

Device Name:

73006060 DAIO Controller

Device ID:

DAIO

Command set for DAIO Version 0.1

July, 1st 2009

CAN COMMANDS:

Motor Action Commands (CAN ____ 65 [CMD] [VAL]):

Num	COMMAND	Description
0	START_MOTOR_TARGET	Moves COAX output to specified value
1	START_MOTOR	Moves COAX output to pre-defined target
3	INCREMENT_MOTOR	Increments COAX output by increment value
4	INCREMENT_INC	Sets Increment value
5	DECREMENT_MOTOR	Decrements COAX output by value
6	DECREMENT_INC	Sets Decrement value
16	FAKE_SYNCH_SIGNAL	If the action queue is enabled, this command will start the first command on the action queue just like an external synch signal.
22	PERSONALITY_LOAD	See tripath docs
23	PERSONALITY_SAVE	See tripath docs

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

GET LONG DATA / SET LONG DATA

Num	S E T	G E T	tested	COMMAND	Description
0	X	X	X	CURRENT_DEVICENUM	Standard
1		X	X	MODULE_LEGACY	Standard
2	X	X	X	MODULE_DATE	Standard
3		X	X	VERSION_NO	Standard
4	X	X	X	LEP_DEVICE_TYPE	Standard
5	X	X	X	MOTOR_POSITION	READ: Reads value of COAX output WRITE: Sets COAX output to value specified
6	X	X	X	MOTOR_ENCODER	READ: Returns Zero WRITE: Does Nothing
7	X	X	X	MOTOR_TARGET	READ: Reads current target value of COAX output WRITE: Sets target value
8	X	X	X	MOTOR_INCREMENT	READ/WRITE Current positive motor increment...used for CAN __ 65 3 0
12	X	X	X	MOTOR_STARTING_SPEED	Always Reports zero
13	X	X	X	MOTOR_TOP_SPEED	Ramp speed in steps/second used during moves
14	X	X	X	MOTOR_RESOLUTION	Always Reports zero
15	X	X	X	MOTOR_POWER_LEVEL	Always Reports one
20	X	X	X	REQUESTED_DEVICENUM	Standard
30	X	X		SYNCH_COMPARE	????
31	X	X		SYNCH_QUEUE_CONFIGURE	????
33	X	X		CONFIG_REPORT_ENABLE	Standard
34	X	X	X	REQUEST_REPORT	Standard
35	X			CONFIG_REPORT_MASK	????

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Num	S E T	G E T	tested	COMMAND	Description
36	X			CONFIG_RPT_INTERVAL	Standard
37		X	X	ONE_WIRE_PRESENT	Always reports not present
210	X	X	X	ACCEL_UP	Always Reports 0
211	X	X	X	ACCEL_DWN	Always Reports 0
212	X	X	X	MOTOR_TOP_SPEED	Always Reports 0
234	X	X	X	MOTOR_POWER	NOT USED, Always reports 1
235	X	X	X	ENCODER_MODE	Not USED
236		X	X X X X X X X X	STATUS_5000 Bit 0 Bit 1 Bit 2 Bit 3 Bit 4 Bit 5 Bit 6 Bit 7	Bit 0: Busy Bit 1: Set if DAC value >0 Bit 2: Set if Increment Value is < 0 Bit 3: Joystick Enabled Bit 4: Set if DAC value is Ramping Bit 5: If Ramping Up set to 1 else set to zero Bit 6: Trigger Input Bit 7: Control Loop Settled on target...If open loop then this is DA got to position
248	X	X	X	MOTOR_DIRECTION_REV	Always Reports 0
251	X		X	BLINK_LEDS	Standard
263		X	X	IS_CMD_AVAIL	
268		X	X	ANALOG_INPUT_BINARY	Raw A/D Values in format A B C D where A is MSB Byte A specifies the Channel to read (0-3)

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Num	S E T	G E T	tested	COMMAND	Description
269	X	X	X	ANALOG_OUTPUT_BINARY	<p>Set D/A to specified value Value specified is in format A B C D where A is MSB Byte A specifies the Channel to read (0-7) BCD specifies the value...only lower 16 bits used.</p> <p>Special Bits in Byte A for DAIO board Bit 4 – If set will set the power on default for the specified channel Bit 5 – If set will restore all outputs to their default values.</p>
273*	X	X	X	GPIO_CONTROL	<p>Read / Set GPIO Registers Value specified in A B C D where A is MSB.</p> <p>C D – Specifies value</p> <p>A B=0 – Logic I/O Input Register A B=1 – Logic I/O Input Latch Register A B=2 – Logic I/O Output Register A B=3 – Logic I/O Direction Register A B=4 – Switch I/O Output Register A B=5 – Switch I/O Status Register</p> <p>AB=0x102 – Default Output AB=0x103 – Default Direction AB=0x104 – Default Switch AB=0x200 – Reset all to defaults</p> <p>Note for MAC 5 comp....Logic Inputs on Bits 8-15 Outputs on Logic 0-7 and SW 0-7</p>

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Num	S E T	G E T	tested	COMMAND	Description
274*	X	X	X	PWM_PERIOD	Specifies pwm period Range 85 to 87000 or 8.5us to 87ms
275*	X	X	X	PWM_CONTROL	Read / Set PWM Control Low byte contains control bits Bit 0 – Start/Stop PWM 1 Bit 1 – Level PWM 1. 0 Indicates Normally Low Bit 4 – Start/Stop PWM 2 Bit 5 – Level PWM 2. 0 Indicates Normally Low Bit 7 – Enable. 1 indicates both channels are enabled
276*	X	X	X	PWM_DUTY_CYCLE	High byte selects channel, low 2 bytes determine duty cycle in .01% increments....50%=5000 (0-10000)

* refers to New commands added for DAIO module

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Commands	Length*	Use	High Level Equivalent	CAN Command Equivalent
97	1	Read digital input	READ I GPIO O I	CAN __ 84 273 0
129	1	Read latched input	GPIO O L	CAN __ 84 273 &h00010000
68	1	Load digital output	WRITE O GPIO O S=	CAN __ 83 273 &h000400xx
100	1	Read digital output	READ O GPIO O S	CAN __ 84 273 &h00040000
104	1	Read analog input channel 0 (8 bit res)		CAN __ 84 268 &h00000000
106	1	Read analog input channel 1 (8 bit res)		CAN __ 84 268 0x01000000
107	1	Read analog input channel 2 (8 bit res)		CAN __ 84 268 0x02000000
108	1	Read analog input channel 3 (8 bit res)		CAN __ 84 268 0x03000000
140	2	Read analog input channel 0 (12 bit res)		CAN __ 84 268 0
141	2	Read analog input channel 1 (12 bit res)		CAN __ 84 268 0x01000000
142	2	Read analog input channel 2 (12 bit res)		CAN __ 84 268 0x02000000
143	2	Read analog input channel 3 (12 bit res)		CAN __ 84 268 0x03000000

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Commands	Length*	Use	High Level Equivalent	CAN Command Equivalent
109	1	Read analog output channel 0 (8 bit)		CAN __ 84 269 0
110	1	Read analog output channel 1 (8 bit)		CAN __ 84 269 0x01000000
111	1	Read analog output channel 2 (8 bit)		CAN __ 84 269 0x02000000
112	1	Read analog output channel 3 (8 bit)		CAN __ 84 269 0x03000000
77	1	Load analog output channel 0 (8 bit)		CAN __ 83 269 0x0000vv00
78	1	Load analog output channel 1 (8 bit)		CAN __ 83 269 0x0100vv00
79	1	Load analog output channel 2 (8 bit)		CAN __ 83 269 0x0200vv00
80	1	Load analog output channel 3 (8 bit)		CAN __ 83 269 0x0200vv00
69	2	Load analog output channel 0 (16 bit)	BVOLT I= VOLT I=	CAN __ 83 269 0x0000vvvv
101	2	Read analog output channel 0 (16 bit)	BVOLT I VOLT I	CAN __ 84 269 0
		Load analog output channel n (16 bit) N=0..7 for 8 output channels	DAVAL O Bn=vvvv DAVAL O Vn=vvvv	CAN __ 83 269 0x0n00vvvv

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Commands	Length*	Use	High Level Equivalent	CAN Command Equivalent
		Read analog output channel n (16 bit) N=0.7 for 8 output channels	DAVAL O Bn DAVAL O Vn	CAN __ 84 269 0x0n000000
		Read analog input channel n (16 bit)	ADVAL O Bn	CAN __ 84 268 0x0n000000
		Load Default analog output value for chn n N=0x10..0x17 for power up defaults		CAN __ 83 269 0x1n00vvvv
		PWM Control (on/off, level, enable) See can description for bit definitions	PWM O C=val	CAN __ 83 275 v
		PWM Period Value specified in 0.1uS	PWM O P=val	CAN __ 83 274 v
		PWM Duty Cycle N specifies channel (0,1) V is in 0.01%	PWM O Dn=val	Can __ 83 276 0xnnvvvvvv
		Set Coax Output to value	HERE O=val	CAN __ 83 5 vvvv
		Read Coax Output Value	WHERE O	CAN __ 84 5 0
		Move Coax Output to value, ramp designated by speed O	MOVE O=val	CAN __ 65 0 val
		Set Ramp Speed of Move in steps/sec	SPEED O=val	CAN __ 83 13 val

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

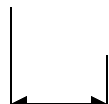
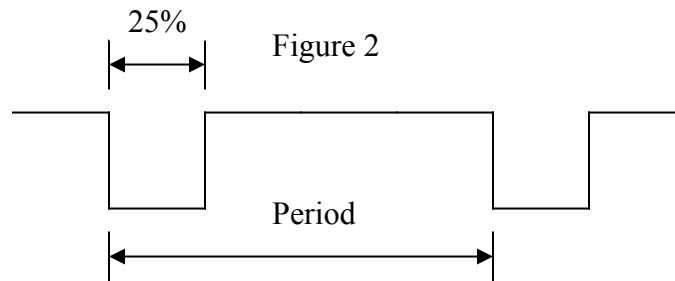
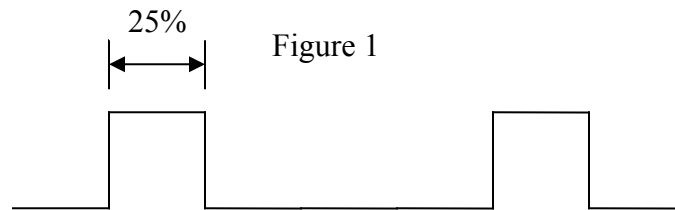
Commands	Length*	Use	High Level Equivalent	CAN Command Equivalent
		Read Ramp Speed of Move in steps/sec	SPEED O	CAN __ 84 13 0

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

PWM Specifics: n-indicates Channel x-don't care

Enable Bit 7	Start/Stop n Bit 0 or 4	Level n bit 1 or 5	Duty Cycle n	Output Level n Appears on OUT 5 and 6
0	X	x	x	Controlled by Switch bit
1	0	0	x	L
1	0	1	x	H
1	1	0	0	L
1	1	0	10000	H
1	1	0	2500	See Fig 1
1	1	1	0	H
1	1	1	10000	L
1	1	1	2500	See Fig 2



Device Name:
Device ID:

73006060 DAIO Controller
DAIO

Pin Definitions:

Pin	MAC 5 Name	MAC 6 Name	Port Description	High Level Access
J1-1	IN0	DIN_0	TTL Level I/O Pin (default Input)	GPIO [dev] I0 GPIO [dev] O0 [=val]
J1-2	IN2	DIN_2	TTL Level I/O Pin (default Input)	GPIO [dev] I2 GPIO [dev] O2 [=val]
J1-3	IN4	DIN_4	TTL Level I/O Pin (default Input)	GPIO [dev] I4 GPIO [dev] O4 [=val]
J1-4	IN6	DIN_6	TTL Level I/O Pin (default Input)	GPIO [dev] I4 GPIO [dev] O4 [=val]
J1-5	OUT0	POUT_0	Power Switch Output	GPIO [dev] S0 [=val]
J1-6	OUT2	POUT_2	Power Switch Output	GPIO [dev] S2 [=val]
J1-7	OUT4	POUT_4	Power Switch Output	GPIO [dev] S4 [=val]
J1-8	OUT6	POUT_6	Power Switch Output	GPIO [dev] S6 [=val]
J1-9		PA3	Power Analog Output, AO2	DAVAL [dev] [B/V]2[=val]
J1-10		PA4	Power Analog Output, AO3	DAVAL [dev] [B/V]3[=val]
J1-11		N\$19	TTL Level I/O Pin	GPIO [dev] I8 GPIO [dev] O8 [=val]
J1-14	IN1	DIN_1	TTL Level I/O Pin (default Input)	GPIO [dev] I0 GPIO [dev] O0 [=val]
J1-15	IN3	DIN_3	TTL Level I/O Pin (default Input)	GPIO [dev] I3 GPIO [dev] O3 [=val]

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

J1-16	IN5	DIN_5	TTL Level I/O Pin (default Input)	GPIO [dev] I5 GPIO [dev] O5 [=val]
J1-17	IN7	DIN_7	TTL Level I/O Pin (default Input)	GPIO [dev] I7 GPIO [dev] O7 [=val]
J1-18	OUT1	POUT_1	Power Switch Output	GPIO [dev] S1 [=val]
J1-19	OUT3	POUT_3	Power Switch Output	GPIO [dev] S3 [=val]
J1-20	OUT5	POUT_5	Power Switch Output	GPIO [dev] S5 [=val]
J1-21	OUT7	POUT_7	Power Switch Output	GPIO [dev] S7 [=val]
J1-22		A7IN	Analog Input Chn3	ADVAL [dev] [B/V]3
J1-23		A6IN	Analog Input Chn2	ADVAL [dev] [B/V]2
J1-24		AN4_OUT	Analog Output Chn 1, AO1	DAVAL [dev][B/V]1[=val]
J3-1	(OUT8)	A3IN	Analog Input Chn 1	ADVAL [dev] [B/V]1
J3-2	Ramp Flag	OUT9	TTL Level I/O Pin (Default output)	GPIO [dev] I15 GPIO [dev] O15 [=val]
J3-4	POSc	POS_c	TTL Level I/O Pin (Default output)	GPIO [dev] I12 GPIO [dev] O14 [=val]
J3-5	POSb	POSb	TTL Level I/O Pin (Default output)	GPIO [dev] I13 GPIO [dev] O13 [=val]
J3-6	POSa	POSa	TTL Level I/O Pin (Default output)	GPIO [dev] I14 GPIO [dev] O14 [=val]

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

J3-8	INPOS	INPOS	TTL Level I/O Pin (Default output)	GPIO [dev] I9 GPIO [dev] O9 [=val]
J3-9	OPT	N\$17	TTL Level I/O Pin (Default output)	GPIO [dev] I10 GPIO [dev] O10 [=val]
J3-10	OPT	A2	Analog Output, AO5	DAVAL [dev] [B/V]5[=val]
J3-11	OPT	A1	Analog Output, AO4	DAVAL [dev] [B/V]4[=val]
J3-12	MOTOR-	MOTOR-	Power Analog Output, AO7	DAVAL [dev] [B/V]7[=val]
J3-13	MOTOR+	MOTOR+	Power Analog Output, AO6	DAVAL [dev] [B/V]6[=val]
J3-14	IN9	IN9	TTL Level I/O Pin (Default output)	GPIO [dev] I11 GPIO [dev] O11 [=val]
J3-15	OPT	A4IN	Analog Input Chn 0	ADVAL [dev] [B/V]0
BNC		A3	Analog Output, AO0	DAVAL [dev] [B/V]0[=val] VOLT [dev][=val] BOVLT [dev][=val]

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

GPIO Control Definitions & Locations:

Port	Bit	Default Direction	Default Level	Pin Location
GPIO (I)nput (O)utput (D)irection (L)atch	0	1-input	0	J1-1 MAC5-Input 0
	1	1	0	J1-14 MAC5-Input 1
	2	1	0	J1-2 MAC5-Input 2
	3	1	0	J1-15 MAC5-Input 3
	4	1	0	J1-3 MAC5-Input 4
	5	1	0	J1-16 MAC5-Input 5
	6	1	0	J1-4 MAC5-Input 6
	7	1	0	J1-17 MAC5-Input 7
	8	0-output	0	J1-11
	9	0	0	J3-8
	10	0	0	J3-9
	11	0	0	J3-14
	12	0	0	J3-4
	13	0	0	J3-5
	14	0	0	J3-6
	15	0	0	J3-2
GPIO Power (S)witch (F)ault Status	0	N/A	0	J1-5 MAC5-Output 0
	1	N/A	0	J1-18 MAC5-Output 1
	2	N/A	0	J1-6 MAC5-Output 2
	3	N/A	0	J1-19 MAC5-Output 3
	4	N/A	0	J1-7 MAC5-Output 4
	5	N/A	0	J1-20 MAC5-Output 5
	6	N/A	0	J1-8 MAC5-Output 6
	7	N/A	0	J1-21 MAC5-Output 7
ANALOG INPUTS ADVAL	0	N/A	N/A	J3-15
	1	N/A	N/A	J3-1
	2	N/A	N/A	J1-23
	3	N/A	N/A	J1-22

Device Name:
Device ID:

73006060 DAIO Controller
DAIO

ANALOG OUTPUTS	1	N/A	0	J1-24
	0	N/A	0	J4-COAX MAC5-Analog Output 0
	3	N/A	0	J1-10
DAVAL	2	N/A	0	J1-9
	5	N/A	0	J3-10
	4	N/A	0	J3-11
	7	N/A	0	J3-12
	6	N/A	0	J3-13
PWM Out PWM	0	N/A	0	J1-20 (Switch Output 6 must also be 0 when enabled)
	1	N/A	0	J1-7 (Switch Output 5 must also be 0 when enabled)

Device Name:

73006060 DAIO Controller

Device ID:

DAIO

BIT DEFINITIONS:

MAC 5 Digital Inputs – Lowest 8 bits on GPIO Input register or GPIO Latch register (equivalent to GPIO O I)

MAC 5 Digital Outputs – Lowest 8 bits on SWITCH output register (equivalent to GPIO O S)

MAC 6 Logic Level Inputs/Outputs – 16 bits on GPIO Input, Output, Latch, Direction register. (GPIO O [I/L/O/D])

MAC 6 High Power Outputs – 8 bits on GPIO Switch register (GPIO O S)

MAC 6 High Power Inputs – If Upper 8 bits on GPIO Switch register set to 1 then Lower 8 bits on GPIO Switch Status Register show fault...can be used for inputs. (GPIO O R)

In standard mode MOVE commands can be used to change the Analog Output going to coax connector. This will allow ramping of the output....useful if controlling piezo driver, etc.

In NOSE mode MOVE command tries to move the Nose Piece changer using GPIO bits 14..12 as 7 pos encoder input and AO 7..8 to control the motor, LEDS reflect position, GPIO 8=INPOS, GPIO 15=ramp flag, etc. (Not sure if this will be a compile time option or CAN configurable Option.

PWM Register Definitions:

Period: Specifies the period of the PWM signal in 0.1us steps

Duty Cycle: Specifies the Duty cycle of the PWM signal in 0.01% steps

High Level Command & enumeration Explanation:

Enumeration:

First board enumerates as 9 or Device O

Second board enumerates as 8 or Device I

Device Name:

73006060 DAIO Controller

Device ID:

DAIO

Compatibility Commands:

Note with these command can only access 8 bits of Input and 8 bits of Digital IO

READ I – reads all input pins....16 bits (lower 8 bits from device 9 upper 8 bits from device 8) Equivalent of GPIO O I + (GPIO I I)*256

READ In – reads the status of bit n

READ O-reads status of all output bits...last value written...16 bits (lower 8 bits from device 9, upper 8 bits from device 8)

READ On-read status of output bit n

WRITE O – writes all output bits (16 bits...lower 8 bits from 9, etc.)

WRITE On – writes output bit n

VOLT I – Read DA Channel 0 () output.

BVOLT I – Read DA channel 0 () output.

VOLT I= - Write DA Channel 0 () output.

BVOLT I= - Write DA Channe0 1 () output.

MAC6000 Extensions:

GPIO [dev] [I/O/S/L/D/F][n]

This command will read the status of the bits for the specified device [dev] (I or O), and port [I/O/S/D] (I-input, O-Output S-Switch L-Latched Input D-Direction, F-Switch Fault).

GPIO [dev] [O/S/D][n]=[val]

This command will write the bits for the specified device [dev] (O, S or D only). When specifying direction [D] a 1 indicates an input port and a 0 indicates an output port.

ADVAL [dev] [B/V][n]

This command will read the full 16 bit value of any A/D in either mV format or Binary format

DAVAL [dev] [B/V][n] or DAVAL [dev] [B/V][n]=[val]

This command will read or write the full 16 bit value of any D/A in either mV format or Binary format. [chn]=0-7

PWM [dev] [P/D/C][chn]=[val]

P-Period – 0.1uS increments....3ms would be 30000

D-Duty Cycle – 0 to 10000 equal to 0.00 to 100.00%

C-Control – See can command for bit definitions

Device Name:

73006060 DAIO Controller

Device ID:

DAIO

Default Configuration:

GPIO Output Register is 0x0000
GPIO Direction Register is 0x00ff
GPIO Input Register is 0x00ff
GPIO Latch Register is 0x0000
GPIO Switch Register is 0x0000
GPIO Fault Register is 0x0000

DA0-7 Output Register is 0x0000

PWM Enable Register is set to 0
PWM Period is set to 30000 (3mS)
PWM Duty Cycle Register set to 5000 (50%)

To change defaults for GPIO the can commands need to be issued and then SAVECFG.
To change defaults for GPIO the can commands need to be issued and then SAVECFG.
To change defaults for PWM set the PWM values to desired and issue SAVECFG.

Command Operation:

Examples:

X=GPIO O I	‘ Reads Input port on device 9
X=GPIO O I4	‘ Read Input port bit 4 on device 9
GPIO O O3=1	‘ Sets Output port bit 3 to 1
GPIO O O=&h1f45	‘ Sets Output port to 0x1f45
X=GPIO O L	‘ Reads latched input register
X=GPIO O D	‘ Read Direction Register
GPIO O D=0x00ff	‘ sets upper 8 bits to input and lower 8 bits to output (default)
GPIO O S4=1	‘ Turns on bit 4 of the high power switch outputs
GPIO O S=0	‘ Turns off all bits of the switch
X=GPIO O S	‘ Reads last switch write
X=GPIO O F	‘ Reads last switch status byte