engineering
mannesmann
Rexroth

MT-CNC / MTC200
Software Version 17

Installation - New Functions

SYSTEM200

DOK-MTC200-INS*BOF*V17-AW01-EN-P

Rexroth
Indramat

Title MT-CNC / MTC200 Software-Version 17

Kind of document Installation, New Functions

Docu.Type DOZ-MTC200-INS*BOF*V17-ANW1-EN-P

Internal filing remarks Drawing no. 109-1041-4101-00

Purpose of this document This document describes the installation procedure of the User Interface and the new functions included in software version 17.

Furthermore the different configuration possibilities for the installation of a MT-CNC or a MTC200 are described.

Revision	Date	Remarks
109-1041-4101-00	06/97	New issue

Trademarks MS-DOS, Windows and Windows NT are registered trademarks of Microsoft Corporation, IBM is a registered trademark of International Business Machines Corporation.

Publisher INDRAMAT GmbH • Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main

Phone +49-9352/40-0 • Tx 689421 • Fax +49-9352/40-4885

ENC (OI)

Contents

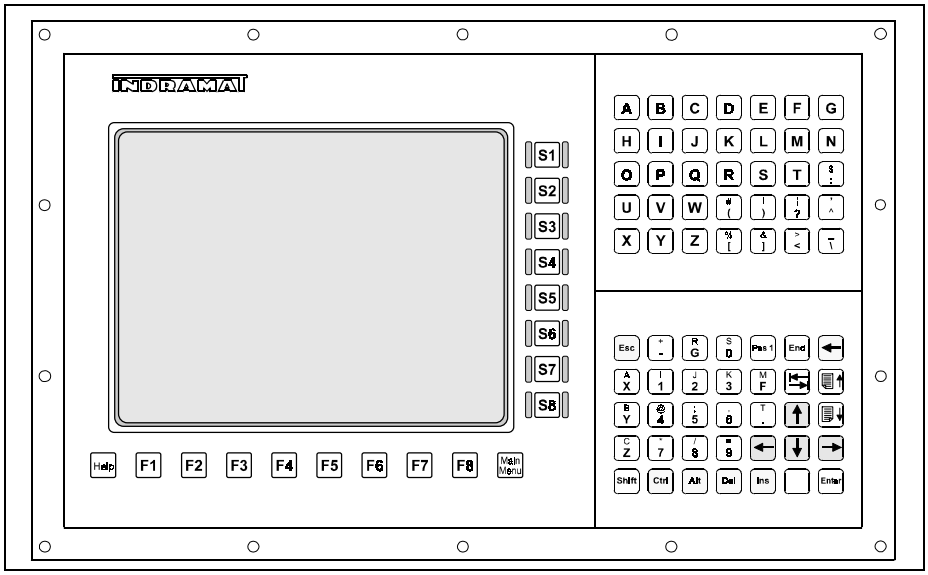
1 Installing the GUI

The GUI install program decompresses and copies the GUI program and other GUI files from the installation disks to your hard disk. Before using the GUI it is necessary to execute the install program.

This chapter will show you how to install and setup the GUI on your hard disk. You will see how to install the GUI for the first time, how to execute an update of an already existing installation, how to install an additional language and firmware programming. Finally it is explained how to remove the GUI from the hard disk with the help of the install program.

1.1 Hardware and Software Requirements

BTV01.2



The suitable hardware platform to operate the GUI in connection with the MT-CNC is the INDRAMAT operator terminal BTV01.2 which is an industrial IBM compatible PC.

Standard equipment of the BTV01.2:

- Processor 5x86/133
- 16 Mbytes RAM
- 256 Kbytes Cache
- At least 500 Mbytes hard disk
- 10,5“-TFT-color display
- Serial interface RS232C for connecting the MT-CNC
- Parallel printer interface
- Complete NC keyboard with 80 keys
- 8 machine function keys
- Possibility to connect an external PC keyboard

If required, the following options are available:

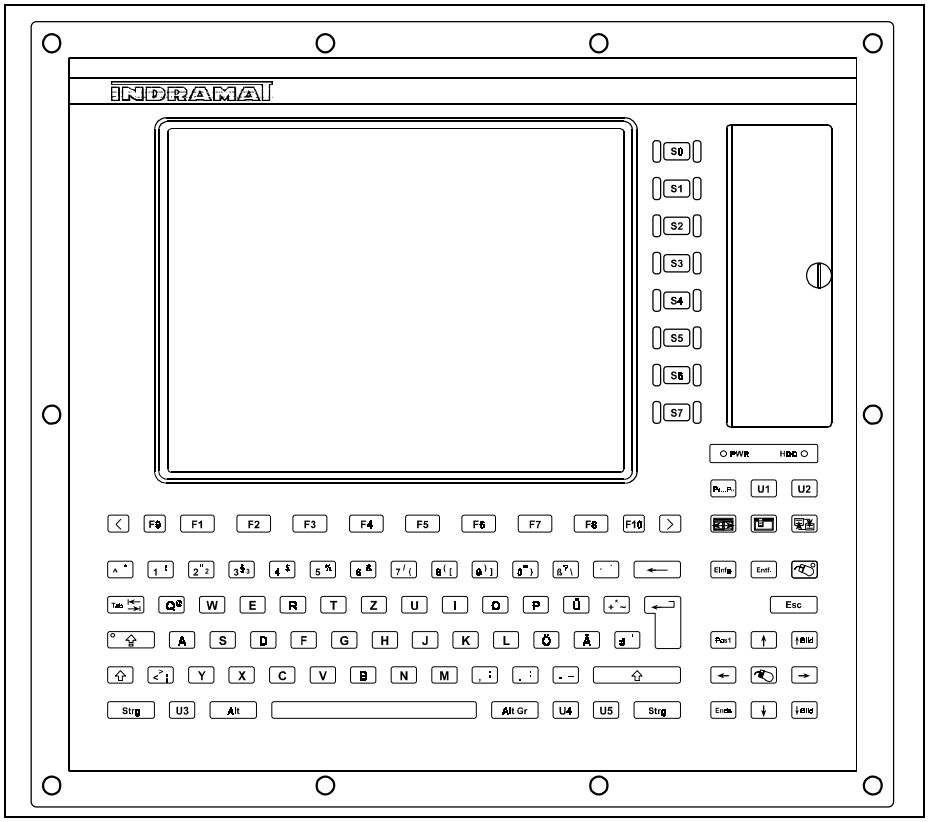
- RAM-expansion to a maximum of 64 MB

- Serial interface RS485 as a bus interface to connect several MT-CNCs
- Second serial interface RS232C or RS485
- ISA-Busadapter with third serial interface RS232C
- Installed floppy disk drive
- Connection for an external floppy disk drive
- Integrated Ethernet interface
- Profibus-FMS interface

The complete information on the technical data as well as the requirements for the use of the BTV01.2 are given in "MT-CNC Techn. Documentation", Mappe 4.

The GUI can also be installed and run on each other "IBM compatible" PC which has the same or better performance than the BTV01.2. In this case, version 5.0 of the operating system MS-DOS is required.

BTV30



In connection with the control components of the MTC200 family, the INDRAMAT operator terminal BTV30 is used.

The BTV30 is an industrial PC which is used with standard PC components. It has a passive AT-Bus Backplane with 10 slots. One slot is occupied by a slot CPU.

Standard equipment of the BTV30:

- SLOT-CPU with processor 5x86/133 with integrated graphics controller and 1 MB video memory
- 16 Mbytes RAM (expansion to a maximum of 64 Mbytes possible)
- At least 500 Mbytes hard disk

- 3,5“ floppy disk drive
- 10,4“-TFT-color display
- 2 free serial interfaces RS232C
- Parallel printer interface
- ASCII-keyboard with function keys, cursor-block and special keys, German or American keyboard layout
- 8 machine function keys
- Possibility to connect an external PC keyboard.

The BTV30 can be delivered as a PC for connecting a MT-CNC or with integrated control cards MTC-P and MTS-P as a complete MTC200 control system.

The complete information on the technical data as well as the requirements for the use of the BTV30 are given in "MTC200 Techn. Documentation", Mappe 4.2.

Recommendation for Compatible PCs

Different hardware installed in a computer may require special device drivers and / or TSR programs (Terminate and Stay Resident) to be loaded into memory. Some of these programs may interfere with the operation of the GUI software. If problems appear during the start or the operation of the GUI, you should deactivate all these programs first (e. g. by disabling them in the files CONFIG.SYS or AUTOEXEC.BAT).

The GUI software requires at least **600 Kbytes** free RAM in order to be started. Using the command 'MEM', you can find out how much conventional memory is available on your PC. By removing memory resident drivers or programs you can put more conventional memory at the disposal of the GUI. The program MEMMAKER (which is available with MS-DOS version 6.0 or more recent versions of MS-DOS) can be used to free more conventional memory by moving drivers into the high memory area.

Note: Do not execute MEMMAKER if the GUI is already installed and automatically started within AUTOEXEC.BAT during the start of the PC!

The following pages list the system files CONFIG.SYS and AUTOEXEC.BAT installed in the BTV01 at delivery. In addition, examples for system files are shown for compatible PCs. These examples only contain the essential data necessary to run the GUI.

The File *CONFIG.SYS* of the BTV 01.2/BTV30

```
REM*****************************************************
REM ***** CONFIG.SYS                        Ver.01V00 *****
REM ***** ---------------------------------------- *****
REM *****MT-CNC GBO                 Version xx.17/xx*****
REM *****************************************************
DEVICE=C:\DOS\HIMEM.SYS
REM MT-CNC
DEVICE=C:\DOS\EMM386.EXE NOEMS
REM MTC200
REM DEVICE=C:\DOS\EMM386.EXE NOEMS X=D000-D1FF
BUFFERS=10,0
FILES=30
DOS=HIGH,UMB
LASTDRIVE=E
FCBS=4,0
BREAK=OFF
REM DEUTSCH:
COUNTRY=049,850,C:\DOS\COUNTRY.SYS
REM ITALIANO:
REM COUNTRY=049,850,C:\DOS\COUNTRY.SYS
REM ESPANOL
REM COUNTRY=049,850,C:\DOS\COUNTRY.SYS
REM ENGLISH UK
REM COUNTRY=049,850,C:\DOS\COUNTRY.SYS
REM ENGLISH USA
REM COUNTRY=049,850,C:\DOS\COUNTRY.SYS
```

Example of the File *CONFIG.SYS* of Compatible PC

```
DEVICEHIGH=C:\DOS\SETVER.EXE
DEVICE=C:\DOS\HIMEM.SYS
DEVICEHIGH=C:\DOS\EMM386.EXE NOEMS
DEVICEHIGH=C:\DOS\ANSI.SYS /X
DOS=HIGH,UMB
STACKS=0,0
SHELL=COMMAND.COM /E:512 /P
FILES = 30
BUFFERS = 10,0
BREAK = OFF
```

DOS commands are described briefly, for detailed information please refer to your DOS manual.

The file CONFIG.SYS is used in the PC to load special device drivers and to set up hardware options. The settings for FILES and BUFFERS are very important.

The FILES command should be set to 30 or more than 30. This command specifies the number of files that can be opened simultaneously, the GUI software uses multiple files during operation.

The BUFFERS command (in connection with SMARTDRV) should be set to 10. Reserving more than 10 data buffers does not always accelerate the operating speed in connection with SMARTDRV in spite of the additional reserved memory but it requires additional memory area.

Note: Too large values for FILES and BUFFERS may occupy conventional RAM unnecessarily. If the free working memory is not sufficient for the start of the GUI, these values have to be reduced to the minimum values.

In PCs with processors 386 or 486 and expanded memory installed, the expanded memory manager is usually installed by the command DEVICEHIGH, e. g.

```
DEVICEHIGH=C:\DOS\EMM386.EXE NOEMS
```

If WINDOWS is installed in your PC, you may also use the following commands:

```
DEVICE=C:\WINDOWS\HIMEM.SYS
DEVICEHIGH=C:\WINDOWS\EMM386.EXE NOEMS
```

If the BTV30 or another PC is used with the control cards MTC-P and / or MTS-P, the memory area which is used for the communication with the control cards (normally X=D000-D1FF) has to be masked after executing EMM386.EXE using parameter 'X'.

The File *AUTOEXEC.BAT* of the BTV01

```
@ECHO OFF
REM ***************************************************
REM *****AUTOEXEC.BAT                    Ver. 01V00*****
REM *****-----------------------------------------*****
REM *****MT-CNC GBO            Version xx.16/xx*****
REM *****-----------------------------------------*****
REM *****        (C) INDRAMAT GmbH       04. 03. 97*****
REM ***************************************************
PROMPT $p$g
PATH C:\DOS
SET TEMP=C:\DOS
REM SYSTEM MEMORY 8 MB / ARBEITSSPEICHER 8 MB
LH C:\DOS\SMARTDRV.EXE 2048 C
REM System MEMORY 16 or 32 MB / ARBEITSSPEICHER 16 oder 32 MB
REM LH C:\DOS\SMARTDRV.EXE 4096 C
C:\HDDSTDBY
REM DEUTSCH:
LH KEYB GR,,C:\DOS\Keyboard.SYS
rem ITALIANO:
rem LH KEYB IT,,C:\DOS\Keyboard.SYS
rem ESPANOL:
rem LH KEYB SP,,C:\DOS\Keyboard.SYS
rem ENGLISH UK:
rem LH KEYB UK,,C:\DOS\Keyboard.SYS
rem ENGLISH USA:
rem LH KEYB US,,C:\DOS\Keyboard.SYS
```

An external PC keyboard can be connected to the BTV01. The corresponding country code has to be selected by modifying the file AUTOEXEC.BAT. The default setting selects the German keyboard. If a different keyboard is to be connected, the German keyboard driver needs to be deactivated using the command REM and the desired keyboard driver has to be activated by deleting the command REM. If certain letters do not appear correctly, a wrong setting in the AUTOEXEC.BAT may be the cause.

The File *AUTOEXEC.BAT* of the BTV30

```
@ECHO OFF
REM ****************************************************
REM *****AUTOEXEC.BAT                    Ver. 01V00*****
REM *****-----------------------------------------*****
REM *****MT-CNC GBO            Version xx.16/xx*****
REM *****-----------------------------------------*****
REM *****        (C) INDRAMAT GmbH       04. 03. 97*****
REM ****************************************************
PROMPT $p$g
PATH C:\DOS
SET TEMP=C:\DOS
REM SYSTEM MEMORY 8 MB / ARBEITSSPEICHER 8 MB
LH C:\DOS\SMARTDRV.EXE 2048 C
REM System MEMORY 16 or 32 MB / ARBEITSSPEICHER 16 oder 32 MB
REM LH C:\DOS\SMARTDRV.EXE 4096 C
REM DEUTSCH:
LH KEYB GR,,C:\DOS\Keyboard.SYS
rem ITALIANO:
rem LH KEYB IT,,C:\DOS\Keyboard.SYS
rem ESPANOL:
rem LH KEYB SP,,C:\DOS\Keyboard.SYS
rem ENGLISH UK:
rem LH KEYB UK,,C:\DOS\Keyboard.SYS
rem ENGLISH USA:
rem LH KEYB US,,C:\DOS\Keyboard.SYS
```

It is possible to connect an external PC keyboard to the BTV30. The corresponding country code of the external keyboard must be selected in the file AUTOEXEC.BAT. The default setting selects the German keyboard. If another keyboard is to be connected, the commands of the German keyboard driver have to be deactivated with the command REM and the commands of the desired keyboard driver have to be activated by removing the command REM. If certain letters do not appear correctly during the operation of the external keyboard, you should check the settings in the file AUTOEXEC.BAT whether they are correct.

Example of the File *AUTOEXEC.BAT* for Compatible PCs

```
@ECHO OFF
PROMPT $P$G
PATH=C:\DOS;\WINDOWS;C:
SET TEMP=C:\WINDOWS\TEMP
SMARTDRV 2084 1024 C
LH DOSKEY
CALL MT-RUN
```

By calling the batch MT-RUN at the end of AUTOEXEC.BAT you make sure, that the GUI is loaded automatically when booting the PC.

If the hard disk cache program 'SMARTDRV.EXE' is used, the "Write-Behind-Caching" mode has to be deactivated!

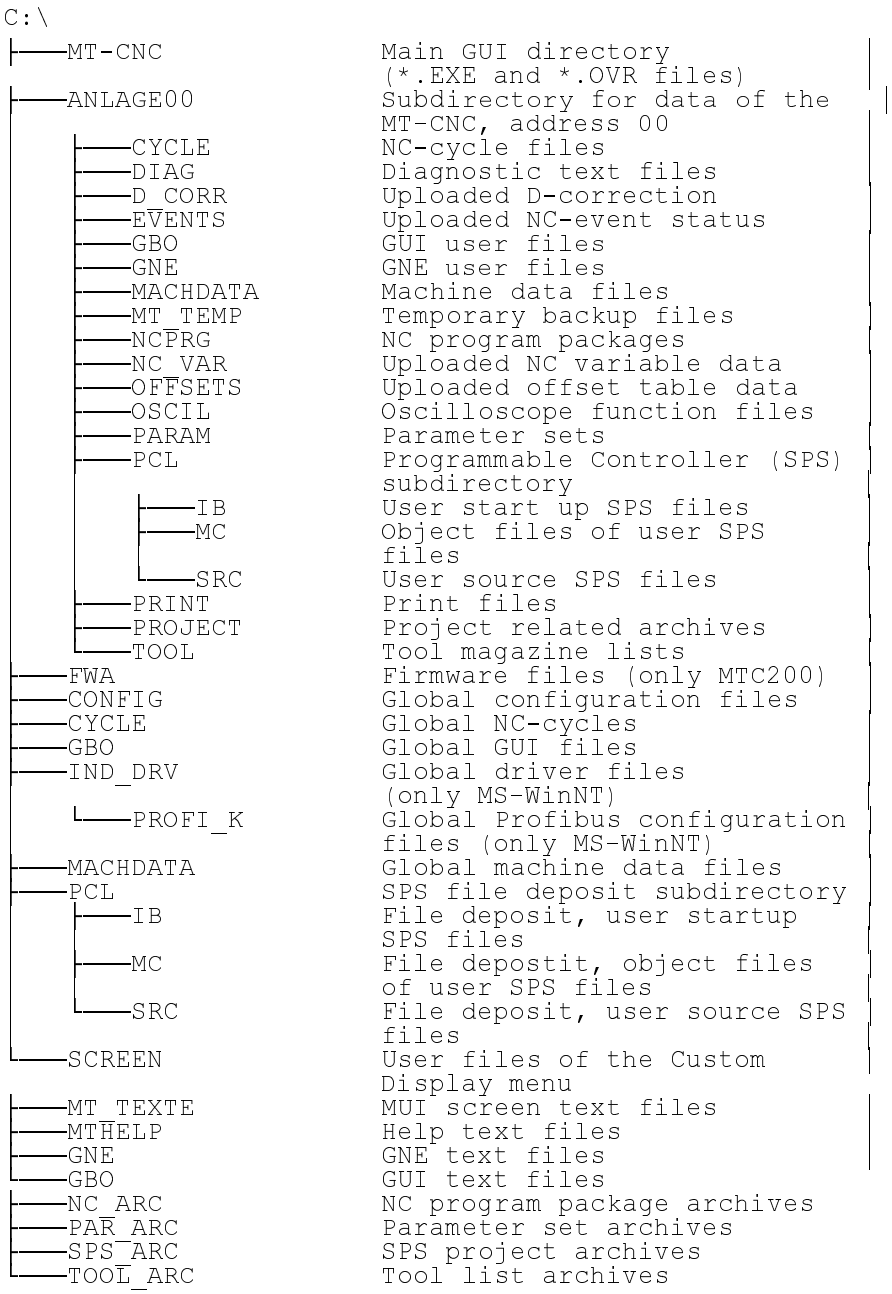
GUI Directory Tree

The GUI install program generates the GUI directory structure on the PC's hard disk and copies the appropriate files to the correct target.

On the next page you will see the file directory tree for an installation with a MT-CNC / MTC200 defined with the address in the GUI. A second control with the address leads to another directory tree which starts with ...\ANLAGE01\..., etc.

The ..._ARC directories contain compressed data (archives). A compressed parameter file for example can contain multiple files in order to save space on the hard disk. These files are used in case the active file had been destroyed or deleted.

It is the users responsibility to archive user data of the single menu items or to make a complete backup of the GUI user data by using the archive function (MUI menu item no. 1).


C:\
MT-CNC
Main GUI directory (*.EXE and *.OVR files)
ANLAGE00
Subdirectory for data of the MT-CNC, address 00
CYCLE
NC-cycle files
DIAG
Diagnostic text files
D_CORR
Uploaded D-correction
EVENTS
Uploaded NC-event status
GBO
GUI user files
GNE
GNE user files
MACHDATA
Machine data files
MT_TEMP
Temporary backup files
NCPRG
NC program packages
NC_VAR
Uploaded NC variable data
OFFSETS
Uploaded offset table data
OSCIL
Oscilloscope function files
PARAM
Parameter sets
PCL
Programmable Controller (SPS) subdirectory
IB
User start up SPS files
MC
Object files of user SPS files
SRC
User source SPS files
PRINT
Print files
PROJECT
Project related archives
TOOL
Tool magazine lists
FWA
Firmware files (only MTC200)
CONFIG
Global configuration files
CYCLE
Global NC-cycles
GBO
Global GUI files
IND_DRV
Global driver files (only MS-WinNT)
PROFI_K
Global Profibus configuration files (only MS-WinNT)
MACHDATA
Global machine data files
PCL
SPS file deposit subdirectory
IB
File deposit, user startup SPS files
MC
File depostit, object files of user SPS files
SRC
File deposit, user source SPS files
SCREEN
User files of the Custom Display menu
MT_TEXTE
MUI screen text files
MTHELP
Help text files
GNE
GNE text files
GBO
GUI text files
NC_ARC
NC program package archives
PAR_ARC
Parameter set archives
SPS_ARC
SPS project archives
TOOL_ARC
Tool list archives

The File *MT-RUN.BAT*

The file MT-RUN.BAT is generated during the installation of the GUI and is in the DOS root directory of the correspondent drive which contains the GUI software installation.

If it is installed on drive 'C' and the name of the directory is 'MT-CNC' and the control MT-CNC, the file MT-RUN.BAT has the following contents:

```
ECHO OFF
REM INDRAMAT MT-CNC (c) Copyright 1997
REM ---------------------------------
SET DPMIMEM=MAXMEM 4096
    C:
    CD C:\MT-CNC
    TSRPG25I
    MT-CNC /H /B=10
    CD\
REM ---------------------------------
```

If it is installed on drive 'C' and the name of the directory is 'MT-CNC' and the control MTC200, the file MT-RUN.BAT has the following contents:

```
ECHO OFF
REM INDRAMAT MT-CNC (c) Copyright 1997
REM ---------------------------------
SET DPMIMEM=MAXMEM 4096
    C:
    CD C:\MT-CNC
    TSRPG25I /R0 /D=$XXXX,$XXXX
    MT-CNC /H /B=10
    CD\
REM ---------------------------------
```

If required, the following switches can be added to the line **TSRG25I** of MT-RUN.BAT. Please contact INDRAMAT Service before using the switches in parenthesis (the letters are not case sensitive):

/? or /?	:	Help display (English)
(/A)	:	Displays the processing during MUI booting
/B	:	Prevent [Ctrl]+[Alt]+[Del]
/C1 [/C]	:	Enables execution with MS-Windows-NT (DOS box)
/C2	:	Enables execution with MS-Windows-NT (DOS box) Can only be used in conjunction with the INDRAMAT Function Interface
/D		Programmable communication address (e. g. $D000,$0000) (MTC200: $xxxx, $xxxx)
(/G)	:	Generates the file "\GLOBAL.DAT"
(/I=$xx,$yy)	:	Programmable interrupt setting $xx = TSR-Interrupt $yy = DPR-Address
(/K)	:	TSR-Program working without GUI environment
/L	:	Activation of the GUI error log function
(/O=xxxx)	:	Serial interface rate setting:

1:55,5ms 2:27,7ms 4:14ms 8:7ms 16:3,5ms 32:1,7ms 64:868 µs 128:434 µs 256:217 µs 512:108 µs, 1024:54 µs 2048:27 µs 4096:13 µs.

The default setting (standard interrupt time) is 1.7ms in case /O is not defined. Different settings can be used in case of communication problems. When using Windows NT (3.5), switch /O=2 (27.7ms) has to be set.

/P	: TSR program text is taken from hard disk
(/Q)	: IPC-DPR driver activation
(/R)	: IPC-DPR protocol with BYTE swapping
(/R0)	: IPC-DPR protocol without BYTE swapping
(/T)	: Disable time synchronization with hardware time
(/U)	: TSR program debug mode
(/U0)	: Indramat Function Interface test release
(/W)	: Prevents main memory from swapping Reduces the memory area below 640 Kbytes
(/X)	: DTR/RTS switching for RS-485
(/Y)	: Activation of the TELEBYTE function which displays the serial communication between the GUI and the MT-CNC (Data are stored in \TELEGRAM.TXT).
(/Z)	: Data protocol switching (Check sum for TRANSMIT-counter)

If required, the following software options can be added to the first line **MT-CNC** of MT-RUN.BAT. Please contact INDRAMAT Services before using the switches in parenthesis (the letters are not case sensitive):

/?	: Help display (English)
/B=xx	: The GUI automatically boots the main menu item xx, e. g. /B=09 menu item 9, Custom display, or /B=10 menu item 10, GUI.
(/E)	: Displays the developer's name when viewing EXE-versions.
(/F)	: Disables the hard disk memory warning. This warning is generated if there is less than 1 MByte available memory on the hard disk.
/H	: Any EXE-file can be executed using one of the available F-keys. The name of the EXE-file and the related F-key has to be determined in the file ..\MT_TEXTE\MAIN_EXE.DAT.
/I	: The original INDRAMAT text for diagnostics will be used. User-defined text will be suppressed.
(/M)	: Free conventional working memory is not checked when starting the MUI. CAUTION: Unexpected errors may occur during operation which may cause the GUI to terminate!
(/N)	: New installation of the GUI software (deletes the file \MT_TEXTE\MT_START.DAT)
(/S)	: Boots the GUI into the Setup mode
(/V)	: Inserts the version of MT-v into the EXE-header.
/Z	: Displays the software license number

1.2 Before Installing the GUI

If you have ordered a completely configured **BTV30** with control cards, the user interface and the correspondent firmware are already installed at delivery. The following settings are installed as the default installation:

For the interface data the following values are installed:

- Channel: Online
- I/O address: $0318
- Memory address: $D000:$0000

For the user data the following values are installed:

- User name: INDRAMAT
- Password: MTC200

In this case you need the following chapters only for installing German or English or for the update of your installation. If you use the BTV or another PC with external control hardware or if you would like to use the control cards MTC-P and MTS-P with another PC, the GUI has to be installed with regard to the following description!

The GUI version needs at least 600 Kbytes of free conventional working memory to run on your BTV or PC. To determine how much conventional working memory is available you can use the DOS command 'MEM'. Check also the settings in CONFIG.SYS and AUTOEXEC.BAT as they are important for the working memory.

Note: The software version of the GUI and the firmware version of the MT-CNC / MTC200 must have the same version designation (e. g. 17VRS) to run correctly. Before installing the GUI or updating an existing installation you have to check whether the firmware version of the MT-CNC is compatible for operating the MT-CNC.

If this is the first time that you are installing the GUI, please follow the installation procedure described in "New Installation" (Page 1-12).

If you would like to update an existing installation, follow the procedure described in 'Updating' (Page 1-22).

If you would like to add German or English help texts or one of these languages as an additional language to your existing installation, follow the procedure described in 'Installing German or English later' (Page 1-27).

If you would like to install a language module (e. g. French, Spanish, Italian) with your existing installation, follow the procedure described in 'Installing an language module' (Page 1-32).

If you would like to delete an existing installation including all user data, follow the procedure described in 'Un-Installing the GUI' (Page 1-36).

If you would like to load the firmware of the control cards in connection with a MTC200 (for updating or after changing hardware), please follow the procedure described in 'Firmware Programming' (Page 1-40).

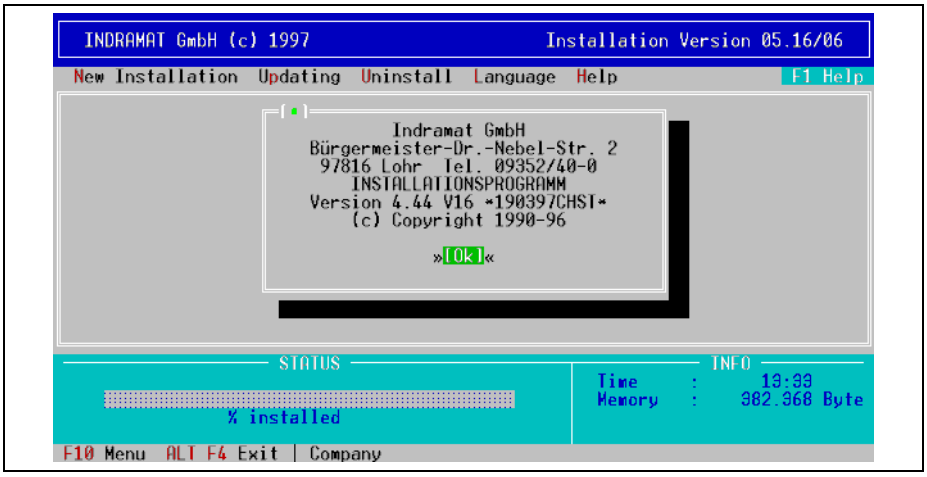
1.3 New GUI Installation

The complete installation of the German GUI without user programs requires at least 40 MB (installing the English text files requires 54 MB) free memory on your hard disk. For user data, about 10-20 MB free memory should be available. Execute the command 'DIR' in the main directory of your hard disk and make sure that there is enough free memory available before installing the GUI. Please also read the software license agreement before installing the GUI.

For installing the GUI, insert disk #1 into drive A or B of your PC (in the following description we are using drive A). Return to the root directory of your hard drive (e. g. 'CD\') and log on to drive A (e. g. A: [Enter]). For starting the automatic GUI install program, type 'INSTALL' and press [Enter].

A Microsoft or compatible mouse can also be used with the install program.

At the language prompt screen use the cursor key to select the desired language (default is German) that should be used during the installation and mark it by pressing the space bar. The press [Enter] to continue.



The main install screen is displayed after the language for the install program is selected. When the screen is first opened, a window will display the version

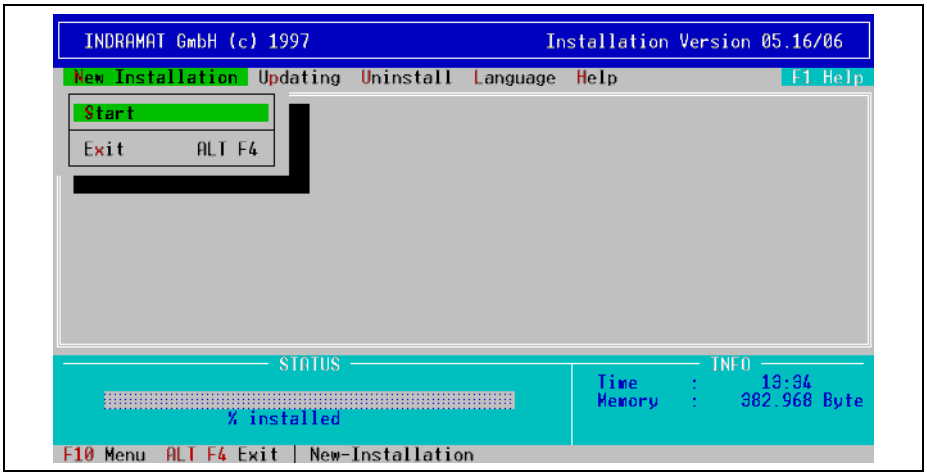
and copyright information about the install program. Press [Enter] to confirm this window or click the button using the mouse.

The install program provides help for the different screens and errors.

Press [F1] to open the help window for the current menu or error.

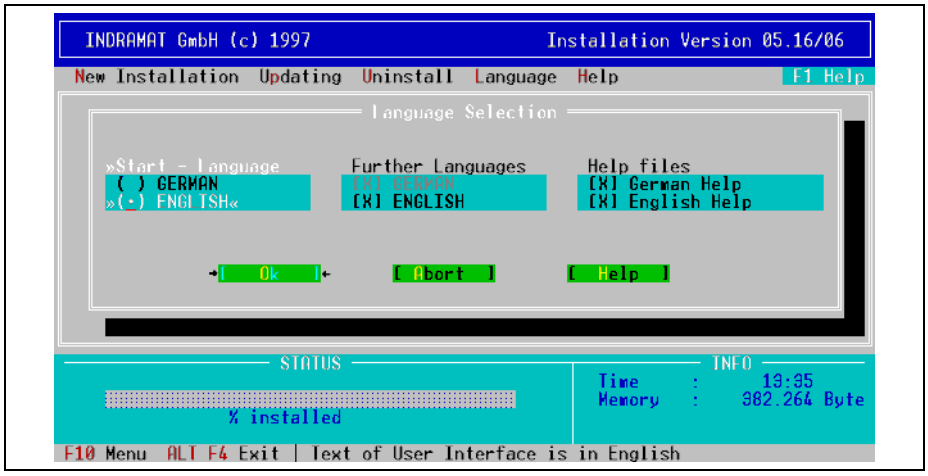
Press [F10] or [Alt] +[N] to select "New Installation". [Alt]+[F4] allows to exit the install program.

For starting "New Installation" select "Start" by using the cursor and pressing [Enter] or [S].



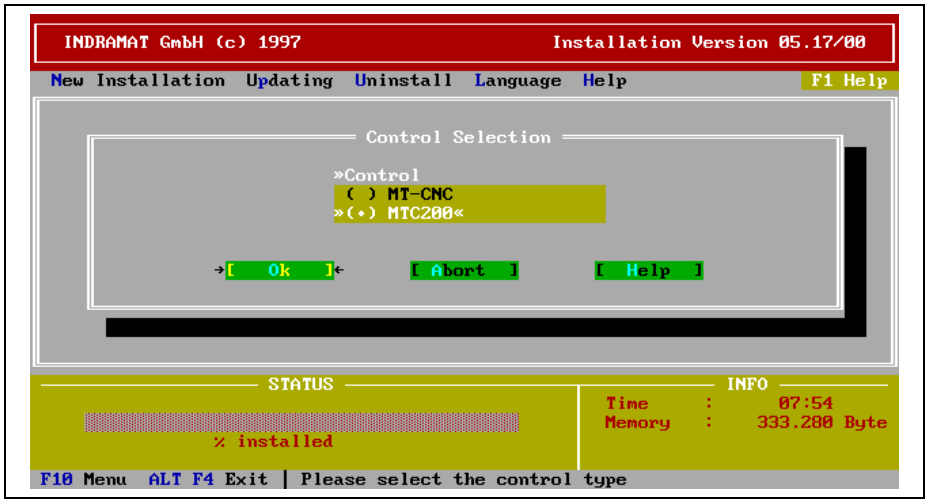
The user is then prompted for the GUI language options. Select all languages that you would like to have available in the GUI installation. The language German is always installed as a service language. The [Tab] key switches between the columns and the OK button. The "Start Language" is used in the GUI at GUI boot up. 'Further languages' can be tagged by pressing the [Space Bar] and are available in the installed GUI. They can be selected through the SETUP. As multiple languages require large disk space, they can be selected separately.

Press [Enter] or click the OK button to complete the language selection.

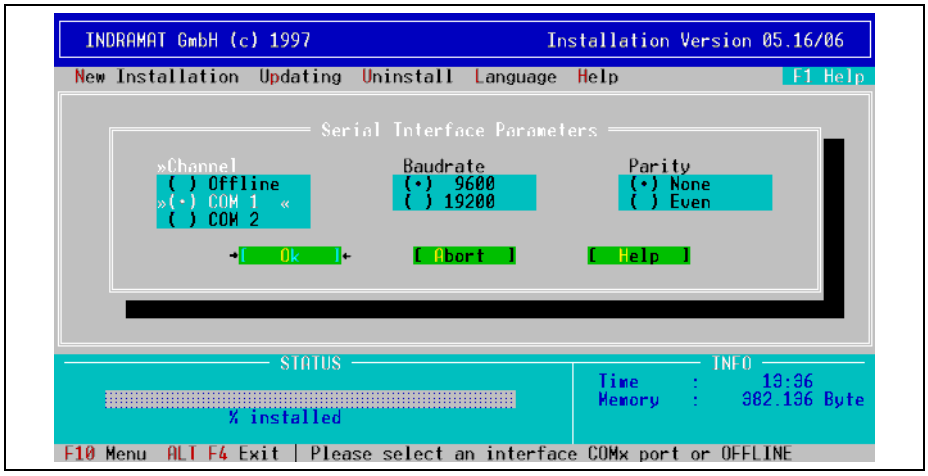


In the next screen you have the possibility to select the control. E. g. for selecting a MTC200, use the cursor keys to select MTC200 and confirm your selection by pressing the [Space Bar].

For finishing the control selection, press [Enter] or click on the OK button by using the mouse.



When selecting a MT-CNC you will have the following interface parameter menu:

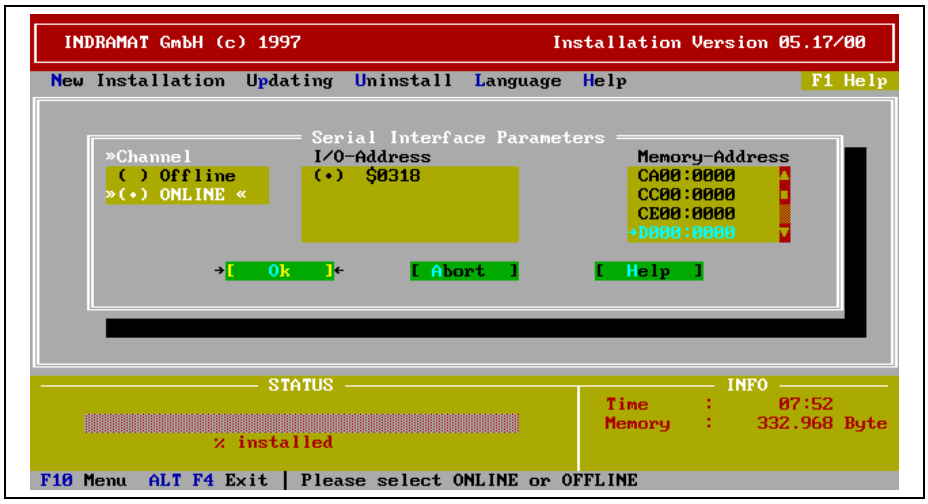


This screen allows you to select the settings of the serial interface for the time when the GUI starts.

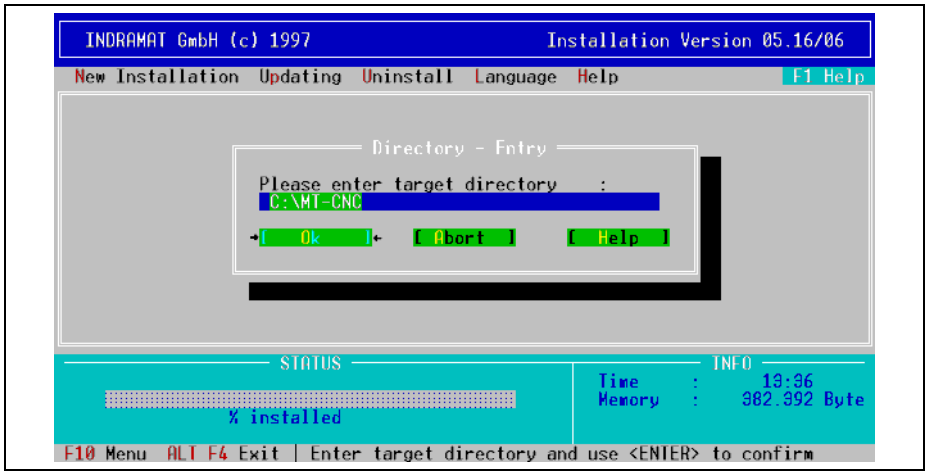
'Offline' allows to use the GUI without a connection to the control.

Baudrate and parity selection must match the switch settings in the SIOB board or CPUB respectively (default: 9600, no parity).

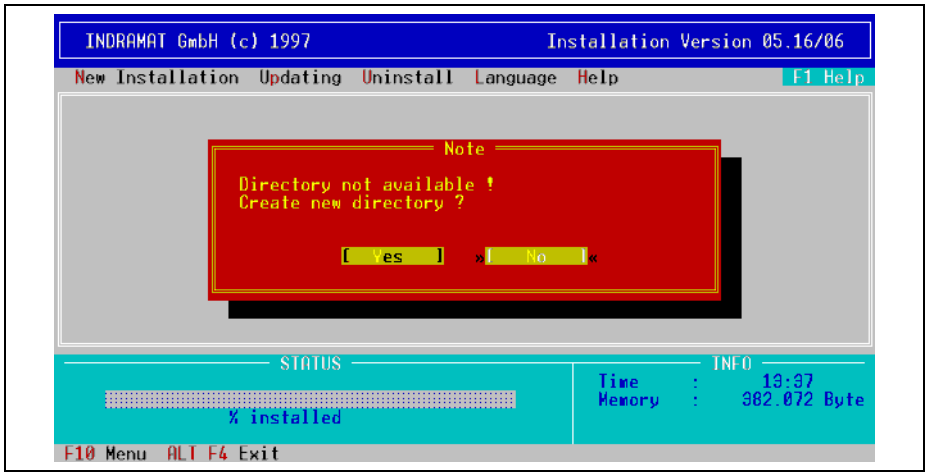
When selecting a MTC200 you will have the following interface parameter menu:



This screen allows you to set the communication with a control card MTC-P. Under I/O address it is shown where the install program found a MTC-P. Furthermore you have the possibility to set the DPR memory sector which the PC and the MTC-P use to communicate. Default is D000:0000.

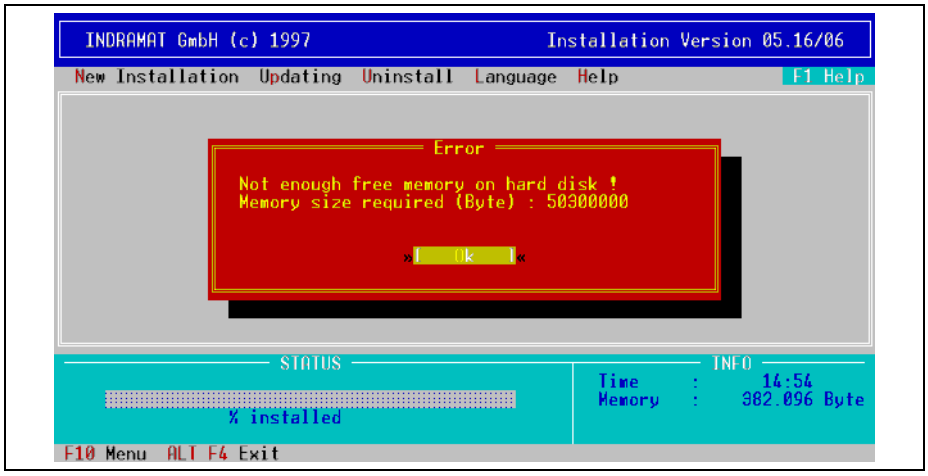


Before the installation starts, the user is prompted to give the directory on the hard disk where the GUI should be installed. Default is 'C:\MT-CNC'. It is recommended to use this directory, eventually on a different drive. The destination drive must have a minimum of 54 MB (English language) of free space available for executing the installation successfully. Enter a new path or use the cursor keys first to modify the default path. The [Tab] key allows to move between the different fields. Click the OK button or press [Enter] after you have entered the correct path.



The install program prompts a message indicating the specified directory already exists or that it does not exist. The directory must be generated if it does not exist.

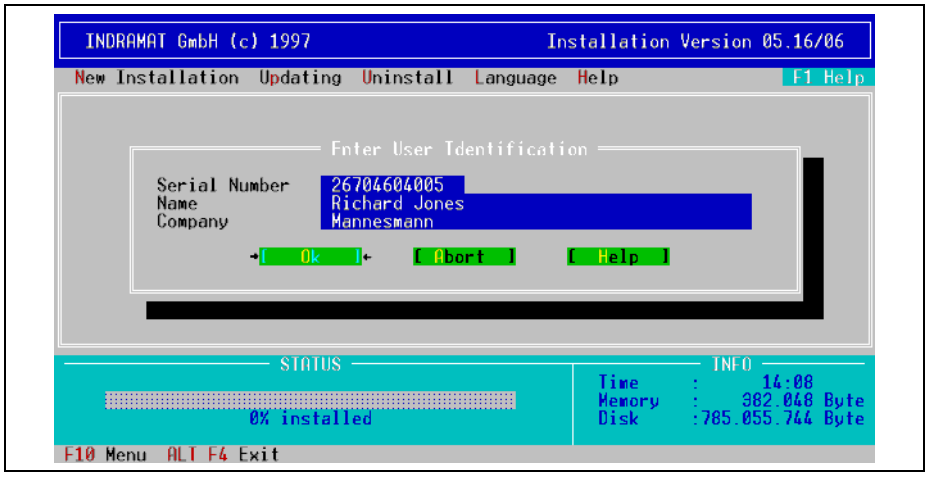
Press [Y] or [Enter] to create the specified directory and to continue the installation.



The install program will now check for the available memory on the specified hard disk.

If the hard disk provides insufficient memory, the above message is displayed.

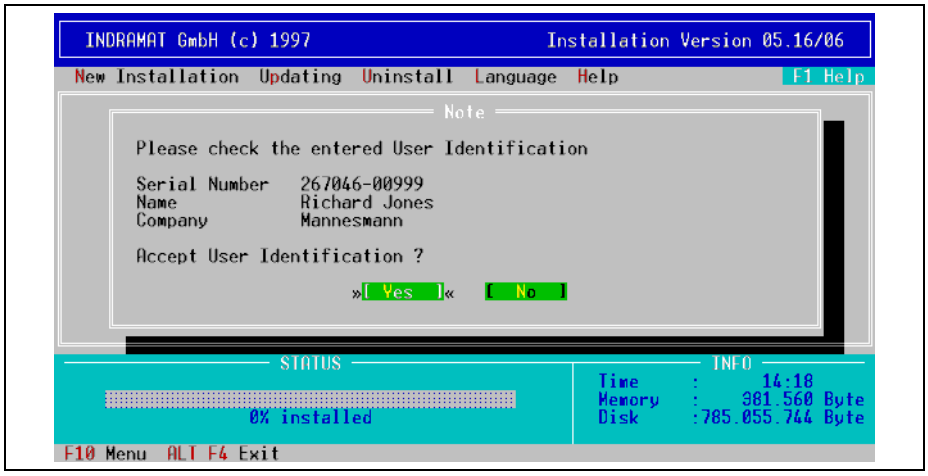
The install program returns to the main menu after pressing [Enter] or clicking the OK button.



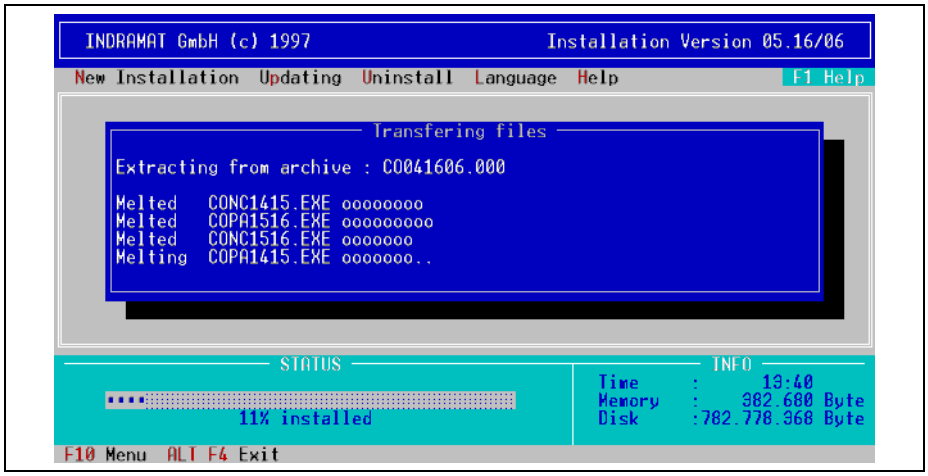
During the first installation the GUI will be licensed. You are asked to type in the name and company name of the legal software user.

Please consider that name and company will be displayed every time when booting the GUI. Furthermore, name and company name are printed whenever printing user data, e. g. NC programs!

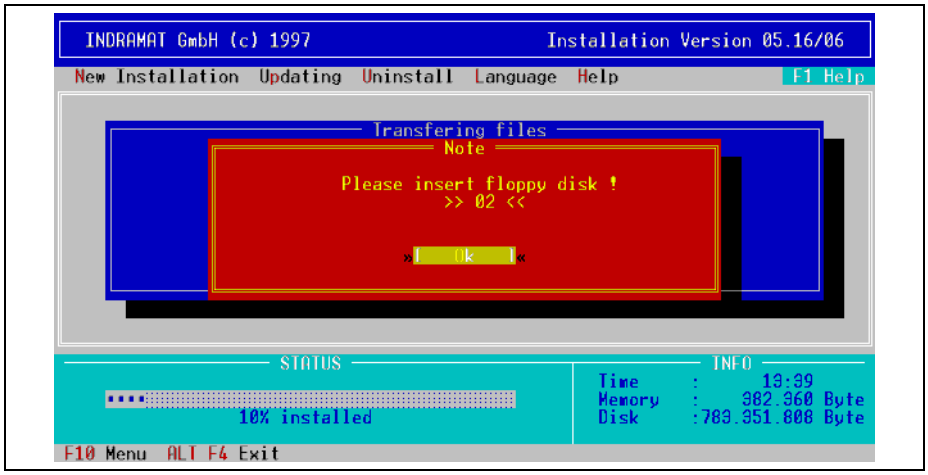
If you have a copy license (SWL), this window appears only with the first installation. The specified name and company name will then be used for every additional installation.



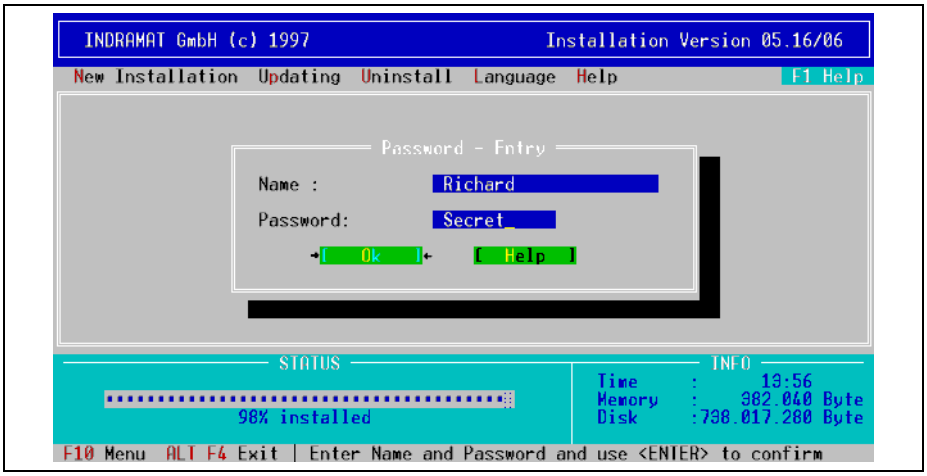
Name and company name will be displayed again to be confirmed. If you would like to correct your input data, select 'NO' and correct it. After confirming the input data by selecting 'YES' and pressing [Enter], name and company name are stored on the floppy disk.



During the installation process, the window on the screen will show status information and the process of decompressing the files.



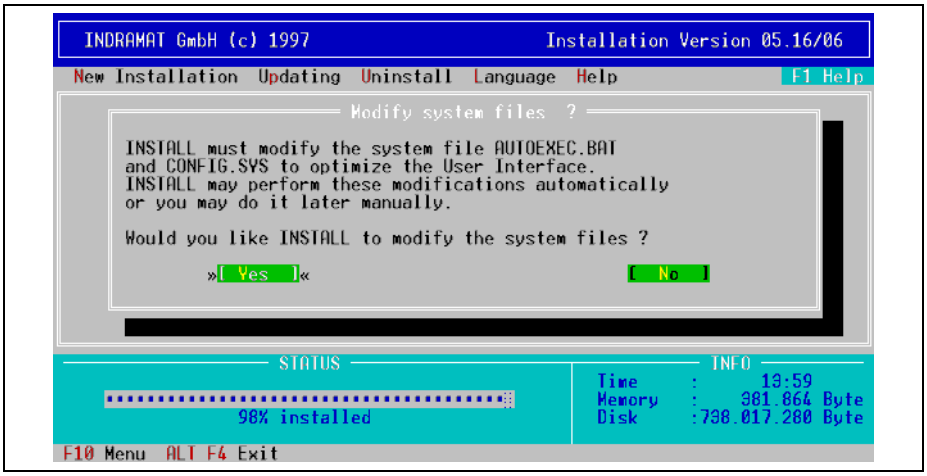
The user will be prompted to insert the required disks. For software version 17 it will be necessary to insert 15 disks.



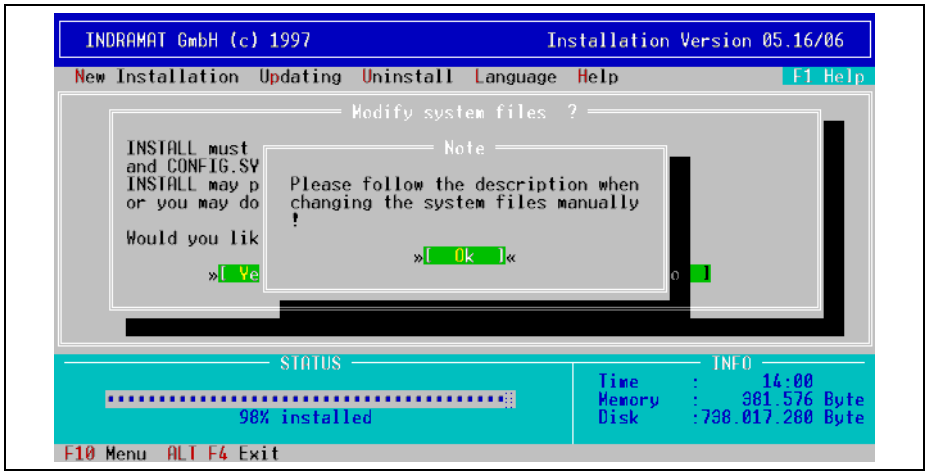
Once the installation procedure is completed, the user is prompted to enter an initial Login Name and PASSWORD. Only this user has the right to introduce new users and the related rights.

Please memorize the user name and password. If you are not able to type in the correct password, the GUI must be reinstalled and the user data will be lost. INDRAMAT service can assist you to determine a forgotten password.

Additional users and their passwords may be added and modified via the MUI Setup Menu after the installation is completed.



The user is asked if the CONFIG.SYS and AUTOEXEC.BAT files should be modified to the MUI settings. The changes are automatically integrated if the OK button is confirmed by pressing [Enter].



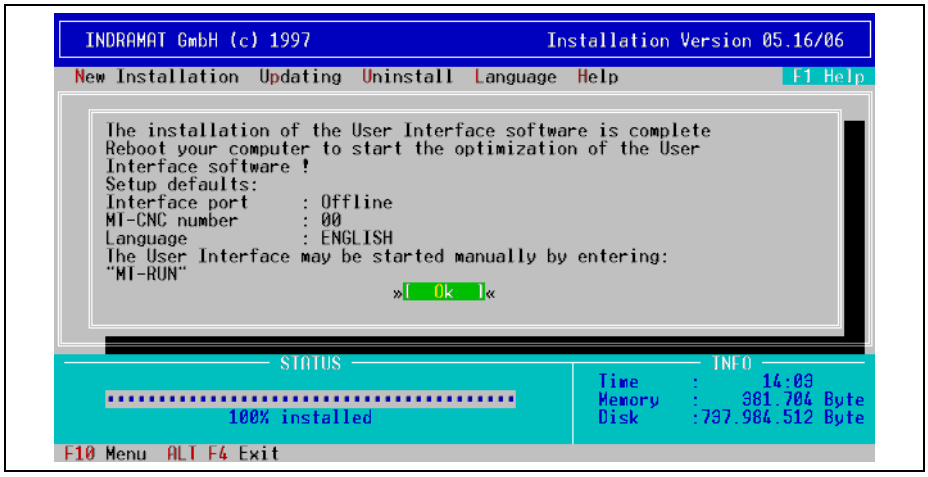
Use [Tab] and press [Enter] or click [NO] if the modification should not be performed. The settings in the CONFIG.SYS and AUTOEXEC.BAT must then be performed manually later.

The last screen shows the settings of the GUI (here defaults):

COM1: The GUI will try to communicate with the MT-CNC via the PC's serial port COM1.

00: Up to 16 MT-CNCs can be administrated via the GUI. At boot up, the GUI selects the MT-CNC with the communication address 00.

ENGLISH: The GUI will boot up in this language.



The installation is now completed and the DOS prompt will be displayed after pressing [Enter] or OK by using the mouse. The root directory of the hard disk drive contains the MT-RUN.BAT batch file with the standard settings. The possible settings are shown in section "The File MT-RUN.BAT" (Page 1-9).

To prevent PC lockup during the first GUI boot up, disable other devices that are connected to the PC's selected serial port (default COM1). The GUI will try to communicate with the MT-CNC via this serial port since the default setting is set to COM1 for ONLINE MODE.

If you have already selected OFFLINE MODE, the GUI will not try to communicate with the MT-CNC and the serial port can be used for other peripheral devices like mouse or printer.

The file MT-RUN.BAT may also be modified to boot into the MUI Setup Menu which allows to select OFFLINE MODE.

To exit the GUI, press [F10] to return to the MUI main menu and [Ctrl]+[C] to access DOS. The login name and password entry is prompted if no password is active. Unauthorized users cannot return to the operating system level DOS.

1.4 Updating GUI Installations

The following must be considered before updating an existing older GUI version to this new version:

- Restore all user data (backups) that should be converted to this new version into the already existing old GUI version. Use the archiving utilities of the old and currently installed GUI version to do so. This is necessary since backups of earlier GUI versions cannot be read or converted when retrieving or restoring them with this version.
- When updating a GUI of a machine, make sure that all MT-CNC control components contain the correct firmware. This information can be obtained by:
  - using [Ctrl]+[F1] in MUI menu item 7 to display the firmware that is installed in the MT-CNC, MTC200, RECO, BTM,
  - checking the version displayed in the bottom line of the SOT main menu.

The drive that contains the current GUI installation must provide an additional 20 MB of free HD memory to perform the update. Make a 'DIR' at the root of the hard disk and assure this free memory before updating the GUI.

Type code of GUI software release:

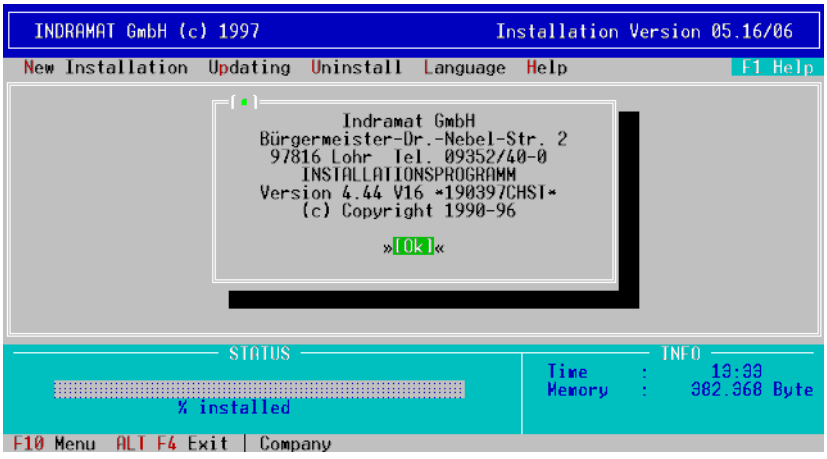
SWA-MT*GBO17V00

- └ Correction index
- └ Version
- └ Type: GUI

You can update every GUI installation to the current version.

To update the GUI insert disk #1 into drive A or B of your PC (in the following description we are using drive A). Return to the root directory of your hard disk drive (e. g. 'CD\') and log on to drive A (e. g. 'A: [Enter]). To start the automatic GUI install program, type 'install' and press [Enter]. A Microsoft compatible mouse may also be used with the install program.

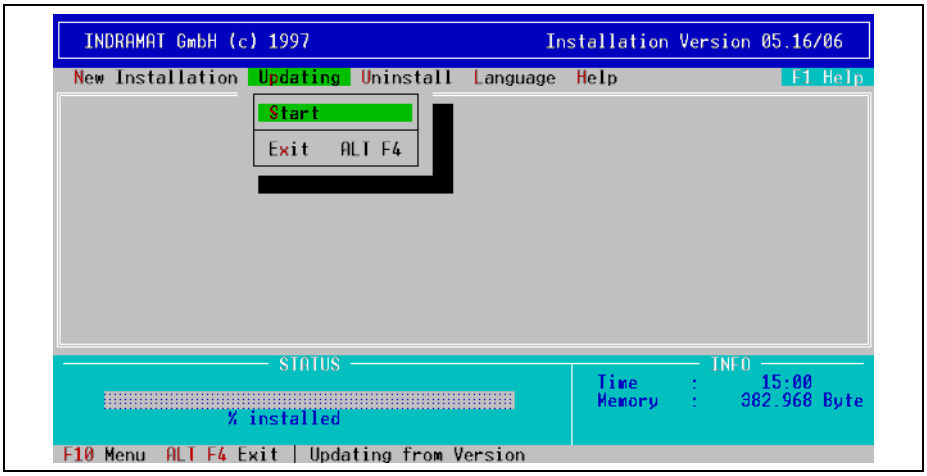
At the language prompt screen use the cursor key to select the desired language (default is German) that should be used during the installation and mark it by pressing the [Space Bar]. Then press [Enter] to continue.



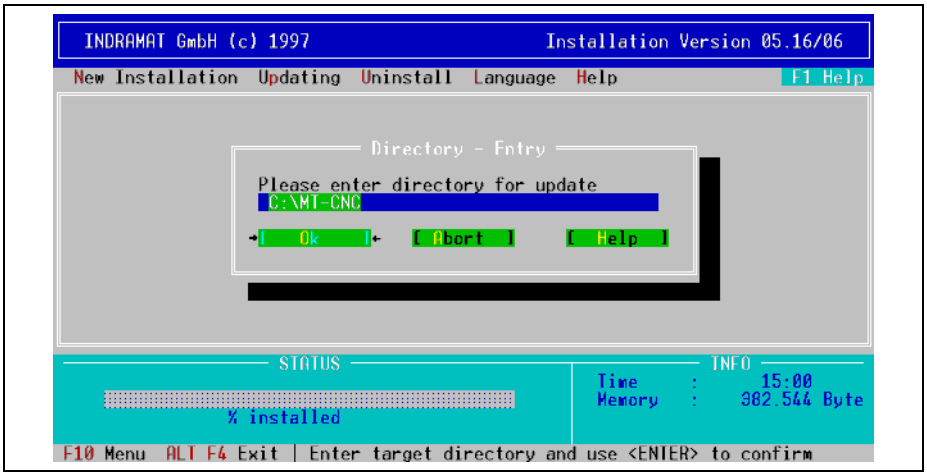
Then the main install screen is displayed. When the screen is opened, a window will display the version and copyright information about the install program.

Press [Enter] to confirm this window or click the button using the mouse.

The install program provides help for different screens and errors.
Press [F1] to open the help window for the current menu or error.

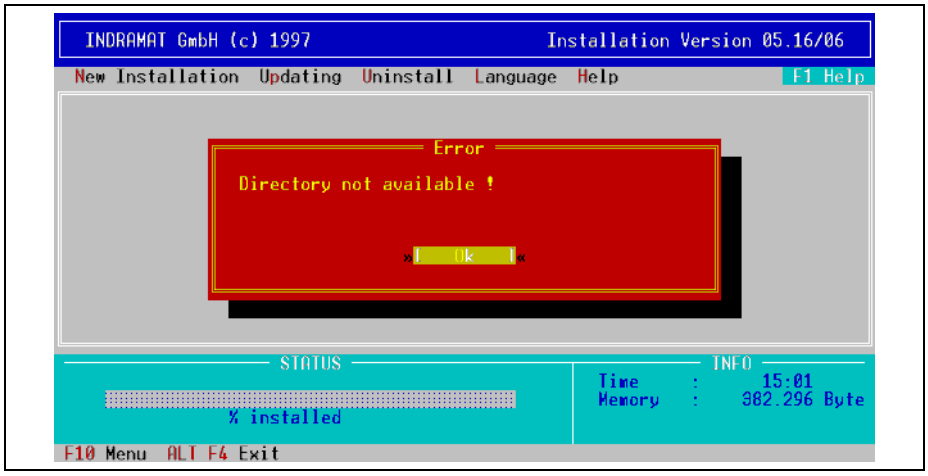


Press [F10] or [Alt]+[P] to select 'Updating'.
[Alt]+[F4] allows to exit the install program.

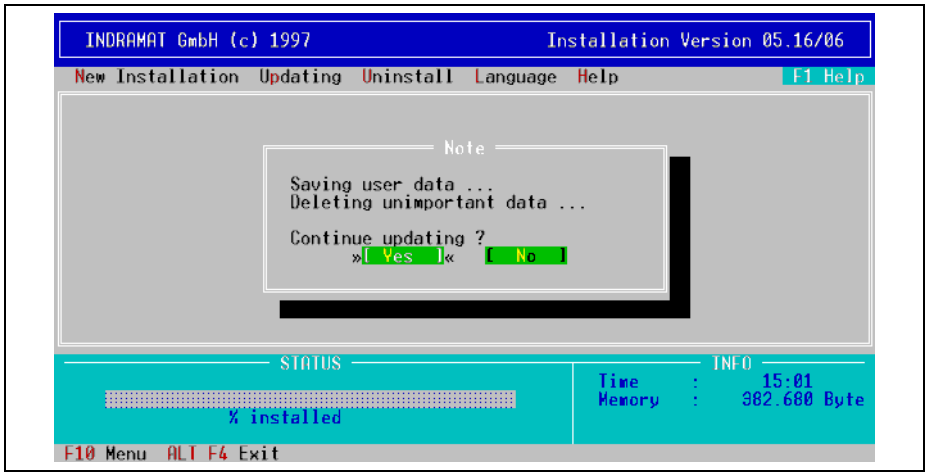


The user is prompted for the directory where the current GUI software is installed. The default is 'C:\MT-CNC'. Confirm this directory or enter the correct drive and directory name.

The [Tab] key allows to move between the selected fields. Click the OK button or press [Enter] after the correct path is entered.



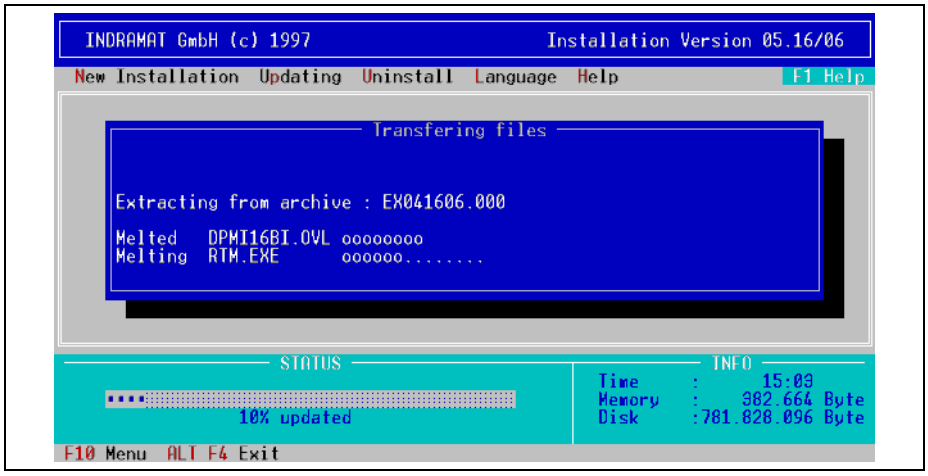
The install program prompts a message if the specified directory does not exist on the specified hard drive or if it is no GUI main directory.



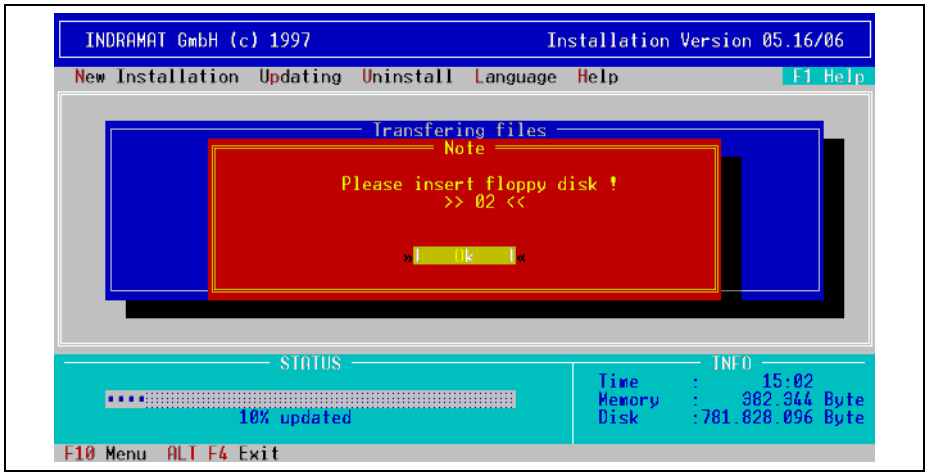
A safety message is prompted once the specified directory is recognized as a GUI main directory.

Press [N] to abort the update.

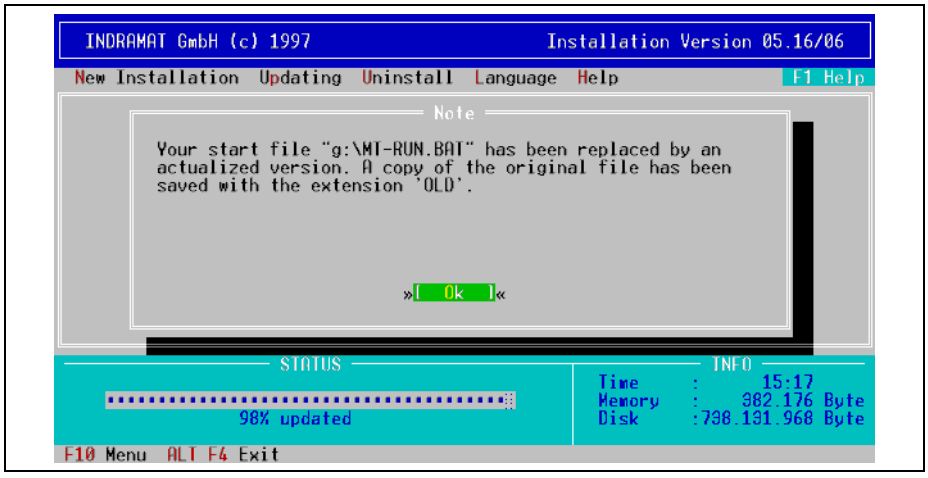
Press [Y] to continue. All GUI data will be replaced by the data of the new version. User data remains on the hard disk and is converted into the new version.



During the installation process, the window on the screen shows status information and the progress of decompression.



The user will be prompted to insert the required disks.



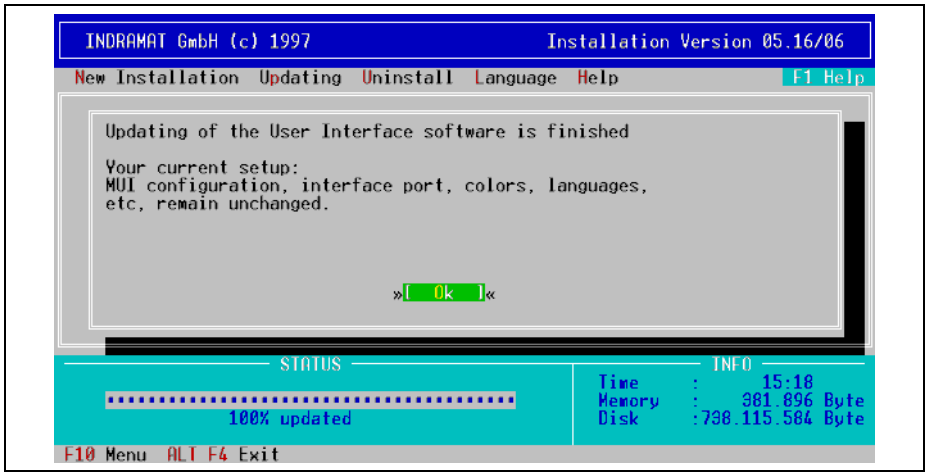
When the update procedure is complete, the user will be informed that nothing of the previous GUI setup has been changed during the update.

Press [Enter] or click the OK button and the install program will return to the DOS prompt.

The update is now completed and the DOS prompt is displayed. The root directory of the hard drive contains the new MT-RUN.BAT batch file. The original file with the previous settings has been saved with the extension 'old' (MT-RUN.OLD). Modifications have to be checked and eventually set again. The possible settings are shown in section "The File MT-RUN.BAT" (Page 1-9)

To run the GUI type "MT-RUN" at the DOS prompt and press [Enter].

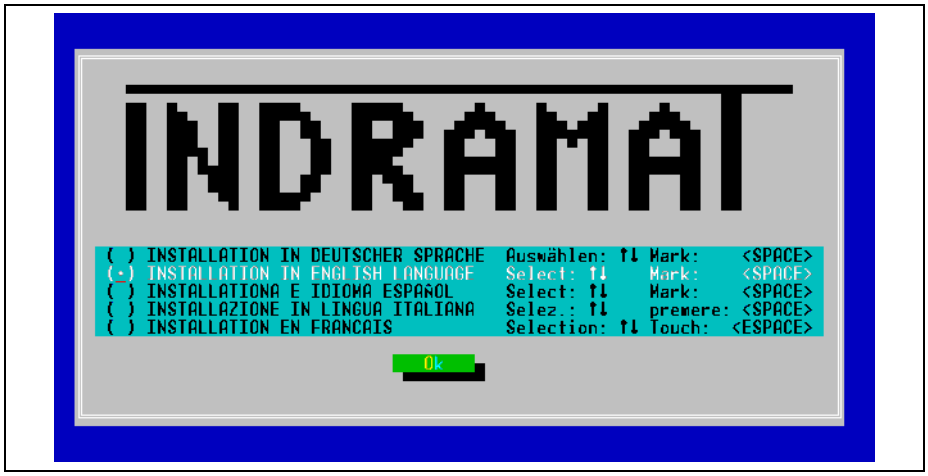
To exit the MUI, press [F10] to return to its main menu and [Ctrl]+[C] to return to DOS. The login name and password entry is prompted if no password is active. Unauthorized users cannot return to the operating system level.



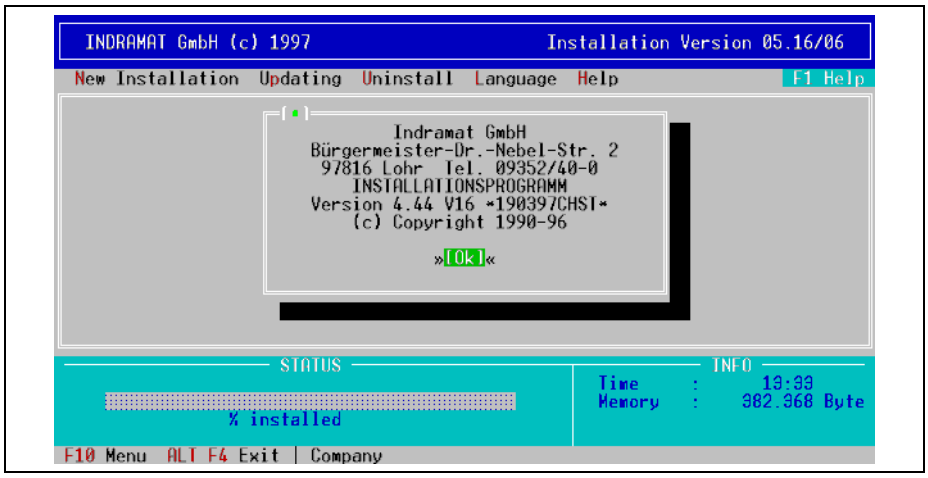
1.5 Installing German or English Later

For installing German or English later (you have already installed one of these two languages and would like to add the other one), insert disk #1 into drive A or B of your PC (in the following description we are talking about drive A). Return to the root directory of your hard disk drive (e. g. 'CD\') and log on to drive A (e. g. 'A:' [Enter]).

A Microsoft or compatible mouse can also be used with the install program.



At the language prompt screen use the cursor key to select the desired language (default is German) that should be used during the installation and mark it by pressing the [Space Bar]. Then press [Enter] to continue.



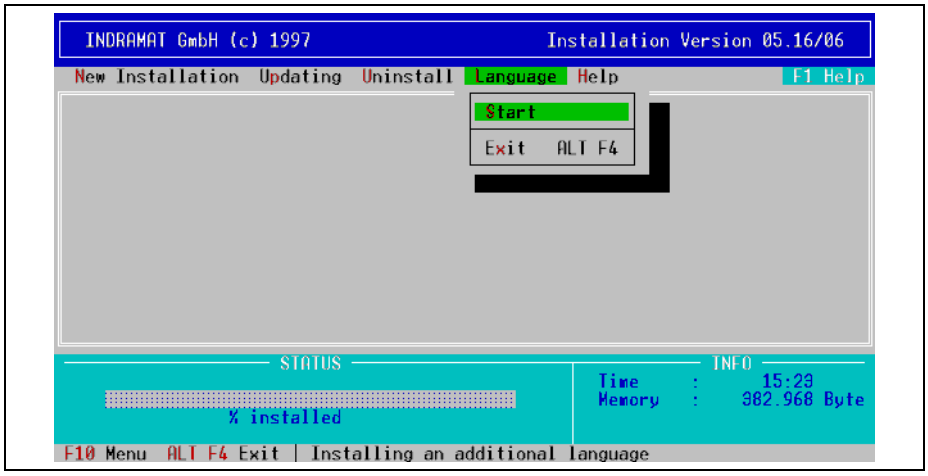
Then the main install screen is displayed. When the screen is opened, a window will display the version and copyright information on the install program. Press [Enter] to confirm this window or click the OK button by using the mouse.

The install program provides help for the different screens and errors.

Press [F1] to open the help window for the current menu or error.

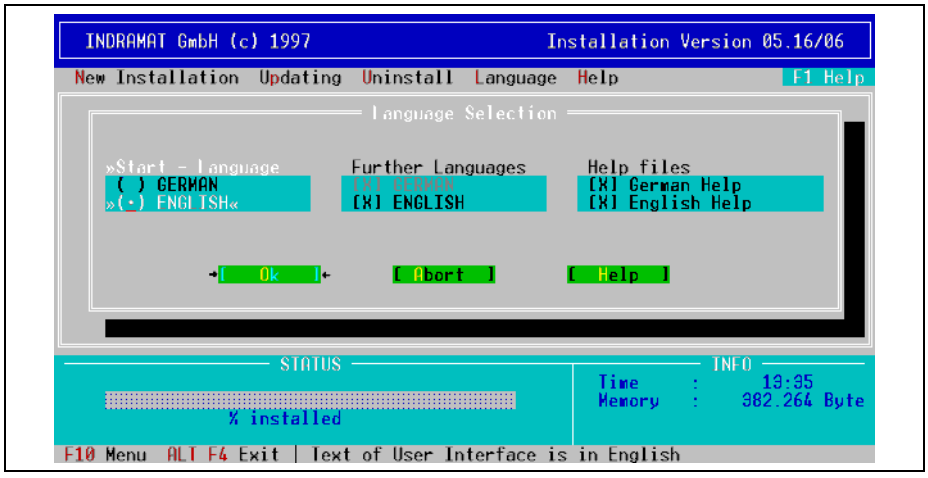
Press [Alt]+[L] to select 'Language' or use the mouse to click on 'Language'. [Alt]+[F4] allows you to abort and to exit the install program.

To start the installation select 'Start' with the mouse or press [S].

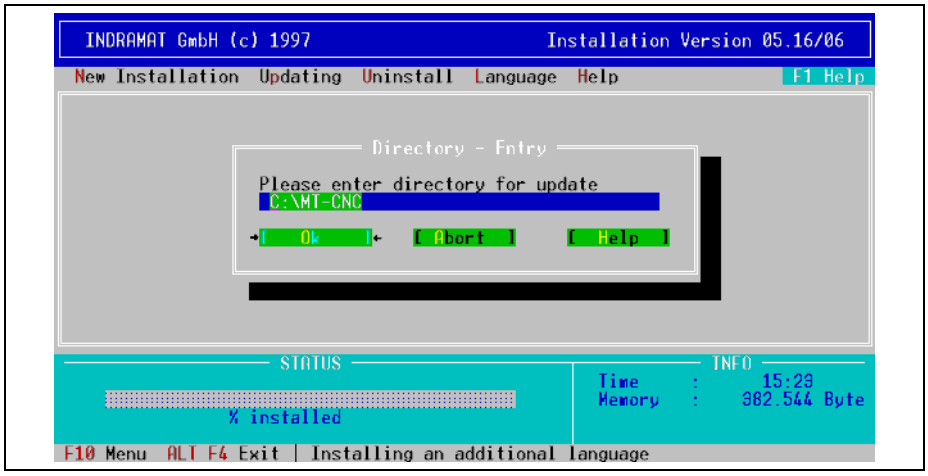


Then you are prompted to determine the possibilities for the languages. Now select the language you would like to add or select the language for which you would like to install the help system. The [Tab] key allows to move between the selected fields.

When the GUI is started the first time after this installation, the language selected in menu item 'Start' is used. 'Further languages' can be marked by the [Space Bar] and are then available in the Setup Menu of the GUI.

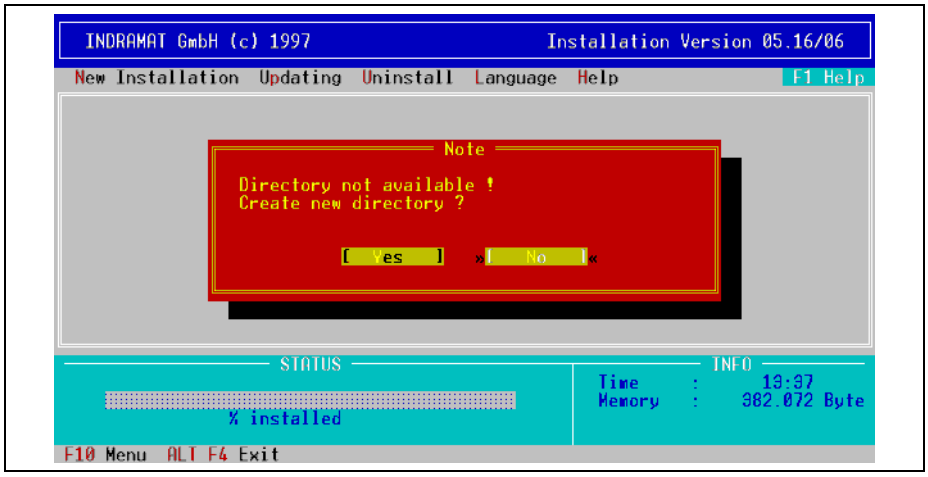


To complete the selection of the languages press [Enter] or click the OK button with the mouse.

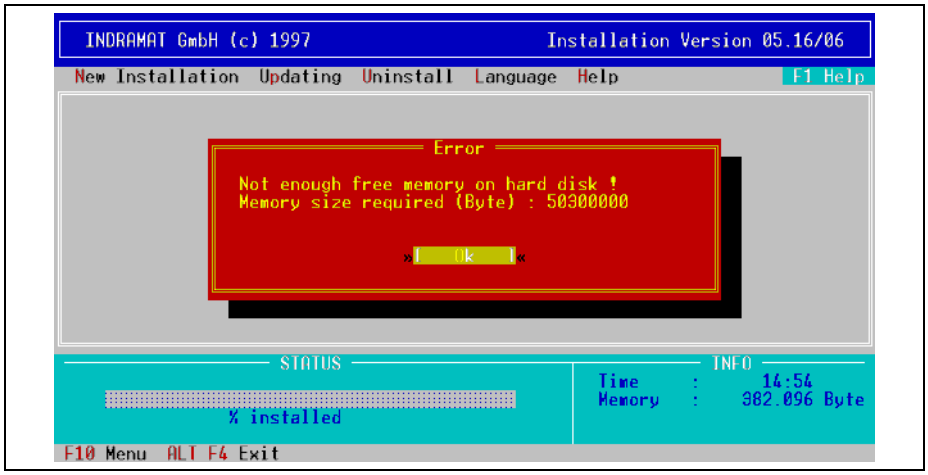


The user is prompted for the directory where the current GUI software is installed. The default is "C:\MT-CNC". Confirm this directory or enter the correct drive and directory name.

The [Tab] key allows to move between the selected fields. Click the OK button or press [Enter] after having entered the correct path.



The install program prompts a message if the specified directory does not exist on the specified hard disk drive or if it is no GUI main directory.

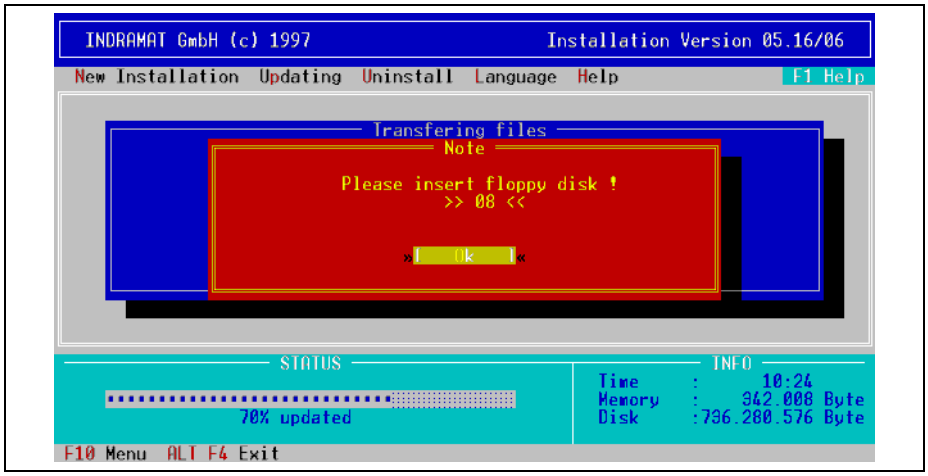


Now the install program checks whether there is enough free memory capacity on the selected hard disk drive.

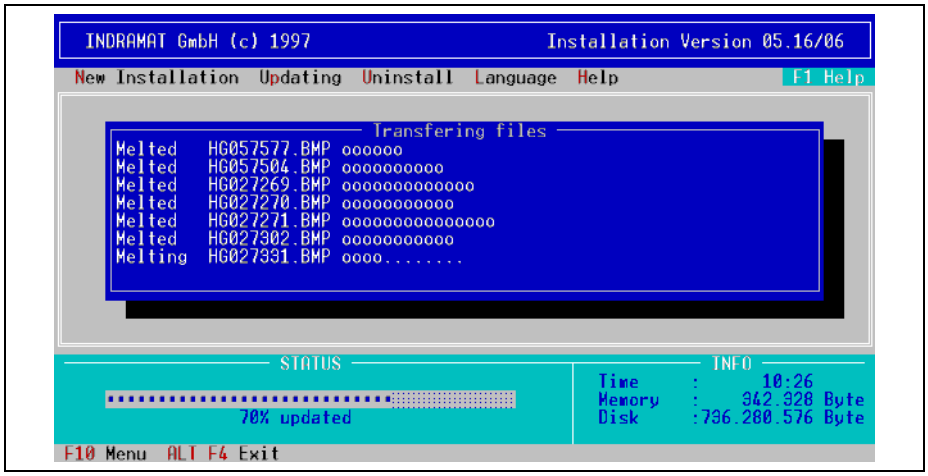
If this is not the case, you will receive the message shown above.

After pressing [Enter] or clicking the OK button with the mouse, the install program will return to the main menu.

For installing another language or help system not all disks are necessary. The number of the concerning disks are shown on the screen in the correct order and you will be asked to insert the concerning disks.

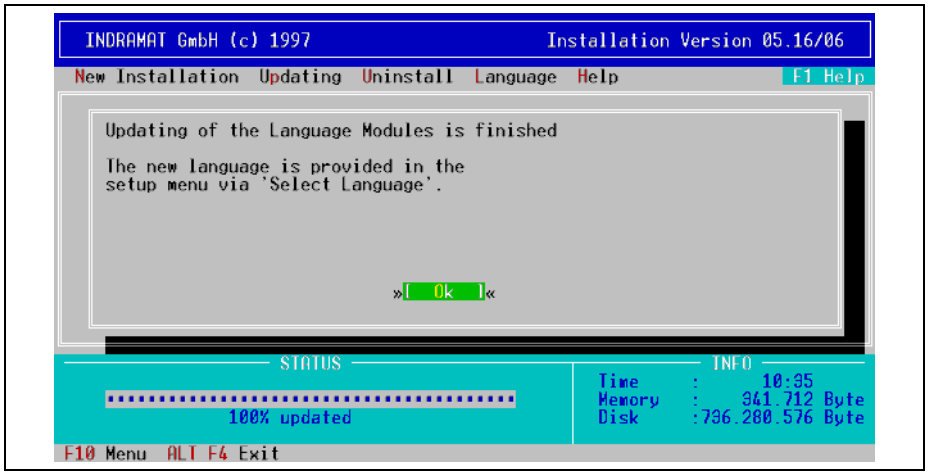


During the installation process the window on the screen shows status information and the progress of decompressing.



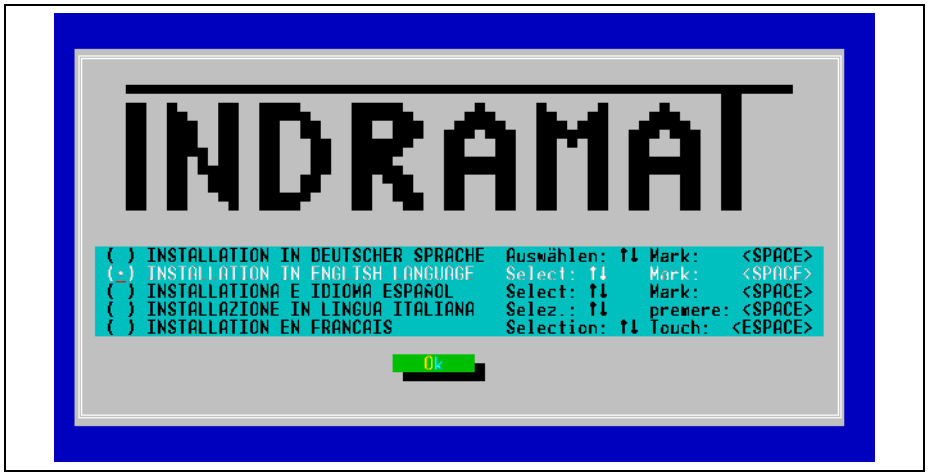
When the installation procedure is completed the user is informed that the new language is now available in the Setup Menu (language selection).

Press [Enter] or click the OK button by using the mouse to return to the DOS prompt.

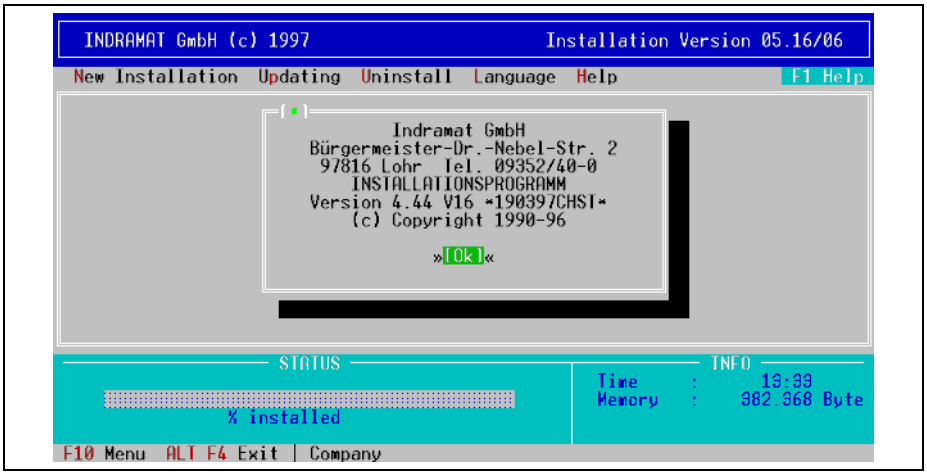


1.6 Installing a Language Module

Language modules can be delivered in different languages and have to be installed separately. For installing a language module, please insert the corresponding disk in drive A or B of your PC (in the following description we are talking about drive A). Return to the main directory of your hard disk drive (e. g. 'CD:\') and change to drive A (e. g. A:[Enter]). Enter 'install' and press [Enter] to start the automatic install program. A Microsoft or compatible mouse can also be used with the install program.

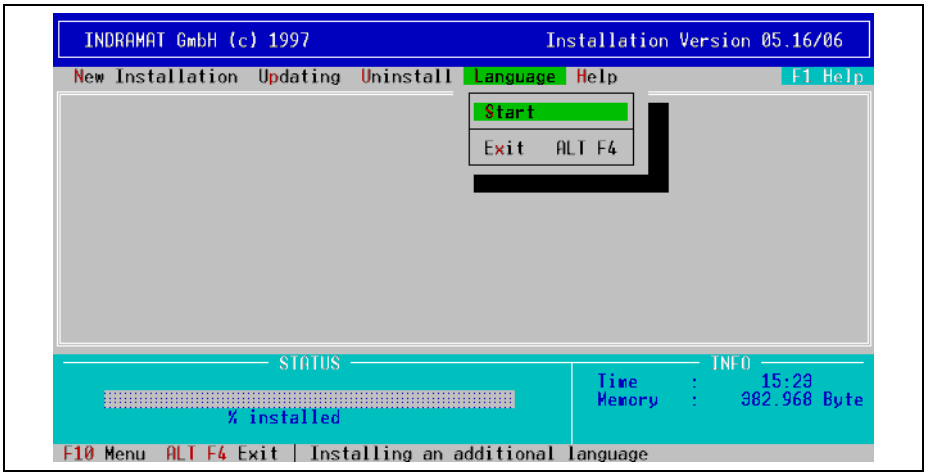


Then the main install screen is displayed. When the screen is opened, a window will display the version and copyright information of the install program. Press [Enter] to confirm this window or click the OK button using the mouse to continue the installation.



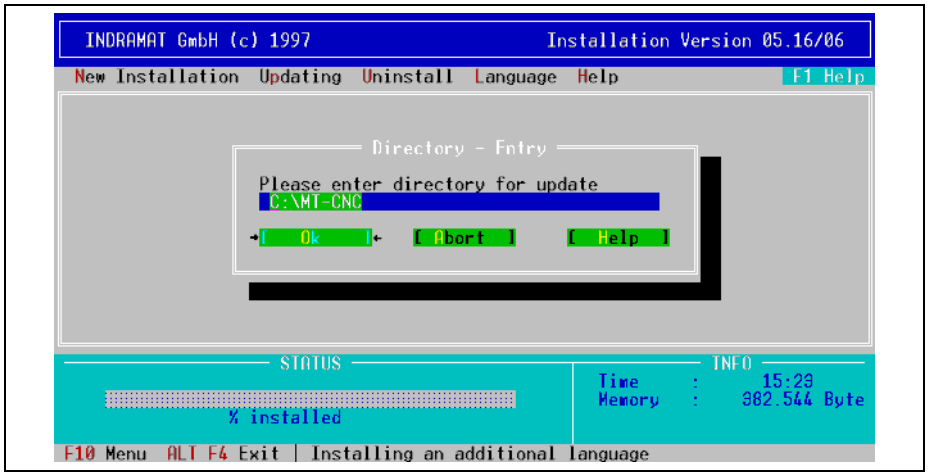
The install program provides help for different screens and errors.
Press [F1] to open the help window for the current menu or error.

Press [Alt]+[L] to select 'Languages' or use the mouse.
Now select 'Start' by pressing [S] or using the mouse.
[Alt]+[F4] allows to abort and to exit the install program.

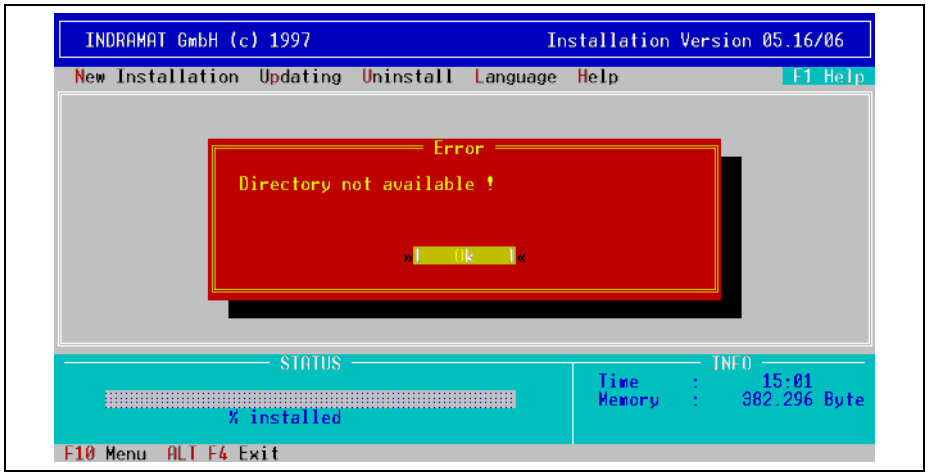


The user is prompted for the directory where the current GUI software is installed. The default is 'C:\MT-CNC'. Confirm this directory or enter the correct drive and directory name.

The [Tab] key allows to move between the fields. Click the OK button or press [Enter] after having entered the correct path.



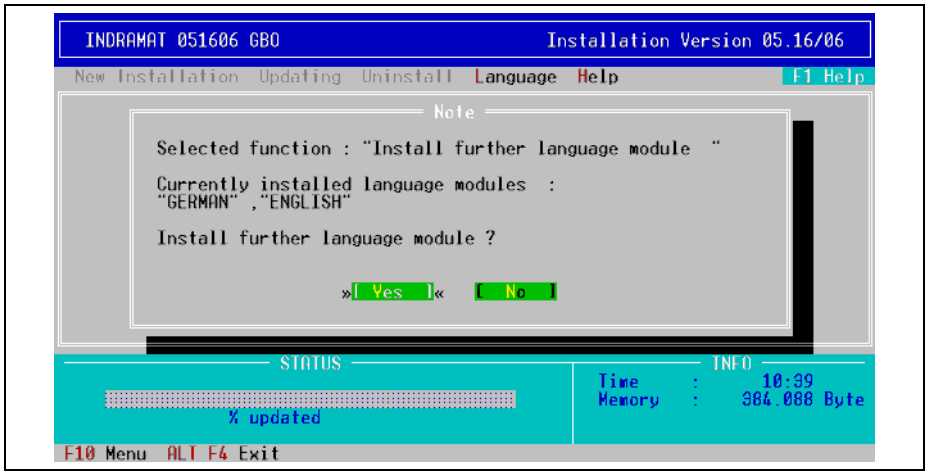
The install program prompts a message if the specified directory does not exist on the specified hard disk drive or if it is no GUI main directory.



A safety message is prompted once the specified directory is recognized as GUI main directory.

Press [N] to abort the update.

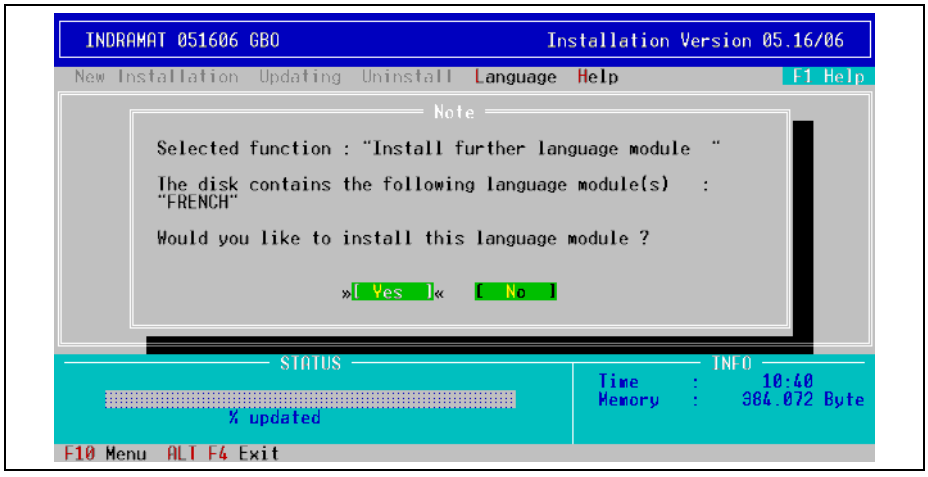
Press [Y] to continue the installation of the new language module.



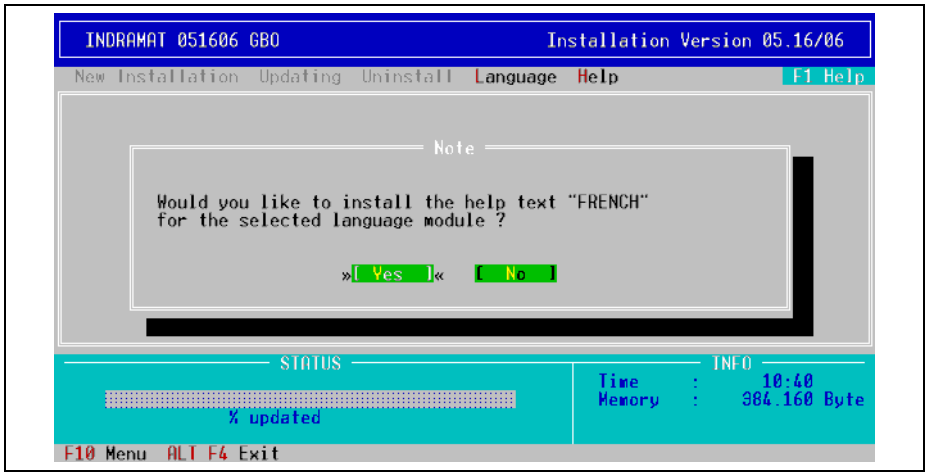
It is shown which language module is on the disk inserted.

You still have the possibility to abort the installation by pressing [N].

Confirm by pressing [Y] if you would like to install the language module shown.

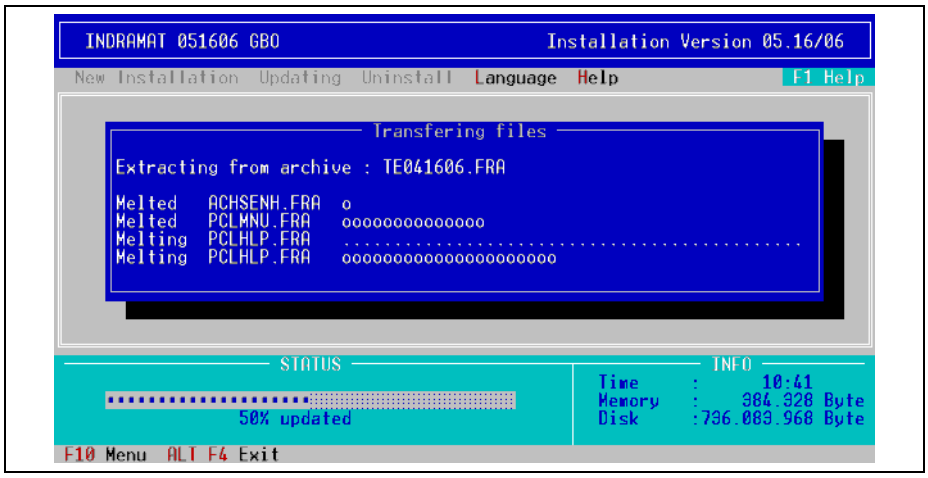


The next window asks the user whether the help texts for the correspondent language module should also be installed. Please select the desired function.



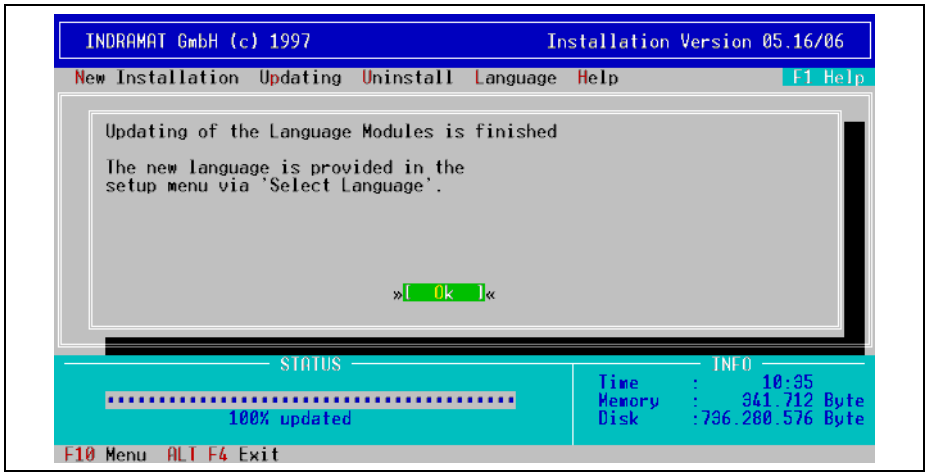
Now the installation starts.

During the installation process, the window on the screen shows status information and the progress of decompressing the files.



When the installation procedure is completed, the user will be informed that the new language will now be available in the Setup Menu (language selection).

Press [Enter] or click on the OK button to return to the DOS prompt.

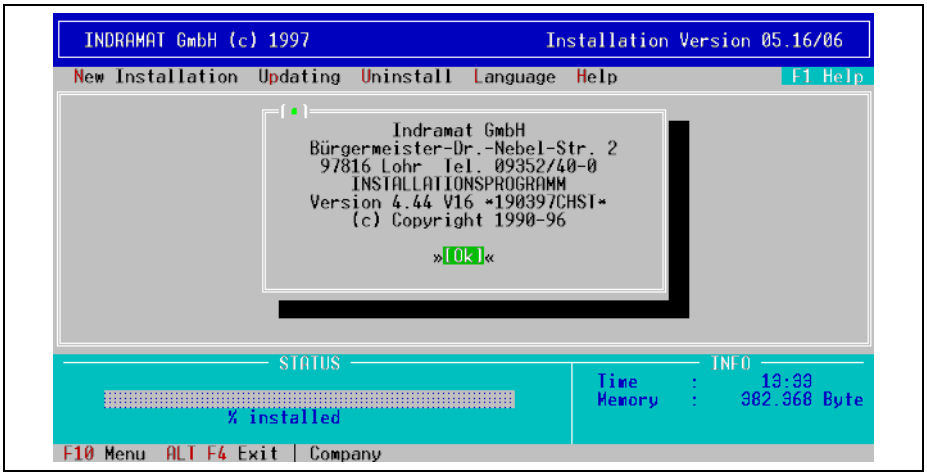


1.7 Uninstalling the GUI

This feature can be used to remove all GUI files, MT-CNC user files and their directories from the specified hard disk drive!

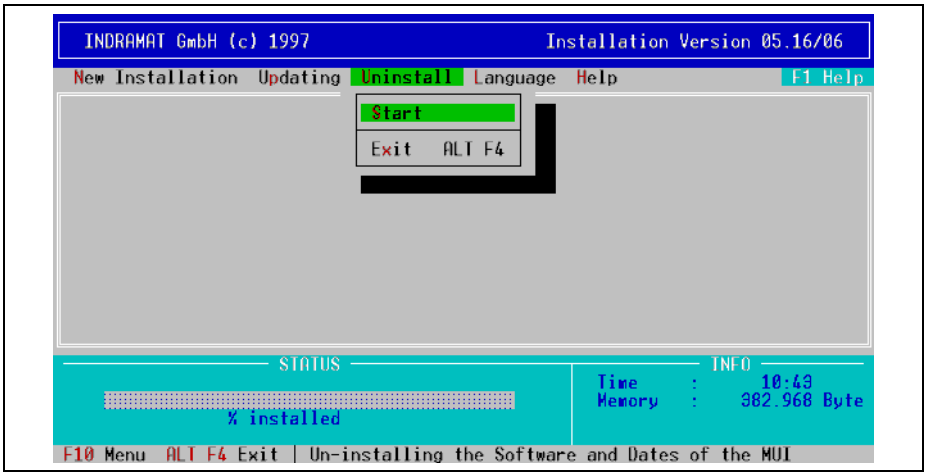
For uninstalling the GUI, insert disk #1 into drive A or B of you PC (in the following description we are using drive A). Return to the root directory of your hard disk drive (e. g. 'CD\') and log on to drive A (e. g. 'A:[Enter]'). Type 'install' and press [Enter] to start the automatic install program. A Microsoft or compatible mouse can also be used with the install program.

At the language prompt screen use the cursor keys to select the desired language (default is German) that should be used during the installation and mark it by pressing the [Space Bar]. Then press [Enter] to continue.

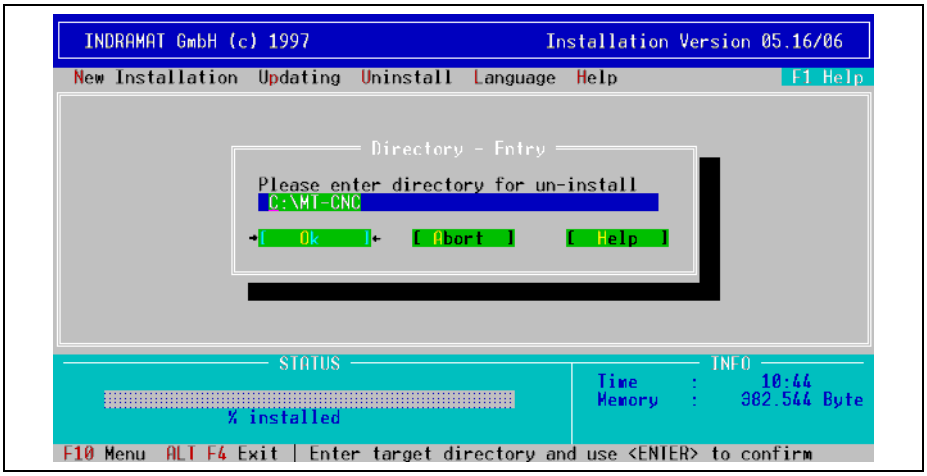


The main install screen is displayed after the language selection. When the screen is first opened, a window will display the version and copyright information on the install program. Press [Enter] to confirm this window or click the OK button by using the mouse.

The install program provides help for the different screens and errors.
Press [F1] to open the help window for the current menu or error.



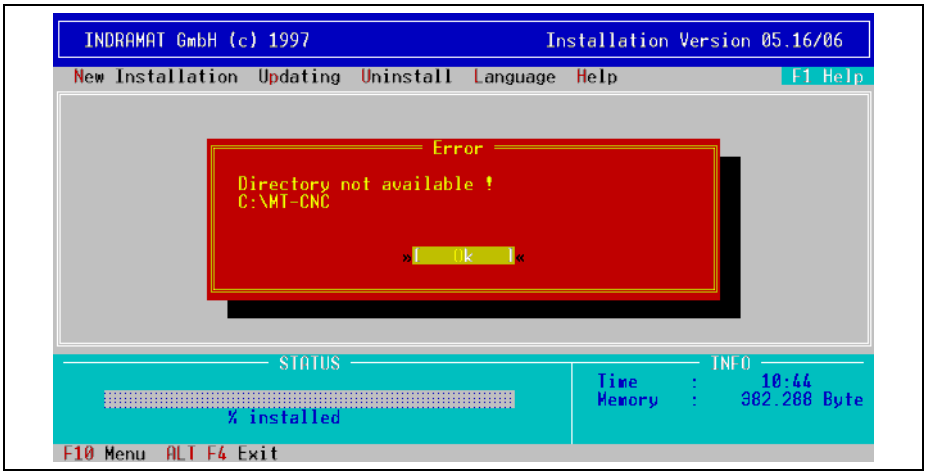
Press [F10] or [Alt]+[U] to select 'Un-Install'.
[Alt]+[F4] allows to abort and to exit the install program.



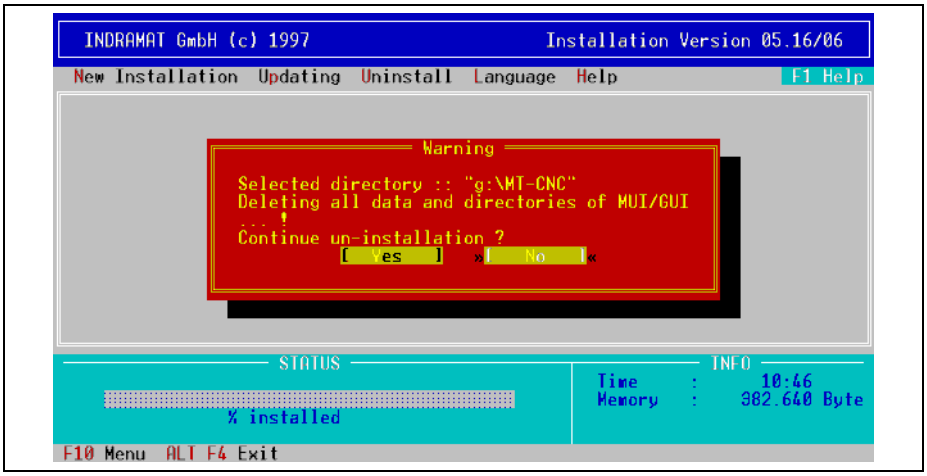
The user is prompted for the directory where the current GUI software is installed. Default is 'C:\MT-CNC', this entry has to be confirmed or the correct drive and directory name have to be entered.

The [Tab] key allows to move between the fields.

Click the OK button or press [Enter] after the correct path is entered.



The install program prompts a message if the specified directory does not exist on the specified hard disk drive or is no GUI main directory.

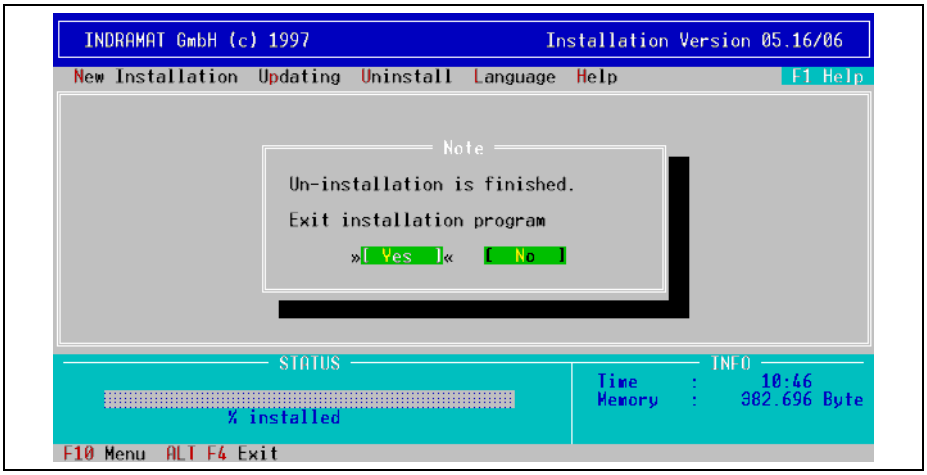


A safety message is prompted once the specified directory is recognized as a GUI main directory.

Press [N] to abort the un-installing.

Press [Y] to continue.

All GUI and user program data on the specified hard disk drive will be erased !



When the install program is completed, all GUI related files including user data are erased from the hard disk.

Press [Enter] or click the OK button and the install program will return to the DOS prompt.

The GUI and all related data are now erased from the hard disk and the DOS prompt is displayed. If the GUI program call has been initiated from the AUTOEXEC.BAT, the concerning command line should be removed now.

1.8 Firmware Programming

The control components of the MTC200 family are equipped with electronic erasable Flash memory. For installing or updating the firmware of these components there is no change of EPROM chips. Instead, the firmware is loaded via the PC the same way as software.

Remark:

This functionality is only available for control components of Indramat. Additional parts e. g. fieldbus boards or network cards cannot be operated via this function.

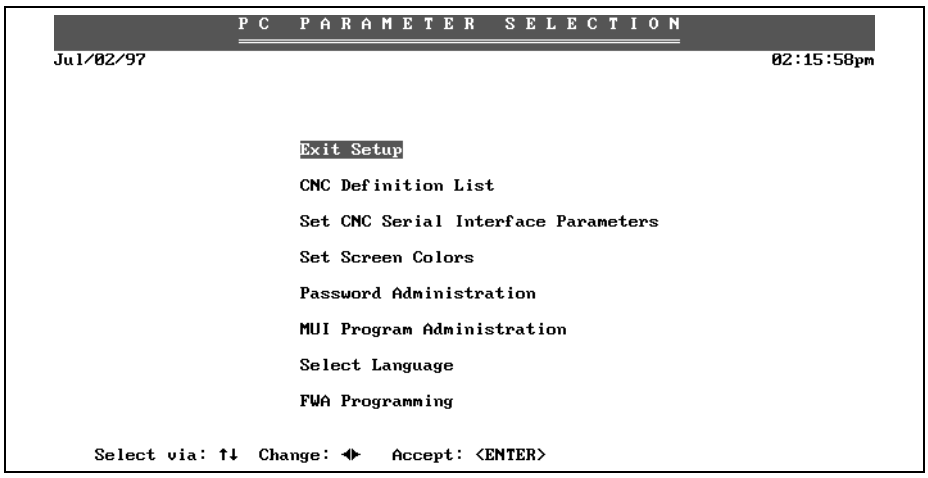
Firmware programming is not included in the install program. This function is available in the Setup Menu after the GUI has been installed completely.

The firmware programming is a new item in the Setup Menu. The Setup Menu is activated in the Main Menu by pressing [Shift]+[F1].

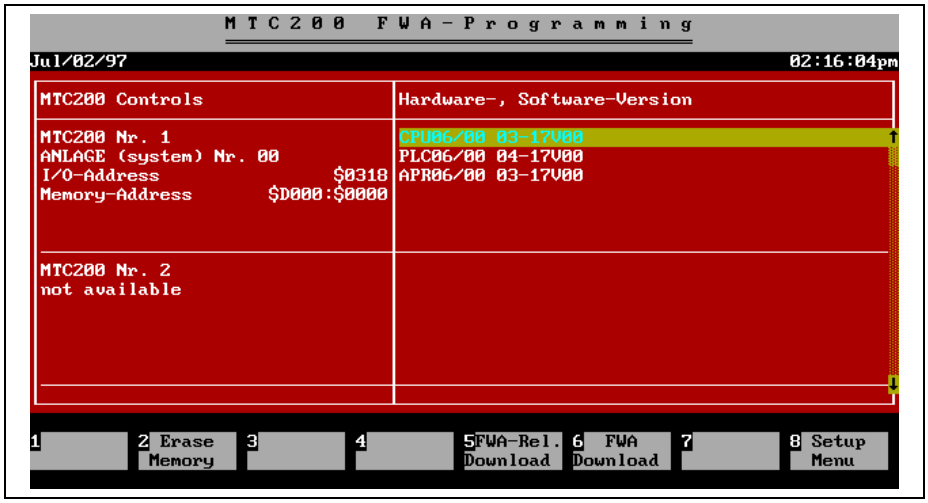
You have to select the language before you can see the Setup Menu.

The function 'Exit Setup' saves modifications in the Setup and you return to the main menu.

If you modified multiple settings, the initialization can take some time when exiting Setup.



After selecting 'FWA Programming' you will see the following screen:



The softkeys [F5] and [F6] provide two possibilities to transfer the firmware data into the circuit boards.

[F5] allows to load all circuit boards existing in the system with the current firmware.

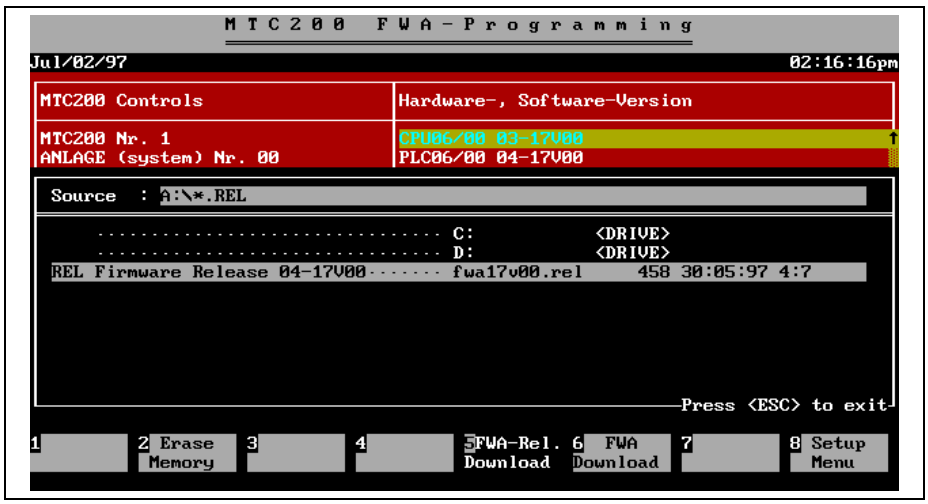
[F6] allows to transfer the firmware for the specified circuit board you have selected.

Complete Firmware Download

After pressing the softkey [F5] the window for the file selection is opened. [Tab] allows you to move between the two windows to select the source.

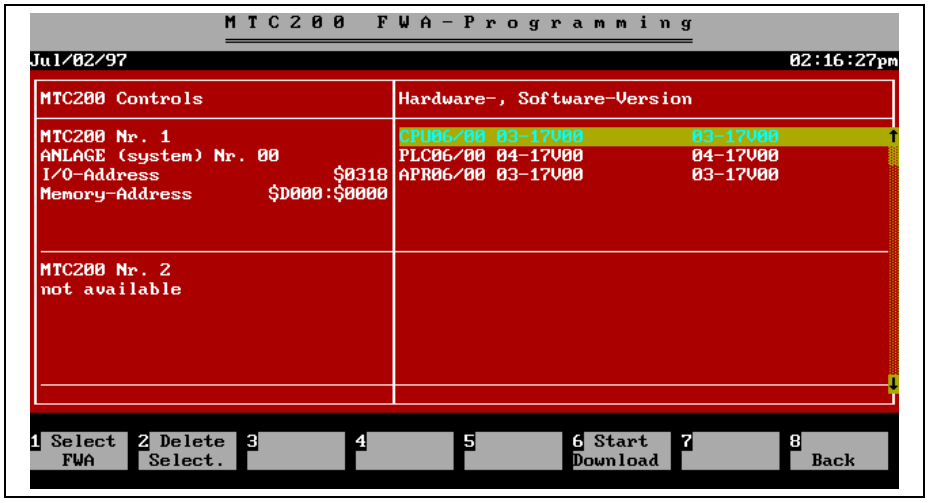
If the files do not exist on the hard disk, you need the firmware disk (SWD-MT*FWA-004-17Vxx-NN-C1,44), which is included in the delivery of SWA-MTC200. If this is not the case, you only need a firmware disk if you would like to update the firmware.

If you use the disk, the data are automatically transferred to the hard disk after having selected the desired firmware release version.



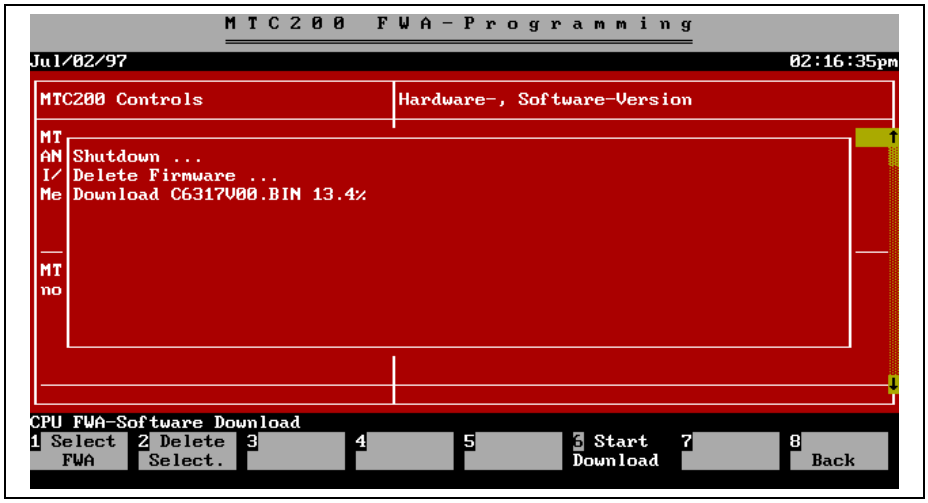
The right column of the window has the following contents:

In the left column, the firmware which is currently in the circuit board is shown. In the right column, the firmware version which is to be transferred is displayed.



If this data should be transferred into the control, the firmware download can be started by pressing the softkey [F6].

After confirming the safety prompt with [Y], the transfer is automatically started. The following window is displayed:



The process of the firmware transfer includes four steps:

- Reset of the control (machine is disconnected)
- (Eventually decompressing the data files)
- Transfer of the firmware
- New start of the control

Now the selected firmware is automatically transferred into all circuit boards of the system. This process may take 30 seconds for each selected circuit board.

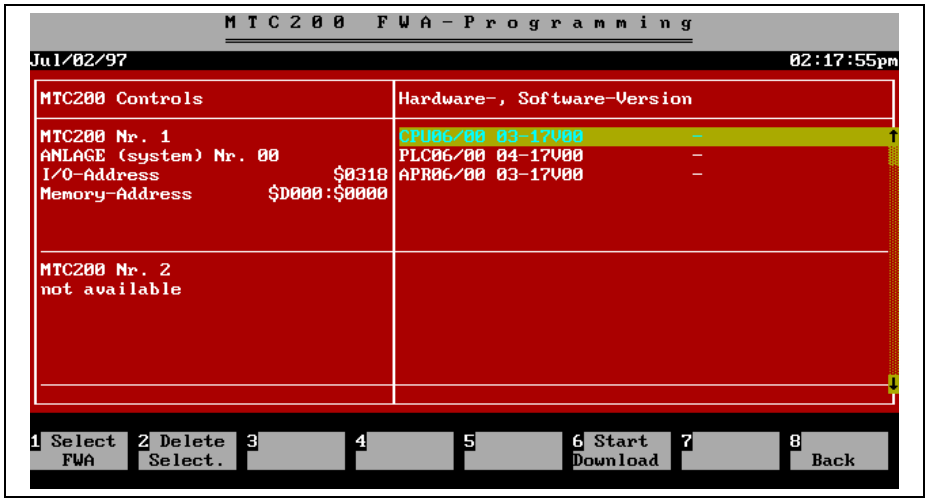
Selective Firmware Download

The selective firmware download is executed the same way as the complete firmware download described before. The difference is that only the specified circuit board selected by pressing [F6] is loaded with the new firmware when executing the selective firmware download.

In the right column of the window the following is shown:

In the left column, the firmware which is currently in the circuit board is shown. In the right column, the firmware version which is to be transferred is shown after having completed the selection.

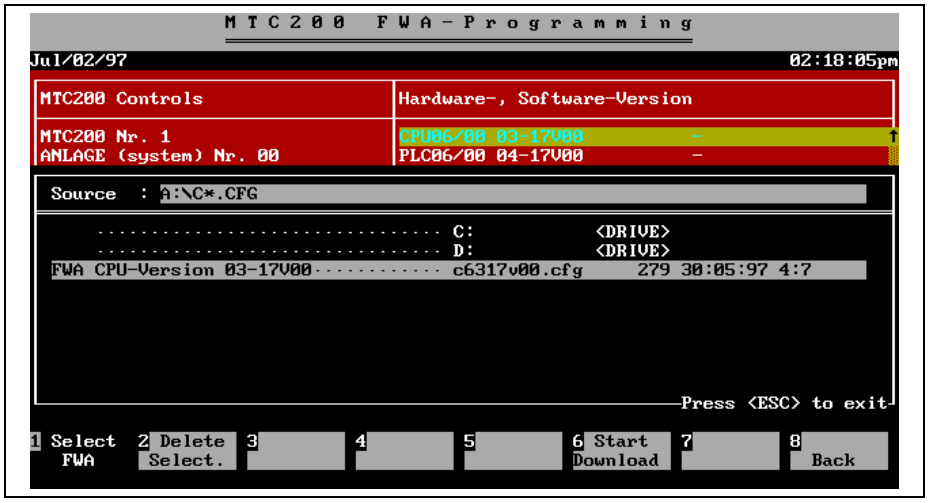
Please select the circuit board which is to be loaded with the new firmware by using the cursor keys.



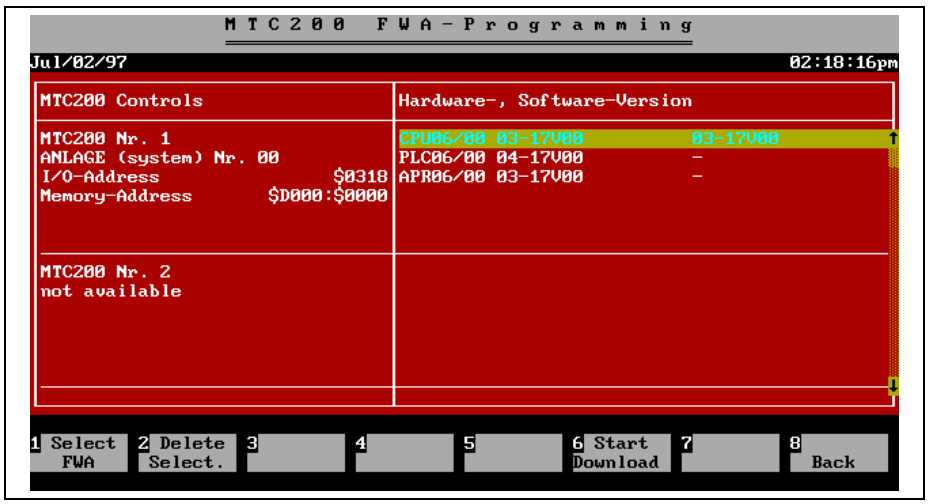
After pressing the softkey [F1] the window for the file selection is opened. [Tab] allows you to move between these two windows to select the source.

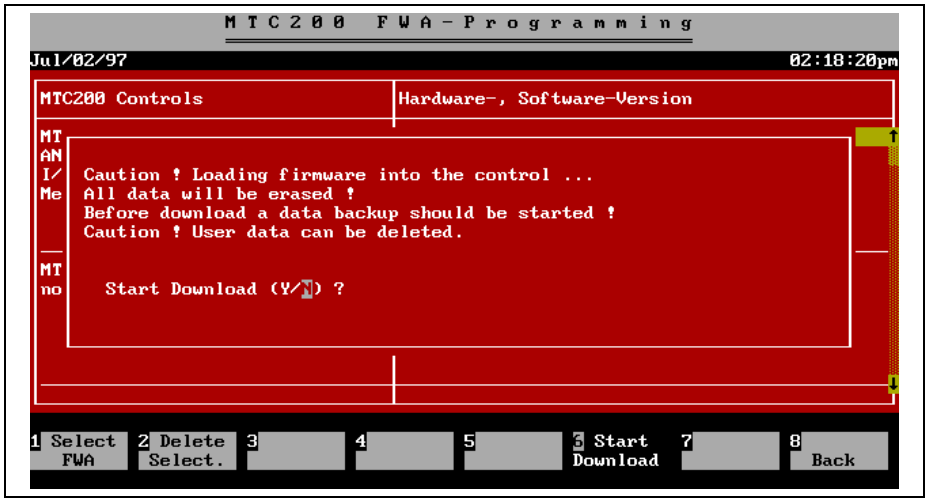
If the files do not exist on your hard disk, you will need the firmware disk (SWD-MT*FWA-004-17VxxN-C1,44). If they already exist on your hard disk, you only need the firmware disk if you would like to execute an update of the firmware.

The data is automatically transferred to your hard disk after having selected the firmware version when using the disk.

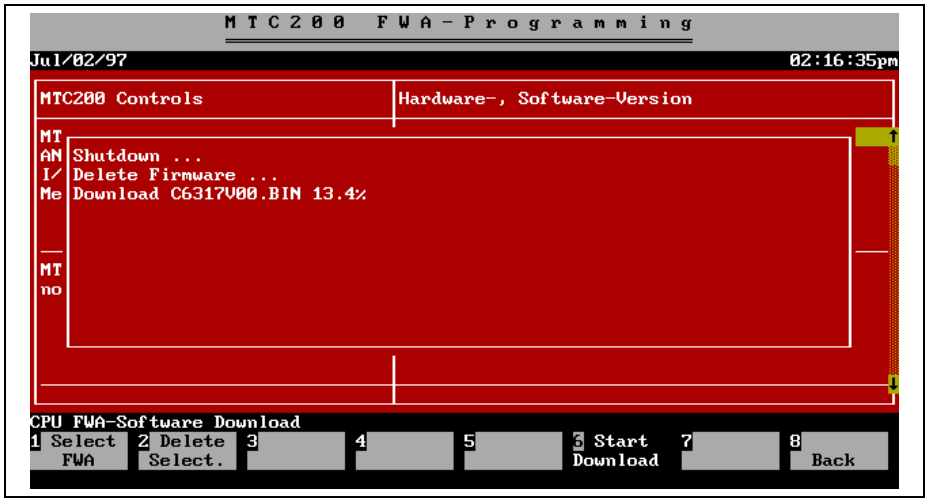


If you would like to transfer the data into the control, the firmware download must be started by pressing the softkey [F6].





After confirming the safety message by pressing [Y], the transfer is automatically started. The following window is shown:



The process of the firmware transfer includes four steps:

- Reset of the control (machine is disconnected)

- (Eventually decompressing the data files)
- Transfer of the firmware
- New start of the control

2 New Functions

2.1 User Interface

Graphical User Interface GUI

NC-program Handling

- The function **#57 'NC-program Handling (GUI)'** provides the NC-program Package Index on the hard disk and NC-memory A and B. The active NC-program package is written in red color. Softkey functions to insert, delete and modify entries are available.
- <F6> allows to download the selected NC-program Package into NC-memory A or B including the call of the compiler.
- Copy NC-program Package (Function not available in MUI. Function in GUI has advantage that the NC-program Package in the NC-memory can be copied and manipulated without the active NC-program Package becoming inactive.)

NC-program Index in CNC

Call of editor for any NC-program in NC-memory A or B (similar to "Active NC-program Editor") with subsequent compilation and download error when Download ⇨ automatic call of Editor or reactivation of old NC-program.

- Display of NC-program status bit "C"
- Insert or delete NC-program or modify entry in the NC-memory of CPU
- NC-program selection as function in the NC-program Index display
- Display of Compiler progress SFP-Compiler/NC-Compiler

NC-program Index on HD

- Call of Editor without download
- Copy of NC-programs within a station and NC-program package on the Hard Disk (HD)
- Display of NC-program status bits "C" (compiled), "N" (not compiled) and "E" (error)
- Insert and delete NC-program or modify entry
- Compiler call via function key
- Error status display

A NC-program Package is marked with the letter "E" at the end of the NC-program Package header if one or more NC-programs in the corresponding station have the status "E".

Graphical NC-Editor

- Call of Graphical NC-Editor (GNE)
- Recognition of GNE key words and automatic contour recall in GNE if cursor on keyword when pressing GNE key
- Introduction of 'Function Support' key. Can be used when editing NC-blocks to compute arithmetic and geometric values and accept them.
- Error file display after compilation with reference to the NC-program

MDI-Editor

- Entry of defined Macro definitions (call of compiler)

Tool Data Handling GUI

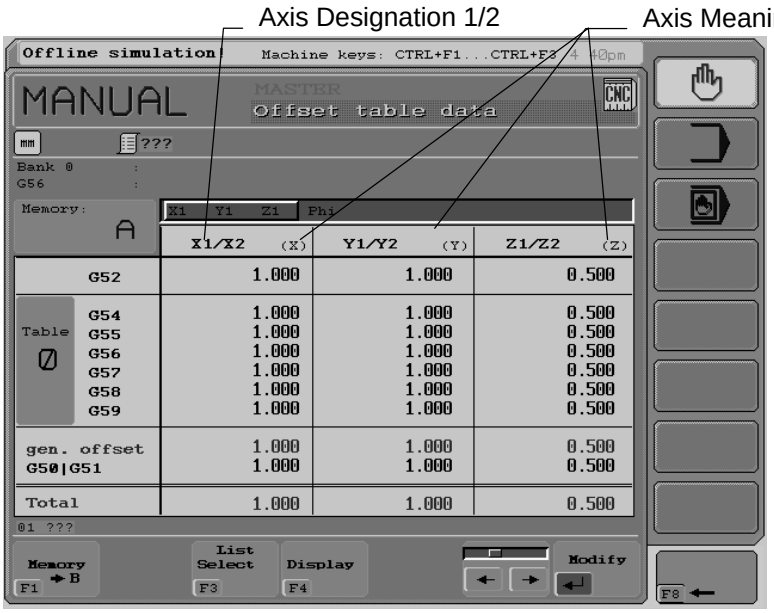
- Display/Modify all tool data (defined in the parameters) for a single tool.

- Configuration of Tool Data menu sequence (geometry, offset, status, etc.) - Menu Display.
- Location and T-number oriented display.
- Location oriented display with or without empty locations.
- Generation of Tool Data List sorted by tool locations.
- Display of tool data in the Tool Data List which was selected when exiting the single tool display.
- Status of 4 SPS identifiers when 'replacing' tools:

  mTL_PLACE (UINT) ⇨ Tool Location
  mTL_STORE (UINT) ⇨ Tool Storage
  mTL_STAT (UINT) ⇨ Station Number
  mTL_REPLA(BOOL) ⇨ Flag for Replaced status
  (must be reset by the user SPS program)
- Password protection according to the password levels in the dialog box.

Offset Table Data

Display of axis meaning in the Zero Offset Table.



NC-variable List

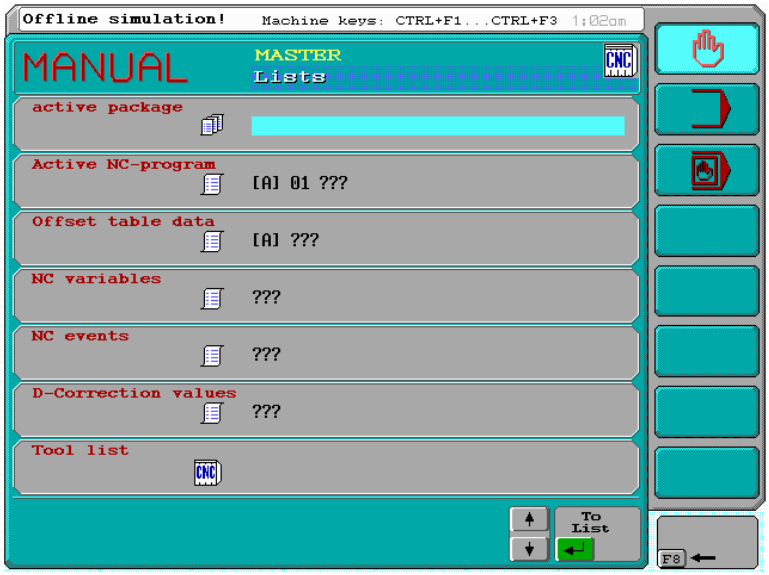
Insert new NC-variable into NC-variable list before the line marked by the cursor.

Basic Screen

- Display of cutting velocity (feedrate).
- Display in the 2. or 3. basic screen window the NC-blocks selectable from the source NC-program or the compiled NC-program. (call via <Shift>+<F8., select 2. or 3. window via cursor or <Tab>)
- Display of a maximum of 5 source NC-program blocks.

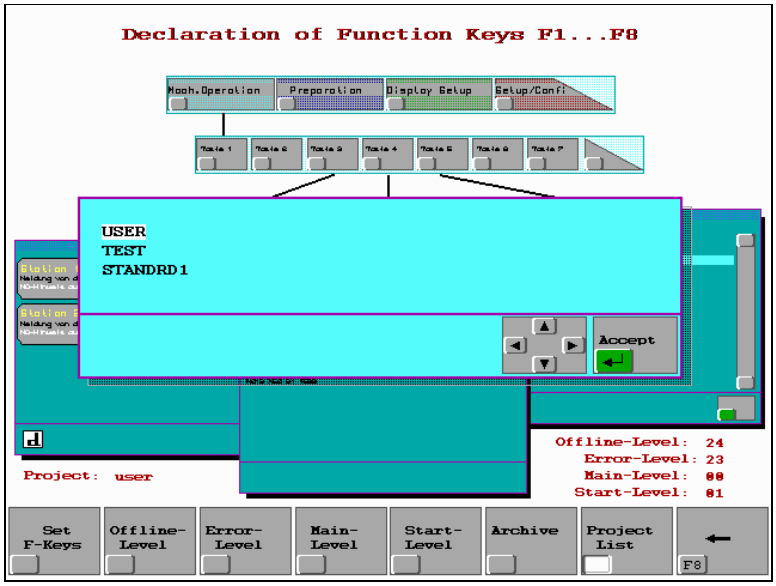
Station- / Function Selection

- Station Index with display of actual list in all stations.
- Menu Item **#54 "List Overview"** (display of all lists for a station that allows call of the respective menu) for softkey catalog.

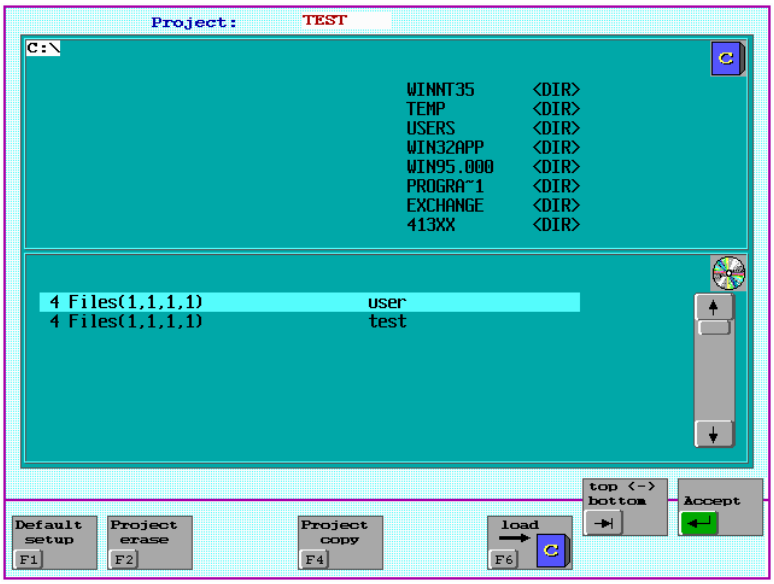


MAP-File Adaptation to a new MAP-File logic and structure for all GBO access routines.

Archive F-Key Enhanced functions to generate multiple project archives for F-key configurations. Select archived projects via <F7>, cursor and <Enter>.

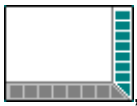
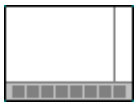


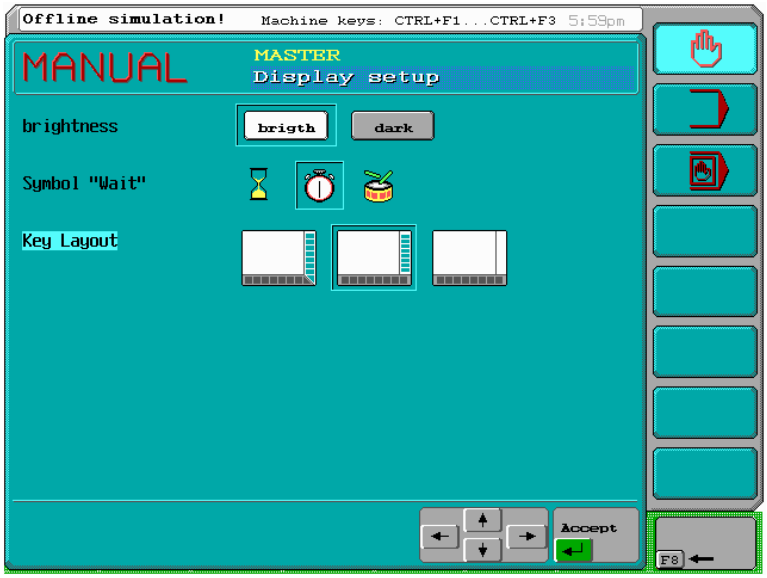
Loading Indramat's default setup via <F1>, Erase an existing project archive via <F2>, copy a project via <F4>, store the selected softkey setup to the path selected via <Tab> using <F6>, and activate the selected softkey setup via <Enter>.



Display Setup of Machine-Key Layout

Function #53 “Screen Setup” allows to select the **Key Layout** for the BTV01

 , BTV03  or PC  (no M-keys).



Display of Active NC-program

- Display of NC-cycle blocks
- Display that NC-block is executed when in Single Block Mode (Symbol „Start“  flashes)

Indramat internal GUI Installation Program

- The installation of the GUI software can occur from any path on the hard disk or floppy disk for Indramat internal purpose. Two disks are required when installing from a floppy disk.

User Interface MUI

Menu Overlapping Functions

General

Expansions:

- Install program (from V4.42)
  A LOG-file is created during installation documenting the install process. The file remains in the root directory C:\INDRAMAT.LOG if the install program does not complete. The file is located in ..\MT-CNC\CONFIG\INDRAMAT.LOG if the installation is completed correctly. The file name is modified to INDRAMAT.??? with ??? being an incrementing number.

Menu-Functions

1 = Archives Administration (Menu Item 1)

- Adapted to new NC-data (due to Compiler Data, extended Syntax, ..) => NC-archive cannot be used !!

MT-Backup

- **The data of the GNE are not stored at this time !**

  Data archiving program

2 = NC Program Administration (Menu Item 2)

Expansions:

- NC-Compiler support when editing an NC-program
- Graphics Editor support

NC-Programming

Expansions:

- Direct call of cycle program section possible from GUI

CYCLES

Expansions:

- NC-Compiler support
- Graphics Editor support
- Cycle-EXE program integrated into NC-EXE-program (this means no longer an individual EXE file)

3 = Machine Data (Menu Item 3)

Expansions:

- Introduction of “Machine Data - Preparation” Index (also Off-line)

```
              M a c h i n e   D a t a   -   P r e p a r a t i o n
              ================================================
Mar/30/97  OFFLINE MODE          Default MT-CNC Address 0              06:00:33pm


  Nr   Name                                Size   Date     Time        Assoc.Param.
-→01 x                                      1453 03/06/97 03:31:40am 01 - 08:16:12









1         2         3 Modify  4 Print   5 Assoc.  6Ma-Data  7  View   8To act.
 Create    Delete     Range     Index     Param.    ->MTCNC  o. Modify  Ma-Data
<CTRL>=Additional Functions           <F9>or<HELP>=Help,<F10>or<MENU>=Main Menu
```

- Edit of Machine Data definitions

```
                    M a c h i n e   D a t a   M o d i f y
                    -------------------------------------
Mar/30/97  OFFLINE MODE          Default MT-CNC Address 0              01:01:07am
  01 x                                  1453 03/30/97 00:06:56am 01 - 08:16:12

  +---------------------------- PAGE Edit Nr.: 200 ----------------------------+
  |                                                                            |
  |    STRUCT 200 test                                  PAGE Size: 00000 Bytes |
  |      PAGE Data                                      Data Sets :00000       |
  |    END_STRUCT                                                              |
-?|                                                                            |
  |    ARRAY [                                                        Number   |
  |           Dim1 Name       *value1*                    Dim1Def.    0000     |
  |           Dim2 Name       xxx                         Dim2Def.    0000     |
  |          ] OF STRUCT                                                       |
  |                                                                            |
  |                                                                            |
  |                                                                            |
  |                                                                            |
  +-----¦Select: <Tab>,????,<Enter>... ¦ Accept: <Ctrl>+<Enter> ¦ Abort: <Esc>++

1         2         3 Modify  4 Print   5 Delete  6          7View or  8To Mach
   New      Delete     Name    MachData  MachData              Modify   DataInde
<CTRL>=Additional Functions           <F9>or<HELP>=Help,<F10>or<MENU>=Main Menu
```

- Import / Export of Machine Definitions and Data

4 = Global - Documentation (Menu Item 4)

Expansions:

- Support of extended SPS expressions

5 = Machine Parameter Administration (Menu Item 5)

Expansions:

- Expansion of Update-Data of digital drive (SERCOS) parameters

Before	Update	Data value
New	Units	At entry min. and max. value

Expansions:

- Axis APR-association
  Expanding of axis number from 4 to 8 per APR to support MTC200

```
        S Y S T E M   P A R A M E T E R S   A D M I N I S T R A T I O N
        ---------------------------------------------------------------
Mar/30/97  OFFLINE MODE          Default MT-CNC Address 0              00:01:34am
NUMBER:  03  TITLE: w/ tool management

  Par.    Description                                              Value Unit
  A00.028  External Mechanism   28
  A00.029  External Mechanism   29
  A00.030  External Mechanism   30
  A00.031  External Mechanism   31
  A00.032  Axis  1  Type      (APR Module 1 - Axis 1        Digital Main Spindle
  A00.033  Axis  2  Type      (APR Module 1 - Axis 2         Digital Linear Axis
  A00.034  Axis  3  Type      (APR Module 1 - Axis 3         Digital Linear Axis
➔A00.035  Axis  4  Type      (APR Module 1 - Axis 4         Digital Linear Axis
  A00.036  Axis  5  Type      (APR Module 2 - Axis 1                 Not Present
  A00.037  Axis  6  Type      (APR Module 2 - Axis 2                 Not Present
  A00.038  Axis  7  Type      (APR Module 2 - Axis 3                 Not Present
  A00.039  Axis  8  Type      (APR Module 2 - Axis 4                 Not Present
  A00.040  Axis  9  Type      (APR Module 3 - Axis 1                 Not Present
  A00.041  Axis 10  Type      (APR Module 3 - Axis 2                 Not Present
  A00.042  Axis 11  Type      (APR Module 3 - Axis 3                 Not Present

1 APR-↑   2 APR-↓   3 Modify  4 Print   5  Copy   6         7         8 Select
  Assoc.    Assoc.   Parameter   List    Parameter            Parameter
<CTRL>=Additional Functions           <F9>or<HELP>=Help,<F10>or<MENU>=Main Menu
```

7 = NC Status and Diagnostics (Menu Item 7)

OPEN

- Adaptation of active NC-block display to new NC-block format

SOT

Expansions

- Adaptation of active NC-block display to new NC-block number format

2.2 CNC

Modifications and Expansions (CNC-core)

- Support for MTC200
- Variable association of up to 8 axis per axis processor. This function is available for the MT-CNC and the MTC200. For the MT-CNC this feature should not be publicized according to O. Illig.
- Expansion of PAGE definition for Machine Data to allow definition of type information for Dim variables.
- Introduction of identification for the Machine Data.
- The NC-commands HLT, EEV and DEV do no longer result in an abort of the tool path compensation (G42,G42). This allows to program the NC-command HLT within a contour. In the past, the compensation was removed and reactivated which caused a contour violation in some situations. Also when G02 or G03 was active the error #370 "*G41/G42 activated with circular interpolation" after these NC-commands.
- The error #277 "*Error in circular interpolation arc coordinates" is generated at helical interpolation if the circle path is much smaller than the linear distance. The error can occur if a full circle becomes a small partial circle due to computation inaccuracies

The version 17VRS is only supported by the CPU-3 (part of MTC0x.x CPUB) and the PPU circuit board (MTC200). Versions for the CPU-2 and SIO-2 are no longer supported.

CNC Functionality

Compiler

Starting with the software version 005-17VRS a standard Indramat NC-compiler is integrated into the user interface software, allowing to pre-compile NC-programs during the download.

The following functions are provided with this new function:

- Chamfers and Roundings (see below),
- Extended NC-block Look Ahead function,
- Graphical NC-Editor (for contour and cutting programming),
- Macro tools and
- Modal function

INDRAMAT-Compiler

The INDRAMAT NC-compiler

- searches the source NC-program for the keywords (listed in *italic*) depending on the NC-compiler setup,
- checks if all required conditions are fulfilled,
- remembers new Macro / Modal definitions and
- inserts the programmed
  - ⇒ Macro instructions,
  - ⇒ Modal instructions,
  - ⇒ Chamfers and Roundings,
  - ⇒ Cutting processes (chip removal cuts or contour cuts for the contours generated with the GNE dialogue) and
  - ⇒ performs the specified path velocity optimization.

User-Compiler

User-Compiler allow the OEM to integrate his own know how into the control. Technology specific functions, e. g., pre-collision-checks can be performed. The user can define compilers that are executed before and after the standard Indramat NC-compiler.

The standard Indramat NC-compiler must be switch on (yes) in the NC-program if the compiler function is activated in the NC-program Options menu.

```
                    N C - p r o g r a m   O p t i o n s
                    ----------------------------------
Mar/31/97  OFFLINE MODE         Default MT-CNC Address 0              09:51:00pm

+-------------------------------------------------------------------------------+
|                                                                               |
|---------------------- Compiler, Macros, Syntax check ----------------------|
| Compiler active.....................        yes                              |
| Syntax check........................         no                              |
|                                                                               |
|------------------------------ User Compiler -------------------------------|
| User Compiler 1.....................   ▒▒▒▒▒▒▒▒                              |
| User Compiler 2.....................   ▒▒▒▒▒▒▒▒                              |
| Indramat-Compiler                                                             |
| User Compiler 3.....................   ▒▒▒▒▒▒▒▒                              |
| User Compiler 4.....................   ▒▒▒▒▒▒▒▒                              |
| Syntax check                                                                  |
|                                                                               |
|------------------------ Global Variable Definitions -------------------------|
| Min.Execution Time of NC-block METB          3 ms                             |
+-------------------------------------------------------------------------------+
Enter name for User Compiler
1         2         3         4         5         6         7         8NC-Pkg.
                                                                        Index
```

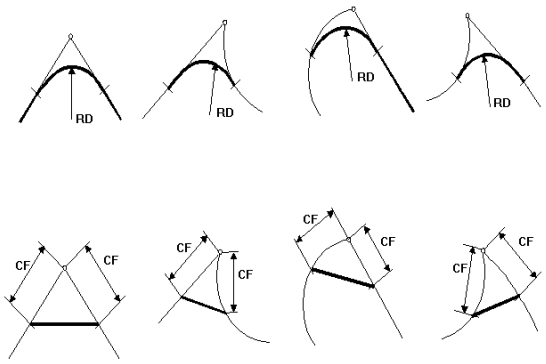
Chamfers and Roundings

The NC-commands

- *CF..* or *CF=..*(chamfer insert) and
- *RD..* or *RD=..* (rounding insert)

make it possible to insert chamfers and roundings.

Applications



Graphical NC-Editor

The Graphical NC-Editor provides an effective and also highly precise (standard) tool to support the NC-programming. This tool allows the user to graphically define in a simple manner geometry turning and milling elements (e. g., partial contours) and to specify their machining.

GNE adapts to the active Parameter Set and allows machine specific menu driven GNE parameter setup, GNE menu setup with icon editor and the milling / turning axis configuration setup. Setup definitions can be saved, selected and copied for future use and adaptation.

At the end of the machining dialog the user can chose to store the data required for machining in form of NC-blocks or as function call with associated parameters into the NC-program at the selected NC-block.

Window definitions

WINDOW_xx(..., . . .)

Contour definitions

CONT

```
START...    ;start point
LINE...     ;straight line
CW...       ;circle clockwise
CCW...      ;counter clockwise
```

END_CONT

Cutting instructions

CYCLE_xx(..., ..., . . .)

Macro-Technique

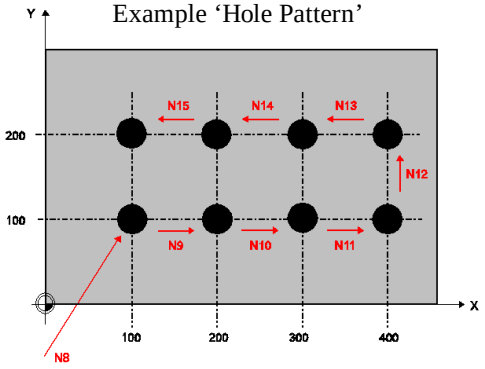
A *Macro* is defined as the summary of individual NC-instructions (usually programmed multiple times) to a total instruction with a new name.

```
                  N C - p r o g r a m   O p t i o n s
                  -----------------------------------
Mar/30/97  OFFLINE MODE         Default MT-CNC Address 0              04:12:58pm

+-------------------------------------------------------------------------------+
|------------------------------- User Compiler --------------------------------|
| User Compiler 1.....................                                          |
| User Compiler 2.....................                                          |
| Indramat-Compiler                                                             |
| User Compiler 3.....................                                          |
| User Compiler 4.....................                                          |
| Syntax check                                                                  |
|                                                                               |
|----------------------- Global Variable Definitions -------------------------|
| Min.Execution Time of NC-block METB          3 ms                             |
| Vel.Factor for NC-Block Trans.VFBT           1                                |
| Block Buffer - Tool Path Comp.BBTC      1                                     |
|                                                                               |
|----------------------------- Macro Definitions ------------------------------|
| Macro Table                                                                   |
+-------------------------------------------------------------------------------+
Open Macro Table by pressing <Enter>
1         2         3         4         5         6         7         8NC-Pkg.
                                                                      Index
```

```
                           M a c r o   T a b l e
                           ---------------------
Mar/30/97  OFFLINE MODE         Default MT-CNC Address 0              04:21:35pm
7 of 100 Macro's (max) defined
+-------------------------------------------------------------------------------+
|Comment   :  TOOL CHANGER                                                      |
|DEFINE M6                              AS                                      |
|BSR .TCH                                                                       |
|                                                                               |
+-------------------------------------------------------------------------------+
|Comment   :  SPINDLE ON                                                        |
|DEFINE M860                            AS                                      |
|M86 M3 S10                                                                     |
|                                                                               |
+-------------------------------------------------------------------------------+
|Comment   :  MACHINE DATA ACCESS                                               |
|DEFINE POSN_X                          AS                                      |
|MTD(112,4,@100,7)                                                              |
|                                                                               |
+-------------------------------------------------------------------------------+
+-------------------------------------------------------------------------------+

1  New    2 Delete  3 Modify  4         5         6         7         8  NC-
  Macro     Macro     Macro                                            Options
```

Modal functions

The Modal function *MODF_ON(...)* and *MODF_OFF* provide the user with a tool that allows him to program repeated expressions one time only.



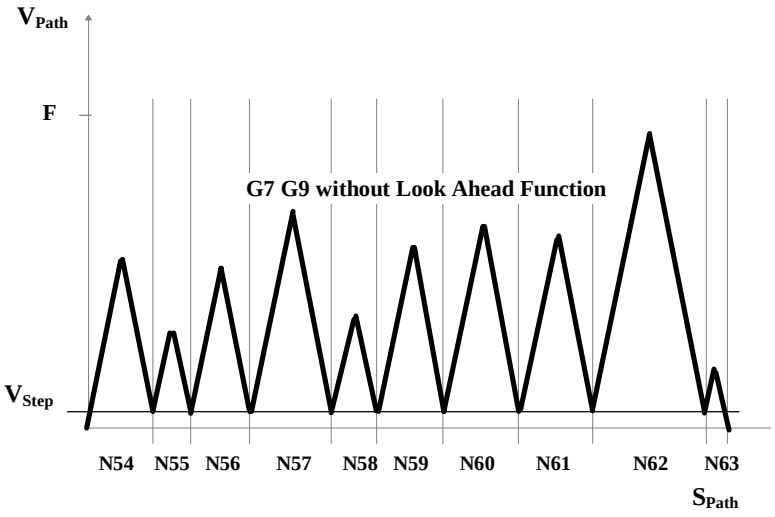
Extended NC-block Look Ahead Function

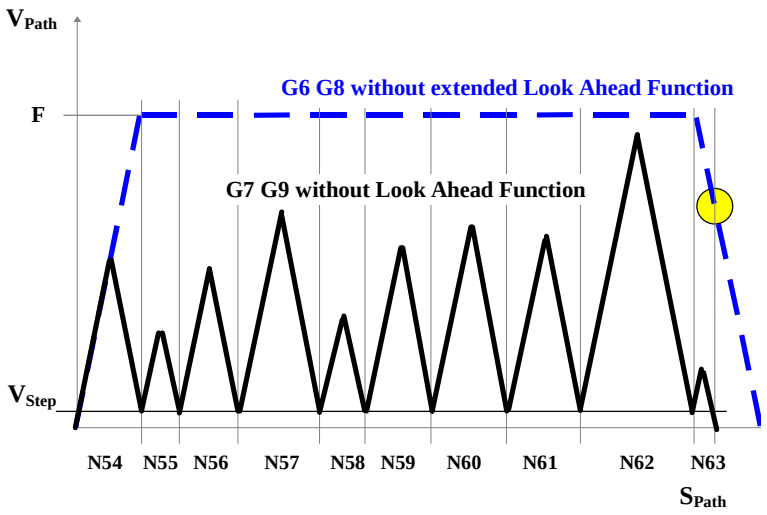
The extended NC-block Look Ahead function *LA_ON* (and *LA_OFF*) optimizes the path velocity profile of the programmed path movement during the compilation process and NC-program download.

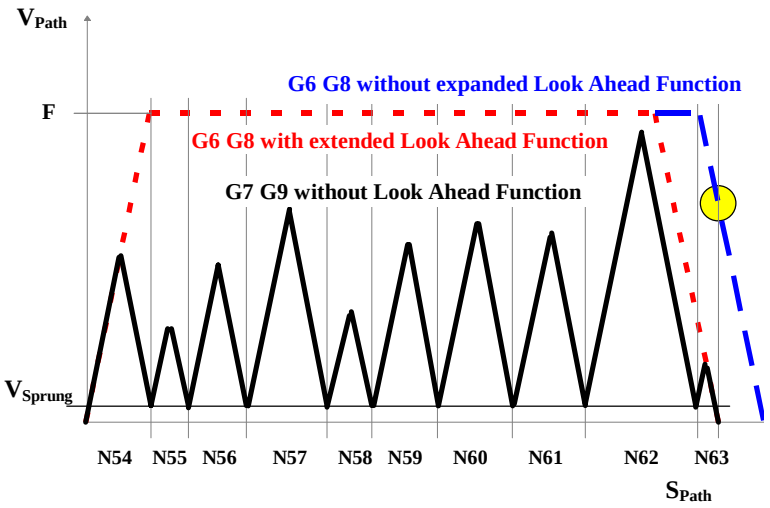
```
                    N C - p r o g r a m   O p t i o n s
                    -----------------------------------
Mar/31/97  OFFLINE MODE          Default MT-CNC Address 0              01:01:03am

+-------------------------------------------------------------------------------+
| Compiler active.....................          yes                              |
| Syntax check........................          yes                              |
|                                                                                |
|------------------------------- User Compiler --------------------------------|
| User Compiler 1.....................                                           |
| User Compiler 2.....................                                           |
| Indramat-Compiler                                                              |
| User Compiler 3.....................                                           |
| User Compiler 4.....................                                           |
| Syntax check                                                                   |
|                                                                                |
|----------------------- Global Variable Definitions -------------------------|
| Min.Execution Time of NC-block METB          3 ms                              |
| Vel.Factor for NC-Block Trans.VFBT           1                                 |
| Block Buffer - Tool Path Comp.BBTC      1                                      |
+-------------------------------------------------------------------------------+
Minimum NC-block cycle time (2.5 - 30.0 ms)
1         2         3         4         5         6         7         8NC-Pkg.
                                                                      Index
```

Required in-between NC-blocks are inserted to create a smooth path velocity profile in this process without contour modification.

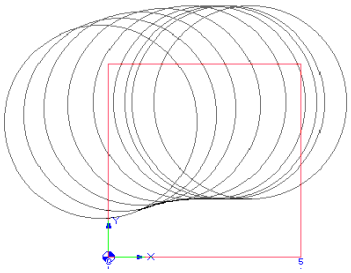
Most of the global variables for the Look Ahead function can be specified in the NC-program Options menu:




V Path
G6 G8 without extended Look Ahead Function
F
G7 G9 without Look Ahead Function
V Step
N54 N55 N56 N57 N58 N59 N60 N61 N62 N63
S Path


V Path
G6 G8 without expanded Look Ahead Function
F
G6 G8 with extended Look Ahead Function
G7 G9 without Look Ahead Function
V Sprung
N54 N55 N56 N57 N58 N59 N60 N61 N62 N63
S Path

Example: Extended Look Ahead Function



```
N0001   T2 BSR .M6                      ;activate tool
N0002   TL_RADIUS [ ] = ACD_COMP[@2]
N0003   G0 G40 G48 G54 M3 S...          ;initial setting
N0004  @1=2000                          ;loop counter
N0005  .LOOP @0=@1-0 BEQ .ABR           ;loop done ?
N0007  TRC=1                            ;tool corr. left
N0008  ADTRC=1                          ;approach distance
N0009  ACC_EFF=90                       ;eff. path acceleration
N0010  LA_ON                            ;ext. Look Ahead ON
N0011  G1 X... Y...                     ;Polygon
         :
N0030  LA_OFF                           ;ext. Look Ahead OFF

         :
N0051  @1=@1-1 BRA .LOOP                ;decrement loop
         :
```

Global variable for setup:

Name : METB (Minimum Execution Time for a Block)
Value range : 2.5 ... 30.0 [ms]
Preset : in *NC-Options*
Explanation : The global variable *Minimum Execution Time for a Block* METB defines the minimum execution time of a NC-block within the polygon course that is to be optimized. METB must be selected greater than or equal to the NC-block cycle time.

Name : VFBT (Velocity Factor for Block Transition)
Value range: 1.0 ... 25.0 [-]
Preset : in *NC-Options*
Explanation : The global variable *Velocity Factor for Block Transition* VFBT allows to influence the velocity change at non tangential NC-block transitions. It is specified:

Name : BBTPC (block buffer for tool path compensation)
Value range : 1 ... 10 [-]
Preset : in *NC-Options*
Explanation : The global variable '*block buffer for tool path compensation* BBTPC' specifies the number of NC-blocks that must be considered in the pre-calculation and pre-check of the tool radius path correction when using the extended Look Ahead function.

Velocity change = 2 * Axis acceleration * VFBT [mm/s²]

Name : TRC (tool radius correction for look ahead function)
Value range : 0 ... 2 [-]
Preset : always 0
Explanation : TRC=0: The extended Look Ahead function does NOT perform a Radius Path correction.
TRC=1: The extended Look Ahead function performs the Radius Path correction to the left of the contour.

TRC=2: The extended Look Ahead function performs the Radius Path correction to the right of the contour.

Note : Independent of the Tool Path correction of the extended Look Ahead function, the tool path compensation of the MT-CNC should NOT be activated when executing polygon courses.

Name : TL_RADIUS[T-Nr., E-Nr.]

Value range : 1 ≤ T-Nr. ≤ 9999999, 1 ≤ E-Nr. ≤ 9

With the help of the pre-defined fields TL_RADIUS[T-Nr., E-Nr.] the for the extended Look Ahead function required tool radii can be defined centrally at the NC-program begin. This allows to read the data from the Active Tool List at the time of NC-program compilation and download.

In case that no T-Nr. or no E-Nr. is specified, the active T- or E-number in the active tool spindle (SPTx) of the Active Tool List are used by the NC-compiler.

Note : In case the NC-compiler does not find in the NC-program definitions regarding tool radii via T_RADIUS[T-Nr., E-Nr.], the NC-compiler accesses the maximum and minimum tool radius of the corresponding tool in the Tool Setup List and calculates the radius as follows:

Radius = ½ * (R_min + R_max)

Note : If the tool radius path correction of the extended Look Ahead function is used (TRC <> 0), the via the field TL_RADIUS[T-Nr., E-Nr.] specified tool radius must exist at the time of processing when compiling the NC-program.

Name : ADTRC (Approach Distance for Tool Radius Comp.)

Value range : ?

Name : ACC_EFF (Effective ACCeleration)

Value range : 1..200%

Note : In difference to the NC-command ACC, the command ACC_EFF does NOT limit the maximum path acceleration specified in the process parameters, but modifies the real path acceleration depending on the defined value.

Name : ACD_COMP[..] (Actual Data for NC-COMPiler)

Value range : <NC-variable definition>

Allows to embed the actual value of a NC-variable at the time of NC-program compilation and download.

Extended Machine Data

The extended Machine Data implementation can be used as

- modifiable machine parameters (setup register, follower axes, main spindle synchronization, ...),
- protected data (machine options, measurement, tool monitoring, ...),
- as work memory for structured data (pallet management, axis positions, MPR override, ...) and

- to process large data quantities (part production, additional variables, ...).

Machine Data is separated into

- Indramat Machine Data (PAGE 0..99),
- OEM Machine Data (PAGE 100..199) and
- User Machine Data (PAGE 200..199).

(See under 1.2 item 3 = Machine Data)

OEM and User Machine Data provides a user tool to create new PAGEs (two dimensional data structures) and to assign values to their elements.

Machine Data in the control can be read / written by the user via the MUI menu, the SPS and the NC, depending on the assigned access rights.

It is possible to save Machine Data definitions and the associated data into a file on the PC and to load them back into the control. The saved data can also be exchanged between PC and an external media. Using a text editor, the definition and data can externally be modified as well.

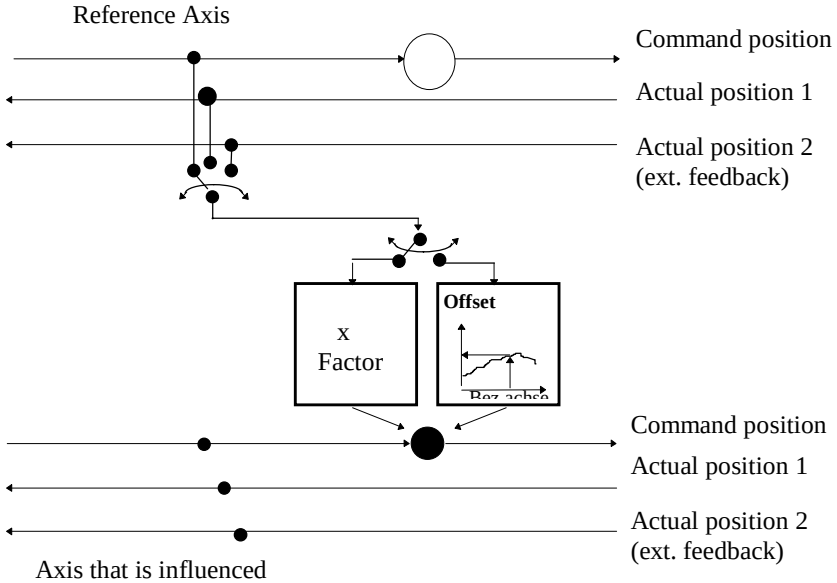
Electronic Axis Coupling and Table Interpolators

The electronic axis coupling (in APR 2ms timing) allows additional manipulation of axis position information via the SPS program. The

- command position,
- the actual position 1 or
- the actual position 2 (external feedback) can be accessed and multiplied by a factor depending the computation mode or
- with the use of a read/write table a position offset can be read and added to the command value of the axis that should be influenced.

Furthermore the functionality of fictitious axis is available with 005-17VRS.

Basic operating principle:

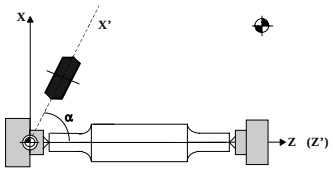


Applications:

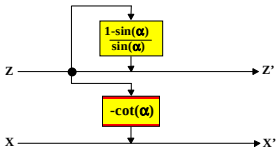
- MPG (manual pulse generator or handwheel) override in automatic operating mode to

- part touching with running program and cutter
- threading a tool
- ONLINE fine corrections
- contouring

- slanted axis



$$Z' = Z + Z * [\{1-\sin(\alpha)\} / \sin(\alpha)]$$
$$X' = X - Z * \cot(\alpha)$$




```
.HOME
  :
BRF .HOME_1
G74 Z0                          ;to reference point
G74 X0
G1 Z0 F5000                     ;to mach. zero point
G1 X0 F5000
AXD(X:P-7-3608)=...*10000  ;dyn. motion limit X
AXD(X:P-7-3609)=...*10000
AXD(X:P-7-3613)=2               ;electr. axis coupling ON
AXD(X:P-7-3616)=(1-sin(a)/sin(a))*10000  ;Table fact.
AXD(X:P-7-3619)=2               ;Multiplication mode ON
AXD(X:P-7-3620)=...             ;Axis number of slanted axis
AXD(X:P-7-3621)=1               ;Transformation X ON
  :
.HOME_1
  :
```

- axis moving in same and opposing direction
- axis that moves along
- gearing function
  - rotations when polygon turning
  - simple slanted cut gear
- any movement
  - fictitious axis
  - table interpolators

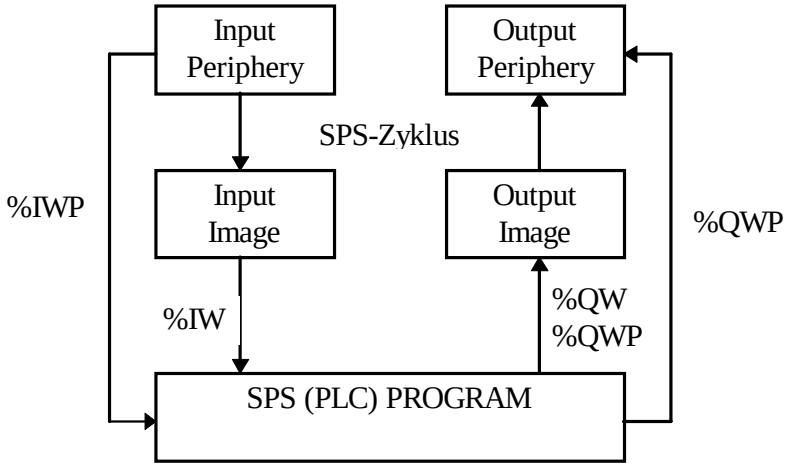
2.3 SPS

New Functions

2ms-Implementation

For fast reactions upon external events (e. g., switch turret off) a SPS program section that is executed every 2 msec is provided on the program level. This program section is limited to about 80 instructions (<200µsec scan time) to prevent excessive SPS program scan times. The use of the 2ms-Implementation will however slow down overall SPS program execution and increase the overall scan time.

The processing of the 2ms-Implementation is enabled in the PLC via the system Identifier *FastEnabl*.



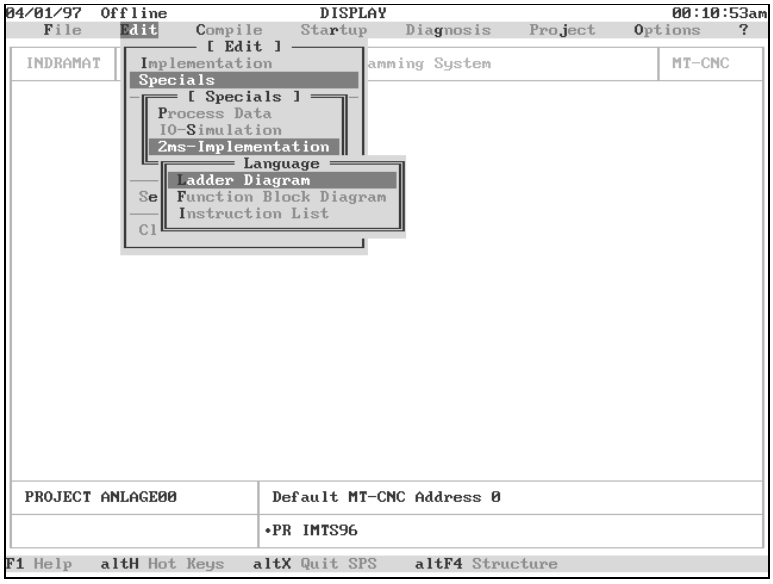
When upgrading or changing from InterBus-S generation 3 to generation 4 (MTC200) the 2ms-Implementation can be used in place of process data interface interlocks (no longer available in generation 4). This may be necessary when using SPS programs from MTC0x.x with MTC200 controls.

Fast I/Q Access

The 2ms-Implementation requires for a fast reaction the direct access to the I/O peripherals. New absolute addresses allow direct access of InterBus-S I/Q's in the master module DPR.

The Indramat fiber optic SPS interface and the local DEAB are not supported by this feature since data can not be made available in a fast manner.

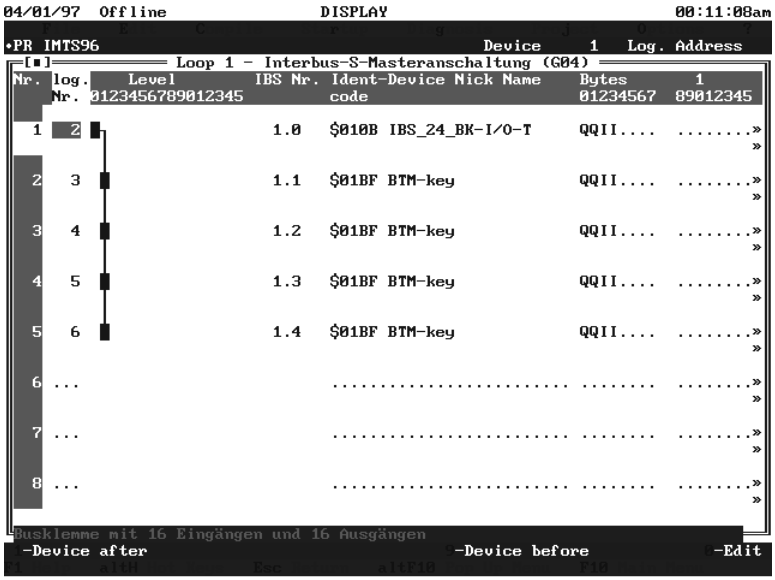
To guarantee consistent data within a direct access only the direct BYTE and WORD access is implemented (%IBP..., %IWP..., %QBP..., %QWP...). The direct access of InterBus-S I/Q's is possible in the normal SPS program level and the 2ms-Implementation level.



InterBus-S

Expanded the I/O capacity of the InterBus-S master module to 2048 inputs and 2048 outputs.

InterBus-S generation 4 is supported for the MTC200.



Indramat SPS Fiber Optic I/O

The remoter I/O device RECO02 was developed for use with the Indramat SPS fiber optic interface. The device node limits for the node remain the same as for the RECO01 (max. of 256 points and one serial SPS interface).

Profibus-DP

A Profibus-DP slave interface module is available for the MTC200 control product.

Control Type

The control MTC200 is supported with release 17VRS.

SFC / ACTION_BLOCKs

The commands for block read (<Ctrl>+<K> <R>) and write (<Ctrl>+<K> <W>) are now available in the SFC and ACTION_BLOCK editor.

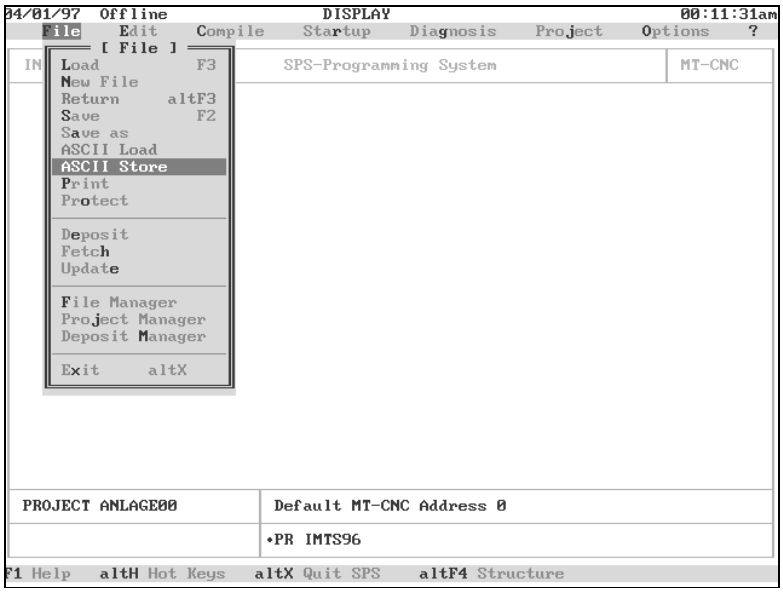
File Handling

Beside the Load/Save function of a SPS program in the internal format (as in the past) the SPS program can now also be loaded/saved in the ASCII format.

In order to gather all file work a File Manager was implemented. Functions to Erase, Rename, Copy, Load of BAK-file as well as a functionally extended file project Archive is provided.

In the Archive any POU (Program Organization Unit) can be saved (also multiple SPS programs simultaneously). The archive can be compressed to minimize memory requirements.

Archived POUs can be loaded selectively when reading the Archive.



Pointers

For projects with extensive data Pointer functionality is now available. Since typed Pointers are used, monitoring via Pointer is possible during run-time when reading / writing. In the case of an error a run-time error is generated (compare to overflow at an addition). Pointer can used for

- transferring data ARRAYs to FBs,
- type conversion of two ARRAYs, and
- for the reading/writing of data that is of different type.

This prevents multiple storing of the data.

Pointers reduce the memory requirements in the SPS for large data types. No improvements regarding run-time can be expected.

Type Conversion

The following type conversion introduced in 17VRS:

- SINT_INT <-> INT_SINT (Short Integer <-> Integer)
- SINT_BYT <-> BYTE_SINT (Short Integer <-> Byte)
- UINT_INT <-> INT_UINT (Unsigned Integer <-> Integer)
- UINT_W <-> W_UINT (Unsigned Integer <-> Word)
- DW_RL <-> RL_DW (Double Word <-> Real) ??

FB Expansions

The access of NC-data of the MT-CNC was unified. With the use of FUNCTION_BLOCKs Tool data, Offset Table Data, D-corrections and Machine Data can be read and written with the data types INTEGER, DOUBLE INTEGER and REAL.

- TLD_RD / TLD_WR
- DCD_RD / DCD_WR
- OTD_RD / OTD_WR
- MTD_RD / MTD_WR

CTRL_COM ;serial interface status information

PCLLIB-File

The firmware FUNCTIONs, FUNCTION_BLOCKs and TYPEs are prepared for translation into languages beside German and English. Up to now only the latter two languages are supported.

The SPS program compilation and download is no longer required when switching between user interface languages. The STATUS display is immediately active.

Protection of POUs

All user POUs (PROGRAMs, FUNCTIONs, FUNCTION_BLOCKs) can be password protected. The levels ‘open’, ‘read_only’ and ‘locked’ are possible.

‘open’

POU can be modified and is the unprotected state.

‘read_only’

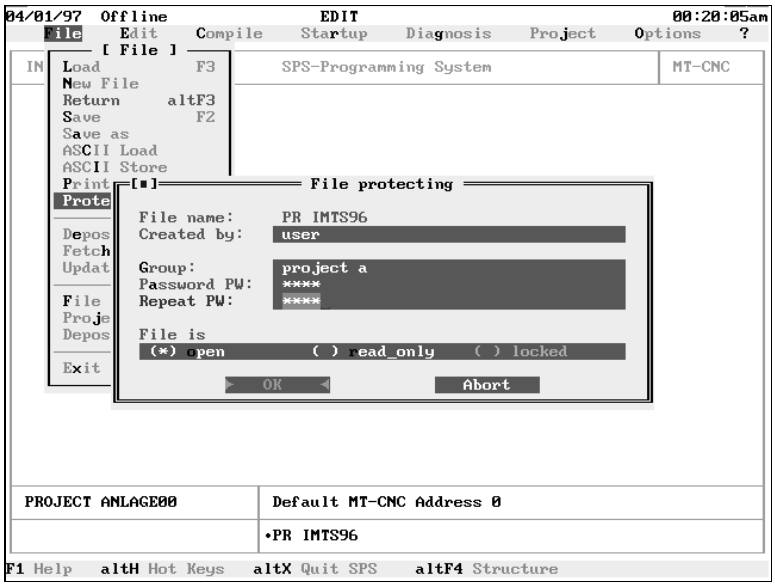
POU contents can be viewed and printed but not modified.

‘locked’

POU cannot be viewed, printed or modified.

In addition to the password, the information ‘Created by’ and ‘Group’ is recorded.

An overall supervisor password is available at the SPS group Dresden.



Search

The search function for Identifiers was extended to search in the LD/FBD Editor for specific information such as coils, normally open and normally closed contacts.

System software

The system software (firmware) was converted to high level programming language for future use with other CPU platforms.

Help Programs

The Indramat service program <Alt>+<U> to look at the control’s internal memory is now available in the SPS programming interface.

Number of Timers

The maximum number of timers was increased from 256 to 1024 !

Data Base

Starting with 17VRS up to

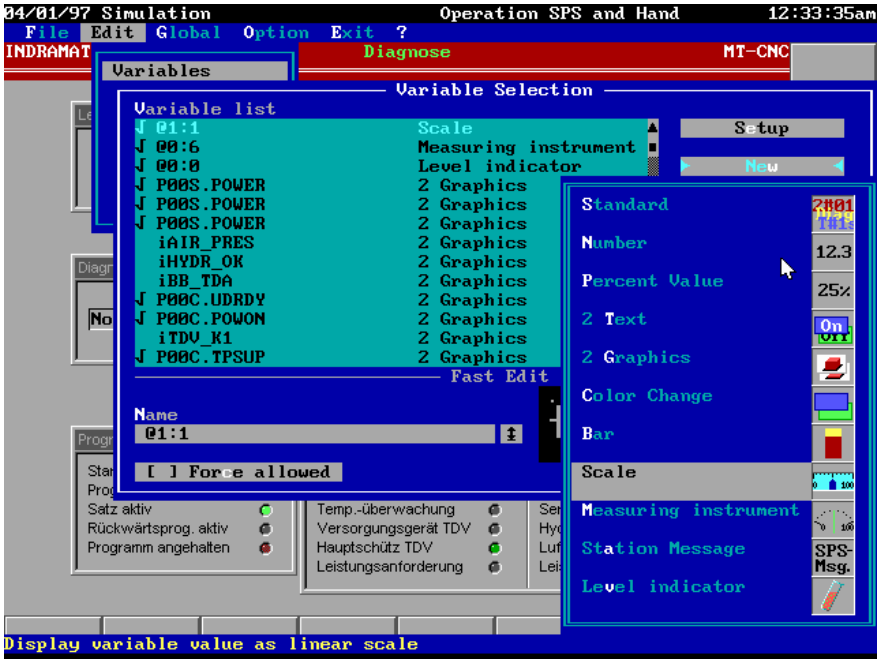
- 9999 Identifiers,
- 7999 Constants, and
- 9999 comments are supported by each POU

(PROGRAM, FUNCTION, FUNCTION_BLOCK)

2.4 Custom Display

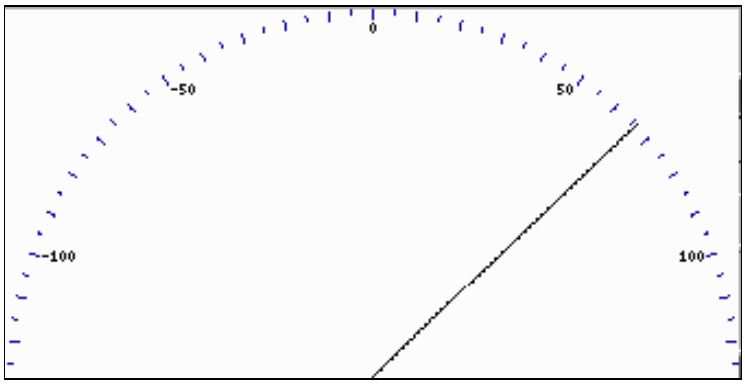
Implemented Modifications

- Integrated screen editor provides help system (when translated into English).
- Axis position values of the Program and Machine coordinate system can be displayed.
- The call of the integrated Custom Display Editor is now assigned to a global softkey via the Action „ScreenEdit“.
- The exit of the Custom Display is no longer hard programmed, but configurable as a global key (known Action „QuitProc“).
- Softkeys and Machine Keys can now be labeled with text and graphics together. The corresponding dialog offers a permanent result preview for improved look and feel.
- Every display element possesses now its own dialog. Only the for the element required setup is possible with optimum user support (permanent result preview for improved look and feel).



- All numerical and text output can be left, right or center aligned.
- Some existing display elements were combined (e. g., binary, decimal, real, ... became ‘Number’).
- Calling of a new display element (switch ‘New’ in ‘Variable Selection’ window) immediately generates an element with useful default values that can be further adapted.
- Graphics in the screen mask (and the global mask) are now layered according to their specified sequence.
- For all graphics there no longer a maximum limit. Basically the available memory specifies the available limit.
- In the dialog screen mask all text and variables that are position on top of a graphics object can optionally be moved together with the graphics object.
- The integrated graphics editor can be accessed in all dialogs that use graphics.

- All color selections are available in form of color pallets as in the graphics editor.
- A pointing device is supported by many dialogs (e. g., fast selection by clicking on mini preview screen).
- The existing display elements Bar and Scale are now graphical. They provide now better looks and much finer display resolution.
- New ‘Analog Instruments’ (60, 90, 120, 180, 270, 360, transparent).



- New display element ‘Level indicator’ allows filling of any technology shapes (e. g., horizontal level filling of a silo).
- The new editor menu item ‘Option’ provides the item ‘Simulation’ for selection of OFF-LINE element simulation speed, value range and activation.
- The “System MAP-File” can be selected when in OFF-LINE mode.
- Expanded the integrated Graphics Editor.
- Internal graphics objects can now be exported as PCX files.
- Importing of PCX and BMP graphics with higher resolution (also true color) with consideration of the contained color information. Color true color depth reduction with different methods are applied.
- Accelerated the graphics import, especially at BMP files.
- Pixel scrolling with <Alt>+<Cursor keys>.
- Undo of modified pixels via <Alt>+<BkSp>.
- Archives can now be save in compressed form.
- Single files can now be save automatically with all of their references (graphics and ASCII Character Sets).
- New action ‘LoadArchive’: This action allows to load archives without the use of the integrated editor (e. g., OEM update of machine).
- The display of ARRAY elements is possible. The elements must be specified with constants (no dimension variables as in SPS).
- Access to POINTER variables are NOT supported.
- The max. number of global keys increased to 40.

2.5 Graphical NC-Editor (GNE)

Short Description

The Graphical NC-Editor provides an effective and also highly precise (standard) tool to support the NC-programming.

The GNE call softkey is offered in all NC-editor and allows the user to graphically define in a dialog, geometry for turning and milling elements (e. g., partial contours) and to specify their machining.

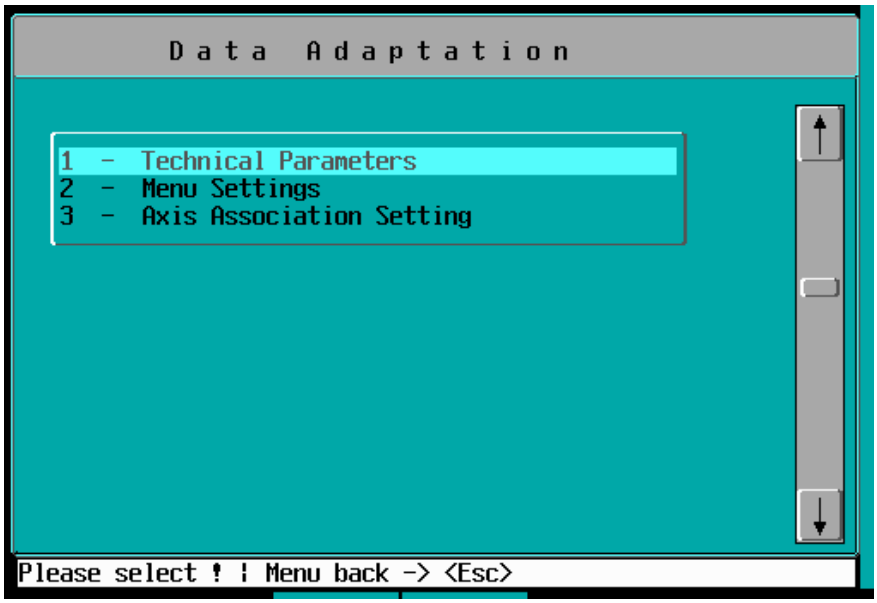
The GNE is a standard tool in the 17VRS GUI. After machining / cutting method selection, results of the GNE can be inserted (above cursor position) into the NC-program as cycles with parameter list or as a sequence of NC-blocks. GNE is a contour and cutting programming tool but not to be confused with the optional SFP system.

At the first call or if the active Parameter Set changed the GNE adapts to the active Parameter Set and allows further machine specific menu driven GNE parameter setup, GNE menu setup with icon editor and the milling / turning axis configuration setup. Setup definitions can be saved, selected and copied for future use and adaptation.

The OEM can configure in a function catalog application specific functions to a machine specific dialog.

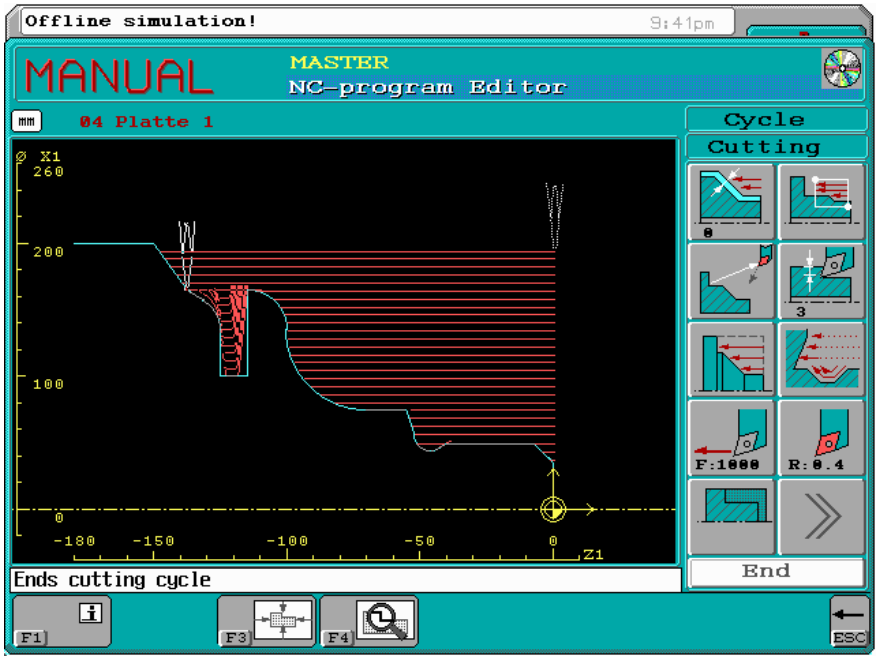
The current version provides functions for:

- Data adaptation: Techn. Parameter, Menu setup, Axis Association

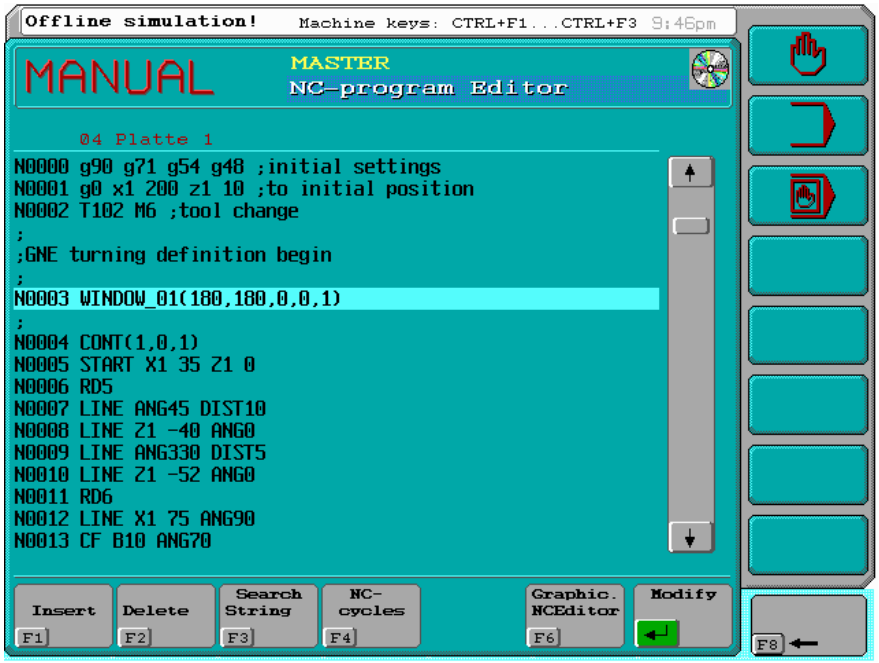


- Contour definition including chamfers, roundings and free cuts according to DIN standard

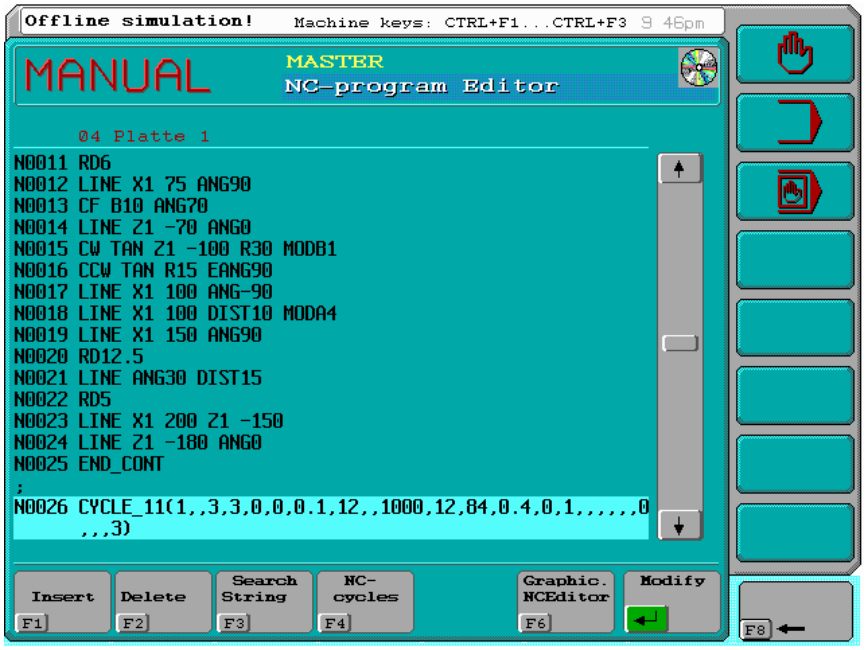
- Turning cycles: chip removal, contour cut and rest cut



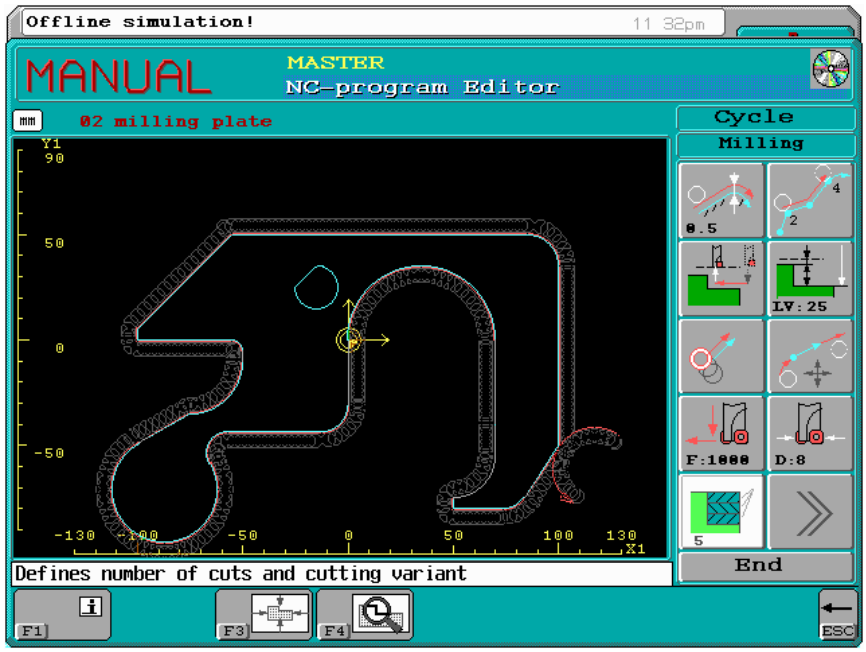
- GNE WINDOW (work area definitions) and programmed CONTour definitions in the NC-program. Putting the cursor on WINDOW will provide the work area when entering the GNE. The contour can be modified when the cursor is on any NC-block between CONT .. CONT_END the contour can be modified when calling the GNE.



- GNE CYCLE definition in the NC-program. The CYCLE definition contains all machining and cutting information that can be modified by pressing <F6> when the cursor is positioned on the NC-block.



- Milling cycle: contour cutting.



- **Function Support:** It is available via <F3> in the GUI NC-program Editor window.

Germany

Distribution Area Central	Distribution Area East	Distribution Area West	Distribution Area North
INDRAMAT GmbH D-97816 Lohr am Main Bgm.-Dr.-Nebel-Str. 2 Telephone: 09352/40-0 Telefax: 09352/40-4885	INDRAMAT GmbH D-09120 Chemnitz Beckerstraße 31 Telephone: 0371/3555-0 Telefax: 0371/3555-230	INDRAMAT GmbH D-40849 Ratingen Hansastraße 25 Telephone: 02102/4318-0 Telefax: 02102/41315	INDRAMAT GmbH D-22085 Hamburg Fährhausstraße 11 Telephone: 040/227126-16 Telefax: 040/227126-15
Distribution Area South	**Distribution Area South West**		**INDRAMAT Service Hotline**
INDRAMAT GmbH D-80339 München Ridlerstraße 75 Telephone: 089/540138-30 Telefax: 089/540138-10	INDRAMAT GmbH D-71229 Leonberg Böblinger Straße 25 Telephone: 07152/972-6 Telefax: 07152/972-727		INDRAMAT GmbH Telephone: D-0172/660 040 6 -or- Telephone: D-0171/333 882 6

Customer Service in Germany

Europe

Austria	Austria	Belgium	Denmark
G.L.Rexroth Ges.m.b.H. Geschäftsbereich INDRAMAT A-1140 Wien Hägelingasse 3 Telephone: 1/9852540-400 Telefax:1/9852540-93	G.L.Rexroth Ges.m.b.H. Geschäftsbereich INDRAMAT A-4061 Pasching Randlstraße 14 Telephone: 07229/64401-36 Telefax: 07229/64401-80	Mannesmann Rexroth N.V.-S.A. Geschäftsbereich INDRAMAT B-1740 Ternat Industrielaan 8 Telephone: 02/5823180 Telefax: 02/5824310	BEC Elektronik AS DK-8900 Randers Zinkvej 6 Telephone: 086/447866 Telefax: 086/447160
England	**Finnland**	**France**	**France**
Mannesmann Rexroth Ltd. INDRAMAT Division Cirencester, Glos GL7 1YG 4 Esland Place, Love Lane Telephone: 01285/658671 Telefax: 01285/654991	Rexroth Mecman OY SF-01720 Vantaa Riihimiehentie 3 Telephone: 0/848511 Telefax: 0/846387	Rexroth - Sigma S.A. Division INDRAMAT F-92632 Gennevilliers Cedex Parc des Barbanniers 4, Place du Village Telephone: 1/41475430 Telefax: 1/47946941	Rexroth - Sigma S.A. Division INDRAMAT F-69634 Venissieux - Cx 91, Bd 1 Joliot Curie Telephone: 78785256 Telefax: 78785231
France	**Italy**	**Italy**	**Netherlands**
Rexroth - Sigma S.A. Division INDRAMAT F-31100 Toulouse 270, Avenue de lardenne Telephone: 61499519 Telefax: 61310041	Rexroth S.p.A. Divisione INDRAMAT I-20063 Cernusco S/N.MI Via G. Di Vittoria, 1 Telephone: 02/92365-270 Telefax: 02/92108069	Rexroth S.p.A. Divisione INDRAMAT Via Borgomanero, 11 I-10145 Torino Telephone: 011/7712230 Telefax: 011/7710190	Hydraudyne Hydrauliek B.V. Kruisbroeksestraat 1a P.O. Box 32 NL-5280 AA Boxtel Telephone: 04116/51951 Telefax: 04116/51483
Spain	**Spain**	**Sweden**	**Switzerland**
Rexroth S.A. Centro Industrial Santiago Obradors s/n E-08130 Santa Perpetua de Mogoda (Barcelona) Telephone: 03/718 68 51 Telex: 591 81 Telefax: 03/718 98 62	Goimendi S.A. División Indramat Jolastokieta (Herrera) Apartado 11 37 San Sebastion, 20017 Telephone: 043/40 01 63 Telex: 361 72 Telefax: 043/39 93 95	AB Rexroth Mecman INDRAMAT Division Varuvägen 7 S-125 81 Stockholm Telephone: 08/727 92 00 Telefax: 08/64 73 277	Rexroth SA Département INDRAMAT Chemin de l`Ecole 6 CH-1036 Sullens Telephone: 021/731 43 77 Telefax: 021/731 46 78
Switzerland	**Russia**		
Rexroth AG Geeschäftsbereich INDRAMAT Gewerbestraße 3 CH-8500 Frauenfeld Telephone: 052/720 21 00 Telefax: 052/720 21 11	Tschudnenko E.B. Arsenia 22 153000 Ivanovo Rußland Telephone: 093/22 39 633		

European customer service without Germany

Outside of Europe

Argentina Mannesmann Rexroth S.A.I.C. Division INDRAMAT Acassusso 48 41/7 1605 Munro (Buenos Aires) Argentina Telephone: 01/756 01 40 01/756 02 40 Telex: 262 66 rexro ar Telefax: 01/756 01 36	Argentina Nakase Asesoramiento Tecnico Diaz Velez 2929 1636 Olivos (Provincia de Buenos Aires) Argentina Argentina Telephone 01/790 52 30	Australia Australian Industrial Machenery Services Pty. Ltd. Unit 3/45 Horne ST Campbellfield VIC 2061 Australia Telephone: 03/93 59 0228 Telefax: 03/93 59 02886	Brazil Mannesmann Rexroth Automação Ltda. Divisão INDRAMAT Rua Georg Rexroth, 609 Vila Padre Anchieta BR-09.951-250 Diadema-SP Caixa Postal 377 BR-09.901-970 Diadema-SP Telephone: 011/745 90 65 011/745 90 70 Telefax: 011/745 90 50
Canada Basic Technologies Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8 Telephone: 905/335-55 11 Telefax: 905/335-41 84	China Rexroth (China) Ldt. Shanghai Office Room 206 Shanghai Intern. Trade Centre 2200 Yanan Xi Lu Shanghai 200335 P.R. China Telephone: 021/627 55 333 Telefax: 021/627 55 666	China Rexroth (China) Ldt. Shanghai Parts & Service Centre 199 Wu Cao Road, Hua Cao Minhang District Shanghai 201 103 P.R. China Telephone: 021/622 00 058 Telefax: 021/622 00 068	China Rexroth (China) Ldt. 1430 China World Trade Centre 1, Jianguomenwai Avenue Beijing 100004 P.R. China Telephone: 010/50 50 380 Telefax: 010/50 50 379
China Rexroth (China) Ldt. A-5F., 123 Lian Shan Street Sha He Kou District Dalian 116 023 P.R. China Telephone: 0411/46 78 930 Telefax: 0411/46 78 932	Honkong Rexroth (China) Ldt. 19 Cheung Shun Street 1st Floor, Cheung Sha Wan, Kowloon, Honkong Telephone: 741 13 51/-54 und 741 14 30 Telex: 3346 17 GL REX HX Telefax: 786 40 19 786 07 33	India Mannesmann Rexroth (India) Ltd. INDRAMAT Division Plot. 96, Phase III Peenya Industrial Area Bangalore - 560058 Telephone: 80/839 21 01 80/839 73 74 Telex: 845 5028 RexB Telefax: 80/839 43 45	Japan Rexroth Co., Ltd. INDRAMAT Division I.R. Building Nakamachidai 4-26-44 Tsuzuki-ku, Yokohama 226 Japan Telephone: 045/942-72 10 Telefax: 045/942-03 41
Korea Rexroth-Seki Co Ltd. 1500-12 Da-Dae-Dong Saha-Gu, Pusan, 604-050 Telephone: 051/264 90 01 Telefax: 051/264 90 10	Korea Seo Chang Corporation Ltd. Room 903, Jeail Building 44-35 Yoido-Dong Youngdeungpo-Ku Seoul, Korea Telephone: 02/780-82 07 ~9 Telefax: 02/784-54 08	Mexico Motorización y Diseño de Controles, S.A. de C.V. Av. Dr. Gustavo Baz No. 288 Col. Parque Industrial la loma Apartado Postal No. 318 54060 Tlalnepantla Estado de Mexico Telephone: 5/397 86 44 Telefax: 5/398 98 88	
USA Rexroth Corporation INDRAMAT Division 5150 Prairie Stone Parkway Hoffman Estates, Illinois 60192 Telephone: 847/645-36 00 Telefax: 857/645-62 01	USA Rexroth Corporation INDRAMAT Division 2110 Austin Avenue Rochester Hills, Michigan 48309 Telephone: 810/853-82 90 Telefax: 810/853-82 90		

Customer service out of Europe

Notes

282690

Printed in Germany

Rexroth Indramat