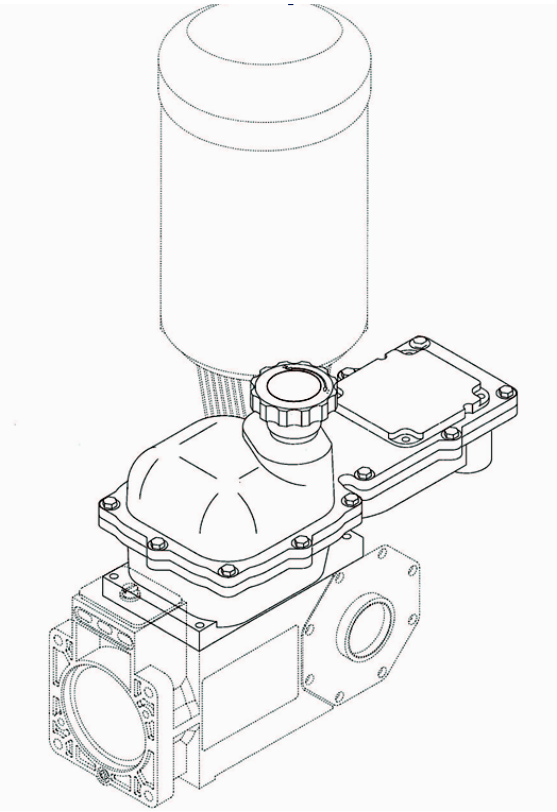
PULSAFEEDER®
ENGINEERED PRODUCTS

Installation, Operation & Maintenance Instruction



PULSAR® ECA
NEMA Type 4X
ELECTRONIC CONTROL ASSEMBLY

IOM-CTL-2001-Rev E

ECA FACTORY SERVICE POLICY

Your *ECA* is a state of the art 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.

FCC Warning

This equipment generates and uses radio frequency energy. If not installed and used properly, in strict accordance with the manufacturer’s instructions, it may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures necessary to correct the interference.

Copyright

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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. THIS MANUAL MUST BE CONSULTED IN ALL CASES WHERE THE WARNING SYMBOL IS MARKED IN ORDER TO FIND OUT THE NATURE OF THE POTENTIAL HAZARDS AND ANY ACTIONS WHICH HAVE TO BE TAKEN TO AVOID THEM.

CAUTION, POSSIBILITY OF ELECTRIC SHOCK

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.

Revision History:

Rev E (07-24-2014)

– Updated to reflect requirements of UL 61010-1 3rd Edition

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. Please refer to this IOM for important safety and operational instructions for your PULSAR pump.

2. FOREWORD

The pumps to which these “instructions” refer to are **designed for use in industrial areas** and therefore cannot be treated as retail products. The present documentation gives instructions to be used by qualified personnel only. **It must be used in compliance with the regulations, laws and technical standards in force** and cannot, under any circumstances, take the place of plant standard or additional regulations, including any which are not legally enforceable, which have been issued with the scope of ensuring safety.

Equipment with special manufacturing or constructive variances may differ in details with respect to this description.

In case of any difficulty, please contact PULSAFEEDER, INC. Technical Service.

The ECA is rated for NEMA 4 locations as identified on the controller nameplate.

2.1 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. The controller allows for precise adjustment of output flow of a process media by means of stroke length positioning.

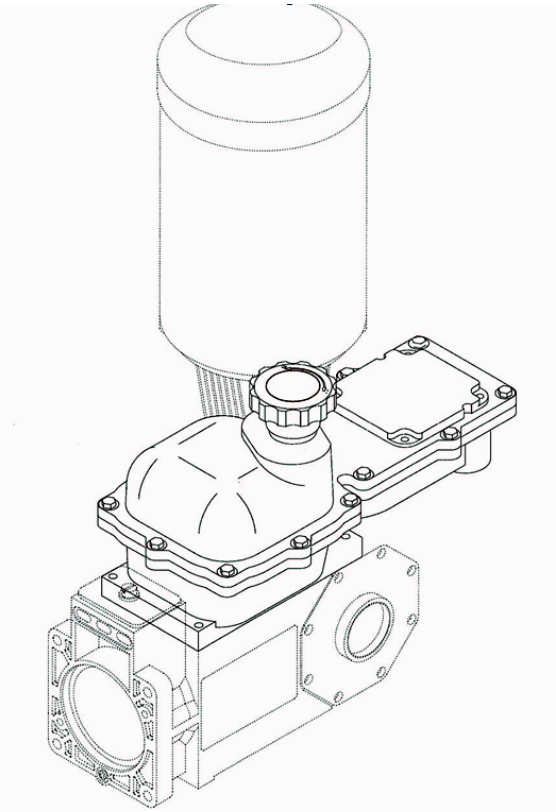
The ECA is designed for the international industrial market. The analog control signals offer flexible remote control. They are fully isolated - from each other as well as earth ground - for improved protection and reliability.

The *ECA* is designed to simplify and automate the calibration of the analog signals. Analog signal calibration is accomplished by simple push button entry. Calibration functions must be completed while the internal circuitry of the unit is accessible, and therefore at a time when the surrounding environment is considered safe for electronic work.

2.2 ECA Standard Features

- Electronic Stroke Length Control
- NEMA Type 4x enclosure
- 4-20mA input and output
- EEPROM storage of calibration data
- Diagnostics and Self-Test mode

The *ECA* is available for 115 or 230 VAC operation, at either 50 or 60 Hz. Each ECA controller must be operated on the appropriate AC supply as per the nameplate ratings.



3. SAFETY CONSIDERATIONS

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:

- Read and understand all related instructions and documentation before attempting to install or maintain this equipment
- Observe all special instructions, notes, and cautions.
- Act with care and exercise good common sense and judgment during all installation, adjustment, and maintenance procedures.
- Ensure that all safety rules, work procedures, and standards that are applicable to your company and facility are followed during the installation, maintenance, and operation of this equipment.

3.1 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.

3.2 Electrical Safety

The ECA can be considered an industrial process controller. Improper application and use can be hazardous. You are solely responsible for its use.

The ECA's electrical installation must conform to all local, state and national 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 electro-magnetic energy and may generate radio frequency interference. Its use is restricted to industrial applications. You are responsible for shielding this energy/interference.

Certain wiring procedures may require that the user wear a wrist strap to dissipate static charges.

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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. Certain calibration functions must be completed while the electronic section of the unit is exposed and power is applied to the unit, be certain to ensure that proper procedures are followed and that fingers, tools, and wiring do not contact exposed circuitry and components.

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.

3.3 Fire Safety

In case of electrical fire, use a Class C fire extinguisher. Never use water to extinguish a Class C fire.

Class C fires involve electrical equipment, such as appliances, wiring, circuit breakers and outlets. Never use water to extinguish class C fires - the risk of electrical shock is far too great! Class C extinguishers do not have a numerical rating. The C classification means the extinguishing agent is non-conductive. Geometric symbol (blue circle)

3.4 Hydraulic Safety

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

3.5 Liability Exclusion

Pulsafeeder, Inc. is unable to monitor the observance of the instructions given in this manual, nor verify the actual working conditions and installation of the equipment, the correct operation and maintenance of the equipment and accessories. An incorrect installation, or misuse of the equipment, may cause serious damage and may pose a danger to persons or property. Any anomalies must be reported to the maintenance supervisor. The user is not authorized to tamper with the machine for any reason.

Attempts to disassemble, modify or tamper in general by unauthorized personnel will void the guarantee and will release Pulsafeeder, Inc. from any liability for damage caused to persons or property resulting from such actions.

Pulsafeeder, Inc. is considered released from any liability in the following cases:

- improper installation;
- improper use of the equipment by non-professional or inadequately trained operators;
- use not in compliance with regulations in the Country of use;
- lack of maintenance or improperly performed;
- use of non-original spare parts or incorrect parts for the model in question;
- total or partial failure to observe the instructions;
- exceptional environmental events.

DO NOT PERFORM ANY WORK ON THE PUMP, MOTOR OR ECA CONTROL UNIT WITH ELECTRICAL POWER CONNECTED TO THE ECA CONTROL UNIT. DO NOT OPERATE ECA UNIT WITH THE COVER REMOVED. DANGER OF ELECTRONIC SHOCK AND MECHANICAL PINCH HAZARD!

INSTALLATION AND REPAIRS SHOULD ONLY BE PERFORMED BY AUTHORIZED PERSONNEL!

- **FOLLOW ALL SAFETY/ LOCAL LOCK-OUT, TAG-OUT PROCEEDURES!**

4. TRANSPORT AND STORAGE

4.1 Consignment receipt and unpackaging

Immediately after receipt of the equipment it must be checked against the delivery/shipping documents for its completeness and that there has been no damage in transportation.

Check any crate, boxes or wrappings for any accessories or spare parts that may be packed separately with the equipment or attached to side walls of the box or equipment.

Each product has a unique serial number. Check that this number corresponds with that advised and always quotes this number in correspondence as well as when ordering spare parts or further accessories.

Shortages or damage should be reported immediately to the carrier and your Pulsafeeder Representative.

4.2 Handling

Boxes, crates, pallets or cartons may be unloaded using fork lift vehicles or slings dependent on their size and construction.

4.3 Lifting

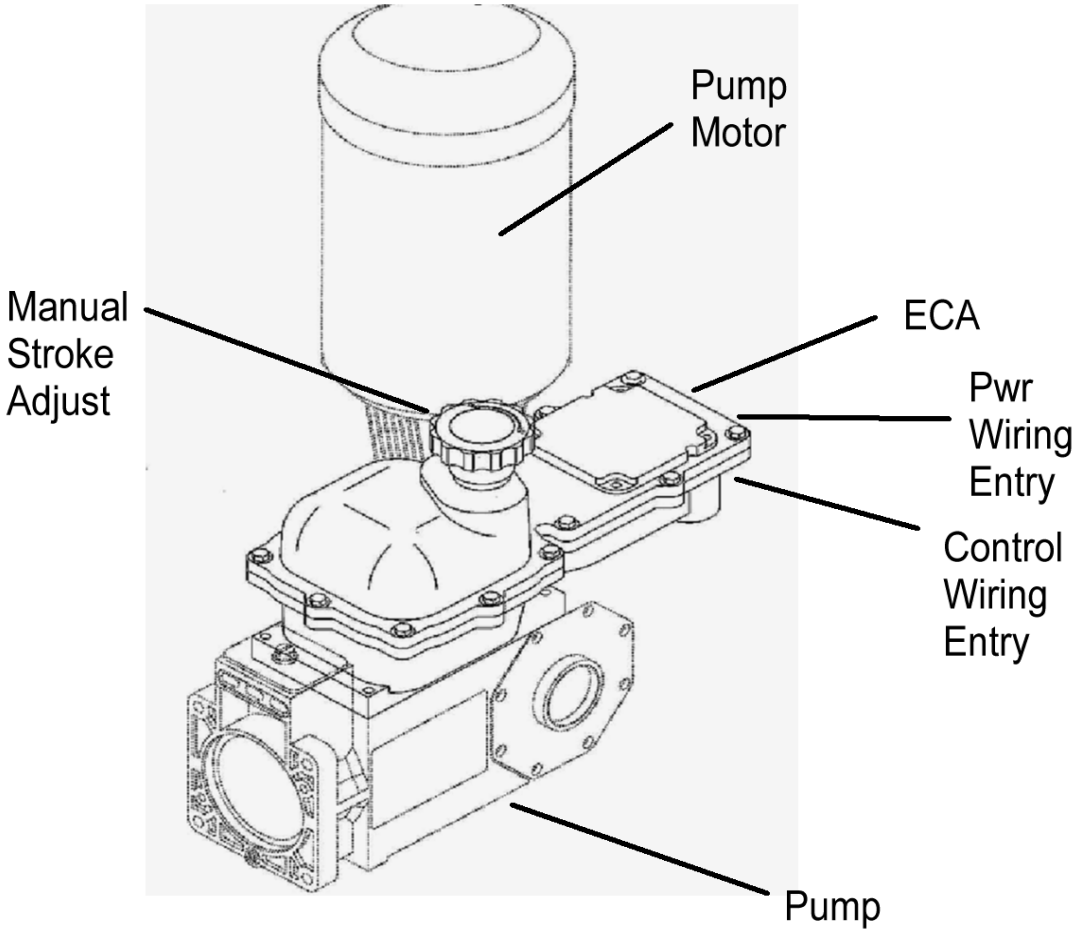
A crane must be used for all controller/pump sets in excess of 25 kg (55 lb). Fully trained personnel must carry out lifting, in accordance with local regulations.

Slings, ropes and other lifting gear should be positioned where they cannot slip and where a balanced lift is obtained.

4.4 Recycling and end of product life

At the end of the service life of the product or its parts, the relevant materials and parts should be recycled or disposed of using an environmentally acceptable method and local requirements. If the product contains substances that are harmful to the environment, these should be removed and disposed of in accordance with current regulations. This also includes the liquids and/or gases that may be used in the "seal system" or other utilities.

Make sure that hazardous substances are disposed of safely and that the correct personal protective equipment is used. The safety specifications must be in accordance with the current regulations at all times.



5. STORAGE INSTRUCTIONS

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

5.1 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 40° Celsius (0 to 104° 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.

NOTE **If the *ECA* is removed from the pump 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.**

5.2 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. Inspect the unit carefully for any signs of damage and remove the desiccant before placing it into operation.

NOTE **Special note for long-term storage:**

If AC input power has not been applied to the ECA for a period greater than 12 months, the controller must be prepared for operation. The ECA should have AC power applied at the input for a period of 8 hours before placing pump into normal operation. Refer to Installation and Wiring section for AC power connection instructions.

6. INSTALLATION AND WIRING

6.1 Location

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

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

Maintenance Instruction Manual (current version) 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 statement. The installation of this device must comply with national, state and local codes.

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.

6.2 Installation Notes

- 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.
- 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. In accordance with any applicable codes provide sealed entries and conduit drains near the point of entry as required.
- All applicable codes and regulations should be adhered to in the installation and wiring of the ECA.

The safety of any system incorporating the ECA is the responsibility of the assembler of the system.

6.3 Installation guidelines for EMC compliance

- The cover must be installed properly.
- Shielded cables used for analog inputs and outputs
- Proper Earth grounding
- Insure Power mains are properly filtered for isolation from line transients, lightning strikes, or other electrical noise sources.

Failure to observe the guidelines above may lead to erratic and possibly unsafe operating conditions.

6.4 Housing Access

All wiring and programming of the *ECA* must be accomplished through the removal of the housing cover. Use this procedure for removal and replacement:

Cover Removal

- Disconnect power at the source (follow your local Lock-Out-Tag-Out procedures).
    - Disconnect power at the source.
    - Loosen and remove the 4 Phillips head screws which secure the rear cover.
    - Grasp the cover and lift straight up.

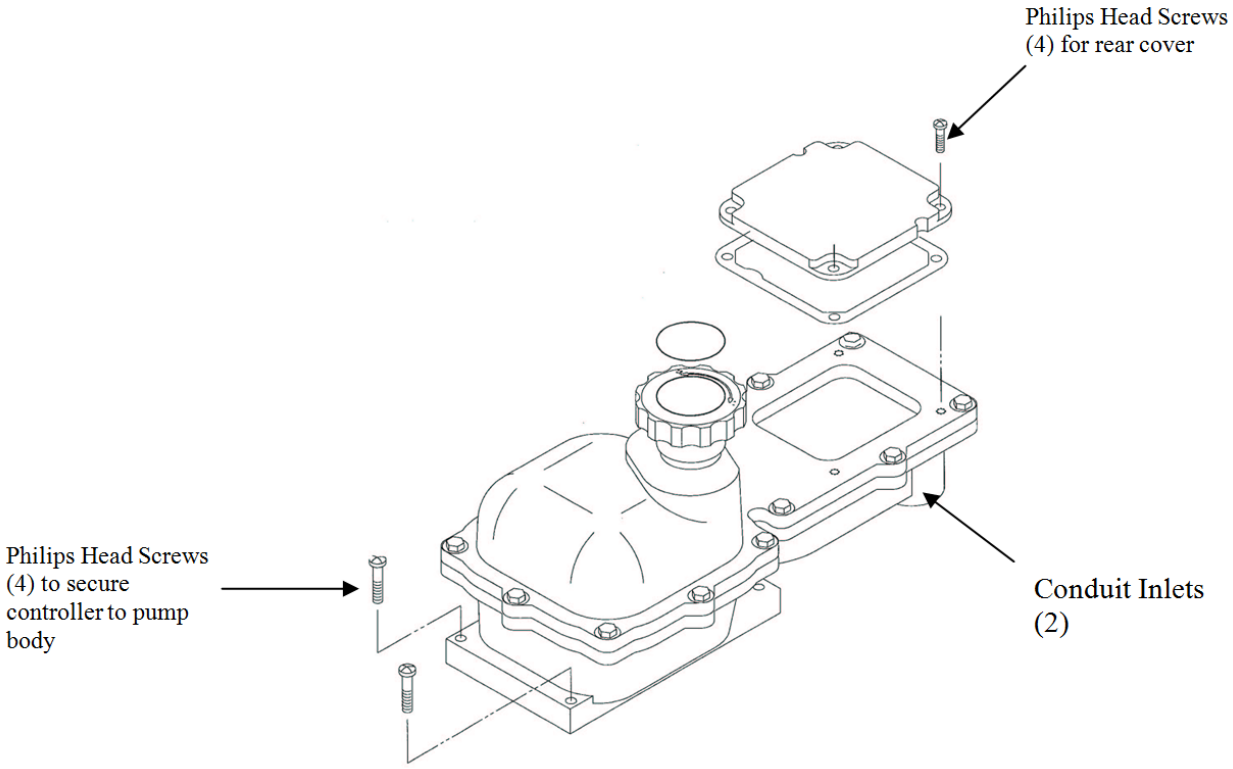


Figure 1

Cover Re-installation

1. Disconnect power at the source (follow your local Lock-out-Tag-out procedures).
2. Verify that the mating surface of the lower half of the *ECA* is clean.
3. Inspect the mating surface for any indication of damage or dirt.
4. Position the cover and set in place.
5. Insert and tighten the 4 phillips head screws.
6. Return the *ECA* to the desired operating condition.
7. Torque the 13 Socket Head Cap Screws to 100in-lb (11.3 N-m). Use a crisscross pattern to tighten the bolts to ensure a proper seal around the entire perimeter.

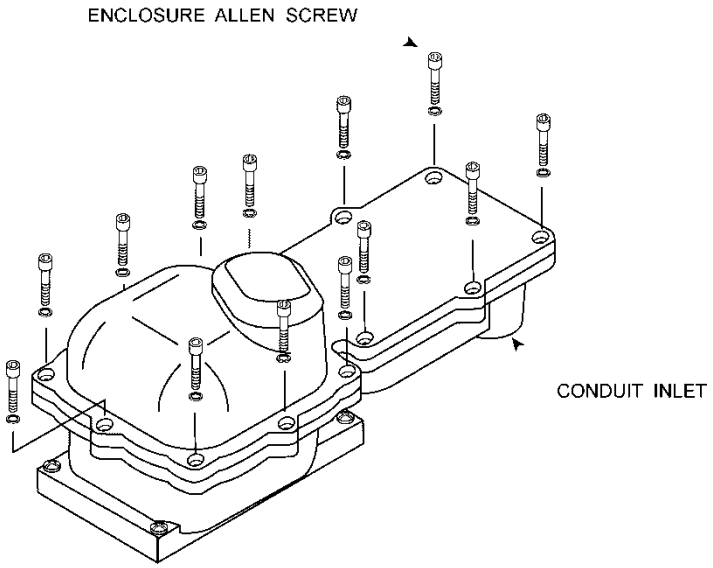


Figure 2

8. Check the cover lies flat with no air gaps. Re-torque the cover bolts if needed. DO NOT exceed a maximum of 125in-lb (14.1N-m) torque.
9. When wiring is completed and cover is properly replaced, the ECA is now ready for operation. Remove Lock-out-Tag-out protection and restore power. See 4.4 for Electrical Wiring.

6.5 Electrical Wiring


WHILE THE ECA WIRING REQUIREMENTS ARE VERY SIMPLE, ALWAYS KEEP IN MIND THAT ACCESS TO THESE CONNECTORS REQUIRES THE REMOVAL OF THE COVER, AND AS SUCH THIS PROCEDURE SHOULD ONLY BE PERFORMED BY A TRAINED PROFESSIONAL.

Wait a minimum of 3 minutes after disconnecting power before servicing the ECA or pump motor. Capacitors retain a charge even after power is removed from the controller.

It is highly recommended that you take a step-by-step approach to wiring and confirming proper ECA operation:

1. Make the Line voltage connections. These will allow you to operate the ECA and attached Pulsafeeder pump.
2. Decide which low voltage Inputs and Outputs (e.g., 4-20mA in) will be used and make those connections
3. Power-up and test the ECA to confirm the connections and check for proper operation.

6.6 Power Wiring Information

THESE PROCEDURES REQUIRE REMOVAL OF THE ENCLOSURE COVER. THIS SHOULD BE DONE ONLY IF THE AREA IS KNOWN TO BE SAFE FOR ELECTRONIC WORK.

- **Verify the correct supply voltage (115VAC or 230VAC) with the nameplate affixed to your ECA. Ensure that your supply voltage matches the ECA configuration.**

- **Wires should be routed within the enclosure in a manner that maintains separation between line voltage and extra-low voltage conductors.**

- **Applicable national and local electrical codes take precedence over recommendations in the table below.**

- **A circuit breaker or fuse must be provided as noted below.**

Power Requirements	Recommended Minimum Wiring and Circuit Breaker									
	115 VAC Operation					230 VAC Operation				
	Actual Draw	Circuit Breaker	Wire Size	Wire Size	Safety Approvals[1]	Actual Draw	Circuit Breaker	Wire Size	Wire Size	Safety Approvals[1]
ECA	200ma	10A	14 AWG	2.5 mm^2	UL, CUL, CE	200ma	10A	14 AWG	2.5 mm^2	UL, CUL, CE

Note 1: UL File E217212, Applicable standards are CSA 22.2 14-23, Cenelec EN61326-1, UL61010-1, and EN61010-1 3rd edition

Note the ECA input current ratings from the name plate and check the applicable electrical codes for required wire type and size, grounding requirements, over-current protection, and incoming power disconnect before wiring the controller. Connect the proper AC voltage supply to power the ECA at connector J7. Neutral and Line connection points are indicated on the circuit board under the connector. The Earth connection is made to the stud on the chassis via a ring terminal (provided). See Figure 3 for details. Remove approximately 0.3 inches, (7-8mm) of insulation from the end of each conductor. Loosen the terminal strip screw, and insert the stripped wire end fully into the terminal. Tighten the screw to 5 in-lbs. (0.5 Nm) to secure the conductor. Make certain that the terminal grips the wire, not the insulation. The operating voltage and frequency of the ECA is 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 nameplate), it will malfunction/damage and void the warranty.

NOTE

Note: Power wiring should have a rating of at least 300 volts AC (rms) and a temperature rating of at least 105 Degrees C.

A circuit breaker or disconnect switch with fuses, must be provided in accordance with all applicable local and national electrical codes and regulations. Size external fusing/breaker for ratings for the wiring used for the unit.

NOTE

Applicable national and local electrical codes take precedence over recommendations made here.

NOTE

To ensure proper operation, the ECA should remain powered at all times. A dry contact input provides the ECA with motor status (on vs. off). See *Motor Status Input Section*

NOTE

Input Power must be run in separate conduit. Do not combine Power and Control wires in a common conduit!

WARNING

Field Wiring conductors shall be copper conductors only!

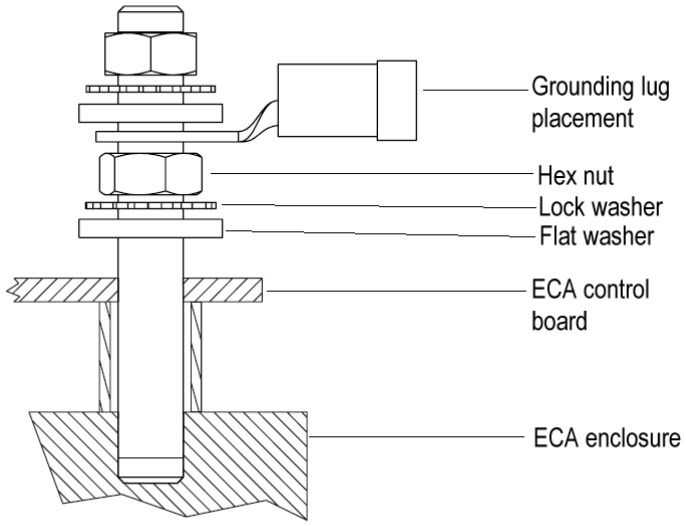


Figure 3 – Earth grounding

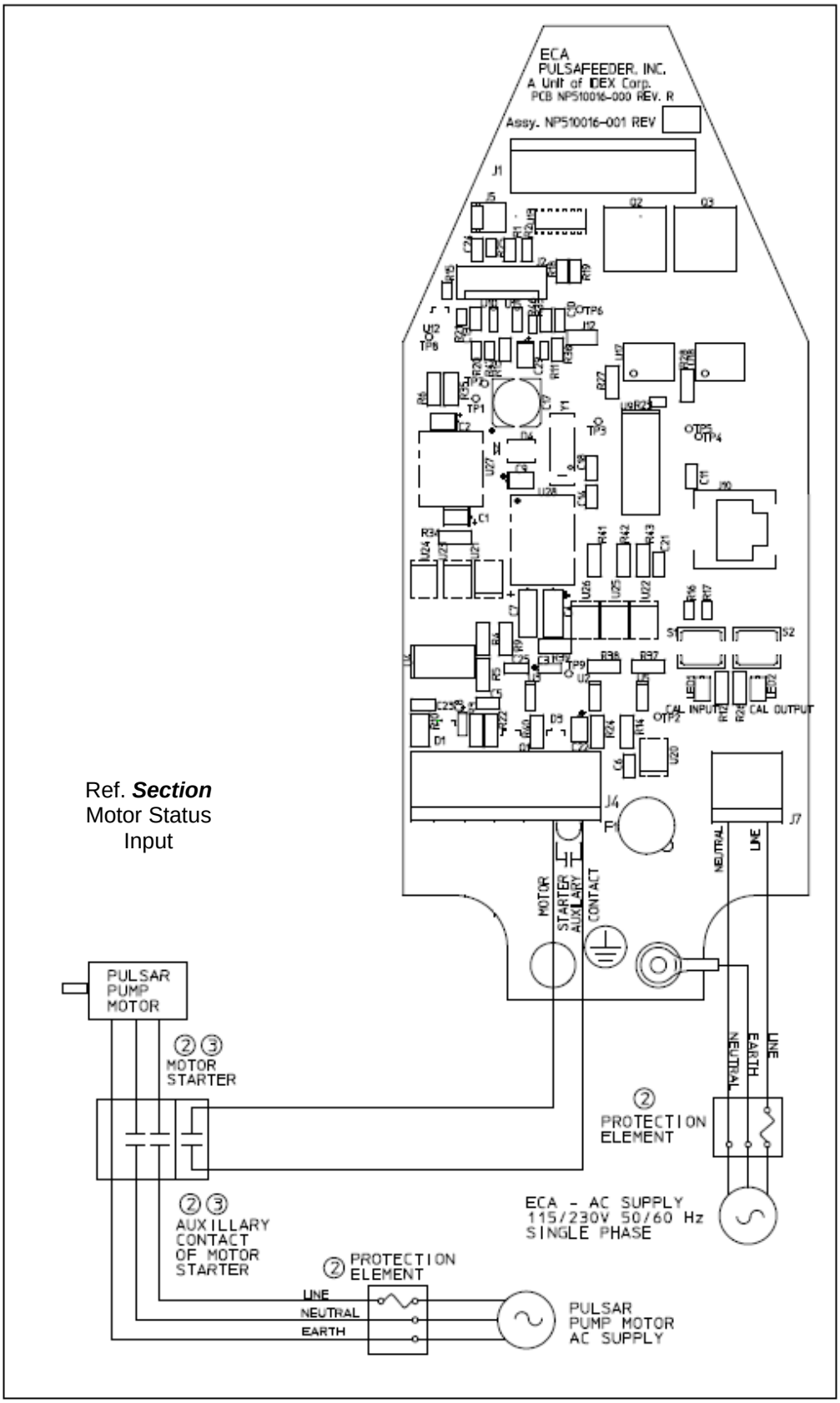
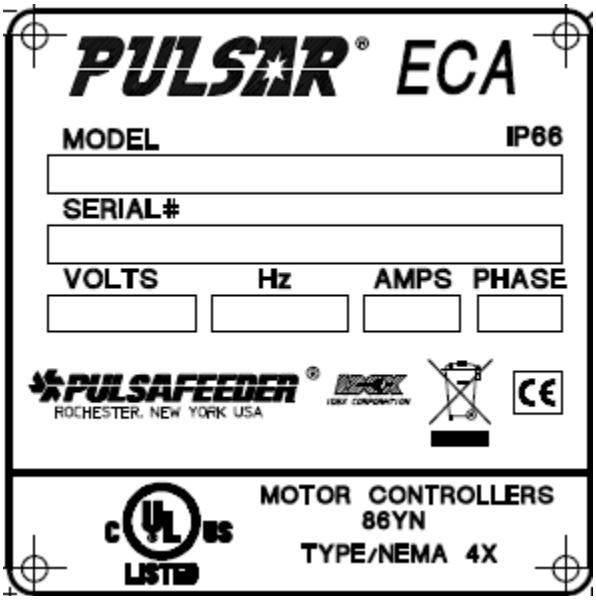

ECA
PULSAFEEDER, INC.
A Unit of IDEX Corp.
PCB NP510016-000 REV. R
Assy. NP510016-001 REV
Ref. Section
Motor Status
Input
MOTOR STARTER AUXILARY CONTACT
NEUTRAL
LINE
PULSAR PUMP MOTOR
② ③ MOTOR STARTER
② PROTECTION ELEMENT
② ③ AUXILLARY CONTACT OF MOTOR STARTER
② PROTECTION ELEMENT
LINE
NEUTRAL
EARTH
ECA - AC SUPPLY
115/230V 50/60 Hz
SINGLE PHASE
PULSAR PUMP MOTOR AC SUPPLY

Figure 4

6.7 Labeling – Nameplate



6.8 Control Input and Output Connections

6.8.1 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 inputs (J4-5 and J4-6) at the *ECA*, after removing the factory installed jumper wire. Remove approximately 0.3 inches, (7-8mm) of insulation from the end of each conductor. Loosen the terminal strip screw, and insert the stripped wire end fully into the terminal. Tighten the screw to 5 in-lbs. (0.5 Nm) to secure the conductor. Make certain that the terminal grips the wire, not the insulation. It is critical that the ECA receive this input, as stroke length should only be adjusted when the pump motor is running. An alternate contact that represents motor status (for example a relay contact in a local control cabinet) can also be used for this function.

WARNING

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

6.8.2 Analog Input (current loop)

The Analog Input is used for remote control of the pump flow. It 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. Use shielded cable (minimum 2-conductor) for connection to the Analog Input. Recommended: use shielded cable, 22AWG, 3-pair, and 6-conductor for connections (e.g. Belden 5545FE). Attach the positive lead to terminal J4-1 and the negative lead to terminal J4-2 (see Figure 5). Position indicators are printed on the circuit board below each terminal. Remove approximately 0.3 inches, (7-8mm) of insulation from the end of each conductor. Loosen the terminal strip screw, and insert the stripped wire end fully into the terminal. Tighten the screw to 5 in-lbs. (0.5 Nm) to secure the conductor. Make certain that the terminal grips the wire, not the insulation. The *ECA* will provide approximately 160 ohms of resistance to a current loop. It will also accept voltage signals in the 0-4 volt DC range. The Analog Input is electrically isolated from all other inputs, outputs and earth ground.

6.8.3 Analog Output (current loop)

The Analog Output sends a signal representing the actual stroke length position. It can be adjusted to source current in the 0 to 25 mA range (4-20mA factory default). The output can also be set up for reverse-acting or split-ranging operation. The Current Output can be used to control slave devices (e.g. *ECA*'s, ELMA's, PULSAMATICs, etc.) or to fulfill closed loop system requirements. Use shielded cable (minimum 2-conductor) for connection to the analog output. Recommended: use shielded cable, 22AWG, 3-pair, and 6-conductor for connections (e.g. Belden 5545FE). Attach the positive lead to terminal J4-3 and the negative lead to terminal J4-4 (see Figure 5). Position indicators are printed on the circuit board below each terminal. Remove approximately 0.3 inches, (7-8mm) of insulation from the end of each conductor. Loosen the terminal strip screw, and insert the stripped wire end fully into the terminal. Tighten the screw to 5 in-lbs. (0.5 Nm) to secure the conductor. Make certain that the terminal grips the wire, not the insulation. The Analog Output will drive a maximum load of approximately 700 ohms. The Analog Output is electrically isolated from all other inputs, outputs, and earth ground.

NOTE

Note: Analog Input and Analog Output wiring should have a rating of at least 300 volts AC (rms) and a temperature rating of at least 75 Degrees C.

Note: If strip length guidelines in above sections are not followed, there is a risk of electric shock as well as shorting of adjacent connections generating hazardous sparks.

Ref. ***Section*** **Analog Output**

Ref. ***Section*** **Analog Input**

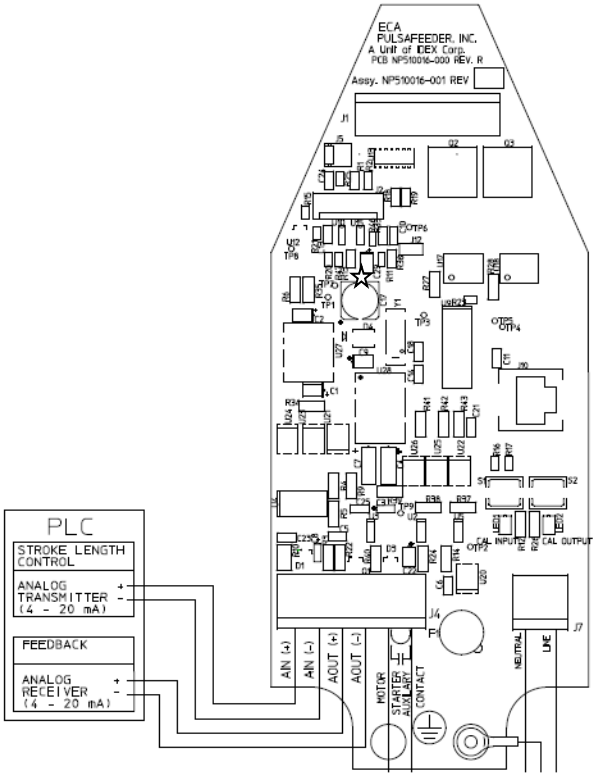


Figure 5

7. START UP AND OPERATION

7.1 Overview

Once all electrical connections have been made, your ECA is ready for Start-up. The following sections detail the procedures required to complete the ECA start up.

WARNING: The ECA NEMA 4X Stroke controller includes a manual stroke control wheel. DO NOT OPERATE THIS MANUAL STROKE CONTROL WHEEL WHILE THE POWER TO THE STROKE CONTROLLER IS OFF. This will cause the electronics to error. The ECA will stop operation and will need to be reset to look for the motor zero position!

- **WARNING: DO NOT attempt to remove the cover of the ECA and set up the ECA in a very wet or rainy environment. While care has been taken to insulate power connections, DANGEROUS voltages are present and can cause electric shock, and possible electrocution if safety procedures are not followed**

WHEN POWER IS SUPPLIED TO THE UNIT, LINE VOLTAGE MAY BE PRESENT WITHIN THE ECA ENCLOSURE EVEN WHEN THE MOTOR IS OFF.

DURING START-UP, IT MAY BE NECESSARY TO RUN THE PUMP MOTOR. THIS WILL CAUSE FLUID TO DISCHARGE FROM THE PUMP. YOU ARE RESPONSIBLE FOR SAFELY DIVERTING FLOW FROM THE PUMP DURING START-UP AND CALIBRATION.

THE ECA IS DESIGNED TO CONTROL THE PUMP STROKE LENGTH WITHIN THE PUMPS RATED PRESSURE AND FLOW. OPERATION BEYOND RATED SPECIFICATIONS, EVEN INTERMITTENTLY, MAY DAMAGE EQUIPMENT AND VOID THE WARRANTY.

IF THIS EQUIPMENT IS USED IN ANY MANNER NOT SPECIFIED BY PULSAFEEDER, PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

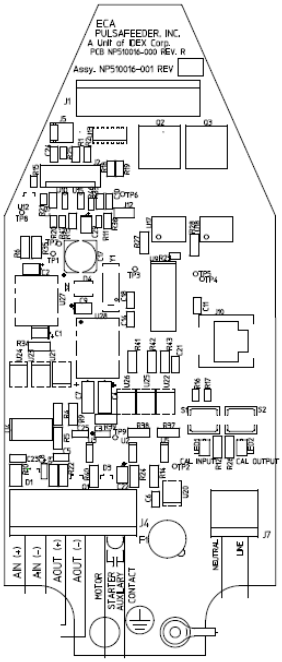


Figure 6

8. INPUT/OUT SETUP

- **WARNING: DANGEROUS LINE VOLTAGES ARE PRESENT ON THE CIRCUIT BOARD DURING THIS PROCEDURE. USE CAUTION WHILE PRESSING BUTTONS.**

8.1 System User Calibration

8.1.1 Analog Input Signal Calibration

The analog input signal should be user 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. Note that the minimum span, or difference between low and high values, is 2.0 mA. The ECA will not actuate to change stroke length during this process.

WARNING

THIS PROCEDURE REQUIRES REMOVAL OF THE ENCLOSURE COVER. THIS PROCEDURE SHOULD BE PERFORMED ONLY IF THE AREA IS KNOWN TO BE SAFE FOR ELECTRONIC WORK.

- 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.
- Send the low analog signal to the *ECA* (generally 4 mA) 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.
- When the low analog input value has stabilized (allow 10-15 seconds), press the white Input Cal pushbutton to accept it as the 0% flow analog signal value. The Cal Input LED will now blink rapidly.
- Send the desired analog high signal (generally 20 mA).
- When the high analog input value has stabilized (allow 10-15 seconds), 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.

NOTE

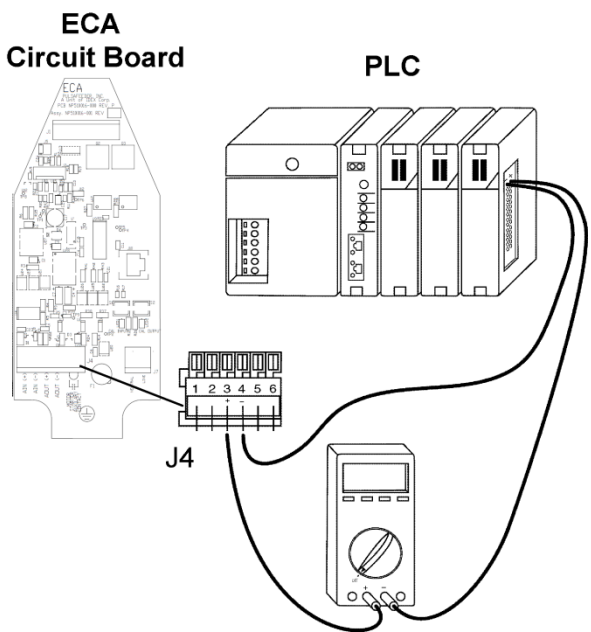
Reverse-acting calibration is accomplished by input of a high signal (i.e., 20 mA) as the low (0% stroke) analog input value, and a low signal (i.e. 4 mA) as the high (100% stroke) analog signal.

- Replace the cover (see ***Section Cover Re-installation***) and continue with the output calibration if that function is being utilized.

8.1.2 Analog Input Signal Loss

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 Signal Loss 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, the stroke position will be driven to 100% and no error condition occurs.

In the event of a loss of analog signal or an abnormally low signal, the ECA will drive to the zero stroke position. The ECA will recover once a valid analog signal is present and resume control to the appropriate set point.



8.1.3 Analog Output Signal Calibration

WARNING

THIS PROCEDURE REQUIRES REMOVAL OF THE ENCLOSURE COVER. THIS SHOULD BE DONE ONLY IF THE AREA IS KNOWN TO SAFE FOR ELECTRONIC WORK.

Figure 7

To calibrate the analog output, attach a milli-ammeter to the output circuit of the ECA in series with the PLC used to control the process (as shown in figure 7). It is recommended that you calibrate the ECA analog output values to whatever is required by the PLC. For example, the ECA output can be adjusted at the zero point so that the screen on the PLC system reads zero %, regardless of the actual mA value of the signal. The ECA will not actuate to change stroke length during this process.

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 set point 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 set point 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.
6. Remove Power to the ECA. Replace the cover (see ***Section Cover Re-installation***) and return power to the *ECA.*

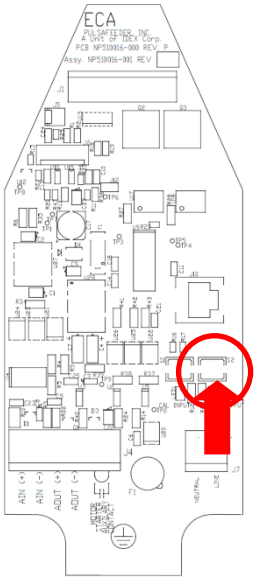


Figure 10

9. MECHANICAL ZERO CALIBRATION

WARNING

THIS PROCEDURE REQUIRES REMOVAL OF THE ENCLOSURE COVER. THIS SHOULD BE DONE ONLY IF THE AREA IS KNOWN TO BE SAFE FOR ELECTRONIC WORK.

If the ECA was shipped with a pump attached, the mechanical zero calibration was performed at the factory. If the ECA was shipped without a pump attached, performing the mechanical zero calibration is mandatory to successful installation/operation. The ECA controller automatically performs a mechanical zero calibration if it does not have a valid zero calibration set point stored. If you suspect the zero calibration set point is incorrect, follow the calibration procedure below**. The pump MUST be running during this process to ensure an accurate zero position is calibrated. Therefore you MUST ensure it is safe to operate the pump during the procedure.**

- Verify that power to the *ECA* is **off**
- Remove the enclosure cover.

- Press and hold the *BLACK* pushbutton
- Apply power to the *ECA*.
- A mechanical zero calibration routine will begin. The routine begins when the motor internal to the ECA starts motion looking for the zero position. Once the ECA begins the routine you may release the pushbutton.
- The calibration routine is complete when the motor reaches the zero position and the rotor locks for approximately 30 seconds. Zero calibration ends when the motor stops running. .
- Remove Power to the ECA. Replace the cover (see ***Section Cover Re-installation***) and return power to the *ECA.*

9.1 Factory Re-initialization

THIS PROCEDURE REQUIRES REMOVAL OF THE ENCLOSURE COVER. THIS SHOULD BE DONE ONLY IF THE AREA IS KNOWN TO BE SAFE FOR ELECTRONIC WORK.

A Factory Re-initialization restores all EEPROM calibration settings and mode 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 performed, 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. Memory Corruption usually manifests itself with inconsistent or erratic operation. A number of factors could cause memory value corruption including:

1. Disregard of electrostatic precautions during installation,
2. Improper wiring,
3. Voltage surges, spikes, etc.

The pump MUST be running during this process to ensure an accurate zero position is obtained. Therefore you MUST ensure it is safe to operate the pump during the procedure.

- Verify that power to the *ECA* is **off**.
- Remove the enclosure cover.
- Press and hold both black and white pushbuttons while applying power to the *ECA*.
- Release the CAL pushbuttons and the unit is restored to the factory default settings.
- The unit will automatically perform a new mechanical zero calibration as part of the Factory Re-Initialization routine.
- Perform any additional calibration procedures as required.
- Remove Power to the ECA. Replace the cover and return power to the *ECA.*

10. DIAGNOSTICS

10.1 Trouble Code Reporting

The *ECA* is designed to be as fault-tolerant and self-recovering as possible. When the *ECA* encounters an abnormal condition, a trouble code is indicated by blinking CAL LED's located on the ECA main board, internal to the enclosure, as follows:

- Both LED's will blink once.
- The Cal Input LED will blink a number of times to indicate the first trouble code digit.

- The Cal Output LED will blink a number of times to indicate the second trouble code digit.

  This sequence will repeat until the trouble condition is cleared.

10.2 Trouble Codes

Code	Definition	Description	Action
11 or 12	Encoder Error	The CPU failed to read an encoder pulse, or has not received the expected signals in a certain amount of time. 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.	Clear error by cycling power.
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.	Wait 10 minutes, or clear fatal error by cycling power.
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) at which point the error clears automatically.	Correct reason for motor Over-Temperature condition.
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.	Correct reason for low input signal.
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).	Refer to Self-Test Mode
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).	Refer to Self-Test Mode
24	Self-Test Thermistor Error	Thermistor readings are not within specifications.	Contact factory
33	Self-test passed	Refer to ***Self-Test Mode*** description for additional information.	No action.

10.3 Self-Test Mode

The *ECA* has a diagnostic test mode which can be used to verify performance and troubleshoot problems. To initiate the self-test:

- Remove power from the ECA, and remove the top cover.
- Disconnect any field wires attached to J4, and connect Analog Out to Analog In. (jumper J4-1 to J4-3 and J4-2 to J4-4).

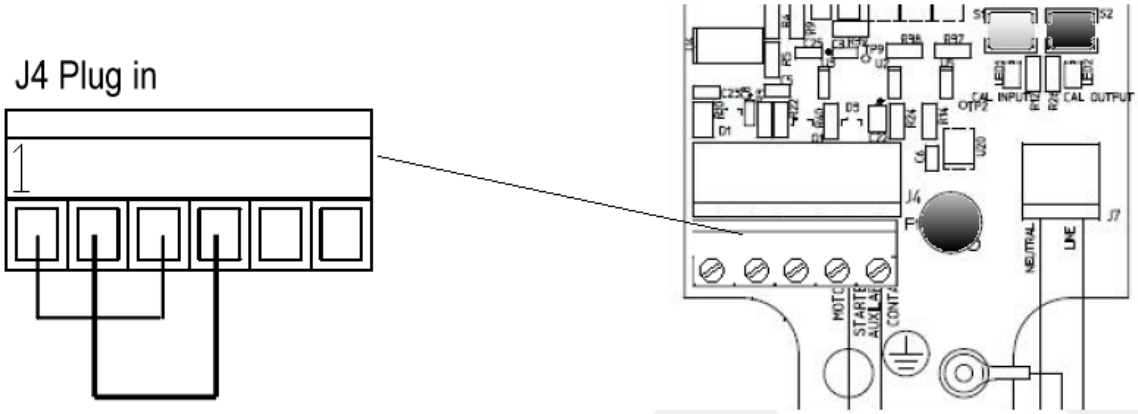


Figure 11

- Press and hold the white Input Cal pushbutton.
- Apply power to the *ECA* and release white Input Cal pushbutton. The *ECA* will enter the self-test mode and automatically perform the following tests:

Calibrates mechanical zero position

Drives to the 0% stroke position, testing the motor drive and the encoder. Both Cal LED's will blink if the zero calibration fails.

Pauses for 30 seconds, and then confirms that the Analog Output and the Analog Input are correct. Sets trouble code 22 if analog ports do not agree.

Drives to the 100% stroke position, testing the motor drive and the encoder. Sets the trouble code to 13 if the 100% position is not attainable.

Pauses for 30 seconds, and then confirms that the Analog Output and the Analog Input are correct. Sets trouble code 23 if analog ports do not agree.

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

Sets trouble code 33 to indicate test passed.

Turn power off to the *ECA*, and remove the jumpers installed in step 2. Re-connect field wires.

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

10.4 Error Recovery

In cases of abnormal operation, the following procedure is recommended:

1. First, check all power and process connections to ensure all wiring is secure and properly connected.
2. Check the internal connections within the *ECA.*
3. Ensure that the cable connections from the stroke adjustment motor and encoder are secure and seated properly.
4. Perform a Factory Re-initialization, as previously mentioned in this IOM. This will also force a new mechanical zero calibration to be performed. The pump motor should be operating during this process as the *ECA* will adjust stroke to re-locate the zero position. **Ensure that it is safe to operate the pump during this step.**
5. Perform a new Analog Input signal calibration
6. Perform a new Analog Output signal calibration

11. SPECIFICATIONS

Input Power		115 Volt/ 60Hz, 115 Volt/ 50Hz, 230 Volt/ 60 Hz, or 230 Volt/ 50Hz
Input Current		200ma nominal, 2 amperes (short circuit)
Stroke Length Control		0 – 100% control range Resolution – 0.0625% increments
Stroke Adjustment response		Approximately 1% per second
Analog Input		
Operating Range		0 to 25.5mA (4-20 mA factory default)
Input Impedance		160 ohms
Minimum Span		2.0 mA
Isolation		500V from all other inputs, outputs and ground, optically isolated
Conditioning		8 second running average.
		Split Ranging and Reverse Acting accessible via calibration.
Analog Output		
Operating Range		0 to 25.5mA (4-20 mA factory default)
Maximum Load		700 ohms
Minimum Span		2.0 mA
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		NEMA4, IP66, NEMA 4X
Approvals		UL/ULC - NEMA 4X CE – IEC EN 61010-1
Transient Voltage		Max Impulse withstand 1500V (115VAC Models), 2500V (230VAC Models) at 50uS
Voltage Overload		120% Continuous,
Pollution Degree		Suitable for Pollution Degree 3
Input Voltage		115 (105-125 acceptable range) or 230 (208 – 240 acceptable range) VAC Note: factory configured only for correct input voltage range (specified at time of purchase) Single phase input only 50 or 60

		Hz. Input frequency range 48 Hz to 62 Hz
Altitude:		3300 Ft (1000 M) above sea level (de-rate 5% per additional 3300 Ft)
Humidity		0-90% (non-condensing)
Temperature		0° C (32° F) Minimum operating temperature 40° C (104° F) Maximum operating temperature
Earth Leakage Current		Size Earth Leakage Circuit Breakers (ELCB) to a detection level of 30 mA or greater
Fuse		One Power input fuse (AC over current protection) is located on the main control board. This fuse is a 2 amp slow-blow type (Schurter 34.6618, Digikey 486-1138-ND. The fuses should be checked after any failure of the unit to power up properly.

12. POWER-UP OPTIONS SUMMARY

Upon application of input power, the ECA will perform certain functions if the pushbuttons are used, as follows:

Pushbuttons pressed at power-up	**Function**	***Reference Section***
NONE	Normal operation, use all calibration data from memory	
BLACK key	Forces a mechanical zero position calibration	*Mechanical Zero Calibration*
WHITE key	Initiates self-test with jumpers	*Self-Test Mode*
BOTH keys (WHITE and BLACK)	Resets all to factory default values, performs an automatic mechanical zero calibration, analog signals will require re-calibration	*Error Recovery*

13. FIELD WIRING SUMMARY

Connector Location		Function/Connection	*Reference Section*
J7	Line	Line connection 115VAC, Line 1 connection 230 VAC	*Electrical Wiring*
	Neutral	Neutral connection 115 VAC, Line 2 connection 230 VAC	*Electrical Wiring*
	Ground	Earth ground connection 115 or 230 VAC	*Electrical Wiring*
J4	Position 1	Analog input (control) signal positive (+)	*Analog Input (current loop)*
	Position 2	Analog input (control) signal common (-)	*Analog Input (current loop)*
	Position 3	Analog output (feedback) signal positive (+)	*Analog Output (current loop)*
	Position 4	Analog output (feedback) signal common (-)	*Analog Output (current loop)*
	Position 5	Motor enable dry contact	*Motor Status Input*
	Position 6	Motor enable dry contact	*Motor Status Input*

14. TROUBLESHOOTING GUIDE

Problem	Potential Cause	Solution
INTERNAL LED DISPLAY		
No LED Display	Normal, after setup.	No action required
	No power supplied.	Check power source. plug & circuit breaker
	Supply power wired incorrectly. Supply power outside of specification.	Check wiring. Check voltage/frequency against specification.
LED's are flashing	Normal at startup	Adjust as per *Start-up & Operation* section
	Indicates operation fault	See table in Diagnostics *Trouble Code* section for LED blink codes
POWER		
No power Indicators	No power supplied.	Check power source. Plug & Circuit Breaker
	Supply power wired incorrectly.	Check wiring.
	Supply power outside of specification.	Check voltage/frequency against specification.
Motor		
Motor not working/ No stroke control	No power supplied	Check power source. Plug & Circuit Breaker
	Internal fuse is blown	Replace internal fuse, Call service if condition continues
	Damaged electronics or motor	Call field service

15. MAINTENANCE & SPARE PARTS

All maintenance work must be carried out only when the ECA and connected equipment is stopped and disconnected from mains supply (including auxiliary circuits). Maintaining original characteristics over time must be ensured by an efficient maintenance and inspection plan, developed and managed by qualified technicians, taking into account the service and the actual environmental conditions in which it operates.

15.1 Operating Precautions

All operations must be performed by qualified personnel.

Work on the unit should only be performed with safety supervisor authorization, after having verified that:

a) Disconnect power at the source (follow your local lockout tag out procedures)

b) The power line is disconnected and no parts are energized, including any auxiliaries

c) Ensure that any risk of accidental restart has been excluded

d) Consult Manufacturers Pump Operating Manual for instructions on minimizing risk due to pressurized or chemically dangerous conditions with in the Pump system

e) **With pump switched off**, that the ON-OFF valves on the suction and discharge pipelines are closed.

f) Pump has been adequately cleaned, when operating in environments exposed to aggressive chemicals.

g) Maintenance personnel shall refer to the *Installation & Wiring Instruction* section for safe return to service after repair.

Since the machine object of supply is a product designed and intended for operation in industrial areas, **additional measures must be adopted and assured by the person responsible for the installation, should more restrictive safety conditions be required.**

15.2 Cleaning and Decontamination

The ECA enclosure may be cleaned with water and mild detergent. Decontamination shall occur when the ECA is exposed to a release of process chemicals. Follow the SDS for clean-up in the event of a chemical spill.

15.3 User Replaceable Parts for the ECA

MFG & MFG P/N	Description
Schurter 34.6618	Fuse, 2 amp slow-blow type (available via Digikey 486-1138-ND)

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