## C H A P T E R

## Hardware Reference

The information in this chapter will enable you to:

- Use this chapter as a quick-reference tool for most system specifications (dimensions and performance)
- Use this chapter as a quick-reference tool for DIP switch settings


## Environmental Specifications

## Drive Temperature

$131^{\circ} \mathrm{F}\left(50^{\circ} \mathrm{C}\right)$ measured at the heatsink fins. An internal thermostat will shut down the drive if the unit reaches $158^{\circ} \mathrm{F}\left(70^{\circ} \mathrm{C}\right)$ internally. Current settings in excess of 4 A in high ambient temperature environments (above $113^{\circ} \mathrm{F}\left[45^{\circ} \mathrm{C}\right]$ ) may require fan cooling to keep the heatsink temperature within allowable limits and to keep the drive from shutting itself down due to over temperature.

## Motor Temperature

$212^{\circ} \mathrm{F}\left(100^{\circ} \mathrm{C}\right)$ maximum allowable motor case temperature. Actual temperature rise is duty cycle dependent.

## Electrical Specifications

## Input Power

- 90VAC to 132VAC @ $50 / 60 \mathrm{~Hz}$


## Output Power

- Low power: 0.1 to 6 A per phase at 170 VDC
- High power: 0.2 to 8 A per phase at 170 VDC


## Output Type

- Two phase MOSFET bipolar (H-bridge) switching at 21 kHz (nominal), pulse width modulated


## Fault Output

- Open-collector
- Open emitter
- 4N35
- $\mathrm{V}_{\mathrm{CE}}=35 \mathrm{VDC}$
- $V_{C E S A T}=0.3 \mathrm{VDC}$
- Collector Current $=10 \mathrm{~mA}$ minimum
- Dissipation $=100 \mathrm{~mW}$ maximum


## Minimum Motor Winding Inductance

- 2 mH (Compumotor recommends 5 mH measured in series or parallel)


## Maximum Motor Winding Inductance

- None (Compumotor recommends 50 mH measured in series or parallel)


## Minimum Motor Hipot

- 500 VAC


## Step \& Direction Signal Specification

The inputs are optically isolated and may be driven (activated) by providing a positive pulse to the plus input with respect to the minus input. These inputs may also be differentially driven. The input driver must provide a minimum of 6.5 mA ( 15 mA maximum).

## Step Pulse Input

You must operate the step pulse input within the following guidelines.

- 200 nanosecond-pulse minimum
- $40 \%-60 \%$ duty cycle ( 2 MHz max pulse rate)


## Direction Input

The direction input may change polarity coincident with the last step pulse. The direction input must be stable for at least 2 ms before the drive receives the first pulse.

## Shutdown \& Set Zero Phase Signal Specification

The inputs are optically isolated and may be driven (activated) by providing a positive pulse to the plus input with respect to the minus input. The input driver must provide a minimum of 2.5 mA (30 mA maximum). The maximum reverse voltage for this input is $3 V D C$.

## Shutdown Input (Amplifier Disable)

You may enable this function when the motor is not moving. The input must be active for 100 ms to disable the amplifier. The SHUTDOWN input must be inactive for 100 ms before the first step pulse is received.

## Set Zero Phase Input

This input allows you to reset the motor phase currents to power-up position. It is primarily for linear motor applications. The input must be active for 100 ms to reset the motor phase currents to the zero state. The ZERO PHASE input must be inactive for 100 ms before the first step pulse is received.

## Fault Output

This output is an open-collector, open emitter output from a 4N35 OPTO isolator. The output transistor will conduct when the drive is functioning properly. The transistor will not conduct when any of the following conditions exist:

- No power is applied to the drive
- There is insufficient AC line voltage (90VAC)
- The drive temperature is too high
- The drive detects a motor fault
- The Shutdown input is enabled


## Helpful Hint: Electric Parameters-Outputs

This output has the following characteristics:

- $\mathrm{V}_{\mathrm{CE}}=35 \mathrm{VDC}$
- $\mathrm{V}_{\text {CESAT }}=0.3 \mathrm{VDC}$
- Collector Current $=10 \mathrm{~mA}$ minimum
- Dissipation $=100 \mathrm{~mW}$ maximum


## Operational Specifications

## Accuracy

$\pm 5$ arcminutes typical (unloaded, bidirectional) with Compumotor motors.

## Repeatability

$\pm 5$ arcseconds typical (unloaded, unidirectional).
Hysteresis
Less than 2 arcminutes $\left(0.0334^{\circ}\right)$ unloaded, bidirectional.
Rotor Inertia

| Size 23 | Rotor Inertia oz-in ${ }^{2}$ | Rotor Inertia $\left(\mathrm{Kg}-\mathrm{m}^{2} \times 10-{ }^{6}\right)$ |
| :--- | :--- | :--- |
| S57-51 | 0.546 | 9.998 |
| S57-83 | 1.1 | 20.1 |
| S57-102 | 1.69 | 30.9 |
| Size 34 | Rotor Inertia oz-in ${ }^{2}$ | Rotor Inertia $\left(\mathrm{Kg-m}^{2} \times 10-{ }^{6}\right)$ |
| S83-62 | 3.47 | 63.4 |
| S83-93 | 6.76 | 124 |
| S83-135 | 10.47 | 191 |
| Size 42 | Rotor Inertia oz-in ${ }^{2}$ | Rotor Inertia $\mathrm{Kg-cm}^{2}$ |
| S106-178 | 44.0 | 8.05 |
| S106-205 | 52.0 | 9.51 |
| S106-250 | 63.0 | 12.14 |
| Rotor Inertia (Compumotor Motors) |  |  |

## Motor Current \& Torque

Speed/torque curves for the $S$ Drive are provided later in this chapter.

| Motor Size | Current | Static Torque (in-oz) |
| :--- | ---: | :---: |
| S57-51 S | 1.18 | 65 |
| S57-51 P | 2.28 | 65 |
| S57-83 S | 1.52 | 100 |
| S57-83 P | 3.09 | 100 |
| S57-102 S | 1.71 | 130 |
| S57-102 P | 3.49 | 130 |
| S83-62 S | 2.19 | 150 |
| S83-62 P | 4.42 | 150 |
| S83-93 S | 2.85 | 290 |
| S83-93 P | 5.62 | 290 |
| S83-135 S | 3.47 | 400 |
| S83-135 P | 6.00 | 343 |

Motor Specifications (S6)

| Motor Size | Current | Static Torque (in-oz) |
| :--- | ---: | :---: |
| S106-178 S | 6.02 | 1000 |
| S106-178 P | 8.0 | 667 |
| S106-205 S | 3.55 | 1900 |
| S106-205 P | 6.99 | 1900 |
| S106-250 S | 6.02 | 1450 |
| S106-250 P | 8.0 | 967 |

S: Series Configuration P: Parallel Configuration
Motor Specifications (S8)

## Drive Dimensions



S Drive Dimensions
The fan kit is optional with the low-power version of the S Drive.

## Motor Dimensions



View B

Size 23 frame

| Model | A |
| :---: | :---: |
| S 57-51 | $2.0(5.1)$ |
| S 57-83 | 3.1 (7.8) |
| S 57-102 | $4.0(10.2)$ |

NEMA 23 Motor Dimensions



S106-205


S106-205 Motor Dimensions

## DIP Switch Summary

The S Drive has two sets of DIP switches (refer to Chapter (3). Each set of DIP switches has eight individual switches. The first set of switches is referred to as SW1 and the second set as SW2. The individual switch will be preceded by the \# symbol. Hence, the third switch on SW1 is referred to as SW1-\#3, while the third switch on SW2 is referred to as sw2-\#3.

| Switch \# | Function |
| :---: | :---: |
| SW1-\#1 | Current-most significant bit |
| SW1-\#2 | Current |
| SW1-\#3 | Current |
| SW1-\#4 | Current |
| SW1-\#5 | Current |
| SW1-\#6 | Current-least significant bit |
| SW1-\#7 | Auto Standby |
| SW1-\#8 | Auto Standby |
| SW2-\#1 | Motor Resolution |
| SW2-\#2 | Motor Resolution |
| SW2-\#3 | Motor Resolution |
| SW2-\#4 | Motor Resolution |
| SW2-\#5 | Waveform |
| SW2-\#6 | Waveform |
| SW2-\#7 | Waveform |
| SW2-\#8 | Auto Test $=$ on, Normal operation $=$ off |
| DIP Switch Summary |  |

## Motor Current

| Motor Size | Current | SW1-\#1 | SW1-\#2 | SW1-\#3 | SW1-\# 4 | SW1-\#5 | SW1-\#6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S57-51S | 1.18 | off | off | on | on | off | off |
| S57-51P | 2.28 | off | on | on | off | off | off |
| S57-83S | 1.52 | off | on | off | off | off | off |
| S57-83P | 3.09 | on | off | off | off | off | off |
| S57-102S | 1.71 | off | on | off | off | on | off |
| S57-102P | 3.47 | on | off | off | on | off | off |
| S83-62S | 2.19 | off | on | off | on | on | on |
| S83-62P | 4.42 | on | off | on | on | on | off |
| S83-93S | 2.85 | off | on | on | on | on | off |
| S83-93P | 5.62 | on | on | on | off | on | on |
| S83-135S | 3.47 | on | off | off | on | off | off |
| S83-135P | 6.00 | on | on | on | on | on | on |
| S: Series Configuration P: Parallel Configuration |  |  |  |  |  |  |  |

S6 Drive Motor Current (Compumotor Motors)

| Motor Size | Current | SW1-\#1 | SW1-\#2 | SW1-\#3 | SW1-\#4 | SW1-\#5 | SW1-\# 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S106-178S | 6.02 | on | off | on | on | on | on |
| S106-178P | 8.0 | on | on | on | on | on | on |
| S106-205S | 3.55 | off | on | on | on | off | off |
| S106-205P | 6.99 | on | on | off | on | on | on |
| S106-250S | 6.23 | on | on | off | off | off | on |
| S106-250P | 8.0 | on | on | on | on | on | on |
| S: Series Configuration P: Parallel Configuration |  |  |  |  |  |  |  |

Low-Power S6 Drive

| Current | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | Current | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.04 | off | off | off | off | off | off | 3.09 | on | off | off | off | off | off |
| 0.13 | off | off | off | off | off | on | 3.19 | on | off | off | off | off | on |
| 0.23 | off | off | off | off | on | off | 3.28 | on | off | off | off | on | off |
| 0.32 | off | off | off | off | on | on | 3.38 | on | off | off | off | on | on |
| 0.42 | off | off | off | on | off | off | 3.47 | on | off | off | on | off | off |
| 0.51 | off | off | off | on | off | on | 3.57 | on | off | off | on | off | on |
| 0.61 | off | off | off | on | on | off | 3.66 | on | off | off | on | on | off |
| 0.70 | off | off | off | on | on | on | 3.76 | on | off | off | on | on | on |
| 0.80 | off | off | on | off | off | off | 3.85 | on | off | on | off | off | off |
| 0.89 | off | off | on | off | off | on | 3.95 | on | off | on | off | off | on |
| 0.99 | off | off | on | off | on | off | 4.04 | on | off | on | off | on | off |
| 1.08 | off | off | on | off | on | on | 4.14 | on | off | on | off | on | on |
| 1.18 | off | off | on | on | off | off | 4.23 | on | off | on | on | off | off |
| 1.27 | off | off | on | on | off | on | 4.33 | on | off | on | on | off | on |
| 1.37 | off | off | on | on | on | off | 4.42 | on | off | on | on | on | off |
| 1.46 | off | off | on | on | on | on | 4.51 | on | off | on | on | on | on |
| 1.52 | off | on | off | off | off | off | 4.58 | on | on | off | off | off | off |
| 1.62 | off | on | off | off | off | on | 4.68 | on | on | off | off | off | on |
| 1.71 | off | on | off | off | on | off | 4.77 | on | on | off | off | on | off |
| 1.81 | off | on | off | off | on | on | 4.86 | on | on | off | off | on | on |
| 1.90 | off | on | off | on | off | off | 4.96 | on | on | off | on | off | off |
| 2.00 | off | on | off | on | off | on | 5.05 | on | on | off | on | off | on |
| 2.09 | off | on | off | on | on | off | 5.15 | on | on | off | on | on | off |
| 2.19 | off | on | off | on | on | on | 5.24 | on | on | off | on | on | on |
| 2.28 | off | on | on | off | off | off | 5.34 | on | on | on | off | off | off |
| 2.38 | off | on | on | off | off | on | 5.43 | on | on | on | off | off | on |
| 2.47 | off | on | on | off | on | off | 5.53 | on | on | on | off | on | off |
| 2.57 | off | on | on | off | on | on | 5.62 | on | on | on | off | on | on |
| 2.66 | off | on | on | on | off | off | 5.72 | on | on | on | on | off | off |
| 2.76 | off | on | on | on | off | on | 5.81 | on | on | on | on | off | on |
| 2.85 | off | on | on | on | on | off | 5.91 | on | on | on | on | on | off |
| 2.95 | off | on | on | on | on | on | 6.00 | on | on | on | on | on | on |

High-Power S8 Drive

| Current | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | Current | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.05 | off | off | off | off | off | off | 4.12 | on | off | off | off | off | off |
| 0.18 | off | off | off | off | off | on | 4.25 | on | off | off | off | off | on |
| 0.30 | off | off | off | off | on | off | 4.38 | on | off | off | off | on | off |
| 0.43 | off | off | off | off | on | on | 4.50 | on | off | off | off | on | on |
| 0.56 | off | off | off | on | off | off | 4.63 | on | off | off | on | off | off |
| 0.69 | off | off | off | on | off | on | 4.75 | on | off | off | on | off | on |
| 0.81 | off | off | off | on | on | off | 4.89 | on | off | off | on | on | off |
| 0.93 | off | off | off | on | on | on | 5.01 | on | off | off | on | on | on |
| 1.06 | off | off | on | off | off | off | 5.14 | on | off | on | off | off | off |
| 1.19 | off | off | on | off | off | on | 5.26 | on | off | on | off | off | on |
| 1.31 | off | off | on | off | on | off | 5.39 | on | off | on | off | on | off |
| 1.44 | off | off | on | off | on | on | 5.51 | on | off | on | off | on | on |
| 1.59 | off | off | on | on | off | off | 5.64 | on | off | on | on | off | off |
| 1.69 | off | off | on | on | off | on | 5.77 | on | off | on | on | off | on |
| 1.82 | off | off | on | on | on | off | 5.90 | on | off | on | on | on | off |
| 1.94 | off | off | on | on | on | on | 6.02 | on | off | on | on | on | on |
| 2.03 | off | on | off | off | off | off | 6.11 | on | on | off | off | off | off |
| 2.16 | off | on | off | off | off | on | 6.23 | on | on | off | off | off | on |
| 2.28 | off | on | off | off | on | off | 6.36 | on | on | off | off | on | off |
| 2.41 | off | on | off | off | on | on | 6.48 | on | on | off | off | on | on |
| 2.54 | off | on | off | on | off | off | 6.61 | on | on | off | on | off | off |
| 2.66 | off | on | off | on | off | on | 6.73 | on | on | off | on | off | on |
| 2.79 | off | on | off | on | on | off | 6.87 | on | on | off | on | on | off |
| 2.91 | off | on | off | on | on | on | 6.99 | on | on | off | on | on | on |
| 3.04 | off | on | on | off | off | off | 7.12 | on | on | on | off | off | off |
| 3.17 | off | on | on | off | off | on | 7.24 | on | on | on | off | off | on |
| 3.297 | off | on | on | off | on | off | 7.37 | on | on | on | off | on | off |
| 3.42 | off | on | on | off | on | on | 7.49 | on | on | on | off | on | on |
| 3.55 | off | on | on | on | off | off | 7.62 | on | on | on | on | off | off |
| 3.67 | off | on | on | on | off | on | 7.75 | on | on | on | on | off | on |
| 3.80 | off | on | on | on | on | off | 7.87 | on | on | on | on | on | off |
| 3.93 | off | on | on | on | on | on | 8.00 | on | on | on | on | on | on |

Setting S8 Drive Motor Current (Non-Compumotor Motors)

## Automatic Standby Function

| Current | SW1-\#7 | SW1-\#8 |  |
| :--- | :--- | :--- | :--- |
| ${ }^{*}$ | Full Current | off | off |
| $75 \%$ |  | on | off |
| $50 \%$ | off | on |  |
| $25 \%$ | on | on |  |

* Default Setting

Automatic Standby Function

## Motor Resolutions

| Resolution | SW2-\#1 | SW2-\#2 | SW2-\#3 | SW2-\#4 |
| :---: | :---: | :---: | :---: | :---: |
| 50,800 steps | off | off | off | on |
| 50,000 steps | off | off | on | off |
| 36,000 steps | off | off | on | on |
| 25,600 steps | off | on | off | off |
| 25,400 steps | off | on | off | on |
| * 25,000 steps | off | off | off | off |
| 21,600 steps | off | on | on | off |
| 20,000 steps | off | on | on | on |
| 18,000 steps | on | off | off | off |
| 12,800 steps | on | off | off | on |
| 10,000 steps | on | off | on | off |
| 5,000 steps | on | off | on | on |
| 2,000 steps | on | on | off | off |
| 1,000 steps | on | on | off | on |
| 400 steps | on | on | on | off |
| 200 steps | on | on | on | on |
| * Default Setting |  |  |  |  |
| Motor Resolution S |  |  |  |  |

## Motor Waveforms

| Waveform Shape | SW2-\#5 | SW2-\#6 | SW2-\#7 |
| :---: | :---: | :---: | :---: |
| Pure Sine | on | on | off |
| -2\% 3rd harmonic | on | off | on |
| * -4\% 3rd harmonic | off | off | off |
| -4\% 3rd harmonic | on | on | on |
| -4\% 3rd harmonic | On | off | off |
| -6\% 3rd harmonic | off | on | on |
| -8\% 3rd harmonic | off | on | off |
| -10\% 3rd harmonic | off | off | on |
| fault Setting |  |  |  |
| otor Waveform Settings |  |  |  |

## Automatic Test Function

| • SW2-\#8 OFF Disables Auto Test |
| :---: |
| SW2-\#8 ON Enables Auto Test |

* Default Setting


## Motor Performance Specifications

S Series motors are designed to allow you to change the motor winding configuration easily. The following performance indicate that different performance levels can be obtained by connecting the step motor windings in series or parallel. Use caution when you run motors in a parallel configuration. Sustained operation at high speeds may cause the motor to overheat due to electrical pole heating.









S106-205, SX106-205

*Parallel connected motors are limited to 50\% duty cycle when operated above 5 rps .
For greater than $50 \%$ duty cycle above 5 rps , you must connect the motor in series.
Fan cooling the motor will increase duty cycles above 5 rps .

