ER-CIM

User's Manual

Part 1

Chapters 1–13 & Appendices A–E

Catalog #100037

ESHED ROBOTEC

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ER-CIM version 1.84

Installation Prerequisites

Software Plug

Software protection plugs are *no longer required* for any part of the ER-CIM software.

Drive H:

Before installing the ER-CIM software, be sure the central CIM computer can access drive H:

This can be achieved by means of one of the following:

• Using a LAN, such as NOVELL.

• Including the line LASTDRIVE= H (or greater) in the CONFIG.SYS file. (Be sure to reboot the computer after editing the CONFIG.SYS file.)

LAN Communication Network

Any LAN can be used in the ER-CIM.

Before installing the ER-CIM software, install the LAN software.

The ER-CIM software installation requires the presence of two batch files, LANSER.BAT and LANCIM.BAT, in the central CIM computer.

LANSER.BAT

If the central CIM computer is also the network server, this batch file must contain the command to activate the server. LANSER.BAT is called by the central CIM computer's AUTOEXEC.BAT.

If the server is on another computer, this batch file must be present, but empty.

LANCIM.BAT

This batch file contains all the commands required for the central CIM computer to login to the server, and assigns drive H: to the CIM directory.

If you are using either a NOVELL or LANTASTIC network, it is recommended that you use the utility contained in ER-CIM Diskette #1 for building the necessary batch files for these networks. (You may however, use any text editor for this purpose.)

After installing the LAN software, and before installing the ER-CIM software, insert Diskette #1 into drive A: and type:

```
        A:
        SETLAN NOVELL

or      SETLAN LANTASTI
```

This will automatically create the proper batch files and place them in the root directory.

If necessary, edit these files specifically for your computer.

If you are using a network other than NOVELL or LANTASTIC, you will need to use a text editor to create and edit the LANSER.BAT and LANCIM.BAT files

If you are not using a LAN, you do not need to create or edit these files; the ER-CIM installation procedure will create them.

Installation and Upgrade Procedure

If you are upgrading the software, the installation procedure will detect your current configuration and maintain it.

To install/upgrade the ER-CIM software, follow the steps below.

1. Remove all unessential cards (such as unused LAN cards) from the computers in the ER-CIM.

2. To activate the installation procedure, insert Diskette #1 into drive A: in the central CIM computer, make A: the default drive, then type MCIM followed by < Enter> .
Insert diskettes #2 through #4 as prompted.

Note   If an error message appears during the installation, *do not* instruct the system to ignore the error. Abort the installation procedure and contact your technical support representative.

3.   After the software is installed, the CIM Setup Definition screen is displayed. Select the options according to your actual ER-CIM installation. Press < Esc> to save and exit this screen.

4.   Reboot the central CIM computer.

5.   Modify the programs for each station (as described below, in the section, "Station Files.")

6.   Initialize the central CIM controllers and the station controllers, using the options in the CIM Main Menu.

CONFIG.SYS and AUTOEXEC.BAT Files

The installation of ER-CIM version 1.84 appends lines to the CONFIG.SYS and the AUTOEXEC.BAT, but does not alter existing lines in these files.

During the installation, the old AUTOEXEC and CONFIG files are saved with extension OLD.

If your existing AUTOEXEC and CONFIG files contain the appended lines from the previous ER-CIM version, the upgrade installation procedure will result in duplication of some of these lines. You should delete the redundant lines (otherwise, drivers may load twice into memory, and error messages may appear).

CIM Main Menu

When you complete the **ATS to ASRS station** operation, and when you exit the ASRS software module, the RS232 switcher between the computer and the station controller is disconnected. This allows another computer to connect to the same controller without requiring the switcher to be repowered.

CIM Setup Definition

Additional options now appear in the CIM Setup Definition screen:

- Definition of the direction of the conveyor's movement.

- Definition of the robots used in conjunction with **Controller-B**: **SCORBOT-ER-IX**, **SCORA-ER 14**, **PERFORMER-MK2**.

ASRS

ASRS – ACL Files

The directory H:\CIMSYS\ST has three files which contain the programs for the specific type of ASRS used in the ER-CIM:

- ASRCRC.DMC (carousel)

- ASRSQR.DMC (square)

- ASRCMP.DMC (compact)

In addition, this directory has three files which contain the commands needed for calling the .DMC files.

- ASRCRC.DNL

- ASRSQR.DNL

- ASRCMP.DNL

When you complete and exit the CIM Setup Definition screen, the appropriate ASR*xxx*.DNL file is copied to the file named ASR.DNL,

When the ASRS controller is initialized, downloading of the ASR.DNL calls the ASR*xxx*.DMC file. (Note that the ASR.DNL file no longer contains ACL programs.)

Retrieve/Store Part

The **Retrieve/Store a Part** option has been changed. You are no longer prompted to specify a Destination or Source when a part is moved from or to the ASRS.

By default, the part is taken from Buffer 1 or placed on Buffer 1, except at an **ASRS**[2], which uses pallets and not buffers.

REPORTS

The following features have been added to the REPORTS software:

- An option for saving all messages originating in the controller, which can be used for reconstructing the process.

- An ER-CIM interface for MAPICS and FOURTH-SHIFT, which is activated from the REPORTS software module.

AUTOCNC

You can now define and use up to four machines in one station.

Graphic Tracking

VIEW.BAT

A new batch file has been added in this version. It allows you to view the different graphic representations of the ER-CIM system before using the CHANGE option.

To activate, use the same format as for CHANGE. Type, for example:

```
H:\WIZCON> VIEW OV 103A
```

where OV (or SQ) is the shape of the conveyor, and 103A is the graphic layout for one of the ER-CIM configurations.

If you type VIEW OV or VIEW SQ without specifying the specific graphic, a list of graphics for you to chose from will be displayed.

Station Files

All the files for each specific station are now located in individual station subdirectories (accordingly named: 1, 2, 3, 4, 5, and 6) within the H:\CIMSYS directory. Each directory contains the following files:

USER*n*.DNL   station programs; *n* = station number

POINT*n*.CBU   station positions (created during backup)

STATION*n*.CBU   station controller contents (created during backup)

PAR*xx*.CBU   all parameters for robot, gripper and accessories at specific station; *xx* = the type of robot:

CONFIG.ACL   station controller configuration

REPORT.DLD   log of last controller initialization

During the installation/upgrade procedure, the station specific files (USER*n*.DNL and POINT*n*.CBU) are moved to the appropriate station directories (and removed from the CIMSYS\ST directory).

USER*n*.DNL

This is a user file which contains the programs for the specific station. It is created and edited during ER-CIM installation and modification.

This file is used by **Station Setup/Initialize controller** menu option.

From the H:> prompt at the central CIM computer, type:

        STATION

to change the current directory to H:\CIMSYS\ST

In this directory, locate a file named *xxxx*.SMP (where *xxxx* is the name of a sample file which you want to use). Some of the samples files included in the ER-CIM software are, for example: USERMILL.SMP, USERLATH.SMP, USERWELD.SMP, ASMBALLS.SMP

Copy and rename this file to directory H:\CIMSYS\ST*n* (where *n* = 2, 3, 4, 5, or 6: the number of the station):

Type: COPY *xxxx*.SMP   *n*\USER*n*.DNL

Then use the **Station Setup/Edit station program** menu option to modify the file, if necessary. Be sure to make all changes to the USER*n*.DNL file in the directory H:\CIMSYS\ST*n*.

POINT*n*.CBU

This file is created by the **Station Setup/Backup controller points** menu option.

It contains all positions currently in the station controller at the time of the backup.

This file is used by menu options **Station Setup/Restore controller points** and **Station Setup/Initialize controller**.

It is no longer necessary to delete existing points in the controller before using the option **Station Setup/Restore controller points.**

STATION*n*.CBU

This file is created by the **Station Setup/Backup controllers** option.

It contains all controller contents but not the configuration.

This file is used by menu option **Station Setup/Restore controllers**.

This file is intended for use only after a controller breakdown.

PAR*xx*.CBU

This file is created by the **Station Setup/Station setup definition** option.

It is used by the **Station Setup/Initialize controller** option.

xx = 5, 5plus, 7, 9, 14, MK2 : the type of robot:

Replace the existing file in the directory with the PAR*xx*.CBU file from the **ATS** diskette which was supplied with the robot installed at the station.

If you change the controller parameters (for example, when accessories are added), backup the newly established parameters to the file PARxx in the directory H:\CIMSYS\ST*n*.

CONFIG.ACL

This file contains the station controller configuration.

It is created by **Station Setup/Station setup definition**, and used by the **Station Setup/Initialize controllers** to configure the controller.

You may make changes to this file. However, you will lose these changes the next time you use **Station Setup/Station setup definition**, unless you have "locked" the file.

To protect your changes, do the following:

1. Change the current directory to H:\CIMSYS\ST;
   from the H:> prompt, type:

   ```
   STATION
   ```

2. Make the CONFIG.ACL a read-only file; type:

   ```
   LOCK n
   ```
   where *n* is the station number

   To change the CONFIG.ACL back to a read-write file, type:

   ```
   UNLOCK n
   ```

REPORT.DLD

This file is created during each controller initialization. All data sent to and from the controller during the initialization is recorded in this file, in order to facilitate troubleshooting in the event of a failed initialization.

Sample (.SMP) Files

A number of sample application files have been added to the directory H:\CIMSYS\ST. These files have the extension SMP.

Refer to the section above, "USERn.DNL," for details on using the sample files.

ACL – Central CIM Controller

New Variables

RELTM   Following a ''not found'' message from ASRS, the wait time before the next attempt to get material from ASRS; in hundreths of a second;
= 3000 (default)
= 0: do not try again

QCFLG   = 1: uses results of a quality control inspection (default).
= 0: assumes part has passed quality control inspection.

MAPIX   = 0: production orders are executed only after a start production command is entered (default).
= 1: all production orders are executed as soon as received.

ACL – Station Controller

New Variables

For program WTM*n*

(*n*= machine number)

(TASK*n*)   (read only; same as in previous versions)

INFO*n*   Read/Write;
User defined information about the part, which remains associated with the part throughout processing.

RES*n*   Write only;
Result of a quality control inspection.
= 0: part passed inspection (default).

$\neq$ 0: (user defined value) part failed inspection;
system then activates commands for removing part from production process (to rejection box) and releasing another part instead.

For program FB and RJCT

RESUL   If part rejected, RESUL receives value of RES.

For non-robot assembly program ASMNR

PARTA   ID number of part to be assembled.

For program START

ACOFF   If AUTOCNC is not used, this variable may be set to a non-zero
                 value, thereby permitting use of COM2 (normally reserved for
                 AUTOCNC) for user programs.

New Programs

LIGHT   Station light control: by default turns on output 1 (green light on) if a
                 template is on any buffer;
                 turns output 1 off (red light on) if all buffers are empty.

                 At ASRS station: also turns on output 1 (green light on) if ASRS
                 safety lamp is on.

RJCT   Takes part being held by robot to "rejection bin"; can use variables:
                 PART, RAW, RAWN, TASK, SUBP, INFO, RESUL (as in
                 program FB)

ASMNR   When assembly does not require robot, use this program instead of
                 program ASMBL;
                 this program uses variable: PARTA

ATACH   Attaches user position vector to group B.
                 If slidebase is defined in the setup, the command ATTACH CIMB is
                 executed by default.
                 If slidebase is not defined, program is empty.

GTROB   Starts using robot
FRROB   Finishes using robot

                 To use robot in WTMn program, user commands for the robot must
                 be preceded and followed by these two commands.

```
     GOSUB GTROB
   .
   . (user commands for the robot)
   .
     GOSUB FRROB
```

                 This ensures that no other programs are using the robot at the same
                 time.

RSKBD

A new program has been added to the ER-CIM software to facilitate communcation with the SQC software.

This is a resident (TSR) program which places all data received from the RS232 port into the keyboard buffer; this data is then treated the same as manual keyboard entries.

The program is located in the central CIM computer, in the directory H:\UTIL.

To activate, type one or both of the following:

RSKBD   for RS232 on COM1 (default)

RSKBD /C2   for RS232 on COM2

To remove from memory, type the following:

```
RSKBD /U
RSKBD /C2 /U
```

Device Installation

The following sections give instructions for the connection of devices to the RS232 controller ports.

Using SQC Software

1. Connect the SQC computer to a controller port *n*.

2. In the USER*n*.DNL file, make the following changes:

   • Add the following lines at the beginning of the file:

   ```
   #INCLUDE \CIMSYS\ST\PORTn.DMC
   #INCLUDE \CIMSYS\ST\SQC.DMC
   ```

   > (*n*= station controller port number)
   > (#INCLUDE is an **ACLoff-line** command)

   • To send data to the SQC program, include the following lines at the appropriate locations in your ACL station programs:

   ```
   SET    NSIZE = n            ;number of digits
   SET    NSEND = num          ;number to send
   GOSUB  SENDL                ;send the number
   ```

   • To send the data ID to the SQC program, include a prolog (two lines) at the appropriate locations in your ACL station programs:

   ```
   SET    NSEND = id           ;id of sample
   GOSUB  SNDLS                ;send the id (4 digits)
   ```

    and send a (one line) epilog:

   ```
   GOSUB  SNDLE
   ```

3. Before starting a production order, you must do the following:

   • Run the program RSKBD on the SQC computer.

   • Activate SQC and define the proper values.

   • Call up the Real Time menu (which will then remain on display during production).

Height Gauge

1. Connect the Height Gauge to port 4 of the switcher.
    Connect controller port *n* to port 3 of the switcher.

    Configure switcher port 4 as follows:

    > baud rate = 2400
    > data bits = 8
    > stop bits = 2
    > no parity
    > no XON/XOFF

2. In the USER*n*.DNL file, make the following changes:

    *   Add the following lines at the beginning of the file:

        ```
        #INCLUDE \CIMSYS\ST\PORTn.DMC
        #INCLUDE \CIMSYS\ST\HG.DMC
        ```

        > (*n*= station controller port number)
        > (#INCLUDE is an **ACLoff-line** command)

    *   You must add the program START:

        ```
        PROGRAM START
        ```

        which must contain the line:

        ```
        GOSUB  HGSTR
        ```

    *   In program WTM*n*, include the following lines:

        ```
        MOVE    CIMB[3]               ;first point
        GOSUB   CKHG1
        MOVE    CIMB[4]               ;second point
        GOSUB   CKHG2
        IF      HGRES = 0
          SET     RESn = 1            ;reject
        ENDIF
        ```

        > (*n*= machine number)

---

3. ***OPTIONAL***:
   To also use SQC statistical software program:

   - Add the following lines at the beginning of the USER*n* file (preceding the #INCLUDE lines (from Step 2):

     ```
     #INCLUDE \CIMSYS\ST\PORTn.DMC
     #INCLUDE \CIMSYS\ST\sqc.dmc
     ```

     (*n*= controller port connected to SQC computer)

   - Add the following lines to the WTM*n* file (following the lines previously added (from Step 2):

     ```
     SET    NSIZE = 5
     SET    NSEND = HGRES
     GOSUB  SENDL
     ```

   - In the SQC software program, define the following:

     3 digits to left of decimal point

     2 digits to the right of point.

     ID = not used

     number of samples = 1

Laser Scan Micrometer

1. Connect the LSM to a controller port, *n*.

2. In the USERn.DNL file, make the following changes:

    *   Add the following lines at the beginning of the file:

        ```
        #INCLUDE \CIMSYS\ST\PORTn.DMC
        #INCLUDE \CIMSYS\ST\LSM.DMC
        ```

        (*n*= station controller port number)
        (#INCLUDE is an **ACLoff-line** command)

    *   You must add the program START:

        ```
        PROGRAM START
        ```

        which must contain the line:

        ```
        GOSUB  LSTRT
        ```

    *   In program WTM*n*, include the following:

        ```
        GOSUB   LMES1
        ```

        or:
        ```
             GOSUB   LREAD                    ;read
             IF      LRES < minimum
               ORIF    LRES > maximum
               SET     RESn = 1               ;reject
             ENDIF
        ```

3. *OPTIONAL*:
    To also use SQC statistical software program:

    *   Add the following lines at the beginning of the USER*n* file (preceding the #INCLUDE lines (from Step 2):

        ```
        #INCLUDE \CIMSYS\ST\PORTn.DMC
        #INCLUDE \CIMSYS\ST\SQC.DMC
        ```

        (*n*= controller port connected to SQC computer)

    *   In the SQC software program, define the following:

        4 digits to left of decimal point
        3 digits to the right of point.
        ID = 4 digits
        # samples = 5

    *   In the WTM*n* file, do not use the GOSUB line(s) (from Step 2). Instead, add the line:

        ```
        GOSUB   LMES                     ;5 samples
        ```

SCORBOT-ER III Controller for I/O Expansion

1. Connect the ER III controller RS232 port (marked "computer") to an ACL controller port, *n*.

2. In the USER*n*.DNL file, add the following lines at the beginning of the file:

   ```
   #INCLUDE \CIMSYS\ST\PORTn.DMC
   #INCLUDE \CIMSYS\ST\ER.DMC
   ```

   (*n*= station controller port number)
   (#INCLUDE is an **ACLoff-line** command)

3. Include the following lines at the appropriate locations in your **ACL** station programs:

   ```
   .SETOUT   n s

   .IFINPUT   n s

      .
      .        (additional lines)
      .

   ENDIF
   ```

   $n =$ 1–8: number of input/output
   $s =$ 0,1: status: 0= off; 1= on.

   Note that the period (.) before SETOUT and IFINPUT indicate that these are macro commands.
   SETOUT alters the state of the ER III outputs, and IFINPUT reads the state of the ER III inputs.

ROBOTVISIONpro – ER-CIM Interface

Install the **ROBOTVISIONpro** hardware and software according to the instructions in the **ROBOTVISIONpro** *User's Manual*,
but *do not* perform the ACL Controller Setup.

In the USER*n*.DNL file, make the following changes:

• Add the following line at the beginning of the file:

```
#INCLUDE \CIMSYS\ST\RVPRO.DMC
```

   (#INCLUDE is an **ACLoff-line** command)

• In program WTM*n*, you may include any command which calls a vision function. For example:

```
GOSUB SCAN

GOSUB SNAP

GOSUB THRES
```

The results of vision functions are written to global variables, such as:

```
SCNST

SCNCN
```

Refer to the **ROBOTVISIONpro** *User's Manual* for a complete list and explanation of the vision variables and the vision functions which can be accessed by ACL programs.

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Installation/Upgrade and Setup Procedures

Installation/Upgrade of ER CIM Program Files

A set of four diskettes, labeled CIM-1 through CIM-4, is used for installation or upgrading of existing software.

Instructions that are written in *italics* should only be followed when upgrading the software.

Before installing or upgrading the software:

- Turn on the central CIM computer.

- Turn on all other computers to be used. Turn on any printers which are connected.

- Make sure all software protection keys are plugged in.

  All computers in the CIM system are supplied with a software protection key. The key must always be plugged into a printer (parallel) port on the computer while you are operating the CIM system. If you are using a printer, plug the printer cable into the connector on the protection key. Printer operation is not affected by the key.

  The central CIM computer needs a second protection key for operating the graphic tracking software. The two keys are daisy chained.

- *Make sure all station files (user programs USER2.DNL . . . USER4.DNL) and position files (POINTS1.CBU…POINTS4.CBU) are properly backed up on diskette.*

- Make sure the hard disks in all computers have a directory \DOS which contains the necessary DOS files.

- Make sure an Ethernet network card is installed in every computer from which you want to access the central CIM computer.

- Make sure a COM3 card is installed in the central CIM computer.

Central CIM Computer Program Installation

1.   Insert diskette CIM-1 into drive A:

Make sure the DOS prompt is A:

2.   Check whether your cell has a LAN network.

   If so, type MCIM and press < Enter> .

   If not, type MCIM NOLAN and press < Enter> .

   All files will be copied to the hard disk.

3.   When prompted by the system, insert diskettes CIM-2, CIM-3 and CIM-4, and press
   < Enter> .

4.   When the station setup screen appears, enter the information for your cell (refer to the
   chapter "The CIM Menu" in this manual.)

   Press < Esc> to exit this screen.

5.   If your cell **does not** have a LAN (i.e. the command MCIM NOLAN was used in
   section 2), skip the rest of this section and proceed to section 6.

   (Note: the following instructions apply only to the standard LAN software used with the
   ER CIM cell).

   If your cell has a LAN, the Ethernet LAN Main Functions menu will appear.

   If you are entering this menu for the first time, only the option Control Directory
   Maintenance will appear.

   If this is not the first time this menu has been entered, the full Main Functions menu
   screen will appear. If you **do not** want to change the setup, press < Esc> to exit the
   program and proceed to section 6.

   If this is the first time you are entering this menu, or if you want to change the LAN
   setup, select the option Control Directory Maintenance and press < Enter> .

   The Control Directory Maintenance menu will be displayed.
   Choose Create Control Directory and press < Enter> .

   To create the default control directory C:\LANTASTI.NET, press < Enter> .

   You will return to the Control Directory Maintenance menu. Press < Esc> to return to
   the Main Functions menu.

Choose Individual Account Management and press < Enter> .

You will see a list of the current users.
Press < Ins> and a window will open up, prompting you for a user name.

Type USER and press < Enter> .
When prompted for the user's password, press < Enter> .
When prompted for the user's description, press < Enter> .

When prompted for the number of concurrent logins for this user, type 10 and press < Enter> .

You will return to the list of current users. You can add additional users if desired.

Now press < Esc> to return to the Main Functions screen. Choose the option Shared Resources Management and press < Enter> .

The Shared Resources Management screen will display the path C:\LANTASTI.NET.

Press < Ins> . You will be prompted for a resource name.
Type CIM and press < Enter> .

Next you will be prompted for the server's true path (a true path does not contain virtual directory names). Type C:\CIM and press < Enter> .

This information will be added to the Shared Resources management table.

Press < Esc> to return to the Main Functions menu, then press < Esc> again to exit the program.

6. Remove the diskette from drive A.

7. If you have received a special **ASRS**[2] diskette, insert this diskette into the A: drive of the central CIM computer.

   From the A: prompt, type UPDATE and press < Enter> .

8. Remove the diskette from drive A.

9. Turn off the computer, and then turn it on again.

Central Station Second or Third Computer Program Installation

1. Insert diskette CIM-1 into drive A:

Make sure the DOS prompt is A:

2.   Type: MCIM 2 and press < Enter> .
      All files will be copied to the hard disk.

      To initialize a third central station computer, type: MCIM 3 and press < Enter> .

3.   When installation is completed, remove the diskette from drive A.

4.   Turn off the computer, and then turn it on again.

Station Computer Program Installation

1.   Insert diskette CIM-1 into drive A:
      Make sure the DOS prompt is A:

2.   Type: MCIMS *n* and press < Enter> ,
      where *n* is the number of the station.
      For example, to install the ER CIM software at station 2, type: MCIMS 2

ASRS Station (ASRS^2 Version)

First initialize the station computer as the ASRS station computer. For example, to initialize station 1, type: MCIMS 1 ASRS and press < Enter> .

When intallation is completed, remove the diskette from drive A.

If you have received a special **ASRS^2** diskette, **and** the ASRS station computer is **not** connected to a network, perform the following steps:

• insert the diskette into the A drive

• copy the file ASRSSQR.EXE from diskette to the C:\ASRS directory using the same name

• copy the file ASRSSQR.EXE from the diskette to the directory C:\ASRS using the name ASRS.P

When intallation is completed, remove the CIM-1 diskette from drive A.

CNC Station with Automatic Downloading

To initialize a station computer that will store CNC programs for automatic downloading to a CNC machine, insert diskette CIM-1 into drive A and make sure the DOS prompt is A:> .

Then type: MCIMS *n* CNC and press < Enter> ,where *n* is the number of the station. For example: MCIMS 3 CNC.

Note: If the CNC programs will be downloaded from the central CIM computer over an Ethernet link, do not add the modifier CNC when initializing the CNC station computer.

3.   When installation is completed, remove the diskette from drive A.

4.   Turn off the computer, and then turn it on again.

Additional Installation Procedures – Loading USERn.DNL Files

After computer programs have been installed, you can load previously prepared station programs contained in the USER*n*.DNL files (*n* is a station number).

The following procedures must be executed, in sequence:

1.   At the central CIM computer type: CIM followed by **< Enter>** .

This will log into the H: (CIM) drive.

You will be prompted to enter a name.

```
name:
```

Type USER followed by **< Enter>** .

You will be prompted for a password:

```
password:
```

Do not type anything; simply press **< Enter>** .

The CIM Main Menu will be displayed.

To perform the following step, press F9 to exit the Main Menu. You will receive the DOS prompt H:> .

2.	Type: STATION and press < Enter> .

This will bring you into the directory H:\CIMSYS\ST. This directory contains the sample ER CIM application USERx.SMP files (x = LATHE, MILL or ASSM). Refer to the chapter ''Station Application Programs'' in this manual for further explanation and a listing of these files.

Create the USER*n*.DNL files and save them in the H:\CIMSYS\ST directory. You can use the USERx.SMP files if desired and modify them to suit your needs.

If you are using a SCORBOT–ER VII, SCORBOT–ER IX or SCORA–ER 14 at station *n* you must be sure to copy the robot's unique parameter file PAR#.CBU (where # is 7, 9 or 14) from the ATS diskette for the robot into the directory H:\CIMSYS\ST\n. Be sure that the serial number on the diskette matches that of the robot.

Any time you add a robot to a station, or change the robot used at a station, you must be sure to copy the robot's *unique* parameters to this directory.

3.	To return to the CIM Main Menu, type CIMM.

CNC Program Directories for Automatic Downloading During Production

CNC files that will be downloaded to the CNC machines using AutoCNC must be located in specific downloading directories reserved for this purpose. These directories are generally located on the CNC station(s) computer, but may alternately be located on the central CIM computer if it is connected to the CNC station computer via an Ethernet LAN.

You are advised not to store the CNC programs at both the CNC station PC and the central CIM computer, but if this is done, both versions must be identical.

CNC Station PC

When CNC program files are stored in the CNC station PC, the downloading directory for each machine is defined as follows:

C:\CNC\Ss\Mm

where s is the station number and m is the machine number.

For example, if station 3 contains two CNC machines, the CNC programs will be found in the following locations:

for machine 1

C:\CNC\S3\M1

for machine 2

C:\CNC\S3\M2

Central CIM Computer

When CNC program files are stored in the central CIM computer, the files for each CNC machine must be located in the following directory:

H:\CNC\S$s$\M$m$

where s is the station number and m is the machine number.

Note: To import a CNC program from another location such as a CAD program directory, or diskette, to a downloading directory, use the AutoCNC file handling utility.

Central and Station Controller Program Installation

Using the **Setup Menu** (and its submenus), accessed by pressing F8 in the **CIM Main Menu**, execute the following procedures at the central CIM computer. Refer to the Controller Setup section in Chapter 2, "The CIM Menu" for more information.

1. Access the setup screen and verify that all information is correct. If not, update the screen.

2. Initialize the central CIM controller.

3. Make sure all RS232 cables are connected and that all automatic RS232 switchers are on and free for access from the central computer (no local computer-controller connections are active).

4. Check that the RSNET map represents the configuration of your cell. If not, update the configuration.

5. Initialize the controller at each station.

If a file POINT*n*.CBU exists (this file contains the most recent backup of the positions from the controller's memory), it will be downloaded to the station *n* controller during initialization.

Barcode Scanner Programming Setup

Make sure the barcode scanner's internal programming has been setup as described in the appendix "Preparing the LS 6x20 Barcode Scanner for Operation".

The CIM Menu

The CIM Menu allows direct access and activation of all available CIM software.

```
┌─────────────────────────────────────────────────────────┐
│         ER-CIM - Computer Integrated Manufacturing       │
│         Version 1.72, Copyright (C) 1992 Eshed Robotec    │
│                                                           │
│                                                           │
│                  ┌──── Main menu ────┐                    │
│                  │ CIM definition    F1│                  │
│                  │ Production        F2│                  │
│                  │ ASRS              F3│                  │
│                  │ MRP               F4│                  │
│                  │ Reports           F5│                  │
│                  │ Graphics  menu    F6│                  │
│                  │ Communication menu F7│                 │
│                  │ Setup  menu       F8│                  │
│                  │ Exit              F9│                  │
│                  └───────────────────┘                    │
│                                                           │
├───────────────────────────────────────────────────────────┤
│  ↓/↑    - Pick option                                     │
│  Enter - Activate option                                  │
└─────────────────────────────────────────────────────────┘
```
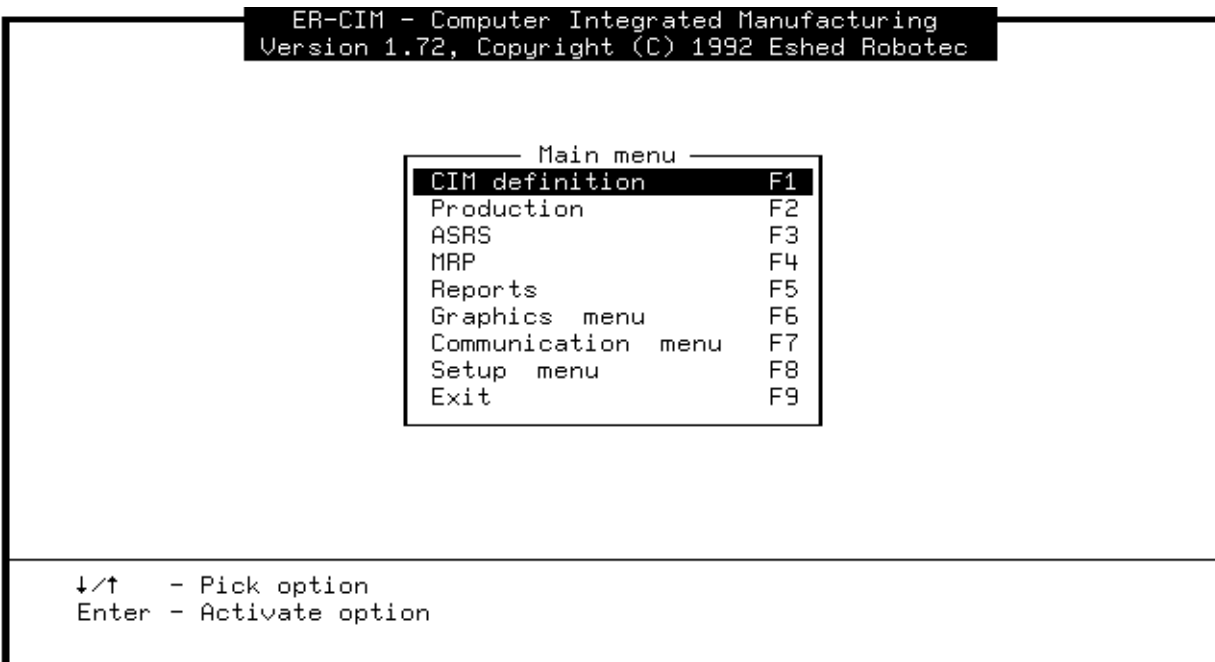
Figure 1: Main CIM Menu Activated from Central CIM Computer

Use the arrow keys to highlight each field and < Enter> to make your selections. Or, simply press the appropriate function key.

If you activate CIM from a secondary central CIM computer or a station computer that is connected to the Ethernet LAN, some options will be displayed within parentheses, and you will *not* be able to select them. This is discussed in the section "Using the CIM Menu at a Secondary Central CIM Computer or a Station Computer".

From the main menu, selecting the following function keys activates the various CIM software modules:

F1 Activates CIMDEF Software.

CIMDEF is used to set up the CIM structure, materials, processes and orders.

F2   Activates PROD Software.

PROD is used to download production orders to the central CIM controller and to activate CIM production.

F3   Activates ASRS Software.

When this option is selected, the software attempts to connect to the ASRS station controller. Following this connection the ASRS Software is loaded. ASRS Software is used as an interface to the ASRS controller.

F4   Activates MRP Software.

MRP Software is used to manage the raw material requirements of the CIM cell.

F5   Activates Reports Software.

Used to monitor the status of the cell during production.

F6   Activates Graphics Menu.

Used to provide an on-line graphic representation of the working CIM cell.

F7   Activates the Communication Menu.

Used to access and connect the various elements within the RS232 communication network.

F8   Activates the Setup Menu.

Used to define the elements at each station, initialize controllers, activate ATS, and perform backup and restore functions

F9   Exit to DOS.

Exit to the DOS environment.

Activating CIM System Programs

Selecting options **F1** through **F5** in the CIM main menu directly accesses the detailed ER CIM programs.

Refer to the User Guide chapters in this manual which describe the CIMDEF, PROD, ASRS and MRP software in detail.

Graphic Tracking Menu

Select **F6** in the Main Menu to activate the Graphics Menu.

```
          ER-CIM - Computer Integrated Manufacturing
           Version 1.72, Copyright (C) 1992 Eshed Robotec




                        ┌─ Graphics menu ─┐
                        │ Tracking     F1 │
                        │ Simulation   F2 │
                        └─────────────────┘










     ↓/↑   - Pick option
     Enter - Activate option
     Esc   - Abort
```

Figure 2: Graphic Tracking/Simulation Menu

The only option currently available is Tracking (F1).

Selecting F1 will activate the CIM On-Line Graphic Tracking Software. This provides a graphic representation of the working CIM cell, and also gives you on-line report options.

For more details, refer to the CIM Graphic Tracking Software chapter in this manual.

Communication Menu

Select **F7** in the Main Menu to activate the RS232 Communications Menu.

This menu is used for access to the various elements which are located on the RS232 network. The RSNET software can be activated for user initiated RS232 connections to the required stations, or alternately, the software performs the connection automatically and then loads ATS for user communication.

```
       ER-CIM - Computer Integrated Manufacturing
       Version 1.8,  Copyright (C) 1992 Eshed Robotec




                    Communication menu
          RSNET                               F1
          Activate ATS to central controller  F2
          Activate ATS to ASRS controller     F3
          Activate ATS to station controller  F4
          Activate ATS                        F5
          AUTOCNC                             F6
          RSDNL                               F7
          External user defined program  (1) F8
          External user defined program  (2) F9



    ↓/↑   - Select option
    Enter - Activate option
    Esc   - Abort
```

Figure 3: RS232 Communications Menu

The Communication Menu offers you a number of options:

F1   Activates RSNET Software.

        Refer to the RSNET Software User's Guide chapter.

F2   Activates ATS to the central CIM management controller.

F3   Activates ATS to the ASRS station controller: attempts to connect the central CIM computer to the ASRS controller and then load ATS for direct user communication.

F4   Activates ATS to a specific station controller: attempts to connect the central computer to the specified station controller and then load ATS for direct user communication.

A Select Station menu will be displayed. Up to six stations can be selected, depending upon the number of stations defined in the Setup menu (Station Controller Setup).

```
┌─────────────── Communication menu ───────────────┐
│ RSNET                                      F1     │
│ Activate ATS to central controller         F2     │
│ Activate ATS to ASRS controller            F3     │
│ Activate ATS to station controller         F4     │
│ Activate ATS              ┌─── Select station ───┐│
│ AUTOCNC                   │ Station 1        F1  ││
│ RSDNL                     │ Station 2        F2  ││
│ External user defined program (1) │ Station 3    F3  ││
│ External user defined program (2) │ Station 4    F4  ││
└───────────────────────────┴──────────────────────┘
```
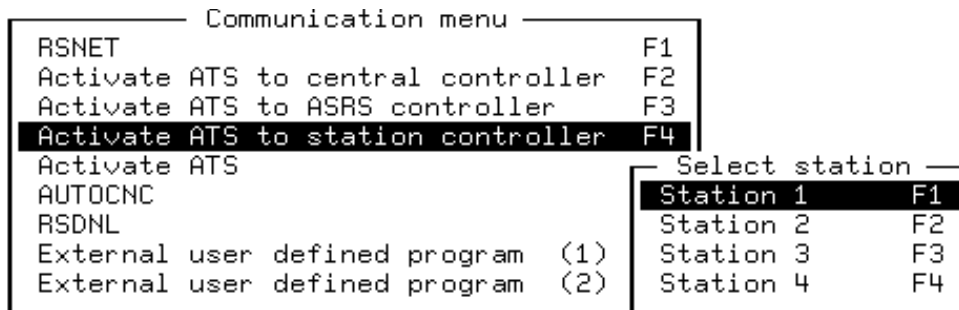
F5   Activates ATS without performing any new network connections. Usually this option will be used for communications with a previously connected station or after the connection path has been selected using RSNET.

F6   Enter the AutoCNC software to activate automatic downloading of CNC programs from a CNC station PC, or the central CIM computer, to a CNC machine over the switched RS232 network, during production.

F7   Enter the RSDNL software to download a file from a PC to a device such as a switcher or a CNC machine using RS232 communication.

F8,F9   These options are used to activate user-defined programs (such as a CAD/CAM program).

The option activates the user batch files USER1.BAT or USER2.BAT. You must customize these batch files (located in the C:\CIM, or H: directory) to meet your specific needs.

If communication is not properly established, an appropriate message will be displayed.

```
┌─────────────── Communication menu ───────────────┐
│ RSNET                                      F1     │
│ Activate ATS to central controller         F2     │
│ Activate ATS to ASRS controller            F3     │
│         ┌──────────── Error ────────────┐  station │
│ Switcher not responding, check if switcher is ON  │
│         └───────────────────────────────┘  1    F1 │
│ RSDNL    ┌── How to continue? ──┐   Station 2    F2 │
│ Extern   │        Retry         │(1) Station 3    F3 │
│ Extern   │        Abort         │(2) Station 4    F4 │
│          │        Ignore        │                   │
│          └──────────────────────┘                   │
└──────────────────────────────────────────────────┘
```
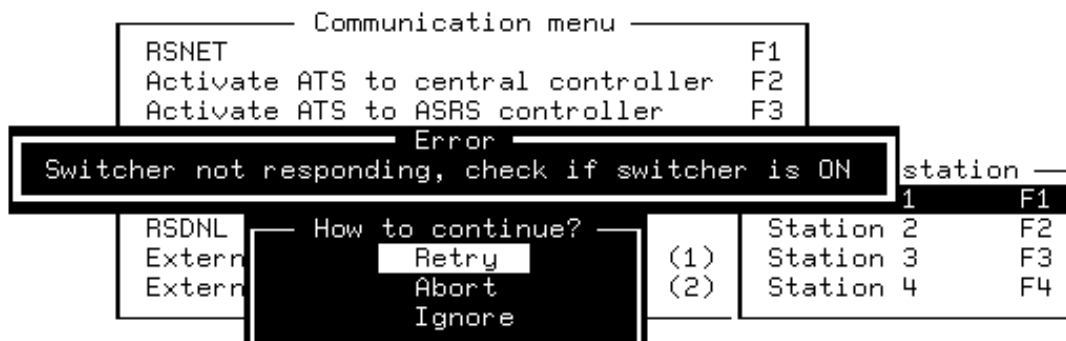
Controller Setup

Select **F8** in the Main Menu to activate the Setup Menu.

This menu is used for initializing the CIM-ACL controller and for performing the backup and restore operations on one or all the controllers in the CIM system.

When this menu is activated, you are presented with two options:

F1   for central CIM controller operations;

F2   for station controller operations.

```
        ER-CIM - Computer Integrated Manufacturing
        Version 1.72, Copyright (C) 1992 Eshed Robotec




                        ┌──── Setup menu ────┐
                        │ Central controller  F1 │
                        │ Station controllers F2 │
                        └────────────────────┘








    ↓/↑    - Pick option
    Enter - Activate option
    Esc    - Abort
```
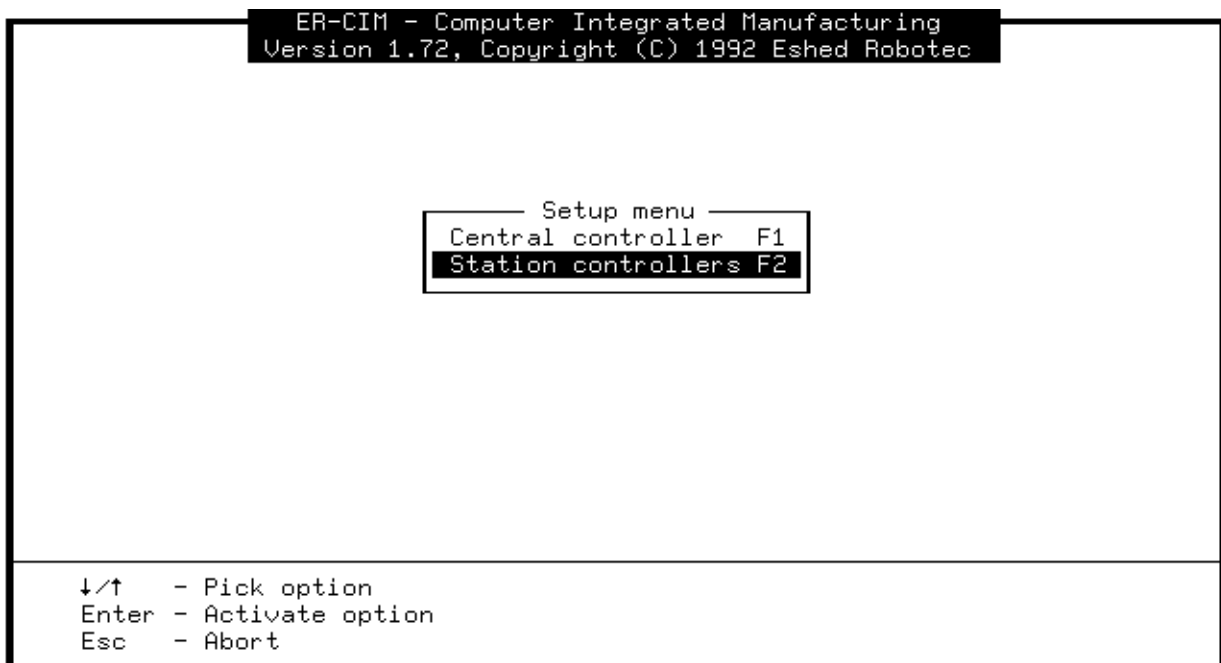
Figure 4: Setup Menu

Central CIM Controller Initialization

Select F1 in the Setup Menu to setup the central CIM controller. You will be presented with three options:

```
        ┌─ Central controller setup ─┐
        │ Activate ATS            F1 │
        │ Initialize controller   F2 │
        │ Update setup            F3 │
        └────────────────────────────┘
```
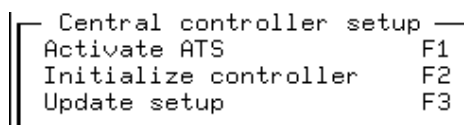
F1 activates ATS to the central CIM controller.

F2 initializes the central CIM controller.

> This option performs the proper configuration for the central CIM controller and then downloads all CIM-ACL system programs to the controller.

> This procedure can take up to 30 minutes. You will see the programs scroll on the screen as they are downloaded.

F3 updates the central controller's setup information.

> This option makes sure the information in the central CIM controller matches the current station setup information. Use this option after making changes to the station setup definitions, but before initializing the controllers.

Station Setup Definitions

Select F2 in the Setup Menu to display the menu for initialization, backup/restore operations and program editing for the station controllers.


```
        ER-CIM - Computer Integrated Manufacturing
        Version 1.72, Copyright (C) 1992 Eshed Robotec




               ─ Station controllers setup ─
              Station setup definitions    F1
              Initialize controllers       F2
              Activate ATS                 F3
              Backup controllers           F4
              Restore controllers          F5
              Backup controller points     F6
              Restore controller points    F7
              Editing station program      F8



  ↓/↑   - Pick option
  Enter - Activate option
  Esc   - Abort
```
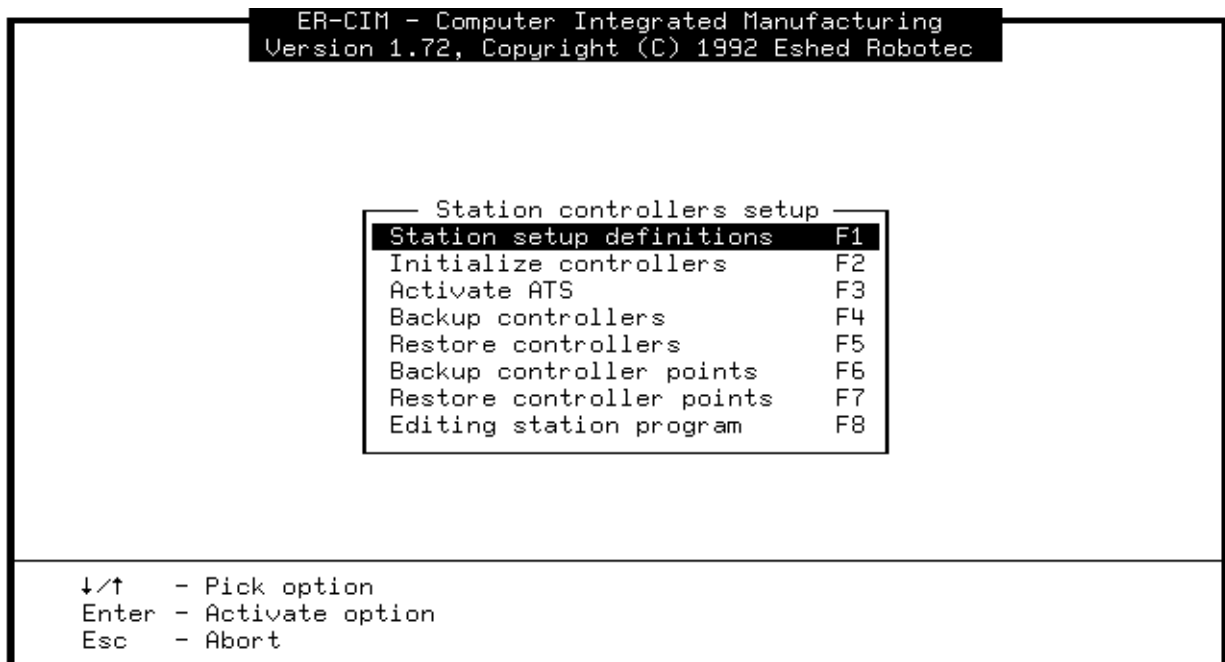
Figure 5: Station Controllers Setup Menu

When this menu is accessed from the central CIM computer, you will be prompted for the station at which to activate the option (with the exception of the first option, Station setup definitions). When this menu is accessed from a station computer, all options will operate on the station controller.

F1 activates the program INITST for station definition.

The following screen will be displayed and will allow you to define the robots and peripheral equipment at each station.

```
══════════════════════ CIM Setup Definition ═══════════════════
 Number of stations (1 - 8) : 4        ASRS station number : 1
 Number of pallets : 8                 ASRS type :carousel/compact/square
 Conveyor cycle (in 1/100 sec.): 6400
 ┌──────────────────────────────┬────┬────┬────┬────┬────┬────┬────┬────┐
 │ Station #                    │  1 │  2 │  3 │  4 │    │    │    │    │
 │ Station location             │  1 │  8 │ 17 │ 24 │    │    │    │    │
 │ Robot type                   │  7 │  7 │  7 │  7 │    │    │    │    │
 │ Number of peripherals        │  2 │  2 │  2 │  2 │    │    │    │    │
 │ Number of machines           │  0 │  1 │  1 │  0 │    │    │    │    │
 │ Robot on slidebase           │ NO │ NO │ NO │ NO │    │    │    │    │
 │ Using SCORBASE               │ NO │ NO │ NO │ NO │    │    │    │    │
 │ Speed controlled conv.       │ ---│ ---│ ---│ ---│    │    │    │    │
 └──────────────────────────────┴────┴────┴────┴────┴────┴────┴────┴────┘
 ══════════════════════════ Station Setup ══════════════════════
                                                      │ buffers │
 Station # : 2                                        │         │
 Location (1 - 32) :    8                  _____│         │
 Robot type : 5 / 5+ / 7        machine 1  │    2     │
 Number of peripherals: 0 / 1 / 2 / 3 / 4 / 5
 Number of machines : 0 / 1 / 2 / 3 / 4
 Is the robot located on slidebase : NO / YES
 Using SCORBASE : NO / YES

  <F1> - Previous station,   <F2> - Next station,   <ESC> - Update and exit
```

Figure 6: CIM Station Setup Screen

This definition is used later for selecting the proper configuration and CIM-ACL system files that will be downloaded when the station controller initialization is performed.

This stage must be performed before initialization of the station controllers is carried out. If this setup is not first performed, you will not be able to access any other options in this submenu.

Make sure you modify this setup whenever the robots or equipment used in the cell are changed. You must then reinitialize the central CIM controller, and all station controllers affected by the change.

The top two rows ask you to define the number of stations, the ASRS location, the number of pallets, the ASRS type (carousel, compact or square) and the conveyor cycle (the amount of time required for the conveyor to make a complete circuit of the cell, in hundredths of a second).

Next you must define the specific characteristics of each station. The definition is performed for each station on the bottom half of the screen while the top half continually displays the station definitions. Use the arrow keys to move within the screen.

The information you must supply includes the location of the station on the graphic tracking representation of the conveyor. The conveyor is divided into 32 sectors. The first station is generally located at sector 1.

Other fields include the number of peripherals and the number of machines.

Up to five controller axes (depending on the number of driver cards installed in the controller) may be connected to peripheral devices such as a linear slidebase or an ASRS carousel. The field "Number of peripherals" gives the number of available axes.

A machine is a station device that actively performs a production activity and is not connected to the ACL controller. Examples of machines include CNC machines and machine vision units. The ASRS carousel is not a machine in this sense, since it is connected to an axis of the ACL controller.

Each machine generally requires two buffers. The table on the right side of the screen lists the number of buffers per machine at each station.

Once you have entered definitions, they are saved in a file SETUP.CIM in the CIMSYS\ST\ directory. Once the SETUP.CIM file has been created, all available options in the Station Controller Setup menu will be active.

F2   initializes specified or all station controllers with CIM-ACL system programming.

    Performs the proper configuration for all or selected controllers and downloads the proper CIM-ACL programs. Programs scroll on the screen as they are downloaded.

    In addition to ACL system programs, the specific user programs for the selected stations are also downloaded during station controller initialization.

    These programs are taken from the filer USERn.DNL, where n is the station number. Refer to the chapter, "CIM-ACL Station Programs."

F3   activates ATS at a selected station.

Backup/Restore of Station Controllers

F4 through F7   perform backup and restore operations to station controllers and are used to save to disk(ette) the contents of all station controllers.

    Use this option to backup all CIM cell applications at the end of a working session.

    The backup files are located in the H:\CIMSYS\ST directory. The contents of a controller are saved in a file called STATIONn.CBU, where n is the station number. When only positions are backed up, they are saved in a file called POINTSn.CBU.

The backup/restore procedure can take up to 15 minutes per station. During the procedure, you will see the asterisk moving across the bottom of the screen.

If a station controller is re-initialized after a backup of positions has been performed, the positions stored in the backup will be restored to the controller.

```
┌── Station controllers setup ──┐
│ Station setup definitions    F1 │
│ Initialize controllers       F2 │
│ Activate ATS                 F3 │
│ Backup controllers           F4 │
│ Restore controllers          F5 ┌── Select station ──┐
│ Backup controller points     F6 │ Station 1      F1 │
│ Restore controller points    F7 │ Station 2      F2 │
│ Editing station program      F8 │ Station 3      F3 │
└─────────────────────────────────┘ Station 4      F4 │
                                   │ All stations  F10 │
                                   └───────────────────┘
```

F4   Performs backup of entire contents of selected or all station controllers.
F5   Restores entire contents of selected or all station controllers.
F6   Performs backup of positions only at selected or all controllers.
F7   Restores positions only at selected or all controllers.

You can select one specific station, or all stations.

F8   Edit the file USER*n*.DNL for the selected station.

This file contains all of the user ACL programs for station *n*. These programs are described in the chapter "ACL CIM Application Programs and Positions". You will **not** be able to access the ASRS station programs using this option.

If you are using DOS5, you will access the file through the regular DOS editor. Otherwise, you will enter the editor defined in the batch file EDIT.BAT in the root directory of H:\.

Once you have finished editing the USER*n*.DNL file, you must reinitialize controller *n*.

Using the CIM Menu at a Secondary Central CIM Computer or a Station Computer

When the command CIM is entered at the secondary central CIM computer, or at a station computer connected to the Ethernet LAN, the system loads the net drivers and prompts you for your user name and password. Once the computer has been booted, you will receive the DOS prompt, C:\> .

Type CIM followed by **< Enter>** .

You will be prompted to enter a name.

```
name:
```

Type USER followed by **< Enter>** .

You will be prompted for a password:

```
password:
```

Do not type anything; simply press **< Enter>** .

Next the main CIM menu will appear on the screen. Figure 7 gives an example of how the main CIM menu may appear.

```
          ER-CIM - Computer Integrated Manufacturing
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                        ┌──── Main menu ────┐
                        │ CIM definition   F1 │
                        │ (Production      F2) │
                        │ (ASRS            F3) │
                        │ MRP              F4 │
                        │ Reports          F5 │
                        │ Graphics  menu   F6 │
                        │ Communication  menu  F7 │
                        │ Setup  menu      F8 │
                        │ Exit             F9 │
                        └────────────────────┘




     ↓/↑   - Pick option
     Enter - Activate option
```
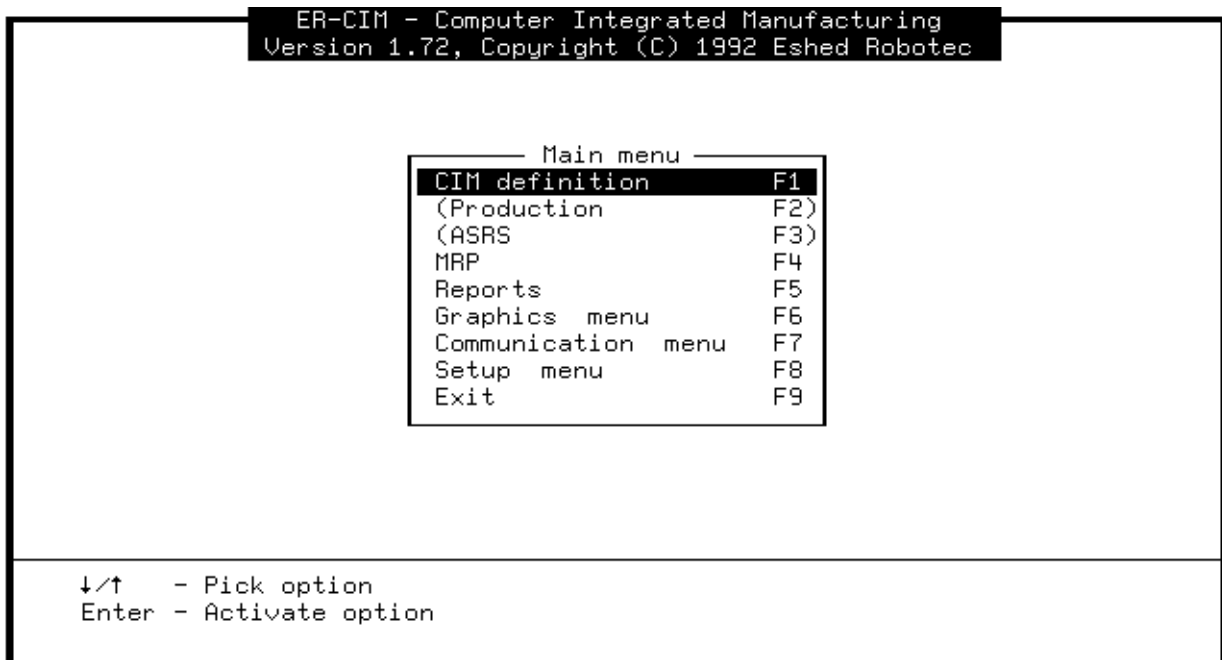
Figure 7. The CIM Menu Activated from a Station (other than the ASRS).

As can be seen, the Production and ASRS options are enclosed by parentheses and cannot be activated from this station.

The options available at the secondary CIM computer are same as those available from the central CIM computer, with the exception of those options that use the central CIM controller. Options that are not available are enclosed in parentheses.

The ASRS option is available at both the ASRS station and the secondary CIM computer. The Production option, however, is only available at the central CIM computer.

Options that are activated from a station access the station controller and not the central CIM controller. For example, choosing the Activate ATS to Station from the Communication menu will activate ATS at the station controller. You will not be given a choice of stations at which to activate the program.

```
         ER-CIM - Computer Integrated Manufacturing
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                   ┌──────── Communication menu ────────┐
                   │ RSNET                           F1 │
                   │ (Activate ATS to central controller F2)│
                   │ (Activate ATS to ASRS controller   F3)│
                   │ Activate ATS to station controller F4 │
                   │ Activate ATS                    F5 │
                   │ AUTOCNC                         F6 │
                   │ RSDNL                           F7 │
                   │ External user defined program (1) F8 │
                   │ External user defined program (2) F9 │
                   └────────────────────────────────────┘



  ↓/↑   - Pick option
  Enter - Activate option
  Esc   - Abort
```

Figure 8 gives an example of the communication menu when activated from a station.

Figure 8. The Communication Menu Activated from a Station (other than the ASRS).

DOS Commands for Activating System Programs

The CIM Main Menu is usually sufficient for accessing and activating all CIM programs. However, if you wish to directly activate various options from the DOS prompt, following is a list of the available commands.

These DOS commands can be entered only after you have exited to the DOS prompt H: by pressing F9 from the CIM Main Menu.

CIMM
Activates the CIM Main Menu.

RSNET
Activates the RS232 Network Management software.

Can be activated from any computer in the CIM system.

At central CIM management computer, the screen will display the entire CIM communication network.

At station computer, the screen will only display the communication configuration for the station.

ATS
From central CIM management computer, activates the Advance Terminal Software (ATS) at the central CIM controller.

From central CIM secondary computer, activates ATS at the station controller currently connected by RSNET.

From station computer, activates ATS at that station's controller.

ATSST
From central CIM secondary computer, activates ATS at the station controller currently connected by RSNET.

WIZ
Activates the Graphic Tracking software (WIZCON).

Can only be activated at the central CIM management computer.

CIMDEF
Activates the software for defining the CIM system elements (machines, equipment, materials), production sequences, etc.

PROD
Used for selecting and downloading production orders to the main controller and activating the manufacturing process.

Can only be activated at the central CIM management computer.

ASRS	Activates the ASRS (automatic storage and retrieval system) software.
	Can be activated at the central CIM management computer and at the ASRS station computer.
DOWNLOAD	Downloads ACL Off-Line programs to the various controllers.
SEND	Sends a command to an ACL controller.
CENTER	Enters the directory containing the programs for initializing the main controller.

	DNL	Initializes the central CIM controller and loads system programs.
		Can only be activated at the central CIM management computer.

REPORT	Activate the REPORT software for a complete on-line display of the production status of all the CIM elements.
STATION	Enters the directory containing the programs for initializing the station controllers.

	INITST	Defines the types of robots and peripheral equipment at each station.
	DNLST	Loads system programs to station controllers.
	BACKST	Performs backup of entire contents of station controller.
	BACKSTP	Performs backup of station controller positions only.
	RESTST	Restores entire contents of station controller.
	RESTSTP	Restores station controller positions only.

Refer to the chapter, "CIM-ACL System Program Management," for additional descriptions of these commands.

Disk Structure for ER CIM System

```
H:\  ── ROBOT ────────
                      └─ ACL ──────────
                                       ├─ ATS Program
                                       ├─ DOWNLOAD Program
                                       ├─ SEND Program
                                       └─ Standard Parameters
     ├─ CIMSYS ────────
                       ├─ CIMP – CIM Menu
                       ├─ CENTER ───────
                       │                ├─ Main Controller ACL-CIM Programs
                       │                └─ DNL Program
                       └─ ST ───────────
                                        ├─ Station Controller ACL-CIM Programs
                                        ├─ INITST Program
                                        ├─ DNLST Program
                                        ├─ BACKST Program
                                        ├─ BACKSTP Program
                                        ├─ RESTST Program
                                        └─ RESTP Program

                                        ├─ 1 ─────────
                                        ├─ .          ├─ (PAR7.CBU)
                                        ├─ .
                                        └─ 6 ─────────
                                                       └─ (PAR7.CBU)
     └─ CNC ──────────
                      ├─ RSDNL Program
                      ├─ RSDNL Data files
                      ├─ AutoCNC Program

                      ├─ S1 ──────────
                      │               ├─ M1 ─────────
                      │               │              └─ CNC Programs (G-code)
                      ├─ .            └─ M2 ─────────
                      │                              └─ CNC Programs (G-code)
                      └─ S6 ──────────
                                      ├─ M1 ─────────
                                      │              └─ CNC Programs (G-code)
                                      └─ M2 ─────────
                                                     └─ CNC Programs (G-code)
```

– REPORT

　　　　　　– REPORT Program
　　　　　　– REPORT Configuration Files

– RSNET

　　　　　　– RSNET Program
　　　　　　– RSNET Configuration files

– RSNET1

　　　　　　– RSNET Configuration files for station 1

– .
– .
– .

– RSNET6

　　　　　　– RSNET Configuration files for station 6

– WIZCON

　　　　　　– WIZCON Program (Graphic Display)
　　　　　　– WIZCON Working Data Files

　　　　　　– Data

　　　　　　　　　　– WIZCON Data Files

　　　　　　– OV

　　　　　　　　　　– Layout Data for Oval Conveyors

　　　　　　– SQ

　　　　　　　　　　– Layout Data for Square Conveyors

– CIMDEF

　　　　　　– CIMDEF Program
　　　　　　– PROD Program
　　　　　　– MRP Program
　　　　　　– CIMDEF Data Files

– ASRS

　　　　　　– ASRS Program
　　　　　　– Data Files

– PLC

　　　　　　– PLC Program

– Batch files for program activation

H: is a virtual disk name which refers to the physical C:\CIM directory in the central CIM computer.

CIMDEF Software User's Guide

Introduction

The CIMDEF software is used to set up the CIM structure, materials, processes and orders. The program allows the user to define the actual process which will take place during production. CIMDEF's simple, user-interface makes it easy for the user to quickly learn to operate the software.

Stations and Machines

A station is a location around the CIM conveyor where specific activities take place. The ASRS (Automatic Storage and Retrieval System) station stores and retrieves parts used in the manufacturing process. A machining station may contain CNC (Computer Numerically Controlled) machines for processing parts. A quality control station (QC) may utilize a vision system. Machines are grouped at stations (together with the robots) to perform the tasks required at each station. CIMDEF lets you define the stations in your CIM environment and the machines which operate at these stations.

Processes and Subprocesses

A process is the sequence of actions a material follows in the CIM environment. Each process consists of one or more subprocesses. Each subprocess defines exactly where the material should be at a specific stage (that is, at which station and at which machine (if any) in that station) and what is to be done at that location (for example, the task the machine should perform).

Materials

Materials, or parts, are the entities which move between stations and machines according to a predefined path, or process. The CIM system recognizes three types of materials:

Raw Material: A material which will be processed.
Processed Material: A material which results from the processing of a material.
Assembly: A part which is assembled from processed materials.

Orders

Orders instruct the CIM system which and how many parts to produce. During the production stage orders are selected and downloaded to the central CIM controller. Refer to the PROD software User's Guide chapter for more details.

Activating the CIMDEF Program

Getting Started

To run CIMDEF, select the CIM Definition Menu (F1) from the CIM Main Menu.

Alternately, type CIMDEF followed by < Enter> at the DOS prompt on all computers logged in on the CIM ETHERNET LAN. The first screen displayed is the main menu:

```
                  CIMDEF - CIM cell definition
            Version 1.50, Copyright (C) 1990 Eshed Robotec




                           ── Main menu ──
                  Station definition            F1
                  Process definition            F2
                  Material/assembly definition  F3
                  Order entry                   F4
                  File manager                  F5
                  Exit                          F9




    ↓/↑   - Pick option
    Enter - Activate option
```
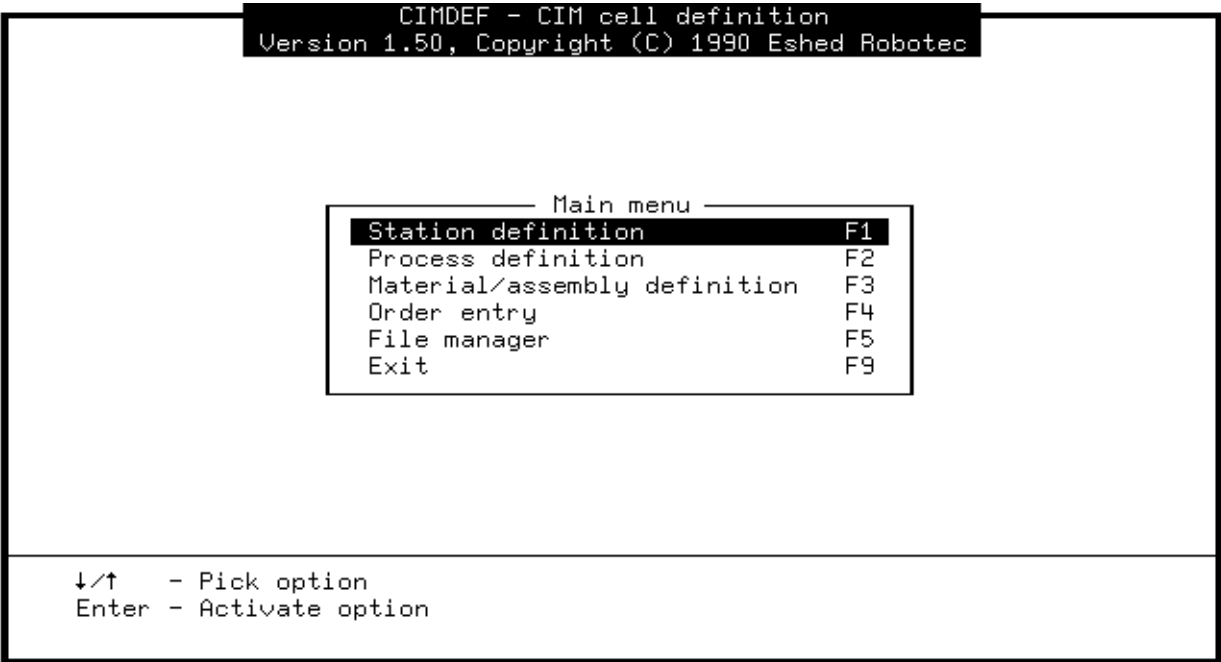
Figure 1: CIMDEF Main Menu

A number of options are available. To activate any of the following screens, press the corresponding function key, or use the up and down arrow keys followed by < Enter> :

Station definition: Define stations and machines.

Process definition: Define processes and subprocesses.

Material/Assembly definition: Define materials.

Order entry: Enter orders.

File manager: Define the CIMDEF file names.

Exit: Exit the program.

Common Features

Some functions are used by several options. The Report and Save functions are used in Station, Process and Material/Assembly definition and in Order entry. The Select and Delete functions are used in Process and Material/Assembly definition and in Order entry.

Report

The Report function lets you receive information on a range of objects. For example, you can get a report of all the processes defined. Activate this option by pressing F5 where available (at bottom of screen). The following window will then appear:

```
┌── Type of report ──┐
│      Partial       │
│       Full         │
└────────────────────┘
```
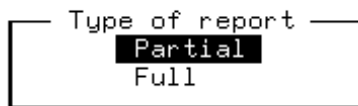
Figure 2: Type of report Window

Two types of reports are possible:

Partial: A report of a range of objects. You are prompted to define the requested range. For example, a report of processes 4 to 15.

```
┌── Type of report ──┐
│      Partial       │
│       Full         │
├── Enter process range ──┤
│  From: ___4 To: 15__    │
└─────────────────────────┘
```
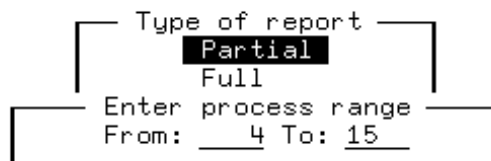
Figure 3: Range of report Window

Full: A report of all the objects defined. For example, a station report gives a report of all the stations defined.

After selecting the type of report, select where to direct the report.

```
 ┌─ Report destination ─┐
 │        Screen        │
 │        Printer       │
 │        File          │
 └──────────────────────┘
```
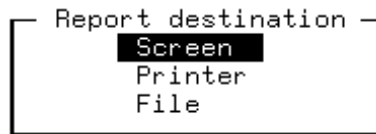
Figure 4: Report destination Window

Three options are possible:

Screen: The report is sent to the monitor. This allows the user to scroll
                   through the report.

Printer: The report is sent to a printer. Make sure a printer is connected and
                   ready.

File: The report is sent to a file. You are prompted for a report file name.
                   The extension .REP will automatically be added to the name. For
                   example, if you enter XX, the actual report file name will be
                   XX.REP.

```
           ┌─ Report destination ─┐
           │        Screen        │
           │        Printer       │
           │        File          │
 ┌─ Enter file name (without extension) ─┐
 │              process                  │
 └───────────────────────────────────────┘
```

Figure 5: Report file name Window

Save

To keep the changes you have made after defining or modifying a station, process,
material or order, and before exiting the screen, use the Save option. This will save your
changes to disk. Press F3 when in the Station definition screen and F2 when in all
others. Note that you are always prompted to save your changes.

```
 ╔════════ Verify ════════╗
 ║ Part not saved. Save? (y/n) ║
 ╚════════════════════════╝
```

Figure 6: Save before exit verification Window

Select

Each process, material and order has a unique identification number. To define, modify or view a specific object, select it by typing the object's ID number and pressing < Enter> when you first enter the Process, Material/Assembly or Order screens. If you have already selected an object and want to select a different one, pressing F1 will usually let you enter another object's ID number.

Delete

To cancel a process, material or order previously selected, press F3 when the Delete function is available (displayed at the bottom of screen). This will delete from disk the file describing the selected object. (Note that deleting unnecessary files frees disk space.)

Station Definition

The Station Definition menu lets you define, view or modify definitions of stations and machines working at each station. The stations are numbered from 1 to 8; that is, up to eight stations can be defined. To define or view station information, use the F1 and F2 keys to reach the desired station number. After you have selected a station you can view or modify its definition.

```
┌──────────────────────■ Station definition ■──────────────────────┐
│                                                                   │
│   Station #    :   2                                              │
│                                                                   │
│   Station name :Machining station                                 │
│                                                                   │
│   Number of machines at station :    1                            │
│                                                                   │
├───────────────────────────────────────────────────────────────────┤
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
├───────────────────────────────────────────────────────────────────┤
│   F1  - Previous station        F4  - Machine definition          │
│   F2  - Next    station         F5  - Report                      │
│   F3  - Save to disk            Esc - Previous menu                │
└───────────────────────────────────────────────────────────────────┘
```

Figure 7: Station definition Screen

The information displayed at the top of the Station definition screen is:

Station #:   The number of the current station.

Station name: The name of the station.

Number of machines at station:

          Define how many machines are functioning at that station. Up to 10 machines can be defined.

```
┌─────────────────────── Station definition ───────────────────────┐
│                                                                   │
│   Station #    :____                                              │
│                                                                   │
│   Station name :_____                                │
│                                                                   │
│   Number of machines at station :____                             │
│                          ▐ Machine definition ▌                   │
│ ──────────────────────────────────────────────────────────────── │
│   Machine #    :____                                              │
│                                                                   │
│   Machine name :_____                                │
│                                                                   │
│   Type         :Asrs /Feeder /Packer /▐Mill ▌/Lathe /Qc /Other    │
│                                                                   │
│                                                                   │
│   Remarks      :_____        │
│                 _____        │
│                 _____        │
│                                                                   │
├───────────────────────────────────────────────────────────────── │
│  F1  - Previous machine                                           │
│  F2  - Next machine                                               │
│  Esc - Station definition                                         │
└───────────────────────────────────────────────────────────────────┘
```

To define, view or modify the machines at the selected station, press F4. Use the F1 and F2 keys to reach the desired machine number.

Figure 8: Machine definition Screen

The information in the middle of the screen is:

Machine name: The name of the machine.

Type: Define the machine type. Use the right and left arrow keys to choose the type and press < Enter> to confirm selection. The different types are: Asrs, Feeder, Packer, Mill, Lathe, Qc and Other. If you select Other, you will be prompted to enter a name for the Other type.

Remarks: User remarks for this machine.

Process Definition

The Process Definition menu lets you define, view or modify definitions of processes and their subprocesses. Processes are numbered from 1 to 1000; thus, up to 1000 different processes can be defined at a time. (You can define even more processes by

```
┌─────────────────────────[ Processes definition ]─────────────────────────┐
│                                                                           │
│   Process # :    1   Name :Base making           Number of subprocesses :   5 │
│                                                                           │
│   Remarks       :This process is                                          │
│                  used to make a base                                      │
│                  for a lamp.                                              │
│                                                                           │
├───────────────────────────────────────────────────────────────────────────┤
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
├───────────────────────────────────────────────────────────────────────────┤
│   F1  - Select a process          F4  - Subprocess definition             │
│   F2  - Save current process      F5  - Report                            │
│   F3  - Delete current process    Esc - Previous menu                     │
└───────────────────────────────────────────────────────────────────────────┘
```

using other process-definition files; refer to the File Manager section for more details). To define or view a process you must select it (enter its ID number). After you have selected a process you can modify or view its definition.

Figure 9: Process definition Screen

The information displayed at the top of the Process definition screen is:

Process #:   The number of the selected process.

Name: The name of the process.

Number of   Define the number of subprocesses. Up to 100 subprocesses can be
subprocesses: defined.

Remarks: User remarks for this process.

```
┌──────────────────────── Processes definition ────────────────────────┐
│                                                                         │
│   Process # :____    Name :_____   Number of subprocesses :____ │
│                                                                         │
│   Remarks     :_____      │
│               _____      │
│               _____      │
│               _____      │
│  ┌─────────────────────── Subprocess definition ──────────────────────┐ │
│   Subprocess # :____             Subprocess name :_____    │
│                                                                         │
│   Station #    :____             Station name    :_____    │
│                                                                         │
│   Using a machine ? :Yes /No     Machine # :____   name :_____ │
│                                                                         │
│   Task #       :____             Expected processing time :_____ Min. │
│                                                                         │
│   Remarks      :_____     │
│                _____     │
│                _____     │
│                _____     │
│  ├──────────────────────────────────────────────────────────────────── │
│   F1  - Previous subprocess       Shift+F1 - 10 subprocesses back        │
│   F2  - Next     subprocess       Shift+F2 - 10 subprocesses forward     │
│   Esc - Processes definition                                             │
└─────────────────────────────────────────────────────────────────────────┘
```

To define, view or modify the subprocesses of the selected process, press F4. Use the F1 and F2 keys to move one subprocess backward or forward, or the < Shift> + F1 and < Shift> + F2 keys to move ten subprocesses backward or forward.

Figure 10: Subprocess definition Screen

The information displayed in the middle of this screen is:

Subprocess #:   The number of the current subprocess.

Subprocess name: The name of the subprocess.

Station #:   The station at which this subprocess takes place.

Station name: Updated automatically according to the station definition.

Using a machine?: Yes/No:

                          Whether this subprocess uses a machine. Use the left and right arrow keys to select and press < Enter> to confirm your selection.

Machine #:   If using a machine, enter the machine number at that station.

Name: Updated automatically according to the machine definition.

Task #:   The task to be performed in this subprocess.

Expected processing time:
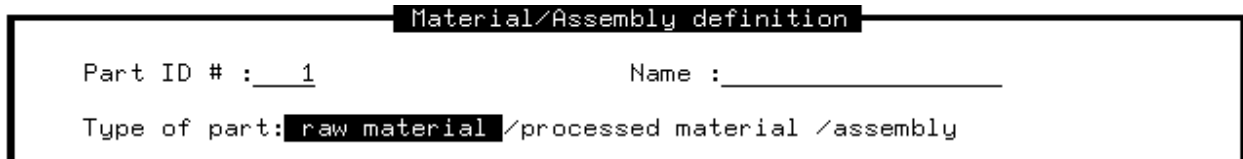
The amount of time you expect the subprocess to take.

Remarks: User remarks for this subprocess.

Material/Assembly Definition

The Material/Assembly Definition menu lets you define, view or modify definitions of materials (parts).

```
┌──────────────■ Material/Assembly definition ■──────────────┐
│                                                            │
│ Part ID # :___1___              Name :_____   │
│                                                            │
│ Type of part:█ raw material █/processed material /assembly │
│                                                            │
└────────────────────────────────────────────────────────────┘
```

Parts are numbered from 1 to 1000; thus up to 1000 different parts can be defined at a time (You can define even more parts by using other parts-definition files; refer to the File Manager section for more details). To define or view a part you must select it (enter its ID number). After you have selected a part you can modify or view its definition.

Figure 11: Material/Assembly definition Screen (top)

The information at the top of this screen is:

Part ID #:   The number of the selected part.

Name: The part name.

Type of part: raw material /processed material /assembly:

                         Select the type of the part.

                                   Raw: A material which will be processed.

                                   Processed: A material which results from the processing of a material.

                                   Assembly: A part which is assembled from processed materials.

                         Use the left and right arrow keys to select and press < Enter> to confirm your selection.

If Raw material is selected, the following fields are displayed:

```
┌────────────────────■ Material/Assembly definition ■────────────────────┐
│                                                                         │
│   Part ID # :____                        Name :_____       │
│                                                                         │
│   Type of part:█ raw material █/processed material /assembly            │
│                                                                         │
│   Source station # :____                 Name :asrs_____         │
│                                                                         │
│                                                                         │
│                                                                         │
│                                                                         │
│                                                                         │
│                                                                         │
│                                                                         │
│   Remarks      :_____        │
│                _____         │
│                _____         │
│                                                                         │
├─────────────────────────────────────────────────────────────────────── │
│   F1 - Select a part             F5 - Report                            │
│   F2 - Save current part         Esc - Previous menu                    │
│   F3 - Delete curent part                                               │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 12: Part definition for raw material Screen

Source station #:   Define the station from which the part is to be taken.

Name: Updated automatically according to the source station definition.

If Processed material is selected, the following fields are displayed:

```
┌────────────────────■ Material/Assembly Definition ■────────────────────┐
│                                                                         │
│   Part ID # :                            Name :                         │
│                                                                         │
│   Type of part: Raw material /█Processed material █/Assembly            │
│                                                                         │
│   Source material ID #    :              Name :                         │
│                                                                         │
│   Manufacturing process # :              Name :                         │
│                                                                         │
│   Target station #        :              Name :                         │
│                                                                         │
│                                                                         │
│                                                                         │
│   Remarks      :_____                 │
│                                                                         │
├─────────────────────────────────────────────────────────────────────── │
│   F1 - Select a part             F5 - Report                            │
│   F2 - Save current part         Esc - Previous menu                    │
│   F3 - Delete current part                                              │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 13: Part definition for processed material Screen

Source material ID #:

> Define the source material (part) number from which the processed part will be manufactured.

Name:

> Updated automatically according to the source material part definition.

Manufacturing process #:

> Specify which process will manufacture this part.

Name:

> Updated automatically according to the manufacturing process definition.

Target station #: The station to which this part is to be taken after it has been processed.

Name: Updated automatically according to the target station definition.

If Assembly is selected, the following fields are displayed:

```
┌──────────────── Material/Assembly definition ────────────────┐
│ Part ID # :____              Name :_____           │
│ Type of part: raw material /processed material /[assembly]    │
│ Number of parts to assemble (0 to 8) :____                    │
│      ┌──────────────┬──────────┬──────────────────────┐       │
│      │  material #  │ quantity │ manufacturing process #│      │
│      │    ____      │   ____   │        ____           │       │
│      │    ____      │   ____   │        ____           │       │
│      └──────────────┴──────────┴──────────────────────┘       │
│                                                               │
│                                                               │
│                                                               │
│  Assembly station # :____        Name :_____       │
│  Target station   # :____        Name :_____       │
│  Remarks         :_____     │
│                   _____     │
│                   _____     │
│                                                               │
│  F1 – Select a part           F5 – Report                     │
│  F2 – Save current part       Esc – Previous menu             │
│  F3 – Delete curent part                                      │
└───────────────────────────────────────────────────────────────┘
```

Figure 14: Part definition for Assembly Screen

Number of parts to assemble (0 to 8):

> The number of (processed) part types used to assemble this part. If you choose a number from 1 to 8, a table of parts will be displayed. This table defines the various parts from which the assembly is to be assembled.

Table of parts:

Material #:
> The number of a raw material to be processed by the manufacturing process for use in the assembly.

Quantity:
> The amount of parts of Material # needed for the assembly.

Manufacturing process:
> The process which the material undergoes before assembly.

Assembly station #:
> The station at which the assembly of the parts will take place.

Name:
> Updated automatically according to the assembly station definition.

Target station #:
> The station to which the part is to be taken after it has been assembled. In the current versions of the CIMDEF and CIM-ACL system programs this station should be the same as the Assembly station.

Name:
> Updated automatically according to the target station definition.

Remarks:
> User remarks for this part.

Order Entry

The Order Entry menu lets you enter, view or modify orders. Orders are numbered from 1 to 1000; thus, up to 1000 different orders can be defined at a time (You can define even more orders by using other order-entry files; refer to the File Manager section for more details). To define or view an order you must select it (enter its ID number). After you have selected an order you can modify or view it.

Each order can contain up to 40 lines; thus, you can specify up to 40 different parts in one order.

```
┌──────────────────────────[ Order entry ]──────────────────────────┐
│                                                                    │
│   Order # :____              Priority :____                        │
│                                                                    │
│   Order date :_____       Delivery date :_____               │
│          ┌─────────┬───────────┬─────────────────┬──────────┐      │
│          │ Line #  │ Part ID # │    Part name    │ Quantity │      │
│          │         │           │                 │          │      │
│          │     1   │      0    │ ─────────────── │     0    │      │
│          │     2   │      0    │ ─────────────── │     0    │      │
│          │     3   │      0    │ ─────────────── │     0    │      │
│          │     4   │      0    │ ─────────────── │     0    │      │
│          │     5   │      0    │ ─────────────── │     0    │      │
│          │     6   │      0    │ ─────────────── │     0    │      │
│          │     7   │      0    │ ─────────────── │     0    │      │
│          │     8   │      0    │ ─────────────── │     0    │      │
│          │     9   │      0    │ ─────────────── │     0    │      │
│          │    10   │      0    │ ─────────────── │     0    │      │
│          └─────────┴───────────┴─────────────────┴──────────┘      │
│                                                                    │
├────────────────────────────────────────────────────────────────────┤
│   F1 - Select an order         F5 - Report                         │
│   F2 - Save current order      PgUp/PgDn - Scroll up/down          │
│   F3 - Delete current order    Esc - Previous menu                 │
└────────────────────────────────────────────────────────────────────┘
```

Figure 15: Order entry Screen

The information displayed in this screen is:

Order #:   The number of the selected order.

Priority: Define the priority of the selected order.

                    The priority is a number between 1 to 10. 1 is the highest priority,
                    10 is the lowest.

                    This field will be used later for the MRP (Material Resource
                    Planning) analysis.

Order date: Date order was entered.

Delivery date: Planned date for order delivery.

                    This field will be used later for the MRP (Material Resource
                    Planning) analysis.

A table is displayed in the middle of the screen. There are 40 lines in one order but you
can view only ten at a time. Use the < PgDn> and < PgUp> keys to scroll the lines up
and down. The information in this table is:

Line #:   The line number in the order .

Part ID #:   The number of the part you want to order.

Part name: Updated automatically according to the Part ID # field.

Quantity: The amount of parts of Part ID # you want to order.

File Manager

The File Manager menu lets you view or modify the names of the files used by CIMDEF.

This facility lets you define different CIM configurations, and save each of them under a different name.

```
┌─────────────────────────┤ File manager ├─────────────────────────┐
│                                                                   │
│                                                                   │
│       CIM application name             : cim                      │
│                                                                   │
│                                                                   │
│       Station definition file          : cim                      │
│                                                                   │
│       Process definition file          : proc1                    │
│                                                                   │
│       Material/assembly definition file : newpart                 │
│                                                                   │
│       Order entry file                 : cim                      │
│                                                                   │
│                                                                   │
│                                                                   │
├───────────────────────────────────────────────────────────────────┤
│                                                                   │
│   Esc - Previous menu                                             │
│                                                                   │
└───────────────────────────────────────────────────────────────────┘
```

Figure 16: File manager Screen

Five names are possible

CIM application name:

> The name of the current CIM application. This name is copied to the next four file names if < Enter> is pressed while the cursor is in this field.

Station definition file:

> The name of the current station definition file.

> CIMDEF adds the extension .STN to this name to form the actual station file name (for example, CIM.STN).

Processes definition file:

> The name of the current processes and subprocesses definition file.

> CIMDEF adds the extension .PRC to this name to form the actual process index definition file name (for example, CIM.PRC).

Material/assembly definition file:

> The name of the current parts definition file.

> CIMDEF adds the extension .PAR to this name to form the actual material/assembly index definition file name (for example, CIM.PAR).

Order entry file:

> The name of the current order definition file.

> CIMDEF adds the extension .ORD to this name to form the actual order entry index file name (for example, CIM.ORD).

Command Line Options

Several options can be set by activating CIMDEF with command line options.

The command line syntax is:

> `CIMDEF [Application_Name] [Date_Switch]`

Application_Name: :   The CIMDEF Application name

Date Switches: `/ad`   American date format (mm-dd-yy)

> `/ed`   European date format (dd-mm-yy)

Examples:

```
CIMDEF CIM_B /ad
```

This will load the CIMDEF software with the configuration files CIM_B and use American format dates.

`CIMDEF ?`   When entered at the DOS prompt, this will give a list of the command line options.

RSNET - Switched RS232 Network Software User's Guide

Introduction

The Switched RS232 Network is used to communicate between

- the Central CIM station computer and any of the CIM elements

- a station computer and a CIM element at that station

Unless otherwise stated, the descriptions in this chapter refer to the first function.

The RSNET software allows the user to activate or deactivate a communication path and to change the communication configuration by adding, deleting or modifying elements.

CIM elements include station/robot controllers, CNC machines, vision systems, computers and other devices.

Accessing the Software

To access the Switched RS232 Network software, select the Communications Menu (F7) from the CIM Main Menu, then select RSNET (F1).

Alternately, type RSNET at the DOS prompt.

You will see the On-Line screen.

The RSNET On-Line Screen

Figure 1 shows the On-Line screen. Single-frame squares represent machine elements (such as a lathe, or controller), while double-frame squares indicate stations (such as quality control). The connecting lines show possible RS232 communication connections between the elements
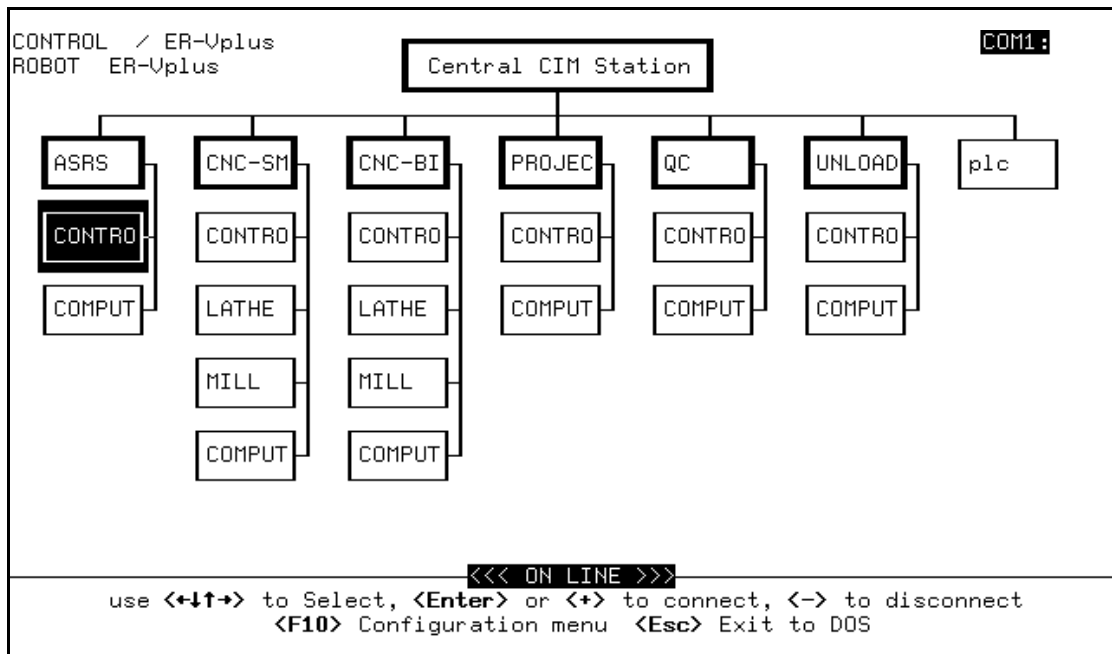
Figure 1: RSNET On-Line Screen

The uppermost central block shows the computer from which the RSNET screen was accessed. If you are working at a CIM station, you will see the name of the station here, and if you are at the Central CIM computer, you will see:

```
Central CIM Station
```

The communication path connects the uppermost central block to the selected (highlighted) block (the ASRS controller in Figure 1). It is indicated by a double line (or a violet line on color monitors). The name and alternate name of the selected block appear in the upper left corner of the screen.

The current communication channel (COM1 or COM2) is shown in the upper right corner of the screen. In this example COM 1 is used. Further explanation may be found in the section on RSNET configuration data files at the end of this chapter.

Activating a Communication Path

To activate a communication path, use the $\rightarrow \leftarrow \uparrow\downarrow$ keys to highlight the element to be connected. The element's name and alternate name will appear in the upper left corner of the screen. To activate the connection, press < Enter> or < + > .

If communication is established, the activated path will be indicated by a double or violet line. If communication is not established, the line will remain unchanged.

To sever the connection with the selected element, press the < -> key .

Pressing < Esc> returns you to the CIM Main Menu (or to DOS, if the software was entered from the DOS shell).

Changing Configuration

The RSNET software can be used to add, delete or modify the stations and machines in the communication configuration. To activate this option, press < F10> from the On-Line screen. The following window appears:

```
Enter CONFIGURATION screen (Y/N)?
```

Pressing Y displays the Configuration screen shown in Figure 2.
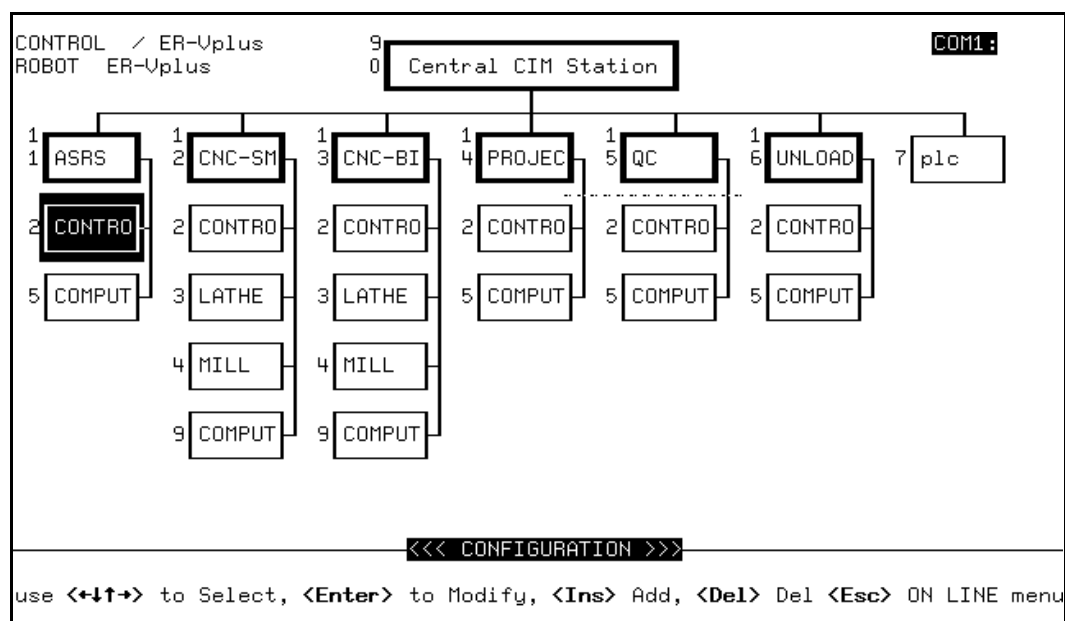
Figure 2: RSNET Configuration Screen

This screen is similar to the On-Line screen with the following differences:

On the left side of each station (the elements enclosed in double squares) there are two numbers. The upper number is the number of the station switcher port connected to the central CIM switcher. The lower number is the station number, which is also the central CIM switcher port to which this station is connected.

For example, in the Configuration screen shown above, port 1 on the project station switcher is connected to port 4 on the Central CIM switcher.

On the left of each machine (the element enclosed in a single square) is a number. This is the switcher port to which the machine is connected.

In the configuration shown in Figure 2, for example, the controller in the project station is connected to port 2 of the station switcher, and the PLC is directly connected to port 7 on the central CIM switcher.

The following keys may be used to make configuration changes. (Make sure the NumLock key is not pressed).

< Ins>   Add machine or station to configuration.

< Del>   Delete machine or station from configuration.

< Enter>   Modify information on an existing element.

Inserting Elements

Note: When inserting an element, there is no need to illuminate the location in the diagram at which you want to place the element. The software will position the element according to its station and port numbers.

Pressing < Ins> from the Configuration screen displays the following window in the upper left corner of the screen:

```
 LEVEL
level 1
level 2
```

An element inserted at Level 1 is connected directly to the element in the upper–most central block, while an element at Level 2 is connected through a station.

To select the desired level, use the ↑↓ keys, followed by < Enter> .

If Level 1 is chosen, the following window appears in the left corner of the screen:

```
Station
Machine
```

Station represents a CIM station connected to the central CIM switcher.

A machine represents an element which is directly connected to the central CIM switcher.

To select an option, use the ↑↓ keys, followed by < Enter> .

Inserting a Station

```
┌──────────── NEW STATION ─────────┐
│                                  │
│ Name       :_____             │
│                                  │
│ Alt. name :_____              │
│                                  │
│ Number of ports : 5 / 9          │
│                                  │
│ Station number:_0                │
│                                  │
│ Description:_____ │
│             _____ │
│                                  │
│ Station port connected to center:_0 │
│                                  │
│ Control character <Ctrl>T        │
│                                  │
│ Delay before disconnect:____0    │
│                                  │
│       <F1> update  <Esc> quit    │
└──────────────────────────────────┘
```

Choosing the Station option displays a station definition window on the Configuration screen, as shown in Figure 3:

Figure 3: Station Definition Window

This is a description of a station. All stations are connected directly to the central CIM network switcher.

The following fields must be entered:

Name :   Name of station - up to 8 letters.

Alt. name :   Alternate station name - up to 8 letters.

                                        If AutoCNC software will be used, be sure to use
                                        the required names as specified in the chapter
                                        AutoCNC Software User's Guide.

Number of ports: 5/9   Switchers may have 5 or 9 communication ports
                                        depending on the number of elements to be
                                        connected. Usually the Central CIM Network
                                        switcher has 9 ports and the station switchers have
                                        5 ports.

Station number: Stations are identified by a number - up to 8
                                        stations allowed. This is also the number of the
                                        Central CIM Network switcher port at which this
                                        station is connected.

Description: Two line description of the station. This text is
                                        displayed in upper left corner of the screen when
                                        this element is selected (highlighted).

Station port   The number of the Station switcher port connected
connected to center   to the Central CIM Network switcher.

Control character < Ctrl> T   This is the factory preset control character for the
                                        RS232switcher. The control character for the
                                        Central CIM Network switcher is ^U, while the
                                        control character for the station switchers is ^T.

Delay before disconnect: 0   This option not currently in use.

The → ← ↑↓ keys are used to move between fields. All changes must be followed by
< Enter> or they will not be saved once you move to the next field.

The following options are available to exit the screen:

< F1>   Saves the new station description, prints DONE on
                                        the screen and returns to the Configuration screen.
                                        The new station will be added to the graphic
                                        display.

< Esc>	Return to the Configuration screen without saving the changes.

When < Esc> is pressed, this message appears on the screen:

```
Quit with no update, are you sure (Y/N)?
```

Pressing Y removes the New Station window from the Configuration screen; pressing N erases the above message.

Inserting a Machine

A machine element is inserted by pressing < Ins> from the Configuration screen. This displays the following window in the upper left corner of the screen:

```
  LEVEL
level 1
level 2
```

To select the level, use the ↑↓ keys and press < Enter> .

If Level 1 is chosen, a Machine definition window will be displayed on the screen, as shown in Figure 4:

```
                NEW MACHINE
  Name       :_____

  Alt. name :_____


  Connected at port :_0

  description:_____
             _____
         <F1> update  <Esc> quit
```

Figure 4: Machine Definition Window (Level 1 connection)

This is a description of a machine which is directly connected to the central CIM network switcher.

The following fields must be entered:

Name :   Name of machine; up to 8 letters may be used.

Alt. name :   Alternate machine name; up to 8 letters may be used.

                                If AutoCNC software will be used, be sure to use the required names as specified in the chapter AutoCNC Software User's Guide.

Connected at port: Number of port on the central CIM network switcher to which machine is connected.

description: Two line description of the machine. This text is displayed in upper left corner of the screen when this element is selected (highlighted).

The → ← ↑↓ keys are used to move between fields. All changes must be followed by < Enter> or they will not be saved once you move to the next field.

The following options are available to exit the window:

< F1>   Save the new station description, print DONE on the screen and return to the Configuration screen. The new machine will be added to the graphic display.

< Esc>   Return to the Configuration screen without saving the changes.

When < Esc> is pressed, the following message is displayed on the screen:

> Quit with no update, are you sure (Y/N)?

Pressing N removes the above message. Pressing Y erases the New Machine window from the Configuration screen.

If Level 2 is chosen (after pressing < Ins> from the Configuration screen), the Machine definition window will be displayed on the screen, as shown in Figure 5:

```
┌─────────────■ NEW MACHINE ■─────────────┐
│                                          │
│  Name      :_____                     │
│                                          │
│  Alt. name :_____                     │
│                                          │
│  Connected at station number :_0         │
│                                          │
│  Connected at port :_0                   │
│                                          │
│  description:_____     │
│                                          │
│              _____     │
│                                          │
│        ■<F1> update  <Esc> quit■         │
└──────────────────────────────────────────┘
```

Figure 5: Machine Definition Window (Level 2 connection)

This is a description of a machine located at one of the stations.

The following fields must be entered:

Name :	Name of machine; up to 8 letters may be used.
Alt. name :	Alternate machine name; up to 8 letters may be used.
	If AutoCNC software will be used, be sure to use the required names as specified in the chapter AutoCNC Software User's Guide.
Connected at station number:	Number of station at which the machine is located.
Connected at port:	Number of port on station switcher to which machine is connected. **Be careful not to use the number of the port connected to the central CIM switcher.**
description:	Two line description of the machine. This text is displayed in upper left corner of the screen when this element is selected (highlighted).

The → ← ↑↓ keys are used to move between fields. All changes must be followed by < Enter> or they will not be saved once you move to the next field.

The following options are available to exit the window:

< F1>   Save the new station description, print DONE on
                               the screen and return to Configuration menu. The
                               new machine will be added to the graphic display.

< Esc>   Return to the Configuration screen without saving
                               the changes.

When < Esc> is pressed, the following message is displayed on the screen:
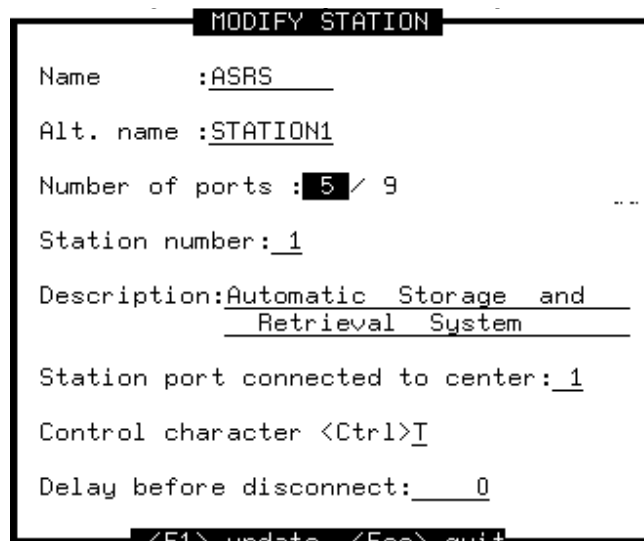
> Quit with no update, are you sure (Y/N)?

Pressing N removes the above message; pressing Y removes the New Machine window
from the Configuration screen.

Modifying an Element

This feature allows you to modify the description of an existing element in the
configuration.

Pressing < Enter> when a station is highlighted on the Configuration Screen (the ASRS
station, for example) displays the Modify Station window shown in Figure 6:

```
╔═════════▌MODIFY STATION▐═════════╗
║                                  ║
║  Name       :ASRS____            ║
║                                  ║
║  Alt. name :STATION1             ║
║                                  ║
║  Number of ports :█5█/ 9         ║
║                                  ║
║  Station number:_1               ║
║                                  ║
║  Description:Automatic  Storage  and___ ║
║               Retrieval  System         ║
║                                  ║
║  Station port connected to center:_1    ║
║                                  ║
║  Control character <Ctrl>T       ║
║                                  ║
║  Delay before disconnect:____0   ║
║                                  ║
╚══════<F1> update  <Esc> quit═════╝
```

Figure 6: Modify Station Window

The → ← ↑↓ keys are used to move between fields. All changes must be followed by
< Enter> or they will not be saved once you move to the next field. Note that you
cannot change the station number from this screen.

Pressing < Enter> when a machine element is highlighted on the Configuration Screen
(the ASRS Controller, for example) displays the window shown in Figure 7:

```
╔════════════MODIFY MACHINE════════════╗
║                                       ║
║  Name       :CONTROL                  ║
║                                       ║
║  Alt. name :ER-Vplus                  ║
║                                       ║
║  Connected at station number : 1      ║
║                                       ║
║  Connected at port : 2                ║
║                                       ║
║  description:ROBOT  ER-Vplus          ║
║                     _____  ║
║                                       ║
╚═══════════<F1> update  <Esc> quit═════╝
```

Figure 7: Modify Machine Window

Again, the → ← ↑↓ keys are used to move between fields. All changes must be
followed by < Enter> or they will not be saved once you move to the next field. Note
that you cannot access the third and fourth fields, since they refer to the network
configuration.

The following options are available to exit the window:

< F1>   Save the updated machine configuration description and print DONE
                     on the screen.

< Esc>   Return to the Configuration screen without saving the changes.

When < Esc> is pressed, the following window appears on the screen:

```
Quit with no update, are you sure (Y/N)?
```

Pressing Y removes the Modify Machine widow from the Configuration screen; pressing
N erases the above message.

Deleting Elements

To remove a machine, use the → ← ↑↓ keys to highlight the machine on the Configuration Screen that you want to delete, then press < Del> . The following message will be displayed on the screen:

```
Remove machine! are you sure (Y/N)?
```

Entering N removes the message; entering Y removes the element and displays the following message on the screen for a few seconds:

```
Done
```

The same procedure may be used to delete a station, however this message will appear:

```
Remove station! are you sure (Y/N)?
```

Entering N removes the message; entering Y removes the element and displays "Done" on the screen for a few seconds.

Warning: You can only delete an empty station (a station that does not contain any machines). If you attempt to delete a station that contains machine(s) by entering Y in response to the above message, the following message will appear on the screen for a few seconds:

```
Station not empty, can't remove
```

If you want to delete a station that contains machine(s), you must first delete all of the machines and then delete the empty station.

Saving Configuration Changes

To return to the On-Line screen from the Configuration screen, press < Esc> .

If you have made changes to the configuration, this message will be displayed on the screen:

```
Save new RS232 configuration (Y/N)
```

Entering N returns you to the On-Line screen without saving the changes; entering Y saves the new configuration and returns you to the On-Line screen.

Using RSNET for Communication within a Station

RSNET may be used to define and modify the communication paths within a station by running the program from the station computer. The communication paths run from the station computer to the station elements, hence the station name should appear in uppermost block in the graphic display.

Machines may be added, deleted or modified, as described previously. All connections will be Level 1 connections between the station switcher and the machine.

Figure 8 shows the On-Line screen when RSNET is run from the computer at a typical CNC station.
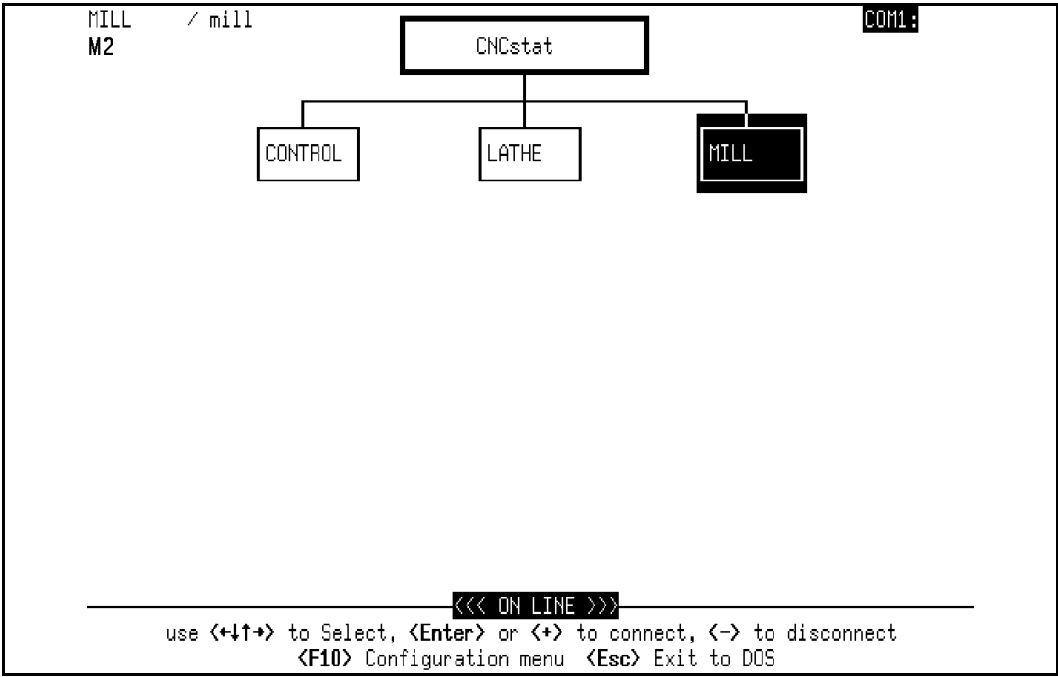
Figure 8: RSNET On-Line Screen for CNC Station

Notice that the uppermost central block contains the CNC station, and the station elements (lathe, mill and controller) are displayed horizontally across the screen. The station computer does not appear in the diagram, since it is implicitly represented by the uppermost central block.

To modify the uppermost central block, highlight this block from the Configuration screen and press < Enter> . The Modify Station window will be displayed on the screen as shown in Figure 9:

```
┌──────────┤ MODIFY STATION ├──────────┐
│                                        │
│   Name      :CNCstat                   │
│                                        │
│   Alt. name :_____                  │
│                                        │
│   Number of ports : 5 / █9█            │
│                                        │
│   Station number:_0                    │
│                                        │
│   Description:_____    │
│              _____     │
│                                        │
│   Station port connected to center:_1  │
│                                        │
│   Control character <Ctrl>T            │
│                                        │
│   Delay before disconnect:____0        │
│                                        │
│      █<F1> update  <Esc> quit█         │
└────────────────────────────────────────┘
```

Figure 9: Modify Station Window (for Upper Block)

This station may be modified in same way as any other station with the following exception. If the station name is not specified, the program will supply the default name CENTRAL CIM STATION.

RSNET Configuration Data Files

The configuration data used by RSNET is contained in the following files:

stations.D1   This file is used when the Central CIM Network switcher is connected to COM1 port on Central CIM station computer.

stations.D2   This file is used when the Central CIM Network switcher is connected to COM2 port on Central CIM station computer.

These files cannot be accessed directly by the user.

The program searches for these files in the following locations, in this order:

• the current directory (from which the RSNET software is run)

• the directory specified by the environment variable RSNET.

• the directory \RSNET

When the desired file is not found in the first location, the program looks in the second location, and so forth until the file is found. If it is not found in the third location a message is printed on the screen.

If the environment variable is set, the software does not search for the \RSNET directory (even if the configuration file has not been found).

By default, the station computers will contain a command similar to:

```
SET RSNET = \RSNET1
```

in their AUTOEXEC.BAT files. This directory will contain the relevant configuration files for communication within each specific station.

Command Line Options

The complete syntax for entering commands from the command line of the DOS shell is:

```
RSNET [station_name] [machine_name] [/Ccom]
```

Any or all of the options within brackets [ ] may be used. If you do not enter any options, you will enter the RSNET graphic display as described in this chapter.

Activating a Communication Path

A communication path can be activated from the command line without invoking the graphic display. To use this option, the station and machine names must be specified, and the path must already exist in the configuration.

The syntax is:

```
RSNET [station_name] [machine_name]
```

The options in brackets are:

station_name   Name of the station to be connected to. The alternate station name may also be used.

machine_name   Name of machine to be connected to.

Note: If the station name is omitted, the connection is made with the first machine of that type that occurs in the configuration (i.e. starting with station 1).

If communication cannot be established, you will receive the following message:

```
Communication error.
```

Defining the Communication Port

The RS232 computer port to which the Central CIM Network switcher is connected is defined from the command line.

The syntax is:

```
RSNET [/Ccom]
```

The options for /Ccom are:

/C1   The COM1 port is used. RSNET will use the configuration data file stations.D1

/C2   The COM2 port is used. RSNET will use the configuration data file stations.D2

Examples:

```
RSNET QC CONTROL
```

Activates a communication path from the Central CIM station to the controller of the QC station. There will not be any graphic display.

This is the equivalent of entering the RSNET On-Line screen, highlighting the CONTROL element at the QC station and pressing < Enter> .

```
RSNET /C2
```

Instructs the program to use computer port COM2 for its communication. RSNET will use configuration data defined for COM2, which is stored in the file STATIONS.D2. COM2 will be displayed in the upper right corner of the On-Line and Configuration screens.

PROD Software User's Guide

Introduction

The PROD software is used to transfer production orders to the central CIM controller and to activate the CIM system. Serving as a production supervisor, PROD provides the following features:

- Creation and modification of orders.

- Downloading of production orders to the central CIM controller.

- Production control.

Orders and Downloading

Orders instruct the CIM system which and how many parts to produce.

Download means transferring data from one computer to another by means of communication. PROD downloads data from the central CIM management computer to the central CIM controller.

When you create an order (using CIMDEF or PROD programs) your order is saved on a file which is stored on your PC disk.

When you want to manufacture the parts listed in an order, you must first download the production data associated with that order to the central CIM controller. Then production of those parts can start. The production data is the information needed by the central CIM controller for the production of that order.

The production data includes information about the type and quantity of parts (order information), the initial and final locations of those parts (material/assembly information), and where and how to process them (process information).

After downloading the production data you can run or stop production. You can also download another order while the previous one is being manufactured. To create the production data, PROD uses definitions stored in CIMDEF files. Refer to the CIMDEF User's Guide chapter for more details.

Activating the PROD Program

Getting Started

The PROD program will usually run at the central CIM management computer. To activate, select the Production Menu (F2) from the CIM Main Menu.

Alternately, type PROD followed by < Enter> at the DOS prompt. The first screen displayed is the main menu.

```
PROD - CIM PRODuction management user interface
    Version 1.30 Copyright (C) 1990 Eshed Robotec




                    ─── Main menu ───
                    Production Setup   F1
                    Order Entry        F2
                    File Manager       F3
                    Exit               F9




    ↓/↑   - Pick option
    Enter - Activate option
```
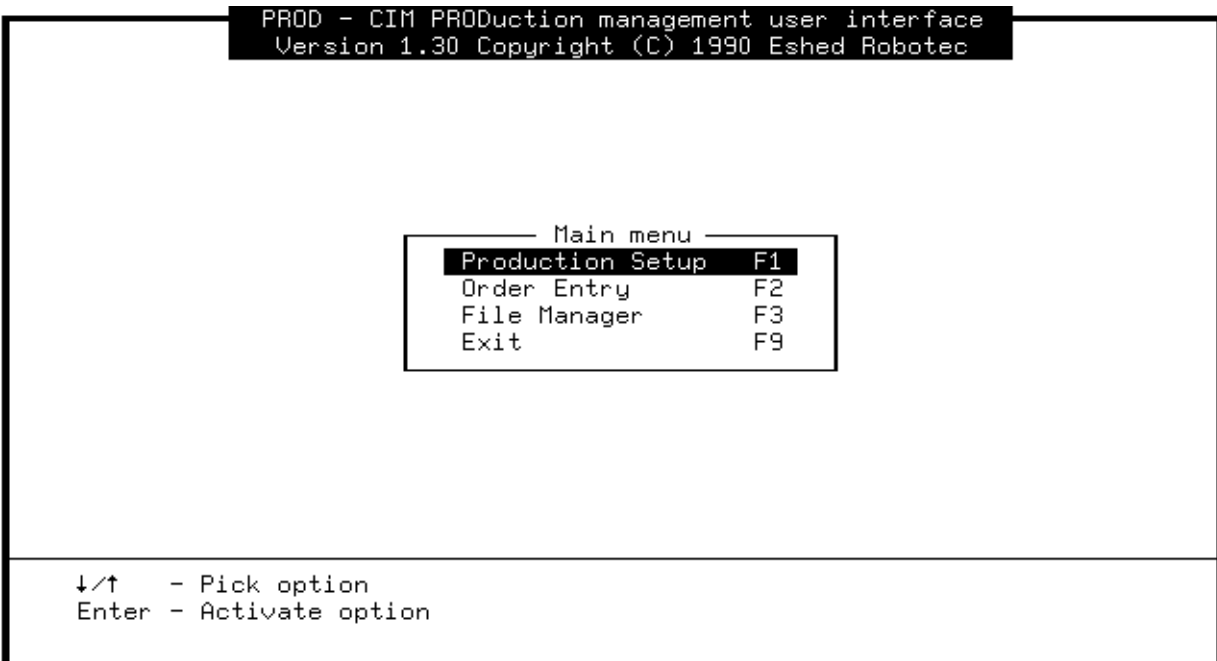
Figure 1: PROD Main Menu

A number of options are available. Press the corresponding function key, or use the arrow keys, to activate any of the following screens:

Production setup: Select and download orders, control production.

Order entry: Enter complete orders.
(Similar to the Order entry module in the CIMDEF program.)

File manager: Define the CIMDEF file names that PROD will use.

Exit: Exit the program.

Production Setup

This menu lets you select an order, download the selected order and start or stop the manufacturing process.

```
┌──────────────────────────── Production Setup ────────────────────────────┐
│                                                                           │
│                                                                           │
│                                                                           │
│                     ┌──── Production Setup menu ────┐                     │
│                     │ Select production order       │                     │
│                     │ Download production data       │                     │
│                     │ CIM production                 │                     │
│                     │ Reset CIM cell                 │                     │
│                     └────────────────────────────────┘                     │
│                                                                           │
│                                                                           │
├───────────────────────────────────────────────────────────────────────────┤
│  ↓/↑   - Pick option                                                      │
│  Enter - Activate option                                                  │
│  Esc   - Abort                                                            │
└───────────────────────────────────────────────────────────────────────────┘
```
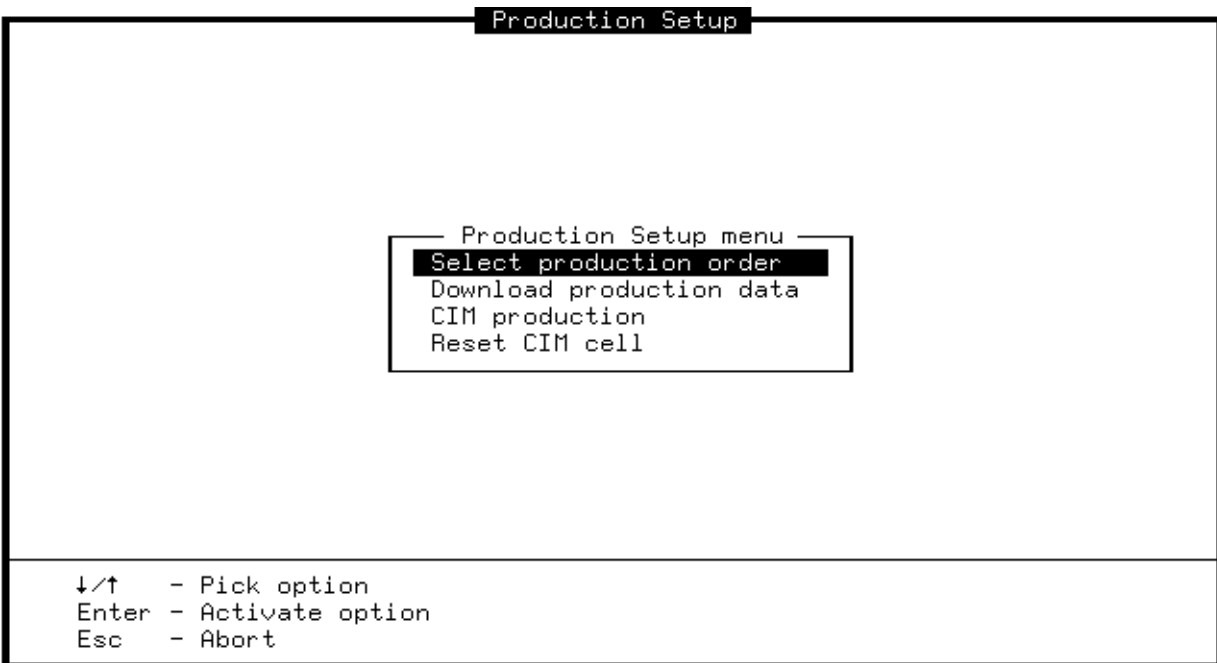
Figure 2: Production Setup Menu

The options in this menu are:

Select Production Order:

        Select the order for downloading.

Download production data:

        Perform the actual download to the central CIM controller.

CIM production: Control the manufacturing of the downloaded order.

Reset CIM Cell: Resets the CIM System.

Use the up and down arrow keys to select the desired option, and press < Enter> .

Select Production Order

This option prompts you to define the type of order you want to select.

```
┌──── Production Setup menu ────┐
│ Select production order       │
│ Dow┌─ Type of order ─┐ta      │
│ CIM│   Previous      │        │
│ Res│   Immediate     │        │
└────┴─────────────────┴────────┘
```
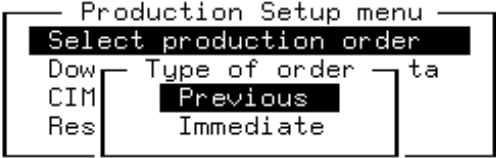
Figure 3: Type of order Window

There are two types of orders:

Previous: This is an order previously defined in the Order Entry option of the CIMDEF or PROD programs.

Immediate: An immediate order which the user creates after selecting this option.

 To select a previous order, type its number.

```
┌──── Production Setup menu ────┐
│ Select production order       │
│ Dow┌─ Type of order ─┐ta      │
│ CIM│   Previous      │        │
│ Res│   Immediate     │        │
└────┤ Enter order # ├──────────┘
     │      1        │
     └───────────────┘
```
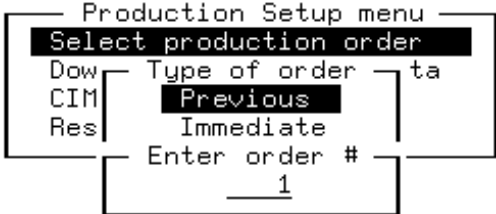
Figure 4: Previous order number entry Window

You can now view (but not modify) your selected order. Use the < PgUp> and
< PgDn> keys to scroll 10 order lines up or down, and the < Esc> key to exit.

```
┌──────────────────────────────────────────────────────────────────────────────┐
│                           ▐ Selected order ▌                                   │
│                                                                                │
│   Order # :    4   Order date :15/01/91  Delivery date :15/01/91  Priority :  1│
│                                                                                │
│              ┌─────────┬───────────┬──────────────────────┬───────────┐        │
│              │ Line #  │ Part ID # │      Part name       │ Quantity  │        │
│              │         │           │                      │           │        │
│              │    1    │     3     │ Lamp                 │    2      │        │
│              │    2    │    11     │ Lamp cover           │    4      │        │
│              │    3    │     0     │                      │    0      │        │
│              │    4    │     0     │                      │    0      │        │
│              │    5    │     0     │                      │    0      │        │
│              │    6    │     0     │                      │    0      │        │
│              │    7    │     0     │                      │    0      │        │
│              │    8    │     0     │                      │    0      │        │
│              │    9    │     0     │                      │    0      │        │
│              │   10    │     0     │                      │    0      │        │
│              └─────────┴───────────┴──────────────────────┴───────────┘        │
│                                                                                │
│ ─────────────────────────────────────────────────────────────────────────     │
│   PgUp/PgDn - Scroll up/down                                                   │
│   Esc - Previous menu                                                          │
│                                                                                │
└──────────────────────────────────────────────────────────────────────────────┘
```

Figure 5: Select Previous order Screen

```
┌──────────────────────────────────────────────────────────────────────────────┐
│                          ▐ Immediate order ▌                                   │
│                                                                                │
│                                                                                │
│              ┌─────────┬───────────┬──────────────────────┬───────────┐        │
│              │ Line #  │ Part ID # │      Part name       │ Quantity  │        │
│              │         │           │                      │           │        │
│              │    1    │     2     │ Base for a lamp      │    1      │        │
│              │    2    │     0     │                      │    0      │        │
│              │    3    │     0     │                      │    0      │        │
│              │    4    │     0     │                      │    0      │        │
│              │    5    │     0     │                      │    0      │        │
│              │    6    │     0     │                      │    0      │        │
│              │    7    │     0     │                      │    0      │        │
│              │    8    │     0     │                      │    0      │        │
│              │    9    │     0     │                      │    0      │        │
│              │   10    │     0     │                      │    0      │        │
│              └─────────┴───────────┴──────────────────────┴───────────┘        │
│                                                                                │
│ ─────────────────────────────────────────────────────────────────────────     │
│   F1 - Clear order                                                             │
│   PgUp/PgDn - Scroll up/down                                                   │
│   Esc - Previous menu                                                          │
│                                                                                │
└──────────────────────────────────────────────────────────────────────────────┘
```

Figure 6: Immediate order entry Screen

Use F1 to clear the immediate order contents.

A table is displayed in this screen. There are 40 lines in one order, but you can view only ten lines at a time. Use the < PgDn> and < PgUp> keys to scroll the lines up and down. The information in this table is:

Line #:   The line number in the order.

Part ID #:   The number of the part you want to order.

Part name: Updated automatically according to the Part ID # field.

Quantity: The amount of parts of Part ID # you want to order.

Download Production Data

This function performs the actual downloading of the selected order.

Choose this option only after you have selected an order.

You are prompted to confirm whether or not you want to continue.
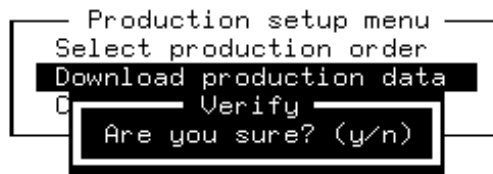
Figure 7: Pre-downloading verification Window

After you press Y (Yes to confirm), PROD starts to process the selected order and the data associated with it, and to compile the production data to be downloaded.
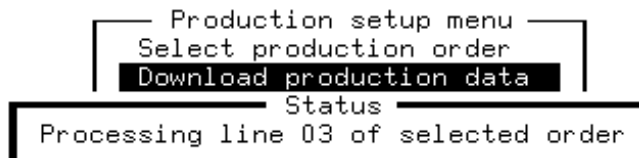
Figure 8: Processing order Status Window

If an error occurs during the processing stage, an error message will be displayed, and the processing (and downloading) will stop. If this happens, note the line number which was being processed when the error occurred and the nature of the error. To correct such an error you will have to correct your order or, sometimes, exit PROD and enter CIMDEF to adjust the associated definitions.

```
┌── Production setup menu ──┐
│    Select production order │
│   Download production data │
├───────── Status ──────────┤
│ Processing line 01 of selected order │
├────────── Error ──────────┤
│ Part # 1 is a raw material │
└────────────────────────────┘
```

Figure 9: Error while processing an order Message

Figure 9 shows an example of an error that can be corrected from within PROD. Changing the part number in line number 1 of the selected order will correct this error.

When downloading begins, a status window will appear showing the percentage of the downloading completed so far.

```
┌── Production setup menu ──┐
│    Select production order │
│   Download production data │
├───────── Status ──────────┤
│ Downloading production data to controller │
├─── Percentage completed ───┤
│ 34% ████████░░░░░░░░░░ │
└────────────────────────────┘
```

Figure 10: Downloading completion Status Window

If a previous order is being manufactured, you will be prompted with a How to

```
┌── Production setup menu ──┐
│    Select production order │
│   Download production data │
├───────── Status ──────────┤
├───────── Status ──────────┤
│ Previous order has not been fully manufactured │
└────────────────────────────┘
    ┌──── How to continue? ────┐
    │ Add new order to existing order │
    │ Replace existing order with new order │
    │ Abort download │
    └────────────────────────────┘
```

continue? message.

Figure 11: How to continue? Window

There are three options:

Add new order to existing order:

> This will cause the new order information to be appended to the existing one. The two combined orders will be treated as one larger order. The production of the previous order and the newly requested products will continue.

Replace existing order with new order:

> This will cause the new order to replace the existing one.

> The products already in process will complete their production cycle. New material relating to the previous order will not be released.

Abort download: This option will cancel the download sequence.

CIM Production

```
 ┌─ Production Setup menu ─┐
 │  Select production order │
 │  Download production data│
 │ ▐CIM production▌         │
 │ ┌─ CIM Production menu ─┐│
 │ │▐Run    Production▌    ││
 │ │ Stop   Production     ││
 └─┴───────────────────────┴┘
```
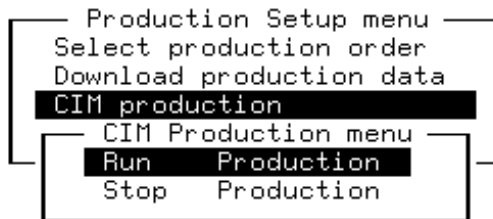
This option lets you start or stop the production of the previously downloaded order(s).

Figure 12: CIM Production Menu

The options available in this menu are:

Run production: Start the production of the previously downloaded order(s).

Stop production: Pause the production of the order currently being produced. To restart the production use the Run Production option.

Reset CIM Cell

Selecting this option will reset the CIM cell. All status variables, production requests and material flow commands will be cleared.

This command may be useful for restarting CIM production after an abnormal halt in CIM cell activities (such as a machine collision or a power failure).

After performing a CIM Reset, all templates and material must be removed from all conveyor pallets, station buffers and machines.

Order Entry

The Order Entry menu lets you enter, view or modify orders. This menu is essentially the same as in the Order Entry menu in the CIMDEF program.

Orders are numbered from 1 to 1000; thus up to 1000 different orders can be defined at a time. (You can define even more orders by using other order-entry files; refer to the File Manager section for more details.)

Several options are available:

Select

Each order has a unique identification number.

To define, modify or view a specific order select it by typing the order's ID number and pressing < Enter> when you first enter the Order Entry screen. If you have already selected an order and want to select a different one, pressing F1 will usually let you enter another order's ID number.

Note that this selection has nothing to do with the selection of an order for downloading. In this section the term *select* refers to order-entry selection.

Order Entry Screen

To define or view an order you have to select it by entering its ID number. After you have selected an order you can modify or view it.

An order can contain up to 40 lines. Thus you can specify up to 40 different parts in an order.

You can view only ten lines of an order at a time. Use the < PgDn> and < PgUp> keys to scroll the lines up and down.

```
┌──────────────────────┤ Order entry ├──────────────────────┐
│                                                            │
│  Order # :   4                    Priority :    1          │
│                                                            │
│  Order date :15/01/91             Delivery date :15/01/91  │
│        ┌────────┬──────────┬──────────────────┬─────────┐  │
│        │ Line # │ Part ID #│    Part name     │ Quantity│  │
│        │        │          │                  │         │  │
│        │    1   │     3    │ Lamp             │    2    │  │
│        │    2   │    11    │ Lamp cover       │    4    │  │
│        │    3   │     0    │                  │    0    │  │
│        │    4   │     0    │                  │    0    │  │
│        │    5   │     0    │                  │    0    │  │
│        │    6   │     0    │                  │    0    │  │
│        │    7   │     0    │                  │    0    │  │
│        │    8   │     0    │                  │    0    │  │
│        │    9   │     0    │                  │    0    │  │
│        │   10   │     0    │                  │    0    │  │
│        └────────┴──────────┴──────────────────┴─────────┘  │
│                                                            │
├────────────────────────────────────────────────────────────┤
│  F1 - Select an order          F5 - Report                 │
│  F2 - Save current order       PgUp/PgDn - Scroll up/down  │
│  F3 - Delete current order     Esc - Previous menu         │
└────────────────────────────────────────────────────────────┘
```

Figure 13: Order entry Screen

The information in this screen is:

Order #:   The number of the selected order.

Priority: The priority of the selected order.

                      The priority is a number between 1 to 10; 1 is the highest priority,
                      10 is the lowest.

                      This field will be used later for the MRP (Material Resource
                      Planning) analysis.

Order date: Date order was entered.

Delivery date: Planned date for order delivery.
                      This field will be used later for the MRP (Material Resource
                      Planning) analysis.

The table in this screen provides the following information:

Line #:   The number of line in the order.

Part ID #:   The number of the part you want to order.

Part name: Updated automatically according to the Part ID # field.

Quantity: The amount of parts of Part ID # you want to order.

Save

To keep the changes you have made after defining or modifying an order, and before exiting the screen, use the Save option. This will save your changes to disk.

Press F2. Note that you are always prompted to save your changes.

```
━━━━━━━━━ Verify ━━━━━━━━━
Order not saved. Save? (y/n)
```

Figure 14 :   Save before exit verification Window

Delete

To cancel the currently selected order press F3. This will delete from disk the file describing the order. Note that deleting unnecessary files frees disk space.

Report

The Report function lets you receive information on a range of orders. Activate this option by pressing F5.

```
┌─ Type of report ─┐
│     Partial      │
│     Full         │
└──────────────────┘
```
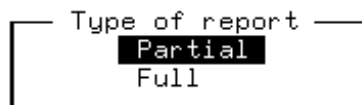
Figure 15: Type of report Window

Two types of reports are possible:

Partial: A report of a range of orders. You are prompted to define the requested range. For example, a report of orders 4 to 15.

```
┌─ Type of report ─┐
│     Partial      │
│     Full         │
├─ Enter order range ─┤
│ From: ___4 To: 15__ │
└─────────────────────┘
```
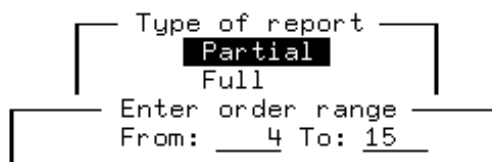
Figure 16: Range of report Window

Full: A report of all the orders defined.

After selecting the type of report, select where to direct the report.

```
┌─ Report destination ─┐
│      ███████         │
│      Screen          │
│      Printer         │
│      File            │
└──────────────────────┘
```

Figure 17: Report destination Window

Three options are possible:

Screen: The report is sent to the monitor. This allows the user to scroll
                   through the report.

Printer: The report is sent to a printer. Make sure a printer is connected and
                   ready.

File: The report is sent to a file. You are prompted for a report file name.
                   The extension .REP will automatically be added to this name. For
                   example, if you enter xx then the actual report file name will be

```
      ┌─ Report destination ─┐
      │      Screen          │
      │      Printer         │
      │      ███████         │
┌─────┤      File            ├──────┐
│ Enter file name (without extension) │
│          order                      │
└─────────────────────────────────────┘
```
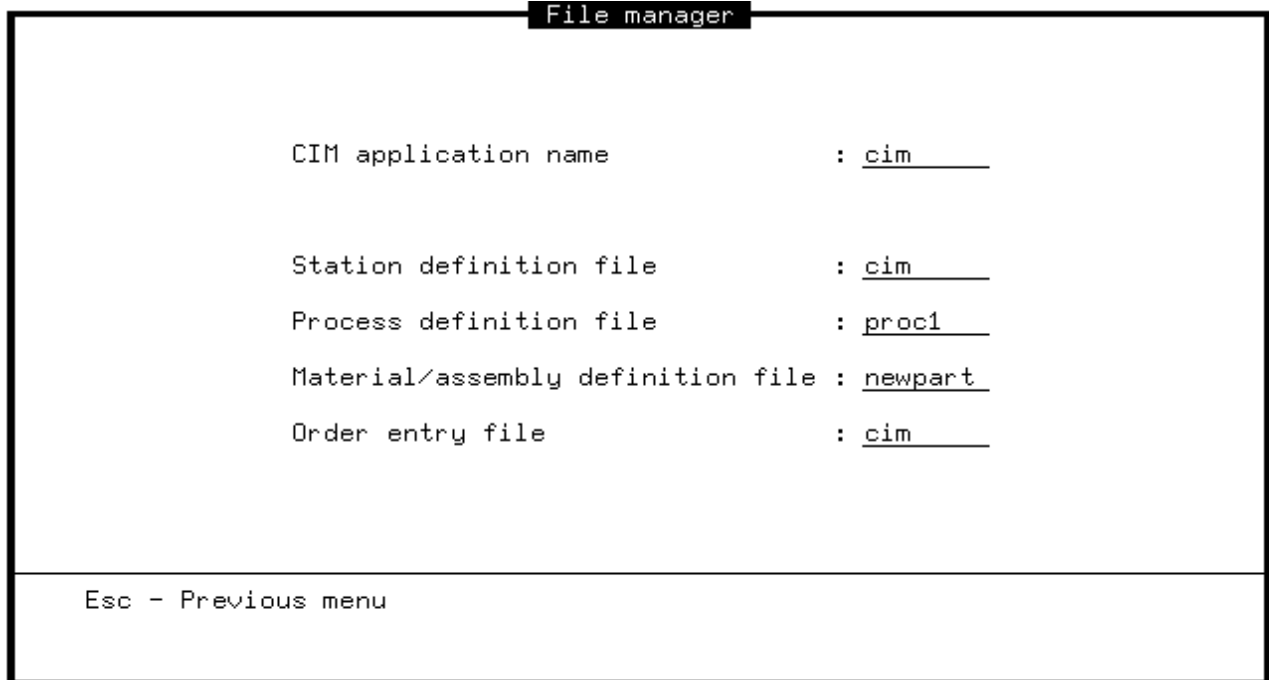
XX.REP.

Figure 18: Report file name Window

File Manager

The File Manager menu lets you view or modify the names of the CIMDEF files used by PROD. These are the definitions which detail the way to interpret the requested orders and their production processes. This option is essentially the same as the File Manager in the CIMDEF program.

```
┌──────────────────────■ File manager ■──────────────────────┐
│                                                            │
│                                                            │
│                                                            │
│         CIM application name          : cim_____           │
│                                                            │
│                                                            │
│         Station definition file       : cim_____           │
│                                                            │
│         Process definition file       : proc1____          │
│                                                            │
│         Material/assembly definition file : newpart_       │
│                                                            │
│         Order entry file              : cim_____           │
│                                                            │
│                                                            │
│                                                            │
│                                                            │
├────────────────────────────────────────────────────────────┤
│  Esc - Previous menu                                       │
│                                                            │
└────────────────────────────────────────────────────────────┘
```

Figure 19: File Manager Screen

Various CIM configurations and definitions can be saved under different file names. Five names are possible:

CIM application name:

>The name of the current CIM application. This name is copied to the next four file names if < Enter> is pressed while the cursor is in this field.

Station definition file:

>The name of the current station definition file.

>CIMDEF adds the extension .STN to this name to form the actual station file name (for example, CIM.STN).

Processes definition file:

>The name of the current processes and subprocesses definition file.

>CIMDEF adds the extension .PRC to this name to form the actual process definition index file name (for example, CIM.PRC).

Material/assembly definition file:

>The name of the current parts definition file.

>CIMDEF adds the extension .PAR to this name to form the actual material/assembly definition index file name (for example, CIM.PAR).

Order entry file:

>The name of the current order definition file.

>CIMDEF adds the extension .ORD to this name to form the actual order entry index file name (for example, CIM.ORD).

Command Line Options

Several options can be set by activating PROD with command line options. PROD can be activated in batch mode to download an order, run production, stop production or reset the CIM cell. Use the batch switches for this purpose. If an error occurs while in this mode, PROD will print an error message and return a non-zero DOS exit code.

The command line syntax is:

```
PROD [Batch_Switch] [Date_Switch] [Communication_Switch]
```

Batch_Switches:

/d [Application_Name] Order_Number:

>Application_Name is the CIMDEF application name. If a name is not specified, the default configuration name CIM is used for all files.

>Selecting this option will download the requested order. The relevant definitions will be taken from the CIMDEF application definition specified.

>If a previous order has not been fully manufactured the new order will be added to the existing one.

/r	Selecting this option will start the production of a previously downloaded order.
/s	Selecting this option will suspend the currently produced order.
/t	Selecting this option will reset the CIM cell.

Date_Switches:

These switches will affect the date fields in the production entry screens.

/ad	American date format (mm-dd-yy).
/ed	European date format (dd-mm-yy).

Communication_Switches:

This switch selects the part which should be used for communication with the central CIM controller.

/c1	Communication port used is COM1.
/c2	Communication port used is COM2.

Examples:

```
PROD /D 11 /C2
```

Will download order 11 using CIM configuration files with the name CIM. Downloading will be performed on COM2.

```
PROD ?
```
When entered at the DOS prompt, will give a list of the command line options.

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ASRS Software User's Guide

Introduction

The ASRS Station

The ASRS (Automatic Storage and Retrieval System) station stores and retrieves parts in different stages of processing.

The station contains a controller, a PC computer, a carousel, a robot, buffers, templates, parts and feeders. These devices have the following functions:

- the controller handles requests from the central CIM controller, the station PC, and the central CIM computer, while controlling the movement of the carousel and the robot.

- the PC, with its ASRS software, interfaces between the user and the controller.

- the carousel, a multi-level rotating warehouse, stores parts, templates and feeders.

- the templates hold parts.

- the feeders serve as magazines for raw materials.

- the buffers temporarily store templates.

- the robot transfers parts and templates between the carousel, the buffers and the conveyor.

The ASRS Software

The ASRS software serves as a user interface to the ASRS controller. The program's simple user-interface makes it easy to learn to operate the ASRS software.

The ASRS software provides the following features:

- Real time graphic display of the ASRS cell contents.

- On-line updating of ASRS cell contents.

- Storage and retrieval of selected parts or templates.

- Automatic verification of template identity using a barcode scanner.

- Separate backup and restore of ASRS cell contents and template correspondence data.

- Off-line mode for creating or modifying ASRS contents and template data using the graphic display.

For a listing of robot and carousel positions used by ASRS programs, refer to the section "ASRS Station Positions" at the end of this chapter.

All programs necessary for ASRS control and operation are included in the CIM-ACL system programs and in the ASRS software. For a listing of the ACL-ASRS programs, refer to the ASRS section of the appendix "CIM-ACL System Program Listing."

For information on setting up the barcode scanner's internal programming, refer to the appendix "Preparing the LS 6x20 Barcode Scanner for Operation".

Activating the ASRS Program

Getting Started

For the ASRS program to function correctly, the ASRS controller must be loaded with its own specific software. This initialization is usually done only when the entire CIM system is installed.

To activate ASRS in on-line mode, do one of the following:

- From the ER CIM Main Menu, select F3.

- At the central CIM computer's H:> prompt, type ASRS and press < Enter> .

- At the ASRS station's DOS prompt, type ASRS and press < Enter> .

The ASRS program will first try to establish communication with the ASRS controller.


```
══════════════════ Status ══════════════════
Establishing communication with controller
```

Figure 1: Communicating with controller Status Window

If the ASRS program fails to communicate with the controller, the following message is displayed:
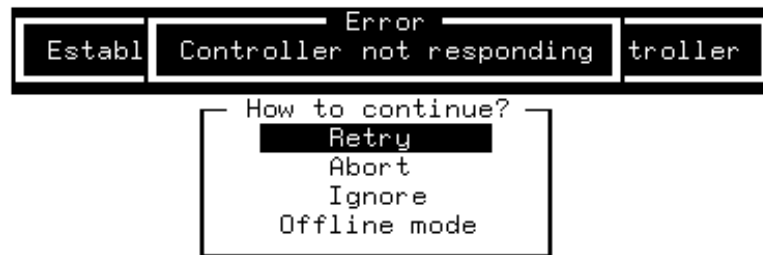
Figure 2: Controller Not Responding Message

If this happens, you should check that:

- the station's RS232 switcher is turned on and is currently connecting the PC with the ASRS controller. You can use the RSNET software if necessary.

- the station controller is turned on (the power LED indicator lights).

- the PC and the controller RS232 cables are correctly connected.

You then have three options as to how to continue:

Retry: Try to reestablish communication. Use this option after you have tried to correct the problem.

Abort: Exit the program.

Ignore: Enter the program without establishing communication.

Off-line mode: Enter off-line mode. This allows you to change the ASRS storage and template data within the program without affecting the contents of the controller's memory. This data can be stored to a file on disk and restored to the controller at a later time.

If you want to access the off-line mode directly, do one of the following:

- At the central CIM computer's H:> prompt, type ASRS /O and press < Enter> .

- At the ASRS station's DOS prompt, type ASRS /O and press < Enter> .

If communication is established, or if either Ignore or Off-Line mode was selected, the ASRS main menu will be displayed.

```
┌─────────────────────────────────────────────────────────────┐
│ Compact ASRS (Automatic Storage & Retrieval System) user interface │
│         Version 1.30 Copyright (C) 1991-92, Eshed Robotec         │
│                                                                 │
│                                                                 │
│                        ┌──── Main menu ────┐                    │
│                        │ Inspect/Update contents  F1 │          │
│                        │ Template definition      F2 │          │
│                        │ Store/Retrieve a part    F3 │          │
│                        │ Barcode Setup            F4 │          │
│                        │ Utilities                F5 │          │
│                        │ Exit                     F9 │          │
│                        └─────────────────────────────┘          │
│                                                                 │
│  ├─────────────────────────────────────────────────────────┤   │
│   ↓/↑   - Pick option                                           │
│   Enter - Activate option                                       │
└─────────────────────────────────────────────────────────────┘
```
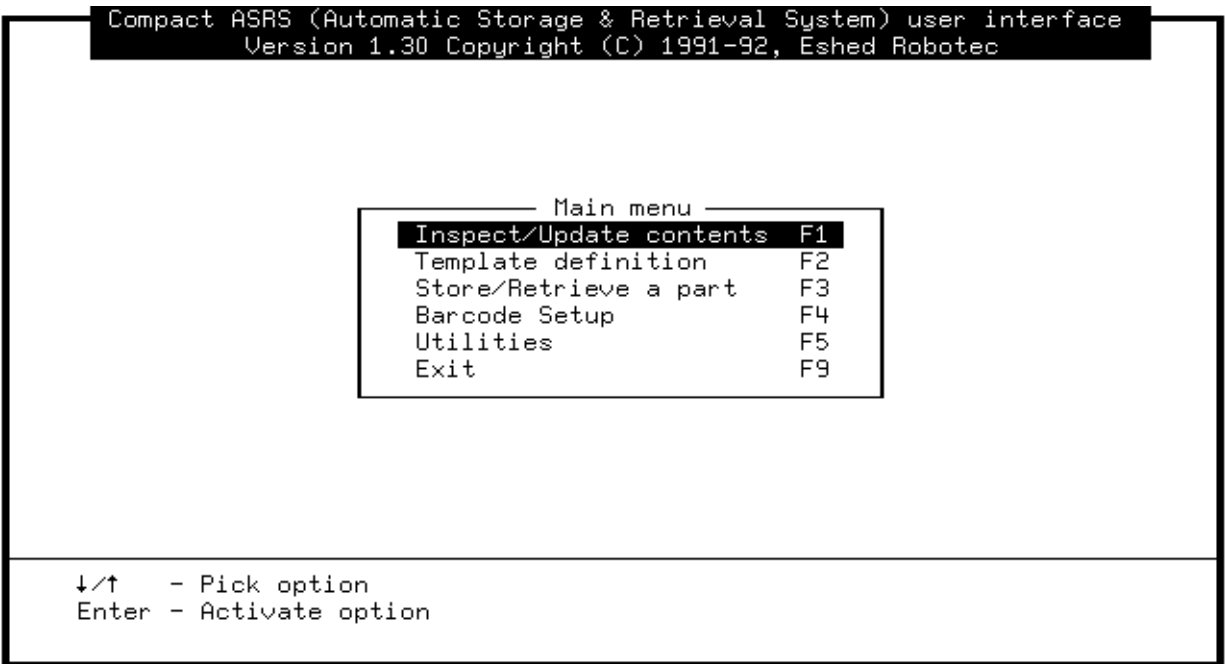
Figure 3: ASRS Main Menu

You can choose between several options:

Inspect/Update contents:

> View and modify the contents of each cell at each level of the carousel.

Template Definition:

> Define which parts can be held by each template type.

Store/Retrieve a part:

> Transfer parts on templates, or empty templates, between the buffers and the carousel using the ASRS robot.

Barcode Setup

> Activate or test the optional barcode reader to read the template type number from a barcode sticker on the side of the template.

Utilities:

> Access ATS, reset the ASRS controller after the control has been disrupted, backup and restore ASRS and template data to disk from the controller's memory, create a file for MRP analysis,

Exit: Exit the program. If you are running the program in off-line mode and have changed the ASRS cell contents or template data, you will be prompted to save the changes before leaving the program.

Inspect/Update Contents

In this module of the ASRS software you can view or modify the contents of each cell.

After you have selected this option, you will see a screen similar to the one shown in Figure 4, however the cell contents will be different.
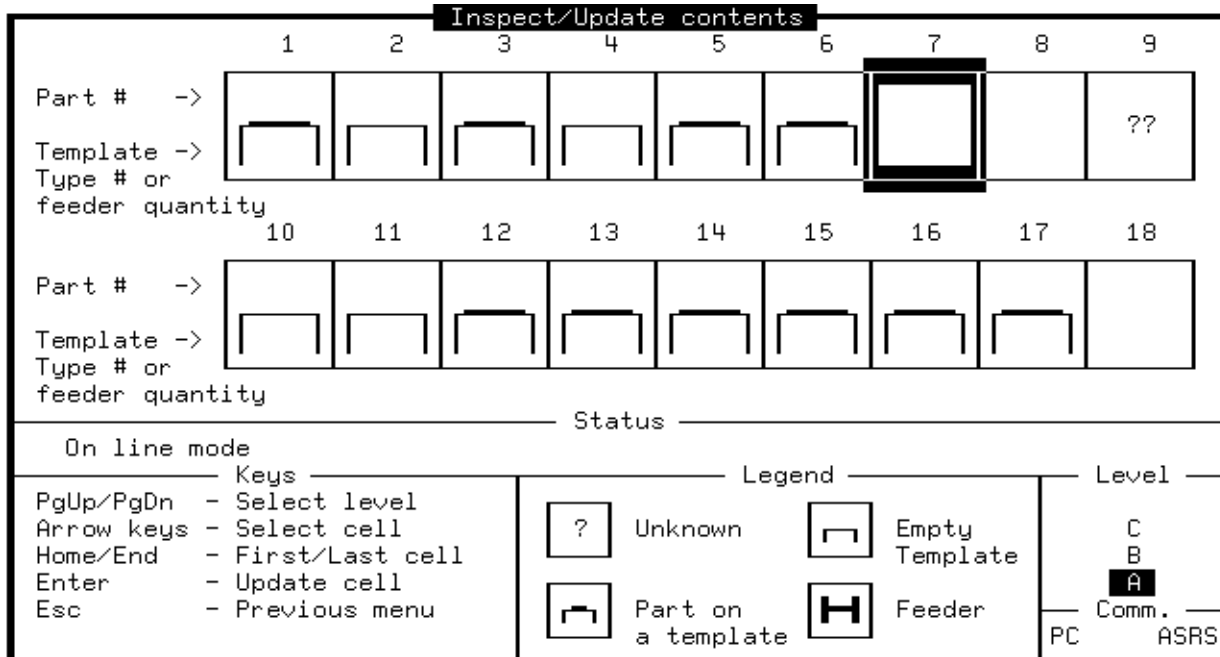
Figure 4: Inspect/Update Contents Screen

In On-Line mode, the graphic display is continuously updated to show the contents of the ASRS controller's memory. Similarly, changes entered from this screen are continuously transmitted to the controller's memory.

In Off-Line mode, the contents of the carousel are automatically cleared directly after entering the program. To display ASRS contents data that was previously saved to a file, a Utilities option must be used to load the contents of a file to the program. Changes made from this screen can also be stored to a file using a Utilities option.

Inspect/Update Contents Screen Structure

The Inspect/Update Contents screen is divided into 6 sections:

1. Current level cell contents:

    This is the upper part of the screen. It contains two rows of cells: the upper row shows the contents of cells 1 to 9 and the bottom row shows the contents of cells 10 to 18.

2. Status line   This line is located directly beneath the cell displays.
    In on-line mode, status messages show the current ASRS activity, such as "Retrieving part …".
    In off-line mode, the message "Off-line" is displayed.

3. Keys: Displays the keys available at present time.

4. Legend: A legend for the cell contents. There are five types of cell contents: empty cell, empty template, part on a template, feeder and unknown. Each has its own graphic representation. When a cell is empty, no symbol appears.

5. Current level: Shows the level whose cell contents are currently displayed in the upper sector. The carousel levels are marked from A, the lowest level, to C, the highest level. Use the < PgUp> and < PgDn> keys to change the current level.

6. Communication: Shows the communication status between the PC computer (marked PC) and the ASRS controller (marked ASRS). The name of the side which is working at that moment (either PC or ASRS) will blink and be highlighted. When data is transferred, an arrow showing the direction will appear between the two sides.

Modifying Cell Contents

The user should make sure that the ASRS contents are properly updated whenever parts and templates are manipulated manually.

To modify the contents of a cell, do the following:

1. Select current level:

    The current level is the highlighted letter in the current level sector.
    Use < PgUp> and < PgDn> to select the desired level.

2.   Select current cell: The current cell is the cell whose frame is highlighted. The number of each cell appears above it. Use the arrow keys to select the desired cell.

If you want the current cell to be in front of the robot's location (so that you can see it), press the < Alt> + M keys and the carousel will rotate. Make sure the robot's gripper is outside the carousel so the carousel can turn freely.

3.   Press Enter: Pressing Enter will open a five-option window with the five different cell contents available.


```
┌─ Current cell contents ─┐
│  Empty cell             │
│  Empty template         │
│ ▣Part on a template     │
│  Feeder                 │
│  Unknown                │
└─────────────────────────┘
```

Pick an option and press < Enter> . The new cell contents will be updated both on your PC screen and in the ASRS controller's memory.

The different options are:

Empty cell: The current cell is an empty one.

Empty template: The current cell holds an empty template. You will be prompted for the template type number.

Figure 5a:
Template Type

Part on a template:

The current cell contains a template holding a part.

You will be prompted only for the part number. (The template type number is obtained from the Template Definition Table.)
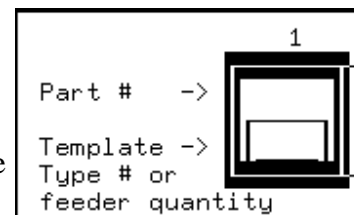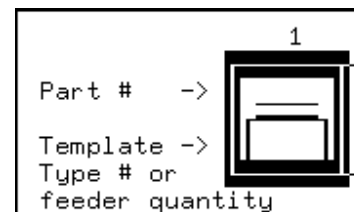
Figure 5b: Part #

Feeder: The current cell holds a feeder for a specific type of part.

You will be prompted for both the number of the part in the feeder and the quantity. When the ASRS system is instructed to supply a part which can be found only in the feeder, the robot will place the matching template on a buffer and will then fetch the part from the feeder and put it on the template.
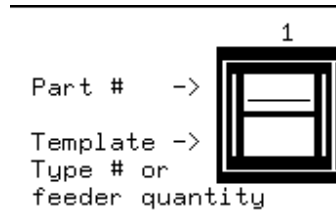
Figure 5c: Part #
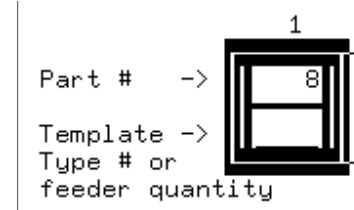
Figure 5d: Feeder Quantity

Unknown: The current contents of the cell are unknown.

This designation is automatically assigned to a cell by the program when there is a conflict between the information entered by the user and the template type detected by the barcode reader. The system will not store a template in a cell marked unknown, nor will it remove a part or template from such a cell.
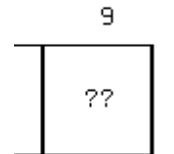
Figure 5e: Contents

Template Definition

Templates are special trays designed to hold different parts. Each part has a unique template type which can hold it. A specific type of template can hold up to eight different predefined parts.

Each template has a specific type number (from 1 to 99) that identifies it. This number appears on a barcode sticker, as shown in Figure 6. This sticker is affixed to the side of the template that faces the barcode scanner.

Figure 6: Template Barcode Sticker

There are six digits in the barcode. The first (left) two digits represent the template type number while the next four digits are used as an ID number for the specific template.

When the barcode scanner is activated by the user, all store and retrieve operations are automatically verified by comparing the template type read from the barcode with the information stored in the ASRS controller. For more information on the barcode scanner and its required settings, refer to the appendix "Preparing the LS 6x20 Barcode Scanner for Operation".

The Template Definition module lets you define which template types can hold which parts. After this option is selected, ASRS reads the correspondence information from the controller.

```
┌─────────────────── Status ───────────────────┐
│        Reading data from controller          │
├────────────── Percentage completed ──────────┤
│ 63% ████████████████████████░░░░░░░░░░░░░░░   │
└───────────────────────────────────────────────┘
```

Figure 7: Reading data completion Status Window

You will then see a screen similar to the following figure:

```
┌──────────────────────── Definition ────────────────────────┐
│                                                             │
│  ┌─────────┬───────────────┬─────────────────────────────┐ │
│  │ Line #  │ Template type #│ Can hold part #            │ │
│  ├─────────┼───────────────┼─────────────────────────────┤ │
│  │    1    │       9        │  8   0   0   0   0   0   0   0 │ │
│  │    2    │      10        │ 11  22  33  44  55  66  77  88 │ │
│  │    3    │      11        │  1   2   3  12   0   0   0   0 │ │
│  │    4    │      12        │  4   5   6   7   0   0   0   0 │ │
│  │    5    │      13        │ 20  23  24  25   0   0   0   0 │ │
│  │    6    │      99        │  1   0   0   0   0   0   0   0 │ │
│  │    7    │       0        │  0   0   0   0   0   0   0   0 │ │
│  │    8    │       0        │  0   0   0   0   0   0   0   0 │ │
│  │    9    │       0        │  0   0   0   0   0   0   0   0 │ │
│  │   10    │       0        │  0   0   0   0   0   0   0   0 │ │
│  └─────────┴───────────────┴─────────────────────────────┘ │
│                                                             │
│ Enter          - Input field     Home/End       - Start/End of line │
│ ↓/↑            - Move line       Tab/Shift+Tab - Move field │
│ PgUp/PgDn      - Move page       Esc            - Previous menu │
└─────────────────────────────────────────────────────────────┘
```

Figure 8: Template to part correspondence Screen

The table contains 30 lines, but you can view only ten lines at a time. Use the up and down arrow keys to scroll one line up or down and the < PgUp> and < PgDn> keys to

scroll ten lines up or down.

The information in this screen is:

Line #:   The line number in the correspondence table.

Template type #:   The type number of the template. This number should be in the
                           range of 1 through 99.

Can hold part #:   List of up to 8 different parts which can fit on the corresponding
                           template type.

                           In Figure 8, for example, template type 11 can hold parts 1, 2, 3 and
                           12, and part 44 can only fit on template type 10.

                           Remember to define a unique template type for each part type in the
                           system.

When finished, press the < Esc> key to exit.

```
╔════════════ Verify ════════════╗
║ Save changes to controller?  (y/n) ║
╚════════════════════════════════╝
```

If you have made any changes, you will be prompted with the following message:

Figure 9: Save changes verification Window

Press Y (yes to confirm) if you want your changes to be saved. The information will
then be written to the controller's memory.

Store/Retrieve a Part

This option lets you use the robot to store and retrieve specific parts or empty templates.

Store and retrieve operations are performed automatically during production, following a
request from the central CIM controller. This option lets you request the storage or
retrieval of a part or an empty template. You will be prompted by four windows to
determine what and where to retrieve or store.

```
┌─────────────────────────────────────────────────────────────┐
│                    ▐ Retrieve/Store ▌                        │
│                                                               │
│                    ┌─ Type of action ─┐                      │
│                    │█Retrieve from ASRS█│                     │
│            ┌─ Destination ─┬ Store in ASRS │                 │
│            │ █Buffer 1█    │                                  │
│            │  Buffer 2     │                                  │
│            └───────────────┤                                  │
│                    ┌─ Type of object ─┐                       │
│                    │█Part on a template█│                     │
│                     Empty template    ┌─ part # ─┐           │
│                ┌──────── Verify ───────┤        1 │           │
│                │ Retrieve the object? (y/n) │      └──────────┘│
│                └───────────────────────────┘                  │
│                                                               │
│                                                               │
│  ─────────────────────────────────────────────────────────── │
│    Esc  - Abort                                               │
│                                                               │
└─────────────────────────────────────────────────────────────┘
```
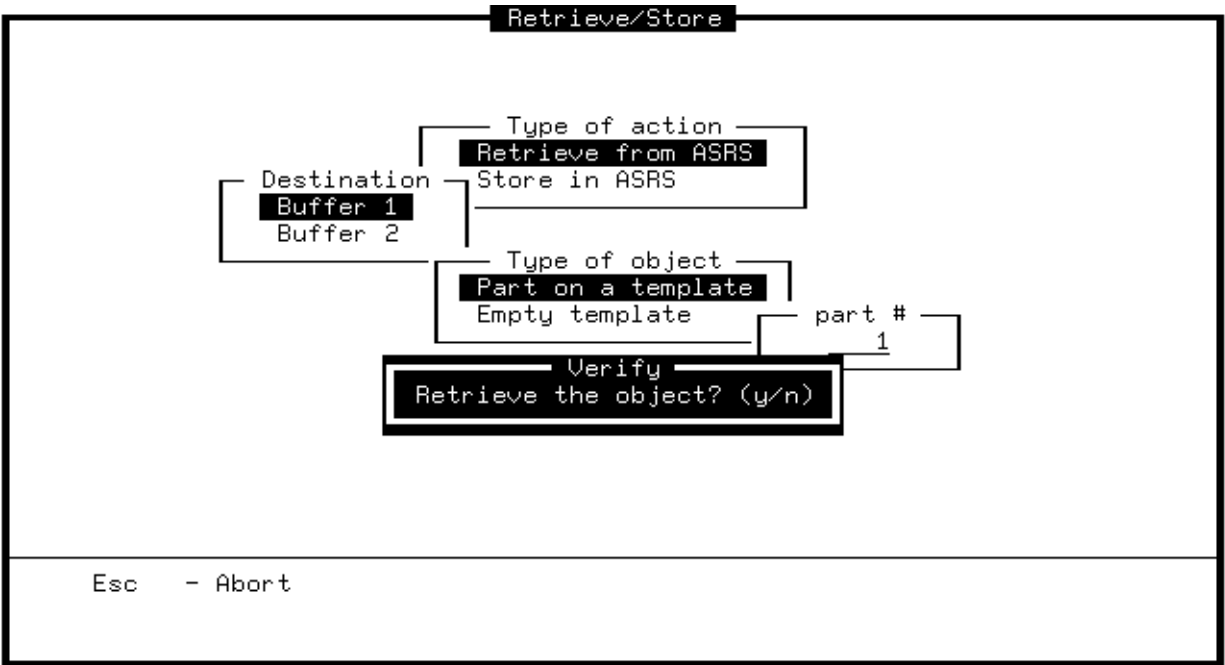
Figure 10: Retrieve and Store Screen

The four windows are:

Type of action:

> What action should be performed? There are 2 options:
>
>> Retrieve from ASRS: Retrieve a part or an empty template from the carousel.
>>
>> Store in ASRS: Store a part or an empty template in the ASRS carousel.

Destination/Source:

> Define where a part or empty template will be taken to when retrieving, or where it will be taken from when storing. There are 2 options:
>
>> Buffer 1
>>
>> Buffer 2
>
> (Buffer 2 is not currently available).

Type of object: What to retrieve or store? Again, there are 2 options:

>   Part on a template: A part on a fitting template.

>   Empty template: A template without a part on it.

Part #/Template type #:

>   Enter the number of the part or the template type number.

After you press Y (yes) to confirm the verification message, the system will perform the requested action.

While the action is being performed, you can abort it by pressing < Esc> .

Search Algorithm Used in Store/Retreive

The carousel automatically rotates to a holding position after every store or retrieve operation. In this position, cell 9 is directly across from the robot.

When a store or retrieve operation is initiated, the program searches for the cell with the required contents (or an empty cell, in the case of a store operation) that is nearest to cell 9. The object is to minimize the carousel rotation that will be required to bring the selected cell across from the robot. The algorithm first checks the contents of cell #9 on each level, starting with A and ascending to C. If no suitable cell is found, the algorithm checks cell #10 on each level, then cell #8 on each level, and so on, until a suitable cell is found.

The user can change the order of the search by modifying the values of the ACL array SRSI used by the program SRSII (refer to the appendix "CIM-ACL System Program Listing"). SRSI[1] is the number of the first cell that will be checked, SRSI[2] is the number of the second cell that will be checked, and so forth. Cell numbers 1 - 18 refer to level A, 19 – 36 refer to level B and 32 – 54 refer to level C.

Barcode Setup

The barcode scanner reads the template type number from a sticker affixed to the side of the template. The barcode contains six digits. The first (left) two digits represent the template type number while the next four digits are used as an ID number for the specific template.

The Barcode Setup option lets you activate the barcode reader and test its operation. When this option is chosen from the main ASRS menu, the following screen appears:

```
┌──────────────────────────────■ Barcode Setup ■──────────────────────────────┐
│                                                                              │
│                                                                              │
│                                                                              │
│                                                                              │
│                                                                              │
│                                                                              │
│                                ┌── Barcode Setup Menu ──┐                     │
│                                │ Test barcode           │                     │
│                                │ Barcode active   NO    │                     │
│                                └────────────────────────┘                     │
│                                                                              │
│                                                                              │
│                                                                              │
│                                                                              │
│                                                                              │
├──────────────────────────────────────────────────────────────────────────────┤
│  ↓/↑    - Pick option                                                         │
│  Enter  - Activate option                                                     │
│  Esc    - Abort                                                               │
└──────────────────────────────────────────────────────────────────────────────┘
```
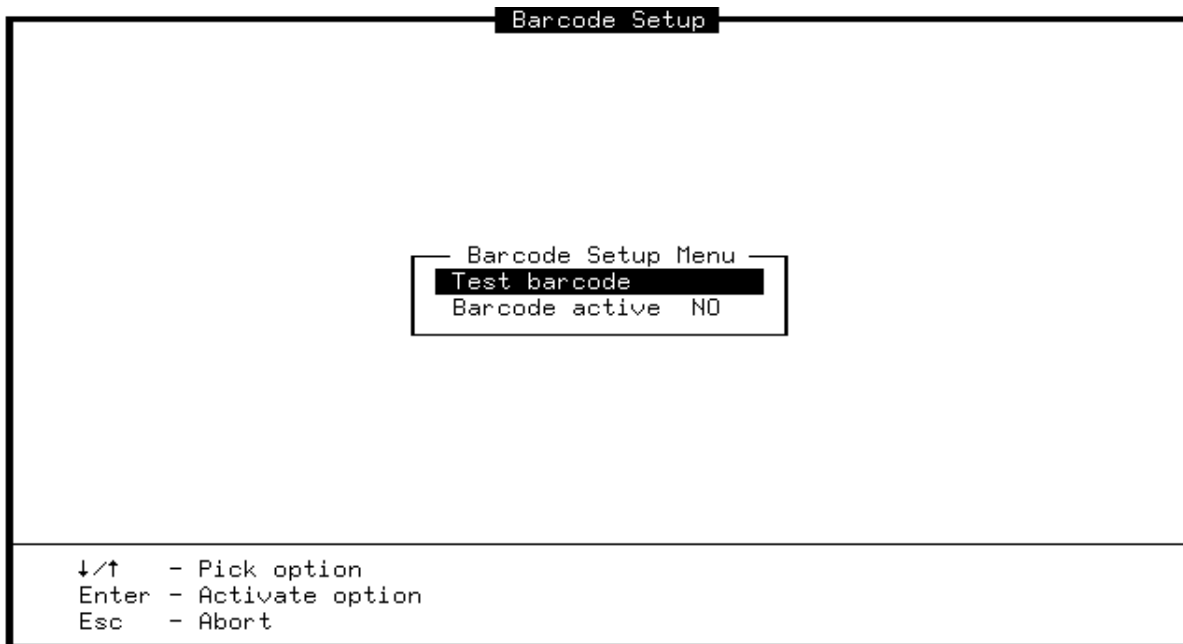
Figure 11. Barcode Setup Screen

Testing the Barcode

The first option, Test barcode, activates a barcode test sequence. To run this sequence, you must first place a template that has a barcode sticker on buffer 1.

If you select this option, the following message will appear on the screen:

```
Place template on buffer 1. Ready? (y/n)
```

In this sequence, the robot removes the template from buffer 1 and carries it to a point across from the scanner so the barcode may be read. Next the robot returns the template to buffer 1.

If the barcode can be read, the following message will appear.

```
Barcode is: ...
```

The barcode number will appear on the screen.

If the scan was not successful, the following message will appear:

```
Error reading barcode.
```

If this message appears, you must identify and correct the problem. Possible causes include:

• robot is not aligned properly in front of the barcode scanner (robot position was not properly set or robot was not homed).

• barcode scanner RS232 cable not properly connected to the ASRS controller (point to point network).

• barcode scanner not properly connected to the power source on the ASRS controller.

• barcode scanner not properly setup (the setup procedure is described in the appendix "Preparing the LS 6x20 Barcode Scanner for Operation".

• barcode label is missing, damaged, misaligned or obscured by dirt.

Activating the Barcode

Selecting the second option, Barcode Active, toggles between yes (barcode reader activated) and no (barcode reader inactivated).

When the Barcode Active option is chosen, the robot takes all templates (both empty and those carrying a part) as they are stored or retrieved to the barcode scanner to verify their template type numbers. This includes store and retrieve operations performed automatically during production, as well as those initiated by the user.

If the template type read from the barcode does not agree with the controller's data, the following will occur:

• if the template is being stored, the system will place it in a cell and mark the contents as unknown.

• if the template is being retrieved, the system will return the template to a cell in the carousel, mark the contents as unknown, and will then attempt to remove another suitable template.

Utilities

The ASRS Utilities module lets you backup or restore the ASRS data and the contents of the controller's memory, initialize the controller, and create an MRP file for further processing by the MRP software.

```
┌──────────────────────────── Utilities ────────────────────────────┐
│                                                                    │
│                                                                    │
│                        ┌───── Utilities menu ─────┐                │
│                        │ ATS (Advanced Terminal Software) │         │
│                        │ Reset ASRS control        │               │
│                        │ Save ASRS data to disk    │               │
│                        │ Load ASRS data from disk  │               │
│                        │ Create MRP file           │               │
│                        └───────────────────────────┘               │
│                                                                    │
│                                                                    │
├────────────────────────────────────────────────────────────────────┤
│  ↓/↑   - Pick option                                               │
│  Enter - Activate option                                           │
│  Esc   - Abort                                                     │
└────────────────────────────────────────────────────────────────────┘
```

Figure 12: Utilities Menu

The options in this menu are:

ATS (Advanced Terminal Software)

> Load ATS from disk to access the controller's ACL environment

Reset ASRS

> Reset various ACL variables to regain controller function after a sudden loss of control, such as may occur when an abort command is entered from the teach pendant during a user-initiated store or retrieve operation.

Save ASRS data to disk:

> Save to disk data describing the current status and contents of ASRS carousel and the template to part correspondence list.

Load ASRS data from disk:

> Restore from disk to the ASRS station's controller data on contents of ASRS carousel and template to part correspondence.

Create MRP file:

> Create an MRP (Material Resource Planning) file. This file can be used later by the MRP program for various planning and purchasing functions. The name of the file created is SRS.MRP.

ASRS Positions

The ASRS robot positions are stored in the vector CIM[500], and the carousel positions are stored in the vector SRSP[18]. These position vectors are automatically defined when the ASRS software is loaded to the ASRS controller, however the locations of the positions must be taught before the system can be operated. A listing of the required robot and carousel positions follows.

Robot Positions

All robot positions use the vector CIM[500].

Pallet at Conveyor Station Positions

CIM[9]   on pallet

CIM[19]   above 9

Buffer Positions

The ASRS station currently uses only one buffer.

Positions for a template:

CIM[1]   on buffer

CIM[11]   above 1

Barcode Scanner Positions

CIM[10]   above buffer 1, in front of the barcode scanner

CIM[8]   Between 10 and 11

Positions for Placing a Part on a Template which is on a Buffer

Differently shaped parts may require different robot positions in order to be placed or removed from a template. For this reason, parts are grouped into 100 families of 10 parts each: parts 1-10, 11-20,… ,991-1000. Within a family, all parts use the same two robot positions: one above and one on a template.

For part number n ($1 \leq n \leq 1000$), the robot positions are:

CIM[p1]   above the template

CIM[p2]   on the template

where:

$$p1 = 201 + int((n-1)/10)$$
$$p2 = p1 + 100$$

and int(x) is the integer part of x (e.g. int $(3/2) = 1$, int $(4/5) = 0$)

For example:

Parts 1 - 10:

p1 = 201   above the template

p2 = 301   on the template

Parts 11 - 20

p1 = 202   above the template

p2 = 302   on the template

ASRS Robot Positions (for Removing a Template from the Carousel)

Positions for access to ASRS Level 1:	CIM[31], [41], [51], [61]
Positions for access to ASRS Level 2:	CIM[32], [42], [52], [62]
Positions for access to ASRS Level 3:	CIM[33], [43], [53], [63]

The positions should be recorded at the following locations (for each level, respectively).

Positions next to ASRS:	CIM[31], [32], [33]
Positions in front of ASRS cell:	CIM[41], [42], [43]
Positions inside ASRS cell above template:	CIM[51], [52], [53]
Positions inside ASRS cell on template:	CIM[61], [62], [63]

ASRS Robot Positions (for Removing a Part from a Feeder)

Feeders at Level 1:	CIM[71], [81], [91]
Feeders at Level 2:	CIM[72], [82], [92]
Feeders at Level 3	CIM[73], [83], [93]

The positions should be recorded at the following locations (for each level, respectively).

Positions in front of ASRS for feeder access:	CIM[71], [72], [73]
Inside ASRS at feeder; positions for grasping part:	CIM[81], [82], [83]
Inside ASRS above feeder; positions for removing part	CIM[91], [92], [93]

ASRS Carousel Positions

The 18 circular positions of the carousel are defined in the Group B position vector SRSP[18].

Carousel position of Cell 1:   SRSP[1]
                                              .
                                              .
Carousel position of Cell 18:   SRSP[18]

The user needs only to set SRSP[1]. All other carousel positions are set relative to this position, with an offset between cell locations of 1706.66 encoder units.

Cell 1 on the carousel is labelled. The numbering of the rest of the cells proceeds in a counter-clockwise direction.

To move the carousel, use the teach pendant keys that control Axis 7. Then use the teach pendant to record SRSP[1].

To set the rest of the positions automatically, run the program MKSRS from the ASRS station PC. Alternatively, you can run program 10 from the teach pendant.

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MRP (Material Resource Planning)
Software User's Guide

Introduction

The MRP (Material Resource Planning) software aids the user in managing the raw material requirements of the ER CIM cell. The program accesses the CIMDEF and ASRS database to create reports and raw material purchase orders according to the user's specifications. The software also supports a database for raw material information.

Activating the MRP Program

To activate the MRP software, select the MRP Menu (F4) from the CIM Main Menu. Alternately, type MRP < Enter> at the DOS prompt.

You will see the Main MRP Menu, shown in Figure 1.

```
          MRP (Material Resource Planning)
       Version 1.00, Copyright (C) 1991 Eshed Robotec




                    ┌──── Main Menu ────┐
                    │ Raw material information     F1 │
                    │ Raw material purchase orders F2 │
                    │ Queries                      F3 │
                    │ File manager                 F4 │
                    │ Exit                         F9 │
                    └─────────────────────────────────┘




   ↓/↑   - Pick option
   Enter - Activate option
```
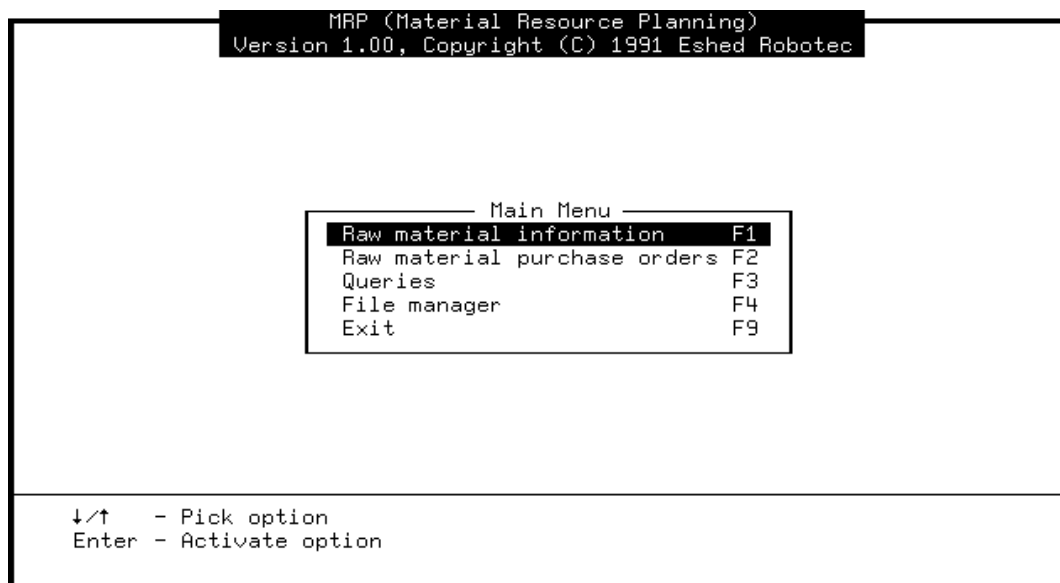
Figure 1: Main MRP Menu

These options are available:

Raw material information:

> Supplements information on raw materials in the CIMDEF database. Includes inventory and supplier information. Used to generate MRP queries/reports and raw material purchase orders.

Raw material purchase orders:

> Generates purchase order according to user's specifications.

Queries/Reports: Reports on quantities of raw material required to produce a selected range of orders or to meet minimum inventory requirements.

Produces reports of ASRS inventory or production order validity.

File Manager: Reviews or modifies the names of the CIMDEF data files used by the MRP software.

Exit: Exits the MRP software.

Each of these options will be described in more detail in the following sections.

Common Features

A number of common features are found in many MRP screens:

- The ↑ and ↓ keys are used to select an option from a menu. In most screens, pressing < Enter> activates your choice.

  Alternatively, you can select and activate an option by pressing the corresponding function key listed in the menu.

- In screens that require you to supply information in a number of fields, you must press < Enter> after each entry, or the previously saved value will remain. Pressing < Enter> also moves the cursor to the next field.

  To simply move the cursor between the fields, use the ↑ and ↓ keys.

- When a report option is listed at the bottom of the screen, it is activated by pressing < F5> .

- Pressing < Esc> returns you to the previous screen.

Reports and Production Orders

The MRP software allows you to generate various types of reports and purchase orders. Each time you activate one of these options, the following series of screens will appear:

1. If a partial report is available, the first menu will ask you to choose between a full and a partial report, as shown below.

```
 ┌─ Type of Report ─┐
 │   ▐ Partial ▌     │
 │     Full          │
 └───────────────────┘
```

When a partial report is chosen, the next window prompts you for the range. The particular range depends on the type of report you have requested. In the example below, a raw material information report was requested and the user is prompted for the range of part numbers.

```
 ┌─ Type of Report ─┐
 │   ▐ Partial ▌     │
 │     Full          │
 ┌── Enter raw range ──┐
 │ From: ___1 To: 1000 │
 └─────────────────────┘
```

2. The next window, or the first if a partial report is not available, prompts you for the report's destination.

    Once an option is chosen, a message will flash on the screen informing you that the report is currently being prepared.

```
 ┌─ Report Destination ─┐
 │      Screen          │
 │      Printer         │
 │     ▐ File ▌          │
 └──────────────────────┘
```

Choosing the screen option will display the report on the screen. The bottom of the screen shows the numerical keypad keys used to view the report:

PgDn/PgUp   Move one page down/up.

↑/↓   Move one line down/up.

Home/End   Move to start/end of file.

To exit the report and return to the previous screen, press < Esc> .

If you choose the printer option, you will receive the following message:

```
Make sure printer is connected and ready. Press <Enter> to continue
```

To continue printing, press < Enter> . To abort the print command, press < Esc> . This will return you to the Report Destination window.

If you choose to send the report to a file, you will be prompted for the file name:

```
┌─ Enter file name (without extension) ─┐
              raw
```

Enter a name with up to eight characters. Do not add any extensions; the program automatically adds .REP to the name you entered.

If this file already exists, you will receive the following message:

```
═══════ Verify ═══════
File "raw.rep" already exists. Overwrite? (y/n)
```

You can either write over the previous contents of the file, or enter a new file name.

Raw Material Information

The raw material database supplements the information on raw materials contained in the CIMDEF database. It allows the user to create, view or modify the following information:

- minimum stock quantity definition

- unit price

- minimum order quantity

- delivery time

- supplier information.

This information is used by the MRP software to generate queries, reports and raw material purchase orders.

Choosing the Raw Material Information option from the main MRP menu displays the selection screen, shown in Figure 2.

```
┌──────────────────────────── Raw Material Information ────────────────────────────┐
│                                                                                    │
│                                                                                    │
│     Raw material ID # :    1                                                       │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
│                                                                                    │
├────────────────────────────────────────────────────────────────────────────────┤
│                                                                                    │
│     Enter - Select current                                                         │
│     F5 - Report                                                                    │
│     Esc - Previous menu                                                            │
│                                                                                    │
└────────────────────────────────────────────────────────────────────────────────┘
```

Figure 2: Raw Material Information Selection Screen

From this screen you can view the information on a particular raw material or issue a report on all or a selected range of raw materials.

If you choose to generate a report from this screen by pressing < F5> , you must then specify the report type (full or partial), the range of raw material part numbers (for a partial report) and the report's destination (screen, file or printer).

To view the information on a particular raw material, enter its part number and press < Enter> . Part numbers from 1 to 1000 may be entered. If there is no part defined for this number, you will receive the following message:

```
┌──────── Error ────────┐
│ Part does not exist    │
└───────────────────────┘
```

If the number entered does not correspond to a raw material part, this message will appear on the screen:

```
┌──────────────── Error ────────────────┐
│ This part is not defined as a raw material │
└────────────────────────────────────────┘
```

Once you have typed an acceptable part number and pressed < Enter> , you will receive
the Raw Material Information Screen as shown in Figure 3.

```
┌──────────────────────┤ Raw Material Information ├──────────────────────┐
│                                                                        │
│                                                                        │
│   Raw material ID # :   1           Name :Plastic, 10*10*2             │
│                                                                        │
│   Minimum stock quantity :  30                                         │
│                                                                        │
│   Unit price :      12.5 $                                             │
│                                                                        │
│   Minimum order quantity :  10                                         │
│                                                                        │
│   Delivery time :   2 Days                                             │
│                                                                        │
│   Supplier :ACME Plastic Co, 99 Somewhere St, Anytown NA               │
│                                                                        │
│   Remarks  :color - white                                              │
│                                                                        │
│                                                                        │
│                                                                        │
│                                                                        │
├────────────────────────────────────────────────────────────────────────┤
│   F1 - Select                    F5 - Report                           │
│   F2 - Save current              Esc - Previous menu                   │
│   F3 - Delete curent                                                   │
└────────────────────────────────────────────────────────────────────────┘
```

Figure 3: Raw Material Information Screen

The screen contains the following fields:

Part #:   Number assigned to the part in the CIMDEF database. The part
                    identified by this number must be a raw material. This field is not
                    accessible from this screen.

Name: Name assigned to the part in the CIMDEF database. This field is not
                    accessible from this screen.

Minimum stock quantity:

                    Minimum inventory required.

Unit price: Price per item in dollars.

Minimum order quantity:

                    Supplier's requirement for minimum order size.

Delivery time: Number of days required by supplier to deliver an order.

Supplier: Supplier's name and address.

Remarks: Additional comments on the material.

The bottom of the screen lists a number of options:

F1	Return to the raw material selection screen.
F2	Save the current raw material information. You will receive the message "Writing to file".
F3	Delete the current raw material information on this part. You will be asked to verify this command.
F5	Generate a report of the information for all raw material parts or for a selected range.
< Esc>	Exit this screen and return to the previous screen

If you have made changes but have not saved them by pressing < F2> , you will prompted to do so when you exit this screen.

Raw Material Purchase Order

A raw material purchase order contains the information necessary to order the required raw materials from the supplier. Purchase orders may be issued according to the following specifications:

- satisfy minimum stock quantity

- fulfill all production orders

- fulfill a range of production orders

The software numbers the purchase orders consecutively by referring to the file NORD.MRP which stores the number of the last purchase order issued.

When the purchase orders are sent to the printer, each order is printed on a separate page.

Choosing the Raw Material Purchase Order option from the MRP main menu displays the screen shown in Figure 4.

```
┌─────────────────────────────┤ Raw material purchase order ├─────────────────────────────┐
│                                                                                          │
│                                                                                          │
│                                                                                          │
│                                                                                          │
│                        ┌──────────── Issue Purchase Orders Menu ────────────┐            │
│                        │ ▐To satisfy minimum stock quantities             ▌ │            │
│                        │  To fullfill all production orders                 │            │
│                        │  To fullfill selected production orders            │            │
│                        └────────────────────────────────────────────────────┘            │
│                                                                                          │
│                                                                                          │
│                                                                                          │
│                                                                                          │
├──────────────────────────────────────────────────────────────────────────────────────┤
│   ↓/↑    - Pick option                                                                   │
│   Enter - Activate option                                                                │
│   Esc   - Abort                                                                          │
└──────────────────────────────────────────────────────────────────────────────────────┘
```
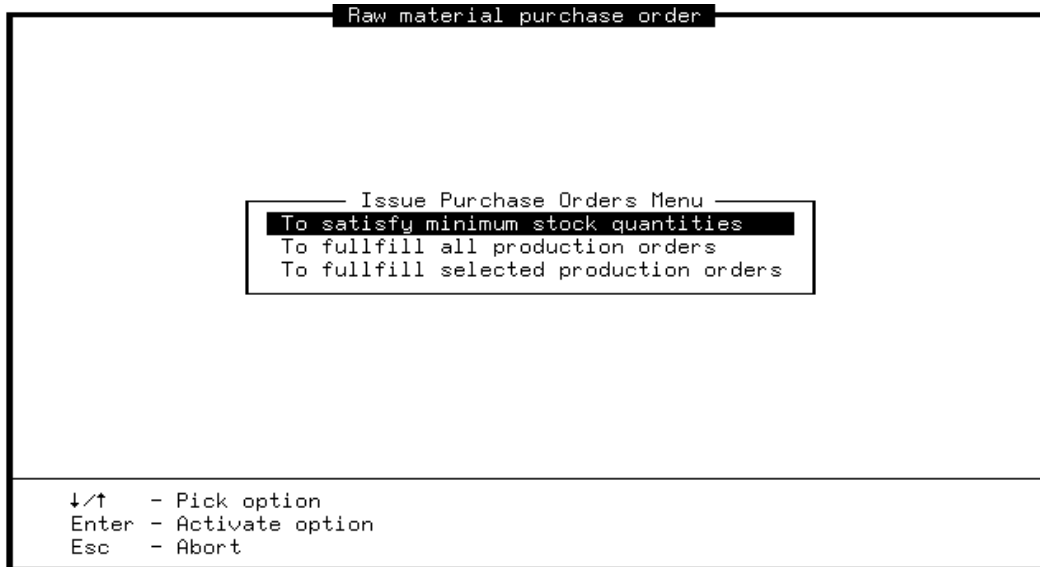
Figure 4: Raw Material Purchase Order Menu

Each of these options will be discussed separately in the next sections.

Satisfy Minimum Stock Quantity

The first option is to satisfy the minimum stock quantity. The raw material database contains the minimum stock quantity for each raw material, while the ASRS files contain the available stock quantity.

The amount ordered is the larger of these two quantities:

• twice the minimum stock quantity, minus the available stock quantity

• the supplier's minimum order quantity

When the satisfy minimum stock quantity option is chosen, the following window appears on the screen:

```
┌─── Report Destination ───┐
│         Screen           │
│         Printer          │
│        ▐ File ▌          │
└──────────────────────────┘
```

You are asked to specify whether the purchase order is printed to the screen, to a file or to the printer.

When the printer is chosen this message appears:

```
┌──────────────────────────────────────────────────────────────┐
│  Make sure printer is connected and ready. Press <Enter> to continue  │
└──────────────────────────────────────────────────────────────┘
```

To continue printing, press < Enter> . To abort the print command, press < Esc> . This will return you to the previous window.

If you choose to send the report to a file, you will be prompted for the file name.

```
┌─ Enter file name (without extension) ─┐
│            raw            │
└───────────────────────────┘
```

Enter a name with up to eight characters. Do not add any extensions - the program automatically adds .REP to the name entered.

If this file already exists, you will receive the following message:

```
┌──────────────── Verify ────────────────┐
│ File "raw.rep" already exists. Overwrite? (y/n) │
└──────────────────────────────────────────┘
```

You can either write over the previous contents of the file, or enter a new file name.

When the purchase orders are written to a file, the program will report the number of purchase orders issued, as shown below:

```
┌──── Status ────┐
│ 4 orders were created │
└─────────────────┘
```

An example of a purchase order is given in Figure 5.

```
┌────────────────────────── Report ──────────────────────────┐
│ ----------------------------------------------------------- │
│  Date: 30/05/91                                             │
│                                                             │
│  Purchasing order #: 25                                     │
│                                                             │
│  To: ACME Plastic Co, 99 Somewhere St, Anytown NA           │
│                                                             │
│    Item #: 1        Item name: Plastic, 10*10*2             │
│                                                             │
│    Quantity: 60                                             │
│    Price per unit: 12.50 $                                  │
│    Total price: 750.00 $                                    │
│    Delivery time: 2 days                                    │
│ ----------------------------------------------------------- │
│ ----------------------------------------------------------- │
│  Date: 30/05/91                                             │
│                                                             │
│  Purchasing order #: 26                                     │
│                                                             │
│  To: ACME PArt 6 Company                                    │
│                                                             │
│    PgDn/PgUp - Move Page, ↓/↑ - Move Line, Home/End - Start/End, Esc - Quit │
└─────────────────────────────────────────────────────────────┘
```

Figure 5: Purchase Order Report

Fulfill All Production Orders

The second option is to fulfill all production orders. The MRP software accesses the CIMDEF database to determine the total production order requirements and the ASRS database to check the quantities in stock. The program uses this information to generate raw material purchase orders to satisfy all production requirements.

When this option is chosen, the next window to appear on the screen asks the user whether to write the purchase orders to the screen, to a file or to the printer.

```
┌─ Report Destination ─┐
│       Screen         │
│       Printer        │
│       █File█         │
└──────────────────────┘
```

If the file option is chosen, you must specify the file name.

```
┌─ Enter file name (without extension) ─┐
│                raw                    │
└───────────────────────────────────────┘
```

Enter a name with up to eight characters. Do not add any extensions - the program automatically adds .REP to the name entered. Remember that all reports generated by the MRP software have this extension.

Fulfill Selected Production Orders

The third option is to fulfill selected production orders.

```
┌──── Issue Purchase Orders Menu ────┐
│ To satisfy minimum stock quantities │
│ To fullfill all production orders   │
│ █To fullfill selected production orders█ │
└─────────────────────────────────────┘
```

This will issue separate purchase orders to ensure sufficient raw material to produce a range of orders, selected according to the following criteria:

•   production order number

•   production order date

•   production order priority

The MRP software accesses the CIMDEF database to determine the production order requirements for the selected range and accesses the ASRS database to check the quantities in stock. This information is used to generate the purchase orders.

When this option is chosen, the following window asks the user to choose the selection criteria:

```
┌─────────────────────┐
│ By order number     │
│ By date             │
│ By priority         │
└─────────────────────┘
```

Order Number

When a selection according to order number is chosen, the next window asks for the range. The default values of 1 to 1000 will always appear. Change these numbers to suit your needs, pressing < Enter> after each change. In the example shown below, a range of 1 to 20 was entered.

```
┌──── Enter order range ────┐
│      From: ___1 To: 20__   │
└───────────────────────────┘
```

Date

When a selection according to date of production order is chosen, the following window asks for the range. The default for the start and end of the range is the current date. Enter suitable dates, pressing < Enter> after each entry.

```
┌──── Enter date range ────┐
│ From: 02/06/91 To: 02/06/91 │
└──────────────────────────┘
```

If the dates you entered are not acceptable, you will receive an error message, as in the example shown below:

```
┌──── Enter date range ────┐
│ From: 00       To: 02/06/91 │
│ Incorrect date! Re-enter    │
└──────────────────────────┘
```

Priority

The third selection criteria available is the priority of the production orders. If this option is chosen, the following window asks for the range of priorities.

```
┌──── Enter priority range ────┐
│      From: ___1 To: __10      │
└──────────────────────────────┘
```

If the range entered is not acceptable, as in the example shown below, an error message is received:

```
┌──── Enter priority range ────┐
│      From: __11 To: __10       │
│ Incorrect range! Re-enter      │
└──────────────────────────────┘
```

Once the selection criteria and an acceptable range are chosen, the next window requests the destination of the report.

```
┌─ Report Destination ─┐
│      Screen          │
│      Printer         │
│     ▐File▌           │
└──────────────────────┘
```

If the file option is chosen, you must specify a file name with up to eight characters. Do not add any extensions; the program automatically adds .REP to the name entered.

Once the program has finished writing the production orders, it prints a message on the screen telling you how many were generated.

Queries and Reports

The Queries option uses the CIM database information to generate three different types of reports:

• Raw material production requirements

• Inventory report.

• Production order validity report.

Selecting this option from the main MRP menu screen displays the following screen:

```
┌──────── Queries Menu ────────┐
│ ▐Production order validity▌   │
│  Inventory report            │
│  Raw material production requirements │
└──────────────────────────────┘
```
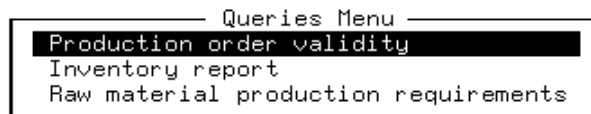
Each of these options will be discussed in the following sections.

Production Order Validity Report

This request produces a report on the validity of all orders or a specified range of orders. This option allows you to find errors before starting the actual production cycle. To correct errors you will need to use the CIMDEF software.

Orders are listed consecutively. Valid orders are followed by the message O.K. If errors are found, the line number in which the error appears is listed, followed by a one line error message.

The following are examples of typical error messages:

Part number is out of range: The part number given in the order is not within the accepted range (1 - 1000).

Empty order: The order does not contain any part numbers.

A summary of the results of the report appears on the last page. It includes number of orders checked, the number valid and the number not valid.

Once the production order validity option is chosen, the next window requests the destination of the report.

```
┌─ Report Destination ─┐
│        Screen        │
│        Printer       │
│        █File█        │
└──────────────────────┘
```

If the file option is chosen, you must specify a file name with up to eight characters and no extension.

```
┌─ Enter file name (without extension) ─┐
│                raw                    │
└───────────────────────────────────────┘
```

An example of a production order validity report is given in Figure 6.

```
                            ▐ Report ▌

                    ┌──────────────────────────────────┐
                    │ Production Orders Validity Report │
                    └──────────────────────────────────┘

    Order #: 1:

    Order #: 2:

    Order #: 3:

    Order #: 4:

    Order #: 5:

       line 27: part number is out of range.
       line 28: part number is out of range.
       line 29: part number is out of range.
       line 30: part number is out of range.
    Order #: 11:
        Empty order.

    Order #: 30:
        OK.

    Order #: 31:
        OK.

    Order #: 45:
       line  1: part 1 is a raw material.

    Order #: 55:
        OK.

    Order #: 67:
 ──────────────────────────────────────────────────────────────
  PgDn/PgUp - Move Page, ↓/↑ - Move Line, Home/End - Start/End, Esc - Quit
```

Figure 6: Production Order Validity Report

Inventory Report

This request produces a short report of all parts and empty templates stored in the ASRS.

```
         ┌─ Report Destination ─┐
         │        Screen        │
         │        Printer       │
         │        ▐ File ▌       │
         └──────────────────────┘
```

When this option is chosen, the following window requests the destination of the report.

If the file option is chosen, you must specify a file name with up to eight characters and no extensions.

An example of an inventory report is shown in Figure 7.

```
┌──────────────────────────── Report ────────────────────────────┐
│                        ┌─────────────────────┐                  │
│                        │  Inventory Report   │                  │
│                        └─────────────────────┘                  │
│                                                                 │
│                                                                 │
│     Parts:                                                      │
│     ========                                                    │
│                                                                 │
│          Part #              Name         Quantity    In feeder(s) │
│          --------        ----------------  ----------   --------------- │
│               3          Lamp                 2                 │
│               6          Part 6 (Raw)         1                 │
│               7                               1                 │
│               8                               1                 │
│              10          Part 10              1                 │
│              12          Part 12              1                 │
│              14          Part 14              1                 │
│                                                                 │
│     Empty Templates:                                           │
│     ==================                                          │
│                                                                 │
│                      Template type #        Quantity           │
│                      ----------------      ------------        │
│                              1                  1              │
│                              9                  1              │
│                             11                  1              │
│                             13                  1              │
│                                                                 │
│  PgDn/PgUp - Move Page, ↓/↑ - Move Line, Home/End - Start/End, Esc - Quit │
└─────────────────────────────────────────────────────────────────┘
```
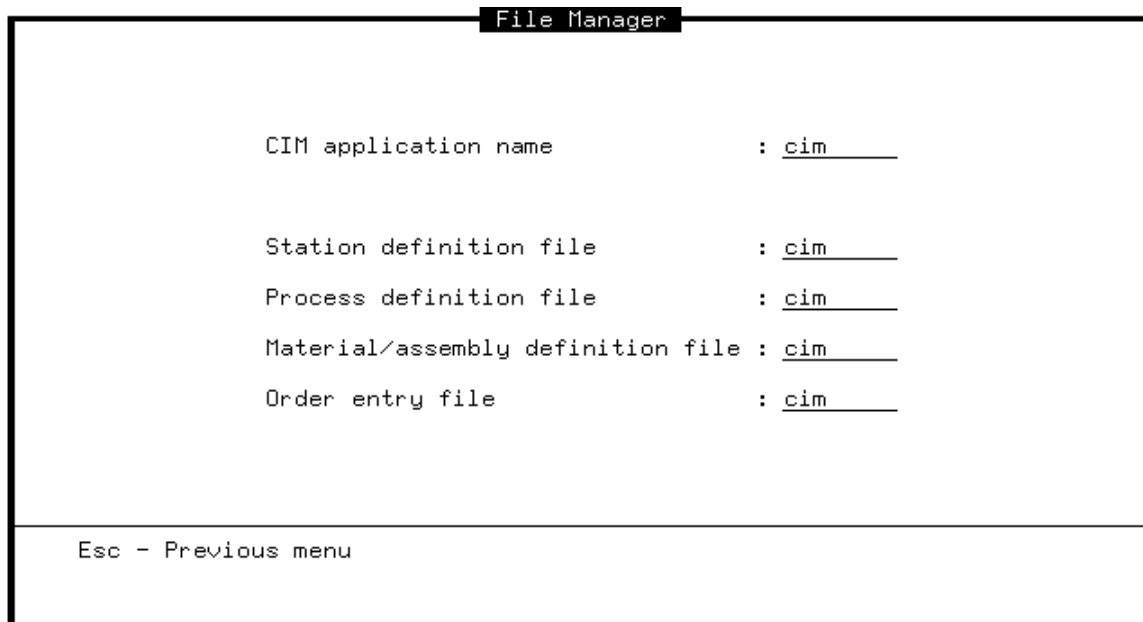
Figure 7: Example of an Inventory Report

Raw Material Production Requirements Queries

This request produces a report describing the quantities of raw materials required to manufacture a specified range of orders.

The specifications include:

• a range of order numbers

• all orders

• all orders satisfying a date range

• all orders satisfying an order-priority range

Once the raw material production requirements queries option is selected, the next window asks you to choose the selection criterion.

```
┌──────────────────┐
│ All orders       │
│ By order number  │
│ By date          │
│ By priority      │
└──────────────────┘
```

Order Number

When a selection according to order number is chosen, the next window asks for the range. The default values of 1 to 1000 will always appear. Change these numbers to suit your needs, pressing < Enter> after each change. In the example shown below, a range of 1 to 20 was entered.

```
┌─── Enter order range ───┐
│    From: ___1 To: 20__   │
└──────────────────────────┘
```

If the range entered is not acceptable, as in this example, an error message is received.

```
┌─── Enter order range ───┐
│    From: ___0 To: 1000   │
└─ Incorrect range! Re-enter ─┘
```

Date

When a selection according to date of production order is chosen, the following window asks for the range. The current date is the default for the start and end of the range. Enter suitable dates, pressing < Enter> after each entry.

```
┌─── Enter date range ───┐
│ From: 02/06/91 To: 02/06/91 │
└────────────────────────┘
```

If the range you enter is not acceptable, you will receive an error message, as in the example shown below:

```
┌─── Enter date range ───┐
│ From: 00      To: 02/06/91 │
└─ Incorrect date! Re-enter ─┘
```

Priority

The third selection criteria available is the priority of the production orders. In this case, the following window asks you to specify the range of priorities.

```
┌─── Enter priority range ───┐
│    From: __11 To: __10      │
└─ Incorrect range! Re-enter ─┘
```

If the range entered is not acceptable, as in the example shown below, an error message is received:

```
 ┌── Enter priority range ──┐
 │  From:  ___1 To:  __10   │
 └──────────────────────────┘
```

Once the selection range has been entered, the next window asks you to choose the report's destination.

```
 ┌─ Report Destination ─┐
 │       Screen         │
 │       Printer        │
 │      █File█          │
 └──────────────────────┘
```

If you choose to send the report to file, you will be prompted for a file name of up to eight letters with no extensions.

An example of a raw material production requirements report is shown in Figure 8.

```
┌──────────────────────████Report████────────────────────────┐
│                                                              │
│                                                              │
│         ┌─────────────────────────────────────────┐         │
│         │ Raw Material Production Requirements Report │       │
│         └─────────────────────────────────────────┘         │
│                                                              │
│            Part #        Required      Available             │
│            ────────      ──────────    ───────────           │
│              1             952            0                   │
│              6             246            1                   │
│                                                              │
├──────────────────────────────────────────────────────────────┤
│ PgDn/PgUp - Move Page, ↓/↑ - Move Line, Home/End - Start/End, Esc - Quit │
└──────────────────────────────────────────────────────────────┘
```

Figure 8: Raw Material Production Requirements Report

File Manager

The file manager lets you view or modify the names of the CIMDEF information files read by the MRP program:

- station definition file

- process definition file

- material/assembly definition file

- order entry file definition file

Choosing the File Manager option from the main MRP menu displays the screen shown in Figure 9.

```
┌──────────────────────────■ File Manager ■──────────────────────────┐
│                                                                    │
│                                                                    │
│            CIM application name            : cim____               │
│                                                                    │
│                                                                    │
│            Station definition file         : cim____               │
│                                                                    │
│            Process definition file         : cim____               │
│                                                                    │
│            Material/assembly definition file : cim____             │
│                                                                    │
│            Order entry file                : cim____               │
│                                                                    │
│                                                                    │
│                                                                    │
├────────────────────────────────────────────────────────────────────┤
│   Esc - Previous menu                                               │
│                                                                    │
└────────────────────────────────────────────────────────────────────┘
```

Figure 9: File Manager Screen

The default file names are CIM followed by the appropriate extension. The extensions are added automatically by the program.

The name appearing in the CIM application name field is copied to the next four file names if < Enter> is pressed while the cursor is in this field.

Any time you modify an entry you must press < Enter> before continuing to another field, or the changes you made will be lost.

Exit

This option exits the MRP software.

When this option is chosen, a message is printed on the screen asking you to verify the command, as shown in Figure 10.

```
        MRP (Material Resource Planning)
     Version 1.00, Copyright (C) 1991 Eshed Robotec




                    ── Main Menu ──
              Raw material information      F1
              Raw ── Verify ──      s F2
              Quer  Are you sure? (y/n)     F3
              File                   F4
              Exit                   F9




   Esc ─ Abort
```
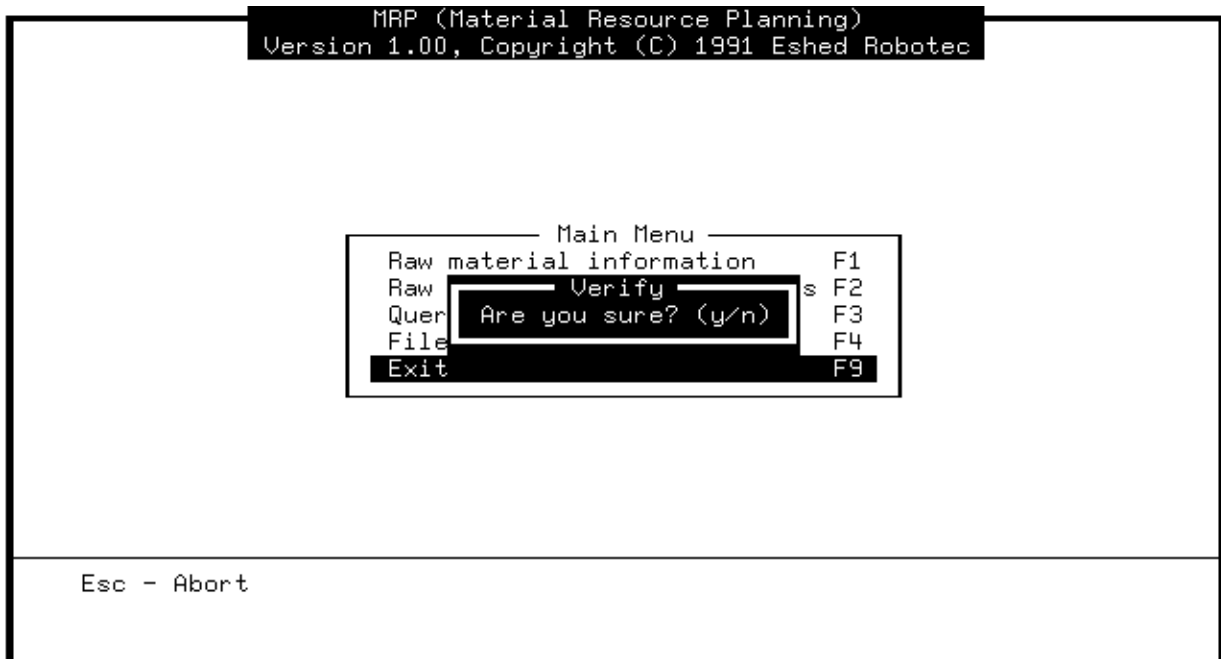
Figure 10: Exit verification Window

Typing Y exits the program; typing n or pressing < Esc> removes the Verify window from the screen.

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CIM Graphic Tracking
Software User's Guide

Introduction

CIM Graphic Tracking Software provides the user with a graphic display of a working
CIM cell, showing the progress of a part as it travels on the conveyor from station to
station. The screen display includes detailed representations of the station elements, such
as computers, controllers, CNC machines, and robots.

The software, which can only be run from the central CIM management computer,
allows the user to change the locations of the stations on the conveyor according to the
configuration of the CIM cell.

Also included are a Utilities option which allows the user to access other CIM software,
and a production report facility.

CIM Graphic Tracking Software utilizes WIZCON to provide these features. WIZCON,
a graphic tracking and reporting software package, has been adapted for this application.

Many WIZCON features are not described in this chapter. For more information, refer
to the WIZCON documentation provided with the CIM software.

Entering the Software

To activate the graphic tracking software from the central management computer, select
the graphics menu (F6) from the CIM Main Menu. You will be presented with two
options. Select the tracking option (F1).

Alternately, type WIZ followed by < Enter> at the DOS prompt.

You will see the CIM_CELL screen, shown in Figure 1.
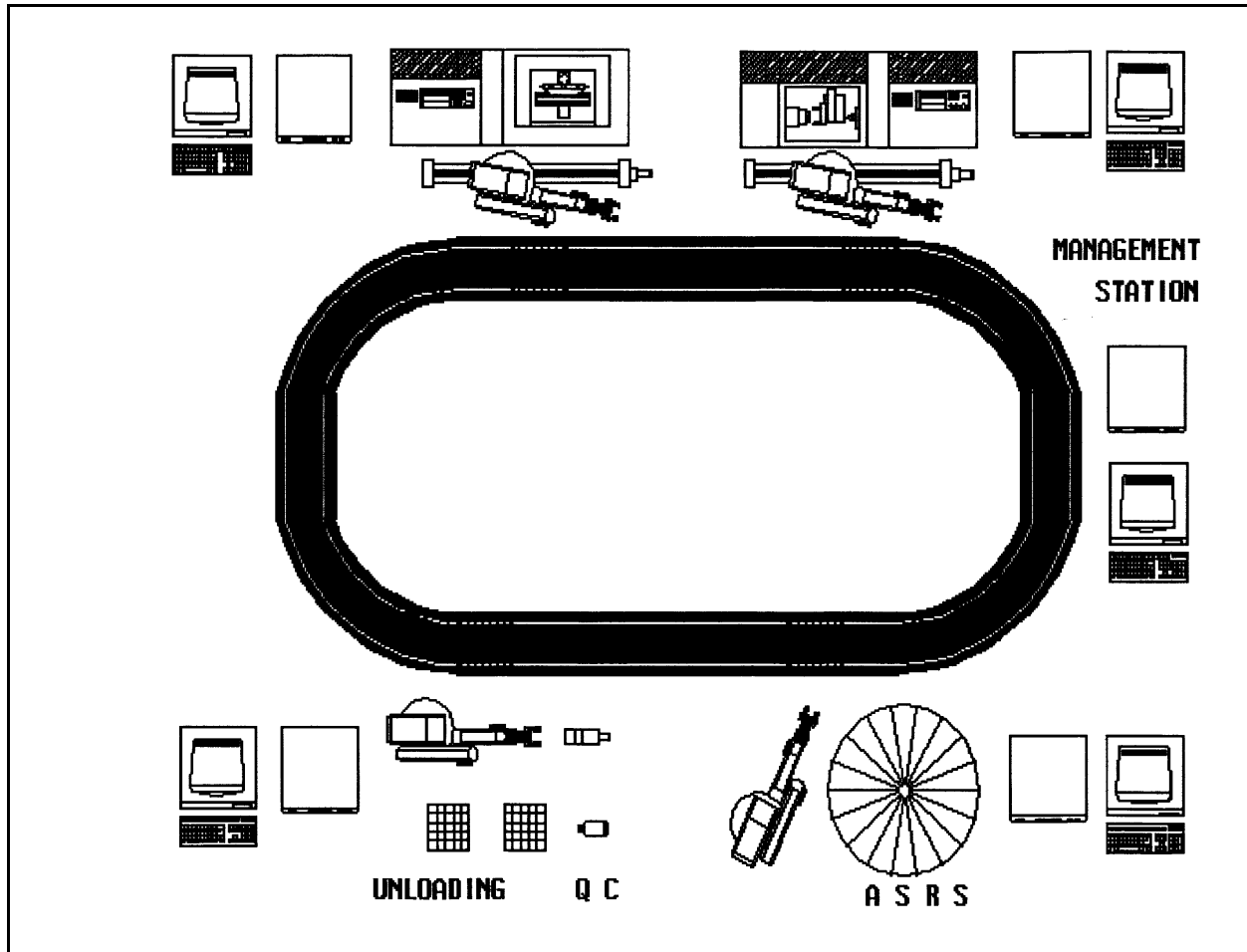
Figure 1: CIM Graphic Tracking CIM_CELL Screen

The CIM_CELL Graphic Display

This CIM_CELL screen, shown in Figure 1, gives a real-time graphic color display of the flow of material in the CIM cell.

On the periphery are detailed representations of the elements located at each station: robots, CNC machines, computers, controllers and other devices.

The CIM cell conveyor is located in the center of the screen. Stations are represented by hatched squares on the conveyor.

When production is in progress, loaded pallets moving on the conveyor are represented by brown squares. The finished part number of the material carried by the pallet is displayed in yellow. For example, when a raw material part is placed on the conveyor,

the screen displays the number of the *processed material* that will be manufactured from this part, according to the current production order. Empty pallets are not shown.

When a pallet reaches a station for processing, the part number and pallet are no longer shown on the screen. Once the processing has finished and part has been returned to the conveyor, the part number and pallet reappear on the screen.

The Function Keys

The function key menu is displayed at the bottom of the CIM_CELL screen:

F1   Access the WIZCON help facility. This is not required for regular CIM operation.

F2   Enter Stations screen. This screen allows you to define and change the location of the stations on the conveyor.

F3   Enter Utilities screen. This screen allows you to run other CIM software.

F4   Enter Production Report screen which shows the status of the production order currently being manufactured.

F5   Start production. This command can only be given after production order and information have been downloaded using the PROD software.

F6   Stop production - suspends manufacturing. Stops release of new raw material into the manufacturing process.

F7   Display second part of function key menu

F9   Exit the program. This will bring you to the WIZCON options menu. Choose the exit option to get back to the DOS shell.

F10   Run the login sequence. Not used in the current version.

The function keys that call up new screens are described in the following sections.

The Stations Screen

Pressing F2 from the CIM_CELL screen calls up the Station Definition screen shown in Figure 2.

station no.1   23

station no.2   1

station no.3   7

station no.4   17

station no.5   0

station no.6   0

station no.7   0

station no.8   0
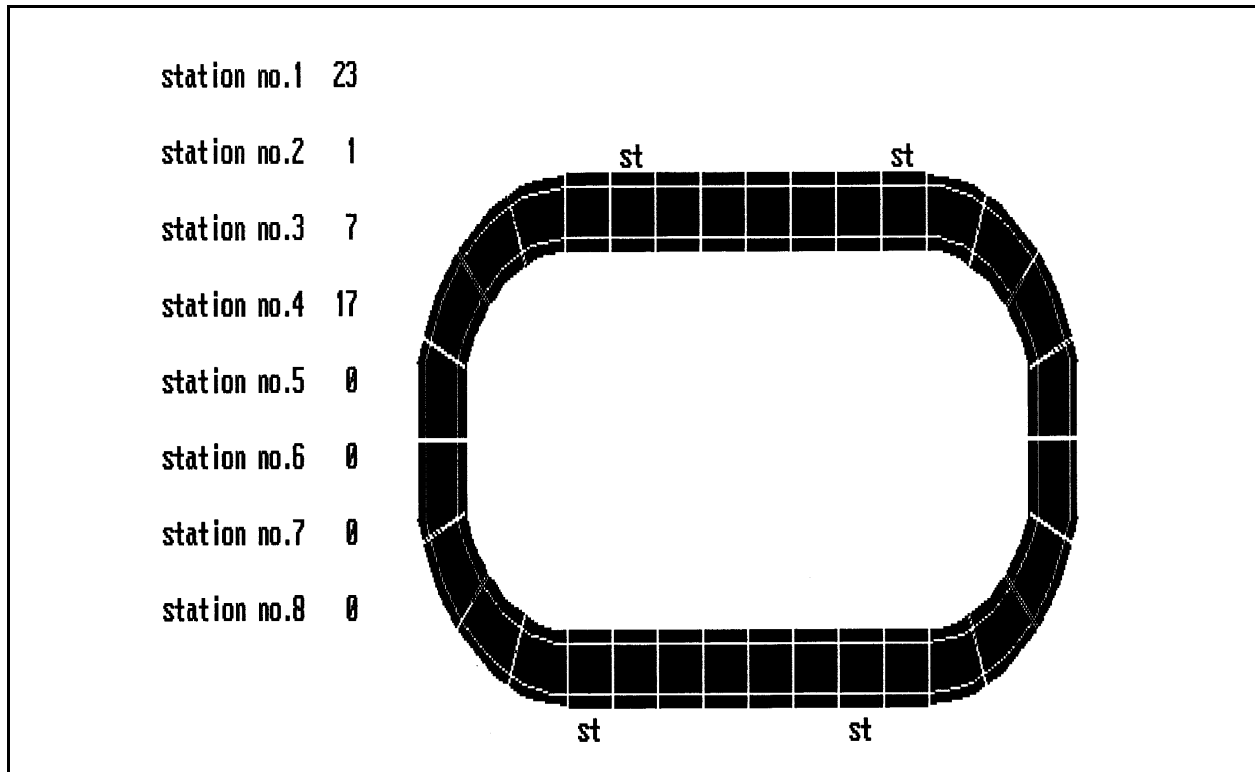
Figure 2: CIM Graphic Tracking Station Definition Screen

The conveyor is divided into 32 numbered sectors, starting with sector 1 in the upper right side and progressing counterclockwise around the conveyor. The yellow letters **st** on the periphery of the conveyor indicate that a station is located at that sector.

The left side of the screen contains a table of the stations and their locations. Up to eight stations are allowed on the conveyor. If less than eight are used, those not in use are listed as being located at sector 0. In the example shown in Figure 2, stations1 - 4 are in use and their locations are listed. The remaining station locations are listed as 0.

The function key menu is displayed at the bottom of the screen.

F5   Define a station location on the conveyor

F9   Return to the CIM_CELL screen

The F4 and F7 key functions will not be covered here.

Setting a Station Location

To set a station location, press < F5> . The following message will appear on the bottom of the screen:

```
Gate select: Hit gate's key, or move + to desired gate, then ↵
```

(Here the word gate means station.)

To select a station, type the station number using the numerical keypad, then press < Enter> .

You may also select a station by using the ↑↓ keys to move the blue circle cursor through the station location table to the desired station number, and then pressing < Enter> .

A new function key menu will appear on the bottom of the screen, along with the following message:

```
Gate: STATION1   STATION PLACE: Enter value, then ↵: 3
```

The selected station appears on the left side of the message and the current station location appears on the far right side. In this example station 1 is currently located at sector 3.

To change the location, type the desired sector number and press < Enter> . The station location table will be updated and the yellow letters **st** will appear next to the desired sector on the conveyor diagram.

Another way of setting a station location, once the station number has been selected, is to use the function keys, listed at the bottom of the screen, to move the yellow letters **st** along the conveyor to the desired sector.

The key functions are:

F5   move to next sector

F6   move to previous sector

F7   move between sectors by increments of 10

F8   move between sectors by increments of -10

The sector number will be displayed on the right side of the message at the bottom of the screen, and will also appear in the station location table.

To keep this station location, press < Enter> .

When you return to the CIM_CELL screen, the updated station locations will appear on the conveyor.

The Utilities Screen

Pressing F3 from the CIM_CELL screen displays the screen shown in Figure 3:

```
          F2      ATS  COM1  (center)

          F3      CIMDEF

          F4      PRODUCTION ORDER

          F5      RSNET

          F6      ATS  COM2  (stations)

          F7      ASRS

          F8      DOS shell

          F9      RETURN TO CIM_CELL screen
```

Figure 3: CIM Graphic Tracking Utilities Menu

The options are:

F1   Activate the Advanced Terminal Software (ATS) for direct access to the Central CIM controller.

F2   Access the CIMDEF software.

F4   Access the PROD software to download or modify an order.

F5   Access the RSNET software. This option is only available if the central computer running WIZCON is connected to the Central CIM Network Switcher.

F6   Access a station controller via the Central CIM Network switcher. This option is only available if the central computer running WIZCON is connected to the Central CIM Network switcher.

F7   Access the ASRS software. RSNET should have been used previously to connect to the ASRS station controller.

F8   Leave the CIM graphic display software and return to the DOS shell. After typing your DOS command you may return to WIZCON by typing exit at the DOS prompt.

F9   Return to the CIM_CELL graphic screen

The Production Report Screen

Pressing F4 from the CIM_CELL screen displays the Production Report screen shown in Figure 4:

```
              PRODUCTION   REPORT
      PART #    ORDERED   IN PROCESS  COMPLETED    REMARKS
        1          3          1           0        RELEASED (missing raw mat.)

        2          5          2           2        READY

        3          5          4           1        WORKING

        0          0          0           0

        0          0          0           0

        0          0          0           0

        0          0          0           0

        0          0          0           0

        0          0          0           0

        0          0          0           0
```

Figure 4: CIM Graphic Tracking Production Report

This screen lists the quantity of each part, by finished part number, in the order   being manufactured. The quantity completed, quantity in progress and specific remarks, generated by the system, are listed for each part number.

The following remarks may appear:

READY: System ready for release of the next raw part from ASRS.

WORKING: Production in progress. Cannot release a raw part at this time.

RELEASED: All raw parts in the order have been released from ASRS.

RELEASED (missing raw mat.):

                    All available raw parts have been released. Number available was
                    insufficient.

DONE: Every item in the order has been processed.

DONE (missing raw mat.):

All available raw parts processed. Number available was insufficient.

This report is generated after production data has been transmitted to the Central CIM Management computer. For an on-line report, use the ACL program RORD as described in the chapter, "CIM-ACL Report/Update Programs."

A function key menu is displayed on the bottom of the screen:

F2   Activate ATS for direct access to the Central CIM controller.

F9   Return to the CIM_CELL screen

The functions of the remaining keys < F1> , < F5> - < F8> , will not be covered here.

The Second Function Key Menu

Pressing F7 from the CIM_CELL screen displays the second function key menu on the bottom of the screen:

F2   Activate ATS for direct access to the Central CIM controller.

F3   Use the TRACE facility for debugging purposes. This displays all messages sent to and from the Central CIM controller on the screen.

F4   Run the CIM ACL system reset program to reset the cell.

The functions of the remaining keys F1 and F5 through F8 will not be covered here.

Defining the Graphic Layout and Conveyor Type

The graphic tracking program takes the layout information from files stored in the directory H:\WIZCON at the central CIM computer. Additional information is contained in files that specify the shape of the conveyor: square or oval.

To set the layout and conveyor shape used in the graphic display, do the following:

1.   Enter the H:\WIZCON directory at the central CIM computer.

2.   Type the following:

       CHANGE shape type

where shape is one of the following:

SQ   a square conveyor

OV   an oval conveyor

and type is the name of the layout file without any extension.

Typical examples of layout file names include:

103   standard 3 station ER CIM configuration

104   standard 4 station ER CIM configuration

For example, to change the graphic layout to an oval conveyor with a standard 3 station ER CIM configuration, type:

       CHANGE OV 103

To see a listing of the available layout files for a particular conveyor shape, type the following:

       CHANGE shape ?

where shape is either SQ or OV.

ACL CIM Application Programs and Positions

Introduction

In an ER CIM system, the user defines which manufacturing processes, or applications, are performed at each station.

Each station controller requires its own ACL programs to control the robot and the machines used in the specific manufacturing application. These programs are termed station application programs.

Default programs for template manipulation are provided with the ER CIM software. In general, these programs are suitable for all stations and will not need to be modified. These programs are given in the section "Template Manipulation Programs."

The programs which control the actual manufacturing process must be written to suit the specific robot, machines and application at each station. Designated names, as given in the section "Part Manipulation Programs," must be used.

The ASRS station programs, which do not normally need modification, are not given in this chapter. They can be found in the appendix "System Program Listings."

A number of ACL variables have been defined for use in the station application programs. These are discussed in the section "Control Variables for Station Application Programs."

Whether you use the original or modified default programs, or write your own, you will need to record the robot and linear slidebase (if present) positions used in the programs for each station. The positions required by each program, and the position numbering conventions, are described in this chapter. The positions required for the ASRS station are also given.

In addition, sample station programs are given in the section "Sample ER CIM Applications." You can use these programs, modify them, or create your own programs based on these examples.

Writing Application Programs

ER CIM station application programs should be written at a PC using the ACL Off-Line utility. This allows you to use any full screen editor to write and easily revise your programs. The entire set of CIM application programs for each station must be saved to a file USERn.DNL (n = station number) in the directory H:\CIMSYS\ST at the central CIM computer.

When a station is initialized, the USERn.DNL file and various system programs are downloaded from the central CIM computer to the station controller. Comment lines that begin with the characters ; or # are not transmitted to the controller.

If you want modify a station application program, or add another program, you should make these changes to the USERn.DNL file and then reinitialize the station controller. The command to initialize the station controllers is found in the Station Controllers Setup menu, which is accessed from the Setup Menu option in the CIM Main Menu.

If you would like to test a new station program or modifications to an existing program, you can write or edit the program directly to the station controller's memory, using ATS. Be aware, however, that the next station initialization will download the current USERn.DNL file and erase any changes you have made. If you want to keep the changes, you must enter them into the appropriate USERn.DNL file and reinitialize the corresponding station controller.

Note: If one program "calls" another using a GOSUB command, the program that is "called" must precede the program that "calls" it in the USERn.DNL file.

Sample sets of CIM application programs are given in the section "Sample ER CIM Application Programs." These files are present in the H:\CIMSYS\ST directory. If you want to use these files, copy the USERx.SMP file (where x is LATH, MILL or ASSM) to the USERn.DNL file for the corresponding station. You must copy the entire file of programs for each station application you choose. Then you may modify the programs for your particular application.

For example, if you want to use the application programs in the file USERMILL.SMP, and the CNC mill is located at station 2 in your ER CIM configuration, do the following:

- Copy the file USERMILL.SMP to the file USER2.DNL in the H:\CIMSYS\ST directory of the central CIM computer.

- Next modify the programs as needed using the ACL Off-Line utility.

- Then initialize station 2.

Control Variables for Station Application Programs

The following ACL global variables (global with respect to all the programs at one controller) are used in the station application programs, as given in the following sections. These variables (with the exception of BFR and INFO) refer to information from the CIMDEF data files. The variables are read only (with the exception of INFO) and should not be changed.

BFR   Buffer currently in use (buffers are numbered from 1 - 8). Used in the programs FB and TOB.

MACH   Machine number.

TASKn   Number of task to be performed at machine n. Used by the program TASKn which may be used to perform automatic downloading of CNC programs when AutoCNC cannot be used.

                This variable can be used, for example, to reference a specific CNC program.

The following variables are used in the programs TOB, FB, TOMn and FOMn,

PART   ID of part to be manufactured.

RAW   ID of raw material at buffer.

RAWN   Number of row in assembly component table which refers to the part.

                For example, an assembly may use two parts which are made from the same raw material, but have undergone different manufacturing processes. The variable RAWN allows the station program to differentiate between the materials.

SUBP   Subprocess that part at buffer will undergo.

TASK   Variable that refers to task to be performed on part at buffer. Used in the programs TOMn, FOMn, FB and TOB.

                When the station contains a machine, this variable refers to the task # in the CIMDEF subprocess definition screen.

                When the tasks at a station are robot activities that do not use a machine, the code for these activities is found in the program TOM1. The variable TASK is used to direct the program flow in TOM1 to the code relevent for the part being manufactured.

INFO   Additional information about part. This variable accompanies a part
                     from station to station. It can be used to transfer information
                     obtained at one station to another station where the data will be used.

                     For example, a part undergoes a quality check at a QC station. The
                     variable INFO is assigned a value according to the result. When the
                     part arrives at an unloading station, station programs use INFO to
                     decide whether to place the part in a finished parts container or
                     discard it.

Commands to Open and Close the Gripper

The robots in an ER CIM cell can use servo controlled grippers or pneumatically
controlled grippers. Servo grippers are connected to driver cards on the ACL station
controller and are controlled using the ACL commands OPEN and CLOSE. Pneumatic
grippers are controlled via output signals from the station controller.

To make the user programs suitable for either type of robot gripper, the programs
OGRIP, which opens the gripper and CGRIP, which closes the gripper, are placed in the
USER*n*.DNL file. These programs are written to suit the type of gripper used at the
station. When a station program performs an action that requires the gripper to be
opened or closed, OGRIP and CGRIP are "called" using the command GOSUB.

Consider the following examples:

1. A pneumatic gripper which opens when controller output 3 is on.

```
PROGRAM OGRIP/Y
SET OUT[3]=1
DELAY 200
END

PROGRAM CGRIP/Y
SET OUT[3]=0
END
```

2. A servo gripper.

```
PROGRAM OGRIP/Y
OPEN
END

PROGRAM CGRIP/Y
CLOSE
END
```

If the type of gripper used at a station is changed, the user only needs to modify the programs OGRIP and CGRIP in the USERn.DNL file. The extension /Y must be added to the program name, as shown above, so that the current version will replace the existing version during downloading to the controller.

Position Numbering Conventions

Robot positions used in the sample CIM application use the position vector CIM. The following numbering conventions are used at each station:

Source or Destination Positions	Position from which a robot takes or places a template or part. Typical source or destination positions are the pallet at the conveyor station and the buffers. For example, position numbers from 1 to 8 are used for the buffers, 9 is used for the pallet at the conveyor station.
Intermediate Positions	Robot position on the way to or from a source or destination position, usually directly above the source or destination position. To obtain the intermediate position number, add 10 to the source or destination number. If there is another intermediate position above the first, add 20.

For example, CIM[4] is a position on a buffer at a station, CIM[14] is directly above CIM[4] and CIM [24] is directly above CIM[14].

Required Programs

Two kinds of programs are required for station applications: template manipulation programs and part manipulation programs. The system contains default template manipulation programs which are usually sufficient for most applications. The part manipulation programs are specific to the station application and must be created or modified in accordance with the station layout, machines, robots and tasks to be performed.

If the default template manipulation programs are sufficient, the USERn.DNL files need only contain the part manipulation programs.

Template Manipulation Programs

The following activities are required at every station, no matter what manufacturing process is carried out:

• The robot removes a template from a conveyor pallet.

• The robot places a template on a buffer.

• The requested manufacturing process is performed.

• The robot removes a template from a buffer.

• The robot returns a template to a conveyor pallet (except at an unloading station).

Since the template activities are common to all stations, default programs for these tasks are stored in the files TMPLTA.DNL and TEMPLTB.DNL (when the robot is mounted on a slidebase).

If the user wants to change the programs for a specific station, for example, to change the robot's speed, he must copy the file using the same name and adding the station number as the last character in the name. For example, to change the template manipulation programs for station 2, copy the file TMPLTA.DNL to TMPLTA2.DNL, and modify the new file as desired.

If necessary, you can also change the template manipulation programs for the ASRS by modifying the programs in the file ASR.DNL. Generally, you should not need to change these programs.

When the station controller is initialized, the following programs are downloaded automatically, along with the system programs.

FROMP   Takes template from the conveyor pallet.

TOPLT   Returns template to the conveyor pallet.

FROMB   Takes template from the buffer [BFR].

TOBFR   Returns template to the buffer [BFR].

You will not usually need to write these programs since adequate default programs are provided, as shown below. The listing is in a format ready for the ACL Off-Line Downloader. If these programs suit your application (and they often will), you only need to record the default positions, as described in the following section.

Note: **bolded** lines will be included only if a linear slidebase is used. The system contains two versions of each of these programs: one for a station with a linear slidebase

and one for a station without. The software automatically selects the proper version to download, according to the station configuration in the Station Setup definition of the Station Setup Menu.

```
# get template from pallet
PROGRAM  FROMP
SPEED   40
MOVED   CIMB[9]
MOVED   CIM[19]
GOSUB OGRIP
SPEEDA  5
MOVELD  CIM[9]
DELAY   50
GOSUB CGRIP
SPEEDA  10
MOVELD  CIM[19]
END


# get template from buffer (uses variable BFR)
PROGRAM  FROMB
DEFINE  B1

SET     B1 = BFR + 10;calculate intermediate position
SPEED   40
MOVED   CIMB[BFR]
MOVED   CIM[B1]
GOSUB OGRIP
SPEEDA  5
MOVELD  CIM[BFR]
GOSUB CGRIP
SPEEDA  10
MOVELD  CIM[B1]
END


# put template on pallet
PROGRAM  TOPLT
SPEED   40
MOVED   CIMB[9]
MOVELD  CIM[19]
SPEEDA  5
MOVELD  CIM[9]
DELAY   50
GOSUB OGRIP
SPEEDA  10
MOVELD  CIM[19]
END
```

```
# put template on buffer (BFR)
PROGRAM  TOBFR
DEFINE   B1

SET      B1 = BFR + 10
SPEED    40@PROGLNS = MOVED    CIMB[BFR]
MOVED    CIM[B1]
SPEEDA   5
MOVELD   CIM[BFR]
GOSUB OGRIP
SPEEDA   10
MOVELD   CIM[B1]
END
```

Optionally, you may substitute your own template manipulation programs, using the above names, in the USERn.DNL file for the station. These programs will replace the system's default programs when the files are downloaded during station installation.

Positions for Default Template Manipulation Programs

To use the default programs, you must first properly record the default positions; these are the positions at which the robot holds the template on the buffer and on the pallet. These positions must be defined at each station.

The CIM application programs use two position vectors:

CIM[500]   Positions for robot (group A);
                  Positions 1 through 19 are used by the default template manipulation programs.

CIMB[100]   Positions for group B (linear slidebase, for example);
                  positions 1 through 9 are used by the default template manipulation programs.

When the station controller is turned on, the AUTO program attaches these vectors to the teach pendant. (Positions recorded from the teach pendant will be automatically assigned to these vectors.)

Robot Positions

Template on buffer 1	CIM[1]
Template on buffer 2	CIM[2].
.	
.	
.	
Template on buffer 8	CIM[8]
Template on pallet	CIM[9]
Above 1	CIM[11]
Above 2	CIM[12]
Above 9	CIM[19]

Linear Slidebase Positions

Buffer 1 (template and part)	CIMB[1]
Buffer 2 (template and part)	CIMB[2]
Pallet (template)	CIMB[9]

Positions CIM[1] through CIM[8] refer to buffers 1 through 8. Position CIM[9] is the position of the template on a pallet at the conveyor station.

If a slidebase is used, Group B positions must also be recorded. CIMB[1] through CIMB[8] are the location of the slidebase for grasping a template that is on the corresponding buffer, while position CIMB[9] refers to the pallet station position.

Define only those positions which refer to your specific station layout. Stations with one or no CNC machines have only two buffer positions. Stations with two CNC machines have four buffer positions: buffers 1 and 2 are near machine 1, and buffers 3 and 4 are near machine 2.

Record these positions while the robot is holding a template at the proper location; that is, position CIM[1] is the location of the robot holding a template at buffer 1, while CIMB[1] is the linear slidebase position when the robot holds a template at buffer 1.

The remaining positions used in the default template manipulation programs are set as relative in XYZ coordinates to the defined positions. For example, position CIM[11] has

been previously defined as 100 mm above position CIM[1]. In some cases, however, the relative definition may cause these positions to be out of the robot's range of motion. If this problem occurs, record these positions as absolute positions.

Backing Up Positions to Disk

After recording station positions, you should always backup the positions using the Backup Controller Points option in the Station Controller Setup. This will ensure that the next initialization includes the updated positions.

Part Manipulation Programs

The application programs for each station **must** include the programs that follow. The ER CIM system activates these programs at run time to transfer parts between the buffers and the machines at each station.

The programs should be written by the user at a PC using the ACL Off-Line tool, and copied into the USERn.DNL (n = station number) files in the directory H:\CIMSYS\ST at the central CIM computer. Once the programs are written, you must initialize the station controller, as discussed previously.

If they suit your needs, you can copy the programs contained in the files USERx.SMP (x= LATH, MILL, ASSM), as given in the section "ER CIM Sample Applications". These programs may be modified to suit your application.

The user may also write additional programs as needed.

The programs should refer to the buffer number stored in the global variable BFR.

Note: The programs WTLn and SFLPn exist as system programs and are available for the user if required. The user should not write them.

When the activity to be performed does not involve a machine, the system software activates programs TOM1, WTM1 and FM1 in turn. TOM1 contains robot commands to perform the desired manufacturing process.

FB   Takes part from template located at buffer number BFR.

TOB   Returns part to template located at buffer number BFR.

TOM1	Usually, this program takes a part to machine number 1 and inserts it. When CNC machines are used, this program commands activities such as door and vice opening.
	If the task does not involve a machine, this program will contain sections of code with robot commands, and the value of the variable TASK will be used to direct the program flow to the code for the required task.
	If you are using AutoCNC for automatic downloading of programs to the CNC machine, you may need to use the program WTLn as described in the following section, "Programs Required for Assembly and Other Advanced Tasks".
	This program uses the variable TASK1.
TOMn (n = 2 – 4)	Similar to TOM1 but takes part to machine number n (if present at the station) and inserts it. Uses the variable TASKn.
	Since this program operates the robot, only one TOMn program may run on the controller at any one time.
WTM1	Activates machine number 1 and waits for it to complete its task. This program uses the variable TASK1.
WTMn (n = 2 – 4)	Similar to WTM1 but activates machine number n (if present at the station). Uses the variable TASKn.
	More than one WTMn program may run on the controller at the same time. For example, if a station contains two CNC machines, both may be run simultaneously to process two parts.
FM1	Removes part from machine number 1. When CNC machines are used, this program commands activities such as door and vice opening.
FMn (n = 2 – 4)	Similar to FM1 but removes part from machine number n (if present at the station).
	Since this program operates the robot, only one FMn program may run on the controller at any one time.

Programs Required for Assembly and Other Advanced Tasks

The following programs are required only for assembly tasks and other advanced
ER CIM applications. For a better understanding of the more advanced ER CIM station
application programs, refer to the sample application programs in the file
USERASSM.SMP, given in the section "Sample Application Programs."

ASMBL   Assembles a part from its components.

GETP   Takes an assembly part from the assembling surface to a transfer
                        point, or takes a part from a local feeder to a transfer point.

The following programs are used during automatic downloading of programs to the CNC
machines using the program AutoCNC.

LMODn   Puts CNC machine n at station in Load mode before downloading a
(n = 1 – 4)   program.

AMODn   Returns CNC machine n at station to Automatic mode after
(n = 1 – 4)   downloading a program.

WTLn   This is a **system** program that waits for the downloading process to
(n = 1 – 4)   be finished. This program **must** be used with CNC machines which
                        cannot accept I/O commands while a program is being downloaded.
                        The user must call this program from the program TOMn using the
                        ACL command GOSUB WTLn. This line must be placed before the
                        first command that sends an I/O signal to the CNC machine.

The following two programs should only be used if robot intervention (in this case,
turning a part over) is required during the manufacturing process.

SFLPn   This is a **system** program which is called by WTMn when the CNC
(n = 1 – 4)   machine is ready for the part to be turned over by the robot.

FLIPn   User programs to turn over a part removed from a CNC machine,
(n = 1 – 4)   called by SFLPn.

Optional Program for Automatic Downloading of CNC Programs

TASKn   Performs automatic downloading of CNC programs when AutoCNC
                        cannot be used. Uses the variable TASKn.

                        During production, this program is run immediately after FB.

Optional User Station Programs

The following optional programs have been created. They have controller-assigned program numbers which allow them to be accessed from the teach pendant, as discussed in the next section.

Default versions of programs STA and STB are included in the ACL system programs; the rest are currently empty. All programs may be modified as required by the application.

STA	Program to home the robot and bring it to a starting position; the default version calls the program STB.
STB	Executes the homing procedure for other axes (HHOME program for axis 7) and brings the slidebase to a starting position.
CLEAR	A user definable program for clearing user variables. Used, for example, to clear a variable describing the status of a loading tray.
START	Runs whenever the controller is turned on or reset.
URST	Runs whenver the controller is turned on.
INIT	Available for the user; at the ASRS station, this program sets the coordinates of the carousel positions or the robot positions for the square ASRS relative to one position.
USERn (n = 1 – 3)	These three programs are available for the user.

Standard Program Numbers for Execution from Station Teach Pendant

Following is a list of the default teach pendant program numbers. This list will help the user to manually execute the programs described. (To find out more about the program numbers, refer to the DIR command in the ACL Reference Guide).

1. STA   Runs the robot homing program STA, which calls the homing program STB. (Make sure the robot is in a safe and suitable position before running this program.) Normally, this will also cause the program CIM to be run.

2.	CIM	Runs all CIM-ACL system programs (after a global abort, for example). This program is automatically executed when the controller is powered ON.
3.	URST	Clears the status of buffers and machines. This program runs automatically whenever the controller is turned on.
4.	CLEAR	Optional user program.
5.	CIMP	Attaches position vectors CIM, CIMB.
6.	USER1	Optional user program.
7.	USER2	Optional user program.
8.	USER3	Optional user program.
9.		(for future use)
10.	INIT	Available for use by the user. At ASRS station with a circular ASRS, sets carousel positions relative to 1.
11.	TOPLT	Place template on pallet at conveyor station.
12.	FROMP	Get template from pallet at conveyor station.
13.	TOBFR	Place template on current buffer.
14.	FROMB	Get template from current buffer.
15.	TOB	Place part on template at current buffer.
16.	FB	Get part from template at current buffer.
17.	TOM	Place part in current machine and operate machine interface.
18.	FM	Get part from current machine.
19.	WTM	Wait for current machine to finish production (performing any necessary interface actions).
20.		(for future use)
21.	SELB1	Set current buffer as buffer number 1.

22.	SELB2	Set current buffer as buffer number 2.
23.	SELB3	Set current buffer as buffer number 3.
24.	SELB4	Set current buffer as buffer number 4.
25.	SELM1	Set current machine as machine number 1.
26.	SELM2	Set current machine as machine number 2.

ASRS Station Programs and Positions

All programs necessary for ASRS control and operation are included in the CIM-ACL system programs and in the ASRS software. For a listing of the ACL-ASRS programs, refer to the ASRS section of the appendix "System Program Listing."

After installation, the ASRS controller should be initialized. This is performed in a manner similar to all other station controllers. (The command to initialize the station controllers is found in the Station Controllers Setup menu which is accessed from the Setup Menu option in the CIM Main Menu.)

The ASRS robot positions are stored in the vector CIM[500], and the carousel positions are stored in the vector SRSP[18]. These position vectors are automatically defined when the ASRS software is loaded to the ASRS controller, however the locations of the positions must be taught before the system can be operated. A listing of the required robot and carousel positions follows.

Robot Positions

All robot positions use the vector CIM[500].

Pallet at Conveyor Station Positions

CIM[9]   on pallet

CIM[19]   above 9

Buffer Positions

The ASRS station currently uses only one buffer. Positions for a grasping a template:

CIM[1]   on buffer

CIM[11]   above 1

Barcode Scanner Positions

CIM[10]   above buffer 1, in front of the barcode scanner

CIM[8]   between 10 and 11

Positions for Placing a Part on a Template which is on a Buffer

Differently shaped parts may require different robot positions in order to be placed or removed from a template. For this reason, parts are grouped into 100 families of 10 parts each: parts 1-10, 11-20,… ,991-1000. Within a family, all parts use the same two robot positions: one above and one on a template.

For part number n ($1 \leq n \leq 1000$), the robot positions are:

CIM[p1]   above the template

CIM[p2]   on the template

where: $p1 = 201 + int((n-1)/10)$
$p2 = p1 + 100$
and int(x) is the integer part of x (e.g. int $(3/2) = 1$, int $(4/5) = 0$)

For example:

Parts 1 - 10:

       p1 = 201   above the template

       p2 = 301   on the template

Parts 11 - 20

       p1 = 202   above the template

       p2 = 302   on the template

ASRS Robot Positions (for Removing a Template from the Carousel)

Positions for access to ASRS Level 1:	CIM[31], [41], [51], [61]
Positions for access to ASRS Level 2:	CIM[32], [42], [52], [62]
Positions for access to ASRS Level 3:	CIM[33], [43], [53], [63]

The positions should be recorded at the following locations (for each level, respectively).

Positions next to ASRS:	CIM[31], [32], [33]
Positions in front of ASRS cell:	CIM[41], [42], [43]
Positions inside ASRS cell above template:	CIM[51], [52], [53]
Positions inside ASRS cell on template:	CIM[61], [62], [63]

ASRS Robot Positions (for Removing a Part from a Feeder)

Feeders at Level 1:	CIM[71], [81], [91]
Feeders at Level 2:	CIM[72], [82], [92]
Feeders at Level 3	CIM[73], [83], [93]

The positions should be recorded at the following locations (for each level, respectively).

Positions in front of ASRS for feeder access:	CIM[71], [72], [73]
Inside ASRS at feeder; positions for grasping part:	CIM[81], [82], [83]
Inside ASRS above feeder; positions for removing part	CIM[91], [92], [93]

ASRS Carousel Positions

The 18 circular positions of the carousel are defined in the Group B position vector SRSP[18].

Carousel position of Cell 1:   SRSP[1]

.

.

Carousel position of Cell 18:   SRSP[18]

The user needs only to set SRSP[1]. All other carousel positions are set relative to this position, with an offset between cell locations of 1706.66 encoder units.

Cell 1 on the carousel is labelled. The numbering of the rest of the cells proceeds in a counter-clockwise direction.

To move the carousel, use the teach pendant keys that control Axis 7. Then use the teach pendant to record SRSP[1].

To set the rest of the positions automatically, run the program MKSRS from the ASRS station PC. Alternatively, you can run program 10 from the teach pendant.

ER CIM Sample Applications

The positions listed here illustrate a possible ER CIM application using the following raw materials:

aluminum rod	Processed by a CNC lathe to make a chess piece
perspex block	Processed by a CNC mill to make a decorative base for the chess piece. A hole is made in the base to hold the chess piece.

The two processed parts can also be assembled to create a finished product: the chess piece set in the decorative base.

Part Numbering Systems

In the ER CIM system, each *raw material* is given a part number. When a raw material is processed it becomes a *processed material* and uses a different part number. An *assembly*, comprised of two or more processed materials, requires its own part number.

In this application, part numbers are grouped into families of 10 parts. Within each family, all parts have similar geometry and can be handled using the same set of robot positions. Each part family is assigned a number, stored in the variable ID.

For example, part family 1 contains parts 1 – 9 and part family 2 contains parts 10 – 19. Hence part 7 has a part ID of 1, and part 11 has a part ID of 2.

In families 1 and 2 in this application, the lowest part number in the family is assigned to the raw material, and the remaining numbers are used by processed materials derived from this raw material. (This assumes that changes in part geometry due to processing will not require new robot positions in order to handle the part).

For example, consider part family 1. Part #1 is the raw aluminum rod before processing, and part # 2 is the rod after it has been processed into a chess piece. Part numbers 3 - 10 are available for other processed materials derived from part #1. The robot can handle all parts in this family using the same positions.

Similarly, part family 2 contains the raw perspex block (part # 11) and parts derived from it such as parts 12 and 13.

One exception to this convention is the assembly, defined in this application as part #21 (or 15 in some cases). This part is arbitrarily assigned to part family 3.

Stations

The programs and positions that follow are for an ER CIM cell configured with the following stations:

- CNC mill station

- CNC lathe station

- Assembly, quality control and unloading station

Sample Application Programs, Positions, and I/O Connections

The following files can be found in the H:\CIMSYS\ST directory of the central CIM computer. If you want to use these files, copy the USERx.SMP file (where x is LATH, MILL or ASSM) to the USERn.DNL file for the corresponding station. You must copy the entire file for each station application you choose.

For example, if you want to use the sample CNC lathe station programs, and the CNC lathe is located at station 2 in your ER CIM configuration, do the following. First copy the file USERLATH.SMP to USER2.DNL, make any modifications you need using the ACL Off-Line utility, then initialize the controller at station 2.

The required positions and I/O connections are given after the program listings for each station application.

CNC Lathe Station Programs (USERLATH.SMP)

```
GLOBAL  ID
GLOBAL  P1
GLOBAL  P2


PROGRAM OGRIP
OPEN
END


PROGRAM CGRIP
CLOSE
END


PROGRAM  ID      ;calculate part family ID # and intermediate
SET   ID = RAW / 10;positions for buffer BFR
SET   ID = ID + 1

SET   P1 = BFR * 20
SET   P1 = P1 + 10
SET   P1 = P1 + ID;P1 = BFR*20 + ID + 10
SET   P2 = P1 + 10

END


PROGRAM  FB      ;take part from template on buffer BFR

GOSUB  ID
SPEEDA  60
MOVED   CIM[150];access point
SPEEDA  40
SPEEDB  4
MOVE  CIM[P2]
MOVED   CIMB[BFR]
GOSUB OGRIP
SPEEDA  10
MOVELD   CIM[P1]
GOSUB CGRIP
MOVELD   CIM[P2]
SPEEDA  60
MOVED   CIM[150]
END
```

```
PROGRAM  TOB     ;return part to template on buffer BFR
GOSUB  ID
SPEEDA  60
MOVED  CIM[150]
SPEEDA  40
SPEEDB  40
MOVE  CIM[P2]
MOVED  CIMB[BFR]
SPEEDA   10
MOVELD  CIM[P1]
GOSUB OGRIP
MOVELD  CIM[P2]
SPEEDA  60
MOVED  CIM[150]
END
PROGRAM  WTM1   ;activate machine 1 and wait for it to finish
DEFINE  R
SET    OUT[3] = 1;start machine
DELAY  100      ;pulse duration
SET    OUT[3] = 0

WAIT   IN[10] = 1;machine working
WAIT   IN[10] = 0;machine stopped

SET    SBUSY = 1
PEND   R FROM ROBOT
SET    OUT[9] = 1;open door
MOVE   CIMB[90]
MOVE   CIM[93]
WAIT   IN[12] = 1
MOVE   CIM[94]
MOVED  CIMB[90]
SET    OUT[9] = 0;close door

GOSUB OGRIP
SPEEDA  10
SPEEDB  2
MOVE   CIM[94]
MOVE   CIM[98]
MOVE   CIM[99]
MOVED  CIM[100]
MOVED  CIMB[100]
GOSUB CGRIP
SET    OUT[2] = 1;open chuck
DELAY 300
SET    OUT[2] = 0
MOVED  CIMB[90]

MOVE   CIM[81]
MOVE   CIM[82]
MOVE   CIM[83]
```

```
       MOVED  CIM[84]
       MOVED  CIMB[100]

       SET    OUT[1] = 1;close chuck
       DELAY  300
       SET    OUT[1] = 0
       GOSUB OGRIP
       DELAY  20
       MOVED  CIMB[99]
       GOSUB CGRIP
       SET    OUT[2] = 1;open chuck
       DELAY  300
       SET    OUT[2] = 0
       MOVED  CIMB[100]
       SET    OUT[1] = 1;close chuck
       DELAY  300
       SET    OUT[1] = 0
       GOSUB OGRIP

       MOVED  CIMB[90]
       MOVE   CIM[83]
       MOVE   CIM[82]

       MOVE   CIM[94]
       MOVED  CIM[93]

       SET    SBUSY = 0
       POST   1 TO ROBOT

       SET    OUT[10] = 1 ;close door
       DELAY  100
       SET    OUT[10] = 0
       WAIT   IN[11] = 1;door closed

       SET    OUT[3] = 1;start machine
       DELAY  100
       SET    OUT[3] = 0
       WAIT   IN[10] = 1;working
       WAIT   IN[10] = 0;stopped
       END


       PROGRAM  FM1     ;remove part from machine 1
       GOSUB ID
       IF    ID = 1     ;do this only if part is alum. rod
         SPEED 25
         SET    OUT[9] = 1;open door
         MOVE   CIMB[90]
         MOVE   CIM[93]
         WAIT   IN[12] = 1;wait for signal that door is open
         MOVE   CIM[94]
```

```
        MOVED  CIMB[90]
        SET    OUT[9] = 0

        GOSUB OGRIP
        SPEEDA  10
        SPEEDB  2
        MOVE   CIM[94]
        MOVE   CIM[98]
        MOVE   CIM[99]
        MOVED  CIM[100]
        MOVED  CIMB[100]
        GOSUB CGRIP
        SET    OUT[2] = 1;open chuck
        DELAY  300
        SET    OUT[2] = 0 ;close chuck
        MOVED  CIMB[90]
        MOVE   CIM[99]
        MOVE   CIM[98]
        MOVE   CIM[94]
        MOVED  CIM[93]
        SET    OUT[10] = 1 ;close door
        MOVE   CIM[90]
        SET    OUT[10] = 0
      ENDIF

      END

      PROGRAM  TOM1     ;take part,insert in machine 1, open/close door
      GOSUB  ID
      IF    ID = 1      ;do only if part is alum. rod
        SPEED  25
        SET    OUT[9] = 1;open door
        MOVE   CIMB[90]
        MOVE   CIM[90]
        MOVE   CIM[93]
        MOVED  CIMB[90]
        WAIT   IN[12] = 1;door opened
        SET    OUT[9] = 0

        SPEEDA  10
        SPEEDB  2
        MOVE   CIM[94]
        MOVE   CIM[98]
        MOVE   CIM[99]
        MOVED  CIM[100]
        MOVED  CIMB[100]
        SET    OUT[1] = 1;close chuck
        DELAY  300
        SET    OUT[1] = 0
        GOSUB OGRIP
        DELAY  20
```

```
     MOVED  CIMB[99]
     GOSUB CGRIP
     SET    OUT[2] = 1;open chuck
     DELAY  300
     SET    OUT[2] = 0
     MOVED  CIMB[100]
     SET    OUT[1] = 1;close chuck
     DELAY  300
     SET    OUT[1] = 0
     GOSUB OGRIP
     MOVED  CIMB[90]
     MOVE   CIM[99]
     MOVE   CIM[98]
     MOVE   CIM[94]
     MOVED  CIM[93]
     SET    OUT[10] = 1  ;close door
     DELAY  100
     SET    OUT[10] = 0
     WAIT   IN[11] = 1 ;door closed
   ENDIF
   END
```

CNC Lathe Station Application Positions

This listing does not include the positions for the default template manipulation programs. Refer to the section "Positions for Default Template Manipulation Programs."

Robot Positions (Group A)

Part from Family 1 on Template

Part from family 1 on buffer 1   CIM[31]

Part from family 1 on buffer 2   CIM[51]

Above 31   CIM[41]

Above 51   CIM[61]

Access point between 6x and 4x   CIM[150]

CNC Machine Tending Positions

Out of the machine   CIM[93]

Near the machine   CIM[94],[98],[99]

Ready to enter the chuck	CIM[100]
Outside of chuck	CIM[81]
Rotate (roll) the part 180°	CIM[82],[83]
Return to chuck with rotated part	CIM[84]

Linear Slidebase Positions (Group B)

CNC Machine Tending Positions

Outside the chuck	CIMB[90]
Inside the chuck	CIMB[100]
Access point near CIMB[100] to push the part exactly in place	CIMB[99]

CNC Lathe Station I/O

Outputs

Door open	OUT[9] pulse
Door close	OUT[10] pulse
Cycle start	OUT[3] pulse
Chuck open	OUT[2] pulse
Chuck close	OUT[1] pulse

Inputs

Door opened	IN[12] = 1
Door closed	IN[11] = 1
Machine cycle started	IN[10] = 1

CNC Mill Station Programs (USERMILL.SMP)

```
GLOBAL ID
GLOBAL P1
GLOBAL P2

PROGRAM ID        ;calculate part family ID, intermediate pos.

SET  ID = RAW / 10
SET  ID = ID + 1

SET  P1 = BFR * 20;P1 = 20*BFR + ID + 10;
SET  P1 = P1 + 10
SET  P1 = P1 + ID
SET  P2 = P1 + 10

END

PROGRAM OGRIP
OPEN
END

PROGRAM CGRIP
CLOSE
END

PROGRAM FB        ;take part from template on buffer BFR

GOSUB ID
SPEEDA 60
MOVED  CIM[150]
SPEEDA 40
SPEEDB 40
MOVE  CIM[P2]
MOVED CIMB[BFR]
 GOSUB OGRIP
SPEEDA  10
MOVELD  CIM[P1]
GOSUB CGRIP
MOVELD  CIM[P2]
SPEEDA 60
MOVED  CIM[150]
END


PROGRAM TOB       ;put part on template on buffer BFR
GOSUB ID
SPEEDA 60
MOVED  CIM[150]
SPEEDA 40
```

```
            SPEEDB 40
            MOVE  CIM[P2]
            MOVED CIMB[BFR]
            SPEEDA  10
            MOVELD  CIM[P1]
            GOSUB OGRIP
            MOVELD  CIM[P2]
            SPEEDA 60
            MOVED  CIM[150]
            END


            PROGRAM WTM1
            SET   OUT[11] = 1;start machine
            DELAY  100
            SET   OUT[11] = 0
            WAIT  IN[13] = 1;working
            WAIT  IN[13] = 0;stopped
            END


            PROGRAM FM1
            GOSUB ID
            IF  ID = 2
             SPEED 25
             SET  OUT[2] = 1;open door
             MOVE  CIMB[90]
             MOVE  CIM[90]
             WAIT  IN[10] = 1;wait for signal that door is open
              MOVED CIMB[90]
             SET  OUT[3] = 0
             SET  OUT[4] = 0
             SET  OUT[3] =  1;open vice
             MOVE  CIM[97]
              MOVED CIM[95]
             JAW  34          ;no room to open gripper, use JAW to open partially
              SPEEDA 10
               MOVELD CIM[100]
              GOSUB CGRIP
             SET  OUT[3] = 0
             MOVEL  CIM[99]
             MOVEL  CIM[98]
             MOVE  CIM[97]
              MOVED CIM[90]
             SET  OUT[2] = 0 ;close door
            ENDIF

            END

            PROGRAM TOM1     ;take part to machine 1,open/close doors, insert
            GOSUB ID
            IF  ID = 2       ;do this only if part is perspex base
```

```
      SPEED 25
      SET OUT[2] = 1  ;open door
      MOVE CIMB[90]
      MOVED CIM[90]
      MOVED CIMB[90]
      WAIT  IN[10] = 1;wait for signal that door is open
      SPEEDA 10
      MOVE  CIM[97]
      MOVED CIM[98]
      MOVE  CIM[99]
      MOVED CIM[100]
      JAW 32          ;no room to open gripper, use JAW to open partially
      MOVED CIM[95]
      GOSUB CGRIP
      SPEEDA 10
      MOVED CIM[96]   ;push part exactly in place
      MOVED CIM[95]
      SET  OUT[3] = 0
      SET  OUT[4] = 0
      SET  OUT[4] = 1;close vice
      MOVE  CIM[90]   ;outside of CNC machine
      DELAY 600
      SET  OUT[4] = 0
      SET  OUT[2] = 0 ;close door
      WAIT  IN[9] = 1;door closed

    ENDIF
   END


   PROGRAM USER1    ;open door if closed, close door if open

   IF OUT[2] = 1
     SET OUT[2] = 0
   ELSE
     SET OUT[2] = 1
   ENDIF

   END
```

CNC Mill Station Positions

This listing does not include the positions for the default template manipulation programs. Refer to the section "Positions for Default Template Manipulation Programs."

Robot Positions (Group A)

Part from Family 2 (Perspex) on Buffer

Part from family 2 on buffer 1	CIM[32]
Part from family 2 on buffer 2	CIM[52]
Above 32	CIM[42]
Above 52	CIM[62]
Access point between 6x and 4x	CIM[150]

CNC Machine Tending Positions

Outside the machine	CIM[90]
Into the machine	CIM[97],[98],[99]
Part in the machine	CIM[100]
Slightly outside the machine	CIM[95]
Pushing the part exactly in place	CIM[96]

Linear Slide Base Positions (Group B)

Near the CNC machine	CIMB[90]

CNC Mill Station I/O

Outputs

Door open	OUT[2] = 1
Door close	OUT[2] = 0

Cycle start	OUT[11] pulse
Vice open	OUT[3] pulse
Vice close	OUT[4] pulse

Inputs

Door opened	IN[10] = 1
Door closed	IN[9] = 1
Machine cycle started	IN[13] = 1

Assembly /QC/Unloading Station Programs(USERASSM.SMP)

This station can perform the following applications:

- quality control using robotvision
- assembly using the palletizing racks as a buffer to store the components required for the assembly and an electric vice to hold the parts during assembly
- unloading to two palletizing racks (grills).

The application given here does not support the use of the palletizing rack for both assembly and unloading.

The palletizing racks use a "last in first out" scheme for storing or retrieving parts. No more than eight pieces can be stored in each rack.

```
GLOBAL   ID
GLOBAL   P1
GLOBAL   P2
GLOBAL   P3
GLOBAL   P4
GLOBAL   P5

GLOBAL   PNT1
GLOBAL   PNT2

GLOBAL   M1TSK
GLOBAL   M1INF
```

```
PROGRAM  ID      ;calculate part family ID, intermediate positions
IF    RAW = 0
  SET   ID = 3
 ELSE
  SET   ID = RAW / 10
  SET   ID = ID + 1
ENDIF

SET   P1 = BFR * 20
SET   P1 = P1 + 10
SET   P1 = P1 + ID
SET   P2 = P1 + 10
END


PROGRAM OGRIP
OPEN
END

PROGRAM CGRIP
CLOSE
END


PROGRAM  FB      ;takes part from template on buffer BFR

GOSUB  ID
SPEEDA  60
MOVED   CIM[150]
SPEEDA  40
MOVE   CIM[P2]
GOSUB OGRIP
SPEEDA  10
MOVELD   CIM[P1]
GOSUB CGRIP
MOVELD   CIM[P2]
SPEEDA  60
MOVED   CIM[150]
END


PROGRAM  TOB     ;returns part to template on buffer BFR
IF    RAW > 0
  ANDIF  TASK > 900;if unloading part - don't return it to template
  GOTO   9
ENDIF

GOSUB  ID
SPEEDA  40
MOVE   CIM[P2]
SPEEDA  10
```

```
MOVELD   CIM[P1]
GOSUB OGRIP
MOVELD   CIM[P2]
SPEEDA  60
MOVED   CIM[150]
LABEL   9
END


PROGRAM  TOG     ;removes parts to palletizing rack
IF      ID = 1  ;for alum. rod, calculates where to place in rack
  SET     PNT1 = PNT1 + 1 ;increments position by 1 each time
  IF      PNT1 > 8
    SET     PNT1 = 1
  ENDIF
  SET     P3 = 100 + PNT1
  SET     P4 = 120 + PNT1
  SET     P5 = 149;access position
ELSE             ;if part is base
  SET     PNT2 = PNT2 + 1
  IF      PNT2 > 8
  SET     PNT2 = 1
  ENDIF
  SET     P3 = 150 + PNT2
  SET     P4 = 170 + PNT2
  SET     P5 = 200;access point
ENDIF

SPEEDA  50
MOVE    CIM[P5]
SPEEDA  40
MOVE    CIM[P4]
SPEEDA  5
MOVELD   CIM[P3]
GOSUB OGRIP
SPEEDA  10
MOVEL   CIM[P4]
SPEEDA  60
MOVED   CIM[P5]
END


PROGRAM  FG     ;take part from rack(remove parts in oppos.order
IF      ID = 1  ;from that in which they were placed)
  SET     P3 = 100 + PNT1
  SET     P4 = 120 + PNT1
  SET     P5 = 149
  SET     PNT1 = PNT1 - 1
  IF      PNT1 < 1
    SET     PNT1 = 8
  ENDIF
```

```
      ELSE
        SET     P3 = 150 + PNT2
        SET     P4 = 170 + PNT2
        SET     P5 = 200
        SET     PNT2 = PNT2 - 1
        IF      PNT2 < 1
          SET     PNT2 = 8
        ENDIF
      ENDIF
    ENDIF

    SPEEDA     50
    MOVE       CIM[P5]
    SPEEDA     40
    MOVE       CIM[P4]
    SPEEDA     5
    MOVELD     CIM[P3]
    GOSUB CGRIP
    SPEEDA     10
    MOVEL      CIM[P4]
    SPEEDA     60
    MOVED      CIM[P5]
    END


    PROGRAM  CLEAR  ;clear grill position variables
    SET     PNT1 = 0
    SET     PNT2 = 0
    END


    PROGRAM  TOM1     ;take part to machine(vision application)and insert it
    GOSUB  ID
    IF     TASK > 900
      GOSUB  TOG
    ELSE
      IF      ID = 1
        SET     P3 = 87;set pos. for vision inspection of alum. rod
        SET     P4 = 88
        SET     P5 = 89
      ELSE
        SET     P3 = 97;set pos. for vision inspection of perspex part
        SET     P4 = 98
        SET     P5 = 99
      ENDIF
      SPEEDA 40
      MOVE   CIM[P3]
      MOVE   CIM[P4]
      SPEEDA 5
      MOVED  CIM[P5]
      GOSUB OGRIP
      SPEEDA 10
```

```
      MOVE    CIM[P4]
      SPEEDA 40
      MOVED  CIM[P3]
    ENDIF
    SET   M1TSK = TASK
    END
    PROGRAM  FM1      ;take part from vision application
    IF     TASK <= 900
      GOSUB  ID
      IF     ID = 1
        SET    P3 = 87
        SET    P4 = 88
        SET    P5 = 89
      ELSE
        SET    P3 = 97
        SET    P4 = 98
        SET    P5 = 99
      ENDIF
      SPEEDA 40
      MOVE   CIM[P3]
      MOVE   CIM[P4]
      GOSUB OGRIP
      SPEEDA 5
      MOVED  CIM[P5]
      GOSUB CGRIP  SPEEDA 10
      MOVE   CIM[P4]
      SPEEDA 40
      MOVED  CIM[P3]
    ENDIF
    END


    PROGRAM  WTM1    ;performs vision application
    IF    M1TSK <= 900;do this if task is not unloading
      SET     OUT[16] = 1;start vision
      WAIT    IN[16] = 1;wait for input from vision (quality is ok)
      SET     OUT[16] = 0;end vision. Note: additional inputs can be
    ENDIF            ;checked if desired.
    END


    PROGRAM  ASMBL   ;put rod into base
    SET    ID = 2
    GOSUB  FG        ;remove base from palletizing rack
    SPEEDA 70
    MOVE   CIM[94]
    MOVE   CIM[93]
    SPEEDA 10
    MOVED  CIM[92]
    GOSUB OGRIP
    MOVE   CIM[91]
    MOVED  CIM[90]
```

```
SET    OUT[1] = 1;close electric assembly vice
MOVE   CIM[93]
SPEEDA 50
MOVED  CIM[94]
SET    ID = 1
GOSUB  FG         ;remove rod from grill
SPEEDA 70
MOVE   CIM[84]
MOVE   CIM[83]
SPEEDA 10


MOVE   CIM[82]
MOVED  CIM[81]
SPEEDA 5
SET    OUT[1]=0  ;open vice so that the base will be free to move
DELAY  100       ;while the rod is inserted
MOVELD CIM[80]   ;put rod into hole in base
GOSUB OGRIP
SET    OUT[1]=1  ;close vice
MOVE   CIM[80]
MOVE   CIM[81]
MOVE   CIM[82]
SPEEDA 50
MOVE   CIM[83]
MOVED  CIM[84]
END

PROGRAM  GETP    ;take finished part from assembly vice
SPEEDA 40
MOVE   CIM[74]
MOVED  CIM[73]
SPEEDA 10
GOSUB OGRIP
SET    OUT[1] = 0
MOVE   CIM[72]
MOVE   CIM[71]
MOVED  CIM[70]
GOSUB CGRIP
MOVE   CIM[70]
MOVE   CIM[71]
MOVE   CIM[72]
SPEEDA 30
MOVE   CIM[73]
MOVED  CIM[74]
END


PROGRAM USER1    ;close electric vice holding assembly parts
SET    OUT[1] = 1
END
```

```
PROGRAM USER2   ;open electric vice holding assembly parts
SET    OUT[1] = 0
END

PROGRAM USER3
RUN    ASMBL
END
```

Assembly/QC/Vision Station Positions

All positions are robot positions (Group A). The listing does not include the default template manipulation positions. Refer to the section "Positions for Default Template Manipulation Programs."

Part on Template

Part from family 1 on buffer 1	CIM[31]
Part from family 2 on buffer 1	CIM[32]
Part from family 3 on buffer 1	CIM[33]
Above 31	CIM[41]
Above 32	CIM[42]
Above 33	CIM[43]
Part from family 1 on buffer 2	CIM[51]
Part from family 2 on buffer 2	CIM[52]
Part from family 3 on buffer 2	CIM[53]
Above 51	CIM[61]
Above 52	CIM[62]
Above 53	CIM[63]
Access point between 6x and 4x	CIM[150]

Vision Positions

Part from family 1 in inspection position	CIM[89]
Above 89	CIM[88]
Above 88	CIM[87]
Part from family 2 in inspection position	CIM[99]
Above 99	CIM[98]
Above 98	CIM[97]

Palletizing Rack Positions

Part from family 1 in cell of palletizing rack 1	CIM[101]-[108]
Above 101 - 108	CIM[121]-[128]
Above palletizing rack 1	CIM[149]
Part from family 2 in cell of palletizing rack 2	CIM[151]-[158]
Above 151 - 158	CIM[171]-[178]
Above palletizing rack 2	CIM[200]

Assembly Positions

Ready to drop part from family 2 into assembly vice	CIM[92]
Push part from family 2 into exact position in assembly vice	CIM[90],[91]
Above 92	CIM[93],[94]
Part # 1 placed inside hole in part # 2	CIM[80]

Above 80
(outside the hole in part # 2)   CIM[81]

Above 81   CIM[82],[83],[84]

Assembled part (# 21)   CIM[70]
in the assembly vice

Near 70   CIM[71]

Above 70,71   CIM[72],[73],[74]

Assembly/QC/Vision Station I/O

Outputs

Close vice   OUT[1] = 1

Open vice   OUT[1] = 0

Start vision   OUT[9] = 1

Inputs

Vision has finished   IN[9] = 1

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REPORTS Software User's Guide

Introduction

The REPORTS software provides a complete on-line display of the production status of all the CIM elements. Using feedback from the controllers, the software generates various reports which track the CIM production.

Activating REPORTS

To activate the program, select the Reports (F5) option from the CIM Main Menu.

Alternatively, at the DOS prompt H:\> , type REPORT and press < Enter> .
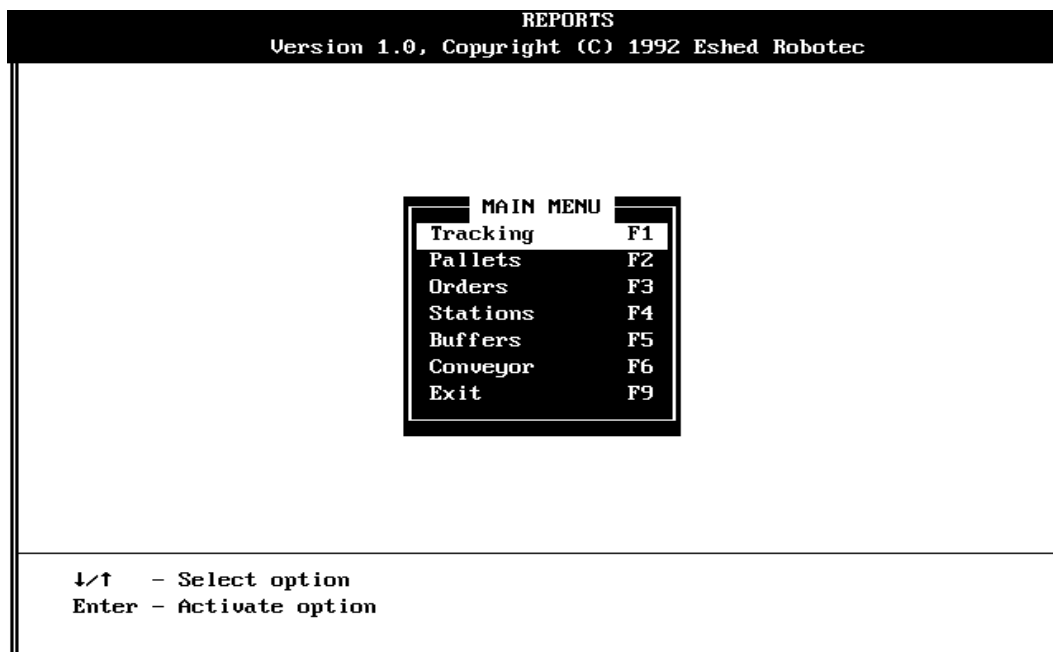
You will see the REPORTS Main Menu, as shown in Figure 1.

```
                        REPORTS
        Version 1.0, Copyright (C) 1992 Eshed Robotec




                     ╺ MAIN MENU ╸
                   │ Tracking    F1 │
                   │ Pallets     F2 │
                   │ Orders      F3 │
                   │ Stations    F4 │
                   │ Buffers     F5 │
                   │ Conveyor    F6 │
                   │ Exit        F9 │



    ↓/↑   - Select option
    Enter - Activate option
```

Figure 1. The REPORTS Main Menu

The following options are available:

Tracking (F1)   A log of the CIM production status.

Pallets (F2)   A report showing the status of the pallets within the CIM cell.

Orders (F3)   A report showing the status of the production orders.

Stations (F4)   A report of the current activity at each of the CIM stations.

Buffers (F5)   A report of the current status of the buffers at the CIM stations.

Conveyor (F6)   A graphic display of the CIM conveyor indicating the status of the
                     production elements on the conveyor.

Exit   Quit the REPORTS software.

Each of these options will be convered in the following sections.

User Interface

The option line at the bottom of each screen displays the specific keys which enable you
to manipulate the display in that particular report screen.

A number of functions are common to many of the REPORTS screens:

- The function keys activate specific report screens. Alternately, you can scroll forward
  and backward through the screens by pressing F10 and F9, respectively.

- The ↑ and ↓ keys are used to highlight a report line or option line.

- Pressing < Enter> activates the option selected.

- Pressing < Esc> takes you from a screen or subscreen to the REPORTS Main Menu.

Tracking

The Tracking screen logs the activities of the CIM cell. The Tracking Report contains
lines of text which give the time and a description of the current activity of the CIM cell.

The tracking information can be displayed on the screen and/or sent to a file and/or sent
to a connected printer.

```
                            TRACKING
18:44:12 ASRS         : COMMUNICATION STATUS: COMMUNICATION O.K.
18:44:12 STATION  3 : COMMUNICATION STATUS: COMMUNICATION O.K.
18:44:12 STATION  2 : COMMUNICATION STATUS: COMMUNICATION O.K.












Alt+F1 - setup
F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 2. The TRACKING Report Screen

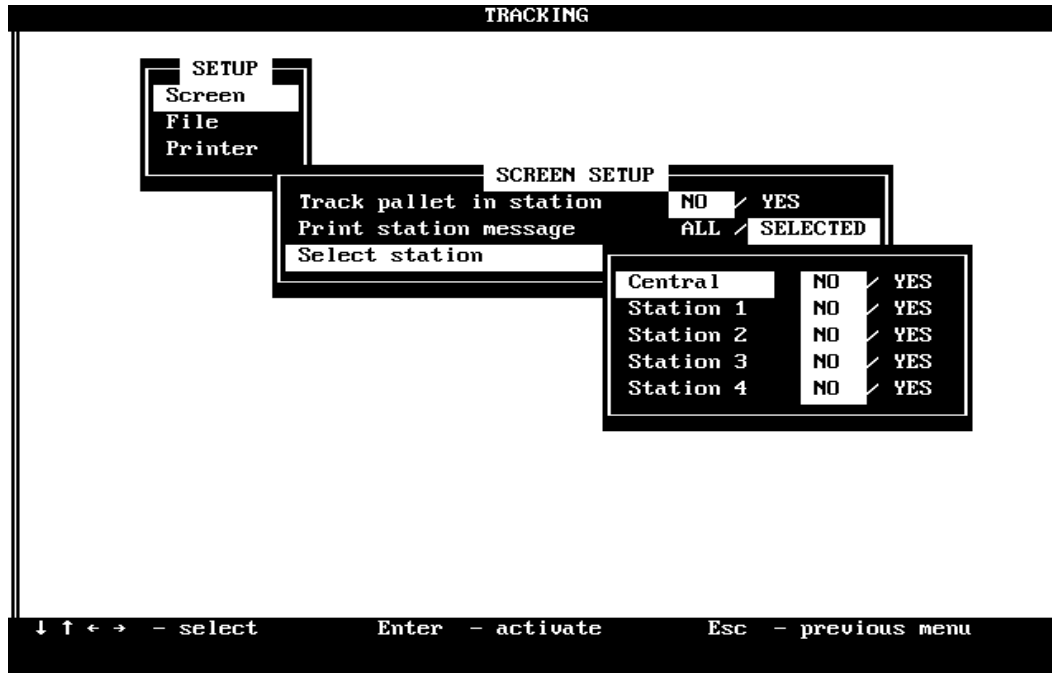# Tracking Setup

To define the Tracking Report output, activate the Tracking Setup menus. Press
< Alt> + F1.

The Tracking Setup screen contains several submenus, which are activated according to
the options you select.

Setup: Screen

This is the default option. All tracking data is displayed on the screen, and no file is
created.

If you select Screen Setup, you then have the following options:

Figure 3. Tracking Setup Screen

Track pallet in station	If you select Yes, a message line will be displayed whenever any pallet arrives at and leaves a selected station.
	Since so many pallets arrive at and leave the stations, the default is set to No, in order to limit the number of lines in the report.
Print station message	If you select All, a message line will be displayed whenever any activity occurs at *all* the stations.
	Select Selected to specify the stations for which you want to see tracking information.
	If you have chosen Yes to the Track Pallet in Station option, pallets arriving at and and leaving the specified stations will be tracked.
Select station	Specify the stations whose activities you want to monitor.
	The number of stations which appear in the menu are determined by the number of stations defined in the SETUP when the system is installed.

Setup: File

In addition to viewing the tracking data on screen, you may also choose to record the data in a file (on either the hard disk or a diskette).

If you select File Setup, you then have the following options:

```
┌─ SETUP ─┐
│ Screen  │
│ File    │
│ Printer │
│         │  ┌──────── FILE SETUP ────────┐
│         │  │ Tracking sent to file   NO / YES           │
│         │  │ File name :            H:\REPORT.TRK        │
│         │  │ Track pallet in station  NO / YES           │
│         │  │ Print station message  ALL / SELECTED       │
│         │  │ Select station    ┌──────────────────────┐
│         │  └───────────────────│ Central      NO / YES │
                                 │ Station 1    NO / YES │
                                 │ Station 2    NO / YES │
                                 │ Station 3    NO / YES │
                                 │ Station 4    NO / YES │
                                 └──────────────────────┘
```

Tracking sent to file   If you select Yes, a window will appear prompting you for a file name.

```
┌──────────────── FILE SETUP ────────────────┐
│ name:H:\REPORT.TRK                          │
└─────────────────────────────────────────────┘
```

REPORT.TRK is the system's default file name. You may use any valid DOS file name and extension, and any path. Simply type the file name and press < Enter> .

The file is created as soon as you exit the Tracking File Setup menu.

The tracking information which you request in the Setup will be sent to this file. The file is automatically updated and saved as long as the REPORTS software is activated, or until the Tracking to File option is reset to No.

Track pallet in station   If you select Yes for the Track Pallet in Station option, a message line will be created whenever any pallet arrives at and leaves the selected station(s).

Print station message

If you select All, a message line will be added to the file whenever any activity occurs at *all* the stations.

Select Selected to specify the station(s) for which you want to record tracking information.

If you select Yes for the Track Pallet in Station option, a message line will be printed whenever any pallet arrives at and leaves the selected station(s).

Select station

Specify the stations whose activities will be recorded.

Setup: Printer

In addition to monitoring the tracking data on screen and recording the data in a file, you can also send the message lines to a connected printer for on-line printing of the tracking information.

```
  ┌─ SETUP ─┐
  │ Screen  │
  │ File    │
  │ Printer │
  └─────────┴────── PRINTER SETUP ──────┐
          │ Tracking sent to printer   NO  ╱ YES      │
          │ Track pallet in station    NO  ╱ YES      │
          │ Print station message      ALL ╱ SELECTED │
          └───────────────────────────────────────────┘
```

The options are the same as those described for the File Setup.

If you select the Tracking Sent to Printer option, you will be prompted to confirm that a printer is connected to the system.

Note: The setup data is recorded and saved in a file named CONFIG.REP. The system refers to this file whenever the REPORTS software is activated. Thus, if the Tracking to Printer option was active when you previously exited the REPORTS software, the next time you activate the software, you will immediately be prompted to confirm that a printer is connected.

Tracking Display

In the example shown in Figure 4, three stations are being tracked. However, production activity has occured only at Station 1 (ASRS) and Station 2 (Machining). Pallets are not being tracked.

```
                              TRACKING
19:38:6  ASRS       : RELEASED RAW MATERIAL #11 FOR PART #35
19:38:14 STATION  2 : PART #2  SUBPROCESS #1 COMPLETED
19:38:28 STATION  2 : ROBOT  GETTING TEMPLATE FROM PALLET
19:38:39 STATION  2 : ROBOT  TAKING TEMPLATE WITH PART #35 TO BUFFER #1
19:38:48 ASRS       : INSTRUCTED TO RELEASE RAW MATERIAL #1 FOR PART #2
19:38:50 STATION  2 : ROBOT  GETTING PART #35 FROM TEMPLATE ON BUFFER #1
19:38:56 ASRS       : CANNOT RELEASE RAW MATERIAL #1 FOR PART #2
19:38:57 ASRS       : INSTRUCTED TO RELEASE RAW MATERIAL #11 FOR PART #12
19:38:58 ASRS       : ROBOT  GETTING TEMPLATE FROM ASRS
19:38:59 STATION  2 : ROBOT  LOADING MACHINE #1 WITH PART #35
19:39:8  STATION  2 : MACHINE #1  STARTED
19:39:22 ASRS       : ROBOT  PUTTING TEMPLATE ON BUFFER
19:39:22 STATION  2 : MACHINE #1  FINISHED (TOTAL PROCESS TIME 0:0:6.86)
19:39:22 STATION  2 : ROBOT  UNLOADING PART #35 FROM MACHINE #1
19:39:23 ASRS       : PART #12  NEW, ON BUFFER #1
19:39:37 STATION  2 : ROBOT  PUTTING PART #35 ON TEMPLATE ON BUFFER #1
19:39:37 STATION  2 : ROBOT  GETTING TEMPLATE WITH PART #2 FROM BUFFER #2
19:39:46 STATION  2 : ROBOT  TAKING TEMPLATE WITH PART #2 TO PALLET
19:40:3  STATION  2 : PART #35  PIECE #4  SUBPROCESS #1 COMPLETED



Alt+F1 - setup
 F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 4. Display of Tracking Messages

Note the colors used for displaying tracking messages:

Brown   Displays the time; used in the column on the left.

Black   Normal CIM production operations.

Red   Error messages.

Blue   Removal and return of parts and templates to the ASRS carousel.

Magenta   Machine activities: start, finish, loading.

Orders

The Orders Report screen shows the information relating to the order which was downloaded from PROD, and is currently in production.

Up to 10 lines can be displayed at a time. If the order has more than 10 lines, use the < PgDn> and < PgUp> keys to scroll through the order lines.

```
                              ORDERS

 LINE  #PART   QTY  #RAW   SUBPR ASS'Y   PCS    IN    FINISH  STATUS
                    MATER        PCS     QTY   PRODUC

     1     2    10     1      3                    1      0   READY(1)
     2    12    20    11      3                    0      0   READY(2)
     3    21    50            2     2              0      0   READY(2)
     4   (21)  100     1      4           2        0      0   READY(2)
     5   (21)   50    11      3           1        0      0   READY(2)
     6    35    60            2     4              0      0   READY(2)
     7   (35)  120     1      3           2        0      0   READY(2)
     8   (35)  120     1      4           2        0      0   READY(2)
     9   (35)   60    11      3           1        0      0   READY(2)
    10   (35)   60    11      4           1        0      0   READY(2)




 ↓/↑    - select line              Enter    - show process table
 F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 5. The ORDERS Report Screen

LINE   The line number in the production order.

#PART   The ID number of the part to be be processed.

                    If a part is a processed material, it appears as one line in the order. For example, Parts #2 and #12 (lines 1 and 2) are processed materials.

                    If a part is an assembly, it will appear on several lines. The first line contains the part number, and the following lines, which do not display a part number, represent the pieces which comprise the assembly.

                    For example: Part #35 in line 6 is an assembly. Lines 7 – 10 describe the four pieces which make up the assembly.

QTY   The number of parts with this part number, or the number of pieces in an assembly that are currently on order.

RAW MATER   The ID number of the raw material used.

SUBPR   The total number of subprocesses to be performed on this specific raw material in order to create the part.

A breakdown of the different subprocesses for each part can also be viewed.

Use the ↓ down and ↑ up arrow keys to highlight the line you want to view, and press < Enter> .

Another frame appears on the screen:

SUBPR   The sequential number of the subprocess.

STATION   The station at which the subprocess takes place.

MACHINE   The machine which performs the subprocess.

TASK   The task which is performed by the machine in the subprocess.

REMARKS   The current activity being performed on the material (other than a subprocess.) The possibilities are:

RELEASE
UNLOAD
UNLOAD FOR ASSEMBLY

In the example shown here, the piece (a component of assembled part #21) is released, undergoes two subprocesses, and is then unloaded.

Press < Esc> to remove the Process Table from the screen display.

ASS'Y PCS   The number of *different* pieces need to assemble *one* part. This
                 information will appear only on lines which contain assembled parts.

PCS QTY   The amount of each type of piece which needs to be processed in
                 order to assemble one part.
                 For example, Part #21 is an assembly which requires 2 pieces of
                 materal #1 (line 4), and 1 piece of material #11 (line 5).

The last three columns relate to the actual production status:

IN PRODUC   The number of parts ordered which are currently in the production
                 process.

FINISH   The number of processes which have been completed.

STATUS   The status of the current line in the order. The options are:

                 READY
                 The amount of materials ready for release into the production cycle.
                 At most, two can be ready for release.

                 WORKING
                 Indicates that two materials are in production. No materials can be
                 released until at least one has finished the first process.

                 ALL RELEASED
                 No more materials are required by the order.

                 MISSING
                 Some materials are missing.

                 DONE-MISSING
                 System has completed production on all available parts and pieces;
                 the remainder are missing.

                 DONE
                 All parts and pieces in the order have been completed.

Conveyor

The Conveyor Report screens provides an on-line graphic display of the elements on the conveyor.
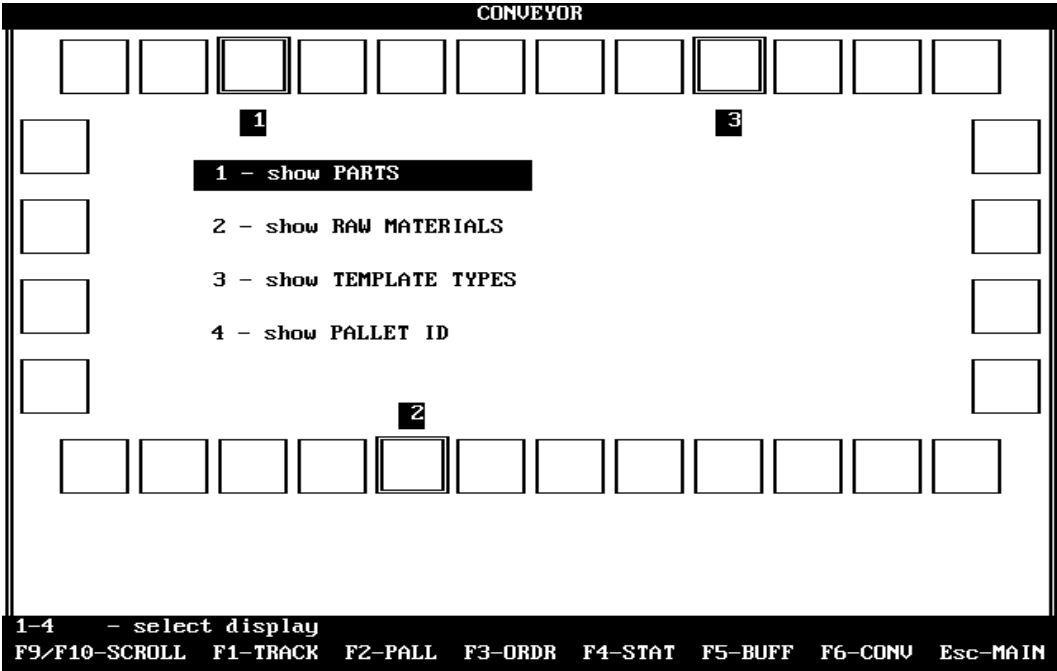
Figure 6. The CONVEYOR Report Screen

The Conveyor screen shows a graphic representation of the 32 sectors which comprise the conveyor.

The CIM station numbers appear along the inner perimeter of the conveyor, and the sectors at which they are located are highlighted.

Sector number 1 is the third box from the right at the top of the screen. In the example shown in Figure 6, stations are located at Sector 2 (Station #3), Sector 8 (Station #1), and at Sector 19 (Station #2).

Numbers representing the elements move in a counter-clockwise direction around the conveyor, reflecting their actual status on the conveyor.

In this example, all the pallets currently on the conveyor are being tracked.

Note that the color of the option line matches the color of the elements displayed on the conveyor.

PALLET ID

Shows all pallets currently on the conveyor, whether or not they are empty.

When this option is selected, the pallet numbers appear in magenta characters in the sector boxes.

TEMPLATE TYPES

Shows all templates currently on the conveyor, whether or not they are empty.

When this option is selected, the template type numbers appear in red characters in the sector boxes.

RAW MATERIALS

Shows the type of raw material currently on the conveyor.

When this option is selected, the raw material type numbers appear in blue characters in the sector boxes.

PARTS

Shows the ID# of the finished parts currently on the conveyor.

When this option is selected, the part numbers appear in black characters in the sector boxes.

Pallets

The Pallets Report screen reflects the status of the pallets which are on the conveyor.

```
                              PALLETS
 ┌────────┬────────┬──────┬──────┬────────┬──────┬──────────┬──────────┬───────────┐
 │ PALLET │ TEMPLT │ PART │ RAW  │ SUBPROC│ INFO │ NEXT STA │ LOCATION │  STATUS   │
 ├────────┼────────┼──────┼──────┼────────┼──────┼──────────┼──────────┼───────────┤
 │    1   │   0    │  0   │  0   │   0    │  0   │    0     │    32    │ MOVING    │
 │    2   │        │      │      │        │      │          │          │ NOT IN USE│
 │    3   │   0    │  0   │  0   │   0    │  0   │    0     │    1     │ STOPPED   │
 │    4   │   2    │  35  │  11  │   1    │  0   │    2     │    12    │ MOVING    │
 │    5   │        │      │      │        │      │          │          │ NOT IN USE│
 │    6   │   2    │  21  │  11  │   2    │  0   │    3     │    20    │ MOVING    │
 │    7   │        │      │      │        │      │          │          │ NOT IN USE│
 │    8   │        │      │      │        │      │          │          │ NOT IN USE│
 │    9   │        │      │      │        │      │          │          │ NOT IN USE│
 │   10   │        │      │      │        │      │          │          │ NOT IN USE│
 │   11   │        │      │      │        │      │          │          │ NOT IN USE│
 │   12   │        │      │      │        │      │          │          │ NOT IN USE│
 │   13   │        │      │      │        │      │          │          │ NOT IN USE│
 │   14   │        │      │      │        │      │          │          │ NOT IN USE│
 │   15   │        │      │      │        │      │          │          │ NOT IN USE│
 └────────┴────────┴──────┴──────┴────────┴──────┴──────────┴──────────┴───────────┘
            _

  F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 7. The PALLETS Report Screen

PALLET	The pallet's ID number, 1–15, as determined by the magnetic code.
TEMPLT	The template type number, ranging 1–99, as defined by the ASRS software.
PART	The ID number of the finished part on the pallet, as defined in the production order.
RAW	The ID number of the raw material used in the part on the pallet, as defined in CIMDEF.

Sample programs installed in the CIM system normally use the following numbers for the materials:
1 indicates the brass rod,
11 indicates the perspex bar.

For example, both pallet #4 and pallet #6 are carrying perspex bars.

SUBPROC   The identifying number of the next subprocesses to be performed on
                 the material on the pallet.

INFO   Optional, user defined variables, used for quality control.

                 For example, you can create the following definitions:
                 1 indicates part which is flawed/defective, but accepted.
                 2 indicates part which requires retooling;
                 3 indicates part which has failed inspection; part rejected.

                 These variables, if used, are defined in the station programs.

NEXT STA   The station at which the next subprocess to be performed will take
                 place.

LOCATION   The conveyor sector, numbered 1–32, at which the pallet is currently
                 located.

STATUS   The pallet's current activity. The possibilities are:

                 MOVING
                 Pallet is moving between stations.

                 STOPPED
                 Pallet is stopped at a station.

                 NOT IN USE
                 The pallet is not on the conveyor.

Stations

The STATIONS Report screen shows the status of production activity at each station.

```
                               STATIONS
┌────────┬──────┬─────────────────────┬────────┬─────────────────────────────────┐
│STATION │LOCAT │ STATUS              │ PALLET │ REMARKS                         │
├────────┼──────┼─────────────────────┼────────┼─────────────────────────────────┤
│   1    │   8  │ COMMUNICATION O.K.  │   4    │ RELEASING MATERIAL FOR PART 12  │
│   2    │  19  │ COMMUNICATION O.K.  │   4    │                                 │
│   3    │   2  │ COMMUNICATION O.K.  │   4    │                                 │
└────────┴──────┴─────────────────────┴────────┴─────────────────────────────────┘




 F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 8. The STATIONS Report Screen

STATION   The station number.

LOCAT   The conveyor sector number at which the station is located.

STATUS   Checks and reports on the status of both RS232 communication and I/O signals between the station controller and the central controller.

                Current communication status at the station. The possibilities are:

                NOT ACTIVE
                There is neither RS232 nor I/O communication with the station.

                RS232 ERROR

                I/O ERROR

                COMMUNICATION O.K.
                Both RS232 and I/O communication are functioning properly.

PALLET   The ID number of the pallet currently at the station, or which has just left the station. The pallet number will change as soon as the next pallet arrives at the station.

REMARKS   Describes the current activity at the station. The possibilities are:

RELEASING MATERIAL FOR PART #

ASSEMBLING PART #

NEED TEMPLATE FOR PART #
Request for an empty template to put part on.

RELEASING TEMPLATE
In response to a request for a template.

RELEASING PART #
Indicates part is completed.

Buffers

The Buffers Report screens show the status of the buffers at each station.

```
                              BUFFERS
                            STATION  2

 MACHINE BUFFER TEMPLT  PART   RAW  SUBPR  INFO   TASK    STATUS

    1      1      2      35    11    1      0      1    IN MACHINE
    1      2      1       2     1    2      0      1    DONE




    MACHINE 1:    WORKING

    ROBOT  :
    PALLET :     ** NO PALLET **



 1,2... - station number to show          PgUp/PgDn - previous/next station
 F9/F10-SCROLL  F1-TRACK  F2-PALL  F3-ORDR  F4-STAT  F5-BUFF  F6-CONV  Esc-MAIN
```

Figure 9. The BUFFERS Report Screen

The STATION # is shown at the top of the screen.

To view the buffers for different stations, press the corresponding number key. For example, to view the status of the buffers at Station 3, press 3. Or use the < PgUp> and < PgDn> keys to scroll through the stations.

MACHINE   The number of the machine at the station.

BUFFER   The number of the buffer at that machine.

TEMPLT   The number of the template which is currently on the buffer.
                 (0 indicates empty.)

PART   The number of the finished part (on the template) which is currently
                 on the buffer.

RAW   The number of the raw material (on the template) which is currently
                 on the buffer. (0 indicates a finished assembly.)

SUBPRO   The total number of the subprocess to be performed, or currently
                 being performed, on the part (on the template) which is on the buffer.

INFO   Optional user defined variables, defined in the station programs.

                 For example, you can create the following definitions:
                 1 indicates part which is flawed/defective, but accepted.
                 2 indicates part which requires retooling;
                 3 indicates part which has failed inspection; part rejected.

                 If a station includes a quality control inspection, these variables can
                 be used to mark the parts, and to inform the system what to do with
                 the part – when it is unloaded from the buffer, for example.

TASK   The machine task which will perform the subprocess.

STATUS   The status of the buffer. The possibilities are:

                 EMPTY
                 No template on the buffer.

                 WAITING
                 Waiting for work in the machine to be completed.

                 IN MACHINE
                 Template on the buffer is waiting for the part in the machine.

                 DONE
                 Work on the part in the machine is finished.

                 EMPTY TEMPLATE.

The frame in the lower portion of the screen provides a description of all the activity at
the station.

```
MACHINE 1:    STOPPED

ROBOT  :      PUTTING TEMPLATE ON PALLET
PALLET :      4 IN STATION
```

In this example, only one machine is located at this station.

MACHINE   The currently activity of each machine at the station. The possibilities are:

STOPPED

WORKING

TURNING
The part in the machine is being turned around.

LOADING PROGRAM
Machining programs are being downloaded from a computer to the machine.

ROBOT   The current activity of the robot at the station.

Many messages are possible. They describe the movement of the robot in taking and returning parts and templates to and from the pallets, buffers, and machines. A few examples are:

GETTING TEMPLATE FROM PALLET

PUTTING TEMPLATE ON BUFFER #

ASSEMBLING PART #

LOADING PART # TO MACHINE #

GETTING PART FROM FEEDER

PALLET   The number of the pallet currently at the station.

** NO PALLET ** will appear if there is no pallet at the station.

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RSDNL Software User's Guide

Introduction

RSDNL software facilitates downloading of files from a PC to a target device, using RS232 communication. The program modifies the PC's transmission parameters to suit the requirements of the target device.

The user defines the directory location and extension of the file to be downloaded. This information, along with transmission parameters, may be saved to an options file for later use. Previously saved options files can be loaded to the software.

The software provides easy access to RSNET software for RS232 communication configurations that include switchers. Using RSNET, you can activate a communication path between the PC and a target device, such as a CNC machine.

Activating RSDNL

To activate the program, type RSDNL and press < Enter> . You will see the RSDNL main menu, as shown in Figure 1.

Figure 1. The RSDNL Main Menu

The choices are:

Options   Define the location and extension of the file to be
                                        downloaded and set the transmission parameters;
                                        save the options information to an options file or
                                        load a previously saved options file.

Rsnet   Access RSNET to activate or disconnect a
                                        communication path or to change the
                                        communication configuration. When you exit
                                        RSNET you will return to the RSDNL main menu.

Download	Enter name of file to be downloaded and activate downloading, display a list of files with the extension and location specified in the Options module.
Exit	Leave RSDNL software.

Each of these options will be covered in the following sections.

Options

Choosing the first item, Options, gives the menu shown in Figure 2.

Figure 2. The Options Menu

The options are:

Program files	Prompts you for the extension and location of the file to be downloaded.
Communication setup	Sets the RS232 transmission parameters of the PC.
Save options	Saves the information entered in the program file and communication setup modules to an options

file. You are prompted for to enter a name for the options file.

Load options   Loads a previously saved options file to the software before downloading. You are prompted for the options file name.

Program Files

If the Program files option is selected, the following box will appear on the screen:

You are prompted to enter the extension and directory location of the program file to be

```
┌──── Main Menu ────┐
│ ──── Options ──── │
│── Program files ──│
│ Extension: tap            │
│ Directory: H:\AUTOCNC     │
└───────────────────┘
```

downloaded. The information used in the previous downloading will appear on the screen. In the example shown above, the extension is .tap and the file is found in the directory H:\AUTOCNC.

To modify the information in a field, first select the field using the ↑↓ arrows, then press < Enter> to access the editing mode. Type the information, then press < Enter> to save and exit the editing mode.

To leave this screen, press < Esc> . You will return to the Options menu.

Communication Setup

When Communication Setup is chosen, the following window appears on the screen:

```
┌──── Main Menu ────┐
│ ──── Options ──── │
│ Communication Setup │
│ Com. port    COM2 │
│ Baud rate    9600 │
│ Data bits       8 │
│ Stop bits       2 │
│ Parity       None │
│ Xon/xoff      Yes │
│ dElay after byte  │
│ deLay after <CR>  │
└───────────────────┘
```

This window lets you specify the transmission parameters required by the target device. The current settings are displayed.

To change a parameter's setting, use the $\uparrow\downarrow$ arrows to highlight the parameter and press < Enter> . A new window will display the available settings. Then use the $\uparrow\downarrow$ arrows to select a setting and press < Enter> . The new value will appear on the screen.

The transmission parameter settings are:

Com. port	The PC's RS232 serial communication port used for transmission. The options are COM1 and COM2.
Baud rate	Sets the transmission speed to the rate required by the target device. The options are 300, 1200, 2400, 4800, and 9600 bits per second.
Data bits	The options are 7 bits and 8 bits.
Stop bits	The options are 1 bit and 2 bits.
Parity	Set the type of parity check. The options are none, odd, and even.
Xon/Xoff	Set whether the Xon/Xoff software protocol is used. The options are yes and no.
delay after byte	This option is intended for CNC machines (such as EMCO C5 and F1) which require delay time.
	You are prompted for the delay in milliseconds. The recommended value for the EMCO C5 and F1 is 37, assuming that the baud rate is 300.
	If no delays are required by the device, enter 0.
delay after < CR>	This option is intended for CNC machines (such as EMCO C5 and F1) which require delay time after a carriage return character is received.
	You are prompted for the delay in milliseconds. Recommended values for the EMCO C5 and F1 are 100, assuming that the baud rate is 300.
	If no delays are required by the device, enter 0.

Note that when a switcher is used to connect between a PC and another device, such as a CNC machine, the switcher is the target device, hence the transmission parameters of the switcher must be entered to the RSDNL software.

To leave the Communication Setup screen, press < Esc> . You will return to the Options menu.

Save Options

The Save Options option allows you to save the communications setup, program file location and program file extension information. If you select this option, you will be prompted for the name of a file in which to save these options, as shown below:

```
┌──── Main Menu ────┐
├─── Options ───┐  │
┌─ Options file name ─┐│
│      OPT1          ││
├────────────────────┘│
│  Load options        │
└─────────────────────┘
```
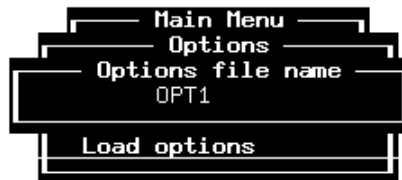
The previously saved options file name will be displayed. In this example, the name OPT1 appears.

The cursor prompts you to add a new name. If you make any changes, you must press < Enter> to save them. You will receive a message that the file is being saved and then you will return to the Options menu.

To exit this window without saving any changes, press < Esc> . You will return to the Options menu.

Load Options

This option lets you load an existing options file to the software. If you choose this option you will see the following screen:

```
┌──── Main Menu ────┐
├─── Options ───┐  │
┌─ Options file name ─┐│
│      OPT1          ││
└────────────────────┘│
```
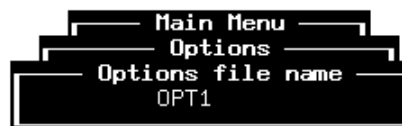
The previous entry for the options file name is displayed. In this example the name OPT1 was used.

The cursor prompts you to add a new name. If you make any changes, you must press < Enter> to save them.

If the name you enter is not in the current directory you will receive an error message.

RSNET

The second option on the main RSDNL menu is RSNET.

If your system includes a switched RS232 network, you can access the RSNET software and activate a communication path to your target device.

If the RSNET option is selected, the program will activate the software and you will see the RSNET ON LINE screen. For more information, refer to the RSNET Software User's Guide.

Download

The third option on the RSDNL main menu is Download. When this option is selected, the following window will appear:

```
┌──── Main Menu ─────┐
│┌──── Download ─────┐│
││    File name      ││
││     Catalog       ││
│└───────────────────┘│
└─────────────────────┘
```

This window lets you choose between entering a file name or viewing a list of files with the directory location and extension specified in the Options module.

File Name

If you select File name, the following window appears and prompts you for the name of the file to be downloaded. The file name that was used in the last download appears on the screen.

```
┌──── Main Menu ─────┐
│┌──── Download ─────┐│
┌┴─ File name for download ─┴┐
│          pawn              │
└────────────────────────────┘
```

You can use this name, or enter a new filename.

Once a name has been typed, pressing < Enter> starts the downloading process.

When the process is complete you will see the following status report:

```
┌──── Main Menu ────┐
│┌──── Download ────┐│
│├──── Status ──────┤│
│█File downloading completed█│
│└────────────────┘│
└──────────────────┘
```
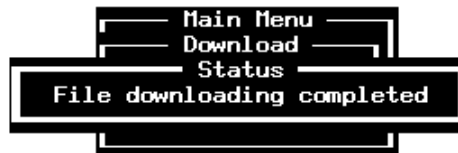
Catalog

The second option, Catalog, displays a list of all files with the location and extension specified in the options module. You may view the file names from this screen but you cannot initiate downloading.

```
┌──── Catalog ────┐
│ A1              │
│ A2              │
│ A3      ┌ain Menu ──┐
│ B1      │ownload ──┐│
│ B2      │le name   ││
│         │█talog█   ││
│         └──────────┘│
└─────────────────────┘
```

To leave this screen, press < Esc> . You will return to the Download window.

Exit

Choosing the last option, Exit, leaves the RSDNL software.

If you have made any changes to the data files while running the program, you will receive a message that the files are being saved when you exit the program.

Command Line Options

The RSDNL software may also be run in batch mode.

The syntax is:

```
RSDNL [Options_File  Download_File]
```

where Options_File is the name (without extension) of an options file generated by RSDNL and Download_File is the name (without extension) of the file to be downloaded.

Note that the extension and location of the file to be downloaded are specified in the options file.

Before using this option, the following steps must be performed:

1. An RS232 communication link must be activated between the PC from which the file will be downloaded and the target device. When the PC and the target device are connected to a switched RS232 communication network, RSNET can be used to activate the communication link.

2. The required options must be entered to the RSDNL software and stored in an options file.

    To receive a brief description of the batch mode options, type:

    ```
    RSDNL  ?
    ```

Pre-production Downloading of CNC Programs Using RSDNL

Using RSNET and RSDNL software, the user may download a program from the central CIM computer, or the CNC station computer, to a CNC, prior to beginning production.

The first step is to connect the computer on which the CNC programs are stored to the CNC machine using RSNET. This can be performed using the graphic display, as described in the chapter on RSNET, or the command line option may be used.

For example, to connect the central CIM computer to a CNC machine at a station, using the command line format, type the following from the H: drive at the central CIM computer:

RSNET [station_name] machine_name

where station_name and machine_name are the alternate names entered into the RSNET software for the CNC station and the specific CNC machine you wish to download to.

If there is only one CNC machine of this type in the ER CIM cell, or if you are using the RSNET configuration for the local CNC station, the station name may be omitted.

The next step is to set the options and program file definitions used by RSDNL.

Once these are set, the RSDNL downloading command can be selected and entered, or the command line option can be used to download the file.

AUTOCNC Software User's Guide

Introduction

The ER CIM system supports three methods of loading CNC programs (G-code) to the CNC machines:

1. Manual programming or loading of a CNC program from tape to a CNC machine before production. This method can only be used if each CNC machine will run only one program during a production order.

2. Remote downloading of programs by the user before the production order is started. A single program is downloaded from a CNC station PC or the central CIM computer to a CNC machine over the switched RS232 network.

    This method is much faster than entering the program lines manually, however it requires the user to access RSNET software to activate the communication link and RSDNL software to perform the actual downloading. The programs may be generated using CADCAM software. As with the previous method, each CNC machine can use only one program during each production order.

    For more information on this method, refer to the chapter "RSDNL Software Users Guide".

3. Automatic downloading of CNC programs from the CNC station PC during production. The fastest method, it allows multiple CNC programs to be used by each machine during production of an order. As in the second method, the programs may be generated using CADCAM software.

    Since the AutoCNC program uses RSDNL to perform the actual downloading, using specific definitions for each machine, the user must make sure the current definitions (transmission parameters, file extension and location) for each machine are suitable before activating AutoCNC.

    This chapter describes the third method, using AutoCNC software to automatically download programs to CNC machines during production.

Required RSNET Alternate Names

The following alternate names must be defined in the RSNET configuration when using AutoCNC:

stations:

station1, station2, … station*n*

where *n* is the station number used in the CIMDEF definitions.

machines:

m1, m2, …, m*m*

where *m* is the machine number used in the CIMDEF definitions for that station.

Required RS232 Connections

The following RS232 connections are required to download CNC programs at a CNC station.

1. Cable from COM 2 of CNC station PC to port 2 of the 8 port RS232 card at the CNC station controller.

2. Cable from COM 1 of CNC station PC to home port of station switcher.

3. Cable from CNC machine to port 3 on the station switcher. At stations with two CNC machines, machine 1 is connected to port 3 and machine 2 is connected to port 4.

    For more information, refer to the section on the switched RS232 network in the appendix CIM RS232 Connections.

Location of CNC Programs

CNC files that are to be downloaded to the CNC machines must be located in specific directories reserved for this purpose. These directories, referred to as the downloading directories, are generally located at the CNC station computer(s).

When the CNC station is connected to the central CIM computer via an Ethernet LAN, the CNC programs may be stored at the central CIM computer in the required downloading directories. The AutoCNC program, running from the CNC station PC, will access these files for downloading.

You are advised not to store the CNC programs at both the CNC station PC and the central CIM computer, but if this is done, both versions must be identical.

Note: If you want to use a CNC program from another location such as a CAD program directory, or diskette, it must first be copied using the Get from Source option in the AutoCNC file handling utility which will automatically place it in the proper downloading directory.

CNC Station PC

The downloading directory for each machine is defined as follows:

> C:\CNC\S$s$\M$m$

where s is the station number and m is the machine number.

For example, if station 3 contains two CNC machines, the CNC programs will be found in the following locations:

> for machine 1
>
>> C:\CNC\S3\M1
>
> for machine 2
>
>> C:\CNC\S3\M2

Note: When performing the initialization procedures for a station computer that will store CNC programs for automatic downloading to a CNC machine,
type: MCIMS n CNC and press < Enter> ,
where n is the number of the station.

(Refer to the chapter "Initialization and Setup Procedures".)

Central CIM Computer

When CNC program files are stored in the central CIM computer, the files for each CNC machine must be located in the following directory:

H:\CNC\S*s*\M*m*

where *s* is the station number and *m* is the machine number.

Note: If the CNC programs will be downloaded to the machines from the central CIM computer over an Ethernet link, do not add the modifier CNC when initializing the CNC station computer (refer to the chapter "Initialization and Setup Procedures").

CNC Program Names, Extensions and Suitability

CNC programs must be written in a format suitable for the machine that will use them.

The CNC program used to perform a specific manufacturing activity appears in the CIMDEF definitions as the task # used in a specific subprocess, as in the example shown in Figure 1. Here task # 2 references a CNC program that mills a hole.

```
────────────── Process Definition ──────────────

   Process # :    2   Name :Make Lamp Base      Number of subprocesses :    3

   Remarks        :mill threaded center hole and finish surface         
                  _____
                  _____

                   ▐ Subprocess Definition ▌
   Subprocess # :    1                  Subprocess name :Center hole       

   Station #     :    2                 Station name     :Machining         

   Using a machine ? :▐Yes▌/No          Machine # :    1   Name :ACME 100       

   Task #        :    2                 Expected processing time :        2.0 Min.

   Remarks        :Mill 16.5 mm diam. hole in center of block        
                  _____
                  _____

   F1  - Previous subprocess         Shift+F1 - 10 subprocesses back
   F2  - Next     subprocess         Shift+F2 - 10 subprocesses forward
   Esc - Processes Definition
```

Figure 1. Example of a Task Number in a Subprocess Definition

The AutoCNC software contains tables of the correspondence between task number and CNC program file name. A separate table is defined for each machine at each station.

The extension of the file to be downloaded is specified in the definitions entered in the RSDNL software. The default extension is .TAP but may be changed for each machine. Refer to the chapter on RSDNL for more information.

Setting Up the Controller to Use AutoCNC

If the version number of your CIM software is less than 1.80, the following steps must be performed at *each* CNC station where automatic switching of CNC programs is required, before starting production.

1. From the DOS prompt at the CNC station PC, access the ACL controller by typing ATS followed by < Enter> . Alternatively, you can access the CNC station controller from the central CIM computer using RSNET.

2. Next set the ACL variable TFLAG which controls whether the station will use automatic switching of CNC programs. The controller will only execute CNC program switching when TFLAG is 1. The default value is 0.

    Type SET TFLAG = 1 < Enter> .

3. Now leave ATS by pressing < Shift> + < F9> followed by < Enter> .
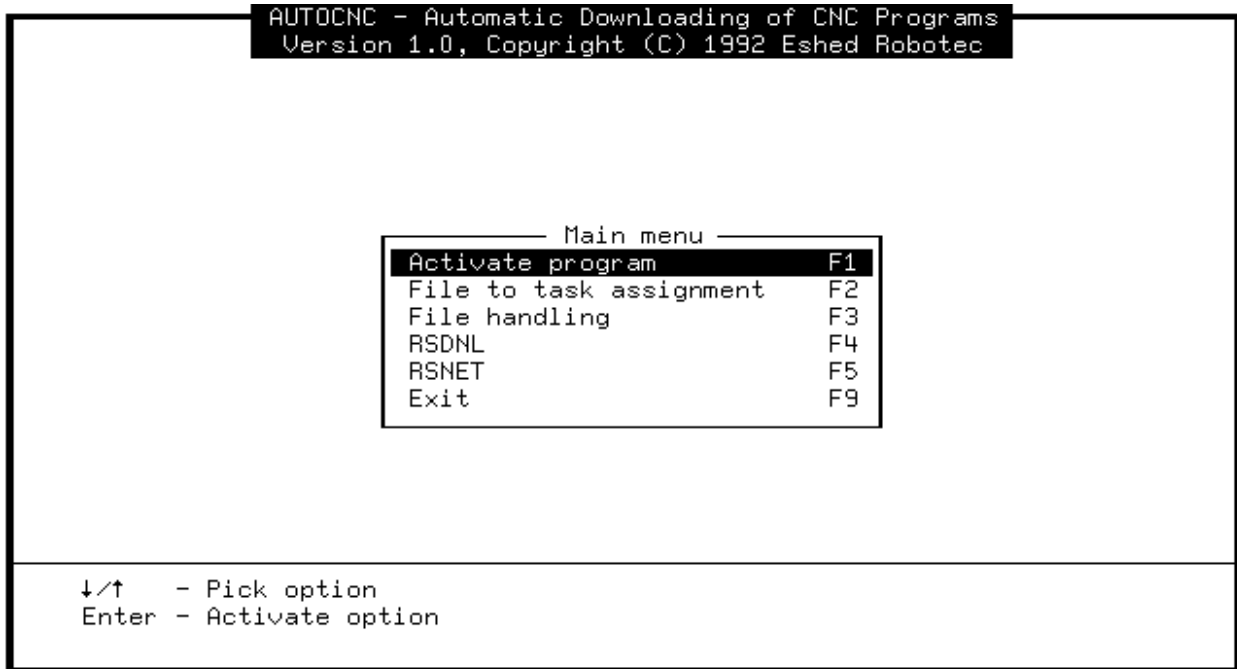
Running the AutoCNC Software

AutoCNC can only be activated at the station at which automatic downloading of programs will take place.

The task to file assignment and and file handling modules may be run from the central CIM station, if the CNC station at which downloading is required is connected to the central CIM computer via the Ethernet LAN.

To activate AutoCNC from the C:\ prompt of the CNC station,
type AC followed by < Enter> .

If the CNC station PC is currently connected to the Ethernet LAN, you can select the AutoCNC option from the communications menu of the main CIM menu. Note that the CNC programs will be taken from the downloading directories of the central CIM computer in this case.

You will see the AutoCNC main menu, as shown in Figure 2.

```
┌──────────────────────────────────────────────────────────────┐
│        AUTOCNC - Automatic Downloading of CNC Programs        │
│          Version 1.0, Copyright (C) 1992 Eshed Robotec        │
│                                                              │
│                                                              │
│                                                              │
│                 ┌──────── Main menu ────────┐                │
│                 │ Activate program       F1 │                │
│                 │ File to task assignment F2 │               │
│                 │ File handling          F3 │                │
│                 │ RSDNL                  F4 │                │
│                 │ RSNET                  F5 │                │
│                 │ Exit                   F9 │                │
│                 └───────────────────────────┘                │
│                                                              │
│                                                              │
│                                                              │
│  ↓/↑    - Pick option                                        │
│  Enter - Activate option                                     │
└──────────────────────────────────────────────────────────────┘
```

Figure 2. The AutoCNC Main Menu.

The main menu presents the following options:

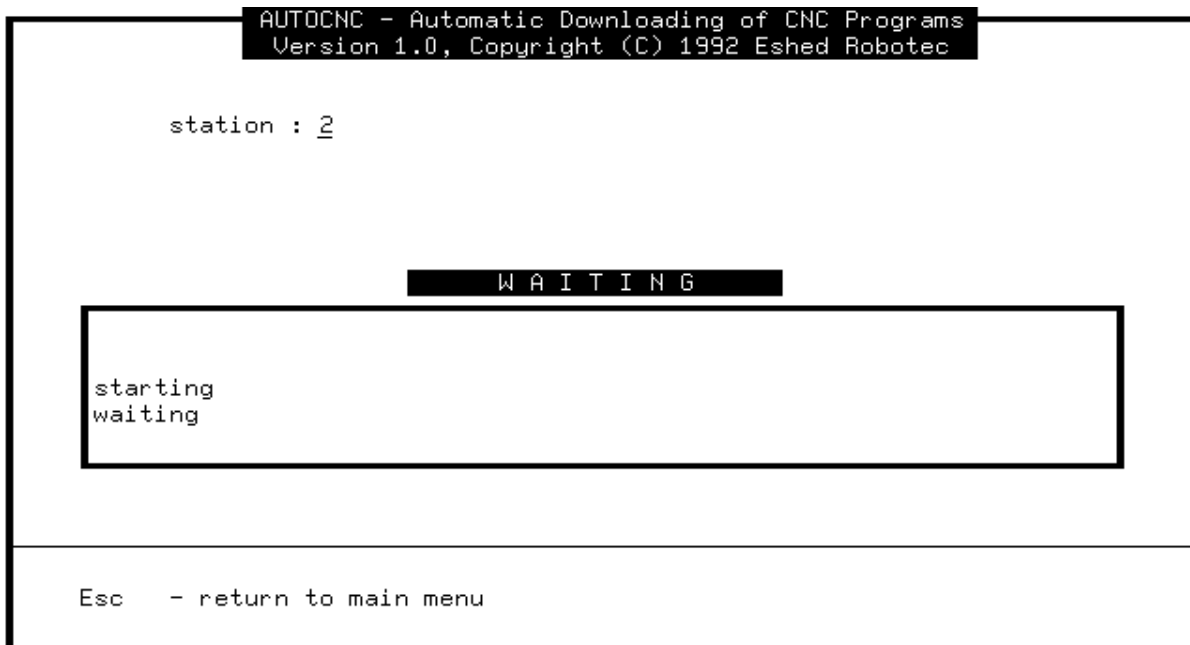|	
Activate program	Run AutoCNC at the specified station. The program will download a file only when requested to do so by the station controller.
	When AutoCNC is running at a CNC station PC, the PC cannot run any other programs.
File to task assignment	Define, view or modify the correspondence between task number (from the CIMDEF subprocess definition) and CNC program file name for each CNC machine at each station.
File handling	Access the file handling utility to copy specified CNC program files to or from the downloading directory, delete a specified file or view a list of specified files in the downloading directory or another directory.

RSDNL	Activate the RSDNL software to change the file extension of the CNC files or other information stored in the RSDNL options file.
RSNET	Enter the RSNET software to change the configuration of the switched RS232 network.
Exit	Exit the program.

Activate Program

Selecting Activate Program from the main menu displays the screen shown in Figure 3.

```
┌──────────────────────────────────────────────────────────────────────┐
│       ┌────────────────────────────────────────────────────┐          │
│       │ AUTOCNC - Automatic Downloading of CNC Programs      │         │
│       │ Version 1.0, Copyright (C) 1992 Eshed Robotec        │         │
│       └────────────────────────────────────────────────────┘          │
│                                                                        │
│        station : 2                                                     │
│                                                                        │
│                                                                        │
│                                                                        │
│                        ┌────────────────────────┐                      │
│                        │   W A I T I N G        │                      │
│                        └────────────────────────┘                      │
│       ┌──────────────────────────────────────────────────────────┐    │
│       │                                                          │    │
│       │ starting                                                 │    │
│       │ waiting                                                  │    │
│       │                                                          │    │
│       └──────────────────────────────────────────────────────────┘    │
│                                                                        │
│  ────────────────────────────────────────────────────────────────     │
│                                                                        │
│   Esc   - return to main menu                                          │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
```

Figure 3. The AutoCNC Status Screen

The top row on the screen displays the station at which the program is running. This information is taken from definitions in the AUTOEXEC.BAT.bat files of each station computer.

The window in the center of the screen shows the program status. In this example, the current status, displayed above the window, is WAITING. Within the window, the first line, starting, shows that the program has been activated and the next line, waiting, shows that it is waiting for a command from the CNC station controller to download a program to the CNC machine.

When the program is downloading, the status box displays the number of the machine being downloaded to, the number of the task and the alternate names of the cell elements currently connected by RSNET.
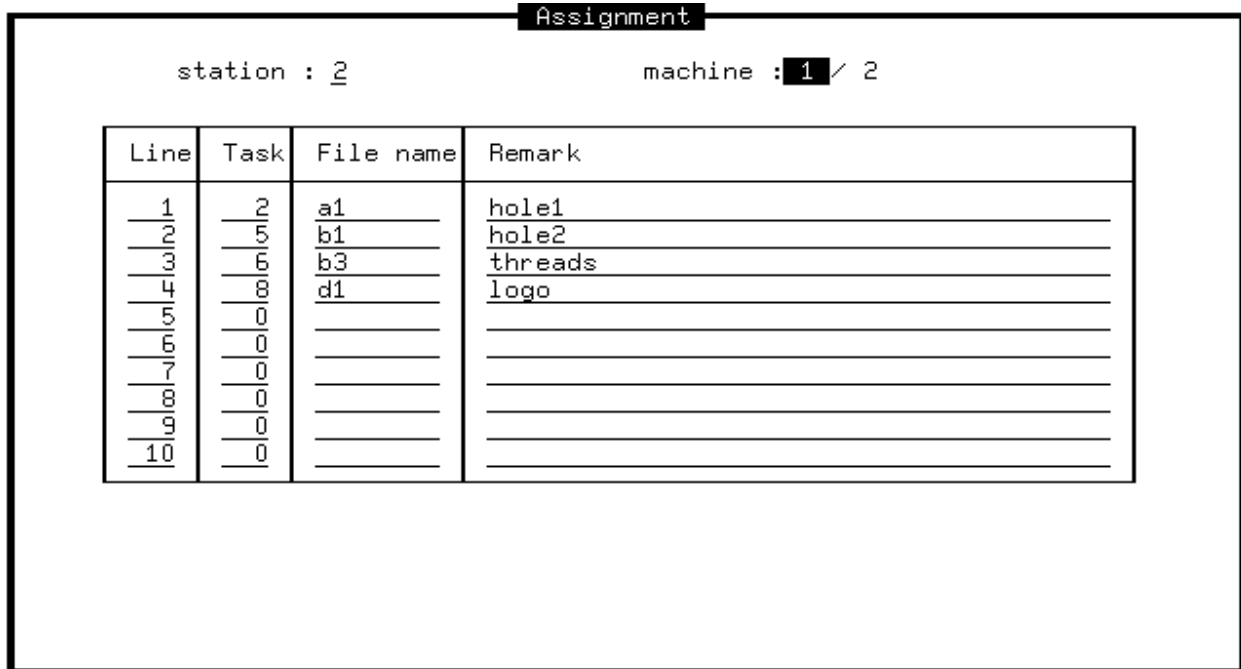
Pressing < Esc> deactivates the automatic downloading and returns you to the main menu.

File to Task Assignment

AutoCNC software allows the user to define the correspondence between task numbers and CNC program files for each machine at each station.

When the central CIM computer (or another computer on which AutoCNC definitions are entered) and the CNC station computer(s) are linked by an Ethernet LAN, the file to task correspondence need only be entered at the central CIM computer.

Selecting the second option, File to task assignment, from the main AutoCNC menu, displays a screen similar to Figure 4.

```
┌─────────────────────────── Assignment ───────────────────────────┐
│                                                                   │
│        station : 2                    machine : ▮1▮ / 2           │
│                                                                   │
│    ┌─────┬─────┬──────────┬──────────────────────────────────┐   │
│    │ Line│ Task│ File name│ Remark                           │   │
│    ├─────┼─────┼──────────┼──────────────────────────────────┤   │
│    │  1  │  2  │ a1       │ hole1                            │   │
│    │  2  │  5  │ b1       │ hole2                            │   │
│    │  3  │  6  │ b3       │ threads                          │   │
│    │  4  │  8  │ d1       │ logo                             │   │
│    │  5  │  0  │          │                                  │   │
│    │  6  │  0  │          │                                  │   │
│    │  7  │  0  │          │                                  │   │
│    │  8  │  0  │          │                                  │   │
│    │  9  │  0  │          │                                  │   │
│    │ 10  │  0  │          │                                  │   │
│    └─────┴─────┴──────────┴──────────────────────────────────┘   │
│                                                                   │
└───────────────────────────────────────────────────────────────────┘
```

Figure 4. The File to Task Assignment Table

The top row of this screen lets you select the current station and machine number. The example in Figure 4 gives the file to task correspondence for machine 1 at station 2.

Each row in the table lists the line number, task number, corresponding file name and any remarks.

Use the ↑, ↓ arrows to access the various fields. If you make any changes, you must press < Enter> to save them.

File Handling

Selecting the third option, File Handling, from the AutoCNC main menu displays the screen shown in Figure 5.

```
┌──────────────────────────┤ File handling ├──────────────────────────┐
│                                                                      │
│  Source directory :b:\cnc_____     │
│                                                                      │
│  station : 2   machine :█1█/ 2         File name : *_____   Extension : tap │
│                                                                      │
│  ┌────────────────────────┐ ┌─────────────────────────────────────┐ │
│  │ Get from source    F1  │ │                                     │ │
│  └────────────────────────┘ │                                     │ │
│  ┌────────────────────────┐ │                                     │ │
│  │ Save to source     F2  │ │                                     │ │
│  └────────────────────────┘ │                                     │ │
│  ┌────────────────────────┐ │                                     │ │
│  │ Delete file        F3  │ │                                     │ │
│  └────────────────────────┘ │                                     │ │
│  ┌────────────────────────┐ │                                     │ │
│  │ Catalog            F4  │ │ A1      TAP    19   03-09-91  04:09 PM │ │
│  └────────────────────────┘ │ B1      TAP    19   03-09-91  04:09 PM │ │
│  ┌────────────────────────┐ │ C4      TAP    19   03-09-91  04:09 PM │ │
│  │ Catalog of source F5  │ │ D3      TAP    19   03-09-91  04:09 PM │ │
│  └────────────────────────┘ │ D1      TAP    19   03-09-91  04:09 PM │ │
│  ┌────────────────────────┐ │       5 File(s)    908288 bytes free │ │
│  │ Main menu         ESC  │ │                                     │ │
│  └────────────────────────┘ └─────────────────────────────────────┘ │
└──────────────────────────────────────────────────────────────────────┘
```
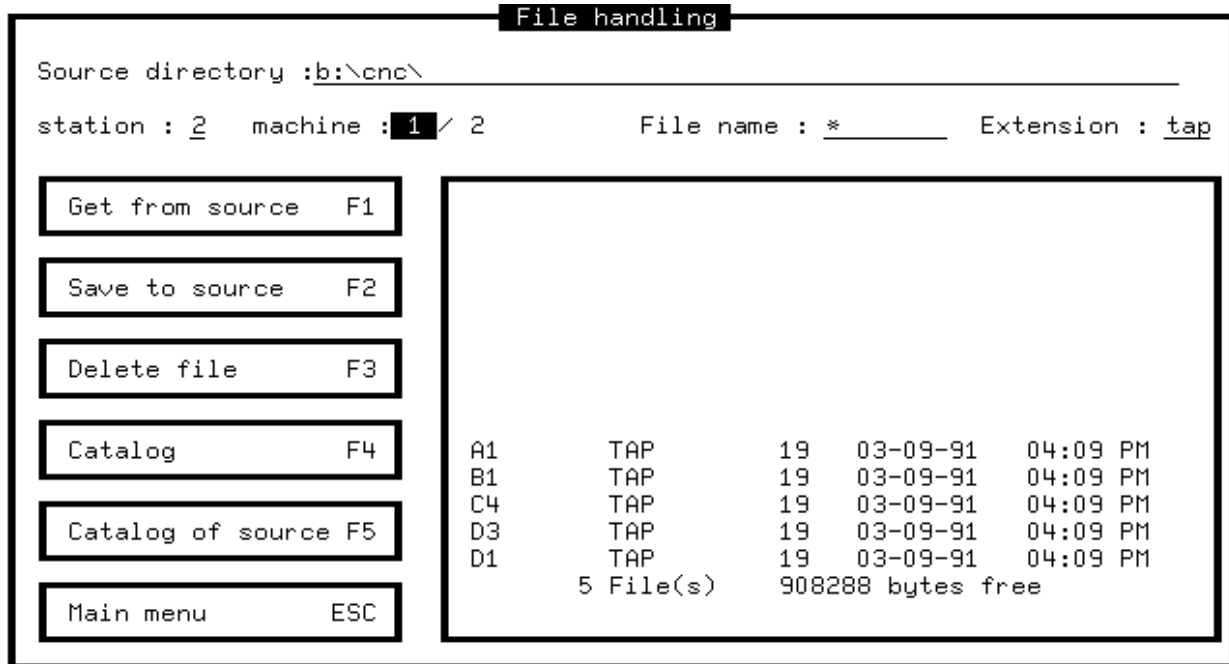
Figure 5. The AutoCNC File Handling Screen

The CNC program files must be located in the proper downloading directories on the CNC station PC in order to be downloaded automatically. When CNC program files are found in another location, such as on a diskette, or in a CAD program directory on the CNC station PC, this location is referred to as the source. The File Handling screen lets you copy CNC files from a source directory to the specified downloading directory, as well as other file handling tasks.

Note: This screen only allows you to list, copy or delete specified files. It does not allow you to specify the file that will be downloaded! (The file that will be downloaded is specified by the task number in the CIMDEF subprocess definition for the part under production, the task to file name correspondence information entered in AutoCNC, and the file extension and location defined in the option file used by RSDNL.)

The file handling screen is divided into three sections. The top section defines the source directory and the files to be handled, the left side of the screen gives six utilities and the window on the right displays the files requested by the various utilities.

The top line on the screen lets you define the source directory. The next field lets you select the station and machine number, CNC file name and file extension.

The utilities available are:

Get from source < F1>   Copy the selected files to the downloading
                                     directory for the specified machine.

Save to source < F2>   Copy the selected files from the downloading
                                     directory to the source directory.

Delete file < F3>   Delete the selected file(s).
                                     Warning: Do not use wild cards (*) to specify files
                                     to be deleted.

Catalog < F4>   List selected file(s) in the downloading directory.

Catalog of source < F5>   List the selected file(s) in the source directory.

Main menu < Esc>   Return to the main AutoCNC menu.

RSDNL

Selecting RSDNL from the main AutoCNC menu accesses the RSDNL software. This allows you to change the information stored in the RSDNL options file, such as the CNC file extensions.

When using RSDNL in combination with AutoCNC, the RSDNL target device is a switcher. The options file contains the transmission parameters required for the switcher and should generally not be changed.

It is possible, however, that you may need to change the following parameters:

delay after byte   This option is intended to compensate for
                                     differences in the Baud rate used by the switcher
                                     and the CNC machines.

                                     You must enter a delay time in milliseconds. The
                                     recommended value for the EMCO C5 and F1 is
                                     37, assuming that their baud rate is 300. If no
                                     delays are required by the device, enter 0.

delay after < CR>

This option is intended for CNC machines (such as EMCO C5 and F1) which require delay time after a carriage return character is received.

You are prompted for the delay in milliseconds. Recommended values for the EMCO C5 and F1 are 100, assuming that their Baud rate is 300.

If no delays are required by the device, enter 0.

If the delays used are too large, the downloading process will take too long. If the delays used are not sufficient, the transmission may be disrupted.

For more information on this software refer to the chapter "RSDNL Software User's Guide".

RSNET

Selecting the RSNET option accesses the RSNET software. This allows you to define the switched RS232 communication configuration. For more information, refer to the chapter RSNET Software User's Guide.

Exit

Choosing this option leaves the AutoCNC software.

This page intentionally left blank.

ACL Report and Reset Programs

The ACL programs described in this chapter perform specific functions that can help you manage the ER CIM cell. These programs allow you to display the status of the cell and to change the data to correct inconsistencies.

Some of these programs perform functions that are usually carried out within ER CIM software modules. For example, the program CSTAT allows you to modify the existence and location of a station on the graphic display. This can also be done by accessing the Station Definition screen of the CIM Graphic Tracking Software.

The RESET program allows you to clear all status variables before restarting the system.

ACL Report Programs

The CIM-ACL system report programs let the user view the current status of the CIM cell or station. These programs also allow the user to modify CIM status and configuration variables. For the proper display of the report tables, ATS version 1.41 or higher must be used.

Main Controller Reports

These programs exist in the central CIM controller. To activate these reports, you must connect the central controller using ATS. Then activate the programs using the format: RUN *progname*.

The station location is given in the range of 1 through 32, with 1 being the upper right corner of the conveyor.

RSTAT   Displays all defined stations, their location and communication status.

CSTAT   Allows modification of station existence and location on the graphic display.

RPLT   Displays the current location of pallets and their contents.

CPLT	Allows the display and alteration of pallet contents.
	Displays the conveyor location of each pallet and the part which is currently placed on each pallet.
RORD	Displays the current order. The order can be changed by using the PROD software.
RPROC	Displays the manufacturing tasks required for each part in the order currently being produced.

Station Controller Reports

The following programs are very useful for monitoring station consistency. They are also vital tools for restarting the production process after an unexpected program halt (such as a user abort or a robot collision).

| RBFR | Displays the contents of buffers, machines, pallet at station (if exists) and robot gripper. |
| CBFR | Allows the alteration of the contents of buffers and machines. |

The usual sequence for restoring station operation after an unexpected halt is as follows:

1. Use RBFR to verify that the reported status is indeed the actual one.

2. If necessary, use CBFR to modify the content of buffers and machines according to their actual status.

3. Run the AUTO program, which will run all necessary CIM-ACL programs.

The Reset Program

The RESET program clears all CIM cell and/or CIM station activities. If the manufacturing sequence is disturbed, this program is useful for clearing the system and restarting activities.

If activated at the main CIM controller, all CIM tracking and status variables are cleared at the main controller and at all connected station controllers. If activated at a station, the status of all buffers and tasks is cleared.

CIM Communication Network

The ER-CIM environment is fully integrated on all levels of communications:

- Inputs/Outputs

- Point-to-point RS232 connections

- Switched RS232 network

- Ethernet LAN

Input/Output Connections

The I/O connections are used for interfacing the robot/station controller and its various peripherals, CNC machines and the pallet tracking sensor. The I/O connections are used for communication with the pallet conveyor's Programmable Logic Controller (PLC) and for direct control of the pallet sensors and stop stations.

For complete details of I/O connections, refer to the appendix, "CIM I/O Connections."

Point-to-Point RS232 Connections

Point-to-point connections link the central controller directly to each station controller. Through these connections, the central controller transmits data such as part ID, task to perform, machine to use.

When production starts, the central controller also uses point-to-point connections to give commands to the ASRS (for raw material inflow) station. During production each of the station controllers communicates with the central controller for real-time on-line production commands and updates.

RS232 peripherals, such as the barcode unit, may also be connected in this manner for immediate on-line communication.

For complete details of RS232 connections, refer to the appendix, "CIM RS232 Connections."

Switched RS232 Network

The switched RS232 network allows the operator – from one computer – to fully interact with any station or machine in the CIM cell.

This communication network links all elements of the cell, starting from the central computer and reaching all stations and machines, including CNC and robot controllers.

During the development of various station programs, the switched RS232 network allows the central computer to work with selected machines. It is then used for preloading the machines with production data and for downloading production commands and programs.

For complete details of RS232 connections, refer to the appendix, "CIM RS232 Connections."

Ethernet LAN

An Ethernet Local Area Network (LAN) connects all cell computers. This facilitates the sharing of a database common to all stations. The common database includes all the data needed to perform the various production tasks: materials, processes, orders, actual manufacturing programs (CNC), and robot programs.

The Ethernet LAN enables the sharing of various devices such as a central server hard disk and central printer, and allows remote access to any computer on the LAN. Any computer on the LAN can then be used to develop the CIM database and configuration, and the various CNC and robot programs.

CIM Production Communication Sequence

A typical CIM communication sequence prior to and during production would include the following stages:

- Station controller is accessed by the central computer (switched RS232).

- Data and programs are read from database on the central computer (Ethernet).

- Production data is downloaded to central CIM controller (point-to-point RS232).

- Production start signals are given (I/O and point-to-point RS232).

- Station signals conveyor PLC to stop pallet with part (I/O).

- Pallet ID is read (I/O).

- Pallet ID is transmitted to central controller (point-to-point RS232).

- Relevant production data is transmitted to the station controller (point-to-point RS232).

- Template with part is taken from pallet and pallet is released (I/O).

- Task to perform is checked in the production database (point-to-point RS232).

- If CNC program needs to be changed, the station controller sends a message to the station computer (point-to-point RS232).

- Station computer downloads the new CNC program (switched RS232).

- Machine is loaded and work is performed (I/O with machine).

- Production data is transmitted to central controller (point-to-point RS232).

- Central CIM controller updates internal production database and transmits the changes and the order status to central computer (point-to-point RS232).

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CIM RS232 Communication

The CIM cell contains two types of RS232 networks:

*   Point-to-point hardwired connections

*   Switched network

Point-to-Point RS232 Connections

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When production starts, the central controller also uses point-to-point connections to give commands to the ASRS (for raw material inflow) station. During production each of the station controllers communicates with the central controller for real-time on-line production commands and updates.

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During the development of various station programs, the switched RS232 network allows the central computer to work with selected machines. It is then used for preloading the machines with production data and for downloading production commands and programs.

The following diagrams describe the various RS232 communication connections.
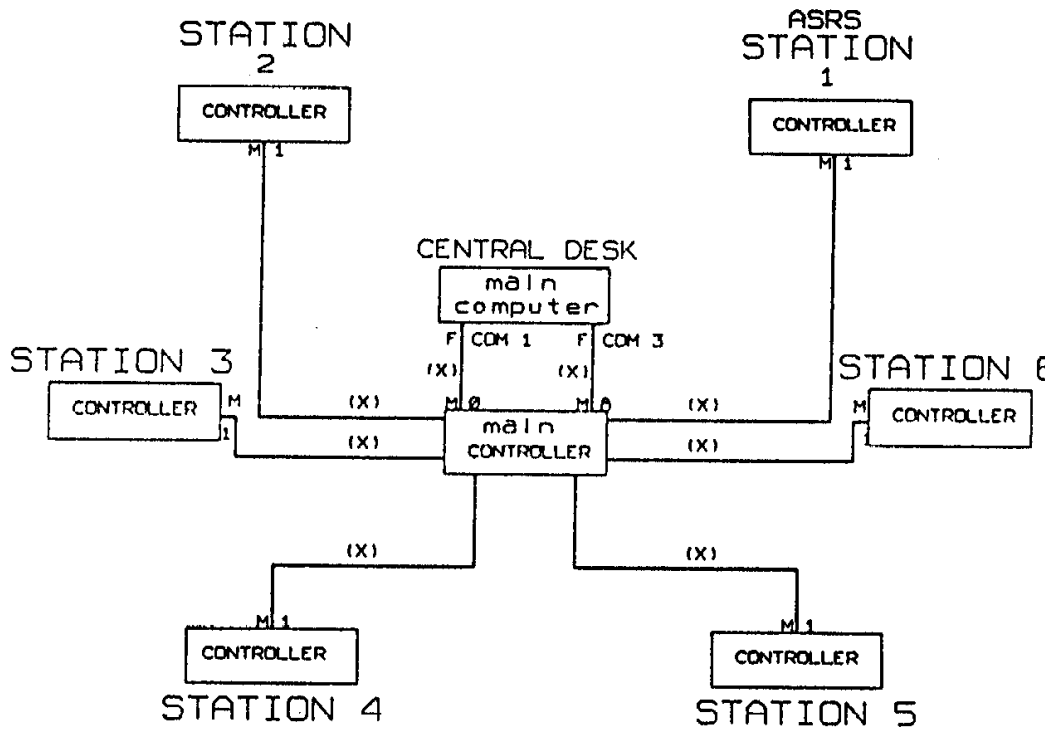
Figure 1: Direct Controller RS232 Network

Legend:

(x)	crossed
(=)	parallel
M	male connector
F	female connector
– – –	optional
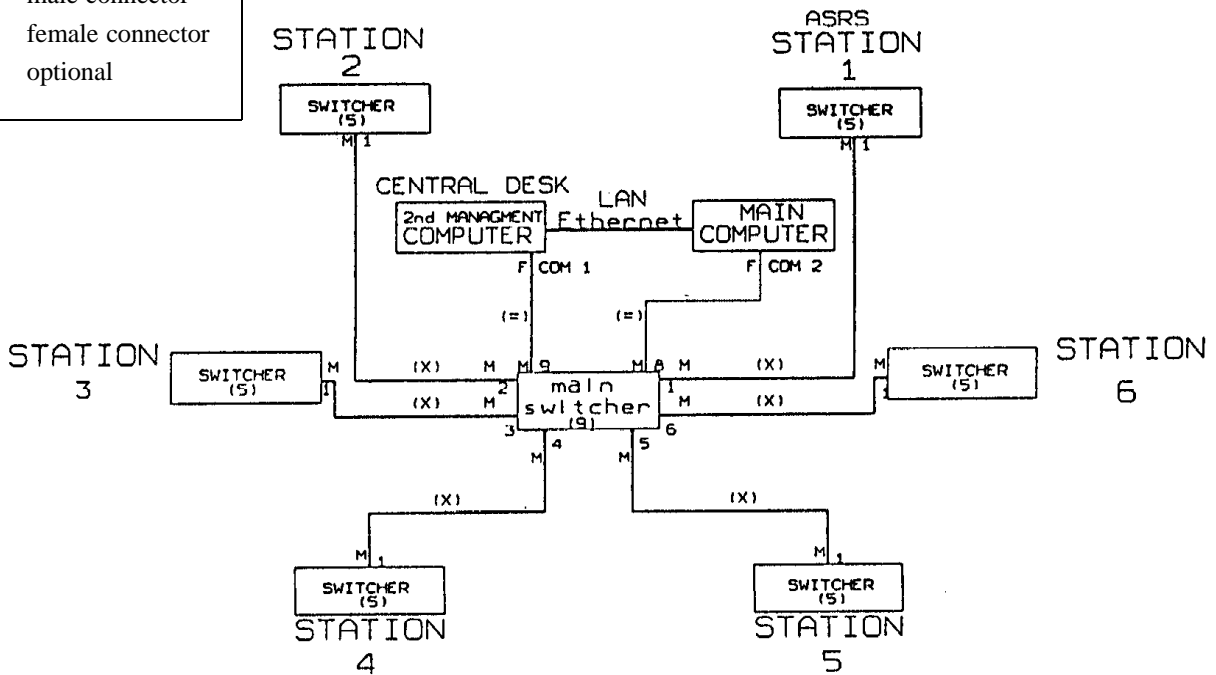
Figure 2: Switched RS232 Network (Option 1)
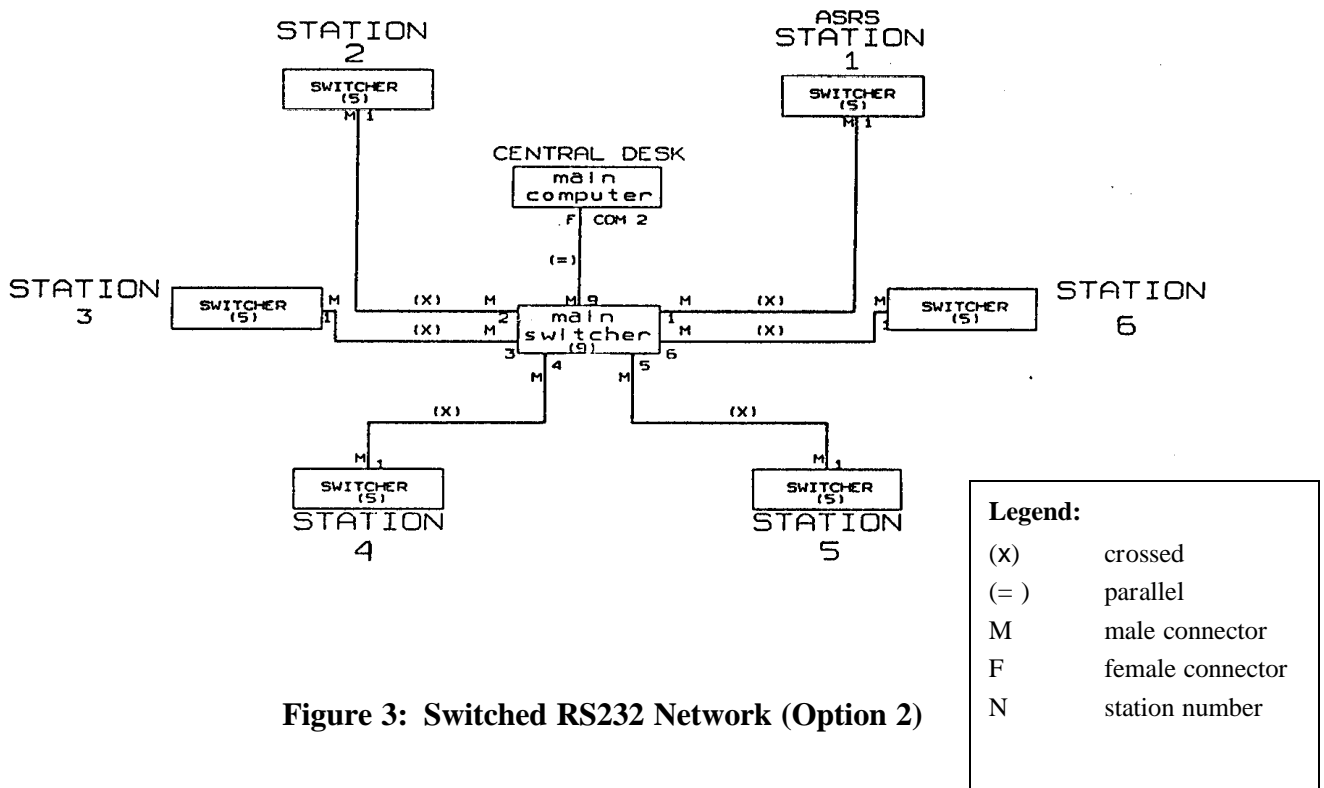
Figure 3: Switched RS232 Network (Option 2)

Legend:

(x)	crossed
(=)	parallel
M	male connector
F	female connector
N	station number
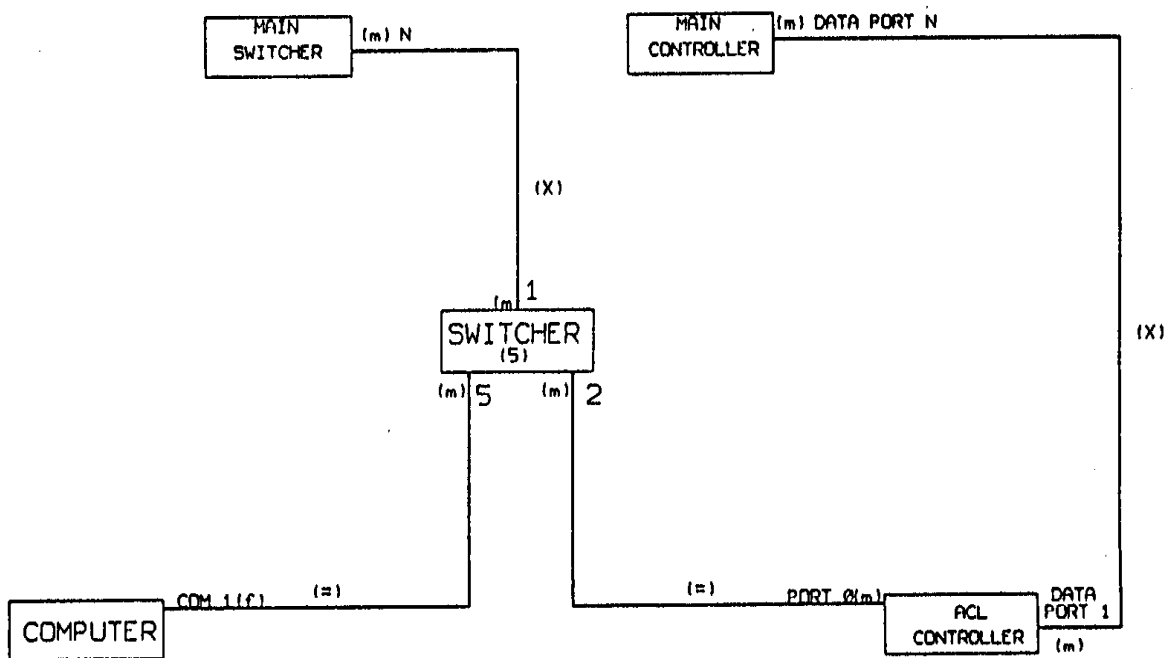
Figure 4: Typical Station with Robot Only
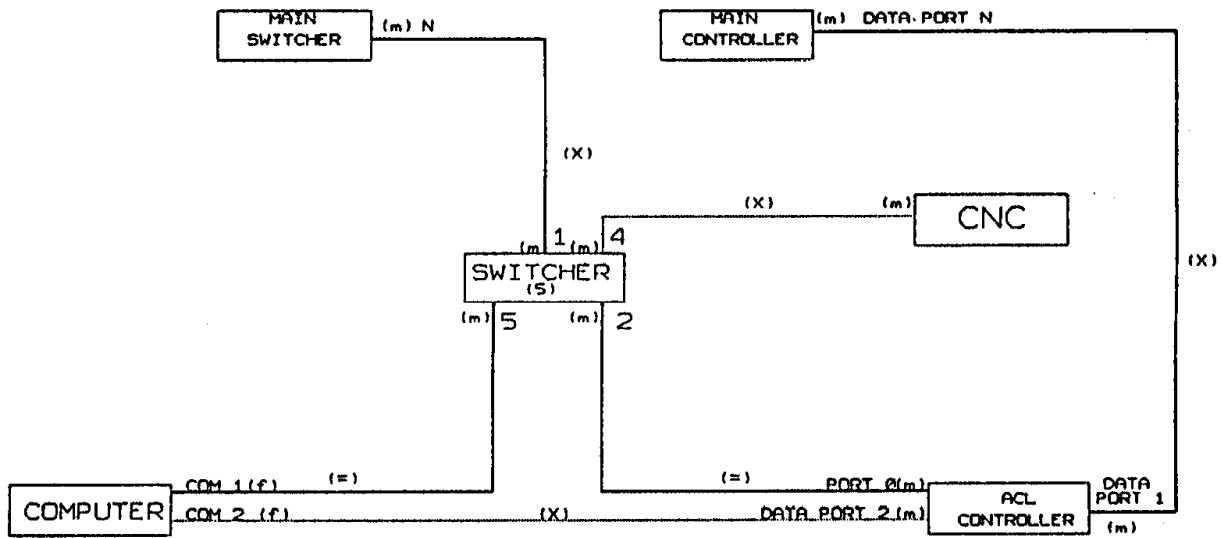
Figure 5: Typical Station with One CNC Machine

Legend:

(X)	crossed
(=)	parallel
M	male connector
F	female connector
N	station number
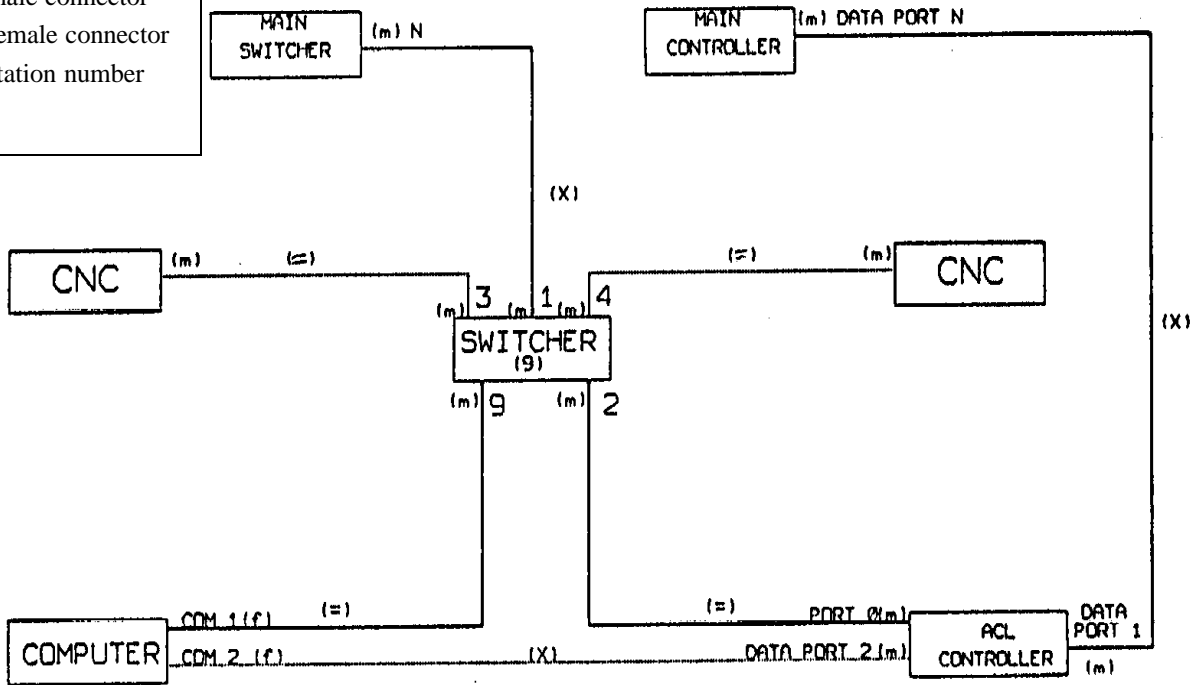
Figure 6: Typical Station with Two CNC Machines

The switcher ports connected to the various devices must be set to the following transmission parameters:

Transmission Parameters	Switcher, PC, ACL controller	EMCO F1,C5	EMCO VMC100, 120P
Baud rate	9600	300	150-2400
Word size	8	7	7
Stop bits	1	2	1
Parity	None	None	Even (1 bit)
XON/XOFF	ON	Off	

CIM I/O Connections

The I/O wiring is divided into three categories:

- Conveyor/PLC

- Main Controller

- Station Controller

Conveyor/Programmable Logic Controller

The conveyor consists of several pallet stations, numbered according to the configuration of the CIM cell.

Each of these working stations contains two sensors and two pistons which are controlled by the Programmable Logic Controller (PLC) in the conveyor's control cabinet.

The conveyor's PLC is connected to all station controllers for command and status communication.

Main Controller

The central CIM controller – at the central control desk – is connected with a single input and a single output to each of the local station controllers and to the conveyor PLC.

Station Controller

Each station controller is connected to the following:

- PLC

- Main controller

- Magnetic multi-sensor identification heads

- CNC or other machines

The station controller may also be connected to other station equipment.

PLC I/O Wiring

PLC INPUT 0	CENTRAL CIM CONTROLLER OUTPUT 11
PLC INPUT 4	(STA1STP) - STATION 1 CONTROLLER OUTPUT 5
PLC INPUT 5	(STA1REL) - STATION 1 CONTROLLER OUTPUT 6
PLC INPUT 6	(STA1-S1) - STATION 1 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 7	(STA1-S2) - STATION 1 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 10	(STA2STP) - STATION 2 CONTROLLER OUTPUT 5
PLC INPUT 11	(STA2REL) - STATION 2 CONTROLLER OUTPUT 6
PLC INPUT 12	(STA2-S1) - STATION 2 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 13	(STA2-S2) - STATION 2 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 14	(STA3STP) - STATION 3 CONTROLLER OUTPUT 5
PLC INPUT 15	(STA3REL) - STATION 3 CONTROLLER OUTPUT 6
PLC INPUT 16	(STA3-S1) - STATION 3 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 17	(STA3-S2) - STATION 3 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 20	(STA4STP) - STATION 4 CONTROLLER OUTPUT 5
PLC INPUT 21	(STA4REL) - STATION 4 CONTROLLER OUTPUT 6
PLC INPUT 22	(STA4-S1) - STATION 4 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 23	(STA4-S2) - STATION 4 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 24	(STA5STP) - STATION 5 CONTROLLER OUTPUT 5
PLC INPUT 25	(STA5REL) - STATION 5 CONTROLLER OUTPUT 6
PLC INPUT 26	(STA5-S1) - STATION 5 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 27	(STA5-S2) - STATION 5 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 30	(STA6STP) - STATION 6 CONTROLLER OUTPUT 5
PLC INPUT 31	(STA6REL) - STATION 6 CONTROLLER OUTPUT 6
PLC INPUT 32	(STA6-S1) - STATION 6 CONVEYOR'S PROXIMITY SENSOR 1
PLC INPUT 33	(STA6-S2) - STATION 6 CONVEYOR'S PROXIMITY SENSOR 2
PLC INPUT 34*	MAIN-CONTROLLER OUTPUT 12

* Not currently in use.

Each proximity sensor has 3 wires:
> + 24V (BROWN)
> GND (BLUE)
> N.O. SIGNAL (WHITE)

PLC I/O Wiring

PLC OUTPUT 201	(STA1-P1) - STATION 1 CONVEYOR'S PISTON 1
PLC OUTPUT 202	(STA1-P2) - STATION 1 CONVEYOR'S PISTON 2
PLC OUTPUT 203	(STA1-OK) - STATION 1 CONTROLLER INPUT 6
PLC OUTPUT 204	(STA2-P1) - STATION 2 CONVEYOR'S PISTON 1
PLC OUTPUT 205	(STA2-P2) - STATION 2 CONVEYOR'S PISTON 2
PLC OUTPUT 206	(STA2-OK) - STATION 2 CONTROLLER INPUT 6
PLC OUTPUT 211	(STA3-P1) - STATION 3 CONVEYOR'S PISTON 1
PLC OUTPUT 212	(STA3-P2) - STATION 3 CONVEYOR'S PISTON 2
PLC OUTPUT 213	(STA3-OK) - STATION 3 CONTROLLER INPUT 6
PLC OUTPUT 214	(STA4-P1) - STATION 4 CONVEYOR'S PISTON 1
PLC OUTPUT 215	(STA4-P2) - STATION 4 CONVEYOR'S PISTON 2
PLC OUTPUT 216	(STA4-OK) - STATION 4 CONTROLLER INPUT 6
PLC OUTPUT 221	(STA5-P1) - STATION 5 CONVEYOR'S PISTON 1
PLC OUTPUT 222	(STA5-P2) - STATION 5 CONVEYOR'S PISTON 2
PLC OUTPUT 223	(STA5-OK) - STATION 5 CONTROLLER INPUT 6
PLC OUTPUT 224	(STA6-P1) - STATION 6 CONVEYOR'S PISTON 1
PLC OUTPUT 225	(STA6-P2) - STATION 6 CONVEYOR'S PISTON 2
PLC OUTPUT 226	(STA6-OK) - STATION 6 CONTROLLER INPUT 6

Central Controller I/O Wiring

Central CIM Controller A I/O	To	Signal Name	I/O Type	
			Controller A at Station	Controller B at Station
OUTPUT 5	STATION 1 CONTROLLER INPUT 7	CTRL#1	NPN	PNP
OUTPUT 6	STATION 2 CONTROLLER INPUT 7	CTRL#2	NPN	PNP
OUTPUT 7	STATION 3 CONTROLLER INPUT 7	CTRL#3	NPN	PNP
OUTPUT 8	STATION 4 CONTROLLER INPUT 7	CTRL#4	NPN	PNP
OUTPUT 9	STATION 5 CONTROLLER INPUT 7	CTRL#5	NPN	PNP
OUTPUT 10	STATION 6 CONTROLLER INPUT 7	CTRL#6	NPN	PNP
OUTPUT 11*	PLC INPUT 0	RUN/STOP	PNP	PNP
OUTPUT 12*	PLC INPUT 34	SUSPEND	PNP	PNP
INPUT 1	STATION 1 CONTROLLER OUTPUT 7	CTRL#1	NPN	NPN
INPUT 2	STATION 2 CONTROLLER OUTPUT 7	CTRL#2	NPN	NPN
INPUT 3	STATION 3 CONTROLLER OUTPUT 7	CTRL#3	NPN	NPN
INPUT 4	STATION 4 CONTROLLER OUTPUT 7	CTRL#4	NPN	NPN
INPUT 5	STATION 5 CONTROLLER OUTPUT 7	CTRL#5	NPN	NPN
INPUT 6	STATION 6 CONTROLLER OUTPUT 7	CTRL#6	NPN	NPN
INPUT 7*	PLC OUTPUT 200	CONFIRMATION SHIELD	NPN	NPN
GND	-24V OF THE POWER SUPPLY		NPN	NPN

* Not currently in use.

Station Controller I/O Wiring

Suggested Wiring for Station *n*

I/O Port	To / From	Signal Name	I/O Type	
			Controller A at Station	Controller B at Station
OUTPUT 5	PLC INPUT 4	STOP	PNP	SOURCE
OUTPUT 6	PLC INPUT 5	RELEASE	PNP	SOURCE
OUTPUT 7	CENTRAL CONTROLLER INPUT *n*	CTRLR	NPN	SINK
INPUT 1	CODE SENSOR NO. 1	SENSOR 1	NPN	SOURCE
INPUT 2	CODE SENSOR NO. 2	SENSOR 2	NPN	SOURCE
INPUT 3	CODE SENSOR NO. 3	SENSOR 3	NPN	SOURCE
INPUT 4	CODE SENSOR NO. 4	SENSOR 4	NPN	SOURCE
INPUT 6	PLC OUTPUT 203	O.K. SHIELD	NPN	SOURCE
INPUT 7	CENTRAL CONTROLLER OUTPUT *x* ($x = n + 4$)	CON	NPN	SINK
CTRLR + 12V	COMMON OF CODE SENSORS	+ 12V SHIELD		
GND	CENTRAL CONTROLLER GND	GND SHIELD		

Suggested Wiring for Station with EMCO F1

Station with Controller A

FROM	TO	SIGNAL NAME	I/O TYPE
CONTROLLER OUTPUT 12	F-1 X 22 1B	LOAD RS232	PNP
CONTROLLER OUTPUT 13	F-1 X 22 2B	HAND/AUTO	PNP
CONTROLLER OUTPUT 14	F-1 X 22 3B	FEEDHOLD	PNP
CONTROLLER OUTPUT 15	F-1 X 22 4B	RUN PROGRAM	PNP
CONTROLLER OUTPUT 2 (COM)	F-1 X 104 PIN 1 TO X 22 9A	+ 24V	
CONTROLLER OUTPUT 2 (N.O.)	F-1 X 22 1C	VICE OPEN/CLOSE	
CONTROLLER INPUT 12	F-1 X 22 7B	"CYCLE - START" STATUS	PNP
CONTROLLER INPUT 13	F-1 X 22 8B	"FEEDHOLD" STATUS9	PNP
CONTROLLER INPUT 14	X 62 - 15	"ERROR" STATUS	PNP
CONTROLLER INPUT 16	F-1 X 22 6B	"HAND/AUTO" STATUS	PNP
CONTROLLER GND	F-1 X 22 9C	GND	PNP

Station with Controller B

In addition to the connections detailed in the table above:

* The output block must be set to EXTERNAL.

* All outputs connected to the EMCO F1 must be set to SOURCE.

* All inputs connected to EMCO F1 must be set to SOURCE.

EMCO F1 Machine Setup

On the back cover of the F1 control unit there is a PC board.

1. Find the X104 connector and connect between the X104 PIN 1 and the X22 PIN 0a which is located on the same back cover panel.

2. On this PC board there are four DIP switches set to 1100. Set position to 1010.

Suggested Wiring for Station with EMCO Compact 5

Station with Controller A

FROM	TO	SIGNAL NAME	I/O TYPE
CONTROLLER OUTPUT 8	C-5 X 22 1B	LOAD RS232	PNP
CONTROLLER OUTPUT 9	C-5 X 22 2B	HAND/AUTO	PNP
CONTROLLER OUTPUT 10	C-5 X 22 3B	FEEDHOLD	NPN
CONTROLLER OUTPUT 11	C-5 X 22 4B	CYCLE START	PNP
CONTROLLER OUTPUT 1 (COM)	C-5 X 104 1 TO X 22-9A	24V	
CONTROLLER OUTPUT 1 (N.O.)	C-5 X 22 1C	CLAMPING DEVICE OPEN /CLOSE	
CONTROLLER INPUT 8	C-5 X 22 7B	"CYCLE START" STATUS	PNP
CONTROLLER INPUT 9	C-5 X 8B	"FEEDHOLD" STATUS	PNP
CONTROLLER INPUT 10	C-5 X 62 15	"ERROR" STATUS	PNP
CONTROLLER INPUT 11	C-5 X 22 6B	"HAND AUTO" STATUS	PNP
CONTROLLER GND	C-5 X 22 9C	GND	

Station with Controller B

In addition to the connections detailed in the table above:

- The output block must be set to EXTERNAL.
- All outputs connected to the EMCO Compact 5 must be set to SOURCE.
- All inputs connected to EMCO Compact 5 must be set to SOURCE.

EMCO Compact 5 Machine Setup

The preparations of the Compact 5 are the same as steps 1 and 2 for the EMCO F1, plus a third step:

Disconnect jumper J4 on the A6A116001 PC board (the jumper is near the X 62 connector on this board).

Suggested Wiring for Station with EMCO VMC 100

Station with Controller A

FROM	TO	SIGNAL NAME	I/O TYPE
CONTROLLER INPUT 8	VMC 100 X 22 7B	STATUS CYCLE START	PNP
CONTROLLER INPUT 9	VMC 100 X 26-12	STATUS DOOR CLOSE	PNP
CONTROLLER INPUT 10	TO BE CONNECTED TO THE DOOR PISTON SENSOR	STATUS DOOR OPEN	PNP
CONTROLLER INPUT 11	VMC 100 X 22 1A	STATUS ALARM	PNP
CONTROLLER OUTPUT 4 (COM)	VMC 100 X 22 0A	24V	
CONTROLLER GND	VMC 100 X 22 9B	GND	
CONTROLLER OUTPUT 8	VMC 100 X 22 0B	LOAD PROGRAM RS232	PNP
CONTROLLER OUTPUT 9	VMC 100 X 22 2B	REFERENCE-HOME	PNP
CONTROLLER OUTPUT 10	VMC 100 X 22 3B	FEEDHOLD	PNP
CONTROLLER OUTPUT 11	VMC 100 X 22 4B	CYCLE START	PNP
CONTROLLER OUTPUT 1 (N.O.)	VMC 100 X 22 1C	VICE OPEN	
CONTROLLER OUTPUT 1 (N.C.)	VMC 100 X 22 2C	VICE CLOSE	
CONTROLLER OUTPUT 2 (N.O.)	VMC 100 X 22 5B	DOOR OPEN/CLOSE	

Station with Controller B

In addition to the connections detailed in the table above:

- The output block must be set to EXTERNAL.

- All outputs connected to the VMC 100 must be set to SOURCE.

- All inputs connected to VMC 100 must be set to SOURCE.

EMCO VMC 100 Machine Setup

The preparations for this machine include both software (parameters) and hardware:

Software Configuration (Parameters)

Enter Edit mode and type MONITOR.

Now set the following parameters:

L01 = 191
L03 = 1
L20 = 1
L40 = 22
011 = 24
040 = 144
041 = 13
T43 = 3

Hardware Preparations

1.   To install the pneumatic valve for the pneumatic door: connect one pole of the pneumatic switch to X 22 PIN 6c and the other pole to X 22 PIN 9b (GND).

2.   To connect the door closing magnetic sensor (only if a new sensor is needed):
Connect the X 26 PIN 13 (24v) to the brown wire and X 26 PIN 12 to the blue wire of this sensor. To gain feedback to the controller's input, connect X-6-12 through X-22 to the proper input.

3.   To install the pneumatic valve for the pneumatic vice: connect one pole of the pneumatic switch to X 22 PIN 3a and the other pole to X 22 PIN 9c (GND).

Suggested Wiring for Station with EMCO 120P

Station with Controller A

FROM	TO	SIGNAL NAME	I/O TYPE
CONTROLLER OUTPUT 3 (N.C.)	120P X 22 1C	CHUCK OPEN	
CONTROLLER OUTPUT 3 (N.O.)	120P X 22 2C	CHUCK CLOSE	
CONTROLLER OUTPUT 12	120P X 22 3C	TAILSTOCK OPEN	PNP
CONTROLLER OUTPUT 13	120P X 22 2B	REFERENCE-HOME5	PNP
CONTROLLER OUTPUT 14	120P X 22 3B	FEEDHOLD	PNP
CONTROLLER OUTPUT 15	120P X 22 4B	CYCLE START	PNP
CONTROLLER OUTPUT 16	120P X 22 4C	TAILSTOCK	PNP
CONTROLLER OUTPUT 4 (N.O.)	120P X 22 5B	DOOR OPEN/CLOSE	
CONTROLLER INPUT 12	120P X 22 7B	STATUS CYCLE START	PNP
CONTROLLER INPUT 13	120P X 22 6A and TO X 6-23	STATUS DOOR COSED	PNP
CONTROLLER INPUT 14	120P X 22 8A	STATUS SPINDLE ON	PNP
CONTROLLER INPUT 15	120P X 22 1A	STATUS ALARM	PNP
CONTROLLER OUTPUTS 1-4 (COM)	120P X 26 13 and TO X 22 7A	24 V	
CONTROLLER GND	120P X 22 9C	GND	
CONTROLLER INPUT 16	120P PISTON SENSOR	STATUS DOOR OPEN	PNP

Station with Controller B

In addition to the connections detailed in the table above:

- The output block must be set to EXTERNAL.
- All outputs connected to the EMCO 120P must be set to SOURCE.
- All inputs connected to EMCO 120P must be set to SOURCE.

EMCO 120P Machine Setup

The preparations for this machine include both software (parameters) and hardware:

Software Configuration (Parameters)

Enter Edit mode and type MONITOR.

Now change the following parameters:

L01 = 191
L03 = 1
L20 = 1
L40 = 54
011 = 24
040 = 144
041 = 13
T43 = 3

Hardware Preparations

1. Connect X 22 PIN 9b to X 22 PIN 9c (GND) and X 26 PIN 22 to X 22 PIN 0a (24V)

2. To install the pneumatic valve for the pneumatic door:
    Connect one pole of the pneumatic switch to X 22 PIN 6c and the other pole to X 22 PIN 9b (GND).

3. Connecting the door closing magnetic sensor (only if a new sensor is needed):
    Connect X 26 PIN 22 (24V) to the brown wire and X 26 PIN 23 to the blue wire of this sensor. (To gain feedback to the controller's input, connect X-26-23 through X-22 to the proper input.)

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CIM-Controller Management Programs

Controller Setup

Following is a description of the software tools used to setup the ACL controllers for CIM operation. These commands download the necessary CIM-ACL system programs and specific station programs.

During normal operation, selecting the proper options in the CIM Main Menu will activate the functions described in this appendix. You can, however, activate these operations from the DOS prompt.

The switched RS232 network must be fully operational and the RSNET software must be properly configured. All station RS232 network switchers must be free for access by the central computer.

Central Controller Setup

Perform the following steps at the central CIM computer.

CENTER   Enters the directory containing the programs for initializing the main controller. (This is usually located at H:\CIMSYS\CENTER).

DNL   Erases the current controller contents and downloads all CIM-ACL system programs to the central controller. (The central CIM controller must be connected to COM1 on the central CIM computer.)

            This procedure requires approximately 40 minutes and should not be halted. If the downloading is stopped before it has finished, you will need to start the process over from the beginning.

Station Controller Setup

All station controllers must be properly connected to the RS232 switched network. The following commands are issued from a computer connected to the central RS232 network switcher.

STATION   Enters the directory containing the programs for initializing the station controllers. (This is usually located at H:\CIMSYS\ST).

INITST   Before performing the download, the system must be informed of various configuration options. This is performed by running the INITST program. This program prompts the user for all the necessary station configuration data.

INITST defines the robots and machines used in the system. This enables the proper downloading of CIM-ACL system programs to each station controller (using DNLST). The user is prompted for:
- Number of stations
- Station number of ASRS (usually station number 1)
- Type of robot (**SCORBOT-ER Vplus** or **SCORBOT-ER VII**)
- Number of machines at station
- Whether robot is mounted on slidebase at each station

This information is saved in the file SETUP.CIM. This program should only be used at the time of installation, or when changes are made in the configuration.

DNLST n   Erases the current controller contents and performs initial loading of CIM-ACL programs and user station programs to the station controller.

For example:
DNLST 2 downloads all necessary CIM-ACL programs to the station 2 controller.

Several controllers can be downloaded simultaneously, using the number parameters for specific stations, or the A parameter for all stations.

For example:
DNLST 3 4 5 loads the controllers of stations 3, 4 and 5.
DNLST A loads programs to all the controllers.

This procedure requires 5 – 20 minutes and should not be halted. If the downloading is stopped before it has finished, you will need to start the process over from the beginning.

Controller Backup

CIM-ACL Station Program Backup

The following utility programs can be used to perform routine backups and maintenance of the CIM-ACL station programs.

These commands are issued at a computer which is connected to the central RS232 network switcher. The switched RS232 network must be fully operational and the RSNET software must be properly configured. All station switchers must be free for access by the central computer.

BACKST n   Creates a backup of the entire contents of station n controller.

        For example: BACKST 3 will backup the entire contents of the station 3 controller.

        Several or all controllers can be backed-up simultaneously, using the number parameters for specific stations, or the A parameter for all stations.

        For example:
        BACKST 4 6 backs-up controllers at stations 4 and 6.
        BACKST A backs-up all the controllers.

        A separate file is created for the backup of each controller. The name automatically assigned to the file reflects the number of the controller which was backed-up.
        For example:
        STATION1.CBU for the contents of station 1.

RESTST n   Restores the backup file created by BACKST n.

        For example: RESTST 3 will backup the entire contents of the station 3 controller.

        Several or all controllers can be backed-up simultaneously, using the number parameters for specific stations, or the A parameter for all stations.
        For example:
        RESTST 4 6 restores controllers at stations 4 and 6.
        RESTSTA restores all the station controllers.

Position Backup

After CIM installation is completed, positions are sometimes updated. The following two commands will help you manage position changes.

BACKSTP n   Executes a backup of station n positions only.

Several or all controllers can be backed-up simultaneously, using the number parameters for specific stations, or the A parameter for all stations.

If this command is executed, and the controller is later reloaded by means of the command DNLST, the positions which were backed-up will be reloaded to the specified station.

RESTSTP n   Restores positions at the specified station which were backed-up by means of the BACKSTP command.

Note: ACL prevents the overwriting of predefined positions. If you want to restore these positions to a preloaded controller, you must first use the ACL command UNDEF to erase the location definition of the positions you want to overwrite with RESTSTP.

If you are using the default position vectors, use the commands UNDEF CIM and UNDEF CIMB.

Use RSNET and ATS to access the requested controller.

Several or all controllers can be restored simultaneously, using the number parameters for specific stations, or the A parameter.

Preparing the LS 6x20 Bar Code Scanner for Operation

To set up the LS 6x20 bar code scanner for operation in the ER-CIM cell, it must be programmed using the bar codes listed in the following table. These bar codes can be found in the section, "Programmer's Guide," of the *Product Reference Guide* for the LS 6x20 scanner. The bar codes must be scanned in the order in which they appear in the table.

Note: To prevent interference from adjacent bar codes on the same page, it may be useful to cut a hole in a blank sheet of paper and place it over the bar code before scanning. If you make a mistake when scanning, you must repeat the entire sequence from step 1.

Step #	Name of Bar Code to Scan	Pg. # in Product Reference Guide (Programmer's Guide Section)
1	SET DEFAULT	19
2	INTERLEAVED 2 OF 5 LENGTH 1 (Range 01 – 31)	22
3	0	23
4	6	23
5	ENTER	23
6	PARITY	28
7	SPACE	28
8	ENTER	28

This procedure sets the bar code scanner for the following setup:

RS232 parameters: Baud rate 9600
                                     8 data bits
                                     2 stop bits
                                     No parity
                                     No handshake

Bar code type: Interleaved 2 of 5, first length = 6

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