

# Command Set Overview

## Reference Key:

# - is the IO Bit Number

m - is the mask value of which bits are affected

W - defines it as a word (16 bits)

expression - an expression must contain no more than a total maximum of 32 operators, values, and parenthesis.

value - a number, variable or math expression with one operand

constant - means a fixed integer

gen# Trajectory generator number: 1 or 2

i - Interrupt number , valid values are from 0 to 7

## Communication Commands:

<b>ADDR=expression</b>	Set motor's serial communications address. Applies for both RS232 and RS485
<b>BAUD(x)=y</b>	This allows for COM0 or COM1 to be changed, x is the channel (0 or 1) and y is baud rate
<b>CADDR=expression</b>	Set CAN address, can be different from serial address, default is 63
<b>CBAUD=expression</b>	Set CAN baud rate, default is 125000
<b>CCHN(RS2,0)</b>	Close communication channel command
<b>ECHO</b>	Must be used to insure all data received in one motor will be echoed to next motor
<b>ECHO_OFF</b>	Default, turn communication's echo off
<b>GETCHR</b>	Get the next character from channel 0
<b>GETCHR1</b>	Get the next character from channel 1
<b>LEN</b>	Number of characters in channel 0 buffer
<b>LEN1</b>	Number of characters in channel 1 buffer
<b>RCADDR</b>	Reports CAN address
<b>RCBAUD</b>	Reports CAN baud rate
<b>RCHN(0)</b>	Report channel 0 error bits
<b>RCHN(1)</b>	Report channel 1 error bits
<b>SILENT</b>	Ignore print commands to channel 0 from user program
<b>SILENT1</b>	Ignore print commands to channel 1 from user program
<b>SLEEP</b>	Ignore commands for channel 0 except the WAKE command
<b>SLEEP1</b>	Ignore commands for channel 1 except the WAKE command
<b>STDOUT=0</b>	Sets internal report commands to RS232 (default)
<b>STDOUT=1</b>	Sets internal report commands to RS485
<b>TALK</b>	Enable prints for channel 0 from user program
<b>TALK1</b>	Enable prints for channel 1 from user program
<b>WAKE</b>	Wake for channel 0
<b>WAKE1</b>	Wake for channel 1

## Program Flow Commands:

<b>CASE expression</b>	Switch case statement
<b>C constant</b>	Subroutine label, e.g. C10 for subroutine 10, must have a RETURN for each C label
<b>DEFAULT</b>	Default action for switch case statement
<b>DITR(i)</b>	Individual interrupt disable

<b>EITR(i)</b>	Individual interrupt enable
<b>ELSEIF expression</b>	Used for IF statements to test another condition, if expression is true, then execute code
<b>END</b>	End program execution
<b>ENDIF</b>	End statement for IF code structures
<b>ENDS</b>	Command for end of switch case statement
<b>GOSUB(value)</b>	Call a subroutine, value up to 999
<b>GOTO(value)</b>	Jump program execution to a label, value up to 999
<b>IF expression</b>	Conditional Test, expression can be multiple math operations
<b>ITR(i, status_wrd#, bit#, s ,label#)</b>	Interrupt setup
<b>ITRD</b>	Global interrupt scanner disable
<b>ITRE</b>	Global interrupt scanner enable
<b>LOOP</b>	Loop command for while loops
<b>PAUSE</b>	Pause program execution, used for interrupts
<b>RESUME</b>	Resume program execution
<b>RETURN</b>	Return from subroutine
<b>RETURNI</b>	Return from interrupt
<b>RUN</b>	Start program execution
<b>RUN?</b>	Wait at this point for RUN command before program starts to execute
<b>STACK</b>	Resets all GOSUB stack returns and Interrupts
<b>SWITCH expression</b>	Switch case statement
<b>TWAIT</b>	Wait for trajectory to complete, only used in program
<b>TWAIT(gen#)</b>	Wait for trajectory generator (gen#) to complete it's move
<b>TSWAIT</b>	Wait for synchronized trajectory to complete, down loaded program only * <b>COMBITRONIC</b> <sup>™</sup>
<b>WAIT=expression</b>	Set wait time in milliseconds
<b>WHILE expression</b>	While loop format

## I/O Commands:

<b>EIGN(#)</b>	Assign a single I/O point as general use input
<b>EIGN(W,0)</b>	Assign all local I/O as general use inputs
<b>EIGN(W,0,12)</b>	Assign inputs 2 and 3 as general use inputs at once (disabling over-travel limits)
<b>EIGN(W,0,m)</b>	Assign a masked word-sized set of local I/O as general use inputs at once
<b>EILN</b>	Set port C (I/O-2) as negative over travel limit
<b>EILP</b>	Set port D (I/O-3) as positive over travel limit
<b>EIRE</b>	Set I/O 6 to capture external encoder's current value
<b>EIRI</b>	Set I/O 6 to capture internal encoder's current value
<b>EISM(6)</b>	Issue (G) when local input 6 goes low
<b>EOBK(#)</b>	Configure a given output to control an external brake
<b>IN(#)</b>	x=IN( ), assign the state of a specific I/O to a variable (x in this case)
<b>IN(W,0)</b>	x=IN(W,0), assign the state of the first word of local I/O to the variable x
<b>INA(A,#)</b>	x=INA(A,#), raw analog reading: 10 bit resolution spanned over signed 16 bit range

\* **COMBITRONIC**<sup>™</sup> These commands require Combitronic with -C or -DN product configuration option to execute.

# Command Set Overview

<b>INA(V,#)</b>	x=INA(V,#), input voltage in millivolts of analog input value for a given I/O defined by #	<b>ADTS=expression</b>	Set sync accel/decel at once for a move * <b>COMBITRONIC™</b>
<b>INA(V1,#)</b>	x=INA(V1,#), scaled 0-5 VDC reading in millivolts directly, 3456 would be 3.456 VDC	<b>Ai(0)</b>	Arm index rising edge of internal encoder
<b>OC(#)</b>	x=OC(#), individual output status, bit 1 if output is being driven	<b>Ai(1)</b>	Arm index rising edge of external encoder
<b>OC(W,#)</b>	x=OC(W,#), block output status, bit 1 if output is being driven	<b>Aij(0)</b>	Arm index rising edge then falling edge internal encoder
<b>OF(#)</b>	x=OF(#), returns present fault state for I/O defined by #	<b>Aij(1)</b>	Arm index rising edge then falling edge external encoder
<b>OF(L,#)</b>	x=OF(W,#), returns bit mask fault latched for I/O points	<b>Aj(0)</b>	Arm index falling edge of internal encoder
<b>OF(W,#)</b>	x=OF(W,#), returns bit mask of present faulted I/O points	<b>Aj(1)</b>	Arm index falling edge of external encoder
<b>OR(value)</b>	Reset output (turn off)	<b>Aji(0)</b>	Arm index falling edge then rising edge internal encoder
<b>OS(value)</b>	Set output (turn on)	<b>Aji(1)</b>	Arm index falling edge then rising edge external encoder
<b>OUT(#)=expression</b>	if expression LSB = 1, then it's true(1), otherwise it's false (0)	<b>AMPS=expression</b>	Current limit value. 0-1023
<hr/>		<b>AT=expression</b>	Set the acceleration target for a move
<b>Math Commands:</b>		<b>ATS=expression</b>	Set sync acceleration target for a move * <b>COMBITRONIC™</b>
-	Subtract	<b>BREAK</b>	Break out of while loop
!	Bitwise exclusive OR	<b>BRKENG</b>	Manually Engage the brake
!=	Not equal to	<b>BRKRLS</b>	Manually Release the brake
%	Modulo (remainder) division	<b>BRKSRV</b>	Brake Servo, engage the brake when the drive is not active (default)
&	Bitwise AND	<b>BRKTRJ</b>	Brake Trajectory
*	Multiply	<b>CTR(0)</b>	Present value of internal encoder
/	Divide	<b>CTR(1)</b>	Present value of external encoder
^	Power limited to 4th power and below, integers only	<b>DEL=expression</b>	Set maximum allowable derivative error limit
	Bitwise inclusive OR	<b>DT=expression</b>	Set the deceleration target for a move
+	Add	<b>DTS=expression</b>	Set sync deceleration for a move * <b>COMBITRONIC™</b>
<	Less than	<b>EL=expression</b>	Set maximum allowable following error limit
<=	Less than or equal to	<b>ENC1</b>	Enable external encoder for servo
==	Equal to	<b>ENC0</b>	Enable internal encoder for servo
>	Greater than	<b>F</b>	Set tuning values
>=	Greater than or equal to	<b>G</b>	Go, initiates all buffered modes of operation
<b>ABS(value)</b>	Absolute Value	<b>G(gen#)</b>	Go, initiate motion in trajectory generator (gen#)
<b>ACOS(value)</b>	Arc Cosine	<b>GS</b>	Go synchronized, initiates linear interpolated moves * <b>COMBITRONIC™</b>
<b>ASIN(value)</b>	Arc Sine	<b>KA=expression</b>	Feed forward gain
<b>ATAN(value)</b>	Arc Tangent	<b>KD=expression</b>	Derivative gain coefficient
<b>COS(value)</b>	Cosine	<b>KG=expression</b>	Gravity offset
<b>FABS(value)</b>	Floating point absolute value	<b>KI=expression</b>	PID integral gain
<b>FSQRT(value)</b>	Floating point square root	<b>KL=expression</b>	PID integral limit
<b>RANDOM=expression</b>	Set the random seed value 0 to 2^31 - 1	<b>KP=expression</b>	PID proportional gain
<b>RRANDOM</b>	Report the next available random number in the range 0 to 2^31 - 1	<b>KS=expression</b>	Differential sample rate
<b>SIN(value)</b>	Sine	<b>KV=expression</b>	Velocity feed forward gain
<b>SQRT(value)</b>	Square Root	<b>MC</b>	Initiate electronic camming
<b>TAN(value)</b>	Tangent	<b>MC(2)</b>	Set Trajectory Generator 2 to run in electronic camming
<b>TMR(x,t)</b>	Sets timer x for t milliseconds	<b>MDB</b>	Enable TOB when in one of the 2 trapezoidal modes
<hr/>		<b>MDE</b>	Set motor to enhanced trapezoidal mode commutation by using encoder
<b>Motion Commands:</b>		<b>MDS</b>	Set motor to sine mode commutation
<b>ADT=expression</b>	Set the accel/decel at once for a move		

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<b>MDT</b>	Set motor to trapezoidal mode commutation using hall sensors (default mode)	<b>SLN=<i>expression</i></b>	Set the negative software travel limit
<b>MFA(<i>value</i>)</b>	Accel over <i>value</i> master distance. Default is zero (off)	<b>SLP=<i>expression</i></b>	Set the positive software travel limit
<b>MFD(<i>value</i>)</b>	Decel over <i>value</i> master distance. Default is zero (off)	<b>T=<i>expression</i></b>	Set the commanded torque while in MT mode
<b>MFDIV=<i>expression</i></b>	Assign Incoming counts Divisor	<b>TH=<i>expression</i></b>	Set maximum allowable thermal limit (degrees C)
<b>MFMUL=<i>expression</i></b>	Assign Incoming counts Multiplier	<b>VT=<i>expression</i></b>	Set the velocity target for a move
<b>MFO</b>	Initiate and zero counter, but do not follow	<b>VTS=<i>expression</i></b>	Set synchronized velocity target for a move <i>* COMBITRONIC™</i>
<b>MFR</b>	Select follow mode using quadrature encoder input.	<b>X</b>	Decelerate to a stop at present deceleration rate
<b>MFR(2)</b>	Set Trajectory Generator 2 to run in Mode Follow Ratio (electronic Gearing)	<b>X(<i>gen#</i>)</b>	Decelerate to a stop , trajectory generate ( <i>gen#</i> )
<b>MFSLEW(<i>value</i>)</b>	Stay at slew for <i>value</i> distance, then decel		
<b>MINV(0)</b>	Default motor commutation direction		
<b>MINV(1)</b>	Invert commutation, shaft rotates opposite direction		
<b>MP</b>	Initiate Position Mode		
<b>MP(1)</b>	Set Trajectory Generator 1 to run in Position Mode		
<b>MS0</b>	Initiate and zero counter, but do not follow		
<b>MSR</b>	Calculate Mode Step Ratio and prepare to follow		
<b>MT</b>	Initiate Torque Mode (Open Loop)		
<b>MTB</b>	Enable mode torque brake		
<b>MV</b>	Initiate Velocity Mode		
<b>MV(1)</b>	Set Trajectory Generator 1 to run in Velocity Mode		
<b>O=<i>expression</i></b>	Set origin, set present position to some value		
<b>O(<i>gen#</i>)=<i>expression</i></b>	Set origin for move <i>gen#</i> to some value		
<b>OFF</b>	Turn the amplifier off		
<b>OSH=<i>expression</i></b>	Origin shift of position counter on the fly		
<b>OSH(<i>gen#</i>)=<i>expression</i></b>	Shift origin for move <i>gen#</i> by some value		
<b>PID1</b>	Set default PID update rate		
<b>PID2</b>	Set default PID/2 update rate		
<b>PID4</b>	Set default PID/4 update rate		
<b>PID8</b>	Set default PID/8 update rate		
<b>PML=<i>expression</i></b>	Sets the position modulo limit wrap value		
<b>PMT=<i>expression</i></b>	Set the position modulo target		
<b>PRT=<i>expression</i></b>	Set the relative target position		
<b>PRTS=(<i>dist1;axis1,dist2;axis2,dist3;axis3</i>)</b>	Set synchronized relative target position <i>* COMBITRONIC™</i>		
<b>PRTSS=(<i>dis1;axis</i>)</b>	Set supplemental synchronized relative target position <i>* COMBITRONIC™</i>		
<b>PT=<i>expression</i></b>	Set the absolute target position		
<b>PTS=(<i>dist1;axis1,dist2;axis2,dist3;axis3</i>)</b>	Set synchronized absolute target position <i>* COMBITRONIC™</i>		
<b>PTSS=(<i>dis1;axis</i>)</b>	Set supplemental synchronized absolute target position <i>* COMBITRONIC™</i>		
<b>S</b>	Instantly stop motor		
<b>S(<i>gen#</i>)</b>	Instantly stop trajectory generator ( <i>gen#</i> )		
<b>SLD</b>	Disable software travel limits		
<b>SLE</b>	Enable software travel limits		
<b>SLM (0)</b>	Make a soft limit only trigger the flag, but not cause a fault		
<b>SLM (1)</b>	Make s soft limit trigger the flag and cause a fault (default mode)		
		<b>CLK=<i>expression</i></b>	System Clock value in milliseconds
		<b>ERRC</b>	Get most recent command error code
		<b>ERRW</b>	Where/Who commanded most recent error
		<b>FSA ( )</b>	FSA(0,0) is default, sets all types of faults to result in MTB
		<b>RAC</b>	Report commanded acceleration
		<b>RAT</b>	Report target acceleration

## Status Commands:

<b>Ba</b>	<i>Over current bit, status word 0, bit 4 status word 1, bit 3</i>
<b>Be</b>	<i>Excessive position error, status word 0, bit 6</i>
<b>Bh</b>	<i>Excessive temperature occurred, status word 0, bit 5</i>
<b>Bi(0)</b>	<i>Rising Edge Capture on Encoder 0 (internal), status word 1, bit 2</i>
<b>Bi(1)</b>	<i>Rising Edge Capture on Encoder 1 (external), status word 1, bit 6</i>
<b>Bj(0)</b>	<i>Falling Edge Capture on Encoder 0 (internal), status word 1, bit 7</i>
<b>Bj(1)</b>	<i>Falling Edge Capture on Encoder 1 (external), status word 1, bit 7</i>
<b>Bk</b>	<i>Main program checksum error, program is corrupt and cannot run, status word 2, bit 15</i>
<b>Bl</b>	<i>Left (-) over travel limit, status word 0, bit 13</i>
<b>Bls</b>	<i>Left (-) over travel software limit occurred, status word 1, bit 13</i>
<b>Bm</b>	<i>Left (-) over travel limit active, status word 0, bit 15</i>
<b>Bms</b>	<i>Left (-) over travel software limit active, status word 1, bit 15</i>
<b>Bo</b>	<i>Motor is off, status word 0, bit 1</i>
<b>Bp</b>	<i>Right (+) over travel limit active, status word 0, bit 14</i>
<b>Bps</b>	<i>Right (+) over travel software limit active, status word 1, bit 14</i>
<b>Br</b>	<i>Right (+) over travel limit, status word 0, bit 12</i>
<b>Brs</b>	<i>Right (+) over travel software limit occurred, status word 1, bit 12</i>
<b>Bs</b>	<i>Command Syntax error note, status word 2, bit 14</i>
<b>Bt</b>	<i>Trajectory in progress, status word 0, bit 2</i>
<b>Bv</b>	<i>Velocity limit, status word 0, bit 7</i>
<b>Bw</b>	<i>Wrap around occurred, position wrapped through +/- 2<sup>31</sup>, status word 3, bit 3</i>
<b>Bx(0)</b>	<i>Hardware index input probe state for internal encoder, status word 1, bit 8</i>
<b>Bx(1)</b>	<i>Hardware index input probe state for external encoder, status word 1, bit 9</i>

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<b>Ra</b>	Report value of variable 'a'	<b>RTMR(x)</b>	Report timer x (present time left in milliseconds)
<b>Rab[0]</b>	Report value of ab[0]	<b>RT</b>	Report commanded torque
<b>Raf[0]</b>	Report floating point value of af[0]	<b>RVC</b>	Report commanded velocity
<b>Ral[0]</b>	Report value of al[0]	<b>RVT</b>	Report target velocity
<b>Raw[0]</b>	Report value of aw[0]	<b>RUIA</b>	Reports current (Amps=UIA/100)
<b>REPTR</b>	Reports EEPROM pointer value	<b>RUJA</b>	Reports bus voltage (Volts=UJA/10)
<b>RCKS</b>	Report Checksum	<b>RVA</b>	Report actual velocity
<b>RB(sw,b)</b>	Report status bit, b, from status word, sw	<b>RW(value)</b>	Report status word
<b>RCLK</b>	Report system clock in milliseconds	<b>Z(sw,b)</b>	Clears/zeros status word bits
<b>RCTR(0)</b>	Report present value of internal encoder	<b>Za</b>	Reset over current bit
<b>RCTR(1)</b>	Report present value of external encoder	<b>Ze</b>	Reset position error bit
<b>RDEA</b>	Report actual derivative error	<b>Zh</b>	Reset over temperature bit
<b>RDEL</b>	Report commanded derivative error limit	<b>Zl</b>	Reset left(-) historical limit bit
<b>RDT</b>	Report target deceleration	<b>Zls</b>	Reset left(-) software historical limit bit
<b>REA</b>	Report actual following error	<b>Zr</b>	Reset right(+) historical limit bit
<b>REL</b>	Report commanded following error limit	<b>Zrs</b>	Reset right(+) software historical limit bit
<b>RI (0)</b>	Report where the rising edge of the internal index was detected	<b>Zs</b>	Reset syntax error bit
<b>RI (1)</b>	Report where the rising edge of the external index was detected	<b>ZS</b>	Clear all errors, reset system latches to power up state
<b>RIN(#)</b>	Report the state of a I/O	<b>Zw</b>	Reset wraparound bit
<b>RIN(W,0)</b>	Report the first word of local I/O		
<b>RINA(A,#)</b>	Reports analog input value for a given I/O defined by #		
<b>RINA(V,#)</b>	Reports voltage level (scaled from supply) of analog input value for a given I/O defined by #		
<b>RINA(V1,#)</b>	Reports voltage level (scaled 0-5 VDC) of analog input value for a given I/O defined by #		
<b>RJ(0)</b>	Report where the falling edge of the internal index was detected		
<b>RJ(1)</b>	Report where the falling edge of the external index was detected		
<b>RMFDIV</b>	Report Divisor		
<b>RMFMUL</b>	Report Multiplier		
<b>RMODE</b>	Report mode of operation		
<b>RPA</b>	Report present actual position		
<b>RPC</b>	Report present commanded position		
<b>RPC(gen#)</b>	Report commanded position for trajectory generator (gen#)		
<b>RPMA</b>	Report the current modulo counter		
<b>RPML</b>	Report position modulo limit		
<b>RPMT</b>	Report the most recent setting of PMT (position modulo target)		
<b>RPRA</b>	Report actual relative position		
<b>RPRC</b>	Report commanded relative position		
<b>RPRT</b>	Report present relative target position		
<b>RPT</b>	Report present target position		
<b>RRES</b>	Report encoder resolution of motor		
<b>RSLN</b>	Report value of negative software limit		
<b>RSLP</b>	Report value of positive software limit		
<b>RSP</b>	Report sampling rate and firmware version		
<b>RSP1</b>	Report firmware revision date		
<b>RTH</b>	Report maximum allowable thermal limit		

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## Variable Commands:

<b>a=expression</b>	Variable, 32 bit signed integers, a-z, aa-zz, aaa-zzz, 78 total variables
<b>ab[x]=expression</b>	Array variables, 8 bit byte arrays, x can be 0-203
<b>af[x]=expression</b>	Floating point array variables, x can be 0-7
<b>al[x]=expression</b>	Array variables, 32 bit long arrays, x can be 0-50
<b>aw[x]=expression</b>	Array variables, 16 bit word arrays, x can be 0-101
<b>EPTR=expression</b>	EEPROM pointer, non-volatile memory, use before VLD and VST commands
<b>VLD(variable,quantity)</b>	Load values from EEPROM to variables starting at EPTR location
<b>VST(variable,quantity)</b>	Store values to EEPROM from variables starting at EPTR location

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## Other Commands:

<b>LOCKP</b>	Disable program (EEPROM) upload
<b>UPLOAD</b>	Upload the program
<b>OCHN(RS2,0,N,9600,1,8,C,1000)</b>	Default: (RS232,chan=0, no parity, 9600 baud,1 stopbit, 8 databits, command,1000 ms timeout)
<b>PRINT("Hello World",#13)</b>	Print command to say "Hello World", see print section for more detailed examples
<b>PRINT1("Hello World",#13)</b>	Print command to say "Hello World" on channel 1, see print section for more detailed example

**Note: See users guide for complete list of commands and full syntax.**

**Many commands such as Cam mode and dual trajectory mode commands are not fully explained here.**