

ROBONUM 820

Commissioning Manual

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ROBONUM 820

COMMISSIONING MANUAL

Update index B

In compliance with Robonum 820 software index E

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NOTES

1 – PRESENTATION

1.1 – PURPOSE OF THE SERVICE 820 SOFTWARE

If you are using the SERVICE 820 software for the first time, refer to Chapter 10, "Initial Installation of the SERVICE 820 Software".

This software is designed for integration of the ROBONUM 820 and debugging of the application(s) to be processed.

The main functionalities are :

1. Access to the 820 utilities :
 - writing of special programmes in EEPROM,
 - modification of robot setup data,
 - save of the contents of the EEPROM,
 - etc...
2. Load and save of the work programmes.
3. In situ testing and debugging of the work programmes.
4. Detailed display of the states and variables of the ROBONUM 820.

1.2 – FUNCTIONS KEYS AVAILABLE AND MEANINGS

Selection of the functionalities accessible from the PC : the operator selects a screen page or a mode using nine keys (F1 to F9) whose function is indicated at the bottom of the screen.

Nine keys are proposed :

RETURN DOS F1	HELP F2	PAGE CONT'D F3	LIST PROG. F4	PROG IN EXEC F5	CURRENT BLOCK F6	DISPLAY ERROR F7	CURRENT POINT F8	MENU CONT'D F9
RETURN DOS F1	F2	PAGE CONT'D F3	VARIAB. PROG F4	PREF DEC1 F5	TOOLS GEOMET F6	INPUTS OUTPUTS F7	CURRENT POINT F8	MENU CONT'D F9
RETURN DOS F1	F2	CALL EDIT F3	CREAT POM F4	ACCESS DOS F5	SERVICE F6	COMPIL LM F7	F8	MENU CONT'D F9
RETURN DOS F1	RESET ZERO F2	PAGE CONT'D F3	MODIF PROG F4	TEST PROG F5	MODIF PREF F6	TOOLS SET F7	SELECT PROG F8	MENU CONT'D F9
RETURN DOS F1	RESET ZERO F2	ENTER PROG F3	ENTER TOOLS F4	ENTER LME F5	DOWN CURPROG F6	DOWN PROG F7	DOWN TOOLS F8	MENU CONT'D F9
F1	STOP EDIT F2	F3	F4	F5	F6	F7	F8	F9
F1	STOP TRANS F2	F3	F4	F5	F6	F7	F8	F9
COMPIL OUTPUT F1	F2	F3	F4	COMPILE F5	F6	LINK EDITING F7	F8	F9
RETURN DOS F1	PLC PROG F2	PAGE CONT'D F3	ENTER PARAM F4	DOWN PARAM F5	SERVICE F6	ENTER F7	DOWN F8	EXIT UTILIT F9

IMPORTANT :

Key F10 provides HELP for each function available in SERVICE 820. Pressing this key displays help for the current page. Then, to obtain help for the other functions displayed in the message block, press the desired function. Press F10 again to exit from the HELP function.

RETURN DOS	: Exit from the SERVICE 820 software, return to standard PC DOS.
MENU CONT'D	: Change the menu proposed on the screen.
STOP TRANS	: Stop the current transmission and return to neutral mode.
STOP EDIT	: Stop editing of a file and return to neutral mode.
PAGE CONT'D	: Go to next page.
LIST PROG	: List the work programmes.
PROG IN EXEC	: Display the programme being executed.
CURRENT BLOCK	: Active and modal functions of a block.
DISPLAY ERROR	: Display the NC error detected.
CURRENT POINT	: Coordinates of the current point.
VARIAB. PROG	: Values of the programme variables.
PREF/DEC1	: Preset and offset values.
TOOLS GEOMET	: Tool geometry and correction.
INPUTS/OUTPUTS	: Display diagnostic messages, external parameters, etc...
CALL EDIT	: Call the file to be edited.
CREATE POM	: Call the MOS programme creation software.
ACCESS DOS	: Access a few DOS commands.
SERVICE	: Dialogue for startup of the NC. Installation of the SERVICE cartridge.
COMPIL LM	: Access the LM compilation and LM link editing commands.
RESET ZERO	: Reset the ROBONUM 820. This function is inoperative unless the robot is stopped.
MODIF PROG	: Modify a file of points or create and modify an ISO type programme.
TEST PROG	: Test the current programme.
MODIF PREF	: Modify presettings and offsets.
TOOLS SET	: Modify tool geometries.
SELECT PROG	: Select current programme.
ENTER PROG (PC-->NC).	: Load a file of points or an ISO type programme.
ENTER TOOLS (PC-->NC).	: Load tool geometries.
ENTER LME (PC-->NC).	: Load an LME type programme.
DOWN CURPROG (CN-->PC).	: Unload the current programme.
DOWN PROG (CN-->PC).	: Unload a file of points or an ISO type programme or a set of files.

DOWN TOOLS (NC-->PC).	: Unload tool geometries.
COMPILE	: Call the compilation procedure for an LMS type file.
LINK EDITING	: Call the link editing procedure for an LMI type file.
COMPIL OUTPUT	: Exit from the LM compilation procedure or LM link editing procedure.
PLC PROG	: Call the TSX 17.20 PLC programming software PL7.2.
ENTER PARAM	: Load the file of machine setup data by utility 5.
DOWN PARAM	: Unload the file of machine setup data by utility 5.
SERVICE	: Dialogue for startup of the NC (utilities).
ENTER	: Load various files using the utilities.
DOWN	: Unload various files using the utilities.
EXIT UTILIT	: Exit from the current utility and return to standard message blocks.
HELP	: Use key F10 (help function).

1.3 – DISPLAY SCREEN (PC)

```
>E60000=0 E61000=0 E62000=0 E63000=0 E64
000=0 E65000=0
E60001=0 E61001=0 E62001=0 E63001=0 E64
001=0 E65001=0
E50001=131300 E51001=0 E52001=0
M4 $ *** ENDURANCE CYCLE ***
G77 H2303
G4 F3
N10 M3 EH99 F150
N20 G90 G0 X+282.504 Y-468.037 Z+575.51
B A+53.859 (Secu point)
```

} 11 display lines maximum

} maximum 3 NC dialogue lines

} maximum 2 PC dialog lines

RETURN	RESET	PAGE	MODIF	TEST	MODIF	TOOLS	SELECT	MENU	} Function keys and assignment
DOS	ZERO	CONT'D	PROG	PROG	PREF	SET	PROG	CONT'D	
F1	F2	F3	F4	F5	F6	F7	F8	F9	

- Each line can contain 40 alphanumeric characters.
- A data page generally occupies the first 11 lines.
- The data entered from the keyboard by the operator are displayed on lines 10, 11 and 12 of the screen, depending on the message length.
- If the dialogue occupies two or three lines, the data on lines 10 and 11 are replaced by the data entered by the operator.
- There is always an empty line between the last programme display line and the first dialogue line.
- The PC dialogue is deleted by the BACKSPACE key.

NOTES

2 – DESCRIPTION OF THE DISPLAY FUNCTIONS

The display functions allow execution of the work programme and the NC states to be monitored.

Eleven display functions are provided :

- PAGE CONT'D : Sequence of pages to be displayed (LIST PROG, TOOLS GEOMET, VARIAB. PROG, etc.).
- LIST PROG : List of the work programme(s).
- PROG IN EXEC : Image of the programme being executed.
- CURRENT BLOCK : All the active and modal functions of the block being executed.
- VARIAB. PROG : Programme variables.
- CURRENT POINT : Coordinates of the current point.
- DISPLAY ERROR : Display of programming errors and machine faults.
- PREF/DEC1 : Presetting and offset values.
- TOOLS GEOMET : Tool dimensions.
- INPUTS/OUTPUTS : Display of diagnostic messages, external parameters or PLC memories.
- SERVICE : System startup dialogue.

NOTE :

Not all the display functions can be selected if the system is in PROG MODE on the teaching pendant.

Control of the display system depends on the MODE selected (JOG, MOS, PREF, etc.). Reference should be made to the chapters using these modes.

During the dialogue, it is not possible to access a page other than the one displayed.

NOTE :

For certain pages, a particular display line is highlighted (current block, number of errors, etc.). Highlighting is by flashing of the cursor at the beginning of the line.

2.1 – LIST PROG

```
%2303(Endurance)
G75 N120
F300
N05 EHL1 G96 XYZA
N10 X-90
N20 Z-90
N30 Y90
N40 A90
N50 A-90
N60 Y-20
N70 Z10
```

RETURN	HELP	PAGE	LIST	PROG	CURRENT	DISPLAY	CURRENT	MENU
DOS		CONT'D	PROG.	IN EXEC	BLOCK	ERROR	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This key is pressed to read the point files and programmes in the memory, the available memory area and the programme size.

If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

Pressing the LIST PROG key displays the beginning of the current programme. The choice available to the operator is displayed on the dialogue line.

If there are no programmes in the memory, only the dialogue line is displayed.

2.1.1 – %%

This function displays the number of the programmes present in the memory, then the first eleven lines of each programme.

The programmes are displayed in the order in which they were loaded in the memory.

NOTE :

If there are no programmes in the memory, action on %%  displays the first three header lines of the page displayed below.

2.1.3 – N

Enter N xxxx  to search for the sequence of the programme displayed. This sequence is displayed on the first line with the rest of the programme.

To search for a sequence in a programme contained in the memory, enter % xx N xx  .

NOTE :

If the sequence does not exist, the message "UNKNOWN BLOCK" is displayed on the dialogue line. To regain control, change pages or select the same page.

2.1.4 – &

Enter % % or % xx preceded by & to read the work programmes contained in the EEPROM (subprogrammes or resident programmes) if it is not locked. The rules given above in the last three paragraphs apply to this search.

2.2 – PROG IN EXEC

```
N80 X90
N90 X-90 Y90 Z-90 A90
N100 X90 Y-20 Z10 A-90
N105 L1=99-L1
N110 L0=L0+1 G79 L0<=1 N05
N120 G77 N05 N05
M2
```

RETURN	HELP	PAGE	LIST	PROG	CURRENT	DISPLAY	CURRENT	MENU
DOS		CONT'D	PROG.	IN EXEC	BLOCK	ERROR	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page displays the image of the programme area being executed.

If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode. This page is not automatically called by the choice of a mode.

The cursor identifies the block being executed.

The change of page takes place automatically during execution when the cursor reaches the last block displayed.

The change of line is carried out either at the end of execution of each block, in continuous mode, or by pressing CYCLE in SEQ mode.

If no programme is being executed, selection of this page displays the current programme number (% xx) on the first line.

Each time this key is pressed, if the programme is being executed, the first line of the current block is displayed.

Procedure

- Press %%  . Display of :

```
PROGRAM AREA IN RAM
      USED :      8988 BYTES
      FREE :     30074 BYTES

%      1.          518 BYTES
B%     99.         6170 BYTES
%     1104.1       118 BYTES
%     1104.2       116 BYTES
%     1104.3       638 BYTES
%     1104.        1108 BYTES
%     2303.        320 BYTES      28"
```

RETURN	HELP	PAGE	LIST	PROG	CURRENT	DISPLAY	CURRENT	MENU
DOS		CONT'D	PROG.	IN EXEC	BLOCK	ERROR	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page indicates the space available for the work programmes and the size of each programme. The total of the two areas may not correspond to the effective memory space if a utility is also present in the system.

- Press PAGE CONT'D : the remaining programmes are listed if there are others or the beginning of the first programme is displayed.
- Press PAGE CONT'D : the remaining programmes are listed or the beginning of the second programme is displayed.

When all the programmes have been listed, the system returns to the PROGRAM AREA IN RAM page after the last programme.

NOTE :

When in the Program Area in RAM page, the cursor > can be moved line by line by the  , ligne key. Pressing the LIST PROG key displays the beginning of the programme pointed to, then pressing PAGE CONT'D displays the following sequences of the same programme.

NOTES :

- The letter B preceding programme % 99 means that this programme is written in LM language.
- The value 27" at the end of the line for programme % 2303 corresponds to the robot execution time for this programme. This time is obtained by running the programme in test mode.

2.1.2 - %

Enter % xxxx  to select the programme to be displayed. Then press PAGE CONT'D to completely display the programme, one page at a time.

If the programme number entered is not in the memory, the message "NO SUCH PROGRAM" is displayed on the dialogue line.

2.3 – CURRENT BLOCK

```
%1 N0 G1 G17 G90 G54 G94 X-311.882  
Y-394.944 Z-416.235 A+0 F100 S0 T0 M5 M9  
M48 ED0 EG100 EH0
```

```
PRG.OFFSET: X+0 Y+0 Z+0 A+0  
TOOL : D1 X+87 Y+16.3 Z+23  
FEED: 0%
```

RETURN	HELP	PAGE	LIST	PROG	CURRENT	DISPLAY	CURRENT	MENU
DOS		CONT'D	PROG.	IN EXEC	BLOCK	ERROR	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page contains :

- the modal data for the executable block, as programmed in the current block and the previous blocks or initialized at power on,
- the programmed offsets,
- the value of the tool dimension corrector used in the block,
- the setting of the feed potentiometer.

This page is active in all modes except ENTER and DOWN during execution.

If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

Presence of an error

If an error is detected, the error number and the number of the block with the error are displayed on the first line. The remainder of the text is shifted one line down.

NOTE :

- This page is updated in the CONT, SEQ. and TEST modes. In the other modes, it keeps the contents it had on exit from the last execution mode.
- In the event a message from the work programme is sent to the display, it is displayed on the first line (e.g. "PALLET FULL").

2.4 – PROGRAMME VARIABLES

PROGRAM VARIABLES			
L	0=	+0.	L 10= +0.
L	1=	+0.	L 11= +0.
L	2=	+0.	L 12= +0.
L	3=	+0.	L 13= +0.
L	4=	+0.	L 14= +0.
L	5=	+0.	L 15= +0.
L	6=	+0.	L 16= +0.
L	7=	+0.	L 17= +0.
L	8=	+0.	L 18= +0.
L	9=	+0.	L 19= +0.

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page displays the table of programme variables L0 to L19 and L100 to L199 as well as the table of address equivalents. The values of L are zero except when the CONT, SEQ and TEST modes are being executed or when the values are used in the work programme.

The page is active in all modes except ENTER and DOWN during execution. If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

Procedure :

- Pressing the VARIAB. PROG key displays variables L0 to L19.
- Pressing the PAGE CONT'D key displays variables L100 to L199, pressing PAGE CONT'D again displays the next twenty variables and so forth.

Upon reaching L199, pressing PAGE CONT'D causes display of variables L100 to L199. To display L0 to L19 again, it is necessary to press the VARIAB. PROG. key twice.

NOTE :

Pressing the VARIAB. PROG key a second time causes display of the table of address equivalents with the following format :

EQUIVALENT ADRESSES

@ A = A	@ B = B	@ C = C	@ D = D
@ E = E	@ F = F	@ G = G	@ H = H

(See the programming manual for explanation of the address equivalent).

2.5 – CURRENT POINT

		CART. COORD.		TO GO
X	+	23.	+	0.
Y	+	16.3	+	0.
Z	-	87.	+	0.
A	+	0.	+	0.

CONFIG 10

RETURN	HELP	PAGE	LIST	PROG	CURRENT	DISPLAY	CURRENT	MENU
DOS		CONT'D	PROG.	IN EXEC	BLOCK	ERROR	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

For each of the cartesian coordinates, this page contains :

- the absolute position value ; current point < ± 99999.999 mm,
- the distance to go ; to go < ± 99999.999 mm.

This page is accessible if origin setting is being performed on all axes.

The page is active in all modes except ENTER and DOWN during execution. If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

Press CURRENT POINT once to display the cartesian coordinates of the current point in the basic robot reference system (CART. COORD.).

Press the key again to display the motor articulation coordinates of the current point (ART. COORD.).

Presence of an Error

If an error is detected, the error number and the number of the block with the error are displayed on the first line and the remainder of the text is shifted one line down.

NOTE :

- In the case of articulation coordinates (ART. COORD.), the letters X, Y, Z, A denote the articulation axes.
- The current point and the distance to go are continuously updated during movement.
- In the event a message from the work programme is transmitted to the display, it is displayed on the first line (e.g. "PALLET FULL").

2.6 – DISPLAY ERROR

This page displays the error message written by the NC. If no errors are detected, the following message is displayed : "NO ERROR REPORTED".

NOTE :

This page is automatically displayed at the end of the TEST mode.

2.7 – PREF/DEC1

		DAT1	DAT2
X	+	23.654+	2.48
Y	+	45.763+	72.397
Z	+	122.47 +	132.635
A	+	0. +	0.
B	+	0. +	0.
C	+	0. +	0.

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

For the axes of the basic coordinate system, this page contains :

- DAT1 which is the offset between the origin of the basic coordinate system and the origin of the workstation coordinate system,
- DAT2 which is the offset between the workstation origin and the origin of the programme coordinate system.

It is active in all modes except ENTER and DOWN during execution. If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

This page is automatically called by the PREF mode.

2.8 – TOOLS GEOMET

TOOL DIMENSIONS						
D	1	X+	34.536	Y+	58.2	Z+ 29.63
D	2	X+	0.	Y+	0.	Z+ 0.
D	3	X+	0.	Y+	0.	Z+ 0.
D	4	X+	0.	Y+	0.	Z+ 0.
D	5	X+	0.	Y+	0.	Z+ 0.
D	6	X+	0.	Y+	0.	Z+ 0.
D	7	X+	0.	Y+	0.	Z+ 0.
D	8	X+	0.	Y+	0.	Z+ 0.
D	9	X+	0.	Y+	0.	Z+ 0.

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page contains the table of nine or ten tool dimension triplets opposite D corrector numbers.

It is active in all modes except ENTER and DOWN during execution. If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode.

This page is not automatically called by selection of a mode, except when entering a tool dimension.

Pressing the TOOLS GEOMET key displays correctors D1 to D9 (D0, which always contains 0, is not displayed).

Pressing PAGE CONT'D displays the triplets for the next ten correctors.

Pressing PAGE CONT'D on the last page (D30 to D32) causes a return to the first page.

2.9 – INPUTS-OUTPUTS

CNC COMMUNICATION DISPLAY

> 0 ERROR MESSAGES
1 PROGRAM PARAMETERS
2 PC DATA

?

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

Pressing this key displays a menu which, by selection, allows display of the following during operation :

- the error messages,
- the external parameters (see Programming Manual),
- the state of the PLC memories.

Positioning the cursor on mode 0, 1 or 2 activates the corresponding page. The cursor is positioned by writing the line number followed by .

This page is active in all modes except ENTER and DOWN during execution. If the system is in MODIF or PREF mode, the mode is aborted and a return is made to neutral mode (no mode selected).

2.9.1 – Error Messages

ERROR MESSAGES

N2 *** POWER ON ENABLED ***

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

When the page is activated (see para. 2.9) the above display appears. If there are no machine errors, message 0 is displayed. Otherwise, one or at most two messages are displayed with their numbers. These messages, contained in programme % 9999, were entered in the programme when the system was placed in operation by the manufacturer.

NOTE :

This page is exited by selecting another page or changing modes.

2.9.2 – External Parameters

PROGRAM PARAMETERS

E62001 + 132635

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page displays the contents of the external parameters of type Exxxx.

When the page is activated, the question PARAMETERS ? appears on the dialogue line.

Enter the number of the parameter to be displayed (e.g. E60000) from the keyboard. This number appears on the dialogue line. Press  to change pages ; the parameter followed by its value is then displayed.

Ten parameters can be displayed simultaneously. To do so, enter their numbers one after the other separated by spaces then press .

To display another parameter after the first, press PAGE CONT'D + (plus) and the number of the parameter to be displayed followed by .

NOTE :

- When the values displayed are dimensions, they are expressed in decimal format with an accuracy of one micron or one thousandth of a degree.
- This page is exited by selecting another page or switching to MODIF, PREF, ENTER or DOWN mode.

2.9.3 – PLC Memory

```

PC DATA
I100 1 1 0 0 1 0 0 0
O000 1 1 0 0 0 0 0 0
SW42 $FFFF -1      11111111 11111111
B1   0 1 0 0 0 0 0 0

```

RETURN		PAGE	VARIAB.	PREF	TOOLS	INPUTS	CURRENT	MENU
DOS		CONT'D	PROG	DEC1	GEOMET	OUTPUTS	POINT	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page displays the states of the PLC inputs/outputs, internal variables, memories, timeouts, PLC programme counters during operation or when stopped.

When the page is activated, the question ADDRESSES? appears on the dialog line.

Enter the operand to be displayed (e.g. B.14) from the keyboard. The entry appears on the dialogue line.

Press  to change pages ; the operand followed by its value appears on the display. For B.14, the value is 0 or 1 depending on the state of the PLC programme internal variable.

To display ten operands simultaneously, enter their numbers one after the other separated by spaces, then press .

Example : ADDRESSES ? B.14 M.10 T.0 .

After requesting an operand, to display a second without deleting the first, enter PAGE CONT'D + (plus) and the operand to be displayed then press .

NOTE :

- numerical operands are displayed in binary, decimal and hexadecimal format (value preceded by sign \$).
- This page is exited by selecting another page or by going into MODIF, PREF, ENTER or DOWN mode.

2.10 – SERVICE

```
RESIDENT UTILITIES
A = ENGLISH      ,      F = FRANCAIS
INPUT  : 9600 b   ,  OUTPUT : 9600 b
"SERVICE" : UTILITIES IN RAM

0 T.B. LINE BAUD RATE
3 FIXED SUBPROGRAMS
5 ROBOT SETUP DATA
6 PC TRANSPARENT MODE
../..

?
```

RETURN	PLC	PAGE	ENTER	DOWN	SERVICE	ENTER	DOWN	EXIT
DOS	PROG	CONT'D	PARAM	PARAM				UTILIT
F1	F2	F3	F4	F5	F6	F7	F8	F9

Press PAGE CONT'D to access the other utilities :

```
RESIDENT UTILITIES
A = ENGLISH      ,      F = FRANCAIS
INPUT  : 9600 b   ,  OUTPUT : 9600 b
"SERVICE" : UTILITIES IN RAM

0 T.B. LINE BAUD RATE
9 ROBOT SETUP DATA
11 EEPROM DATA TREATMENT
13 UTILITIES LOADER

?
```

RETURN	PLC	PAGE	ENTER	DOWN	SERVICE	ENTER	DOWN	EXIT
DOS	PROG	CONT'D	PARAM	PARAM				UTILIT
F1	F2	F3	F4	F5	F6	F7	F8	F9

This page allows the screen to be used as a dialogue interface for maintenance.

When working on a unit, the required utility is selected by entering its number followed by  (see Utilities Manual).

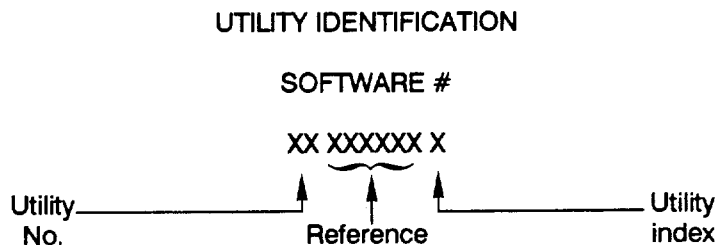
NOTE :

This page is exited by pressing the EXIT UTILIT key.

2.10.1. – Utility Index Display

It is possible to display the index of the utilities stored in REPR0M.

Type Z followed by  . The following page is displayed:



Press the "PAGE CONT'D" key to display a second "UTILITY IDENTIFICATION" page.

Press the "PAGE CONT'D" key again to return to the "RESIDENT UTILITIES" page.

3 – LOAD OF WORK PROGRAMMES, FILES OF POINTS AND TOOL DIMENSIONS

This chapter describes the modes for loading work programmes and files of points and tool dimensions from the PC to the ROBONUM 820. The work programme must be completely stored in the memory before it can be executed.

Three types of files can be loaded in the memory :

- ENTER LME : LME type file (requires option 34560 bit 66).
- ENTER PROG : File of points or ISO type file.
- ENTER TOOLS : File of tool geometries (requires option 34402 bit 28).

The robot must mandatorily be stopped to load a file. Action on one of these keys causes the following processing :

1. Check as required of the system options.
2. Selection of the LOAD mode (TOOL PROG., SELECT PROG.).
3. Display of the page with the cursor pointing to the selected LOAD mode.

INPUT MODES

- 3 CHOICE OF CURRENT PROGRAM
- > 4 PROGRAM FROM DNC
- 5 TOOL CORRECTIONS FROM DNC
- 6 DIALOGUE WITH HOST

(9600bds) _

File PROG1.ISO

STOP
TRANS

F1 F2 F3 F4 F5 F6 F7 F8 F9

4. Display of the transfer message block (STOP TRANS).
5. Operator prompted to enter the DOS filename to be transferred into the ROBONUM 820.
6. Execution of the transfer.

During the transfer, the number of bytes transferred is displayed. When the transfer is complete, the CURRENT POINT page is displayed and the function key message block reappears. Transmission can be stopped by pressing STOP TRANS. A programme which has not been completely transferred is ignored by the ROBONUM 820. If a programme loaded has the same number as a programme already existing in the ROBONUM 820 memory, it overwrites the programme in the memory. In the case of an LME type programme, the system requests the operator to enter the programme number to be assigned to the LME file in the ROBONUM 820.

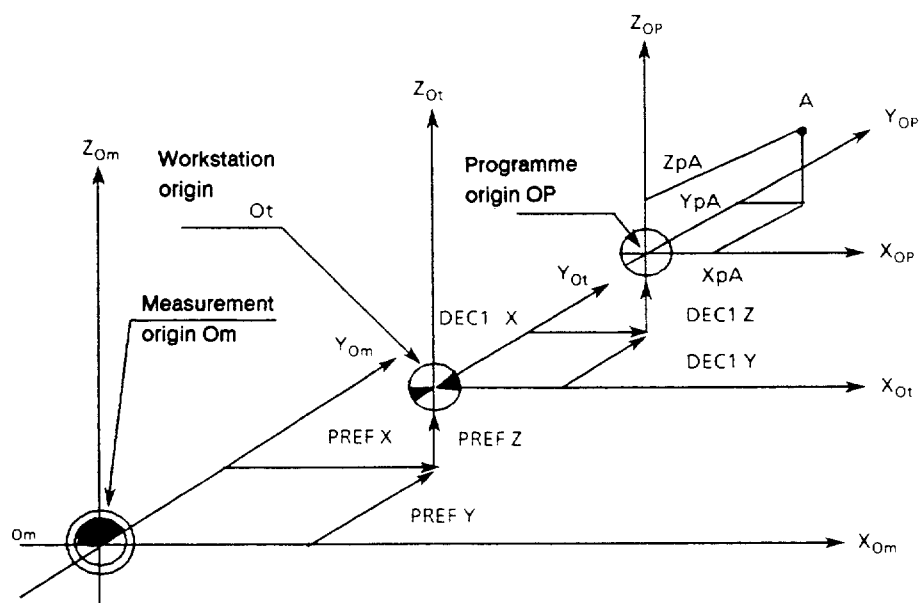
When a load request is made during execution of a part programme, the message "MODE REFUSED" is displayed. This rule does not apply to load of machine parameters.

NOTES

4 – EDITING OF EXECUTION DATA

Before executing a programme in order to debug it, the position of the work reference system must be set (MODIF PREF) as well as the geometry of the tools used (TOOLS SET).

4.1 – DEFINITION OF THE REFERENCE SYSTEMS DEFINED BY PRESETTINGS AND OFFSETS (PREF/DC1)



When the measurement origin (O_m) has been set for all the articulation axes, the basic robot cartesian coordinate system can be defined. Its origin is denoted measurement origin (O_m).

- O_m : Basic reference origin.
- O_t : Workstation reference point.
- O_P : Programme reference system origin.
- O_t/O_m : Workstation origin with respect to the robot origin = PREF.
- O_P/O_t : Programme origin with respect to workstation origin = DEC1.
- O_P/O_m : Programme origin with respect to robot origin = PREF+DEC1.

The position of point A in the basic reference system is :

$$X_{mA} = X_{pA} + \overline{PREFX} + \overline{DEC1X}$$

$$Y_{mA} = Y_{pA} + \overline{PREFY} + \overline{DEC1Y}$$

$$Z_{mA} = Z_{pA} + \overline{PREFZ} + \overline{DEC1Z}$$

The offsets and dimensions are expressed as algebraic values.

4.1.1 – PREF Mode

Entry of PREF and DEC1 offsets.

4.1.1.1 – PREF Defined by the Robot Position

Procedure

- 1 - Position the tool on the workstation reference point by means of the teaching pendant.
- 2 - Select the PREF mode which causes display of the OFFSETS page. "PREF" is displayed on the dialogue line.
- 3 - Enter *Z  or *X  or *Y  (or several axes : *XZ) from the alphanumeric keyboard. The value of PREF in Z, X or Y, which is the value of the current point with respect to the measurement origin (Om), is displayed on the OFFSET page.
- 4 - Repeat from step 1 for the other axes.

4.1.1.2 – PREF Entered from the Keyboard

Procedure

- 1 - Select the MODIF PREF mode. "PREF" appears on the dialogue line of the OFFSET page.
- 2 - Enter the values of PREF from the keyboard. They are displayed on the dialogue line.

Example : PREF : X-12.25 Y-123.158 Z-25.3.

These values are defined with respect to the measurement origin (Om).

- 3 - Press . The values of PREF are transferred to the PREF line of the OFFSET page.

4.1.1.3 – DEC1 Entered from the Keyboard

Procedure

- 1 - Select the MODIF PREF mode. "PREF" appears on the dialogue line.
- 2 - Press PAGE CONT'D. "DEC1" appears on the dialogue line.
- 3 - Enter the values for X, Y and Z from the keyboard. These values appear on the dialogue line.

Example : DEC1 : X - 20.35 Y - 12.382 Z - 112.78.

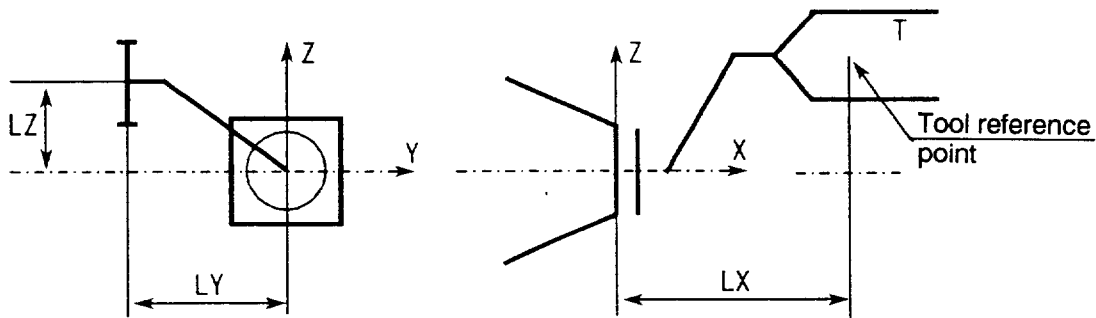
- 4 - Press  to transfer these values into DEC1 X, DEC1 Y, DEC1 Z.

4.2 – TOOL SETTING

This section discusses definition of the tools and the procedure for entering their characteristics from the keyboard. Automatic load from a file is discussed in Chapter 3 and unload is discussed in Chapter 6.

4.2.1 – TOOL DIMENSIONS

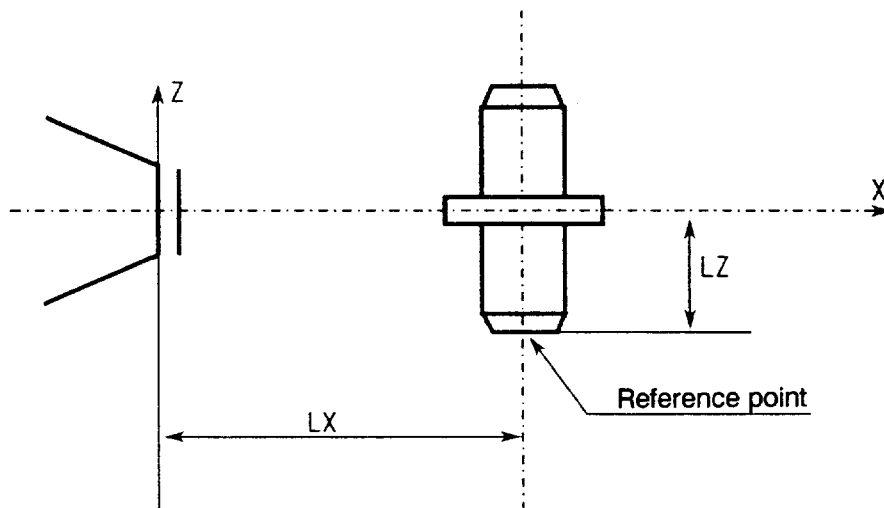
The tool dimensions are entered with respect to the tool attachment surface on the robot wrist ; the directions are defined by the reference system related to the last wrist axis.



Tool dimension :

- in X = LX
- in Y = LY
- in Z = LZ

The reference points may belong to the workpiece carried by the tool.



The set of three tool dimensions is called the tool corrector.

4.2.2 – TOOL SETTING

This function allows entry of tool dimensions from the keyboard. If another mode is active, it must be in a state from which it can be exited, e.g. end of load of a programme in ENTER mode or end of the movement requested.

This mode is exited by requesting a new mode.

Procedure

- 1 - Select the TOOLS SET mode.
- 2 - Enter the corrector number followed by the values for the tool dimensions from the keyboard. These values appear on the dialogue line, regardless of the page selected, except for the INPUTS/OUTPUTS and LIST PROG pages.

D7 + 112.325 Y + 23.287 Z -12.
- 3 - Press . The values are transferred to the tool correction table and the TOOLS page is displayed. The dialogue line is cleared.
- 4 - Repeat from 2 for the other corrections to be entered.

NOTES :

- *The values can be modified or deleted by the same procedure. For a value of zero, enter D7XLF : tool correction of dimension X on corrector 7 cancelled.*
- *Corrector DO, whose contents are always zero, cannot be modified.*

5 – DEBUGGING OF A FILE OF POINTS OR A PROGRAMME AND CREATION OF AN ISO PROGRAMME

5.1 – DEFINITION OF THE CURRENT PROGRAMME

In multiprogramme mode, for execution of a job, the current programme must be defined to the system. The subprogrammes are validated by the current programme.

The current programme is defined as :

- the last programme loaded in the memory from the PC, or
- the programme selected by the SELECT PROG key, or
- the programme selected by the PLC.

Once the current programme has been defined :

- it is automatically selected after a system reset or power on,
- it is displayed by action on the LIST PROG. or MODIF PROG key.

5.2 – SELECTION OF THE CURRENT PROGRAMME

Press the SELECT PROG key.

The following processing is performed automatically :

1. Selection of the LOAD mode.
2. Display of the8 page :

INPUT MODES

- > 3 CHOICE OF CURRENT PROGRAM
- 4 PROGRAM FROM DNC
- 5 TOOL CORRECTIONS FROM DNC
- 6 DIALOGUE WITH HOST

(%..) %1

RETURN	RESET	PAGE	MODIF	TEST	MODIF	TOOLS	SELECT	MENU
DOS	ZERO	CONT'D	PROG	PROG	PREF	SET	PROG	CONT'D
F1	F2	F3	F4	F5	F6	F7	F8	F9

Enter the selected programme number from the keyboard. If the number is incorrect (syntax error or inexistent programme), the cursor is positioned on % and the programme number must be reentered. If the number is correct, the LOAD mode is exited and a return is made to neutral mode.

5.3 – TEST OF CURRENT PROGRAMME

The TEST mode is used to check the work programme under the robot/system conditions. The system analyzes and processes the programme without moving the robot, which saves considerable time.

The following are analyzed and processed :

1. Block syntax and coherence.
2. The preparatory and auxiliary functions.
3. Compatibility of the preparatory data with the linear interpolation, articulation movements, etc.
4. Machine limit switches.
5. Etc...

Conditions of access to the TEST mode :

- PREF, DEC1 completed,
- Programme declared as current,
- Current mode ended.

Pressing TEST PROG causes the following processing :

1. Selection of the TEST mode.
2. Processing of the programme. No movements are made. The PROGRAM IN EXEC page is selected.
3. At the end of the test, the DISPLAY ERROR page is selected and the real programme execution time is displayed opposite the programme number on the LIST PROG. page.

The operator stop function M00 is ignored. If the error is due to overrun of the limit switches, it is necessary to carry out a system reset after correcting the programme or the PREF in order to clear the error before retesting the programme.

5.4 – MODIFICATION OF POINT FILES AND WORK PROGRAMMES

Debugging of point files and programmes is carried out in the MODIF PROG mode.

This mode allows corrections, additions and deletions to be made to the file initially loaded. These modifications are made directly in the file stored in the NC memory.

If the file is an ISO work programme, it is preferable to modify the corresponding DOS file and reload it in the NC memory.

5.4.1 – General

The modification of a programme requires a sequence of operations which must be carried out in the following order. Certain operations may be replaced by others, depending on the modification to be made.

Selection of the Programme

- The programme to be modified is the current programme : selection of the MODIF mode automatically displays this programme.
- The programme to be modified is not the current programme : selection of the MODIF mode causes display of the current programme. The programme to be modified is then entered from the keyboard by % xx  and displayed in place of the current programme.

Choice of the Sequence

When the programme to be modified has been validated, the choice is made by :

- The sequence number entered from the keyboard : N120 .
- The number of a known sequence plus an increment if the required block is not numbered : N150 + 5 .
- Scrolling forward through the programme opposite the pointer > by action on the  key.
- Scrolling backward through the programme opposite the pointer > by action on the  key.
- Scrolling the pointer > opposite the sequences of the programme displayed by action on the  key.
- Search for a character string moving the pointer to the next sequence containing this string each time  is pressed.

Example : M41  The pointer > moves opposite the first block containing M41.
:  The pointer > moves opposite the next block containing M41.

NOTE :

The search for a block not contained in the current programme can be made directly by % xxx N xxx .

Deletion of a Block

The block pointed to is deleted by : - (minus) . The next block automatically becomes the current block.

Addition of a Block

The block to be added is placed after the block pointed to and becomes the current block.

+ N.. X.. 

Modification of a Block

The system provides four possibilities for modifying a block :

- By transfer to the dialogue line of the block pointed to by # .
Modification of the block by cursor control (see 3.2).
Transfer of the dialogue line to the memory by .
- By complete modification of the block : the block pointed to is replaced by the block entered on the dialogue line :
Nxx Xxxx 
- By replacement of a character string with another string already declared :
: M41 : M42  Replacement of M41 by M42 in the block pointed to.
:  Search for the next block containing M41.
- By deletion of one or more coordinates contained in the block :
 - X  The address X and the value associated with X are deleted from the block pointed to.
 - YZ  Coordinates Y and Z are deleted from the block pointed to.

5.4.2 – Learning

This function is not enabled unless origin setting was performed on all the axes.

5.4.2.1 – Robot Movement from the Teaching Pendant

- Select a movement reference and JOG increment.
- Move the robot to the point to be learned by the axis control key. The axis control keys are inoperative if the dialogue is engaged.

For further details, see the Manual mode described in Teaching Pendant Operator's Manual.

5.4.2.2 – Coordinate Addition by Learning

When adding or modifying a block, the character "!" automatically calls the coordinates of the current point. All the coordinates (X, Y, Z, A, B, C) placed in the block to the right of "!" are modified. If no coordinates (X, Y, Z, A, B, C) follow "!", the six coordinates are automatically inserted.

+ N10 ! becomes N10 X350.1 Y0 Z142.78 A0 B-90 C45

+ N10 F100 ! X becomes N10 F100 X350.1

N15 X150 ! Y becomes N15 X150 Y 34.52

NOTE :

The coordinates of the current point are taken in the programming reference system (they take the PREF and DEC1 settings into account).

5.4.2.3 – Coordinate Modification by Learning

The coordinates contained in a block can be modified like any character string by the procedure described above. They can also be modified to take on the values of the current point :

! XB  : coordinates X and B are modified in the block pointed to (if they exist).

!  : all the coordinates present in the block pointed to are modified.

5.4.3 – MODIF PROG Mode

The modifications are made using the NC dialogue line.

5.4.3.1 – Creation of a Programme In ISO Mode

Mode Access Condition

- Reset state.
- Teaching pendant not enabled.

Procedure

- 1 - Select the MODIF PROG mode. The current programme is displayed.
- 2 - Make the following entry from the keyboard with display on the dialogue line:
% n  where n = number of the programme to be created.
- 3 - The message CONFIRM PROGRAM CREATION (Y/N)? is displayed.
- 4 - Enter Y  from the keyboard; the programme is created.

NOTE :

- To write the programme, proceed by deletion, addition or editing (see Sec. 5.4.1).
- For more details on the ISO programming syntax, refer to the "PROGRAMMING MANUAL – 938632".

5.4.3.2 – Deletion of a programme

Mode access condition

- Reset state.
- Teaching pendant not enabled.

Procedure

- 1 - Select the MODIF PROG mode. The current programme is displayed.
- 2 - If the programme to be deleted is the current programme, go to 3. Otherwise make the following entry from the keyboard with display on the dialogue line :
% n  n = number of the programme to be deleted.

This programme is displayed in place of the current programme.
- 3 - With the pointer > on the first block of the programme, i.e. that beginning with %, enter :
- % n  .

"PROGRAMM CLEARED" appears on the dialogue line.
- 4 - To delete other programmes, repeat from 2.

NOTE :

- If the pointer is not opposite the programme number or if the number does not correspond to that of the programme displayed, the message "MODIFICATION NOT POSSIBLE" appears on the dialogue line .
- In this case, repeat over from 1.

5 – Addition of a block

Enter + followed by the block to be inserted which is displayed on the dialogue line.

Example : + N115 Z127 X23.5 

This new block is inserted between the current block and the next block. The inserted block becomes the new current block.

6 – Repeat over from 3 if there are other blocks to be modified.

NOTE :

- It is possible to search for a block which is not included in the current programme by :

% n Np 

n : programme number
p : block number

- A block without an address is searched for by :

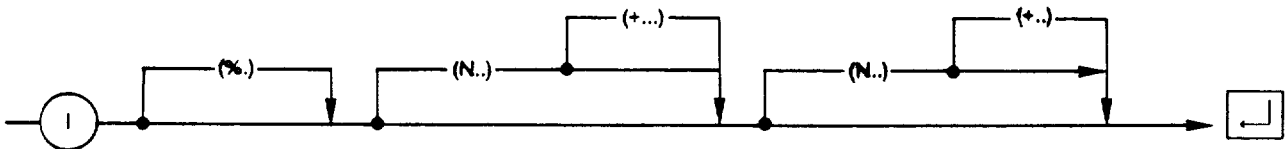
$N_p + q$  p : known block number
 q : increment to N_p to obtain the unaddressed block.

5.4.3.5 – Insertion of a Programme or Part of Programme

This procedure is used to copy a programme or insert part of a programme in another programme.

The blocks are inserted after the blocks pointed to by the cursor with the character "I".

After choosing the programme and the sequence after which the blocks are to be inserted, enter from the keyboard using the following syntax :



Failure to comply with this syntax causes rejection of the command. The dialogue cursor returns to the beginning of the line under the character "I".

When insertion is impossible due to a lack of memory space, the message "MODIFICATION NOT POSSIBLE" is displayed.

The block pointed to, "Np", must not be located inside the limits or on one of the limits of the part of the programme to be inserted.

Example:

```
% 1
N10
|
> Np
|
N50
|
N100
```

I Np N50 is impossible. The message "MODIFICATION NOT POSSIBLE" appears.

NOTES:

- When the programme number %.. is not specified, it is the programme being edited that is addressed.
- The pairs of sequence numbers are the limits of the area to be inserted. The two limits are included in the insertion.
- When only one sequence number N.. is defined in the command, it addresses the beginning of the area to be inserted. The end limit is then the end of the programme.
- A limit can be specified by a sequence number plus a value. For instance, by programming $N10 + 3$, the limit is the third block following sequence N10.

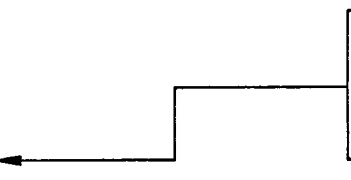
Examples:

```
- Modif Mode
% 1
N10 -
N20 -
N30 -
> N40 -
N50 -
|
|
```

Dialogue line: 1 N10 N30:

Sequences 10 to 30 are inserted after sequence 40.

-	Modif Mode	
	% 2	% 4
	N10 -	N10 -
	N20 -	N20 -
	N30 -	N30 -
	N40 -	N40 -
	N50 -	BLOCK 1 (NOT ADDRESSED)
>	N60 -	BLOCK 2 (NOT ADDRESSED)
	N70 -	BLOCK 3 (NOT ADDRESSED)
		BLOCK 4 (NOT ADDRESSED)
		N50 -
		N60 -



Dialogue line 1 % 4 N20 N40 + 2:

Sequences N20 to N40 + 2 (BLOCK 2 (NOT ADDRESSED)) of programme % 4 are inserted after sequence N60 of programme % 2.

5.4.3.6 – Deletion of a Sequence of Blocks

This procedure is used to delete several blocks from a programme.

Procedure

- 1 - Select the MODIF PROG mode. The current programme is displayed.
- 2 - If the blocks to be deleted are not in the current programme, select the programme by entering:
% n  ; n : programme number.
- 3 - Point to the first block to be deleted by using:
 - . Nxxx  . The sequence is displayed in front of the pointer > and becomes the current block, or
 - .  or  to scroll through the programme block by block opposite the pointer >, or
 - .  alone which moves the pointer > opposite the blocks of the first to the seventh line of the display then returns to the first line and so forth without changing the page displayed, or
 - . a combination of the three above methods.
- 4 - Enter the number of the last block to be deleted after the DEL command, i.e.:
 - . DEL Nxxx  or DEL Nxxx + q .
- 5 - The sequences between the block pointed to and the block specified from the keyboard are deleted.

NOTES :

- *The block pointed to and the block specified from the keyboard are included in the blocks deleted.*
- *The last block to be deleted must be located after the block pointed to.*

Example :

```
% 1          % 1
N10          N10
> N20        N50
N30
N40
N50
DEL N40 
```

NOTES

5.4.3.7 – Modification of a Block

There are three possibilities : by transfer of the current block on the dialogue line, by complete modification of the block or by modification of a character string.

5.4.3.7.1 – By Transfer of the Block on the Dialogue Line

Procedure

- 1 – Select the MODIF PROG mode. The current programme is displayed.
- 2 – If the block to be modified is not in the current programme, select the programme by entering :
% n  n : programme number.
- 3 – Make the sequence to be modified the current block, i.e. the block in front of the pointer > by :
 - . N xxx 
 - .  or  to scroll through the programme block by block opposite the pointer >.
 - .  alone which moves the pointer > opposite the blocks of the first to the seventh line of the display then returns to the first line and so forth without changing the page displayed.
 - . A combination of the three above methods.
- 4 – Transfer the current block to the dialogue line by :
.
- 5 – Make the necessary modifications by moving the cursor (character deletion, character insertion, character modification, etc.).
- 6 – Press  to replace the old current block by the modified block which becomes the new current block.

5.4.3.7.2 – By Complete Modification of the Block

The procedure is the same as above for the first three steps.

In the fourth step, enter # and the block number. The block is displayed on the dialogue line.

Example : # N120 X30 Y100 F100.

Pressing  transfers the block which replaces the current block.

5.4.3.7.3 – By Modification of a Character String

The syntax for this modification is :

; string 1 ; string 2 .

String 1 is replaced by string 2 in the current block. If string 1 does not belong to the current block, the command is refused : the cursor flashes on #.

Example : # ; M41 ; M42  replaces function M41 by function M42 in the current block.

This type of modification can be repeated on other blocks by the command *  .

Example :

OPERATOR COMMAND	SYSTEM REACTION
; M41 	Search for the first block in the programme including function M41. This block becomes the current block and is positioned opposite the pointer >.
# ; M41 ; M42 	M41 is replaced by M42 in this block.
; 	Search for the next block including the same function M41.
* 	Display of the required modification : # ; M41 ; M42 on the dialogue line.
	Execution of the modification : M41 is replaced by M42 in the new block.
; 	Search for the next block including M41.
etc.	

5.5 – COMPILATION AND LINK EDITING OF LM TYPE FILES

Compilation and link editing are necessary to make an LM type file executable.

Pressing the COMPIL LM key displays the page :

- LM COMPILATION
- LM LINK EDITING

and the corresponding message block.

Action on the COMPILE or LINK EDITING key causes the following sequence of operations :

1. Operator prompted to enter the filename (lms or lmi) to be processed.
2. Compilation or link editing executed.

NOTE :

The location and name of the LM compiler or LM link editor on the PC are specified in file C:\NUM820\COMMAND.TXT.

6 – SAVE OF POINT FILES, WORK PROGRAMMES AND TOOL DIMENSIONS

This chapter describes the modes for unloading ROBONUM 820 work programmes, point files and tool dimensions to the PC.

Three types of files can be loaded on the PC :

- DOWN CURPROG : ISO type file declared as current programme.
- DOWN PROG : Point or ISO type file(s) or set of files.
- DOWN TOOLS : File of tool geometries (requires option 34402 bit 28).

The robot must mandatorily be stopped to unload a file. Action on one of these keys causes the following processing :

1. Check if required of the system options.
2. Selection of the DOWNLOAD mode (current programme, programme, tools).
3. Display of the page with the cursor pointing to the SELECTED DOWNLOAD mode.

OUTPUT MODES

- > 3 CURRENT PROGRAM TO DNC
- 4 TOOL CORRECTIONS TO DNC
- 5 OTHER PROGRAM TO DNC
- 6 DIALOGUE WITH HOST

(9600bds) _

File	PROG1.ISO							
	STOP							
	TRANS							
F1	F2	F3	F4	F5	F6	F7	F8	F9

4. Display of the transfer message block (STOP TRANS).
5. Operator prompted to enter the DOS filename to be transferred from the ROBONUM 820.
6. Transfer executed.

During the transfer, the number of bytes transferred is displayed. When the transfer is complete, the CURRENT POINT page is displayed and the function key message block reappears. Transmission can be stopped by pressing STOP TRANS. A file which has not been completely transferred is ignored by the PC (file inexistent). If a file transferred has the same name as a file already existing on the PC, the latter is overwritten by the file transferred after confirmation by the operator.

When a download request is made during execution of a part programme, the message "MODE REFUSED" is displayed. This rule does not apply to load of machine parameters.

The DOWN PROG function prompts the operator to enter the names of the files to be unloaded : the following question is asked :

(&) (%%...,%*,%...)?

Possible answers :

%%	:	output of all the programmes located in RAM.
%*	:	output of the current programme located in RAM.
%9121	:	output of programme 9121 located in RAM.
&%%	:	output of all programmes located in EEPROM.
&%*	:	output of the current programme located in EEPROM.
&%9121	:	output of programme 9121 located in EEPROM.

7 – ACCESS TO CERTAIN DOS COMMANDS

The ACCESS DOS key gives access to a number of DOS commands and utilities for management of the files used :

- FILE DATA : Gives information on the nature and date of update of the file.
- LIST FILES : Lists the desired file on the screen.
- PRINT FILES : The characteristics of the line used are specified in file C : \NUM820 \COMMAND.TXT.
- CHANGE READER : Selects the desired drive.
- CHANGE DIRECTORY : Selects the desired directory (to be turned to the previous directory, select "D..").
- MAKE DIRECTORY :
- RENAME A FILE :
- DELETE A FILE :
- CALL EDITOR : Edits an existing file. The location and name of the editor are specified in file C : \NUM820 \COMMAND.TXT.
- LM COMPILATION : The location and name of the compiler are specified in file C : \NUM820 \COMMAND.TXT.
- LM LINK EDITING : The location and name of the link editor are specified in file C : \NUM820 \COMMAND.TXT.

NOTES

8 – OPERATION WITH THE TEACHING PENDANT

This chapter covers operation of the SERVICE 820 software when the teaching pendant is in use.

The use of the teaching pendant is described in the TEACHING PENDANT OPERATOR'S MANUAL reference 938752.

The teaching pendant is enabled by its key.

The TEACH-IN light indicates that the teaching pendant is enabled.

In this state, all the keys which modify the current mode are disabled. Only the keys which modify the page displayed and the alphanumeric keyboard are active.

If the teaching pendant is enabled on a mode change menu, pressing a mode change key causes display of the message "Operation impossible: teaching pendant enabled" on the service terminal screen.

The MENU CONT'D key does not display the mode change keys.

If the teaching pendant is faulty (connector unplugged on the NC, failure, etc.), the TEACH-IN light flashes and all the keys are active.

When the teaching pendant request is cancelled, the TEACH-IN light goes out and all the keys become active again. The system remains in the current state.

NOTES

9 – ACCESS TO THE UTILITIES FROM THE PC

9.1 – GENERAL

To start up the numerical control it is necessary to use the resident utilities in the NC memory to define the machine setup data, store the system data, etc.

These utilities are called by the SERVICE function which gives access to the utilities menu.

9.2 – DESCRIPTION OF THE FUNCTIONS ACCESSIBLE FROM THE SERVICE MESSAGE BLOCK

NOTE :

The functions which appear in the SERVICE message block must be requested under various specific conditions and under these conditions only.

The ENTER PARAM and DOWN PARAM functions concerning load and unload of the robot setup data must be requested after selecting utility 5 and entering the password.

When one of these functions is called, the following processing is performed :

1. The suitable item is selected.
2. The operator is prompted to enter the DOS filename to be transferred.
3. The transfer is executed.

It is possible to stop the transfer in progress by the STOP TRANS key. The ENTER and DOWN functions concern the transfer of binary files. They must be requested only from utilities 11 or 13. For further information on the use of these functions, refer to the "UTILITIES MANUAL".

The PLC PROG function gives access to the PL7.2 PLC programming software. To establish exchanges between the PLC and the PL7.2 software, it is necessary to first select utility 6 : "PLC TRANSPARENT MODE".

The EXIT UTILIT function is used to exit a utility and the SERVICE message block.

NOTES

10 – INITIAL INSTALLATION OF THE SERVICE 820 SOFTWARE

10.1 – MINIMUM PC CONFIGURATION

The SERVICE 820 software requires an IBM PC compatible computer with the following characteristics as a minimum :

1. PC AT (80286 microprocessor) with high definition EGA screen.
2. One RS 232 C serial port.
3. MS_DOS Version 3.0.
4. A hard disk with 10 megabytes.

If the LM language is used, the system must have the following additional characteristics :

1. One parallel port.
2. 512 K RAM.
3. The compiler occupies 320 K on the hard disk.

The PCs ensuring correct operation include :

1. IBM PS2 model 50.
2. IBM PC AT.
3. Digital VAXmate.
4. Toshiba T1200.
5. Toshiba T1600.
6. Compaq SLT286.
7. ICL DSR M40.

CAUTION :

The system does not operate correctly with :

- IBM PC XT
- IBM PC XT/286

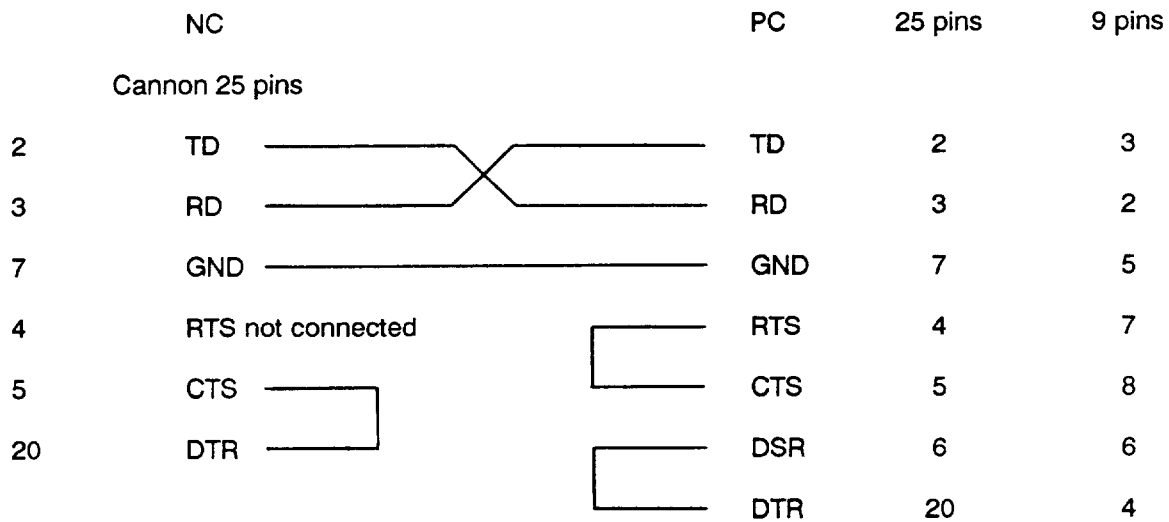
When using the PL7.2 TSX 17.20 PLC programming software, only IBM PC AT III and IBM PS2 50 Z personal computers or compatible must be used.

10.2 – CONNECTION OF THE PC TO THE ROBONUM 820

Characteristics of the PC line used :

- 1. RS 232 C standard.
- 2. Baud rate 9600 bauds.
- 3. 8 data bits.
- 4. No parity.
- 5. One stop bit.
- 6. No start bit.
- 7. Serial port No. 1.

Wiring for a maximum cable length of 20 meters.



For the diagrams of the links between ROBONUM 820 and PC or PS without service signals, see Appendix 2.

10.3 – CONTENTS OF THE SERVICE 820 DISKETTE SUPPLIED BY NUM

The SERVICE 820 software is supplied in two copies which differ only by the format of the magnetic storage medium (one 3 1/2" diskette or two 5 1/4" diskettes).

1. INSTAL820.BAT, CHOILAN.COM : executable software used to install the SERVICE 820 software on the PC and validate the language chosen by the user.
2. SER820.BAT, SER820.COM : executable software used to display the NC variables, modify the robot setup data, load the work programmes in the memory, etc.
3. POM.COM : executable software used to generate the AUTOMATIC ORIGIN SETTING programme according to the robot characteristics.
4. ACCESDOS.COM : executable programme used to access certain DOS functions.
5. CARTOU.TXT : text file containing the message boxes displayed on the screen by the SER820.COM software.
6. MESSAGE.TXT : text file containing the messages displayed on the screen by the SER820.COM software.
7. MESPOM.TXT : text file containing the messages displayed on the screen by the POM.COM software.
8. COMMAND.TXT : text file containing information on the link editor, LM compiler, printer used.
9. MESDOS.TXT : text file containing the messages displayed on the screen by the ACCESDOS.COM software.
10. A number of text files containing help messages.

NOTES :

Of all the files, only COMMAND.TXT can be modified by the user.

The SERVICE 820 software creates a file NUM 820\TEMP.ISO for its internal needs. To prevent any problems, it is therefore recommended not to create a file with this name.

10.4 – USE OF THE INSTAL820 SOFTWARE

This software copies the files required for execution of the SERVICE 820 software onto the hard disk.

- Creation of directory C :\NUM820\
- Copy of the executable files : SER820.BAT
SER820.COM
POM.COM
- Copy of the text files : CARTOU.TXT
MESSAGE.TXT
MESPOM.TXT

Procedure

- 1 - Turn on the PC and insert the NUM diskette in drive A.
- 2 - Enter A : followed by INSTAL820.
- 3 - The system proposes the following dialogue:

Diskette size?
3 1/2 inches ➡ Key 3
5 1/4 inches ➡ Key 5

Format de la disquette utilisée ?
3 1/2 pouces ➡ Frapper 3
5 1/4 pouces ➡ Frapper 5

- 4 - Make your choice then press .
- 5 - The message "êtes vous sûr? are you sure?" is displayed.
- 6 - Enter "O" for Oui, "Y" for Yes or "N" for Non or No then press .
- 7 - The following page is displayed:

Drive?
A ➡ Key A
B ➡ Key B
D ➡ Key D

Lecteur utilisé ?
A ➡ Frapper A
B ➡ Frapper B
D ➡ Frapper D

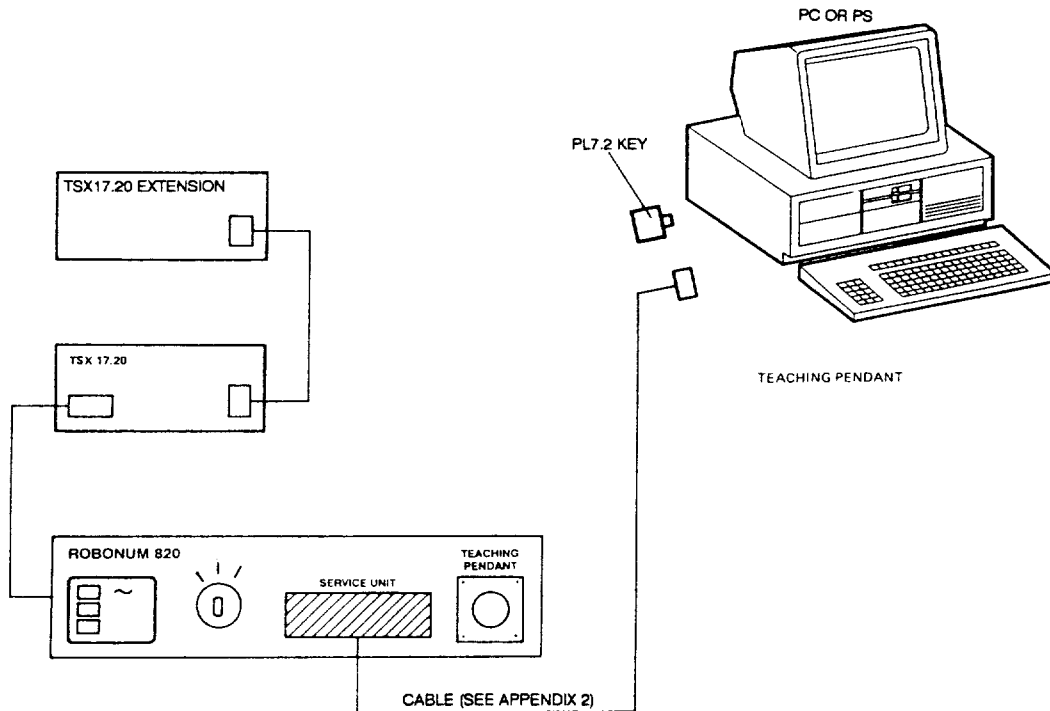
- 8 - Make your choice then press .
- 9 - The system requests the language in which the system is to be used.
- 10 - Enter the selected code (F,E,D,I,S).
- 11 - The software copies the files required for its execution onto the hard disk.
- 12 - When the copy is completed, the system gives the DOS command word for direct access to the SERVICE 820 software : SER820.

APPENDIX 1

PLC PROGRAMMING

A1.1 – INTERCONNECTIONS AND USE OF THE PL7.2 PROGRAMMING SOFTWARE

A1.1.1 – Interconnections



NOTE :

The PLC can be programmed directly from the PC or PS to the PLC without going through the ROBONUM 820 (see *Télemécanique manual : PL7.2 Procedures, IBM PC/PS Microcomputer, Reference TSX D12 004 F*).

A1.1.2 – Configuration Items

- Computer operating system : DOS version 3.3 for PS and 3.2 for PC.
- PL7.2 software version V1.0 (Télemécanique reference TSX TDC BC 2110).
- Key specific to the software.
- Cables defined by NUM.
- Minimum computer configuration :
 - . 640 Kbyte RAM.
 - . 10 megabyte hard disk.
 - . One 64 Kbyte IBM EGA card.
 - . One EGA high resolution screen.
 - . One RS232 serial/parallel card.

A1.1.3 – Hardware

- IBM PC AT III.
- IBM PS2 50 Z.
- Télémécanique programming system TSX TSC BC 2110 F including :
 - . key specific to the PL7.2 software.
 - . 3x3 1/2" diskettes for IBM PS : TSX TDC BC 2110.
 - . 6x5 1/4" diskettes for IBM PC : TSX TDC BC 2110.
 - . PL7.2 language manual, synthesis : TSX D12 002 F.
 - . PL7.2 Procedures Manual. IBM PC/PS microcomputers : TSX D 12004 F.
 - . TSX17.20 micro-PLC manual. Additional information on PL7.2 language : TSX D 12005 F.

A1.1.4 – Installation of the PL7.2 Software on the Microcomputer

- Install the protection key on the parallel port of the microcomputer.
- Set up the connection between the microcomputer (serial port) and the ROBONUM 820 (Service Unit connector).
- Install the software by the method indicated in the Télémécanique documents (TSX TSC BC 2110 F).
- Initiate the PL7.2 software by command G72_17.

A1.1.5 – PLC Programming

Once the PL7.2 and SERVICE 820 software has been loaded in the microcomputer, two operating modes are possible when the NC is connected to the microcomputer :

- Programming or control in local mode.
- Programming, modification or control in connection with the PLC via the ROBONUM 820.

A1.1.5.1 – Programming or Control In Local Mode

In this configuration, the system ignores the program stored in the TSX.17, i.e. it is possible to write or modify a PLC program but the program must be saved on disk for future transfer to the PLC.

Procedure

- 1 - Press the SERVICE key to display the page of resident utilities (see page 2.13).
- 2 - Press the PLC PROG key to call the PL7.2 software.
- 3 - Follow the Télémécanique instructions to continue programming.

A1.1.5.2 – Programming, Modification or Control In Connection with the PLC via the ROBONUM 820

In this configuration, the PLC memory is connected to the microcomputer via the ROBONUM 820. In this mode, the PLC program can be written, an existing program can be modified and the program can be checked.

Procedure

- 1 – Press the SERVICE key to display the page of resident utilities (see page 2.13).
- 2 – Select utility 6 (PLC transparent mode) in the menu by pressing 6 ENTER.

The following messages are displayed on the screen :

WAIT FOR STARTUP AND LINK WITH PL7.2	→	F2
WAIT FOR EXIT FROM UTILITY	→	F9

- 3 – Press the PLC PROG key to access PL7.2, i.e. PLC programming.

NOTE :

If it is not desired to access PL7.2 (for instance after an operator error) press F9 "EXIT UTILIT".

- 4 – When use of PL7.2 is completed, press EXIT. The system exits utility 6 and returns to the CURRENT POINT page.

A1.2 – WORDS EXCHANGED BETWEEN THE ROBONUM 820 AND TSX17.20

A1.2.1 – Variables Displayed on the PLC I/O Page

The transfers between NC and PLC are via an ACIA. For write in the PLC, the transfers are conditioned by the change of state of flags or of data. The use of flags is necessary to preserve the coherence of a set of interrelated data.

Read in the PLC is systematic if there are no other tasks to be executed. Otherwise, it occurs after writing all the data that have changed.

Read of the inputs/outputs and internal variables of the PLC takes place from the NC : PLC memory input/output display page after the request to display the state of an I/O or a variable.

The messages from the PLC are read from the message display page.

With the NC software version D or above, exchanges between the NC and PLC can take place at a rate of 19200 bauds. In order to dialogue at this rate, it is necessary to have the PL7.2 V... software cartridge on the NUM 17.20 PLC.

The baud rate can be modified by machine parameter P82.

The maximum time required to complete a transfer (read or write) is equivalent to the time required for a read transfer, i.e.:

- $T = 80 \text{ ms} + 2 \text{ PLC cycles at } 9600 \text{ bauds,}$
- $T = 45 \text{ ms} + 1 \text{ PLC cycle at } 19200 \text{ bauds.}$

NOTE :

For a PLC cycle time below 60 ms, it is preferable to work at 19200 bauds. Above 60 ms, the cycle time becomes predominant and the character transmission and reception times are distributed on the continuous data flow. A transfer rate of 9600 bauds is then preferable so as not to load the PLC and NC.

The following commands are used in the NC – PLC Memory Input/Output Display page to display the data :

Bxx	To display the value of PLC internal bit xx. A series of eight values is returned such that $8n \leq xx < 8(n+1)$. The value corresponding to bit xx is displayed in reverse video. Possible display : B0 to B255.
SYxx	To display the value of PLC system bit xx. A series of eight values is returned such that $8n \leq xx < 8(n+1)$. The value corresponding to bit xx is displayed in reverse video. Possible display : SY0 to SY23.
Wxx	To display the value of PLC internal word xx. The value is given in hexadecimal format, decimal format or as a series of 16 bits. Possible display : W0 to W127.
SWxx	To display the value of PLC system word xx. The value is given in hexadecimal format, decimal format or as a series of 16 bits. Possible display : SW0 to W63.

Ixx	To display the value of PLC input xx. A series of eight values is returned such that $8n \leq xx < 8(n+1)$. The value corresponding to input xx is displayed in reverse video. Possible display : I0 to I31. : I100 to I131 with I/O extension 1 : I200 to I231 with I/O extension 2 : I300 to I331 with I/O extension 3
Oxx	To display the value of PLC output xx. A series of eight values is returned such that $8n \leq xx < 8(n+1)$. The value corresponding to output xx is displayed in reverse video. Possible display : O0 to O15 : O100 to O115 with I/O extension 1 : O200 to O215 with I/O extension 2 : O300 to O315 with I/O extension 3
Xxx	To display the value of PLC grafcet step xx. A series of eight values is returned such that $8n \leq xx < 8(n+1)$. The value corresponding to grafcet bit xx is displayed in reverse video. Possible display : X0 to X95.
Txx	To display the value of PLC timer xx. Only the current value of the timer is displayed in hexadecimal or decimal format. Possible display : T0 to T31.
Mxx	To display the value of PLC monostable xx. Only the current value of the monostable is displayed in hexadecimal or decimal format. Possible display : M0 to M7.
Cxx	To display the value of PLC counter xx. Only the current value of the counter is displayed in hexadecimal or decimal format. Possible display : C0 to C31.
Dxx	To display the value of PLC cyclic programmer xx. The value of the timeout for the current step and the number of the current step are displayed. The values are displayed in hexadecimal or decimal format. Possible display : D0 to D7.
Rxx	To display the value of PLC register xx. The register input value and output value and type (F or L) are displayed. The values are displayed in hexadecimal or decimal format. Possible display : R0 to R7.
Exx	To display the value of NC exchange bit xx to the PLC. Possible display : E0 to E31.
ENxx	To display the value of NC exchange byte xx to the PLC. Possible display : EN0 and EN1.
ENNxx	To display the value of NC exchange word xx to the PLC. Possible display : ENN0
Axx	To display the value of PLC exchange bit xx to the NC. Possible display : A0 to A23.
ANxx	To display the value of PLC exchange byte xx to the NC. Possible display : AN0 to AN2.

NOTES :

- Bits *Exx* are the images of *W0* and *W1*, bytes *ENxx* are the images of *W2*, word *ENN0* is the image of *W3*.
- Bits *Axx* are the images of *W7* and the LSBs of *W6*, bytes *ANxx* are the images of *W5* and the MSBs of *W6*.
- Display of variables *E*, *EN*, *ENN*, *A*, *AN* on the PLC memory page does not penalize the NC – PLC exchange times.

A1.2.2 – Variables Reserved for the PLC

The operators reserved for the PLC are those on which the data are transmitted between the NC and PLC.

The words used are *W0* to *W3* for write and *W4* to *W9* for read.

For possible options, the reserved operators are therefore *W0* to *W9*.

A1.2.2.1 – PLC Inputs from the NC

CAUTION : When programming, the bit numbers of words *W* are expressed hexadecimally. For instance, *W0,10* is programmed as *W0,A*.

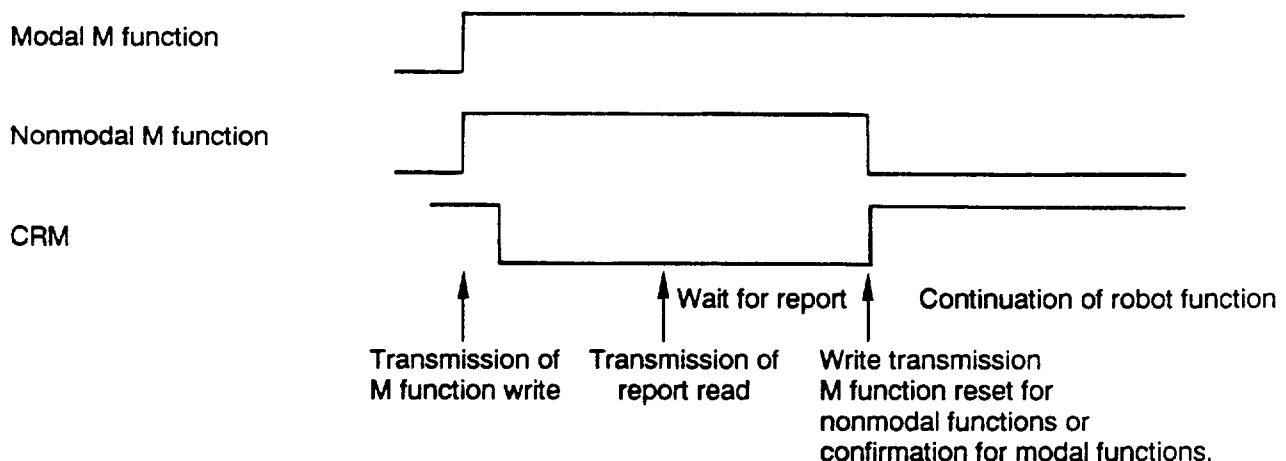
A1.2.2.1.1 – Data on Bits

<i>W0,0</i>	<i>SRAZ</i>	Reset output A pulse present for at least 400 ms in the PLC indicating a system reset. It is set by a reset request from the PC or the teaching pendant, by the end of execution of a programme (<i>M02</i>) or by turning on the equipment. While this pulse is present, the data from the PLC are ignored by the NC.
<i>W0,1</i>	<i>CNPRET</i>	Numerical control ready This bit indicates that power can be applied to the machine. It is set at power on and by action on the reset button. It is reset when the system detects too high a tracking error on an axis or a faulty measurement sensor.
<i>W0,2</i>	<i>SPROG</i>	Programme being executed This bit indicates that a part programme is being executed. It is used to enable auxiliary functions. It is set the first time <i>CYCLE</i> is initiated in one of the following modes : <i>AUTO</i> , <i>IMD</i> or at the end of <i>RNS</i> . It is reset when a programme stop (<i>M00</i>) or a programme end (<i>M02</i>) is detected by the system, at power on or by action on the reset button.
<i>W0,3</i>		Spare
<i>W0,4</i>	<i>AUTO</i>	Automatic mode This mode includes the <i>CONT</i> , <i>SEQ NC</i> modes.

W0,5		Spare
W0,6	MANU	Manual mode This mode includes the JOG and MOS NC modes.
W0,7	INTERV	Intervention mode This mode is a submode of AUTO activated by ARUS.
W0,8	DEFAULT	Fault light output This bit is set to indicate that a machine or programming fault was detected by the system.
W0,9	CYCLE	Cycle output This bit is the image of the CYCLE light on the console. It indicates the execution of certain modes.
W0,10	OPERATEUR	Operator light output This bit indicates the programme stop status caused by M00 enabled. It is reset by detection of a new CYCLE pulse.
W0,11		Spare
W0,12 to W0,15	AXES	Information on one bit indicating the axis in movement. These bits are set at the beginning of execution of each block. They are reset by a RESET, or at the end of execution of a block if the block includes function G09, M00 or M02 or if axis locking is required.
W1,0 to W1,15		Decoded M functions The decoded M functions are the M functions whose meaning is known to the NC.

They include :

- Pre-M functions : these functions are sent to the PLC at the beginning of execution of a block, i.e. before the movements are executed.
- Post-M functions : these functions are sent to the PLC at the end of execution of a block, i.e. after the movements are executed.
- Modal M functions : these functions are set and are only reset by output of a contradictory function.
- Nonmodal M functions : these functions are reset as soon as the NC detects the movement report (W7,6).



The average programme blocking time in the case of use of the report corresponds to the time of two exchanges (one write, one read), i.e.:

- 4 PLC cycles + 120 ms at 9600 bauds,
- 2 PLC cycles + 90 ms at 19200 bauds.

In the case of a nonmodal function, if the PLC is waiting for reset of the M function, an additional exchange is required. In this case, the time required is:

- 6 PLC cycles + 180 ms at 9600 bauds
- 3 PLC cycles + 135 ms at 19200 bauds.

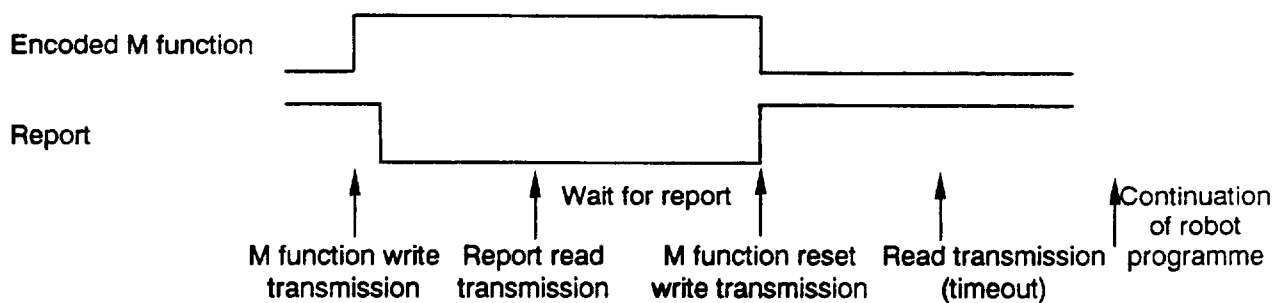
	ADDRESS	TYPE		MOD	NON-MOD	CANCELLED BY	FUNCTION
		PRE	POST				
M3	W1,0	*		*		M4,M5,M2	Open gripper 1
M4	W1,1	*		*		M3,M5,M2	Close gripper 1
M5	W1,2		*	*		M3,M4	Lock gripper 1
M6	W1,3		*		*	CRM	Change gripper
M7	W1,4	*		*		M8,M9,M2	Open gripper 2
M8	W1,5	*		*		M7,M9,M2	Close gripper 2
M9	W1,6		*	*		M7,M8	Lock gripper 2
M10	W1,12		*	*		M11	Lock axes
M11	W1,13	*		*		M10	Unlock axes
M12	W1,11		*		*	ARUS	Programmed INTERV
M997	W1,14	*		*		M999,M998,M2	Force programmed block sequencing
M999	W1,15	*		*		M997,M998,M2	Inhibit S/P call by the PLC and call of the MODIF mode

A1.2.2.1.2 – Data on Bytes

W2,0
to
W2,7

Encoded M functions with report up to M199.

These functions include all the functions other than the uncoded functions. They are considered by the system as Post and Nonmodal functions. It is the PLC which manages their possible procedure. A single encoded M function is allowed in a block.



The average programme blocking time in the case of use of the report corresponds to the time of four exchanges (two write, two read), i.e.:

- 8 PLC cycles + 240 ms at 9600 bauds
- 4 PLC cycles + 180 ms at 19200 bauds.

W2,8
to
W2,15

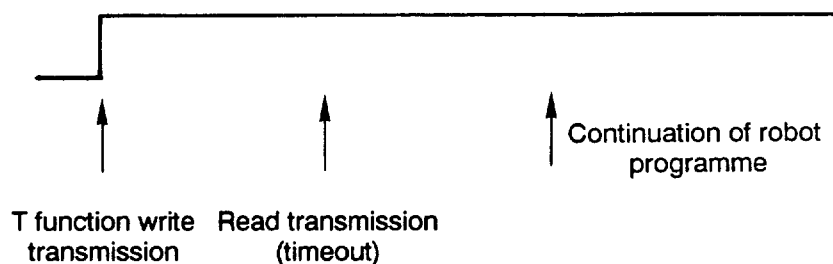
Encoded M functions without report, from M200 to M255.
These functions are Nonmodal Pre functions. There is no report to acknowledge them (on-the-fly M).
A single function of this type is authorized in a block.

An encoded M function up to M199 can be programmed in the same block as an encoded M function from 200 to 255.

W3,0
to
W3,15

Tool number – T function
This function is a modal Pre function without wait for report.

T function



The average programme blocking time corresponds to two transfers (one write, one read), i.e.:

- 4 PLC cycles + 120 ms at 9600 bauds,
- 2 PLC cycles + 90 ms at 19200 bauds.

A1.2.2.2 – PLC Outputs to the NC

CAUTION : When programming, the bit numbers of words W are expressed hexadecimally. For instance, W7,15 is programmed as W7,F.

A1.2.2.2.1 – Data on Bits

W4,0	SELJOG	Movement in JOG mode by the PLC. When this bit is high, the controls of the teaching pendant are inhibited and it is the PLC that specifies the movement conditions.																								
W4,1 to W4,3	REPJOG	Selection of the JOG reference system. If SELJOG is high, these three bits determine the JOG reference system. <table><tr><td>W4,3</td><td>W4,2</td><td>W4,1</td><td></td></tr><tr><td>0</td><td>0</td><td>1</td><td>CARRIER</td></tr><tr><td>0</td><td>1</td><td>0</td><td>AXIS 4</td></tr><tr><td>0</td><td>1</td><td>1</td><td>BASIC reference system</td></tr><tr><td>1</td><td>0</td><td>0</td><td>ORIENTAtion</td></tr><tr><td>1</td><td>0</td><td>1</td><td>PROGrama reference system</td></tr></table> The other combinations do not modify the JOG reference system.	W4,3	W4,2	W4,1		0	0	1	CARRIER	0	1	0	AXIS 4	0	1	1	BASIC reference system	1	0	0	ORIENTAtion	1	0	1	PROGrama reference system
W4,3	W4,2	W4,1																								
0	0	1	CARRIER																							
0	1	0	AXIS 4																							
0	1	1	BASIC reference system																							
1	0	0	ORIENTAtion																							
1	0	1	PROGrama reference system																							
W4,4	RAPJOG	RAPID JOG. If SELJOG is high, this bit high enables fast speeds.																								

W4,5 to W4,7	INCJOG	JOG increment selection.			
		If SELJOG is high, these three bits determine the JOG increment.			
		W4,7	W4,6	W4,5	
		0	0	1	0.001 mm
		0	1	0	0.010 mm
		0	1	1	0.100 mm
		1	0	0	1.000 mm
		1	0	1	10.00 mm
		1	1	0	CONTInuous
The other combinations do not modify the JOG increment.					
W6,0	RAZ	System reset request Pulse command. The transition from 0 to 1 of this bit commands a reset. The only condition for acceptance is that there is no movement in progress on the axes. <u>Important</u> : This request must be made whenever power is applied to the servo-drives.			
W6,1	ARUS	Machining stop request Pulse command. The NC takes this information into account in the CONT, SEQ and incremental JOG modes. It is bistable type command. The first command stops machining and a second command enables movements.			
W6,2	CYCLE	Request for execution of the CONT, SEQ and TEST modes.			
W6,3	RAZERR	Machine error reset request. Pulse command. This request must be made whenever power is applied to the servo-drives.			
W6,4	PUPABS	Partial NC console disable request When this bit is high, the RAZ, ARUS and DCY functions of the teaching pendant are inhibited. These bits can be simulated by the PLC. When this bit is low, the data from the teaching pendant or the PLC are taken into account. When this bit is high, the NEUTRE, POM and CONT PLC data are taken into account.			
W6,5 to W6,7	SELMOD	Mode selection. If PUPABS is high, these three bits determine the mode to be activated.			
		W6,7	W6,6	W6,5	mode
		0	0	0	NEUTRAL
		0	0	1	CONTInuous
		0	1	0	SEQuential
		0	1	1	MANUAL
		1	0	0	POM
		1	0	1	PREF
		1	1	0	ENTER (download)
		1	1	1	DOWN (unload)

NOTES

W7,0	AVANCE	Advance authorization When this bit is reset, movements are stopped in all modes with movement. Movements are resumed when this bit goes high.
W7,1	FMEXT	End of external movement This bit is tested at the end of execution of each block. If it is low, it inhibits sequencing to the next block in AUTO mode. When this bit goes high, the mode is continued normally (cycle reset or execution of the next block).
W7,2	VREDUIT	Deceleration request (debugging)
W7,3	NARFIB	No stop at end of block This is a CYCLE initiation enable in AUTO mode and a block sequencing enable in AUTO mode. When this bit goes low during execution of a block, CYCLE goes low at the end of execution. Restart of the programme by action on CYCLE is not enabled until NARFIB goes high.
W7,4	DEGURG	Emergency clear request When this bit goes high and the system is in AUTO mode, the block being executed is interrupted and the system branches to the last clearance programme declared by function G75. If no clearance programme has been defined, this bit is processed like a machining stop. The wait for an M function report does not differ from execution of an emergency retract requested by the PLC . It is executed immediately.
W7,5	APPSSP	Sub-programme called by the PLC When this bit is set, sub-programme %9999 is called at the end of execution of the current block if functions M997 and M999 are not present.
W7,6	CRM	M function report After each transmission of new M functions to the interface. When this bit is low, the system goes on wait and the following functions of the block being executed are not processed. When this bit is high, the continuation of execution is enabled. It is recommended to set CRM at the beginning of PLC programming and to reset it on function decoding.
W7,7	ETBA	Teaching pendant enable When this bit is low, the teaching pendant is inactive. Mode selection on the PC is enabled. When this bit is high, the teaching pendant is active. Mode selection on the PC is inhibited.
W7,8 to W7,15	AXE0+ to AXE3-	External JOG controls Inputs AXE0 +, AXE0 -, AXE1 +, AXE1 -, etc. indicate enabling (bit high) or inhibiting (bit low) of movement of the machine axis control switches or the axis to be moved if SELJOG is high.
W8,0 to W9,15		Parameters E20000 to E20031 Bits read by the NC. 32 bits are transmitted to the NC in parameters E20000 to E20031. The data to be transferred are selected by the user. These bits can also be read on the NC side as parameter E40000.

A1.2.2.2.2 – Data On Bytes

W5

Messages sent by the PLC

Two message numbers can be sent simultaneously to the NC (one per byte). One of the two messages is displayed on the teaching pendant.

The change of message displayed is by key < – >.

These messages are not displayed on the PC unless the operator enters the message display page. The desired messages must be entered by the operator in part programme %9999.9.

Example : %9999.9

N1 AXIS X ON SWITCH

N2 AXIS Z ON SWITCH

N3 LACK OF AIR PRESSURE

N4 SPINDLE SERVO-DRIVE FAULT

...

If W5 is initialized with \$0104, messages N1 and N4 are displayed.

W6,8

to

W6,15

Current programme selection by the PLC.

This number must be between 1 and 255.

If the MSB of W6 is a zero, no current programme is requested by the PLC.

The requested programme number is read by the system on the rising edge of bit RAZ (W6,0). If the programme requested exists, it becomes the new current programme. If it does not exist, the old current programme is disabled and there is no current programme.

W8,0

to

W9,15

Parameter E40000

Data on 32 bits read by the NC.

32 bits are transmitted to the NC in parameter E40000.

The data to be transferred are selected by the user.

These data can also be read on the NC side as parameters E20000.

A1.2.2.3 – Words Exchanged Between the NC and the PLC

NC-to-PLC exchanges																
Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
W0	MX3	MX2	MX1	MX0		OPERAT	CYCLE	DEFAULT	INTERV	MANU		AUTO		SPROG	CNPRET	SRAZ
W1	M999	M997	M11	M10	M12					M9	M8	M7	M6	M5	M4	M3
W2	M without report								M with report							
W3	T function															
NC-to-PLC exchanges																
Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
W4	reserved for NUM								INCJOG		RAPJOG		REPJOG		SELJOG	
W5	Message 2								Message 1							
W6	Part programme number															
	AN2															
W7	X3-	X3+	X2-	X2+	X1-	X1+	X0-	X0+	ETBA	CRM	APPSSP	DEGURG	NARFIB	VREDUIT	FMEXT	AUTAV
W8	E20015															E20000
W9	E20031															E20016

Reminder :

- Words W0 to W3 are written by the NC, words W4 to W9 are read by the NC.
- Words W8 and W9 can also be read in the NC on parameter E40000.

A1.2.3 – Security of Exchanges Between the NC and PLC

For reasons of security, the PLC must check operation of the NC and the NC-PLC link. In effect, if the dialogue is interrupted for any reason whatsoever, it is preferable not to save the last NC status received. A watchdog monitoring activity on the line must be used in the PLC.

The NC polls the PLC at regular intervals and therefore maintains a certain level of exchanges on the line. To monitor the line, the PLC O.S. sets a bit whenever a request is satisfied. But the user PLC programme must cyclically check the state of this bit and reset it or possibly take the necessary actions in the case of a fault.

This information is given in bit 0 of system word SW42. SW42,0 is set whenever a request is satisfied. To check this bit, the user programme must reset the bit (otherwise, even in case of a fault, this bit remains set). As the duration of a request depends on the PLC cycle time, the setting of bit SW42,0 also depends on the PLC cycle time.

A request lasts approximately: 80 ms + 2 PLC cycles at 9600 bauds and 45 ms + 1 PLC cycle at 19200 bauds. The PLC cycle time can be read in system word SW41.

The user therefore applies a timeout equal to the time between two requests to test SW42,0. If the bit is set, an exchange took place, everything is correct and the bit is reset. If the bit is low, there was no exchange and the programme must branch to activate safety systems (cut off power, reset exchange words W0, W1, W2, W3, reset certain outputs, etc.).

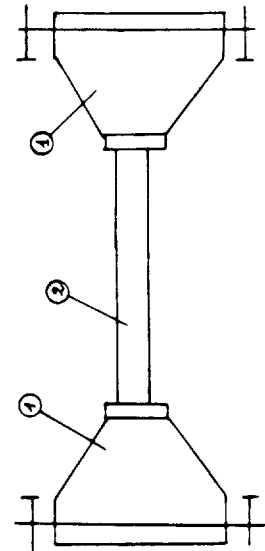
SO AS NOT TO ACCIDENTALLY RESET THE NC-PLC EXCHANGE WORDS, SYSTEM BITS SY0 AND SY1 MUST NOT BE WRITTEN IN THE PLC.

APPENDIX 2

DIAGRAMS OF ROBONUM 820 AND PC OR PS LINKS

25-CONTACT PC CONNECTOR (201606/A)

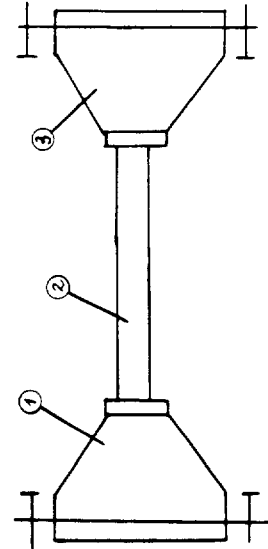
Service terminal connector		Service terminal IBM PC/AT			Line	Part code	Q	Description
Signal name	Symbol	Number	Symbol	Signal name				
TD		2		RD	1	280 020 025	2	Sub-D 25-pin male connector
RD		3		TD	2	280 033 004	2	Set of connector locks
0V Insulated		7		0V	3	280 034 025	2	25-pin metal casing
RTS		4		GND	4	260 100 522		Twisted, shielded 5-pair cable
CTS		5		CTS	5			Maximum length : 5 m
DTR		6		RTS	6			
		20		DTR	7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			



NINE-CONTACT PC CONNECTOR (NO REFERENCE)

Service terminal connector				service terminal IBM PC/AT				Line	Part code	Q	Description
Sub-D 25-pin male connector				Sub-D 9-pin male connector							
Signal name	Symbol	Number		Number	Symbol	Signal name					
TD		2		2		RD					
RD		3		3		TD					
0V Insulated		7		5		0V					
RTS		4		8		GND					
CTS		5		7		RTS					
DTR		20		6		DSR					
				4		DTR					

Diagram of a Sub-D 9-pin male connector. The connector has a central pin (pin 1) and two side pins (pins 2 and 3). The pins are labeled 1, 2, and 3.



NOTES

NUM SA in France

List updated 24-05-91

Head Office		Address	Telephone Telex (Tx)	Fax Minitel
Argenteuil	○ □ ■	NUM SA 21, Avenue du Maréchal Foch BP 68 - 95101 Argenteuil Cedex	(1) 34.23.66.66 Tx : 609 611	(1) 34.23.65.49
Branches				
Bordeaux	■	NUM SA-Telemecanique - Pessac	56.36.20.25	56.07.62.82
Lille	■	NUM SA - Telemecanique - Sedin	20.32.53.55	20.32.44.95
Limoges	■	NUM SA - Telemecanique	55.37.18.44 Tx : 580 410	55.37.66.59
Lyon	□ ■	NUM SA - Telemecanique - Lyon	78.58.88.18 Tx : 370 674	72.73.46.90
Metz	■	NUM SA - Telemecanique - Metz	87.76.97.21 Tx : 860 218	
Mulhouse	■	NUM SA - Mulhouse	89.59.35.44	
Nantes		NUM SA - Telemecanique - Nantes	40.25.12.13	40.25.11.02
Rouen	■	NUM SA - Telemecanique - Mont St Aignan	35.59.78.90 Tx : 770 030	35.59.78.72
St Etienne	■	NUM SA - St Priest en Jarez	77.79.31.33	77.74.65.33
Toulouse	■	NUM SA - Telemecanique - Ramonville St Agne	61.75.69.48	61.75.79.83
Training centre				
Rueil Malmaison	■	CITEF - Rueil Malmaison	47.32.92.44	47.51.06.52 3614 CITEF

NUM SA in the world

Subsidiaries

Germany	□ ■	NUM-GÜTTINGER GmbH - Stuttgart/Nellingen	(711) 34.80.60 Tx : 7256 712	(711) 348.06.10
	□	NUM-GÜTTINGER - Verkaufsbüro West-Mechernich	(2443) 59.59	(2443) 62.43
	□	NUM-GÜTTINGER - Verkaufsbüro Nord-Löhne 2	(5732) 820.07	(5732) 826.43
	□ ■	NUM-GÜTTINGER - Technisches Büro-Ratingen	(2102) 830.97	(2102) 84.37.51
	□ ■	NUM-GÜTTINGER - Technisches Büro- Chemnitz	(722) 64.31.86 (722) 64.31.51 Tx : 777 61, 777 63	
Spain	□ ■	TELENUM SA - San Sebastian/Andoain	(43) 59.42.12 Tx : 38 223	(43) 59.06.51
	□ ■	TELENUM SA - Barcelona/Castelldefels	(3) 636.13.52	(3) 636.29.77
United States	□ ■	NUM Corp. - Naperville (IL.)	(708) 505.77.22	(708) 505.77.54
Great Britain	□ ■	TELENUMERICS Ltd - Coventry	(203) 69.25.25 Tx : 317 208	(203) 69.22.59
Italy	□ ■	NUM Spa - Bologna/Zola Predosa	(51) 75.41.18	(51) 75.40.82
	□ ■	NUM Spa - Milano/Agrate Brianza	(39) 605.73.26 (39) 605.80.79 Tx : 326 423	(39) 65.44.68
	□ ■	NUM Spa - Torino/Rivoli	(11) 955.03.59	(11) 955.03.62
	□ ■	NUM SERVOMAC (Speed change drive unit) - Milano	(2) 33.60.26.08 Tx : 332 436	(2) 33.10.00.76 (2) 33.10.59.70
	○	NUM SERVOMAC (Speed change drive unit) - Cuggiono	(2) 97.24.02.96	(2) 97.24.03.94
Sweden	□ ■	NUM NORDEN AB - Västerås	(21) 35.00.22	(21) 35.00.21

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- - Distribution
- - After-sales Service

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Subsidiaries	Address	Telephone Telex (Tx)	Fax Minitel
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	☐ NUM-GÜTTINGER SA - Bienne	(32) 23.53.73 Tx : 34 333	(32) 23.55.25
Representatives			
Argentina	☐ FASTER SA - Buenos Aires	(1) 766.22.26 (1) 765.63.42 Tx : 25 112	(1) 763.63.92
Belgium	☐ CARON VECTOR SA - Bruxelles	(10) 23.13.11 Tx : 59 509	(10) 23.13.36
Taiwan	☐ TECHRIDGE INDUSTRIAL Co Ltd - Taipei	(2) 731.59.07 Tx : 14 499	(2) 775.37.19
Tunisia	☒ SIME - Tunis	(1) 78.57.13 (1) 78.95.88 Tx : 131 35	(1) 78.46.59
USSR	☒ KHARKOV TECHNICAL MAINTENANCE CENTRE	(0572) 22.46.48 (0572) 23.64.40 (0572) 23.64.41 Tx : 125 649 (National) Tx : 115 147 (International)	
Partners or Representatives			
China	☒ TETS - BEIJING TECHNICAL & SERVICE CENTER - Beijing	(1) 201.66.71 Tx : 222 491	(1) 831.21.66
Colombia	☒ TELEMECANIQUE DE COLOMBIA - Bogota	(1) 413.91.81 Tx : 43 191	(1) 413.90.12
Korea	☒ BOAM R.D Co - Seoul	(2) 551.37.13	(2) 553.66.68
Finland	☐ NUCOS OY - Kerava/Helsinki	(90) 294.35.90	(90) 294.75.90
	☐ NUCOS OY - Kangasala	(911) 79.09.29	(911) 79.08.37
Hong-Kong	☒ TELEMECANIQUE ASIA PACIFIC - Hong-Kong	(5) 65.06.21 Tx : 86 508	(8) 11.10.29
Japan	☒ TELEMECANIQUE JAPAN Ltd - Tokyo	(3) 35.85.66.72 Tx : 254 63	(3) 35.85.66.93
Mexico	☒ TELEMECANIQUE MEXICO SA - Naucalpan/Mexico	(5) 358.86.33 (5) 358.86.62 Tx : 176 13 79	request transmission by fax
Taiwan	☒ NUM TELEMECANIQUE - Taipei	(2) 723.27.47	(2) 723.27.46

- ☐ - Production centre
- ☐ - Distribution
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