

RCS and ANDCO Electric Actuators

Electric Actuator Controller

Microprocessor Based Analog & Digital Positioner
User Technical Manual

Models:

ACT100 – 115/230A

ACT100 - 24VAC

RCS™ and ANDCO™

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CAUTION

When manually operating the actuator, do not move actuator beyond the end of travel limit switch settings!

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 i.e. **CC-r** with upper and lower case letters used to simulate the actual display;
2. Keyboard keys will be shown using the **↑**, **↓**, **←** and **SELECT** symbols in bold;
3. Menu items will be indicated by the mnemonic shown on the controller's display.

First this manual will introduce the concepts required to setup a standard actuator. Other sections will cover the instructions for actuators requiring special settings.

b. Installation Notes

*Note 1: These instructions assume that the ACT board is installed in the actuator and that all **safety**, installation and Controller startup instructions outlined in the specific RCS and ANDCO installation and instruction manuals have been followed. Verify that the actuator is in correct operating condition before an attempt is made to calibrate the ACT board. With the exception of **Step 2.d. Positioning the potentiometer shaft and Step 2.e. Calibrating the controller**, the actuator does not move during the setup.*

Note 2: The Quick Setup instructions are correct for:

- Input signal requirements of 4-20 mAdc, 1-5 Vdc, 0-10 Vdc or 2-10 Vdc
- Output signal requirements of 4-20 mAdc, 1-5 Vdc, 0-10 Vdc or 2-10 Vdc
- To select Loss of input signal:
 - I. The actuator does not move,
 - II. Fails in last place.
 - III. For a setting of zero input signal, the system fails to minimum signal position.
 - IV. For all other options, refer to sections 4 - 7 of this manual.

Note 3: For rotary actuators: the terms “clockwise (C)” and “counterclockwise (CC)” refer to the direction of rotation of the actuator output shaft, as viewed from the top of the actuator. For linear actuators: the term “extend (E)”, applies to the rod moving away from the body of the actuator, and “retract (R)”, applies to the rod moving into the body of the actuator, refer to the direction of movement of the extension rod. The ACT is

*always wired as shown in Figure 2. Refer to **Figure 2** 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 **↑** or **↓** pushbutton until it is displayed, then press the **SELECT** key.
2. Press the **↑** or **↓** pushbutton 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** pushbutton to save the selection.

b. Setting the analog output type:

1. Use the **↑** or **↓** pushbutton until oUt is displayed, then press the **SELECT** key.
2. Press the **↑** or **↓** pushbutton 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** pushbutton to save the selection.

c. Selecting output shaft rotation:

1. Press the **↑** or **↓** pushbutton until rotn is displayed, then press the **SELECT** key.
2. Press the **↑** or **↓** pushbutton 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** pushbutton to save the selection.

d. Positioning the potentiometer shaft:

1. Press the **↑** or **↓** pushbutton until Pot is displayed, then press the **SELECT** pushbutton.
2. The display will change to show the actual potentiometer value in internal divisions (**0-1023**) and the **↑** or **↓** pushbutton 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 **↑** pushbutton to energize the actuator. 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 **↓** pushbutton 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** pushbutton to exit potentiometer setup.

e. Calibrating the controller:

1. Press the **↑** or **↓** pushbutton until **Cal** is displayed, then press the **SELECT** key.
2. Press the **↑** or **↓** pushbutton 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 **|** key. The calibration will be aborted and the previous calibration restored.

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 **←** push button 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 2** 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 **↑** or **↓** key until **io** is displayed, then press the **SELECT** key.
3. Set the process calibrator to the lowest input value.
4. Use the **↑** or **↓** key until **ioFt** is displayed, then press the **SELECT** key.
5. Use the **↑** or **↓** key 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 **↑** or **↓** key until **iSPn** is displayed, then press the **SELECT** key.
9. Use the **↑** or **↓** key 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 **←** 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 **↑** or **↓** key until **io** is displayed, then press the **SELECT** key.
3. Use the **↑** or **↓** key until **ooFt** is displayed, then press the **SELECT** key.
4. Use the **↑** or **↓** key 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 **↑** or **↓** key until **oSPn** is displayed, then press the **SELECT** key.
7. Use the **↑** or **↓** key 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 **←** 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 **↑** or **↓** key until **io** is displayed, then press the **SELECT** key.
2. Use the **↑** or **↓** key until **FSPn** is displayed, then press the **SELECT** key.
3. Use the **↑** or **↓** key to set the fail safe position to the required location. Setting the fail safe position to greater than full scale (101 standard), will enable fail in last position mode.
4. Press the **SELECT** key to save the selection.

b. Setting the Fail Safe Loss of Signal Threshold:

1. Use the **↑** or **↓** key until **io** is displayed, then press the **SELECT** key.
2. Use the **↑** or **↓** key until **Fsth** is displayed, then press the **SELECT** key.
3. Use the **↑** or **↓** key 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 (common) wire through the hole in the current sensor.

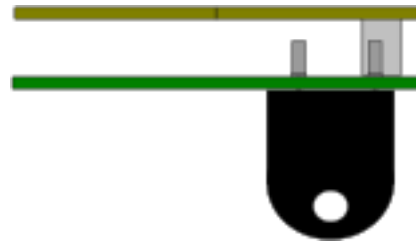


Figure 1 Location of the Current Transformer

The current protection 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, **foc** 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. Pressing any key on the keyboard can also clear the error.

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

Item	Description	Default	Range
hC_{Ur}	<p>This value determines the maximum full load amps of the actuator motor. 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
tC_{Ur}	<p>This value determines the maximum time that the actuator can exceed the preset full load amps hC_{Ur} 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
C_{of}t	<p>This value is automatically set during the calibration. 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 **↑** or **↓** key until **Cal** is displayed, then press the **SELECT** key.
2. Press the **↑** or **↓** 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 **←** key. The calibration will be aborted and the previous calibration restored.

b. Calibration Steps

The display will indicate the calibration step, **C 1** though **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 rotn = CC-r	Lamp 3 rotn = CC-r	Lamp 4 rotn = CC-	Lamp 5 rotn = CC-r
		Lamp 3 rotn = C-E	Lamp 2 rotn = C-E	Lamp 5 rotn = C-E	Lamp 4 rotn = C-
		(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 time, capture actuator potentiometer input span value	On	On until at maximum signal limit	Off	On until at 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. Green lamp 2 is off when at full C-E limit.
2. Green lamp 3 is off when at full CC-r limit.
3. When red lamp 4 is on the motor must run towards the full C-E limit switch.
4. When red lamp 5 is on the motor must run towards the CC-r 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 ⬅ 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 ⬆ key moves up one item within a menu tree. The ⬇ key moves down one item within a menu tree. The ⬆ 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 ⬆ up and ⬇ down keys adjust the value. The ⬅ 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
In	0-10	Sets analog input to 0-10 Vdc range	
	2-10	Sets analog input to 2-10 Vdc range	
	1-5	Sets analog input to 1-5 Vdc range	
	4-20	Sets analog input to 4-20 mAdc range	4-20 mAdc
OUT	0-10	Sets analog output to 0-10 Vdc range	
	2-10	Sets analog output to 2-10 Vdc range	
	1-5	Sets analog output to 1-5 Vdc range	
	4-20	Sets analog output to 4-20 mAdc range	4-20 mAdc
Rotn	CC-r	Maximum input signal moves actuator shaft to fully counter-clockwise or retracted.	CC
	C-E	Maximum input signal moves actuator shaft to fully clockwise or extended	
Pot		Pressing ↑ key moves actuator to increase potentiometer value. Pressing ↓ key moves actuator to decrease potentiometer value. Display shows actual potentiometer value from 10 – 1023	
CAL	No	Used to initiate a self-calibration. See Setup Instructions Section 6 – The Automatic Calibration System.	
Io	ioft	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 4 mAdc = 0%
	iSPn	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 20 mAdc = 100%
	ooFt	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% = 4 mAdc
	oSPn	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% = 20 mAdc
	FSth	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%
	FSPn	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)
	L-r	Set the unit in local or remote. The local setting must be used if you are not controlling the actuator using MODBUS or DeviceNet protocols. See Section 10 – Selecting Remote Operation.	L = local control
	bAUd	Set unit Mosbuss baud rate. See Section 10 – Selecting Remote Operation.	9600
	Addr	Set Modbus Network address. See Section 10 – Selecting Remote Operation.	1

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 **↑** or **↓** key 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 **↑** or **↓** key to display the sub-menu required; **ACC**, **JoG**, **Prot**, or **LPoL**, then press the **SELECT** key to enter the sub-menu.

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 not 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
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. 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 ensures the actuator will move to the limit switch for input signals close to 0. Setting this value to 1 or greater ensures 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 ensures the actuator will move to the limit switch for input signals close to full-scale. Setting this value to 99 or less ensures 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
hLdt	<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 [**JoG**]

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.

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(one) 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 adjusts the jog on value after each jog. This value determines 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
Loon	<p>This value is operational only on V1.00 software and is disabled in all later versions.</p> <p>This value sets the lower limit for the jog on value. V1.00 software automatically adjusts the jog on value after each jog. This value determines 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 [**Prot**]

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 to 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 that 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/ V1.11 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
hCUR	<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 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>The controller has an optional current monitoring system. 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
CofT	<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
CSPn	<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
PFth	<p>The controller has an optional “fail feedback signal system”. This parameter sets the threshold in units (%) of full scale. The default setting of 2 means the feedback signal will be in fault if it is less than or equal to -2 or greater than or equal to 102.</p> <p>To ensure the detection of an open wiper signal condition, connect a resistor of 33 kΩ between terminals 1 and 2 of terminal block TB2. When the sensor used has that resistance or less, it does not need the extra resistor if the circuit is not open.</p>	2	2 – 10
PFPn	<p>The controller has an optional “fail feedback signal system”. The following operations are available upon failure of the feedback signal:</p> <p>0 - disables the option, default setting. 1 - fail in place; 2 - move to minimum command signal position, closed; 3 - move to maximum command signal position, open.</p>	0	0 - 3

iv. The Limit Switch Menu [**LPoL**]


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
oPoL	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.
CPoL	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
f pg	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.
f tb	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.
f ee	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.
f pn	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 (tFLT) 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 11. Connection Drawings for a description of the status indicators.</p>
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 7. The Automatic Calibration System for instruction on performing a calibration and possible problems that could occur during a calibration.

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 minimum signal limit
Lamp 4 rotn = C-E	Motor must run while lamp on until at maximum signal limit
Lamp 5 rotn = CC-r	Motor must run while lamp on until at maximum signal limit
Lamp 5 rotn = C-E	Motor must run while lamp on until at minimum 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  key until position is displayed

10. Selecting Local/Remote Operation

There are 2 modes of operation of the actuator: Local and Remote. Two communication protocols are available in remote mode - Modbus and DeviceNet. Communication protocol for remote operation must be chosen at the time of ordering. The ACT100 actuator card has the Modbus option by default. Refer below section for Modbus Operation and next section for DeviceNet operation. In order to interface to MODBUS there are several communication parameters that need to be selected using the **Basic Parameter Menu**. These are:

a. Manual Operation (L-r)

- I. **L-r.** – Selects Local (Manual control of parameter selection) or **remote** (MODBUS) parameter selection. To manually return to Local operation, push any key for ten seconds until the display changes from **BUSS** to **L-r**.
- II. **Baud rate.**– Selects the communication speed of the device. While in the Basic Parameter Menu, scroll down until the display reads **baUd**. Press the **Select** key, then **Press the ↑ or ↓ key** to scroll thru the available options. These options are: **2400, 4800, 9600, 14,400**. Press the **Select** key to save the option you want.
- III. **Address.** - Selects the Modbus Network address for the ACT-100 unit. While in the Basic Parameter Menu, scroll down until the display reads **Address**. Press the **Select** key, then **Press the ↑ or ↓ key** to increase or decrease the address number until you have the value that you want. The options are: **1-255**. Press the **Select** key to save the option you want.
- IV. **Br.**– Selects the activation point for the SURE POWER Brake. Either Fully Open or Fully Closed. scroll down until the display reads **Br**. Press the **Select** key, then **Press the ↑ or ↓ key** to scroll thru the available options. These options are: **Cr** or **Ce**. Press the **Select** key to save the option you want.

b. Remote Operation Configuration Registers.

- I. **ZERO OFFSET** write to register **0x16 (22 decimal)**.
- II. **SPAN** write to register **0x17 (23 decimal)**.
- III. **OPEN LIMIT TOLERANCE** write to register **0x19 (25 decimal)**.
- IV. **CLOSE LIMIT TOLERANCE** write to register **0x1A (26 decimal)**.
- V. **CONFIG PEAK CURRENT** write to register **0x1B (27 decimal)**.
- VI. **IDLE CURRENT** write to register **0x1C (28 decimal)**.
- VII. **JOG MOVE TOLERANCE** write to register **0x1D (29 decimal)**.
- VIII. **JOG WAIT TIME** write to register **0x1E (30 decimal)**.
- IX. **JOG OPEN TIME** write to register **0x1F (31 decimal)**.
- X. **LOAD ZERO OFSETT** read from register **0x20 (32 decimal)**.
- XI. **LOAD SPAN** read from register **0x21 (33 decimal)**.

c. Remote Operation Commands (BUSS)

- II. **BUSS.** – Unit is in remote mode (MODBUS). To switch back and forth between Local (L-r) and remote (BUSS) write any value to register **0x35 (53 decimal)**.
- XIII. **FULL OPEN** write any value to register **0x01 (01 decimal)**.
- XIV. **STOP** write any value to register **0x02 (02 decimal)**.
- XV. **CALIBRATE** write any value to register **0x03 (03 decimal)**.
- XVI. **RESET** write any value to register **0x04 (04 decimal)**.
- XVII. **LOAD DEFAULTS** write any value to register **0x05 (05 decimal)**.
- XVIII. **PROTECT PARAMETERS** write any value to register **0x06 (06 decimal)**.
- XIX. **REMOVE PARAMETER PROTECTION** write any value to register **0x07 (07 decimal)**.
- XX. **TOGGLE OVERLOAD RESTART** write any value to register **0x09 (09 decimal)**.
- XXI. **FULL CLOSE** write any value to register **0x2F (47 decimal)**.
- XXII. **LOCAL REMOTE SELECT** write any value to register **0x35 (53 decimal)**.
- XXIII. **GO TO XX** write any value BETWEEN 0-MAX (0-100) to register **0x36 (54 decimal)**.

d. Parameters Available by READ Commands.

- I. CURRENT POSITION (2 bytes)** read register 0x0A
(10 Decimal). Returns current position of the shaft.
- II. PEAK CURRENT (2 bytes)** read register 0x0C
(12 decimal). Returns maximum current read.
- III. CURRENT NOW (2 bytes)** read register 0x0D
(13 decimal). Returns most recent current reading.
- IV. PREVIOUS DIRECTION (1 byte)** read register 0x0E
(14 decimal). Returns the last direction the shaft was moving.
- V. LOCAL REMOTE (1 byte)** read register 0x0F
(15 decimal). Returns whether the device is in Local or Remote mode (True/False).
- VI. LAST SEEK VALUE (2 bytes)** read register 0x10
(16 decimal). Returns the last value that the shaft was supposed to move to.
- VII.OVERLOAD (1 byte)** read register 0x12
(18 decimal). Returns whether the device is in overload (True/False).
- VIII. RESTART OVERLOAD STATUS (1 byte)** read register 0x0E
(14 decimal). Returns restart overload status setting.
- IX. LOG TIME (2 bytes)** read register 0x0E
(14 decimal). Returns

e. DeviceNet Operation.-

If the ACT-100 PCB includes the DeviceNet Interface Board (DIB), the device will default to remote mode.

The following are the switch (S1) settings for the DIB in order to select the device address and to set the Communication speed (Baud Rate): See Figures 1 and 2 for wiring diagram for ACT-100 and DeviceNet card.

set device address (0 - 63) S1-1 (MSB) thru S1-8 (LSB)

set device baud rate (0 - 3) S1-9 (MSB) and S1-10 (LSB)

00 = 125K

01 = 250K

02 = 500K

03 = NV

NOTE: For wiring between ACT-100 PCB and DeviceNet Interface Board, wire per table below

ACT-100 PCB	DeviceNet InterfaceBoard (DIB)	Signal
Pin 1	Pin 1	\overline{DO}
Pin 2	Pin 2	DO
Connect SHLD to one end		

For example, to set address 9 with a baud rate of 250K the switch would set as follows:

1	0
2	0
3	0
4	0
5	0
6	1
7	0
8	1
9	0
10	1
S1	

Switch position 1234 5678 910

Switch setting 0000 0101 01

Connect CAN network to J13. Power to board has to be provided by CAN network (7 - 30VDC). Note: ACT-100 normal AC power connection is required. Power to J13 is only from the CAN bus.

V+	CanH	SHLD	CanL	V-
----	------	------	------	----

Upon CAN bus power up: LED's flash green-red consecutively (M LED for "module", N LED for "network", A LED for "actuator")

Once communications with the network is established the "M" and "N" LED are on green. The "A" LED changes color and flashes per actuator direction and motion as per table below

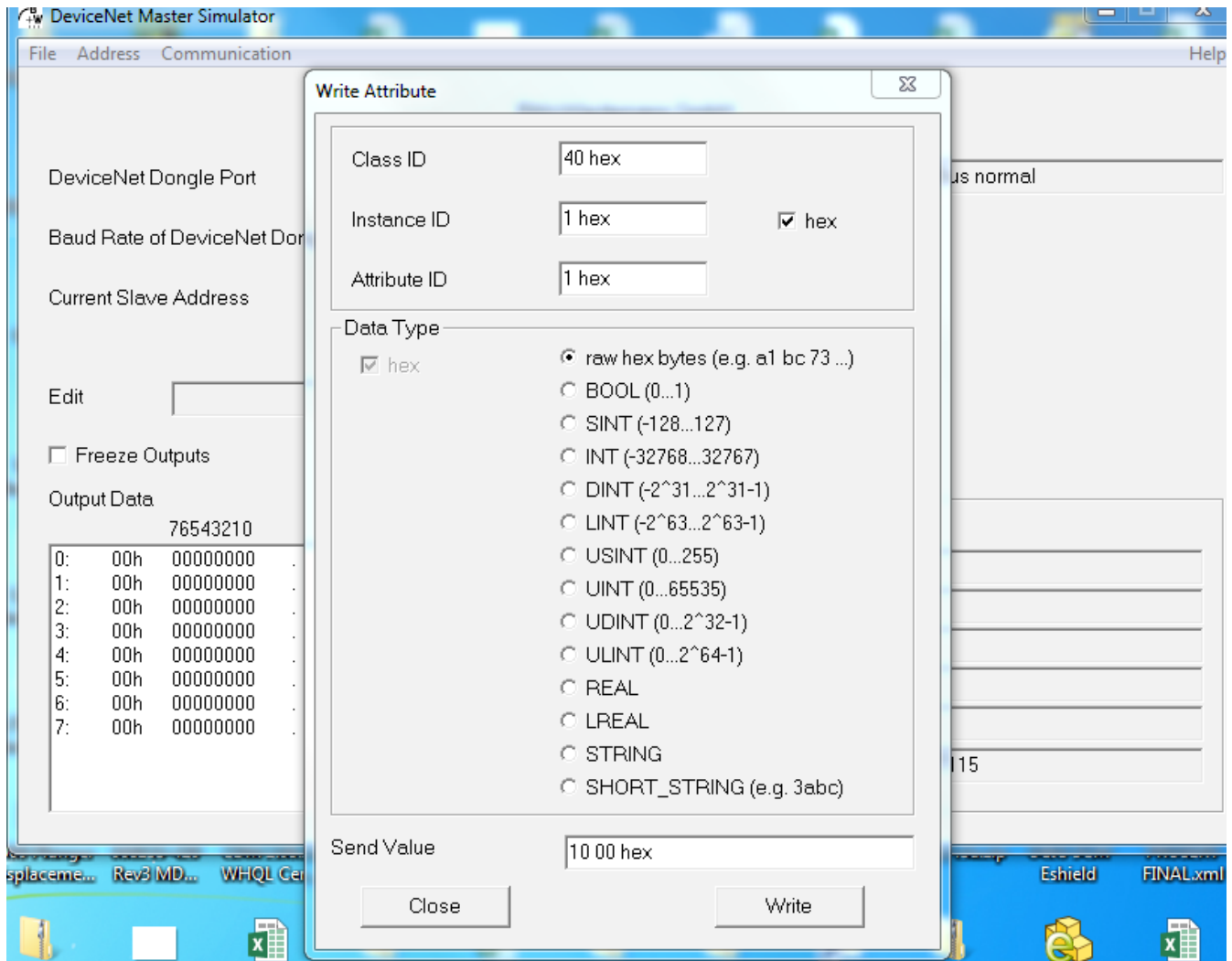
Color	Actuator Indication
RED	Actuator at OL
Blinking RED	Actuator moving OPEN
GREEN	Actuator at CL
Blinking GREEN	Actuator moving CLOSE
RED/GREEN	Actuator STOPPED

Command Words:

At Class 0x40, instance 0x01 and attribute 0x01:

- bit 1 open actuator
- bit 2 close actuator
- bit 3 stop actuator
- bit 4 “remote shutdown” (actually also stop)
- bit 5 calibrate
- bit 6 reset (also stop)

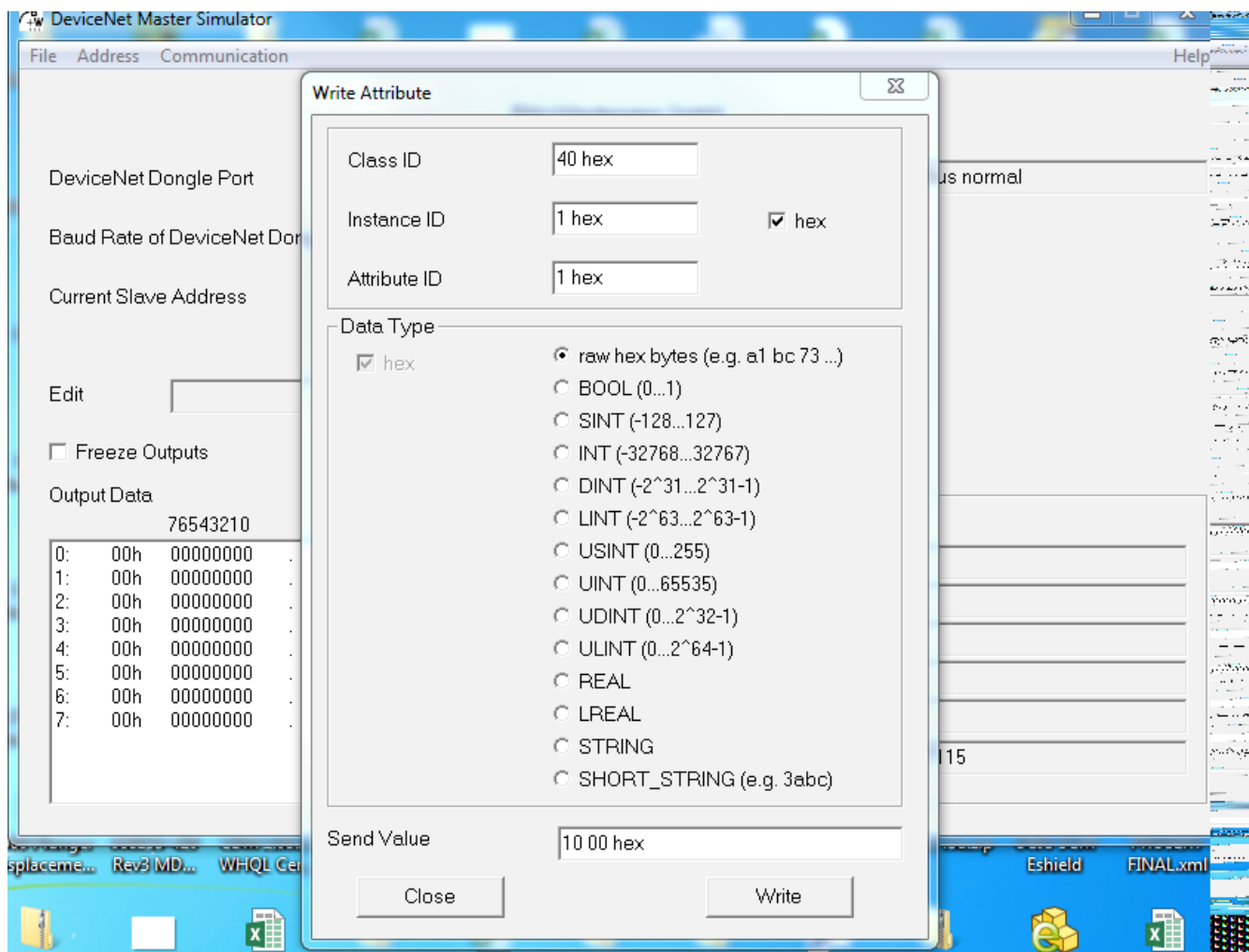
To calibrate the ACT-100 simply issue the command CALIBRATE by setting bit 5 of the command word 0x40, instance 0x01, and attribute 0x01 to “1”. See example below.



Setpoint Words:

At class 0x40 instance 0x01 and attribute 0x02 (forces actuator to specific position). Format 0 - 100%.

See example below for instruction of moving the actuator to 100% (64 Hex).



Status Word:

At class 0x40 instance 0x01 and attribute 0x03 has bit mapped actuator status

- bit 1 open limit reached
- bit 2 closed limit reached
- bit 3 remote mode (will be forced into this mode if deviceNET board is connected to ACT).
- bit 4 local mode
- bit 5 act running open
- bit 6 act running closed
- bit 7 esd active
- bit 8 commanded open
- bit 9 commanded closed

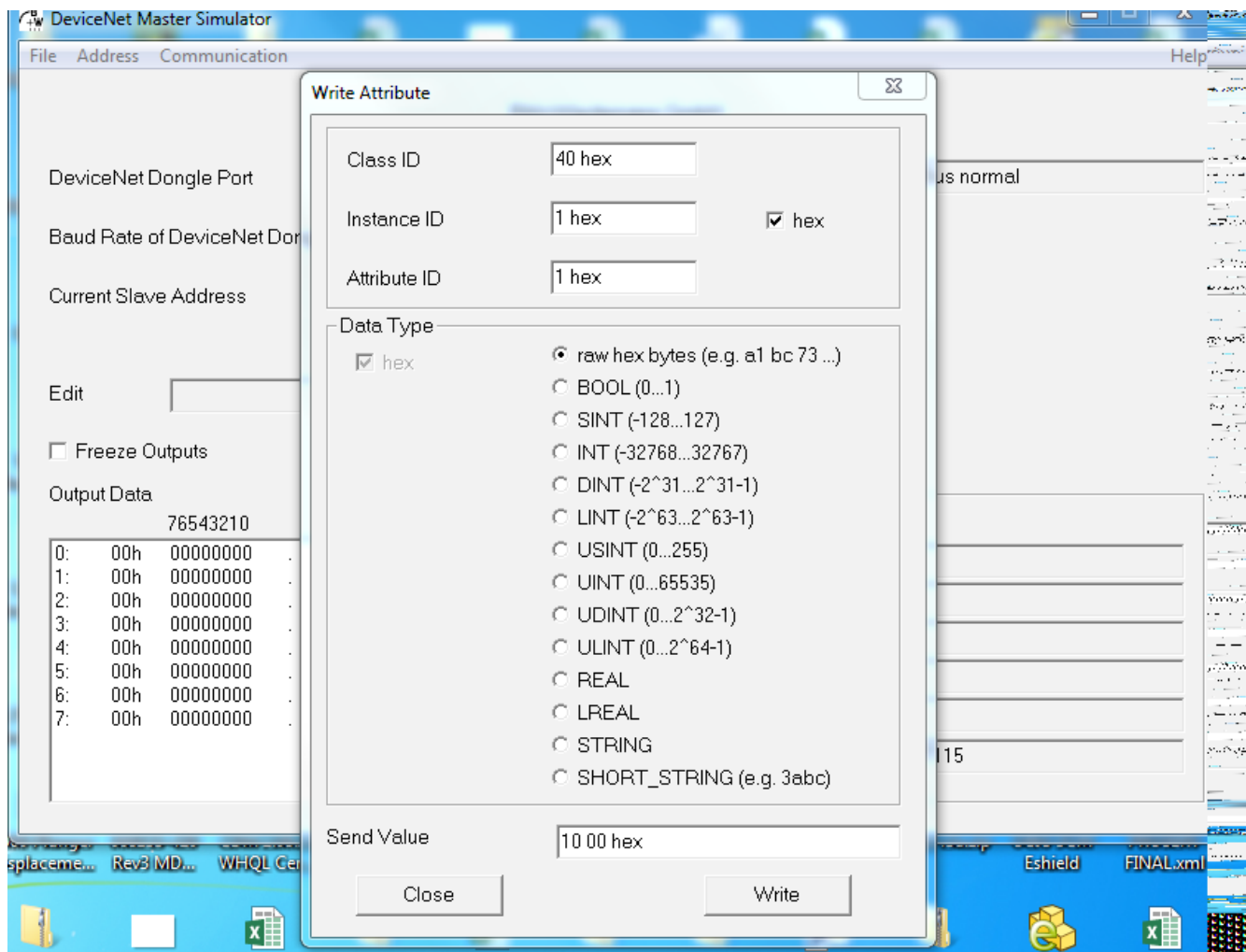
Alarm Word:

At class 0x40 instance 0x01 and attribute 0x04 reads error register from ACT-100 board.

Position:

At class 0x40 instance 0x01 and attribute 0x05 gives you the actuator position in 0 - 100 % format

See example below for instruction to move actuator to 100%.
(64 Hex)



Analog Input:

At class 0x40 instance 0x01 and attribute 0x06 from ACT board.
Deadband Number at class 0x40 instance 0x01 and attribute 0x07 reads/write SACC value of ACT board.

Reversal Delay

At class 0x40 instance 0x01 and attribute 0x0D reads/writes HLDT value of ACT board.

Dimage0

At class 0x40 instance 0x01 and attribute 0x14 gives the 4 digital inputs on J1 and J2 (open reads 1)

J2	GND	DI4	GND	DI3	GND	DI2	GND	DI1	J1
----	-----	-----	-----	-----	-----	-----	-----	-----	----

At class 0x40 instance 0x01 and attribute 0x15 gives the address from S1 (0x000000 to 0x111111)

At class 0x40 instance 0x01 and attribute 0x16 gives baud rate from S1 (0x00 to 0x11).

At class 0x40 instance 0x01 and attribute 0x18 gives position in ADC counts 12-bit format (0x000 to 0xFFF).

At class 0x40 instance 0x01 and attribute 0x01 from ACT board.

Connection Drawing ACT-100



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

Connection Drawing DeviceNet and ACT100

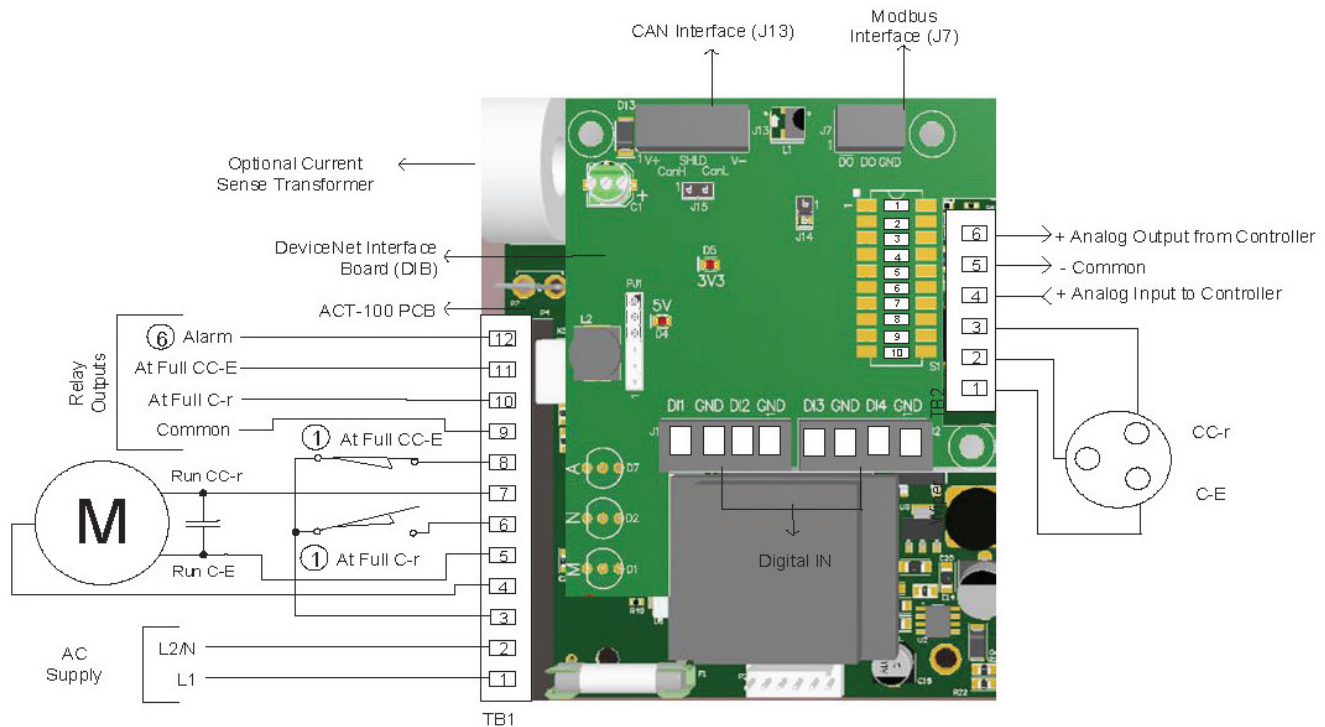


Figure 2 - DeviceNet Card [ACT100+Devicenet Interface Board]

Connection Drawings

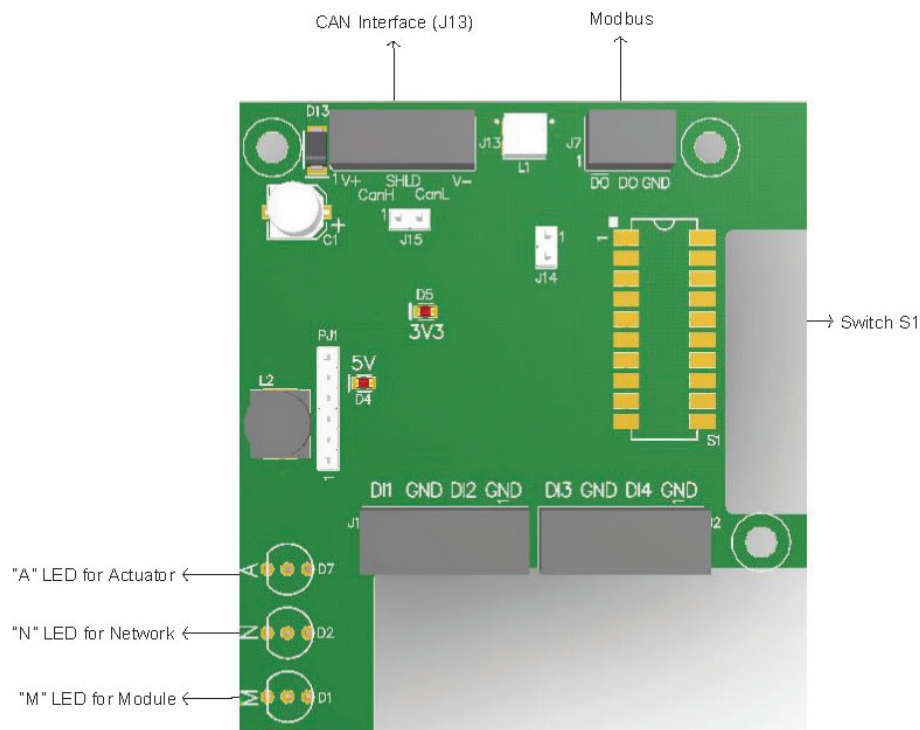


Figure 3 - DeviceNet Interface Board

Connections to the customer Analog input terminals

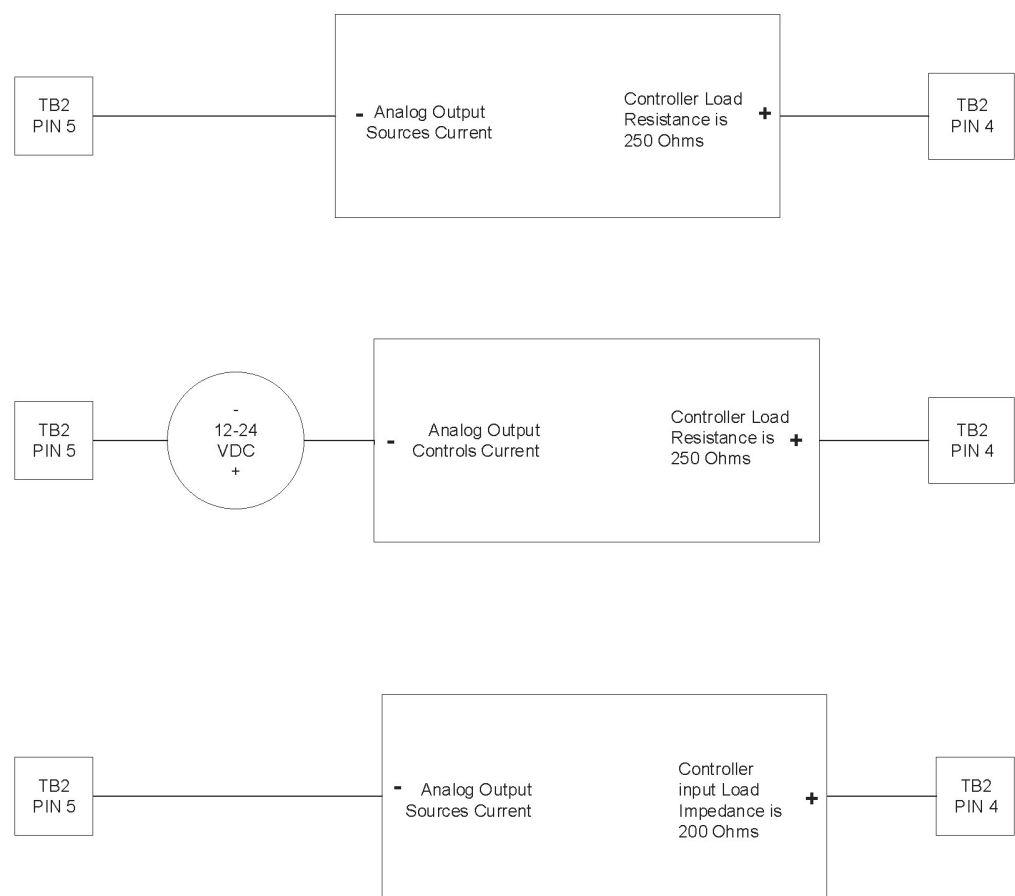


Figure 4 - Connections to the customer analog input terminals

Connections to the customer Analog Output terminals

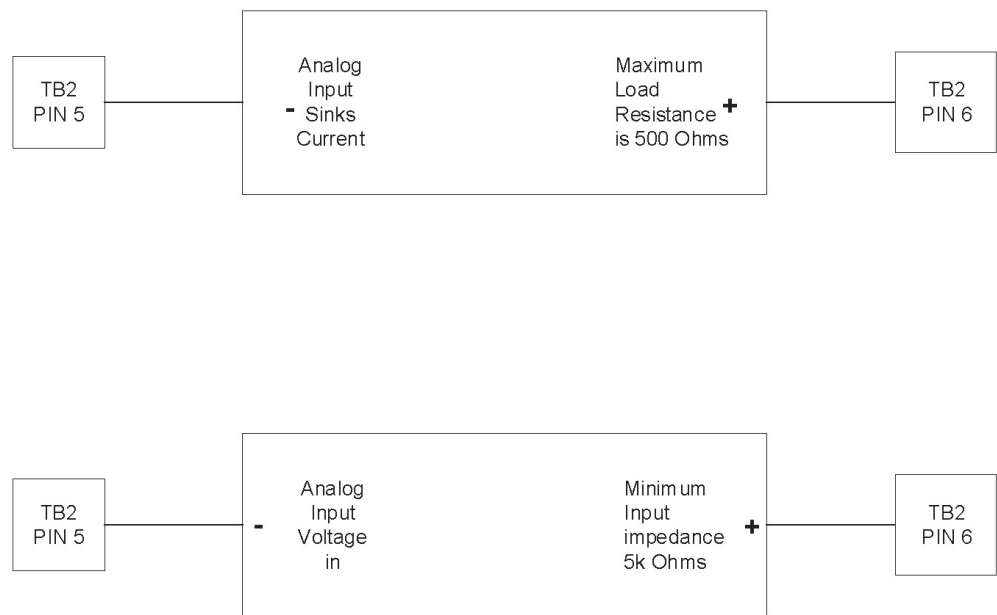


Figure 5 - Connections to the customer analog output terminals

DIRECT SALES OFFICE LOCATIONS

AUSTRALIA

Brisbane:
Phone: +61-7-3001-4319
Fax: +61-7-3001-4399

Perth:
Phone: +61-8-6595-7018
Fax: +61-8-6595-7299

Melbourne:
Phone: +61-3-8807-6002
Fax: +61-3-8807-6577

BELGIUM
Phone: +32-2-344-0970
Fax: +32-2-344-1123

BRAZIL
Phone: +55-19-2104-6900

CHINA
Phone: +86-10-5689-3600
Fax: +86-10-5689-3800

FRANCE
Courbevoie
Phone: +33-1-4904-9000
Fax: +33-1-4904-9010

GERMANY
Ratingen
Phone: +49-2102-108-0
Fax: +49-2102-108-111

INDIA
Mumbai
Phone: +91-22-8354790
Fax: +91-22-8354791

New Delhi
Phone: +91-11-2-6164175
Fax: +91-11-5-1659635

ITALY

Phone: +39-081-7892-111
Fax: +39-081-7892-208

JAPAN

Tokyo
Phone: +81-03-6871-9008
Fax: +81-03-6890-4620

KOREA

Phone: +82-2-2274-0748
Fax: +82-2-2274-0794

MALAYSIA

Phone: +60-3-2161-0322
Fax: +60-3-2163-6312

MEXICO

Phone: +52-55-3640-5060

THE NETHERLANDS

Phone: +31-15-3808666
Fax: +31-18-1641438

RUSSIA

Veliky Novgorod
Phone: +7-8162-55-7898
Fax: +7-8162-55-7921
Moscow
Phone: +7-495-585-1276
Fax: +7-495-585-1279

SAUDI ARABIA

Phone: +966-3-341-0278
Fax: +966-3-341-7624

SINGAPORE

Phone: +65-6861-6100
Fax: +65-6861-7172

SOUTH AFRICA

Phone: +27-11-452-1550
Fax: +27-11-452-6542

SOUTH & CENTRAL AMERICA AND THE CARIBBEAN

Phone: +55-12-2134-1201
Fax: +55-12-2134-1238

SPAIN

Phone: +34-93-652-6430
Fax: +34-93-652-6444

UNITED ARAB EMIRATES

Phone: +971-4-8991-777
Fax: +971-4-8991-778

UNITED KINGDOM

Bracknell
Phone: +44-1344-460-500
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