Honeywell

11280A HercuLine® Actuator with Non-Contact Position Sensing and Motor Control Installation, Operation and Maintenance Manual ISO 9002

61-86-25-07

Rev 4
11/00

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Revision 4 – 11/00

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Sensing and Control
Honeywell
11 West Spring Street
Freeport, Illinois 61032

About This Document

Abstract

This manual contains instructions for installation, operation and maintenance of the 11280A Series Actuators.

References

Honeywell Documents

The following list identifies all Honeywell documents that may be sources of reference for the material discussed in this publication.

Document Title	ID #
Specification	62-86-03-11
Model Selection Guide	62-86-16-18

Non-Honeywell Documents

The following list identifies select non-Honeywell documents that may be sources of reference for the material discussed in this publication.

Title	Author	Publisher	ID/ISDN #
Process Instrumentation Terminology		ISA	ANSI/ISA S 51.1 – 1879 (R1993)

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Sensing and Control	*http://www.honeywell.com/sensing*
International	*http://www.honeywell.com/Business/global.asp*

Telephone

Contact us by telephone at the numbers listed below.

	Organization	Phone Number	
United States and Canada	Honeywell	1-800-423-9883 1-888-423-9883 1-800-525-7439	Tech. Support Q&A Faxback (TACFACS) Service
Asia Pacific	Honeywell Asia Pacific Hong Kong	(852) 2829-8298	
Europe	Honeywell PACE, Brussels, Belgium	[32-2] 728-2111	
Latin America	Honeywell, Sunrise, Florida U.S.A.	(854) 845-2600	

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.
	**WARNING** **PERSONAL INJURY:** Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. **Failure to comply with these instructions could result in death or serious injury.**
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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1. Introduction

1.1 Product Description

Honeywell's 11280A industrially rated rotary control actuators are precision engineered for exceptional reliability, accurate positioning, and low maintenance. Designed for very precise positioning of dampers, vanes, and quarter-turn valves, the 11280A actuators perform especially well in continuous-duty applications in extremely demanding environments.

Precise positioning of the actuator is achieved through state-of-the-art motor control and positioning electronics. The motor starts and stops instantaneously, preventing overshoot and hunting. Positioning accuracy of 0.2 % span or better is achievable for extremely tight process control to take full advantage of modern controllers.

A continuous duty, inverter rated motor is combined with a heavy-duty precision machined output worm gear mesh providing a responsive, low maintenance, and non-backdriving actuator. End-of-travel limit switches are provided as standard to prevent damage to the valve or damper.

Honeywell electric actuators provide instantaneous response to a demand signal, eliminating system non-linearity due to dead time. Additionally, since the actuator is electric, the costs associated with providing and maintaining a clean, dry air supply are eliminated.

A Heavy duty cast crank arm and precision rod-end bearing is provided with each 11280A actuator. Crank arms have an adjustable radius to provide flexibility in linkage set-up.

All 11280A actuators are equipped with a manual handwheel for operation during loss of power or installation. A local auto/manual electric handswitch can be provided for local operation and has an "out of auto" contact to annunciate that condition.

All 11280A actuators are also equipped with a Safety Interlock system. See Figure 1-2. This system, a switch found on the front cover of the unit, allows entry into the unit only after the unit has been manually turned off.

1.2 Applications

Honeywell actuators have a long and respected history in the industrial actuator market. 11280A actuators are designed for precision modulation of final control devices such as dampers and vanes, in applications such as induced draft, forced draft, burner tilt, fluid couplings, scoop tubes, and coal mill dampers. The robustness of the design serves as the basis for long-term reliability and reduced operating costs.

1.3 Features

1.3.1 Non-contact Position Sensing (NCS) with True Shaft Position Indication

Introduction

Non-contacting position sensing eliminates maintenance problems and nuisance shutdowns that are common with slidewire or potentiometer position sensing. Once calibrated, the non-contacting position sensor requires no maintenance.

Description

The non-contacting position sensing assembly consists of a position sensor, an output PCA, and a bracket as shown in Figure 1-3. The position sensor "spoiler" is connected directly to the output shaft, reflecting true shaft position. As the output shaft rotates, the sensor "spoiler" rotates and the sensing circuit detects the change in position. Sensing is accomplished by changing the magnetic field created by the coils on the sensing circuit PCA. There is no contact between PCA and the spoilers.

1.3.2 Slidewire Emulation

Introduction

A truly unique feature, slidewire emulation allows direct replacement of existing three-wire control actuators without requiring controller changes while gaining all of the advantages of the maintenance-free non-contact sensing. This is ideal for replacement of installed actuators that cause control problems due to slidewire wear.

Description

The slidewire emulation assembly consists of a non-contact position sensor, an output board, and a bracket as shown in Figure 1-3. The position sensor is identical to that described in Section 1.3.1.

A potentiometric voltage from the controller is supplied to the slidewire emulation circuit. This voltage is ratiometrically conditioned with respect to the output shaft position from 0 % to 100 % and is available to the controller. Voltages of 1 Vdc to 20 Vdc are accepted and this device will emulate 100 ohm to 1000 ohm slidewires.

1.3.3 Torque Limits

Introduction

Torque Limits may be used to prevent damage to the actuator or externally connected apparatus. These limits may be entered or changed at any time. This permits these limits to be adjusted based on the application or changing conditions.

Description

Torque Limits are set using parameters 41 (Motor Overload Select) and parameter 42 (Motor Overload Current). Refer to the Allen-Bradley User Manual for details on setting these parameters. The current and power output for the drive motor can be displayed by viewing parameters 03 (Output Current) and 04 (Output Power).

1.3.4 Stall Annunciators

Introduction

Drive stall fault conditions may be detected and annunciated by the electronics in order to prevent damage to the drive and alarm the user concerning a possible hazardous condition in external apparatus.

Description

Stall faults are detected as part of the Active Fault system. Active Faults are annunciated using parameter 47 (Output Configuration). This parameter configures the TB3 relay functionality. In addition, the Stall Fault Time may be set using parameter 80 (Stall Fault Time). A full description of the Fault Parameters is included in the Allen-Bradley User Manual.

1.3.5 Inverter

Introduction

The inverter is a microprocessor controlled adjustable frequency drive designed for reliable control of three-phase induction motors

Description

The drive produces a three-phase, pulse width modulated adjustable frequency output to vary the motor speed. Output voltage is a function of output frequency and is adjustable to meet motor parameters so that optimum motor performance can be obtained.

1.3.6 Motor Positioner

Introduction

The Honeywell Motor Positioner PCA develops a voltage input from a current signal to provide an internal closed loop control of the actuator.

Description

The Motor Positioner operates CW/CCW open collectors (opto-isolators) for use as discrete control inputs to the inverter.

CAUTION

The inverter is supplied with an internal 12 Vdc supply for the discrete control inputs. If an external voltage is applied, component damage could occur.

The actuators integral non-contacting sensor (NCS) provides the position feedback signal to the motor positioner. Input signal ranges are adjustable from 0.2 Vdc to 1 Vdc, up to 1 Vdc to 5 Vdc. The actuator is shipped from the factory with the input set to 1 to 5Vdc. (4 mA to 20 mA using a 250 ohm resistor). By using an appropriate shunt resistor, other controller current outputs can also be accommodated.

Fail-safe features are also provided. On loss of input signal, the Motor Positioner may be preset to drive the motor upscale, downscale, to a particular position, or to stop where it is. In the event of actuator NCS failure, the Motor Positioner can be set to drive the motor fully upscale or downscale.

The Motor Positioner is a printed circuit assembly that is integrally mounted in a 11280A Series Actuator feedback enclosure.

1.3.7 Output Board

Introduction

The Output PCA provides an isolated analog current output proportional to the shaft position.

Description

The actuators' integral NCS provides the signal that is used to generate an isolated current output proportional to the NCS signal. This current can be 0-20 mA or 4-20 mA. Using an appropriate dropping resistor, the output can be 0 Vdc to 16 Vdc (800 ohms) or 1 Vdc to 5 Vdc (250 ohms). The actuator is shipped with the output set to 4 mA to 20mA.

1.3.8 Auto/Manual Switch

The Auto/Manual electric handswitch with auxiliary contacts indicating an "Out-of-Auto" position is available for local electric control.

1.3.9 Self-Locking/Releasing Gear Train

The double reduction worm gear combination is self-locking and self releasing and maintains position upon loss of power. This design will not backdrive (overhaul) and provides superior reliability without the maintenance associated with other self-locking and brake mechanisms.

1.3.10 Motor

The continuous duty, inverter rated motor is power matched for use with the inverter and is energy efficient and optimized for variable speed operation and include premium grade insulation system result in low maintenance, high reliability, and long life.

1.3.11 Manual Operation

A manual handwheel is provided for positioning of the actuator during power outages or initial installation.

1.3.12 Field Reversible

As factory shipped, the actuator is set for either clockwise or counter-clockwise rotation. The direction of rotation is determined by the Model Selection Guide. By changing a jumper and reversing two leads, the actuator can be set for opposite rotation. Recalibration is not necessary.

1.3.13 Customer Connections

The 11280A has dedicated wiring terminals for ease of installation.

1.3.14 Warranty

The 11280A actuator warranty is effective for 30 months from the date of shipment or 24 months from the date of installation whichever comes first.

1.4 Honeywell Linkage Kit

Honeywell pipe linkage kit is available and is recommended to provide optimal positioning performance. The rod end bearing connections eliminate all linkage hysteresis assuring accurate and repeatable positioning of the final control element.

1.4.1 Honeywell Actuator Linkage (HAL)

The Honeywell Actuator Linkage (HAL) Analysis Software is available to design a linkage and help select the optimum actuator. The software can be ordered as P/N 51197910-001.

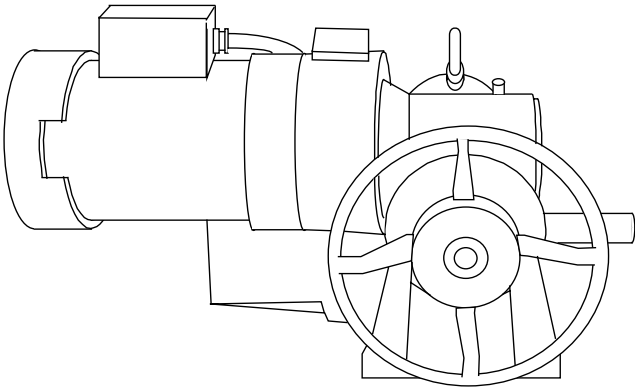


Figure 1-1 11280A Actuator

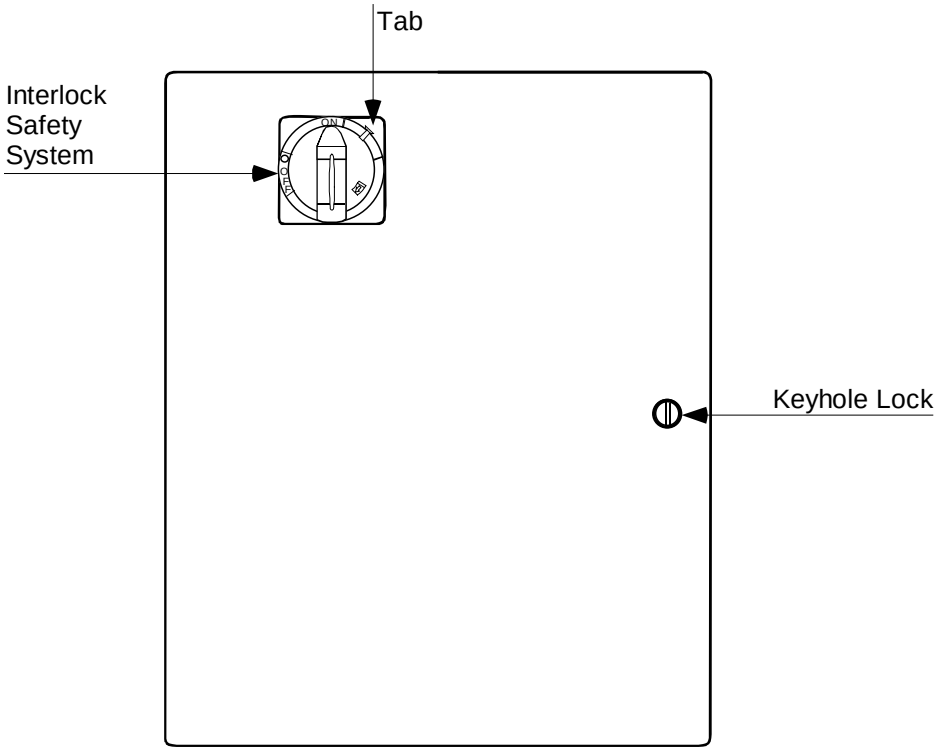


Figure 1-2 11280A Front View with Safety Interlock Shown

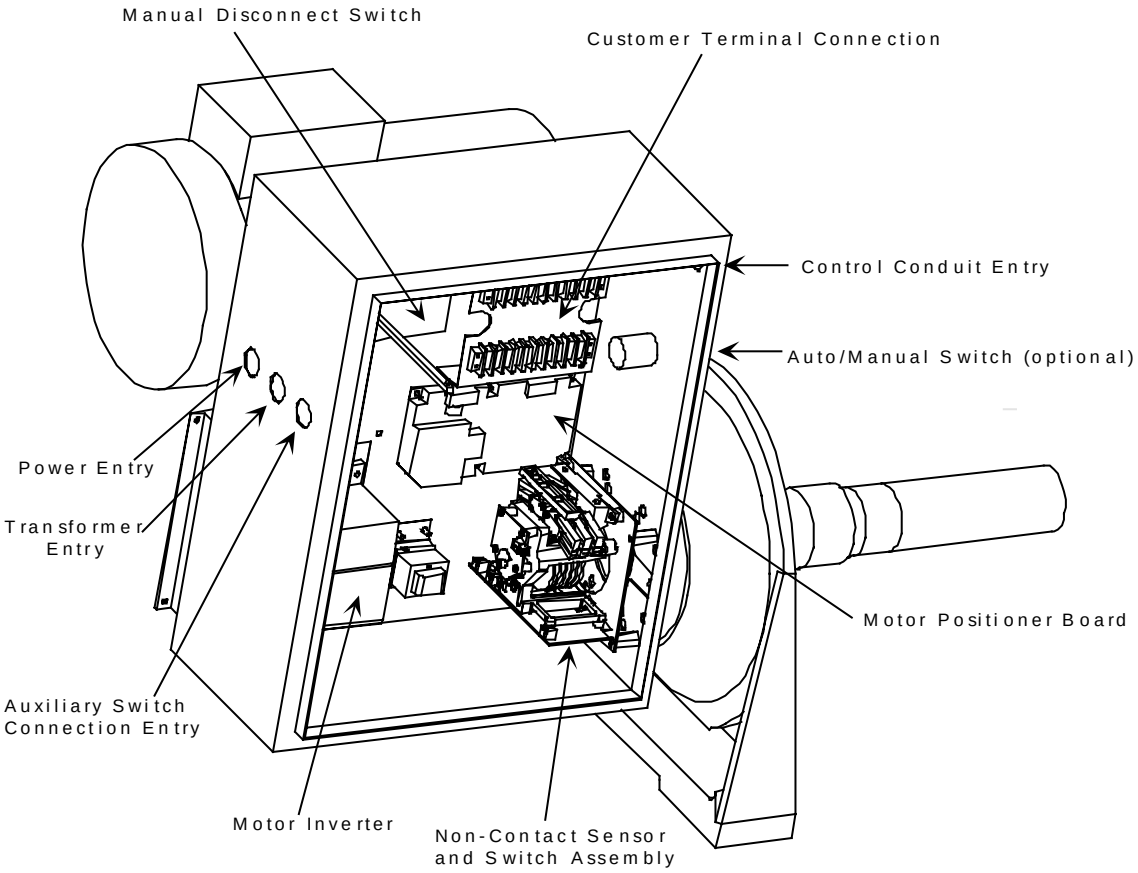


Figure 1-3 11280A Internal View

2. Specifications and Model Selection Guide

2.1 Introduction

This chapter provides the user with the specifications and the Model Selection Guide for the 11280A Series Actuator.

2.2 Specifications

Specification - General

Physical	
Weight	56 kg to 224 kg (150 lb to 600 lb)—See Table for more information.
Enclosure	Precision machined ductile iron with corrosion resistant paint
Gear train	Precision machined double reduction worm gear
Mechanical stops	To prevent over-travel
Operating Temperature	–30 °C to +65 °C (–20 °F to +150 °F) except Model 11287A which has a range of: –20 °C to +65 °C (–4 °F to +150 °F)
Storage Temperature	–40 °C to +93 °C (–40 °F to +200 °F)
Relative Humidity	Fully operable over the range of 0-99 % R.H. non-condensing
Crank Arm	Adjustable radii (8” to 14”) crank arm is standard.
Rotation	90-120 degrees. Factory set at 90 degrees.
Direction of Rotation	Field selectable via switch and jumper. Clockwise rotation - looking into the output shaft.
Manual Handwheel	Provides a means of positioning the actuator in the event of a power failure or set-up.
Lubrication	Mobil Synthetic bearing and gear lubricant SHC 634 (ISO 460) or equivalent
Fuses	Bussmann GDB1.6: 1.6 Amp Fast Littlefuse 312001: 1.0 Amp Fast 25 Amp Fast

Catalog #	Torque lb-ft/(N_M)	Output Shaft Size	Shaft Key Size	Output Shaft Length	Maximum Overhang Load	Handwheel Diameter	Net Weight
11284A	425/575	2" (51 mm)	1/2" 13 mm)	5" (127 mm)	3700 lb. (1380 kg)	10" (254 mm)	150 lb. (56 kg)
11285A	840/1150	2" (51 mm)	1/2" (13 mm)	5" (127 mm)	3700 lb. (1380 kg)	10" (254 mm)	225 lb. (84 kg)
11286A	1500/2025	2" (51 mm)	1/2" (13 mm)	5" (127 mm)	3700 lb. (1380 kg)	18" (457 mm)	300 lb. (112 kg)
11288A	2500/3400	2-1/2" (64 mm)	5/8" (16 mm)	6" (152 mm)	7500 lb. (2798 kg)	18" (457 mm)	550 lb. (205 kg)
11289A	4000/5425	2-1/2" (64 mm)	5/8" (16 mm)	6" (152 mm)	7500 lb. (23798 kg)	18" (457 mm)	600 lb. (224 kg)
11287A	5500/7450	2-1/2" (64 mm)	5/8" (16 mm)	6" (152 mm)	7500 lb. (23798 kg)	18" (457 mm)	600 lb. (224 kg)

Electrical	
Power Input	115/220 Vac, single phase 50/60 Hz up to 1500 lb-ft 208/200 – 240/380 – 480/575, 50/60 Hz
Motor	Inverter rated, 3 phase, continuous duty, C face mounting
Loss of Power	Stays in Place
Local Auto/Manual Switch	Optional – allows local and automatic operation of the actuator.
Limit Switches	Standard – Two SPDT end of travel limits rated (10 A at 125 Vac, 5 A at 250 Vac).
Auxiliary Switches	Two additional SPDT switches are optional (10 A at 125 Vac, 5 A at 250 Vac)
Torque Settings of Crank Arm Bolts	
Clamp Bolts	220 lb-ft
Rod End Bolt	30-35 lb-ft
Slider Bolt	220 lb-ft
Jam nuts	100 lb-ft

Specification – Actuator with Motor Positioner Board

Electrical		
Input Signals	Input: 4-20 mA 1 Vdc to 5 Vdc with appropriate shunt resistor for current range (Resistor: 250 ohms ± 0.1 % Part No.: 070756)	
Input Impedance	Input 4-20 mA 1-5 V with fail-safe Jumper W2 1-5 V without fail-safe Jumper W2	Input Impedance 250 ohms 10 K ohms 10 M ohms
Sensitivity	0.20 % to 5 % span adjustable. Shipped at 0.5 % span.	
Hysteresis	Less than 0.4 % of full scale	
Linearity	± 0.25 % of span	
Repeatability	0.20 % span	
Voltage/ Supply Stability	0.25 % of span with +10/–15 % voltage change	
Temperature Coefficient	0.030 % of span per degree C for 0 to 50 °C 0.05 % of span per degree C for –30 to 65 °C	
Zero Suppression	100 % of span	
Input Filter	Adjustable to smooth input signal	
Maximum Input Voltage	5 Vdc	
Radio Frequency Interference	Per SAMA PMC 33.1	
Output	The Motor Positioner operates CW/CCW open collectors (opto-isolators) for use as discrete control inputs to the inverter.	
Fail-safe operation	If input falls below 2 % of span, there are four choices selected by a movable jumper: stop, go full upscale, go full downscale, or go to a selected (adjustable) position.	
Isolation	Input is isolated from power	

Specification - Actuator with Outputs

Electrical	
Feedback signals	0-20 mA 4-20 mA 1-5 Vdc with 250 ohm resistor 0-16 Vdc with 800 ohm resistor
Slidewire Emulation	Provides output voltage ratiometric to shaft position and potentiometric to supply voltage (1-20 Vdc) without a slidewire. Emulates 100 ohm to 1000 ohm slidewire.
Isolation	Output is isolated from power and input signal

2.3 Model Selection Guide

Reference 62-86-16-18

Instructions

- Select the desired key number. The arrow to the right marks the selection available.
- Make the desired selections from Tables I thru VII using the column below the arrow. A dot (•) denotes unrestricted availability.

Key Number	I	II	III	IV	V	VI	VII	VIII
_ _ _ _ _ _ _	- _	- _	- _ _	- _	- _ _	- _	- _ _ _ _ _ _	- _ _

KEY NUMBER - Electronics

Output Torque lb. - ft. (N - M)		Selection	Availability	
425 (575)	**(Note 1)**	011284A	↓	
850 (1150)	**(Note 1)**	011285A	↓	
1500 (2025)		011286A	↓	
2500 (3400)		011288A	↓	
4000 (5425)		011289A	↓	
5500 (7450)		011287A		↓

TABLE I - POWER SUPPLY

Single Phase	100 - 120 Vac; 50/60Hz	1	a	
	200 - 240 Vac; 50/60Hz	2	a	
Three Phase	200 - 240 Vac; 50/60Hz	4	•	•
	380 - 480 Vac; 50/60Hz	5	•	•
	575 Vac, 60 Hz	6	•	•

TABLE II - STROKE SPEED

Stroke Speed @ 60 Hz	10 sec/90 degrees	1	•	
	30 sec/90 degrees	2	•	•
	60 sec/90 degrees	3	•	•

TABLE III - MOTOR ORIENTATION (See specification 62-86-03-09 for diagrams)

Motor Orientation	Right-hand floor configuration, H.W. Shaft Horizontal (121F)	01	•	•
	Left-hand floor configuration, H.W. Shaft Horizontal (124F)	03	•	•

TABLE IV - CONTROL SIGNAL INPUTS

Up/Dn	Drive Up/Dn 3-wire input	0	•	•
4-20mAdc/1-5Vdc	4-20mAdc or 1-5Vdc (w/resistor change)	1	•	•

TABLE V - CUSTOMER POSITION OUTPUTS

None	No position outputs provided	00	•	•
SEC **(Note 2)**	One slidewire emulation output	01	•	•
Analog Output	4-20mAdc, 0-20mAdc, 0-5Vdc, 1-5Vdc or 0-1.25Vdc	03	•	•

TABLE VI - CONTACT OUTPUTS

		01128_ _ Selection	4A 5A 6A 8A 9A	7A
Limit Switches	1 CW & 1 CCW Limit Switch	0	•	•
Limit/Auxiliary Switches	1 CW, 1CCW, & 2 Auxiliary SPDT Switches	2	•	•
Limit/Auto-Manual	1 CW, 1CCW, Auto/Man Switch	5	•	•
Limit/Auto/Auxiliary	1 CW, 1CCW, Auto/Man Switch & 2 Aux	7	•	•

TABLE VII - OPTIONS

A	Crank Arm	Adjustable 8" to 14" Radii - Standard	0XXXXX	•	•
		None	1XXXXX	•	•
B	Linkage Kit	None	X0XXXX	•	•
		Up to 20 ft. length - customer supplies schedule 40 pipe	X1XXXX	•	•
C	Future Option		XX0XXX	•	•
D	Future Option		XXX0XX	•	•
E	Tagging	None	XXXX0X	•	•
		Linen **(Note 3)**	XXXX1X	•	•
		Stainless Steel **(Note 3)**	XXXX2X	•	•
F	Future Option	Consult Product Manager	XXXXX0	•	•

TABLE VIII - FACTORY OPTIONS

None **(Note 4)**		00	•	•
Motor Orientation **(Note 4)**	Other motor mounting orientations available upon request - reference figure in product specification	XX	•	•

RESTRICTIONS

Restriction Letter		Available Only With	Not Available With	
	Table	Selection	Table	Selection
a	**I**	11284A, 11285A, 11286A	I	11287A, 11288A, 11289A

Note 1: Requires (2) adapters PN 51204694-501 for retrofit of existing Leeds & Northrup 011284 and 011285 actuators.
Note 2: Slidewire emulation is a solid state circuit providing a ratiometric voltage output proportional to shaft position.
Note 3: Customer must supply tagging information: Up to 3 lines (22 characters for each line)
Note 4: Consult Marketing Manager regarding factory specials.

3. Installation

3.1 Introduction

This chapter provides the user with all the mechanical and electrical information required to get the 11280A Series Actuator up and running in the user's specific application. This chapter also addresses safety precautions and unpacking instructions.

3.2 Before Starting

3.2.1 Unpacking

Examine the shipping container carefully before opening it. If there are visible signs of damage, do not open the container. Notify the carrier and Honeywell immediately.

If there is no visible damage, open the container and compare the contents with the packing list. Notify the carrier and Honeywell immediately if there is equipment damage or shortage.

Please do not return goods without contacting Honeywell in advance. The contact number is 1-800-423-9883.

3.2.2 Site Selection

Mount the actuator in a location where it will be easily accessible for maintenance and for manual operation by means of the handwheel. The exact location must be determined in accordance with the linkage used.

It is important that the actuator be mounted securely to a solid foundation commensurate with the maximum torque developed. Use studs or bolts that are as large as the foot mounting holes.

The following precautions should be taken when selecting an installation site.

- The actuator should be shielded from rain or snow.
- There must be sufficient space around the actuator for the removal of all covers to permit inspection or cleaning of parts and to provide access to the handwheel.
- Auxiliary shielding should be used to protect the actuator from excessive heat or cold outside of the rating of the Actuator and from corrosive elements
- Ambient temperature should not exceed 149 °F (65 °C).
- The minimum low temperature limit of –20 °F (–30 °C).

3.2.3 Outline Dimension Drawings

An outline and dimension drawing for mounting is furnished with each actuator. See also Figure 3-1 and Figure 3-2.

3.2.4 Breather Plugs

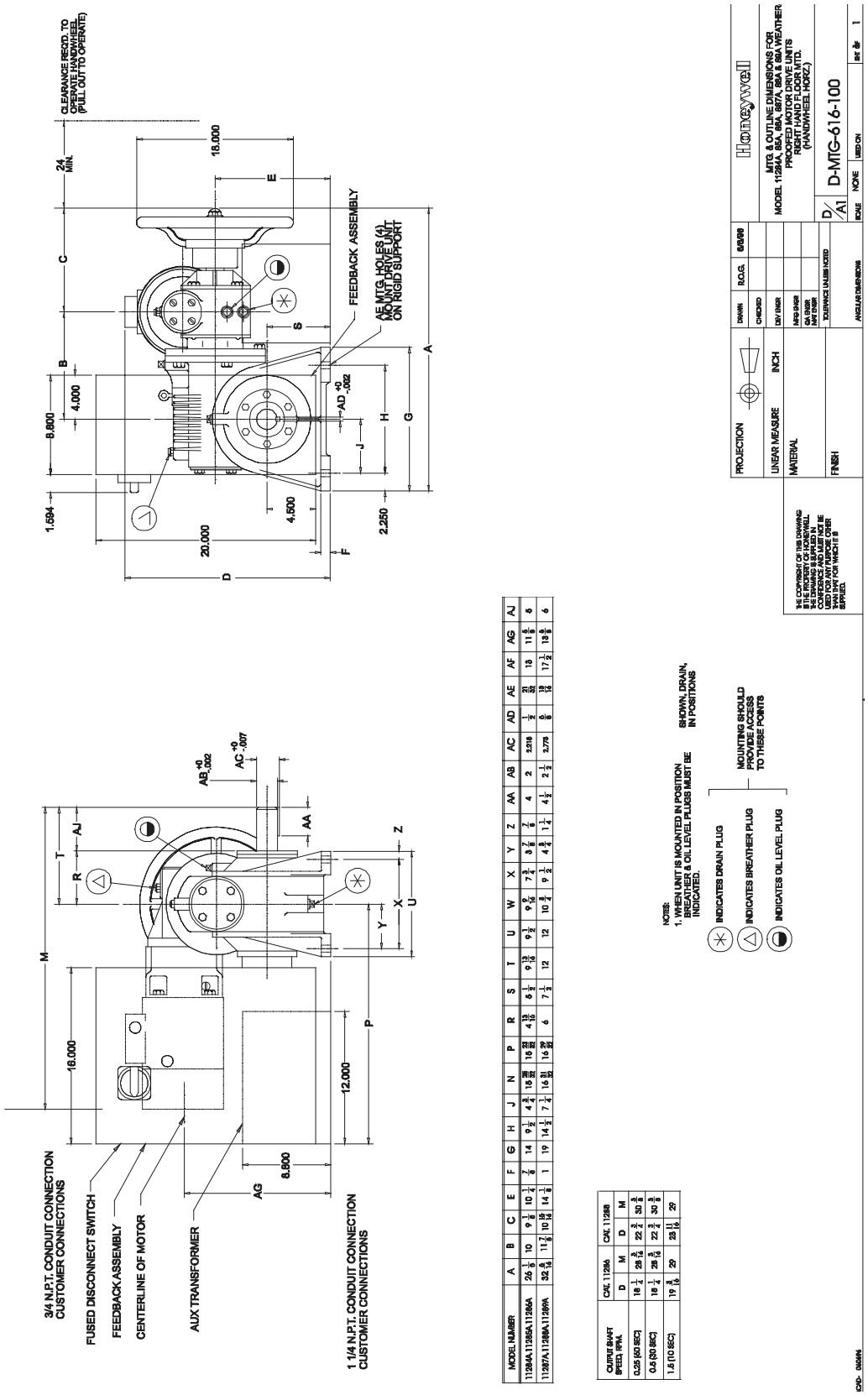
Replace the solid shipping plugs in the gear housing with the breather plugs furnished. The breather plugs maintain atmospheric pressure in the gear housings. A pressure differential between the gear housing and atmospheric pressure could cause the oil to leak through the shaft seals.

CAUTION

If the actuator is to be stored prior to its installation, the breather plugs should be installed to prevent damage to the oil seals due to possible temperature extremes during storage.

3.2.5 International Shipments Only

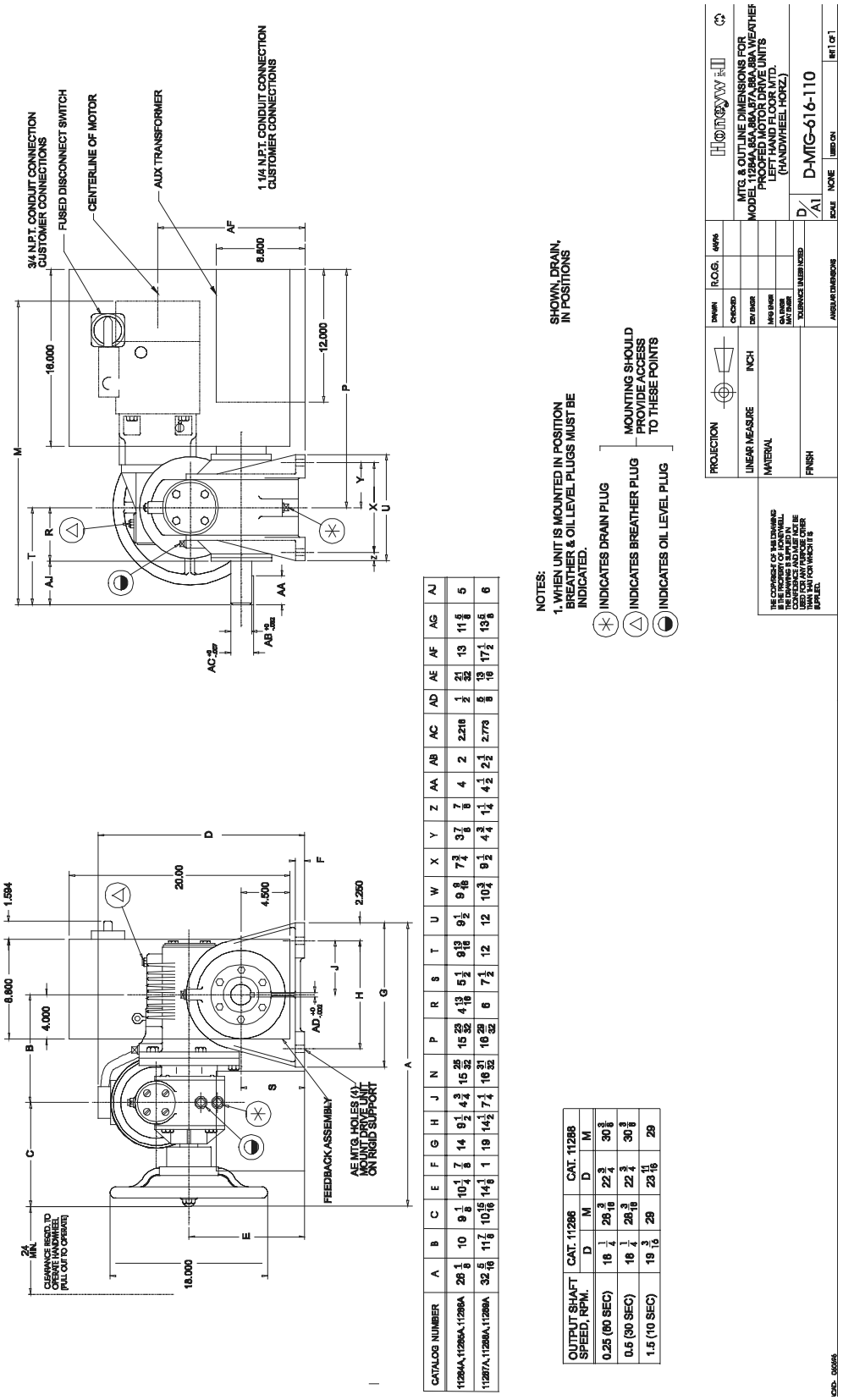
All 11280A Series Actuators for delivery outside the continental United States are shipped without oil in the gear housing.



MODEL NUMBER	A	B	C	E	F	G	H	J	N	P	R	S	T	U	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AJ
11284A,11285A,11286A	29 1/16	10	9 1/16	10 1/16	1/16	14	9 1/2	4 3/4	16 29/32	16 29/32	4 13/16	6 1/2	9 13/16	9 1/2	9 5/16	7 1/2	8 7/16	7/8	4	2	2.510	1/2	21/32	18	11 5/8	6
11287A,11288A,11289A	32 5/16	11 7/8	10 15/16	14 1/8	1	19	14 1/2	7 1/4	16 31/32	14 29/32	6	7 1/2	12	12	10 3/4	9 1/2	4 3/4	1 1/4	4 1/4	2 1/2	3.775	5/8	19/16	17 1/2	10 5/8	6

OUTPUT SHAFT SPEED, RPM.	CKL 11286		CKL 11288	
	D	M	D	M
0.25 (60 SEC)	18 1/4	28 3/16	22 3/4	33 3/8
0.5 (30 SEC)	18 1/4	28 3/16	22 3/4	30 3/8
1.5 (10 SEC)	19 3/16	29	23 11/16	29

Figure 3-1 Mounting and Outline Dimensions for 11284A, 11285A, 11286A, 11288A, and 11289A Weather-Proofed Motor Actuators - Right Hand Floor Mounting, Handwheel Shaft Horizontal (D-MTG-616-100)



CATALOG NUMBER	A	B	C	E	F	G	H	J	N	P	R	S	T	U	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AJ
11284A,11286A,11288A	26 1/8	10	9 1/8	10 1/4	7/8	14	9 1/2	4 3/4	15 25/32	15 23/32	4 13/16	5 1/2	9 13/16	9 1/2	9 9/16	7 3/4	3 7/8	7/8	4	2	2.218	1/2	21/32	13	11 5/8	5
11287A,11288A,11289A	32 5/16	11 7/8	10 15/16	14 1/8	1	19	14 1/2	7 1/4	16 31/32	16 29/32	6	7 1/2	12	12	10 3/4	9 1/2	4 3/4	1 1/4	4 1/2	2 1/2	2.773	5/8	13/16	17 1/2	13 5/8	6

OUTPUT SHAFT SPEED, RPM.	CAT. 11286 D	CAT. 11286 M	CAT. 11288 D	CAT. 11288 M
0.25 (60 SEC)	18 1/4	29 3/16	22 3/4	30 3/8
0.5 (30 SEC)	18 1/4	29 3/16	22 3/4	30 3/8
1.5 (10 SEC)	19 3/16	29	23 11/16	29

Figure 3-2 Mounting and Outline Dimensions for 11284A, 11285A, 11286A, 11288A, and 11289A Weather-Proofed Motor Actuators - Left Hand Floor Mounting, Handwheel Shaft Horizontal (D-MTG-616-110)

3.3 Mechanical Installation

3.3.1 General

Install the 11280A series actuator in a convenient location. Firmly bolt the 11280A to a mounting surface that will not distort when subjected to the torque stresses generated by the actuator. The output shaft of the actuator should be parallel to the output shaft of the driven device.

3.3.2 Linkage Set-up

General information

Many applications will require the use of a linkage assembly; often the final control element does not have a linear torque curve. The 11280A Actuator can be set up to achieve the maximum torque distribution for the level of travel of the linkage, whether it is 120° or 90°. This feature allows the best mechanical advantage over the driven load. To assist with linkage the design, Honeywell offers a linkage analysis software package (HAL).

Constant Torque Linkage

A constant torque linkage is employed when it is desired to provide a linear torque profile throughout the full range of final control element travel. In this situation, the actuator and driven crank arms will be set-up proportionally with respect to each other. Figure 3-3 shows a general linkage setup to achieve a constant torque profile and Figure 3-4 shows the resultant profile.

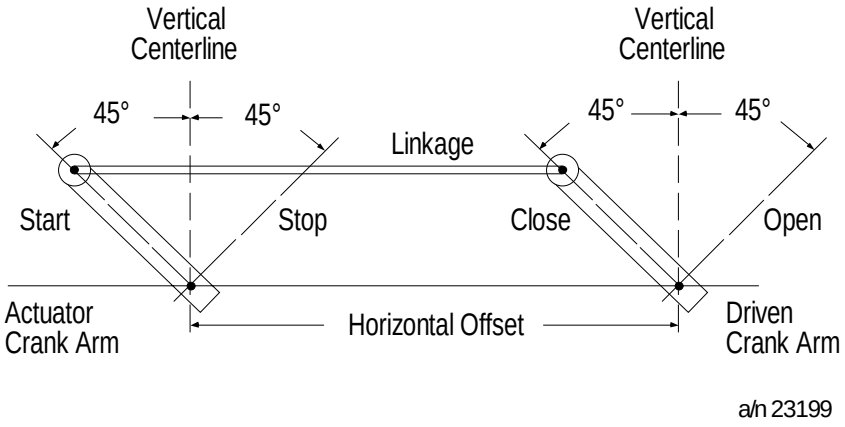


Figure 3-3 Constant Torque Linkage

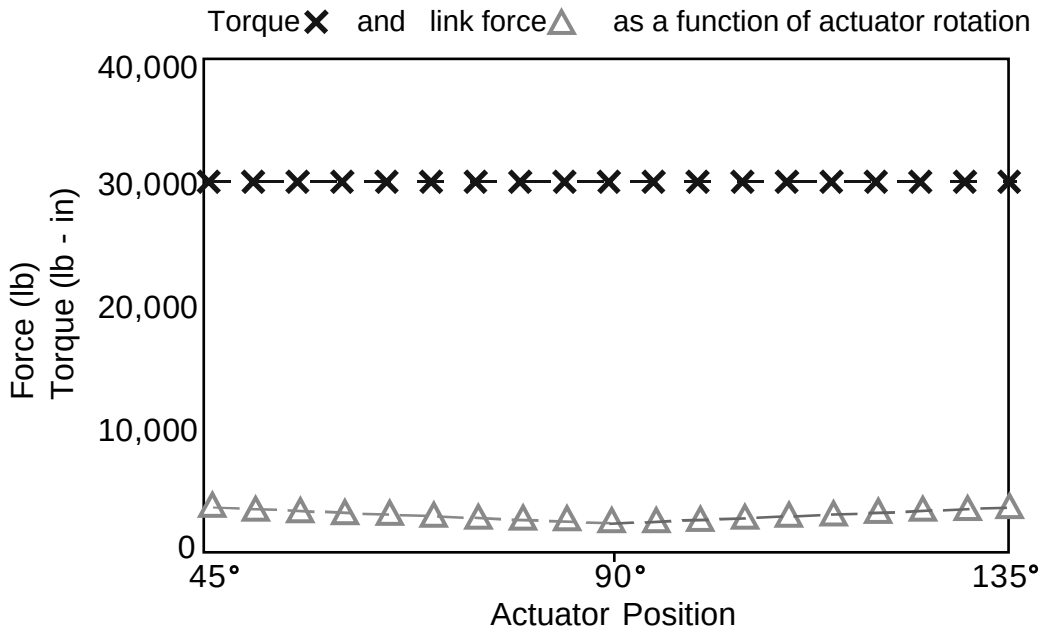
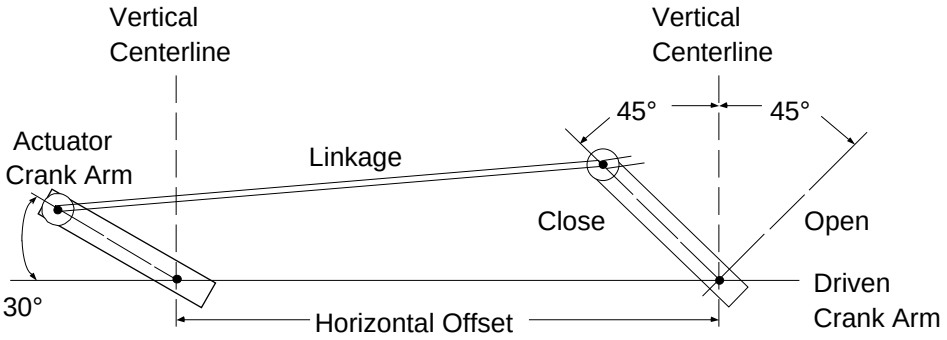


Figure 3-4 Constant Torque Profile for Model 11288 (sample output from HAL software)

Variable Torque Linkage

A variable torque linkage is employed when it is desired to provide a non-linear torque profile over the range of final control element travel. In this general situation, the actuator and driven crank arms will be set up to provide a higher torque for seating or unseating the final control



element.[23200]

Figure 3-5 shows a general linkage setup to achieve a non-linear torque profile and Figure 3-6 shows the resultant profile. This linkage can be characterized in many different ways by varying start angles and rotation requirements of both the Actuator Crank Arm and the Driven Arm.

CAUTION

It is important that the link force does not exceed the maximum overhung load of the actuator.

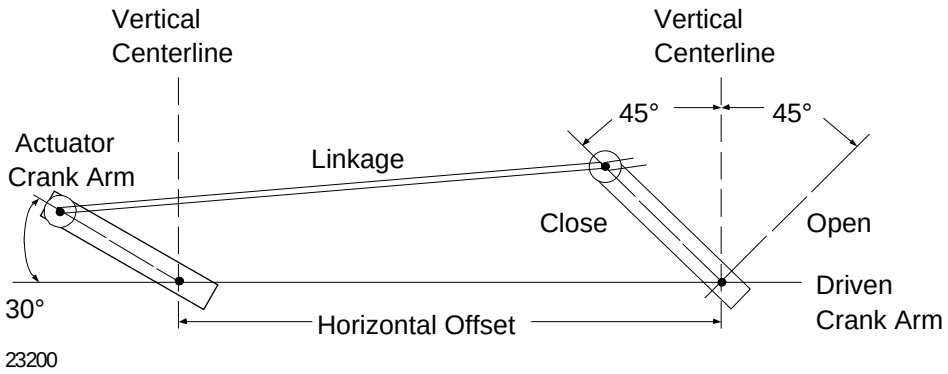


Figure 3-5 Variable Torque Linkage

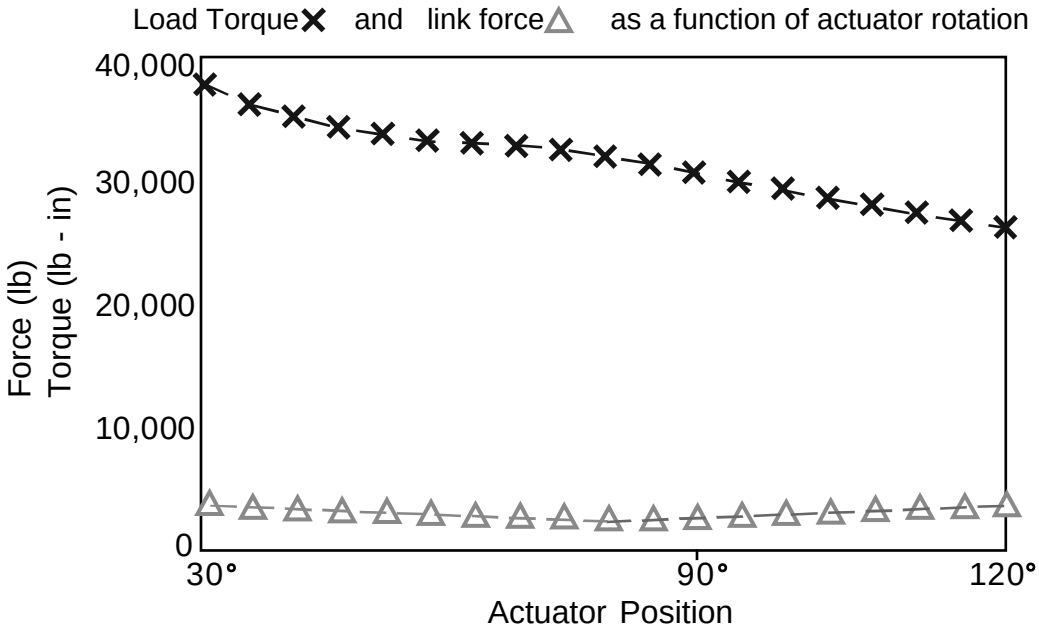


Figure 3-6 Variable Torque Profile for Model 11288 (sample output from HAL software)

Note on Linkage Arrangements:

To gain enhanced resolution and mechanical advantages in the control of end elements, use 100° to 120° of actuator rotation instead of 90° rotation.

Pipe Linkage Kit

This kit is used for linkage lengths from 24 to 240 inches (61 to 610 cm). Pipe linkage kit includes the mechanical pipe couplings, load rod end (left-hand thread), connecting rods and locking nuts. The Customer must supply a length of schedule 40 pipe 2 ½" * (both ends with right-hand NP threads) and a nut and bolt to connect the rod end to the load. The actuator rod end (right-hand thread), nut and bolt are supplied with the actuator. This kit can be ordered with the Actuator, or separately using Honeywell kit p/n 512-04875-001. Kit includes: (1) Rod end, (2) threaded rods, (4) nuts, (2) pipe adapters.

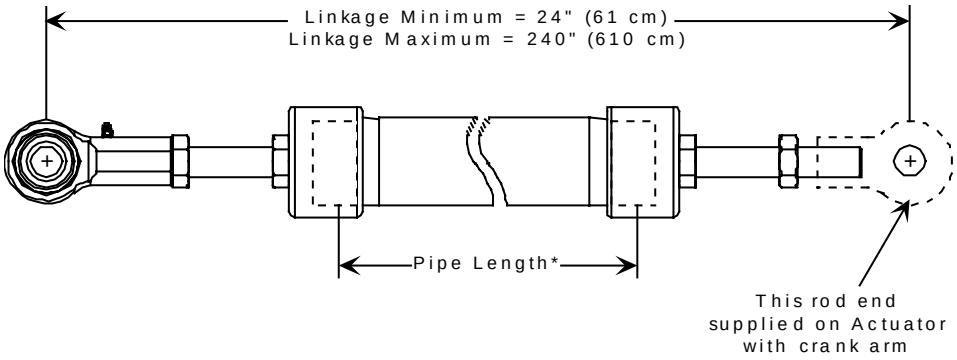


Figure 3-7 Pipe Linkage Kit

*Pipe length = Overall linkage length minus (–) 20 inches (51 cm).

Actuator Crank Arms

The 11280A Series Actuator comes standard with an 8” to 14” adjustable radius crank arm.

The 11280A Series Actuator crank arm uses a standard right-hand thread 1” rod end to compliment the pipe linkage kit.

The crank arm for the 11284A, 11285A and 11286A has a 2” shaft hole, while the crank arm from the 11287A, 11288A and 11289A has a 2 ½” shaft hole.

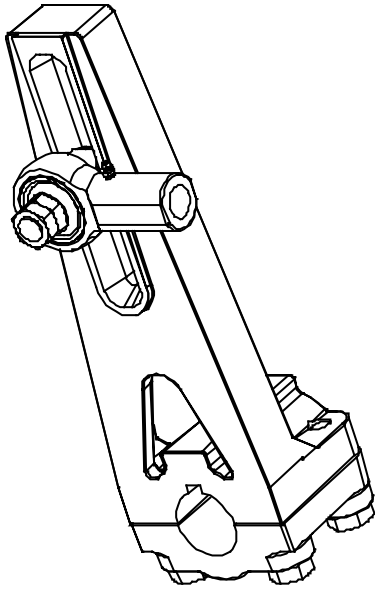


Figure 3-8 11280A Crank Arm

Recommended Bolt Torque

The following table lists the type of bolts to be used and the recommended torque for each bolt.

Table 3-1 Recommended Bolt Torque

Bolt Type	Torque
Clamp bolts	220 lb.-ft
Slider bolt	220 lb.-ft
Jam nuts	100 lb.-ft

3.3.3 External Transformers

120 Vac (Single Phase)

For the customer applications requiring 120/240 Vac single phase operation, a step-up transformer is mounted in a separate box (Model Selection Guide Table I, option 1). Figure 3-9 is the dimension drawing for the transformer box and Figure 3-10 details the necessary wiring.

ATTENTION

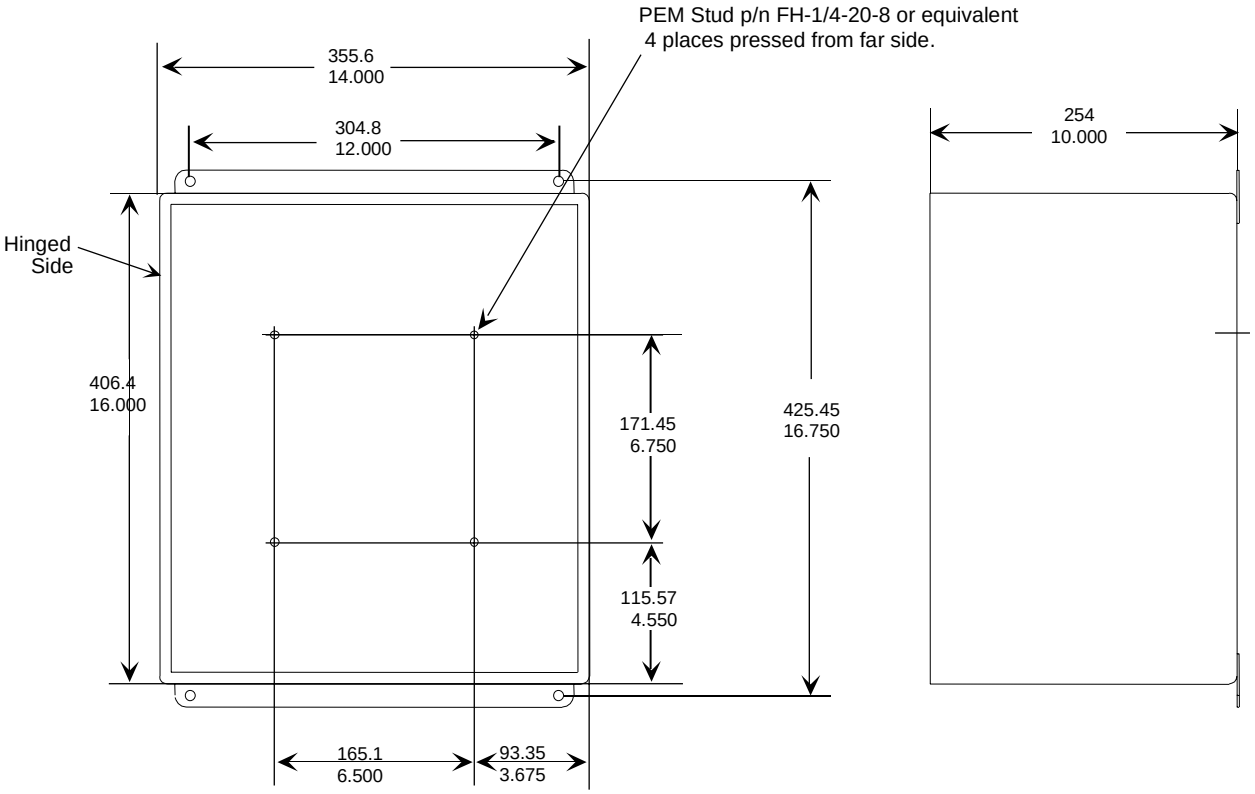
All transformer wiring enters the 11280A through the middle conduit. See Figure 1-3.

575 Vac (3 Phase)

For the customer applications requiring 575/460 Vac 3 phase operation, a step-down transformer is mounted in a separate box (Model Selection Guide Table I, option 6). Figure 3-9 is the dimension drawing for the transformer box and Figure 3-10 details the necessary wiring.

ATTENTION

All transformer wiring enters the 11280A through the middle conduit. See Figure 1-3.



NOTE: Enclosure is shown without door.

Figure 3-9 External Transformer Box Dimension Drawing

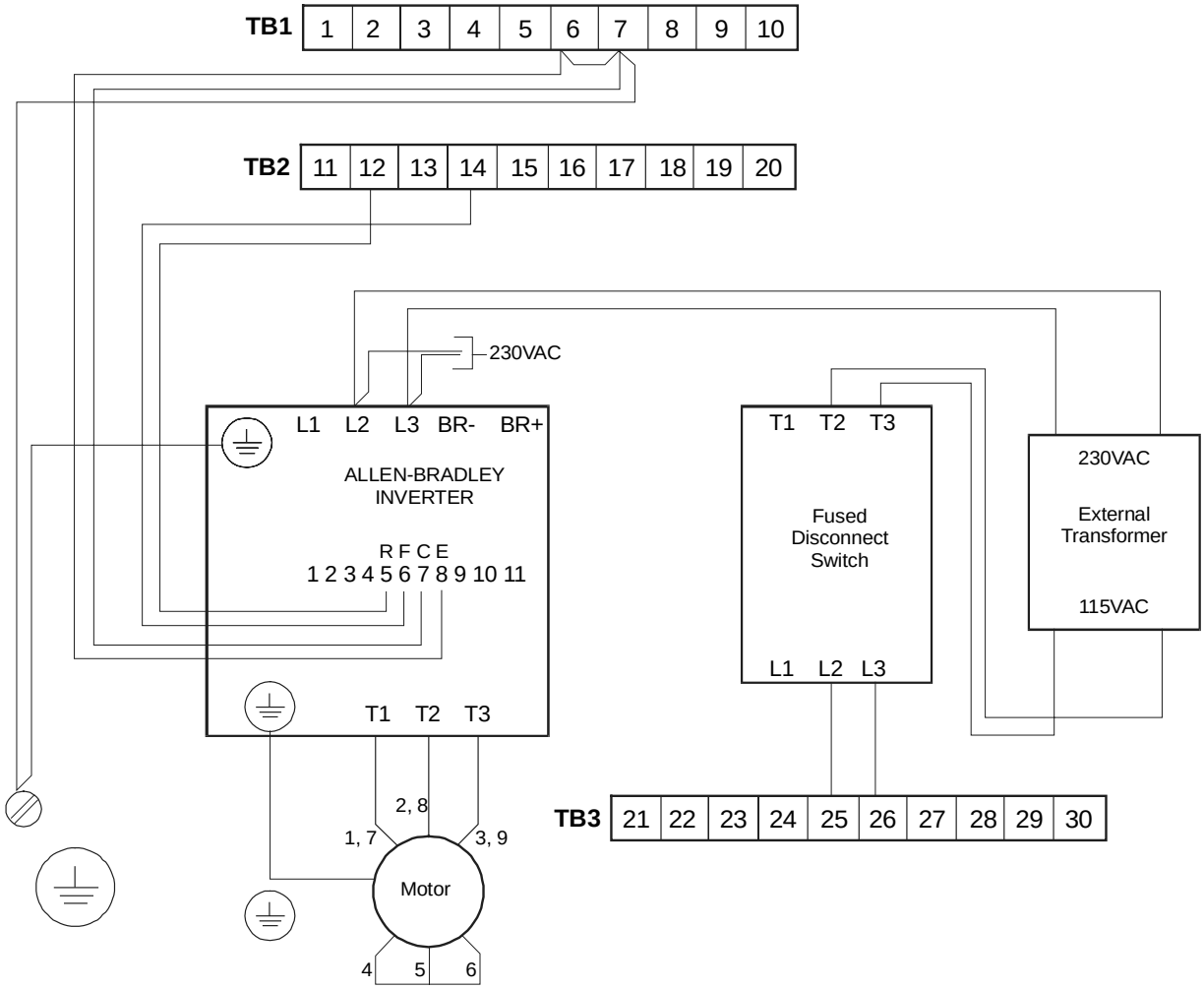


Figure 3-10 240 Vac External Transformer Wiring Diagram

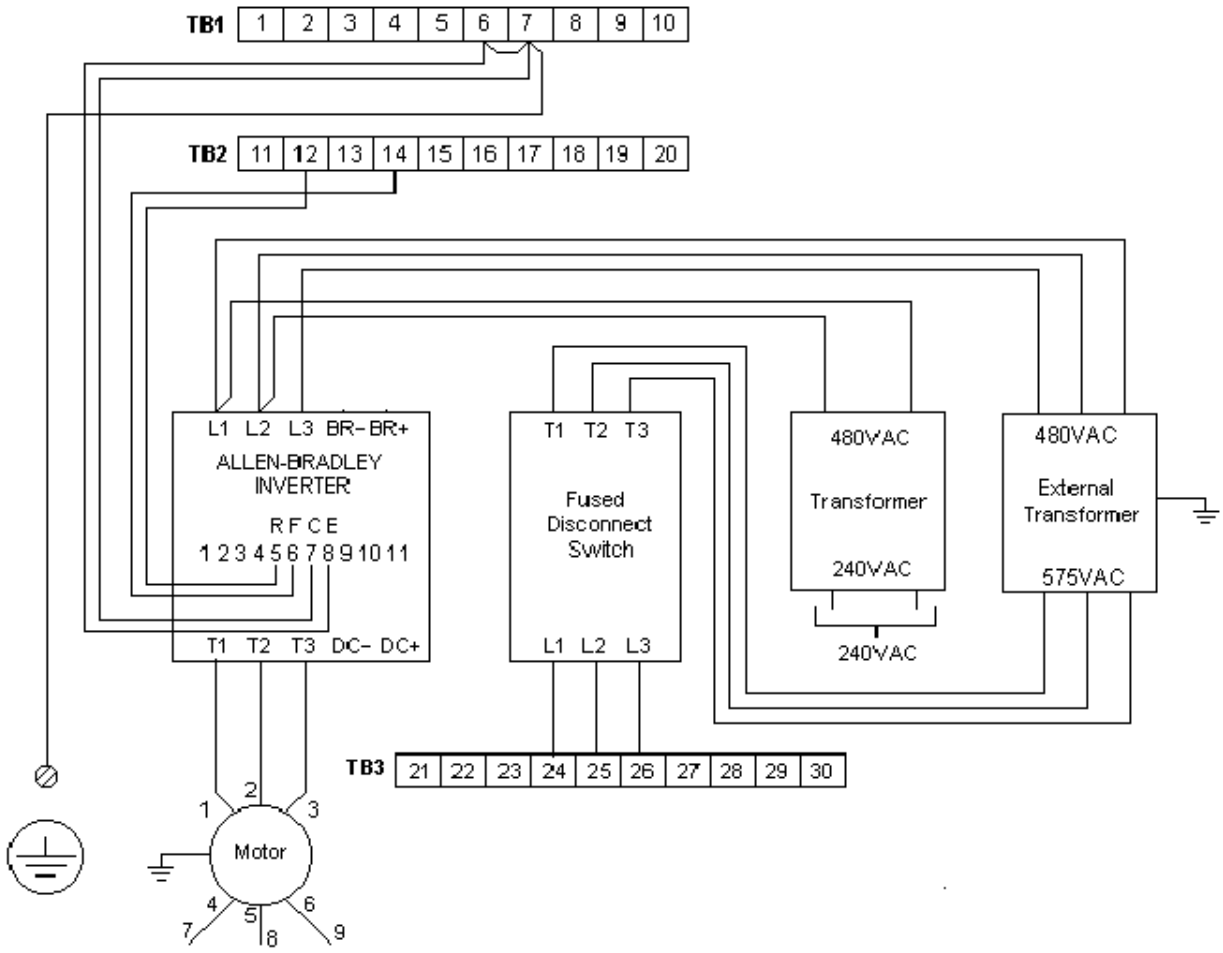


Figure 3-11 575 Vac External Transformer Wiring Diagram

3.4 Electrical Installation

3.4.1 General Wiring Recommendations

WARNING

Only qualified personnel should perform wiring.

Wiring must conform to national and local electrical codes.

In general, stranded copper wire should be used. Unless locally applicable codes dictate otherwise, the recommended minimum wire sizes in Table 3-2 should be observed.

Table 3-2 Recommended Minimum Wire Size

Gage No.	Description
14	Earth ground wire to feedback enclosure.
14	Power leads (120, 240 V, 208, 240, 480, 575 Vac, 1 and 3 phase)
18	All other wiring

Safety Precautions

WARNING

An external disconnect switch must be installed to break all current carrying conductors. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.

WARNING

Disconnect power by using the Safety Interlock before opening the instrument case. Do not defeat the Safety Interlock once the unit is opened as a potentially lethal shock hazard exists inside the case if the unit is powered.

Disconnecting the Safety Interlock System

On the door of the actuator there is a On/OFF switch in the upper left hand corner and a keyhole on the right side. See Figure 1-2. To open the door, use the following procedure.

1. Using a slot screwdriver, turn the lock found on the right side vertical.
2. Holding the tab found on the right corner of the Interlock switch down, turn the arrow from ON to OFF.
3. The power to the actuator is now off and the door will open.

3.4.2 Customer Connections

WARNING

The ground terminal must be connected to a reliable earth ground.

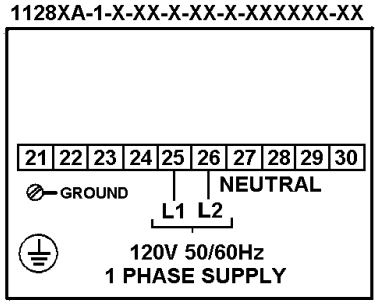
WARNING

Disconnect power by using the Safety Interlock before opening the instrument case. Do not defeat the Safety Interlock once the unit is opened because a potentially lethal shock hazard exists inside the case when the unit is powered.

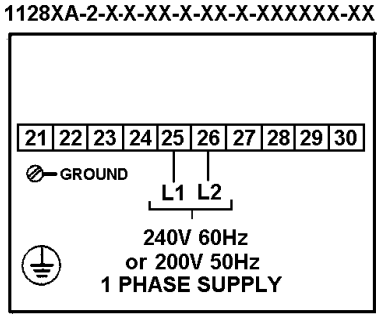
Power Connections

The ground terminal must be tied to a reliable earth ground.

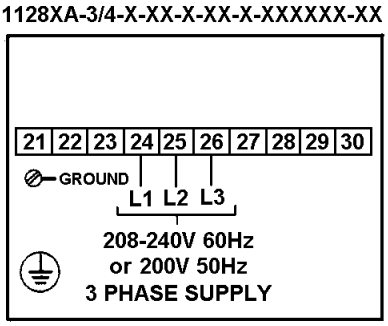
120 V, 50/60 Hz, 1 Phase



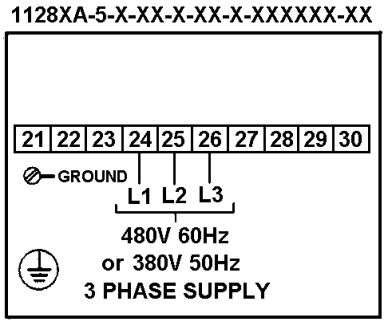
240 V, 60 Hz/200 V, 50 Hz, 1 Phase



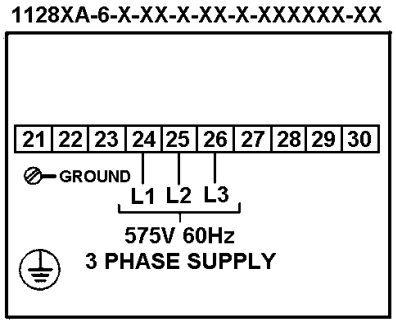
208 V to 240 V, 60 Hz/200 V, 50 Hz, 3 Phase



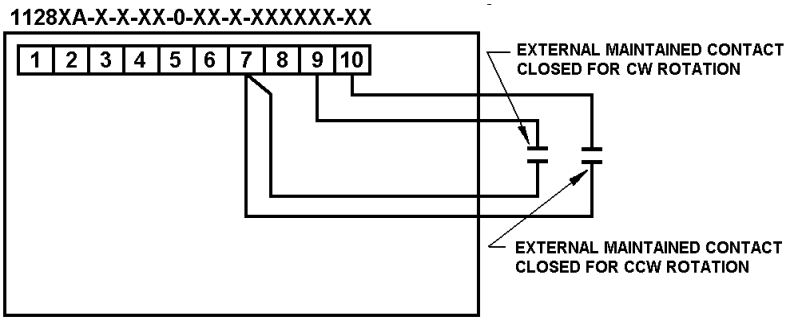
480 V, 60 Hz/380 V, 50 Hz, 3 Phase



575 V, 60 Hz, 3 Phase

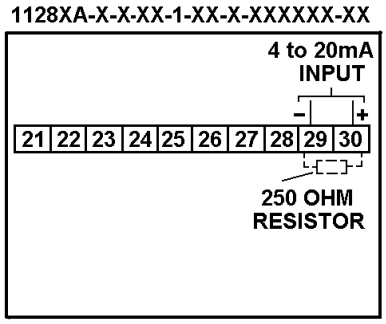


Up/Down Control Connections



The inverter is supplied with an internal 12 Vdc supply. Dry contacts are required for discrete control inputs. If an external voltage is applied, component damage could occur. To convert 120 Vac – CW/CCW drives to dry contacts, see Section 3.4.3 120 Vac Relay Wiring.

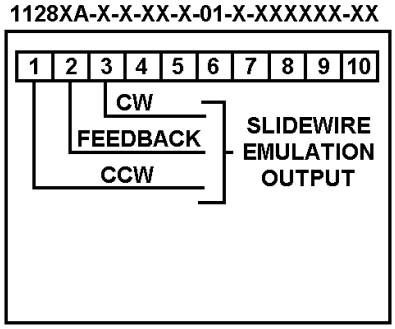
4 mA to 20 mA/1 Vdc to 5 Vdc Proportional Input Connections



ATTENTION

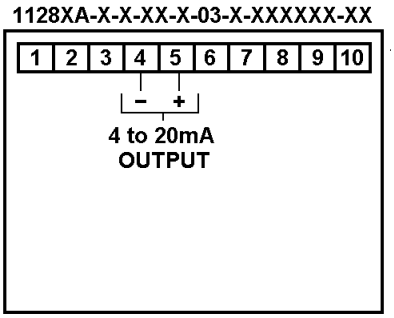
Shielded and grounded cables are recommended.

Slidewire Emulator Connections



4 mA to 20 mA / 1 Vdc to 5 Vdc Analog Output Connections

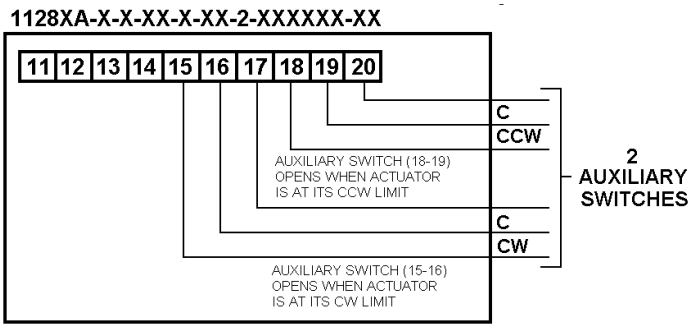
250 ohm resistor to be mounted at the input of the Customer's unit (supplied with actuator)



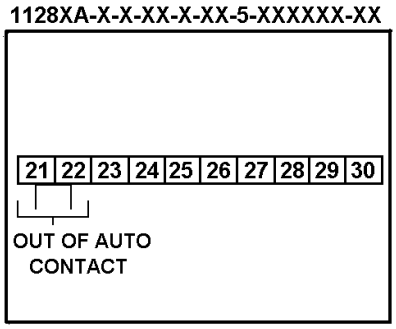
ATTENTION

Shielded and grounded cables are recommended.

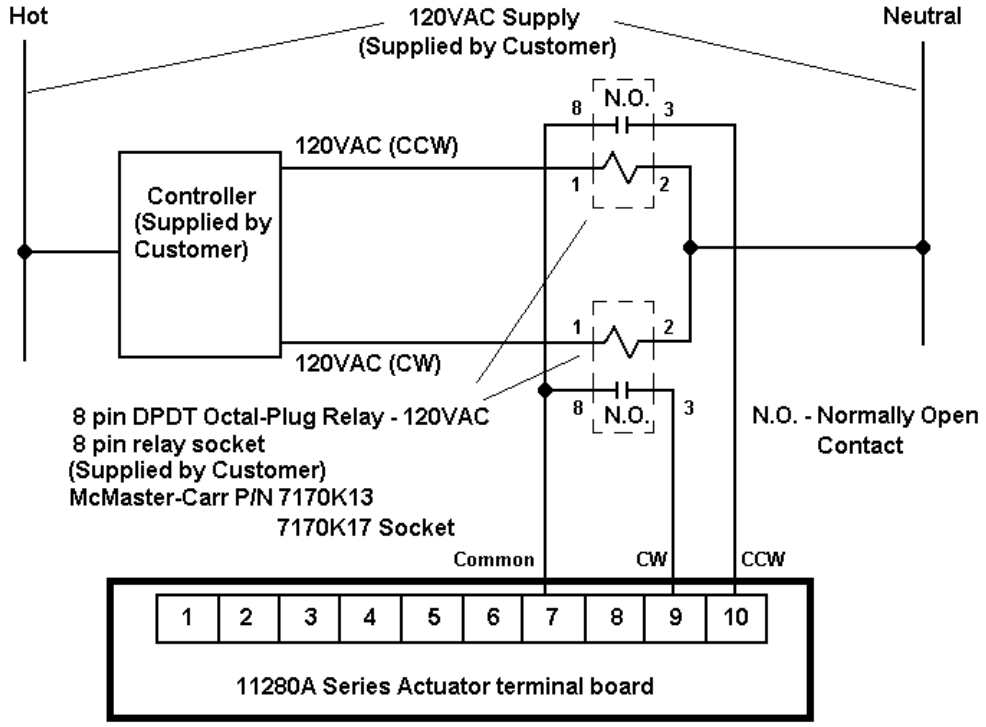
Limit Switches: 2 Limit and 2 Auxiliary Switches



Limit Switches: Auto/Man Switch



3.4.3 To convert 120 Vac – CW/CCW drives to dry contact



4. Calibration Procedures

4.1 Overview

Calibration of the 11280A Series Actuator may consist of setting the limit and auxiliary switches, calibrating the non-contact sensor, calibrating the motor position board that positions the actuator with 4 mA to 20 mA input signal, and calibrating the slidewire emulation output or the 4 mA to 20 mA output signal.

In calibrating the non-contact position sensor assembly, it is necessary to determine whether the actuator is rotating in a clockwise or counterclockwise direction with increasing control signal. Clockwise and counterclockwise rotation is the direction of the output shaft when facing the end of the shaft and refers to the direction of rotation on increasing signal. Right-hand floor actuators are shipped for counterclockwise configuration and Left-hand floor actuators are shipped for clockwise configuration. Counterclockwise operation moves the shaft in a counterclockwise direction on increasing signal and clockwise on decreasing signal. Simply interchanging the leads coming from the positioner PCA at terminals 9 and 10 and a jumper on the output board (see Section 4.8) will change the actuator from counterclockwise operation to clockwise operation.

WARNING

Only qualified personnel should perform calibration.

4.2 Powering the Unit for Calibration

WARNING

While the unit is powered with the door open, the Safety Interlock system has been defeated, a potentially lethal shock hazard exists inside the enclosure.

In order to open the actuator door, the power must be turned off. This is done by using the Safety Interlock system. See the procedure in Section 3.4.1. To be able to calibrate the unit, the power needs to be on.

To turn the power back on once the door has been opened, use a pair of pliers and turn the Operating Shaft of the Safety Interlock system clockwise.

4.3 Setting End-of-Travel Limit Switches

WARNING

While the unit is powered, the Safety Interlock system has been defeated, a potentially lethal shock hazard exists inside the enclosure.

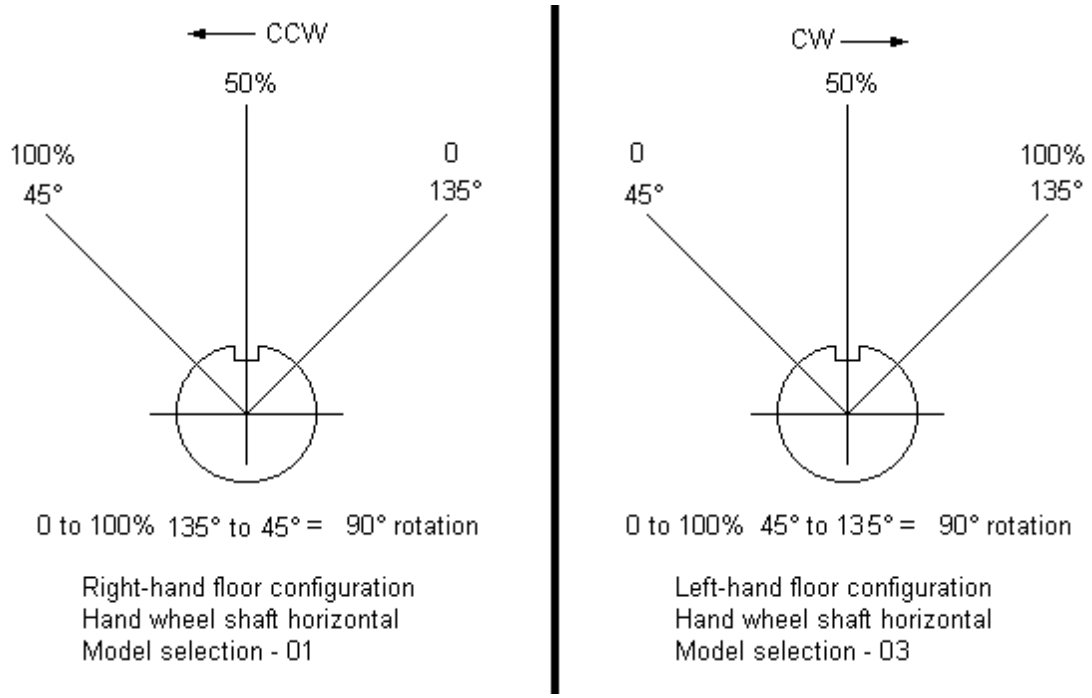


Figure 4-1 Factory Set-ups

ATTENTION

The first two cams (starting from the back) are for the 0 % and 100 % limit switches and should not need any adjustments as they are factory set to stop the drive precisely at 0 % and 100 %.

To adjust the limit switch cams (see Figure 4-2):

1. Turn the locking nut, found behind the sensor, counter-clockwise using a 1/8" allen wrench or the equivalent inserted into the radial holes in the locking nut until it is possible to turn the cams with your fingers.
2. Using a slotted screwdriver on the slots at the edge of the cams, or your finger, rotate the cams until the switches are set. (See Figure 4-2 and Figure 4-3.)
   - Rotate the actuator shaft, using the manual handwheel or the auto/manual switch, to the 0 % position. (This is the 0 % for CCW operation or 100 % for CW operation.) If the actuator is installed on a damper or valve, also make sure that this position is synchronized with the travel of the final control element.
   - Rotate the #1 limit switch operating cam to activate at this position. The switch roller arm should go from being in an up, not depressed state, to a depressed state as the cam is rotated in the direction of the shaft rotation going toward the limit position. This will cause the switch to go from NC to NO and turn off the power to the motor when the switch activates. Switch activation may be detected by the clicking sound or with a continuity tester.

- Rotate the actuator shaft, using the manual handwheel or the auto/manual switch, to the 100 % position. (This is 100 % for CCW operation or 0 % for CW operation.) If the actuator is installed on a damper or valve, also make sure that this position is synchronized with the travel of the final control element.
- Rotate the #2 limit switch operating cam to activate at this position. The switch roller arm should go from being in an up, not depressed state, to a depressed state as the cam is rotated in the direction of the shaft rotation going toward the limit position. This will cause the switch to go from NC to NO and turn off the power to the motor when the switch activates. Switch activation may be detected by the clicking sound or with a continuity tester.
- If optional auxiliary switches were ordered, these switches may also be set at this time. (See Section 4.4 for details of setting auxiliary switches.)

3. Once the cams are set in the correct positions, turn the locking nut clockwise until snug tight (it does not have to be "hard" tight and does not have to completely flatten the spring washer).
4. Double check limit switch actuation by first manually driving the actuator to each end of travel and hearing the switch click or by detecting it with a continuity tester. Secondly, drive the actuator to both ends of travel (using the auto/manual switch or by providing minimum and full input signal) and make sure the switches activate and turn off the motor.

ATTENTION

Make sure not to set the switch too close to the hard stop.

REFERENCE

An unactuated switch will have its normally closed (NC) contacts closed and its normally open (NO) contacts open.
An actuated switch will have its NC contacts become open and its NO contacts become closed.
An unactuated switch has its roller arm in the up position when adjacent to the reduced diameter portion of the cam.

4.4 Setting Auxiliary Switches

WARNING

While the unit is powered, the Safety Interlock system has been defeated, a potentially lethal shock hazard exists inside the enclosure.

ATTENTION

The first two cams (starting from the back) are for the 0 % and 100 % end of travel limit switches and should not need any adjustments as they are factory set to stop the actuator precisely at 0 % and 100 %. See Section 4.2 for setting end of travel limit switches (Switches #1 and #2).

If optional auxiliary switches were ordered, these switches are factory set to 10 % and 90 % for switches #3 and #4. Additional switch settings should be set so that switch #3 operates in synchronism with switch #1 (i.e., both activating when the actuator is going in the same direction) and switch #4 to operate in synchronism with switch #2.

To adjust the switch cams (see Figure 4-2):

1. Turn the locking nut, found behind the sensor, counter-clockwise using a 1/8" allen wrench or equivalent inserted into the radial holes in the locking nut until it is possible to turn the cams with your fingers.
2. Using a slotted screwdriver on the slots on edge of cams, or your fingers, rotate the cams until the switches are set. (See Figure 4-2 and Figure 4-4.)
    - The auxiliary switches should be set so switch #3 operates in synchronism with switch #1 (i.e., both activating when the drive is going in the same direction) and set switch #4 to operate in synchronism with switch #2.

For Switch #3:

- Rotate the actuator shaft, using the manual handwheel or the auto/manual switch, to the desired low scale position.
- Rotate the #3 switch operating cam to activate at this position. The switch roller arm should go from being in an up, not depressed state, to a depressed state as the cam is rotated in the direction of the shaft rotation going toward the limit position. This will cause the switch to go from NC to NO when the switch activates. Switch activation may be detected by the clicking sound or with a continuity tester connected to the terminals.
- Both the NC and NO contact states are available to the customer at the terminals (see Section 3.4.2).

For Switch #4:

- Rotate the actuator shaft, using the manual handwheel or the auto/manual switch, to the desired up scale position.
- Rotate the #4 switch operating cam to activate at this position. The switch roller arm should go from being in an up, not depressed state, to a depressed state as the cam is rotated in the direction of the shaft rotation going toward the limit position. This will cause the switch to go from NC to NO and turn off the power to the motor when the switch activates.
- Both the NC and NO contact states are available to the customer at the terminals (see Section 3.4.2).

3. Once the cams are set in the correct positions, turn the locking nut clockwise until snug tight (it does not have to be "hard" tight and does not have to completely flatten the spring washer).
4. Double check limit switch actuation by first manually driving the actuator to each end of travel and hearing the switch click or by detecting it with a continuity tester. Secondly, drive the actuator to both ends of travel (using the auto/manual switch or by providing minimum and full input signal) and make sure the switches activate and turn off the motor.

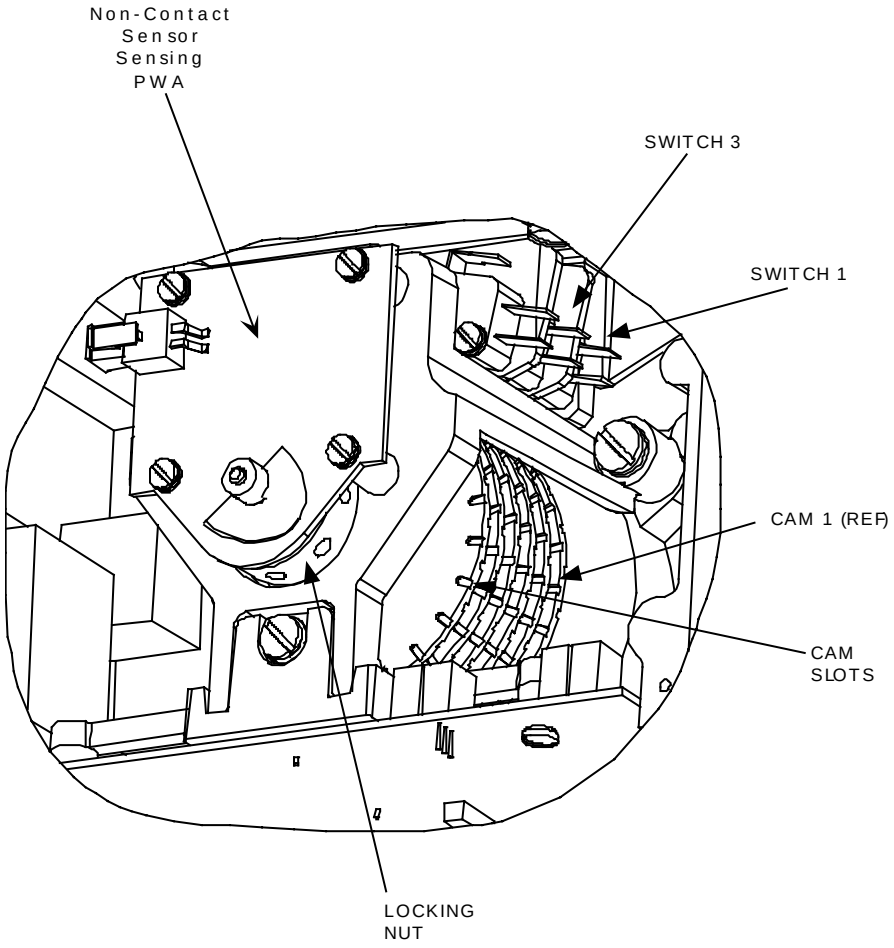
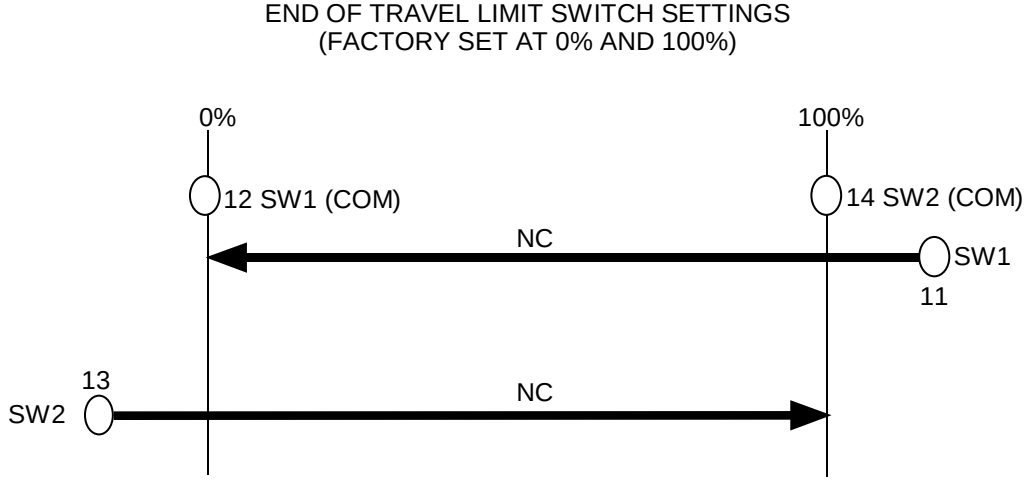
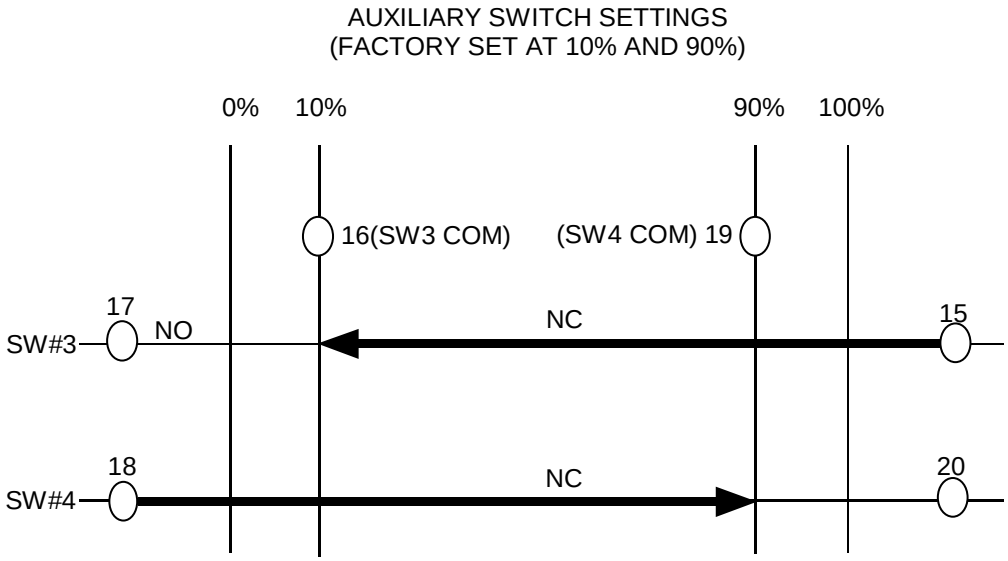


Figure 4-2 Location of Switches



Clockwise and counterclockwise rotation is the direction of the output shaft when facing the end of the shaft. As shown, clockwise rotation of the output shaft activates SW#1 (at 0 %) and CCW rotation activates SW#2 (at 100 %). Terminal numbers are next to circles.

Figure 4-3 End of Travel Limit Switch Settings



Clockwise and counterclockwise rotation is the direction of the output shaft when facing the end of the shaft. As shown, clockwise rotation of the output shaft activates SW#3 (at 10 %) and CCW rotation activates SW#4 (at 90 %). Terminal numbers are next to circles.

Figure 4-4 Auxiliary Switch Settings

4.5 Non-Contact Sensor

WARNING

While the unit is powered, the Safety Interlock system has been defeated, a potentially lethal shock hazard exists inside the enclosure.

ATTENTION

The 11280A Series Actuator comes with the Non-Contact Position Sensor (NCS) already adjusted from the factory for 90 degree rotation.

If it becomes necessary to do an adjustment in the field, use the procedure given below.

1. Loosen the allen screw in the hub of the NCS spoiler just enough to be able to rotate the spoiler. (See Figure 4-5.)
2. Drive the actuator to the zero position. This should be done manually with the hand wheel or with the auto/man electric switch. Next, rotate the NCS spoiler to its 0º position (it is shown in Figure 4-5 with the round of the spoiler and the allen screw at a 45-degree angle or 4:00 o'clock zero position for CCW operating units). For CW operating units, the actuator is positioned at its 100 % position and the NCS spoiler again at a 45-degree angle or 4:00 o'clock position. Tighten NCS spoiler set screw with allen wrench, holding spoilers in position. Spoilers need to be held in position both rotationally and longitudinally along the drive shaft extension (the gaps between each of the spoilers and the sensor circuit board should be approximately equal and any plastic or paper insulating material may be used to aid in this longitudinal positioning). Make sure that neither spoiler is touching the sensor electronics board when the adjustment is complete.

3. Connect the lead wires of a precision digital voltmeter to connector W11 pins on the 4-20 mA output card on the actuator. (The output board is positioned below the control shaft and the W11 connector is on the board just to the left of the center mounting screw). Connect the positive lead (+) to the W11 pin #2 and the negative lead (–) to pin #1.
4. Read the voltage. Voltage should be between 0.01 V and 0.02 V if the spoiler is positioned correctly.
5. If voltage is not correct, re-position the spoiler and take another voltage reading.
6. Once the voltage is within the correct range, the spoiler is in the 0° position.
7. Tighten the spoiler set screw with allen wrench.

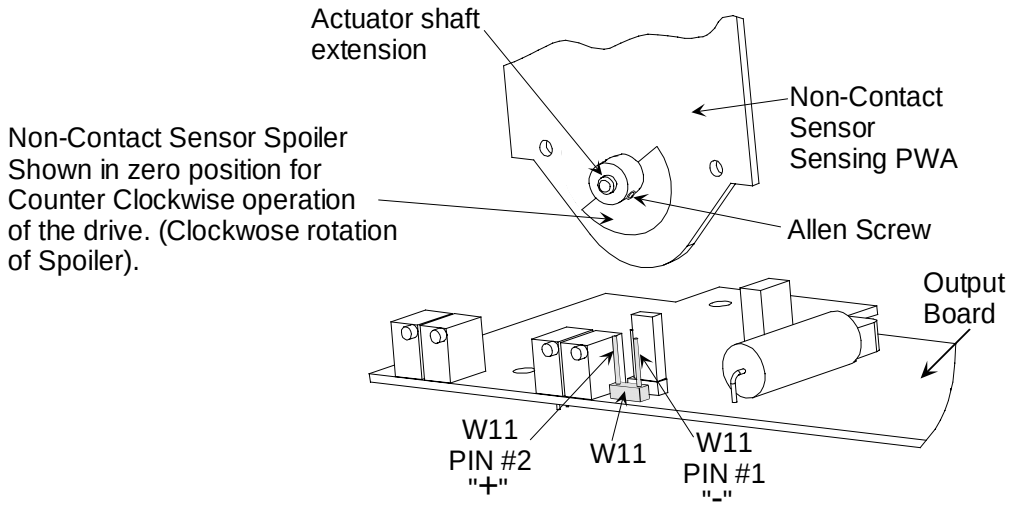


Figure 4-5 Location of NCS Sensor Assembly and Output Board

4.6 Motor Positioner

WARNING

While the unit is powered, the Safety Interlock system has been defeated, a potentially lethal shock hazard exists inside the enclosure.

ATTENTION

The Motor Positioner PCA is mounted inside the feedback enclosure.

The Motor Positioner has been factory calibrated for 0 % and 100 % positioning. It has also been set for default conditions given in Table 4-1.

4.6.1 Overview

The Motor Positioner provides accurate feedback control of the actuator position, proportional to a 4 mA to 20 mA (1 V to 5 V) input signal. It also provides selectable failsafe action, input filtering and deadband sensitivity adjustment.

If the Motor Positioner option has been purchased by the user, its calibration is factory set, but may be adjusted as a part of the 11280A Series Actuator preliminary adjustment sequence. Once all adjustments have been made, the Motor Positioner will be fully operational.

4.6.2 Available Adjustments

Operating adjustments are located on the printed circuit assembly. Altogether, there are two jumpers and five potentiometers with the following designations and functions:

Table 4-1 Available Adjustments

Adjustment	Marking	Function
Jumper	W1	Selects fail-safe actuator position. Selects full up or full down. Remove W1 to disable fail-safe feature. Default is “UP” position.
Jumper	W2	Selects fail-safe actuator position if input signal is lost. Selects stop, or a particular position determined by R14. Remove W2 to disable fail-safe feature. Default is STOP.
Potentiometer	Filter, R1	Input signal filter adjustment. Default is MINIMUM.
Potentiometer	Span, R7	Input signal span adjustment.
Potentiometer	Zero, R11	Input signal zero adjustment.
Potentiometer	Failsafe Set, R14	Adjust fail-safe position of actuator on loss of input signal. Must be enabled by W2.
Potentiometer	D.U.Sens., R19	Adjusts actuator motor deadband from 1 % to 5 %. Default is ½ turn OFF maximum sensitivity. (This is ½ turn off of full CCW.)

4.6.3 ZERO and SPAN Adjustments

WARNING

While the actuator is powered, a potentially lethal shock hazard exists inside the enclosure. Do not open the enclosure while the actuator is powered. Disconnect power before moving jumpers.

REFERENCE

Note that jumpers (W1 and W2) may be inserted to connect the common (center) terminal to either of two other terminals. Pull the jumper straight out from the board surfaces to remove it. To install it, align it with the desired pair of terminals and push it firmly into place.

To set the Zero and Span adjustments, use the following procedure:

1. Disconnect power.
2. Remove jumper W2 from the circuit board and set it aside for later replacement. (See Figure 4-6.)
3. Verify that limit switches and the actuator travel relative to the mechanical stops are correctly adjusted. (See Section 4.3)
4. Make sure actuator is in CCW mode (See Section 4.8, Step 1 only, to reverse direction.)
5. Apply power and set the input to minimum value (4 mA for 4 mA to 20 mA input, for example).
6. Adjust ZERO potentiometer (R11) until the actuator is at the desired “start” position. Set the input to maximum value (20 mA for 4 mA to 20 mA input).
7. Adjust SPAN potentiometer (R7) until the actuator is at the desired “stop” position. Set the input to minimum again and readjust the ZERO setting, if necessary. Repeat steps 6 through 8 until ZERO and SPAN positions are correct.
8. Disconnect power and replace jumper W2 in the desired position (refer to “Fail-safe Adjustments” in this chapter for instructions for installing W2). If CW operation is desired, reverse direction (see Section 4.8).

4.6.4 Fail-Safe Settings; Loss of Signal (L.O.S.)

WARNING

While the actuator is powered, a potentially lethal shock hazard exists inside the enclosure. Do not open the enclosure while the actuator is powered. Disconnect power before moving jumpers.

REFERENCE

Note that jumpers (W1 and W2) may be inserted to connect the common (center) terminal to either of two other terminals. Pull the jumper straight out from the board surfaces to remove it. To install it, align it with the desired pair of terminals and push it firmly into place.

Select the fail-safe setting for the event of a loss of input signal (signal from the controller to the Motor Positioner). There are two fail-safe choices, selectable by jumper W2: stop the actuator immediately, or bring the actuator to a stop at some particular position.

1. To cause the actuator to stop immediately if input signal is lost, install W2 so that it connects the center and “STOP” terminals.
2. To cause the actuator to move to a particular position if input signal is lost, place W2 so that it connects the center and “SET POS,” terminals. Then select the particular positioner that you want, as follows (you may select fully up, fully down, or any point in between).
3. With the W2 jumper installed in “SET POS” position, apply power and interrupt the input signal. The actuator will move to some random position and stop.
4. Adjust FAILSAFE SET potentiometer (R14) until the actuator is positioned at the desired fail-safe point.

To disable this fail-safe feature, remove W2.

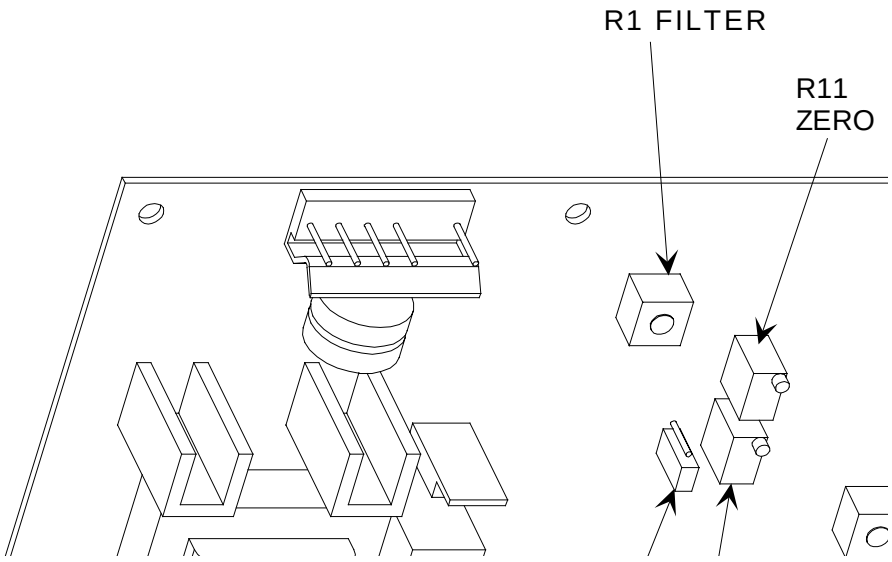


Figure 4-6 Motor Positioner Board

4.6.5 Filter Settings

If the input signal to the Motor Positioner contains transients or spurious signals, hunting or chattering of the actuator may occur. Use the FILTER potentiometer (R1) to smooth the input signal. Turn R1 clockwise to increase filtering.

4.6.6 Deadband and Sensitivity Settings

It is sometimes desirable to introduce some amount of "deadband" between the Motor Positioner and the actuator. (Within this "deadband" zone, the actuator can be moved manually for some distance back and forth without causing a correcting signal from the Motor Positioner.)

The adjustment for "deadband" or "Actuator Sensitivity" is potentiometer R19, labeled "D.U.Sens". Turn R19 counterclockwise to increase the amount of deadband. The adjustment can be made from 0.2% span with R19 turned fully clockwise to 5% with R19 turned fully counterclockwise.

4.7 Output Board Calibration

The 11280A Series Actuator is available with one of three output boards. The first is the 0/4 mA to 20 mA Output board, the next is the Slidewire Emulation board. Finally, there is a basic NO output board that provides signal conditioning and CW/CCW reversing circuitry for the non-contact sensor. (This is used on models with 4 mA to 20 mA input and no output.)

4.7.1 4 to 20 mA PCA Output Board

The 11280A Series Actuator comes already calibrated from the factory. If it becomes necessary to do a calibration in the field, adjust the 4 mA to 20 mA output using the procedure below.

1. Locate the 4 mA to 20 mA output board that is positioned under the control shaft (see Figure 4-5).
2. If actuator is set for CCW operation, position the actuator to 0% (either manually with the handwheel or auto/manual electric switch or for actuators with a Motor Positioner board, by inputting a 4 mA input signal) and go to step 3. If actuator is set for CW operation, it will need to be set back to CCW operation to do the first step of the calibration. To set drive to CCW operation, see Section 4.8, Step 1 only. Position the actuator to 100 % manually or with the auto/manual electric switch or for actuators with a Motor Positioner board, input a 4 mA input signal.
3. Connect a precision voltmeter, + and – leads, to a 250 ohm shunt resistor on the 4 mA to 20 mA output signal terminals on the terminal block.
4. Read the voltage. The reading should be at 1 volt ± 0.75 % of span (± 0.03 volts for 1 to 5 volt output).
5. If the reading is incorrect, adjust R2 (see Figure 4-7) until the reading is in line.
6. Position the actuator to 100 % of span and make another reading.
7. The voltage should read 5 volts, ± 0.75 % of span (± 0.03 volts).
8. If the reading is incorrect, adjust R1 (see
9. Figure 4-7) until the reading comes into line.
10. You must then reposition the actuator to the 0 % position and take another reading.
11. If the reading is out of line, repeat steps 5 through 8 until readings at both the 0 % and 100 % positions are in line.

The following additional steps are for CW units only. The adjustments that are made here will cause the actuator to reposition itself, similar to the Motor Positioner board adjustments. The actuator must be powered and must be in auto mode.

12. Set actuator back to CW operation. Switch the W10 jumper back to the 2_3 position and interchange motor positioner leads connected to terminals 9 and 10.
13. Set the actuator to the 0 % position either manually with the handwheel or auto/manual electric switch or for actuators with a Motor Positioner board, by inputting a 4 mA input signal. Output should read 1 Vdc, ± 0.75 % of span (± 0.03 volts) and actuator should be positioned at 0 %.
14. If reading is incorrect or actuator is not positioned at 0 %, adjust R3 (see
15. Figure 4-7) until the reading is in line, and the actuator is at 0 %.

    Adjusting R3 will cause actuator movement (for units with a Motor Positioner) and may be required to get actuator to 0 % position even if output is within tolerance.
16. Set the actuator to the 100 % position. Output should read 5 Vdc ± 0.75 % of span (± 0.03 volts) and actuator is at 100 % position.
17. If the reading is incorrect or position is not at 100 %, adjust R4 (see
18. Figure 4-7) until the reading is in line, and actuator is at 100 % position.
19. Adjusting R4 will cause actuator movement (for units with a Motor Positioner) and may be required to get actuator to 100 % position even if output is in tolerance.
20. Reposition the actuator to the 0 % position and take another reading.
21. If the reading is still out of line, repeat steps 12 through 16 until both zero and span readings and positions are in line.

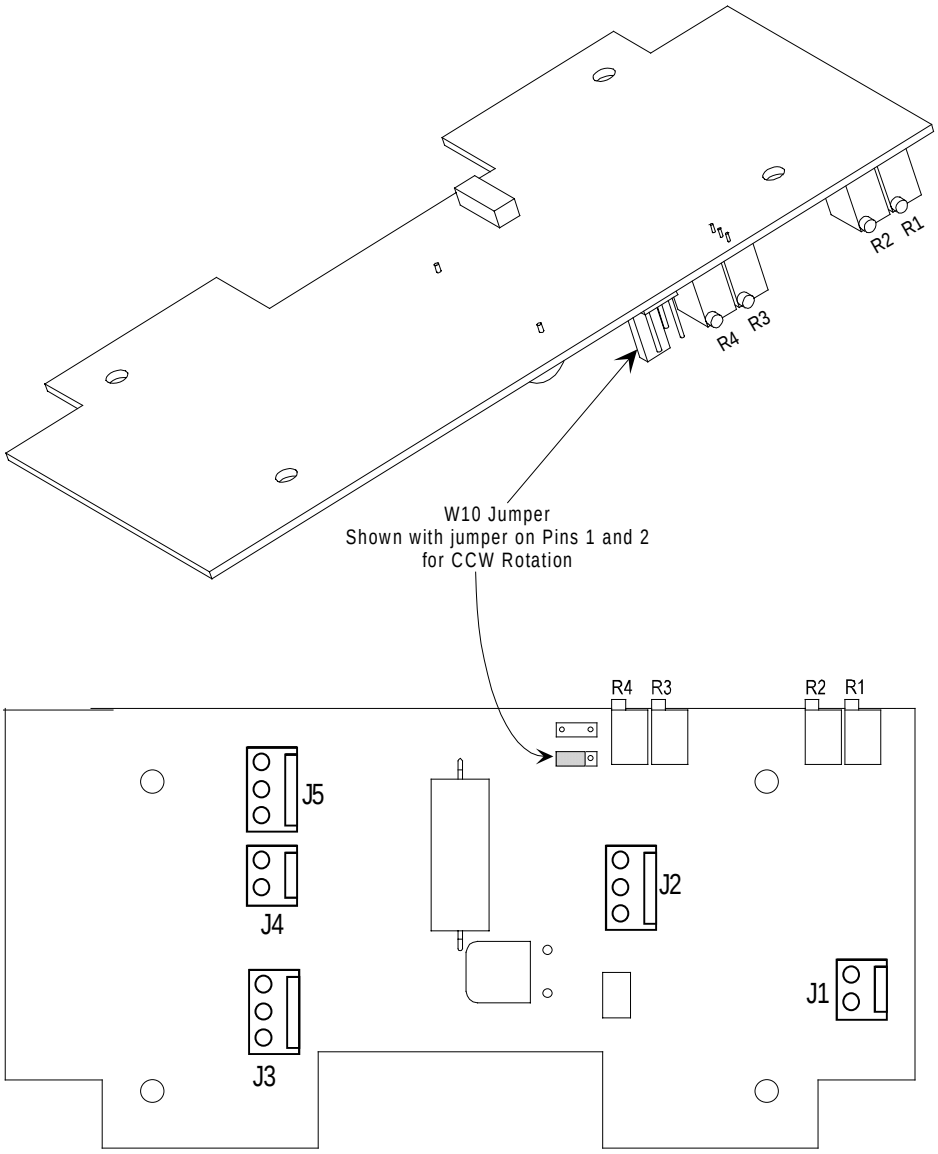


Figure 4-7 0/4-20 mA PWA Output Board

4.7.2 Slidewire Emulation Output Board

The Slidewire Emulation Output Card (51404886-003) can be calibrated for Slidewire Supply voltages between 1.0 Vdc and 20 Vdc. The Actuator leaves the factory with no Slidewire Supply connected to the terminals.

To calibrate the Slidewire Emulation output:

1. Remove power from the actuator, and connect the Slidewire Supply between the "H" and "L" terminals on the terminal plate. (Terminal 34 for the "L", the low voltage side of the source and terminal 36 for the "H", the high voltage side.)
2. Connect a precision voltmeter, + and – leads, to terminals 35 and 34 on the terminal plate.
3. Apply the ac power to the actuator. Apply power from the Slidewire Source.
4. If actuator is set for CW operation, switch it to CCW operation. See Section 4.8, Step 1.
5. Position the actuator to the 25 % position if CCW (75 % position if CW).
6. Read the voltage on the DVM. The reading should be 25 % of the Slidewire Supply ± 0.75 % of span.
7. If the reading is incorrect, adjust R5 (see Figure 4-8) until the reading is within tolerance.
8. Position the actuator to the 75 % position if CCW (25 % position if CW).
9. Read the voltage on the DVM. The reading should be 75 % of the Slidewire Supply, ± 0.75 % of span.
10. If the reading is incorrect adjust R59 (see Figure 4-8) until the reading comes into line.
11. Repeat steps 4 through 9 until the readings are within tolerance.

If CW operation is desired, switch actuator back to CW operation by following Section 4.8.

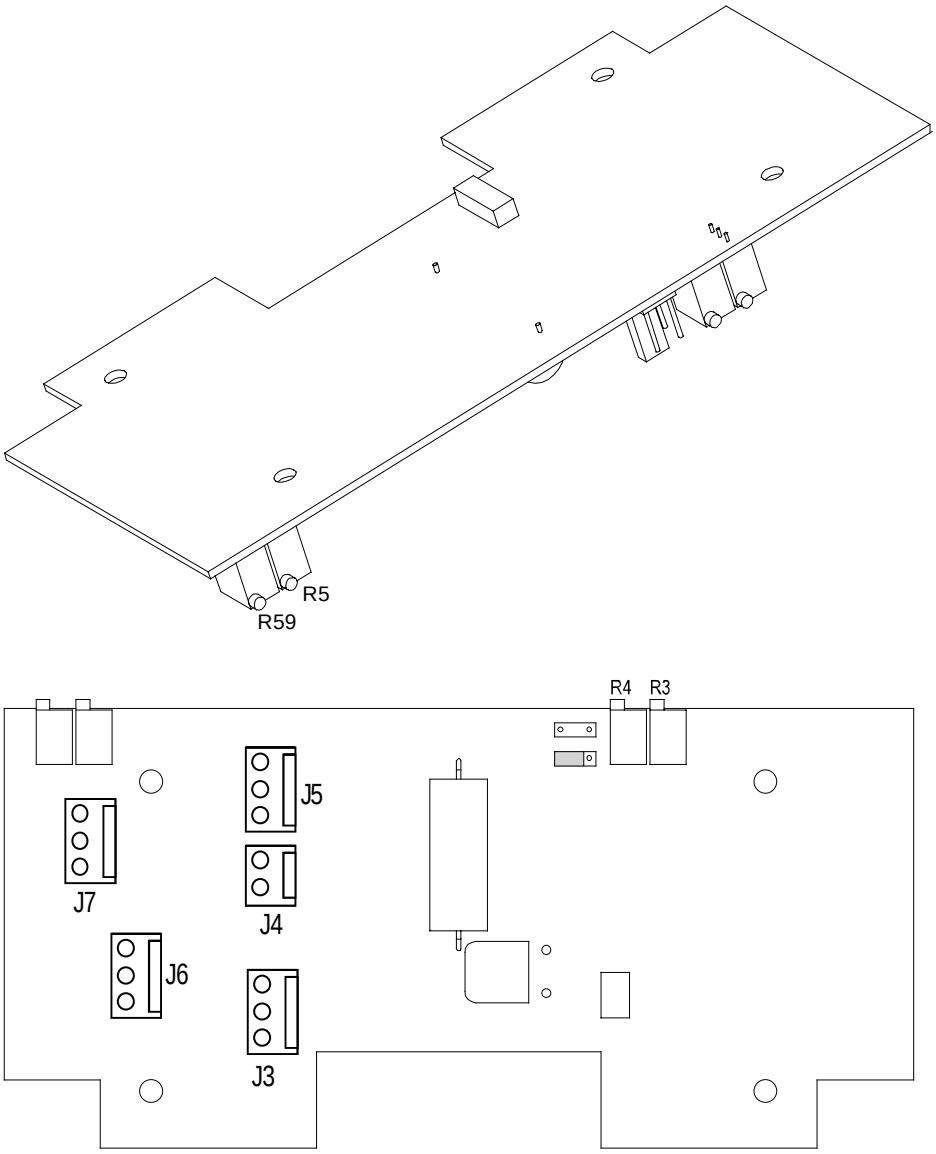


Figure 4-8 Slidewire Emulation Board

4.8 Reversal of Direction

The CW/CCW Inverter Output Circuit is included on each of the versions of the NCS Output Card (51404886-001, 002, and 003). It can be calibrated by monitoring any of the output signals. For this procedure it is assumed that the actuator is configured for CW rotation. The Actuator leaves the factory configured for CCW rotation. (Actuator should be calibrated for both CW and CCW operation and should not require recalibration when reversing direction.)

To change to CW rotation:

1. Remove power from the actuator, and change the jumper on W10 (see Figure 4-9) from the pin 1 to 2 position to the 2 to 3 position. Interchange the Motor Positioner leads on terminals 9 and 10.

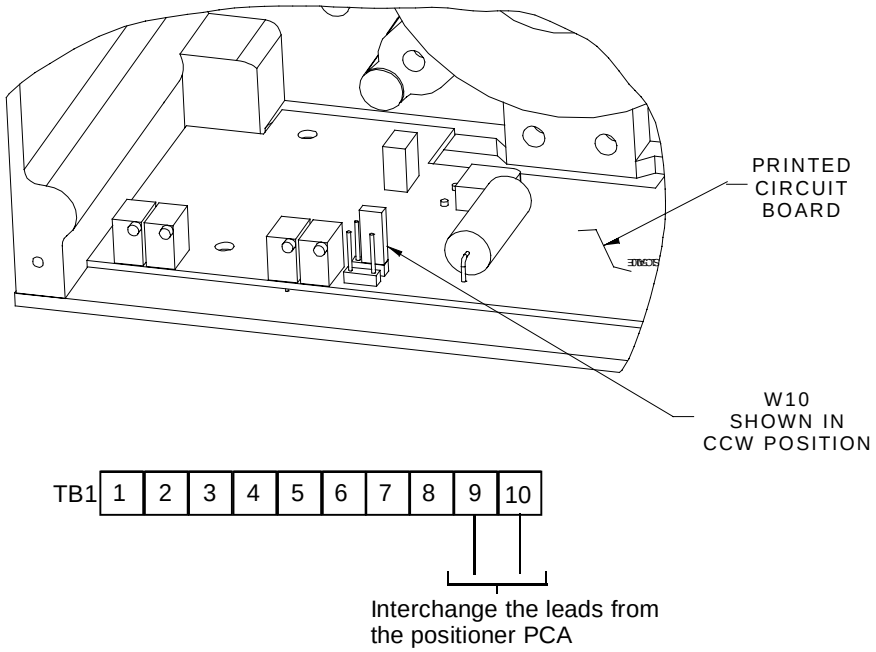


Figure 4-9 Reversal of Direction

4.9 Inverter Settings

Table 4-2 documents inverter settings that have been changed from the Allen-Bradley factory default to be optimized for the 11280A.

Table 4-2 As Shipped Inverter Parameters

Parameter	Value	Description
30 (Accel time)	2.0	Change acceleration time from 10 to 2 seconds
31 (Decel time)	0.1	Change deceleration time from 10 to 0.1 seconds for 1/2 HP, 3/4 HP and 1 HP
	0.2	Change deceleration time from 10 to 0.2 seconds for 1½ HP & 2 HP
	0.6	Change deceleration time from 10 to 0.6 seconds for 3 HP
		(Do not set P31 below the minimum value listed above)
43 (Motor Overload Current)	Varies	See Table 4-3.
46 (Input mode)	1	Change to 2 wire control
59 (Frequency select)	1	Change to internal frequency command P58

Table 4-3 Parameter 42 (Motor Overload Current)

Set to motor nameplate Full Load Amps (FLA).

HP	230 Vac – Typical FLA *	460 Vac – Typical FLA *
½	1.6	0.8
¾	2.2	1.1
1	2.6	1.3
1 ½	4.4	2.2
2	5.6	2.8
3	7.8	3.9

*If motor nameplate FLA is different from Table 4-3, use the motor nameplate FLA.

160 SSC™ Variable Speed Drive (Series C) User Manual can be found at http://www.ab.com/manuals/dr/160/160-5_15.pdf.

4.9.1 To Change Inverter Parameters to Allen-Bradley Factory Defaults

1. To program the value of a program group parameter, enter the Program Group by pressing the ESCape key. The "program mode indicator" will illuminate.
2. Press up/down keys until the desired parameter displays. In this case press the up key until parameter 56 – (Reset Functions) displays.
3. Press SELect key. The program mode indicator flashes indicating you can use up/down keys to change the parameter value.
4. Change the function from the idle state of "0" to "1" by pressing the up key.
5. When the desired value displays press the ENTER key. This restores all inverter parameter settings to factory defaults. After the reset update function is complete, this parameter will set itself back to a "0".

ATTENTION

Revise the parameter settings per Table 4-2.

4.9.2 Limiting Torque

The torque is limited by setting the following parameters:

- parameter 42, Motor Overload Select
- parameter 43, Current Limit

4.9.3 Stall Annunciation

A stall annunciation is indicated by setting the Output Configure (parameter 47) to 4 (Motor Overload).

4.9.4 Allen-Bradley User Manual

Allen-Bradley 160 SSC™ Variable Speed Controller (Series B) User Manual is shipped with the actuator. If it is lost or misplaced the user manual can be downloaded from www.ab.com/manuals/dr/index.html#160 manual number 0160-5.9 May 1998.

5. Start-Up/Operation

5.1 Introduction

After the equipment is completely installed, wired, and the preliminary adjustment made, it is advisable to check the operation of the actuator and controlled device before using the equipment for actual control. In other words, operate the controlled device and check its direction of travel in response to an increase in the controlled variable and make sure it is correct for the process. Actuators having the optional Auto-Manual Switch must have the knob in the AUTO position.

This chapter provides a checklist which can be used to do a walk-through with the actuator before it is actually used for control.

5.2 Operations Checklist

1. Refer to customer's connection diagram supplied with each actuator to determine direction of actuator rotation.
2. If the process being controlled requires opposite actuator rotation from that supplied by the factory, this may be accomplished by changing the wiring connections as noted in the customer's connection diagram.
3. To check the operation of the optional Auto-Manual Switch, move the knob to the CW and CCW MANUAL positions. The output shaft should rotate in the direction indicated by the knob.

6. Maintenance

6.1 Introduction

There is some basic maintenance that is recommended for the 11280A Series Actuators. The Non-contact Sensor, Motor Positioner, Slidewire Emulator, and 4-20 Output Board require no maintenance or servicing under normal conditions.

If there is a problem, this chapter provides the user with the information needed to return the 11280ASeries Actuator to peak performance.

6.2 Basic Maintenance

6.2.1 Gear Box Lubrication

At 3-month intervals, check the oil level in the gear box. Too much oil will cause excessive heating and oil leakage at the shaft openings, while insufficient oil will cause undue wear of gears or bearings. Remove the plug tagged OIL LEVEL and verify that the gear box is filled up to this hole. If it is not, remove the breather plug on the top of the gear box and add oil to bring the level up to the proper point.

Always replace the oil when it becomes dirty. The oil should be free from moisture, as moisture will cause foaming and will result in oil leakage. The gear box should be drained and refilled annually.

The recommended lubricant for operation in ambient temperatures between –20 °F (–28 °C) and +150 °F (+65 °C) is Mobil Synthetic bearing and gear lubricant SHC 634 (ISO 460) or equivalent.

6.2.2 Non-Contact Sensor

There is no maintenance required.

6.2.3 Motor Positioner

There is no maintenance required.

6.2.4 Replacing the Fuses

WARNING

Disconnect power by using the Safety Interlock before opening the instrument case to replace the fuse(s). Do not defeat the Safety Interlock once the unit is opened as a potentially lethal shock hazard exists inside the case if the unit is powered.

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7. Replacement/Recommended Spare Parts

7.1 Introduction

This chapter provides the user with a complete list of all the spare parts that may be needed for the 11280A Series Actuators and the optional equipment.

7.2 HAL Honeywell Actuator Linkage Design Software

Part Number: 51197910-001

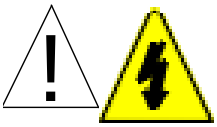
7.3 Replacement Fuses (Not for Sale)

Bussmann GDB1.6:	1.6 Amp Fast
Littlefuse 312001:	1.0 Amp Fast
	25 Amp Fast

7.4 Motor Replacement

REPLACEMENT MOTORS AND KEYWAYS FOR 11280A SERIES ACTUATORS per MODEL NUMBER

HercuLine Actuators	Motor HP	Allen-Bradley	Leeson	Honeywell
11284A-X-1	3/4	1329RS-HAF7518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	114213 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-502
11284A-X-2	1/2	1329RS-HA0F518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	101780 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-501
11284A-X-3	1/2	1329RS-HA0F518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	101780 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-501
11285A-X-1	1	1329RS-HA00118HAV Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	121066 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-503
11285A-X-2	3/4	1329RS-HAF7518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	114213 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-502
11285A-X-3	1/2	1329RS-HA0F518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	101780 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-501
11286A-X-1	2	1329RS-KA00218MCF Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	121065 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-505
11286A-X-2	1	1329RS-HA00118HAV Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	121066 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-503
11286A-X-3	3/4	1329RS-HAF7518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	114213 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-502
11287A-X-2	3	1329RS-VA00318MCF Motor Lovejoy coupling L095 1 1/8 Bore, 1/4 x 1/8 Keyway	131257 Motor Lovejoy coupling L095 1 1/8 Bore, 1/4 x 1/8 Keyway	51500272-506
11287A-X-3	2	1329RS-KA00218MCF Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	121065 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-505
11288A-X-1	2	1329RS-KA00218MCF Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	121065 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-505
11288A-X-2	1	1329RS-HA00118HAV Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	121066 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-503
11288A-X-3	3/4	1329RS-HAF7518MVF Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	114213 Motor Lovejoy coupling L095 5/8 Bore, 3/16 x 3/32 Keyway	51500272-502
11289A-X-1	3	1329RS-VA00318MCF Motor Lovejoy coupling L095 1 1/8 Bore, 1/4 x 1/8 Keyway	131257 Motor Lovejoy coupling L095 1 1/8 Bore, 1/4 x 1/8 Keyway	51500272-506
11289A-X-2	2	1329RS-KA00218MCF Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	121065 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-505
11289A-X-3	1 1/2	1329RS-KA1F518MCF Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	121066 Motor Lovejoy coupling L095 7/8 Bore, 3/16 x 3/32 Keyway	51500272-504



1. Using the enclosure front panel switch, turn the switch to the "OFF" position. Wait 3 minutes for the capacitors in the inverter to discharge to safe voltage levels.
   WARNING! Failure to do so may result in personal injury or death.
2. Open motor junction box cover and disconnect the 3 motor wires (Black, White and Red) from the enclosure to the motor. Write down the motor wire number(s) connected to each wire B, W & R. Write down other motor wire numbers that were connected together. Disconnect the ground wire (green) from the motor.
3. Disconnect the conduit fitting from the motor. Remove the wires in the conduit from the motor.
4. Unbolt the motor from the adapter, save the 4 bolts to mount the replacement motor. Be careful, the motor is heavy!
5. Align the coupling on the replacement motor to mate with the coupling in the adapter. Make sure the spider is in the adapter coupling.
6. Mount the motor using the 4 bolts saved from the removal of the old motor.
7. Open the motor junction box and knock out the appropriate hole in motor junction box.
8. Feed the wires from conduit into motor via the hole in the motor junction box. Connect the conduit fitting to the junction box.

9. Connect the ground wire (green) to the motor. Connect the 3 motor wires from the enclosure to the motor per the motor wire number(s) written down in step 2. Connect wire numbers in the motor that were previously connected together. See table below for connection for low and high voltage.

Actuator	Low Voltage	High Voltage
1128XA-1	L1 to motor wires 3 & 9	
1128XA-2	L2 to motor wires 2 & 8	
1128XA-3	L3 to motor wires 1 & 7	
1128XA-4	Motor wires 4, 5 & 6 tied together	
1128XA-5		L1 to motor wire 3
1128XA-6		L2 to motor wire 2
		L3 to motor wire 1
		Motor wires 4 & 7 tied together
		Motor wires 5 & 8 tied together
		Motor wires 6 & 9 tied together

10. Close and secure the motor junction box cover, using the enclosure front panel switch, turn the switch to the "ON" position.

11. If motor runs backwards, interchange L1 and L3 connectors.

7.5 Spare Parts

HercuLine	Part no.	Description
11284, 5, 6, 8, 9A-1-X	51204882-501	200-240V , 50/60 Hz Single Phase Variable Speed Drive (Inverter)
	51205562-526	Fuse 30 Amps (Package of 3)
	51205561-501	120/240 Vac 1 Phase Transformer
11284, 5, 6, 8, 9A-2-X	51204882-501	200-240 V, 50/60 Hz Single Phase Variable Speed Drive (Inverter)
	51205562-526	Fuse 30 Amps
1128XA-3,4-X	51204882-502	200-240 V, 50/60 Hz 3 Phase Variable Speed Drive (Inverter)
	51205562-524	Fuse 20 Amps (Package of 3)
1128XA-5-X	51204882-503	380-460 V, 50/60 Hz 3 Phase Variable Speed Drive (Inverter)
	51205562-522	Fuse 15 Amps (Package of 3)
1128XA-6-X	51204882-503	380-460 V, 50/60 Hz 3 Phase Variable Speed Drive (Inverter)
	51205562-522	Fuse 15 Amps (Package of 3)
	51204954-501	575/460 Vac 3 Phase Transformer
1128X-X-X-XX-1	51404978-512	4 mA to 20 mA input PCA
11284, 5, 6A	51204679-501	11284, 85 and 86A Crank Arm
11287, 8, 9A	51204679-502	11287, 88 and 89A Crank Arm
	51205757-501	Auto/Man Switch Kit (includes hardware)
	51204847-501	Power Switch Kit
	51404947-502	NCS Transformer

7.6 Kits

Part no.	Description
51404926-501	Non-Contact Sensor (NCS) Replacement
51404885-501	Power Inverter/NCS PCA
51404885-502	4 mA to 20 mA Output PCA
51404885-503	Slidewire Emulator PCA
51205550-501	Limit Switch Kit
51205553-501	Cam Assembly Kit

8. Troubleshooting

8.1 Introduction

Table 8-1 indicates some of the observable symptoms of failure that can be identified by noting the erratic actuator functions.

Symptoms

Compare the actuator's symptoms with those in Table 8-1 and refer to the indicated subsections for the appropriate troubleshooting procedures.

Table 8-1 Observable Symptoms of Failure

Symptoms	See Subsection
Actuator Current Output does not function.	8.2.1
Actuator Slidewire Output does not function.	8.2.2
Non-Contact CW/CCW operation is not correct.	8.2.3
Actuator does not control to proper position.	8.2.4
Auto/Manual Switch does not operate correctly.	8.2.5
CW/CCW switch does not operate correctly.	8.2.6

8.2 Troubleshooting Procedures

Overview

The troubleshooting procedures for the observable symptoms of failure are presented in the same order as they appear in Table 8-1. Each procedure includes what to do if you have that particular failure, as well as instructions for accomplishing the task, or a cross-reference to instructions elsewhere in the manual.

Equipment needed

You will need the following equipment in order to troubleshoot the symptoms listed in the tables that follow:

- DC Milliammeter – mA dc
- Calibration source – Volt, mA, etc.
- Digital Voltmeter

Safety precautions

Exercise appropriate safety precautions when troubleshooting the actuator operation.

WARNING

Disconnect power by using the Safety Interlock before opening the instrument case. Do not defeat the Safety Interlock system once the unit is opened as a potentially lethal shock hazard exists inside the case if the unit is powered.

8.2.1 Actuator Current Output does not function.

Table 8-2 explains how to troubleshoot the actuator current output failure.

Table 8-2 Troubleshooting Current Output

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check that the cables are plugged into the correct headers on the NCS Output Board.	On the NCS Output Board insure that the following are connected: (See Figure 4-7.) J5 – BRN, BRN, YEL; J2 – BLU, BLU, VIO; J3 – RED, GRN, WHT; J1 – GRY, YEL J4 – ORN, YEL (If Motor Positioner board present)
2	Check that a load resistor is connected to the output.	After removing the GRY and YEL wires from TB-32 and 33, measure, using an ohmmeter, the load resistor to verify it is connected between terminals 4 and 5. See Section 3.4.2.
3	Check the input signal to the NCS Output Board.	Using a DVM measure the voltage between the pins on W11. The voltage should be in the range of 0 Vdc to 1.25 Vdc. See Figure 4-5.
4	Check/Recalibrate.	Refer to Section 4 to check calibration and to recalibrate. First check Section 4.5 for proper positioning and calibration of non-contact sensor.
5	Replace the NCS Output Board.	Refer to the replacement procedure in Section 7 – Replacement/ Recommended Spare Parts.

8.2.2 Actuator Slidewire Output does not function.

Table 8-3 explains how to troubleshoot the actuator Slidewire Output failure.

Table 8-3 Troubleshooting Slidewire Output

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check that the cables are plugged into the correct headers on the NCS Output Board.	On the NCS Output Board insure that the following are connected: (See Figure 4-8.) J5 – BRN, BRN, YEL; J7 – ORN,ORN, GRY; J3 – RED, GRN, WHT: J6 – RED, YEL, BLU. J4 – ORN, YEL (If Motor Positioner board is present.)
2	Check that the external controller is supplying a slidewire voltage supply.	Using the Digital Voltmeter measure the voltage from pin 1 to pin 3 on TB. This voltage should be in the range of 1.000 Vdc to 20 Vdc. See Figure 3-11.
3	Check the input signal to the NCS Output Board.	Using a DVM measure the voltage between the pins on W11. The voltage should be in the range of 0 to 1.25 Vdc. See Figure 4-5.
4	Check/Recalibrate.	Refer to Section 4 to check calibration and to recalibrate. First check Section 4.5 for proper positioning and calibration of non-contact sensor.
5	Replace the NCS Output Board.	Refer to the replacement procedure in Section 7 – Replacement/Recommended Spare Parts.

8.2.3 Actuator CW/CCW operation is not correct.

Table 8-4 explains how to troubleshoot the actuator for proper CW/CCW operation.

Table 8-4 Troubleshooting CW/CCW Operation

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check that the cables are plugged into the correct headers on the NCS Output Board.	On the NCS Output Board insure that the following are connected: (See Figure 4-7.) J5 – BRN, BRN, YEL; J3 – RED, GRN, WHT; W10 – jumper pins 1 to 2 – CCW. W10 – jumper pins 2 to 3 – CW. J4 – ORN, YEL (If Motor Positioner board is present.)
2	Check that the shaft turns correctly for CCW drive.	If actuator is used in CCW direction and input is increasing measure, using a DVM, the voltage at W11 See Figure 4-5. It should be increasing from 0 Vdc to 1.25 Vdc as input increases and shaft rotates CCW. If this is not the case go back to STEP 1 and check W10 jumper position. See Figure 4-7.
3	Check that shaft turns correctly for CW drive	If actuator is used in CW direction and input is increasing measure, using a DVM, the voltage at W11. See Figure 4-5. It should be decreasing from 1.25 Vdc to 0 Vdc as input increases and shaft rotates CW. If this is not the case go back to STEP 1 and check W10 jumper position. See Figure 4-7.
4	Check/Recalibrate.	Refer to Section 4 to check calibration and to recalibrate. First check Section 4.5 for proper positioning and calibration of non-contact sensor.
5	Replace the NCS Output Board.	Refer to the replacement procedure in Section 7 – Replacement/Recommended Spare Parts.

8.2.4 Actuator does not control to the proper position.

Table 8-5 explains how to troubleshoot the actuator for the correct control operation.

Table 8-5 Troubleshooting Control Action on Actuator

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check the connectors to the Motor Positioner Board.	Check to make sure connectors are securely seated in headers on Motor Position board. See Figure 4-6.
2	Check that cables are plugged into the correct headers on NCS output board.	Check to make sure connector is seated in header J4 on NCS board. See Figure 4-7.
3	Check NCS Output signal.	On NCS Output Card, using a DVM, check that the voltage across the pins of W11 (Figure 4-5) is in the range of 0 Vdc to 1.25 Vdc. Check that voltage is increasing for CCW operation and decreasing for CW operation.
4	Check input signal.	Using a DVM verify that the input signal at terminals 1 and 2 on the Motor Positioner is in the range of 1 Vdc to 5 Vdc. If not check for the dropping resistor.
5	Check CW/CCW jumper	Upon change of input signal, if actuator travels to 0 % or 100 % check to make sure the motor positioner leads to terminals 9 and 10 and jumper (Figure 4-9) are in correct positions.
6	Check/Recalibrate	Refer to Section 4 to recalibrate actuator. First check Section 4.5 for proper positioning and calibration of Non-contact Position Sensor.
7	Replace CAT/PAT Board.	Refer to the replacement procedure in Section 7 – Replacement/Recommended Spare Parts.

8.2.5 Auto/Manual Switch does not operate correctly.

Table 8-6 explains how to troubleshoot the actuator Auto/Manual Switch.

Table 8-6 Troubleshooting The Auto /Manual Switch

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check the Auto/Manual Switch in Manual Mode (CCW).	Set the Auto/Manual Switch in the CCW position. Verify that shaft turns CCW. (Viewed from shaft end of actuator).
2	Check the Auto/Manual Switch in Manual Mode (CW).	Set the Auto/Manual Switch in the CW position. Verify that shaft turns CW. (Viewed from shaft end of actuator).
3	Check the Auto/Manual Switch in Auto Mode.	Set the Auto/Manual Switch in the Auto position. Using the controller, drive the unit CCW and CW.
4	Replace the controller.	Refer to the replacement procedure in Section 7 – Replacement/Recommended Spare Parts. Or if an external controller is being used refer to its Operator Manual.

8.2.6 Actuator CW/CCW Switch does not operate correctly.

Table 8-7 explains how to troubleshoot the actuator CW/CCW Switch.

Table 8-7 Troubleshooting the CW/CCW Switch

Step	What to Do	How To Do it or Where to Find the Instructions
1	Check that the motor positioner leads to terminals 9 and 10 and the jumper on the NCS Output Board are correct.	Verify that the motor positioner leads are on the correct terminals (see Figure 4-9).
2	Continue Step 1.	Verify that jumper W10 on the NCS Output Board is between pins 2 and 3. See Figure 4-9.
3	Check terminal wiring.	Using the wiring label located on the cover of the actuator verify that the wiring to the units is correct.
4	Check Non-contact Sensor.	Verify that the NCS sensor is positioned correctly. Position actuator to 0% SPAN for CCW drive (100 % SPAN for CW drive) and make sure NCS spoilers are in zero position. (See Figure 4-5.) Using a DVM, measure voltage between pins on W11. Voltage should be between 0.01 V and 0.02 V in ZERO position and should increment as actuator goes CCW. See Section 4 to recalibrate.
5	Replace NCS Output Board.	Refer to the replacement procedure in Section 7 – Replacement/Recommended Spare Parts. Or if an external controller is being used refer to its Operator Manual.

8.3 Moving the actuator when not in automatic mode

There are three ways to move the actuator when not in the automatic mode.

- Use the handwheel to position the output of the actuator. End of limit switches have no effect.
- Use the Auto/Man electric switch to drive the actuator CW/CCW. This mode will allow the end of limit switches to open and stop the actuator when either limit is reached.
- Changing parameter 46 to "2" will allow the inverter to run the actuator CW/CCW. The reset function P56 must be set to "2" for the change to take effect. End of limit switches have no effect.

8.4 Verification of CW/CCW Rotation

Use the startup procedure on page 4-12 and 4-2 of the Allen-Bradley User's Manual and Table 6.B on page 6-3.

8.5 Fault Descriptions

Use Allen-Bradley Table 6.A pages 6-1 and 6-2 to review fault numbers, fault indication, fault description and corrective action.

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61-86-25-07 Rev. 4 1100 Printed in USA

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