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 a 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, and electronic gearing.

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 Windows, .NET, QNX, and Linux.

Features

- *1-axis motion controller with on-board PWM drive for a brush or brushless servo motor; 72V, 7A continuous drive*
- *Ethernet 10/100Base-T; (1) RS232 port up to 19.2 kbaud*
- *USB option*
- *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 TCP master 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 TTL outputs*
- *2 uncommitted analog inputs and 1 analog output*
- *Add 8 analog inputs and 40 digital I/O with DB-28040*
- *ICM-3300 interconnect module provides screw terminals and optical isolation of inputs and outputs*
- *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, .NET, QNX, 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 a 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 configures 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
HW	Handle wait
SA	Send slave command
ZA	Ethernet user variable
ZB	Ethernet user variable

Servo Drive Specifications

The CDS-3310 contains a transconductance, PWM drive for driving brushless or brush-type servo motors. The amplifier drives motors operating at 18–72 VDC (voltage at motor is 10% less), 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

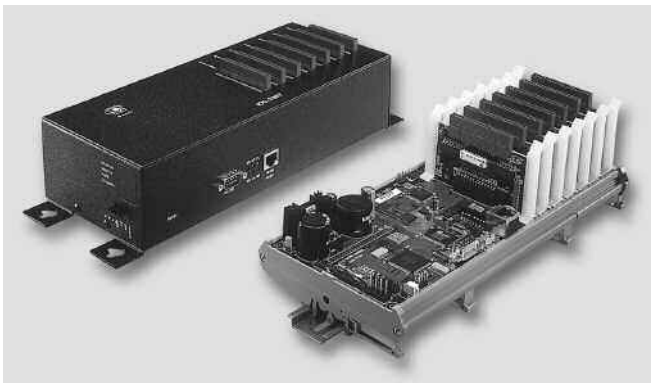
DB-28040 I/O Expansion Board

The DB-28040 mounts directly to the CDS-3310 and provides an additional 40 digital inputs and outputs, and eight ±10 V 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

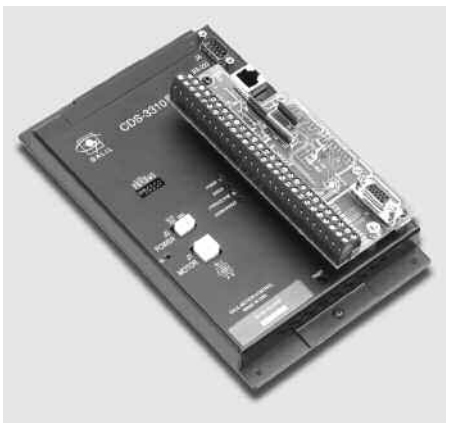
Galil's IOC-7007 I/O controller provides an intelligent solution for adding I/O and PLC functionality to the CDS-3310 Ethernet control system. The IOC-7007 I/O controller connects to the Ethernet network allowing it to communicate with CDS-3310 motion controllers and other devices on the network. The 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

ICM-3300 Interconnect Module

The ICM-3300 attaches directly to the CDS-3310 and breaks out the 37-pin D-sub connector into convenient screw terminals allowing for quick and easy connection to system elements. The ICM-3300 also provides optical isolation for inputs and outputs with the exception of the following signals: brake output, output compare, reset input and digital input 8. Outputs 1 through 4 are high-side, 500 mA drives. The maximum common voltage for the I/O is 28 VDC. The ICM-3300 includes a high density 15-pin D-sub connector which allows direct connection to Galil's BLM-N23 brushless servo motor.



ICM-3300 attached to CDS-3310

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Specifications

System Processor

- Motorola 32-bit microcomputer

Communications Interface

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

Modes of Motion:

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

Memory

- Program memory size — 1000 lines × 80 characters
- 510 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 limit
- Torque limit
- 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/sec^2

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

**For ±10 V use DB-28040*

High Speed Position Latch

- Latches encoder position within 0.1 microseconds

Dedicated Inputs

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

Dedicated Outputs

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

Minimum Servo Loop Update Time

- 250 microseconds

Maximum Encoder Feedback Rate

- 12 MHz

Power

- 0.5 A, 5 V available for external devices
- 40 mA, +12 V, -12 V available for external devices
- Requires 18 V–72 V input

Drive Specifications

- 18–72 Volt; 7 Amp continuous, 10 Amp peak

Environmental

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

Mechanical

- 5.15" × 8.25" metal enclosure (for high current applications, the metal enclosure should be mounted to a metal backing to dissipate heat)

***Optically isolated I/O available with ICM-3300 option.*

CDS-3310

Instruction Set

Servo Motor
AG Set AMP gain
AU Set current loop gain
AW Report AMP bandwidth
BW Brake wait
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
AO Analog out
BW Brake wait
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 for unsolicited messages
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

System Configuration (cont.)
LZ Leading zeros format
MB ModBus
MO Motor off
MT Motor type
PF Position format
QD Download array
QU Upload array
RS Reset
^R^S Master reset
SM Subnet mask
TF Tell FPGA version
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
BK Breakpoint
DA Deallocate variables/arrays
DL Download program
DM Dimension arrays
ED Edit program
ELSE Conditional statement
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
SL Single step
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

Gearing
GA Master axis for gearing
GD Engagement distance for gearing
_GP Correction for gearing
GR Gear ratio for gearing

Distributed Control Commands
HA Handle Assignment
HC Automatic handle configuration
HQ Handle Query
HS Handle switch
HW Handle wait
LO Lockout handle
SA Send slave command
ZA Ethernet user variable
ZB Ethernet user variable

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Connectors—CDS-3310

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 5 V

J3 I/O 37-pin Female D-sub

1 Reset*
2 Amp enable/Error
3 Output 3
4 Output 1
5 Analog in 1 (0 V–5 V)
6 Input 7
7 Input 5
8 Input 3
9 Input 1 (latch)
10 5 V
11 Ground
12 +12 V
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 ±10V)
20 Analog ground
21 Output 4
22 Output 2
23 Encoder-compare output
24 Analog in 2 (0 V–5 V)
25 Input 6
26 Input 4
27 Input 2
28 Forward limit
29 Reverse limit
30 Home
31 -12 V
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 (18 V–72 V)
2 Ground

**Active low*

Connectors—ICM-3300

Screw Terminals

1 Aux. Encoder B+
2 Aux. Encoder B-
3 Aux. Encoder A+
4 Aux. Encoder A-
5 Main Encoder Index +
6 Main Encoder Index -
7 Main Encoder B+
8 Main Encoder B-
9 Main Encoder A+
10 Main Encoder A-
11 Hall C
12 Hall B
13 Hall A
14 Ground
15 5 V
16 Abort Input†
17 Digital Input 8+
18 Digital Input 8-
19 Digital Input 7†
20 Digital Input 6†
21 Digital Input 5†
22 Digital Input 4†
23 Digital Input 3†
24 Digital Input 2†
25 Digital Input 1†
26 Input Common
27 Limit Switch Common
28 Home Input†
29 Reverse Limit Input†
30 Forward Limit Input†
31 Output Compare
32 Amplifier Enable Output†
33 Ground
34 Output Power Return
35 Output Power Supply
36 Digital Output 10†
37 Digital Output 9†
38 Digital Output 8†
39 Digital Output 7†
40 Digital Output 6†
41 Digital Output 5†
42 Digital Output 4†
43 Digital Output 3†
44 Digital Output 2†
45 Digital Output 1†
46 Brake Power Supply
47 Brake Output (Sinking)
48 -12 V output
49 +12 V Output
50 +5 V Output
51 Analog Output 1
52 Analog Input 2
53 Analog Input 1
54 Analog Input Ground
55 Error Output†
56 Reset Input*

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

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

†Optically isolated

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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
ICM-3300	Screw terminal interface with optical isolation	$ 245	$ 145
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-15-1M	15-pin high-density D sub to discrete wires—1 meter	$ 25	$ 17
CABLE-15-2M	15-pin high-density D sub to discrete wires—2 meter	$ 30	$ 20
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, Visual C++, etc.	$ 595	

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