PULSAFEEDER®
A Unit of IDEX Corporation

PULSAR® ECA

NEMA 4X

ELECTRONIC CONTROL ASSEMBLY

INSTALLATION,
OPERATION &
MAINTENANCE
INSTRUCTION

Bulletin #: IOM-PS-ECA-0900-Rev C

PULSAFEEDER
A Unit of IDEX Corporation

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Controls and Systems

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ECA FACTORY SERVICE POLICY

Your *ECA* is a microprocessor-based stroke length control device for use with *PULSAR*® Diaphragm Metering Pumps. If you are experiencing a problem with your *ECA*, consult the trouble-shooting guide. If the problem is not covered or cannot be solved, please contact your local *PULSA* Series Sales Organization or our Technical Service Department at (585) 292-8000 for further assistance.

Trained individuals are available to diagnose your problem and arrange a solution. Solutions may include purchasing a replacement unit or returning the *ECA* to the factory for inspection and repair.

All returns require a Return Material Authorization (R.M.A.) number to be issued by Pulsafeeder. Parts purchased to correct a warranty issue may be credited after examination of the original parts by Pulsafeeder personnel. Parts returned for warranty considerations which are good will be sent back freight collect.

Any field modifications will void the warranty. Out-of-warranty repairs will be subject to Pulsafeeder's standard bench fees and testing costs associated with replacement components.

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Conventions

For the remainder of this bulletin, the following conventions are in effect.

A WARNING DEFINES A CONDITION THAT COULD CAUSE DAMAGE TO BOTH THE EQUIPMENT AND THE PERSONNEL OPERATING IT. PAY CLOSE ATTENTION TO ANY WARNING.

Notes are general information meant to make operating the equipment easier.

Tips have been included within this bulletin to help the operator run the equipment in the most efficient manner possible. These "Tips" are drawn from the knowledge and experience of our staff engineers, and input from the field.

This is a procedure heading. A Procedure Heading indicates the starting point for a procedure within a specific section of this manual.

1. INTRODUCTION

The *ECA* is a microprocessor based stroke length control device for use with the *PULSAR* diaphragm-metering pump. It has been designed to operate in a variety of industrial environments. This document describes the ECA controller only. The operation and maintenance of the *PULSAR* metering pump is covered in the pump IOM.

1.1 Description

The *ECA* is an electromechanical servo controller dedicated to the *PULSAR* diaphragm metering pump series. The unit is physically attached and integrated into the pump's design. Its purpose is to precisely adjust output flow of a process media by means of stroke length positioning.

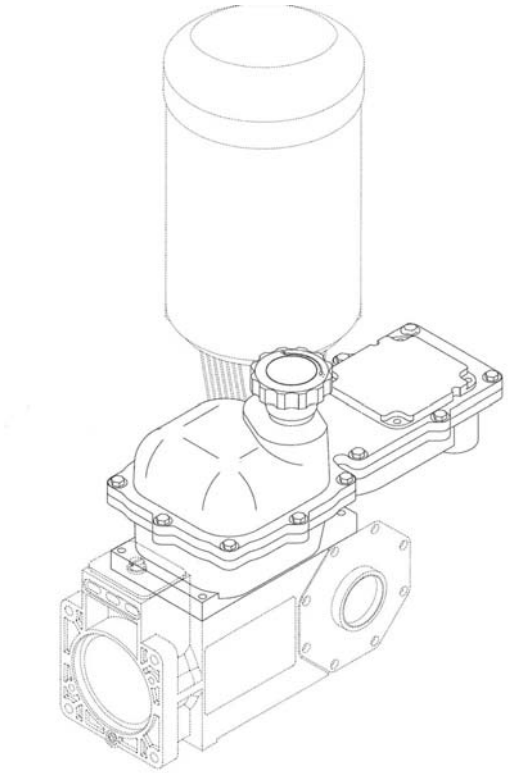
The ECA is designed for the international industrial market. The analog control signals offer flexible remote control. They are fully isolated -- from each other as well as earth ground -- for improved protection and reliability.

The *ECA* is designed to simplify and automate the calibration of the analog signals. Analog signal calibration is also accomplished by simple push button entry.

1.2 Standard Features

- NEMA 4 Enclosure
- 4-20mA Input and Output
- EEPROM storage of calibration data.
- Power loss, manual handwheel adjustment
- Diagnostics and Self-Test Mode

The *ECA* is available in any combination of 120/240 VAC, 50/60 Hz. Each ECA controller must be operated on the appropriate AC supply as per the nameplate ratings.



2. SAFETY

The *ECA* is a sophisticated microprocessor based controller for use only with *PULSAR* diaphragm metering pumps. It yields tremendous control capacity -- electrical, mechanical and (in conjunction with the *PULSAR* pump) hydraulic in nature. In consideration of ***SAFETY***, the user should be mindful of this relative to his/her safety, that of co-workers and of the process environment. Please consider the following prior to the installation and operation of an *ECA* controlled *PULSAR* metering pump:

2.1 General Safety

The *ECA* was designed as a stroke length position actuator for operation solely with the *PULSAR* metering pump. Use for any other application is considered un-safe and voids all certification markings and warranties.

2.2 Electrical Atmosphere Safety

The NEMA 4 version of the ECA is intended for use in Non-hazardous locations only.

2.3 Electrical Safety

The *ECA* 's electrical installation must conform to all location relevant electrical codes.

INSTALLATION AND ELECTRICAL MAINTENANCE MUST BE PERFORMED BY A QUALIFIED ELECTRICIAN.

Before installing or servicing this device, **all power must be disconnected** from the source at the main distribution panel.

The *ECA* emits electromagnetic energy and generates radio frequency interference. Its use is restricted to industrial applications. The user bears all responsibility for shielding this energy/interference.

2.4 Hydraulic Safety

Thoroughly review and adhere to the contents of the *PULSAR* Installation, Operation, Maintenance Instruction manual (current version) for hydraulic installation and operation of your *PULSAR* metering pump.

3. EQUIPMENT INSPECTION

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages or damage should be reported immediately to the carrier and your Pulsafeeder representative.

3.1 Storage Instructions

The *ECA* can be successfully stored for extended periods. The key to this success is control of temperature and humidity.

3.1.1 Short Term (0 - 12 months)...

The *ECA* should be stored in a temperature and humidity controlled environment. It is preferable to keep the temperature constant in the range of -18 to 60° Celsius (0 to 140° Fahrenheit). The relative humidity should be 0 to 90% non-condensing.

If the *ECA* is installed on the pump, it should not be removed during this period - provided the above conditions can be applied to the pump as well.

If the *ECA* is removed from the eccentric box, it should be stored in the same pump mounted orientation. After removing the *ECA* from the eccentric box, seal the opening with a dust and moisture proof material. If the *ECA* was shipped in its own carton, it should be stored in that carton.

3.1.2 Long Term (12 months or more)...

Storage of the *ECA* for periods of longer than twelve months is not recommended. If extended storage is unavoidable, the *ECA* should be stored in accordance with those conditions stipulated for **Short Term Storage**. In addition, a porous bag of 85g (3 oz) silica gel or similar desiccant should be placed within the enclosure. The cover should be re-installed to seal the desiccant within the enclosure. The two conduit connections must be tightly capped.

4. INSTALLATION

4.1 Location

Review the Safety section prior to installing the *ECA*. It contains important information required to properly install and operate the *ECA* in industrial environments.

The site selected for the installation of your *ECA* is largely dependent on that of the *PULSAR* metering pump. Please review the *PULSAR* Installation Operation Maintenance Instruction Manual provided with your *PULSAR* metering pump. It details system related issues that are important to proper operation of the *PULSAR* metering pump. Be mindful of the following *ECA* related issues when selecting a site. Avoid locations where the *ECA* would be subjected to extreme cold or heat. Note the warning statements. The installation of this device must comply with national, state and local codes.

WARNING

AVOID LOCATIONS WHERE THE *ECA* WOULD BE SUBJECTED TO EXTREME COLD OR HEAT [LESS THAN -18° CELSIUS (0° FAHRENHEIT) OR GREATER THAN 40° CELSIUS (104° FAHRENHEIT)] OR DIRECT SUNLIGHT. FAILURE TO OBSERVE THIS WARNING COULD DAMAGE THE *ECA* AND VOID ITS WARRANTY.

4.2 Installation Notes

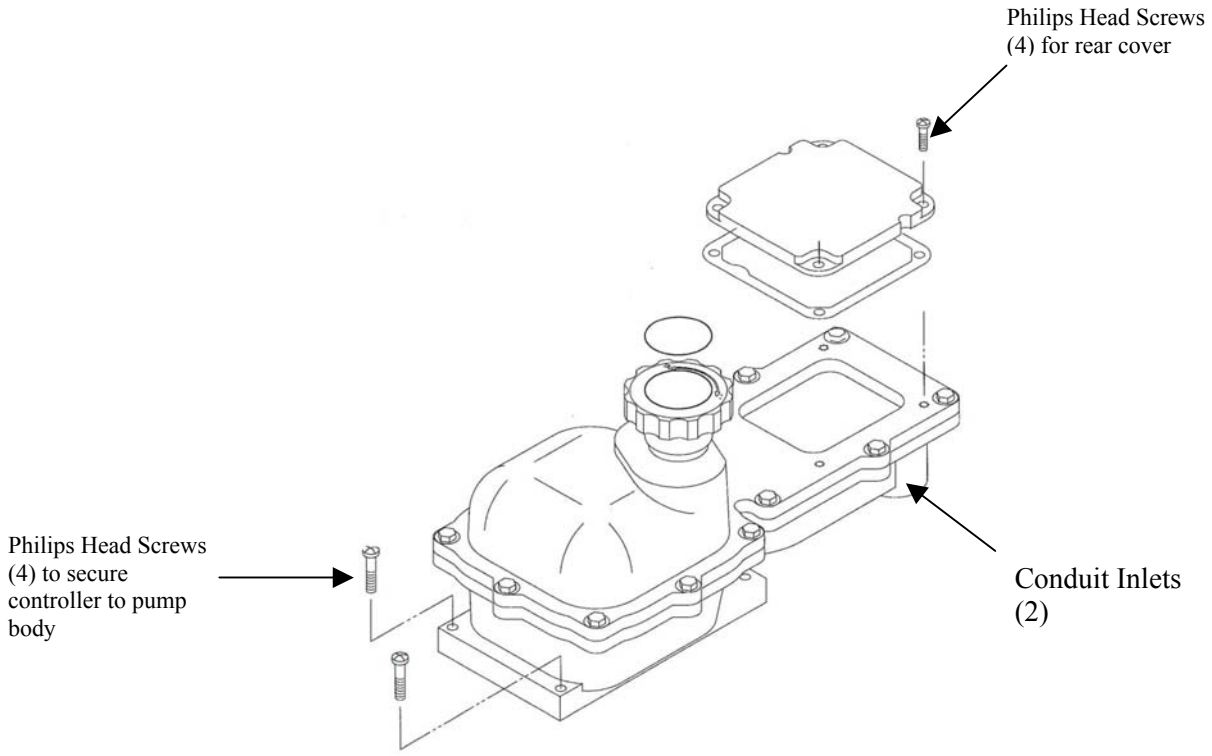
1. The *ECA* is a microprocessor-based controller that uses static sensitive CMOS components. Do not make any electrical connections (high or low voltage) without adequately grounding the *ECA* and the worker to eliminate any electrostatic charge between the two. A conductive wrist strap worn by the worker and attached to the *ECA* enclosure is adequate to satisfy this requirement.
2. Conduit connections can carry fluids and vapors into the *ECA* causing damage and void the warranty. Care should be taken when installing conduit to protect against fluid/vapor entry. If necessary, provide sealed entries or conduit drains near the point of entry.

4.2.1 Installation Preparation

All wiring and programming of the NEMA 4 *ECA* must be accomplished through the removal of the wiring cover. Use these procedures for removal and replacement:

Cover Removal

1. Disconnect power at the source.
2. Loosen and remove the 4 phillips head screws which secure the rear cover.
3. Grasp the cover and lift straight up.



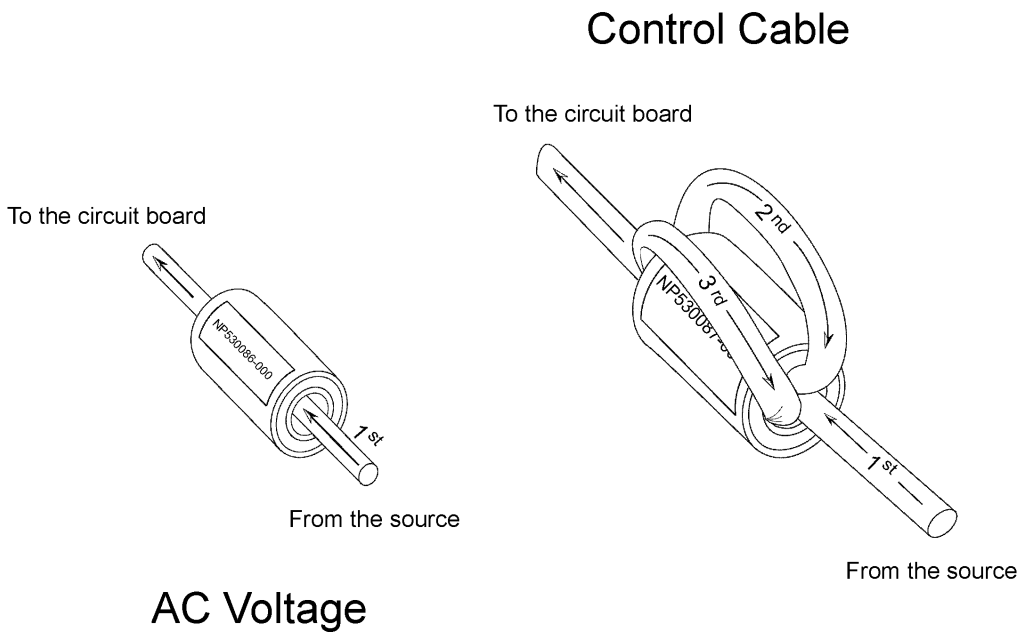
Once the maintenance to be performed has been completed, reinstall the cover as follows:

Cover Installation:

1. Inspect the gasket and mating surface for any indication of damage or dirt.
2. Position the cover and set in place.
3. Insert and tighten the 4 phillips head screws.
4. Return the *ECA* to the desired operating condition.

4.3 Electrical Wiring

As part of the electrical wiring, a Ferrite core must be used in-line with your connections to meet EMC emission and immunity standards.



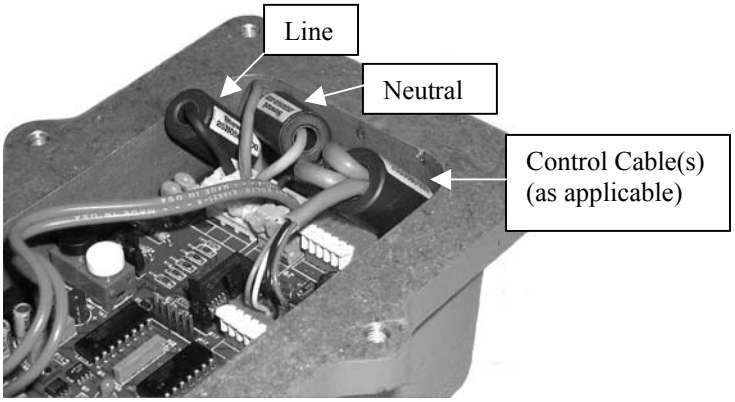
Connections to be made:

1. AC voltage supply. (Each leg is fed separately through part # NP530086-000 once [Line & Neutral].)
2. Control Cable(s) input (e.g., 4-20mA in, 4-20mA out, and Motor On/Off). (Wire(s) must be fed through part # NP530087-000 three times.)

WARNING

FAILURE TO USE THE PROVIDED FERRITE CORES CAN CAUSE EXCESSIVE EMC EMISSIONS TO BE GENERATED BY THIS DEVICE OR REDUCE IMMUNITY TO EXTERNAL EMISSIONS WHICH COULD LEAD TO ERRATIC AND POSSIBLY UNSAFE OPERATING CONDITIONS.

Use caution when replacing the cover. If placed improperly, the Ferrite Cores could damage the motherboard. The example below shows proper core location.

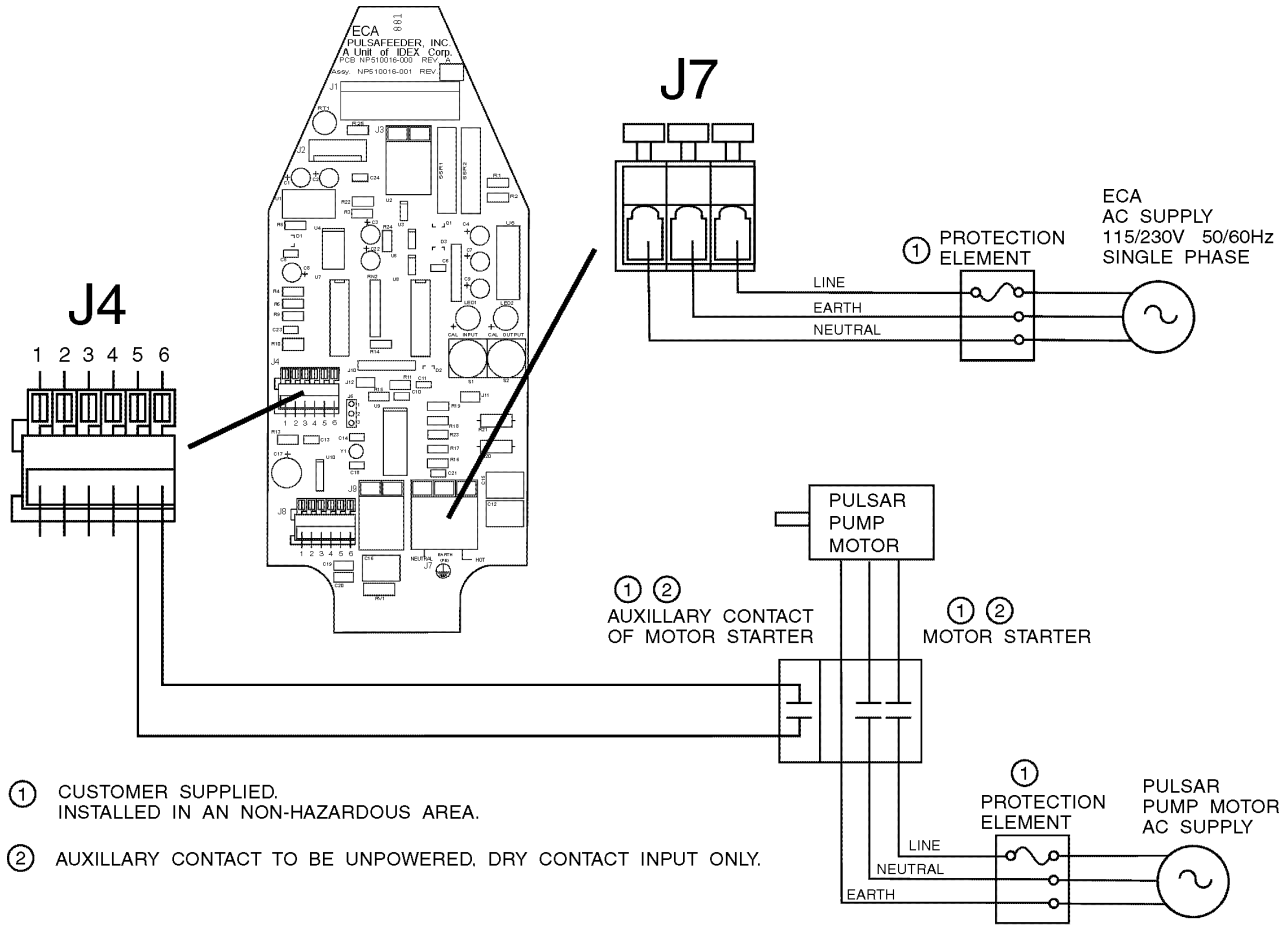


4.3.1 AC Supply

Connect the proper AC voltage supply to power the ECA at connector J7. Neutral, Earth, and Line connection points are indicated on the circuit board. For controllers rated at 220VAC, the two line conductors are wired to the line and neutral inputs. The operating voltage and frequency of the ECA are factory configured -- an internal motor and capacitor are sized according to voltage and frequency. If the power supplied to the unit does not match the factory configuration (shown on the name plate), the ECA will still operate the internal synchronous motor, eventually causing damage and improper operation.

NOTE **To ensure proper operation, the ECA should remain powered at all times. A dry contact input is provided to provide the ECA with motor status (on vs. off). See section 4.3.3.**

NOTE **High Voltage circuits (e.g., branch) should be run in separate conduit. Do not combine High Voltage (i.e., greater than 100VAC) lines and Low Voltage (i.e., less than 28VDC) lines in a common conduit!**



4.3.2 Motor Status Input

The contactor or motor starter controlling the *PULSAR* motor should be equipped with a normally open auxiliary contact, which closes to indicate the *PULSAR* motor is on. This auxiliary contact, which must be an un-powered, dry contact only, is to be wired to the motor on inputs (J4-5 and J4-6) at the *ECA*, after removing the factory installed jumper wire. It is critical that the ECA receive this input as stroke length should only be adjusted when the pump motor is running.

WARNING

DAMAGE TO THE *ECA* MAY OCCUR IF THE STATUS INPUT WIRING RECOMMENDATIONS ARE NOT FOLLOWED.

4.3.3 Analog Input

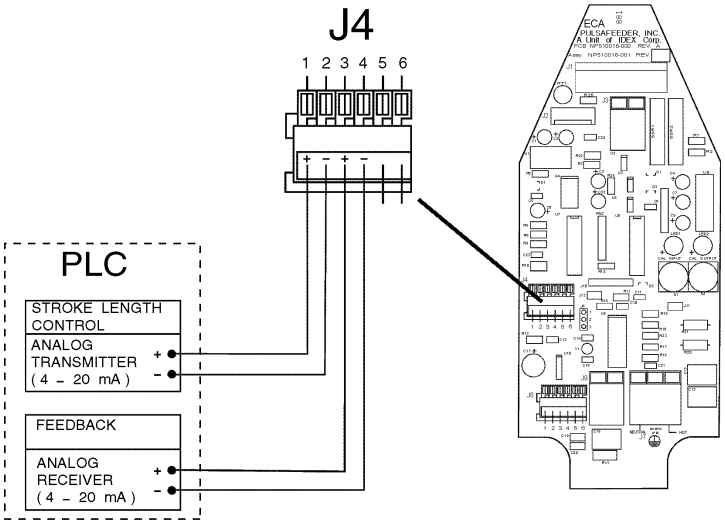
The Analog Input is used for remote control of the *PULSAR* flow. The input accepts current inputs anywhere in the range of 0 to 25mA (e.g., 4-20mA) provided the "span" (the difference between the High and Low value), is greater than 2mA. Voltage signals in the 0 to 4.096 volt range are also accepted.

Use size AWG 20 to AWG 28 wire for hookup. Attach the analog signal generated by an external device (e.g., PLC) to J4-1 and J4-2. Attach the positive lead to J4-1 and the negative lead to J4-2. Position indicators are printed on the circuit board below the terminal. The *ECA* will provide approximately 160 ohms of resistance to a current loop. The Analog Input is isolated from all other inputs, outputs and earth ground.

4.3.4 Analog Current Output

The Analog Current Output Channel follows the stroke length position. It can be calibrated to source current in the 0 to 25 mA range (4-20mA factory default). The output can be calibrated for reverse acting or split ranging operation.

The Current Output is used to control slave devices (e.g., *ECA* 's, ELMA's, PULSAMATICs, etc.) or to fulfill closed loop system requirements. Use size AWG 20 to AWG 28 wire for hookup. Attach the output to J4-3 and J4-4. Attach the positive lead to J4-3 and the negative lead to J4-4. The analog output will drive a maximum load of approximately 700 ohms. The Analog Output is isolated from all other inputs, outputs, and earth ground.



4.4 System Calibration

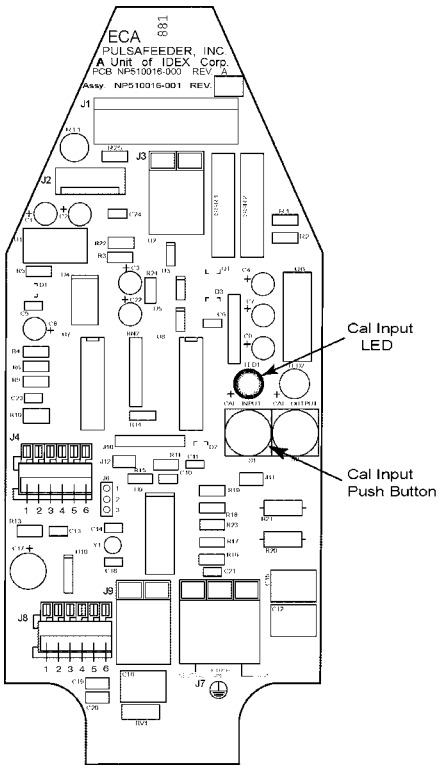
4.4.1 Analog Input Calibration

The analog input signal should be calibrated to each system. To perform a calibration, the signal-generating device (e.g., PLC) must be powered up, wired to the *ECA* and capable of altering its output from the minimum to the maximum signal.

❖ **The procedure to calibrate analog input is as follows:**

1. With the cover removed and power supplied to the *ECA*, press and release the white Input Cal pushbutton. The Cal Input LED will blink slowly, indicating the *ECA* is ready to accept the low (0% stroke) analog input value.
2. Send the low analog signal to the *ECA* (i.e., 0 mA, 1 mA, 4 mA or 1 volt) from the signal-generating device (e.g., PLC). It is highly recommended that you use the actual signal the *ECA* will be receiving during calibration.
3. When the low analog input value has stabilized, press the white Input Cal pushbutton to accept it as the 0% flow analog signal value. The Cal Input LED will now blink rapidly.
4. Send the desired analog high signal (i.e., 10 mA, 20 mA or 4.096 volts).
5. When the high analog input value has stabilized, press the white Input Cal pushbutton to accept it as the high (100% stroke) analog signal value. The Cal Input LED will extinguish, unless the minimum span of 2.0 mA is violated, then the *ECA* will return to step 1 above.

   Reverse-acting calibration is accomplished by input of a high signal (i.e., 10 mA, 20 mA or 4.096 volts) as the low (0% stroke) analog input value, and a low signal (i.e., 0 mA, 1 mA, 4 mA or 1 volt) as the high (100% stroke) analog signal value.
6. Replace the cover and return power to the *ECA*.



4.4.1.1 Analog Input Signal Loss Default Position

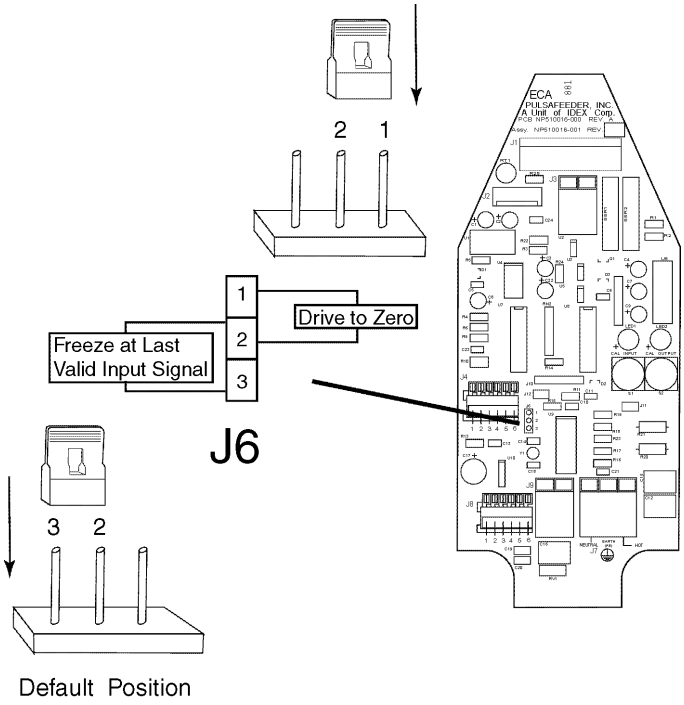
A failure of the analog input signal is detected if the input signal falls below the calibrated 0% stroke signal by 0.3 mA. For example, if the *ECA* is calibrated with a range of 4-20 mA and the signal falls to 3.6 mA then a failure will be logged. If the calibrated 0% stroke signal is 0.3 mA or less, no signal loss failure will be generated. Input signals above the calibrated 100% stroke signal are simply ignored.

For Reverse-acting calibration, if the input signal falls below the calibrated 100% stroke signal, a signal failure condition is detected, and input signals above the calibrated 0% stroke signal are simply ignored.

You can select from the following responses if the analog signal fails.

1. Drive to the zero percent stroke position.
2. Freeze at the last valid analog input signal.

The selection for Loss of Signal position is via a **jumper at J6**.



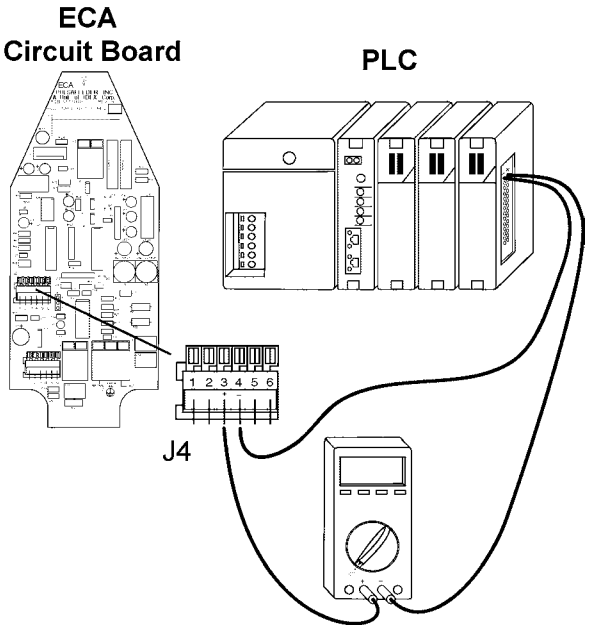
1. Locating the jumper from J6-1 to J6-2 indicates "Drive to zero".
2. Locating the jumper from J6-2 to J6-3 indicates "Freeze at last valid input signal".

Upon restoration of a valid input signal, the *ECA* will automatically return to normal operation (stroke position will resume following the analog input).

Factory ship condition (default position) is with the jumper from J6-2 to J6-3 indicating "Freeze at last Valid Input Signal". This is also the software default should the jumper not be installed in either location.

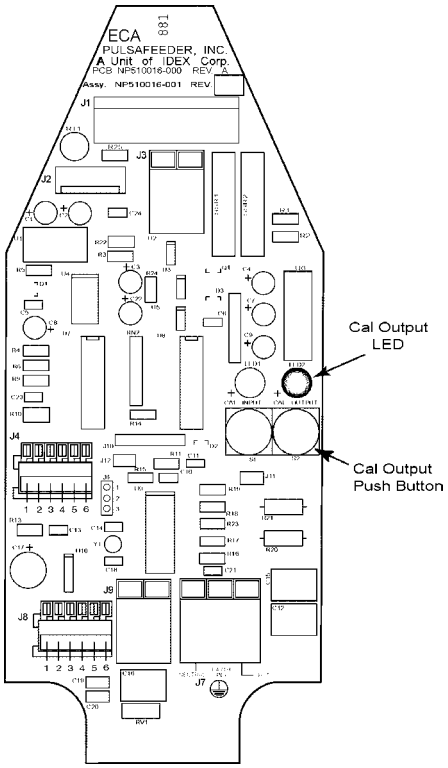
4.4.2 Analog Current Output Calibration

To calibrate the analog output, you need to attach an ammeter to the output circuit. It is recommended that you calibrate to the actual remote equipment and set the analog output values at whatever is required by that equipment. For example, say a remote PLC needs exactly 4.0mA's at 0% stroke. The PLC currently reads its input as 3.8mA and ammeter at the *ECA* reads 4.0mA. Increase the *ECA* output (e.g., 4.2 mA) until the PLC reads correctly.



❖ **The analog output calibration procedure:**

1. With the cover removed and power supplied to the *ECA*, press the black Output Cal pushbutton. The Cal Output LED will blink slowly and current output will be set to the present analog out low calibration value. (4 mA factory default)
2. Press and hold the white Input Cal pushbutton to increase current output until the desired low setpoint is reached. Release and press again to decrease current output. Current will change in steps of approximately 0.02 mA, at a rate of 20 steps per second.
3. Press the black Output Cal pushbutton. The Cal Output LED will blink rapidly and current output will be set to the present analog out high calibration value. (20 mA factory default)
4. Press and hold the white Input Cal pushbutton to decrease current output until desired high setpoint is reached. Release and press again to increase current output. Current will change in steps of 0.125 mA at a rate of 20 steps per second.
5. Press the black Output Cal pushbutton. The Cal Output LED will extinguish, unless the minimum span of 2.0 mA is violated, then the *ECA* will return to step 1 above.



NOTE **To abort the calibration procedure, press and release the Cal Input and Cal Output buttons simultaneously.**

6. Replace the cover and return power to the *ECA*.

4.4.3 Mechanical Zero Calibration

If the ECA was shipped with a pump attached, the mechanical zero calibration was performed at the factory. Typically this setting will not change during the shipping procedure, but performing a mechanical zero calibration will assure accurate operation of your controller.

If the ECA was shipped without a pump attached, performing the mechanical zero calibration is mandatory to successful installation/operation.

❖ **The procedure to calibrate mechanical zero is as follows:**

1. Verify that power to the *ECA* is **off**. (Unplug the power cord or secure power from the main panel.)
2. Remove the enclosure cover.
3. Apply power to the *ECA*. (Plug in the power cord or energize power at the main panel.)
4. Press and release the white Input Cal pushbutton. Cal Input LED will blink slowly.
5. Press and release the black Output Cal pushbutton. Both Cal Input LED and Cal Output LED will light solidly, and the mechanical zero calibration will be performed.
6. Both Cal Input LED and Cal Output LED will extinguish, when the zero calibration is complete.
7. Replace the cover and return power to the *ECA*.

4.5 Factory Re-initialization

A Factory Re-initialization restores all EEPROM calibration settings, mode settings and serial address settings to their factory default values and is typically not required. The user also needs to keep in mind that once the Factory Re-Initialization is preformed, all user calibrations are erased.

This procedure should be performed only if the user has reason to believe that the internal *ECA* memory has become corrupted.

A number of factors could cause this including:

a) Disregard of electrostatic precautions during installation,
b) Improper wiring,
c) Voltage surges, etc.

The condition usually manifests itself with inconsistent or erratic operation.

❖ **Use the following procedure to perform a Factory Re-initialization.**

1. Verify that power to the *ECA* is **off**. (Unplug the power cord or secure power from the main panel.)
2. Remove the enclosure cover.
3. Press and hold both CAL pushbuttons while applying power to the *ECA*. (Plug in the power cord or energize power at the main panel.)
4. Release the CAL pushbuttons and the unit is restored to the factory default settings.
5. Perform any additional calibration procedures as required.
6. Replace the cover and return power to the *ECA*.

5. DIAGNOSTICS

5.1 Trouble Code Reporting

The *ECA* is designed to be as fault tolerant and self-recovering as possible. However, should certain conditions occur, which make proper operation impossible, it is important to be able to diagnose the cause of the problem.

When the *ECA* encounters an abnormal condition, a trouble code is indicated using the CAL LED's as follows:

1. Both LED's will blink once.
2. The Cal Input LED will blink some number of times to signal the first trouble code digit.
3. The Cal Output LED will blink some number of times to signal the second trouble code digit.

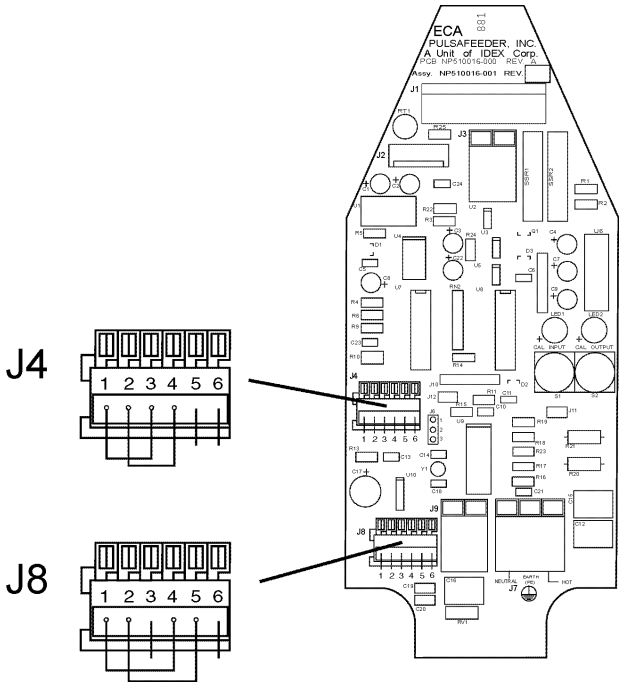
   This sequence will repeat until the trouble condition is cleared.

5.2 Trouble Codes

Code	Description	Definition
11	Encoder Error	Invalid encoder signal transition. The CPU failed to read an encoder pulse. Thus, the controller has lost its zero reference. It then attempts to recover by doing a mechanical zero calibration. If the mechanical zero calibration is successful, this error is cleared, and normal operation continues. If further errors prevent successful mechanical zero calibration, this error is a fatal error and requires user intervention. Cleared by either cycling power or pressing both CAL keys simultaneously.
12	Encoder Error	The Controller did not receive expected encoder signals for a period of one minute. This is a fatal error requiring user intervention. Cleared by either cycling power or pressing both CAL keys simultaneously.
13	Position Error	Failure to reach commanded position within the timeout period (5 minutes). After 10 minutes, the error will clear and the controller will automatically retry the position adjustment. If the error continues to occur for ten consecutive times, no further retries will be attempted, and the error will become a fatal error requiring user intervention. The error can be cleared by cycling power, or by pressing and holding both CAL keys simultaneously, for one second.
14	Over Temperature	The motor thermistor indicates the motor case temperature has reached approximately 90°C (194°F). This will stop motor operation until the motor case temperature drops below approximately 80°C (176°F), when it will clear automatically. This insures that motor duty cycle is not excessive in high ambient temperature situations.
21	Signal Loss	The Analog input signal dropped more than 0.3 mA below the low cal point. This error clears automatically when the analog input signal returns to normal.
22	Self-Test Signal Error	The Analog output signal and analog input signal at 0% stroke position do not agree (refer to ***Self-Test Mode*** description for further details).
23	Self-Test Signal Error	The Analog output signal and analog input signal at 100% stroke position do not agree (refer to ***Self-Test Mode*** description for further details).
24	Self-Test Thermistor Error	Thermistor readings are not within specifications. Contact factory for assistance.
31	Communications Error	Invalid RS-485 characters or commands received. Receipt of a valid command sequence will automatically clear this error.
33	Self-test passed	Refer to ***Self-Test Mode*** description for additional information.

5.3 Self Test Mode

The *ECA* has a diagnostic test mode which can be used to verify performance and trouble-shoot problems. To configure the *ECA* for self-test:



1. Remove power from the *ECA*.
2. Remove the cover from the *ECA*.
3. Connect Analog Out to Analog In. (jumper J4-1 to J4-3 and J4-2 to J4-4).
4. Connect RS-485 out to RS-485 in. (jumper J8-1 to J8-4 and J8-2 to J8-5).

   After making these connections, apply power to the *ECA*. If the RS-485 port is functioning correctly the *ECA* will enter the self-test mode and perform the following tests:

   a) Calibrates mechanical zero position, if necessary.

   b) Drives to the 0% stroke position, testing the motor drive and the encoder.

   c) Pauses for 30 seconds, then confirms that the analog output and the analog input are correct (Calibrated Analog output low value). Sets trouble code 22 if analog ports do not agree.

   d) Drives to the 100% stroke position, testing the motor drive and the encoder.

   e) Pauses for 30 seconds, then confirms that the analog output and the analog input are correct (Calibrated Analog output high value). Sets trouble code 23 if analog ports do not agree.

   f) Confirms that the motor thermistor is reading in correct range. Sets trouble code 24 if thermistor readings are outside specifications.

   g) Sets trouble code 33 to indicate test passed.
5. Turn power off to the ECA.
6. Remove the jumpers installed in steps 3 & 4.
7. Replace the cover and return power to the *ECA*.

6. Specifications

Input Power		115 Volt/ 60Hz, 115 Volt/ 50Hz, 220 Volt/ 60 Hz, or 220 Volt/ 50Hz
Stroke Length Control		0 – 100% control range Resolution – 0.0625% increments
Stroke Adjustment response		1% per second
Analog Input		
Operating Range		0 to 25.5mA (4-20 mA factory default) or 0 to 4.095VDC
Input Impedance		160 ohms
Minimum Span		2mA or 0.4VDC
Isolation		500V from all other inputs, outputs and ground, optically isolated
Conditioning		8 second running average.
		Split Ranging and Reverse Acting accessible via calibration.
Lost Signal Detection		Jumper selection of signal loss action (drive to zero/freeze at last) (Signal loss defined as 0.3mA below the low cal point.)
Analog Output		
Operating Range		0 to 25.5mA (4-20 mA factory default)
Maximum Load		700 ohms
Minimum Span		2mA or 0.4VDC
Conditioning		None. Output represents current stroke position.
		Split Ranging and Reverse Acting accessible via calibration.
Isolation		500V from all other inputs, outputs and ground, optically isolated.
Status Input		
Motor On/Off		Optically isolated dry contact input. Open contact indicates motor is off. Controller will then suspend all stroke control action. Motor starter should provide a contact for connection here.
Environmental		
Rated Ambient Temperature		-20°C to 40°C (-4°F to 104°F)
Storage Ambient Temperature		-25°C to 60°C (-13°F to 140°F)
Enclosure		NEMA7, IP66, NEMA4X
Approvals		UL/ULC – Type NEMA 4X DEMKO–IP66

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