DENSO ROBOT

SUPPLEMENT

Main System Software Version 2.3*

Preface

DENSO WAVE has updated main system software designed for DENSO robot series from Version 2.2* to Version 2.3*, with the introduction of **-G series (configured with RC7M controller).

This book is a supplement to the DENSO robot manuals. It describes newly added and updated functions. Use this supplement together with other robot manuals.

For the following new products, refer to the related manuals as listed below.

(1) **-G series

"General Information About Robot" and "Installation & Maintenance Guide" for the corresponding model

(2) RC7M controller

"Interface Manual for Denso Robot RC7M Controller"

(3) Options including teach pendant, mini-pendant, and extension boards

"Options Manual for Denso Robot RC7M Controller"

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1 Newly added language selection window on TP top screen

The language selection window was added on the teach pendant top screen.

When turning the controller power on, use the teach pendant after selecting the language (English or Japanese).

<Operation method>

(1) When turning the controller power on, the “Language selection window” appears on the teach pendant.

(2) Select the “English”, and press the OK button.

(3) The system message “ Show language select menu on next power on?” appears.

If you select “No” and press the OK button, the teach pendant is usable in English after this operation.

2 Free Curve Interpolation Control

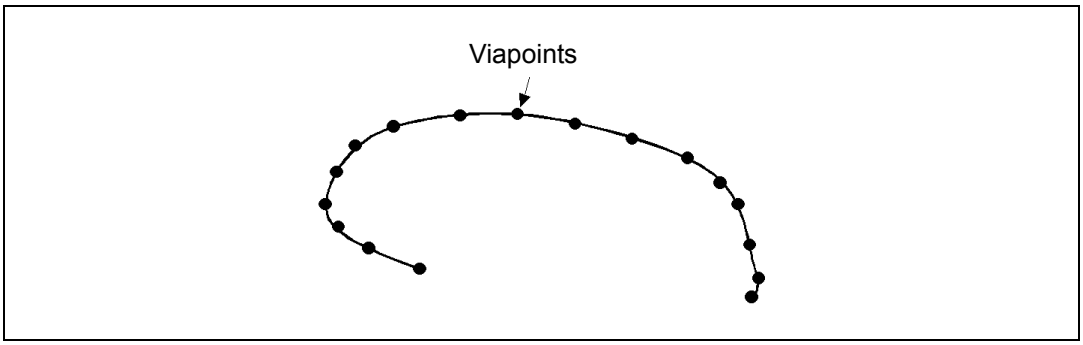
Refer to the PROGRAMMER'S MANUAL (I), Section 3.3 "Interpolation Control."

Main system software version 2.3* supports the free curve interpolation control that is useful in sealing, packing, and deburring.

2.1 Overview

As shown below, the free curve interpolation control moves the robot tool tip on a free curve passing through a series of specified viapoints at a constant speed. The tool tip can accelerate to a constant speed and then decelerate to a stop at the end point.

This control provides stabilized robot motions in sealing, packing, and deburring.



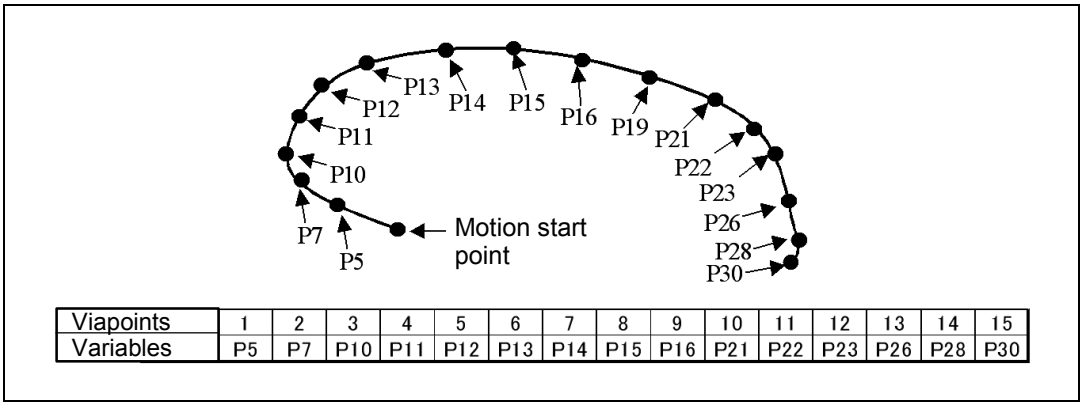
Free Curve Interpolation Control

2.2 Programming

(1) Teaching viapoints

Use the teach pendant to teach viapoints with position (P) or joint (J) variables. Position data taught with homogeneous transform matrix (T) variables requires conversion to position variables using a T2P command in coding described in "(2) Registering viapoints."

Create a correspondence table as shown below for clarifying the relationship between viapoint numbers and position/joint variable numbers.



Viapoints	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Variables	P5	P7	P10	P11	P12	P13	P14	P15	P16	P21	P22	P23	P26	P28	P30

Correspondence Table Sample for Viapoints and Variable Numbers

(2) Registering viapoints

Specify the desired free curve trajectory number and register viapoints with SETSPLINEPOINT commands. It is necessary to specify the trajectory number per viapoint.

As shown in coding sample 1, create source code specifying viapoints in the order of passing through. In this sample, the trajectory number is "1."

See the descriptions of SETSPLINEPOINT and CLRSPLINEPOINT commands for details.

```
PROGRAM  PASSPOINT1
CLRSPLINEPOINT 1
SETSPLINEPOINT  1, P5
SETSPLINEPOINT  1, P7
SETSPLINEPOINT  1, P10
        ⋮
SETSPLINEPOINT  1, P28
SETSPLINEPOINT  1, P30
END
```

Coding sample 1: Registering Viapoints

(3) Executing free curve interpolation

Execute free curve interpolation with the free curve motion command "MOVE S <Trajectory number>." Specification of viapoints should precede the free curve motion command. See the description of MOVE.

When specifying viapoints immediately preceding the free curve motion command, write code as shown in coding sample 2.

```
PROGRAM PRO1
TakeArm
    .
    .
    .
CALL PASSPOINT1     'Register viapoints
MOVE S, 1           "Execute free curve motion of trajectory 1
    .
    .
    .
END
```

Coding sample 2: Specifying Viapoints Immediately Preceding a Free Curve Motion Command

When specifying viapoints in programs other than free curve motion programs, execute an xdSPLClrTakeArm(0) to prevent the specified viapoints from getting erased by execution of TakeArm command in free curve motion programs. This is because execution of the TakeArm command erases all viapoints specified by SETSPLINEPOINT.

Coding sample 3 is an initialization program specifying viapoints.

For details, refer to the description of library xdSPLClrTakeArm.

```
PROGRAM INITIAL
        .
        .
        .
CALL PASSPOINT 1            'Register viapoints
CALL xdSPLClrTakeArm(0)     'Make viapoint clearing by TakeArm invalid
        .
        .
        .
END
```

Coding sample 3: Specifying Viapoints in Initialization Program

(4) Adjusting viapoints

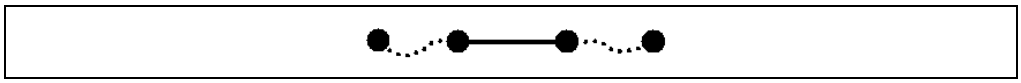
Run the robot in Teach check mode to check the free-curved path move by using Halt, Step Back, and Step Start functions. If the path move deviates from the ideal one, interpolate viapoints to shorten the viapoint-to-viapoint intervals.

Increasing the speed may cause the path move to deviate inside the curve. To adjust it, teach viapoints outside the ideal curve.

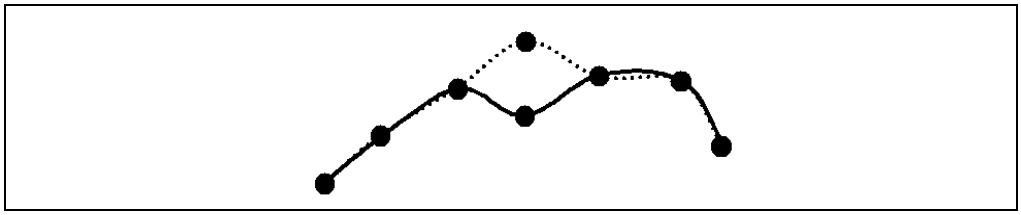
2.3 Free Curve Features

(1) Specifying a single viapoint produces a linear motion.

(2) Teaching four viapoints on a straight line produces a straight path between the middle two viapoints as shown below.

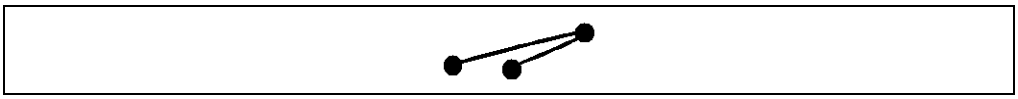


(3) Modifying a viapoint(s) automatically modifies the path between the preceding and following viapoints as shown below.



(4) If the free-curved path move deviates from the ideal one, shorten the viapoint-to-viapoint interval.

(5) Specifying such viapoints that produce reciprocating motions or sharp-angled motions decreases the speed at the viapoints, triggering the "676* Jx command accel limit over" or "60D0 Motion optimization function unexecutable" error. To prevent occurrence of such errors, decrease the speed specified.



(6) To execute a non-motion command such as I/O setting in synchronization with a motion, use an xdWAITSPLINE (library) as shown below.

The coding sample below sets I/O when the robot tool tip passes through P11 (4th viapoint) on the free curve path given in Section 1.2, (1).

```
PROGRAM PRO1
TakeArm
    .
    .
    .
CALL PASSPOINT 1          'Register viapoints
MOVE S, 1, NEXT           'Execute free curve motion specified by trajectory 1
CALL xdWAITSPLINE (4,1)   'Wait for the tool tip to pass through 4th viapoint
SET IO[240]
    .
    .
    .
END
```

2.4 Notes on Using Free Curve Interpolation

(1) Up to 200 viapoints can be specified every trajectory number. Exceeding the limit triggers the "685A Free curve pass point overflow" error.

(2) Up to 20 trajectory numbers can be specified. Exceeding the limit triggers the "685B Number of free curve mismatch" error.

(3) Modifying viapoints after a free curve motion does not allow a Step Back operation on the free curve path specified before the modification of viapoints, and triggers the "737D Cannot step back further" error.

(4) If the move distance between viapoints is short and the posture change is great, the "608* Jx command speed limit over" or "60D0 Motion optimization function unexecutable" error may occur. To prevent occurrence of such errors, decrease the speed specified.

(5) During conveyor tracking, no free curve motion is allowed.

(6) Under the free curve interpolation control, no recovery from power failure is allowed.

2.5 Addition of "Free Curve Interpolation" to Operation Command "MOVE"

Refer to the PROGRAMMER'S MANUAL (I), Section 12.1 "Operation Control MOVE."

MOVE (Statement)

Format

MOVE <Interpolation method>, [@<Pass start displacement>] <Pose> [<EX or EXA option>] [, [@<Pass start displacement>] <Pose > <EX or EXA option>] ---] [, <Motion option>] [, NEXT]

[Ver. 2.3 or later]: Add the following.

For a free curve MOVE S, [@<Pass start displacement>] <Trajectory number> [<EX or EXA option>] [, <Motion option>] [, NEXT]

Explanation

[Ver. 2.3 or later: Add S to the interpolation method.

Selection from four types, P, L, C and S, is possible as the <Interpolation method>.

Interpolation method	Meaning
P (or PTP)	The robot moves from the current position to the designated coordinates using PTP control.
L	The robot moves from the current position to the designated coordinates using CP control.
C	The robot moves to a purpose pose performing arc interpolation via a relay point pose from the current position. The robot performs an interpolation motion from the figure of the current position to that of the purpose pose (the figure of the relay point pose is ignored). In arc interpolation, a relay point pose and a purpose pose must be designated. (A pose array cannot be used for C.) Even if pass start displacement is designated to a relay point pose, the motion does not change. Use MOVE C, P1, @P P2 to designate the pass taken when the arc interpolation motion is finished.
S (Free curve) [Ver.2.3 or later]	Moves from the current position to the final viapoint through the registered viapoints by SETSPLINEPOINT. The path becomes a smooth curve and the tool moves at a constant speed on the path, except upon acceleration/deceleration. The pose passes each viapoint by pass movement.

<Trajectory number> is the trajectory number of the free curve and represents the free curve viapoints registered by SETSPLINEPOINT for each <Axis Number> results. Up to 20 points can be designated.

Example of use

Addition to [Ver.2.3 or later]

```
MOVE S, @P 2, S=10, NEXT   'Pass operation at an internal speed of 10% for a free curve with
                           'Trajectory number 2.
                           'The next command is executed after the operation starts.
```

Notes

[Ver. 2.3 or later] Note 3: Including free curve motion

(3) In CP motion, arc interpolation motion and free curve interpolation motion, if the robot passes in the vicinity of a singular point (refer to “Setting-up Guide, 4.1.3 Figures of the Shoulder, Elbow, and Wrist, [2] Boundaries of Robot Figures”), an error with a level of 6080 (Command speed limit over) will occur and the robot may stop. In this case, reduce the speed or set 2 or 3 in the optimal load capacity setting mode ((refer to “PROGRAMMER’S MANUAL (I), 4.6 Control Sets of Motion Optimization”). If the error still occurs, avoid the path in the vicinity of the singular point.

[Ver. 2.3 or later] Addition of Notes (11) and (12).

(11) If the figure at the viapoint registered by SETSPLINEPOINT differs greatly from the current figure in free curve motion, error 607F (Robot posture mismatch) results.

(12) If the figure change is great because of short moving distance between viapoints in free curve motion, an error at a level of 6080 (designated speed limit over) may occur and motion may stop. In this case, either slow down the speed or set 2 or 3 in optimal load capacity setting mode.

2.6 Commands and Libraries for Free Curve Interpolation

The commands and libraries used for free curve interpolation are shown below.

2.6.1 Commands for Free Curve Interpolation

SETSPLINEPOINT (statement)

Function

Registers viapoints in the free curve motion.

Format

SETSPLINEPOINT <Free curve trajectory number> <Viapoint>

Explanation

Registers the points designated by <Viapoint> as the viapoints of the free curve designated by < Free curve trajectory number>. < Viapoint> is a type P or type J variable.

Related Terms

CLRSPLINEPOINT, GETSPLINEPOINT, MOVE

Example

```
PROGRAM PRO1
TAKEARM
CLRSPLINEPOINT 5      'Clears all viapoints for the free curve with trajectory 5.
SETSPLINEPOINT 5, P4  'Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1  'Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5  'Sets J5 as the third viapoint for the free curve with trajectory 5.
MOVE S, 5             'Executes free curve motion to J5 through P4 and P1.
```

Notes

(1) Up to 200 viapoints can be specified every trajectory number. Exceeding the limit triggers the "685A Free curve pass point overflow" error.

(2) If free curve motion with no viapoint registration is executed, error “685B Number of free curve mismatch” occurs.

(3) Up to 20 trajectory numbers can be specified. Exceeding the limit triggers the "685B Number of free curve mismatch" error.

(4) If a designated viapoint is outside the motion range, an error at the level of 6070 (J* software motion limit over) occurs.

(5) Before executing the “SETSPLINEPOINT” command, change the tool coordinates or the work coordinates to the same ones as teaching viapoints, with the “CHANGETOOL” or “CHANGEWORK” command.

CLRSPLINEPOINT (statement)

Function

Clears all viapoints for free curve motion.

Format

CLRSPLINEPOINT <Free curve trajectory number>

Explanation

Clears all viapoints registered by SETSPLINEPOINT for the free curve trajectory designated by <Free curve trajectory number>.

Related Terms

SETSPLINEPOINT, GETSPLINEPOINT

Example

```
PROGRAM PRO1
TAKEARM
CLRSPLINEPOINT 5        'Clears all viapoints for the free curve with trajectory 5.
SETSPLINEPOINT 5, P4    'Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1    'Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5    'Sets J5 as the third viapoint for the free curve with trajectory 5.
MOVE S, 5               'Executes free curve motion via P4 and P1 to J5.
```

Notes

Executing CLRSPLINEPOINT results in non-registration of viapoints. Execution of free curve motion without viapoint registration results in error “685B Number of free curve mismatch”.

GETSPLINEPOINT (statement)

Function

Gets the viapoints for a registered free curve motion.

Format

<Approach point> = GETSPLINEPOINT (<Free curve trajectory number>, <Viapoint number>)

Explanation

Outputs each viapoint designated by <Viapoint number> for the free curve designated by <Free curve trajectory number> to the <Viapoint>. The <Viapoint> is a type P variable.

Related items

CLRSPLINEPOINT, SETSPLINEPOINT

Example

```
PROGRAM PRO1
TAKEARM
CLRSPLINEPOINT 5        'Clears all viapoints for the free curve with trajectory 5.
SETSPLINEPOINT 5, P4    'Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1    'Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5    'Sets J5 as the third viapoint for the free curve with trajectory 5.
P10=GETSPLINEPOINT(5,2) 'Sets the second viapoint for the free curve with trajectory 5 as
                        'P10. (The data for P1 is set as P10.)
```

Notes

Designating an unregistered viapoint results in error “685C Number of free curve pass point mismatch”.

2.6.2 Libraries for Free Curve Interpolation

xdWAITSPLINE (library)

Function

Waits for the free curve to pass the designated viapoint.

Format

xdWAITSPLINE (<Viapoint number>, <Waiting condition>)

Explanation

Free curve motion in progress waits until passage on the point designated by the <Viapoint number>.

If 0 is designated as the <Waiting condition>, the robot waits until the command value passes the designated viapoint.

If a different value is specified, the robot waits until the encoder value passes the designated viapoint.

Related Terms

MOVE, SETSPLINEPOINT

Example

```
PROGRAM PRO1
TAKEARM
CLRSPLINEPOINT 5          'Clears all viapoints for the free curve with path No. 5.
SETSPLINEPOINT 5, P4      'Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1      'Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5      'Sets J5 as the third viapoint for the free curve with trajectory 5.
MOVE S, 5, NEXT           'Executes free curve motion to J5 through P4 and P1.
CALL xdWAITSPLINE(1,1)    'Waits until the robot passes the first viapoint (P4).
  SET IO[240]             'Sets port 240 to ON.
  CALL xdWAITSPLINE(2,1)  'Waits until the robot passes the second viapoint (P1).
  RESET IO[240]           'Sets port 240 to OFF.
```

Notes

When xdWAITSPLINE is called with the free curve not executed, the robot does not wait.

Also, if xdWAITSPLINE is called after passing the viapoint designated by the <Viapoint number>, the robot does not wait.

xdSPLPASSNUM (library)

Function

Obtains the viapoint through which the free line has passed.

Format

xdSPLPASSNUM (<Viapoint number>)

Explanation

For free curve motion in progress, the robot sets the viapoint number through which the command value has passed to the <Viapoint number>.

Related Terms

MOVE, SETSPLINEPOINT

Example

```
PROGRAM PRO1
TAKEARM
CLRSPLINEPOINT 5          ‘Clears all viapoints for the free curve with trajectory 5.
SETSPLINEPOINT 5, P4      ‘Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1      ‘Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5      ‘Sets J5 as the third viapoint for the free curve with trajectory 5.
MOVE S, 5, NEXT           ‘Executes free curve motion to move to J5 through P4 and P1.
DELAY 500
CALL xdSPLPASSNUM(I1)     ‘Sets the passed viapoint number to I1.
```

xdSPLClrTakeArm (library)

Function

Changes the validity of free curve viapoint clear process execution during TakeArm.

Format

xdSPLClrTakeArm (<Set value>)

Explanation

If the <Set value> is 0, the viapoint of the free curve during TakeArm is not cleared.

If the <Set value> is a different value, the viapoints of the free curve during TakeArm are cleared.

Related Terms

CLRSPLINEPOINT、SETSPLINEPOINT

Example

```
PROGRAM INITIAL
CLRSPLINEPOINT 5          'Clears all viapoints for the free curve with trajectory 5.
SETSPLINEPOINT 5, P4      'Sets P4 as the first viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, P1      'Sets P1 as the second viapoint for the free curve with trajectory 5.
SETSPLINEPOINT 5, J5      'Sets J5 as the third viapoint for the free curve with trajectory 5.
CALL xdSPLClrTaleArm (0)  'Does not clear the viapoints of the free curve during TakeArm.
```

Notes

In the initial state after controller power on, free curve viapoints are cleared during TakeArm. To register the free curve notion viapoints other than by the free curve motion program (for registration by the intialization program), set by CALL xdSPLClrTakeArm(0) so as not to clear the viapoints for the free curve during Take Arm.

3 Reading and writing plural projects by USB flash memory

Refer to the “SETTING-UP MANUAL, Chapter 5”.

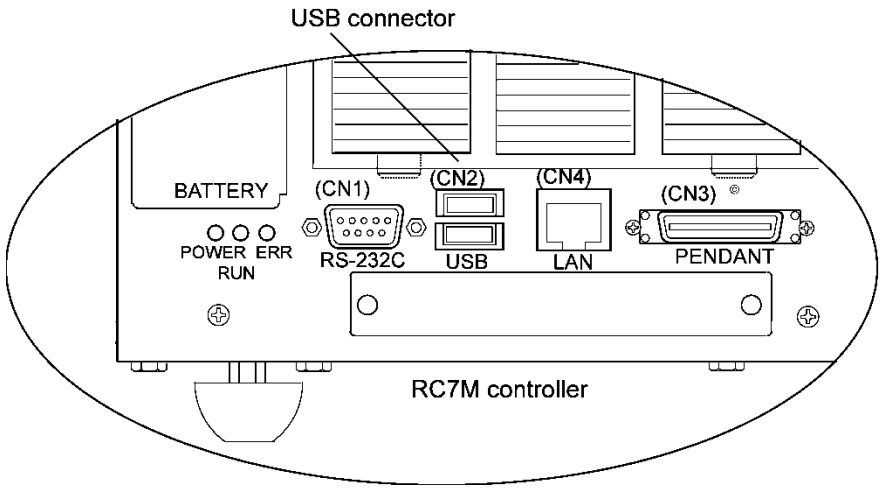
The robot controller RC7M supports to read/write plural projects using the USB flash memory. The following USB flash memories are available to the controller.

Manufacturer	Model
I-O DATA	EDP-###M, EDC-###M
Logitec	LMC-###UDA

Note: (1) ### denotes the capacity.

(2) When formatting the USB flash memory, select tne “FAT” in the file system menu.

(3) Never touch or remove a USB flash memory drive or turn the controller power off when the USB flash memory drive is being accessed. (For details about the USB flash memory access status, refer to the memory's user's manual.)



Data that can be handled by USB flash memory drive

The table below lists data that can be handled by USB flash memory drives. Select the appropriate data to read or write as necessary.

Data Type	File or Data	Remarks
Source program data	Source program files (PAC, H, PNL) Executable files (NIC, MAP) Settings files (DAT)	Only files with their compile flags active ("Enable" in the Use column) can be written into USB flash memory.
Variables data	All global data Number of variables used	Reading variables data into the robot controller automatically changes the "number of variables used" in the controller.
I/O data	I/O settings Settings for expansion board	
Arm data	Arm parameters Tool/work/area coordinates definition	• Never read in arm data prepared for other robots. • Tool and work data modified by TOOL or WORK command will not be updated when written into the memory. To write updated data, first save the system parameters (see the SETTING-UP MANUAL, p. 5-179) and then write data into the USB flash memory.
Visual-related data	Visual equipment settings	Write (to USB flash memory) only.
Log data	Communications settings Version information Various log data	
Backup data	Various data	Version 2.3 or later

Data exchange between robot controller and WINCAPSII

Data can be exchanged between the robot controller and WINCAPSII by means of a USB flash memory drive.

For the operating procedures in WINCAPSII, refer to WINCAPSII Guide, Chapter 4, Sections 4.3.4 and 4.3.5.

USB memory data modification not allowed

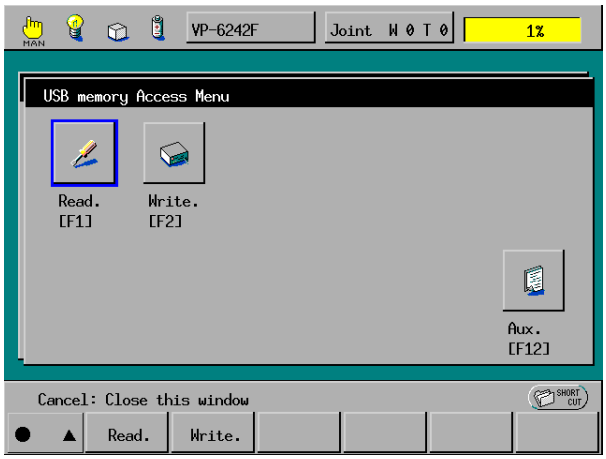
Never modify data stored in the USB flash memory drive from the robot controller. Any modification makes it impossible to access the memory because USB memory data contains check codes used for checking data corruption and guaranteeing accurate data read/write.

3.1 Reading USB Memory Data into Robot Controller

Access: [F6 Set]—[F3 USB Memory]—[F1 Read.]

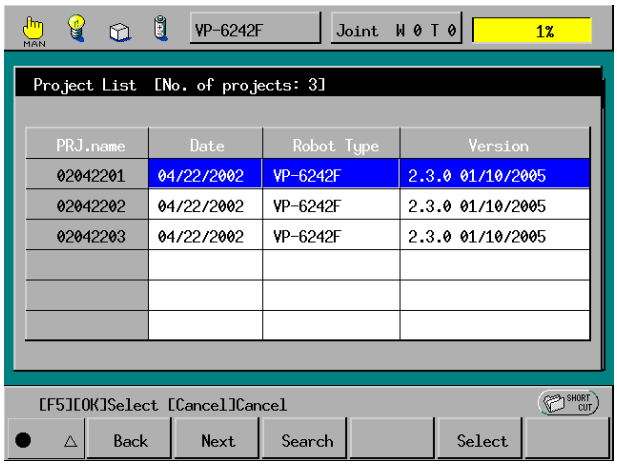
Reads data stored in a USB flash memory into the robot controller.

(1) Press [F3 USB Memory] in the Setting (Main window), and the USB Memory Access Menu appears as shown below.



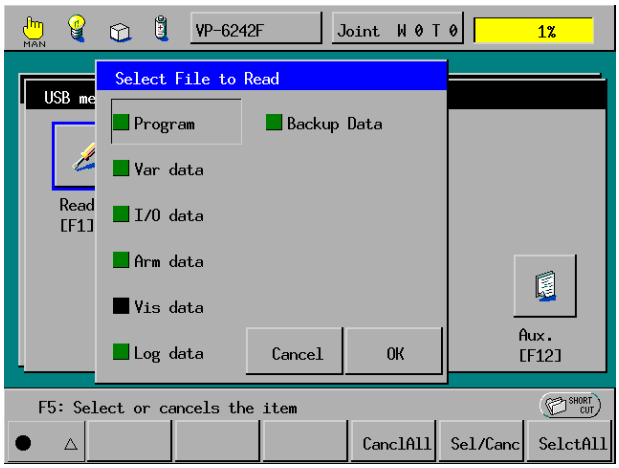
F1 F2

(2) Press [F1 Read.] in the USB Memory Access Menu, and plural projects stored in a USB flash memory appear as shown below.



Select data to read from the USB flash memory and then press the OK button.

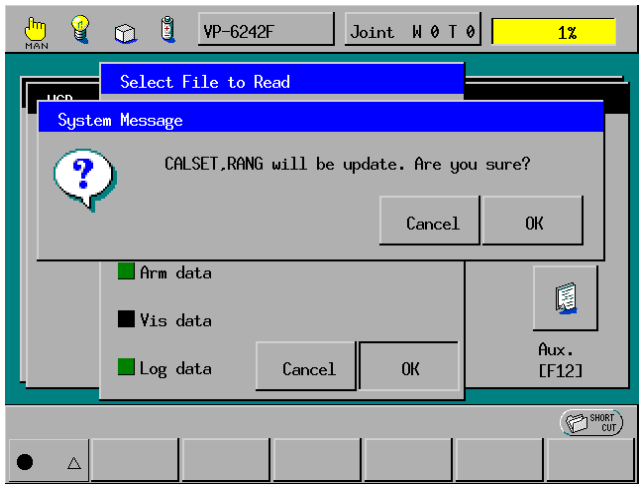
(3) The “Select File to Read” window appears as shown below.



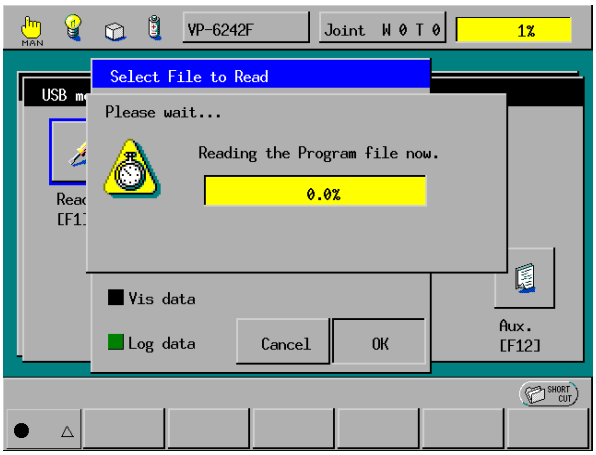
Select data to read from the USB flash memory and then press the OK button.

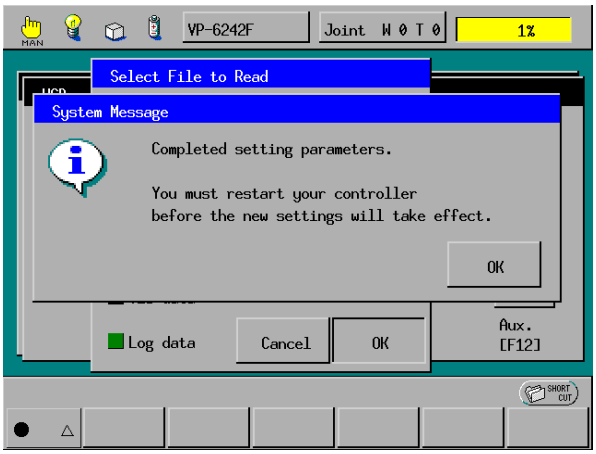
⚠ **Caution:** Never read in arm data prepared for other robots. Doing so will cause the robot to malfunction. It is very DANGEROUS.

(4) System message “ CALSET, RANG will be update. Are you sure?” appears.



(5) Press the OK button, and data reading from the USB flash memory will start. Upon completion of reading, system message appears.





(6) Upon completion of reading, restart the robot controller.

⚠**Caution:** Without restarting the robot controller, the robot may malfunction.

Notes on reading new *variables* data from USB flash memory

Reading new *variables* from the USB flash memory overwrites the current variables stored in the robot controller with the new ones.

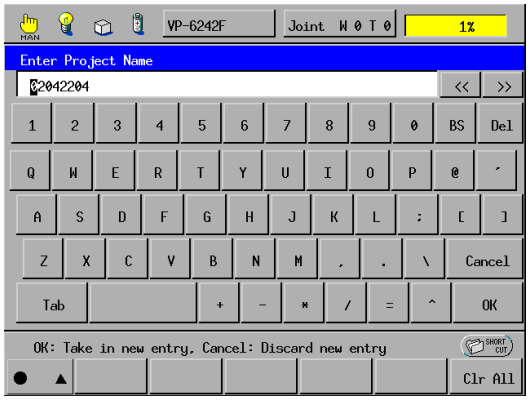
Note that, if the robot controller has 50 integer variables and the USB flash memory contains 30 integer variables, the 31st to 50th variables in the controller will be lost at the end of the read operation.

3.2 Writing Data Stored in Robot Controller into USB Flash Memory

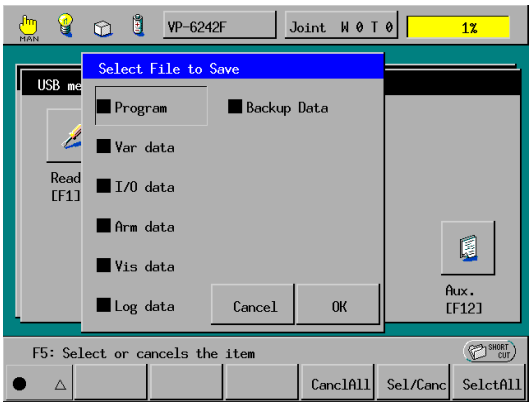
Access: [F6 Set]—[F3 USB Memory]—[F2 Write.]

Writes (Saves) data stored in the robot controller into a USB flash memory.

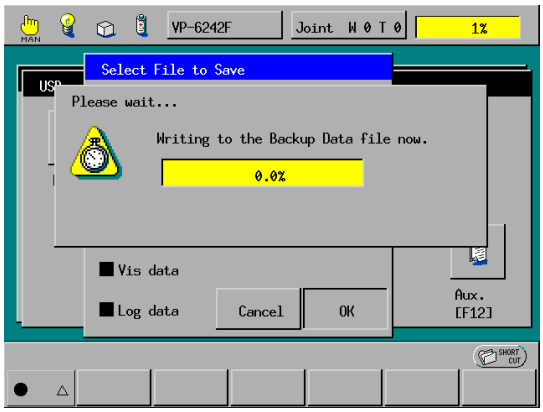
(1) Press [F2 Write.] in the USB Memory Access Menu, and the “Enter Project Name” window appears. Enter the project name.



(2) Press the OK button, and data the “Select File to Save” window appears.



(3) Press the OK button, and data writing (saving) into a USB flash memory will start.



4 Newly added operations by the mini-pendant

Refer to the “SETTING-UP MANUAL, Chapter 6”.

You can operate the following items by the mini-pendant from Ver.2.3 or later.

(1) Performing CALSET

(2) Resetting the motor encoder data

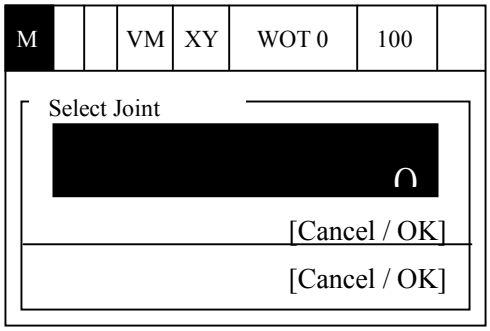
(3) Setting the calendar clock built in the robot controller (Date setting)

(4) Setting the next battery replacement date

4.1 Performing CALSET

Access: [AUX key]—[ArmAux]—[CalSet.]

(1) The “ Select Joint “ screen for CALSET will appear as shown below.



(2) Select the target joint for CALSET.

Note: If selecting “0”, the all-axis CALSET will be performed.

(3) If pressing the OK key, the CALSET will be executed.

TIP: For details about the CALSET procedure, refer to the INSTALLATION & MAINTENANCE GUIDE, Chapter 4, "CALSET."

4.2 Resetting the motor encoder data

(Only for the encoder model connected via bus Ex.: –G siries robot)

Access: [AUX key]—[ArmAux]—[EncRst]

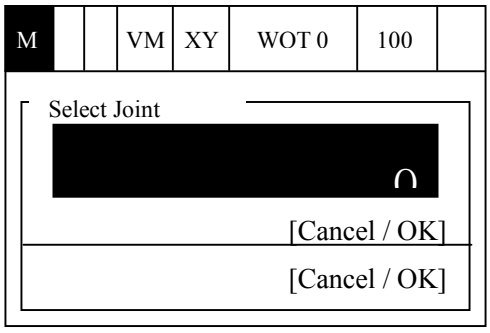
You need to reset encoders and perform CALSET if:

-Error 641* occurs due to run-down encoder backup batteries, or

-Error 677* occurs due to a great impact applied to the robot when the power is off.

(* is any of 1 to 6 denoting the object axis.)

(1) The “ Select Joint “ screen for the encoder resetting will appear as shown below.



(2) Select the target joint for the encoder resetting

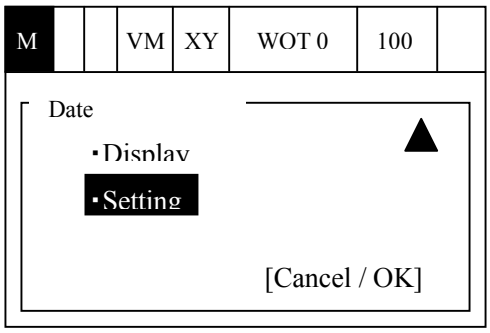
(3) If pressing the OK key, the encoder resetting will be executed.

4.3 Setting the calendar clock built in the robot controller (Date setting)

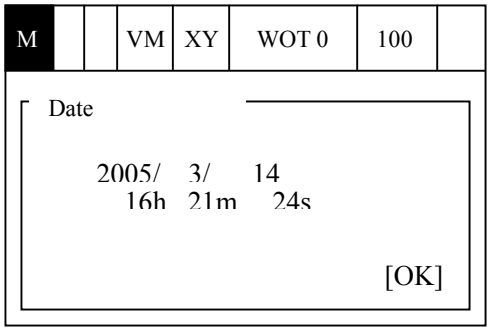
Access: [AUX key]—[Maintenance]—[Date]

Sets the calendar clock built in the robot controller.

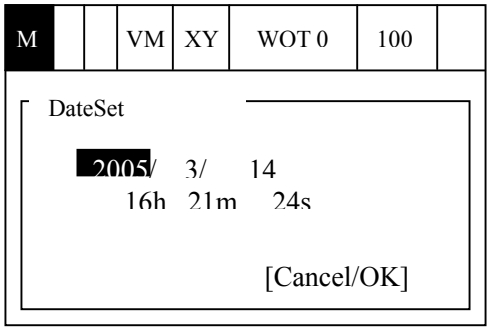
(1) The " Date –Display & setting " screen will appear as shown below.



(2) If selecting "Display", the "Date" screen will appear as shown below.



(3) If selecting "Setting", the "Date Set" screen will appear as shown below.



(4) Choose an input field with the right and left cursor keys, then enter a new value with the numeric keypad. If pressing the OK key, the date will be set.

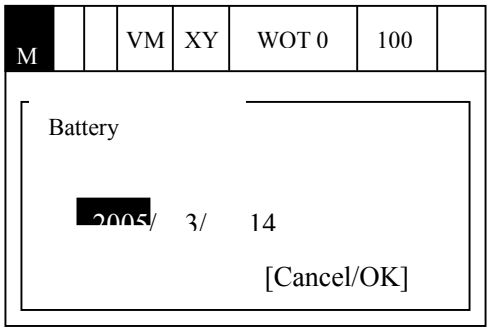
4.4 Setting the next battery replacement date

Access: [Aux key]—[Maintenance]—[Battery]

Sets the next replacement date of the memory backup battery of the robot controller.

When the replacement day comes, an error 2103 (level 1) - " Time to change controller backup battery " will occur.

(1) The next “Battery Replacement“ date screen will appear as shown below.



(2) Choose an input field with the right and left cursor keys, then enter a new value with the numeric keypad. If pressing the OK key, the date will be set.

Note: For the battery replacement procedure, refer to the “INSTALLATION & MAINTENANCE GUIDE”.

5 Error Code Tables Modified

Refer to the ERROR CODE TABLES.

The table below lists the error codes that are modified in Ver. 2.3 or later.

5.1 Error codes added or modified in version 2.3* (1)

Code	Message	Level	Description	Remedy
202E	Mini I/O data error	5	Data error from the mini I/O occurred.	Check that there is no noise source (e.g., welding machine) near the robot unit or controller. And restart the controller.
202F	Controller specifications error	4	The robot type does not match the controller type.	Make a suitable combination of the robot unit and controller. And restart the controller.
602A	Motor on failure	2	Communication timeout occurred and failed motor on.	If the error persists after turning the motor on again, you need to investigate or repair the controller.
602B	Motor on failure	2	Communication data error occurred and failed motor on.	If the error persists after turning the motor on again, you need to investigate or repair the controller.
602C	PWR communication error1	1	Power communication timeout occurred and stopped to execute a process.	If the error occurs frequentry, you need to investigate or repair the controller.
602D	PWR communication error 2	1	Power communication data error occurred and stopped to execute a process.	If the error occurs frequentry, you need to investigate or repair the controller.
6101	Watchdog error	5	(1) Interrupt process stopped. (2) Power supply CPU stopped.（Only for RC7M）	If the error persists after rebooting the controller, you need to investigate or repair the controller.
6140	Motor brake fuse blown	4	(1) The motor brake fuse was blown. (2) The contactor was failed (Only for RC7M).	Check the motor-encoder cable. Check the motor. (3) You need to investigate or repair the contactor (Only for RC7M).
660A	Safety board communication error (ESC)	5	Safety board communication error detected.	(1) Check the connections between the I/O board and peripheral devices. (2) Check that there is no noise source (e.g., welding machine) near the robot controller.
660B	Safety board communication error (BOX)	5	Safety box communication error detected.	(1) Check the connections between the I/O board and peripheral devices. (2) Check that there is no noise source (e.g., welding machine) near the robot controller.

5.2 Error codes for the free curve interpolation added in version 2.3* (2)

Code	Message	Level	Description	Remedy
6858	Free curve calculation error	3	Free curve calculation error occurred.	Check that via points are adequate or not.
6859	Free curve exec. condition error	3	Free curve motion can not be executed,	Check the executable conditions. During conveyor tracking, no free curve motion is allowed.
685A	Free curve pass point overflow	3	Exceeding 200 viapoints were specified in free curve.	Reduce viapoints up to 200.
685B	Number of free curve mismatch	3	Free curve trajectory number is mismatched.	Check the trajectory number of free curve. Specify the viapoints if not specified.
685C	Number of free curve pass point mismatch	3	The viapoint number is mismatch.	Check the viapoint number of free curve.
685D	Free curve step back error	3	Step back error is occurred in the free curve. Modifying viapoints after a free curve motion does not allow a Step Back operation on the free curve path specified before the modification of viapoints.	After execution of the free curve motion, execute Step Back operation.
685E	Free curve path deviation error	3	Path deviation is too much.	Check that via points are adequate or not.

5.3 Error codes for the power supply board added in version 2.3* (3)

Code	Message	Level	Description	Remedy
230D	Power supply start error	5	Power supply start failed.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
230E	Power supply A watchdog error	5	A watchdog error occurred in the power supply A.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
230F	Power supply B watchdog error	5	A watchdog error occurred in the power supply B.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
240D	Power supply communication time-out	4	Power supply communication failed.	If the error occurs frequentry, you need to investigate or repair the controller.
2C07	Interruption power detected	5	Interruption power detected in the AC power supply.	(1) Check the connection of the AC power supply cable. (2) Check the AC power supply voltage.
2C09	DC-BUS over voltage	5	The DC-BUS voltage exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C0A	DC-BUS under voltage	5	The DC-BUS voltage exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C0C	DC-output over voltage	5	The DC-output voltage exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C0E	IPM module over voltage	5	The voltage to the IPM module exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C0F	IPM module under voltage	5	The voltage to the IPM module exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C2B	Regenerative-resistor overheated	5	The temperature of regenerated-resistor exceeded the permissible upper value in the power supply inside the controller.	Check the filter clogged or low rotation of the fan. If the error persists after checking, you need to investigate or repair the controller.
2C2E	11VH over voltage	5	The voltage of 11V-line exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C2F	11VH under voltage	5	The voltage of 11V-line exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C30	Power board overheated (A)	5	The temperature of board (A) exceeded the permissible upper value in the power supply inside the controller.	Check the filter clogged or low rotation of the fan. If the error persists after checking, you need to investigate or repair the controller.
2C50	DC5V of power board over voltage	5	The voltage of 5V-line exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C51	DC5V of power board under voltage	5	The voltage of 5V-line exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C52	DC12V of power board over voltage	5	The voltage of 12V-line exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.

Code	Message	Level	Description	Remedy
2C53	DC12V of power board under voltage	5	The voltage of 12V-line exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C54	DC24V of power board over voltage	5	The voltage of 24V-line exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C55	DC24V of power board under voltage	5	The voltage of 24V-line exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C56	DC24V of power board over voltage (IO)	5	The voltage of 24V-(I/O)-line exceeded the permissible upper value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C57	DC24V of power board under voltage (IO)	5	The voltage of 24V-(I/O)-line exceeded the permissible lower value in the power supply inside the controller.	If the error persists after rebooting the controller, you need to investigate or repair the controller.
2C80	Power board overheated (B-1)	5	The temperature of board (B-1) exceeded the permissible upper value in the power supply inside the controller.	Check the filter clogged or low rotation of the fan. If the error persists after checking, you need to investigate or repair the controller.
Code	Message	Level	Description	Remedy
2C81	Power board overheated (B-2)	5	The temperature of board (B-2) exceeded the permissible upper value in the power supply inside the controller.	Check the filter clogged or low rotation of the fan. If the error persists after checking, you need to investigate or repair the controller.
2C82	IPM harness board overheated (B)	5	The temperature of IPM harness board (B) exceeded the permissible upper value in the power supply inside the controller.	Check the filter clogged or low rotation of the fan. If the error persists after checking, you need to investigate or repair the controller.
2CA1	Caution: Power board overheated (A)	1	The temperature of board (A) exceeded the warning value in the power supply inside the controller.	Check the filter clogged and cooling fan.
2CB0	Cooling fan error	2	The coolling fan stop detected inside the controller.	Check the cooling fan.
2CB1	Caution: Fan speed dropped	1	The low rotation of cooling fan detected inside the controller.	Check the cooling fan.
2CB2	Caution: Power board overheated (B-1)	1	The temperature of board (B-1) exceeded the warning value in the power supply inside the controller.	Check the filter clogged and cooling fan.
2CB3	Caution:IPM Board overheated	1	The temperature of IPM harness board exceeded the warning value in the power supply inside the controller.	Check the filter clogged and cooling fan.
2CB4	Lamp disconnection	2	Disconnection of the motor-on detected lampe.	Check the wiring or connection.
2CB5	Caution:Power board overheated(B-2)	1	The temperature of board (B-2) exceeded the warning value in the power supply inside the controller.	Check the filter clogged and cooling fan.

SUPPLEMENT

Main System Software Version 2.3*

First Edition July 2005

DENSO WAVE INCORPORATED

7G

The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.