

RCS and ANDCO Electric Actuators

Electric Actuator Smart Controller

Microprocessor Based Analog Positioner

Technical Manual

Models:

**SCC10 – 115/230A
SCC10 - 24VAC**

Document **EASC** – DICM
Revision 2.0



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 - Modified to reflect changes in V1.12 software release



1. Getting Started

a. Document Conventions

The following documentation conventions are used throughout this manual:

1. Values shown on the display will be indicated with bold italics ie. **CC-r** with upper and lower case letters used to mimic the actual display;
2. Keyboard keys will be shown using the Υ , β , \bar{U} and **SELECT** symbols in bold;
3. Menu items will be indicated by the mnemonic shown on the controller's display.

The manual will first introduce concepts required for the setup of a standard actuator. Further sections will detail the customization of the controller for actuators requiring special settings.

b. Installation Notes

Note 1: *The following instructions assume that the EASC board is installed in the actuator and all safety, installation and startup instructions outlined in the appropriate RCS and ANDCO installation and instruction manuals have been carried out. Be certain the actuator is in proper operating condition before attempting to calibrate the EASC board. Except for **Step 2.d. Positioning the potentiometer shaft** and **Step 2.e. Calibrating the controller**, the actuator will not move during setup.*

Note 2: *The Quick Setup instructions are suitable for:*





- Input signal requirements of 4-20 mA_{dc}, 1-5 V_{dc}, 0-10 V_{dc} or 2-10 V_{dc}
- Output signal requirements of 4-20 mA_{dc}, 1-5 V_{dc}, 0-10 V_{dc} or 2-10 V_{dc}
- Loss of input signal: actuator does not move, fails in last place. For a setting of zero input signal the system fails to minimum signal position.

For all other options, refer to sections 4 - 7 of this manual.

Note 3: *The terms "clockwise" and "counterclockwise" refer to the direction of rotation of the actuator output shaft, for rotary actuators, as viewed from the top of the actuator. For linear actuators, the term "extend", rod moving away from the body of the actuator, and "retract", rod moving into the body of the actuator, refer to the direction of movement of the extension rod. The EASC is always wired as shown in **Figure 1**. Refer to **Figure 1** for status lamp descriptions. Output rotation, for rotary actuators, or extension rod direction of movement, for linear actuators, is changed using **Step 2.c**.*

c. Key Functions

There are four keys used to select the system menus. The table below describes each key:

	Go BACK one menu level and do not save value
	Move UP through menus or increase a value
	Move DOWN through menus or decrease value
	SELECT a menu item or save value

When working within the menus it is not necessary to return to the top level between setting parameters. The parameter value is saved to non-volatile memory when the **SELECT** key is pressed.



2. Quick Setup Instructions

a. Setting the analog input type:

1. Use the \checkmark or β keys until *in* is displayed, then press the **SELECT** key.
2. Press the \checkmark or β key until the type of input signal required, **1-5 Vdc**, **0-10 Vdc**, **2-10 Vdc**, **4-20 mAdc** is displayed.
3. Press the **SELECT** key to save the selection.

b. Setting the analog output type:

1. Use the \checkmark or β keys until *oUt* is displayed, then press the **SELECT** key.
2. Press the \checkmark or β key until the type of output signal required, **1-5 Vdc**, **0-10 Vdc**, **2-10 Vdc**, **4-20 mAdc** is displayed.
3. Press the **SELECT** key to save the selection.

c. Selecting output shaft rotation:

1. Press the \checkmark or β key until *rotn* is displayed, then press the **SELECT** key.
2. Press the \checkmark or β to select the direction of travel required to move the actuator towards the maximum signal position, **CC-r** (counterclockwise for rotary actuators or retract for linear actuators) or **C-E** (clockwise for rotary actuators or extend for linear actuators)
3. Press the **SELECT** key to save the selection.

d. Positioning the potentiometer shaft:

1. Press the \checkmark or β key until *Pot* is displayed, then press the **SELECT** key.
2. The display will change to show the actual potentiometer value in internal divisions (**0-1023**) and the \checkmark or β keys will now operate the actuator motor.
3. Run the actuator to approximately 50% of travel. Loosen the set screws retaining the potentiometer shaft. Rotate the shaft until the display reads approximately **510** divisions (50% of potentiometer span). Re-tighten the set-screws.
4. To verify the potentiometer and limit switch settings, press the \checkmark key to move the actuator electrically. The value displayed on the LED array should increase towards the maximum of 1023 divisions. When the limit switch stops the actuator, check that the switch setting is correct for the required travel. The displayed value will typically be 975 divisions, but must not exceed 1000 divisions.
5. Now press the β key to move the actuator in the opposite direction of travel. The value displayed should decrease in value towards the minimum value of zero. The displayed value will typically be 50 divisions, but must not be less than 20 divisions. The difference between the end of travel values must be at least 500 divisions.
6. Press the **SELECT** key to exit potentiometer setup.

e. Calibrating the controller:

1. Press the \checkmark or β key until *Cal* is displayed, then press the **SELECT** key.
2. Press the \checkmark or β key until **YES** is displayed, then press the **SELECT** key.
3. The automatic calibration sequence will now begin.
4. To stop a calibration in progress, press the Ü key. The calibration will be aborted and the previous calibration restored.



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The display will indicate the calibration steps, **C 1** through **C 11**, being performed. Should the calibration sequence fail, the display will indicate **CF X**, where **X** is the number of the calibration step that failed. See Section **9. The Automatic Calibration System** for a description of the calibration steps. No calibration values are saved unless the calibration sequence completes normally. When calibration is complete, the display will again show **Cal**.

f. Exiting setup mode:

1. Press the \ddot{U} key until the display shows the actual actuator position and the actuator begins to follow the input command signal.







3. Reloading the Factory Default Settings

The controller can restore all of the operating parameters to known values. The parameters should be restored under the following conditions:

1. The controller is operating erratically or positioning inaccurately;
2. The standard or advanced menus have been modified with unpredictable results;
3. The controller has been re-installed in a different actuator.

There are four available Factory Default setups. Each of the setups is accessed using one of the four keyboard keys as described in the table below:

Key	Analog In/Out	Calibrate Delay Seconds
	1 - 5 Vdc	5
	4 – 20 mAdc	5
	0 – 10 Vdc	5
	4 – 20 mAdc	20

To reload the Factory Default Settings:

1. Disconnect the power source from the actuator.
2. Press and hold the desired key.
3. Restore the power to the actuator.
4. The display will read: **Fact**, then **done**.
5. Release the key.

The controller will require configuration and calibration after the reload operation is complete. See Section 2. **Quick Setup Instructions** for details.



4. Setting Nonstandard Input / Output Ranges

To select a nonstandard input/output range you will require a process loop calibrator or alternately a multimeter and an adjustable process signal source. Connect the process calibrator or multimeter to the analog input and output terminals. See **Figure 1** for connection details. The actuator will not move during this procedure.

a. Setting a nonstandard analog input:

1. Select the voltage or current input range that most closely matches your nonstandard configuration using **Step 2.a** of the **Setup Instructions**.
2. Use the \dot{Y} or β keys until **io** is displayed, then press the **SELECT** key.
3. Set the process calibrator to the lowest input value.
4. Use the \dot{Y} or β keys until **ioFt** is displayed, then press the **SELECT** key.
5. Use the \dot{Y} or β keys to set the controller display to **0**.
6. Press the **SELECT** key to save the selection.
7. Set the process calibrator to highest input value.
8. Use the \dot{Y} or β keys until **ispn** is displayed, then press the **SELECT** key.
9. Use the \dot{Y} or β keys to set the controller display to **100**, or to full scale if the full scale value has been modified from **100**.
10. Press the **SELECT** key to save the selection.
11. Press the \ddot{U} key until the display shows actual actuator position in increments of 0-100% and the actuator begins to follow the input command signal.

b. Setting a nonstandard analog output:

1. Select the voltage or current output range that most closely matches your nonstandard configuration using **Step 2.b** of the **Setup Instructions**.
2. Use the \dot{Y} or β keys until **io** is displayed, then press the **SELECT** key.
3. Use the \dot{Y} or β keys until **ooFt** is displayed, then press the **SELECT** key.
4. Use the \dot{Y} or β keys to set the output signal lowest value as displayed on the process calibrator or multi-meter. The controller will automatically set the output to the lowest value during this step. The display indicates the value of the output d-a converter from **0 – 1023**.
5. Press the **SELECT** key to save the selection.
6. Use the \dot{Y} or β keys until **ospn** is displayed, then press the **SELECT** key.
7. Use the \dot{Y} or β keys to set the output signal highest value as displayed on the process calibrator or multi-meter. The controller will automatically set the output to the highest value during this step. The display indicates the value of the output d-a converter from **0 – 1023**.
8. Press the **SELECT** key to save the selection.
9. Press the \ddot{U} key until the display shows actual actuator position in increments of 0-100% and the actuator begins to follow the input command signal.



5. Selecting an Alternate Fail Position on Loss of Command Signal

The controller can sense the loss of the analog input signal for configurations that have an input signal at least 2% of full scale above zero input. Two settings are available, loss of signal threshold and position on loss of signal. The *EASC* offers four failure modes to control the movement of the actuator in the event of a command signal loss:

- Fail in last position: no actuator movement upon loss of signal. This is the factory default setting.
- Fail to the full clockwise / extend position
- Fail to the full counterclockwise / retract position
- Fail to a preset position

NOTE: For a setting of zero input signal the system fails to minimum signal position.

a. Setting the Fail Safe Position:

1. Use the \checkmark or β keys until *io* is displayed, then press the **SELECT** key.
2. Use the \checkmark or β keys until *FSPn* is displayed, then press the **SELECT** key.
3. Use the \checkmark or β keys to set the fail safe position to the required location. Setting the fail safe position to greater than 100, or full scale, will enable fail in last position. The fail safe system will be disabled if the fail safe position is set to zero..
4. Press the **SELECT** key to save the selection.

b. Setting the Fail Safe Loss of Signal Threshold:

1. Use the \checkmark or β keys until *io* is displayed, then press the **SELECT** key.
2. Use the \checkmark or β keys until *FStH* is displayed, then press the **SELECT** key.
3. Use the \checkmark or β keys to set the input threshold in percent, or units of full scale, where the fail safe function will be activated. The fail safe function will be activated whenever the input signal falls below the threshold setting. Hysteresis of 1% is automatically provided on the fail safe threshold.
4. Press the **SELECT** key to save the selection.

6. Using the Current Protection Option

An optional current sensing protection system is available for the controller. To utilize this system an optional current sense transformer is required. Plug the current sense transformer into the circuit board as shown in Figure 1. Pass the motor neutral wire through the hole in the current sensor.

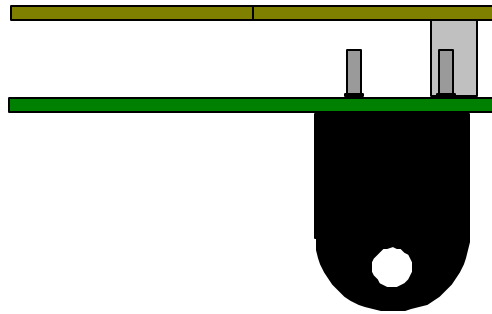


Figure 1 - Location of the Current Sense Transformer

The current system operates by comparing the motor current to a preset value **hCUR**. If the motor current exceeds **hCUR** for longer than the timer **tCUR** and over current error, **f oc** will be displayed and the motor will be stopped. Once in over current, the controller will not respond to further requests for movement in the same direction, until a move in the opposite direction has occurred. The error can also be cleared by pressing any key on the keyboard.

The following advanced menu options require setup to use the current sensing system:

Item	Description	Default	Range
hCUR	<p>This value determines the maximum full load amps of the actuator motor.</p> <p>Set this value to an amount at least 5% above the loaded running amps for the motor. The CSPn setting allows for the scaling of the sensed current value. The running current of the motor can also be displayed using the CSPn function.</p> <p>This value is scaled as 0.00A. Note the display does not show the implied decimal point.</p>	200	0-1023
tCUR	<p>This value determines the maximum time that the actuator can exceed the preset full load amps hCUR of the actuator motor before a fault is declared. The display will indicate f oc should this protection feature activate.</p> <p>This timer is calibrated in 1 second increments for V1.00 software and 0.1 second increments in V1.11 and later software versions. Note the display does not show the implied decimal point.</p>	0	0-255



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Item	Description	Default	Range
Coft	<p>This value is automatically set during calibration.</p> <p>The value is adjusted by selecting the menu item, then adjusting the value to 0.</p> <p>The value is calibrated in 0.01A increments. Note the display does not show the implied decimal point.</p>	0	0-1022
CSPn	<p>This value is set by selecting the menu item and then manually running the actuator motor using a wire jumper or manual push button station. The display will indicate the running amps of the motor. The displayed value can be verified against a clamp-on or in-line ammeter. Use the keyboard to adjust the display to indicate the actual running current of the motor.</p> <p>This value is scaled as 0.01A. Note the display does not show the implied decimal point.</p>	n/a	0-1023



7. The Automatic Calibration System

The controller automatically determines the best operating parameters for the attached actuator. Before starting the calibration be certain that the actuator is safe to move and that the potentiometer and limit switch have been correctly adjusted. See **Section 2.d. Positioning the potentiometer shaft** for information on adjusting the potentiometer and limit switches.

a. Starting a calibration

To initiate an automatic calibration:

1. Press the \bar{Y} or β key until **Cal** is displayed, then press the **SELECT** key.
2. Press the \bar{Y} or β key until **YES** is displayed, then press the **SELECT** key.
3. The automatic calibration sequence will now begin.
4. To stop a calibration in progress, press the \bar{U} key. The calibration will be aborted and the previous calibration restored.

b. Calibration Steps

The display will indicate the calibration step, **C 1** through **C 11**, being performed. Should the controller be unable to complete the calibration cycle, the step where the cycle halted will be displayed as **CFXX**, with **XX** being the step number. The calibration is complete when the display returns to **CAL**. Refer to **Section 10. Connection Drawing** for the location of the status lamps described in the calibration sequence. The following are the steps performed during a calibration:

Step	Description	Lamp 2 <i>rotn = CC-r</i>	Lamp 3 <i>rotn = CC-r</i>	Lamp 4 <i>rotn = CC-r</i>	Lamp 5 <i>rotn = CC-r</i>
		Lamp 3 <i>rotn = C-E</i>	Lamp 2 <i>rotn = C-E</i>	Lamp 5 <i>rotn = C-E</i>	Lamp 4 <i>rotn = C-E</i>
		(Note 1)	(Note 2)	(Note 3)	(Note 4)
C 1	Capture the current detection system input offset	On unless at minimum signal limit	On unless at maximum signal limit	Off	Off
C 2	Run towards the maximum signal limit switch for 2 seconds	On unless at minimum signal limit	On unless at maximum signal limit	Off	On unless at maximum signal limit
C 3	Move to the minimum signal limit switch, then wait CALd time	On until at minimum signal limit	On unless at maximum signal limit	On until at minimum signal limit	Off
C 4	Capture actuator potentiometer input zero offset value	Off	On	Off	Off
C 5	Move to the maximum signal limit switch, then wait CALd	On	On until at	Off	On until at



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Step	Description	Lamp 2 <i>rotn = CC-r</i>	Lamp 3 <i>rotn = CC-r</i>	Lamp 4 <i>rotn = CC-r</i>	Lamp 5 <i>rotn = CC-r</i>
		Lamp 3 <i>rotn = C-E</i>	Lamp 2 <i>rotn = C-E</i>	Lamp 5 <i>rotn = C-E</i>	Lamp 4 <i>rotn = C-E</i>
		(Note 1)	(Note 2)	(Note 3)	(Note 4)
	limit switch, then wait CALd time, capture actuator potentiometer input span value		maximum signal limit		maximum signal limit
C 6	Move to ¼ of full scale position	On	On	On	Off
C 7	Wait 2 seconds, capture the move towards minimum setback value	On	On	Off	Off
C 8	Move to ¾ of full-scale position	On	On	Off	On
C 9	Wait 2 seconds, capture the move towards maximum limit setback value	On	On	Off	Off
C 10	If required, jog motor, jogs will towards the minimum signal limit switch unless ¼ of full scale is reached, then movement reverses towards maximum signal limit; direction changes again if ¾ of full-scale is reached	On	On	On for movements towards the minimum signal limit	On for movements towards the maximum signal limit
C 11	Wait jog off time; if 3 jogs have completed without adjustment, save jog on time, maximum jog on time and minimum jog on time; otherwise adjust jog on time and go to step 10	On	On	Off	Off
CAL	Calibration cycle is complete and new values are saved to non-volatile memory	On	On	Off	Off

Notes:

1. Lamp 2 is off when at full CC-r limit.
2. Lamp 3 is off when at full C-E limit.
3. When lamp 4 is on the motor must run towards the full CC-r limit switch.
4. When lamp 5 is on the motor must run towards the C-E limit switch.

The calibration system only saves the calculated parameters upon completion of a calibration cycle. Terminating of the calibration process by fault or by using the **Ü** key will abort the calibration and restore the previous calibration values.

c. Troubleshooting a failed calibration

The following guide will assist in troubleshooting failed calibrations. A calibration has failed if a **CF X** error is displayed during the calibration. To clear the error message press any key. The following table describes some of the common calibration problems and suggested solutions:

Indication	Problem	Solution
A CF 8 error occurred	The actuator is not receiving a signal from the potentiometer	See Section 2.d Positioning the potentiometer shaft for instruction on setting the potentiometer and confirming the potentiometer input
	The actuator motor is not running when required.	Use the instructions in Section 2.d Positioning the potentiometer shaft to move the motor and verify correct operation
	The limit switches are not working	Use the instructions in Section 2.d Positioning the potentiometer shaft to move the actuator to the limits and verify limit switch operation
A CF 5 error occurred	The actuator running time exceeds 1023 seconds (255 seconds for V1.00 software)	The controller will not work with this actuator, this is the maximum allowed running time
The actuator stops early during step C 3 or C 5 or does not capture the correct span	The CALd timer is not set long enough	The controller senses shaft movement during steps C 3 and C 5 ; if the shaft does not move or moves too slowly, timer CALd may expire prematurely; increase timer CALd for actuators with a long dead period i.e. Sure49's or actuators with a very long run time

8. Controller Menus

There are two control menus. The Basic Menu allows for the standard configuration of the controller. Covered by this menu are the setup of the analog input and output, the setting of the direction of rotation, adjustment of the actuators potentiometer and initiation of the automatic calibration system.

The Advanced Menu allows for the customization of the controller to actuators with operation outside of the standard settings.

The menus are accessed using the system keyboard. Pressing any key from normal operating mode enters the menu system. The \uparrow key moves up one item within a menu tree. The \downarrow key moves down one item within a menu tree. The \leftarrow back key moves up one menu tree or, in the case of the uppermost menu, back to operating mode. Once the menu item has been selected, pressing the **SELECT** key displays the value associated with the item. The \uparrow up and \downarrow down keys adjust the value. The \leftarrow back key aborts any changes made to the item and moves back to the item menu. The **SELECT** key saves the adjusted value to non-volatile memory and returns to the item menu.

a. Basic Setup Menu

The Basic Setup Menu is used for the setup and calibration of standard actuators.

Group	Item	Description	Default Setting
<i>In</i>	<i>0-10</i>	Sets analog input to 0-10 Vdc range	
	<i>2-10</i>	Sets analog input to 2-10 Vdc range	
	<i>1-5</i>	Sets analog input to 1-5 Vdc range	1-5 Vdc
	<i>4-20</i>	Sets analog input to 4-20 mAdc range	
<i>Out</i>	<i>0-10</i>	Sets analog output to 0-10 Vdc range	
	<i>2-10</i>	Sets analog output to 2-10 Vdc range	
	<i>1-5</i>	Sets analog output to 1-5 Vdc range	1-5 Vdc
	<i>4-20</i>	Sets analog output to 4-20 mAdc range	
<i>Rotn</i>	<i>CC-r</i>	Maximum input signal moves actuator shaft to fully counter-clockwise or retracted.	CC
	<i>C-E</i>	Maximum input signal moves actuator shaft to fully clockwise or extended	
<i>Pot</i>		Pressing \uparrow key moves actuator to increase potentiometer value. Pressing \downarrow key moves actuator to decrease potentiometer value. Display shows actual potentiometer value from 10 – 1023	
<i>CAL</i>	<i>No</i>	Used to initiate a self-calibration. See Setup Instructions Section 6 – The Automatic Calibration System.	
<i>Io</i>	<i>ioft</i>	Adjust the analog input offset The display shows the input signal in units of full scale. This function allows the setting of non-standard input ranges. See Section 4 - Setting Nonstandard Input / Output Ranges for instructions to set this value.	Offset set for 1 Vdc = 0%



Group	Item	Description	Default Setting
	<i>ISpN</i>	Adjust the analog input span. The display shows the input signal in units of full scale. This function allows the setting of non-standard input ranges. See Section 4 - Setting Nonstandard Input / Output Ranges for instructions to set this value.	Span set for 5 Vdc = 100%
	<i>ooFt</i>	Adjust the analog output offset. The display shows the output d-a converter value, which must be between 0 and 1024. This function allows the setting of non-standard output ranges. See Section 4 - Setting Nonstandard Input / Output Ranges for instructions to set this value.	Offset set for 0% = 1 Vdc
	<i>oSPn</i>	Analog output span. The display shows the output d-a converter value, which must be between 0 and 1024. This function allows the setting of non-standard output ranges. See Section 4 - Setting Nonstandard Input / Output Ranges for instructions to set this value.	Span set for 100% = 5 Vdc
	<i>FStH</i>	Set the fail-safe threshold in units of full scale. The display shows the current threshold. See Section 5 – Selecting an Alternate Fail Position on Loss of Command Signal for instructions to set this value.	1%
	<i>FSPn</i>	Set the fail-safe position in units of full scale. The display shows the current fail-safe position. See Section 5 – Selecting an Alternate Fail Position on Loss of Command Signal for instructions to set this value.	101% (Do not move on input signal fault)

b. Advanced Setup Menus

The advanced setup menu allows the controller to be adapted to a wide variety of actuators. These parameters should be adjusted only if the pre-set values are not suitable for your application. Erratic operation can occur if these values are adjusted. Use caution when adjusting these parameters. There are four sub-menus in the Advanced Menu system:

Group	Description
ACC	Controller accuracy menu
JoG	Jogging system menu
Prot	Controller protection menu
LPoL	Limit switch polarity menu

Operation of the keyboard and display during Advanced Setup is the same as for Basic Setup. To enter the advanced setup menu:

- 1) From normal operating mode, use the \bar{Y} or β keys until *in* is displayed.
- 2) Press and hold the **SELECT** key for 10 seconds.
- 3) The advanced menu is entered when the display shows **ACC**.
- 4) Use the \bar{Y} or β keys to display the sub-menu required, then press the **SELECT** key to enter the sub-menu.



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i. The Accuracy Menu [ACC]

The Accuracy Menu allows the adjustment of the controller's position accuracy, response time and calibration delay time.

The default configuration of the accuracy menu is:

1. The actuator will adjust to position within ± 1 division of full scale. This means that if the input is calling for 50%, the actuator will be positioned from 49% to 51% (**SACC**);
2. The controller is set to 100 divisions for full scale (**FSCL**), allowing for 1% accuracy;
3. Input signals less than 2% will cause the actuator to move towards 0% until the 0% limit switch turns off, regardless of the potentiometer signal (**FCLS**);
4. Input signals greater than 98% will cause the actuator to move towards full-scale until the full-scale limit switch turns off, regardless of the potentiometer signal (**FoPn**);
5. The actuator will wait for 5 seconds of no movement during calibration steps 4 and 5 before capturing values (**CALd**);
6. The response time (the time before the controller begins to move on a change in input signal) is set to 0.5 seconds (**hLdt**).

If these default values do meet the requirements for the actuator, they can be adjusted using the **ACC** menu.

Item	Description	Default	Range
SACC	<p>This value can be adjusted to increase or decrease the sensitivity of the controller to input signal changes. If more accurate positioning is required, reduce this value to 0. To reduce unwanted movement with a constantly changing input signal, increase this value.</p> <p>After adjusting this value, run the automatic calibration procedure. The automatic calibration will determine the optimum operation of the controller for the accuracy you have selected.</p> <p>Setting this value to zero may cause the controller to continuously move the actuator as it attempts to track very small input signal changes. In applications where high accuracy is required, but excessive actuator movement occurs, the response time can be increased to reduce the movement, see hLdt in this section.</p> <p>This value is in units of full-scale.</p>	1	0-1023



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Item	Description	Default	Range
FSCL	<p>This value determines the number of divisions used for full-scale. This divides the actuator travel into 100 divisions (1%). Most actuators cannot mechanically deliver accuracy better than 1%. The controller can accommodate accuracies in excess of 1 part in 200 (0.5%), but only on mechanical systems capable of this accuracy.</p> <p>The automatic calibration system uses this value to set full-scale for the potentiometer signal.</p> <p>If this value is adjusted, the following menu items will have to be adjusted to reflect the new full-scale setting: FoPn, iSPn, oSPn and FSPn.</p> <p>The automatic calibration system must be run after setting this value.</p>	100	0-1023
FCLS	<p>This setting insures the actuator will move to the limit switch for input signals close to 0. Setting this value to 1 or greater insures that the actuator will move to the 0% limit switch regardless of the potentiometer value.</p> <p>Setting this value to 0 disables the force full-closed feature.</p> <p>This value is in units of full-scale.</p>	2	0-4
FoPn	<p>This setting insures the actuator will move to the limit switch for input signals close to full-scale. Setting this value to 99 or less insures that the actuator will move to the full-scale limit switch regardless of the potentiometer value.</p> <p>Setting this value to full-scale disables the force full-open feature.</p> <p>This value is in units of full-scale.</p>	98	up to -4 from full scale
CALd	<p>During an automatic calibration sequence the controller waits for cessation of change from the potentiometer signal at step 3 (capture 0) and step 5 (capture full-scale). This timer is default set to 5 seconds. Certain actuators have long periods of inactivity while winding return springs or other failsafe devices or may have very long actuation times. Increasing this value will allow the controller to wait longer before assuming the actuator has stopped.</p> <p>The timer is calibrated in 0.1 second increments. Note the display does not show the implied decimal point.</p>	50	1-255



Item	Description	Default	Range
<i>hLdt</i>	<p>This timer forces a delay in the response of the controller to changing input signals. The input signal will have to have changed outside of the accuracy window for at least this length of time before a new move will begin. If the signal is moving in and out of the accuracy window, it must continuously remain outside of the accuracy window for at least this time before a new move will begin.</p> <p>In high accuracy applications this timer can be increased to reduce unwanted movements due to small input signal changes.</p> <p>In applications where quick response is important, this timer can be decreased. It is not recommended that this timer be decreased for high accuracy applications unless the actuator is designed for continuous duty cycle operation.</p> <p>This timer is calibrated in ac line half cycles or 8.33 milliseconds for 60hz and 10.0 milliseconds for 50hz. Note the display is in half-cycles.</p>	60	1-255

ii. The Jogging System Menu

During the automatic calibration sequence the controller determines if jogging is required to achieve the selected accuracy. Jogging is the use of time instead of potentiometer feedback to move the actuator. During calibration, the controller determines how early it must stop the actuator motor to achieve the input position. If the selected accuracy (**SACC**) is smaller than the early stop values, the controller will enable jogging and use timed pulses to accomplish small movements.

For example, if the actuator requires 2 divisions to stop and has an accuracy setting of 1 division, the controller will use timed pulses (jogging) for movements of 1 division or less. For larger movements it will use the potentiometer signal to determine the stop position. By using timed pulses the controller avoids over-running the position and allows for improved accuracy without hunting, especially for high speed actuators.

If jogging is enabled during calibration, the controller will also learn the correct time to move 1 division during calibration. After each jog, a delay is inserted to wait for the potentiometer signal to respond. The potentiometer signal is the final value used to determine if the actuator is in position.

The calibration system will disable jogging if it is not required.

The jogging system can be adjusted to allow for operation not anticipated by the automatic calibration system.



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Item	Description	Default	Range
Jon	<p>This value is the length of the timed motor run pulse. The value is determined automatically during calibration.</p> <p>This value should equal the time to move the actuator 1 division in the same direction as the last move.</p> <p>Most actuators have lash in their gearing systems. This lash creates a requirement for longer motor run times during a move in a direction opposite of the last move. A correctly adjusted jog on time will move the actuator 1 division during a same direction move. It may require several jogs for a single division move in the reverse direction. This is normal.</p> <p>Increasing this value from the calibration determined value may cause the actuator to be unable to achieve the required set-point.</p> <p>This timer is calibrated in ac line half cycles or 8.33 milliseconds for 60hz and 10.0 milliseconds for 50hz. Note the display is in half-cycles.</p>	20	0-255
JoFF	<p>The jog off time is time required for the accurate reading of the position potentiometer after a jog has completed.</p> <p>Setting this value too low will cause actuator hunting. Too large a value will unnecessarily delay movement. The default value of 2 seconds should be satisfactory for most applications.</p> <p>This timer is automatically set to 2 seconds by the calibration system should the calibration system determine that jogging is required.</p> <p>Setting this value to 0 will disable the jogging system.</p> <p>The timer is calibrated in 0.1 second increments. Note the display does not show the implied decimal point.</p>	10 (V1.00) 20 (V1.11/ V1.12)	0-255
hion	<p>This value is operational only on V1.00 software and is disabled in all later versions.</p> <p>This value set the upper limit for the jog on value. V1.00 software automatically adjusted the jog on value after each jog. This value determined the highest value the jog on time could be set to during adjustment.</p> <p>The value is set in jog on time units of ac line half cycles or 8.33 milliseconds for 60hz and 10.0 milliseconds for 50hz. Note the display is in half-cycles.</p>	40	0-255



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Item	Description	Default	Range
Loon	<p>This value is operational only on V1.00 software and is disabled in all later versions.</p> <p>This value set the lower limit for the jog on value. V1.00 software automatically adjusted the jog on value after each jog. This value determined the lowest value the jog on time could be set to during adjustment.</p> <p>The value is set in jog on time units of ac line half cycles or 8.33 milliseconds for 60hz and 10.0 milliseconds for 50hz. Note the display is in half-cycles.</p>	1	0-255

iii. The Protection Menu

The controller incorporates several measures to protect the actuator motor and mechanism from damage. An optional current sense system is also available.

The basic protection measures include maximum running time and a forced delay between moves. The over-current system allows for over-current monitoring and shutdown.

All protection systems disable further movement in the same direction after a fault is detected. Movements in the opposite direction can be initiated and reset the protection system.

Item	Description	Default	Range
tFLt	<p>This value is the maximum motor running time for the actuator. Set automatically to 10 seconds plus the actual running time determined during calibration.</p> <p>If this time is exceeded, the display will show f pn which indicates the actuator failed to reach position in the maximum allowed time.</p> <p>Setting this timer to 0 disables the timed protection system.</p> <p>This timer is calibrated in 1.0 second increments.</p>	60	0-255 V1.00/V 1.11 0-1023 V1.12
trnd	<p>This value is the minimum time delay imposed between movements. This timer allows the actuator motor to stop before each run, reducing motor heating. Do not set this timer shorter than the natural stopping time of the actuator motor.</p> <p>This timer is calibrated in 0.1 second increments. Note the display does not show the implied decimal point.</p>	10	0-255



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Item	Description	Default	Range
<i>hCUR</i>	<p>The controller has an optional current monitoring system. This value determines the maximum full load amps of the actuator motor.</p> <p>Set this value to an amount at least 5% above the loaded running amps for the motor. The <i>CSPn</i> setting allows for the scaling of the sensed current value. The running current of the motor can also be displayed using the <i>CSPn</i> function.</p> <p>This value is scaled as 0.00A. Note the display does not show the implied decimal point.</p>	200	0-1023
<i>tCUR</i>	<p>The controller has an optional current monitoring system. This value determines the maximum time that the actuator can exceed the preset full load amps <i>hCUR</i> of the actuator motor before a fault is declared. The display will indicate <i>fo</i> should this protection feature activate.</p> <p>This timer is calibrated in 1 second increments for V1.00 software and 0.1 second increments in V1.11 and later software versions. Note the display does not show the implied decimal point.</p>	0	0-255
<i>Cof</i>	<p>The controller has an optional current monitoring system. This value sets the zero offset for the current detection system. This value is automatically set during calibration.</p> <p>The value is adjusted by selecting the menu item, then adjusting the value to 0.</p> <p>The value is calibrated in 0.01A increments. Note the display does not show the implied decimal point.</p>	0	0-1022
<i>CSPn</i>	<p>The controller has an optional current monitoring system. This value adjusts the span of the current detection system.</p> <p>To set this value, select the menu item and then manually run the motor using a wire jumper or manual push button station. The display will indicate the running amps of the motor. The displayed value can be verified against a clamp-on or in-line ammeter. Use the keyboard to adjust the display to indicate the actual running current of the motor.</p> <p>This value is scaled as 0.00A. Note the display does not show the implied decimal point.</p>	n/a	0-1023



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iv. The Limit Switch Menu

The controller has relay controlled limit switch outputs. The actuator limit switches are always wired to open at the ends of travel. The relay outputs can be programmed to be either open or closed when at limit.

Item	Description	Default	Range
<i>oPoL</i>	Selects the polarity of the maximum input signal limit switch relay output contact, display of n.o. = normally open, n.c. = normally closed,	n.o.	n.o. / n.c.
<i>CPoL</i>	Selects the polarity of the minimum input signal limit switch relay output contact, display of n.o. = normally open, n.c. = normally closed	n.o.	n.o. / n.c.

9. Error Messages and Troubleshooting

The controller will display an error message when it is unable to complete a requested operation. The following table lists the operations and the associated error messages:

Message	Operation	Fault Description
<i>f pg</i>	Initial application of power	The controller has detected invalid firmware during the power on test process. The operation of the controller may be unpredictable. Do not operate a controller that displays this error message.
<i>f tb</i>	Initial application of power	The controller has detected a corrupted parameter table during the power on test process. During setup and calibration, the controller stores parameters to non-volatile flash memory. A checksum is also stored to verify the table. During the power on test process the parameters are recalled and the checksum verified. If the stored checksum does not match the contents of the recalled table, this message is displayed. To clear this error, see Section 3. Reloading the factory settings to rebuild the parameter table. After completing the factory reload, perform an automatic calibration. After verifying the operation of the controller, re-cycle the controller power. If the error message returns, the controller flash memory is damaged. Do not operate a controller that continues to display this error message after the above steps have been taken.
<i>f ee</i>	Pressing the SELECT key to save a value	The controller was unable to save a parameter to non-volatile memory. Do not operate a controller that displays this message.
<i>f pn</i>	During a positioning operation	<p>The controller was unable to reach position during a move operation. The following causes may have prevented the controller from reaching position:</p> <ol style="list-style-type: none"> 1. The move was to full open or full close and the controller end of travel limit switch did not open; 2. The end of travel limit switch for the direction of move requested has failed; 3. The actuator motor did not run when requested; 4. The actuator is jammed; 5. The controller's maximum motor running time (<i>tFLt</i>) is set to too short a value, this timer is set automatically during calibration; 6. The controller is not correctly calibrated, run the automatic calibration system. <p>The controller has four status lamps to assist in troubleshooting position faults. Verify that the limit switch lamp is on and that the run motor lamp turns on for the direction of move requested. See Section 10. Connection Drawings for a description of the status indicators.</p>



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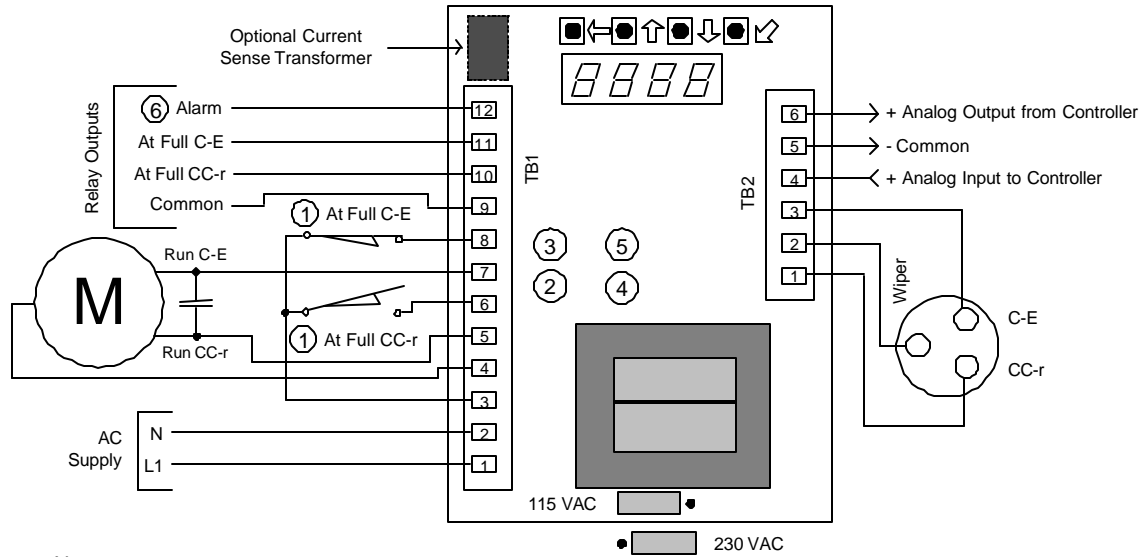
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f oc	During a positioning operation	During a positioning operation, a motor over-current condition has been detected. See Section 6. Setting the over-current protection system for details. If an f oc error occurs and you do not have the current sense option installed, see Section 3. Reloading the factory settings to rebuild the parameter table. This error can only occur by setting parameter tCur greater than 0, which enables current monitoring.
Incorrect position achieved	During a positioning operation	The controller is not correctly calibrated; see Section 6. The Automatic Calibration System for instruction on performing a calibration and possible problems that could occur during a calibration.

The following table describes the operation of the controller's display and status lamps:

Status Lamp	Operation
Lamp 2 rotn = CC-r	On when not at minimum signal limit
Lamp 2 rotn = C-E	On when not at maximum signal limit
Lamp 3 rotn = CC-r	On when not at maximum signal limit
Lamp 3 rotn = C-E	On when not at minimum signal limit
Lamp 4 rotn = CC-r	Motor must run while lamp on until at maximum signal limit
Lamp 4 rotn = C-E	Motor must run until at while lamp on until minimum signal limit
Lamp 5 rotn = CC-r	Motor must run until at while lamp on until minimum signal limit
Lamp 5 rotn = C-E	Motor must run until at while lamp on until maximum signal limit
4 Digit Display	Indicates actual position of the actuator in units of full-scale (Default setting is 0 – 100) Displays calibration menus; cleared by pressing Ü key until position is displayed

10. Connection Drawings



Notes:

1. Limit switches shown in the most CC-r position
2. Green lamp off indicates potentiometer at full CC-r
3. Green lamp on indicates potentiometer at full C-E
4. Red lamp on indicates motor running in CC-r direction
5. Red lamp on indicates motor running in C-E direction
6. Alarm output will be open when power off, if in fault or when display in menu mode

Figure 2 – External Connection Details

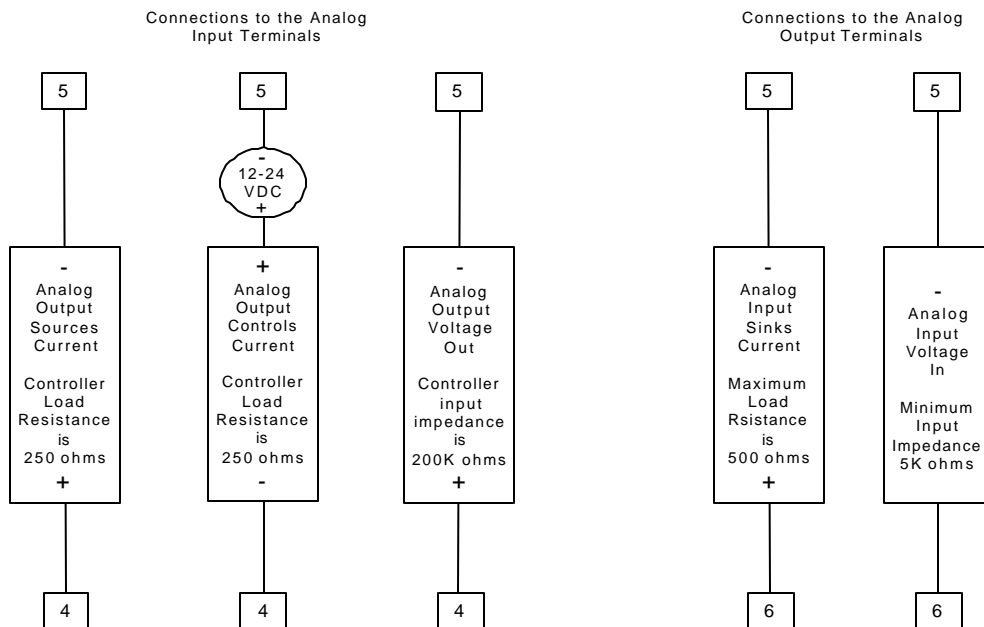


Figure 3 – Description of Analog Sources

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