EIP is to position the valve based on the feedback position provided by a local potentiometer. The feedback position is internally correlated to the valve position through an autocalibration sequence, where the Servo NXT EIP finds the limits of operation by operating the actuator through its range of travel. Once calibrated, the Servo NXT EIP will operate the actuator until the feedback position is close enough to the command position that it is within the deadband, aka the maximum allowed offset in positioning of the valve. The command position is provided by the scanner and ultimately determines the valve position. The Servo NXT EIP is a product that conforms to the requirements set forth in the EtherNet/IP standards, an industrial EtherNet network solution defined by the ODVA. This ensures the Servo NXT EIP operates reliably when connected to other conformant EtherNet/IP devices. Additionally, the Servo NXT EIP uses the same communication objects as other EtherNet/IP devices, making for a consistent experience during setup and use.

3.0 OPERATIONAL MODES

Remote Mode

By default, the operating mode of the Servo NXT EIP is Remote Mode, where the valve is positioned based on commands from the EtherNet/IP network. Exiting another mode of operation generally results in the Servo NXT EIP returning to remote mode.

Local Mode

Local Mode is entered if a connection is made to the Control Box terminals and one or both terminal voltages are pulled low. This allows the Servo NXT EIP to be controlled by a local control box, mounted to or near the actuator. This mode of operation prevents remote operation of the Servo NXT EIP. Once exiting Local Mode, the unit will return to Remote Mode.

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Manual Mode

This operating mode allows for the actuator to be controlled directly from the buttons on the Servo NXT EIP. By utilizing the keypad, the user can change the position of the valve with a single button press. 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 when the unit is in Remote Mode. This mode allows the unit to be positioned using the buttons on the Servo NXT EIP.

> **Up arrow button** – energizes actuator in the open direction
> **Down arrow button** – energizes actuator in the close direction
> **Enter button** – brakes the actuator if it is operating

This mode of operation prevents any previous mode of operation of the Servo NXT EIP. Once exiting Manual Mode, the unit will return to the previous mode of operation.

Autocalibration Mode

The Servo NXT EIP uses an automated calibration sequence to determine the operating points for the application in which it is installed. These operating points allow the Servo NXT EIP to calculate the correct feedback position of the product, making autocalibration an important step during commissioning. Servo NXT EIP units that have not been calibrated will flash the indicator next to autocalibration button to show that they are using default values for calculating position. Autocalibration Mode is entered by pressing and holding the Autocalibration button for at least 3 seconds. While in Autocalibration Mode, the autocalibration indicator remains lit. Upon completion of the autocalibration sequence, the autocalibration indicator will no longer flash and remain off, indicating that the new parameters have been stored in memory. If a fault occurs during autocalibration, then the autocalibration sequence is aborted and all the fault LEDs will start flashing to indicate a failed autocalibration attempt. The unit will not operate while this fault is active. To clear the fault, the handwheel can be pulled out to indicate operator interaction. Additionally, there is also an output bit that can be toggled to clear the fault. No other operating modes can be entered during autocalibration and entering Autocalibration Mode will override any previous mode of operation. This mode of operation prevents remote operation of the Servo NXT EIP. Once exiting Autocalibration Mode, the unit will return to Remote Mode.

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4.0 HARDWARE DESCRIPTION

One terminal strip (4 terminals) for EtherNet/IP connections
> Used to land the EtherNet/IP field connector leads

One terminal strip (7 terminals) for power connections
> 3 terminals for input power (24VAC, or 24VDC, 2 terminals for Neutral)
> 2 terminals for input power (110VAC or 230VAC)
> 2 terminals for the internal heater (optional)
> 2 terminals for motor connections (24VAC or 24VDC)
> 3 terminals for motor connections (120VAC or 230VAC)

One terminal strip (16 terminals) for factory wiring
> 4 terminals limit switches
> 4 terminals torque switches
> 2 terminals handwheel switch
> 3 terminals control box connections
> 3 terminals potentiometer

LED User Interface
> Yellow Ethernet Link LED
> Green Ethernet Speed LED
> Bi-color (red / green) CIP Module Status LED
> Bi-color (red / green) CIP Network Status LED
> Bi-color (red / green) Position LED
> Red Status LEDs
    - Illuminate the Bray logo
> Red Fault LEDs
    - Limit Switch fault
    - Handwheel fault
    - Feedback fault
    - Torque fault
> White Autocalibration LED
> White Manual Mode LED

User switches
> Autocalibration switch
> Manual Mode switch
> Up arrow switch
> Down arrow switch
> Enter switch

Fuse
The Servo NXT EIP is protected by a 5A 250VAC 5×20mm fast-blow glass cylinder fuse. The fuse is located on the side of the module. To check or replace the fuse, use a 1/4” (6.5mm) slotted screwdriver to slightly push in and gently turn the fuse holder counterclockwise until the retaining tab aligns with the slot, at which point the spring will push it out. To reinsert the fuse, be sure to align the retaining tab with the slot during insertion, then use the screwdriver to slightly push in and gently turn the fuse holder clockwise until the screwdriver slot is vertical and it stops turning.

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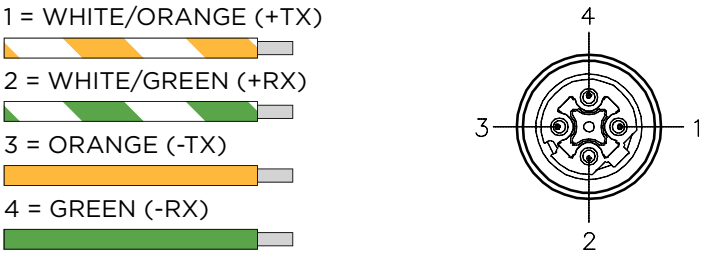
4.1 ETHERNET/IP CONNECTIONS

The Servo NXT EIP has 4 terminals dedicated to EtherNet/IP physical layer connections, 1 pair for data transmission (TX+ & TX-) and 1 pair for data reception (RX+ & RX-). These terminals are treated as pairs since the signal wires in the CAT cables are twisted pairs.

Actuators with the Servo NXT EIP installed will have the option for installation of a field connector for easy termination of EtherNet/IP network cabling at the unit. The connector can be one of the following: the female connectors 09F547-771ES534, 09F547-771ES5ZT and the male connector 09M547-771ES5ZT. The connector 09M547-771ES5ZT is a male 4-pin “D” coded M12 connector as defined in Amendment 1 of IEC 61076-2-101. Since it is a male connector, a cable with a matching female M12 end is required for mating. See required cable pinout below.

Figure 1: EtherNet/IP cable pinout required for connection to Servo NXT EIP M12 connector



4.2 POWER CONNECTIONS

The Servo NXT EIP has 4 terminals dedicated to EtherNet/IP physical layer connections, 1 pair for data transmission (TX+ & TX-) and 1 pair for data reception (RX+ & RX-). These terminals are treated as pairs since the signal wires in the CAT cables are twisted pairs.

Input power
Due to the power requirements of large electric actuators, the Servo NXT EIP has a dedicated power input separate from the EtherNet/IP network cabling. This power input energizes not only the Servo NXT EIP, but also the actuator motor used to position the valve.

Power provided to the Servo NXT EIP should be within 10% of the voltage listed for the actuator. For example, a 24VAC actuator should have power provided that has a voltage within 21.6 and 26.4VAC after voltage drops of the cabling. Additionally, the power supply should be capable of sourcing 5A per actuator, since the actuator is capable of drawing large currents on startup.

Note: 24VAC actuators should have a dedicated 100VA transformer for each actuator

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Heater (optional)
The S70 has an optional cartridge heater that is installed at the factory. Fused power is provided to these 2 terminals from the input power terminals.

Motor
The S70 actuator is driven by either a split capacitor induction motor (120VAC or 230VAC operation) or a brushed DC motor (24VAC or 24VDC operation). The Servo NXT EIP provides power to the motor to operate the actuator and position the valve based on the command position provided by the scanner.

4.3 FACTORY CONNECTIONS

One large terminal strip is provided on the Servo NXT EIP for connections switches and potentiometer internal to the actuator. These connections are generally made at the factory and should not require adjustment in the field.

Limit Switches

Connections for the travel limit switches, which indicate to the Servo NXT IP when an end of travel set point has been reached. These switches prevent the Servo NXT EIP from operating the actuator to a point where the gearing could bind up and become damaged. These switches are engaged by a cam shaft coupled to the output gear of the actuator, and the cams on the cam shaft should be adjusted to ensure the limit switches are engaged before any other mechanical limits are reached.

The Servo NXT EIP provides a logic level voltage at the Open (LO) and Close (LC) 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 Servo NXT EIP to end travel.

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

Torque Switches (optional)

If the torque present on the output of the actuator goes outside the rated torque listed for the unit, then the actuator gearing could be damaged. These switches detect the presence of high torque on the output gear, and if activated, put the Servo NXT EIP into a fault state. This fault state prevents further operation until the torque is reduced.

The Servo NXT EIP provides a logic level voltage at the Open (TO) and Close (TC) 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 Servo NXT to enter a torque switch fault.

Handwheel Switch

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The S70 actuator comes with an external handwheel that can be pulled out to allow for the valve to be positioned manually. If the handwheel is pulled out or engaged, then a switch is activated in the actuator, putting the Servo NXT EIP into a fault state. This fault state is active until the handwheel is pushed back in or disengaged.

Control Box (optional)

Connections for the local control station, if present. The local control station allows for local operation of the actuator, putting the Servo NXT EIP into Local Mode and overriding remote input commands.

The Servo NXT EIP provides a logic level voltage at the Open (BO) and Close (BC) 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 Servo NXT EIP to enter Local Mode. The Servo NXT EIP will not exit Local Mode until the Open and Close terminals return to their original voltage level. Once in Local Mode, the Servo NXT will ignore input commands until remote operation resumes.

Potentiometer

In addition to the limit switches, a potentiometer is also coupled to the cam shaft, this time by a set of gears. Servo NXT EIP feedback potentiometer voltage may be measured between terminals “C” and “PW”. Voltage must be between 0.05 Volts and 3.25 Volts for valve closed and opened positions respectively. To prevent damage to the potentiometer, any voltage value below 0.1VDC and greater than 3.2VDC is considered outside of the range of the potentiometer and puts the Servo NXT EIP into a feedback potentiometer fault. This fault state prevents further operation until the actuator is positioned so the potentiometer is back within its valid range.

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TABLE 1: DESCRIPTION

Indicator State:	Summary	Requirement
Steady Off	No Power	If no power is supplied to the device, the module status indicator shall be steady off.
Steady Green	Device Operational	If the device is operating correctly, the module status indicator shall be steady green
Flashing Green	Standby	If the device has not been configured, the module status indicator shall be flashing green
Flashing Red	Major Recoverable Fault	If the device has detected a Major Recoverable Fault the module status indicatot shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a Major Recoverable Fault
Steady Red	Major Unrecoverable Fault	If the device has detected a Major Unrecoverable Fault, the module status indicator shall be steady red.
Flashing Green/ Red	Self-Test	While the device is performing its power up testing, the module status indicator shall perform the test sequence as described in Section 9-4.1.4

Section 9-4.2.3 of The CIP Networks Library, Volume 2, EtherNet/IP Adaptation of CIP, Ed. 1.33, November 2023)

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4.4 LED DESCRIPTION

Ethernet Link

This yellow LED indicates the status of the Servo NXT EIP ethernet link. If it is on, then the link is good, and communication can occur. In addition, this LED also shows link activity. It blinks whenever an ethernet packet is transmitted or received.

TABLE 2: NETWORK STATUS INDICATOR

Indicator State:	Summary	Requirement
Steady Off	Not Powered No IP Address	The device is powered off, or is powered on but with no IP address configured (Interface Configuration attribute of the TCP/IP Interface Object).
Steady Green	No Connection	An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out.
Flashing Green		An IP address is configured, at least one CIP connection (any transport class) is established, and an Exclusive Owner connection (defined in Volume 1, Chapter 3) has not timed out.
Flashing Red		An IP address is configured, and an Exclusive Owner connection (defined in Volume 1, Chapter 3) for which this device is the target has timed out. The network status indicator shall return to steady green only when all timed out Exclusive Owner connections are reestablished. Devices that support a single Exclusive Owner connection shall transition to steady green when any subsequent Exclusive Owner connection is established. Devices that support multiple Exclusive Owner connections shall retain the O->T connection path information when an Exclusive Owner connection times out. The network status indicator shall transition from flashing red to steady green only when all connections to the previously timed-out O->T connection points are reestablished. Timeout of connections other than Exclusive Owner connections shall not cause the indicator to flash red. The Flashing Red state applies to target connections only. Originators and CIP Routers shall not enter this state when an originated or routed CIP connection times out.
Steady Red		For devices that support duplicate IP address detection, the device has detected that (at least one of) its IP address is already in use.
Flashing Green/ Red		While the device is performing its power up testing, the network status indicator shall perform a test sequence as described in Section 9-4.1.4

Section 9-4.3.3 of The CIP Networks Library, Volume 2, EtherNet/IP Adaptation of CIP, Ed. 1.33, November 2023

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Note: when a single indicator is used to represent multiple IP address interfaces the state of any one interface shall be sufficient to modify the indicator state (per the above behavior in the table).

> Transition to flashing green when any one interface receives an IP address
> Transition to steady green when a CIP connection is established on any interface (and Exclusive owner is not timed out).
> Transition to flashing red when an Exclusive Owner CIP connection times out on any interface.
> Transition to steady red when any of the interfaces detects an IP address conflict.

EtherNet Speed

This green LED indicates the communication speed of the Servo NXT EIP. If it is on, the unit is configured to communicate at 100Mb/s. If it is off, it is configured to communicate at 10Mb/s.

Module Status

This bi–color (green, red) LED provides device status. It indicates whether the device has power and is operating properly.

Network Status

This bi–color (green, red) LED displays EtherNet/IP configuration information for the Servo NXT EIP.

Position

This bi–color (green, red) LED displays the position of the valve. If the valve is fully open and the open limit switch is engaged, the green LED is on and solid. If the actuator is operating in the open direction, the green LED will be flashing. If the valve is fully closed and the close limit switch is engaged, the red LED is on and solid. If the actuator is operating towards the close position, the red LED will be flashing. The LED will be dark if the unit is not operating and it is not positioned at the travel limits.

Product Status

These 2 red LEDs, illuminating the Bray logo, flash periodically to indicate the unit is powered and operational. If these LEDs are not on, then the unit likely does not have power applied. If these LEDs are solid, then the unit should be power cycled to clear any potential internal faults.

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4.5 FAULT INDICATORS

Limit Switch Fault

This red LED is on if a limit switch fault is active. This occurs if the Servo NXT EIP detects that both limit switches are engaged. Since these switches are normally closed and electrically open when engaged, this can occur if the switches become disconnected from the terminals. Additionally, if one switch is engaged and the other switch has a wire disconnected, then this fault will also occur.

Handwheel Fault

This red LED is on if a handwheel fault is active. This occurs if the handwheel is detected to be in use by an operator. If the handwheel is engaged or pulled out, a switch connected to the Servo NXT EIP is engaged and signals that motor operation needs to be cease. The Servo NXT EIP will remain inactive while the handwheel is engaged.

Torque Fault

This red LED is on if a torque switch fault is active. This occurs if one or both torque limit switches are engaged. While these switches are engaged, the unit will not operate until the high torque event has been cleared.

Feedback Fault

This red LED is on if a feedback fault is active. This occurs if the feedback potentiometer is operated outside of its region of safe operation. The potentiometer has internal mechanical limits that cannot be exceeded without damaging the unit. This fault state prevents the potentiometer from being operated beyond its physical limitations.

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Motor Stall Fault

Motor Stall Fault is default disabled. Through Ethernet configuration to enable Motor Stall Fault detection. If the feedback signal provided to the Servo NXT EIP by the potentiometer does not match the expected operation, then a fault state is entered.

More specifically, if the actuator controlled by the Servo NXT EIP is operating the motor either open or close and the feedback potentiometer does not detect any movement, a Motor Stall Fault will occur. This most often occurs when the travel of the actuator is impeded due to excessive valve torque or a blockage in the valve flow stream. When a Motor Stall Fault occurs, the actuator will move in the opposite direction of travel from where the fault occurred for 2 seconds. This relieves the actuator and underlying valve from any static torque load. After this movement, the actuator will stop and continuously flash all five fault indicators simultaneously. The actuator will not respond to further commands and will remain in this state until the handwheel is engaged. After the handwheel is engaged and then disengaged, the actuator will resume normal operation.

Autocalibration

This white LED is on when Autocalibration Mode is active.

This mode of operation prevents remote operation of the Servo NXT EIP. Once exiting Autocalibration Mode, the unit will return to Remote Mode.

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Manual Mode

This white LED is on when the unit is operating in Manual Mode.

This mode of operation prevents remote operation of the Servo NXT EIP. Once exiting Manual Mode, the unit will return to Remote Mode.

4.6 USER SWITCHES

Autocalibration Switch

Switch that engages and disengages the Autocalibration sequence for the Servo NXT EIP.

To enter autocalibration, the switch should be pressed and held for > 1 second. Once the switch is released, the autocalibration LED will turn on, indicating that the autocalibration state is active.

Pressing and holding the switch while autocalibration is active will cause the autocalibration state to be immediately exited without completing, and the autocalibration LED will turn off.

Manual Mode Switch

Switch that engages and disengages Manual Mode for the Servo NXT EIP.

If the unit is in remote mode, pressing and holding the switch for > 1 second will cause the unit to enter Manual Mode once the switch is released. The Manual Mode LED will turn on to indicate the new operational state.

To exit Manual Mode, press and hold the switch for >1 second. Upon release, the Manual Mode LED will turn off and the unit will return to remote mode.

Up Arrow Switch

Used to operate the actuator while in Manual Mode. Pressing on this switch while in Manual Mode operates the actuator in the open direction. Switch has no function outside of manual mode.

Down Arrow Switch

Used to operate the actuator while in Manual Mode. Pressing on this switch while in Manual Mode operates the actuator in the close direction. Switch has no function outside of manual mode.

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Enter Switch

Used to operate the actuator while in Manual Mode. Pressing on this switch while in Manual Mode brakes the actuator if it is currently operating. Switch has no function outside of manual mode.

5.0 ETHERNET/IP INTERFACE

This section is intended as a reference for configuring and using the EtherNet/IP ports on the Servo NXT EIP. For those unfamiliar with EtherNet/IP, below are a list of references that go into significantly more detail on the concerns and requirements for successfully establishing and managing a functional EtherNet/IP network. This list is not exhaustive, and there are many more references available from ODVA website www.odva.org if required.

> EtherNet/IP Media Planning & Installation Manual – Pub 148
> EtherNet/IP Network Infrastructure Guide - Pub 35
> Securing EtherNet/IP Networks - Pub 269

EtherNet/IP Conformance

The Servo NXT EIP has been tested at the ODVA headquarters in Ann Arbor, MI, and has been certified conformant to EtherNet/IP standards. For all certified products, the ODVA issues a Declaration of Conformance, and a copy of this document for the Servo NXT EIP is available on request.

It should be established before a network is commissioned that all devices are conformant to ensure communication quality is maintained. However, even when using conformant devices, it still falls on the network designer to maintain good practice in system level design. The included ODVA references should be strictly adhered to, and ideally, any EtherNet/IP network should be inspected and qualified by a thirdparty.

Scanner Configuration

Before the Servo NXT EIP can be added to an active network, the scanner needs to be configured to recognize it. For Rockwell Logix 5000 scanners, install the Add-on Profile (AOP) file for the Servo NXT EIP which can be found on the Bray website, www.bray.com, or can be provided on request. For all other scanner hardware, upload the Electronic Data Sheet (EDS) file for the Servo NXT EIP to the scanner, which can be found on the ODVA website, www.odva.org, or can be provided on request.

Address Assignment

Every adapter added to an EtherNet/IP network must have an IP address. The Servo NXT EIP is by default in DHCP mode, where an IP address can be provided to it by a DHCP Server. When the Servo NXT EIP is connected to a network, it will automatically attempt to gain a lease for an available IP address.

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If the Servo NXT EIP is going to be connected to a network that uses static addressing, then a scanner will have to be connected to the Servo NXT EIP to adjust the default settings of the TCP/IP object to make the device use the address stored in memory and, if necessary, change the address to one conformant to the network's requirements.

5.1 ESTABLISH CONNECTION

Once an IP address has been assigned to the Servo NXT EIP, a Class 3 connection can be established that allows for class and instance attribute data to be read and written.

Once a Class 3 connection has been established with the Servo NXT EIP, Class 1 implicit messages should be configured based on the Connection Manager attributes defined in the EDS file. The EDS file provides limits for implicit messaging to ensure the device maintains reliable generation of data. Since implicit messaging is connectionless, there is no need to establish, maintain, or terminate a session. Once message generation is started, it continues based on the RPI defined by the scanner, and it does not require the presence of the scanner to occur.

The implicit data generated from the Servo NXT EIP originates from the Assembly Object data attributes.

There are three Assembly Objects available:

> Input Assembly – Servo NXT EIP data array that is generated for consumption by the network scanner, containing data relevant to the device's current operation, such as feedback position.
> Output Assembly – Data array sent to the Servo NXT EIP to affect its operation, containing data that changes how the device is operating, such as command position.
> Configuration Assembly – Data array sent to the Servo NXT EIP that defines the operating conditions and limits of the device. This array is only sent at the initiation of an implicit connection and can therefore not be changed once messaging starts unless message generation is halted.

Since Assembly data is application specific, the following sections contain detailed information on the Assembly Object data present in the Servo NXT EIP.

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TABLE 3: INPUT ASSEMBLY DATA

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Feedback Position	REAL	32	Feedback position from S70 potentiometer. Range: 0-100% (0-90°)	0	0
Motor Current	REAL	32	Current measured from the actuator motor Range: 0-5.0 A (The current value is for reference only)	0	4
Control Deviation	REAL	32	Difference between command position and feedback position Range: 0-100%, (0-90°)	0	8
Close Calibration Offset	REAL	32	Offset between the closed limit switch and the feedback travel limit. Determined during autocalibration. Range: 0-100%, (0-90°)	0	12
Open Calibration Offset	REAL	32	Offset between the open limit switch and the feedback travel limit. Determined during autocalibration. Range: 0-100%, (0-90°)	0	16
Response Time	REAL	32	Time in seconds from change of command position to initial change in feedback position (positive values only)	0	20
Stroke Time	REAL	32	Time in seconds the last full stroke took to complete (positive values only)	0	24
Operating Time	REAL	32	Time in hours that the motor has been running (positive values only)	0	28
Energized Time	REAL	32	Time in hours that the Servo has been powered (positive values only)	0	32
PST Open Initial Time	REAL	32	Time in seconds to complete open direction travel during the initial partial stroke test	0	36
PST Close Initial Time	REAL	32	Time in seconds to complete close direction travel during the initial partial stroke test	0	40
PST Open Last Time	REAL	32	Time in seconds to complete open direction travel during the last partial stroke test	0	44
PST Close Last Time	REAL	32	Time in seconds to complete close direction travel during the last partial stroke test	0	48
Direction Changes	DINT	32	Number of times actuator moves in the opposite direction of its previously commanded direction of travel (positive values only)	0	52
Full Strokes	DINT	32	Number of full strokes completed (positive values only)	0	56

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TABLE 3: INPUT ASSEMBLY DATA (CONTINUED)

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Open Limit Switch	BOOL	1	Set high if the open limit switch has been reached	0	60
Close Limit Switch	BOOL	1	Set high if the close limit switch has been reached	1	
Open Torque Switch	BOOL	1	Set high if the open direction overtorque switch has been engaged	2	
Close Torque Switch	BOOL	1	Set high if the close direction overtorque switch has been engaged	3	
Actuator Stopped	BOOL	1	Set high when the actuator has reached a setpoint	4	
Actuator Closing	BOOL	1	Set high when actuator operating in the closed direction	5	
Actuator Opening	BOOL	1	Set high when actuator operating in the open direction	6	
Autocalibration Running	BOOL	1	Set high when actuator is running through the calibration routine	7	
PST Running	BOOL	1	Set high when actuator is running through the partial stroke test routine	0	61
Local Mode	BOOL	1	Set high when local control box is determining the travel setpoint	1	
Local Open	BOOL	1	Set high when open command state set at control box	2	
Local Close	BOOL	1	Set high when close command state set at control box	3	
Manual Mode	BOOL	1	Set high when operator at controller is determining the travel setpoint using the controller push buttons.	4	
Manual Open	BOOL	1	Set high when the open push button has been pressed while in manual mode.	5	
Manual Close	BOOL	1	Set high when the close push button has been pressed while in manual mode.	6	
Handwheel Turned	BOOL	1	If acuator position changed while handwheel is engaged, bit turned high until handwheel is disengaged and command position has been reached	7	

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TABLE 3: INPUT ASSEMBLY DATA (CONTINUED)

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Handwheel Fault	BOOL	1	Static Fault Set high when HW (handwheel) pulled	0	62
Feedback Fault	BOOL	1	Static Fault Set high when outside allowed feedback pot range	1	
Limit Switch Fault	BOOL	1	Static Fault Set high when both limit switches engaged	2	
Overtorque Fault	BOOL	1	Static Fault Set high when the actuator attempts to operate a load outside the operational torque limits	3	
Motor Stall Fault	BOOL	1	Dynamic Fault Set high in the event of motor stall (no motor movement detected)	5	
Autocalibration Fault	BOOL	1	Dynamic Fault Set high if autocalibration is unable to complete	6	
Fault Active	BOOL	1	Set high if any fault is active	7	
Calibration Result	BOOL	1	Indicates result of last autocalibration. Set high when device has been successfully calibrated.	0	63
PST Result	BOOL	1	Indicates result of last partial stroke test. Set high when test completes successfully: PST Last Time is within the allowable deviation of PST Initial Time	1	
Total Byte Length					64

NOTES:

> Bray does not accept any responsibility for the product if wear parts not tested and approved by Bray are used.

> Bray does not accept any responsibility for the product if maintenance instructions are not followed during maintenance.

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TABLE 4: OUTPUT ASSEMBLY DATA

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Command Position	REAL	32	Customer position setpoint. Range: 0-100% (0-90°)	0	0
—	BOOL	1	Reserve for later use	0	4
—	BOOL	1	Reserve for later use	1	4
PST Start	BOOL	1	Toggle Bit Change bit state to operate the actuator to PST offset position to test device operability.	2	4
PST Stop	BOOL	1	Toggle Bit Change bit state to cancel an ongoing partial stroke test. If no test is running, this bit change is ignored.	3	4
Manual Mode On	BOOL	1	Toggle Bit Change bit state to put the controller into manual mode. If controller is already in manual mode, this bit change is ignored.	4	4
Manual Mode Off	BOOL	1	Toggle Bit Change bit state to take the controller out of manual mode. If controller is not in manual mode, this bit change is ignored.	5	4
Clear PST Times	BOOL	1	Toggle Bit Change bit state to clear stored PST times. If no PST times are stored, this bit change is ignored.	6	4
Clear Dynamic Faults	BOOL	1	Toggle Bit Change bit state to disable any faults labelled as dynamic. If no dynamic faults are active, this bit change is ignored.	7	4
Total Byte Length					8

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TABLE 5: CONFIGUATION ASSEMBLY DATA

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Failure Return Position	REAL	32	Position actuator operates to in the event of loss of Class 1 communication timeout. Range: 0-100% (0-90°) Default: 0% (0°)	0	0
PST Offset Position	REAL	32	Offset from current position that the actuator needs to travel during Partial Stroke Testing. Range: 0.5-50% (0.5-50°) Default: 5% (5°)	0	4
PST Allowable Deviation	REAL	32	Maximum error allowed between PST Initial Time and PST Last Time Range: 0.5-50% (0.5-50°) Default: 10% (10°)	0	8
Deadband	REAL	32	Allowable offset from position. Range: 0.5-10% (0.5-10°) Default: 1% (1°)	0	12
Set Open Speed	REAL	32	Percent of max speed the motor should run at in the open direction. Range: 10-100% Default: 100%	0	16
Open Speed Start	REAL	32	Position where open speed limiting should begin Range: 0-100% (0-90°) Default: 0% (0°)	0	20
Open Speed End	REAL	32	Position where open speed limiting should end Range: 0-100% (0-90°) Default: 100% (90°)	0	24
Set Close Speed	REAL	32	Percent of max speed the motor should run at in the close direction. Range: 10-100% Default: 100%	0	28
Close Speed Start	REAL	32	Position where close speed limiting should begin Range: 0-100% (0-90°) Default: 100% (90°)	0	32
Close Speed End	REAL	32	Position where close speed limiting should end Range: 0-100% (0-90°) Default: 0% (0°)	0	36
Reverse Delay	REAL	32	Time motor delays before reversing direction Range: 1-10s Default: 1s	0	40
Command Resolution	INT	16	Adjustable resolution range for output command position 0: 12-bit (Default) 1: 10-bit 2: 8-bit 3: 6-bit		44

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TABLE 5: CONFIGUATION ASSEMBLY DATA (CONTINUED)

Variable	Data Type	Size (bits)	Notes	Start Bit	Start Byte
Feedback Resolution	INT	16	Adjustable resolution range for input feedback position 0: 12-bit (Default) 1: 10-bit 2: 8-bit 3: 6-bit		46
Reverse Command	BOOL	1	When high, inverts output command position range Default: Low	0	48
Reverse Feedback	BOOL	1	When high, inverts input feedback position range Default: Low	1	
Enable Speed Limiting	BOOL	1	Set high to enable speed limiting for the range specified Default: Low	2	
Enable Torque Limiting	BOOL	1	Set high to enable torque limit switch detection Default: Low	3	
Enable Motor Stall Detection	BOOL	1	Set high to enable motor stall detection Default: Low	4	
Enable Failure Return	BOOL	1	Set high to have actuator operate to Failure Return Position upon loss of communication Default: Low	5	
Position Units	BOOL	1	Low: %, High: ° Default: %	6	
—	BOOL	1	Reserve for later use	7	
Total Byte Length					52

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6.0 QUICK START GUIDE

Add-On Profile (AOP) for Rockwell Logix 5000

1. Extract the AOP files and run the installation on a computer that already has Studio 5000 software.
2. In Studio 5000, add an S70 Servo NXT module to the project.
3. Set the assembly object data attributes for the configuration array using the Module Properties dialog box and the Servo NXT EIP Controller Tags. This must be done before establishing a connection to the EIP module, otherwise default values will be used.
4. Download the program to the Rockwell scanner hardware.
5. Assign the Servo NXT EIP an IP address via DHCP.

Electronic Data Sheet (EDS) for all PLC vendors

1. Upload the EDS file for the Servo NXT EIP into the scanner that will be establishing the network connection, according to the vendor's instructions.
2. Connect the Servo NXT EIP to the EtherNet/IP network through the M12 connector.
3. Assign the Servo NXT EIP an IP address through the DHCP server. Alternatively, assign an address to the Servo NXT EIP through the TCP/IP object and set it to use the address set in memory.
4. Establish an implicit connection with the Servo NXT EIP using the Connection Manager attributes defined in the EDS file.

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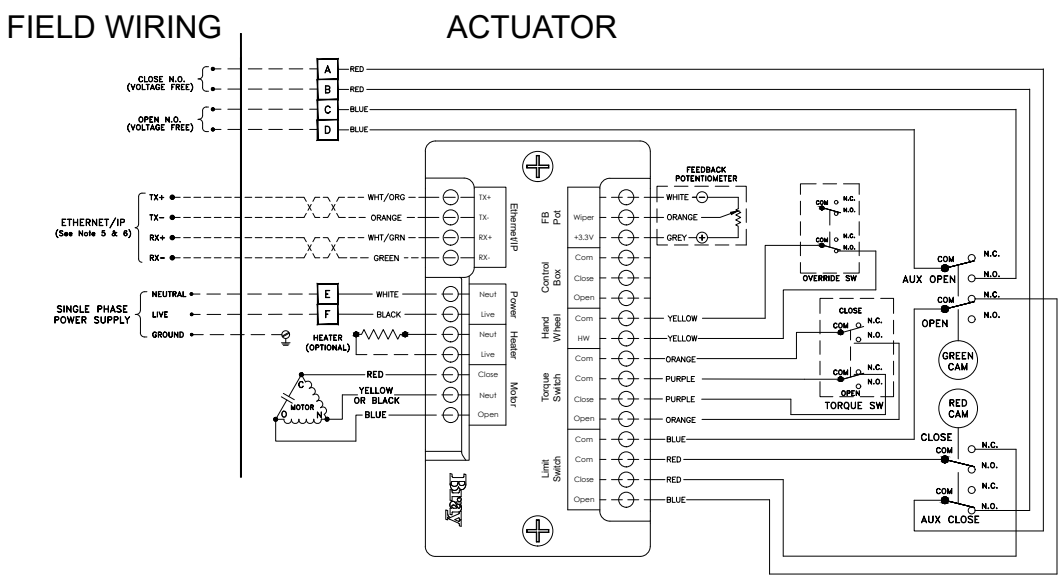
7.0 TECHNICAL SPECIFICATIONS

TABLE 6: WD-000649



NOTES:
1. ACTUATOR SHOWN IN CLOSED POSITION.
2. MANUAL OVERRIDE NOT ENGAGED
3. HEATER OPTIONAL
4. SWITCHS ARE SPDT (FORM C)
5. ALL ETHERNET CABLING SHOULD BE SHIELDED AND ROUTED SEPARATELY FROM POWER CABLING. REFER TO ODVA PUB 148 FOR ETHERNET/IP PLANNING AND INSTALLATION REQUIREMENTS.
6. REFER TO IOM FOR FIELD CONNECTION TYPES AND PINOUTS.

CALIBRATION SEQUENCE:
1. SET TRAVEL LIMIT SWITCHES TO DESIRED END OF TRAVEL POSITIONS.
2. CONNECT POWER SUPPLY
3. WITH ACTUATOR AT MID TRAVEL, PRESS "CALIBRATE" BUTTON FOR TWO SECONDS
4. ACTUATOR WILL SELF CALIBRATE

TERMINAL STRIP:
14-24 AWG FOR SERVO
TIGHTENING TORQUE 3.5 IN-LBS

14-22 AWG FOR OTHER
TIGHTENING TORQUE 3.5 IN-LBS

105 °C, 300V MIN RATED WIRE

LIMIT SWITCH:
125/250VAC, 10A, 1/2 HP
125/250VDC, 0.25A, INDUCTIVE
125/250VDC, 0.5A, RESISTIVE

TABLE 7: Mechanical Specifications

Electronics Enclosure Material	PC/ABS Blend
Mounting Screw Material	Nylon
Terminals	**Wire Gauge:** 26-16 AWG [0.13-1.31 mm2]
	Torque Limit: 3.5 in-lbs [15.6 N]
Fuse Rating	250V/5A
Installation	Designed for use within Bray actuators

TABLE 8: Electrical Specifications

Electrical	
Input Voltage	120VAC ± 10% 230VAC ± 10% 24VAC ± 10% 24VDC ± 10%
Motor Current, max	5 A

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8.0 APPENDIX A

Recoverable faults - Errors that can be resolved automatically or with minimal intervention, allowing the system to continue functioning without significant disruption. Examples include temporary network congestion, momentary loss of connection, or minor communication errors that can be resolved through retries or retransmissions.

Unrecoverable faults - Errors that cannot be easily resolved within the normal operation of the system. These faults typically require manual intervention or system reconfiguration to address. Examples include hardware failures, severe network disruptions, or configuration errors that prevent communication altogether.

9.0 APPENDIX B

(From Section 9-4.1.4 of The CIP Networks Library, Volume 2, EtherNet/IP Adaptation of CIP, Ed. 1.33, November 2023)

Indicators at Power Up

An indicator test shall be performed at power-up in order to allow for visual inspection of red and green states for each indicator. The following power-up test sequence shall be used unless the device has vendor-specific indicators that use an alternative test sequence. In this case, the device shall either use the following test sequence or match the test sequence used on the vendor-specific indicators.

> If present, the Module Status indicator shall turn Green for approximately 0.25 second, turn Red for approximately 0.25 second, and then turn Green and hold that state until the power-up test has completed.
> If present, each Network Status indicator shall turn Green for approximately 0.25 second, turn Red for approximately 0.25 second, and then turn Off and hold that state until the power-up test has completed.
> If both Module Status and Network Status indicators are present, the Module Status indicator test sequence shall occur before or simultaneous to the Network Status indicator test sequence(s). If more than one Network Status indicator is present, then each Network Status indicator test sequence may occur in succession or simultaneously.
> If present, the Combined Module/Network Status indicator shall turn Green for approximately 0.25 second, turn Red for approximately 0.25 second, and then turn Off and hold that state until the power-up test has completed.

After completion of this power-up test, the indicator(s) shall turn to a normal operational state.

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