MODULAR UNIVERSAL ACTUATOR
Instruction Manual

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Version 2 : 04-2023

APPLICABLE MODELS

This manual is applicable to the following models:

UMH
UMD
UMT

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1. INTRODUCTION

1.1. Description

The VICI universal actuator models are designed to work with both two position and multiposition valves, with any number of ports. This is accomplished through simple programming via the manual remote or the serial port.

The actuator consists of a stepper motor/gearbox assembly, a separate electronics Control Module, a universal AC input (100-240 VAC, 50-60 Hz) to 24 VDC 2.5 amp power supply, a manual remote, and cables. See figure in Section 1.5.

Actuator control can be accomplished in four different ways: 1. by use of the Manual Remote controller buttons; 2. through one of two selectable serial interface options, either RS-232 or half duplex (two wire) RS-485; 3. by use of two digital (TTL) input pins on a six pin header; or 4. by use of an optional BCD (TTL I/O) board.

1.2. Getting Started

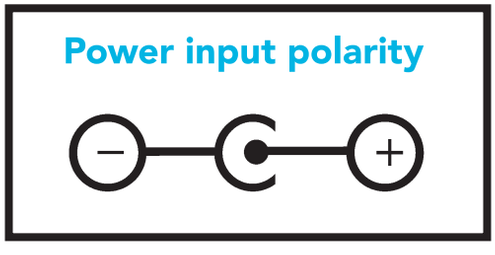
If you ordered a valve and actuator together and will be operating the unit solely with the manual remote, this section of the document contains the basic information you need to use the valve and actuator. If you will be controlling the actuator via the standard interface or one of the optional interfaces, refer to the Table of Contents to locate the appropriate chapter. OEM users might find useful information in Appendix A: Setup Mode: Using the Manual Remote to Configure the Actuator. See Sections 6 and 7.

1.2.1. Mounting

The actuator should be oriented so that any potential leakage of liquid from the valve or the fittings flows away from rather than into the actuator. Appendix B: Mounting and Dimensions. See Section 8.

1.2.2. Power

24-28 VDC is supplied through a 2.5 x 5.5 x 9MM barrel connector with center pin positive. The positioning current requirements can vary from 2.1 to 2.5 amps; standby current draw is typically 80 - 120 milliamps. The actuator should not share a power supply with other noise-sensitive electronics, as the high current draw could cause problems for other devices.



1.2.3. Actuator Output Torque

Actuator torque and speed are functions of the specific actuator assembly, which are designated as Models UMH, UMD and UMT, in order of increasing torque/ decreasing speed. All models have different gearboxes which provide differing speed and torque values. See the table below.

ACTUATOR MODEL	MAX RECOMMENDED TORQUE LOAD
UMH	10 lb/in (1.1 Nm)
UMD	22 lb/in (2.5 Nm)
UMT	45 lb/in (5.0 Nm)

1.3. Multiposition Valve Switching Times

The time it takes to step a valve from one position to another depends upon the actuator model, the number of positions for which the actuator is set, and the total amount of rotation involved. Actual times can be computed from the tables below.

1.4. Two-Position Valve Switching Times

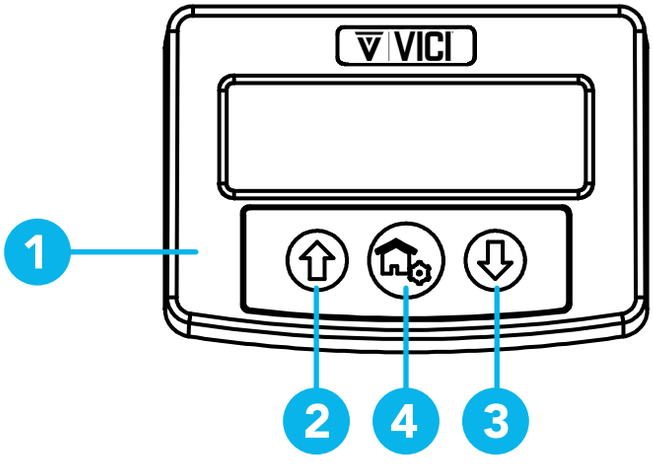
The actual time required to switch the valve from Position A to Position B, as seen in the table below, depends on two factors: the model number (reflecting the actuator speed) and the degree of rotation between positions. The move times accuracies are +/- 10ms and may vary with direction changes.

VALVE	UMH (high speed/low torque)		UMD (midrange speed/torque)		UMT (low speed/high torque)	
Number of positions	Single position move time	Move time per each additional port	Single position move time	Move time per each additional port	Single position move time	Move time per each additional port
4	235 mSec	215 mSec	545 mSec	525 mSec	870 mSec	790 mSec
6	160 mSec	145 mSec	370 mSec	345 mSec	610 mSec	525 mSec
8	125 mSec	105 mSec	280 mSec	265 mSec	475 mSec	395 mSec
10	105 mSec	85 mSec	230 mSec	215 mSec	405 mSec	315 mSec
12	85 mSec	75 mSec	195 mSec	175 mSec	345 mSec	270 mSec
16	75 mSec	65 mSec	150 mSec	135 mSec	280 mSec	195 mSec

1.4.1. Basic Operation with the Manual Remote

The manual remote provides simple valve positioning capabilities, but in the setup mode, it can also be used to execute extensive actuator setup functions. For more information, refer to Setup Mode: Using the Manual Remote to Configure the Actuator. See Sections 6 and 7.

Do not attempt to enter the setup mode by holding down the two arrow buttons, as with the Microelectric actuator.



Display

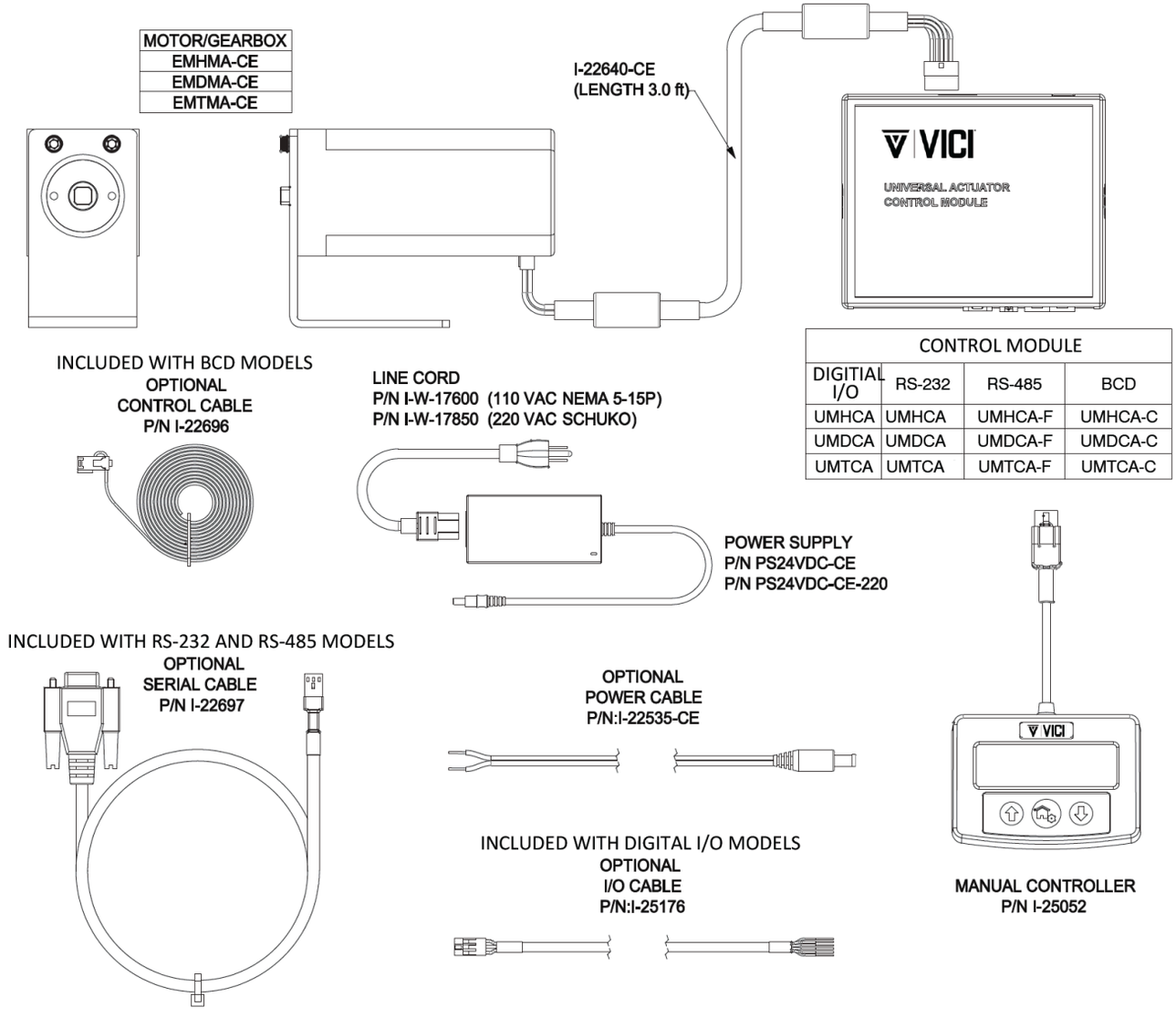
UP arrow button: In the *two position mode*, pressing the UP arrow button moves the actuator to Position B. If it is already in Position B, nothing happens. In *multiposition mode*, pressing the UP arrow button advances the actuator one position, i.e., from 1 to 2, 4 to 5, etc.

DOWN arrow button: In the *two position mode*, pressing the DOWN arrow button moves the actuator to Position A. If it is already in Position A, nothing happens. In *multiposition mode*, pressing the DOWN arrow button reverses the actuator one position, i.e., from 2 to 1, 5 to 4, etc.

HOME/SETUP button: In the *two position mode*, pressing the HOME button moves the actuator to Position A. If it is already in Position A, nothing happens. In *multiposition mode*, pressing the HOME button sends the actuator to Position 1. Pressing and holding the HOME/SETUP button for 5 seconds sends the manual remote into the Setup mode. (See Sections 6 and 7).

Pressing and holding the HOME button for 5 seconds sends the manual remote into the setup mode. If this occurs unintentionally, press the UP arrow to escape and return to normal operation. Changing settings in this mode can cause the unit to be inoperable.

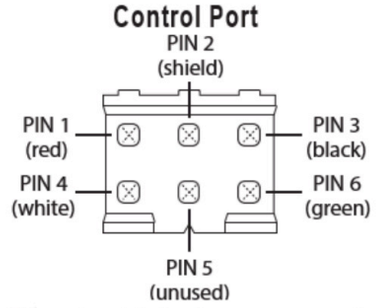
1.5. Modular Universal Actuator Components



CONTROL MODULE			
DIGITIAL I/O	RS-232	RS-485	BCD
UMHCA	UMHCA	UMHCA-F	UMHCA-C
UMDCA	UMDCA	UMDCA-F	UMDCA-C
UMTCA	UMTCA	UMTCA-F	UMTCA-C

2. CONTROL PORT FUNCTIONS

Basic actuator control functionality facilitates position switching in two position mode, and STEP and HOME functions in the multiposition mode. This is done via direct input signals from switch closures, relay contacts, or TTL-compatible interfaces. The control cable has six pins: however, only five are used.



Standard interface connector
(colors reference cable I-25176)

2.1. Two position modes

Pins 4 and 6 are digital inputs for switching valve positions. They remain high when not active but are activated by a low input signal from a 3.3-5VDC TTL/CMOS logic output, by an activated open-collector output, or by contact closure to ground (pin 2). These input signals must be applied for a minimum of 25 mSec to initiate a move. The switching functions are established by the SM settings “1” through “4” and are defined under Digital Input Modes in Section 2.1.1.

Position feedback can be read from the A and B outputs. These are 5VDC tolerant, 3.3VDC outputs, sourcing and sinking a maximum of 10 milliamperes each. An output will go high (3VDC) when the valve reaches the respective position.

PIN #	MULTIPOSITION FUNCTIONS
1	Motor Run output
2	Common
3	Home output
4	Home input
5	Unused
6	Step input

PIN #	TWO-POSITION FUNCTIONS
1	A output
2	Common ground
3	B output
4	A input
5	Unused
6	B input

2.1.1 Two position modes

Digital Input Modes:

Four input mode options are provided to expand the control flexibility of the actuator. The factory default setting is Mode 1. All four modes are described below. The mode is set via the serial port using the SMn command and is retained even when the power is cycled to the controller. See the serial commands section on Section 3.7. for details. NOTE: Changing the input mode does not affect the digital output functions.

Mode 1 (dual signal control mode)

In mode 1 (default) the digital inputs use the two input signals for position control. Asserting input pin 4 causes the actuator to go to Position A, and asserting input pin 6 sends it to Position B.

Mode 2 (single signal toggle mode)

Operation in this mode uses a single signal for position control with two options. Asserting pin 4 causes the actuator to toggle from the current to the opposite position. Asserting pin 6 causes the actuator to toggle to the opposite position, delay for a user settable period of time (the default is 1000 mSec), then toggle back to the original position. The delay time is set using the DTn serial port command. See the serial commands Section 3.3. for details.

Mode 3 (state mode with enable)

This mode uses the pin 4 input as a state input, meaning that a low signal (asserted) on pin 4 causes the actuator to move to Position A. A high signal (deasserted) on pin 4 causes the actuator to move to Position B. Pin 6 is used as an enable/disable pin to prevent startup irregularities. The actuator is normally disabled when pin 6 is in its high (deasserted) state; it must be pulled low (asserted) to enable the actuator to move.

Mode 4 (state mode with disable)

This mode differs from Mode 3 only in the status of pin 6. As in Mode 3, a low signal (asserted) on pin 4 causes the actuator to move to Position A and a high signal (deasserted) on pin 4 causes the actuator to move to Position B. However, in Mode 4 the actuator is normally enabled when pin 6 is in its high (deasserted) state. It is disabled only when pin 6 is pulled low (asserted), which is the opposite of how pin 6 works in Mode 3.

Mode Setup:

To set the actuator mode, connect it to a serial port as described in the section establishing Serial Communications on page 9 and 10. To see the current setting, enter the SM command as shown in the Serial Commands chart on page 19. To change the mode, enter SMn, where n is a number between 1 and 4. Mode settings are saved when the actuator is powered off.

2.2. Multiposition modes

2.2.1. Step Command

Applying a 25 mSec low signal to the "Step" input pin causes the actuator to move to the next position in the currently-set direction of rotation.

2.2.2. Home Command

Applying a 25 mSec low signal to the "Home" input pin causes the actuator to go to the HOME position (position 1), moving in the currently-set direction of rotation. Feedback is obtained from the Motor Run and Home output pins. The Motor Run output (pin 1) goes low when the motor is running, and the Home output (pin 3) output goes low when the valve is in the HOME position.

For all modes: asserting or reasserting a digital input during a move can cause the move to be aborted and the new position to become the target. Asserting a position multiple times during a move can cause a positioning failure.

3. SERIAL PORT CONFIGURATION

Models UM(x)A and UM(x)C have been factory-preset for RS-232; Models UM(x)F are set for RS-485. An RS-232 model can be changed to an RS-485 model, or vice versa, by setting the internal serial port configuration jumpers as described below.

To access the COMM and TERM jumper boards:

Grip the lower section of the control module enclosure on the two opposing sides that have the curved release tabs.

With the top cover facing upwards, carefully depress the tabs while lifting the top cover upwards with the other hand. We recommend that the enclosure be opened in a static free environment, following all proper ESD protection techniques. CAUTION: Once the control module cover has been removed, the printed circuit board can fall out.

3.1. Serial Communication Protocol

Serial communication is based on an ASCII string protocol. A Carriage Return (OD hex) or a Line Feed (OA hex) character parse the communications by defining the end of each command. Two serial connectors, connected to one internal serial port are provided for multidrop applications. Software flow control (Xon/Xoff) and hardware handshaking are not supported. Section 3 describes and explains all the commands available. A more complete explanation follows in the Serial Command table in Section 3.7.

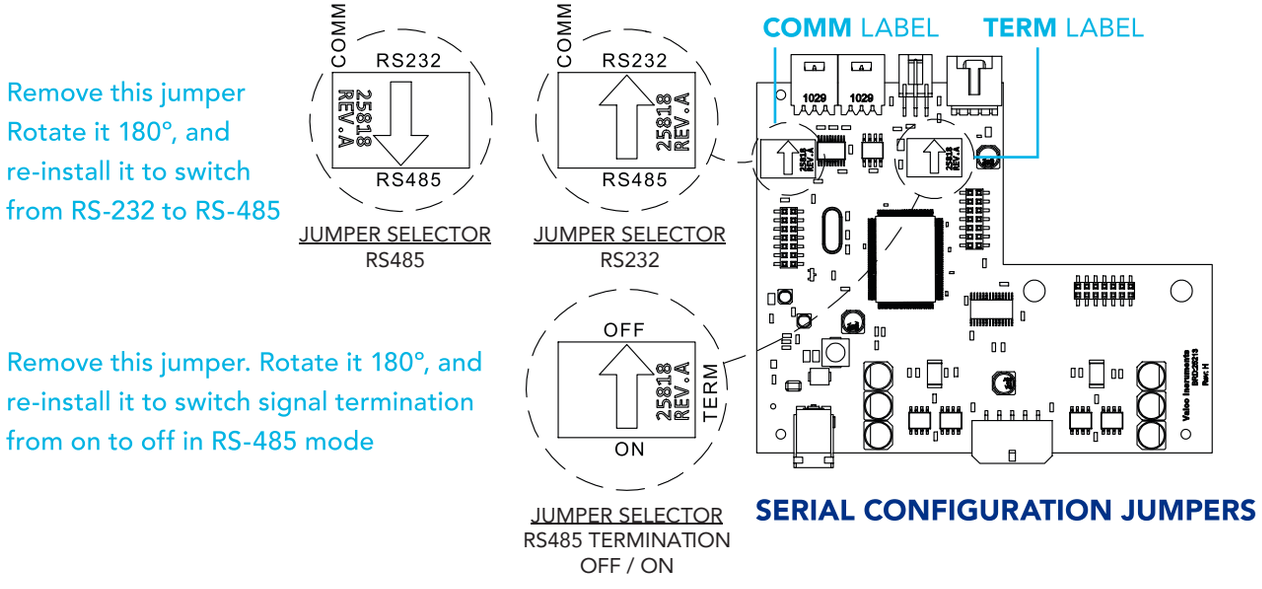
PIN #	RS-232	RS-485	DB9*
1	Ground	Ground	5
2	Transmit to host	A (–)	2
3	Receive from host	B (+)	3

** These pin numbers are used in the VICI cable I-22697*

3.2. Switching serial modes

As discussed in the "Using the Device ID Feature" in Section 3.4, all RS-485 communications require an ID. If the actuator has had an ID set previously, that ID will be recalled and retained. Otherwise, the ID will be set to the factory default value of "Z".

When switching from RS-485 to RS-232, the ID used in the RS-485 mode will be retained, and if not required must be cleared using a serial port ID command. To clear any ID, the wildcard ID can be used. Example: "*ID*" where the first "*" addresses all devices on the serial port, and where the second "*" clears all RS-232 devices addressed.



3.3. Establishing Serial Communication

Serial communications with the device can be established using terminal emulation software (such as PuTTY or CoolTerm) running on a PC or compatible computer. Set the serial port parameters to the factory default of 9600 baud, no parity, 8 data bits, 1 stop bit, no hardware or software handshaking.

3.4. Serial Command Table

SERIAL COMMANDS		
COMMAND	**MODES***	**DESCRIPTION**
AL<enter>	2, 3	Moves the actuator drive shaft to the reference position prior to valve installation
AM<enter>	1, 2, 3	Displays the current actuator mode
AM*n*<enter>	1, 2, 3	Sets the actuator mode to [1] two position with stops, [2] two position without stops, or [3] multiposition
CC<enter>	1, 2	Sends the actuator from Position A to Position B
	3	Decrements the actuator one position. (For example, from position 5 to position 4)
CC*nn*<enter>	3	Sends the actuator in the "negative" or "down" direction to position *nn* (from NP to 1)
CNT<enter>	1, 2, 3	Displays the current value in the actuation counter
CNT*nnnnn*<enter>	1, 2, 3	Sets the actuation counter from 0 to 65535
CP<enter>	1, 2, 3	Displays the current position
CW<enter>	1, 2	Sends the actuator from Position B to Position A
	3	Increments the actuator one position. (For example, from position 4 to position 5)
CW*nn*<enter>	3	Sends the actuator in the "positive" or "up" direction to position *nn* (from 1 to NP)
DT<enter>	1, 2	Displays the current delay time in milliseconds
DT*nnnnn*<enter>	1, 2	Sets the delay time from 0 to 65,000 milliseconds
GO*nn*<enter>	1, 2	Sends the actuator to position *n*, where n is A or B
	3	Sends the actuator to position *nn* (from 1 to NP) via the shortest route
HM<enter>	3	Moves the valve to position 1 (home)
ID*a/n*<enter>	1, 2, 3	Sets the ID of the actuator to *a/n* (must be a number 0-9 or letter A-Z)
IFM<enter>	1, 2, 3	Displays the current actuator response setting
IFM*n*<enter>	1, 2, 3	Sets the actuator response where [0] = no response string to move commands; [1] = basic response string to end of move; [2] = extended response strings motor and error status
LG<enter>	1, 2, 3	Displays the serial response string format
LG*n*<enter>	1, 2, 3	Sets the serial response string format where [0] = limited serial response command set; [1] = extended serial response command set (default)
LRN<enter>	1	Automated procedure to locate A & B mechanical stop positions

MA<enter>	1, 2, 3	Displays the current motor setting
MA*aaa*<enter>	1, 2, 3	Sets the controller to operate the type of motor assembly to be used: EMH, EMD or EMT
NP<enter>	2, 3	Displays the number of positions the actuator is currently set to index
NP*nn*<enter>	2	Sets the number of ports (nn) for the current valve.
	3	Sets the number of positions (nn) for the current valve.
SB<enter>	1, 2, 3	Displays the current baud rate
SB*nnnn*<enter>	1, 2, 3	Sets the baud rate to 48(00), 96(00), 192(00), 384(00), 576(00), or 1152(00). The parity setting, number of data bits, and number of stop bits cannot be changed.
SD<enter>	1, 2, 3	Displays the digital input type of 0 - 3
SD*n*<enter>	1, 2, 3	Sets the digital input type to [0] BCD, [1] disabled, [2] parallel, or [3] binary. NOTE: Setting SD to [1] locks out digital inputs until it is changed, or a power cycle occurs. If set to [3], SD reverts to [0] at power up. See Note **
SL<enter>	1, 2, 3	Displays current Data Latch signal status where 0 = required and 1 = unused
SL*n*<enter>	1, 2, 3	This command displays or changes the requirement for a Data Latch signal to accompany BCD inputs. When set to [0] (factory default), the data latch is required for digital inputs. When set to [1], the data latch is NOT required. This feature can reduce the number of control lines required for a system with a dedicated digital output port and only one actuator connected. NOTE: In SL1 mode, be sure all the digital inputs are asserted within 20 milliseconds of each other, or the actuator may be misdirected.
SM<enter>	3	Displays the current default rotational direction
SM<enter>	3	In Two Position Mode (AM1,2) SM(n) sets the function of the Control Port inputs from 1 to 4 as follows: SM 1 (dual signal control mode), SM 2 (single signal toggle mode, SM 3 (state mode with enable), SM 4 (state mode with disable). In Multiposition Mode (AM3), SM(n) sets the direction of rotation for the actuator, where F: Forward (toward the next highest numeric position), R: Reverse (toward the next lowest numeric position), A: Auto (shortest route). (See Section 3.6.3 Figure 1)
SO<enter>	3	Displays the current offset value
SO*nn*<enter>	3	Sets the offset value of the first position to be any number from 1 to 96 minus the total number of positions. Example: for a 10 position valve, the offset can be set from 1 to 86.
STAT<enter>	1, 2, 3	Displays the status of the actuator
TM<enter>	1, 2, 3	Displays the amount of time required for the previous move, in milliseconds
TO<enter>	1, 2	Toggles the actuator to the opposite position
TT<enter>	1, 2	Toggles the actuator to the opposite position, waits a preset delay time, then rotates back to the original position.
VR*n*<enter>	1, 2, 3	Displays the current firmware version for the main PCB where *n* is not used, or for firmware version for the optional interface PCB where *n* = [2].
?<enter>	1, 2, 3	Displays a list of valid commands

* Column 2, table "Modes" are described in Sections 3.6.1., 3.6.2., and 3.6.3.
Note: In this chart, [n] represents numbers to be entered, and [a] represents letters; <enter> = CR(0x0D)

3.5. Using the Device ID Feature

When an ID is set, the actuator responds only to commands which begin with the correct ID prefix, and its serial transmit output is disabled when not sending data. This allows up to 10 actuators to be controlled from one computer serial port. A single command can be broadcast to all actuators by using an asterisk (*) as the command prefix. In this usage, any broadcast command which elicits a response from the serial port (such as *VR or *ID) will elicit a combined and unintelligible response.

Note: RS-232 actuators are shipped with the ID feature disabled. RS-485 actuators (product number ending in "F") are set to a default ID of "Z". All RS-485 communications require a "/" as a beginning of message character followed by a valid ID character: i.e. "/ZVR<enter>". The command to clear the ID, "/*ID*" sent to an RS-485 device will reset its ID to "Z".

For permanent multidrop applications, the RS-485 mode is the preferred solution. However, just as RS-232 control requires the host to have an RS-232 serial port, the PC host or control system must have an RS-485 port to communicate with the actuator in the RS-485 mode. Plug-in PCI cards with RS-485 ports or adapters that change an RS-232 signal to an RS-485 signal are available from several common electronic manufacturers. If your computer lacks a serial port, adapters which convert USB ports to RS-232 or to RS-485 are also readily available.

When installing or replacing actuators on a shared serial port, make sure that no two devices have been set to the same ID number.

3.6. Setting or Changing the Device ID

To set an ID on a device which has no ID, type "ID5<enter>" to set it to 5.

To change an ID on a device which has an ID of Z, type "ZID3<enter>" to change it to 3.

3.7. Setting the Operation Mode

This section employs some simple serial commands to complete a basic configuration of the valve/actuator combination. A more advanced discussion of serial control begins in the next section.

3.7.1. Mode 1: Two Position with Stops

This is the proper mode for most two position applications. (Note exceptions in the next section.) In this mode, the actuator automatically finds the correct positions using a combination of the valve's mechanical stops and the actuator's quadrature encoder.

To set up the actuator in this mode:

With no valve on the actuator, type AM1<enter> to set the actuator to Mode 1, Two Position With Stops.

Install the valve on the actuator, ensuring the valve is flush on the clamp, and the clamp screw is tight.

Type LRN<enter>. The actuator will search for the valve stops, "learning" and recording the locations.

When the process is completed, the valve is set to Position A.

Anytime the valve is removed from the actuator, the LRN step must be performed when the valve is reinstalled for proper operation.

3.7.2. Mode 2: Two Position without Stops

In this mode the actuator uses its encoder to position the valve. It is for use with two position valves that have no mechanical stops and the proper keyed valve mounting hardware.

To set up the actuator in this mode:

With no valve on the actuator, set the controller to Two Position Without Stops (AM2).

Set the Number of Ports (NPnn) to the number of ports on the valve.
NOTE: For Valco's internal sample valves, please consult technical support to confirm the proper NP configuration setting for each valve model which may vary from the visible port count.

Move the actuator to Position A (GOA).

Install the valve on the actuator, ensuring the keyhole is aligned and engaged and the valve is flush against the face of the clamp ring. Tighten the clamp screw.

Installing a valve with mechanical stops with the actuator in Mode 2 could damage the actuator.

3.7.3. Mode 3: Multiposition (factory default)

Select this mode for any Valco or Cheminert multiposition selector valve. The actuator will use its encoder to calculate the proper rotation to find each position.

To set up the actuator in this mode:

With no valve on the actuator, set the controller to Multiposition (AM3).

Type AL<enter> to move the square drive on the actuator output shaft to the proper starting position.

Install the valve on the actuator, ensuring the keyhole is aligned and engaged and the valve is flush against the face of the clamp ring. Tighten the clamp screw.

Set the number of positions (NPnn) where nn is the number of positions the valve has.

Send the valve to position 1 (HM).

In this mode, a CW command moves the actuator in the "positive" or "up" direction, like position 4 to position 5, while CC moves the actuator in the "negative" or "down" direction, like position 5 to position 4.

Installing a valve with mechanical stops with actuator in Mode 3 could damage the actuator.

Do not confuse the number of positions with the number of ports. Many multiposition valves have more than one port associated with each position.

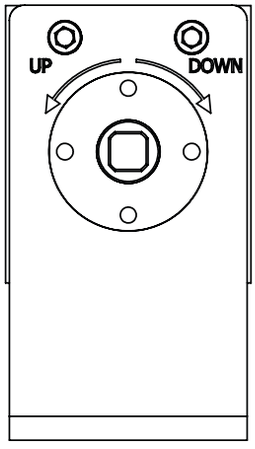


Figure 1: Actuator rotational direction reference

3.8. Command Reference

Note: Return string examples are based on LG1 (default). For additional return string, see APPENDIX D: SERIAL RESPONSE STRINGS

AL	Moves the actuator drive shaft to the reference position prior to valve installation. Should be executed before a valve is installed to ensure proper alignment	
	Modes Available	Two position without stops (2), multiposition (3)
	Example Command: **Returns:**	**AL**<enter> This command rotates the actuator drive shaft to the reference position. Position is unknown[0x0D]
AM[*n*]	Sets the actuator mode or displays the current mode, where n = 1 for two position with stops (see LRN), 2 for two position without stops, 3 for multiposition (factory default)	
	Modes Available	All (modes are discussed in Sections 3.6.1., 3.6.2., and 3.6.3.)
	Example Command: **Returns:** **Example Command:** **Returns:**	**AM**<enter> Displays the current mode setting AM = 1[0x0D] **AM1**<enter> Sets the actuator mode to two positions with stops AM = 1[0x0D]
CC[*nn*]	Moves the actuator in the CC direction (counting down) to position nn, where *nn* = valid position. (See page 15 Figure 1 for direction clarification.)	
	Modes Available	All
	Ex. (multiposition, mode 3) - Command: **Returns:** **Example Command:** **Returns:** **Ex. (two-position, modes 1 & 2) Command:** **Returns:**	**CC3**<enter> Moves the actuator to position 3 in the CC direction NO RESPONSE **CC**<enter> Decrements the actuator one position. If the starting position is 6 it will move to position 5. NO RESPONSE **CC**<Enter> Moves the actuator from position A to position B. If the actuator is already in position B, the command is ignored. NO RESPONSE

CNT[*nnnnn*]	Displays the current number of actuation cycles, or resets the counter to zero, where nnnnn = 0 to 2,147,483,647	
	Modes Available	All: In two position modes (1 & 2), the counter is incremented every time the valve moves. In the multiposition mode (3), the counter is incremented by the number of positions the valve moves; i.e., moving from position 2 to position 4 increments the cycle count by 2.
	Example Command: **Returns:**	**CNT**<enter> CNT = nnnnn [0x0D] (*nnnnn* = current valve of counter)
	Example Command: **Returns:**	**CNT0**<enter> Resets the cycle counter to 0 (zero) CNT = 0[0x0D]
	Example Command: **Returns:**	**CNT100**<enter> Sets the cycle counter to 100 CNT = 100[0x0D]
CP	Displays the current position of the actuator	
	Modes Available	All (see below)
	Ex. (two-position, modes 1 & 2) **Command:** **Returns:**	 **CP**<enter> Position is "n"[0x0D] (*n* = 'A' or 'B')
	Ex. (multiposition, mode 3) **Command:** **Returns:**	 **CP**<enter> Position is = *nn*[0x0D] (*nn* = current position)
CW[*nn*]	Moves the actuator in the CW direction (counting up) to position nn, where *nn* = valid position. (See page 15 Figure 1 for direction clarification.)	
	Modes Available	All
	Ex. (multiposition, mode 3) **Command:** **Returns:**	 **CW3**<enter> Moves the actuator to position 3 in the **CW** direction. NO RESPONSE
	Example Command: **Returns:**	**CW**<enter> Decrements the actuator one position. If the starting position is 6 it will move to position 7. NO RESPONSE
	Ex. (two-position, modes 1 & 2) **Command:** **Returns:**	 **CW**<enter> Moves the actuator from position B to position A. If the actuator is already in position A, the command is ignored. NO RESPONSE
DT[*nnnnn*]	Display or sets the time used by the TT and SM2 functions as a delay interval before returning to the previous position, where nnnnn = 1 – 32767 (milliseconds) (See TT and SM2.)	
	Modes Available	Two position (1 and 2)
	Example Command: **Returns:**	**DT**<enter> DT = *nnnn* [0x0D] (*nnnn* = current delay setting)
	Example Command: **Returns:**	**DT1000**<enter> Sets the delay timer to 1000 milliseconds NO RESPONSE

GO[*nn*]	Tells the actuator to go to position *nn*, where *nn* = 1 to NP (multiposition, mode 3), = 'A' or 'B' (two position, modes 1 and 2) (see also **NP** and **SM** commands)	
	Modes Available	All (see below)
	Ex. (two-position, modes 1 & 2) **Command:** **Returns:** **Example Command:** **Returns:** **Ex. (multiposition, mode 3)** **Command:** **Returns:** **Example Command:** **Returns:**	 **GO**<enter> Toggles the actuator to the other position NO RESPONSE **GOB**<enter> Moves the actuator from position A to position B NO RESPONSE **GO**<enter> Advances the actuator incrementally (SM = F or A), or decrementally (SM = R) NO RESPONSE **GO3**<enter> Moves the actuator to position 3 in the direction set by the SM command NO RESPONSE
HM	Moves the actuator to position 1. If the actuator is already in position 1, the command is ignored.	
	Modes Available	Multiposition (3)
	Example Command: **Returns:**	**HM**<enter> Moves the actuator from the current position to position 1 NO RESPONSE
ID[*n/a*]	Sets a command prefix requirement of a single character [n/l] for all serial port commands, where [n] can be "0 – 9" or [a] can be "A – Z" (upper or lower case are the recognized as the same value). "*" is a broadcast ID responded to by all devices.	
	Modes Available	All
	Example **Set ID Command:** **Returns:** **Change ID Command:** **Returns:** **Clear ID Command:** **Returns:**	 **ID3**<enter> Sets the ID to "3" NO RESPONSE **3ID5**<enter> Changes "5"s ID from "3" to "5" NO RESPONSE **5ID***<enter> Clears ID "5" NO RESPONSE Note: "RS-485" devices must have an ID, therefore they reset to "Z" by default. "*ID*<enter>" resets the ID of all devices on the current serial link
IFM[*n*]	Sets the actuator response mode to [n], determining how the actuator responds to action commands, where n = 0: no response string to move commands, 1: basic response string to end of move, 2: extended response strings including motor and error status	
	Modes Available	All
	Example Command: **Returns:**	**IFM0**<enter> Turns off all responses to move commands IFM = 0[0x0D]
LG[*n*]	Sets the actuator response mode to [n], where n = 0: limited serial response command set, (Universal actuator compatible) 1: extended serial response command set (default), (Micro Multi and Two Position compatible)	
	Modes Available	All
	Example Command: **Returns:**	**LG0**<enter> Sets serial response to limited command set LG0[0x0D]

LRN	Initialization procedure required for installation or reinstallation of two position valves with stops. This command teaches the actuator where the valve physical stops are located for both positions of the valve. When issued, the actuator immediately starts the learning process which involves several moves back and forth.	
	Modes Available	Mode 1 (Two position with stops). See also **AM** command & **Setting Operation Mode**
	Example Command: **Returns:**	**LRN**<enter> Initiates the learning process NO RESPONSE
MA[*aaa*]	Selects the Actuator Motor assembly to be used, where *aaa* = EMH, EMD or EMT. (**EMH** = EMHMA-CE, **EMD** = EMDMA-CE, **EMT** = EMTMA-CE	
	Modes Available	All
	Example Command: **Returns:**	**MA EMD**<enter> Sets the controller to operate the attached motor assembly. MA = EMD[0x0D] Note: While the controller may appear to operate correctly with an improper setting, it may fail under certain conditions and is not recommended.
NP[*nn*]	Sets or displays the current setting for the number of ports (two position) or positions (multiposition) on the valve attached to the actuator, where nn = 2 – 96.	
	Modes Available	Two position without stops (2)*, multiposition (3)
	Ex. (two-position, mode 2) **Command:** **Returns:** **Ex. (multiposition, mode 3)** **Command:** **Returns:**	 **NP**<enter> NP = nn [0x0D] (nn = current setting for number of ports) **NP6**<enter> Sets the number of positions to 6 NP = 6 Note: For Valco's internal sample valves without stops, please consult technical support to confirm the proper NP configuration setting for each valve model.
SB[*nnnn*]	Sets the baud rate of the serial port, where *nnnn* = 48, 96, 192, 384, 576, or 1152	
	Modes Available	All
	Example Command: **Returns:**	**SB192**<enter> Sets the baud rate for the serial port to 19200 NO RESPONSE (Baud rate changes are immediate)
SD[*n*]	Displays or sets the digital input type on the optional BCD interface, where *n* = 0: BCD (factory default) 1: Disable, 2: Parallel, 3: Binary Note: Setting SD to [1] locks out digital inputs until it is changed or a power cycle occurs. If SD is set to [1] at power down, it resets to [0] on power up.	
	Modes Available	Multiposition (3)
	Example Command: **Returns:** **Example Command:** **Returns:**	**SD**<enter> SD = n[0x0D] (*n* = digital input type) **SD1**<enter> Sets the digital inputs to binary type SD = 1[0x0D]

SM	In Two Position Mode (AM1,2) SM(n) sets the function of the Control Port inputs from 1 to 4 as follows: SM 1 (dual signal control mode) SM 2 (single signal toggle mode) SM 3 (state mode with enable) SM 4 (state mode with disable) In Multiposition Mode (AM3), SM(n) sets the direction of rotation for the actuator, where a is: F: Forward (toward the next highest numeric position), R: Reverse (toward the next lowest numeric position), A: Auto (shortest route) (See Section 3.6.3 Figure 1)	
	Modes Available	All
	Ex. (two-position, mode 1&2) **Command:** **Returns:** **Example Command:** **Returns:**	 **SM**<enter> SM = 1 [0x0D] Displays current setting **SM2**<enter> Sets single signal toggle mode SM = 2 [0x0D]
SO[*nn*]	Defines the numeric value of the first position of the valve. This can be any number from 1 and the value of NP – 1, maximum value of 96, making it possible to control more than one actuator from a single digital output control source. The factory default of SO is "1" so an actuator with an NP of 10 responds to move commands for positions "1" to "10". For an SO of "10" the actuator will respond to move commands for positions "10" through "19". Note: While the digital inputs can be paralleled from a single control source, the digital outputs cannot be paralleled.	
	Modes Available	Multiposition (3)
	Example Command: **Returns:** **Example Command:** **Returns:**	**SO**<enter> SO = nn [0x0D] (*nn* = current offset value) **SO10**<enter> Sets the offset value to 10. The valve will now start counting as if 10 = position 1 SO = 10[0x0D]
STAT	Returns (via the serial port) the following information, CP = current position, AM = current mode, NP = number of ports (modes 1 and 2) or positions (mode 3) on the current valve, SO = current position offset (See also CP, AM, NP and SO commands)	
	Modes Available	All
	Example Command: **Returns:**	**STAT**<enter> Current status of the actuator Position is = 10[0x0D] (nn = current position) AM = 3[0x0D] (n = current mode setting) NP = 6[0x0D] (nn = current setting for number of ports) SO = 10[0x0D] (nn = current offset value) Return example is AM3
TM	Returns the amount of time, in milliseconds, required by the previous move time	
	Modes Available	All
	Example Command: **Returns:**	**TM**<enter> Returns the amount of time, in milliseconds, required by the previous move TM = nnn[0x0D] (*nnn* = previous move time)

TO	Toggles the actuator to the opposite position from its current position; i.e., if the actuator is currently in Position B, it will toggle to Position A.	
	Modes Available	Two position (1 and 2)
	Example Command: **Returns:**	**TO**<enter> Causes the actuator to toggle from one position to the other NO RESPONSE
TT	Timed toggle: the actuator will toggle from its current position to the opposite, wait for a programmed amount of time, then toggle back to its original position. (See DT command)	
	Modes Available	Two position (1 and 2)
	Example Command: **Returns:**	**TT**<enter> The actuator will initiate the timed toggle procedure NO RESPONSE
VR[*n*]	Reports the current firmware version for the main PCB firmware, VR2 reports optional interface board firmware.	
	Modes Available	All
	Example Command: **Returns:** **Example Command:** **Returns:**	**VR**<enter> Current revision of the main PCB firmware MUA_MAIN_*a_nn[0x0D] (a=version nn=subversion)* aaa nn nnnn[0x0D] (aaa=month nn=day nnnn=year) **VR2**<enter> Current revision of the optional interface board firmware MUA_MAIN_*a_nn[0x0D] (nnnn=type a=version nn=subversion)* aaa nn nnnn[0x0D] (aaa=month nn=day nnnn=year)
?	Displays a list of the active serial commands for the actuator. The list is similar to the command table above but may not include all of the commands shown.	
	Modes Available	All
	Example Command: Returns:	**?**<enter> Displays a list of the active serial commands

4. OPTIONAL BCD INTERFACE

4.1. Hardware Input/Output Protocols

The digital interface is made through a 26 pin connector which also provides power (+5 volts/100 ma maximum) and ground out-puts. The ground should be connected to the control system to maintain commonality between the actuator and the controlling device. If you intend to provide your own power supply, make sure that it has an isolated output or that it shares a common ground with the controlling system.

Digital input/output control of the actuator is designed for flexibility of function. The STEP input signal can be used in modes 1 and 2 to toggle from one position to the other. The STEP input can be used to advance the position, and HOME input can be used to send the valve to position 1. The chart in Section 4.2 lists other control options.

The inputs are held to a logical high (+5 volts) by pull-up resistors and are designed to be driven low either by contact closure, 5 volt digital logic, or open collector transistor outputs. The signal polarity is defined as "negative true" – asserting the signal involves shorting the signal (in the case of contact closure) or driving it (in the case of logic or transistor signals) to within 0.8 volts of ground potential. These input signals must be at least 30 milliseconds in duration.

The outputs are also "negative true" signals driven by standard high speed CMOS gates, capable of driving standard logic input gates. They include the BCD position, motor run, rotational direction, and error signals. If the actuator stops out of position due to a stuck valve, the BCD output is set to "0" (all lines high for a negative true output).

4.2. Digital Input Signal Definitions

PIN	COLOR	SIGNAL	DIRECTION	PIN	COLOR	SIGNAL	DIRECTION
1	Brown	Home	Input	14	Yellow	4 BCD	Output
2	Red	Motor run	Output	15	Green	20 BCD	Output
3	Orange	Step	Input	16	Blue	2 BCD	Output
4	Yellow	Error	Output	17	Violet	10 BCD	Output
5	Green	Manual Dir.	Input	18	Gray	1 BCD	Output
6	Blue	Direction	Output	19	White	80 BCD	Input
7	Violet	Auto Dir.	Input	20	Black	8 BCD	Input
8	Gray	Data Latch	Input	21	Brown	40 BCD	Input
9	White	+5 VDC 100 ma	Output	22	Red	4 BCD	Input
10	Black	Ground	Output	23	Orange	20 BCD	Input
11	Brown	80 BCD	Output	24	Yellow	2 BCD	Input
12	Red	8 BCD	Output	25	Green	10 BCD	Input
13	Orange	40 BCD	Output	26	Blue	1 BCD	Input

4.3. Digital Input Protocols

The digital input mode can be configured by using the serial SD command (as shown above) or by using the Universal Manual Remote menu options Interface Setup > BCD (as shown below).

BCD (Binary Coded Decimal) (SD0) (default)

For the 96 possible input positions, all 8 digital input data lines are required. See the reference chart.

Disables (SD1)

Disables the digital inputs to prevent user intervention during automated control via the serial port. It resets to SD0 during the power up sequence.

Parallel Input Mode (SD2)

This mode configures each single line as a position limiting the number of positions to 8. Multiple lines will be ignored. See the reference chart.

Binary Input Mode (SD3)

This mode configures the input lines for a binary count. The number of positions is still limited to 96 total. See the reference chart.

Pin Signal Definitions for the Various Input Modes

MODE	SD0	SD2	SD3	DATA INPUT LINES							
Input Type	BCD	Parallel	Binary	1BCD	2BCD	4 BCD	BCD	10BCD	20BCD	40BCD	80BCD
Position	1	1	1	X	–	–	–	–	–	–	–
	2	2	2	–	X	–	–	–	–	–	–
	3	*	3	X	X	–	–	–	–	–	–
	4	3	4	–		X	–	–	–	–	–
	5	*	5	X		X	–	–	–	–	–
	6	*	6	–	X	X	–	–	–	–	–
	7	*	7	X	X	X	–	–	–	–	–
	8	4	8	–		–	X	–	–	–	–
	9	*	9	X		–	X	–	–	–	–
	*	*	10	–	X	–	X	–	–	–	–
	*	*	11	X	X	–	X	–	–	–	–
	*	*	12	–		X	X	–	–	–	–
	*	*	13	X		X	X	–	–	–	–
	*	*	14	–	X	X	X	–	–	–	–

Pin Signal Definitions for the Various Input Modes

MODE	SD0	SD2	SD3	DATA INPUT LINES							
Input Type	BCD	Parallel	Binary	1BCD	2BCD	4 BCD	BCD	10BCD	20BCD	40BCD	80BCD
Position	*	*	15	X	X	X	X	–	–	–	–
	10	5	16	–		–	–	X	–	–	–
	11	*	17	X		–	–	X	–	–	–
	12	*	18	–	X	–	–	X	–	–	–
	13	*	19	X	X	–	–	X	–	–	–
	14	*	20	–		X	–	X	–	–	–
	15	*	21	X		X	–	X	–	–	–
	16	*	22	–	X	X	–	X	–	–	–
	17	*	23	X	X	X	–	X	–	–	–
	18	*	24	–		–	X	X	–	–	–
	19	*	25	X		–	X	X	–	–	–
	*	*	26	–	X	–	X	X	–	–	–
	*	*	27	X	X	–	X	X	–	–	–
	*	*	28	–		X	X	X	–	–	–
	*	*	29	X		X	X	X	–	–	–
	*	*	30	–	X	X	X	X	–	–	–
	*	*	31	X	X	X	X	X	–	–	–
	20	6	32	–	–	–	–	X	–	–	–
	40	7	64	–	–	–	–	–	–	X	–
	80	8	128	–	–	–	–	–	–	–	X

4.4. Additional Digital Input and Output Signals

Data Latch Input

When the **SL** is set to **0** (factory default), holding this signal low for a minimum of 25 mSec will cause the actuator to read the BCD Input signals. This will begin a move to the position read on the inputs. When **SL** is set to **1**, the Data Latch Input is ignored, and any BCD input that is stable for 25 mSec is immediately executed.

BCD Output Signals

These signals output the current position in a BCD protocol, regardless of the Input protocol setting.

Note: The BCD Output Signals are only updated after the motor has finished moving (see **Motor Run** below) and if there is no error (see **Error** below).

Step Input

Holding this signal low for a minimum of 25 mSec causes the actuator to advance one position.

Home Input (multiposition only)

For the 96 possible input positions, all 8 digital input data lines are required. See the reference chart.

Manual Direction Input (multiposition only)

When the signal is high and a move is sensed, the actuator will move in a clockwise direction. If it is low, the move will be in the counterclockwise direction. It is affected by the setting of the Auto Direction input.

Auto Direction Input (multiposition only)

When the signal is high and a move is sensed, the Manual Direction signal dictates the move direction the actuator uses. When the signal is low, the actuator ignores the Manual Direction input, and chooses the shortest direction for the move to the new position.

Motor Run Output

This signal goes high when a move begins and goes low when the move is finished.

Error Output

During normal operation, this signal is low. When a move error is sensed, this signal goes high. It is cleared at the beginning of the next move request.

5. APPENDIX A: SETUP

5.1. Setup Mode: Using the Manual Remote to Configure the Actuator

In the absence of an optional RS-232, USB, or serial interface, the manual remote can be used to perform extensive actuator setup functions.

5.1.1 Accessing the Setup Mode

To access the Setup mode, press and hold the HOME/SETUP button for 5 seconds.

5.1.2 Button Functions

When a screen appears, a line will be highlighted. Use the UP and DOWN arrow keys to highlight a different line.

When the desired line is highlighted, press the HOME/SETUP button to enter that value.

For parameters such as number of ports or positions, use the arrow keys to toggle up and down to the desired value, which is then entered by pressing the HOME/SETUP button.

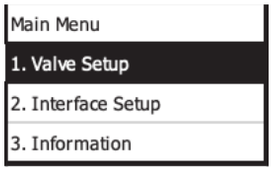
Only two menus—the Interface Setup and Baud rate—have more than three options. Use the arrow keys to scroll down to additional screens to select the desired value or parameter.

The UP arrow key also functions as a back button.

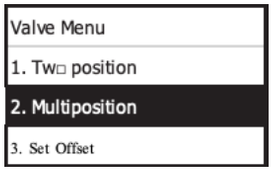
5.1.3 Examples

To configure the actuator for a 10 position multiposition valve:

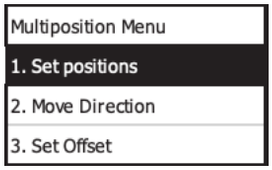
On the main menu, use the arrow buttons to highlight Valve Setup. Press the HOME/SETUP button.



On the Valve Menu, use the DOWN arrow button to highlight Multiposition. Press the HOME/SETUP button.



On the Multiposition Menu, press the HOME/SETUP button when Set positions is highlighted.

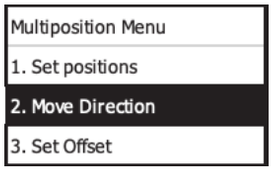


Use the UP and DOWN arrow buttons to move through the numbers until 10 is showing. Press the HOME/SETUP button.

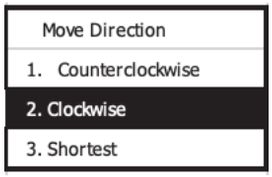
In the multiposition mode, "counterclockwise" means that the actuator moves in the "positive" direction—position 1 to position 2. The clockwise direction is "negative", moving in the direction of position 2 to position 1. To set the just-configured 10-position actuator to move in a clockwise direction:

Repeat Steps 1 and 2 above to get to the Multiposition Menu.

Use the DOWN arrow button to highlight Move Direction. Press the HOME/SETUP button.

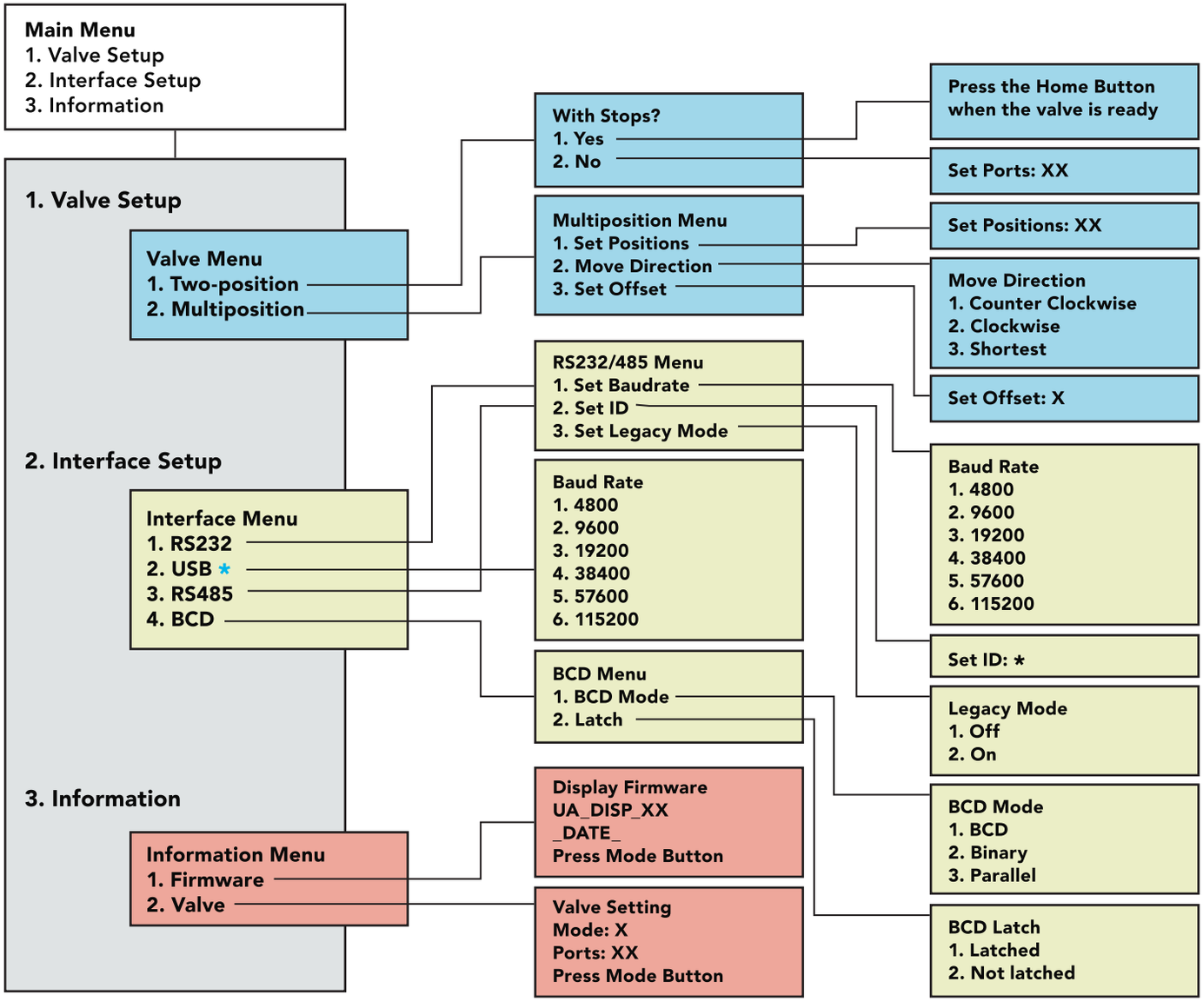


Use the DOWN arrow button to highlight Clockwise. Press the HOME/SETUP button.



6. APPENDIX A: MENU TREE

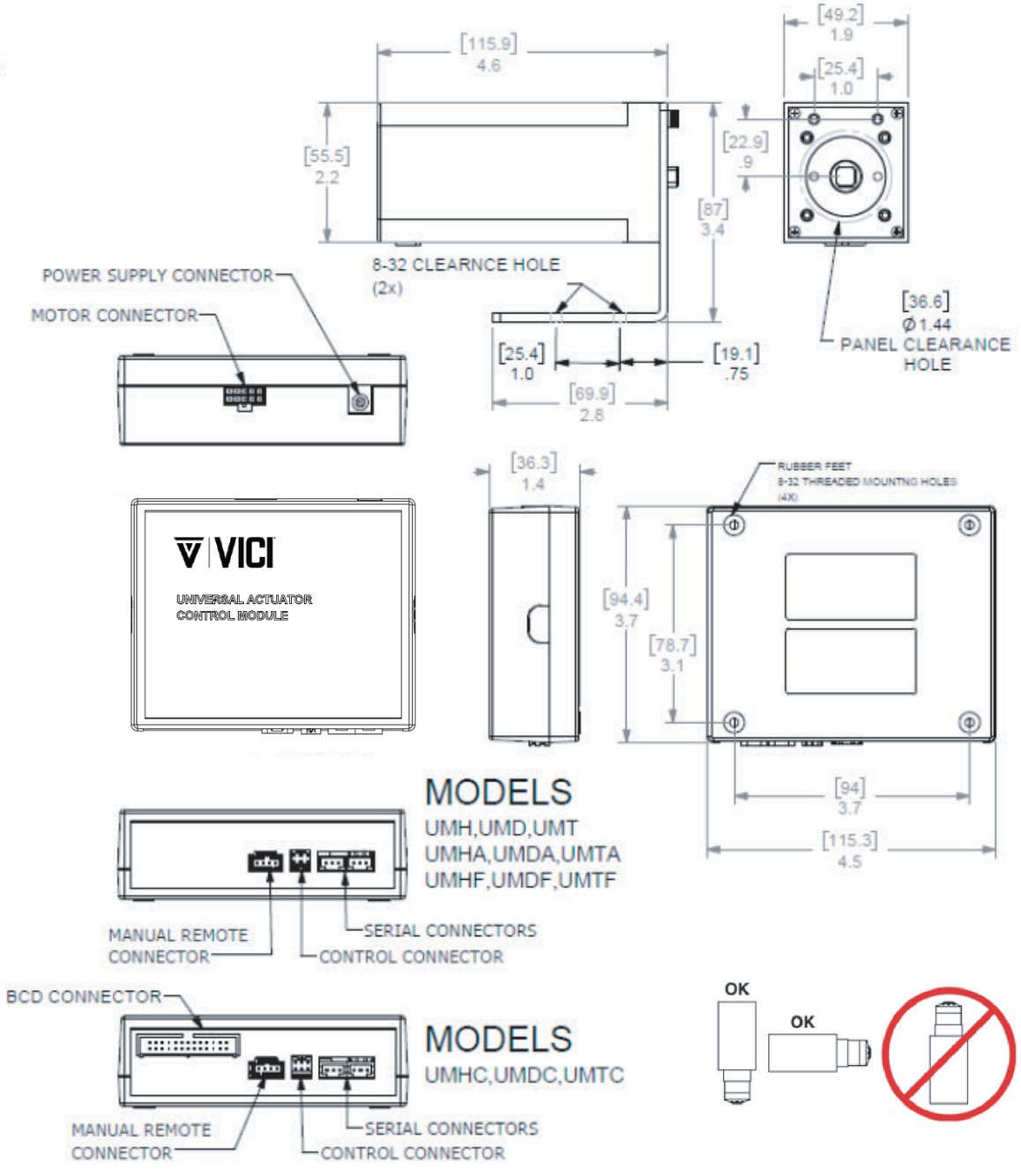
Menu Tree



*Note:

Modular universal actuator and universal actuator use the same manual remote. USB not available on the modular universal actuator.

7. APPENDIX B: MOUNTING & DIMENSIONS



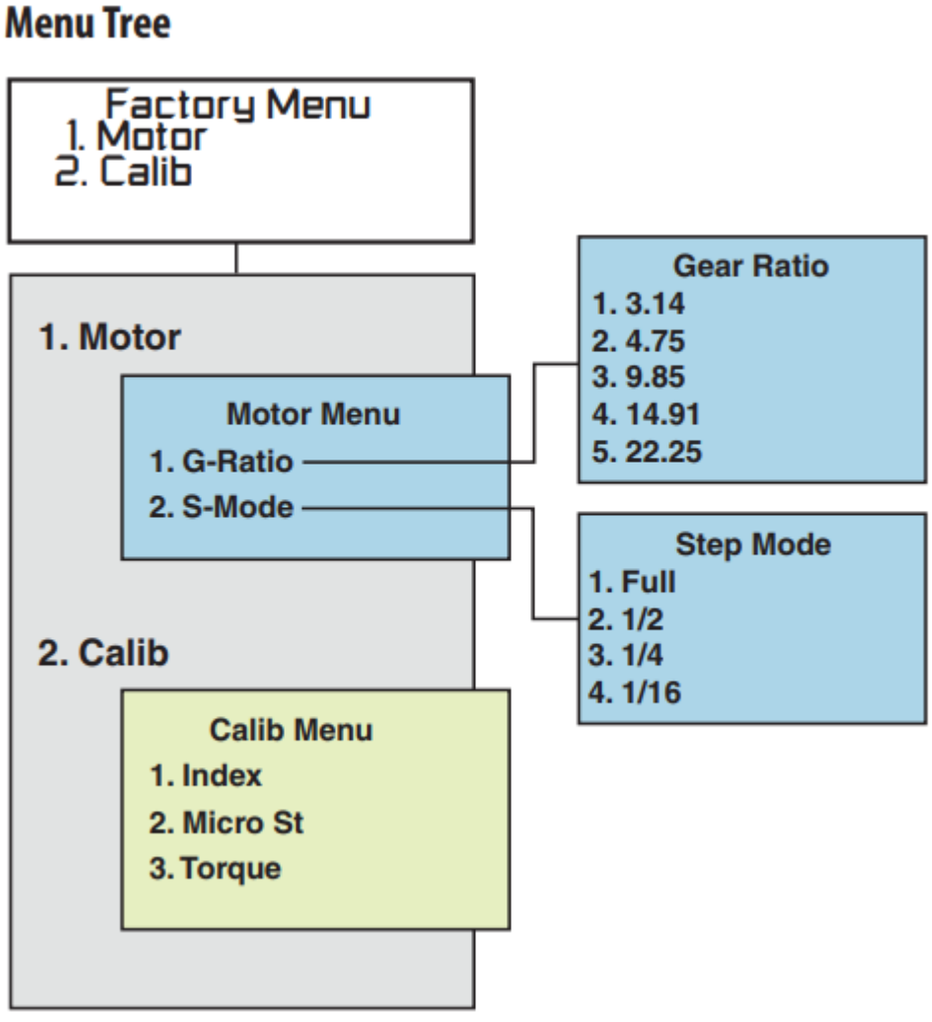
8. APPENDIX C: MANUAL REMOTE FACTORY MODE

8.1. Setup Mode: Using the Manual Remote to Configure the Actuator

The Factory mode allows access to basic parameters which are set at the factory. These parameters should not be altered by the user except via direct consultation with a VICI Technical Support representative.

Note: the new firmware version of the manual remote does not have access to these menus.

If the factory mode is entered accidentally, press the UP arrow button to escape and return to normal operation.



9. APPENDIX D: SERIAL RESPONSE STRINGS

9.1. Modular Universal Command Response Reference Table, Setup = LG1,LG0" (factory default)

CMD	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
AL	<NO RESPONSE>	
AM	AM = 3*	0x41 0x4d 0x20 0x3d 0x20 0x33 0x0d
CC	<NO RESPONSE>	
CNT	CNT = 1*	0x43 0x4e 0x54 0x20 0x3d 0x20 0x31 0x0d
CP	Position is = 10*	0x50 0x6f 0x73 0x69 0x74 0x69 0x6f 0x6e 0x20 0x69 0x73 0x20 0x20 0x3d 0x20 0x31 0x30 0x0d
CW	<NO RESPONSE>	
DT	DT = 1000*	0x44 0x54 0x20 0x3d 0x20 0x31 0x30 0x30 0x30 0x0d
GO	<NO RESPONSE>	
HM	<NO RESPONSE>	
ID	ID = not used*	0x49 0x44 0x20 0x3d 0x20 0x6e 0x6f 0x74 0x20 0x75 0x73 0x65 0x64 0x0d
IFM	May 26 2022	0x49 0x46 0x4d 0x20 0x3d 0x20 0x30 0x0d
LG	LG = 1	0x4c 0x47 0x20 0x3d 0x20 0x31 0x0d
MA	MA = EMD	0x4d 0x41 0x20 0x3d 0x20 0x45 0x4d 0x44 0x0d
NP	NP = 10*	0x4e 0x50 0x20 0x3d 0x20 0x31 0x30 0x0d
SB	SB = 9600*	0x53 0x42 0x20 0x3d 0x20 0x39 0x36 0x30 0x30 0x0d
SD	SD = 0*	0x53 0x44 0x20 0x3d 0x20 0x30 0x0d
SL	SL = 0*	0x53 0x4c 0x20 0x3d 0x20 0x30 0x0d
SM	SM = A*	0x53 0x4d 0x20 0x3d 0x20 0x41 0x0d
SO	SO = 1*	0x53 0x4f 0x20 0x3d 0x20 0x31 0x0d
TM	TM = 105*	0x54 0x4d 0x20 0x3d 0x20 0x31 0x30 0x35 0x0d
VR	MUA_MAIN_F_PRE	0x4d 0x55 0x41 0x5f 0x4d 0x41 0x49 0x4e 0x5f 0x46 0x5f 0x50 0x52 0x45 0x0d
	May 26 2022	0x4d 0x61 0x79 0x20 0x32 0x36 0x20 0x32 0x30 0x32 0x32 0x0d

Note: Responses will vary according to position, setting or value.

9.2. Modular Universal Command Response Reference Table, Setup = LG0, IFM0

CMD	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
AL	E1	0x45 0x31 0x0d
AM	AM3	0x41 0x4d 0x33 0x0d
CC	<NO RESPONSE>	
CNT	CNT10	0x43 0x4e 0x54 0x31 0x30 0x0d
CP	CP10	0x43 0x50 0x31 0x30 0x0d
CW	<NO RESPONSE>	
DT	DT1000	0x44 0x54 0x31 0x30 0x30 0x30 0x0d
GO	<NO RESPONSE>	
HM	<NO RESPONSE>	
ID	ID	0x49 0x44 0x0d
IFM	IFM0	0x49 0x46 0x4d 0x30 0x0d
LG	LG0	0x4c 0x47 0x30 0x0d
MA	MAEMH	0x4d 0x41 0x45 0x4d 0x48 0x0d
NP	NP10	0x4e 0x50 0x31 0x30 0x0d
SB	SB9600	0x53 0x42 0x39 0x36 0x30 0x30 0x0a 0x0d
SD	SD0	0x53 0x44 0x30 0x0d
SL	SL0	0x53 0x4c 0x30 0x0d
SM	SMA	0x53 0x4d 0x41 0x0d
SO	SO1	0x53 0x4f 0x31 0x0d
TM	TM105	0x54 0x4d 0x31 0x30 0x35 0x0d
VR	MUA_MAIN_F_PRE	0x4d 0x55 0x41 0x5f 0x4d 0x41 0x49 0x4e 0x5f 0x46 0x5f 0x50 0x52 0x45 0x0d
	May 26 2022	0x4d 0x61 0x79 0x20 0x32 0x36 0x20 0x32 0x30 0x32 0x32 0x0d

Note: Responses will vary according to position, setting or value.

9.3. Modular Universal Command Response Reference Table, Setup = LG0, IFM1

CMD	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
AL	E1	0x45 0x31 0x0d
AM	AM3*	0x41 0x4d 0x33 0x0d
CC	CP10*	0x43 0x50 0x31 0x30 0x0d
CNT	CNT10*	0x43 0x4e 0x54 0x31 0x30 0x0d
CP	CP10*	0x43 0x50 0x31 0x30 0x0d
CW	CP01*	0x43 0x50 0x30 0x31 0x0d
DT	DT1000*	0x44 0x54 0x31 0x30 0x30 0x30 0x0d
GO	CP04*	0x43 0x50 0x30 0x34 0x0d
HM	CP01*	0x43 0x50 0x30 0x31 0x0d
ID	ID*	0x49 0x44 0x0d
IFM	IFM1*	0x49 0x46 0x4d 0x31 0x0d
LG	LG0*	0x4c 0x47 0x30 0x0d
MA	MAEMH*	0x4d 0x41 0x45 0x4d 0x48 0x0d
NP	NP10*	0x4e 0x50 0x31 0x30 0x0d
SB	SB9600*	0x53 0x42 0x39 0x36 0x30 0x30 0x0a 0x0d
SD	SD0*	0x53 0x44 0x30 0x0d
SL	SL0*	0x53 0x4c 0x30 0x0d
SM	SMA*	0x53 0x4d 0x41 0x0d
SO	SO1*	0x53 0x4f 0x31 0x0d
TM	TM105*	0x54 0x4d 0x31 0x30 0x35 0x0d
VR	MUA_MAIN_F_PRE	0x4d 0x55 0x41 0x5f 0x4d 0x41 0x49 0x4e 0x5f 0x46 0x5f 0x50 0x52 0x45 0x0d
	May 26 2022	0x4d 0x61 0x79 0x20 0x32 0x36 0x20 0x32 0x30 0x32 0x32 0x0d

Note: Responses will vary according to position, setting or value.

9.4. Modular Universal Command Response Reference Table, Setup = LG0, IFM2

CMD	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
AL	E1	0x45 0x31 0x0d
	M1	0x4d 0x31 0x0d
	M1	0x4d 0x31 0x0d
	M0	0x4d 0x30 0x0d
AM	AM3*	0x41 0x4d 0x33 0x0d
CC	M1	0x4d 0x31 0x0d
	E0	0x45 0x30 0x0d
	M1	0x4d 0x31 0x0d
	CP10	0x43 0x50 0x31 0x30 0x0d
	M0	0x4d 0x30 0x0d
CNT	CNT10*	0x43 0x4e 0x54 0x31 0x30 0x0d
CP	CP10*	0x43 0x50 0x31 0x30 0x0d
CP	E1	0x45 0x31 0x0d
CW	M1	0x4d 0x31 0x0d
	E0	0x45 0x30 0x0d
	M1	0x4d 0x31 0x0d
	CP01	0x43 0x50 0x30 0x31 0x0d
	M0	0x4d 0x30 0x0d
DT	DT1000*	0x44 0x54 0x31 0x30 0x30 0x30 0x0d
GO	M1	0x4d 0x31 0x0d
	E0	0x45 0x30 0x0d
	M1	0x4d 0x31 0x0d
	CP01*	0x43 0x50 0x30 0x31 0x0d
	M0	0x4d 0x30 0x0d
HM	M1	0x4d 0x31 0x0d
	E0	0x45 0x30 0x0d
	M1	0x4d 0x31 0x0d
	CP01	0x43 0x50 0x30 0x31 0x0d
	M0	0x4d 0x30 0x0d
ID	ID	0x49 0x44 0x0d
IFM	IFM1*	0x49 0x46 0x4d 0x31 0x0d

CMD	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
LG	LG0*	0x4c 0x47 0x30 0x0d
MA	MAEMH	0x4d 0x41 0x45 0x4d 0x48 0x0d
NP	NP10*	0x4e 0x50 0x31 0x30 0x0d
SB	SB9600*	0x53 0x42 0x39 0x36 0x30 0x30 0x0a 0x0d
SD	SD0*	0x53 0x44 0x30 0x0d
SL	SL0*	0x53 0x4c 0x30 0x0d
SM	SMA	0x53 0x4d 0x41 0x0d
SO	SO1*	0x53 0x4f 0x31 0x0d
TM	TM105*	0x54 0x4d 0x31 0x30 0x35 0x0d
VR	MUA_MAIN_F_PRE	0x4d 0x55 0x41 0x5f 0x4d 0x41 0x49 0x4e 0x5f 0x46 0x5f 0x50 0x52 0x45 0x0d
	May 26 2022	0x4d 0x61 0x79 0x20 0x32 0x36 0x20 0x32 0x30 0x32 0x32 0x0d

Note: Responses will vary according to position, setting or value.

9.5. Modular Universal Command Error Response Reference Table, Setup = IFM0

CMD	LG MODE	ERROR CONDITION	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
(unrecognized commands)	0, 1, 2	invalid characters when followed by a CR (0x0d)	<NO RESPONSE>	
AM4	0	out of range	E2 AM4 Invalid*	0x45 0x32 0x20 0x41 0x4d 0x34 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
AM4	1/2	out of range	AM4 = Bad command*	0x41 0x4d 0x34 0x20 0x3d 0x20 0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
CC100	0	out of range	E2 CC100 Invalid*	0x45 0x32 0x20 0x43 0x43 0x31 0x30 0x30 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
CC100	1/2	out of range	CC100 = Bad command*	0x43 0x43 0x31 0x30 0x30 0x20 0x3d 0x20 0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
CP	0	out of position	E1	0x45 0x31 0x0d
Cp	1/2	out of position	Position is near to = 2*	0x50 0x6f 0x73 0x69 0x74 0x69 0x6f 0x6e 0x20 0x69 0x73 0x20 0x6e 0x65 0x61 0x72 0x20 0x74 0x6f 0x20 0x3d 0x20 0x32 0x0a 0x0d

CMD	LG MODE	ERROR CONDITION	TYPICAL ASCII RESPONSES	HEXADECIMAL RESPONSE
CW18	0	out of range	E2 CW18 Invalid*	0x45 0x32 0x20 0x43 0x57 0x31 0x38 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
CW18	1/2	out of range	CW18 = Bad command*	0x43 0x57 0x31 0x38 0x20 0x3d 0x20 0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
DT99999	0	out of range	E2 DT99999 Invalid*	0x45 0x32 0x20 0x43 0x57 0x31 0x38 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
DT99999	1/2	out of range	Bad command	0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
GO18	0	out of range	E2 GO18 Invalid*	0x45 0x32 0x20 0x47 0x4f 0x31 0x38 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
GO18	1/2	out of range	Bad command	0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
NP100	0	out of range	E2 NP100 Invalid*	0x45 0x32 0x20 0x4e 0x50 0x31 0x30 0x30 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
NP100	1/2	out of range	Bad command	0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
SB14	0	out of range	E2 SB14 Invalid*	0x45 0x32 0x20 0x53 0x42 0x31 0x34 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
SD5	0	out of range	E2 SD5 Invalid*	0x45 0x32 0x20 0x53 0x44 0x35 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
SD5	1/2	out of range	Bad command	0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
SL2	0	out of range	E2 SL2 Invalid*	0x45 0x32 0x20 0x53 0x4c 0x32 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
SL2	1/2	out of range	Bad command	0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d
SM3	0	out of range	SMA	0x53 0x4d 0x41 0x0d
SM3	1/2	out of range	SM = A*	0x53 0x4d 0x20 0x3d 0x20 0x41 0x0d
SO0	0	out of range	E2 SL2 Invalid*	0x45 0x32 0x20 0x53 0x4c 0x32 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
SO100	0	out of range	E2 SO100 Invalid*	0x45 0x32 0x20 0x53 0x4f 0x31 0x30 0x30 0x20 0x49 0x6e 0x76 0x61 0x6c 0x69 0x64 0x0d
SO100	1/2	out of range	SO100 = Bad command*	0x53 0x4f 0x31 0x30 0x30 0x20 0x3d 0x20 0x42 0x61 0x64 0x20 0x63 0x6f 0x6d 0x6d 0x61 0x6e 0x64 0x0d

Note: Responses will vary according to position, setting or value.

10. REVISION HISTORY

DOCUMENT NAME	DATE [DD.MM.YYYY]	REASON FOR CHANGES	VERSION
VICI_MU Actuator_User Manual_V1.pdf	02.09.2022	New Manual Creation	0.1
VICI_MU Actuator_User Manual_V2.pdf	04.25.2023	Updates to tables	0.2