Myostat Motion Control Inc.

Cool Muscle 1 RT3 Application Note

AN100

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Introduction

This application note demonstrates common application examples used in the Cool Muscle 1 (CM1) motor. It is specific to RT3 motors and generally based on firmware version RT3.12 unless otherwise specified.

Each example will have a brief description and then list the CML (Cool Muscle Language) code. The user should be somewhat familiar with the motor application software (CoolWorks Lite) and how to send data.

Contents

1. General Notes

1. Using Comments

Comments are allowed in CML code and are indicated with a single forward slash '/'. There are a few rules regarding comments:

- Comments should be on their own line
- Comments are not allowed inside program banks or logic banks.
- Comments should not exceed 40 characters from '/' to the carriage return.

Examples:

Valid Comments	Invalid Comments

/This comment is not more
/than 40 characters long
/P1 sets the bottom position
P1.1=1000
S1.1=10
A1.1=5
	/This comment is more than 40 characters long
	P1.1=1000 /P1 sets the bottom position
	S1.1=10
	A1.1=5

/Bank1 will move to the bottom position B1.1 A1.1,S1.1,P1.1 END.1	B1.1 /set acc, speed and position A1.1,S1.1,P1.1 /move to the bottom position END.1

2. Calculating Speed (pulses/sec ←→RPM)

Speed values (S0, S1, etc.) are set in the motor in pulses/second with a speed unit defined in K37. Speed units are 100p/s, 10p/s or 1p/s depending on the K37 value.

The general calculation to from pulses/second to RPM is:

$$RPM\left(\frac{revolution}{minute}\right) = \left(SPEED \times SpeedUnit\left(\frac{pulses}{second}\right)\right) \times 60\left(\frac{second}{minute}\right) \div RESOLUTION\left(\frac{pulses}{revolution}\right)$$

$$SPEED = \ RPM\left(\frac{revolution}{minute}\right) \div 60\left(\frac{second}{minute}\right) \times RESOLUTION\left(\frac{pulses}{revolution}\right) \div SpeedUnit\left(\frac{pulses}{second}\right) ($$

Example 1 (RPM→ SPEED):

K37=3 which defines a speed unit of 100 pulses/second and a resolution 1000pulses/revolution. If we want to run at 120 rpm this gives is an S value:

$$SPEED = \ RPM\left(\frac{revolution}{minute}\right) \div 60\left(\frac{second}{minute}\right) \times RESOLUTION\left(\frac{pulses}{revolution}\right) \div SpeedUnit\left(\frac{pulses}{second}\right)$$

$$SPEED = 120 \div 60\left(\frac{second}{minute}\right) \times 1000\left(\frac{pulses}{revolution}\right) \div 100\left(\frac{pulses}{second}\right)$$

$$SPEED = 120 \div 6$$

$$SPEED = 20$$

So for the case of K37=3 you can easily always divide by six to get RPM. E.g. S = 1500rpm/6 = 250.

Example 2 (SPEED→RPM):

K37=30 which defines a speed unit of 10 pulses/second and a resolution of 50000 pulses/revolution. If we have set an S0=33500 what is the RPM equivalent?

$$RPM\left(\frac{revolution}{minute}\right) = \left(SPEED \times SpeedUnit\left(\frac{pulses}{second}\right)\right) \times 60\left(\frac{second}{minute}\right) \div RESOLUTION\left(\frac{pulses}{revolution}\right)$$

$$RPM\left(\frac{revolution}{minute}\right) = \left(33500 \times 10\left(\frac{pulses}{second}\right)\right) \times 60\left(\frac{second}{minute}\right) \div 50000\left(\frac{pulses}{revolution}\right)$$

$$RPM\left(\frac{revolution}{minute}\right) = 402$$

3. Motor ID

Motors on a network auto ID themselves according to their position on the network. A single motor will always be assigned ID 1.

When a motor is powered up you will see the ID in the power up information.

E.g: "ID1 :CM1v3.12CH.5 #01236"

In this case the motor has ID1, firmware version 3.12 and hardware version 5. It has an internal serial number 01236.

The ID is assigned during programming by appending a ".ID" at the end of the command or register name.

Example CML Code:

```
/sets motor 1 position 1 to 1000.
P1.1=1000
/sets motor 2 speed 3 to 56
S3.1=56

/write a basic bank in motor 1
B1.1
A1.1,S1.1, P1.1
END.1

/write a basic bank in motor 2 calling motor 3.
/Note that the ID is set back on the END.2 and not assumed to be 2.
B1.2
A1.3,S1.3,P1.3
END.2

/set output 2 on motor 1 on
O2.1
/set output 2 on motor 5 off
F2.5
```

It is good practice to always append the ID on the end of all commands however it is not necessary. Once a motor ID has been called it will be the default until it is changed.

4. Switching off RS485 mode – '{#'

K62 sets the RS485 node ID. If K62=0 RS485 is off. If K62 is set to any other number that number is the node ID.

The motor is in RS485 slave mode if it is streaming '{' with a number following it on power up. The motor is requesting that it have communication access as it has something to report. To switch back to standard serial we need to:

1) give the motor communication access,
2) let it report its message,
3) gain communication access again
4) set K62=0

The process to do this is the following

1) Send the motor bank its request. I.e if the motor is streaming "{1" send back "{1". If it is send "{56" send back "{56".
2) At this point the motor will send some information (power up ID position, etc) and then "{0" to close communication.
3) To gain bank communication access we send the RS485 ID again. I.e. "{1" or "{56" as in the above examples.
4) Send "K62=0" to switch off RS485.

If there is a logic bank or program bank running that is reporting information constantly timing is critical. As soon as the {0 is received from the motor we must send bank {ID. If we don't and the motor has more to report it will start streaming the communication request again.

2. Direct Mode

1. Basic Point to Point Move

The basic move structure in CML is to define a position (P0), speed (S0), acceleration (A0) and optionally a torque (M0). These 4 values form the core of a basic direct mode move. They are set in read/write registers. P0 is always in absolute coordinates and all values are with respect to the current motor resolution. In this example we assume it to be default (K37=3) which defines that the motor has a resolution of 1000 pulses/rev and a speed unit of 100 pulses/sec.

CML Code Used:

P0	→ position in pulses in absolute coordinates
S0	→ speed in pulses/sec (x 100 as per K37).
A0	→ acceleration in kilopulses/sec^2
M0	→ torque limit in % of peak torque
^	→ execute the direct move

Example CML Code:

```
/set the direct mode registers
P0.1=10000
S0.1=10
A0.1=5

/execute the absolute move
^.1
```

2. Speed control

Speed Control is set by setting P0=1000000000 (1 billion, 1 and 9 0's). To start the motion execute the dynamic move with the '^'. S0, A0 and M0 can now be changed at any time to adjust motor speed, acceleration and torque while the motor is moving.

CML Code Used:

P0	→ position set to 1 billion
S0	→ speed in pulses/sec (x 100 as per K37).
A0	→ acceleration in kilopulses/sec^2
M0	→ torque limit in % of peak torque
^	→ start the speed control

Example CML Code:

```
/set the direct mode registers
P0.1=1000000000
S0.1=10
A0.1=5
M0.1=100

/execute the absolute move
^.1
```

```
/change the speed as required
S0.1=100
```

3. Program Banks

1. Basic Program Bank

This example shows how to write a very basic program bank that moves the motor to position 10000 pulses and back to 0.

1) Register values are assigned
2) Program bank 1 in motor 1 (B1.1) is created
3) Bank 1 is executed

CML Code Used:

P1, P2	→ position values
S1	→ assigned speed
A1	→ assigned acceleration
B1	→ start of bank1 programming
END	→ end of bank programming
[1	→execute bank1. The '[' character indicates starting the bank. The number following it indicates which bank is executed

Example CML Code:

```
/initialize the registers
P1.1=10000
P2.1=0
S1.1=50
A1.1=10

/program the bank
B1.1
A1.1,S1.1,P1.1
P2.1
END.1

/execute the bank
[1.1
```

Notes:

1) Inside the bank a speed and acceleration are always called at least once before the 1st position. This ensures a known speed and acceleration is set before a position is executed.
2) All commands on the same line are executed together. Commands on different lines are executed sequentially once the previous line is complete. In this example P1 will complete before P2 is executed.
3) Unless and M value (torque) is called the M0 value is used as the torque. By default this is 100 (%).

2. Starting a Program Bank on Power-Up

This example shows how to start a program bank on power up. It uses both logic banks and program banks. Essentially only a logic bank can be started on power up, so, a logic bank is used to execute a program bank.

In this example the motor will start to run continuously clockwise immediately on power up.

CML Code Used:

P1=1000000000 → position 1 register. If this is set to 1 billion the motor is in speed control.
A1=100 → acceleration 1 register.
S1=30 → speed 1 register.

B1 → beginning of program bank

L1 → beginning of logic bank 1
END → end of logic bank

[L1 → execute/run logic bank 1
]L → stop the logic bank

K87=1 → logic bank execution time in milliseconds.
K85=1 → logic bank number started on power up

Example CML Code:

```
/set the logic scan time
K87=1
/set logic bank on power up
K85=1

/set pos, spd and accel
P1=1000000000
S1=30
A1=100

/Program Bank 1
/running speed control
B1
A1,S1,P1
END

/Logic Bank 1 on power up
/executes program bank 1
/then jumps to Logic 2 to do nothing
L1
[1.1
END

L2.1
END
```

3. Running 2 motors in a program bank

This example runs two motors from a program bank in motor 1. All position moves are absolute. The move sequence is as follows:

1) Move motor 1 to 10000 pulses
2) Move motor 2 to -5000 pulses
3) Move motor 1 to 0 pulses
4) Move motor 2 to 0 pulses

When executing a move for the first time a speed and acceleration must be set for that motor. Careful note should also be taken with the motor ID. Note that the last position called is P2.2. When the END of the bank is called it must have END.1 or it will be associated with motor 2 and will not load correctly.

CML Code Used:

```
P1.1=10000     → position 1 motor 1 register.
P2.1=0         → position 2 motor 1 register
A1.1=10        → acceleration 1 motor 1 register.
S1.1=30        → speed 1 motor 1 register.

P1.2=5000      → position 1 motor 2 register.
P2.2=0         → position 2 motor 1 register
A1.2=20        → acceleration 1 motor 1 register.
S1.2=10        → speed 1 motor 1 register.

B1.1    → beginning of program bank 1 in motor 1
END.1   → end of program bank 1 in motor 1

[1.1    →start bank 1 in motor 1
```

Example CML Code:

```
/load motor 1 registers
P1.1=10000
P2.1=0
A1.1=10
S1.1=30

/load motor 2 registers
P1.2=5000
P2.2=0
A1.2=20
S1.2=10

/load bank 1 in motor 1
/note A and S are called before P
B1.1
A1.1,S1.1,P1.1
A1.2,S1.2,P1.2
P2.1
P2.2
END.1

/start the bank 1 motor 1
[1.1
```

4. Logic Banks

1. Basic Logic Bank

This example shows how we can write a very basic logic bank and execute it. This logic bank does a simple mathematic calculation. If for example the motor is connected to a ballscrew actuator that had a 2mm pitch (2mm/rotation), the motor resolution is 1000 pulses per revolution and you want to have a variable that always changes a position from millimeters to pulses.

CML Code Used:

P1 → calculated position in pulses
P2 → entered position in mm
V1 → screw pitch
V2 → motor resolution

L1 → beginning of logic bank 1
END → end of logic bank

[L1 → execute/run logic bank 1
]L → stop the logic bank

K87 → logic bank execution time in milliseconds.

Example CML Code:

```
/set the scan time
K87=200

/set default position to 0
P1=0

/position in mm
/can be changed at will
P2=50

/screw pitch
V1=6
/motor resolution
V2=1000

/calculate the pulses
L1
P1=P2*V2/V6
END

/start the logic bank
[L1
```

Notes:

1) Once started the equation will return P1 on the serial port. To stop this and only see the value if queried we can put a semi-colon ‘;’ at the end of the line. This stops the logic bank from displaying the result. I.e. P1=P2*V2/V6;
2) The logic bank can be stopped by sending]L.

2. Starting and Stopping Logic Banks

A logic bank is started with the "[L#" command, where '#' is the logic bank number, and stopped with the "]L" command.

This example application sets V2 equal to the motor position.

CML Code Used:

V1="Px" → internal motor position state
V2 → value to be set to motor position

L2 → beginning of logic bank 2
END → end of logic bank

[L2→ execute/run logic bank 2
]L → stop the logic bank

K87 → logic bank execution time in milliseconds.

Example CML Code:

```
/set the scan time
K87.1=200

/internal motor position
V1="Px"
/variable to save the position
V2=0

/set V2 to position
L2
V2=V1
END

/start the logic bank
[L2.1
```

Notes:

1) Once the logic bank is executing it will continue to run in the bank ground. In this application example it will execute every 200ms.
2) To stop the logic bank send "]L".

3. Starting a Logic Bank on Power-up

K85 sets the startup/power-up logic bank. E.g. Set K85=1 to run logic bank 1 on power-up.

E.g.
1) Set K85=1
2) Run the Basic Logic Bank example.

4. ‘if – then – else’ statement in a logic bank

Logical statements can be used with variables, inputs and most other registers inside logic and program banks. This example looks at the status of input 3 and will start or stop the motor depending on if it is on or off.

Logical statement overview:

LOGIC, TRUE, FALSE

E.g. (with V1=0)

CML Code	C Equivalent

I3==V1,].1,^.1	if (IN3==0)
	{
	        ].1 //stop the motor
	}
	else
	{
	        ^.1 //start the motor
	}

CML Code Used:

V1.1=0→ variable set to 0 to compare to Input 3
I3.1 → Input 3 bank status
].1→ CML command to stop a motor
^.1 → CML command to start a direct mode move
P0.1=1000000000 → set direct move position to 1 billion for speed control
S0.1=50→ set direct move speed to 50
A0.1=10 →set direct move accel to 10

L1.1→ beginning of logic bank 2
END.1 → end of logic bank

[L1.1→ execute/run logic bank 2

K87.1=1 → logic bank execution time to 1 millisecond.

Example CML Code:

```
/set the scan time
K87.1=1

/internal motor position
V1.1=0

/set direct mode variables
P0.1=1000000000
S0.1=50
A0.1=10

/set V2 to position
L1.1
I3.1==V1.1,].1,^.1
END.1
```

```
/start the logic bank
[L1.1
```

Notes:

1) Like most logical statements the compared value can be implied. I.e. you can say I3.1,].1,^.1
2) Logical statements can be used in program and logic banks.

5. Inputs

1. Speed Control Using Multiple Digital Inputs as Binary Control

This example uses inputs 1-4 on the motor as digital inputs to set a speed. It uses a binary combination of the inputs to calculate 16 different set-points. All calculations and executions are done in three logic banks. The 1st logic bank calculates the binary combination. If it has changed the 2nd logic bank decides if the motor should be stopped or a speed is set. The 3rd logic bank sets required speed.

CML Code Used:

.1 → sending just the motor ID allows all following commands to be sent to that ID.

K87=5 → 5ms logic bank scan time
K85=1 → Logic bank 1 is started on power-up

P0=1000000000 → set direct mode to speed control
S0=0 → default speed is 0
A0=10 → default acceleration is 10

N10-N25 → N registers define constants to compare the binary combination too.
S1-S15 → S registers set the speed options for the binary combination

V0=0 → used to calculate and hold the binary combination
V1=0 → temporary variable used in calculations

V2=2 → binary multiplier for IN2
V4=4 → binary multiplier for IN3
V8=8 → binary multiplier for IN4

L1-L3 → indicated the start of a logic bank
END → indicates the end of a logic bank

$ → save the data to the eeprom so it is retained on a power cycle

Example CML Code:

```
/set ID to motor 1
.1

/set logic bank scan time
/and startup bank
K87=5
K85=1

/clear program banks
/and logic banks
B100
L100

/set P0 to speed control
/default speed is 0
P0=1000000000
S0=0
A0=10
```

```
/assign N values to be
/used as constants to compare
/to the input combination
N10=0
N11=1
N12=2
N13=3
N14=4
N15=5
N16=6
N17=7
N18=8
N19=9
N20=10
N21=11
N22=12
N23=13
N24=14
N25=15

/define speeds
S1=10
S2=20
S3=30
S4=40
S5=50
S6=60
S7=70
S8=80
S9=90
S10=100
S11=110
S12=120
S13=130
S14=140
S15=150

/set default values for variables
V0=0
V1=0
V3=0
V2=2
V4=4
V8=8

/scan inputs and calculate
/binary combination
/if it has changed call logic 2
L1.1
V0=I1;
V1=I2*V2;
V0=V0+V1;
V1=I3*V4;
V0=V0+V1;
V1=I4*V8;
```

```
V0=V0+V1;
V0!=V3, CL2,T0
END.1

/depending on combination
/stop the motor or set a speed
/by calling L3
L2.1
V3=V0;
V0==N10,],CL3
END.1

/set the speed and start the motor
L3.1
V0==N11,S0=S1,T0
V0==N12,S0=S2,T0
V0==N13,S0=S3,T0
V0==N14,S0=S4,T0
V0==N15,S0=S5,T0
V0==N16,S0=S6,T0
V0==N17,S0=S7,T0
V0==N18,S0=S8,T0
V0==N19,S0=S9,T0
V0==N20,S0=S10,T0
V0==N21,S0=S11,T0
V0==N22,S0=S12,T0
V0==N23,S0=S13,T0
V0==N24,S0=S14,T0
V0==N25,S0=S15,T0
^.1
END.1

/save data to eeprom
$.1

/start the logic bank
[L1.1
```

2. Feed function. Use input and logic bank to set a feed.

This example uses IN2 on the CM1 to set a feed function. A logic bank will start scanning the input on power up. If IN2 is true the motor will feed to an infinite position with a defined speed and acceleration. When IN2 is false the feed will stop.

You will notice that a value us used to hold the old input value. This will allow us to change on an edge of the signal. If the level is used and the] command is continuously sent the motor will not hold position correctly as it is continuously streamed a stop command. The stop command tells the motor to stop on its current position. If there is any error in position this will become the new position. If the application was vertical for example this could case the system to slowly drift downwards under gravity.

CML Code Used:

.1 → sending just the motor ID allows all following commands to be sent to that ID.

K87=1 → 1ms logic bank scan time
K85=1 → Logic bank 1 is started on power-up

P0=1000000000 → set direct mode to speed control
S0=100 → default speed is 100
A0=50 → default acceleration is 100
M0=100 → set the default peak torque to 100%

V2=0 → hold the old value of the input.

L1-L2 → indicated the start of a logic bank
END → indicates the end of a logic bank

^ → start the feed
] → stop the feed

$ → save the data to the eeprom to it is retained on a power cycle

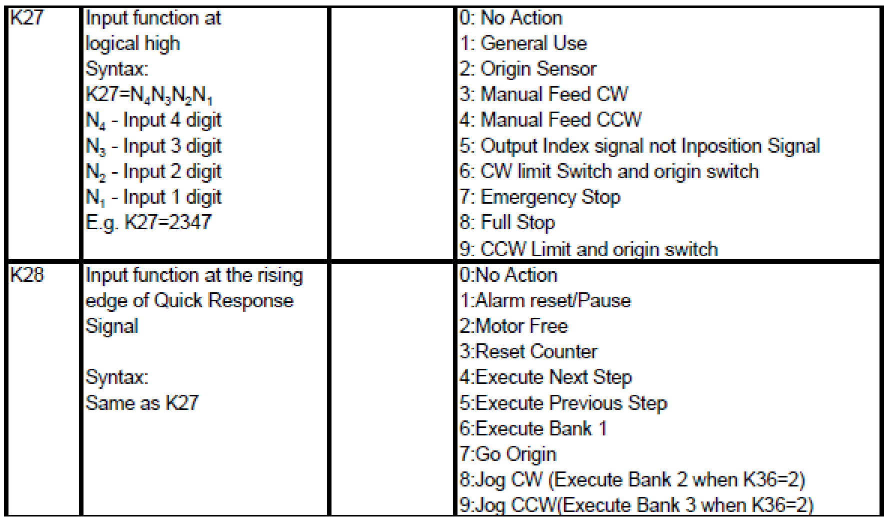
Example CML Code:

```
/set ID to motor 1
.1

/set logic bank scan time
/and startup bank
K87=1
K85=1

/clear program banks
/and logic banks
B100
L100

/set direct command registers.
P0=1000000000
S0=100
A0=50
M0=100

L1.1
I2.1!=V2.1, CL2.1, T0.1
END.1

L2.1
V2.1=I2.1
V2.1, ^.1, ].1
END.1

$.1
```

3. Input functions. Setting Inputs to Execute Banks or Switches

This example will overview how to utilize the input signals to run various actions on the Cool Muscle, specifically we will look at running a program bank and setting up an origin switch. There are 4 inputs available on a standard Cool Muscle motor. Each of the four input can be used for various actions such as an origin sensor, manual feed in a clockwise direction, to execute a bank or as an emergency stop.

There are 2 main K parameters that control input functions. K27 and K28. You can best see them explained on the Quick Reference Guide. Below you can see the parameters as found on the guide.



K27	Input function at logical high Syntax: $K27=N_4N_3N_2N_1$ N_4 - Input 4 digit N_3 - Input 3 digit N_2 - Input 2 digit N_1 - Input 1 digit E.g. K27=2347		0: No Action 1: General Use 2: Origin Sensor 3: Manual Feed CW 4: Manual Feed CCW 5: Output Index signal not Inposition Signal 6: CW limit Switch and origin switch 7: Emergency Stop 8: Full Stop 9: CCW Limit and origin switch
K28	Input function at the rising edge of Quick Response Signal Syntax: Same as K27		0:No Action 1:Alarm reset/Pause 2:Motor Free 3:Reset Counter 4:Execute Next Step 5:Execute Previous Step 6:Execute Bank 1 7:Go Origin 8:Jog CW (Execute Bank 2 when K36=2) 9:Jog CCW(Execute Bank 3 when K36=2)

The parameters K29, K30, K31 and K32 also utilize the above functions and are set the same way but perform based upon a slow response signal. The inputs are set Based on a bit system, where each digit of the number represents one of the 4 inputs.

$$K27=N_4N_3N_2N_1$$

Where N_4 is IN4, and N_1 is IN1.

In this example we will be setting input 3 to run execute program bank 1 and input 4 is being used as an origin sensor.

CML Code Used:

.1 → sending just the motor ID allows all following commands to be sent to that ID.

K27=2000 → Set input 4 to function 2, which is "Origin Sensor"
K28=0600 → Set Input 3 to function 6, which is "Execute Bank 1"

K42=20 →Origin search speed set to 20 (unit 100pps)
K43=20 → Origin search acceleration set to 20 (unit kpps^2)
K45=1 →Set origin search direction to 1, which is CCW (See Quick reference guide)
K46=3 →Choose origin search method, 3= Origin switch (start search on power up)
K48=0 →Set offset distance for origin search (unit 100pulses)

A1=30 → Acceleration 1 is 30Kpps^2
S1=50 → Speed 1 is 50 (see K27 for unit)
P1=5000 → Position 1 is 5000 pulses

B1 → indicated the start of a program bank
END → indicates the end of a program bank

$ → Save the data to the eeprom to it is retained on a power cycle

Example CML Code:

```
//set ID to motor 1
.1

//Set your input functions
K27=2000
K28=0600

//Set your origin search settings
K42=20
K43=20
K45=1
K46=3
K47=30
K48=0

//clear program banks
//and logic banks
B100
L100

//Set command registers
A1=30
S1=50
P1=5000

B1
A1,S1,P1
END

$.1
```

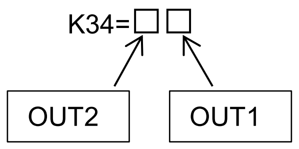
6. Outputs

1. Manually setting an output

This application example shows how we can manually switch an output on and off. The CM1 has two outputs. These outputs can be used for serial communication. In this case because we are using OUT1 for communication so we are going to manually switch OUT2.

The ‘O’ and ‘F’ CML commands are used to switch the output. ‘O’ switches the output on and ‘F’ switches the output off. The output also needs to be configured for general use. There are other uses for the output such as an alarm output or inposition output. K34 sets the output functionality. If the output by default needs to be inverted this can be changed in K33. Note that if the motor detects the serial port on OUT1 the K33 and K34 functions are ignored.

In K33 and K34 the inputs are set up as: left most digit → OUT2, right most digit → OUT1.



This CML can be run in CWLite. We can load the K33 and K34 parameters either together on the edit window or individually in the single line command. Then O2 and F2 commands we send through the single line command when we want to switch them.

CML Code Used:

K33=00 → outputs are set to normally open
K34=41 → set OUT2 to 4. This sets the output to use O2 and F2. Leave OUT1 at default
O2 → set OUT2 on.
F2 → set OUT2 off.

Example CML Code:

```
/set the output setup registers
/set to normally open
K33=00
/set OUT2 to manual use
K34=41

/switch the output on
O2

/switch the output off
F2
```

2. Setting an output to activate a brake if the motor is disabled

This example will show how to let the motor handle automatic switching on and off of an output depending on the status of the motor. In this case we are looking for the motor disabled status. If the motor is disabled then we will set on an output, if it is enabled we will switch off the output. The brake is attached to the output selected.

CML Code Used:

.1 → sending just the motor ID allows all following commands to be sent to that ID.
K87=1 → 1ms logic bank scan time
K85=1 → Logic bank 1 is started on power-up
K34=40→ Set both OUT2 to manual use

L100 → Clear all logic banks that could have been previously loaded

V1="Ux"→ Motor internal status
V2=16 → A status of 16 indicates the motor is disbled

O2.1 → Set output 2 on
F2.1 → Set output 2 off

L1	→ indicated the start of a logic bank
END	→ indicates the end of a logic bank
[L1.1	→ start logic bank 1
$	→ save the data to the eeprom so it is retained on a power cycle

Example CML Code:

```
.1
K87.1=1
K85.1=1
K34.1=40

V1.1="Ux"
V2.1=16

L100.1

L1.1
V1.1==V2.1,O2.1,F2.1
END.1

$.1

[L1.1
```

7. Analog Control

1. Basic Speed Control

This example shows how to set the Cool Muscle to run speed control on the analog input. It uses predefined functions within the K parameters. In this example the max rpm=1000.

CML Code Used:

.1	→ sending just the motor ID allows all following commands to be sent to that ID.
K62=9	→ switches on analog control
K38=0	→sets the analog control to speed control
K40	→sets the maximum speed in RPM in both directions.

The speed is linear over the following ranges

0V	2.4V-2.6V	5V
-max rpm	0 rpm	max rpm

Example CML Code:

```
.1
K62=9
K38=0
K40=1000
```