

Ethernet/RS232 1-axis Controller and Drive

CDS-3310

Product Description

Galil's CDS-3310 is a single-axis controller and drive system for precisely controlling a brush or brushless servo motor. It combines a high-performance, programmable motion controller with a PWM drive in a compact, cost-effective package. The CDS-3310 provides a 10/100 Base-T Ethernet port and up to eight individual CDS-3310 units may be connected on a distributed network and programmed as a single controller. The communication burden is minimized because the host PC only has to talk with the master CDS-3310, which in turn communicates with the other CDS-3310 units in the network.

*CDS-3310
Single-axis
Controller and
Drive System*



The CDS-3310 incorporates a 32-bit microcomputer and provides such advanced features as PID compensation with velocity and acceleration feedforward, program memory with multitasking for simultaneously running up to eight programs, and uncommitted I/O for synchronizing motion with external events. Modes of motion include point-to-point positioning, jogging, contouring, electronic gearing and ECAM.

Like all Galil controllers, these controllers use a simple, English-like command language which makes them very easy to program. Galil's WSDK servo design software further simplifies system set-up with "one-button" servo tuning and real-time display of position and velocity information. Communication drivers are available for DOS, Linux and all current Windows operating systems.

Features

- 1-axis motion controller with on-board PWM drive for a brush or brushless servo motor; 72V, 7A drive
- Ethernet 10/100Base-T; (1) RS232 port up to 19.2kbaud
- Distributed control allows connection of up to 8 CDS-3310 units on an Ethernet network
- Ethernet supports multiple masters and slaves. TCP/IP, UDP and ModBus protocol for communication with I/O devices
- Accepts encoder feedback up to 12 MHz
- PID compensation with velocity and acceleration feedforward, integration limits, notch filter and low-pass filter
- Modes of motion include jogging, point-to-point positioning, contouring, electronic gearing and ECAM
- Over 200 English-like commands executable by controller. Includes conditional statements and event triggers
- Non-volatile memory for programs, variables and arrays. Concurrent execution of up to eight programs
- Dual encoder, home and limits
- 8 TTL uncommitted inputs and 10 outputs
- 2 uncommitted analog inputs and 1 analog output
- Add 8 analog inputs and 40 digital I/O with DB-28040
- Brake drive 24V, 0.5A
- High speed position latch and output compare
- Small size: 5.15" x 8.25" metal enclosure
- DIN-Rail mount clip available
- On-board DC-to-DC converter for single 18 V to 72 V DC input
- Communication drivers for Windows, DOS and Linux
- Custom hardware and firmware options available
- SSI encoder interface option

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Distributed Control

In some mechanical systems it is advantageous to have CDS-3310 single axis motion controllers physically distributed throughout the system to reduce wiring. Up to eight CDS-3310 units can be distributed.

Communication overhead and motion coordination issues typical with distributed, single-axis systems are minimized with the CDS-3310. The communication burden with the host PC is minimized because the PC communicates to the CDS-3310 controller configured as the master, which in turn communicates with all other CDS-3310 controllers on the network. This allows multiple controllers connected on an Ethernet network to be programmed as a single controller. A special set of commands for distributed control ease communication issues on the network. For example, the command HC connects the Ethernet handle of a particular controller to the network. The complete list of distributed commands is found in the instruction set shown below.

Distributed Control Commands

HA	Handle Assignment
HC	Automatic handle configuration
HQ	Handle Query
HR	Handle restore
HS	Handle switch
HW	Handle wait
LR	Launch slave record
LO	Lockout handle
SA	Send slave command
QW	Slave record update rate
ZA	Ethernet user variable
ZB	Ethernet user variable

Servo Drive Specifications

The CDS-3310 contains a transconductance, PWM drive for driving brush-less or brush-type servo motors. The amplifier drives motors operating at 18–72 VDC, up to 7 Amps continuous, 10 Amps peak. The gain settings of the amplifier are user-programmable at 0.4 Amp/Volt, 0.7 Amp/Volt and 1 Amp/Volt. The switching frequency is 60 kHz. The amplifier offers protection for over-voltage, under-voltage, over-current, and short-circuit. The amplifier status can be read through the controller, and the BS command allows easy hall sensor set-up. The SR-19900 shunt regulator is available for the CDS-3310.

I/O Expansion Options

DB-28040 I/O Expansion Board

The DB-28040 mounts directly to the CDS-3310 and provides an additional 40 digital inputs and outputs, and eight analog inputs (Outputs source 3.3 V. For 24 open collector outputs that sink 5 V, order DB-28040-5V). The small 2.55" × 3.08" board attaches directly to the 50-pin header on the CDS-3310 controller, and no cable is required between the controller and I/O board.

The 40 digital I/O signals are available on a 50-pin IDC header, and the analog inputs are available on a 16-pin header. With a controller firmware modification, the I/O board can also be modified to accept feedback from SSI encoders.

IOC-7007 Controller for Ethernet I/O Expansion

Galil's IOC-7007 I/O controller provides an intelligent solution for adding I/O and PLC functionality to the CDS-3310 Ethernet control system. The IOC-7007 I/O controller connects to the Ethernet network allowing it to communicate with CDS-3310 motion controllers and other devices on the network. The intelligent I/O controller has an on-board microprocessor for coordinating I/O events and performing tasks normally handled by a PLC. The IOC-7007 unit accepts up to seven plug-in I/O modules for easy connection to optoisolated inputs, optoisolated outputs, analog inputs and outputs and dry-contact relays. Packaging options include card-level, box-level and DIN-rail mount. Consult the IOC-7007 datasheet for complete specifications.



IOC-7007 BOX and IOC-7007-DIN

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Specifications

System Processor

- Motorola 32-bit microcomputer

Communications Interface

- Ethernet 10/100BASE-T, (1) RS232 port up to 19.2 kb
Commands are sent in ASCII. A binary communication mode is also available as a standard feature

Modes of Motion:

- Point-to-point positioning
- Position Tracking
- Jogging
- Electronic Gearing
- Electronic Cam
- Contouring
- Teach and playback

Memory

- Program memory size—1000 lines $\times$ 80 characters
- 254 variables
- 8000 array elements in up to 30 arrays

Filter

- PID (proportional-integral-derivative) with velocity and acceleration feedforward
- Notch and low-pass filter
- Velocity smoothing to minimize jerk
- Integration limits
- Torque limits
- Offset adjustments

Kinematic Ranges

- Position: 32 bit (± 2.15 billion counts per move; automatic rollover; no limit in jog or vector modes)
- Velocity: Up to 12 million counts/sec for servo motors
- Acceleration: Up to 67 million counts/sec²

Uncommitted I/O

- 8 buffered inputs
- 10 TTL outputs
- 2 analog inputs; 0–5 Volts, 12-bit ADC
- 1 uncommitted analog output ± 10 V, 16-bit DAC

High Speed Position Latch

- Latches encoder position within 0.1 microsecond

Dedicated Inputs (per axis)

- Main encoder inputs—Channel A, A-, B, B-, I, I- (± 12 V or TTL)
- Auxiliary encoder inputs
- Forward and reverse limit inputs—TTL
- Home input—TTL
- High-speed position latch input

Dedicated Outputs (per axis)

- Analog motor command output with 16-bit DAC resolution
- Error output
- High-speed position compare output

Minimum Servo Loop Update Rate

- 125 microseconds

Maximum Encoder Feedback Rate

- 12 MHz

Power

- 0.5A, 5V available for external devices
- Requires 18V–72V input

Environmental

- Operating temperature: 0–70° C
- Humidity: 20–95% RH, non-condensing

Mechanical

- 5.15" $\times$ 8.25" metal enclosure

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Instruction Set

Servo Motor

AG	Set AMP gain
AU	Set current loop gain
AW	Report AMP bandwidth
DV	Dual velocity
FA	Acceleration feedforward
FV	Velocity feedforward
IL	Integrator limit
KD	Derivative constant
KI	Integrator constant
KP	Proportional constant
NB	Notch bandwidth
NF	Notch frequency
NZ	Notch zero
OF	Offset
PL	Pole
SH	Servo here
TK	Set AMP peak current
TL	Continuous torque limit
TM	Sample time

I/O

AL	Arm latch
BW	Brake
CB	Clear bit
CO	Configure I/O points
II	Input interrupt
OB	Define output bit
OC	Output compare function
OP	Output port
SB	Set bit
@IN[x]	State of digital input x
@OUT[x]	State of digital output x
@AN[x]	Value of analog input x

System Configuration

BN	Burn parameters
BP	Burn program
BR	Brush motor enable
BS	Brushless set-up
BV	Burn variables and arrays
CE	Configure encoder type
CF	Configure serial port
CN	Configure switches
CW	Data adjustment bit
DE	Define dual encoder position
DP	Define position
DV	Dual velocity (dual loop)
EO	Echo off
IA	Set IP address
IH	Internet handle
IT	Independent smoothing
LZ	Leading zeros format
MB	ModBus

System Configuration (cont.)

MO	Motor off
MT	Motor type
PF	Position format
QD	Download array
QU	Upload array
RS	Reset
~R~S	Master reset
VF	Variable format

Math Functions

@SIN[x]	Sine of x
@COS[x]	Cosine of x
@COM[x]	1's complement of x
@ASIN[x]	Arc sine of x
@ACOS[x]	Arc cosine of x
@ATAN[x]	Arc tangent of x
@ABS[x]	Absolute value of x
@FRAC[x]	Fraction portion of x
@INT[x]	Integer portion of x
@RND[x]	Round of x
@SQR[x]	Square root of x

Interrogation

LA	List arrays
LL	List labels
LS	List program
LV	List variables
MG	Message command
QH	Query hall state
QR	Data record
QZ	Return data record info
RP	Report command position
RL	Report latch
~R~V	Firmware revision information
SC	Stop code
TA	Tell AMP status
TB	Tell status
TC	Tell error code
TD	Tell dual encoder
TE	Tell error
TI	Tell input
TP	Tell position
TR	Trace program
TS	Tell switches
TT	Tell torque
TV	Tell velocity

Programming

DA	Deallocate variables/arrays
DL	Download program
DM	Dimension arrays
ED	Edit program
ELSE	Conditional statement

Programming (cont.)

ENDIF	End of cond. statement
EN	End program
HX	Halt execution
IF	If statement
IN	Input variable
JP	Jump
JS	Jump to subroutine
NO	No-operation—for remarks
RA	Record array
RC	Record interval
RD	Record data
'	Remark program
UL	Upload program
ZS	Zero stack

Error Control

BL	Backward software limit
ER	Error limit
FL	Forward software limit
OE	Off-on-error function
TL	Torque limit
TW	Timeout for in-position

Trippoint

AD	After distance
AI	After input
AM	After motion profiler
AP	After absolute position
AR	After relative distance
AS	At speed
AT	After time
AV	After vector distance
MC	Motion complete
MF	After motion—forward
MR	After motion—reverse
WC	Wait for contour data
WT	Wait for time

Independent Motion Commands

AB	Abort motion
AC	Acceleration
BG	Begin motion
DC	Deceleration
FE	Find edge
FI	Find index
HM	Home
IP	Increment position
IT	Smoothing time constant
JG	Jog mode
PA	Position absolute
PR	Position relative
PT	Position tracking
SP	Speed
ST	Stop

Contour Mode

CD	Contour data
CM	Contour mode
DT	Contour time interval
WC	Wait for contour data

ECAM/Gearing

EA	ECAM master
EB	Enable ECAM
EC	ECAM table index
EG	ECAM go
EM	ECAM cycle
EP	ECAM interval
EQ	Disengage ECAM
ET	ECAM table entry
GA	Master axis for gearing
GD	Engagement distance for gearing
GP	Correction for gearing
GR	Gear ratio for gearing

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Connectors

J1 Motor Output 4-pin AMP Mate-n-lock II

- 1 NC
- 2 A
- 3 C
- 4 B

J2 15-pin, Hi-density Female D-sub

- 1 I+
- 2 B+
- 3 A+
- 4 AB+
- 5 Ground
- 6 I-
- 7 B-
- 8 A-
- 9 AA-
- 10 Hall A
- 11 AA+
- 12 AB-
- 13 Hall B
- 14 Hall C
- 15 5V

J3 I/O 37-pin Female D-sub

- 1 Reset*
- 2 Amp enable
- 3 Output 3
- 4 Output 1
- 5 Analog in 1 (0V–5V)
- 6 Input 7
- 7 Input 5
- 8 Input 3
- 9 Input 1 (latch)
- 10 5V
- 11 Ground
- 12 +12V
- 13 Ground
- 14 Brake Power
- 15 Input 8- (differential input)
- 16 Output 9
- 17 Output 7
- 18 Output 5
- 19 Analog out 1 (16-bit resolution $\pm 10V$)
- 20 Error Output*
- 21 Output 4
- 22 Output 2
- 23 Encoder-compare output
- 24 Analog in 2 (0V–5V)
- 25 Input 6
- 26 Input 4
- 27 Input 2
- 28 Forward limit
- 29 Reverse limit
- 30 Home
- 31 -12V
- 32 Brake output (500mA sinking)
- 33 Input 8+ (differential input)
- 34 Output 10
- 35 Output 8
- 36 Output 6
- 37 ABORT*

J5 Power 2-pin AMP Mate-n-lock II

- 1 +VM (18V–72V)
- 2 Ground

*Active low

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Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
CDS-3310	1-axis motion controller with 500W servo drive; Ethernet/RS232	\$ 745	\$ 495
-DIN	DIN-rail mounting clip	\$ 25	\$ 20
DB-28040	I/O expansion board for 8 analog inputs and 40 digital I/O (outputs source 3.3 V)	\$ 295	\$ 195
DB-28040-5V	I/O expansion board for 40 digital I/O (maximum 24 digital outputs) and 8 analog inputs. Outputs are open collector and sink 5 V	\$ 295	\$ 195
SR-19900	Shunt regulator for CDS-3310	\$ 75	\$ 40
CABLE-Ethernet	Ethernet cables	Consult factory	
CABLE-9-pin D	RS232 cable	\$ 10	
IOC-7007	Intelligent I/O controller box for Ethernet I/O expansion	\$ 595	\$ 495
Galil Utilities	Communication drivers, SmartTERM, DMCDOS	\$ 20 for CD; free download	
DMCWIN32	Windows API Tool Kit (VB, C, C++, etc.)	Included with Utilities	
WSDK	Set-up, tuning and analysis software	\$ 195	
ActiveX Tool Kit	Custom ActiveX controls for Visual Basic or Visual C++	\$ 595	

Galil offers additional quantity discounts for purchases between 1 and 100. Consult Galil for a quotation.