

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## Features

- ❑ Supports high-speed synchronous 3-phase spindle motors
- ❑ Motor speed up to 50 000 RPM
- ❑ Output current up to 12A
- ❑ Single power supply 24 to 90 VDC
- ❑ Compatible with Logosol distributed motion control network
- ❑ Jumper selectable stand-alone mode of operation
- ❑ Comprehensive motor output short-circuit protection:
  - Output to output
  - Output to ground
  - Output to power
- ❑ 3 digital inputs with pull-up
- ❑ 3 digital open collector outputs
- ❑ Analog input 5 to 30 V full scale
- ❑ Communication speed 19.2 - 115.2 Kbps
- ❑ Command rate up to 1000/sec
- ❑ Small footprint (5" x 4" x 0.85")



## Description

LS-515 is an intelligent single-axis 3-phase spindle drive for high-speed synchronous motors.

The drive is compatible with Logosol distributed control network (LDCN). Up to 31 intelligent drives can be controlled over a multi-drop full duplex RS-485 network. Standard RJ-45 connectors and commercially available cables are used to connect modules into a network.

In addition to **LDCN mode**, LS-515 can be used as a stand-alone spindle controller in **ADC mode** with analog input for motor velocity control and digital I/Os for external device monitoring and activation.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

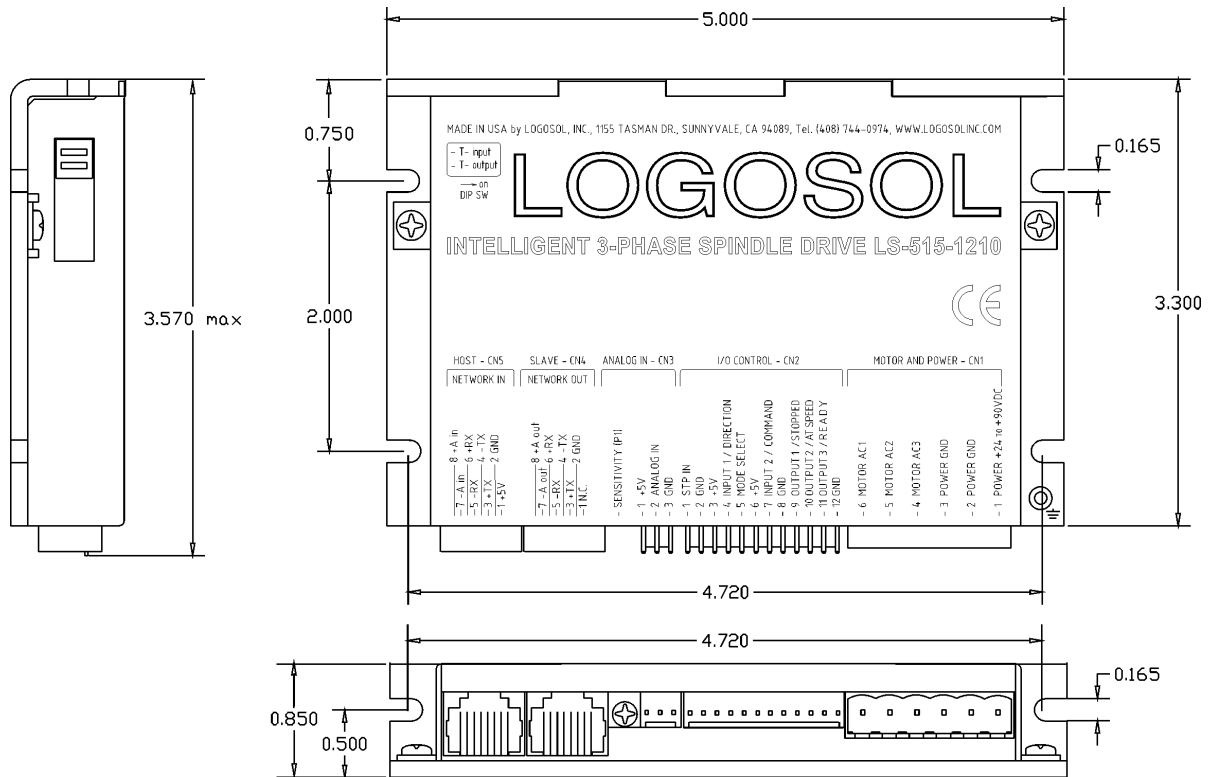
## **TECHNICAL SPECIFICATIONS** rated at 25°C ambient, POWER SUPPLY = 48VDC

POWER SUPPLY VOLTAGE	24 to 90 VDC (18 to 100 VDC absolute maximum range)
MOTOR SPEED Min Max	5,000 RPM 50,000 RPM
MAX MOTOR OUTPUT CURRENT	12A peak
PWM SWITCHING FREQUENCY	40 KHz
SERIAL BAUD RATE	19.2 – 115.2 Kbps
INPUTS Digital Inputs Analog input	0 ≤ LOW ≤ 1.5V, 3.3V ≤ HIGH ≤ 48V 5V ÷ 30V ADC full scale adjustment
DIGITAL OUTPUTS	Open collector type Voltage applied to the output – typically 24V, max 48V Max output current – 1A
INDICATORS	Red LED (two intensity levels)
+5V SOURCE Max current	200 mA for all pins combined
PROTECTION Short circuit  Overheat shut off	Motor output to motor output Motor output to POWER GND Motor output to POWER (+) Digital outputs to I/O power supply Activated at 80° C
FIRE SAFETY Internal fuse	10A Quick blow
THERMAL REQUIREMENTS Storage temperature range Operating temperature range	–30 to +85° C 0 to 45° C
MECHANICAL Size Weight	L=5", H=0.85", D=4" 0.75lb. (340gr.)
MATING CONNECTORS Power & Motor Digital I/O Analog Input Communication	Phoenix contact MSTB 2.5/6-ST-5.08 Molex 22-05-3127 housing with 08-50-0114 pins (12 pcs.) Molex 22-05-3037 housing with 08-50-0114 pins (3 pcs.) 8 pin RJ-45

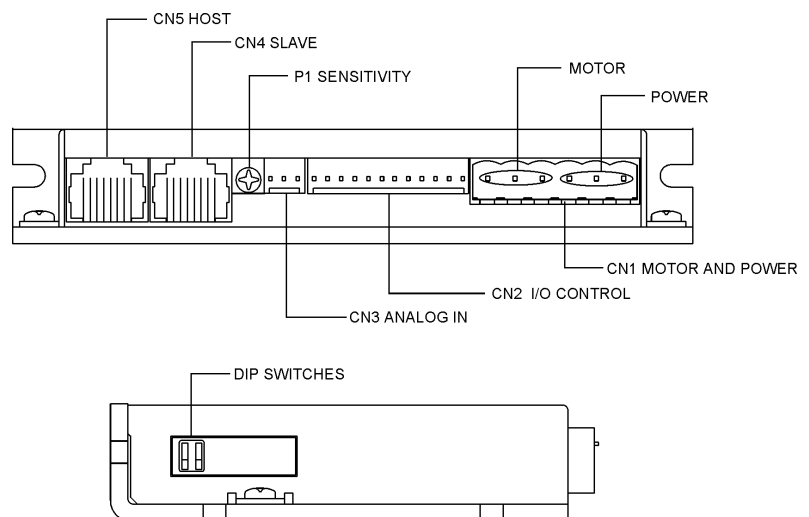
# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## DIMENSIONAL DRAWING



## CONNECTORS AND CONTROLS LAYOUT



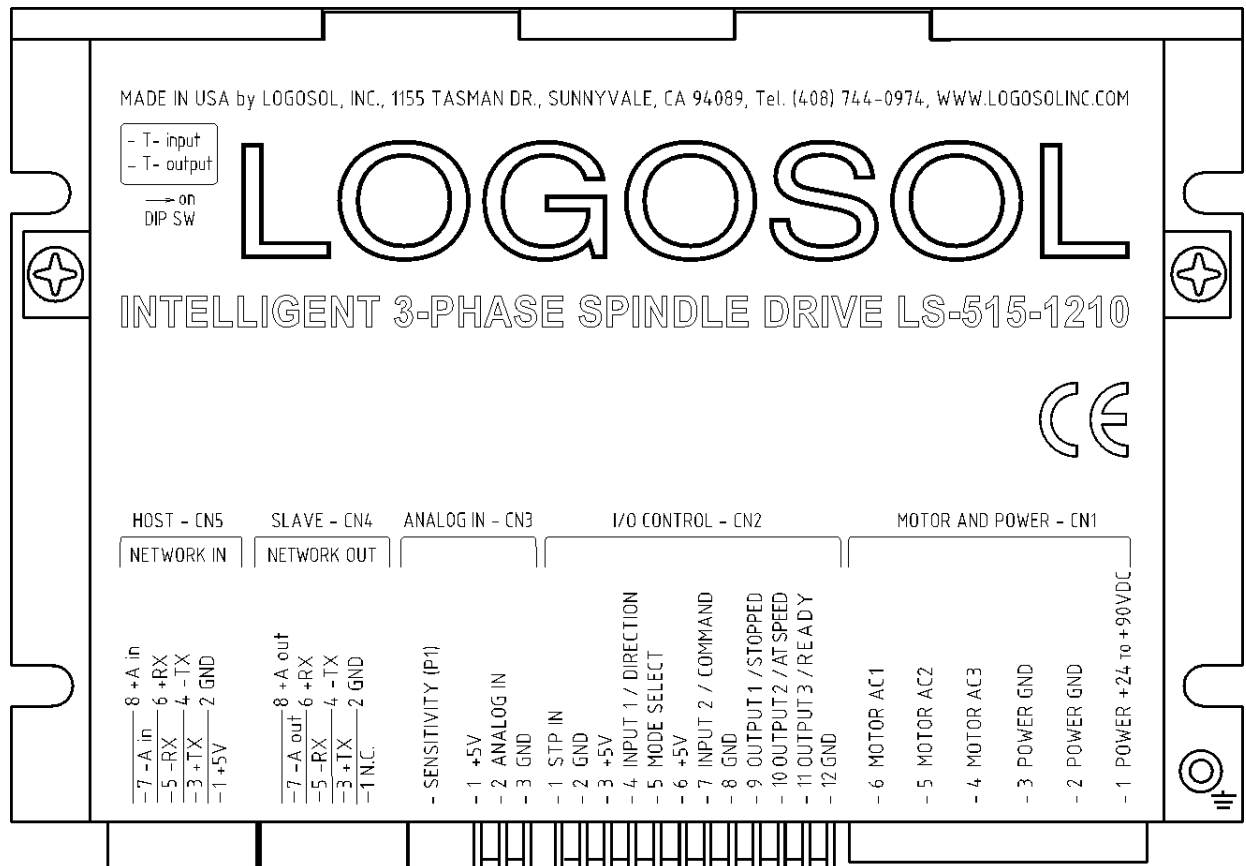
## ORDERING GUIDE

PART NUMBER	MODEL	DESCRIPTION
912515001	LS-515-1210	Intelligent 3-phase spindle drive
230601019	LS-515-CN	Mating connector kit

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## CONNECTORS AND CONTROLS PINOUT



### DIP SW – DIP SWITCHES

SW	SIGNAL	DESCRIPTION
1	T-input	Receive line terminator
2	T-output	Transmit line terminator

### CN1 – MOTOR AND POWER CONNECTOR

PIN	SIGNAL	DESCRIPTION
1	POWER +24 TO +90VDC	+24 to +90 VDC power supply, positive terminal
2	POWER GND*	Power supply ground
3	POWER GND*	Power supply ground
4	MOTOR AC3	Output to motor terminal AC3
5	MOTOR AC2	Output to motor terminal AC2
6	MOTOR AC1	Output to motor terminal AC1

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## CN2 – I/O CONTROL

PIN	SIGNAL	DESCRIPTION
1	STP IN	Stop input HIGH (open) = Motor Stop LOW (short to GND) = Motor Enabled
2	GND*	Signal ground
3	+5V**	+5V Power supply output
4	INPUT1 / DIRECTION	LDCN mode <sup>1</sup> - General purpose input ADC mode <sup>2</sup> - Direction input
5	MODE SELECT	LDCN mode = Open <i>The MODE SELECT input is checked during Power On or when Hard Reset command is received from the LDCN</i> ADC mode = +5V
6	+5V**	+5V Power supply output
7	INPUT2 / COMMAND	LDCN mode - General purpose input ADC mode - Command input HIGH (open) = Motor Stop; Clear FAULT condition LOW (short to GND) = Motor Run
8	GND*	Signal ground
9	OUTPUT1 / STOPPED	LDCN mode - General purpose output ADC mode - Motor stopped output HIGH (open) = Motor is moving LOW = Motor is stopped
10	OUTPUT2 / AT SPEED	LDCN mode - General purpose output ADC mode - Motor at speed output HIGH (open) = Motor is accelerating, decelerating or stopped LOW = Motor is at constant speed
11	OUTPUT3 / READY	LDCN mode - General purpose output ADC mode - Ready output HIGH (open) = FAULT condition (STP IN activated, Overload, Motor Short, Overvoltage or Overheat) LOW = Ready
12	GND*	Signal ground

## CN3 – ANALOG INPUT

PIN	SIGNAL	DESCRIPTION
1	+5V**	+5V Power supply output
2	ANALOG IN	LDCN mode - Analog input ADC mode - Velocity control input
3	GND*	Signal ground

\* POWER GND and GND are electrically connected. Drive's case is isolated from the drive's circuitry and may be grounded externally.

\*\* 200 mA Max withdraw current for all four pins combined.

<sup>1</sup> LDCN mode – RS-485 network command mode

<sup>2</sup> ADC mode – Stand-alone mode with analog velocity control

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## CN4 – NETWORK OUT (SLAVE)

PIN	SIGNAL	DESCRIPTION
1	N.C.	Not connected
2	GND*	Interface ground
3	+TX	(+) Transmit data
4	-TX	(-) Transmit data
5	-RX	(-) Receive data
6	+RX	(+) Receive data
7	-A out	(-) Address output
8	+A out	(+) Address output

## CN5 – NETWORK IN (HOST)

PIN	SIGNAL	DESCRIPTION
1	+5V**	RS-232 adapter power supply
2	GND*	Interface ground
3	+TX	(+) Transmit data
4	-TX	(-) Transmit data
5	-RX	(-) Receive data
6	+RX	(+) Receive data
7	-A in	(-) Address input
8	+A in	(+) Address input

\* POWER GND and GND are electrically connected. Drive's case is isolated from the drive's circuitry and may be grounded externally.

\*\* 200 mA Max withdraw current for all four pins combined.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## ADC (stand-alone) MODE APPLICATION-1

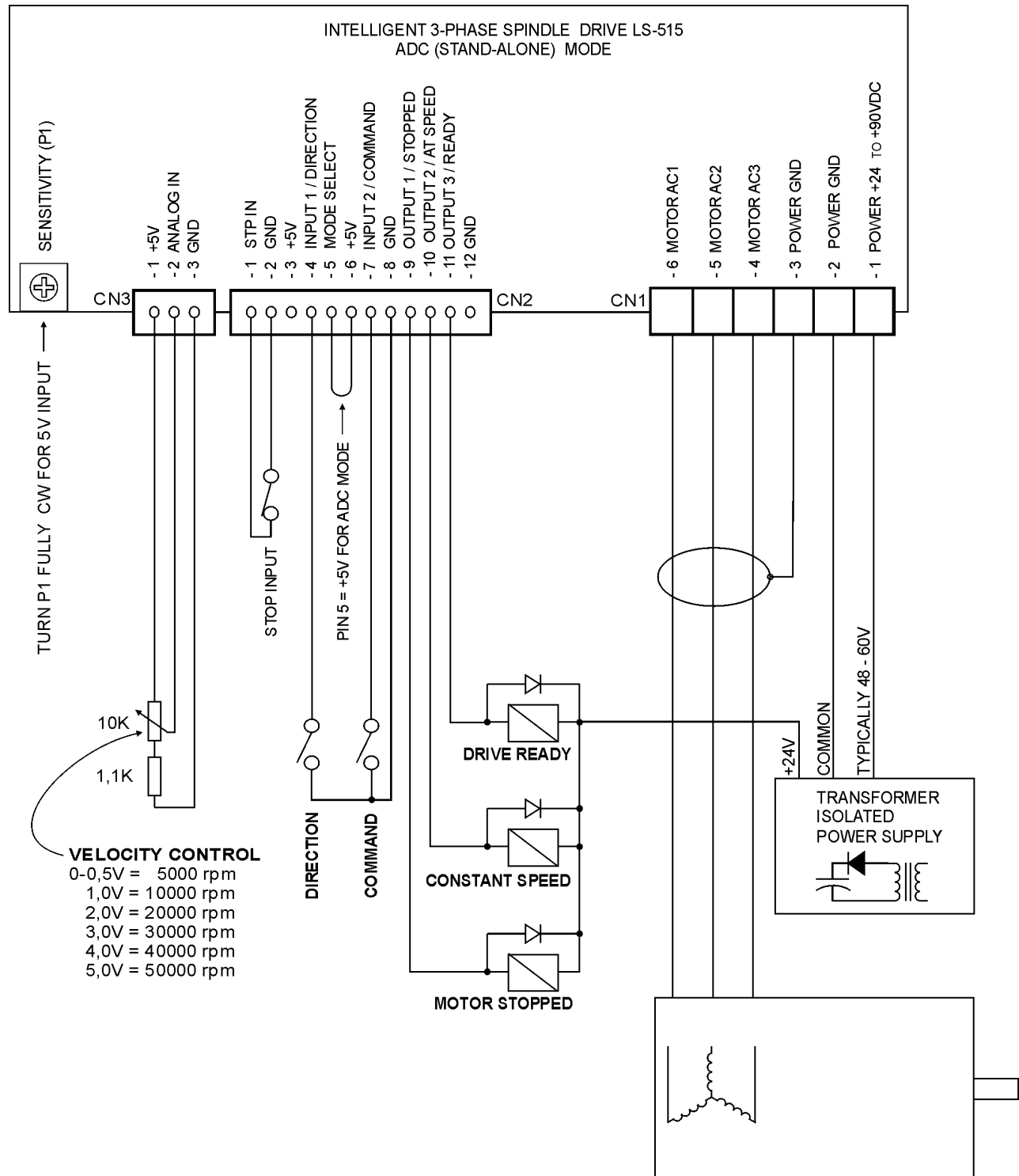


Figure 1

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## ADC (stand-alone) MODE APPLICATION-2

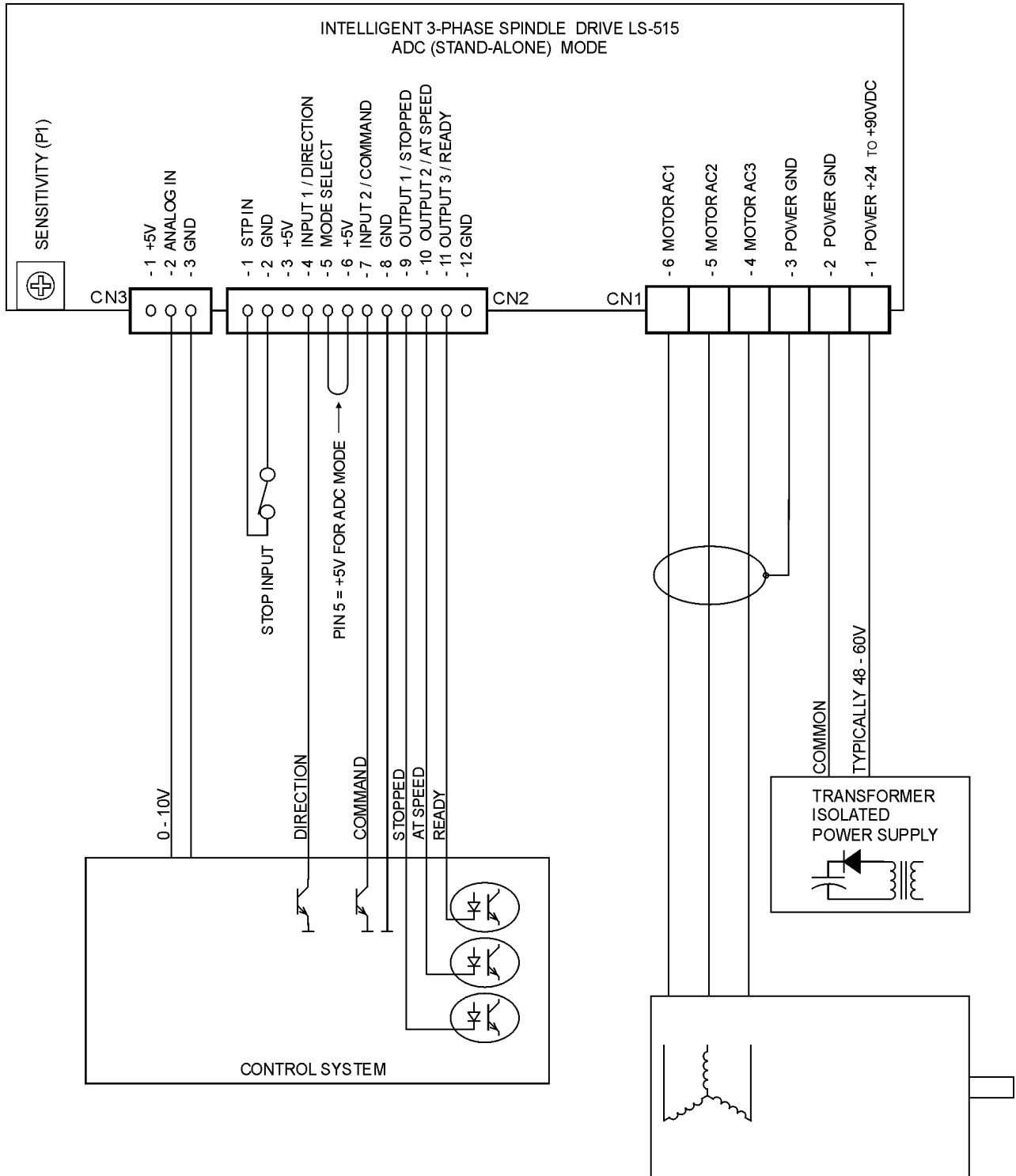


Figure 2

# Logosol Intelligent 3-Phase Spindle Drive LS-515

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## LDCN MODE APPLICATION

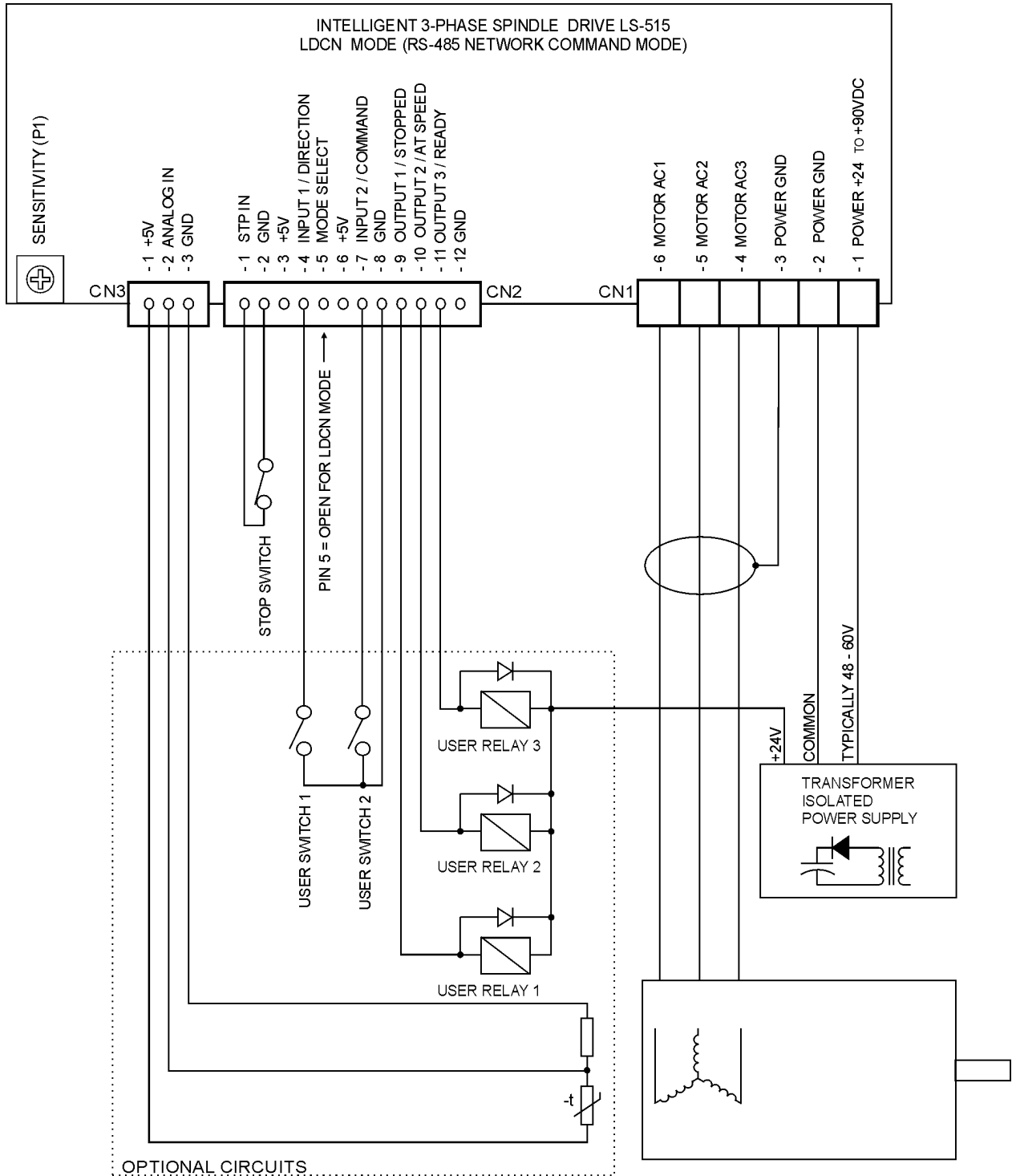


Figure 3

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## LS-515 QUICK START GUIDE – ADC (stand-alone) MODE

### Hardware Setup - see figure 1 and 2

#### 1. Mandatory:

- Connect power supply (24 to 90 VDC) to LS-515.
- Connect the motor.
- Connect normally closed switch to STOP input or ground it.
- Connect the **MODE SELECT** input to +5V. The **MODE SELECT** input is checked only during **Power On** or when **Hard Reset** command is received from the LDCN interface.
- Connect a command switch to INPUT2 / COMMAND.
- Connect potentiometer or voltage source to Velocity control input – ANALOG IN.

#### 2. Optional – connect any other I/O you may have.

#### 3. Turn the power ON.

#### 4. If the drive is connected to a LDCN network and is not the first node, the network should be initialized first.

### List of conditions in ADC mode

CONDITION	STP IN	INPUT 1 DIRECTION	INPUT 2 COMMAND	OUTPUT 1 STOPPED	OUTPUT 2 AT SPEED	OUTPUT 3 READY
Ready	LOW	X	HIGH	LOW	HIGH	LOW
Acceleration Deceleration	LOW	X	LOW	HIGH	HIGH	LOW
Constant forward speed rotation	LOW	HIGH	LOW	HIGH	LOW	LOW
Constant reverse speed rotation	LOW	LOW	LOW	HIGH	LOW	LOW
FAULT Overcurrent or Motor short or Overvoltage or Overheating or Stop activated	X	X	X	X	X	HIGH
Digital output Shorted	X	X	X	HIGH	HIGH	HIGH

HIGH = open; LOW = short to GND

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## LS-515 QUICK START GUIDE – LDCN MODE

### Hardware Setup - see figure 3

- Connect power supply (24 to 90 VDC) to LS-515.
- Connect the motor and any other I/O you may have.
- Connect RS-232 adapter and RJ-45 network cable between LS-515 and your host computer.
- Connect normally closed switch to STOP input or ground it.
- Leave the **MODE SELECT** input open. The **MODE SELECT** input is checked during **Power On** or when **Hard Reset** command is received from the LDCN interface.
- Set DIP-switches T-input and T-output to ON. If more than one device is connected, only the last one must have T-input and T-output set to ON. All of the rest must have T-input and T-output set to OFF.

### Software Installation

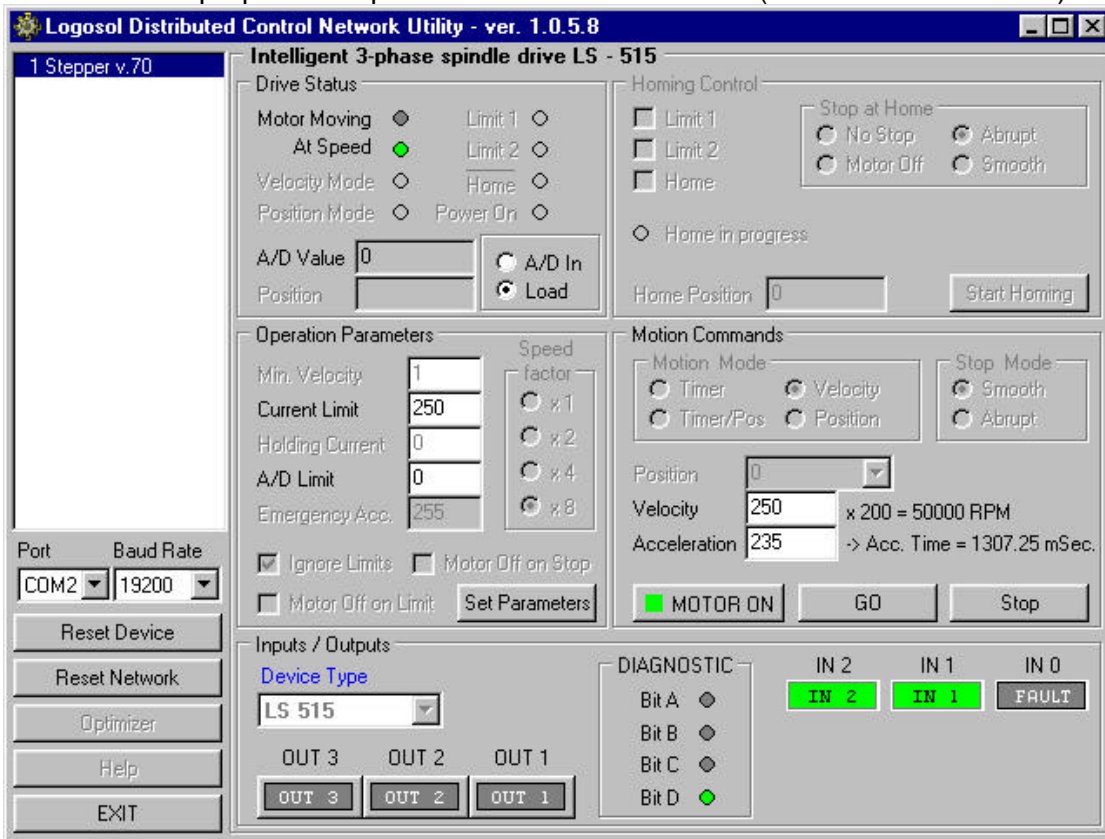
#### 1. Installation and using Logosol Distributed Control Network Utility

##### A. Installation

Run dcsetup.exe. The installation wizard will guide you through the setup process.

##### B. Initial Connection to the Host

1. Turn on the power supply.
2. Run the Logosol Distributed Control Network Utility.
3. Choose the proper COM port and select the baud rate (default value is 19200).



4. Set the parameters as shown on the picture above.
5. Click "MOTOR ON" button.
6. Click "GO" button. The motor should run at 50,000 RPM. Click "Stop" to stop the rotation. More information about using LDCN utility is available in LDCN Help.

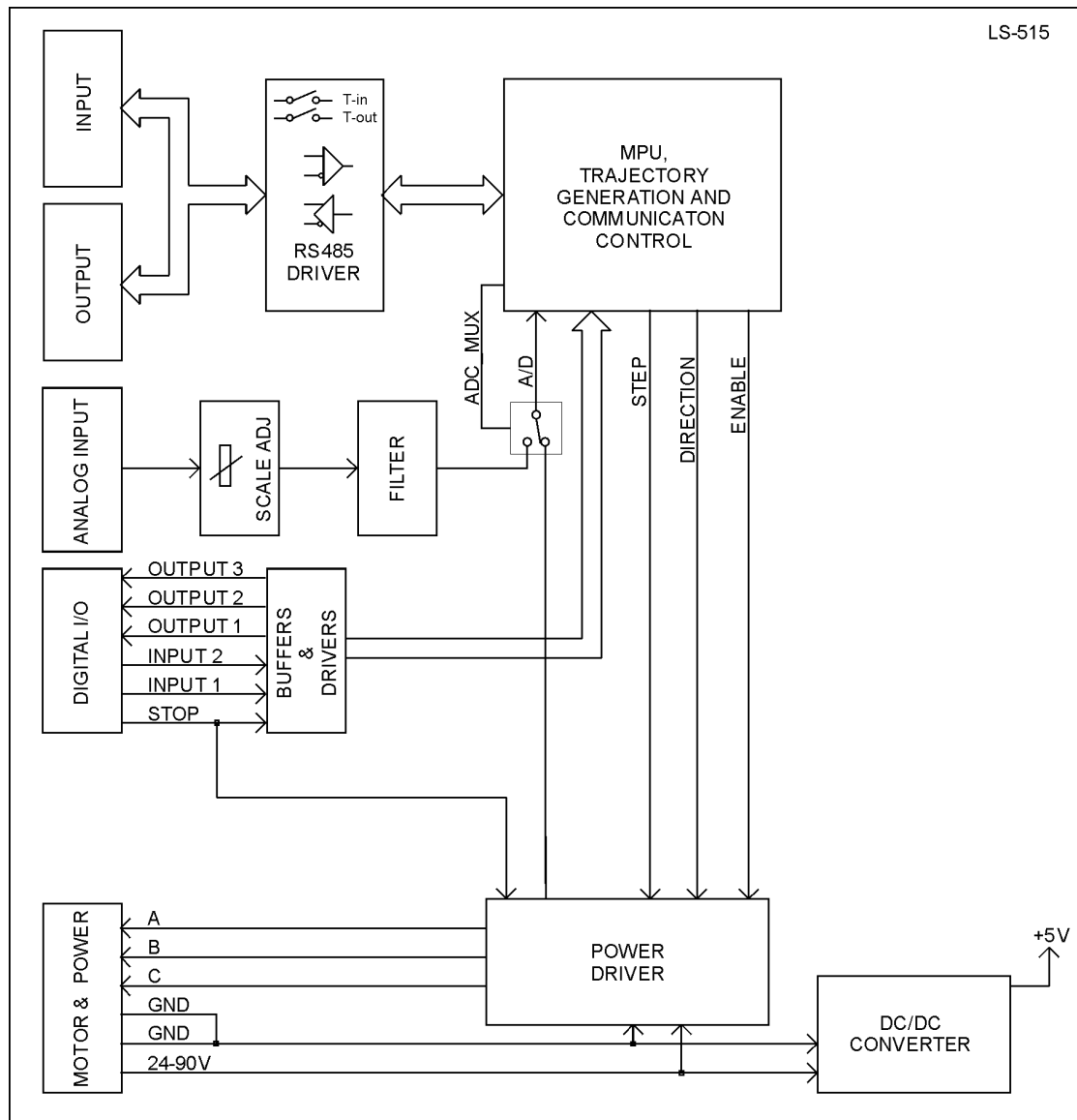
# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## LS-515 ARCHITECTURE

### Overview

The LS-515 Intelligent 3-Phase Spindle Drive is a fully integrated device including high-speed motion controller and 12A PWM power driver. It supports multi-drop RS-485 serial interface using the same LDCN communication protocol as all other members of Logosol Distributed Motion Control Network. LS-515 features three open collector outputs, two digital inputs and one stop input. One analog input with 8-bit ADC is available for velocity control in ADC mode or multi functional applications in LDCN mode.



The motor output is protected against short-circuit and overloading. Shorting any of the motor terminals to another terminal or to the motor power/ground immediately shuts off the power driver. The output motor current depends on the motor shaft load. During the operation the increased shaft load causes the drive to deliver higher current to the motor. The output maximum current is limited to 12A for about 1.5 second. If the overload lasts longer then 1.5

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

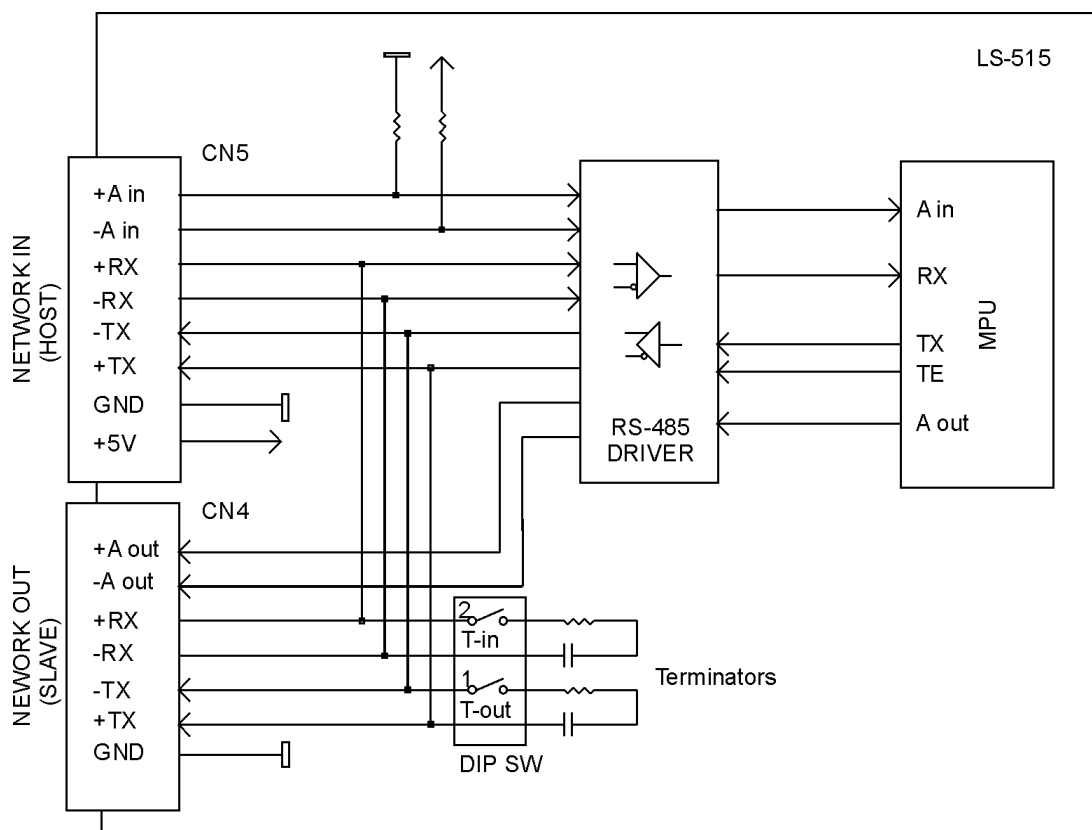
second, the power amplifier is automatically shut down. The spindle speed may be set in the range 5,000 to 50,000 RPM.

A network of up to 31 controllers can be connected directly to a single standard serial port (RS-232 adapter may be necessary).

## Serial Command Interface

Serial communication with the LS-515 drives adheres to a full-duplex (4-wire) 8 bit asynchronous protocol with one start bit, followed by 8 data bits (LSB first), followed by a single stop bit.

The communication protocol of the LS-515 also supports a full-duplex multi-drop RS-485 interface that allows multiple LS-515 spindle drives to be controlled over a single RS-485 port. In this case, the host sends commands over its RS-485 transmit line and receives all status data back over the shared RS-485 receive line.



The command protocol is a strict master/slave protocol in which the master sends a command packet over the command line to a specific LS-515 slave. The command is stored in the buffer of the LS-515 until the end of the current cycle (0.512 ms max.) and then the command is executed. The servo drive then sends back a status packet. Typically, the host does not send another command until a status packet has been received to insure that it does not overwrite any previous command data still in use.

Each command packet consists of following:

- Header byte (0xAA)
- Address byte - individual or group (0x00 - 0xFF)
- Command byte
- 0 - 15 data bytes
- Checksum byte

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

The command byte is divided into upper and lower nibbles: the lower nibble is the command value; the upper nibble is the number of additional data bytes, which will follow the command byte. The checksum byte is 8-bit sum of the address byte, the command byte and the data bytes. The number of data bytes depends on the particular command chosen. After a command is issued, the corresponding controller will send back a status packet consisting of:

*Status byte*

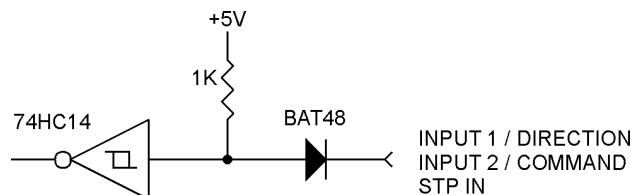
*0-15 optional bytes of status data*

*Checksum byte*

The status byte contains basic status information about the LS-515, including a checksum error flag for the command just received. The optional data bytes may include data such as the velocity, acceleration, etc. and are programmable by the host. The checksum byte is the 8-bit sum of the status byte and the additional optional status data bytes. All 16-bit and 32-bit data is sent the least significant byte first

## Digital Inputs

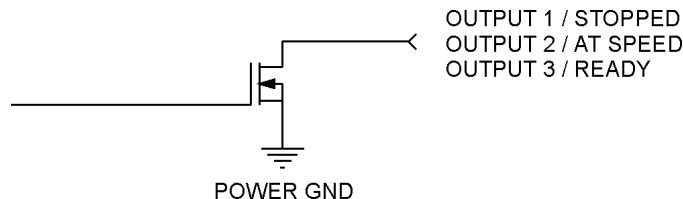
LS-515 is equipped with 3 digital inputs – INPUT1 / DIRECTION, INPUT2 / COMMAND and STP IN. Each input has internal pull-up resistor to +5V and a diode in series. This allows the inputs to endure up to 48V input voltage. The threshold, however, remains at TTL level:  $0 \leq \text{LOW} \leq 1.5\text{V}$ ,  $3.3\text{V} \leq \text{HIGH} \leq 48\text{V}$ . The STP IN is a general stop input. To operate the spindle drive STP IN must be tied to ground. Leaving it open stops the motor and turns the power driver off.



LS-515 Digital inputs schematic

## Digital Outputs

LS-515 features three open collector outputs – OUTPUT1 / STOPPED, OUTPUT2 / AT SPEED and OUTPUT3 / READY designed with high current MOS transistors. An external clamp diode is required if a high inductance load is connected to the output. The outputs are rated for up to 48V and 1A load current. The outputs are protected against overload or short-circuit. In case one or more of the outputs are overloaded all digital outputs are shut off and the motor is stopped. To recover after overload or short-circuit in **LDCN mode** send the Motor ON command. In **ADC mode** the outputs protection is cleared automatically every second after the motor is stopped.



LS-515 Digital outputs schematic

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## ADC

LS-515 is equipped with one 8-bit ADC. The full-scale sensitivity can be adjusted with **P1**. When fully clockwise, the analog input measures voltage between 0 and 5V. In order to adjust the scale, set the controller in LDCN mode, rotate P1 fully CCW, run the LDCN utility, check the **A/D in** button, apply the maximum voltage (up to 30V) to the analog input and rotate P1 CW until the **A/D value** becomes 254 - 255.

In **ADC mode** this input is used for spindle velocity control. Any A/D value between 0 and 25 sets the velocity to 5,000 rpm. The A/D value of 250 to 255 sets the maximum velocity of 50,000 rpm. If the value is between 25 and 250, the commanded velocity in RPM can be obtained by multiplying this value by 200.

In **LDCN mode** the internal control bit ADC\_MUX selects one of the following functions:

### Drive Load measurement

Setting the internal control output ADC\_MUX to OFF selects Drive Load measurement function. This is the default configuration after power up. The ADC is returning a value proportional to the power driver load (0-255). The difference between the A/D values with free running and loaded spindle motor is proportional to its load.

In Drive Load measurement **A/D Limit** should be set to 0.

### Analog Input

Setting the internal control output ADC\_MUX to ON selects Analog Input function. LS-515 may be programmed to automatically shut off the drive at certain analog input level. The primary application of that feature is a motor thermal protection. With an external thermistor / resistor bridge LS-515 may automatically turn off the motor to prevent overheating. Thermistors with either positive or negative temperature coefficient may be used. The threshold may be set at any value between 0 and 255. If it is set to an even value (2, 4, 6, etc), the drive will be shut off when A/D value is lower than the threshold. If the threshold is odd (1, 3, 5, etc), the shutdown will occur when the A/D value is greater than that value. Setting the threshold to 0 disables the shutoff feature. The analog input may be read at any time, it doesn't matter whether the shutdown feature is enabled or not.

## Current limit

The drive output limitation is controlled by Current limit parameter (50-255).

Current limit of 50 represents 2.5A output current limit. Current limit of 255 represents 12A. If Current limitation is active for more than 1.5 sec the power driver shuts off automatically with diagnostics status *Overcurrent*.

## Addressing

In a network of Logosol motion controllers each device must have unique address. LS-515 doesn't have hardware switches to configure the address. Instead it is dynamically assigned. The host sets the address of each LS-515 with the aid of the daisy-chained "A in" and "A out" lines. This allows additional LS-515 controllers to be added to the network with no hardware changes. On power-up, "A in" of the first LS-515 is pulled low, its communication is enabled and the default address is 0x00. When the *Set Address* command is issued to give this LS-515 new unique address, it will lower its "A out" pin. Connecting "A out" pin to the "A in" pin of the next servo drive in the network will enable its communication at default address of 0x00. Repeating this process allows a variable number of controllers present to be given unique addresses.

## Group Addresses

In addition to the individual address, each controller has a secondary group address. Several LS-515 drives may share a common group address. This address is useful for sending commands, which must be performed simultaneously by a number of drivers (e.g. *Start*

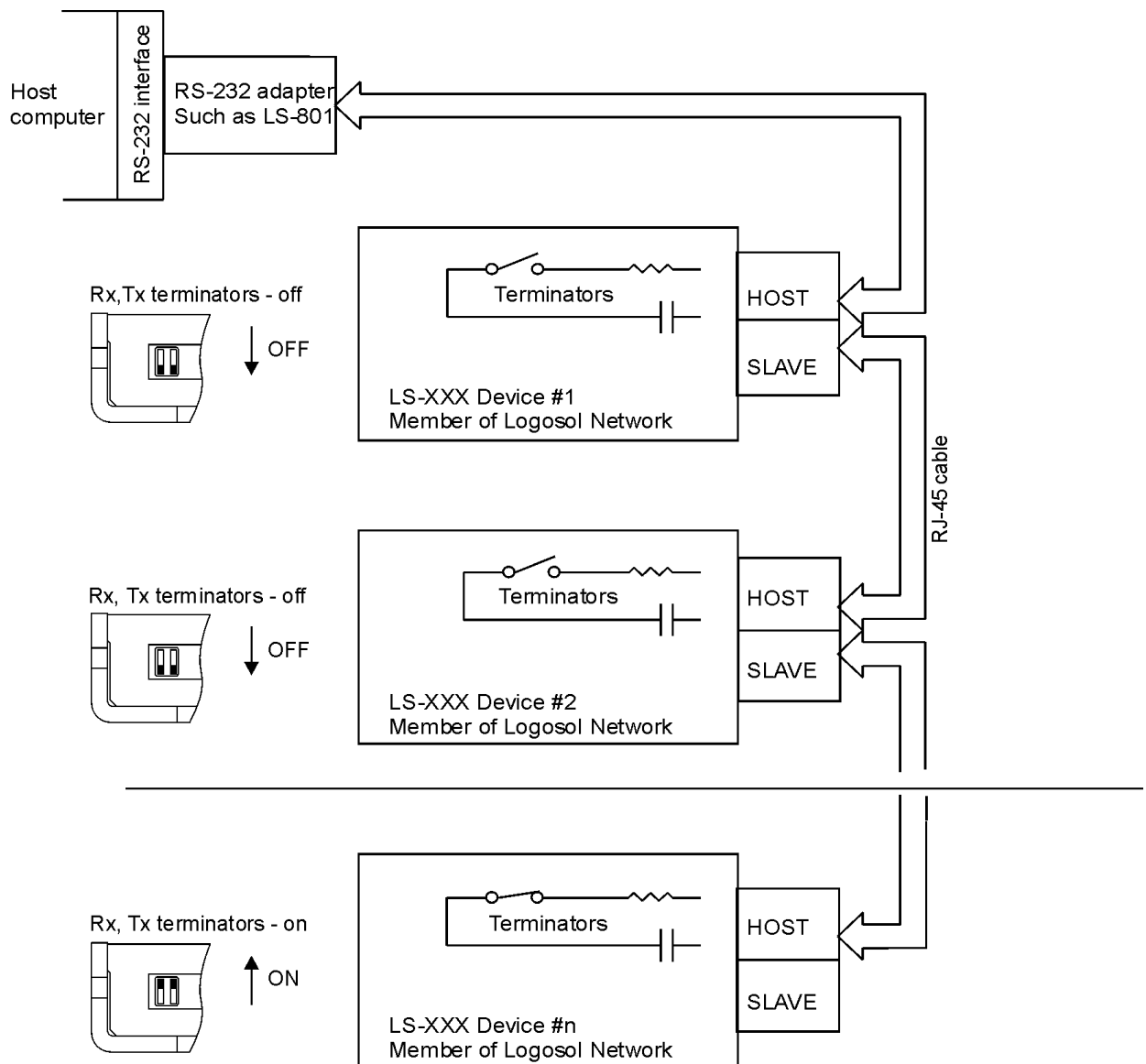
# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

motion, Set Baud Rate, etc.). When a LS-515 receives a command sent to its group address, it will execute the command but not send back a status packet. This prevents data collisions on the shared response line. In programming group addresses, however, the host can specify that one member of the group is the "group leader". The group leader will send back a status packet just like it would for a command sent to its individual address. The group address is programmed at the same time as the unique individual address using the *Set Address* command.

## DIP Switches

DIP switches are used to configure the line terminators. T-input and T-output, are used to turn ON/OFF receive and transmit lines terminators. In a network of Logosol devices only the last one (at the remote end) is supposed to have its line terminators ON. All other devices located between this device and the host must have their terminators set to OFF.



Setting the terminators for multi-device configuration

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## Diagnostics

LS-515 is protected against overvoltage, overheating, overcurrent, motor short, and digital output short. Any one of these conditions turns the power driver off. After motor is stopped the state of Diagnostic bit D from the status byte and Diagnostic bits A, B and C and IN0 bit from the input byte can be used for diagnostic. Motor On command restores the drive functionality if there is no more fault reason present.

Motor ON	Bit D	Bit C	Bit B	Bit A	IN0 (FAULT)	Diagnostics
x	1	0	0	0	0	OK
0	1	0	1	1	1	Digital Output Shorted
0	1	0	0	1	1	Motor Short or Overvoltage
0	1	0	1	0	1	Overcurrent
0	0	1	0	0	1	Overheating
0	0	1	1	1	1	Stop activated
0	1	0	0	0	1	Stop latched <i>not available in ADC mode</i>

## THEORY OF OPERATION

Velocity profile mode is used to smoothly accelerate from one velocity to another. Velocities are specified as integer values (**S**) between 25 and 250.

The actual velocity **V** in RPM can be obtained using the formula:

$$\mathbf{V} = 200 * \mathbf{S}, \quad \text{in RPM (min} = 200*25 = 5,000 \text{ RPM; max} = 200*250 = 50,000 \text{ RPM)}$$

where

**S** is the integer velocity value (range 25 - 250)

The acceleration or deceleration is achieved by incrementing (or decrementing) the current integer velocity value by one until the goal velocity is reached. The actual time for acceleration from one velocity to another can be obtained using the formula:

$$\mathbf{T}_{\text{acc}} = | (64 - 0.25 * \mathbf{Acc}) * (\mathbf{S}_{\text{tar}} - \mathbf{S}_{\text{cur}}) | \text{ in ms,}$$

where

**Acc** is the acceleration value (range 200 - 240),

**S<sub>cur</sub>** is current velocity value (range 25 - 250),

**S<sub>tar</sub>** is target velocity value (range 25 - 250), and

**T<sub>acc</sub>** is the time to accelerate from velocity **S<sub>cur</sub>** to **S<sub>tar</sub>** with acceleration **Acc**

Examples:

1. Accelerating from current velocity 35 to target velocity 125 with acceleration 200.

$$\mathbf{S}_{\text{cur}} = 35, \mathbf{S}_{\text{tar}} = 125, \mathbf{Acc} = 200.$$

$$| (64 - 0.25 * 200) * (125 - 35) | = | 14 * 90 | = | 1260 | = 1260 \text{ ms (1.26 s)}$$

2. Decelerating from current velocity 125 to target velocity 35 with acceleration 200.

$$\mathbf{S}_{\text{cur}} = 125, \mathbf{S}_{\text{tar}} = 35, \mathbf{Acc} = 200.$$

$$| (64 - 0.25 * 200) * (35 - 125) | = | 14 * (-90) | = | -1260 | = 1260 \text{ ms (1.26 s)}$$

*Note:* To change the direction of motion, a stop command must first be issued before a velocity in the opposite direction is commanded.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## COMMAND SPECIFICATION

### List of Commands

Command	CMD Code	# Data bytes	Description	While Moving?
Set address	0x1	2	Sets the individual and group addresses	Yes
Define status	0x2	1	Defines which data should be sent in every status packet	Yes
Read status	0x3	1	Causes particular status data to be returned just once	Yes
Load trajectory	0x4	1-9	Loads motion trajectory parameters	Maybe
Start motion	0x5	0	Executes the previously loaded trajectory	Maybe
Set parameters	0x6	5	Sets the motion parameters and operating limits	Yes
Stop motor	0x7	1	Stops the motor in one of three manners	Yes
I/O control	0x8	1	Sets the output values	Yes
Set baud rate	0xA	1	Sets the baud rate	Yes
Nop	0xE	0	Simply causes the defined status data to be returned	Yes
Hard reset	0xF	0	Resets the controller to its power-up state.	Yes

## LS-515 Command Description

### Set Address

Command value: 0x1

Number of data bytes: 2

Command byte: **0x21**

Data bytes:

1. Individual address: 0x01-0x7F (initial address 0x00)
2. Group Address: 0x80-0xFF (initial value 0xFF)

### Description:

Sets the individual address and group address. Group addresses are always interpreted as being between 0x80 and 0xFF. If a Drive is to be a group leader, clear bit 7 of the desired group address in the second data byte. The device will automatically set bit 7 internally after flagging the Drive as a group leader (If bit 7 of the second data byte is set, the module will be a group member by default). The first time this command is issued after power-up or reset, it will also enable communications for the next Drive in the network chain by lowering it's "A out" signal.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## Define Status

Command value: 0x2  
Number of data bytes: 1  
Command byte: **0x12**

### Data bytes:

#### 1. Status items: (default: 0x00)

Bit 0: reserved. Set to 0.  
1: send A/D value (1 byte)  
2: reserved. Set to 0.  
3: send input byte (1 byte)  
4: reserved. Set to 0.  
5: send device ID and version number (2 bytes)  
(device ID = 3, version number = 70 - 79)  
6: send I/O state byte  
7: reserved. Set to 0.

### Description:

Defines what additional data will be sent in the status packet along with the status byte. Setting bits in the command's data byte will cause the corresponding additional data bytes to be sent after the status byte. The status data will always be sent in the order listed. For example if bits 1 and 3 are set, the status packet will consist of the status byte followed by the A/D value, followed by the input byte, followed by the checksum. The status packet returned in response to this command will include the additional data bytes specified. On power-up or reset, the default status packet will include only the status byte and the checksum byte.

## Read Status

Command value: 0x3  
Number of data bytes: 1  
Command byte: **0x13**

### Data bytes:

#### 1. Status items:

Bit 0: reserved. Set to 0.  
1: send A/D value (1 byte)  
2: reserved. Set to 0.  
3: send input byte (1 byte)  
4: reserved. Set to 0.  
5: send device ID and version number (2 bytes)  
(device ID = 3, version number = 70 - 79)  
6: send I/O state byte  
7: reserved. Set to 0.

### Description:

This is a non-permanent version of the *Define Status* command. The status packet returned in response to this command will incorporate the data bytes specified, but subsequent status packets will include only the data bytes previously specified with the *Define Status* command.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## Load Trajectory

Command value: 0x4  
Number of data bytes:  $n = 1-3$   
Command byte: **0xn4**

Data bytes:

1. Control byte:

Bit 0: reserved. Set to 0.  
1: load velocity data ( $n = n + 1$  byte)  
2: load acceleration data ( $n = n + 1$  bytes)  
3: reserved. Set to 0.  
4: direction - 0 = positive, 1 = negative  
5,6 reserved. Set to 0.  
7 start motion now

### Description:

All motion parameters are set with this command. Setting one of bits 1 and 2 in the control byte will require additional data bytes to be sent (as indicated) in the order listed. The velocity data (range 25 to 250, corresponding to 5000 to 50000 rpm) is used as the goal velocity. The acceleration data should be in the range of 200 to 240.

Bit 4 indicates the velocity direction.

## Start Motion

Command value: 0x5  
Number of data bytes: 0  
Command byte: **0x05**

### Description:

Causes the trajectory information loaded with the most recent Load Trajectory command to execute. This is useful for loading several step devices with trajectory information and then starting them simultaneously with a group command.

## Set Parameters

Command value: 0x6  
Number of data bytes: 5  
Command byte: **0x56**

Data bytes:

1. Control byte:

Bit 0: reserved. Set to 0.  
1: reserved. Set to 0.  
2: reserved. Set to 1.  
3: reserved. Set to 0.  
4: reserved. Set to 0.  
5,6,7: reserved. Set to 0.  
2. Byte reserved. Set to 1.  
3. Byte Current limit (50-255).  
4. Byte reserved. Set to 0.  
5. Byte A/D limit (0-255 – value of 0 disables limiting)

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## Description:

This command must be issued before any motion can be executed. If the A/D limit value is even, the shutdown will occur when the A/D value is lower than the limit. If the A/D limit is odd, the shutdown will occur when the A/D value is greater than the limit.

## **Motor ON / Stop**

*Command value:* 0x7  
*Number of data bytes:* 1  
*Command byte:* **0x17**  
*Data bytes:*

### *1. Stop control byte:*

*Bit* 0: turn motor on/off  
1: reserved. Set to 0.  
2: reserved. Set to 0.  
3: stop smoothly  
4-7: reserved. Set to 0.

## Description:

Stops the motor in the specified manner. If bit 0 of the Stop Control Byte is set, the motor will be turned on. If bit 0 is cleared motor will be turned off, regardless of the state of the other bits. If bit 3 is set, the motor will decelerate to a stop.

## **Set outputs**

*Command value:* 0x8  
*Number of data bytes:* n=1  
*Command byte:* **0x18**  
*Data bytes:*

### *1. Set outputs control byte*

*Bit* 1-4: output values – *OUT1, OUT2, OUT3, and ADC\_MUX* (0=OFF, 1=ON)  
0,5-7: not used

## Description:

Immediately sets the values of outputs.

## **Set Baud Rate**

<i>Command value:</i>	0xA	<b>sample values:</b>	
<i>Number of data bytes:</i>	1	9600	BRD = 0x81
<i>Command byte:</i>	<b>0x1A</b>	19200	BRD = 0x3F
<i>Data bytes:</i>		57600	BRD = 0x14
<i>1. Baud rate divisor,</i>	<i>BRD</i>	115200	BRD = 0x0A

## Description:

Sets the communication baud rate. All the drives on a network must have their baud rates changed at the same time; therefore this command should only be issued to a group including all of the controllers on the network. A status packet returned from this command would be at the new baud rate, so typically (unless the host's baud rate can be accurately synchronized) there should be no group leader when this command is issued.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

---

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## **No Operation**

*Command value:* 0xE  
*Number of data bytes:* 0  
*Command byte:* 0x0E

### Description:

Does nothing except cause a status packet with the currently defined status data to be returned.

## **Hard Reset**

*Command value:* 0xF  
*Number of data bytes:* 0  
*Command byte:* 0x0F

### Description:

Resets the control module to its power-up state. No status will be returned. Typically, this command is issued to all the modules on the network, although if the baud rate is set at the default, it is possible to reset and re-initialize the addresses of a contiguous sub-chain of modules.

Note: *Hard Reset* command sent at address 0xFF will be executed by all Drives, regardless of their own group address.

# Logosol Intelligent 3-Phase Spindle Drive LS-515-1210

Doc. # 712515001 / Rev. 2.1, 12/05/2001

## STATUS BYTE AND INPUT BYTE DEFINITIONS

### Status Byte

<u>Bit</u>	<u>Name</u>	<u>Definition</u>
0	Motor is moving	Set if the motor is moving and cleared otherwise.
1	Cksum_error	Set by a checksum error in the command packet.
2	Motor is on	Set after Motor ON command with no fault condition.
3	Bit D	Diagnostics bit D. See <b>Diagnostics</b> section.
4	At commanded velocity	Set if the commanded velocity is reached.
5	Reserved	
6	Reserved	
7	Reserved	

### Input Byte

<u>Bit</u>	<u>Name</u>	<u>Definition</u>
0	IN0	Diagnostics bit FAULT. See <b>Diagnostics</b> section.
1	IN1	The value of INPUT1 / DIRECTION.
2	IN2	The value of INPUT2 / COMMAND.
3	Bit A	Diagnostics bit A. See <b>Diagnostics</b> section.
4	Bit B	Diagnostics bit B
5	Bit C	Diagnostics bit C
6	Mode	0=LDCN mode, 1=ADC mode
7	Reserved	

### I/O State Byte

<u>Bit</u>	<u>Name</u>	<u>Definition</u>
0	IN0	Diagnostics bit FAULT. See <b>Diagnostics</b> section.
1	IN1	The value of INPUT1 / DIRECTION.
2	IN2	The value of INPUT2 / COMMAND.
3	OUT0	Reserved
4	OUT1	The value of OUTPUT1 / STOPPED.
5	OUT2	The value of OUTPUT2 / AT SPEED.
6	OUT3	The value of OUTPUT3 / READY.
7	ADC_MUX	The value of the internal control bit.

---

*Note:* IN0, IN1 and IN2 in Input byte and I/O state byte are the same inputs.