DC900

CAMBRIDGE TECHNOLOGY, INC.

DC900 Digital Servo Controller

Part Number: P0900-0119 Revision: 2.17

Installation and Operation Manual

DC900 Digital Servo Controller

INSTALLATION AND OPERATIONS MANUAL

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Revision	Date	Changes
2.17	8/17/10	Temperature updates
2.16	4/10/09	Updates for 3-4-0 Image release
2.15	07/23/08	Release of SmartConnect Manual. Updated References.
2.14	06/04/08	Added part numbers to connectors and cables
2.13	4/30/08	Updated Scanner Adaptation section to match the updated DC2000 Manual
2.12	3/19/08	Rearranged to match DC2000 document.
2.11	2/28/08	Rearranged SmartDirect cabling diagram to eliminate confusion
2.10	8/17/06	Fixed laser blanking output pin references in text to agree with figure 7 Updated top view of dimensional diagram
2.9	6/29/06	Updated SmartDirect and SerialDAC interface diagrams for Rev 5.2 of the CPU module. Interface is incompatible with prior revisions of the DC900. SmartDirect and SerialDAC interfaces are no longer mutually exclusive factory options. Are now field-selectable. Fixed incorrect clock period in SmartDirect timing diagram (was 50ns)
2.8	3/24/06	Fixed error in diagram showing incorrect jumper settings for the digital input options
2.7	2/22/06	Clarified input grounding for single-ended analog command input
2.6	2/4/06	Major edit clarifying many interfacing issues

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Manual developed with cooperation of Smartmove GMBH

If you are running the DC product for the first time and would like to know how to find the best setup for increased speed in marking, refer to Application Note # A.1.2.1.1.B, Digital State Space Speed Application Note.
This can be found on the CD accompanying the board or through our download website. To access this please call Cambridge Technology Applications Department.

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SPECIFICATIONS

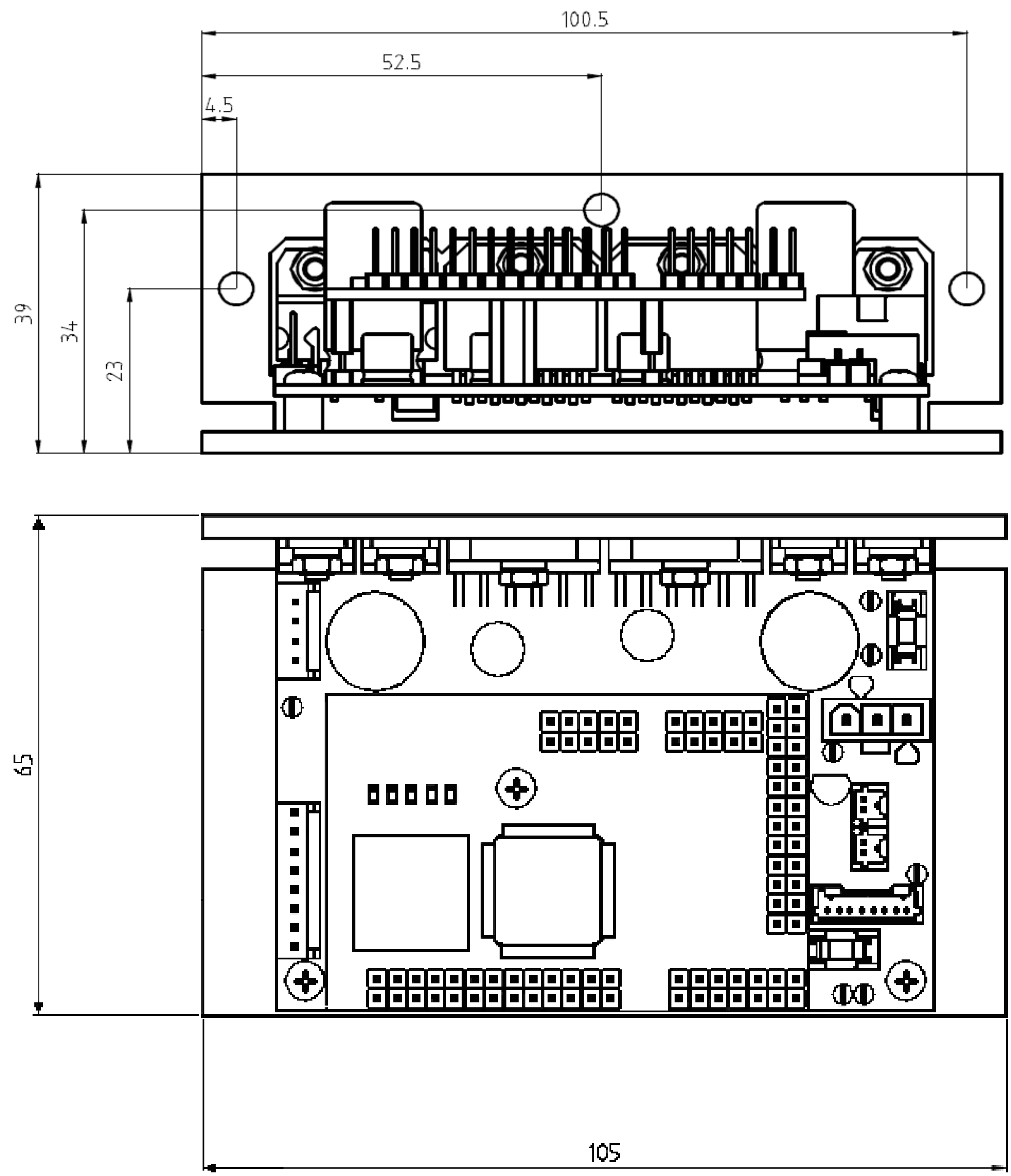
Configuration	
Galvo type	Cambridge Technology 62xx family Different galvo family members and mirror configurations supported through separate firmware images and programmable parameter sets
Angle range	±15 degrees mechanical standard ±10, ±20 selectable via parameters
Electrical Signals	
Analog command input	±5 V differential, ±10V single-ended
Analog position output	±5 V differential
Supply voltage	±15V to ±28V
Peak current	10A
RMS current	2.5A max The actual operating RMS current will be limited by the thermal dissipation capability of the galvo and the command waveforms used.
Fuses	
Motor output	Galvo dependant
AGC output	62 mA
Weight	180 g

INSTALLING THE DC900

Mounting

See Figure 1 for dimensions of the DC900 mounting bracket. For high performance the bracket must be mounted with all three screw holes on an appropriate heat sink with heat sink compound. The maximum temperature that the mounting bracket should be allowed to attain is 80°C.

Figure 1 DC900 Mounting Bracket



Power Connector

The power supply is connected via SV1 connector (connector type MTA 100, see Figure 2). Each pin of this connector is specified for 10A maximum current. The mating cable connector is Amp 770602-5 with crimp socket terminal 770666-1. These items are supplied in connector kit PN: DC900CK.

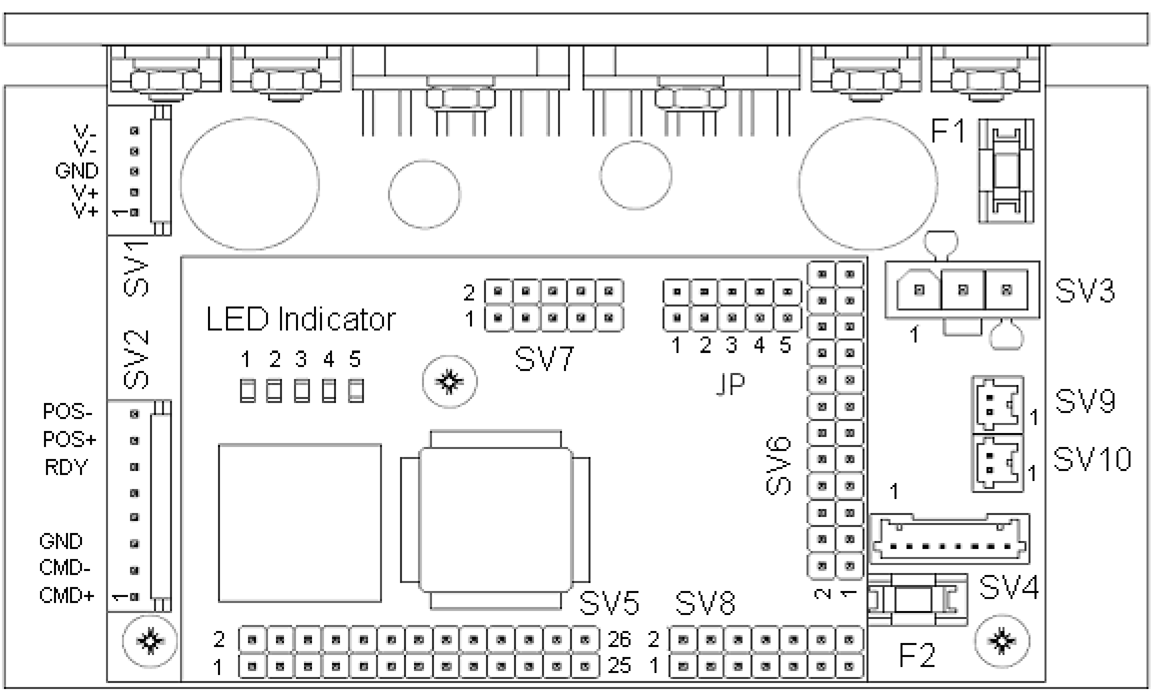
Use a symmetrical supply voltage between ±15V to ±28 V for the input power. Note that the controller parameters are pre-configured at CTI for a specific power supply voltage. Altering the supply voltage after the controller has been configured will not damage the controller, but it may lead to faulty behavior.

The RMS current requirement of the module is approximately 2.5A, but peak currents demands approach 10A. The connections are shown in table 1. Make note that using 2 wires to the positive and negative voltage will help higher current applications

Table 1 SV1: Power supply signals

Pin#	Function
1	Supply voltage (+)
2	Supply voltage (+)
3	GND
4	Supply voltage (-)
5	Supply voltage (-)

Figure 2 DC900 Connector Locations



Analog Input and Position Output

The analog input and output signals are located on SV2 connector (type MTA100). The mating cable connector is Amp 770602-8 with crimp socket terminal 770666-1. These items are supplied in connector kit PN: DC900CK. When configured for analog input (no jumper on JP4 or JP5) the DC900 accepts a differential input signal on Pin 1 and 2 of SV2. The input voltage range of ±5V (a 10V differential between the input pins) is mapped on an angle range of ±15 degrees mechanical. If the differential feature is not needed, one of the input pins should be connected to GND, SV2 pin 3 and the return for the signal source should also be connected to this pin. In this case, the input voltage on the driven pin may swing from +10V to –10V.

The DC900 also offers a differential analog position output on pin 7 and 8 of SV2. If a single ended position signal is needed, use one of the differential pins referenced to GND on pin 3 of SV2.

Pin 6 is scanner ready, meaning the galvo is now in closed loop operation and ready to start running the input command line. If the galvo leaves closed loop for any reason this line will again change back.

☞ **NOTE:** If using single-ended measurement mode, do not connect the other differential output pin to GND as damage to the module may result.

Table 2 SV2: User signals

Pin	Function
1	Command In (+)
2	Command In (-)
3	GND
4	
5	
6	Scanner Ready
7	Position Out (+)
8	Position Out (-)

Galvo Connectors

The galvo is connected via SV3 (Minifit Jr.) and SV4 (AMP Mini CT), which fit the Cambridge Technology standard cables. Always connect the galvo before power up.

☞ **NOTE:** Never remove connector SV4 during operation. This may lead to scanner damage.

Table 3 SV3: Motor drive

Pin	Function
1	Shield
2	Motor (-)
3	Motor (+)

Table 4 SV4: Position detector signals

Pin	Function
1	Ia
2	Ib
3	Diode Common
4	Cathode
5	Anode
6	Shield
7	
8	

Digital Data Input and Output

The DC900 supports two different serial digital interfaces for transferring command input data and reading back controller status information. Using digital inputs will reduce the system noise, avoid aliasing issues and save expensive analog electronic components.

One interface uses standard 3.3V TTL signal levels and follows a standard 16-bit Serial Peripheral Interconnect (SPI) protocol, which is also used to communicate to the D/A converter used for analog command input digitization. This interface only supports command data transfer to the controller. This interface is referred to as the *Serial DAC* interface.

A second interface uses RS422 differential line drivers and receivers and is compatible with the industry standard XY2-100 protocol. The XY2-100 protocol supports up to three axes of command transfer to the servo controllers(s), and provides a means for transferring merged X-Y status information back to the signal generation controller. This interface is referred to as the *SmartDirect* interface.

☞ The two interfaces are mutually exclusive and are jumper configured (see Figure 3).

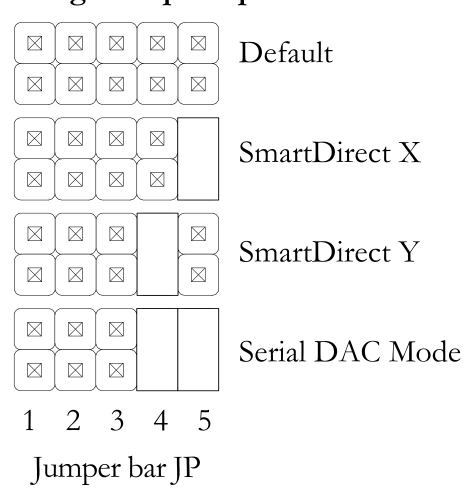
Both interfaces require well-controlled clock sources for proper operation. For most galvanometers, the standard internal controller update rate is 20µs, for smaller galvanometers (6200, 6210 smaller inertias,) the update rate is 10µs, for larger 6240 inertias utilizing 20mm apertures or larger a 40us update rate may be needed. The DC900 tries to synchronize its internal update frequency with the digital command frame sync signal through a software Phase-Lock-Loop (PLL). This synchronization helps avoid aliasing effects. Synchronization will succeed if the data update rate is equal to the internal update rate within a limit of 1%. If the controller is configured for 20µs, it is able to synchronize also on a 10µs input signal. For these controllers, however, only every other command input value will be used. Frequency stability better than 0.4% is recommended. The need to synchronize can also be turned off through the use of the parameter file. This option would allow missed or repeated data as well..

Table 5 shows the various configurations that are selectable via the jumper bar JP (see Figure 2). Figure 3 shows how the different input modes that can be selected. If neither of the input mode jumpers JP4 and JP5 is set, the programmed default mode (usually smartDirect) is used. The parameters can also change the default mode. If running the *SmartDirect* interface, X and Y servos must be jumpered as X and Y separately with the XY2-100 cable going to the X board and a jumper cable connecting the X board and the Y board. This is to merge the status information of two separate DC900 controllers before transfer back to the signal generation controller. Therefore the two jumper configurations *SmartDirect X* and *SmartDirect Y* can be selected.

Table 5 JP: Configuration jumpers

Pin	Function
1	Enter Remote Support mode
2	Reserved
3	Force motor adaptation process on next power-up cycle
4	Digital Input Mode 1
5	Digital Input Mode 0

Figure 3 Digital Input Options



Serial DAC Interface

The digital lines for the Serial DAC interface are located on pins 20-26 on SV5. Figure 4 illustrates the timing relationships for the signals.

The minimum clock frequency is a result of the bandwidth necessary to send a 16-bit word during one update period. For 20us update rates the minimum frequency is 800kHz and for the 10us case, 1.6MHz. The FS signal must be synchronously applied every 10us or 20us. The controller synchronizes the control loop to these frame syncs via a phase-lock loop so they must be stable in time. See table 6 for digital input timing specifications. Note that the SCLK signal must be active at least one clock cycle before the falling edge of FS. It is recommended that SCLK be applied continuously. Table 7 defines the signal pins on connector SV5. A Serial DAC cable to connect two DC900s with the EC1000 is available, CTI part number 6016-5S, available in 10" and 20" lengths.

Figure 4 Serial DAC Interface Timing

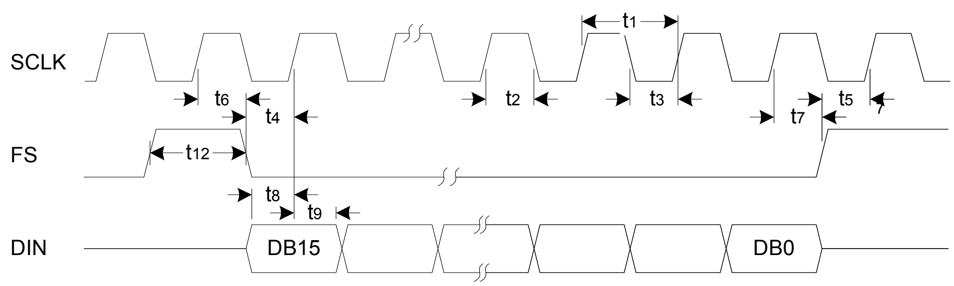


Table 6 Digital interface-timing requirements

	Min	Max
f	800kHz	1.2MHz
t_1	400ns	1250ns
t_2	200ns	
t_3	200ns	
t_4	200ns	
t_5	200ns	
t_6	200ns	
t_7	0ns	
t_8	200ns	
t_9	100ns	
t_{12}	200ns	

Table 7 SV5: Digital signals

Pin	Function
2, 4, 6, 8, 10, 12, 14	Reserved
14	Laser Delay Out
16	Laser Delay In
18	Reserved
20	Reserved
22	Digital IO DIN
24	Digital IO FS
26	Digital IO SCLK
Odd Pins	GND

Command data format

The serial data passed to the controller must be represented in offset binary form. Offset binary is illustrated in the table 8.

Table 8 Offset binary data format

Numeric value	Binary	Hex
+ Full Scale (32767)	1111 1111 1111 1111	0xFFFF
+ 1	1000 0000 0000 0001	0x8001
0	1000 0000 0000 0000	0x8000
-1	0111 1111 1111 1111	0x7FFF
- Full Scale (-32768)	0000 0000 0000 0000	0x0000

SmartDirect Interface

The *SmartDirect* interface protocol is a XY2-100 compatible serial protocol with a clock line CLK, a frame Sync Signal FS, two data channels CH1 (Data-X) and CH2 (Data-Y) and a status channel. The physical transmission takes place through RS422 differential transceivers in order to provide noise immunity and good signal integrity. In a dual-axis configuration with proper cabling, two DC900s can be connected to receive the X and Y data channels respectively, and to combine their status information into the single XY2-100 status channel. See Figure 6 and Figure 7 for cabling guidelines.

Note An XY2-100 cable to connect the DC900 with an EC1000-IO board is available, CTI part number 6016-5D, available in 10", 20", 40", 80", 120" and 200" lengths. Also, an inter-board cable is available, CTI part number 6016-5B available in 6" and 10" lengths.

Table 9 defines the meaning of the status information. The digital lines for the *SmartDirect* interface are located on pins 1-10 on SV8 as shown in table 10. Figure 5 illustrates the timing relationships for the signals.

The status channel provides several error messages indicating scanner or servo exceptions. When an error condition occurs, the corresponding bit is set to low level. When the error is cleared, the corresponding bit is set to high level. After power up or reset the status line is held low until the *SmartDirect* Interface is up and running.

Table 9 *SmartDirect* status bit definitions

Status Bit	Definition
PwrErr	Indicates if SmartDirect interface is up and running.
TmpErr	Galvo coil temperature error. This error indicates that the motor coil temperature is close to maximum. The system will proceed until the critical temperature is reached and then it will shut down.
X/Y-PosErr	Position error. Occurs whenever the motor position differs from the command by a certain limit. This limit is a system parameter (see section on Modifying Tuning Parameters -> Input/Output Parameters).

Table 10 SV8: *SmartDirect* pin assignments

Pin	Function
1	SD_CLK (-)
2	SD_CLK (+)
3	SD_FS (-)
4	SD_FS (+)
5	SD_CH1 (-)
6	SD_CH1 (+)
7	SD_CH2 (-)
8	SD_CH2 (+)
9	Reserved
10	Reserved
11	SD_STATUS (-)
12	SD_STATUS (+)
13-14	Reserved

Figure 5 *SmartDirect* signal timing

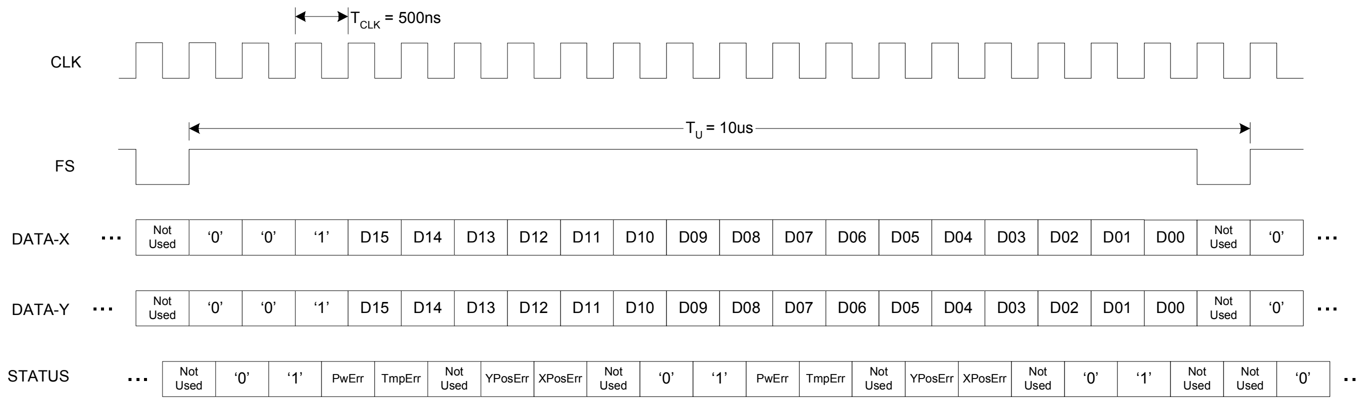


Figure 6 *SmartDirect* cabling schematic

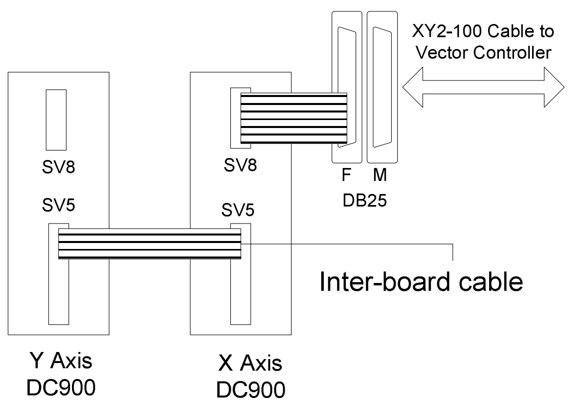
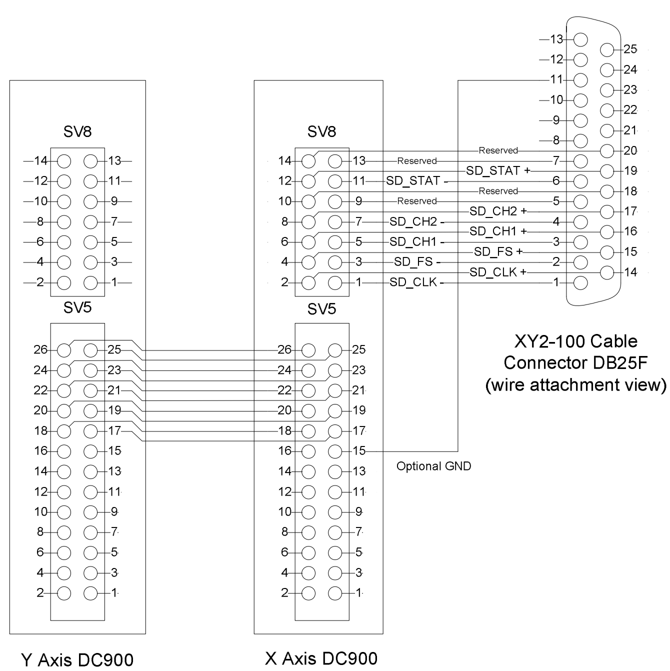


Figure 7 *SmartDirect* cabling details



OPERATING THE DC900

Booting Phase and LED Indicator Test

After power up the system will boot and switch on all 5 LEDs of the LED indicator (see Figure 2) for about half a second. Any led's lighted before the led tests are meaningless.

NOTE At the moment of turn on the Scanners WILL move and operate the mirrors for at least a minute and may be as much as five minutes if the galvo's are connected to the boards for the first time. This is normal and very different from most analog scanners.

Scanner Adaptation

If connected to a new scanner the DC900 needs to adapt to specific torque and linearity properties of that scanner due to product specific tolerances. It will also record the resonant spectrum and friction plot of the new galvo for comparison in maintenance and trouble shooting. The adaptation cycle is triggered automatically after the first power up if the board is in factory reset state or no scanner adaptation data is stored. It can also be triggered manually by a jumper (see following paragraph). The adaptation cycle starts after the normal boot process and may last several minutes. After finishing the cycle, the DC900 performs a software reset and restarts in normal operation mode.

Any time a new scanner is connected to the DC900 the scanner adaptation cycle should be triggered again. In this case the scanner adaptation mode is selected by putting a jumper on position 3 of the jumper bar JP (see Figure 2) before power up. After the scanner adaptation is finished the green LEDs on the LED indicator (LED 1, 2, 4 and 5, see Figure 2) will blink. The jumper should then be removed and the DC900 power cycled to enter normal operation mode.

Troubleshooting note: If you are testing a second galvo to verify if the board or the galvo has a problem, the adaptation is unimportant. It is not needed for functionality only for extra precision. If you decide to leave the galvo connected, you should do it at that time.

Normal Startup – System test

Under normal startup (scanner is already adapted) after a power up, the DC900 performs several system tests and runs a short re-calibration cycle. This can last about one minute.

LED Conditions

The LED's have two separate operations, one during the startup and the other during closed loop operation. During startup they show some of the error conditions that can occur. They only cover some of the more basic errors, for detailed errors you will need to use SmartConnect. Once the board is in closed loop then they show the temperature management and Overload.

Error Conditions

If a serious error is detected during the system test or the calibration phase of the DC900 will reset and start over again. The most common errors are displayed before the reset on the LED indicator as shown in table 11. There are more errors possible. To know other errors you will need to use SmartConnect and use the list in the addendum of the SmartConnect Manual.

Table 11 Status LED function

LED Pattern					Error	Description
1	2	3	4	5		
X		X			GALVO RANGE	The motor cannot be driven into its valid angle range. Check to see if the motor is working or if the mirror can be easily moved
	X	X			GALVO NOT CONNECTED	The motor is not connected correctly or not connected at all. This error message can also appear if the motor is defective.
		X	X		NOISE LEVEL	The noise level in the motor's position detector is too high. Strong electromagnetic interferences or faulty cables can cause this.
		X	X	X	BAD FIT	The automatic tuning delivers a result that is out of range. Possible causes are: input power supply too low, input power unstable, or a damaged motor, etc.

Normal Operation – Closed loop

. After finishing the tests the system enters the control loop. The system is then ready to receive input data via the configured input channel (default is analog input). The scanner ready line on SV2 (see Figure 2) will then go to high level, indicating that the system is running with no errors.

Temperature Management and Overload Protection

Because of the high bandwidth of the DC900, the scanner can be commanded to perform waveforms that can cause a very fast temperature rise in the galvo coil while the temperature of the galvo case rises more slowly. The servo automatically adapts itself to changes in the coil temperature by monitoring changes in the coil resistance. When the coil temperature climbs over a critical value, the bandwidth of the servo is automatically lowered in order to prevent damage to the scanner.

During the control loop the LED indicator is used for displaying temperature information as shown in table 12.

Table 12 Status LEDs during operation

LED State	Temperature Condition
LED 1 on, all others off	The systems temperature increased but is well below critical limits.
LED 1 and 2 on, all others off	Coil temperature is 60 degrees C higher than during the system calibration cycle.
LED 1,2 and 3 on	Critical temperature is reached. The system has to limit bandwidth to protect the motor. It is not recommended to further operate the system at this temperature level.

Improvement in the total performance can be gained by making good thermal contact between the galvo housing and the environment (heat-sink) as well as using active cooling. Active cooling of the scanners is required if high frequency large-angle moves are expected for a significant length of time. In any case to avoid galvo damage ensure that a maximum allowable galvo housing temperature of 50°C is not exceeded (see CTI specification sheet).

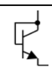
☞ **NOTE:** If the critical coil temperature has been reached, switch off the system and wait several minutes before the next power up. The temperature management of the DC900 can only fully protect the galvo if the motor temperature during the motor adaptation phase is well below the maximum specified housing temperature. This is also true at startup in standard operation with out tempsense.

☞ In addition to the thermal protections, the module includes protection mechanisms that prevent the servo from becoming unstable or from over-positioning. For such errors, the scanner attempts to restart, if possible, and return to full bandwidth and full control.

Temperature Measurement

The DC900 includes provisions to measure temperature. There are three measurements available for use by a system integrator. These measurements are accessible via the remote support interface described later in this manual. The three temperature measurements that are available are the ambient temperature of the base module, and two external measurements using a diode type detector. The diode probes are ideally the base-emitter junction of a 2N3904 transistor. They are connected to the base module via connectors SV9 and SV10 (see Figure_2). Table 13 illustrates these connections. Further application information can be found in the National Semiconductor specification sheet for the LM83 temperature measurement chip.

Table 13 SV9 & SV10: Temperature probes

Sensor schematic	Connector pin	Function
	2	Sensor base-collector: LM83 D+ terminal
	1	Sensor emitter: LM83 D- terminal

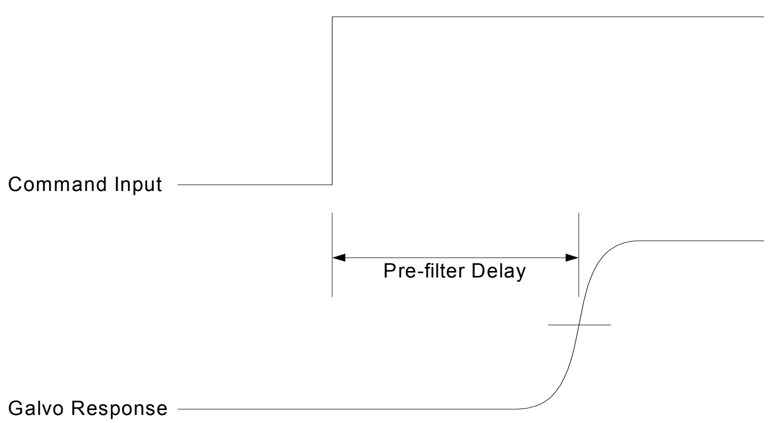
Temp-Sense

The RT Exttemp2 may be used as a temperature sense for the Software to read the actual temperature of the galvo's at power on. This prevents the rare occasions of turning on already warm galvo's and the software thinking they are room temperature. This is usually not a problem in normal operation.

Pre-filter Delay

In order for the DC900 to use it's predictive nature to drive a scanner, the algorithm of the DC900 module takes all input signals and inserts them into a known buffer. This buffer allows the system to predict what is coming and make a speedy solution for galvo movement. This buffer also gives a constant delay between command and position called the *pre-filter delay*. The pre-filter is used by the controller firmware to adjust the input waveform to ensure that the waveform is drivable given the constraints of the power supply and galvo. Figure 8 illustrates this effect.

Figure 8 Pre-filter delay



Laser Timing

When the DC900 is used in laser marking systems, it is often necessary to delay the laser control signals to match the pre-filter delay so that galvo motion and laser on/off synchronization is maintained. The DC900 provides the capability to create a control signal with the corresponding delay time. A user supplied 3.3V logic signal is sampled at pin 16 of SV5 (see Table 7), delayed by the pre-filter delay time, and sent back out pin 14 of SV5. The output signal has a logic-high level of 3.3 V. The output signal on pin 14 of SV5 can then be connected to the enable input of a laser system. To ensure the laser remains off during the module startup procedure, pull down the signal connected to pin 14 of SV5 with a 4.7k resistor to GND. All odd numbered pins of connector SV5 are GND. Recommended connectors are CTI part number P0070-0447 or AMP part number 87631-3 and pins CTI part number P0070-0354 or AMP part number 353907-1 or connectors of a similar style.

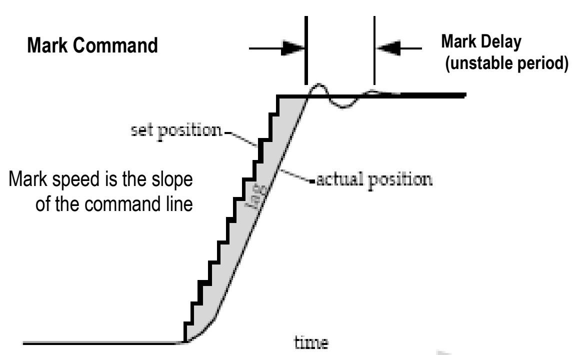
☞ NOTE: The laser delay signal is not available if the module is configured to use the RS232 Serial Communications port while in closed loop.

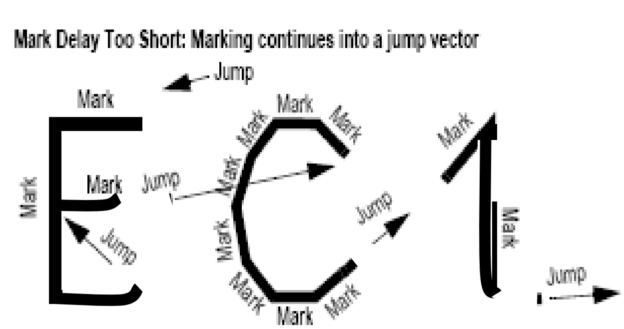
Maximizing marking speed with the DC State Space Servo

Laser Marking Definitions:

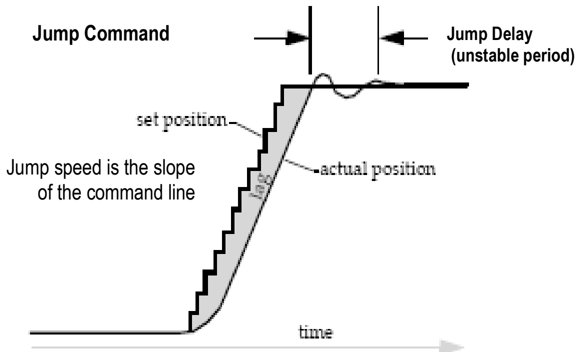
- Speed is always defined in the relationship of Distance to Time. To accurately state a speed you need both time and distance. To compare different speeds together you can remove one of those measures providing the other his held constant. This will of course be an average speed, as during any given time cycle the speed can and will vary. However, obtaining a very high instantaneous speed is of no use if it must be followed by a very slow speed, or worse a delay.
- Laser Marking Speed is defined as the number of characters marked divided by the Total Mark Time (TMT). The TMT is defined as the sum of a marking jobs actual laser marking time, the jump times between marks and any required galvo system settling time before marking or jumping to the next mark. By using the same characters or mark for testing and setup the numerator of this equation is held constant. This allows us to use the denominator or Total Mark Time (TMT) as the measure to compare speeds. To accurately setup a digital application and compare it to an analog one, we recommend using your standard test mark that examines all of your quality concerns, and measure the TMT for comparison.
- As a result, the time to perform a laser marking job is a function of the pattern to be marked and its distribution of marking strokes, jumps, sizes and all galvo settling delays required to achieve the desired marking quality. A typical laser marking system has the following system control parameters:

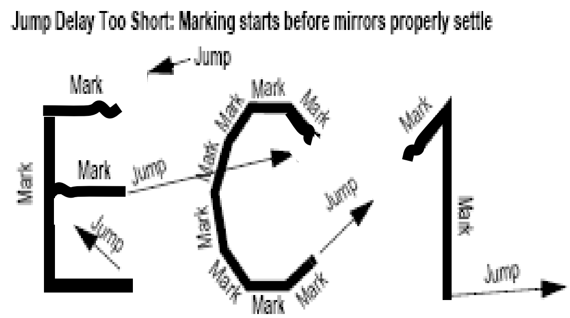
Mark speed & Mark delay



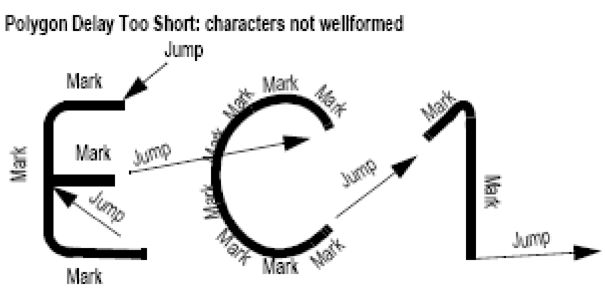


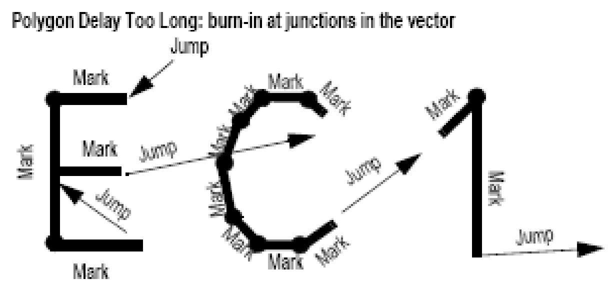
Jump speed & Jump Delay





Polygon Delay





The Speed Advantages of the DC2000.

The DC2000 State Space Servo offers two types of speed advantage for high speed laser marking:

1. Faster Step time, large & small >> faster mark speeds & jump speeds!

2. Higher bandwidth & significantly reduced tracking error >> optimization and dramatic reduction of all galvo system settling delays!

Without optimized settings of the marking system to match the capabilities of the DC2000, you may not achieve the expected speed improvement! To do this you begin by setting the speeds equally constant, and adjusting the delays first. Once the correct delays are found, then the speeds can be increased.

Setting Marking System Parameters for achieving maximum DC2000 Digital State Space Speed

Mark your test pattern with your current Analog setup. Make sure to record the Total Mark time of that mark. You will want to use the same mark for setting up the delays and speed comparisons of the digital head.

Note that the DC2000's pipeline pre-filter delays the galvo scanner position by a fixed amount of time that is in the range of 300 t0 400usecs. Laser timing should be synchronized with the galvo motion by either passing the laser power signal through the DC2000's laser delay signals on the Scanhead connector or for initial testing simply by adding a matching delay in your system laser timing control.

Mark Speed – If you do not know the maximum speed your laser will allow for you to process material mark some straight lines over as much of the fields as you can. Do not worry about corners or wiggles yet. Keep increasing the speed until the laser is not affecting the surface well enough for your needs. This is the maximum speed the laser will allow. If there is enough laser power for the application then the DC2000 allows you to increase Mark speed to a speed only limited by the power supply voltage available, not the bandwidth of the servo. Return the speed to the setting for the analog head. We will experiment with higher marking speeds after we adjust the delays. This establishes the maximum Mark speed useable.

Jump Speed – The DC2000 is particularly fast on large moves but if you increase Jump speed too much then you may have to increase Jump delay and lose all benefit. A good starting point is to set Jump Speed to be equal to the analog Mark Speed. We will further experiment with this after setting the delays.

Polygon Delay - With the DC2000's minimal tracking error, this parameter can be reduced to 0 to 2 update ticks. Start with Zero.

Mark Delay – With the DC2000's minimal tracking error, this parameter is normally 1 – 5 update ticks. Starting with 1 tick is probably good

Jump Delay – With the DC2000's minimal tracking error, this parameter is also normally 1 – 5 update ticks. This number will maintain a relationship with the Mark delay that will be similar to the relationship between Mark speed and Jump speed. Since we are starting with those speeds equal, start with these delays equal as well.

1st Experimentation – For the first tests do not change the speeds, only the delays. We want to take the speed changes out of the investigation for the moment. Make several tests of the mark noting quality and Total Mark Time (TMT).

Adjust Polygon delay up a little, often this only increases TMT without changing mark quality.

Now look for the effects of Mark and Jump delay. Examples of these are included above. It is typical to need a little more Jump delay than Mark. Especially when we start to increase Jump speed later on.

Look for the best trade off between TMT and quality.

Also now consider using Rmean and Smean inside the DC parameters as well.

2nd Experimentation of Mark and Jump Speed – Now increase Mark and Jump speed together as far as you can. The mark speed cannot go faster than the speed we determined in step one.

During this step you may want to adjust the Mark and Jump delays a little. At this point it should not be much. Find the trade off between TMT and quality.

Jump Speed – Now that mark speed is set as fast as our laser process will allow we can slowly increase jump speed. Jump delay may increase as well, but will still be 1-5 update ticks. Make note that over increasing jump speed will cause jump delay to increase our TMT beyond what gained earlier. We want to have a good quality mark with the lowest TMT. We should be able at this point to see a vast improvement in the TMT of the digital vs. the Analog, even if the Jump speed is less than in the analog, which it could be.

For more details behind laser marking, marking system parameters, reducing Jump speed and taking advantage of the DC2000 State Space Servo's capability see the "Maximizing DC Speed Application Note".

ADAPTING TO DIFFERENT GALVO TYPES

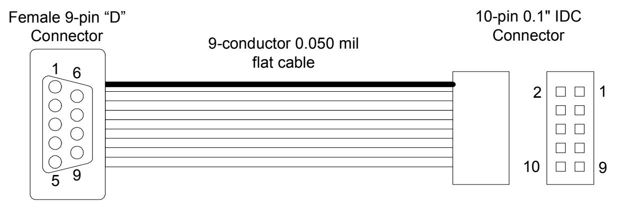
This section describes how to set up a DC900 digital servo controller for new applications. The DC900 cannot successfully auto-tune without preparing it with a set of initial condition parameters. These parameters, which are stored in on-board Flash memory, configure the controller for a nominal galvo and mirror combination. Manufacturing process variations in the galvo and mirror are automatically compensated for through the auto-tuning process. DC900 controllers shipped from CTI are always configured with a set of parameters suitable for the customer chosen galvo-mirror system.

For new applications, parameter files can be obtained from CTI. To load the parameter files, see the Smartconnect Installation and Operations Manual (P0900-0128). With the use of smart connect many features can be adjusted or read directly from the board through the RS 232.

Configuring the controller for user interaction

The DC900 has a 10-pin header on the digital module that is used to connect the controller DSP to a host PC via an RS-232 connection. Even though only TXD, RXD and GND are required for communications to take place, this header is wired in such a way as to simplify the construction of an adapter cable by means of mass-terminated IDC style connectors. Figure 9 illustrates an adapter cable that is suitable for plugging into a standard 9-pin male D-type COM port connector used on most commercial PC systems. Table 14 defines the signals that are actually used by the DC900. An RS-232 cable to connect the DC900 with a serial port is available, CTI part number 6017-1, available in 24" and 72" lengths.

Figure 9 Serial Port Adapter Cable



9-Pin "D"	Signal	Direction	10-Pin IDC
1	DCD*	Host←	1
2	RXD	Host←	3
3	TXD	→DC900	5
4	DTR**	→DC900	7
5	GND	← →	9
6	DSR*	Host←	2
7	RTS**	→DC900	4
8	CTS**	Host←	6
9	RI**	Host←	8
		<not used>	10

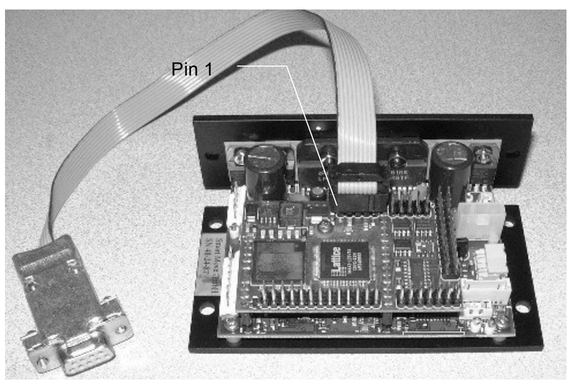
* Connected together on the DC900, but not driven
** Not used by the DC900

Table 14 SV7: Communications signals

Pin	Function
1	
2	
3	RS232 TXD
4	
5	RS232 RXD
6	
7	
8	
9	GND
10	

The 9-pin "D" end of the cable should be connected directly to one of the COM ports on the PC, or to the PC via an extension cable. The other end should be connected to header SV7 on the digital board of the DC900 controller as illustrated in Figure 10.

Figure 10 Attaching a serial cable to the DC900



Remote Support

The DC900 supports remote access to several operational variables via the RS-232 communications interface. For more information on this, refer to the Smartconnect Installation and Operations Manual (P0900-0128)