

IMPORTANT PRODUCT INFORMATION

READ THIS INFORMATION FIRST

Product: **IC693DSM302 Module**
 IC693DSM302AC
 Firmware Version 1.20

The DSM302 Module is a twoaxis motion control module which is highly integrated with the logic solving and communications functions of the IC693 PLC. Two primary control loop configurations are provided, Standard mode and Follower mode. The basic capabilities of the DSM302 are described below:

High Performance

- Digital Signal Processor (DSP) provides vector control of GE Fanuc AC servos
- Servo loop update: 250 μ sec (torque), 1 msec (velocity), 2 msec (position)
- Block processing time under 5 msec
- Velocity Feed Forward and Position Error Integrator to enhance tracking accuracy
- High resolution of programming units
 - ◆ Position: –8,388,608 . . . +8,388,607 User Units
 - ◆ Velocity: 1 . . . 8,388,607 User Units / sec
 - ◆ Acceleration: 1 . . . 134,217,727 User Units / sec / sec

Easy to Use

- Simple and powerful instruction set
- Oneaxis or twoaxis motion programs with synchronized block start
- Program support for a short motion program (called Program Zero) which can be created in the MS-DOS[®] programming software configuration function
- Nonvolatile (flash) storage for 10 programs and 40 subroutines
- User scaling of programming units (in Standard mode only)
- Generic programming using command parameters as operands for Acceleration, Velocity, Move and Dwell commands
- Configured with MSDOS configuration software
- Automatic data transfer between PLC tables and the DSM302 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 GE Fanuc digital AC servos
- 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 master axis
- 13-bit analog output for each auxiliary axis can be controlled by PLC or used as servo tuning monitor

Product ID

IC693DSM302AC

Hardware ID: AP3B1 (44A737294G01R03 or later)

Software ID: Firmware version 1.20 Boot: 44P725986408B

App: 44S750607G01R03

Firmware Update Kit

44A732298–G02 (firmware version 1.20)

Applicable Documents

GFK1464, *DSM302 for IC693 PLCs User's Manual*

GFK1362, *Using the WindowsBased Motion Programmer*

GFK0664A, *IC693PLC Axis Positioning Module (APM) Programmer's Manual*

Special Operational Notes

IC693 CPU Firmware

Use of DSM302 firmware version 1.20 requires that version 6.50 or higher of the IC693 CPU firmware be installed in the CPU module.

IC693 MSDOS Programming Software

Use of DSM302 firmware version 1.20 requires that version 8.02 or higher of the MSDOS Programming Software be used to configure the DSM302 module.

Windows Programming Software

Use of DSM302 firmware version 1.20 requires that version 2.11 or higher of the Windows-based Programming Software be used to configure the DSM302 module.

Motion Programmer

Motion programs 1-10 must be created/edited with separate Motion Programmer software. Two different software packages are available for this purpose. For Windows® 95 and Windows NT®, use of DSM302 firmware version 1.20 requires that version 2.0 or higher of the Windows-based Motion Programmer be used. For MSDOS, use of DSM302 firmware version 1.20 requires that version 1.50 or higher of the APM300 MSDOS Motion Programmer be used.

Essential Configuration Parameters

Either Windows-based Programming Software version 2.11 or higher, or MSDOS Programming Software version 8.02 or higher must be used to configure the DSM302 module. The following configuration parameters will not default to the settings required for many applications and must be changed by the user.

Caution

Fdback Type and Ctl Loop MUST be changed first. Any change to either Fdback Type or Ctl Loop resets all other parameters to default values.

AI/AQ Len:	Set according to the minimum requirements of your application. Setting <u>40/6</u> can be used for Standard mode. Follower mode requires at least setting <u>50/9</u> if Master Axis position and velocity are to be monitored by the PLC. Setting <u>64/12</u> provides the maximum amount of analog I/O references.
Fdback Type:	Must be changed to <u>DIGITAL</u> . Feedback types <u>ENCODER</u> , <u>LINEAR</u> , <u>RESOLVR</u> , <u>CUSTOM1</u> and <u>CUSTOM2</u> are not supported in this release of the firmware.
Ctl Loop:	Select <u>STANDARD</u> for Standard control loop mode or <u>FOLLOWER</u> for Follower control loop mode. <u>CCL2</u> is reserved for special applications. <u>CCL1</u> is not supported in this release.
Servo Cmd:	Must be changed to <u>DIGITAL</u> . <u>ANALOG</u> and <u>DUAL</u> are not supported in this release.
Motor1 Type, Motor2 Type:	Must be changed to the correct GE Fanuc motor type. Select type 0 only if no servo is used.
Pos Err Lim:	Change from default setting of 4096 to a typical value of 15000 – 30000.
Pos Loop TC:	Change from default setting of 1000 ms to a typical value of 30 – 50 msec.
Vel at 10v:	Must be changed to : 139,820 * (User Units / Counts)

Configuration NOTEQ (Not Equal)

When a rack configuration containing a DSM302 module is downloaded to an IC693 PLC CPU with a firmware revision earlier than 8.10, the MSDOS-based programmer status area will still show CONFIG NOTEQ even though the store operation completes successfully. If the configuration is immediately loaded back into MSDOS programming software, the status area will now show the expected CONFIG EQUAL. The status area will continue to show the correct CONFIG EQUAL setting until a new configuration is again downloaded to the PLC CPU.

PLC %Q Bits

PLC %Q bits are, by design, RETENTIVE in nature. These bits ONLY become NONRETENTIVE after the location is 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 *DSM302 for IC693 PLCs User's Manual* describes the I/O cable grounding requirements necessary for a system to meet CE Mark installation guidelines. These guidelines include the use of grounding bars and clamps, both of which are available from GE Fanuc. The Grounding Bar may be ordered as part number 44B295864001, and the Ground Clamp as part number A99L00350001.

Cables

Five different cables are available for use with the DSM302, 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 nonapproved cables may adversely affect the servo system.

Terminal Boards

Two terminal boards for user I/O connections are available for use with the DSM302, 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 and Appendix E of GFK-1464, *DSM302 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 DSM302. 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.

Problems Resolved by this Release (1.20)

Input IN4_C Does Not Function As Described

The on/off state of the IN4_C input (see GFK-1464, *DSM302 for IC693 PLCs User's Manual*, chapter 5, "DSM302 to PLC Interface," for details) was inverted from what was documented. This has now been corrected in firmware version 1.20, such that the on/off state of the input matches the documentation.

Firmware Reports D6 Error Sporadically during Normal Operation

Previous firmware contains an error that causes a D6 error to be reported incorrectly during normal operation. The nature of the firmware error also causes errors D3-D9 to be reported incorrectly. These firmware errors have been fixed in version 1.20.

Documentation Issues in GFK-1464, *DSM302 for IC693 PLCs User's Manual*, Resolved by Revision A (May 1998) Release

The following table outlines the previously identified documentation issues that have been resolved by the revision A release of GFK-1464, *DSM302 for IC693 PLCs User's Manual*:

Issues Resolved by Revision A of GFK-1464 (May 1998 Release)

Documentation Issue	Location	Description/Resolution
PCR Connectors Mislabeled in Pin Configuration Diagrams	Chapter 2	Two different connector pin configurations for the emergency stop JX5 connector on the β Series servo amplifier were shown with the labels (HIROSE and HONDA) incorrectly reversed. The labels were switched.
Grounding Bars and Clamps Need to Be Documented	Chapter 3	The "I/O Cable Grounding" section did not specify the part numbers for the grounding bars and clamps needed for proper installation. These have been added to the manual.

Issues Resolved by Revision A of GFK-1464 (May 1998 Release) - Continued

Documentation Issue	Location	Description/Resolution
Quadrature Specifications Not Documented	Chapter 3	The technical specifications for quadrature devices used as a follower master axis were not documented. These have been added to the manual.
Incorrect Part Numbers Listed for Terminal Block Connection Cables	Chapter 3	The incorrect part numbers were given for the Terminal Board Connection cables. The incorrect part numbers listed were IC800CBL324 and IC800CBL325. These part numbers should have been IC693CBL324 and IC693CBL325, respectively, and have been corrected.
Input IN4_C Wiring Not Described	Chapter 3	The appropriate wiring for input IN4_C was not described. The description has been added.
<i>Final Home Velocity</i> Valid Command Range Incorrectly Specified	Chapter 4	The "Configuring the DSM302" section incorrectly specified the valid range as 1..8,388,607. The range is actually 1..65535 and has been corrected in the manual.
<i>Select Return Data</i> Command Incorrectly Described	Chapter 5	Section incorrectly stated that information is returned in the <i>Commanded Position</i> %AI word for each axis. Data is actually returned via the <i>User Selected Data</i> %AI word for each axis. Text has been corrected.
Wrong Graphic Used for Velocity Profile	Chapter 7, Figure 7-6	Figure showed an expected velocity profile for a program example describing "hanging" the DSM302 when distance runs out. The incorrect graphic that was included has been replaced with the correct one.
Error Code 35 Not Documented	Appendix B	Axis status error code 35 was not documented. This error is now correctly described as a "find home while follower enabled" error.
Wire Size, Screw Torque and MOVs for Terminal Blocks Not Specified	Appendix E	The wire size, screw torque and MOV descriptions for terminal block assemblies IC693ACC335 and IC693ACC336 were not specified. These descriptions have been added.

Problems Resolved by Previous Release (1.10)

Encoder 3 Home Position

During a *Find Home* cycle on the Aux 3 axis, the Encoder 3 home position was not registered correctly in firmware version 1.00 when the encoder marker pulse was sensed. This was corrected in firmware version 1.10. Note that this problem only pertained to Follower mode operation.

Module Sometimes Hangs Responding to COMMREQ Commands

When the DSM module was receiving a high rate of COMMREQ commands from the PLC CPU and was simultaneously executing a series of short move commands, the module would sometimes halt execution and flash a 6count/ 7count error code on its STAT LED (see Appendix B of GFK-1464, *DSM302 for IC693 PLCs User's Manual*, for details). This timing problem was corrected in firmware version 1.10.

New Features and Functionality for this Release (1.20)

Expanded Follower A/B Ratio

The A/B slave/master follower ratio has been expanded from the original range of 32:1 to 1:32 to a range that supports 32:1 to 1:10,000. Existing AQ command 2Dh can be used to specify an expanded range at runtime. Specifying the expanded range (ratio greater than 1:32) at configuration time requires release 9.0 or higher of the MS-DOS Programming Software, or Windows-based Programming Software release 2.11 or higher.

Enhanced Position Loop Resolution

Enhanced position loop resolution, at the expense of maximum supported motor velocity, has been added to the product in this firmware release. Prior to this release, a non-configurable position loop resolution of 8192 counts per encoder revolution was provided. The table below describes the various selections now supported, along with the maximum supported motor velocity for each setting. Note that the configuration data is specified by entering a value of "1" (to select parameter 1) in the "Tuning Par1" field for axis 1 or in the "Tuning Par2" field for axis 2. The appropriate resolution setting value (0..3) is then entered in the "Tuning Dat1" field for axis 1 or in the "Tuning Dat2" field for axis 2.

Enhanced Position Loop Resolution Selections Supported

Encoder Resolution (in Counts per Revolution)	Maximum Motor Velocity (Revolutions per Minute)	Configuration Data	
		Parameter #	Value
8192 cts/rev	4400 rpm ^{1,2}	1	0
16384 cts/rev	3662 rpm ²	1	1
32768 cts/rev	1831 rpm	1	2
65536 cts/rev	915 rpm	1	3

¹ Default Setting.² Some motors are restricted to a lower maximum rpm rating.

New Features and Functionality for Previous Release (1.10)

HV Motors

Support for the following three HV motors was added in firmware release 1.10:

<u>Motor Model</u>	<u>Motor Type Code</u>
α 12HV/3000	3
α 22HV/3000	4
α 30HV/3000	5

Set Aux Axis 3 Position Command Enhancement

The *Set Aux Axis 3 Position* command was enhanced to execute regardless of the axis' current velocity. In firmware version 1.00, the command would be ignored and a 0X52 axis status error reported if the axis' velocity exceeded 128 counts per second.

Restrictions and Open Problems

Restriction/Problem	Description
<i>Axis Mode</i> = LINEAR may not operate correctly if <i>Pos EOT</i> = <i>Hi Limit</i> or <i>Neg EOT</i> = <i>Lo Limit</i>	If <i>Axis Mode</i> = LINEAR, the axis will stop at the configured Positive / Negative End of Travel limits if these values equal the corresponding Hi / Lo Count Limits. However, you may not be able to jog back off the EOT. To avoid this problem when using <i>Axis Mode</i> = LINEAR, always set <i>Pos EOT</i> below (to a lower value than) the <i>Hi Limit</i> and <i>Neg EOT</i> above (to a higher value than) the <i>Lo Limit</i> . For example, if the <i>Hi Limit</i> was set to +1000, and the <i>Low Limit</i> to -1000, the <i>Pos EOT</i> could be set to +990, and the <i>Neg EOT</i> to -990.
<i>Axis Mode</i> = LINEAR should not be selected when <i>Ctl Loop</i> = FOLLOWER	In Follower Mode, if the <i>Axis Mode</i> is set to LINEAR, the <i>Pos EOT</i> / <i>Neg EOT</i> values are internally set to the corresponding Hi/Lo Count Limits. Because of the problem listed above, a <i>Jog</i> or programmed Move may not work at the configured EOT limit. In addition, the EOT limits do not apply to motion generated by Follower Master Axis inputs. Therefore <i>Axis Mode</i> = LINEAR should not be selected for either servo axis when <i>Ctl Loop</i> = FOLLOWER.
MCON can be left enabled when aborting a Jog	If the following sequence is followed <u>exactly</u> , MCON will be left on in error following the cessation of all motion: Begin a Jog operation, turn on the abort bit to abort the jog, turn off the jog bit, wait for motion to completely stop, then turn off the abort bit.