

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Parker / Digiplan HD130* at our website: ***Click HERE***

HD65 & HD130 Stepper Drives User Guide

For engineering assistance in Europe:
Parker Hannifin plc
Digiplan Division
21 Balena Close
Poole, Dorset
England, BH17 7DX
Telephone: 0202-699000
Fax: 0202-695750

For engineering assistance in the U.S.:
Parker Hannifin Corporation
Digiplan Division
5500 Business Park Drive
Rohnert Park, CA 94928
USA
Telephone: (800) 358-9070
Fax: (707) 584-8015

Part No: 1600.051.07 7th September 1992

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

IMPORTANT INFORMATION FOR USERS

Installation and Operation of Digiplan Equipment

It is important that Digiplan motion control equipment is installed and operated in such a way that all applicable safety requirements are met. It is your responsibility as a user to ensure that you identify the relevant safety standards and comply with them; failure to do so may result in damage to equipment and personal injury. In particular, you should study the contents of this user guide carefully before installing or operating the equipment.

Under no circumstances will the suppliers of the equipment be liable for any incidental, consequential or special damages of any kind whatsoever, including but not limited to lost profits arising from or in any way connected with the use of the equipment or this user guide.



SAFETY WARNING

High-performance motion control equipment is capable of producing rapid movement and very high forces. Unexpected motion may occur especially during the development of controller programs. **KEEP WELL CLEAR** of any machinery driven by stepper or servo motors. Never touch it while it is in operation.

High voltages exist within enclosed units, on rack system backplanes (motherboards) and on transformer terminals. Keep clear of these areas when power is applied to the equipment.

The information in this user guide, including any apparatus, methods, techniques, and concepts described herein, are the proprietary property of Parker Digiplan or its licensors, and may not be copied, disclosed, or used for any purpose not expressly authorised by the owner thereof.

Since Digiplan constantly strives to improve all of its products, we reserve the right to modify equipment and user guides without prior notice. No part of this user guide may be reproduced in any form without the prior consent of Digiplan.

© Digiplan Division of Parker Hannifin plc, 1991
– All Rights Reserved –

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

User Guide Change Summary

The following is a summary of the primary changes to this user guide since the last version was released. This user guide, version 1600.051.07, supersedes version 1600.051.06.

This user guide has been updated to incorporate the style common to our user guides. Some drawings have also been updated. All technical information remains unchanged.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table of Contents

Introduction 1
Product Description 1
Specification 1
Power Connections 2
Motor Connections 2
General Wiring & Earthing Recommendations 2
Transformer Primary Connections 5
Control Signals 8
Setting Up the Drive 10
Motherboard Link 10
Current Programming 11
Stepping Mode Selection 11
Standby Current 12
Boost Current 12
Anti-resonance Dropout Speed 12
Current Profile Setting (Half-step Mode) 13
Fuses 14
Test Points 14
MS20 Microstep Card 15
Description 15
Setting Up the Microstep Card 16
Operation of the Drive Protection Systems 17
Overload Protection 17
Supply Failure Protection 17
Overtemperature Protection 17
Fault-finding Guide 19
Returning the System 20

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction

Product Description

The HD65 and HD130 stepper drives are bipolar, chopper-regulated units designed to operate with a wide range of motors. They incorporate all power supply components for direct operation from a mains transformer. The two drives deliver nominal motor currents of 6.5A and 13A respectively, and both operate at a motor supply of 240V DC.

All translation and current control functions are performed by a ULA-hybrid translator, and this incorporates a number of useful features including an anti-resonance circuit and automatic current square-off. The drives can be fitted with the optional MS20 microstep card which gives 1000 or 2000 steps/rev from a standard 200-step motor.

Specification

Nominal output current (2 phase on)	6.5A (HD65), 13A (HD130)
Motor supply voltage	240v DC
Current boost	30%
Maximum boost duration	5 seconds (internally limited)
Nominal standby reduction	50% (at rated current)
Current programming	By DIL switch down to 50% of rated current
Current programming steps	0.5A (HD65), 1A (HD130)
Maximum stepping rates	Full step 20kHz Half step 50kHz 1/5 step 100kHz 1/10 step 100kHz
AC power requirements	Motor supply range 86-172v AC at 7A (HD65), 14A (HD130). Logic supply 18-0-18 at 850mA. Fan supply (HD130) 115v RMS at 150mA.
Auxiliary DC output	+24v at 250mA (500mA with external 2200uF capacitor added)
Input logic levels	Logic 1 level +11v to +13v or open circuit. Logic 0 level <+1v or short circuit to 0v
Input impedance	Clock input 1K to +12v Other inputs 4K7 to +12v
Logic outputs	Open-collector NPN, +30v max. (off), 15mA max. (on)
Operating temperature range	0° - 50°C
Maximum heatsink temperature	85°C
Suitable motor type	2/4 phase; 4, 6 or 8-lead (5-lead not suitable)
Typical motor current rating (bipolar)	6A - 9A (HD65) 12A - 18A (HD130)
Minimum motor inductance	1.5mH (HD65) 0.75mH (HD130)
Weights	3.2kg (HD65) 4kg (HD130)
Dimensions (mm	Height overall 262, pcb only 233, Depth overall 262, pcb only 220 Width 106 (4.2" nominal)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Connections

Power and motor connections are made to the drive motherboard as illustrated in Figure 1. Screw terminals are provided on the motherboard for the AC input from the mains transformer. Suitable transformers for the HD drives are type TO132 for a single HD65 and type TO124 for two HD65 drives or a single HD130. Refer to page 5 for the primary connections for various AC supply voltages.

Connect the 172-volt winding to terminals L1 and L2 on TB1. Connect one 172-volt secondary to each drive when using a TO124 to power two HD65 drives, and connect the two 172-volt windings in parallel when operating an HD130 (see diagrams on page 4). If a three-phase transformer is used, the line-to-line voltage must be 172 volts and connections are made to terminals L1, L2 and L3.

The HD130 requires 115 volts AC to operate its cooling fan and these connections are made to the "FAN" terminals on TB1. If required this supply can come directly from 115v AC mains. The fan connections are commoned together on a multi-axis rack.

The logic supply requires 18-0-18v AC and this supply is connected to terminals 9, 10 and 11 respectively on socket SK1. The logic supply connections are also commoned together on a multi-axis rack.

Motor Connections

Motor connections are made to screw terminals on TB2. Refer to pages 6 and 7 for motor connection details, and ensure that the connections are made correctly. 1.5mm2 cable is recommended. To reverse the direction of rotation relative to the direction control input, interchange the connections to 1A and 1B.

General Wiring & Earthing Recommenda -tions

It is advisable to use a central earth stud mounted on the rack end plate or close to it. Mains earth, the transformer screen, the rack 0v bus and the enclosure metalwork should all be connected to this stud. In particular, the connection to the rack 0v bus should use 1mm^2 cable and should be kept as short as possible.

Input/output signal connections longer than about 500mm should use wires having a collective or individual screen. In general it is better to route signal connections separately from power and motor connections. If the motor leads run in the same trunking as signal leads, then either the motor or signal leads should be screened. Connect the screen to the earth stud at one end, and insulate it at the remote end.

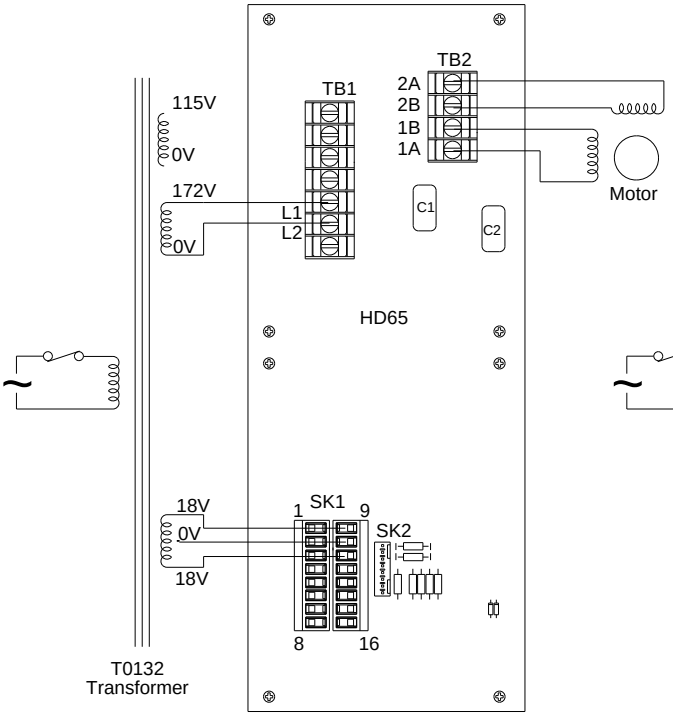
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Where signal connections pass between units mounted in different enclosures and separately energised from the mains, optical isolation of all communication lines is recommended. It is still desirable that all such isolated systems have their 0v rails directly connected to earth.

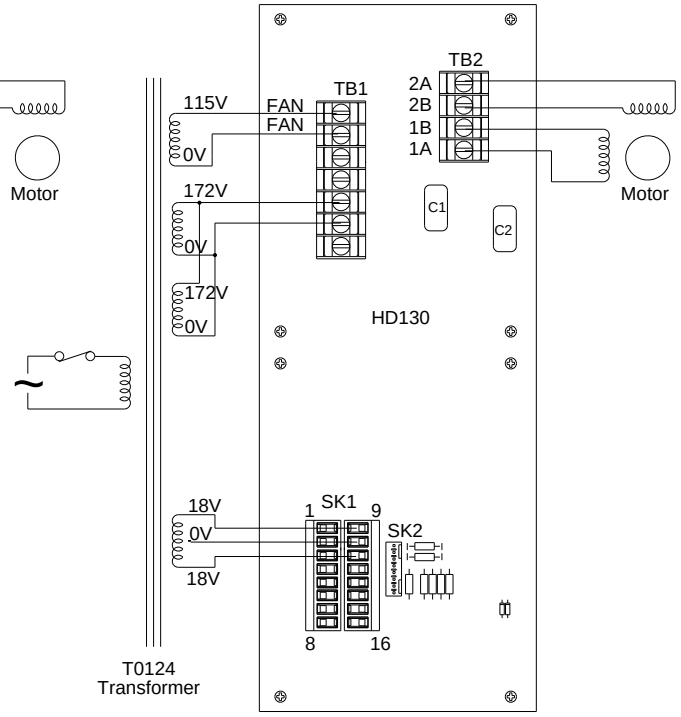
Motor leads should be collectively screened if they run close to power switching lines, particularly those driving unsuppressed inductive loads. Whilst noise picked up on the motor leads is unlikely to affect the motor directly, the noise gets coupled back into the drive system and can cause problems as a result.

Contactors and relays feeding inductive loads should be adequately suppressed.

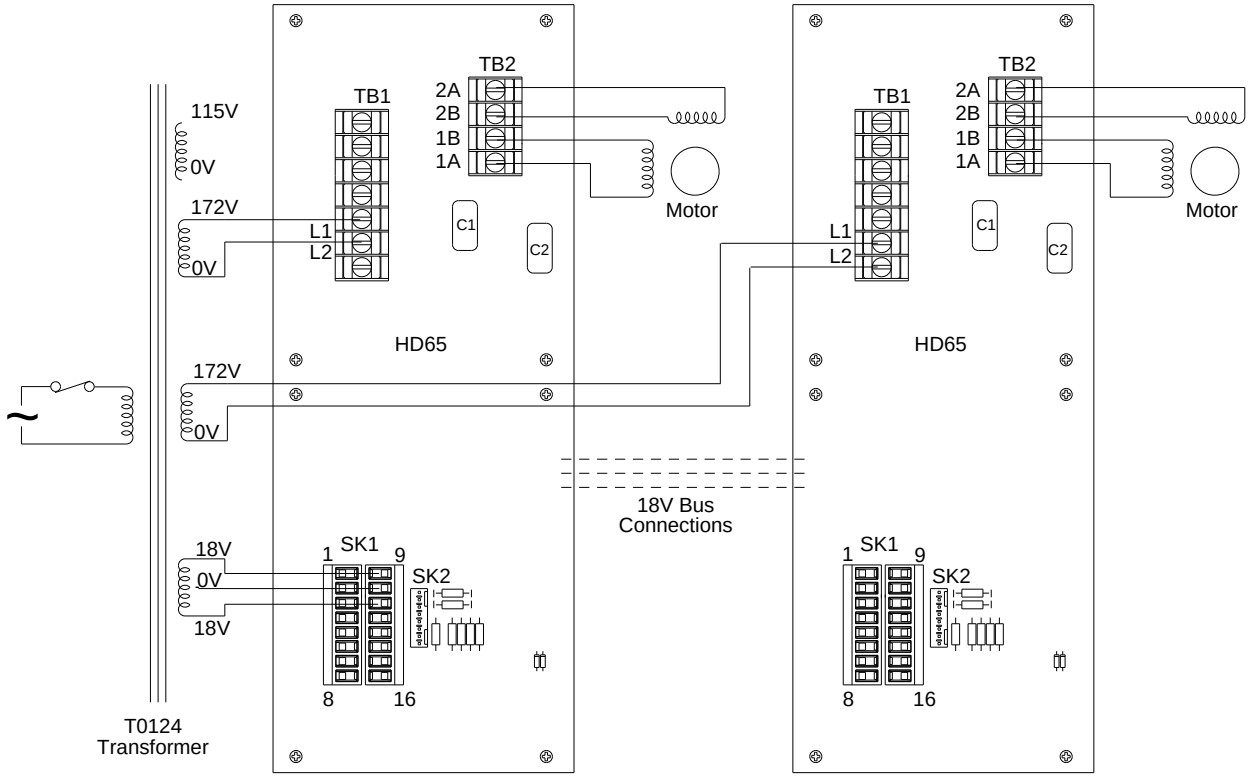
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Connections for Single HD65 Drive



Connections for Single HD130 Drive



Connections for Two HD65 Drives

Figure 1. Power and Motor Connections

Transformer Primary Connections

Standard Digiplan mains transformers for HD series drives have a four-winding primary arrangement as shown below. The table shows the primary voltages which can be selected, the sample connections being for 240v AC. Always wire the transformer primary first, then check the secondary output voltages on open-circuit BEFORE connecting to the drive.

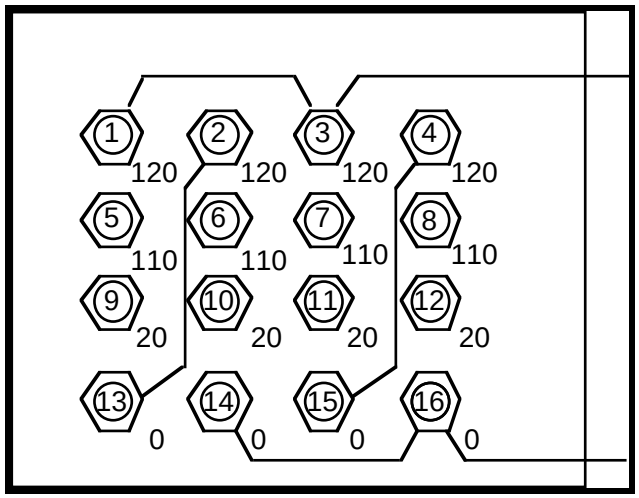


Figure 2. Transformer Primary Windings

Input Voltage	AC Line 1	AC Line 2	Links
100	1	9	1, 2, 3 & 4; 9, 10, 11 & 12
110	5	13	5, 6, 7 & 8; 13, 14,15 & 16
120	1	13	1, 2, 3 & 4; 13, 14,15 & 16
200	1	10	9 & 2; 11 & 4; 1 & 3;10 & 12
220	5	14	13 & 6; 15 & 8; 5 & 7; 14 & 16
230	1	14	1 & 3; 13 & 6; 15 & 8; 14 & 16
240	1	14	1 & 3; 13 & 2; 15 & 4; 14 & 16
360	5	12	9 & 6; 10 & 7; 11 & 8
380	5	16	9 & 6; 10 & 7; 11 & 8
400	1	12	9 & 2; 10 & 3; 11 & 4
420	1	16	9 & 2; 10 & 3; 11 & 4
440	5	16	13 & 6; 14 & 7; 15 & 8
460	5	16	13 & 6; 14 & 3; 15 & 4
480	1	16	13 & 2; 14 & 3; 15 & 4

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOTOR CONNECTION DATA - WINDINGS IN SERIES

N.C. - no connection.

MAKE	TYPE	1A	1B	2A	2B	NOTES
Evershed & Vignoles	6-lead	Red	Green	Blue	Yellow	Brown & Black N.C.
	8-lead	Red	Green	Blue	Yellow	Link Grey & Pink, link White & Violet
	T.box	1	3	4	2	Link 5 & 6, link 7 & 8
Sigma	6-lead	Black	Orange	Red	Yellow	White/Blk/Org, White/Red/Yel N.C.
	8-lead	Black	Orange	Red	Yellow	Link Wh/Blk & Wh/Org Link Wh/Red & Wh/Yel
	T.box	1	3	2	4	Link 5 & 6,link 7 & 8
Astrosyn, Rapidsyn, Slo-syn	6-lead	Red	Red/Wh	Grn	Grn/Wh	White & Black N.C.
	T.box (x6)	1	3	4	5	2 & 6 N.C.
Slo-syn	8-lead	Red	Red/Wh	Grn	Grn/Wh	Link Black & White, link Org & Blk/Wh
	T.box (x8)	1	3	5	4	Link 2 & 6, link 7 & 8
Stebon	8-lead	Red	Yel	Pink	Blk	Link Blue & violet, link White & Grey
	T.box	1	2	3	4	Link 5 & 6, link 7 & 8
G.E.C.	T.box	1	2	3	4	Link 5 & 6, link 7 & 8
M.A.E.	6-lead	Grn/Wh	Grn	Red	Red/Wh	White & Black N.C.
	8-lead	Black	Orange	Red	Yellow	Link Wh/Blk & Wh/Org, Link Wh/Red & Wh/Yel
	T.box	6	5	8	7	Link 1 & 3, link 2 & 4
Zebotronics	T.box	1	4	5	8	Link 2 & 3, link 6 & 7
Oriental	6-lead	Black	Green	Red	Blue	Yellow & White N.C.
Sonceboz	8-lead	Green	Grn/Wh	Red	Red/Wh	Link Org & Blk/Wh, link Black & White
Japan Servo	6-lead	Red	Blue	Green	Yellow	2 x White N.C.
Escap	8-lead	Brown	Org/Wh	Red	Yel/Wh	Link Brn/Wh & Org, Link Red/Wh & Yellow.
Bodine	8-lead	Brown	Orange	Yellow	Red	Link Wh/Brn & Wh/Org, link Wh/Yel & Wh/Red.
	T.box	1	3	4	2	Link 5 & 7,link 6 & 8
Digiplan/Compumotor RM Motor	8-lead	Black	Orange	Red	Yellow	LinkWh/Blk & Wh/Org. Link Wh/Red & Wh/Yel
Digiplan/Compumotor QM Motor	8-lead	Red	Black	White	Green	Link Yel & Blue Link Org & Brown

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOTOR CONNECTION DATA - WINDINGS IN PARALLEL

For 6-lead motors, connections shown are for one half-winding.
N.C. - no connection.

MAKE	TYPE	1A	1B	2A	2B	NOTES
Evershed & Vignoles	6-lead	Red	Brown	Blue	Black	Grn & Yellow N.C.
	8-lead	Rd & Pink	Grn & Grey	Blue & Violet	Yel & White	
	T.box	1 & 6	3 & 5	4 & 8	2 & 7	
Sigma	6-lead	Black	Wh/Blk/ Orange	Red	Wh/Red/ Yellow	Or & Yellow N.C.
	8-lead	Black & Wh/Or	Or & Wh/Blk	Red/ Wh/Yel	Yel & Wh/Red	
	T.box	1 & 5	3 & 6	2 & 7	4 & 8	
Astrosyn, Rapidsyn, Slo-syn	6-lead	Red	Black	Green	White	Red/Wh & Grn/Wh N.C.
	T.box(x6)	1	6	4	2	3 & 5 N.C.
Slo-syn	8-lead	Red & White	Blk & Red/Wh	Grn & Blk/Wh	Org & Grn/Wh	
	T.box(x8)	1 & 2	3 & 6	4 & 7	5 & 8	
Stebon	8-lead	Rd & Blue	Yel & Violet	Wh & Pink	Black & Grey	
	T.box	1 & 6	2 & 5	3 & 8	4 & 7	
G.E.C.	T.box	1 & 6	2 & 5	3 & 8	4 & 7	
M.A.E.	6-lead	Grn/Wh	White	Red	Black	Grn & Red N.C
	8-lead	Black & Wh/Or	Or & Wh/Blk	Red & Wh/Yel	Yel & Wh/Red	
	T.box	3 & 6	1 & 5	4 & 8	2 & 7	
Zebotronics	T.box	1 & 2	3 & 4	5 & 6	7 & 8	
Oriental	6-lead	Black	Yellow	Red	White	Grn & Blue N.C.
Sonceboz	8-lead	Grn & Blk/Wh	Or & Grn/Wh	Red & White	Blk & Red/Wh	
Japan Servo	6-lead	Red	White*	Green	White*	
Escap	8-lead	Brn & Orange	Brn/Wh & Org/Wh	Red & Yellow	Red/Wh & Yel/Wh	
Bodine	8-lead	Brn & Wh/Or	Wh/Brn & Orange	Yel & Wh/Red	Wh/Yel & Red	
	T.box	1 & 7	3 & 5	4 & 6	2 & 8	
Digiplan/Compumotor RM Motor	8-lead	Black & Wh/Or	Orange & Wh/Black	Red & Wh/Yellow	Yellow & Wh/Red	
Digiplan/Compumotor QM Motor	8-lead	Red & Blue	Blk & Yellow	Wh & Brn	Green & Org.	

* Use correct White for each phase.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

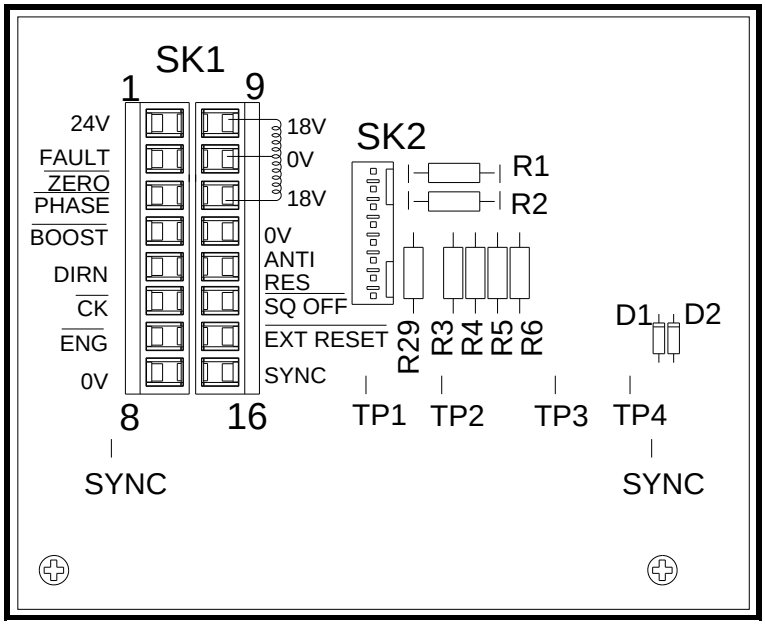


Figure 3. Terminals on HD-Series Motherboard

Control Signals

When the rack system is equipped with Digiplan control modules, the signal connections are made via 8-way jumper cables fitted to a mating connector on each drive motherboard. In these systems it is not normally necessary to make external signal connections to the drives, since all control signals go to the control card motherboard.

Where the rack is equipped with drives only, control connections are made to the two-part connectors on the drive motherboard (see Figure 3). The following list describes the function of each terminal.

PIN 1 - +24v. This is an auxiliary fused output which provides 24 volts unregulated at up to 500mA. If the load is to exceed 250mA, fit an external 2200uF 35v capacitor between this terminal and terminal 8 (0v). Remember to observe the correct polarity.

PIN 2 - Fault. This is a composite output signal which goes high in the event of an overload, short circuit, supply failure or overtemperature fault. It is driven by an open-collector transistor and should therefore be pulled up by an external resistor when the signal is required. The resistor should be returned to a voltage no higher then 30 volts and should not allow more than 15mA to flow when the output is low.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PIN 3 - $\overline{\text{Zero Phase}}$. The zero phase output is low when the translator is in its primary state. This occurs every 8 steps in the half-step mode, and the signal will therefore go low 50 times per rev. with a 200 step/rev. motor. It corresponds with current flowing from A to B in each motor phase. At switch-on the translator is always reset to the zero phase state. The signal is used when establishing a mechanical reference or "datum" position. Ratings are the same as for the fault circuit. An LED on the front of the drive shows when the translator is in the zero phase state.

PIN 4 - $\overline{\text{Boost}}$. Connecting this input to 0v increases the motor current by approximately 30%. The drive is not rated for continuous operation with boost applied, and if the input is held low the current will revert to its normal level after 5 seconds.

PIN 5 - Direction. Taking this input low will reverse the direction of motor rotation. The direction should only be changed when the motor is stationary or running within the start/stop speed range. Do not change the direction signal within 5uS of the low-going edge of a clock pulse.

PIN 6 - $\overline{\text{Clock}}$. A low-going transition on this input causes the motor to advance one step. The width of the low-going pulse should be at least 4uS. Ensure that the pulse width is consistent with the maximum input frequency, which can be as high as 100kHz with the microstepping option operating at 2000 steps/rev.

PIN 7 - $\overline{\text{Energise}}$. This input enables the motor to be de-energised so that it may be rotated slowly by hand without switching the system off. Switch 9 on the motherboard must be turned off in order to use this facility. The input should then be connected to 0v in order to energise the motor. DO NOT turn the motor at high speed with the drive de-energised as this may overload the power dump circuit. Similarly the drive should not be de-energised whilst the motor is running.

PIN 8 - 0v. Use this terminal as a common return for the control signals.

PIN 9 - 18v AC in. See power connection on page 4.

PIN 10 - 0v. Connection for the 18v AC centre tap.

PIN 11 - 18v AC in.

PIN 12 - 0v. An additional common return for control inputs.

PIN 13 - Anti-resonance. With this input connected to 0v, the drive operates in its normal chopping mode at all speeds. With the input high or open-circuit, the anti-resonance system is brought into

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

operation provided the speed is less than about 440 half steps/sec. This speed is programmable (see "Setting up the drive"). Switch 6 may be turned on to hold this input permanently at 0v and so prevent the anti-resonance system from operating.

PIN 14 - $\overline{\text{Square-off.}}$ When this input is open-circuit, the motor current is "squared off" to the one-phase-on level at approximately 3200 half steps/sec. This gives improved midrange torque compared with the usual two-level current profile. However the input may be taken to 0v which will cause the drive to square off permanently. Square-off can also be disabled (see programming switch 0 under "Setting Up the Drive").

PIN 15 - $\overline{\text{External Reset.}}$ Connect to 0v to reset a fault condition (provided the cause of the fault has been removed). An alternative method of resetting is to temporarily remove power.

PIN 16. Sync. Connecting the sync terminals of several drives together will cause all the chopper regulators to synchronise, eliminating beat fre-quencies and minimising the audible noise at standstill. Turret lugs are provided on each side of the motherboard to simplify interconnection between adjacent drives. All drives in a single rack may be interconnected in this way, but it is not recommended to connect drives in different racks together.

Setting Up the Drive

Motherboard Link

The two-position link on the motherboard is fitted in position "a" for a standard drive operating in the full or half step mode. Position "b" is used when the optional microstep card is fitted.

A 10-position programming switch on the motherboard sets up the main operating conditions, and in most applications this will be the only adjustment required. Certain parameters are determined by resistors on the drive and on the motherboard, and again the values as supplied have been optimised for all normal applications. Information is given on changing these parameters should this prove necessary.

The functions of the programming switch are as follows:

1-4: Current programming. (see next section).

5: Square-off switch. Turning this switch "on" has the same effect as grounding the "square-off" terminal, i.e. gives permanent square-off at the one-phase-on current except at standby.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

6: Anti-resonance. Turn "on" to inhibit the anti-resonance circuit (closing this switch performs the same function as connecting terminal 13 to 0v.).

7 & 8: Mode switches. (See table on following page under Stepper Mode Selection.)

9: Energise. Turn "on" to keep the drive permanently energised (closing this switch performs the same function as connecting terminal 7 to 0v).

0: Square-off inhibit. Turn "on" to delay the onset of square-off until a clock pulse frequency of 15kHz is reached. This effectively inhibits the square-off function. Square-off operates normally with this switch "off". The switch is only active in the 200 or 400 step/rev mode.

Current Programming

The following table shows the settings of switches 1-4 for various motor currents. The values shown in the table are two-phase-on levels, and are nominal values only since they depend to some extent on motor inductance. The selected current should not exceed the current rating of the motor. In the half step mode the one-phase-on current is approximately 35% greater than the level with two phases on, giving a similar electrical power into the motor. Bear in mind that if permanent square-off is selected there will be a significant increase in average motor current at low speeds.

DIP Switch Settings 1	2	3	4	Motor Current for HD65	Motor Current for HD130
OFF	OFF	OFF	OFF	6.5A	13A
ON	OFF	OFF	OFF	6A	12A
ON	ON	OFF	OFF	5.5A	11A
OFF	OFF	ON	OFF	5A	10A
OFF	ON	ON	OFF	4.5A	9A
OFF	OFF	OFF	ON	4A	8A
ON	ON	OFF	ON	3.5A	7A
ON	ON	ON	ON	3A	6A

Stepping Mode Selection

The following table shows the stepping modes selected by switches 7 and 8.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolution (with 200 step/rev motor)	Stepping Mode	DIP Switch Settings 7	8
200 steps/revolution	Full step	ON	OFF
400 steps/revolution*	Half step	OFF	OFF
1,000 steps/revolution	1/5 step	OFF	ON
2,000 steps/revolution**	1/10 step	ON	ON

* Default resolution setting for HD65/130
** Default resolution setting for HD65/130M

The 1/5 and 1/10 step modes only apply if the optional microstep card is fitted (types HD65M and HD130M). In a standard drive (HD65 or HD130) the half-step mode is almost always preferable to full step, since the slight loss of torque is more than offset by smoother performance at low speeds.

Standby Current

The motor current is automatically reduced at standby; the reduction depends on the current setting, and is 50% with the drive set to its full current. At minimum current setting the standby reduction is to approximately 80% of regulated current.

A larger reduction may be obtained by changing R76 on the drive, which is normally set at 560 ohms. Reduce the value to reduce the standby current further. This resistor is located at the bottom of the PCB opposite the main power supply capacitor, and is accessible without dismantling the drive. Do not use a value higher than 560R without consulting Digiplan.

The standby current may be measured by a meter connected in series with one of the motor leads, or by using an oscilloscope (see "Test points" on page 14). Note that in modes other than full-step the current will vary with step position, so it is safest to make the measurement with the drive on zero phase. Remember to switch off before disconnecting a motor lead.

Boost Current

When boost is applied the motor current increases by approximately 30%. This is set by R77 on the drive and is normally 68K. The resistor is located next to R76 opposite the power supply capacitor, and its value may be increased in order to reduce the amount of boost. Do not use a value lower than 68K.

Anti-resonance Dropout Speed

The anti-resonance circuit is inhibited at speeds above 440 full steps/sec, and this is determined by R1 on the motherboard. The standard value is 47K, and halving the resistor value will double the dropout frequency.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Current Profile Setting (Half-step Mode)

In the half step mode, a two-level current profile is used at low speeds to equalise torque on alternate steps. Figure 4 shows this current profile with A and B representing the two-phase-on condition, and C the one-phase-on condition. When two phases are energised the current levels are 6.5A and 13A for the HD65 and HD130 drives respectively. These current levels are increased in the one-phase-on condition to 9A (HD65) and 18A (HD130) to help maintain the torque on intermediate steps.

The function of the square-off circuit is to maintain torque output in the middle speed range where the average motor current is falling off due to winding inductance. The current profile is "squared off" to the one-phase-on level at 3200 half steps/sec. The square-off speed is determi-ned by R2 on the drive motherboard. The standard value is 33K, and halving the resistor value will double the square off speed. Do not change this resistor value without first consulting Digiplan.

Turning on switch 5 will give permanent square-off. This will give a significant increase in low speed torque, but will also increase motor noise and temperature rise. This setting should therefore be used with discretion. Square-off is logically inhibited at standstill to prevent overheating. Turning on switch 0 will have the effect of permanently inhibiting square-off.

When using a microstepping drive (HD65M or HD130M), switch 5 should be in the "off" position. Note that selecting permanent square-off in a micro-step mode would effectively return the drive to the full step current profile.

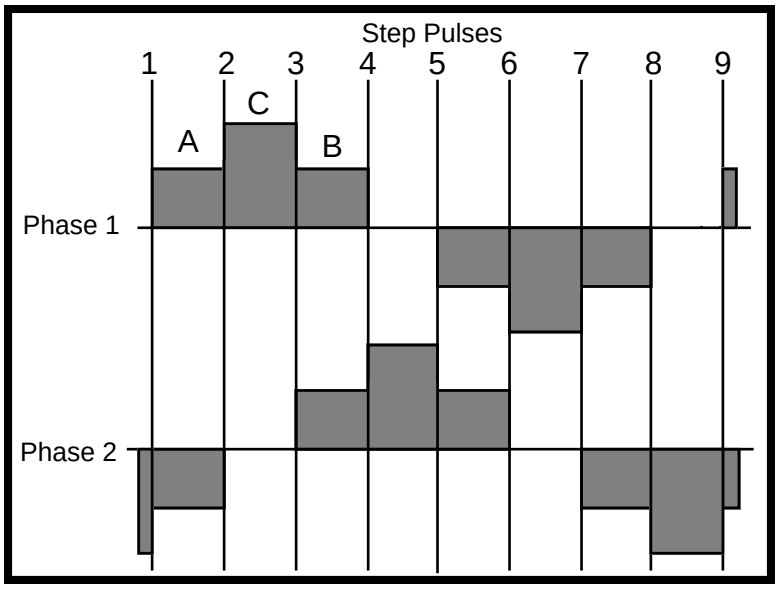


Figure 4. Normal Current Profile (Half-step Mode)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

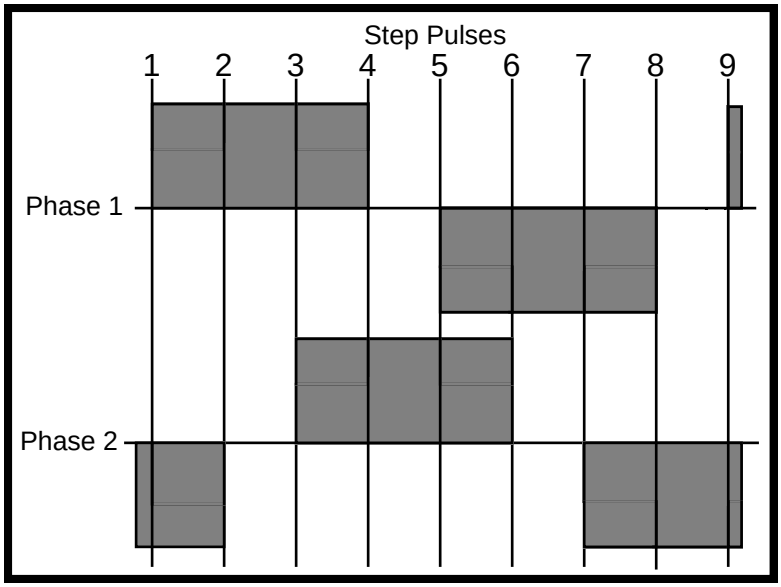


Figure 5. Current Profile with Square-off

Fuses

The main fuses are fitted on the inside of the motherboard and are accessible by removing the drive. Ensure that the power has been turned off before any fuses are inspected. Fuse ratings are as follows:

FS1	-	Fan fuse, 500mA quick acting.
FS2	-	Power dump fuse, 2 amp time-delay.
FS3, FS4, FS5	-	172v AC input fuses; 12.5 amp time-delay for HD65, 25 amp time-delay for HD130.
FS6, FS7	-	18v AC input fuses, 1 amp time-delay.
FS8	-	24v DC auxiliary output fuse, 500mA quick acting.

In addition there is an internal fuse within the drive module itself, in the 240v DC supply between the main capacitor and the switch set. This is a quick-acting type rated at 10A (HD65), 20A (HD130).

All fuses are 1-1/4 inch type. HBC (high breaking capacity) fuses are recommended for fuses FS3, FS4, FS5 and the internal drive fuse.

Test Points

At the base of the motherboard are test points which may be used to monitor motor current using an oscilloscope. The sensitivity is 10.8 amps/volt for the HD65 and 21.5 amps/volt for the HD130.

TP1 - phase 1 current monitor
TP2 - phase 2 current monitor
TP3 - reference voltage (factory use only)
TP4 - 0v (use for scope probe earth lead)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MS20 Microstep Card

Description

The HD65M and HD130M drives are fitted with the MS20 Microstep Card which gives improved resolution and smoothness from a standard motor. Microstepping is achieved by proportioning the currents in the two motor windings so that the rotor takes up a series of intermediate step positions. In this way a standard 200-step motor may be made to perform 1000 steps/rev (1/5 step mode), or 2000 steps/rev (1/10 step mode).

Ideally the intermediate current levels will produce equally-spaced step positions as well as equal dynamic torque, without exceeding the dissi-pation limit of the motor. In practice this can be difficult to achieve and a compromise has to be made. If the current levels are plotted against rotor position the resulting profile resembles a sinusoidal shape. The optimum profile varies from one type of motor to another, and for this reason the MS20 card has a selection of 64 alternative profiles which are stored in an Eprom and selected by an 8-position DIL switch. This switch is accessible between the two edge connectors at the rear of the drive. The card has been programmed with a set of profiles which have been derived theoretically.

A sinusoidally-based profile is obtained with all bit switches in the "off" position. Switches 2 - 6 may be used to set in an increasing binary number which will cause the profile to progressively "fill out" from a sinewave (switch 2 is the least significant bit). By turning on switch 7, increasing the number in switches 2 - 6 will then trim the profile down towards a triangular shape. In practice this tends to be more useful than the "filled out" form. Switches 1 and 8 should be left permanently off.

A few examples are shown below - a "1" indicates that the switch is "on" .

Switch position								Profile
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	0	0	0	0	Sinewave
0	0	0	0	0	0	1	0	Slight fill-out
0	0	1	0	0	0	0	0	Moderate fill-out
0	0	1	1	1	1	1	0	Maximum fill-out
0	1	0	0	0	0	1	0	Slight trimming
0	1	1	0	0	0	0	0	Moderate trimming
0	1	1	1	1	1	1	0	Maximum trimming

Setting Up the Microstep Card

Link 1 on the microstep card should be left in position "a". This link is provided for future implementation of an alternative profile in boost.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Link 2 is normally in position "a". Moving it to position "b" will cause a sinusoidal profile to be selected at standstill. With some motors this will give better static positioning than a filled-out or trimmed profile. Choosing the optimum profile for a given motor is best carried out with equipment which will accurately measure shaft position and torque. Since this is seldom available, empirical methods are normally used and can give perfectly acceptable results.

The logical starting point is with all switches off to give a sinusoidal profile. Attach a light pointer to the motor shaft (cable ties are ideal), and run the motor very slowly. It will be visually apparent whether the steps are all similar or there is a cyclic variation in step size as the shaft rotates. Slowly increase the speed, and the sound from the motor will give an idea of the relative torque produced on successive steps. Again a cyclic pulsing sound implies associated torque variations

Switch off, remove the drive and try setting a trimmed profile (see table on page 15). Repeat the exercise and compare the results. From this it should be clear whether more or less trimming is required, so choose another setting and try again. It is usually best to aim for the smoothest rotation rather than best static positioning. If the application demands significant torque from the motor, repeat the exercise with the motor loaded. This method usually reveals the useful range of profiles quite quickly.

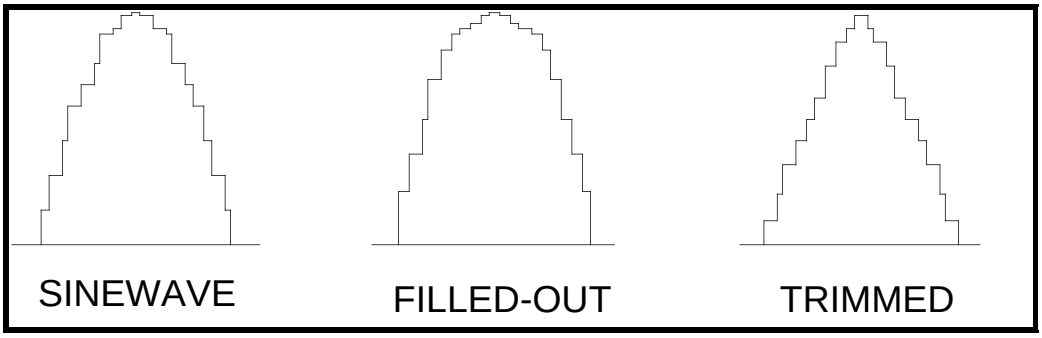


Figure 6. Microstepping Current Profiles

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Operation of the Drive Protection Systems

There are three basic protection systems built into the drive, and these guard against damage caused by overloads, power supply faults and excess temperature. Operation of any of these protection circuits will de-energise the drive, and the reason for shutdown is indicated by an LED on the front of the drive. Provided the cause of the fault has been removed the drive may be re-energised by taking control terminal 7 to 0v or by temporarily removing power. Figure 7 is a simplified diagram of the protection circuitry.

Overload Protection

An overload condition may be brought about by incorrect motor connection, short circuits across the motor terminals or any other condition causing excess current to flow. It may also arise if a very low inductance motor is desynchronised during deceleration. In any of these circumstances the overcurrent comparator will set the fault latch, turning on the appropriate LED and giving a fault output signal.

Supply Failure Protection

Should the high-voltage supply rise excessively, or any of the logic supply rails fall outside preset limits, the supply protection circuit comes into operation. It functions by using a comparator to compare each of the supply rails with fixed reference levels. If the preset limits are exceeded, the fault latch is set and the supply failure LED is illuminated. Note that an excessive rise in the high-voltage supply may result from failure of the power dump fuse FS2.

Over-temperature Protection

This mode of shutdown occurs if the heatsink temperature reaches 85°C, which will generally be the result of inadequate cooling. The heatsink temperature is monitored by a thermal sensor mounted on the drive pcb. The output from the sensor sets the fault latch directly, and illuminates the Overtemperature LED. It will be necessary to allow time for the drive to cool down before it can be reset.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

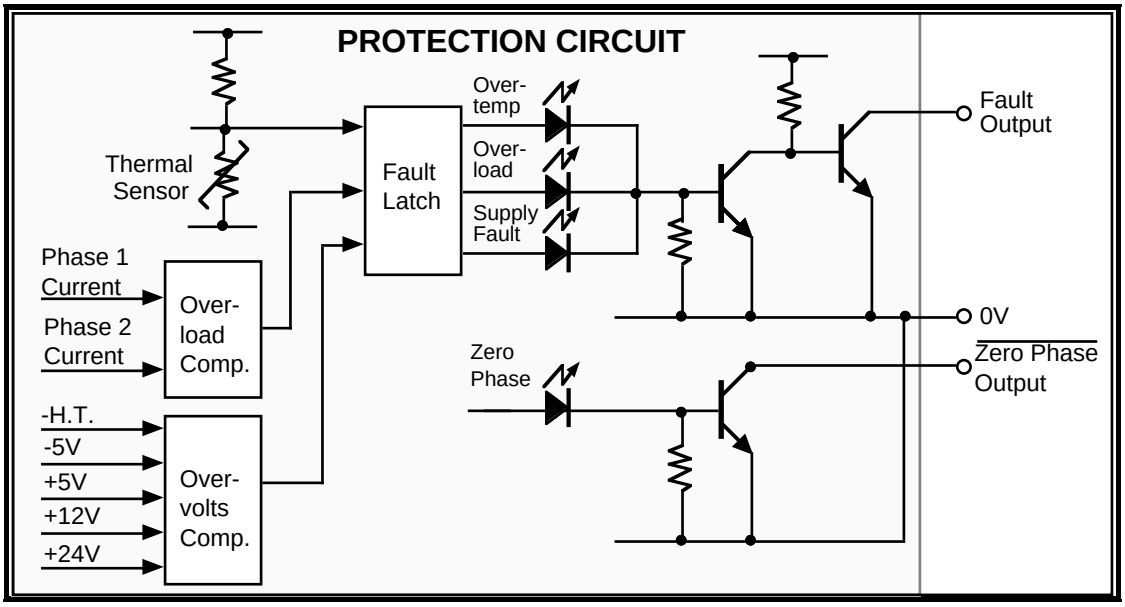


Figure 7. Simplified Protection Circuit

Fault-finding Guide

If there is no response from the motor and the more obvious checks have been made, the following guide may help to identify the problem. Before going through the procedure, make sure that the motor shaft is free to rotate with the drive switched off.

Turn the drive on and see which LEDs are illuminated. Then go to the appropriate heading below.

Zero phase - listen for audible noise from the motor. If there is none, check for open-circuit motor leads, check energise input (motherboard switch 9 on or terminal 7 connected to 0v).

Overload - switch off, disconnect the motor and switch on again. If the overload LED is still on, the drive has been damaged. If not check for short circuits or crossed motor connections. A very low inductance motor could also cause the drive to trip out, if this is suspected try connecting the motor in series.

Supply failure - check the AC supplies coming into the motherboard. If these are OK, switch off, wait for 3 minutes, unplug the drive and check the fuses on the back of the motherboard. If OK, there is probably an internal failure within the drive.

Over-temperature - the drive has overheated and should be switched off and left to cool. If it was previously working satisfactorily, better cooling is needed. On the HD130, check that the fan is running and is not obstructed.

None at all - check as for "supply failure".

If there is audible noise from the motor but the drive does not respond to clock pulses, look to see if the zero phase LED flashes. If clock pulses are entering the drive, the LED should flash or go dim depending on speed. If it doesn't, the drive is either not getting any pulses or is not responding to them. Make sure the clock pulses go low for at least 4uS and that the logic low level is below +1v.

CAUTION

Note that if the dump fuse (FS2) is blown it will take approximately 3 minutes for the main supply capacitor to discharge. Always allow adequate time for the capacitor to discharge

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

before unplugging the drive. Whilst the drive will operate with FS2 missing or blown, it is essential that this fuse is fitted for safety reasons.

Returning the System

If you must return your HD Drive to effect repairs or upgrades, use the following steps:

1. Get the serial number and the model number of the defective unit, and a purchase order number to cover repair costs in the event the unit is determined by the manufacturers to be out of warranty.
2. Before you return the unit, have someone from your organisation with a technical understanding of the equipment and its application include answers to as many of the following questions as possible:

- What is the extent of the failure/reason for return?
- How long did it operate?
- Did any other items fail at the same time?
- What was happening when the unit failed (i.e., installing the unit, cycling power, starting other equipment, etc.)?
- How was the product configured (in detail)?
- What, if any, cables were modified and how?
- With what equipment is the unit interfaced?
- What was the application?
- What was the system environment (temperature, enclosure, spacing, unit orientation, contaminants, etc.)?
- What upgrades, if any, are required (hardware, software, user guide)?

3. In the UK, call Digiplan for a GRA (Goods Returned Authorisation) number. Returned products cannot be accepted without a GRA number. The phone number for Digiplan Repair Department is 0202 690911. For Customer Service/Applications Department phone 0202 699000.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Ship the unit to: Parker Hannifin plc
Digiplan Division,
21, Balena Close,
Poole,
Dorset,
England.
BH17 7DX

4. In the USA, call Parker Compumotor for a Return Material Authorisation (RMA) number. Returned products cannot be accepted without an RMA number. The phone number for Parker Compumotor Applications Department is (800) 358-9070.

Ship the unit to: Parker Hannifin Corporation
Digiplan Division
5500 Business Park Drive
Rohnert Park, CA 94928
Attn: RMA # xxxxxxx

5. Elsewhere: Contact the distributor who supplied the equipment.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP