MEMEX
Measuring Manufacturing Excellence

Memory Upgrade
For Fanuc Series 0 Models A/AD/B/C/D

Installation Instructions

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M100702E

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Introduction

General

The following instructions are for the installation of additional SRAM for Fanuc® Series 0-A, 0-B, 0-C and 0-D controls.

The 0-A control can be upgraded 48K (120 meters), while the 0-B, 0-C, 0-D and the Amada 0-4PC controls can be upgraded with 128K (320 meters).

The SRAM based memory is located in sockets on either the Main CPU board (0-A and 0-B) or on the Memory Card (0-C, 0-D and 0-4PC) as illustrated on pages 4 and 5. The supplied IC's (integrated circuits) will be used to add to the existing SRAM on these boards.

These instructions will assist you in completing the memory upgrade for your Fanuc 0 Series control. Please read through this document completely to familiarize yourself with the installation before actually performing your upgrade.

Applicable Master Boards

0-A & 0-AD	0-B	0-C / 0-4PC / 0-D *
A16B-1010-0150	A16B-1010-0280	A20B-1002-0360
A16B-1010-0210	A16B-1010-0281	A20B-1003-0750
A16B-1010-0240	A16B-1010-0285	A20B-2000-0175
	A16B-1010-0286	A20B-2000-0179
		A20B-2000-0180
		A20B-2001-0120 *

Sample "B" Software Versions: 415, 815…

Applicable Memory Cards (0-C and 0-4PC)

Memory Cards	A16B-1212-0210	Analog Spindle
(MEM-A3)	A16B-2201-0103	Analog Spindle
	A16B-1212-0215	16 bit, Serial Spindle
	A16B-1212-0216	32 bit, Serial Spindle
	A16B-2201-0101	32 bit, Serial Spindle

Sample "C" Software Versions: 460,462,465,469,660,662,690,665,880,135…

Locating SRAM Modules (0-A / 0-AD / 0-B)

A16B-1010-0150 (Analog)
A16B-1010-0210 (Digital)
A16B-1010-0240 (0-Mate)
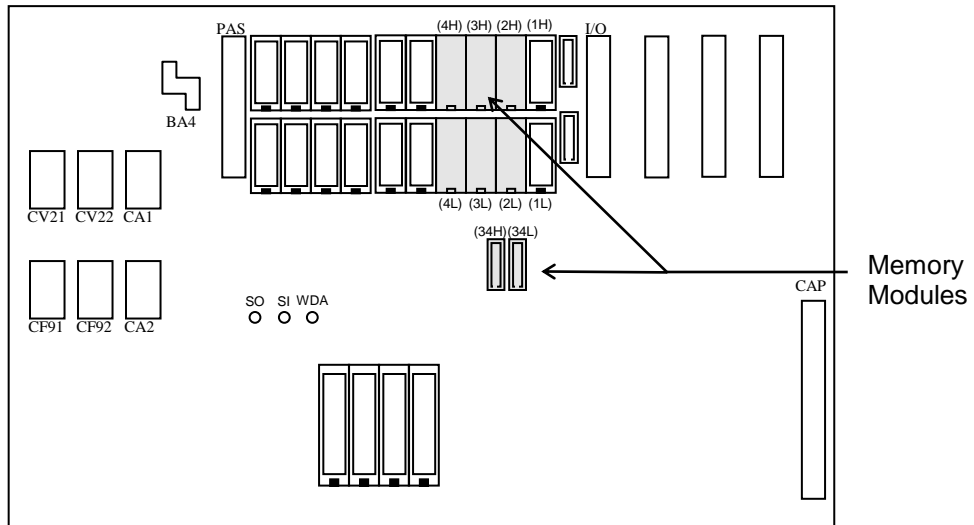
A16B-1010-0280
A16B-1010-0281
A16B-1010-0285
A16B-1010-0286
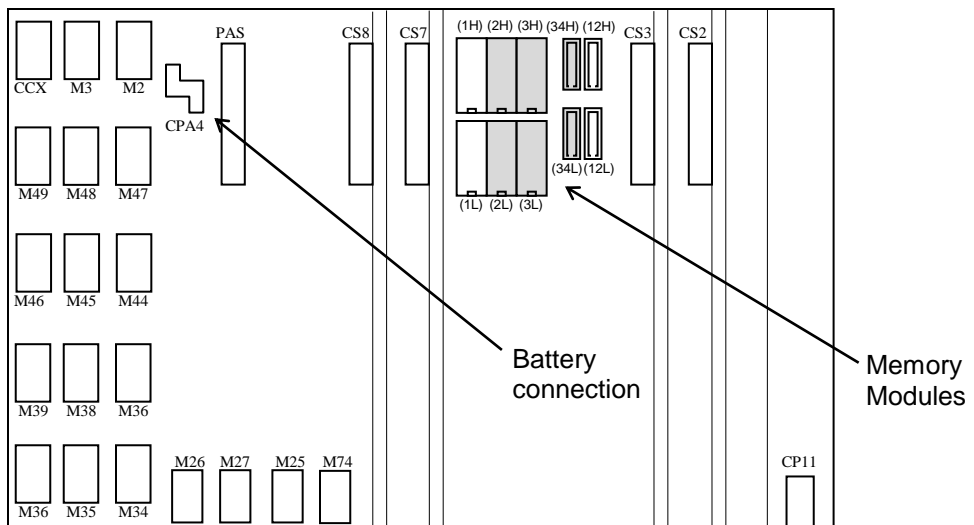
Locating MEM-A3 Card (0-C / 0-4PC)

Power
Supply

Memory
Card
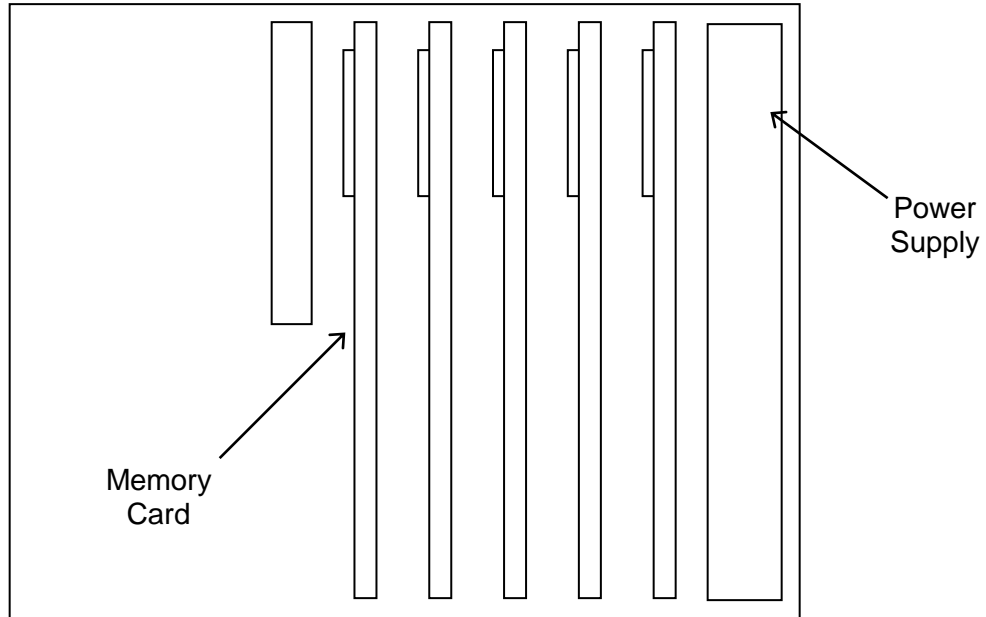
Locating SRAM Modules (0-C / 0-D / 0-4PC)

A16B-1212-0210
A16B-1212-0215
A16B-1212-0216
A16B-2201-0101
A16B-2201-0103

Memory
Modules

(2H)(2L)
(3H)(3L)

M27

M12
M26

M3
CCX5

Battery
Connection

CPA7

M5
M74
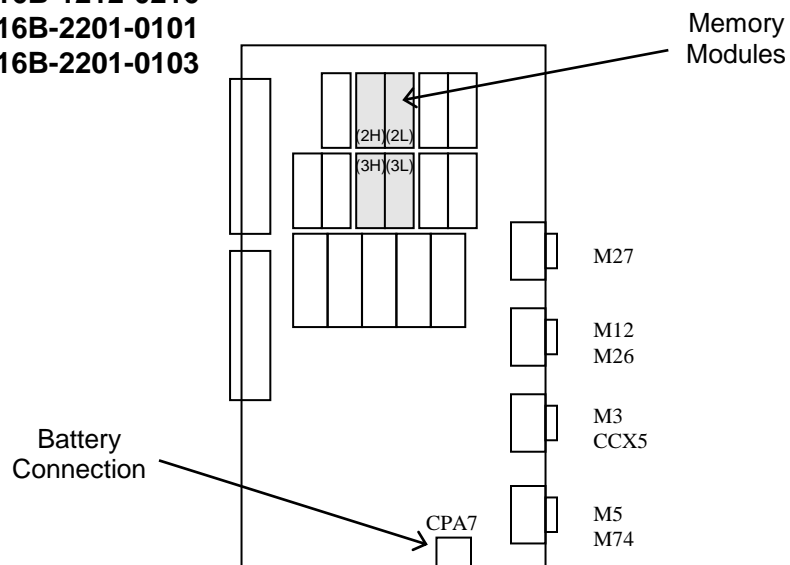
The Basics

Installation Considerations

The installation of the SRAM modules should be conducted with care. Never install or remove a board with the control power on (the main power can be on, but not the control). Take care with the handling of the integrated circuits, as they are static sensitive. Do not place the IC's in any other sockets than as per pages 4 and 5. Do not force, drop or otherwise mishandle the modules during the installation procedure and always check the functionality of the machine at the end of the installation (i.e. move the axes, perform a tool change, run a program, etc.).

Backup Critical Parameters

For a Fanuc Series 0 upgrades it is very important that you have a hard copy back-up of all your control's critical parameters. The following instructions will assist you in dumping a majority of the Fanuc's parameters to a PC to be saved. However, it is still advised to keep or make, if you haven't already, a written copy of ALL the critical parameters. You can use the Parameter Sheets in the Appendix of this manual to write down all Settings, PC and Diagnostics parameters. All of the Diagnostic parameters between D300 and D600 **must** be written down here. If you have a Fanuc 0C, you can serially download the PMC Diagnostic parameters. Be sure that all of the files you downloaded have been successfully recorded and saved on your computer before performing the upgrade to your control. Otherwise you will have no choice but to enter ALL parameters by hand in MDI.

Verify Your Control

Once the memory modules have been installed and all parameters have been restored, satisfy yourself that the control is working properly.

Test the machine by the following procedure through either MDI or program:

- Home all axes, tool-changers and pallets – check for need to reset Absolute Pulse Coders here.

- Check spindle functionality through all speeds and gear ranges.

- Check also Clockwise and Counter-clockwise rotation with M3 and M4 commands.

- Check the tool changer. Be sure that the tool you received was the tool requested and that the carousel rotates in the proper direction.

- Check the pallet changer (if applicable). If your machine requires special custom macros for a pallet changer or tool changer, be sure that they have been loaded.

Once your machine has been proven, you have successfully upgraded your control.

Installation for Fanuc® 0

Backup Your Control

Before starting the installation, power on the control and verify that the machine tool is in good working order.

I.   Parameter Settings for Punching

Set up the following communication parameters for the desired CNC port. Please make note of the original settings for proper restoration of the new memory (see page 16).

On the SETTINGS (HANDY) screen, set the following:

TVON =	0	(TV Check off)
ISO =	1	(ISO data format)
I/O =	0	(port number)
PWE =	0	(Parameter Write Enable OFF)
TAPE =	0	

Write down the previous settings so that they can be restored upon completing the upgrade. Also set the following parameters:

Chart 1

CNC Parameter	Port 1-M5 I/O=0	Port 1-M5 I/O=1	Port 2-M74 I/O=2	Port 2-M74 I/O=3	Current Settings
0002	1xxxxxx0	--	--	--	
0012	--	1xxxxxx0	--	--	
0038	10xxxxxx	10xxxxxx	xx10xxxx	xx10xxxx	
0050	--	--	1xxx0xx0	--	
0051	--	--	--	1xxx0xx0	
0250*	--	--	10	--	
0251*	--	--	--	10	
0552*	10	--	--	--	
0553*	--	10	--	--	

* Parameters 250, 251, 552 and 553 represent the baud rate during communication and are set here to 4800 baud. Parameter 552 is used if Setting I/O=0, 553 if I/O=1, 250 if I/O=2 and 251 if I/O=3. The protocol is Even parity, 7 data bits and 1 stop bit. For more baud rate choices refer to the following Chart 2.

Trace the RS-232 cable from the serial port connector back to the CNC MEMORY PCB to determine if you are connected to Port 1 (M5) or Port 2 (M74). Then, label the serial port connection so it is visible from the outside.

Chart 2 for Serial Baud
Parameter on 552/553 or 250/251

Parameter Value	Baud Rate
1	50
2	100
3	110
4	150
5	200
6	300
7	600
8	1200
9	2400
10	4800
11	9600

II.   PUNCHING CNC NC PARAMETERS (CNC - PC)

- Connect the Fanuc serial cable between the serial ports on your computer and the CNC.
- Set up your computer with a terminal software program (Telix / ProCom+ / Hyper Terminal).
- Perform the following steps on the PC and CNC as follows:

PC--   Using the Baud Rate set in parameters 552 & 553, Even parity, 7 Data bits and 1 Stop bits, set your terminal program to receive a file.

PC--   Enter a file name to record the NC parameters. ie; **#103.NCP** (103 being the machine #)

CNC-- Go into EDIT mode.

CNC-- Make sure the "Memory Protect" key is off.

CNC-- Press DGNOS/PARAM, [PARAM], then hold EOB while you press OUTPUT/START.
>   *NB: Hold the EOB key while pressing the OUTPUT/START key to punch ALL*
>   *the NC Parameters, including the 900 level options.*
(The CNC will flash OUTPUT in the lower right corner of the CRT.)
(The PC will display the text and count lines until finished.)

PC--   Save the file you just received from the CNC on the computer.

IMPORTANT: Check the .NCP file with a text editor to visually confirm that system parameters N0900 series have been sent to the computer. If these parameters are not found in your listing, please repeat this section (Punching CNC Parameters). Take this moment to write down the 900 level system parameters for backup purposes.

III.   RECORD THE PMC PARAMETERS

You must **manually** copy down on paper ALL of the Diagnostic parameters between No. 300 – 600 (see page 18). These parameters represent the Timers, Counter, Keep Relays & Data Tables used by the machine builder. On the Fanuc 0-C you can punch these PMC parameters. This backup is necessary before continuing this memory upgrade. Be sure that all of the files above have been successfully recorded or saved on your computer. If there is any doubt, please contact Memex Automation before continuing. Some parameters are changing, ignore these – generally it is every 5th one that you need as you can see on the attached chart.

Sample Fanuc 0-C PMC Parameter Dump

```
_&HE:_%                        <—– Delete the feed info before the first % sign
N10300 Π 00101000
N10301 Π 00000000
N10302 Π 00000000
N10303 Π 00000000
N10304 Π 00000000
N10305 Π 00001010
N10306 Π 00000000
N10307 Π 00001111
N10308 Π 10001111

…
N10597 Π 00000000
N10598 Π 00000000
N10599 Π 00000000
%_
```

IV.   PUNCHING CNC PART PROGRAMS (CNC - PC)

- Ensure that Macro files in the 9000 range can be downloaded – set NC Parameter 10 bit 4 = 0 (xxx0xxxx) so that ALL programs can be backed up properly.

- Perform the following steps on the PC and CNC as follows:

PC--   Enter a file name to receive the NC parameters. ie; **#103.PRG** (103 being the machine #)

CNC-- In EDIT mode, with the "Memory Protect" key off, press PRGRM, [LIB], O-9999, then OUTPUT/START.

PC--   Save the file you just received from the CNC on the computer.

V.   PUNCHING CNC TOOL OFFSETS (CNC - PC)

- Perform the following steps on the PC and CNC as follows:

PC--   Enter a file name to receive the NC parameters. ie; **#103.TOF** (103 being the machine #)

CNC-- In EDIT mode, with the "Memory Protect" key off, press OFFSET, and then OUTPUT/START.

PC--   Save the file you just received from the CNC on the computer.

Installation Procedures for Fanuc® 0

Make a print out of your .NCP parameter file. **When you are confident that you have completely saved all of your CNC information, you will be ready to proceed with your memory upgrade**.

The part program and system memory is located on the Master Board for Fanuc 0-A and 0-B Series controls and on the MEM-A3 card for 0-C and 0-4PC Series (see pages 4-5). Locate this board in your machine control cabinet.

* Check that you have received all of the information out of your CNC control. Check also that any Custom Macro Variables have been written down and recorded.

1. Power OFF the control and the machine. Open the cabinet door to expose the control's Master Board.

2. Clearly label all of the cables, daughter boards *and their locations* that are connected to the Master Board. Once all the cables and boards are labeled, you can loosen and remove the cables and daughter boards using a screwdriver including the MEM-A3 board (for 0-C and 0-4PC upgrades). You are now ready to potentially remove the battery connection (CPA7) from the bottom of the Master Board (see "Master Trick" note blow).

   > **Master Trick:**
   > With great care, it is possible to install the modules and not have the battery removed. If each module is carefully inserted so as not to short the battery to ground, you may find the main memory has been saved. Worst case is that you will have to do the manual restore listed below. Test this by powering up **not** holding RESET & DELETE in the beginning.

3. Put on an anti-static wrist strap if available and clip the other end of it to the GND post in the top corner of the Master Board. Locate the SRAM socket positions on the Master Board / MEM-A3 board (see pages 4-5). This is where you have to insert or replace the larger of the new memory modules. Optionally if there are already modules in these locations, you can use the small screwdriver or a chip puller to carefully remove them. Also locate the smaller SRAM parity socket positions on the Master Board (0-A and 0-B upgrades only). This is where the smaller of the new memory modules go.

4. One by one, remove the memory module from the kit. Check that the pins are straight and be wary of static discharge that may damage the memory modules.

5. Orient one supplied memory module above the socket with the "notch" in the same direction as the "notch" in the socket (Pointing "**Down**"). Place one row of pins in the socket, then with a little sideways pressure put the second row in. With steady pressure, push the memory module down into the socket. Check that none of the pins have bent in during this process. Repeat this step for the remaining modules. *If components exist in the sockets – leave them.*

6. Again, check your work before replacing any daughter boards back in the control. After you replace the daughter boards and restore all of the cable connections, check your work. After you are confident that every cable has been correctly connected, power up the control.

7. **If the CNC boots normally, then jump to the next step of enabling the option (set P901=x1x00001 for 320M) and reload your 8000/9000 Macro Programs. You are done.** However, if the controls comes up with a parity error, then turn off and on the CNC power while holding the **RESET & DELETE** keys simultaneously. This will erase the new Master Board memory in preparation for your information.

8. Now you are ready to proceed with the reloading of all of your parameters and programs.

Fanuc 0C Memory Upgrade - 320M
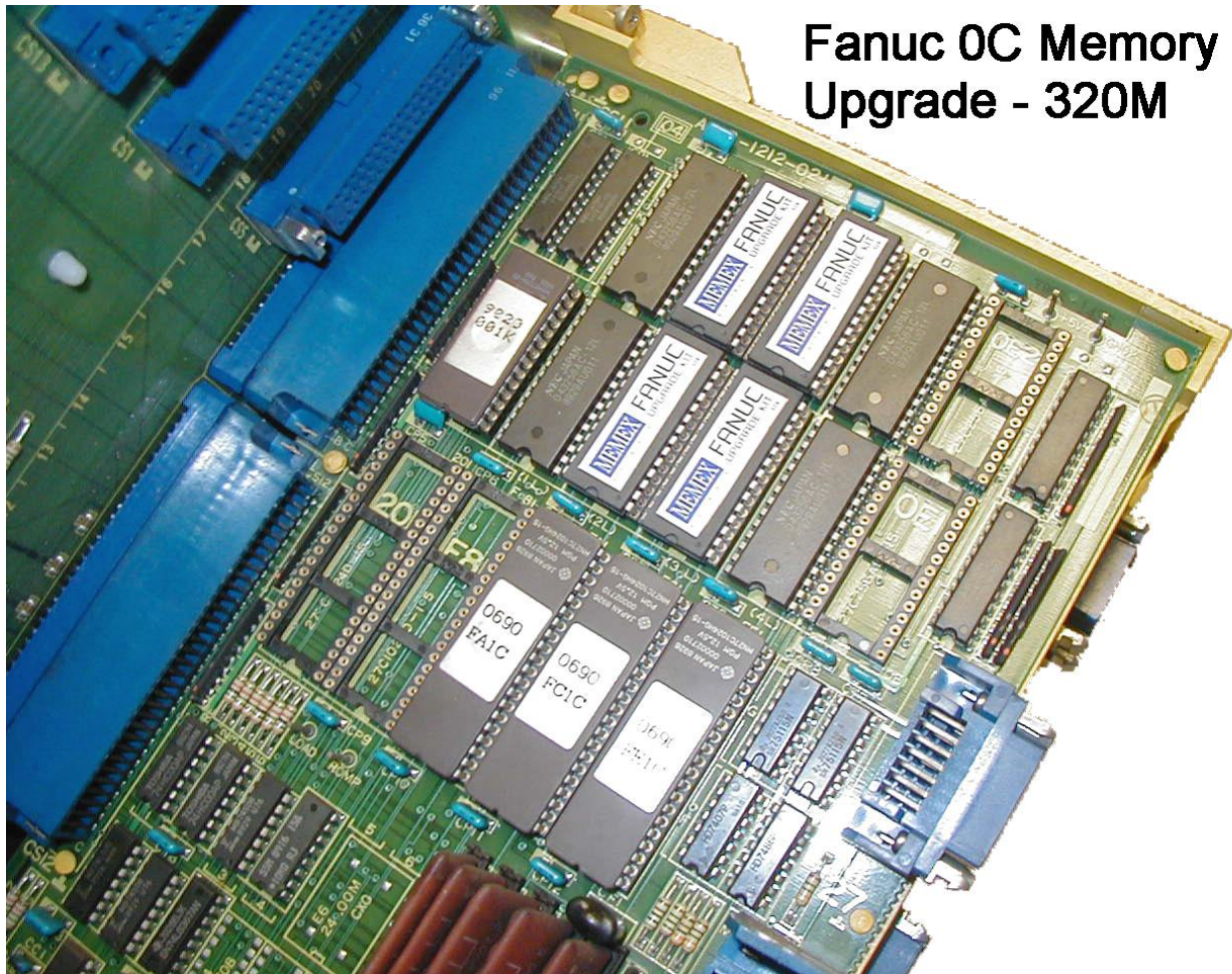
Restoring your Fanuc® 0

I.   RESTORING THE SYSTEM PARAMETERS

With the Emergency Stop button depressed, set the PWE parameter on page 2 of the SETTINGS screen to a 1. Press DGNOS/PARAM, [PARAM] and page down to parameter 900. Enter the values for parameters 900-1000. At this time, set up the communication parameters again the same way you did in Part 1-CNC Parameter Settings. When you are finished, turn off the power to the control, then power on again.

II.   READING CNC PARAMETERS (PC - CNC)

* Set the PWE parameter, then press DGNOS/PARAM, [PARAM] and set up the CNC communication parameters in accordance with the following.

On the SETTINGS (Handy) screen and in MDI mode, set the following:

TVON =	0	(TV Check off)
ISO =	1	(ISO data format)
I/O =	0	(desired port number placed here)
PWE =	1	(Parameter Write Enable OFF)
TAPE =	0	

For example – if you used Port 0 you would set parameters P901.6 to 1, P552=11 (for 9600 baud), P2=1xxx xxx0 for E71 with no feed and P38=10xx xxxx to get serial communications going again.

NB: Check that after using the software that Parameter 901=x1x0 0001 (where x is don't care) for 320M on Fanuc 0B &C, or P901=x1x0 0010 is set for 120M on the Fanuc 0A.

You should have the original settings written on page 16 (as per page 7) to be restored after all other parameters are restored via the serial port. In order to do this set the parameters for the serial ports as per Chart 1 (page 7) and Chart 2 (page 8).

- Set up the communications software on your computer to send a file.
- Perform the following steps on the PC and CNC as follows:

CNC-- In EDIT mode, press the DGNOS/PARAM, [PARAM], INPUT keys.
　　　 (The CNC will flash *LSK* in the lower right corner of the CRT.)

PC-- Send the file with the **.NCP** extension to the control. When the parameters have been received, 　　Power OFF the control, then power it ON again.

III.　WRITING THE PC PARAMETERS

You must **manually** input into the control, ALL of the Diagnostic parameters between No. 300-600. At the end of this entering what you can, cycle the power completely (that is power off even back to the main breaker - this reset the servo drives by the way).

IV.　READING CNC TOOL OFFSETS

- Set up the CNC parameters in accordance with section 1.
- Set up the communications software on your computer to send a file.
- Perform the following steps on the PC and CNC as follows:

CNC-- In EDIT mode, press the OFFSET, then [INPUT] keys.
　　　 (The CNC will flash *LSK* in the lower right corner of the CRT.)

PC-- Send the file with the **.TOF** extension to the control. This should reload all of your tool offsets.

CNC-- Execute this **.TOF** file to set the Tool Offsets.

CNC-- Delete this file from the Programs in the CNC.

V.　READING CNC PART PROGRAMS

- Set up the CNC parameters in accordance with section 1.
- Set up the communications software on your computer to send a file.
- Perform the following steps on the PC and CNC as follows:

CNC-- In EDIT mode, with the memory protect KEY switched off, Press the EDIT/AUTO, [PRGRM], 　　then INPUT keys.(The CNC will flash *LSK* or "lead skip" in the lower right corner of the CRT.)

PC-- Send the file with the **.PGM** extension to the control. This should reload all of your programs.
　　　 Don't forget to reset parameter 10 if you had previously changed it. That will protect your macro　programs (if applicable).

VI.   CLEAR ABSOLUTE ENCODER (if applicable)

1. Power up with "No.QRP" + "CAN" *or* "P" + "CAN" to clear (or reset) any absolute encoders if applicable. You will know this is needed if the machine over-travels upon homing, but is a long way from normal home.

2. Reference machine manually as usual.

Restore any of the NC parameters that you changed from their original state (see SETTING, communications settings etc. You will have to set PWE to do this. Double check the INCH versus METRIC setting in the SETTING HANDY screen (a metric setting which is the default, will make the machine seem to crawl when a program asks for what it thought was an INCH move). Check the MIRROR AXES settings as well.

- Also remember to re-protect your 9000 level programs with parameter 10 bit 4 (xxx1 xxxx) if applicable.

After a complete test - including exercising the tool changer if applicable - you will have completed your installation.

Remember to change the 3 D cell batteries that keep your control memory backed up on a regular basis (once a year) with the CNC control power **ON**. Call Memex if you would like to investigate our permanent Fanuc MxBRU Battery Replacement Unit (see below).

Fanuc Serial Cable:

Pin 1	Frame Ground	Pin 4	Request to Send	Pin 7	Signal Ground
Pin 2	Transmit Data	Pin 5	Clear to Send	Pin 8	Carrier Detect
Pin 3	Receive Data	Pin 6	Data Set Ready	Pin 20	Data Terminal Ready

Normally pins 6, 8 & 20 are jumpered on the Fanuc side. Also pins 2 & 3 are usually crossed, as are 3 & 4, when connected to a PC with a DB25 connector.

Note that Fanuc has +24 volts on pin 25!

Appendix

Technical Summary for Fanuc® 0

PUNCHING

Punch NC Parameters	-	EDIT mode, PARAM screen, EOB + OUTPUT/START
Punch PC Parameters	-	EDIT mode, DGNOS screen, OUTPUT/START
Punch All Programs	-	EDIT mode, PRGRM screen, 0-9999, OUTPUT/START
Tool Offsets	-	EDIT mode, OFFSET screen, OUTPUT/START

READING

Load NC Parameters	-	EDIT mode, PARAM screen, EOB + INPUT
Load PC Parameters	-	EDIT mode, DGNOS screen, INPUT
Load All Programs	-	EDIT mode, PRGRM screen, INPUT
Load Tool Offsets	-	EDIT mode, OFSET screen, INPUT

CLEARING

Delete All memory	-	Power On holding RESET + DELETE

Standard Fanuc® Serial Port: (DB-25 Female)

1 = Frame Ground	6 = Data Set Ready
2 = Transmit Data	7 = Signal Ground
3 = Receive Data	8 = Carrier Detect
4 = Ready To Send	20= Error (Data Terminal Ready)
5 = Clear To Send	25= +24 Volts DC

The usual software handshaking cable configuration has 2, 3 crossed & 7 connected straight through (with 4&5 jumpered - or used if hardware handshake lines are preferred) and pins 6,8 & 20 jumpered on the control side only.

Fanuc® ISO Protocol: (E,7,x)
The standard protocol for Fanuc® controls is "Even parity", "7 data bits" and either "1 or 2 stop bits")
See Parameters 101, 111, 121 and 131 above

Determination of Fanuc 0 Model Types

To determine the version of the Fanuc 0 series CNC Control, check the master board number and/or the software version. The Master board number is found on the top left side of the main circuit board, usually mounted in the control cabinet that has the daughter card attached. It should not be confused with "A02B-????-????" numbers, which are Fanuc's ordering numbers and are usually found on a sticker above the master board.   Use the following table to determine which unit you have.

You can determine the software version by powering-up the control with E-stop active (button depressed). The control should hang on the software version screen (in the lower right corner of this screen, you will see the servo version number as well). Please note that Memex has a **MxBRU** (Battery Replacement Unit) available that provides a maintenance-free rechargeable Lithium battery backup for this control.

1985 / 1986 Fanuc 0-MA and Fanuc 0-TA 120M maximum battery backed resident memory.
1987 / 1989 Fanuc 0-MB and Fanuc 0-TB 320M maximum battery backed resident memory.
1990 / 1998 Fanuc 0- MC and Fanuc 0-TC 320M maximum battery backed resident memory.
1999 / today Fanuc 0- MD and Fanuc 0-TD 320M maximum battery backed resident memory

Parameter Worksheet

Company:_____   Machine No.:_____   Date:_____

Fanuc® 0-____   Software Version: _____   Main CPU Board No.: _____

Setting Screen Data

TV ON		PWE	
ISO		TAPE	
I/O			

PC Parameters

Par.	Value	Par.	Value	Par.	Value	Par.	Value	Par.	Value

Par. = Parameter Number

Diagnostics Parameters

Parameter	Data	Parameter	Data
D300		D375	
D301		D376	
D305		D390	
D306		D391	
D310		D395	
D311			
D315		COUNTER 1	
D316		D380	
D320		D381	
D321		D382	
D325			
D326		COUNTER 2	
D330		D385	
D331		D387	
D335			
D340		PC SWITCH	
D341		D400	
D345		D420	
D346		D421	
D350		D422	
D351		D423	
D355		D424	
D356			
D360		DATA TABLE	
D361		D440	
D365		D441	
D366			
D370		TOOL CHANGE	
D371		D382	
		D387	

Spare Parameter Sheet

No.	Data	No.	Data	No.	Data	No.	Data.
0		0		0		0	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
0		0		0		0	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
0		0		0		0	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
0		0		0		0	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
0		0		0		0	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	

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