IC693DSM314

New In Stock!

GE Fanuc

http://www.pdfsupply.com/automation/ge-fanuc/series-90-30/IC693DSM314

Series 90-30

1-919-535-3180

In Stock! 4 AXIS Motion Control IC693D IC693DS IC693DSM

www.pdfsupply.com

Email: sales@pdfsupply.com

  - 3-4 Axis Analog mode, no Local Logic: 2.0msec (position)
  - Any Axis Analog Torque Mode: Velocity loop update:
  - Torque Mode Velocity Loop: 0.5msec (velocity) – fixed per each axis configured as Torque Mode
- Block processing time under 5msec
- Velocity Feed Forward and Position Error Integrator to enhance tracking accuracy
- Local Logic
- Electronic CAM
- Fast Backplane Status Access Read/Write Support (SVREQ #46)
- High resolution of programming units
  - Position: -536,870,912 .. +536,870,911 User Units (at 1:1 User Units / Counts)
  - Velocity: 1 .. 1,000,000 User Units / sec (at 1:1 User Units / Counts)
  - Acceleration: 1 .. 1,073,741,823 User Units / sec / sec (at 1:1 User Units / Counts)

Ease of Use

- Single point of programming
- Simple and powerful instruction set
- One or two axis motion programs with synchronized block start on axis 1 & axis 2
- Up to four concurrent single axis motion programs
- Integrated Motion programming, Local Logic programming, and Electronic CAM programming in VersaPro and CIMPLICITY Machine Edition Logic Developer – PLC software
- Backplane Motion, Local Logic, and CAM program transfer
- User scaling of programming units
- Generic programming using command parameters as operands for Acceleration, Velocity, Move and Dwell commands
- Configured with CIMPLICITY Machine Edition or VersaPro software
- Automatic data transfer between PLC tables and the DSM314 without user programming
- Ease of I/O connection with factory cables and terminal blocks as well as a serial port for connecting programming devices

Versatile I/O

- Control of digital AC servos & Analog servos with $\pm$ 10V Velocity Command Interface
- Home and overtravel switch inputs for each servo axis
- Two position capture strobe inputs for each position feedback input
- 5V, 24V and analog I/O for use by the PLC
- Incremental quadrature encoder input for Follower mode
- 13-bit analog output for each auxiliary axis can be controlled by PLC or used as servo tuning monitor

Product Id:

IC693DSM314-AE

H/W Id:	AP3B1 (44A737294-G01R03 or later)	
S/W Id:	Firmware version: 3.01	App: 44F725986-417AE

Firmware Update Kit

If you wish to upgrade a previous version of DSM314 to firmware version 3.01, you may purchase upgrade kit number 44A749487-G04, or download the upgrade free of charge from the GE Fanuc web site at http://www.gefanuc.com/support/plc/motionsolutions.htm. Any previous version can be upgraded to 3.01.

Applicable Documents

GFK-1742, *DSM314 for IC693 PLCs User's Manual*

Special Operational Notes

IC693 CPU Firmware

Use of DSM314 firmware version 3.0 requires that version 10.00 or higher of the IC693 CPU firmware be installed in the CPU module. CPU firmware version 10.00 or higher is available for CPUs 350, 352, 360, 363, 364, and 374.

Configuration and Programming Software

One of the following software tools must be used for configuration and programming the DSM314 module:

- CIMPLICITY Machine Edition Logic Developer – PLC, version 2.1 or later
- VersaPro version 1.50 or later
- The DSM314 is not compatible with any other PLC programming software or with the DOS-based Motion Programmer software. Additionally, the Electronic CAM function requires the CAM Editor version 1.0 or later. The CAM Editor package can be ordered as an add-on to VersaPro. (The part number for the CAM Editor add on for VersaPro is IC641VPSCAMA.) The CAM Editor is integrated with Logic Developer – PLC.

Essential Configuration Parameters

The following configuration parameters do not default to the settings required for many applications and must be changed by the user or are features not available in this firmware release.

Motor1 Type, Motor2 Type:	For digital servos, Motor Type must be changed to match the specific type number of the motor used. Select type 0 only if no servo is used or in ANALOG mode.
Analog Servo Command	*Torque* is supported in this firmware release.
Acceleration Feed Forward Percentage	*Acceleration Feed Forward Percentage* is not supported in this firmware release.
Feedback Source	*Feedback Source* must use *default* or *Ext Quadrature Encoder. Ext Quadrature Encoder* is used with Digital Mode Axis-1 only. Other choices are not supported in this firmware release.
Feedback Mode	If *Feedback Source* is set to *Ext. Quadrature Encoder*, then *Feedback Mode* is always Incremental (even if set to Absolute).
Ramp Makeup Mode	*Ramp Makeup Mode must use Makeup Time.*
Ramp Makeup Velocity	The *Ramp Makeup Velocity* is used when the Follower Disable Action is Inc Position or Abs Position and the follower slave axis reverses direction after a follower disable trigger. The ability to reverse direction after a Follower Disable Trigger is an improvement in firmware release 2.0.

PLC %Q Bits

PLC %Q bits are, by design, RETENTIVE in nature. These bits ONLY become NON-RETENTIVE after their locations are used (programmed) in a PLC program. All motion causing %Q bits such as Drive Enable, Start Motion program, Jog, etc. must be controlled from a programmed PLC coil reference for safe operation.

Grounding Bars and Clamps

The *DSM314 for IC693 PLCs* User's Manual describes the I/O cable grounding requirements required for a system to meet CE Mark installation guidelines. These guidelines include the use of grounding bars and clamps. A Grounding Bar may be ordered as part number 44B295864-001R02 and a Ground Clamp as part number A99L-0035-0001.

Cables

Two I/O, two command, and one communication cable are available for use with the DSM314, as described below. Consult the factory regarding custom length cables.

- IC693CBL324: 1 meter terminal board connection I/O cable
- IC693CBL325: 3 meter terminal board connection I/O cable
- IC800CBL001: 1 meter servo command cable
- IC800CBL002: 3 meter servo command cable
- IC693CBL316: Motion programmer communications cable

Caution

The I/O and command cables listed above are custom manufactured with special shielding and internal construction. Substituting non-approved cables may adversely affect the servo system.

Terminal Boards

Two terminal boards for user I/O connections are available for use with the DSM314, as described below.

IC693ACC335: Servo terminal board

IC693ACC336: Auxiliary terminal board

These terminal boards provide screw terminal connections for I/O signals such as Position Strobes, Home Switches, Limit Switches, Analog Inputs, and Analog Outputs. For additional information, refer to Chapter 3 of GFK-1742, *DSM314 for IC693 PLCs User's Manual.*

Caution

The terminal blocks contain Metal Oxide Varistor (MOV) circuit protectors, which prevent excessive electrical energy from affecting the DSM314. The maximum recommended input voltage for any of the 24v I/O circuits is 30 VDC with respect to earth ground ("S" terminal) or circuit common.

Strobe Input Differences between Analog and Digital Mode

The strobe input faceplate pins for Axis 1 and Axis 2 depend on the DSM servo mode (Analog or Digital). In Digital Mode, the Axis 1 and 2 strobe inputs use faceplate inputs IN1 and IN2, which can be either single ended or differential. In Analog mode, the Axis 1 and 2 strobe inputs use faceplate inputs IO5 and IO6, which are single ended only. Axes 3 and 4 always use IO5 and IO6 as the strobe inputs.

Note: The input circuits for IO5 and IO6 contain 4.7k pullup resistors to internal +5v. If no signal is connected to these inputs, the input will always appear to be ON. Normally a single ended TTL or CMOS driver must be used to drive these circuits from the strobe sensor.

The strobe inputs are summarized in the table below.

Servo Type	*Axis 1 Strobe Inputs*	*Axis 2 Strobe Inputs*	*Axis 3 Strobe Inputs*	*Axis 4 Strobe Inputs*
Digital	IN1_A, IN2_A (Single Ended or Differential)	IN1_B, IN2_B (Single Ended or Differential)		
Analog	IO5_A, IO6_A (Single Ended)	IO5_B, IO6_B (Single Ended)	IO5_C, IO6_C (Single Ended)	IO5_D, IO6_D (Single Ended)

Follower Disable and Abort Operation

When the follower function is active, the DSM Abort %Q bit DOES NOT disable the follower function. The user can immediately halt motion by turning off the Enable Follower %Q bit. Thus, the Abort %Q bit halts programmed motion, and the Enable Follower %Q bit halts follower motion. This operation is different from DSM314 releases 1.0 and 1.1. In these earlier releases the abort %Q bit halted both programmed motion and follower motion.

CAM in Absolute Mode can Lose Synch if Master Drive is Disabled

If the Master Drive is Disabled and then Re-enabled, the CAM axis will lose master counts that result from master axis motion while the master axis is disabled. In Absolute mode, this can cause the CAM axis to lose synch from the absolute master value. It is recommended that when the CAM command is operated in absolute mode, the CAM be aborted when the master axis is disabled.

Problem Resolved by this Release (3.01)

Inconsistent Jump Operation when Executing consecutive CMOVEs

When a motion program has a Jump command active during a CMOVE that results in executing another CMOVE, operation of the servo motion should not stop if the latter CMOVE is valid. However, for certain velocity and acceleration combinations, the DSM would incorrectly stop motion between the CMOVEs. This has been corrected in firmware revision 3.01

Problems Resolved by Release 2.0

Inconsistent operation of Absolute Rotary Mode

When the configuration for Software EOT is set to disabled and the DSM is in rotary mode, commanded and actual positions are allowed to roll over at the configured limits. An Absolute mode %AQ move command works as expected – the axis always moves within 1 revolution to the absolute position specified in the command. However, if a motion program with a combination of incremental and absolute moves is used, an absolute move may cause unexpected results - the axis may move many revolutions when the user expected it to move only within one revolution. If %AQ move commands are used instead of a motion program, the axis works as expected. This has been corrected in firmware version 2.0.

Select analog output mode cannot be sent from axis 4 AQ command registers

The Select Analog Output mode command (AQ command 47h) can only be sent from the AQ command registers for Axis 1-3. If the command is sent in the axis 4 command registers it will not have any effect. This has been corrected in firmware version 2.0.

Follower Registration Move is referenced to previous cycle

When a Follower registration move (Follower Disable mode = Inc Position) is initiated by a faceplate input (CTL bit), the actual registration distance relative to the position at the instant the faceplate input turns on is 0-2 ms less than the programmed registration distance. The only noticeable effect will be on a local logic program which corrects for 2 ms sampling variations using slave axis strobe data and the local logic position increment command. The strobe position must be compared to the Actual Position of the cycle before the strobe rather than the cycle after the strobe. This has been corrected in firmware version 2.0.

Problems Resolved by Release 1.1

None

New Features and Functionality of this Release (3.01)

None

New Features and Functionality of Release 3.0

Torque Mode (Analog Mode)

The motion module firmware has been enhanced to include support for Analog Torque Mode control. In Analog Torque Mode, the module provides closed loop position and velocity control for up to four servomotors. Thus, the servo amplifier is responsible for providing the torque control function. The interface between the DSM module and the servo amplifier is a ± 10 volt signal that corresponds to motor torque. The maximum torque mode top speed is 8192 rpm.

Analog Torque Mode is very similar to the pre-existing Analog Velocity mode. The difference is that in Analog Velocity mode the controller performs closed loop position control only. It then outputs a voltage that is the analog of motor velocity. In Torque Mode, the module closes not only the position loop but the velocity loop as well. The additional loop allows the module to output a voltage that is the analog of motor torque.

Consult the User's Manual (GFK-1742) for more information.

Beta M1/5000 & BetaM0.5/5000 Motor Support (Digital Mode)

The motion module firmware is enhanced to include support for the FANUC Beta M1/5000 and Beta M 0.5 motors.

Motor Model	*Motor Type Code*
Beta M0.5/5000	115
Beta M1/5000	116

A9 Error Loss of Position Feedback Behavior

The DSM314 A9 Error – Loss of Position Feedback behavior has been enhanced to allow the user to configure the error to be either a Status Only error (default) or a Stop Fast error. If the user chooses the default behavior (Status Only) the PLC program is responsible for taking appropriate action based upon the application. This is the same action taken by prior DSM314 firmware versions and thus the feature is backward compatible. The user can also, through module configuration, choose to have the module perform a Stop Fast. The feature is activated with tuning parameter #11 in the Advanced tab in the configuration software. To configure the module, use the following code and enter only one tuning parameter for A9 behavior per axis.

Axis # Par #	*Axis # Data*	*Mode*
11	0	A9 Error generates a Status Only Error
11	1	A9 Error generates a Fast Stop Error
11	All Other Values	Invalid

New Features and Functionality of Release 2.0

Electronic CAM

An electronic CAM is analogous to a mechanical CAM but will never mechanically wear out. Electronic CAMs also provide flexibility for quick transition between different profiles without the need for mechanical cam replacement. DSM314 CAM profiles are configured with a new easy to use graphical editor addition to VersaPro 1.5.

Electronic CAMs are used in the machine industry to perform complex motions that require tight coordination between axes. Often the cam profile follows the input from a master encoder mounted on the machine but can also follow another controlled axis within the same DSM314 module. Some examples of applications that can benefit from CAM profiling are:

- Rotary cutoff
- Flying shear
- Profiled container filling
- Material handling

Consult the User's Manual (GFK-1742A or later) or on-line help for more information.

New Features and Functionality of Release 1.1

External Position Feedback (DIGITAL Mode Only)

External position feedback allows the user to control the servo position loop of axis 1 from a position feedback device (Quadrature Encoder) that is different from the position encoder mounted on the motor. The standard digital servo motor feedback (from the serial encoder) will be used for motor commutation and feedback for the remaining loops.

Axis 1 in the DSM314 can be configured to use an external encoder connected to the Axis 3 "C" connector. Refer to the *DSM314 for IC693 PLCs User's Manual* for more details on the axis connectors. In the hardware configuration software, the Axis 3 mode must be set to "**Auxiliary Axis**" (in the "Settings" tab). In the "Axis # 1" tab the "Feedback Source" must be set to "**Ext Quadrature Encoder.**" The external feedback feature is not available for Axis 2.

Note: The quadrature encoder must be wired in phase with the encoder that is in use on the digital servo motor. To check the wiring for correct operation:

1. Wire the external encoder to the module and configure the module for three servo axes.
2. Configure **Axis 3 Mode** as an *Auxiliary Axis*. Do not enable the **Ext Quadrature Encoder** feature for axis 1 at this point. This simple configuration will allow the DSM to report the position read from the FANUC motor mounted encoder (axis 1) and the external quadrature encoder (axis 3).
3. Verify that the **Axis Direction** configuration parameters for axis 1 and axis 3 are set to *Normal*.
4. Turn on the %Q Enable Drive bit and place the command code for Force Digital Servo Velocity to 0 in the %AQ table. Confirm that the servo amplifier is enabled (the motor should exhibit holding torque). The %Q Enable Drive bit must be maintained ON for the Force Digital Servo Velocity command to function.
5. Send the command code for Force Digital Servo Velocity. You should send a small value such that the servo motion will not harm the driven load.
6. Confirm that the motor position reported for axis 1 and the encoder position for axis 3 have the same phase. For example: If the reported axis 1 position is positive and increasing, the reported axis 3 position should also be positive and increasing. If the positions are out of phase (i.e. positive/negative) reverse the encoder channel A and channel B inputs for the external encoder and repeat the above test.
7. If this does not fix the problem, consult the documentation that came with your encoder. Once the encoder and motor feedback devices have the same phase, you can proceed with setting up the external encoder feature.

Note: In the tab Tuning #1, you must enter a *Velocity at Max Cmd* value. The Velocity at Max Cmd data must be the velocity at which the external quadrature encoder would be rotating if the digital servo motor were running at 4096 rpm. The data does not imply that the digital servo can run at 4096

rpm, it is only used to set the DSM internal gain factors for position loop gain and velocity feedforward. Note that the above process of setting *Velocity at Max Cmd* would need to be redone if the User Units to Counts ratio for axis 1 is changed.

The Velocity at Max Cmd data units are axis 1 user units/sec. You must calculate the axis 3 encoder output in cts/sec and convert to axis 1 user units/sec. The maximum allowed value for Velocity at Max Cmd is 1 million cts/sec (DSM hardware and firmware limit), which is enforced by the hardware configuration software.

When Axis 1 is configured for external feedback, the Find Home cycle will still use the 24V Home Switch input from the “A” connector even though the external encoder is connected to the “C” connector. Similarly, the Axis 1 Overtravel Limit Switch inputs will be from the “A” connector. Axis 1 strobes will use the axis 3 inputs from the "C" connector (IN5_C and IN6_C) and are subject to analog strobe timing specifications. Axis 3 strobe will not operate, although the level of the axis 3 strobe inputs will still be reported to Local Logic and CTL bits.

Note: External quadrature encoders which have the same resolution as the digital servo motor’s serial encoder (8192 cts/rev) cannot be configured properly if they are geared to run more than 1.7x faster than the digital servo motor. External quadrature encoders geared at 1:1 with the digital servo motor cannot have resolution greater than about 14,000 cts/rev.

Features and Functionality of Release 1.0 (Initial Release)

Local Logic Programming

The DSM314 includes Local Logic capability. The Local Logic program works in conjunction with the PLC logic program and motion program to yield a flexible programming environment. Specifically, Local Logic programs provide the ability to perform math and logic that is deterministic and synchronized with the DSM Position Loop execution rate. This ability is critical to many applications where the accuracy and/or speed require this tight synchronization. *In release 1.0, some Local Logic variables are not extended to Axis 3 or 4. Consult the User's Manual (GFK-1742) or the Local Logic Variable Table in the configuration/programming software for more information.*

Follower Configuration and Sources

The DSM314 supports a virtual (time based) Auxiliary master axis that can be configured in place of one or more of the controlled axes. Other axes on the same module can be independently configured to follow this virtual axis or a real encoder master. Other follower mode enhancements include:

- User defined units can be used in follower mode
- An independent acceleration setting is now available for follower make-up move
- Registration move option added to follower disable action list (incremental position)
- Separate %I bit to indicate the follower ramp is active
- Configurable follower enable and disable triggers

4 Axis Analog/ 2 Axis Digital Servo and 1 Axis Analog Control

The DSM314 provides the user with four-axis analog servo or two-axis digital servo control plus an additional analog axis.

Improved Strobe Resolution

Strobe resolution is +/- 2 counts with 10 microsecond of additional variance. If a strobe occurs during extreme accelerations, the resolution will decrease slightly.

Single Point of Programming with VersaPro 1.10

The motion programming tool suite is integrated into the VersaPro programming and configuration package. All module programming occurs through this package. No additional connections, other than the CPU connection, are required.

Incremental Encoder Support

Set Position is allowed on the first revolution when digital servos are configured for incremental mode.

Fast Backplane Status Access Functionality

The Fast Backplane Status Access function (Service Request #46) provides another PLC sweep mode. In this sweep mode, the CPU transfer a limited amount of digital I/O information to and from the module(s). Thus, sweep times can be decreased during certain critical sections. The backplane Fast Backplane Status Access function will write 4 bits to the DSM314 and read 8 bits from the DSM314.

Position Loop Update Rate

The DSM314 dynamically adjusts the position loop update rate for optimal performance based on the number and type of axes configured:

- 2ms if Any Axis is Digital or 3-4 Axes Analog or 2 Axis Analog with Local Logic
- 1ms for 2 Axis Analog (no Local Logic)
- 1ms for 1 Axis Analog (with Local Logic)
- 0.5ms for 1 Axis Analog (no Local Logic)

Backplane Motion and Local Logic Program Transfer

Each time the PLC powers-up, the DSM314 programs are loaded via the backplane to each module. This allows multiple DSM314 modules to share the same program and also allows swapping DSM314 modules during troubleshooting without transferring programs.

Enhanced I/O Assignment

- All I/O references are identical for each of the 4 axes
- Output arbitration between PLC control and Local Logic program control can be configured by the user
- There are 32 CTL bits
- CTL bits and output bit assignments are configurable

Enhanced Parameter Resolution and Ranges vs. DSM302

Resolution Changes:

- Position Loop Time Constant: From 1ms in the DSM302 to 0.1ms in the DSM314
- Velocity Feedforward: From 1% in the DSM302 to 0.01% in the DSM314
- Torque Limit AQ Command: From 1% in the DSM302 to 0.01% in the DSM314

Range Changes:

- Position Range: Increased from -8,388,608/+8,388,607 User Units (UU) in the DSM302 to -536,870,912 / +536,870,911 UU in the DSM314
- Accel Range: Increased from 134,217,727 User Units per Seconds Squared (UU/S^2) in the DSM302 to 1,073,741,823 UU/S^2 in the DSM314

Parameter Based Subroutine Calls

Motion program subroutine calls can be dynamically altered by using parameter-based references instead of the fixed references.

In-Zone Bit Based on Position Error Only

In the DSM302, the *In-Zone* %I bit was controlled by the *Position Error* status and the *Moving* %I bit. In the DSM314, the *In-Zone* %I bit is controlled only by the *Position Error* status, allowing this bit to be used to determine if an axis is accurately following the command during a move.

Reversal Compensation Changes

The reversal compensation value is not reflected in the commanded position or actual position values, allowing a more accurate determination of axis position in systems with backlash.

Restrictions and Open Problems

Restriction/Problem	*Description*
Cyclic Circular CAM with Negative-going Master - problem w/CAM blend and 2nd CAM is ABS	This problem is restricted to a **cyclic-circular** CAM **in absolute master mode** in a **sequence of CAMs** with the **master going backward**: If the master has already rolled over (moved a few counts) in the previous CAM and the slave did not roll over (because the previous CAM exited), the slave will not automatically rollover backwards into the next sequential CAM without an intervening Move command. Otherwise, this could generate a velocity limit error as the slave attempts to move without rolling over to the corresponding value matching the current master position.

Documentation Error

GFK-1742A, *DSM314 for IC693 PLCs User's Manual,* Figure 3-23 on page 3-35

DSM Pin number 18: The corresponding Aux TB Terminal number should be 18 instead of 8.

This error has been corrected in GFK-1742B and later.