

## **NOTICE DO NOT DISCARD**

In a continuing effort to satisfy our customers, Danaher Motion has provided this packet of instructions with your product. This information provides safety, warranty, and liability information. This information enables you, the customer to get this unit up and running with installation steps. Tuning information is contained in the technical manuals on this CD-ROM. The software for this product is also contained on this CD-ROM. The included CD-ROM has all the technical manuals in PDF format. For your convenience, Adobe®'s Acrobat Reader can also be installed from this CD-ROM. Danaher Motion's technical documentation is subject to change without notice. Be sure to check the website for the latest version ([www.danahermotion.com](http://www.danahermotion.com)). Compare wiring diagrams to the latest version on the website to prevent damage to equipment.

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# SAFETY

Only qualified personnel are permitted to transport, assembly, commission, and maintenance this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their jobs. The qualified personnel must know and observe the following standards and regulations:

IEC 364 resp. CENELEC HD 384 or DIN VDE 0100

IEC report 664 or DIN VDE 0110

National regulations for safety and accident prevention or VBG 4

- Read all available documentation before assembly and commissioning. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information on the installation requirements.
- It is vital to ensure that all system components are connected to earth ground. Electrical safety is impossible without a low-resistance earth connection.
- The **SERVOSTAR**<sup>®</sup> product contains electro-statically sensitive components that can be damaged by incorrect handling. Discharge yourself before touching the product. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface.
- During operation keep all covers and cabinet doors shut. Otherwise, there are deadly hazards that could possibly cause severe damage to health or the product.
- In operation, depending on the degree of enclosure protection, the product can have bare components that are live or have hot surfaces. Control and power cables can carry a high voltage even when the motor is not rotating.
- Never pull out or plug in the product while the system is live. There is a danger of electric arcing and danger to persons and contacts.
- After powering down the product, wait at least ten minutes before touching live sections of the equipment or undoing connections (e.g., contacts, screwed connections). Capacitors can store dangerous voltages for long periods of time after power has been switched off. To be safe, measure the contact points with a meter before touching.

When the symbols below appear in this manual, be alert to the potential for personal injury and/or damage to the equipment. Follow the recommended precautions and safe operating practices included with the alert symbols. Safety notices in this manual provide important information. Read and be familiar with these instructions before attempting installation, operation, or maintenance. The purpose of this section is to alert users to possible safety hazards associated with this equipment and the precautions that need to be taken to reduce the risk of personal injury and damage to the equipment. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, or operational difficulty.



**WARNING**

***Potential physical danger or harm. Failure to follow warning notices could result in personal injury or death.***



**CAUTION**

***General precautions, which if not followed, could result in personal injury and/or equipment damage.***



**NOTE**

***Information critical to your understanding or use of the product.***

## **DIRECTIVES AND STANDARDS**

The SERVOSTAR® CD product series have been successfully tested and evaluated to meet UL/cUL 508C for both U.S. and Canadian markets. This standard describes the fulfillment by design of minimum requirements for electrically operated power conversion equipment, such as frequency converters and servo amplifiers, which is intended to eliminate the risk of fire, electric shock, or injury to persons, being caused by such equipment.

## **CE MARK CONFORMANCE**

Servo drives are components that are intended to be incorporated into electrical plant and machines for industrial use. When the servo drives are built into machines or plants, drives cannot be operated until the machine or plant fulfills the requirements of the EC Directive on Machines 89/392/EEC and the EC Directive on EMC (89/336/EEC). EN 60204 and EN 292 must also be observed.

In connection with the Low Voltage Directive 73/23/EEC, the harmonized standards of the EN 50178 series are applied to the amplifiers, together with EN 60439-1, EN 60146 and EN 60204.

The manufacturer of the machine or plant is responsible for ensuring that they meet the limits required by the EMC regulations. Advice on the correct installation for EMC - such as shielding, grounding, arrangement of filters, treatment of connectors and the laying out of cabling - can be found within this documentation.

Conformance with the EC Directive on EMC 89/336/EEC and the Low Voltage Directive 73/23/EEC is mandatory for the supply of servo drives within the European Community.

An authorized testing laboratory in a defined configuration with the system components has tested the servo drives. Any divergence from the configuration and installation described in this documentation means that you are responsible for the performance of new measurements to ensure that the regulatory requirements are met.

Danaher Motion's CD-Series drives and systems have been successfully tested and evaluated to the limits and requirements of the EC Directive on EMC (89/336/EEC) and the EC Directive on Low Voltage (72/73/EEC). The product lines have been evaluated to EN50178 and EN60204 as a component of a machine and other relevant standards.

The EMC of a system can be identified by emissions and immunity. Emissions refer to the generation of EMI (electromagnetic interference) and immunity refers to the susceptibility levels of the equipment. Limits were derived from generic standards EN55081-2 and EN55082-2 for heavy industrial environments. The SERVOSTAR CD series of drives and BUS Modules have been tested for radiated emissions, conducted emissions, EFT, ESD, surge, conducted immunity, and radiated immunity. These tests have been done in accordance with EN55011, EN61000-4-2, ENV50140, IEC 1000-4-4, EN61000-4-5, and ENV50141.



***Installation of the equipment is critical in designing for system and machine electromagnetic compatibility (EMC). You must apply the installation recommendations and the CE filtering Practices when mounting and installing the drive system for CE conformance.***

# UNPACKING AND INSPECTING

Open the box(es) and remove all the contents. Check to ensure there is no visible damage to any of the equipment.



WARNING

**Electronic components in this amplifier are design hardened to reduce static sensitivity. However, proper procedures should be used when handling.**



WARNING

**Remove all packing material and equipment from the shipping container. Be aware that some connector kits and other equipment pieces may be quite small and can be accidentally discarded if care is not observed when unpacking the equipment. Do not dispose of shipping materials until the packing list has been checked.**



CAUTION

**Upon receipt of the equipment, inspect components to ensure that no damage has occurred in shipment. If damage is detected, notify the carrier immediately. Check all shipping material for connector kits, manuals, diskettes, and other small pieces of equipment.**

## GROUNDING

System grounding is essential for proper performance of the drive system. A ground bus bar may be used as a single point ground for the system. Safety grounding should be provided to all pieces of the system from a "star point." In addition to the safety grounding, a high frequency ground must be provided that connects the back panel to the enclosure and, ultimately, to earth ground. The objective is to provide an extremely low impedance path between the filters, drives, power supplies, and earth ground. This high frequency ground is accomplished with the use of a flat braid or copper bus bar. It is important not to rely on a standard wire for the high frequency ground. In general, a wire has an inductance of 8 nH-per-inch, regardless of diameter. At higher frequencies, this unwanted inductance between grounds equates to limited filter performance. When connecting high frequency grounds, use the shortest braid possible.

## BONDING

The proper bonding of shielded cables is imperative for minimizing noise emissions and increasing immunity levels of the drive system. Its effect is to reduce the impedance between the cable shield and the back panel. Danaher Motion recommends that all shielded cables be bonded to the back panel.

Power input wiring does not require shielding (screening) if the power is fed to the cabinet (enclosure) via metallized conduit. If the metallized conduit is used with proper high frequency grounds, bonding technology, and recommended wire routing, then power input wire shielding has no affect. In the event that metallized conduit is not implemented into the system, shielded cable is required on the power input wires and proper bonding technologies should be implemented.

The motor and feedback cables should have the shield exposed as close to the drive as possible. This exposed shield is bonded to the back panel using either non-insulated metallic cable clamps or cable bonding clamps offered by Phoenix Contact (and others). Refer to the *Installation Manual* for details.

## CE FILTERING TECHNIQUES

The SERVOSTAR<sup>®</sup> drive system (BUS Module, drive, motor) meets the CE Mark standards stated in the front of this manual. It is imperative for you to apply proper bonding and grounding techniques, described earlier in this section, when incorporating EMC noise filtering components for the purpose of meeting this standard.

Noise currents often occur in two types. The first is conducted emissions that are passed through ground loops. The quality of the system grounding scheme inversely determines the noise amplitudes in the lines. These conducted emissions are of a common-mode nature from line to neutral (or ground). The second is radiated high-frequency emissions usually capacitively coupled from line-to-line and are differential in nature.

To properly mount the filters, the enclosure should have an unpainted metallic surface. This allows for more surface area to be in contact with the filter housing and provides a lower impedance path between this housing and the back plane. The back panel, in turn, has a high frequency ground strap connection to the enclosure frame or earth ground.

## INPUT POWER FILTERING

The SERVOSTAR CD electronic system components require EMI filtering in the input power leads to meet the conducted emission requirements for the industrial environment. This filtering blocks conducted-type emissions from exiting onto the power lines and provides a barrier for EMI on the power lines.

Care must be taken to adequately size the system. The type of filter is based on the voltage and current rating of the system and whether the incoming line is single or three-phase. One input line filter is used for multi-axis control applications. These filters are mounted as close to the incoming power as possible so noise is not capacitively coupled into other signal leads and cables. Similarly, care should be taken when routing wires from the load side of the filter to the BUS Module. These lines may be noisy and should be separated from other sensitive cabling to avoid unwanted coupling of noise. Several manufacturers of these filters are listed below. They should be able to recommend the best filter design for most typical motor control applications. Danaher Motion has also provided specific filters recommendations that adequately attenuate the conducted noise to levels well below the CE limits. The implementation of the EMI filter should be done in accordance with the following guidelines:

- Filter should be mounted on the same panel as the drive and BUS Module.
- Filter should be mounted as close as possible to incoming cabinet power.
- Filter should be mounted as close as possible to BUS Module. If separation exceeds 30cm. (1 ft.), flat cable (braid) is used for the high frequency connection between filter and BUS Module.
- When mounting the filter to the panel, remove any paint or material covering. Use an unpainted metallic back panel, if possible.
- Filters are provided with an earth connection. All ground connections are tied to ground.
- Filters can produce high leakage currents. **Filters must be earthed before connecting the supply!**
- Filters should not be touched for a period of 10 seconds after removing the supply.

| BUS Module Model # | Recommended EMI Line Filter                   | Danaher Motion Part # |
|--------------------|---|-----------------------|
| PALM*              | Corcom F7202A                                 | A-97181               |
| Cx03               | Filter Concepts SF7<br>Schaffner FN258-7/07   | n/a<br>A-96776-001    |
| Cx06               | Filter Concepts SF15<br>Schaffner FN258-16/07 | n/a<br>A-96776-002    |
| Cx10               | Schaffner FN258-16/07                         | A-96776-002           |

\*PALM is not used for Series 5 (Version 2)



NOTE

**The filters called out in the table on the previous page are used on a one-to-one correspondence with the drive. If drives are paralalled off one filter, it needs to be sized.**

**Drives can be ganged off one EMI filter as shown in the Filter and Bonding Diagrams.**

## MOTOR LINE FILTERING

Motor filtering may not be necessary for CE compliance of SERVOSTAR systems. However, this additional filtering increases the reliability of the system. Poor non-metallic enclosure surfaces and lengthy, unbonded (or unshielded) motor cables that couple noise line-to-line (differential) are just some of the factors that lead to the necessity of motor lead filtering.

Motor lead noise may be either common-mode or differential. The common-mode conducted currents occur between each motor lead and ground (line-to-neutral). Differential radiated currents exist from one motor lead to another (line-to-line). The filtering of the lines feeding the motor provide additional attenuation of noise currents that enter surrounding cables and equipment I/O ports in close proximity. Refer to the *Installation Manual* for details.

# INSTALLATION

These installation steps are designed to lead you through the proper installation and setup of a SERVOSTAR® CD system. They were developed with the assumption that you have a fundamental understanding of basic electronics, computers, mechanics, and proper safety practices. However, you do not have to be an expert in motion control to install and operate the drive system. It is recommended that you read the entire manual completely before attempting installation or operation.



***High voltage can present dangerous and hazardous conditions if not performed by a qualified electrician. Be certain to follow all national and local codes during installation. Follow all safety precautions outlined in the accompanying CD-ROM documentation.***

1. Open the box(es) and remove all the contents. Check to ensure there is no visible damage to any of the equipment.
2. Mount the SERVOSTAR CD to the back panel. Refer to the Outline Dimension. ***Metal-to-metal contact is important for electrical noise control!***
3. Wire the SERVOSTAR CD according to the System Wiring Diagram.
4. Connect solid earth ground to frames of all components.
5. Wire the main power (115/230 VAC). For CDxx260, CDxx261, CDxx560 or CDxx561 product, wire the 24 volt supply to the connector at the top of the drive.
6. Wire user I/O at connector C3: At a minimum, 24 volts must be brought in to the enable circuit. Be certain that connector C3 is inserted correctly.
7. Wire the motor and feedback. Refer to the Feedback Wiring Diagram for additional information.
8. Wire Regen Resistor kit, if applicable.
9. Verify that all wiring is correct.
10. Verify that earth grounds are connected.
11. Verify all electrical and safety codes are met.
12. Connect the serial cable to connector C2 and PC. Refer to the System Wiring Diagram.
13. Install **MOTIONLINK** on the PC (from the CD-ROM or website ([www.DanaherMotion.com](http://www.DanaherMotion.com))).

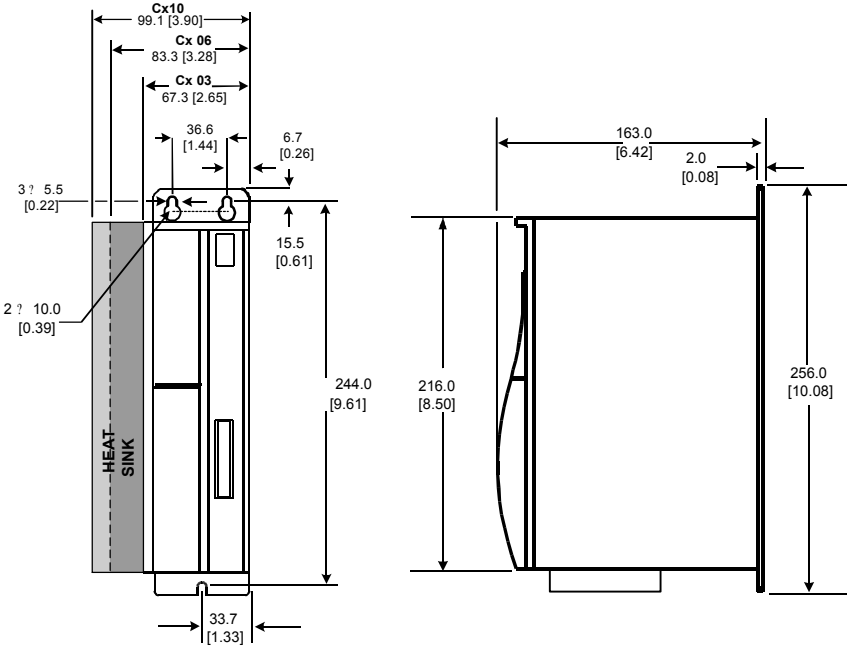


***Startup processes can cause motor motion. Be certain that all applicable safety precautions are taken to ensure that no harm to personal or machine can occur.***

14. Using the Startup Wizard in **MOTIONLINK**:
  - A. Configure the SERVOSTAR CD for your particular motor, if this was not done at the factory. Refer to the **MOTIONLINK** Startup Wizard.
  - B. Enable the system.

# WIRING

## OUTLINE DIMENSIONS

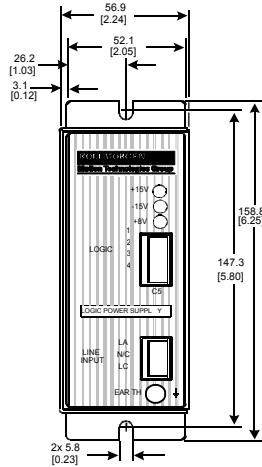
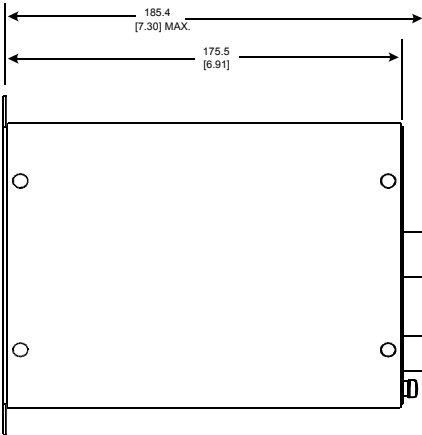


## PA-LM UNITS



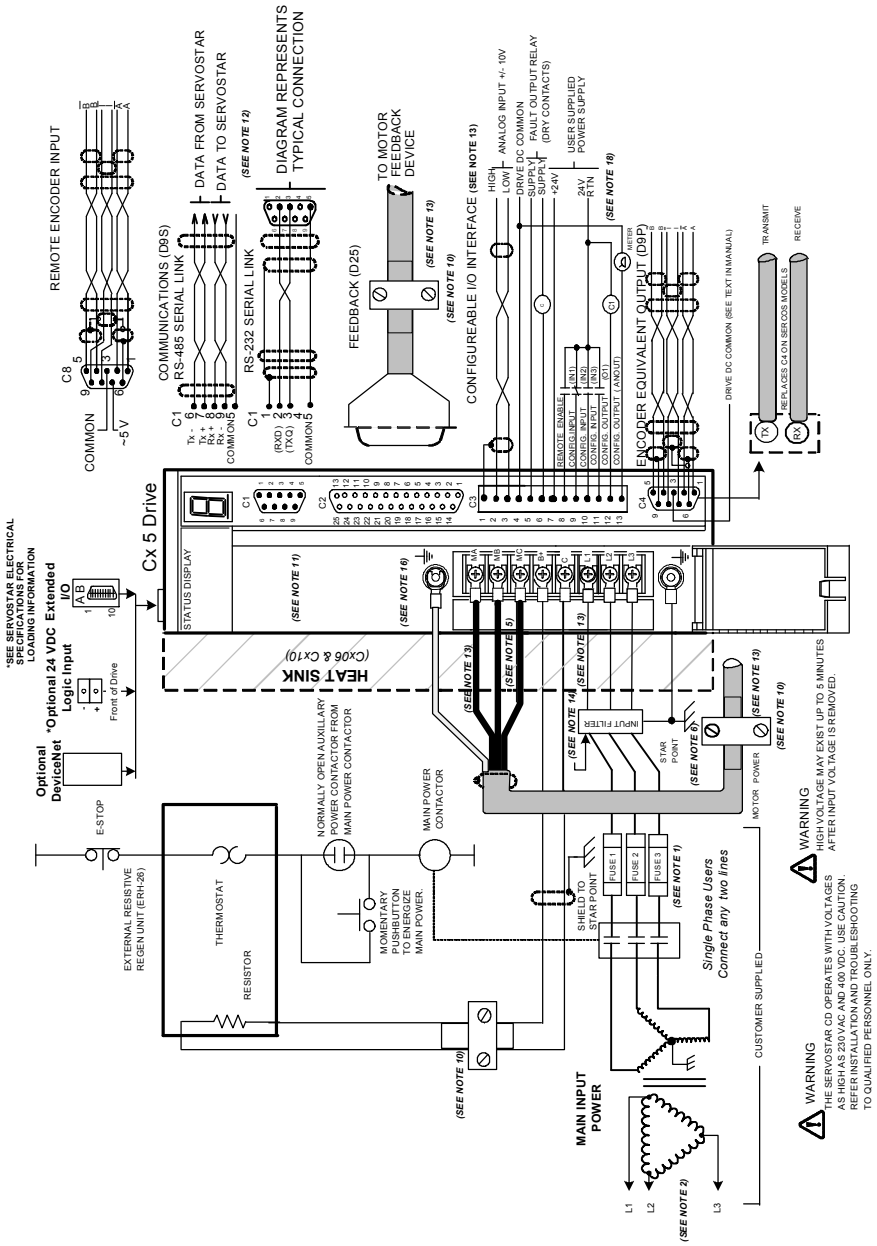
**NOT USED IN SERIES 5 UNITS!!**

**NOTE**

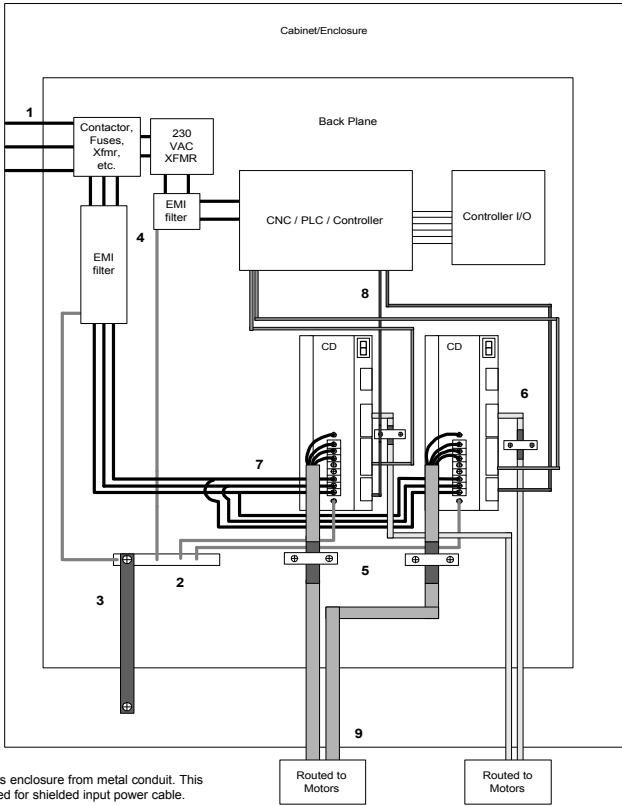




# Cx SYSTEM WIRING DIAGRAM



# CX FILTER AND BONDING DIAGRAM



**Note 1**  
Input power enters enclosure from metal conduit. This eliminates the need for shielded input power cable.

**Note 2**  
Single point ground. A bus bar (ground bus) is an excellent way to achieve this.

**Note 3**  
High frequency ground between non-conductive back panel and enclosure. Also, a high frequency ground is required between the enclosure and earth ground.

**Note 4**  
EMI filter grounding. Safety grounds must be provided on the filters. Hazard potentials exist even when the power is off because of the capacitors internal to the filters.

**Note 5**  
Bonding of motor cables. The use of armored (screened) motor cables bonded as close to the drive as possible are essential for CE compliance and strongly recommended to better the overall performance and reliability of the system.

**Note 6**  
Feedback cable bonding is required for CE compliance. As with the motor cables, the feedback cables should be bonded to the back panel. This bonding does two things. First, it cuts down radiation from the drive, which may be in the form of high frequency energy resulting from internal processor clocks. Second, it provides immunity for the drive. Since the feedback device is located internal to the motor, it is going to pick up some noise currents and transmit them along the feedback cable. The bonding directs the currents from the shield of the feedback cable to back panel ground. This reduces the amount of noise entering the drive.

**Note 7**  
AC power lines that must be routed past other lines (such as motor cables or I/O lines) should cross at a 90° angle. This minimizes the coupling effect. Additionally, the power lines should be routed as close to the back panel as possible. Any noise currents on the lines are capacitively coupled to the ground plane and not to other lines.

**Note 8**  
Control (I/O) signals should be kept separate from all power and motor cables, if possible. Keep control wiring as short as possible and use screened wire. Bonding is also recommended but not required for CE compliance. A separation distance of 20 cm. (8 in.) is sufficient in most cases. Where control cables must cross power cables, they should cross at a 90° angle.

**Note 9**  
Motor cables and feedback cables exiting the cabinet going to the motor should be separated as much as possible. Ideally, the use of separate conduits provides good isolation which can limit coupling of noise from motor to feedback cables.



# PINOUT CONNECTORS

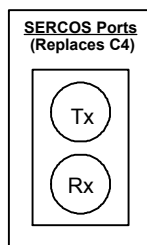
| C1: Communications Connector |                         |
|------------------------------|-------------------------|
| Pin                          | Function                |
| 1                            | Shield                  |
| 2                            | REC (RXD) (RS232)       |
| 3                            | XMIT (TXD) (RS232)      |
| 4                            | Reserved DO NOT CONNECT |
| 5                            | Common                  |
| 6                            | TxD+ (RS485)            |
| 7                            | TxD- (RS485)            |
| 8                            | RxD+ (RS485)            |
| 9                            | RxD- (RS485)            |

| C3: User I/O Connector |  |
|------------------------|--|
| Pin                    | Function   |
| 1                      | Analog Signal Shield                               |
| 2                      | Analog Differential Input + (High)                 |
| 3                      | Analog Differential Input - (Low)                  |
| 4                      | DC Reference for ANOUT*                            |
| 5                      | Fault Output Relay Contact                         |
| 6                      | Fault Output Relay Contact                         |
| 7                      | +24V Input (Common Rail for return pins 8,9,10,11) |
| 8                      | Remote Enable Input                                |
| 9                      | Configurable Input(See IN)                         |
| 10                     | Configurable Input (See IN2)                       |
| 11                     | Configurable Input (See IN3)                       |
| 12                     | Configurable Output (See O1)                       |
| 13                     | *Configurable Output (See ANOUT)                   |

\* Internal DC common for Referencing ANOUT. It is also used to tie electrical equipment commons together (inside the drive) to prevent excess common mode voltage from destroying I/O (internally-fused).

| C4: Encoder Equivalent Output |                           |
|-------------------------------|---------------------------|
| Pin                           | Function                  |
| 1                             | Channel A Output + (High) |
| 2                             | Channel A Output - (Low)  |
| 3                             | DC Common                 |
| 4                             | Channel B Output + (High) |
| 5                             | Channel B Output - (Low)  |
| 6                             | Shield                    |
| 7                             | Index Output + (High)     |
| 8                             | Index Output - (Low)      |
| 9                             | Shield                    |

| C2: Feedback Connector |                 |                 |                  |
|------------------------|-----------------|-----------------|------------------|
| Pin                    | Resolver        | Encoder         | Sine Encoder     |
| 1                      | Sine High       | A               | A                |
| 2                      | Sine Low        | /A              | /A               |
| 3                      | Shield          | Shield          | Shield           |
| 4                      | Cosine High     | B               | B                |
| 5                      | Cosine Low      | /B              | /B               |
| 6                      | Shield          | Shield          | Shield           |
| 7                      |                 | E5V Return      | E5V Return       |
| 8                      |                 | E5V Return      | E5V Return       |
| 9                      |                 | H1B             | H1B/(C) (/Data)  |
| 10                     |                 | H2B             | H2B/(D) (/Clock) |
| 11                     |                 | H3B             | H3B              |
| 12                     | Shield          | Shield          | Shield           |
| 13                     | Thermostat High | Thermostat High | Thermostat High  |
| 14                     | Shield          | Shield          | Shield           |
| 15                     | Ref. High Out   | Index           | Index            |
| 16                     | Ref. Low Out    | /Index          | /Index           |
| 17                     | Shield          | Shield          | Shield           |
| 18                     |                 | E5V Supply      | E5V Supply       |
| 19                     |                 | E5V Supply      | E5V Supply       |
| 20                     |                 | E5V Supply      | E5V Supply       |
| 21                     | Shield          | Shield          | Shield           |
| 22                     |                 | H1A             | H1A (C) (Data)   |
| 23                     |                 | H2A             | H2A (D) (Clock)  |
| 24                     |                 | H3A             | H3A              |
| 25                     | Thermostat Low  | Thermostat Low  | Thermostat Low   |



Notes for DIP switch:

The 10 position DIP switch is provided for drive configuration. The first 6 switches control communications parameters and are read only at power up. Any changes in these settings will require cycling the power. The other two switch functions (7, 8) control the motor operation and are monitored in real-time. This switch provides the following functions:

**MultiDrop Address Select:** Switches 1 through 5 set the drive's address. A drive having address 0 powers up in the addressed state. If these five switches are set to anything but 0, the drive will assume an address code indicated by the switch settings.

**Baud Rate:** Switch 6 sets the Serial/SERCOS baud rate to either 9600/2M (switch off) or 19200/4M (switch on).

**Position Hold:** Activating switch 7 causes the drive to enter a position hold mode. The condition is enunciated to the user by a flashing status display. The display maintains its current OPMODE code. If the drive is running during a HOLD command detection, the motor will ramp to a stop at the DECSTOP rate.

**Enable:** Switch 8 is an input to the drive enable circuitry and can be used to force the drive to a disabled state.

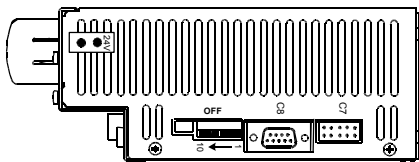
**SERCOS Power Level:** Functions only on SERCOS interface™ products. If switch 9 is set to 0, the SERCOS transmitter uses a low power setting so the receiver is not overdriven when using short cables. Long cables require more power.

**Factory Reserved:** *Must be set to 0.*



NOTE

Setting the switch to "1" means "Closed" or "On".



| DIP (Configuration) Switch |                         |  |
|----------------------------|-------------------------|--|
| Switch                     | Function                | Settings                                       |
| 1                          | MultiDrop Addressing    | Bit 0 of MultiDrop Address (LSB)               |
| 2                          |                         | Bit 1 of MultiDrop Address                     |
| 3                          |                         | Bit 2 of MultiDrop Address                     |
| 4                          |                         | Bit 3 of MultiDrop Address                     |
| 5                          |                         | Bit 4 of MultiDrop Address (MSB)               |
| 6                          | Serial/SERCOS Baud Rate | 0 = 9600 (2M)<br>1 = 19200 (4M)                |
| 7                          | HOLD Mode Switch        | 0 = Hold Mode Inactive<br>1 = Hold Mode Active |
| 8                          | Drive Enable / Disable  | 0 = Drive Enable<br>1 = Drive Disable          |
| 9                          | SERCOS Transmit Power   | 0 = Low Power<br>1 = High Power                |
| 10                         | Factory Reserved        | Must Be set to 0                               |

**C7: MultiDrop Communications**

**Type:** 10 Pin (0.1"x 0.1") Female Ribbon Cable. Connector and cable are included in the optional CK100 kit. This connector functions only when using the RS232 interface. It will NOT function using RS485.

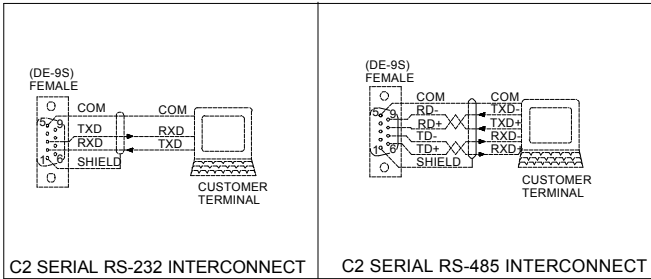
| C8: Remote Encoder Input |                   |
|--------------------------|-------------------|
| Pin                      | Function          |
| 1                        | A Input + (High)  |
| 2                        | A Input - (Low)   |
| 3                        | DC Common         |
| 4                        | B Input + (High)  |
| 5                        | B Input - (Low)   |
| 6                        | Shield Connection |
| 7                        | Reserved          |
| 8                        | Index +           |
| 9                        | Index -           |

| C9: External User I/O* |                              |
|------------------------|------------------------------|
| Pin                    | Function                     |
| A3                     | Configurable input (see IN5) |
| B3                     | Configurable input (see IN4) |
| B4                     | Configurable input (see IN6) |
| B5                     | Common for IN4, IN5, and IN6 |
| A8                     | Output O3                    |
| B8                     | Output O2                    |
| B9                     | Common for O2 and O3         |

\*Valid for Series 5 ONLY

# SERIAL COMMUNICATION WIRING DIAGRAM

NOTE: Do NOT connect unused pins!



## HARDWARE SPECIFICATIONS

| Amplifier Model           |                                       | Cx03  | Cx06                       | Cx10      |
|---------------------------|---------------------------------------|---|----------------------------|-----------|
| Unit Weight               | Lbs./Kgs.                             | 3.56/1.61   | 4.9/2.22                   | 5.94/2.69 |
| Mounting Hardware         | English (Metric)                      | 10-32 (M4)  |                            |           |
|                           | Applied Torque                        | 20 lb-in. (2.26 Nm.)  |                            |           |
| Connection Hardware       | Line Screw Size/Torque                | M3.5/12 lb-in. (1.35 N-m)   |                            |           |
|                           | BUS Screw Size/Torque                 |   |                            |           |
|                           | Motor Screw Size/Torque               |   |                            |           |
|                           | Ground Screw Size/Torque              |   |                            |           |
| Wire Size (AWG#)          | Control Logic (AWG/ mm <sup>2</sup> ) | 16 / 1.5  |                            |           |
|                           | Motor Line (AWG/ mm <sup>2</sup> )    | 14 / 2.5  |                            |           |
|                           | Main Input (AWG/ mm <sup>2</sup> )    | 14 / 2.5  | 12 / 4                     |           |
|                           | Configurable I/O wire gauge           | 22-18 AWG (0.3-0.75 mm <sup>2</sup> ) Ferrules recommended:<br>18 AWG Type H0 - 75/14 Weidmuller 4629.0 or equivalent<br>20 AWG Type H0 - 5/14 Weidmuller 6907.0 or equivalent<br>22 AWG Type H0 - 34/12 Weidmuller 90257.7 or equivalent |                            |           |
|                           | Spade Terminals                       | 16/14 AWG (1.5 mm <sup>2</sup> ):<br>Hollingsworth XSS0954S OR SS20947SF or equivalent<br>12/10 AWG (4-6 mm <sup>2</sup> ):<br>Hollingsworth XSS20836 OR SS20832F or equivalent   |                            |           |
| Clearance Distance        | Side-to-Side                          | 0.5 in (12.7 mm)  |                            |           |
|                           | Top/Bottom                            | 2.5 in (63.5 mm)  |                            |           |
| Mating Connector Hardware | CK100 Kit                             | Includes: C1, C2, C4, C7 (plus 2 ft./0.69 m. of stranded bus ribbon), C8  |                            |           |
|                           | C3                                    | Danaher Motion #: A-93899-013<br>Vendor Info: Weidmuller BL3.5/13 Cat.No. 161574  |                            |           |
|                           | C5                                    | Danaher Motion #: A-81014-004   | Vendor Info: PCD ELFP04110 |           |
|                           | Connector Screw Torque                | 2.25 lb-in. (0.25 N-m)  |                            |           |
|                           | 24 V Logic (optional)                 | Danaher Motion #:A-81014-002  | Vendor Info: PCD ELFP02210 |           |

# ELECTRICAL SPECIFICATIONS

| Product Model   |  | Cx03*  | Cx06*                               | Cx10                |
|---|--|--|-------------------------------------|---------------------|
| <b>Main Input Power</b>   | Voltage (VAC <sub>L-L</sub> ) Nominal $\pm$ 10%  | 110 to 230   |                                     | 230                 |
|   | 115 VAC  | 1 $\phi$ or 3 $\phi$                                     |                                     | 3 $\phi$ only       |
|   | 230 VAC  | 1 $\phi$ or 3 $\phi$                                     |                                     | 3 $\phi$ only       |
|   | Line Frequency   | 47-63  |                                     |                     |
|   | KVA at 115 VAC   | 0.44 (1 $\phi$ )<br>0.6 (3 $\phi$ )                      | 0.89 (1 $\phi$ )<br>1.1 (3 $\phi$ ) | 2.4 (3 $\phi$ only) |
|   | KVA at 230 VAC   | 0.88 (1 $\phi$ )<br>1.4 (3 $\phi$ )                      | 1.8 (1 $\phi$ )<br>2.8 (3 $\phi$ )  | 4.6 (3 $\phi$ only) |
|   | Continuous Current (A)   | 6.2 (1 $\phi$ )<br>4 (3 $\phi$ )                         | 10 (1 $\phi$ )<br>7.8 (3 $\phi$ )   | 13 (3 $\phi$ only)  |
|   | Peak Current (amps) for 500 ms   | 18.6 (1 $\phi$ )<br>12 (3 $\phi$ )                       | 30 (1 $\phi$ )<br>23.4 (3 $\phi$ )  | 26 (3 $\phi$ only)  |
|   | Peak Current (amps) for 2s   | 12.4 (1 $\phi$ )<br>8 (3 $\phi$ )                        | 20 (1 $\phi$ )<br>15.6 (3 $\phi$ )  | 26 (3 $\phi$ only)  |
|   | Line Fuses (FRN-R, LPN, or equiv.)   | 10   | 15                                  | 15                  |
| <b>Logic Input Power<br/>CxXX26X and CxXXX56x<br/>Models ONLY</b> | +24 VDC Ext. Logic Voltage (V)   | 22 to 27   |                                     |                     |
|   | +24 VDC Ext. Logic Current (amps sink)   | 1.5  |                                     |                     |
|   | +24 VDC Ext. Logic Current (amps max surge)  | 2.6  |                                     |                     |
| <b>SoftStart</b>  | Max. Surge Current (A)   | 30   |                                     |                     |
|   | Max. Charge Time (sec)   | 0.25   |                                     |                     |
| <b>Protection Functions</b>                                       | Fault Contact Rating (A)   | 1  |                                     |                     |
|   | Fault Contact Closing Period (ms)  | Close = 3 ms, Open = 2 ms                                |                                     |                     |
|   | Over-Temperature Trip ( $^{\circ}$ C/ $^{\circ}$ F)  | 80/176   |                                     |                     |
| <b>Rated Main Output<br/>(Ma, Mb, Mc)</b>                         | Continuous Power (KVA) at 115 VAC<br>Line Input (45 $^{\circ}$ C (113 $^{\circ}$ F) Ambient) | 0.35 (1 $\phi$ )<br>0.55 (3 $\phi$ )                     | 0.7 (1 $\phi$ )<br>1.1 (3 $\phi$ )  | 1.8 (3 $\phi$ )     |
|   | Continuous Power (KVA) at 230 VAC<br>Line Input (45 $^{\circ}$ C (113 $^{\circ}$ F) Ambient) | 0.7 (1 $\phi$ )<br>1.1 (3 $\phi$ )                       | 1.4 (1 $\phi$ )<br>2.2 (3 $\phi$ )  | 3.5 (3 $\phi$ )     |
|   | Continuous Current (A <sub>RMS</sub> )   | 3  | 6                                   | 10                  |
|   | Peak Current (Arms) for 500 ms   | 9  | 18                                  | 20                  |
|   | Peak Current (Arms) for 2 sec  | 6  | 12                                  | 20                  |
|   | PWM Frequency (kHz)  | 16   | 8                                   | 8                   |
|   | PWM Motor Current Ripple (kHz)   | 32   | 16                                  | 16                  |
| Form Factor (rms/avg)   | $\approx$ 1.01   |  |                                     |                     |
| <b>Protective Functions</b>                                       | Under-Voltage Trip (nominal) (VDC)   | 90   |                                     |                     |
|   | Over-Voltage Trip (VDC)  | 430  |                                     |                     |
|   | Over-Temperature Trip ( $^{\circ}$ C/ $^{\circ}$ F)  | 80/176   |                                     |                     |
|   | Internal heat dissipation (watts)  | 60   | 80                                  | 132                 |
| <b>Environment</b>  | Operation temperature ( $^{\circ}$ C/ $^{\circ}$ F)  | 5/41 to 45/113   |                                     |                     |
|   | Storage temperature ( $^{\circ}$ C/ $^{\circ}$ F)  | 0/32 to 70/158   |                                     |                     |
|   | Ambient humidity (%)   | 10 to 90   |                                     |                     |
|   | Atmosphere   | without corrosive gasses or dust                         |                                     |                     |
|   | Altitude   | Derate 5% per 1000 ft.(300 m)<br>above 3300 ft. (1000 m) |                                     |                     |
|   | Vibration (g)  | 0.5  |                                     |                     |

\*Model Numbers Cx0x200 are single phase only!

# BUS MODULE ELECTRICAL SPECIFICATIONS



**NOT USED FOR SERIES 5.**

**NOTE**

| Product Model               |                                   | PA-LM  |
|-----------------------------|-----------------------------------|--|
| Logic Input Power           | Voltage (AC) Nom. ?10%            | 110 to 120   |
|                             | Max. Current 1? (A)               | 1  |
| Logic Output Power (Source) | Line Frequency                    | 47-63  |
|                             | Internal Fuse (amps) (internal)   | 2.5  |
|                             | +8 VDC Supply Voltage (VDC)       | +7.25 to +8.5                                      |
|                             | +8 VDC Supply Current (amps)      | 2.2  |
|                             | 15 V Supply Voltage ( $\pm$ VDC)  | 14.25 to 16  |
|                             | 15 V Supply Current (amps)        | 0.8  |
|                             | Internal Fuses (amps) (?15V/+8 V) | 1.5/3.5  |
|                             | Max. # of Drives Sourced          | <i>Refer to Bus Module Sizing Application Note</i> |
| Environment                 | Internal heat dissipation         | 7  |
|                             | Operation temperature (?C/?F)     | 5/41 to 45/113                                     |
|                             | Storage temperature (?C/?F)       | 0/32 to 70/158                                     |
|                             | Ambient humidity (%)              | 10 to 90   |
|                             | Atmosphere                        | without corrosive gasses or dust                   |
|                             | Altitude                          | Derate 5% per 1000 ft. above 3300 ft.              |
|                             | Vibration (g)                     | 0.5  |

## REGEN INFORMATION

| Product Model            |   | Cx03    | Cx06    | Cx10 |
|--------------------------|---|---------|---------|------|
| External Shunt Regulator | Peak current (amps)                             | 20      |         |      |
|                          | Minimum resistance (ohms)                       | 20      |         |      |
|                          | watts   | 200     |         |      |
| Application Information  | Capacitance (Farads)                            | 0.00082 | 0.00164 |      |
|                          | BUS Voltage (nominal) (VDC)                     | 325     |         |      |
|                          | V <sub>HYS</sub> (Regen circuit turn-off) (VDC) | 370     |         |      |
|                          | V <sub>MAX</sub> (Regen circuit turn-on) (VDC)  | 390     |         |      |
| External Regen Kits      | ERH-26  | □       | □       | □    |

\*See the **SERVOSTAR<sup>®</sup>** S/CD-Series Regeneration Requirements Application Note on the PSP CD-ROM for guidance on application sizing of Regen Kits.



# PRODUCT FAMILY CONTROL SPECIFICATIONS

|   |                                     |   |
|---|-------------------------------------|---|
| <b>Current Loop</b>   | Update Rate                         | 62.5 ?S (16 kHz)  |
|   | Bandwidth                           | <2000 Hz  |
| <b>Commutation Loop</b>   | Update Rate                         | 62.5 ?S (16 kHz)  |
|   | Max. Commutation Frequency          | 400Hz   |
| <b>Velocity Loop</b>  | Output Waveform                     | Sinusoidal  |
|   | Update Rate                         | 250 ?S (4k Hz)  |
|   | Bandwidth                           | <400 Hz   |
|   | Speed Command Resolution            | Serial: 1 RPM or 1mm/sec or VLIM/16384<br>Analog: (1/6554) * VMAX                               |
| <b>Position Loop</b>  | Long-term Speed Regulation          | 0.01% (?P clock tolerance)  |
|   | Update Rate                         | 500 ?S (2 kHz)  |
| <b>I/O Connector (C3 by pinout)</b>                               |                                     |   |
| <b>Analog Input (2, 3)</b>  | Absolute Maximum Voltage            | 13 V differential   |
|   | Input Resolution                    | 14 Bit/1.2  |
|   | Sensitivity                         | 1.53 mV min   |
|   | Voltage Range                       | -10V to +10V = -120% Motor rated speed to +120% Motor rated speed (Adjustable Vsacle parameter) |
|   | Input Impedance/CMR                 | > 10 K? /50 dB  |
|   | Long-term Drift                     | 100 ppm (0.075%/?C)   |
| <b>Fault Output Relay (5, 6)</b>                                  | Max Capacity                        | 1 A at 24 VDC   |
| <b>Remote Enable (7, 8)<br/>Configurable Inputs(7, 9, 10, 11)</b> | Bandwidth                           | 2.5 kHz (Opto-isolated)   |
|   | Input Voltage Range                 | 12 V to 24 V Nominal (bi-directional)   |
|   | Min. On/Max. Off                    | 10 V/1 V  |
|   | Current Demand per Input            | 20 mA (max)   |
| <b>Configurable Digital Output (7, 12)</b>                        | Output Voltage (max.)               | 0 V to 48 V Nominal – bi-directional (Open Collector)   |
|   | (Min. On)                           | 1V  |
|   | Max. Output Current                 | 60 mA   |
| <b>Configurable Analog Output (13, 4)</b>                         | Max. Output Current                 | 1 mA (1 K? internal series resistance)  |
|   | Sensitivity / Resolution            | 4.9 mV/12 Bit   |
|   | Voltage Range                       | -10 V to +10V   |
| <b>Encoder Equivalent Output (C4 by pinout)</b>                   |                                     |   |
| <b>A/B/I &amp; Complements<br/>(1, 2, 4, 5, 7, 8)</b>             | Output Voltage (high level) at 25?C | 2.5 V min. at 20mA Differential   |
|   | RS 485 Line Drive Type              | DS26C31TM   |
| <b>Remote Encoder Input (C8 by pinout)</b>                        |                                     |   |
| <b>A/B/I &amp; Complements<br/>(1, 2, 4, 5, 7, 8)</b>             | Input Voltage at 25?C               | ±5 V Differential   |
|   | Input Sensitivity                   | ±0.2V   |
|   | Input Impedance                     | 100?  |
|   | RS 485 Line Receiver Type           | SN75173   |
| <b>Extended I/O Connector (C9 by pinout)</b>                      |                                     |   |
| <b>Analog Input (A1, B1)</b>                                      | Absolute Maximum Voltage            | 12.5 V differential   |
|   | Input Resolution                    | 14 Bit  |
|   | Sensitivity                         | 1.53 mV min   |
|   | Voltage Range                       | -10V to +10V = -120% Motor rated speed to +120% Motor rated speed (Adjustable Vsacle parameter) |
|   | Input Impedance/ CMR                | > 10 k ?50 dB   |
|   | Long-term Drift                     | 100 ppm (0. 075%/? C)   |
| <b>Configurable Inputs<br/>(A3, B3, A4, B4, A5, A6, B6, A7))</b>  | Bandwidth                           | 4.6 kHz (Opto- isolated)  |
|   | Input Voltage Range                 | 12 V to 30 V typical, 24 V Nominal (bi- directional)  |
|   | Min. On/ Max. Off                   | 10 V/ 1 V   |
|   | Current Demand per Input            | 20 mA (max)   |
| <b>Configurable Digital Outputs<br/>(A8, B8,A9, B10)</b>          | Output Voltage (max.)               | 0 V to 48 V Nominal – uni- directional (Opto isolated Open Collector) type Source               |
|   | (Min. On)                           | 1V  |
|   | Max. Output Current                 | 60 mA   |
| <b>Configurable Analog Output (B2)</b>                            | Max. Output Current                 | 1 mA (1 K? internal series resistance)  |
|   | Sensitivity / Resolution            | 4.9 mV/ 12 Bit  |
|   | Voltage Range                       | -10 V to +10V   |

See the section on Position Loop in for features using this input.

**A flyback diode is necessary for inductive loads connected across the 01 output.**

**Extended I/O (C9) only A3,B3 and B4 are available.**

## FIRMWARE UPDATES



NOTE

**NOT APPLICABLE FOR SERIES 5.**

If your unit has the following label:



UCB1V2

It requires firmware version 4.0.0 or higher. Other unit types will work with all firmware versions.



NOTE

**Firmware version 4.0.0 and higher is not compatible with the older versions of IGNITE (firmware loading software). Attempting to load incompatible firmware results in the IGNITE program generating an error.**

## TROUBLESHOOTING

Additional troubleshooting information is found in the *Installation Manual*.

### TROUBLESHOOTING TOOLS

The SERVOSTAR's **MOTIONLINK** package comes with a comprehensive monitoring and troubleshooting help set. For troubleshooting the drive, it provides a Status screen. The Status screen allows you to check the drive enable switches, the Status Display LED, fault status with complete error history, and mode settings for several of the drive's protection features. If using the terminal mode, you can simply check the contents stored in the STATUS, FLTHIST, and ERR variables.

An additional help provided by **MOTIONLINK** is the I/O screen. The I/O screen gives you the ability to check the status of the hardware position limit switches, the motor thermostat, and the encoder equivalent output. It also allows you to set up the I/O on the C3 connector for a variety of troubleshooting and monitoring approaches.

For monitoring system performance, **MOTIONLINK** comes with a variety of monitoring tools. You can monitor a variety of variables from the Monitor screen to compare up to three variables against themselves at one time. The Tune and Record screen allows you to evaluate the system's actual performance against a predefined command profile. Also from this screen, adjusting the gains until optimum following is achieved can vary the performance.

### ERROR CODES

In most cases, the SERVOSTAR communicates error codes with a text message via the serial port to the host. Some error codes are also transmitted to the Status Display. The same message is saved in the EEPROM under an error history log (FLTHIST, ERR) so that nothing is lost when power is removed. Not all errors reflect a message back to the host. In these cases, the no-message errors communicate to the Status Display only.

The response of the SERVOSTAR to an error depends on the error's severity. There are three levels of severity:

- 1) Warnings, simply called errors, are not considered faults and do not disable operation
- 2) Non-fatal errors, or simply faults, that disable the drive and indicate a fault status
- 3) Fatal errors, or fatal faults, that disable almost all drive functions (including communications)



NOTE

**The drive is automatically disabled at the occurrence of a fault. Executing a drive disable command (DIS or K) followed by the EN command, or toggling the Remote Enable line (REMOTE) resets the fault latch, and if the fault condition is no longer present, re-enables the system.**

## ERROR CODES

| Series 5 Error Codes |                               |                                     |                                     |             |
|----------------------|-------------------------------|-------------------------------------|-------------------------------------|-------------|
| Error Code           | Fault Message                 | Fatal                               | Non-Fatal                           | LED Display |
| 0                    | .No Error                     |                                     | <input checked="" type="checkbox"/> |             |
| 1                    | .Power stage over temperature | <input checked="" type="checkbox"/> |                                     | t           |
| 2                    | .Over voltage                 | <input checked="" type="checkbox"/> |                                     | o           |
| 3                    | .Over current                 | <input checked="" type="checkbox"/> |                                     | P           |
| 4.0                  | .External feedback fault      | <input checked="" type="checkbox"/> |                                     | r 0         |
| 4.1                  | .Resolver line break          | <input checked="" type="checkbox"/> |                                     | r 1         |
| 4.2                  | .RDC error                    | <input checked="" type="checkbox"/> |                                     | r 2         |
| 4.3                  | .Sine Encoder init fail       | <input checked="" type="checkbox"/> |                                     | r 3         |
| 4.4                  | .A/B line break               | <input checked="" type="checkbox"/> |                                     | r 4         |
| 4.5                  | .Index line break             | <input checked="" type="checkbox"/> |                                     | r 5         |
| 4.6                  | .Illegal halls                | <input checked="" type="checkbox"/> |                                     | r 6         |
| 4.7                  | .C/D line break               | <input checked="" type="checkbox"/> |                                     | r 7         |
| 4.8                  | .A/B out of range             | <input checked="" type="checkbox"/> |                                     | r 8         |
| 4.9                  | .Burst pulse overflow         | <input checked="" type="checkbox"/> |                                     | r 9         |
| 4.10                 | EnDat comm error              | <input checked="" type="checkbox"/> |                                     | r 10        |
| 4.12                 | Hiperface comm error          | <input checked="" type="checkbox"/> |                                     | r 12        |
| 4.13                 | Sw R2D Feedback Fault         | <input checked="" type="checkbox"/> |                                     | r 13        |
| 5                    | .Under voltage                | <input checked="" type="checkbox"/> |                                     | u           |
| 6                    | .Motor over temperature       | <input checked="" type="checkbox"/> |                                     | H           |
| 6.1                  | EnDat over temperature        | <input checked="" type="checkbox"/> |                                     | H1          |
| 7.1                  | .Positive analog supply fail  | <input checked="" type="checkbox"/> |                                     | A 1         |
| 7.2                  | .Negative analog supply fail  | <input checked="" type="checkbox"/> |                                     | A 2         |
| 8                    | .Over speed                   | <input checked="" type="checkbox"/> |                                     | J           |
| 8.1                  | .Over speed (1.8*VLIM)        | <input checked="" type="checkbox"/> |                                     | J 1         |
| 9                    | .EEPROM failure               | <input checked="" type="checkbox"/> |                                     | E           |
| 10                   | .EEPROM checksum failure      | <input checked="" type="checkbox"/> |                                     | e           |
| 12                   | .Foldback                     | <input checked="" type="checkbox"/> |                                     | F           |
| 14.1                 | .Positive over travel fault   | <input checked="" type="checkbox"/> |                                     | d 5         |
| 14.2                 | .Negative over travel fault   | <input checked="" type="checkbox"/> |                                     | d 6         |
| 15.1                 | .Numeric position deviation   | <input checked="" type="checkbox"/> |                                     | d 1         |
| 15.2                 | .Excessive position deviation | <input checked="" type="checkbox"/> |                                     | d 2         |
| 16                   | .Communication interface      | <input checked="" type="checkbox"/> |                                     | c           |
| 20                   | Unknown command               |                                     | <input checked="" type="checkbox"/> |             |
| 21                   | Unknown variable              |                                     | <input checked="" type="checkbox"/> |             |
| 22                   | Checksum error                |                                     | <input checked="" type="checkbox"/> |             |
| 23                   | Drive active                  |                                     | <input checked="" type="checkbox"/> |             |
| 24                   | Drive inactive                |                                     | <input checked="" type="checkbox"/> |             |
| 25                   | Value out of range            |                                     | <input checked="" type="checkbox"/> |             |
| 26                   | Value negative                |                                     | <input checked="" type="checkbox"/> |             |
| 27                   | Not in proper Opmode          |                                     | <input checked="" type="checkbox"/> |             |
| 28                   | Syntax error                  |                                     | <input checked="" type="checkbox"/> |             |
| 33                   | Auto tune failed              |                                     | <input checked="" type="checkbox"/> |             |
| 34                   | Bad bandwidth                 |                                     | <input checked="" type="checkbox"/> |             |
| 35                   | Bad stability                 |                                     | <input checked="" type="checkbox"/> |             |
| 36                   | Not programmable              |                                     | <input checked="" type="checkbox"/> |             |
| 37.01                | Current loop design failed    |                                     | <input checked="" type="checkbox"/> |             |

| Series 5 Error Codes |                              |       |                                     |             |
|----------------------|------------------------------|-------|-------------------------------------|-------------|
| Error Code           | Fault Message                | Fatal | Non-Fatal                           | LED Display |
| 37.02                | MENCRES out of range         |       | <input checked="" type="checkbox"/> |             |
| 37.03                | MENCOFF out of range         |       | <input checked="" type="checkbox"/> |             |
| 37.04                | MSPEED out of range          |       | <input checked="" type="checkbox"/> |             |
| 37.05                | MBEMF out of range           |       | <input checked="" type="checkbox"/> |             |
| 37.06                | MJ out of range              |       | <input checked="" type="checkbox"/> |             |
| 37.07                | ACC out of range             |       | <input checked="" type="checkbox"/> |             |
| 37.08                | DEC out of range             |       | <input checked="" type="checkbox"/> |             |
| 37.09                | DECSTOP out of range         |       | <input checked="" type="checkbox"/> |             |
| 37.10                | VLIM out of range            |       | <input checked="" type="checkbox"/> |             |
| 37.11                | VOSPD out of range           |       | <input checked="" type="checkbox"/> |             |
| 37.12                | VSCALE out of range          |       | <input checked="" type="checkbox"/> |             |
| 37.13                | O1TRIG out of range          |       | <input checked="" type="checkbox"/> |             |
| 37.14                | O1RST out of range           |       | <input checked="" type="checkbox"/> |             |
| 37.15                | DISSPEED out of range        |       | <input checked="" type="checkbox"/> |             |
| 37.16                | MENCTYPE out of range        |       | <input checked="" type="checkbox"/> |             |
| 38                   | Communication error          |       | <input checked="" type="checkbox"/> |             |
| 39                   | Not in proper Compmode       |       | <input checked="" type="checkbox"/> |             |
| 40                   | EXT vel param warning        |       | <input checked="" type="checkbox"/> |             |
| 41                   | Vel loop design failed       |       | <input checked="" type="checkbox"/> |             |
| 42                   | Invalid EEPROM               |       | <input checked="" type="checkbox"/> |             |
| 43                   | Recording active             |       | <input checked="" type="checkbox"/> |             |
| 44                   | Rec data not available       |       | <input checked="" type="checkbox"/> |             |
| 45                   | EEPROM is empty              |       | <input checked="" type="checkbox"/> |             |
| 46                   | Argument must be binary      |       | <input checked="" type="checkbox"/> |             |
| 47                   | Burnin is active             |       | <input checked="" type="checkbox"/> |             |
| 48                   | Burnin is not active         |       | <input checked="" type="checkbox"/> |             |
| 49                   | Conflicts with ENCOUT        |       | <input checked="" type="checkbox"/> |             |
| 50                   | Conflicts with VLIM          |       | <input checked="" type="checkbox"/> |             |
| 51                   | Not available                |       | <input checked="" type="checkbox"/> |             |
| 52                   | Drive is in Hold mode        |       | <input checked="" type="checkbox"/> |             |
| 53                   | Limit switch Hold            |       | <input checked="" type="checkbox"/> |             |
| 54                   | Command into limit           |       | <input checked="" type="checkbox"/> |             |
| 55                   | Drive is in Zero mode        |       | <input checked="" type="checkbox"/> |             |
| 56                   | Motor is jogging             |       | <input checked="" type="checkbox"/> |             |
| 57                   | Argument not divisible by 20 |       | <input checked="" type="checkbox"/> |             |
| 58                   | Encoder init process active  |       | <input checked="" type="checkbox"/> |             |
| 60                   | Tune failed - No rotation    |       | <input checked="" type="checkbox"/> |             |
| 62,66<br>70,74       | Tune failed - Current sat    |       | <input checked="" type="checkbox"/> |             |
| 63,67<br>71,75       | Tune failed - No vel design  |       | <input checked="" type="checkbox"/> |             |
| 76                   | Disable during Tune          |       | <input checked="" type="checkbox"/> |             |
| 77                   | Hold during Tune             |       | <input checked="" type="checkbox"/> |             |
| 78                   | Low velocity limits          |       | <input checked="" type="checkbox"/> |             |
| 79                   | Use lower bandwidth          |       | <input checked="" type="checkbox"/> |             |
| 80                   | Drive is in Dual Fb mode     |       | <input checked="" type="checkbox"/> |             |
| 81                   | Drive is in Gear mode        |       | <input checked="" type="checkbox"/> |             |
| 82                   | Functionality is occupied    |       | <input checked="" type="checkbox"/> |             |
| 83                   | Warning: A/B line not routed |       | <input checked="" type="checkbox"/> |             |

| Series 5 Error Codes |                              |       |                                     |             |
|----------------------|------------------------------|-------|-------------------------------------|-------------|
| Error Code           | Fault Message                | Fatal | Non-Fatal                           | LED Display |
| 84                   | Warning: Limit sw not routed |       | <input checked="" type="checkbox"/> |             |
| 85                   | Move is pending              |       | <input checked="" type="checkbox"/> |             |
| 90                   | Incorrect password           |       | <input checked="" type="checkbox"/> |             |
| 91                   | Password protected           |       | <input checked="" type="checkbox"/> |             |
| 92                   | Capture during Homing        |       | <input checked="" type="checkbox"/> |             |
| 93                   | Homing during Capture        |       | <input checked="" type="checkbox"/> |             |
| 94                   | Capture process not done     |       | <input checked="" type="checkbox"/> |             |
| 95                   | Capture process not active   |       | <input checked="" type="checkbox"/> |             |
| 96                   | Capture process not enabled  |       | <input checked="" type="checkbox"/> |             |
| 97                   | ENCSTART while Aconfig       |       | <input checked="" type="checkbox"/> |             |
| 98                   | EnDat comm error             |       | <input checked="" type="checkbox"/> |             |
| 999                  | SERCOS test failure          |       | <input checked="" type="checkbox"/> |             |

## FATAL FAULT ERROR CODES

| Status Display | Fault Message                | Possible Cause                                    | Err # |
|----------------|------------------------------|---|-------|
| t              | Power stage OverTemp         | overload, fan malfunction, power stage failure    | 1     |
| o              | OverVoltage                  | excessive decel rate*                             | 2     |
| P              | OverCurrent                  | power stage surge current*                        | 3     |
| r0             | External feedback fault      | Feedback signal through C8 not correctly detected | 4.0   |
| r1             | Resolver line break          | break in resolver feedback detected               | 4.1   |
| r2             | RDC error                    | fault in resolver-to-digital converted detected   | 4.2   |
| r3             | Sine Encoder init fail       | sine encoder card has not initialized properly    | 4.3   |
| r4             | A/B line break               | break in encoder A/B input lines detected         | 4.4   |
| r5             | Index line break             | break in encoder index line                       | 4.5   |
| r6             | Illegal halls                | illegal hall combination detected                 | 4.6   |
| r7             | C/D line break               | break in sine encoder C/D line detected           | 4.7   |
| r8             | A/B out of range             | sine encoder A/B level out of range               | 4.8   |
| r9             | Burst pulse overflow         | sine encoder fault                                | 4.9   |
| r10            | Endat Communication Fault    | Serial communication to the Endat Encoder failed  |       |
| u              | Under voltage                | bus voltage is too low                            | 5     |
| H              | Motor over temperature       | motor overload caused overheating                 | 6     |
| A1             | Positive analog supply fail  | Failure in +12 V supply (regulated)               | 7.1   |
| A2             | Negative analog supply fail  | Failure in -12 V supply (regulated)               | 7.2   |
| J              | OverSpeed                    | velocity ? VOSPD                                  | 8     |
| J1             | OverSpeed                    | Velocity ? 1.8 x VLIM                             | 8.1   |
| E              | EEPROM failure               | Faulty EEPROM                                     | 9     |
| e              | EEPROM checksum fail         | EEPROM checksum invalid on power up*              | 10    |
| F              | Foldback                     | System in FoldBack mode                           | 12    |
| d5             | Positive over travel fault   | PFB exceeded PMAX with PLIM=1                     | 14.1  |
| d6             | Negative over travel fault   | PFB exceeded PMIN with PLIM=1                     | 14.2  |
| d1             | Numeric position deviation   | Internal fault                                    | 15.1  |
| d2             | Excessive position deviation | PE > PEMAX  | 15.2  |
| c              | Communication interface      | A communications fault has occurred               | 16    |

*\*These faults are only cleared by cycling power*

## NON-FATAL ERROR CODES

| Error Message              | Possible Cause  | Err # |
|----------------------------|---|-------|
| No Error                   | no error was recorded   | 0     |
| Unknown Command            | Undefined command   | 20    |
| Unknown Variable           | undefined variable name   | 21    |
| Checksum error             | error on comm. message checksum (ACKMODE 2)   | 22    |
| Drive Active               | drive needs to be inactive for the requested command or variable                      | 23    |
| Drive Inactive             | drive needs to be active for the requested command or variable                        | 24    |
| Value out of range         | variable value out of range   | 25    |
| Negative Number            | variable must be $\geq 0$   | 26    |
| Not in proper Opmode       | not in correct Opmode for specified command   | 27    |
| Syntax Error               | communication message syntax error  | 28    |
| Tune Failed                | auto tuning failed  | 33    |
| Bad Bandwidth              | AutoTuning BW is out of range   | 34    |
| Bad Stability              | bad stability   | 35    |
| Not programmable           | variable is read-only   | 36    |
| Current loop design failed | CONFIG failed due to current loop design failure                                      | 37.01 |
| MENCRES out of range       | CONFIG failed due to MENCRES  | 37.02 |
| MENCOFF out of range       | CONFIG failed due to MENCOFF  | 37.03 |
| MSPEED out of range        | CONFIG failed due to MSPEED   | 37.04 |
| MBEMF out of range         | CONFIG failed due to MBEMF  | 37.05 |
| MJ out of range            | CONFIG failed due to MJ   | 37.06 |
| ACC out of range           | CONFIG failed due to ACC  | 37.07 |
| DEC out of range           | CONFIG failed due to DEC  | 37.08 |
| DECSTOP out of range       | CONFIG failed due to DECSTOP  | 37.09 |
| VLIM out of range          | CONFIG failed due to VLIM   | 37.10 |
| VOSPD out of range         | CONFIG failed due to VOSPD  | 37.11 |
| VSCALE out of range        | CONFIG failed due to VSCALE   | 37.12 |
| O1TRIG out of range        | CONFIG failed due to O1TRIG   | 37.13 |
| O1RST out of range         | CONFIG failed due to O1RST  | 37.14 |
| DISSPEED out of range      | CONFIG failed due to DISSPEED   | 37.15 |
| MENCTYPE out of range      | CONFIG failed due to MENCTYPE   | 37.16 |
| Communication error        | Error at physical comm. layer   | 38    |
| Not in proper COMPMODE     | The REFRESH command was given with COMPMODE $\neq 3$                                  | 39    |
| EXT velocity param warning | D, H, R parameters for COMPMODE 3 do not have the proper relationship.                | 40    |
| Vel loop design failed     | The velocity loop can't be con-figured with given parameters                          | 41    |
| Invalid EEPROM             | The EEPROM test failed  | 42    |
| Recording active           | The requested command cannot be executed as it conflicts with a recording in progress | 43    |
| Rec data not available     | No data are available for the GET command   | 44    |
| EEPROM is empty            | Data cannot be loaded because the EEPROM is empty                                     | 45    |
| Argument must be binary    | Variable argument must be a power of 2  | 46    |
| Burnin is active           | The requested function cannot be executed during Burnin (a factory function)          | 47    |
| Burnin is not active       | Burnin (factory function) cannot be stopped if it is not active                       | 48    |
| Conflicts with ENCOUT      | The requested value for VLIM conflicts with ENCOUT.                                   | 49    |
| Conflicts with VLIM        | The requested value for ENCOUT conflicts with VLIM.                                   | 50    |

| Error Message                         | Possible Cause  | Err #          |
|---------------------------------------|---|----------------|
| Not available                         | The requested variable value is not available; refer to the description of the variable to determine why.     | 51             |
| Drive is in Hold mode                 | Motion was requested with the drive in Hold mode  | 52             |
| Limit Switch Hold                     | Drive is in Hold mode due to limit switch being tripped   | 53             |
| Command Into Limit                    | Requested motion is in direction of tripped limit switch  | 54             |
| Drive is in Zero Mode                 | Motion requested while in Zero mode   | 55             |
| Motor is Jogging                      | Tune cmd cannot be executed because motor is jogging  | 56             |
| Argument not divisible by 20          | Argument must be a multiple of 20 to be accepted  | 57             |
| Encoder Initialization Process Active | A command cannot be executed because it has been requested while the encoder initialization process is active | 58             |
| Tune failed-no rotation               | Tune cmd failed because motor could not rotate  | 60             |
| Tune failed-current sat               | Tune cmd failed because the current loop saturated  | 62,66<br>70,74 |
| Tune failed-no vel design             | Tune cmd failed because the vel loop could not be designed  | 63,67<br>71,75 |
| Disable During Tune                   | Tune cmd failed because drive was disabled while tuning   | 76             |
| Hold During Tune                      | Tune cmd failed because drive entered Hold mode while tuning  | 77             |
| Low Velocity Limits                   | Tune cmd failed because VLIM is too low   | 78             |
| Use Lower Bandwidth                   | Tune cmd requires a lower bandwidth in order to execute   | 79             |
| Drive in Dual Feedback mode           | Command cannot be accepted because dual feedback is active  | 80             |
| Drive is in Gear mode                 | Command cannot be accepted because drive is in gear mode  | 81             |
| Functionality is occupied             | Selected INxMODE function is already assigned to another INxMODE  | 82             |
| Warning: A/B Line not routed          | Selected GEARMODE requires A/B inputs to be routed using INxMODE 5 and 6.                                     | 83             |
| Warning: Limit sw not routed          | Limit switches must be routed using INxMODE 1 and 2.  | 84             |
| Move is pending                       | The last ordered move command has not been completed yet.   | 85             |
| Incorrect password                    | The password entered was incorrect  | 90             |
| Password protected                    | The command/variable requested is password protected (intended for factory use only)                          | 91             |
| Capture during homing                 | A position capture occurred during homing   | 92             |
| Homing during capture                 | A homing request was made during position capture   | 93             |
| Capture process not done              | The requested command can't be processed due to pos capture not being complete                                | 94             |
| Capture process not active            | The requested command can't be processed due to pos capture not being active                                  | 95             |
| Capture process not enabled           | Position capture cannot be executed   | 96             |
| ENCSTART while ACONFIG                |   | 97             |
| SERCOS test failure                   |   | 999            |

## NO MESSAGE FAULTS

| Display | Fault Description  | Fatal                               | Non-Fatal                           | Flashing Display                    | Steady Display                      |
|---------|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| ?       | Watchdog (DSP)   | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| ?       | Watchdog (HPC)   | <input checked="" type="checkbox"/> |                                     |                                     | <input checked="" type="checkbox"/> |
| -1      | No Compensation  | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| -2      | Invalid Velocity Control                                 | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| -3      | Encoder not Initialized on attempt to enable             | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| -4      | Encoder Initialization failure                           | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| -5      | AutoConfig failure                                       | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| L 1     | Hardware CW limit switch open                            |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |
| L 2     | Hardware CCW limit switch open                           |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |
| L 3     | Hardware CW and CCW limit switches open                  |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |
| L 4     | Software CW limit switch is tripped (PFB>PMAX & PLIM=2)  |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |
| L 5     | Software CCW limit switch is tripped (PFB<PMIN & PLIM=2) |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |
| A 3     | Positive and negative analog supply fail                 | <input checked="" type="checkbox"/> |                                     | <input checked="" type="checkbox"/> |                                     |
| I       | RAM failure (during init)                                | <input checked="" type="checkbox"/> |                                     |                                     | <input checked="" type="checkbox"/> |
| c       | EPROM checksum (during init)                             | <input checked="" type="checkbox"/> |                                     |                                     | <input checked="" type="checkbox"/> |
| E101    | Altera load failure (during init)                        |                                     |                                     | <input checked="" type="checkbox"/> |                                     |
| E102    | Altera DPRAM failure (during init)                       |                                     |                                     | <input checked="" type="checkbox"/> |                                     |
| E103    | DSP load fail (during init)                              |                                     |                                     | <input checked="" type="checkbox"/> |                                     |
| E104    | DSP alive failure (during init)                          |                                     |                                     | <input checked="" type="checkbox"/> |                                     |
| 8       | Test LED   |                                     |                                     | <input checked="" type="checkbox"/> |                                     |
| B       | Indexed position with zero velocity                      |                                     |                                     | <input checked="" type="checkbox"/> |                                     |

## CUSTOMER SUPPORT

Danaher Motion products are available world-wide through an extensive authorized distributor network. These distributors offer literature, technical assistance and a wide range of models off the shelf for fastest possible delivery.

Danaher Motion sales engineers are conveniently located to provide prompt attention to customers' needs. Call the nearest office listed for ordering and application information or for the address of the closest authorized distributor. If you do not know who your sales representative is, contact us at:

### Danaher Motion Customer Support

**Phone:** (815) 226-2222

**Email:** [customer.support@danahermotion.com](mailto:customer.support@danahermotion.com)

**Website:** [www.DanaherMotion.com](http://www.DanaherMotion.com)