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.

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 motor 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, and Linux.

Features

- 1-axis motion controller with on-board PWM drive for a brushed or brushless servo motor; 72 V, 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 electronic cam
- 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, and Linux
- Custom hardware and firmware options available
- SSI encoder interface option
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 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/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

*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 V; 7 Amp continuous, 10 Amp peak

Environmental
- Operating temperature: 0–70º 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)

Connectors
- 37-pin Female D-sub — I/O
- 15-pin HD Female D-sub — encoder

**Optically isolated I/O available with ICM-3300 option.
Ethernet/RS232 1-axis Controller & Drive
CDS-3310

Instruction Set

Ethernet
IA Set IP address
IH Open IP handle
IK Ethernet port blocking
MB Modbus
MW Modbus wait
SA Send command
SM Subnet mask

Servo Motor
AF Analog feedback
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
@AN[x] Value of analog input x
@IN[x] State of digital input x
@OUT[x] State of digital output x

System Configuration
BN Burn parameters
BP Burn program
BR Brush motor enable
BS Brushless set-up
BV Burn variables and arrays
CC Configure communications port
CE Configure encoder type

System Configuration (cont.)
CF Configure for unsolicited messages
CI Configure communication interrupt
CN Configure switches
CW Data adjustment bit
DE Define dual encoder position
DP Define position
EO Echo
IH Internet handle
IT Independent smoothing
LZ Leading zeros format
MO Motor off
MT Motor type
PF Position format
QD Download array
RS Reset
*R'S Master reset
VF Variable format

Math Functions
@ABS[x] Absolute value of x
@ACOS[x] Arc cosine of x
@ASIN[x] Arc sine of x
@ATAN[x] Arc tangent of x
@COM[x] T's complement of x
@COS[x] Cosine of x
@FRAC[x] Fraction portion of x
@INT[x] Integer portion of x
@RND[x] Round of x
@SIN[x] Sine of x
@SQR[x] Square root of x
@TAN[x] Tangent

Interrogation
LA List arrays
LL List labels
LS List program
LV List variables
MG Message command
QH Query hall state
QR Data record
QU Upload array
QZ Return data record info
RL Report latch
RP Report command position
*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
TF Tell FPGA version
TH Tell handle

Interrogation (cont.)
TI Tell input
TP Tell position
TR Trace program
TS Tell switches
TT Tell torque
TV Tell velocity
TZ Tell I/O configuration
WH Which handle

Programming
BK Breakpoint
DA Deallocate variables/arrays
DL Download program
DM Dimension arrays
ED Edit program
ENDF 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
RE Return from error routine
REM Remark program
RI Return from interrupt routine
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
TW Timeout for in-position

Tripoint
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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# Ethernet/RS232 1-axis Controller & Drive

## CDS-3310

### Connectors—CDS-3310

<table>
<thead>
<tr>
<th>J1 Motor Output 4-pin</th>
<th>J1 I/O 37-pin Female D-sub</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMP Mate-n-lock II</td>
<td>1  NC</td>
</tr>
<tr>
<td></td>
<td>2 Motor phase A</td>
</tr>
<tr>
<td></td>
<td>3 Motor phase C</td>
</tr>
<tr>
<td></td>
<td>4 Motor phase B</td>
</tr>
<tr>
<td></td>
<td>1 NC</td>
</tr>
<tr>
<td></td>
<td>2 Motor phase A</td>
</tr>
<tr>
<td></td>
<td>3 Motor phase C</td>
</tr>
<tr>
<td></td>
<td>4 Motor phase B</td>
</tr>
</tbody>
</table>

| J2 15-pin, Hi-density | J2 Screw Terminals         |
| Female D-sub          | 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 Ground                  |
|                       | 56 Reset*                  |
|                       | *(Active low)              |

**Active low**

### Connectors—ICM-3300

<table>
<thead>
<tr>
<th>J5 Power 2-pin AMP Mate-n-lock II</th>
<th>J7 15-pin, Hi-density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 +VM (18 V–72 V)</td>
<td>1 Main Encoder I+</td>
</tr>
<tr>
<td>2 Ground</td>
<td>2 Main Encoder I+</td>
</tr>
<tr>
<td>3 Main Encoder B+</td>
<td>3 Main Encoder B+</td>
</tr>
<tr>
<td>4 Main Encoder A+</td>
<td>4 Main Encoder A+</td>
</tr>
<tr>
<td>5 Main Encoder A-</td>
<td>5 Ground</td>
</tr>
<tr>
<td>6 Main Encoder B-</td>
<td>6 Main Encoder B-</td>
</tr>
<tr>
<td>7 Main Encoder A-</td>
<td>7 Main Encoder A-</td>
</tr>
<tr>
<td>8 Main Encoder A+</td>
<td>8 Main Encoder A+</td>
</tr>
<tr>
<td>9 Aux Encoder A-</td>
<td>9 Aux Encoder A-</td>
</tr>
<tr>
<td>10 Aux Encoder A+</td>
<td>10 Hall A</td>
</tr>
<tr>
<td>11 Hall A</td>
<td>11 Hall B</td>
</tr>
<tr>
<td>12 Hall B</td>
<td>12 Hall A</td>
</tr>
<tr>
<td>13 Hall C</td>
<td>13 Hall C</td>
</tr>
<tr>
<td>14 Hall C</td>
<td>14 Hall C</td>
</tr>
<tr>
<td>15 5 V</td>
<td>15 5 V</td>
</tr>
</tbody>
</table>

| J7 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 Hall C                        |
| 15 5 V                           |

**Active low**

†Optically isolated
Ethernet/RS232 1-axis Controller & Drive

CDS-3310

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 per network.

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 motor controller and provides an additional 40 digital inputs and outputs, and eight ±10 V analog inputs (default I/O is 3.3 V. For 5 V I/O, 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.

**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.

Ordering Information

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY 1</th>
<th>QUANTITY 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS-3310</td>
<td>1-axis motion controller with 500W servo drive; Ethernet/RS232</td>
<td>$ 745</td>
<td>$ 495</td>
</tr>
<tr>
<td>-DIN</td>
<td>DIN-rail mounting clip</td>
<td>$ 25</td>
<td>$ 20</td>
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<tr>
<td>ICM-3300</td>
<td>Screw terminal interface with optical isolation</td>
<td>$ 245</td>
<td>$ 145</td>
</tr>
<tr>
<td>DB-28040</td>
<td>I/O expansion board for 8 analog inputs and 40 digital I/O (outputs source 3.3 V)</td>
<td>$295</td>
<td>$195</td>
</tr>
<tr>
<td>DB-28040-5V</td>
<td>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</td>
<td>$295</td>
<td>$195</td>
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<tr>
<td>SR-19900</td>
<td>Shunt regulator for CDS-3310</td>
<td>$ 75</td>
<td>$ 40</td>
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<tr>
<td>CABLE-15-1M</td>
<td>15-pin HD D sub to discrete wires—1 meter</td>
<td>$ 25</td>
<td>$ 17</td>
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<tr>
<td>CABLE-15-2M</td>
<td>15-pin HD D sub to discrete wires—2 meter</td>
<td>$ 30</td>
<td>$ 20</td>
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<tr>
<td>WSDK</td>
<td>Set-up, tuning and analysis software</td>
<td>$ 195</td>
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</tr>
</tbody>
</table>

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