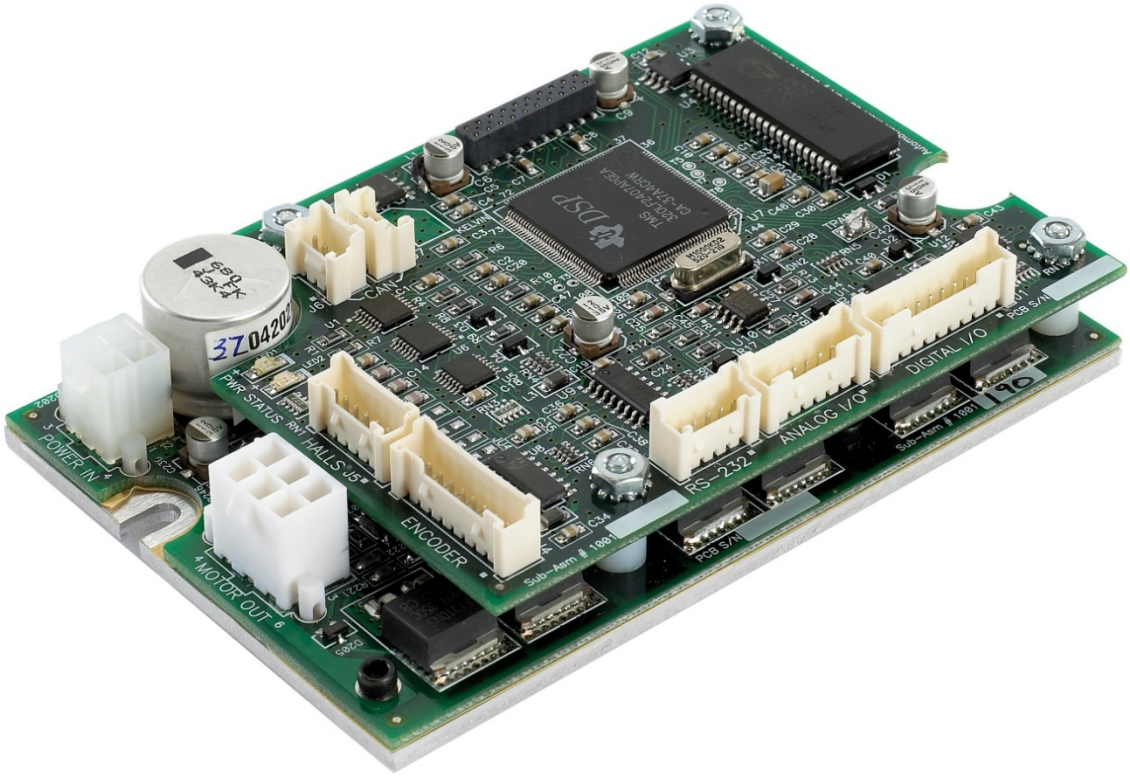

MODEL ACS100-XXXX

User's Manual

Digital Velocity/Torque/Position Mode Servo Drive

This manual covers the use and maintenance of the model ACS100 series Torque, Velocity and Position mode brushless motor control product family.

ElectroCraft
Incorporated

Title: **ACS100 User Manual**
Installation and Operation

Type of Documentation: User Hardware Manual

Document Type code: ACS100UM Rev 1.0 09-22-09.doc

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Purpose of Documentation: This documentation describes…

- Installation and operation of the ACS100 family drive.

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Published by: ElectroCraft MI, Incorporated
P.O. Box 7746, Ann Arbor, Michigan 48108 USA

Tel.: 734-662-7771 • Fax: 734-662-3707
http://www.electrocraft.com

Table of Contents

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1 ACS100 Controller

1.1 Overview

This manual describes the installation and operation of the ACS100 series of digital high voltage servo-amplifiers manufactured by ElectroCraft MI, Inc.

This document applies to serial numbers ending with xxxx0105 and beyond.

The ACS100 amplifier is:

- Configurable operation modes: Torque, Velocity, and Position.
- Selectable BLAC (sine wave, flux vector) or BLDC (Six step, trapezoidal) commutation.
- 4 Quadrant performance.
- Phase output, PWM controlled output.
- Full digital control of all loops
- Variable servo rate from up to 16 kHz.
- Loop tuning via serial interface (No potentiometers!).
- Drive setup & status information available serially via RS232 link.
- 12 – 48 VDC input power supply range.
- Output current of 5.0 Amp continuous, 10 Amp peak.
- Compact package size.
- **ElectroCraft CompletePower™ Plus** graphical windows interface for Setup, Configuration and Tuning.

Software

For further documentation support of software and its usage, refer to the **ElectroCraft CompletePower™ Plus** software user's manual.

Parameters and Variables

For further documentation support of parameters, variables, commands and graphing refer to the ElectroCraft Parameter Guide.

2 ACS100 Introduction

2.1 Amplifier

The ACS100 is a fully digital servo amplifier that uses DSP technology to provide a powerful feature set that is fully configurable by means of a RS232 serial port. The ACS100 servo drive is configurable as a Torque, Velocity, or Position mode servo amplifier. The ACS100 is designed to operate a single 3 phase Brushed or Brushless DC or AC, permanent magnet motor. The motor may have either a WYE or Delta wound stator. The ACS100 provides commutation using Hall sensors or encoder feedback.

The ACS100 Torque, Velocity or Position modes accept +/- 10 volt DC analog or digital PWM.

2.2 Theory of Operation

The ACS100 operates as a "mode configurable" digital servo amplifier. This product is typically applied as a component within an end use industrial application. Within industry, application requirements for servo amplifiers vary widely. For example, one application may require an amplifier with an analog input reference for speed. Another application may require an amplifier that offers torque control and Hall sensor commutation only. For this reason the ACS100 offers a choice of many different servo-operating modes. This flexibility is made possible because all of the control functions within the ACS100 are implemented in software. The ACS100 physical I/O and closed loop functionality are selected using the **ElectroCraft CompletePower™ Plus** software setup utility. See Section 7, Introduction to the **ElectroCraft CompletePower™ Plus** software, and the **ElectroCraft CompletePower™ Plus** software User Manual for additional information on using this software.

The internal firmware architecture of the ACS100 is modular. ACS100 software is built as a series of components (or modules) that are linked together to form an ACS100 servo-operating mode. ACS100 software components are stored in flash memory. These components exist as Reference input modules, Feedback modules, PI (D) control modules, commutation modules and firmware extension modules.

An internal digital signal processor is used to read I/O signals, motor feedback signals and to process serial communication messages. Flash memory inside the ACS100 is used to store a library of modular software components. RAM memory is used for data logging and graphical tuning of the ACS100. The serial EEPROM provides nonvolatile memory for retention of user-configured parameters and operating mode.

3 Product Safety Precautions

READ THIS ENTIRE SECTION BEFORE ATTEMPTING TO USE THE ACS100 SERVO DRIVE! GIVE SPECIAL ATTENTION TO ALL BOLD PRINT ITEMS.

WARNING!

To operate your control successfully, these minimum safety precautions MUST be followed to insure proper performance without injury to the operator and damage to motor or control. **FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS COULD RESULT IN SERIOUS BODILY INJURY, INCLUDING DEATH IN EXTREME CASES.**

3.1 Operation

1. Do not touch any of the output connector pins from connectors P1 (DC Input) or P2 (Motor Output) when power has been applied. The voltages at these connector pins are dangerous and can produce an electric shock. Bare wires from adjacent connector pins must never be allowed to touch one another.

2. P1 pin 4, must be connected to an external earth ground. Follow wiring procedures carefully. Know and understand which connectors are NOT electrically isolated from the DC voltages within the drive.

3. Read ElectroCraft's Life Support Policy in section 3.5 for application limitations.

4. Follow precautionary guidelines in this manual with regard to proper installation of an external shunt resistor. See Section 13 of this manual.

5. Do not operate the control in an explosive area or near explosive or flammable materials.

6. Do not use the control in environments where it is likely to be exposed to strong and/or frequent static discharge.

7. Conduct trial operations on the servo drive alone with the motor shaft disconnected from the machine to avoid any unexpected accidents. Motor shaft should be uncoupled and free to rotate without coming in contact with user or any stationary object during set up and preliminary operation.

8. Under no circumstances should a phase output from the control be connected to anything other than a passive inductive/resistive motor load. Short circuit protection for the drive is limited to momentary conditions only! Repetitive short circuits on any of the output pins for P2 will likely cause permanent damage to the ACS100.

9. Never touch any moving parts while the motor is running. Failure to observe this warning may result in injury.

10. Excessive speed and current can destroy some motors and possibly injure the user. Check the motor manufacturer's specifications to ensure that the maximum current and voltage for your control model, does not exceed their limitations.

11. External methods are advisable to limit both the top speed and travel motion of the motor and its load. Whenever the ACS100 drive is disabled for any reason, the motor is placed into a free/spinning coast mode.

12. When using the servomotor for a vertical axis, install safety devices to prevent work pieces from moving due to occurrences of over travel. Failure to do this may cause injury to work pieces or person.

13. Provide an appropriate stopping device on the machine side to ensure safety. A holding brake for a servomotor with brake is not a stopping device for ensuring safely. Failure to observe this warning may result in injury.

14. Do not parallel multiple motors off the same control.

15. Do not make any extreme adjustments or settings changes of parameters. Failure to observe this caution may result in injury due to instable operation.

16. Do not turn the control on or off frequently unless necessary. Failure to observe this caution may cause internal parts to deteriorate.

17. Avoid frequently plugging connector P1 into the control while live power is applied to the connecting cables. Ignoring this precaution will cause electrical arcing at the connector pins, which can cause permanent connector damage. ElectroCraft recommends using a disconnect switch ahead of P1 if the ACS100 must be disconnected often.

18. Do not remove the connectors on ports P1, P2, J1 through J6 from the control while the motor is operating.

19. Do not service or modify this product. Only authorized personnel must perform disassembly or repair of the drive. Failure to observe warning may result in injury or damage to product.

3.1.1 Use of ACS100 Jumpers

ACS100 Jumpers JU201 and JU202 – DC Operating Voltage

1. The ACS100 has two jumpers that must be set according to the desired input DC operating voltage range. Failure to set these jumpers correctly can result in permanent damage to the ACS100. Please see section 3.3 “Use of ACS100 Jumpers JU201 and JU202” and select the proper jumper setting for your application before applying power to the ACS100.

ACS100 Jumpers JU1, JU2, JU3, JU4 – Use of Encoder Feedback

1. The ACS100 has jumpers that must be set according to the type of feedback device used. When a differential encoder feedback is used A, A!, B, and B!, you can leave Z and Z! unconnected.
   If a single ended encoder feedback A and B, (and not the A! and B!)is used, all four jumpers on the daughter card, right next to the encoder connector J4, must be shorted. These are JU1, JU2, JU3 and JU4. You can then leave Z and Z! unconnected.
2. If only Hall Effect is used and no encoder at all, leave the encoder connector unconnected.
3. See section 6.6.4, J4 Encoder Interface Circuitry, for additional information.

3.2 Storage and Transportation

1. Do not store or install the product in the following place
    a. Locations subject to temperature outside of the range specified.
    b. Locations subject to humidity outside the range specified.
    c. Locations subject to condensation as the result of extreme changes in temperature.
    d. Locations subject to corrosive or flammable gases.
    e. Locations subject to dust, salts, or iron contaminants.
    f. Locations subject to exposure to water, oil, or chemicals.
    g. Locations subject to shock or vibration.

    Failure to observe this caution may result in fire, electric shock, damage to the product.

2. Do not hold the product by the cables or motor shaft while transporting it. Failure to observe this caution may result in injury or malfunction.
3. Store the ACS100 drive when not in use, in temperatures between -20 to +85 degrees C.

3.3 Installation

4. Take appropriate and sufficient countermeasures when installing systems in the following locations.
    a. Locations subject to static electricity or other forms of noise.
    b. Locations subject to strong electromagnetic fields and magnetic fields.
    c. Locations subject to possible exposure to radioactivity.
    d. Locations close to power supplies including power lines.

    Failure to observe this caution may result in damage to the product.

5. Keep any external shunt resistor away from flammable materials. Read Section 13 carefully for more shunt installation details.

6. Never use this product in an environment subject to liquids, corrosive chemicals or gases, or combustibles, or where foreign materials are allowed to fall onto or collect inside the drive Failure to observe this caution may result in electric shock or fire.

7. Do not place heavy objects on the product. Failure to observe this warning may result in stopping operation of the product.

8. Do not cover or prevent air from escaping or entering through the vents with obstruction or foreign object. Failure to observe this caution may cause internal elements to deteriorate resulting in malfunction or fire.

9. Provide the specified clearance between the drive and the control panel or with other devices. Provide sufficient space around the drive for cooling by natural convection or provide cooling fans to prevent excessive heat, see section 6.3 for details. Failure to observe this caution may result in fire or malfunction.

3.4 Wiring

1. Verify **ALL** wiring **BEFORE** applying power to the control and motor. Motor may RUN AWAY or oscillate uncontrollably if improperly wired. Drive may be damage or improper wiring may prevent drive from operation.

2. **The ground P1, pin 3 or 4, MUST always be connected** to an appropriate external earth ground.

3. Connect the ground terminal to the electrical codes (ground resistance should be less than 100 ohms. Improper grounding may result in electric shock or fire.

4. Do not connect a three-phases or any supply power to the U, V, and W terminals. Failure to observe this caution may result in injury or fire.

5. Securely connect the power supply terminals and motor output terminals. Failure to observe this caution may result in fire.

6. Do not bundle or run power and signal lines together in the same duct. Keep power and signal lines separated by at least 30cm.

7. Use twisted-pair shielded wires or multi-core twisted pair shielded wires for signal and encoder feedback lines.

8. Always use the specified power supply voltage. An incorrect voltage may result in burning. Be particularly careful where the power supply is unstable. An incorrect power supply may result in damage to the product.

9. Install external breakers or other safety devices against short-circuiting in external wiring. Failure to observe this caution may result in fire or damage to the control.

3.5 Life Support Policy

READ THIS ENTIRE SECTION BEFORE ATTEMPTING TO USE THE ACE SERVO DRIVE! GIVE SPECIAL ATTENTION TO ALL BOLD PRINT ITEMS.

ElectroCraft's products are not authorized for use as critical components in life support devices or systems without the express written approval from ElectroCraft MI, Incorporated.

1. Life support devices or systems, are devices or systems which are intended for surgical implant into the body, or support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the User's Manual and in the labeling, can be reasonable expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

4 Checking Product on Delivery

When your package arrives, inspect the shipping box and the unit carefully, and save ALL packing materials. Compare the packing slip against all items included in the shipping box. Any shortages or other inspection problems should be reported to ElectroCraft immediately.

The following procedure is used to check products upon delivery. Check the following items when your ACS100 is delivered.

- Verify that the model number marked on the nameplate of the drive(s) is the correct unit ordered.
- Check the overall appearance. Check for damage or scratches that may have occurred during shipping.

If any damage, or if the unit is the wrong type, contact your ElectroCraft sales representative immediately.

Your ACS100 has arrived carefully packaged from ElectroCraft MI, in an antistatic bag. As you unseal this bag, inspect the contents carefully. There should not be any loose or damaged parts inside.

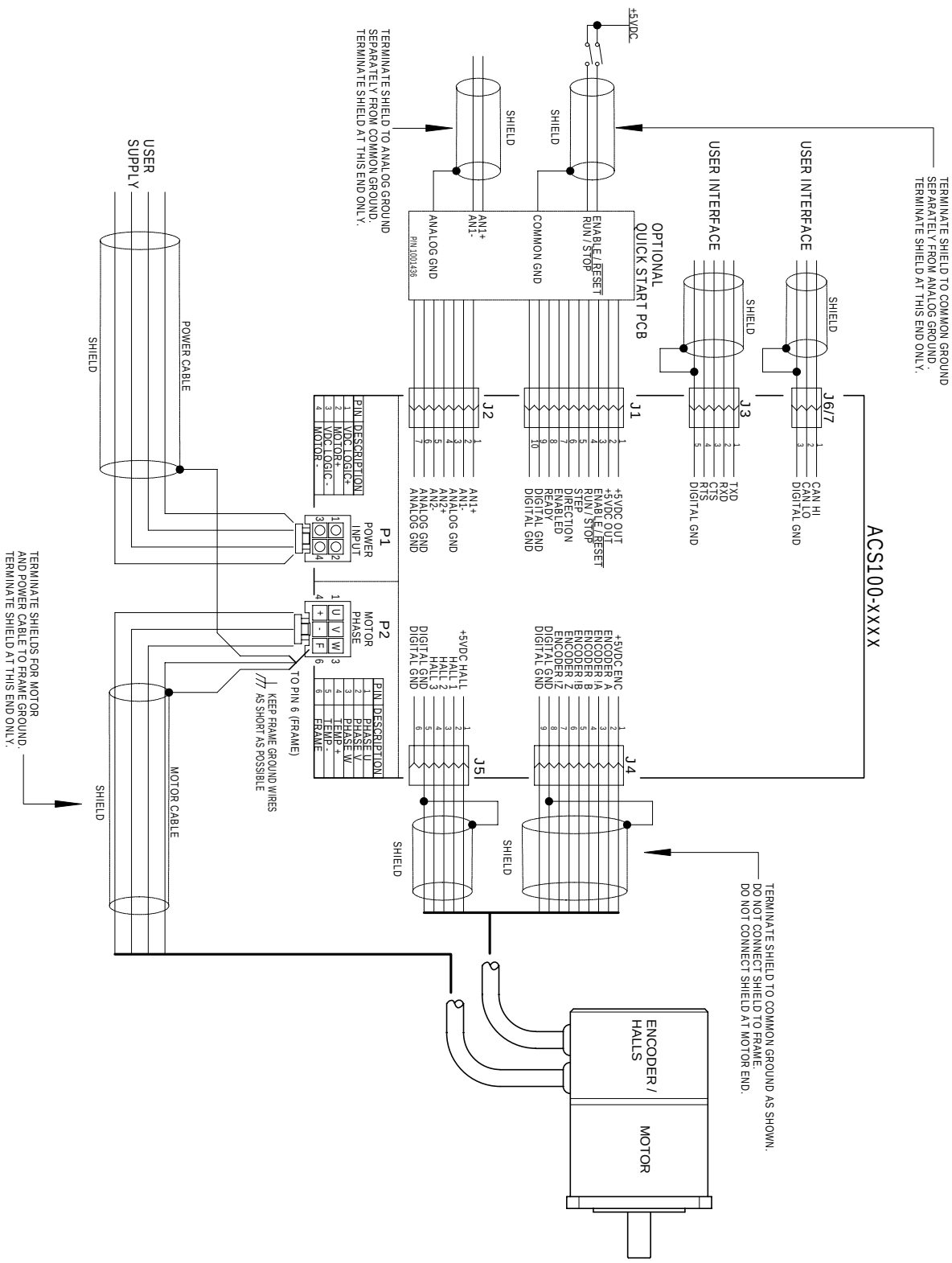
Never attempt to operate or power-up the drive if there is any visible external damage or if it sounds as though there are loose materials inside the chassis. While unpacking, if you discover any loose or damaged parts, notify ElectroCraft within two working days.

ElectroCraft recommends that all packing materials be saved in the event that the ACS100 needs to be shipped back. Always place the ACS100 in the same antistatic bag used in the original shipment. Abundant anti-static filler material should always be placed around the ACS100 so that it cannot shift inside the box. Extreme care should be exercised when placing packing material around all external connectors to prevent mechanical stress damage.

All material to be returned to ElectroCraft must have a Return Material Authorization (RMA) tracking number assigned before shipment. This may be obtained by contacting the ElectroCraft Service Dept. Any product returned without this number will be rejected by ElectroCraft.

Always insure your shipment for the proper replacement value of its contents. ElectroCraft will not assume responsibility for any returned goods that have been damaged outside of our factory because of improper packaging or handling. All goods shipped to ElectroCraft must be shipped FREIGHT PREPAID.

5 Recommended Cabling and Installation



6 ACS100 Installation and Setup

READ ENTIRE USER MANUAL FIRST BEFORE ATTEMPTING TO USE THIS PRODUCT.

If you require further assistance then provided within this manual, please email, call, or fax:

ElectroCraft MI, Incorporated®

P.O. Box 7746
Ann Arbor, MI USA 48107

(734) 662-7771
Fax #(734) 662-3707

www.electrocraft.com

This chapter presents installation procedures and instructions on how to setup your ACS100 drive.

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6.1 Mounting the ACS100

Use this preferred hardware type, see table below, for mounting your ACS100 drive. Mount your ACS100 in the following manner.

Base Mounted: Two M3/ No. 6 pan head screws. Include spring (locking) washer with plain washer.

Weight: 182g (0.40lb)
Size: 3.0" (76.2mm) x 4.5" (114.3mm) x 0.942" (23.93mm).

6.2 Environmental Conditions in the Control Panel

- Storage Temperature: -20-85 degree C
- Humidity: 5-95%RH, Non-condensing
- Operating Temperature range: 0-50 degree C
- Vibration: Install a vibration isolator beneath the drive to avoid subjecting it to vibration

6.3 Installation in the Control Panel

Base Mount

When installing the ACS100, provide at least 10 mm (0.39 in) between units or control panel and at least 50 mm (1.97 in) above and below each drive. Install cooling fans above or below the drive to maintain a constant temperature inside the control panel and to prevent an excess temperature rise around the drive.

6.4 Use of the ACS100 Jumpers JU201 and JU202

❖ Jumpers JU201 and JU202 are located next to the power input connector P1; See Figure 2.

JU201:
Install JU201 when powering the ACS100 motor and logic inputs with the same supply.

Note: When JU201 is installed it is recommended that JU202 is **NOT** installed.

JU202:
Install JU202 when the voltage supplied to the logic power input (P1 pin 1) is between +12Vdc and +24Vdc. Remove JU202 when the voltage supplied to the logic power input is greater than +24Vdc.

The standard configuration is that JU202 is NOT installed (left open). When installed, JU202 bypasses some circuitry that protects the internal logic power supplies from voltages above +48V.

6.5 Simplified ACS100 Internal Block Diagram

This following diagram is provided to familiarize the user with the internal architecture of the ACS100. An internal digital signal processor (DSP) is used to read I/O signals, motor feedback signals and to process serial communication messages. ROM memory inside the ACS100 is used to store a library of modular software components. RAM memory is used for data logging and graphical tuning of the ACS100. The serial EEPROM provides nonvolatile memory for retention of user-configured parameters and operating mode. EEPROM memory is also used to extend the program functionality of the ACS100.

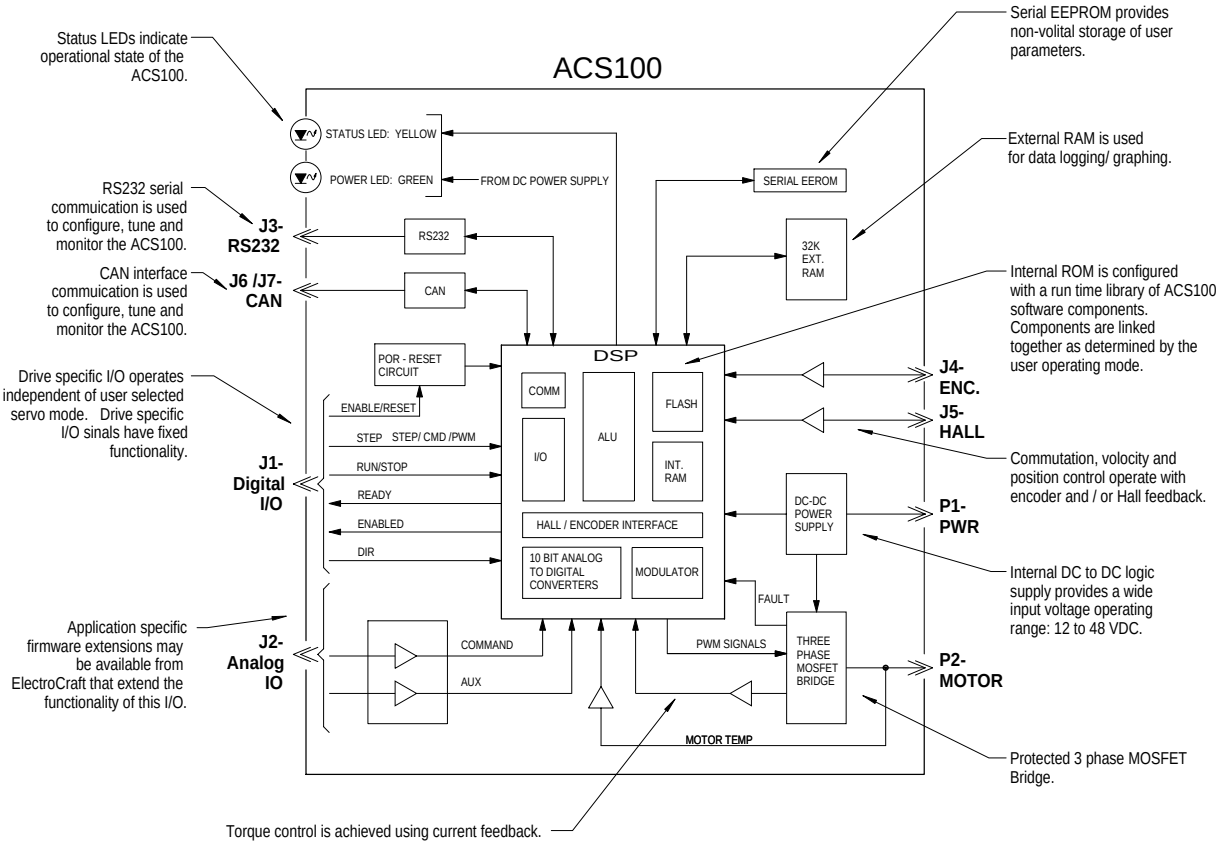

Figure 1: ACS100 Block Diagram

6.6 ACS100 Connector Description

Drive specific I/O operates independent of the user selected operating mode. Dive specific I/O signals have fixed functionality. These signals are used to interface the ACS100 to an outside control system. They provide signals for enabling, disabling, and monitoring the status of the ACS100. For visual reference to the ACS100 connectors, see Figure 2 below.

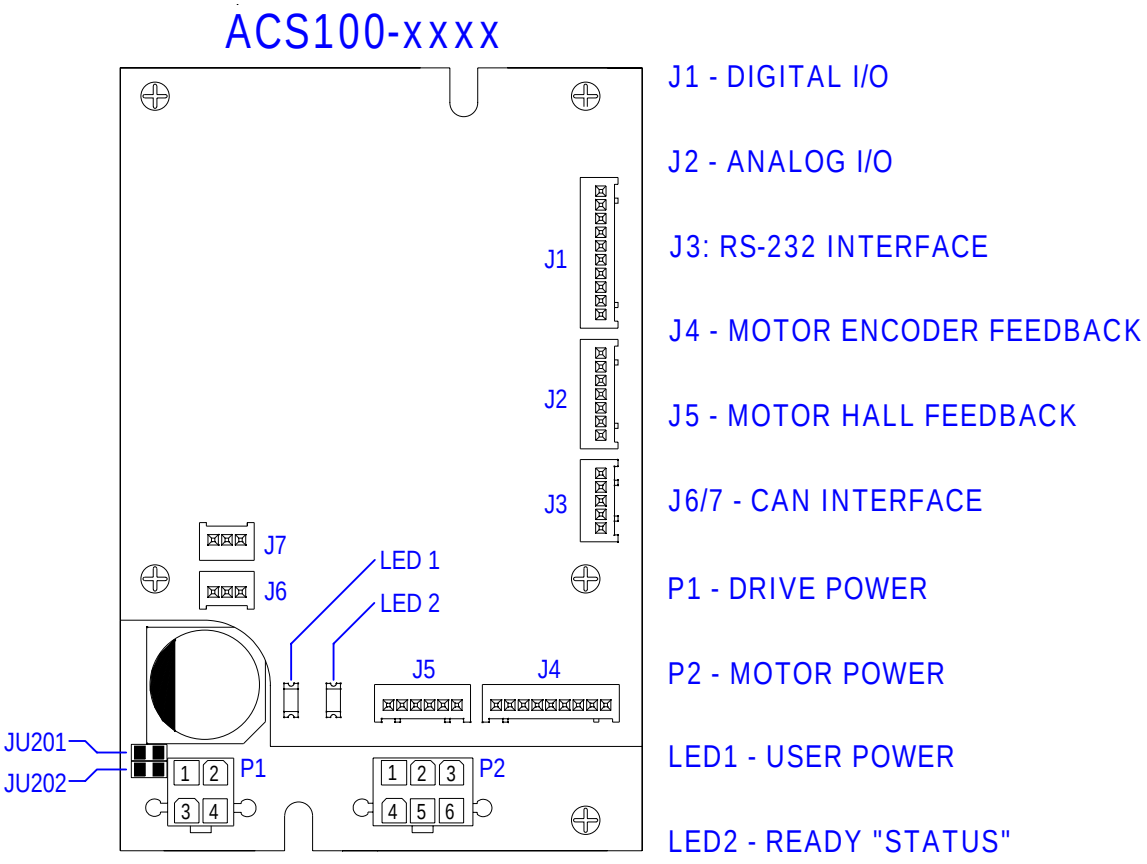

Figure 2: ACS100 Connector Layout

6.6.1 J1 Connector: User Digital I/O Control, Molex 35362-1010

Pin #	I/O	Description
1	Output	+5 Volts DC Power. Supplied regulated +5VDC power. 250mA Total available from drive from all pins.
2	Output	+5 Volts DC Power. Supplied regulated +5VDC power. 250mA Total available from drive from all pins.
3	Input	Enable/!Reset Control Signal Input; TTL compatible. +5.5 VDC maximum signal amplitude. 0 Volts minimum. 10K ohm internal pull down. Positive true logic. Forces a master hardware reset for entire drive on a falling edge. Drive recovers beginning after rising edge. Drive remains disabled while logic "0" is applied to this input.
4	Input	Run Command Signal Input; TTL compatible. 5.5 VDC maximum signal amplitude. 0 Volts minimum. 10K ohm internal pull down. Positive true logic. A logic "1" state will allow motor commutation once some level of current is commanded. A logic "0" state places motor into a coast state.
5	Input	Step Input; 0 to +5 VDC logic signal. TTL compatible. 10K ohm internal pull down. Used in step and direction mode. Used with direction input.
6	Input	Direction Input; Zero to +5 Volt logic signal. TTL compatible. +5.5 VDC maximum signal amplitude. 0 Volts minimum. 10K Ohm internal pull down. Selects relative direction of “Step” command. High is “positive” direction.
7	Output	Enabled Output; 0 to +5 VDC logic signal. Logic 0 when drive is in “Reset”. Logic 1 when drive is enabled and initialized.
8	Output	Ready Output; 0 to +5 VDC logic signal. Logic 0 when drive is in “Standby” or “Reset”. Logic 1 when drive is in “Run” mode and ready to deliver current.
9	Output	Common Return.
10	Output	Common Return.

6.6.2 J2 Connector: User Analog I/O Control, Molex 35362-0710

Pin #	I/O	Description
1	Input	AN1+ Differential Input; zero to ±10 Volt external command signal input. The polarity of this signal controls the relative applied direction of output motor torque. Input is protected to ±24 Volt maximum.
2	Input	AN1- Differential Input; zero to ±10 Volt external command signal input. The polarity of this signal controls the relative applied direction of output motor torque. Input is protected to ±24 Volt maximum.
3	Input	Common Return.
4	Input	AN2+ Differential Input; zero to ±10 Volt external command signal input. The polarity of this signal controls the relative applied direction of output motor torque. Input is protected to ±24 Volt maximum.
5	Input	AN2- Differential Input; zero to ±10 Volt external command signal input. The polarity of this signal controls the relative applied direction of output motor torque. Input is protected to ±24 Volt maximum.
6	Input	Common return.
7	Input	Common return.

6.6.3 J3 Connector: RS-232 Communications, Molex 35362-0510

Pin #	I/O	Description
1	TX	RS232 TXD Output, RS232 signal level.
2	RX	RS 232 RXD Input, RS232 signal level.
3	CTS	RS 232 CTS Input, This input not implemented as a 'Clear to Send" and is only used for programming flash.
4	RTS	RS232 RTS Output, This output is not currently implemented.
5	GND	Common return.

6.6.4 J4 Connector: Encoder Feedback, Molex 35362-0910

Pin #	I/O	Description
1	Output	+5 Volts DC Power. Supplied regulated +5VDC power. 250mA Total available from drive from all pins.
2	Input	Encoder "A" Signal; zero to +5 Volt logic signal.
3	Input	Encoder "A!" Signal; zero to +5 Volt logic signal.
4	Input	Encoder "B" Signal; zero to +5 Volt logic signal.
5	Input	Encoder "B!" Signal; zero to +5 Volt logic signal.
6	Input	Encoder "Z" Marker Signal; zero to +5 Volt logic signal.
7	Input	Encoder "Z!" Marker Signal; zero to +5 Volt logic signal.
8	Output	Common return.
9	Output	Common return.

6.6.5 J5 Connector: Hall Feedback, Molex 35362-0610

Pin #	I/O	Description
1	Output	+5 Volts DC Power; Supplied regulated +5VDC power. 250mA Total available from drive from all pins.
2	Input	Hall Signal Input S1; zero to +5 Volt logic signal. 2.2K ohm internal pull up to +5v.
3	Input	Hall Signal Input S2; zero to +5 Volt logic signal. 2.2K ohm internal pull up to +5v.
4	Input	Hall Signal Input S3; zero to +5 Volt logic signal. 2.2K ohm internal pull up to +5v.
5	Output	Common return.
6	Output	Common return.

6.6.6 J6 and J7 Connectors: CAN Communications, Molex 35362-0310

Pin #	I/O	Description
1	-	CAN HI; CAN Bus Communication.
2	-	CAN LO; CAN Bus Communication.
3	-	Common Return.

6.6.7 P1 Connector: DC Input, Molex Mini-Fit Jr. 44472-0452

Pin #	I/O	Description
1	Input	DC Input; +12 to +48 VDC Logic power.
2	Input	DC Input; 0 to +48 VDC Motor power.
3	Input	DC Common Return.
4	Input	DC Common Return.

Note: Pin 3 is internally shorted to P4.

6.6.8 P2 Connector: Motor Output, Molex Mini-Fit Jr. 44472-0652

Pin #	I/O	Description
1	Output	Motor Phase U; peak voltage out of this terminal is dependent upon the incoming voltage on connector P1 pin 2. Peak amperage is model dependent.
2	Output	Motor Phase V; peak voltage out of this terminal is dependent upon the incoming voltage on connector P1 pin 2. Peak amperage is model dependent.
3	Output	Motor Phase W; peak voltage out of this terminal is dependent upon the incoming voltage on connector P1 pin 2. Peak amperage is model dependent.
4	Input	Temp +; 4.99K ohm internal pull up to +5v.
5	Input	Temp –; motor temperature input. PTC, NTC, or switch.
6	Input	Frame Ground.

Note: Reference section 13.7.1 Motor Temp Circuit Description and Fig. 12 for more information

7. ACS100 Status LED's

In normal operation, the ACS100 is either in a "Ready" state or in an "Error" state. When power is first applied, the green LED will come on steady, meaning that power has been applied. The Yellow LED should be flashing, meaning that the drive is enabled.

When the drive is placed into "run mode" the flashing Yellow LED will come on steady.

7.1. User Ready "Status" LED (Yellow)

FLASH CODE	DESCRIPTION	POSSIBLE CAUSE	RESULT	RECOVERY METHOD
ON Steady	ACS100 is in "RUN" mode.	User commanded RUN mode via user interface	Clear all faults and STATUS flags Enable three-phase PWM	Not applicable
OFF	Processor is inoperable.	Drive is in reset Processor fault Improper user supplied +5Volts Drive is being reprogrammed	ACS100 will stay in a DISABLED mode	Disconnect power from the ACS100 for 1 min. to reset the microprocessor. Then re-apply power to allow microprocessors to operate
1	Drive is in "Standby" mode	The user commanded standby mode from the user interface A drive error placed the drive in standby mode.	The drive is placed in standby mode	Command run mode Toggle the run line, see Note 1
2	Reserved	-	-	-
3	Over Current Fault	Current is over the designated drive current for more than 0.5mS	The drive is placed in standby mode	Toggle the run line, see Note 1
4	Rail or Power Supply fault	Internal logic power supplies out of spec (+15V and +5V) Rail voltage > +60V	The drive is placed in standby mode	Toggle the run line, see Note 1
5	Reserved	-	-	-
6	EEPROM Fault or Check sum fault	The user EEPROM has a checksum error or DSP program memory error	The drive is placed in standby mode (hard fault)	Check the error using the "CF' command in the terminal page. If the error is "MEMORY EEPROM", issue the command "CR23130". If the error is "MEMORY DSP FLASH", reprogram the DSP. ➢ Warning! Either operation will reset all drive parameters to default state. Reload parameter file after these operations
7	Miscellaneous Faults	To determine cause use the RS232 connection and "CF" command in terminal window, see Note 2	The drive is placed in standby mode	Toggle the run line, see Note 1

Note 1: To toggle the run command, set the Run/! Stop signal to a logic '0' state for 100mS, then back to logic '1'

Note 2: If a drive fault does occur and a flash code appears on the Status LED, more details regarding the cause of the fault can be obtained using the "CF" Check Faults command through the drive's RS232 communications.

7.2. User Power LED (Green)

LED	Description	Possible Cause	Result	Recovery Method
ON	+5 VDC Power Indicator	• On if user power is on	• Required to Run	• N/A
OFF	+5 VDC Power Indicator	• No logic power	• Drive will not Run	• Apply +12 – 48VDC
DIM	+5 VDC Power Indicator	• Logic voltage input to low	• Drive may not run properly	• Apply +12VDC minimum

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8. Introduction to ElectroCraft CompletePower™ Plus Software

ElectroCraft CompletePower™ Plus is a Windows® -based program used for setup, parameterization, system diagnostics and motion control management. **ElectroCraft CompletePower™ Plus** will lead the user through an 8-Step Wizard to create the correct parameter configuration and information required for the user to run a particular motor with a particular drive. The result will be an "Application" containing all of the parameter information required to run the motor with the drive.

This section is described within the software user manual: **ElectroCraft CompletePower™ Plus** software users manual. Please refer to the user's manual for full documentation support to properly configure and operate your drive.

Windows® is a registered trademark of the Microsoft Corporation.

The remainder of this page is intentionally left blank.

9 Recommended Minimum Hookup

Apply DC voltage to the Quick Start I/O interface:

a. J1 pin 1/2: +5VDC.
b. J1 pin 9/10: Common return

For additional information pertaining to the optional Quick Start I/O Test Interface, refer to document: Quick Start User Guide.doc(x) located at the ElectroCraft web site.

9.1 Diagram

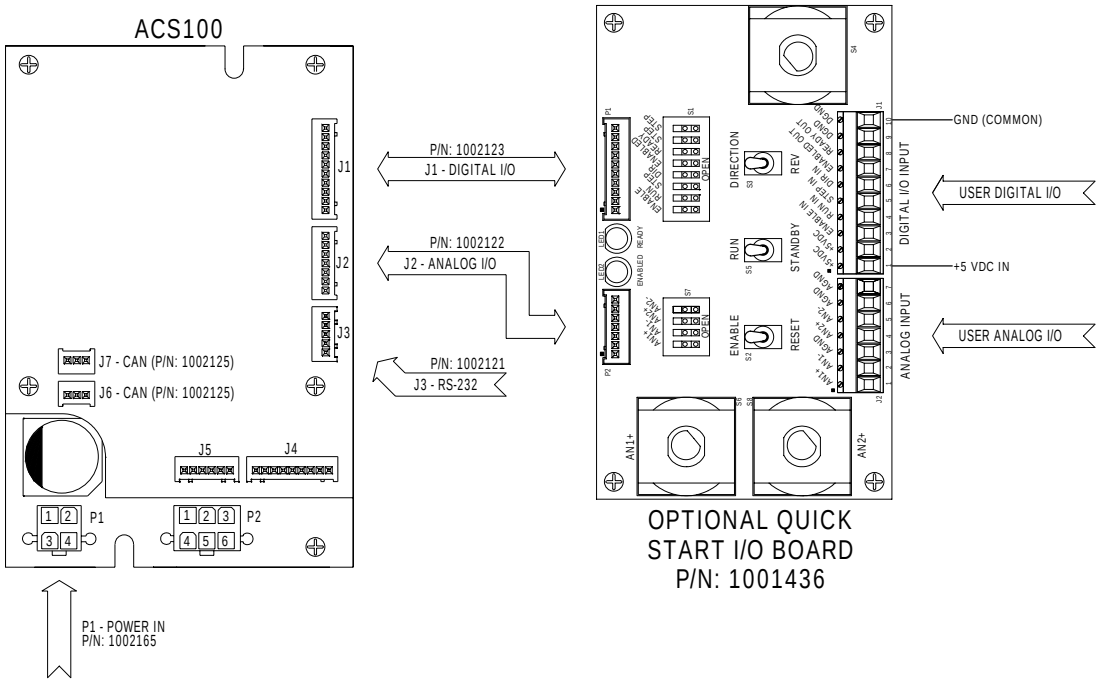

Figure 3: Optional Drive Setup

9.2 Wiring Diagrams for Optional User Interfaces

For mating connectors, see section 11.

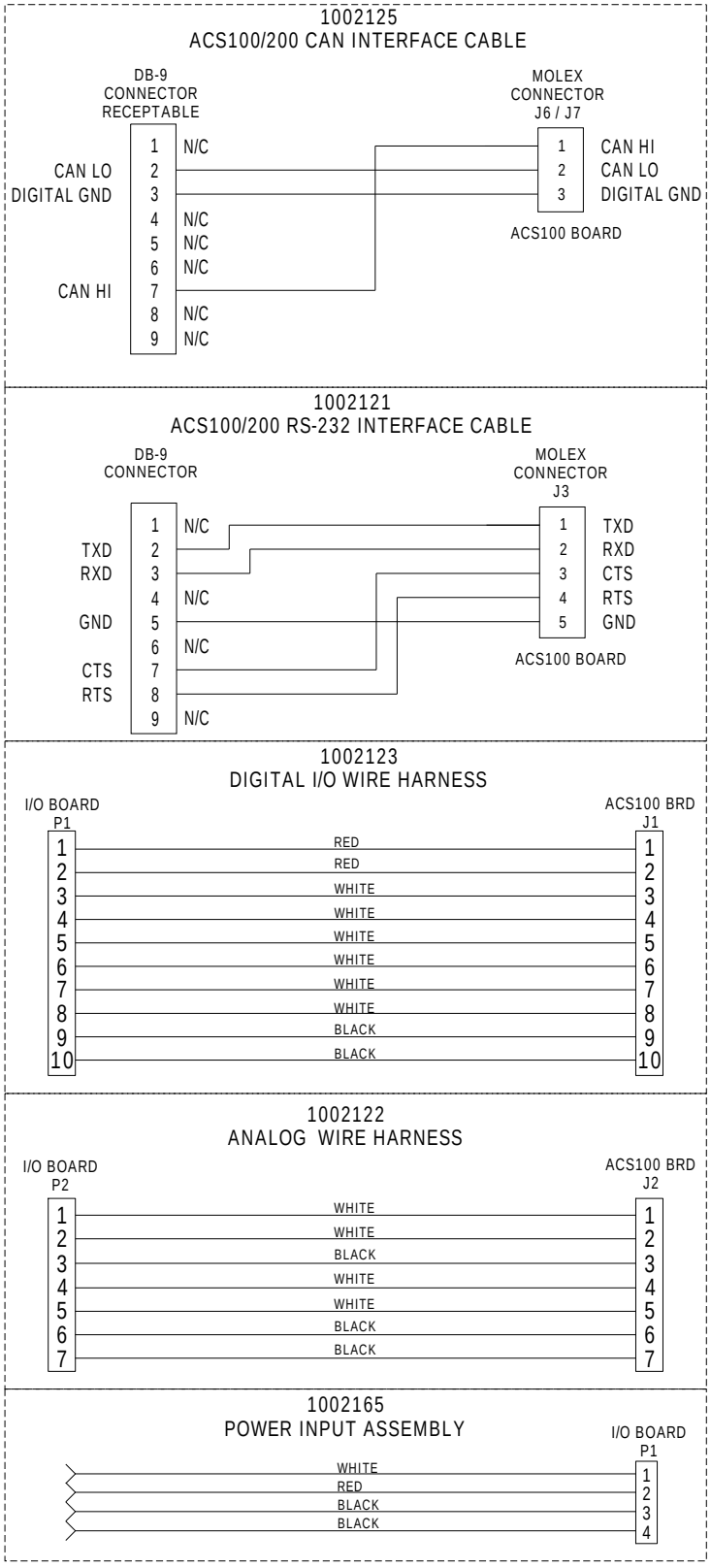

Figure 4: Optional Drive Setup Wiring Diagram

10 First Time Operation

10.1 Phasing the Motor

ElectroCraft has determined the correct motor phasing for all ElectroCraft motors. If your drive was ordered with an ElectroCraft motor specified, the correct parameter set for the mating ElectroCraft motor was loaded into your drive at the factory prior to shipment.

Alternate ElectroCraft motor parameters can be selected from the motor selection file on the software disk supplied with your drive, or you can contact ElectroCraft for these files.

In addition, ElectroCraft has established the correct motor phasing relationships for many other popular US and foreign motor manufacturers. A listing of these additional motor manufacturers may be obtained from ElectroCraft upon request.

10.2 Using ElectroCraft CompletePower™ Plus

To establish the correct motor phasing for a new or unknown motor ElectroCraft has provided a Window based setup utility. Please refer to the **ElectroCraft CompletePower™ Plus** software user manual to setup your drive and analyze the performance of the drive as well as the motor.

Getting Started

To make use of this feature proceed as follows:

1. Install **ElectroCraft CompletePower™ Plus** software onto user PC.
2. Connect all phase and hall wires to the drive.
3. Place drive into standby
4. Connect power and establish communications
5. Load a starting parameter set (Use default supplied in drive, user saved parameter set, or contact ElectroCraft for assistance)
6. The motor should now be properly phased for the ACS100. You can now proceed with drive loop tuning.

10.3 ACS100 Electrical Ratings

Ratings at Temperatures = 0…50°C, (unless otherwise noted)

Parameter	Conditions	Value	Units
Supply			
Supply voltage	Transient peak	-03 to 60	VDC
Supply voltage	Nominal operating	12 to 48	VDC
Supply current, surge	Inrush pulse duration <=100mS	30	A
Supply current, idle	No load condition.	40 to 340	mA
Supply current, operating		8 to 16	A
Over voltage protection	Internal peak supply limited.	58 to 62	VDC
Reversed polarity withstand	Continuous; supply current externally limited to:	-15	A
+5VDC Supply regulation	Encoder Inputs, Hall Inputs and Digital I/O	4.75 to 5.25	V
+5VDC Supply current available for external use	Encoder Inputs, Hall Inputs and Digital I/O	250	mA
P2-Motor Outputs			
Output current, continuous	No additional heatsink	-5.0 to 5.0	Arms
Output current, peak		-10 to 10	A
Short circuit withstand	Phase-to-phase, phase-to-ground, phase to-supply threshold.	+/- 16 to +/- 25	Amp
Short circuit protection delay		5 to 20	uS
On state voltage drop	Phase current = +/-5Amp	-500 to 350	mV
Off-state leakage current	Phase Voltage = +/-48V.	-500 to 500	uA
PWM frequency	Programmable, PWMPER	30	kHz
J1-Digital I/O Maximum Ratings			
Input voltage	All inputs (opto-isolated); referenced to +COM	-9 to 5	V
Input current	All inputs (opto-isolated); referenced to +COM	-20 to 20	mA
Output voltage	All outputs	-0.3 to 7	V
Output current	All outputs	48	mA
J1-Digital Inputs			
On state voltage threshold	Referenced to +com	-5 to -3	V
Off state voltage threshold	Referenced to +com	-1 to 0	V
On state current	Input = -5V	-8 to -12	mA
On state pulse width	Off voltage = 0V , On voltage = -3V	10	uS
Off state pulse width	On voltage = -5V , Off voltage = -1V	15	uS
J1-Digital Outputs			
On state current	Referenced to +com	10 to 15	mA
On state voltage drop	On state current = 15 mA	0.2 to 0.4	V
Off state voltage	Sustained	5 to 7	V
Off state leakage current	Off state = 5.5V	5 to 20	uA
J2-Analog Inputs			
Input voltage Common-mode	Referenced to AGND	-12 to 50	V
Input voltage differential	Nominal operating	-10 to 10	V
Input impedance	Differential	24	K Ohm
Input impedance	Common mode, referenced to AGND	12	K Ohm
Analog ground current	Maximum AGND to GND	-25 to 25	mA

ACS100 Electrical Ratings, continued

Ratings at Temperatures = 0…50°C, (unless otherwise noted)

Parameter	Conditions	Value	Units
J4-Encoder Inputs			
Input voltage, Max.	Common-mode, referenced to GND	-25 to +25	V
Input voltage, Max.	Differential peak A to A , B to B , Z to Z	-30 to +30	V
Input voltage, differential	RS422 receiver, A to A, B to B, Z to Z operating.	-5 to +5	V
J5-Halls			
Input voltage range	Transient peak	-0.3 to +5.3	V
Low level voltage	Operating	0 to 1.8	V
Low level input current	Internal 1 K pull up to +5V	4 to 5	mA
Input hysteresis		0.2 to 0.5	V
Other			
Thermal resistance	Base plate to ambient	1.24	°C/W
Frame isolation voltage withstand	GND to Frame.	250	V
Operating temperature	powered	0 to +50	°C
Storage temperature	Not powered	-20 to +85	°C
Humidity	Non-condensing	5 to 95	%RH
Weight		0.40 /182	Lb./g

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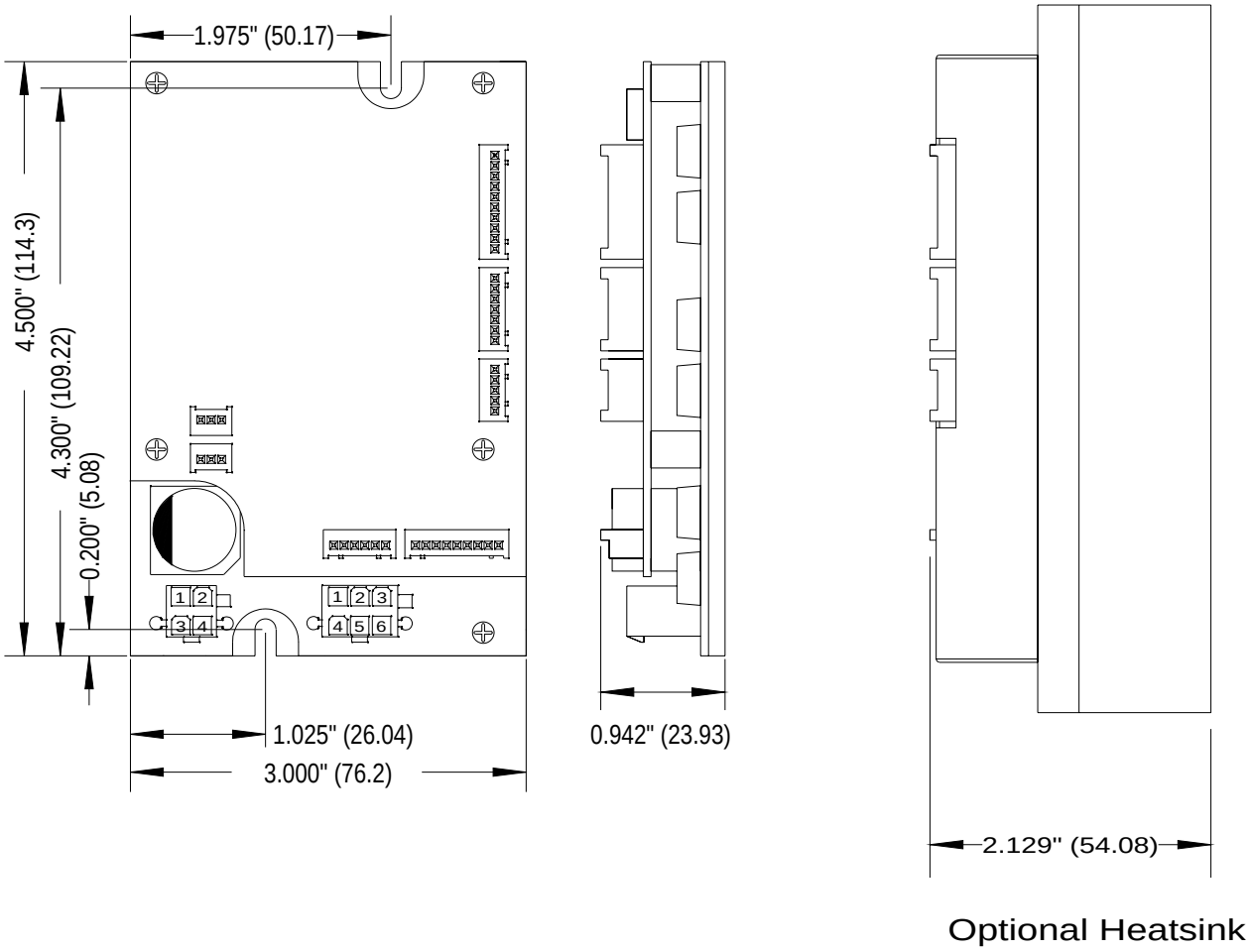
11. ACS100 Dimensional Drawing

Units: in [mm]



Note: For Optional heatsink and or cover please contact the Sales department.

Figure 5: ACS100 Package Outline

12. List of Mating Connectors

Ref.	Connector Name	Manufacturer	P/N	P/N Crimp Pin
J1	User Digital I/O Control	10 Pin Molex Sherlock	35507-1000	50212-8100
J2	User Analog I/O Control	7 Pin Molex Sherlock	35507-0700	50212-8100
J3	RS232 Communications	5 Pin Molex Sherlock	35507-0500	50212-8100
J4	Encoder Interface	9 Pin Molex Sherlock	35507-0900	50212-8100
J5	Hall Interface	6 Pin Molex Sherlock	35507-0600	50212-8100
J6 & J7	CAN Communications	3 Pin Molex Sherlock	35507-0300	50212-8100
P1	DC Input	4 Pin Molex Mini-Fit Jr.	3901-3042	5556 or 44476(HC)
P2	Motor Output	6 Pin Molex Sherlock	3901-2060	5556 or 44476(HC)

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13. ACS100 Interface Circuitry

13.1. J1: Digital I/O

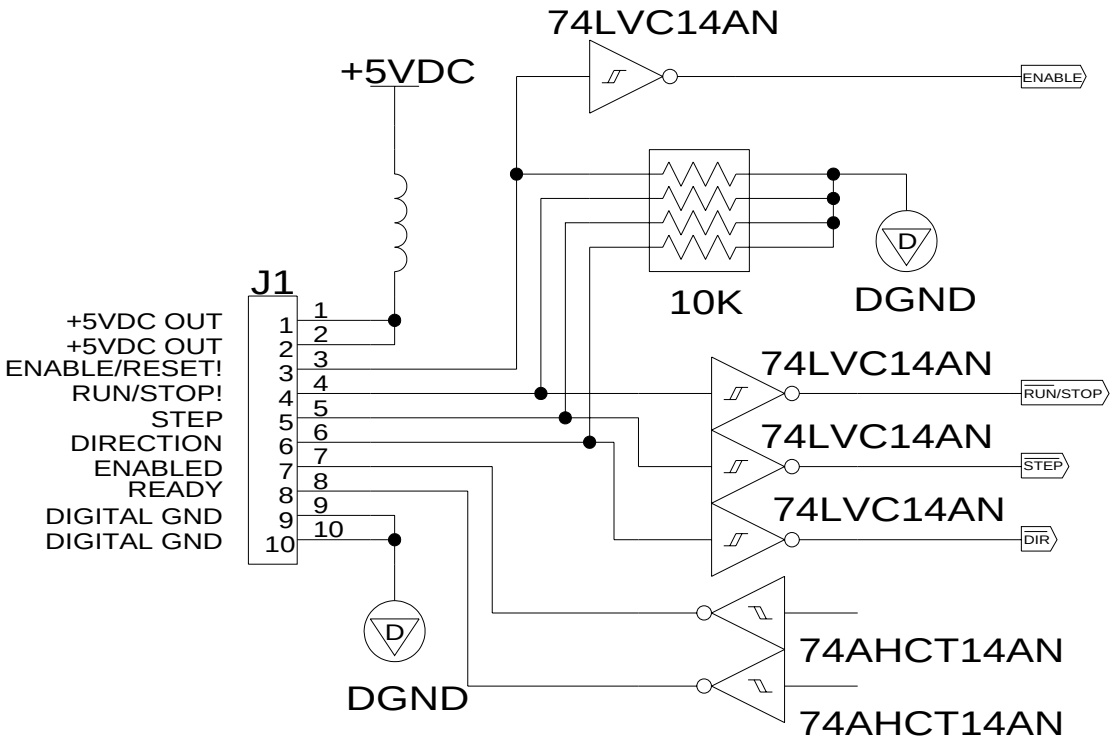

Figure 6: Digital I/O Interface Circuitry

13.2. J2: Analog I/O

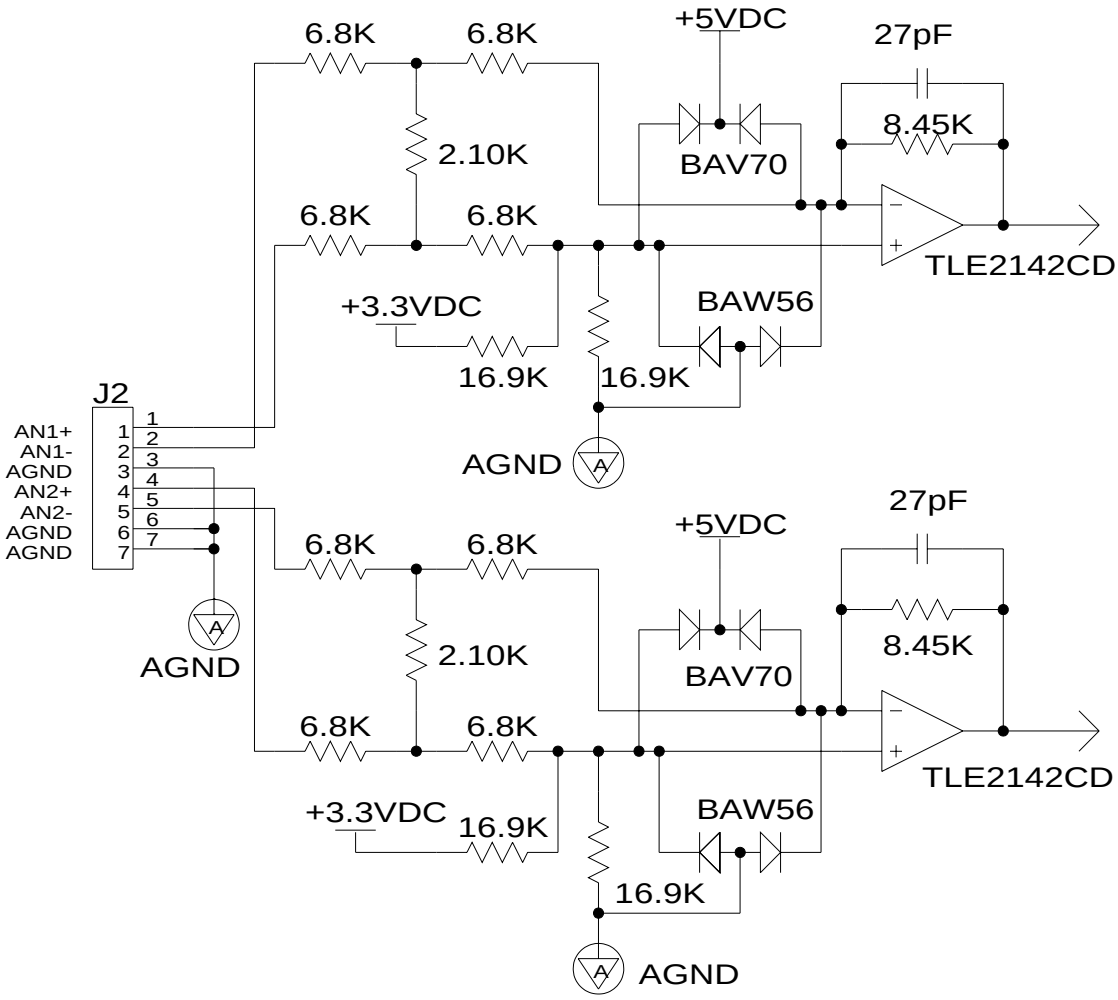

Figure 7: Analog I/O Interface Circuitry

13.3. J3: RS232 Communications Interface

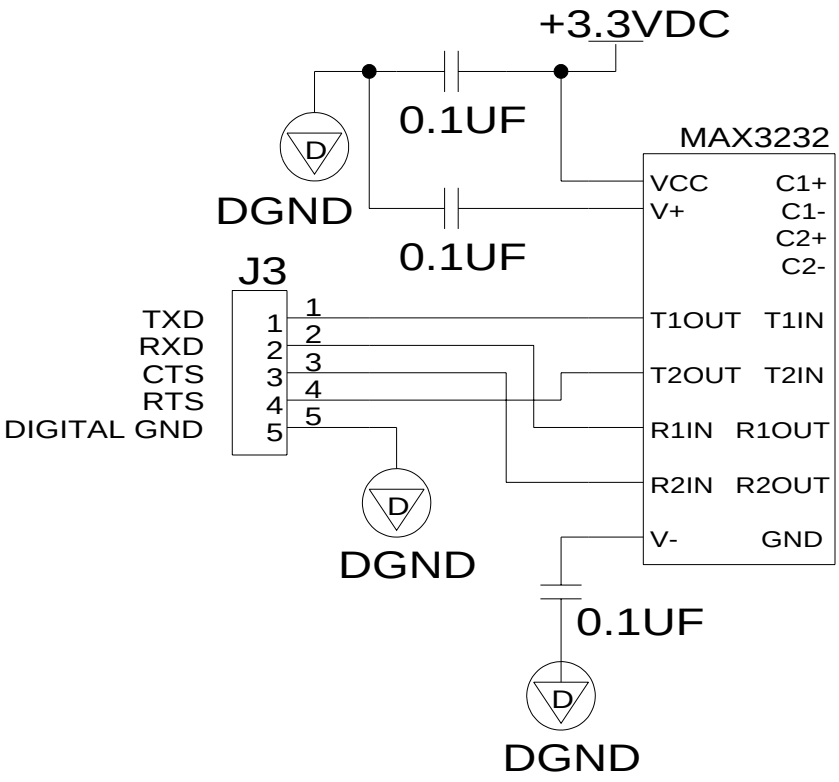

Figure 8: RS232 Communications Interface Circuitry

13.4. J4: Encoder Interface Overview

When using differential encoder feedback A, A!, B, and B!, user may leave Z and Z! unconnected.
If only a single ended encoder feedback A and B is used (and not the A! and B!), then the four jumpers JU1, JU2, JU3 and JU4, which is located on the ACS100 daughter board, must be shorted. You may then leave Z and Z! unconnected.

13.4.1. J4: Encoder Interface

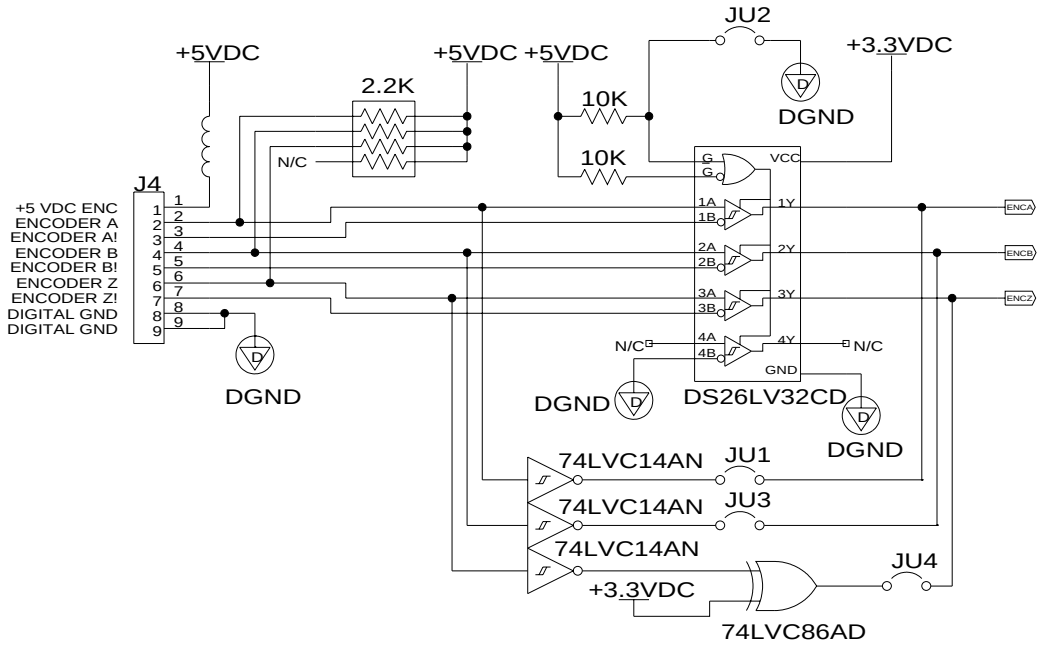

Figure 9: Encoder Interface Circuitry

13.5. J5: Hall Interface Overview

When only Hall based feedback is used and no encoder, leave the encoder connector open.

13.5.1. J5: Hall Interface

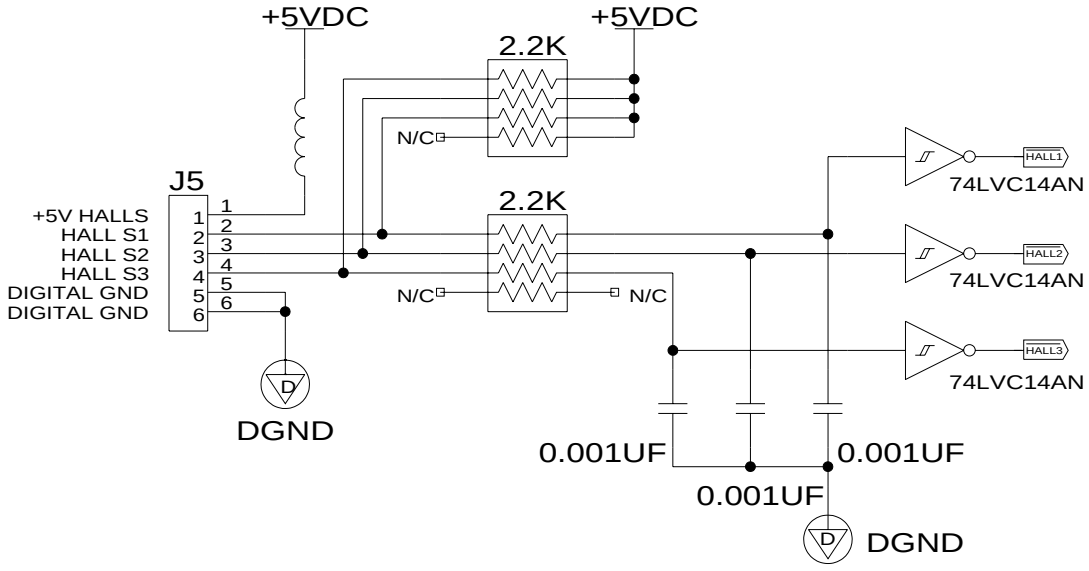

Figure 10: Hall Interface Circuitry

13.6. J6 and J7: CAN Interface

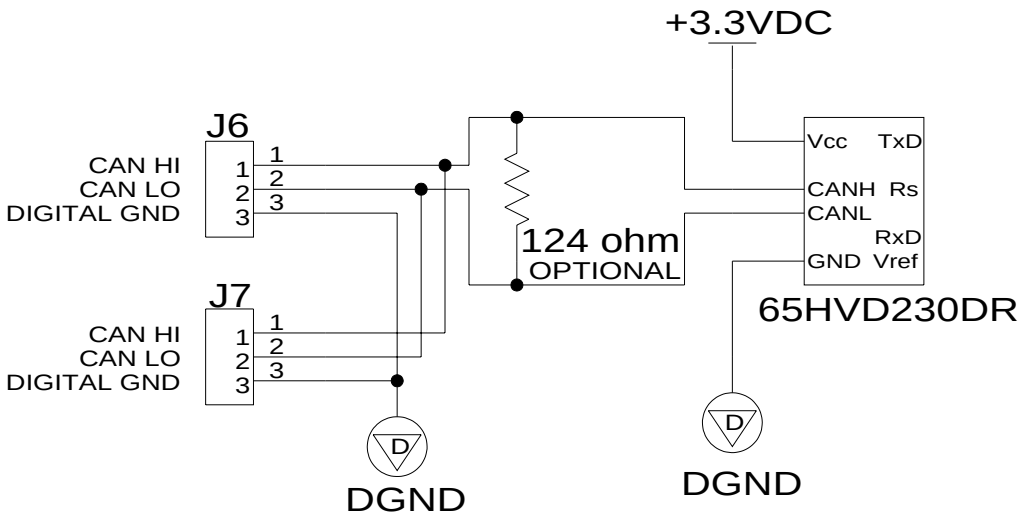

Figure 11: CAN Interface Circuitry

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13.7. Motor Temperature Overview

The **ElectroCraft CompletePower™ Plus** software allows the user to select a PTC or NTC temperature switch.

13.7.1. Motor Temperature Input Circuit

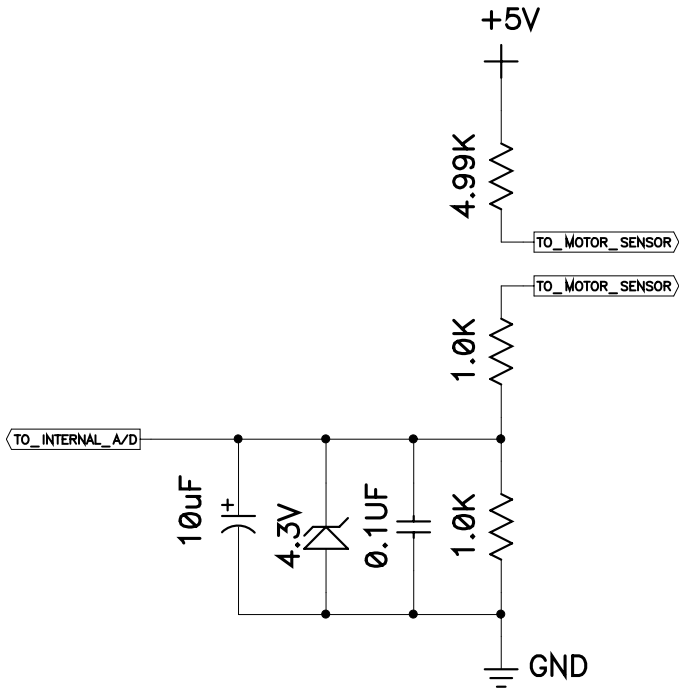


Figure 12: Motor Temperature Input Circuitry

14. External Shunt

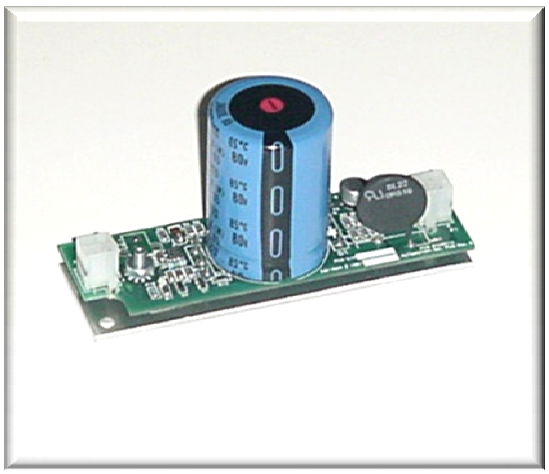


Figure 13: Optional Shunt Assembly

14.1. Use and Selection of the Optional Shunt Assembly

CAUTION!

WHEN THIS PRODUCT USES THE OPTIONAL SHUNT ASSEMBLY, PRECAUTIONS MUST BE FOLLOWED TO PREVENT A POSSIBLE FIRE HAZARD.

Never mount the external shunt where it can make contact with flammable materials, flammable liquid and/or flammable chemicals. Never use the ACS100, either with or without a shunt resistor of any type, in an explosive atmosphere. Never place the shunt resistor in the proximity of flammable materials that could melt or drop upon the shunt resistor body or the ACS100 drive.

THIS PRODUCT USES ELECTRIC POWER AND POSES A SHOCK HAZARD TO THE USER.

Shunt resistors function using high voltage electric power. Avoid physical contact with them whenever the ACS100 has power applied. Shunt resistor(s) can also become extremely hot. Follow the precaution statements, and in conjunction with the manufactures precautions, to help prevent a fire hazard. The electrical terminals of shunt resistors are also a shock hazard. High voltage electricity may be present on these terminals whenever the ACS100 has power applied.

In most applications when heavy dynamic braking and/or regenerative braking are involved, the ACS100 will require an external shunt resistor. To connect such a resistor requires the use of the optional ACS100 Shunt board. See Figure 13 above.

The minimum permissible combined resistance value for the shunt resistor(s) is 4 Ohms. Higher resistance values may be used. The resistor(s) should be rated for high momentary overloads. The External Shunt Board is supplied with a 40 watt / 50 ohm shunt resistor.

When the ACS100 shunt board is used it is wired between the P1 DC Input connector and the DC power source. Please refer to section 6.6.7 for connector wiring.

The optional ACS100 shunt board operates in conjunction with a transistor switch that places the resistor(s) across the DC power rail. Should the transistor ever fail in the ON condition the resistor would remain powered continuously. This could result in the shunt resistor becoming very hot.

The selected wattage rating for the shunt resistor is application dependent. Usually a heavy-duty wire wound resistor will work best. However, not all wire wound resistors are suitable for shunt service. ElectroCraft has found the Ohmite type 250 series works reliably in many shunt applications.

If the user is supplying their own shunt resistor contact ElectroCraft for further application advice. Ask for Field Application Bulletin #101-0195.

14.2. Connecting the Optional Shunt Board

The shunt board is designed to plug directly between the ACS100 and the users power supply.

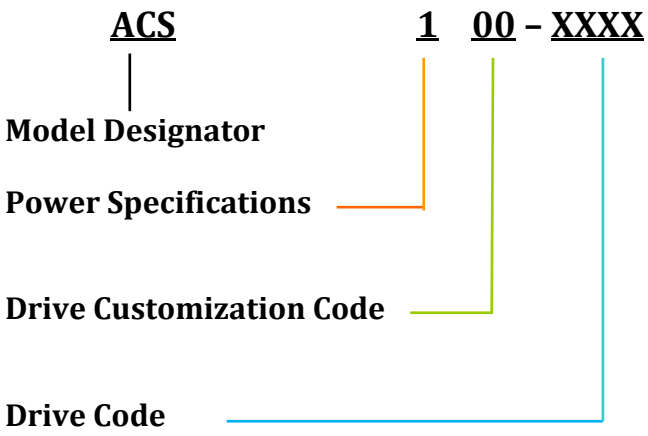
To install, plug a cable (Part No. 1001734) from the power supply directly into P1 on the shunt board. Then plug cable (Part No. 1001730) from P2 of the optional shunt board to P1 of the ACS100. Both P1 and P2 connectors, of the optional shunt board, have the same pin out.

Shunt Board:
P1 - Power input from Power Supply.
P2 - Power output to ACS100.
Pin1: +12v to +48v drive logic supply (pass through connection from P1 to P2).
Pin2: 0 to +48v drive motor supply.
(Blocking diode at P1 isolates all shunt board operations from power supply).
Pin3: Drive logic supply common (pass through connection from P1 to P2).
Pin4: Motor supply common (pass through connection from P1 to P2).

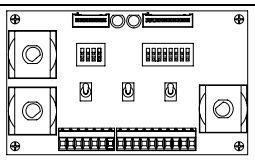
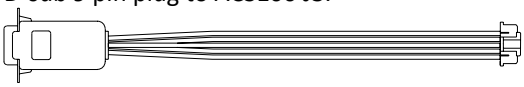
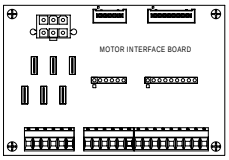
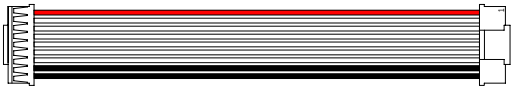
Note: If the ACS100 is setup to operate from a single supply for both logic and motor, only the motor supply (pins 2 and 4) need to be connected.

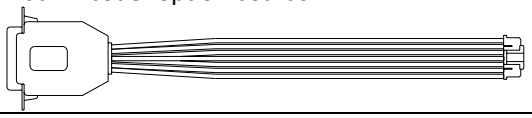
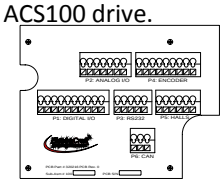
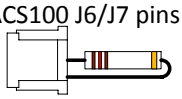
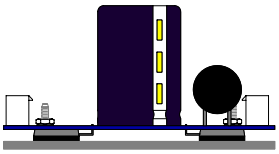
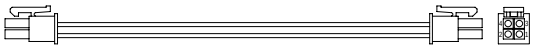
The shunt “turn-on” threshold is approximately 56V and the “turn-off” threshold is approximately 52V. A blocking diode in the shunt board prevents the excess voltage from feeding back to the power supply. As the drive “regenerates”, the shunt board will cycle on and off to dispose of the excess energy through the shunt resistor. Care should be taken to ensure the shunt resistor is not mounted next to any flammable material, as it could get hot.

15. Model Identification



16. Appendix A - Optional Accessories

Name	Length mm (inch)	Description	Part No.	
ACS100/200 Mating connectors and cable Kit	(305mm (12”)	ACS100/200 (7 cable assembly) to wire ends: Loose wires at user end. 	1002115	
Quick-Start I/O Test Board	108 x 65 x 36mm (4.25 x 2.5 x 1.4”) (W x H x D)	Test Board 	1001436	1002999 (set)
Quick Start to ACS100/200 Digital I/O Cable	305mm (12”)	Quick Start Test Board P1 to ACS100 J1. 	1002119	
Quick Start to ACS100/200 Analog I/O Cable	305mm (12”)	Quick Start Test Board P2 to ACS100 J2. 		
RS232 Interface Cable (Interface cable for PC)	356mm (14”)	D-sub 9 pin plug to ACS100 J3. 	1002121	
Motor Interface Test Board	96 x 65 x 21mm (3.8 x 2.5 x 0.83”) (W x H x D	Test Board used to easily wire motor to the ACS100 drive. 	1001732	
Hall Cable	305mm (12”)	Interface board J3 to ACS100 J5. 	1002112	
Encoder Cable	305mm (12”)	Interface board J2 to ACS100 J4. 	1002113	
Motor Phase Cable	356mm (14”)	Interface board J1 to ACS100 P2. 	1002118	
Power Input Cable	356mm (14”)	Interface board J1 to ACS100 P2. 	1002165	

Name	Length inch (mm)	Description	Part No.	
ACS to R/D or Dual Encoder Interface Cable	356mm (14”)	D-sub 15 pin to ACS100 J4. Used with R/D or Dual Encoder option boards. 	1002129	
ACS Connector Board	76.20 x 99.06mm 3.0 x 3.9”	Adapter Board with spring terminals to easily wire perifual devices to the ACS100 drive. 	1001203	
Can Interface – Wire ends	305mm (12”)	Loose wires at user end to ACS100 J6/J7. 	1002159	
CAN Interface – DB9F (Interface cable for PC)	356mm (14”)	D-sub 9 pin Plug to ACS100 J6/J7. 	1002125	
CAN Terminating Resistor	n/a	120 ohm resistor between ACS100 J6/J7 pins 1 and 2. 	1002127	
Shunt Board Assembly	114.3 x 64 x 35.56 mm (4.5 x 2.5 x 1.40”) (W x H x D)	External Shunt Board 	1001193	1002991 (set)
Shunt Board wire harness assemblies	356mm (14”)	Shunt board P2 to ACS100 P1. 	1001730	
	356mm (14”)	Shunt board P1 to user supply: Loose wires at user end. 	1002165	

Note: Custom lengths or applications may be ordered.