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## TSX T407 Terminal - PL7-2 Operating Modes

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# Preface

## TSX T407 Terminal - PL7-2 Operating Modes

### PL7-2 languages for the TSX T407 terminal

Programmable controller		TSX T407 terminal
Type	Software cartridge	Language cartridge
TSX 17-20	TSX P17 20 FA (without clock)	TSX TS4 50 E (Ladder and Grafcet)
	TSX P17 20 FB (with clock)	
TSX 27 TSX 47-J TSX 47-10 TSX 47-20		TSX TS4 20 E (Ladder language)
		TSX TS4 21 E (Ladder and Grafcet)

### Applicability

IN GENERAL, THE CONTENTS OF THIS DOCUMENT APPLY TO THE FOLLOWING PLCs:

- TSX 17-20, TSX 27, TSX 47-J, TSX 47-10 and TSX 47-20.

IN CASES WHERE THE TEXT DOES NOT APPLY TO ALL OF THESE, THE TYPES OF PLCs CONCERNED ARE SPECIFICALLY MENTIONED.

### Representation of keys in the text

- The soft keys are represented between square brackets.  
Example : [MOD], [YES], etc.
- The function keys are represented between arrowheads.  
Example : <ZM>, <ENT>, etc.

# 1. Introduction to the TSX T407 Terminal

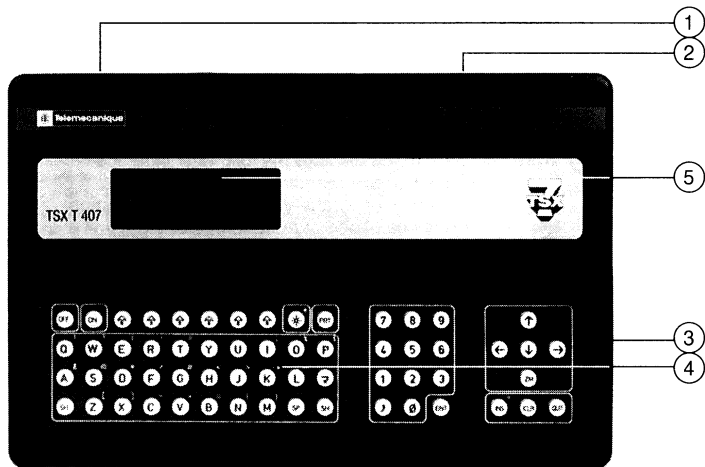
## 1.1 General

The TSX T407 terminal, equipped with the appropriate language cartridge, is designed to program the following TSX Series 7 programmable controllers (PLCs) in PL7-2 language:

- Cartridge TSX TS4 20E/21E: TSX 27, 47-J, 47-10 and 47-20 PLCs,
- Cartridge TSX TS4 50E : TSX 17-20 micro-PLC.

The terminal can be used either on-line (Connected mode) or off-line (Local mode) for the entry and modification of programs written in two fully-graphic programming languages, Ladder or Grafset.

In the Connected mode, the terminal can also be used for the debugging and adjustment of all TSX Series 7 PLCs programmed in PL7-2 language.



- ① Connecting cable to power supply (Local mode) or PLC (Connected mode),
- ② Peripheral connector (printer, modem, tape recorder, etc.),
- ③ Language cartridge,
- ④ Keyboard,
- ⑤ LCD screen.

The terminal exists in 2 versions :

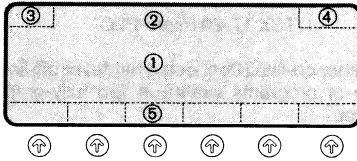
- TSX T407 0: for use in the Connected mode (i.e. connected to a TSX Series 7 PLC which contains the user memory and the power supply).  
Connection to a TSX 17-20 micro-PLC requires the use of the TSX 17 ACC7 power supply and line adapter unit.
- TSX T407 1: for use in the Local or Connected mode. In the Local mode, the terminal must be connected to the TSX TA4 2 power supply and line adapter unit. The working memory can be either :
  - the user memory in the PLC (in the Connected mode), or
  - the internal memory of the terminal (in the Local mode).



# 1. Introduction to the TSX T407 Terminal

## 1.2 LCD Screen

The LCD screen comprises 6 lines of 24 characters and is divided into 5 zones as follows:



- ① **Program zone**: which can display a Ladder contact network or part of a Grafcet chart.
- ② **Input zone**: which displays comments, I/O addresses, label and function block numbers, etc., as entered by the operator.
- ③ **Warning zone**: which displays the following warnings :
  - ! Presence of a memory or I/O fault, or system bit SY8 at 1.
  - !B Presence of a battery fault in the RAM memory of the terminal.
  - !F Presence of one or more forced bits.

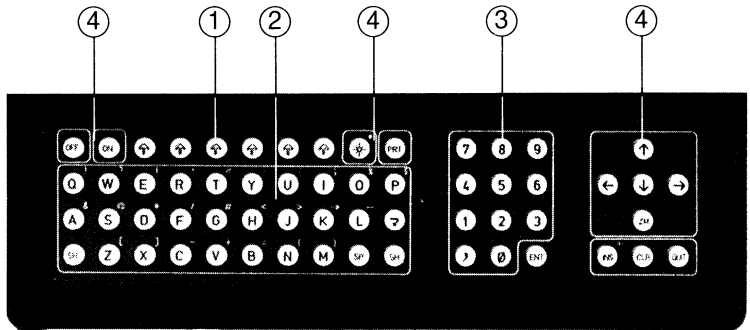
On power up, this zone displays the results of the self-tests in the case of abnormal operation (see Section 2.3).

- ④ **PLC status zone**: which displays the operating status of the PLC, or the type of breakpoint that has been inserted (for debugging):
  - RUN** The PLC is running, i.e. executing the program stored in its memory.
  - STOP** The PLC is stopped.
  - WAIT** The watchdog monitoring the execution of the program has indicated a fault. The user memory must be initialized (by pressing **[CLM]**), or the program must be modified.
  - INT** The terminal (TSX T407 1) is in the Local mode, i.e. using its INTERNAL memory).
  - DCN** Connection fault, the terminal is not properly connected to a TSX-7 PLC.
  - S/L** Stop on Label (breakpoint), the program stops after execution of the specified Ladder contact network. The inputs and outputs are displayed in their true states.
  - S/□** Stop on Step (breakpoint), the program stops when the specified Grafcet step is active. The downstream transition cannot be crossed.
  - S/D** Stop on Drum (breakpoint), the program stops when the specified drum step is active. The drum cannot pass to the next step.
  - S/CY** Stop on Cycle (breakpoint), the program stops at the start of the next cycle (after the outputs have been updated).
- ⑤ **Soft key zone**: which displays the current functions of the six dynamic soft keys.

# 1. Introduction to the TSX T407 Terminal

## 1.3 Keyboard

The keyboard is used to enter the program and data in memory and to dialogue with the PLC. It is continuously monitored to prevent incorrect entries and syntax errors which are indicated by an audio warning. The keyboard has 60 keys which are grouped in 4 zones as follows:



- ① **6 soft keys**, the functions of these keys vary according to the context of the program and the mode of operation. They are used to enter graphic program elements such as inputs, outputs, function blocks, steps, transitions, etc. Their functions at any given time are displayed along the bottom of the screen.
- ② **Alphabetic keys**, which are used to enter (in capitals) all the letters of the alphabet when writing addresses, labels, comments, etc. When pressed simultaneously with <SH>, the character marked above the key is entered.
- ③ **Numerical keys**, which are used to enter the numbers from 0 to 9 and the comma.
- ④ **Function keys**, which are used to control the functions of the terminal and include the ON/OFF keys, cursor control keys, Enter, Clear, Quit, Zoom, Insert, Delete and Print keys.

## 2. Installation

### 2.1 Equipment check

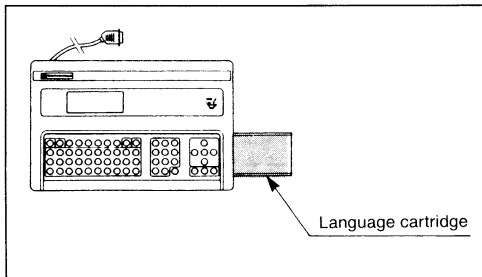
The PL7-2 software packs for the TSX T407 terminal are composed of an A5 ring binder containing a language cartridge and the associated documentation:

- **For TSX 17-20:** Software pack TSX TS4 500E (Ladder and Grafcet) containing:
  - Language cartridge TSX TS4 50E
  - PL7-2 language summary TSX D12 002E
  - T407/PL7-2 operating modes TSX D12 001E
  - PL7-2 supplement for TSX 17 TSX D12 005E
- **For TSX 27/47-J/47-10/47-2 :** Software pack TSX TS4 200E (Ladder only) containing:
  - Language cartridge TSX TS4 20E
  - PL7-2 language summary TSX D12 002E
  - T407/PL7-2 operating modes TSX D12 001E
- **For TSX 27/47-J/47-10/47-20:** Software pack TSX TS4 210E (Ladder and Grafcet) containing:
  - Language cartridge TSX TS4 21E
  - PL7-2 language summary TSX D12 002E
  - T407/PL7-2 operating modes TSX D12 001E

**Note:** The last letter of the reference number indicates the national language in which the software and documentation is written:  
E = English, F = French, G = German.

### 2.2 Connection

#### Installing the language cartridge

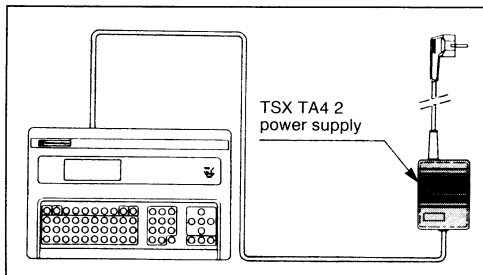


(\*) If a message is displayed refer to appendix A2-1.

1. Slide out the cartridge housing cover on the right side of the terminal.
2. Install the language cartridge in its housing and check that it is pushed fully home.
3. Reinstall the cover and check that it is correctly closed(\*)).

**Note:** The cartridge can be installed and removed whether the terminal is powered up or not.

#### Connecting the terminal (TSX T407 1) in the Local mode



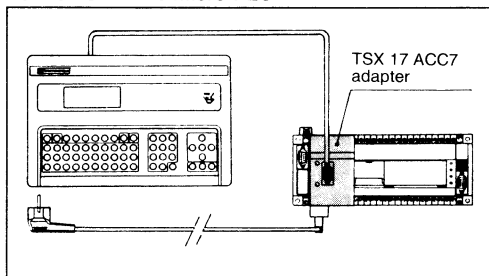
1. Set the voltage selector on the back of the TSX TA4 2 power supply unit to the required voltage (110 V or 220 V).
2. Connect the terminal to the power supply unit.
3. Connect the power supply unit to the AC power source.

## 2. Installation

### Connection (Cont'd.)

#### Connecting the terminal (TSX T407 1) in the Connected mode

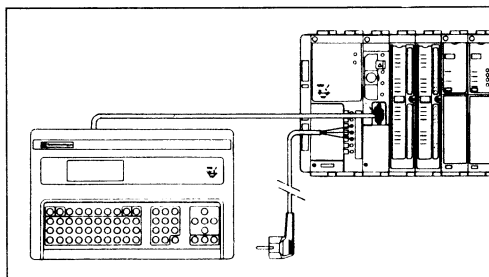
##### To the TSX 17-20 micro-PLC



1. Install the TSX 17 ACC7 adapter on the front of the TSX 17-20 micro-PLC. (See Note below).
2. Connect one end of the power cord to the adapter and the other end to the AC power source.
3. Connect the terminal to the adapter.

**Note:** Alternatively, the adapter can be installed within 3 feet of the of the micro-PLC and can be connected to it by the TSX 17 CTC 03 connecting cable.

##### To the TSX 27/47-J/47-10 or 47-20



1. Connect the terminal to the programming port of the TSX Series 7 PLC.

**Note:** In this case, the terminal is powered by the PLC, which must therefore be energized to permit operation of the terminal.

## 2.3 Power Up Sequence

### Self-tests



After being switched on (by pressing the ON key on the top line of the keyboard), the terminal runs a series of self-tests.

If a fault is detected, the screen displays the corresponding error code. These codes, and the remedial action to be taken, are detailed in Appendix 2 - Error Messages - page A2/1.

### Accessing the Mode Selection Display

The Mode Selection Display allows the operator to select the required operating mode.

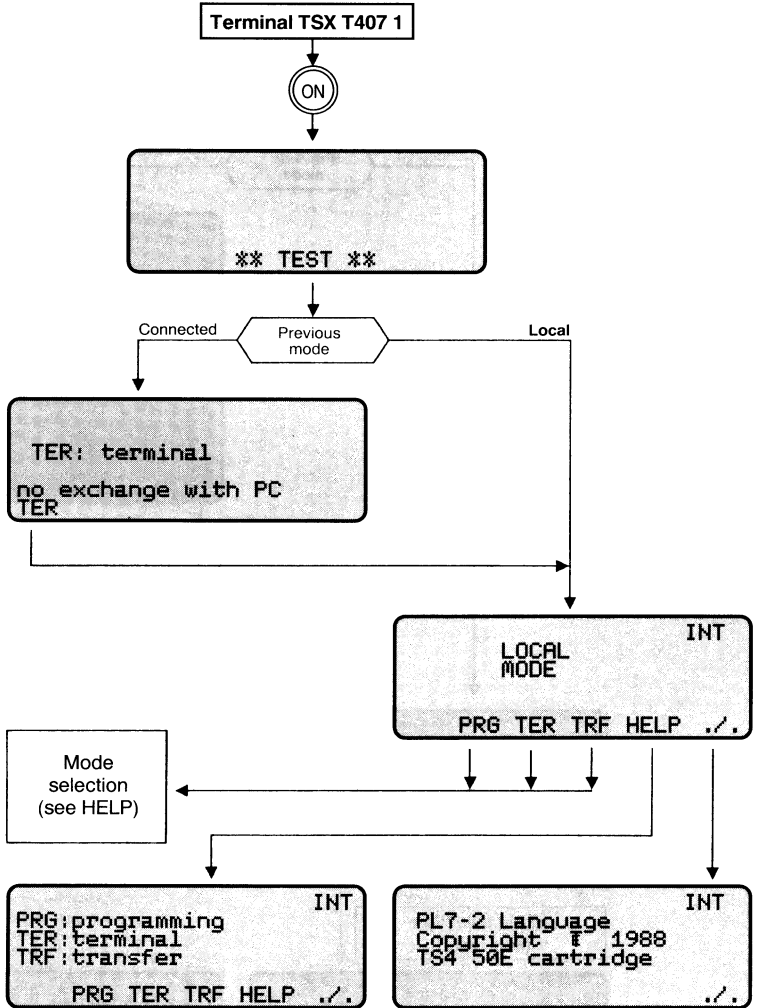
If the connection mode of the terminal (Local or Connected) has not been changed since it was last used, the Mode Selection Display appears on the screen as soon as the self-tests are completed.

If the connection mode of the terminal (Local or Connected) has been changed since it was last used, the user must follow the sequences described in the following flow charts.

# 2. Installation

## Power Up Sequence (Cont'd.)

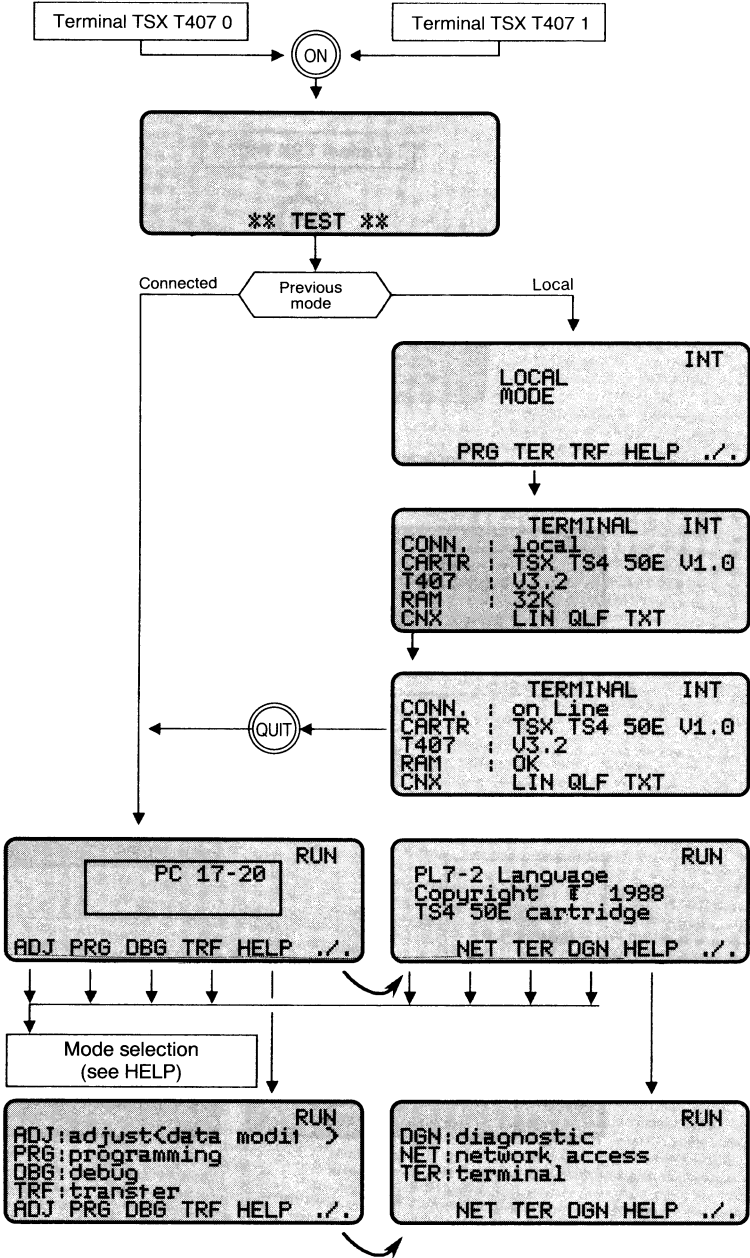
Using the terminal in the Local mode



# 2. Installation

## Power Up Sequence (Cont'd.)

Using the terminal in the Connected mode



# 3. Using the TSX T407 Terminal

## 3.1 Principle of Keyboard Entries

---

### Keyboard

The keyboard is used to enter the program and data in memory and to dialogue with the PLC. It has 4 types of keys, as described below:

### Soft keys

The functions of these keys vary according to the context of the program and the mode of operation of the terminal. They continuously guide the operator throughout all operations, since only the authorized functions are displayed at any given time. Their use is described in detail in the following Sections dealing with each Operating Mode.

#### Examples of soft keys:



Displays in full the functions of the main soft keys.



Puts the terminal in the Programming mode.



Enters a normally-open input contact symbol (in Ladder language).



Enters a Grafcet step symbol.



Permits the display of a second line of soft keys (or the return to the first line of soft keys).

### Function keys

These keys control the functions of the terminal, for example:



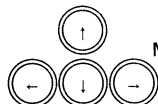
Switches the terminal on or off.



Increases or reduces the brightness of the display.



Prints the screen display (if a printer is connected to the terminal).



Moves the cursor inside a display, or scrolls the program up or down.



Calls up the cursor inside a display, or displays the parameters of a function block, or the actions associated with a Grafcet step.



Permits the insertion of a contact network.



Deletes the element indicated by the cursor.



Cancels the ongoing entry, or returns to the previous display.



Quits the current operating mode and returns to the Mode Selection Display.



Stores the entry in memory (also referred to as "validation" of the entry).

# 3. Using the TSX T407 Terminal

## Principle of Keyboard Entries (Cont'd.)

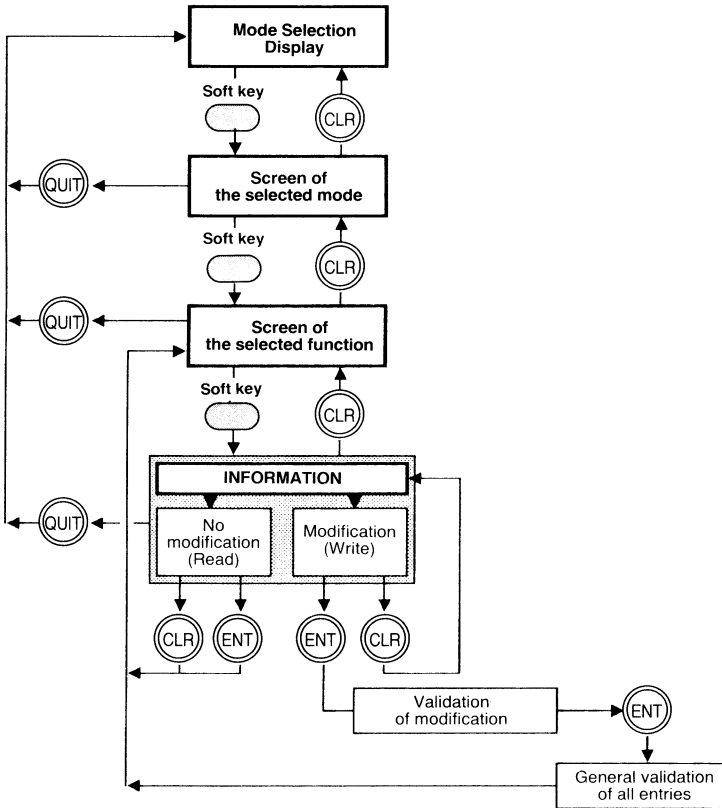
### Alphabetic keys

These keys are used to enter the letters of the alphabet (in capitals only) when writing addresses, comments, etc. When pressed simultaneously with the shift key (SH), the character marked above the key is entered. The key (SP) represents the space bar.

### Numerical keys

These keys are used to enter the numbers 0 to 9 and the comma.

### Principle of screen display sequences





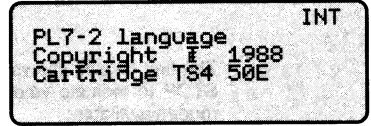
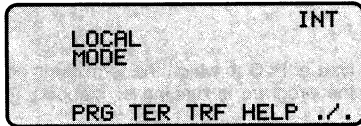
# 3. Using the TSX T407 Terminal

## 3.2 Mode Selection Display

---

The Mode Selection Display shows the operating modes that are available. It varies according to whether the terminal is in the Local mode or the Connected mode.

### Mode Selection Display for operation of the terminal in the Local mode



Operating modes available

**PRG**

#### PROGRAM Mode

Permits the initialization of the memory, the configuration of the PLC and the entry or modification of the program.

**TER**

#### TERMINAL Mode

Permits the switching of the TSX T407 1 terminal from the Local mode to the Connected mode (or vice versa), and permits the configuration of the printer link.

**TRF**

#### TRANSFER Mode

Permits the printing of the program, or the transfer of the program from the internal memory of the terminal to a RAM or EPROM cartridge, or to a tape cassette.

In this Mode Selection Display, the letters INT in the top right corner of the screen indicate that the working memory is the INTERNAL memory of the terminal.

When the HELP key is pressed, the operating modes available are shown in full.

When the "Continue" key (./) is pressed, a second display appears showing the software language used (PL7-2), the copyright date, and the type of language cartridge used, in this case TSX TS4 50E (Ladder and Grafset). The letter at the end of the reference number indicates the national language version of the cartridge (E = English, F = French, G = German).



# 4. Program Mode - General

## 4.1 Presentation of the Mode

---

The Program mode enables the operator to create, read and modify the control program, and to define the hardware and software structure of the application, including:

- Initialization of the memory,
- Configuration of the size of the memory,
- Configuration of the PLC (I/O, function blocks, common words, constant words, and outputs to be saved in case of a power break),
- Configuration and diagnostics of the program.

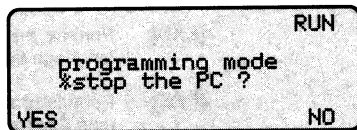
**Note:** Selection of the required programming language is made during initialization of the memory. Selection of the correct language is automatic if the program has already been created.

### Accessing the Program Mode

Accesses the mode. If the terminal is connected to a PLC that is running, the menu below appears.

**For obvious safety reasons, it is recommended to make all modifications to the program with the PLC stopped.**

- [YES] Stops the PLC (STOP).  
[NO] Keeps the PLC running (RUN).



### Programming with the PLC running

In exceptional circumstances (for example if the controlled process cannot be interrupted), it is possible to modify the program (except for the Sequential section of a Grafset program) with the PLC running, **provided that the following rules are strictly observed**:

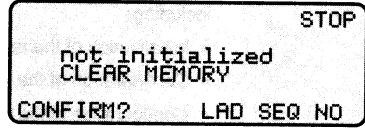
- **Before making any modification to the program, it is essential to be fully aware of its consequences on the application and to ensure that all the necessary precautions have been taken. Modifications to the program should therefore be made by authorized personnel only.**
- All modifications to the program (creation or modification of Ladder contact networks) must be validated **and confirmed** by pressing <ENT> and [YES].
- All the elements of a contact network (except function blocks) can be inserted or deleted.
- Function blocks should not be inserted, as their parameters cannot be modified while the PLC is running. They can, however, be deleted.

# 4. Program Mode - General

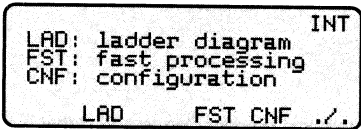
## Presentation of the Mode (Cont'd.)

### Memory initialization

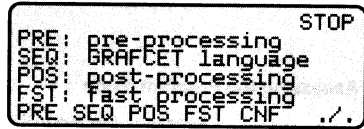
This display appears only if the working memory has not been initialized (i.e. the memory is blank). To initialize the memory, select the required language by pressing [LAD] for Ladder or [SEQ] for Grafcet.



If the working memory has already been initialized, one or other of the menus below appears. (To clear the memory or change from one language to the other press [CLM] - see below).



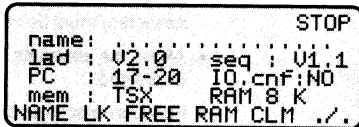
Ladder language menu



Grafcet language menu

### Soft keys

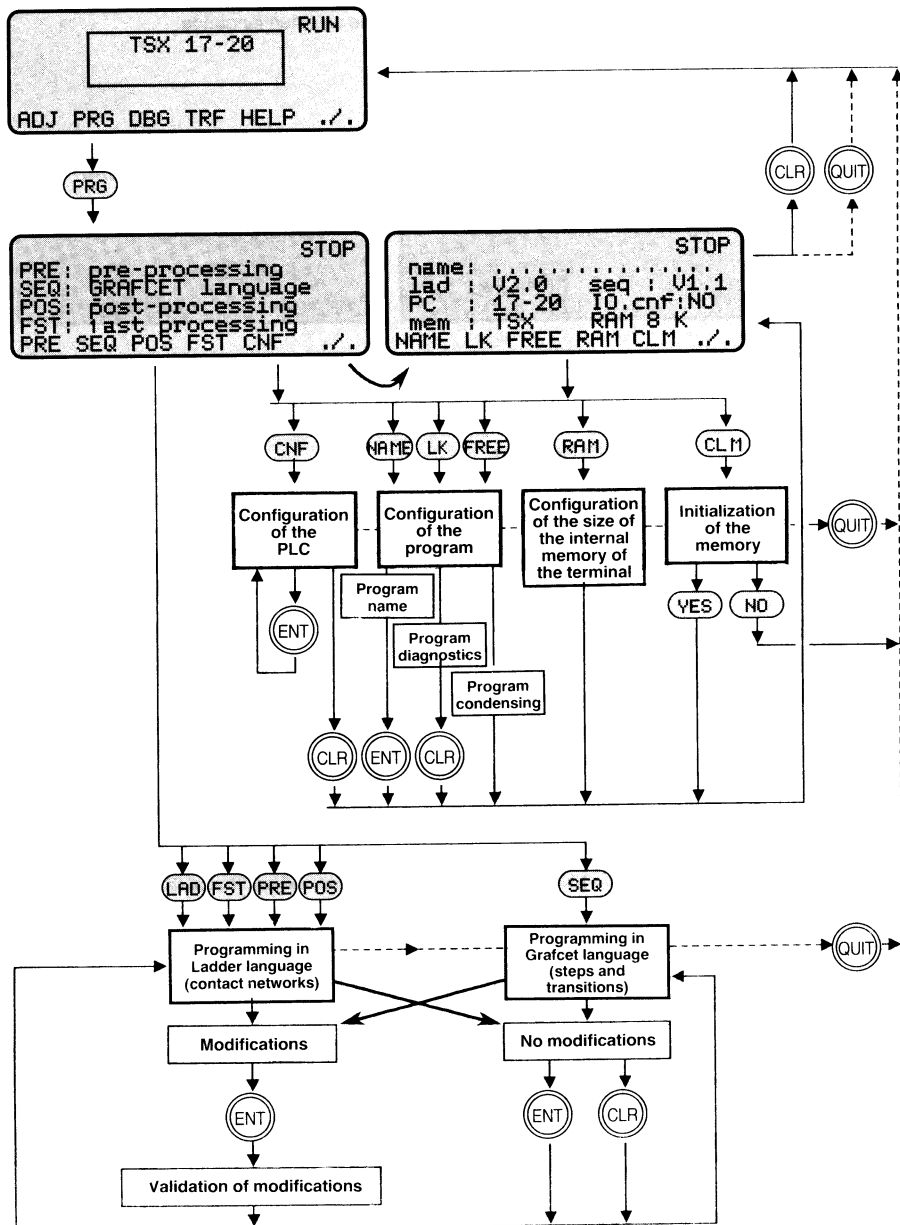
- [LAD] Permits programming of the main program (or Master task) in Ladder language (see Section 5).
- [PRE] Permits programming of the Pre-processing section in Ladder language (see Section 5).
- [SEQ] Permits programming of the Sequential processing section in Grafcet language (see Section 6).
- [POS] Permits programming of the Post-Processing section in Ladder language (see Section 5).
- [FST] Permits programming of the Fast task in Ladder language (see Section 5).
- [CNF] Permits the configuration of the PLC (see Section 4.4).
- [./.] Calls up the next line of soft keys (for the details of this display see Section 4.2).
- [NAME] Refer to Section 4.5 "Configuration of the Program".
- [LK] Refer to Section 4.5 "Configuration of the Program".
- [FREE] Refer to Section 4.5 "Configuration of the Program".
- [RAM] Permits configuration of the internal memory of the terminal (see Section 4.3).
- [CLM] Permits the clearing and reinitialization of the working memory, and changing from one language to the other (see Section 4.2).



# 4. Program Mode - General

## Presentation of the Mode (Cont'd.)

Program mode flowchart



# 4. Program Mode - General

## 4.2 Initializing the Memory

CLM

Permits initialization of the working memory, whether the terminal is in the Local mode or the Connected mode. **This operation completely clears the memory** and restructures it to receive a new program in the selected language.

### Initialization of the user memory in the PLC

CLM menu for TSX 17-20

```
          STOP
GRAFCET language
CLEAR MEMORY
TSX: 17-20  URS:1.0
SIZ: 8      CONFIRM ?
SIZ          LAD SEQ NO
```

CLM menu for TSX T27/47-J/47-10/20

```
          STOP
GRAFCET language
CLEAR MEMORY
CONFIRM?  LAD SEQ NO
```

- [LAD] Initializes the RAM memory in the PLC and restructures it for programming in Ladder language.
- [SEQ] Initializes the RAM memory in the PLC and restructures it for programming in Grafcet language.
- [NO] Cancels the memory initialization request and returns to the Mode Selection Display.
- [SIZ] Permits the definition of the size of the size of the user memory in the TSX 17-20: 8 or 24 Kbytes (24 Kb by default).

### Initialization of the internal memory of the terminal

CLM menu for TSX 17-20

```
          INT
ladder diagram
CLEAR MEMORY
TSX: 17-20  URS:1.0
SIZ: 8      CONFIRM ?
SIZ          LAD SEQ NO
```

CLM menu for TSX T27/47-J/47-10/20

```
          INT
GRAFCET language
CLEAR MEMORY
PC : 47-20  URS:0.1->3.4
SIZ: 32    CONFIRM ?
SIZ PC URS LAD SEQ NO
```

- [SIZ] Successive pressures on this key permit the declaration of the size of the internal memory of the terminal:
- 8 or 24 Kbytes for the TSX 17-20,
  - 8, 16 or 32 Kbytes for the TSX 27/47-J/47-10/47-20.
- [PC] Successive pressures on this key permit the declaration of the type of PLC that will execute the program (for TSX 27/47-J/ 47-10/47-20 only). For TSX 47-J/47-10 enter 47.
- [VRS] Successive pressures on this key permit the declaration of the software version of the PLC (for TSX 27/47-J/47-10/20 only).

## 4. Program Mode - General

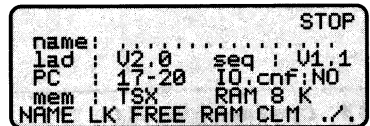
### Initializing the Memory (Cont'd.)

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- [LAD]** Validates the initialization of the RAM memory in the terminal for programming in Ladder language (memory size, type and software version of the destination PLC).
- [SEQ]** Validates the initialization of the RAM memory in the terminal for programming in Grafcet language (memory size, type and software version of the destination PLC).
- [NO]** Cancels the memory initialization request and returns to the Mode Selection Display.

### Memory and configuration information

The [CLM] soft key is proposed on the **second** menu of the Program mode selection display, as shown opposite. This menu also gives the following information:



```
STOP
name : .....
lad  : U2.0   seq : U1.1
PC   : 17-20 IO.cnf:NO
mem  : TSX   RAM 8 K
NAME LK FREE RAM CLM ./.
```

- name:** Indicates the name of the application program, as entered by the user (see Section 4.5).
- lad:** Indicates the software version of the Ladder language.
- seq:** Indicates the software version of the Grafcet language.
- pc:** Indicates the type of PLC in which the program will be executed, as determined by the language cartridge selected by the user:
- TSX TS4 50E (Ladder and Grafcet) for the TSX 17-20,
  - TSX TS4 20E (Ladder) or TSX TS4 21E (Ladder and Grafcet) for the TSX 27/47-J/47-10/47-20).
- I/O.cnf:** Indicates whether the I/O have been configured (see Section 4.4).
- mem:** Indicates the location of the working memory:
- INT = the internal memory of the PLC,
  - PC = the user memory cartridge in the PLC.
- RAM:** Indicates the size of the memory, as configured by the user (see Section 4.3).

## 4. Program Mode - General

### 4.3 Configuring the Size of the Internal Memory of the Terminal

**RAM**

Permits the configuration of the size of the internal memory of the terminal, so that the program can be transferred to the PLC. (The contents of one memory cannot be transferred to another unless the size of the source memory is equal to or less than the size of the destination memory).

Press the key as often as required to obtain the desired memory size:

- 8 or 24 K for the TSX 17-20,
- 8, 16 or 32 K for the TSX 27, 47-J, 47-10 or 47-20.

```
%condensing      INT
name: OVEN
lad : U2.0      seq : U1.1
PC  : 17-20    IO.cnf:NO
mem : INT      RAM 24K
NAME LK FREE RAM CLM ./.
```

This operation automatically condenses the internal memory of the terminal.

### 4.4 Configuring the PLC

**CNF**

Permits the configuration of the PLC, including the I/O, the outputs to be saved in case of a power break, the programming port data link, the Telway 7 common words, and the number and contents of constant words.

**[I/O]** Permits configuration of the I/O modules.

**[SAV]** Permits declaration of the outputs (and internal bits) to be saved in case of a power break.

**[LIN]** Permits configuration of the programming port data link.

**[COM]** Permits declaration of the number of Telway common words.

**[NCW]** Permits declaration of the number of constant words.

**[CWi]** Permits entry of the contents of constant words.

```
I/O : inputs/outputs STOP
SAV : power save
LIN : terminal connect.
COMi, i = 4      NCW = 128
I/O SAV LIN COM NCW Cwi
```



# 4. Program Mode - General

## Configuring the PLC (Cont'd.)

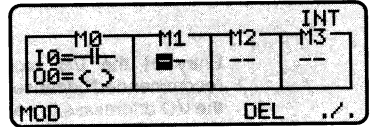
### Configuring the I/O of the TSX 17-20

**I/O**

Calls up the display representing the basic configuration of the TSX 17-20 (M0) and its 3 possible extension modules (M1, M2 and M3) which, if they are present, **must** be identified by their code numbers (otherwise the I/O fault light on the front of the TSX 17-20 comes on).

**[MOD]** Successive pressures on this key permit configuration of:

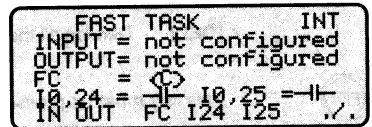
- Input I0,0 as a normal input or as a RUN/STOP input,
- Output O0,0 as a normal output or as a safety output.



To enter or modify the code numbers of the extension modules, position the cursor under M1, M2 or M3 and enter the corresponding code number (see Appendix 1).

**[DEL]** Deletes all the code numbers of the extension modules.

**[./.]** Calls up the next line of soft keys, which permit the configuration of the Fast task.



**[IN]** Successive pressures on this key permit the selection of the 8 inputs that are assigned to the Fast task (when this task is activated): **I0,0 to 7, or I0,8 to 15, or I0,16 to 23.**

**[OUT]** Successive pressures on this key permit the selection of the 8 outputs that are assigned to the Fast task (when this task is activated): **O0,0 to 7, or O0,8 to 15.**

**[FC]** Successive pressures on this key configure the fast counter/ timer as a fast **counter (C)** or as a fast **timer (T)**.

**[I24]** Successive pressures on this key configure input I0,24 as a **normal input** or as an **event-triggered input**.

**[I25]** Successive pressures on this key configure input I0,25 as a **normal input** or as an **event-triggered input**.

**ENT**

This key **must** be pressed to validate the I/O configuration.

### Configuring the I/O of the TSX 27

The configuration of the I/O modules of the TSX 27 is automatic. Input module 1 and output module 0 are automatically assigned to the Fast task when this task is activated (SY19 = 1).

## 4. Program Mode - General

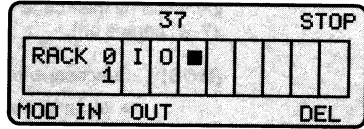
### Configuring the PLC (Cont'd.)

#### Configuring the I/O of the TSX 47-J/47-10/47-20

**I/O**

Calls up the display representing the two possible racks of a TSX 47.

**[MOD]** Permits entry or modification of the code number of the I/O module indicated by the cursor.



Entry of the I/O module code numbers is not mandatory, but is strongly recommended because it enables the PLC to check the configuration, and also allows the I/O addresses to be displayed with the prefix I or O.

**[IN]** Successive pressures on this key enable the input module indicated by the cursor to be assigned to or removed from the Fast task.

**[OUT]** Successive pressures on this key enable the output module indicated by the cursor to be assigned to or removed from the Fast task.

**[DEL]** Deletes all the code numbers of the modules.

**ENT**

This key **must** be pressed to validate the I/O configuration.

After the I/O configuration is validated by pressing **<ENT>**, the PLC checks that the code numbers of the I/O modules configured in the memory correspond with those physically present in the racks. In case of non-conformity, the PLC declares the module defective, resets system bit SY10 to 0 to indicate an I/O fault, and turns on the "I/O Fault" LED on the front of the processor. Since the module is considered defective, none of its bit states are read by the PLC.

#### Notes:

- All the I/O modules must be configured if any of them are assigned to the Fast task.
- I/O modules that are assigned to the Fast task can be located in either rack 0 or rack 1. However, for maximum processing speed it is preferable to configure them in rack 0.
- The two intelligent modules that can be installed in the TSX 47-20 must be located in the first four slots of rack 0.

# 4. Program Mode - General

## Configuring the PLC (Cont'd.)

### Saving of output states

During a hot restart after a power break/return, all the outputs are normally reset to 0 (this is the configuration by default).

However, if the user wants to save the states of certain outputs and/or internal bits during a hot restart, this can be done by proceeding as follows:

**SAV**

Calls up the cursor on the top line of the configuration menu so that the address of the output bit or internal bit to be saved can be entered (for example output O0,1).

```
          ■          STOP
I/O : inputs/outputs
SAV : power save
LIN : terminal connect.
COMi, j = 4   NCW = 128
I/O SAV LIN COM NCW CWI
```

**ENT**

Validates the entry and displays the 16 bits of the output module concerned (or of the group of internal bits concerned) with the cursor on the bit that has just been saved.

```
          00,2          STOP
          power save
          15          0
          .....■....x.*..
MOD
```

**[MOD]** Is a flip-flop that can then be used to save or "unsave" any of the 16 bits displayed.

- The bits that have been saved are indicated by an asterisk.
- The bits that have not been saved are indicated by a dot.

<→> <←> These keys move the cursor along the line of 16 bits.

<↓> <↑> These keys display the next group of 16 bits or the previous group of 16 bits.

# 4. Program Mode - General

## Configuring the PLC (Cont'd.)

### Configuring the programming port data link

**LIN**

Accesses the configuration of the programming port data link.

In the case of the TSX 17-20, the programming port is automatically configured either for connection to a Uni-Telway multidrop bus or for connection to a peripheral in the ASCII character mode. The transmission characteristics are given by default and can be changed by using the following soft keys:

If the TSX 17-20 is in the UNI-TELWAY mode

**[BAU]** Successive pressures on this key permit selection of the required baud rate: 300, 600, 1200, 2400, 4800 or 9600

```
TSX <-> UNITW INT
BAUD : 9600 DATA : 8
PRTY : ODD STOP : 1
ADR : 0
CAR. BAU ADR
```

**[ADR]** Permits the entry of the address of the TSX 17-20 on the UNI-TELWAY multidrop bus.

**[CAR]** Permits the configuration of the programming port data link to be changed to the ASCII character mode.

If the TSX 17-20 is in the character mode

**[BAU]** Successive pressures on this key permit selection of the required baud rate: 300, 600, 1200, 2400, 4800 or 9600

```
TSX <-> CARACT INT
BAUD : 9600 DATA : 8
PRTY : ODD STOP : 1
ECHO : NO
UTW BAU PAR ECO DAT STO
```

**[PAR]** Permits entry of the parity: (EVEN), (ODD) or none (NO).

**[ECO]** Permits entry or deletion of the echo check.

**[DAT]** Defines the number of data bits: 7 or 8.

**[STO]** Defines the number of stop bits: 1 or 2.

**[UTW]** Permits the configuration of the programming port data link to be changed to the UNI-TELWAY mode.

For the TSX 27/47-J/47-10/47-20

The programming port data links of these PLCs operate in the ASCII character mode only.

The 5 soft keys proposed are the same as those described above and can be used in the same way to configure the data link.

```
PERIPHERAL LINE STOP
BAUD RATE : 1200
PARITY : EVEN
STOP BITS : 1
DATA : 8 BITS
BAU PAR STO DAT
```

# 4. Program Mode - General

## Configuring the PLC (Cont'd.)

### Configuring the TELWAY 7 common words (for TSX 47-J/47-10/47-20 only)

In the case of point-to-point transmission between two PLCs on the Telway 7 network, it is possible to delete the common words of the stations concerned.

**[COM]**

Enables the user to assign (COM<sub>i</sub>=4) or delete (COM<sub>i</sub>=0) the 4 common words associated with the PLC in the Telway 7 table of 64 common words.

```
                                STOP
I/O : inputs/outputs
SAV : power save
LIN : terminal connect.
COMi, i = 4   NCW = 128
I/O SAV LIN COM  NCW Cwi
```

### Configuring the number of constant words

The number of constant words can be configured in order to optimize the amount of working memory available. The number must be chosen from the following list: 128, 256, 384, 512, 640, 768, 896 or 1024.

**[NCW]**

Permits entry of the required number of constant words. To modify this number, the PLC must be stopped (STOP).

```
                                STOP
I/O : inputs/outputs
SAV : power save
LIN : terminal connect.
COMi, i = 4   NCW = █
I/O SAV LIN COM  NCW Cwi
```

**[ENT]**

Validates the number of words entered.

### Configuring the contents of constant words

**[Cwi]**

Calls up the cursor at the top of the screen to allow entry of the number of the constant word to be configured. Enter the desired number and press <ENT>.

```
                                STOP
I/O : █ inputs/outputs
SAV : power save
LIN : terminal connect.
COMi, i = 4   NCW = 128
I/O SAV LIN COM  NCW Cwi
```

The contents of the word are then displayed in decimal.

**[MOD]** Permits the contents of the word to be modified.

```
                                INT
                                CW1
                                = M'HOPPER 5 EMPTY'
MOD CNV
```

**[CNV]** Successive pressures on this key display the contents of the word in decimal (e.g. 20304), hexadecimal (H'4F50'), binary (e.g. L'0100111101010000') or message mode (e.g. M' HOPPER 5 EMPTY'). In the message mode, the contents of the next 7 constant words are also displayed.

**Note:** If the message has an odd number of characters, it must be completed by a space.

# 4. Program Mode - General

## 4.5 Configuring the Program

---

These functions include:

- The naming of the program,
- The diagnosis of the program,
- The condensing of the program.

### Naming the program

**NAME**

Permits the entry of the program name (15 characters max.). The name is entered on the operator input line and validated by pressing <ENT>.

```
                                INT
name: OVEN
lad : U2.0      seq : U1.1
tsx : 17_20    IO.cnf: VES
mem : INT      RAM 24K
NAME LK FREE RAM CLM ./.
```

### Diagnosing the program

**LK**

Permits the diagnosis of the program. The type of language is displayed together with the result of the diagnosis.

```
                                diagnostic INT
GRAFCET language OK
ladder diagram OK
```

If there are no faults in the program "OK" is displayed. If a fault is encountered, the type of fault is displayed (unresolved program jump, incorrect connectors between two Grafcet pages, etc.).

**Note:** This function is a very useful programming aid, especially when programming with the terminal in the Local mode. For instance, after entering 1 or 2 K of program, or after making a modification, <LK> can be pressed to check that the program is executable and, if not, to indicate the type of fault.

### Condensing the program

**FREE**

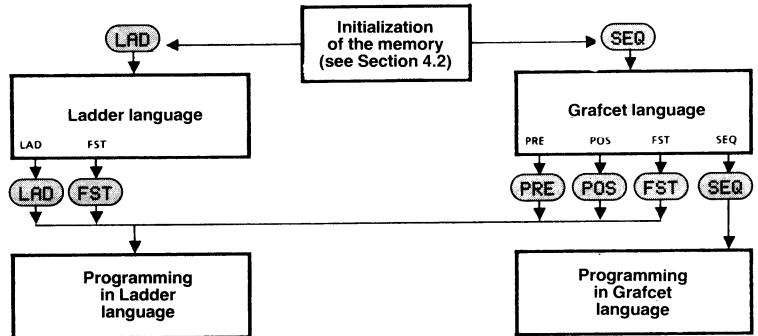
Condenses the program in the working memory (i.e. the internal memory of the terminal in the Local mode, or the memory cartridge in the PLC in the Connected mode), and then indicates the amount of memory (in bytes) that remains available.

```
                                free =22525 INT
name: OVEN
lad : U2.0      seq : U1.1
PC  : 17_20    IO.cnf: NON
mem : INT      RAM 24K
NAME LK FREE RAM CLM ./.
```

# 5. Program Mode - Ladder Language

## 5.1 Access to Programming in Ladder Language

The choice of programming language is made during the initialization of the memory (by pressing <LAD> or <SEQ>).  
If the program already exists, the correct language is chosen automatically.



If Ladder language is chosen, access to the following program modules is proposed:

- [LAD] Master task,
- [FST] Fast task.

If Grafcet language is chosen, access to the following program modules is proposed:

- [PRE] Pre-processing,
- [POS] Post-processing,
- [FST] Fast task,
- [SEQ] Sequential processing.

The Pre-processing and Post-processing modules, and the Fast task, are programmed in Ladder language. Only the Sequential processing module is programmed in Grafcet language.

### Contact networks

A Ladder language program is composed of a series of contact networks. Each contact network is composed of:

- 1 to 4 lines of input contacts, with a maximum of 9 inputs per line,
- 1 to 4 output coils,
- Function blocks and operation blocks as required,
- The necessary horizontal and vertical links.

After selecting the required program module (LAD, FST, PRE or POS), the 3 main functions available in the Program mode are:

- Reading of the program,
- Creation of the program,
- Modification of the program.

If a program already exists in the selected module, the first contact network of the program is displayed, the terminal is then in the read mode.

The program displayed can be modified by pressing <ZM> and [MOD], the terminal is then in the modification mode.

To create a new contact network, [INS] must be pressed, the terminal is then in the creation (or insertion) mode. The new contact network is inserted upstream of the one displayed on the screen.

If there is no program in the selected module, the terminal automatically sets itself to the creation (or insertion) mode.

# 5. Program Mode - Ladder Language

## 5.2 Reading a Program in Ladder Language

In the read mode, the terminal displays the program by showing one contact network at a time. All the graphic elements of the contact network are displayed. The cursor is not present, but can be called up by pressing <ZM>, the address of a contact or coil can then be read by positioning the cursor in front of the corresponding graphic symbol.

### Soft keys

TOP

Displays the first contact network of the program in the selected module.

BOT

Displays the message "End of program". Press <↑> to display the last contact network.

LAB

Calls up the contact network specified by the label number: [LAB] xxx <ENT>. The label numbers can be from 1 to 999 for the Master task and the Pre- and Post-processing modules, and from 1 to 20 for the Fast task.

INS

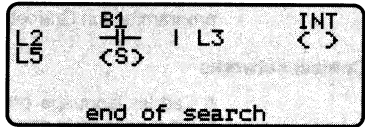
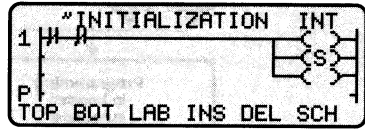
Permits the insertion of a new contact network upstream of the one that is displayed (see Section 5.4).

DEL

Deletes from memory, after confirmation by [YES], the contact network displayed (see Section 5.4).

SCH

Searches for a specific program element (after its address has been entered) and displays the list of contact networks in which it is used and in what form (contact, coil, comparison block, or operation block).



### Function keys

ZM

Calls up the cursor in the contact network displayed on the screen. The address of any graphic element (contact, coil, function block) can then be displayed by positioning the cursor in front of the element concerned.

In the case of a function block, pressing <ZM> a second time will display the parameters of the function block.

CLR

Causes the return to the previous display (if the cursor is absent), or removes the cursor if it is present.

↓

↑

When the cursor is absent, these keys can be used to display the next or previous contact network.

←

→

When the cursor is present, these keys can be used to move it anywhere on the screen, as required.

↓

↑

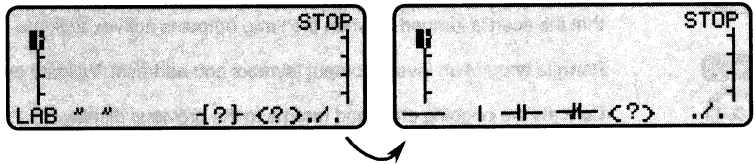


# 5. Program Mode - Ladder Language

## 5.3 Creating a Program in Ladder Language

If there is no program in the selected module (LAD or FST), the terminal is automatically in the creation (insertion) mode and the cursor is present on the screen. Each graphic element is entered by positioning the cursor and pressing the required soft key. In the case of contacts and coils, the address must then be entered and validated by <ENT>, a new symbol can then be entered.

### Entering a contact network



Permits entry of the label number of the contact network, validate the entry by <ENT>. **All contact networks must be labelled:** 1 to 999 for the Master task (LAD), and 1 to 200 for the Fast task (FST).



Permits entry of a comment (optional) of 15 characters max., validate by <ENT>.



Calls up the function block and operation block soft key menu.



Calls up the output coil soft key menu.



Enters a horizontal link.



Draws a vertical link downwards, or deletes it if the cursor is already on a vertical link.



Permits entry of a normally open input (graphic symbol and address), validate by <ENT>.










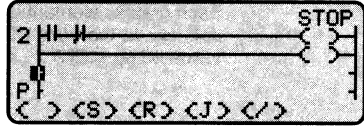
Permits entry of a normally closed input (graphic symbol and address), validate by <ENT>.

# 5. Program Mode - Ladder Language

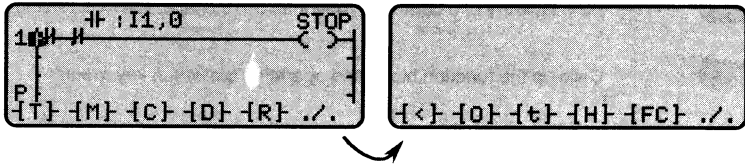
## Creating a Program in Ladder Language (Cont'd.)











### Entering an output coil

-  Permits entry of a direct output (symbol and address). Validate by <ENT>.
-  Permits entry of a latched (SET) output (symbol and address). Validate by <ENT>.
-  Permits entry of an unlatched (RESET) output (symbol and address). Validate by <ENT>.
-  Permits entry of a jump output (symbol and destination label of the contact network that the scan is jumped to when the jump output is active). Validate by <ENT>.
-  Permits entry of an inverse output (symbol and address). Validate by <ENT>.
-  Cancels the ongoing entry and returns to the previous display.
-  Must be pressed to validate a completed contact network.



### Entering a function block or operation block (see Sections 5.5 and 5.6)



-  Timer function block (3 lines deep).
-  Monostable function block (3 lines deep).
-  Counter function block (4 lines deep).
-  Drum controller function block (3 lines deep).
-  Register function block (3 lines deep).
-  Comparison operation block (1 line deep).
-  Compute and transfer operation block (1 line deep).
-  Text function block (4 lines deep).
-  Time/date function block (3 lines deep).
-  Fast counter/timer function block (4 lines deep). Available with TSX 17-20 micro-PLC fitted with software cartridge TSX TS4 50F only.

**Note:** Blocks 4 lines deep can be entered only on the 1st line of the contact network; blocks 3 lines deep can be entered on the 1st or 2nd line.

# 5. Program Mode - Ladder Language

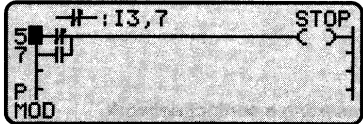
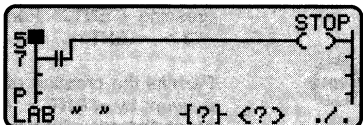
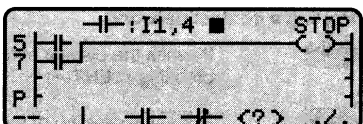
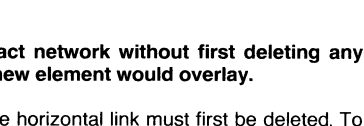
## 5.4 Modifying a Program in Ladder Language

Any part of a program that has been entered in memory can be displayed and modified by proceeding as follows:

### Selecting the mode, module and contact network

- PRG** Selects the Program mode.
- PRE** (For example) displays the first contact network in the selected program module (LAD - FST - PRE - or POS).
- LAB** Permits the display of the required contact network by entering its label number and pressing **<ENT>**. For example, to display contact network 53 press: **[LAB] <5> <3> <ENT>**.

### Modifying a contact network

- ZM** Calls up the cursor in the top left corner of the screen, and the soft key **[MOD]** appears on the bottom line.
 
- ←** **→**  
**↑** **↓** Position the cursor to the left of the element to be modified.
 
- MOD** Permits modification and calls up the Ladder diagram soft keys. Elements can now be added to the network (e.g. on line 3), but not deleted or inserted.
 
- SH** **INS** To delete an element (except vertical links - see below), press these 2 keys simultaneously. The deleted element can then be replaced by any other element of the same size.
 
- ENT** Must be pressed to validate the modified contact network.

### Inserting graphic elements

**Elements cannot be inserted in a contact network without first deleting any portion of the existing network that the new element would overlay.**

For example, to insert an input in a line, one horizontal link must first be deleted. To insert a function block in a line, **two** horizontal links must be deleted. Take care that the bottom of the block will not overlap the bottom of the network, otherwise it cannot be entered. Most function blocks are 3 lines deep and can be entered on the 1st or 2nd line, **but the Counter, Text, and Fast counter/timer function blocks are 4 lines deep and can be entered on the first line only.**

# 5. Program Mode - Ladder Language

## Modifying a Program in Ladder Language (Cont'd.)

---

### Modifying the address of an element

To modify the address of an element that has been entered in memory (input, output or function block), the associated graphic symbol must be deleted and then re-entered with the new address, otherwise the address cannot be modified.

### Modifying horizontal and vertical links

**Horizontal links** are entered by pressing the soft key **[--]** and are deleted by pressing **<SH>** and **<INS>** simultaneously, in the same way as for the inputs, outputs and blocks.

**For vertical links** the soft key **[I]** acts as a flip-flop: when pressed it will draw a vertical link downwards from the cursor; when pressed twice (without moving the cursor) it will delete the vertical link.

Consequently, vertical links cannot be deleted by pressing **<SH>** and **<INS>**. To delete a vertical link, place the cursor on the top of the link and press **[I]**.

### Inserting a contact network

The new contact network is inserted upstream of the one displayed on the screen:

**LAB**

Permits the display of the required contact network by entering its label number and pressing **<ENT>**. For example, to display contact network 53 press: **[LAB] <5> <3> <ENT>**.

**INS**

Permits the creation of a new contact network (see Section 5.3). Validate the new network by **<ENT>**. The terminal then returns to the read mode. To return to the Mode Selection Display, press **<QUIT>**.

### Deleting a contact network

**LAB**

Permits the display of the required contact network by entering its label number and pressing **<ENT>**.

**DEL**

Requests deletion of the contact network.

**YES**

Confirms and effectively deletes the contact network. The next contact network is then displayed.

**NO**

Cancels the deletion request.

# 5. Program Mode - Ladder Language

## 5.5 Function Blocks

---

### General

The function blocks offer the user a pre-programmed range of functions such as timing, counting, etc. They occupy a special zone in the memory of the CPU and are consequently limited in number.

Function blocks must be entered in the “Test zone” of the contact network, i.e. in the first nine columns of the network. This zone is normally reserved for testing input contacts, whereas the tenth column, known as the “Action zone” is reserved for outputs or operation blocks.

There are six types of function blocks available in the TSX 27, 47-J, 47-10 and 47-20:

- Timer,
- Monostable,
- Counter,
- Drum controller,
- Register,
- Text.

The TSX 17-20 micro-PLC, when fitted with the TS4 50E software cartridge, offers two additional types of function blocks:

- The Time/date block (or “H” block), which is not limited in number.
- The Fast counter/timer (or “FC” block), which is limited to one.

### Displaying function blocks

Each function block can be displayed in two ways:

- **In a contact network:** The function block is shown as rectangle two columns wide by 1, 2, 3 or 4 lines deep.
- **Enlarged:** By pressing the zoom key <ZM>, the function block can be enlarged to show all its different parameters which, initially, are given by default. Each parameter can then be modified by pressing the corresponding soft key.

### Rules for using function blocks

Each function block comprises inputs (e.g. E, C) and outputs (e.g. D, R). Each output is associated with an output bit (e.g. T6,D) which can be tested by the program. Each function block output can control one or more output coils, or another function block.

**At least one output of a function block must be connected, directly or indirectly with an output coil.**

In certain function blocks (Timer, Counter, Monostable) the user can modify the parameters in the Adjust mode.

# 5. Program Mode - Ladder Language

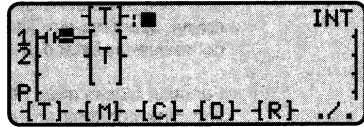
## Function Blocks (Cont'd.)

### Timer function block



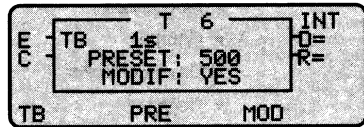
Permits entry of a Timer function block graphic symbol and number:

- T0 to T31 for the TSX 17-20,
- T0 to T15 for the TSX 27 and TSX 47-J, 47-10 and 47-20.



Displays the parameters of the function block.

**[TB]** Successive pressures on this key modify the time base:  
1mn, 1s, 100ms, 10ms  
(1mn by default)



**[PRE]** Permits modification of the preset value from 0 to 9999 (9999 by default).

**[MOD]** Authorizes or prohibits modification of the parameters in the Adjust mode (YES by default).

### Inputs and outputs

**E** : Enable input (on a falling edge, initializes the timer).

**C** : Control input (at state 1, runs the timer).

**D** : Done output (goes to 1 when the timer is done).

**R** : Running output (goes to 1 when the timer is running).

# 5. Program Mode - Ladder Language

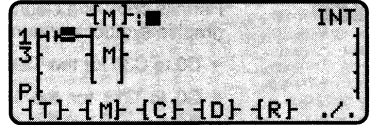
## Function Blocks (Cont'd.)

### Monostable function block



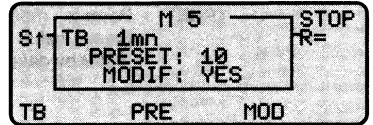
Permits entry of a Monostable function block graphic symbol and number:

- M0 to M7.



Displays the parameters of the function block.

- [TB]** Successive pressures on this key modify the time base:  
1mn, 1s, 100ms, 10ms  
(1mn by default)



- [PRE]** Permits modification of the preset value from 0 to 9999 (9999 by default).
- [MOD]** Authorizes or prohibits modification of the parameters in the Adjust mode (YES by default).

### Inputs and outputs

**S↑**: Start input (on a rising edge, initializes the monostable).

**R** : Running output.

# 5. Program Mode - Ladder Language

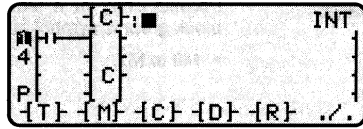
## Function Blocks (Cont'd.)

### Counter function block



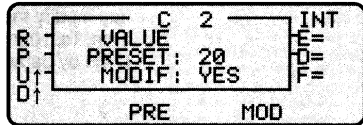
Permits entry of a Counter function block graphic symbol and number:

- C0 to C30 for the TSX 17-20,
- C0 to C15 for the TSX 27 and TSX 47-J, 47-10 and 47-20.



Displays the parameters of the function block.

**[PRE]** Permits modification of the preset value from 0 to 9999 (9999 by default).



**[MOD]** Authorizes or prohibits modification of the parameters in the Adjust mode (YES by default).

### Inputs and outputs

**R** : Reset input (at state 1, resets the current value to 0).

**P** : Preset input (at state 1, initializes the counter).

**U**↑: Upcount input (on a rising edge, increments the current value).

**D**↑: Downcount input (on a rising edge, decrements the current value).

**E** : Empty output (= 1 when a downcount overflows from 0 to 9999).

**D** : Done output (=1 when the counter is done).

**F** : Full output (=1 when an upcount overflows from 9999 to 0).



# 5. Program Mode - Ladder Language

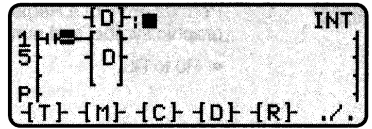
## Function Blocks (Cont'd.)

### Drum controller function block



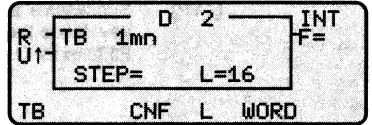
Permits entry of a Drum controller function block graphic symbol and number:

- D0 to D7.

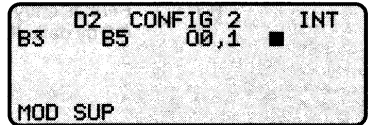


Displays the parameters of the function block.

**[TB]** Successive pressures on this key modify the time base: 1mn, 1s, 100ms, 10ms (1mn by default).



**[CNF]** Permits the configuration of the command bit addresses. The number of the column concerned is shown at the top of the screen after "CONFIG".

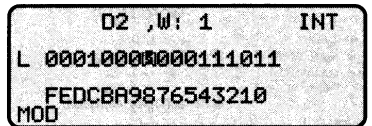


**[MOD]** Permits the entry or modification of the command bit address indicated by the cursor.

**[SUP]** Cancels the command bit indicated by the cursor.

**[L]** Permits entry of the number of drum steps: 1 to 16 (16 by default).

**[WORD]** Displays the states of the command bits of a step; the number of the step is shown at the top of the screen after "W".



<↑> <↓> Use these keys to display the required step.

**[MOD]** Permits modification of the bit indicated by the cursor (0 by default).

### Inputs and outputs

**R** : Reset input (resets the drum to step 0)

**U↑**: Advance input (on a rising edge, advances the drum by one step and updates the command bits).

**F** : Full output (current step = last step defined).

# 5. Program Mode - Ladder Language

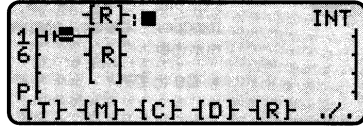
## Function Blocks (Cont'd.)

### Register function block



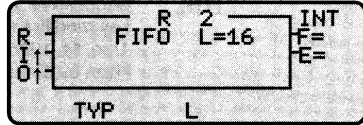
Permits entry of a Register function block graphic symbol and number:

- R0 to R3.



Displays the parameters of the function block.

**[TYP]** Successive pressures on this key define the type of register: FIFO or LIFO.



**[L]** Permits entry of the number of words of the register: 1 to 16 (16 by default).

### Inputs and outputs

**R** : Reset input (at state 1, initializes the register).

**I↑** : Storage input (on a rising edge, loads the contents of the input word Ri,I into the register).

**O↑** : Retrieval input (on a rising edge, loads the contents of a register word into output word Ri,O).

**F** : Full output.

**E** : Empty output.

# 5. Program Mode - Ladder Language

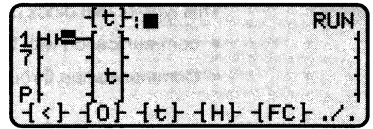
## Function Blocks (Cont'd.)

### Text function block



Permits entry of a Text function block graphic symbol and number:

- TXT0 to TXT7.

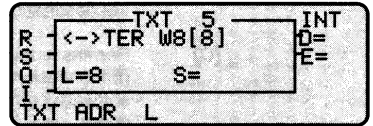


Displays the type and parameters of the function block.

### TER type text block:

This type of text block permits communication with peripherals through the programming port (terminal socket) on the front of the TSX 17-20, TSX 27 version V3.0 or later, and TSX 47-J/10/20.

**[ADR]** Permits entry of the address of the first word of the reception table and its length in bytes (between square brackets).



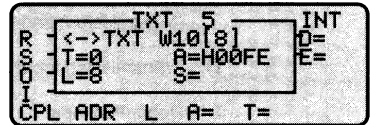
**[L]** Permits entry of the length in bytes of the transmission table.

**[TXT]** Permits access to the TXT type text block.

### TXT type text block:

This type of text block permits inter-PLC communication between the TSX 47-J, 47-10 and 47-20 10/20 through a Telway 7 network.

**[ADR]** Permits entry of the address of the first word of the reception table and its length in bytes (between square brackets).



**[L]** Permits entry of the length in bytes of the transmission table.

**[A]** Permits entry of the number of the destination station.

**[T]** Permits entry of the number of the destination text block.

**[CPL]** Permits access to the CPL type text block.

**[TXT]** Permits access to the TXT type text block.

# 5. Program Mode - Ladder Language

## Function Blocks (Cont'd.)

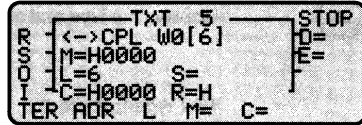
### CPL type text block:



This type of text block permits:

- communication with the intelligent modules in the TSX 47-20,
- Communication through the Uni-Telway bus in the TSX 17-20 micro-PLC.

**[ADR]** Permits entry of the address of the first word of the reception table and its length in bytes (between square brackets).



**[L]** Permits entry of the length in bytes of the transmission table.

**[M]** Permits entry of the address of the destination module, or the number of the destination station on the Uni-Telway bus.

**[C]** Permits entry of the request code which defines the task to executed (transmission of the software configuration of a module, reading of the software configuration, writing of a table, etc.). For the list of these request codes, refer to the user's manual of the intelligent module concerned.

**[TER]** Permits access to the TER type of text block.

### Inputs and outputs:

**R** : Reset input (at state 1, inhibits the Start input. If set to 1 during an exchange, the exchange is interrupted).

**S** : Start input (on a rising edge, starts the exchange as defined by inputs O (transmission) and I (reception)).

**O** : Transmission input (at state 1, sets the text block to the transmission mode).

**I** : Reception input (at state 1, sets the text block to the reception mode).

**D** : Done output.

**E** : Error output (at state 1, indicates that the exchange has been interrupted because of an error. The type of error is indicated by the status word TXTi,S).

**Note** : If inputs O and I are both set to 1, the text block is set to the "transmission then reception" mode.

# 5. Program Mode - Ladder Language

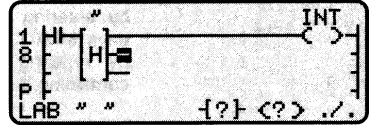
## Function Blocks (Cont'd.)

### Time/date function block (or "H" block)

This block is available only in the TSX 17-20 micro-PLC equipped with the TSX P17 20FB software cartridge.



Permits entry of an "H" block. In the write mode, the parameters of the block can then be entered. After validation by <ENT> the block is displayed as shown opposite.

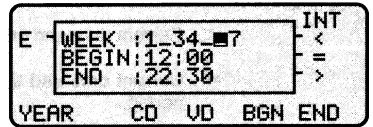


In the read mode, this key displays the parameters of the block indicated by the cursor.

**Note:** There are two types of "H" block, the WEEK type and the YEAR type. In both cases, the parameters to be entered can be either constant or variable. The constant parameters are defined by the user when the block is entered on the terminal. The variable parameters are entered as an internal word Wi whose contents are defined by the program.

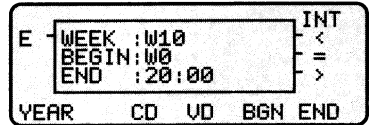
### WEEK type "H" block

**[CD]** Configures the days of the week as constant parameters. The days of the week are displayed (1234567: Monday = 1) and the cursor appears.



All the days of the week are activated by default. To deactivate a day, position the cursor on the day concerned and press **[CD]**. A day that is deactivated is shown by a space underlined (e.g. 123\_5\_7), and can be reactivated by pressing **[CD]** again.

**[VD]** Configures the days of the week as variable parameters. The cursor appears so that the word containing the selected days can be entered.



**[BGN]** Permits entry of the beginning of the active time period, which can be entered as a constant by entering the hours and minutes (HH:MM), or as a variable by entering the word (Wi) containing the required time.

**[END]** Permits entry of the end of the active time period, which can be entered as a constant or a variable as described above.

**[YEAR]** Permits access to the YEAR type "H" block.

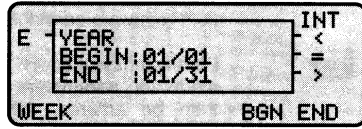
# 5. Program Mode - Ladder Language

## Function Blocks (Cont'd.)

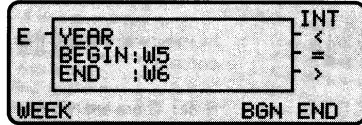
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### YEAR type "H" block

**[BGN]** Permits entry of the beginning of the active time period, which can be entered as a constant by entering the months and days (MM/DD), or as a variable by entering the word (W) containing the required date.



**[END]** Permits entry of the end of the active time period, which can be entered as a constant or a variable as described above.



**[WEEK]** Permits access to the WEEK type "H" block.

### Inputs and outputs

**E** : Enable input (at state 1, validates the "H" block)

**<**: Current date and time less than the beginning of the preset time/date period.

**=**: Current date and time between the beginning and end of the preset time/date period.

**>**: Current date and time more than the end of the preset time/date period.

## 5. Program Mode - Ladder Language

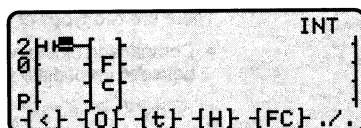
### Function Blocks (Cont'd.)

#### Fast timer/counter function block

This block is available only in the TSX 17-20 micro-PLC.

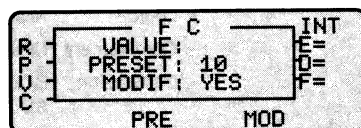


Permits entry of the fast timer/counter function block.



Permits entry of the parameters of the block.

**[PRE]** Permits modification of the preset value of the block from 0 to 9999 (9999 by default).



**[MOD]** Authorizes or prohibits modification of the parameters of the block in the Adjust mode (YES by default).

#### Inputs and outputs

**R** : Reset input (at state 1, resets the current value to 0).

**P** : Preset input (at state 1, permits loading of a new preset value by the program).

**V** : Read current value input (at state 1, permits reading of the current value by the program).

**C** : Control input (at state 1, validates the counter).

**E** : Empty output (goes to 1 when the hardware reset input on the front panel is at 1)

**D** : Done output (goes to 1 when the preset value is reached).

**F** : Full output (preset value not reached)

# 5. Program Mode - Ladder Language

## Operation Blocks

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### General

Unlike the function blocks, the operation blocks are not limited in number.

There are two types of operation blocks:

- Comparison blocks, which permit the following operations between 16-bit words, or between immediate values and 16-bit words:

<>, <, >, <=, >=, =.

- Compute and transfer blocks, which permit the following operations:

- Arithmetic : +, -, \*, /, REM (remainder).
- Logic : AND, OR, XOR (exclusive OR).
- Complement : CPL
- Conversion : BCD to binary, or binary to BCD  
ASCII to binary, or binary to ASCII.
- Shift : Circular left or right.
- Transfer : Bit strings to words and vice versa.

### Displaying operation blocks

Each operation block can be displayed in two ways:

- **In a contact network:** The operation block is shown as rectangle 1 line deep, which is located in the Test zone for comparison blocks and in the Action zone for compute and transfer blocks.
- **Enlarged:** By pressing the zoom key <ZM>, the operation block can be enlarged to show its parameters which can then be modified by pressing the corresponding soft key.

The immediate values can be entered in the following codes:

- Binary : L'0000100111100100'
- Hexadecimal : H'09E4'
- Message : M'...'
- Decimal (the code by default) : 2532. This value must be between -32768 and +32767 (the maximum values on 16 bits).



# 5. Program Mode - Ladder Language

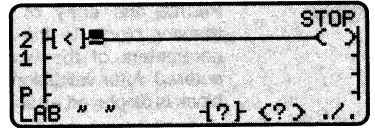
## Operation Blocks (Cont'd.)

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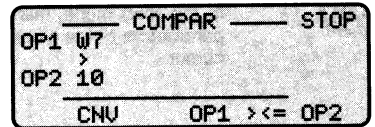
### Comparison operation block



Permits the entry of a comparison block. In the write mode, the parameters of the block can then be entered. After validation by <ENT> the block is displayed as shown opposite.



In the read mode, this key displays the parameters of the block indicated by the cursor.



**[CNU]** Successive pressures on this key display the immediate value of the 2nd operand in binary, hexadecimal, message, and decimal.

**[OP1]** Permits the entry or modification of the 1st operand (which can be any word object).

**[><=]** Successive pressures on this key permit selection of the type of comparison required: <>, >, <, >=, <=, and =.

**[OP2]** Permits the entry or modification of the 2nd operand (which can be any word object, or an immediate value).

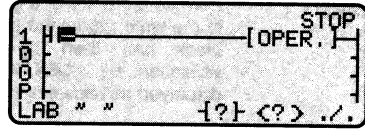
# 5. Program Mode - Ladder Language

## Operation Blocks (Cont'd.)

### Compute and transfer block

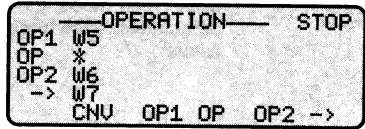
**{0}**

Permits the entry of a compute and transfer block. In the write mode, the parameters of the block can then be entered. After validation by <ENT> the block is displayed as shown opposite.



**ZM**

In the read mode, this key displays the parameters of the block indicated by the cursor.



**[CNV]** Successive pressures on this key display the immediate value of the 2nd operand in binary, hexadecimal, message, and decimal.

**[OP1]** Permits the entry or modification of the 1st operand (which can be any word object).

**[OP]** Permits the entry of the type of operation to be performed:

- Arithmetic : +, -, \*, /, REM (remainder),
- Logic : AND, OR, XOR (exclusive OR),
- Complement : CPL
- Conversion of words : BIN, BCD, BTA, ATB
- Circular shifts : SRC, SLC.

**[OP2]** Permits the entry or modification of the 2nd operand (which can be any word object, or an immediate value).

**[→]** Permits entry of the address of the word in which the result of the operation will be stored, or in which the contents of OP2 will be stored in the case of simple transfer.

The types of words that can be used to receive the result or transfer are as follows:

- Internal words : Wi
- Common words : COMi,j
- Function block preset words : e.g. Ti,P
- Output register words : OWxy,i

## 5. Program Mode - Ladder Language

### Operation Blocks (Cont'd.)

#### Using the parameters

Operation	OP1	OP	OP2	→
Arithmetic	any word	+, -, *, /, REM	any word or immediate value	any word except CW
Logic	any word	AND OR XOR	any word or immediate value	any word except CW
Complement		CPL	any word or immediate value	any word except CW
Conversion		BIN, BCD BTA, ATB	any word (1)	any word except CW
Circular shift		SLCn (2) SLDn (2)	any word	any word except CW
Transfer			(3)	(3)

(1) Address of the 1st of the 3 words to be converted (Wi, CWi, or COMi,j) if OP = ATB (conversion from ASCII to Binary).

(2) n = the number of bits to be shifted (n < 16).

(3) See the table below :

OP2 (source)	→ (destination)
<ul style="list-style-type: none"> <li>• Immediate value</li> <li>• String of 16 bits</li> <li>• Word</li> <li>• Indexed word</li> </ul>	<ul style="list-style-type: none"> <li>• String of 16 bits</li> <li>• Word</li> <li>• Indexed word</li> </ul>
<ul style="list-style-type: none"> <li>• Immediate value Vi</li> </ul>	<ul style="list-style-type: none"> <li>• String of n bits (<math>V_i \leq 2n</math>)</li> </ul>
<ul style="list-style-type: none"> <li>• String of n bits</li> </ul>	<ul style="list-style-type: none"> <li>• String of m bits (n = m)</li> </ul>
<ul style="list-style-type: none"> <li>• Table of n words</li> </ul>	<ul style="list-style-type: none"> <li>• Table of m words (n = m)</li> </ul>

# 5. Program Mode - Ladder Language

Notes

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# 6. Program Mode - Grafcet Language

## 6.1 Access to Programming in Grafcet Language

The choice of programming language is made during the initialization of the memory (by pressing <LAD> or <SEQ>). The choice of sequential processing (SEQ) permits programming in Grafcet language. If the program already exists, the correct language is chosen automatically (see Section 5.1).

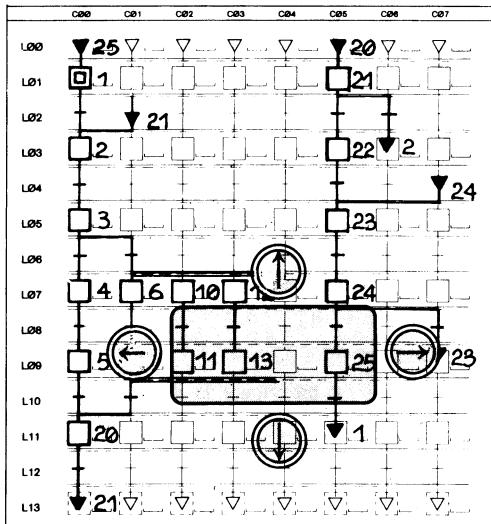
### Grafcet programming summary

A Grafcet chart is composed of a sequence of steps and transitions that can be written on one or more Grafcet pages (P0 to P7). Several charts can be written on one Grafcet page.

A Grafcet page is composed of 14 lines of 8 columns.

The continuation from one page to another must be indicated by connectors. Each source connector must have a destination connector and vice versa.

The programming elements (steps, transitions and connectors) are limited in number as follows:

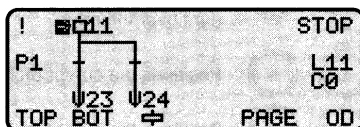


- Steps : 96 max. (0 to 95) of which 16 can be initial steps,
- Transitions : 128 max. of which 24 can be active simultaneously,
- Connectors : 42 max. (0 to 41).

### Grafcet screen

During program reading and writing, the LCD screen of the TSX T407 terminal acts as a "window" which can be moved over a Grafcet page by using the cursor control keys and which displays an area 4 columns wide by 3 lines deep (as outlined on the Grafcet page shown above).

As the screen moves over the page, it displays the page number on the left (P1), and the line (L11) and column (C0) on which the cursor is located on the right.



# 6. Program Mode - Grafcet Language

## 6.2 Reading a Program in Grafcet Language

After selecting the Sequential program module (SEQ), if a program already exists in the module, the first page containing a Grafcet chart is displayed. The whole of the program can then be read by using the cursor control keys to move the "window" represented by the LCD screen over the pages, and by using the following keys.

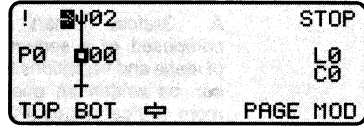
### Soft keys



Displays the first page containing a Grafcet chart.



Displays the last page containing a Grafcet chart.



Permits entry of a specific step number and, when <ENT> is pressed, displays the specific step.



Permits entry of a specific page number and, when <ENT> is pressed, displays the specific page.

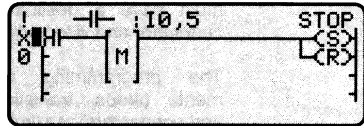


Permits modification of the various elements of the Grafcet chart.

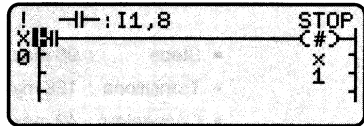
### Function keys



If the cursor is positioned on a step, pressing this key displays the associated contact network (action).



If the cursor is positioned on a transition, pressing this key displays the associated contact network (condition).



If a contact network is displayed (action or condition), pressing this key returns to the Grafcet chart.

If a Grafcet chart is displayed, pressing this key returns to the previous menu (Grafcet module selection: PRE, POS, FST, SEQ).



Moves the cursor up or down within the window, and then moves the window up or down over the page.



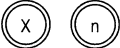
Moves the cursor left or right within the window, and then moves the window left or right over the page.



Positions the cursor on line n.



Positions the cursor on column n.



Positions the cursor on step n.



Displays the page number.

# 6. Program Mode - Grafcet Language

## 6.3 Creating a Program in Grafcet Language

If there is no program in the Sequential program module (SEQ), the cursor is automatically positioned at the top of page 0 so that a Grafcet chart can be entered.

As all charts must start with a source connector, only the connector soft key is displayed [↓]. As soon as the source connector has been entered, the cursor descends to the next line and the appropriate soft keys are displayed.

### Entering a Grafcet chart



Permits entry of a step (when the cursor is on an odd numbered line).  
Validate by <ENT>.



Enters a transition (when the cursor is on an even numbered line).



Permits entry of a source or destination connector. Validate by <ENT>.



Draws a vertical link downwards.



Permits entry of the start or end of a sequence selection by calling up the 2 soft keys below:



Enters the start or end of a sequence selection to the right.



Enters the start or end of a sequence selection to the left.

**Note:** The transitions at the start or end of a sequence selection are limited to 4 max. To prevent them from being cleared simultaneously, their conditions should be exclusive.



Permits entry of the start or end of a simultaneous activation of steps by calling up the 2 soft keys below:



Enters the start or end of a simultaneous activation of steps to the right.

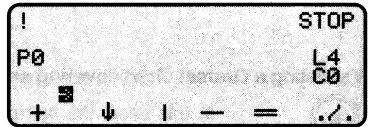
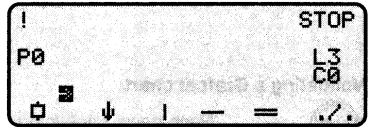


Enters the start or end of a simultaneous activation of steps to the left.

**Note:** The number of steps that can be simultaneously activated or deactivated is limited to 4 max.



Calls up two more soft keys, described on the next page.



# 6. Program Mode - Grafcet Language

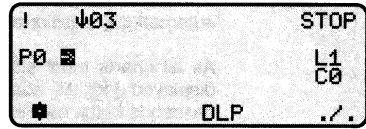
## 6.3 Creating a Program in Grafcet Language (Cont'd.)



Permits the entry of an initial step.



Deletes all the contents of the Grafcet page whose number is shown on the left of the screen (P0 to P7).



Each step must be numbered, from 0 to 95.

Each destination connector must be numbered with the number of the destination step that the control flowpath is going to (0 to 95).

Each source connector must be numbered with the with number of the source step that the control flowpath is coming from (0 to 95).

### Validating a Grafcet chart



Each page containing one or more Grafcet charts must be validated. The terminal then checks whether each chart can be executed and if not indicates the type of error.

### Validating a Grafcet chart covering several pages



In this case, the last page of the chart must be validated first. The terminal then displays the message "Remaining pages not val." and displays the previous page so that the remaining pages can be validated in inverse order of entry.

### Entering an action



When the cursor is positioned on a step, pressing this this key permits entry of the action contact network associated with the step, which is automatically labelled with the number of the step (Xn).

A maximum of 4 actions can be written in this contact network, but only the SET and RESET output coils can be used. For details of entering contact networks, refer to Section 5.

The action contact network can be entered immediately after the step symbol has been entered, or after the whole chart has been entered.

### Entering a transition condition



When the cursor is positioned on a transition, pressing this this key permits entry of the condition contact network associated with the transition.

The output coil (#) which automatically appears in the action zone symbolizes the transition from one step to another. No other kind of output can be used. However, the test zone must be completed, since a transition condition that is not entered is never cleared. For details of entering contact networks, refer to Section 5.

The condition contact network can be entered immediately after the transition symbol has been entered, or after the whole chart has been entered.



# 6. Program Mode - Grafcet Language

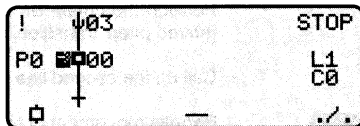
## 6.3 Modifying a Program in Grafcet Language

### Deleting an element and its contents



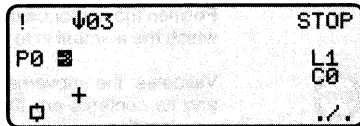
Position the cursor on the element to be deleted (step, transition, connector).

Press these 2 keys simultaneously to delete the graphic element and its contents.



Enter a new element in place of the old one.

Validates the modified chart.



### Deleting part of a single horizontal line (sequence selection)

Position the cursor below and to the left or right of the element to be deleted.



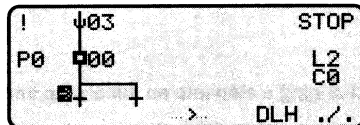
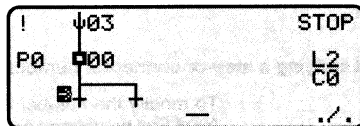
Permits deletion.



Deletes the element to the right.



Deletes the element to the left.



### Deleting part of double horizontal line (simultaneous activation)

Position the cursor below and to the left or right of the element to be deleted.



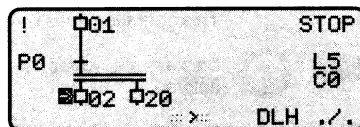
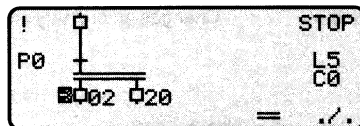
Permits deletion.



Deletes the element to the right.



Deletes the element to the left.



### Deleting all of a single or double line (sequence selection or activation)

Position the cursor below and to the left or right of the element to be deleted.



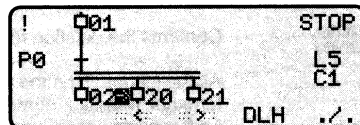
Permits deletion of a single line.



Permits deletion of a double line.



Deletes the whole of the single or double line.



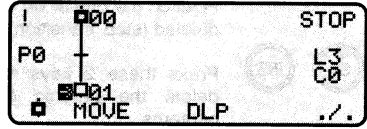
# 6. Program Mode - Grafcet Language

## Modifying a Program in Grafcet Language (Cont'd.)

### Moving an element and its contents on the same page

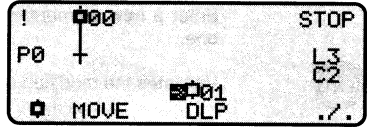
Position the cursor on the element to be moved (step, transition, connector).

Call up the second line of soft keys.



Permits movement of the element.

Position the cursor on the new location to which the element is to be moved.



Validates the movement. The element and its contents are then moved to the new location.

Note: If it is not possible to insert the element in its new location, the message "impossible here" appears. The cursor must then be moved to a suitable position before the element can be moved.

### Modifying a step or connector number

To modify the number associated with an element (step or connector), the element must first be deleted and then reentered with its new number.

### Changing a step into an initial step and vice versa

It is not necessary to reenter the step:



Changes an initial step into an ordinary step.



Changes an ordinary step into an initial step.

### Deleting the contents of a page

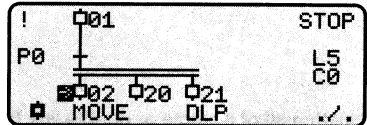
This operation does not modify the contents of the other pages.



Displays the cursor in the page to be deleted.



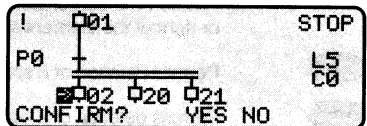
Permits modification. Then call up the next line of soft keys.



Deletes the contents of the page.



Confirms the deletion request.



All the elements on the page are deleted, together with their contents (step actions and transition conditions).

# 7. Terminal Mode

## 7.1 Presentation of the Mode

---

The Terminal mode enables the operator to:

- Select the connection mode of the TSX T407 1 terminal (Local or On line).
- Configure the peripheral data link of the TSX T407 1 terminal,
- Use the terminal as an operator dialogue unit to exchange messages and data with an automated system controlled by a TSX Series 7 PLC (Text function).

### Accessing the Terminal mode

**TER**

Accesses the mode and displays the following soft keys:

**[CNX]** Permits selection of the connection mode of the TSX T407 1 terminal:



```
                TERMINAL      INT
CONN. : on line
CART  : TS4 50E V1.0
T407  : V3.2
RAM   : 32 K
CNX   : LIN QLF TXT
```

- On line: the working memory is the user memory in the PLC,
- Local: the working memory is the internal memory of the terminal.

**[LIN]** Permits configuration of the peripheral data link.

**[QLF]** Reserved for the use of Telemecanique service personnel.

**[TXT]** Access the Text function (see Section 7.3).

This screen also displays the following information:

**CONN.** : Type of connection (Local or On line),

**CART** : Type of language cartridge in the terminal:

- TSX TS4 50E for the TSX 17-20 micro-PLC,
- TSX TS4 20E or 21E for the TSX 27, 47-J, 47-10 and 47-20.

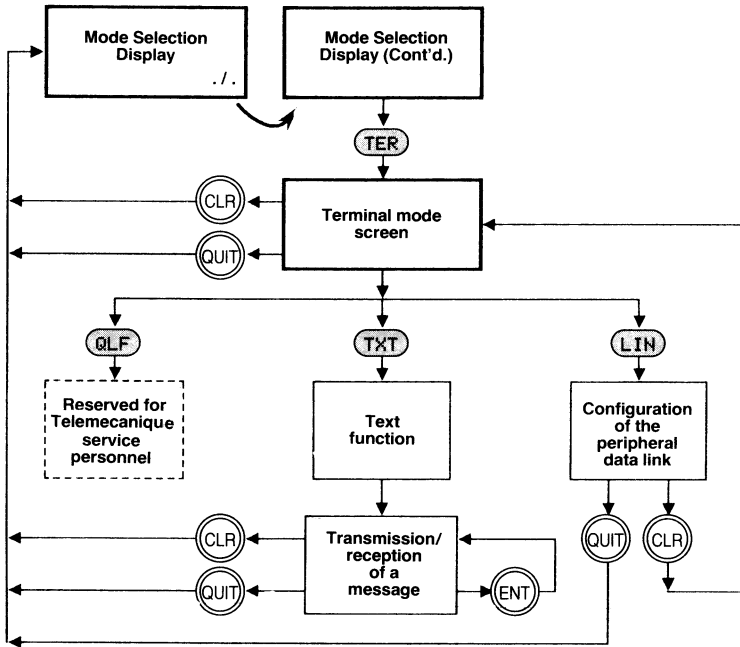
**T407** : Indicates the software version of the terminal.

**RAM** : Indicates the size configured for the internal RAM memory of the terminal (8, 16 or 32 bytes - see Section 4.3).

# 7. Terminal Mode

## Presentation of the Mode (Cont'd.)

Terminal mode flowchart



## 7.2 Configuring the Peripheral Link

**LIN**

Permits configuration of the serial data link of the terminal.

### Peripheral line

**[BAU]** Defines the baud rate:  
75/300/600/900/1200/2400  
/4800/9600 or 19200.

```

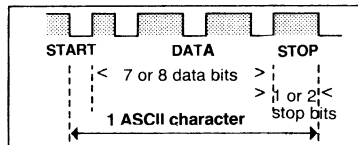
    PERIPHERAL LINE INT
    BAUD RATE : 300
    PARITY : NO
    STOP BITS : 1
    DATA : 8 BITS
    BAU PAR STO DAT
  
```

**[PAR]** Defines the parity: Odd, Even or None.

**[STO]** Defines the number of stop bits: 1 or 2.

**[DAT]** Defines the number of data bits: 7 or 8.

The transmission format of a character on the serial data line is as follows:



# 7. Terminal Mode

## Configuring the Peripheral Link (Cont'd.)

---

The start bit is always a single bit. The number of stop bits (1 or 2) and the number of data bits (7 or 8) must be configured according to the characteristics of the peripheral.

The type of parity check is optional. The baud rate defined for the TSX T407 terminal must be the same as that of the peripheral to which it is connected.

### PLC line

The serial data line connecting the terminal to the PLC is automatically configured as soon as the terminal is connected to a TSX Series 7 PLC. The maximum transmission speed on this line is 9600 baud.

---

## 7.3 Text Function

---

**TXT**

Enables the TSX T407 to be used as an operator dialogue terminal for the transmission and reception of messages.

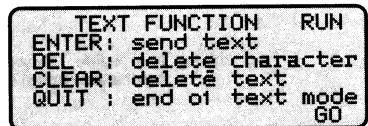
**[GO]** Displays a blank screen for the entry or reception of a message.

**<ENT>** Transmits the message to the PLC and then clears the screen ready for the next message.

**<SH> <INS>** Pressed simultaneously, deletes a character.

**<CLR>** Clears the screen.

**<QUIT>** Quits the Text function and calls up the Mode Selection Display.



```
TEXT FUNCTION RUN
ENTER: send text
DEL : delete character
CLEAR: delete text
QUIT : end of text mode
GO
```

### Transmitting a message

Use the alphabetic keys to enter the message. The size of the message is limited to one line of the screen, i.e. 24 ASCII characters. Longer messages must be divided into several sections of 24 ASCII characters each.

After entering the message, press **<ENT>** to transmit the message to the PLC. The PLC must be ready to receive the message in a Text function block configured for reception. The message is read asynchronously by the PLC during the execution of the program.

# 7. Terminal Mode

## Text Function (Cont'd.)

---

### Receiving a message

The terminal can also receive a message from the PLC for the purpose of displaying information to the machine operator. The user program transmits these messages to the terminal by using a Text function block configured for transmission.

The following control characters can be used:

**DEL**(FF):

Clears the screen and positions the cursor in the top left corner.

**BS**(08), **HT**(09), **LF**(0A), **VT**(0B):

Moves the cursor one space up or down, left or right (equivalent to the cursor control keys < → > < ← > < ↑ > < ↓ > ).

**BELL**(07):

Sounds a bell.

**TAPE ON**(12):

Opens the data link between the terminal and a peripheral.

**TAPE OFF**(14):

Closes the data link between the terminal and a peripheral.

**Note:** The value shown between brackets is the hexadecimal code of the associated control character.

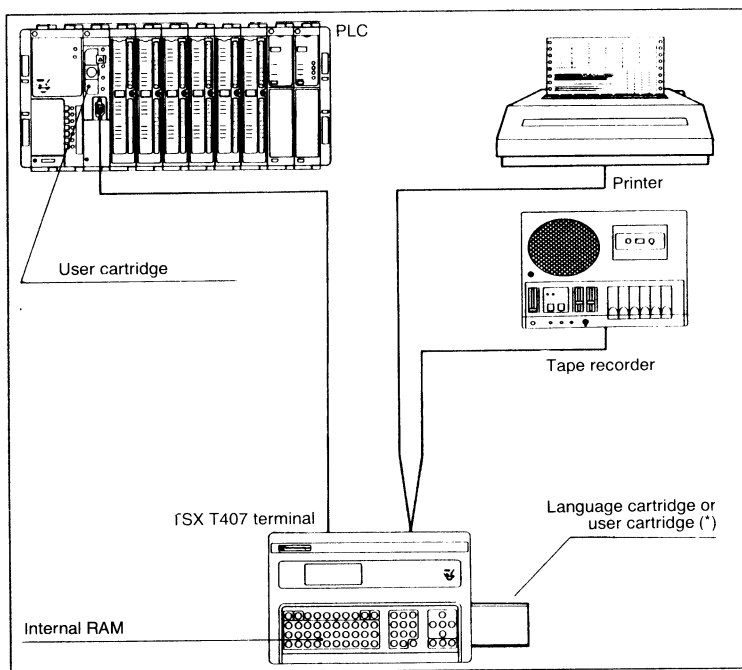
# 8. Transfer Mode

## 8.1 Presentation of the Mode

This mode enables the operator to copy the contents of a source memory to a destination memory. The following transfers are permitted:

- The RAM memory (PLC or Terminal) ↔ a cartridge in the terminal.
- The RAM memory (PLC or Terminal) ↔ a tape recorder.
- The RAM memory (PLC or Terminal) → a printer.
- The RAM memory in the PLC ↔ a cartridge in the terminal.
- The RAM memory in the PLC ↔ the RAM memory of the terminal.

For TSX 27, 47-J, 47-10 or 47-20, if the destination cartridge is an EPROM, it must be inserted in the terminal.



(\*) To insert a user cartridge for the TSX 17 micro-PLC, the cartridge must be mounted on the TSX 17 ACC 6 cartridge adapter.

### Accessing the transfer mode

**TRF**

Gives access to the Transfer mode. The first menu then appears, which permits the definition of the source memory (as described overleaf).

# 8. Transfer Mode

## Presentation of the Mode (Cont'd.)

---

### Definition of the source memory

#### TSX 17-20 micro-PLC

[CAR] EPROM user cartridge in the terminal (mounted on the TSX 17 ACC6 cartridge adapter).

[TSX] Internal RAM memory of the TSX 17-20 micro-PLC.

[INT] Internal RAM memory of the terminal.

[V24] Tape recorder equipped with a V24 (RS232C) connector.

[PRM] User cartridge (EPROM or EEPROM) in the TSX 17-20.

```
TRANSFERT          STOP
SOURCE?
CAR:T407 cartridge
TSX:TSX Prog. contr.
INT:T407 internal ram
CAR TSX INT V24 PR
```

#### TSX 27/47-J/47-10/20

[CAR] User cartridge in the terminal.

[PC] User cartridge in the PLC.

[INT] Internal memory of the terminal.

[TAP] Tape recorder equipped with a V24 (RS232C) connector.

```
TRANSFERT          RUN
SOURCE?
CAR:cartridge
PC :Prog. contr.
INT:internal ram
CAR PC INT TAP
```

### Definition of the destination memory

After the source memory has been defined, the menu below appears permitting the definition of the destination memory.

#### TSX 17-20 micro-PLC

[CAR] EPROM user cartridge in the terminal (mounted on the TSX 17 ACC6 cartridge adapter).

[TSX] Internal RAM memory of the TSX 17-20 micro-PLC.

[INT] Internal RAM memory of the terminal.

[V24] Tape recorder equipped with a V24 (RS232C) connector.

[PRM] User cartridge (EPROM or EEPROM) in the TSX 17-20.

[PRT] Printer.

```
TRANSFERT          STOP
CAR --> DEST.?
V24:tape
PRM:TSX cartridge
PRT:printer
CAR TSX INT V24 PRM PRT
```



# 8. Transfer Mode

## Presentation of the Mode (Cont'd.)

**TSX 27/47-J/47-10/20**

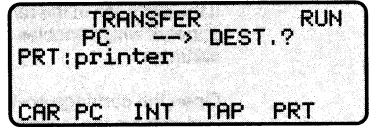
**[CAR]** User cartridge in the terminal.

**[PC]** User cartridge in the PLC.

**[INT]** Internal memory of the terminal.

**[TAP]** Tape recorder equipped with a V24 (RS232C) connector.

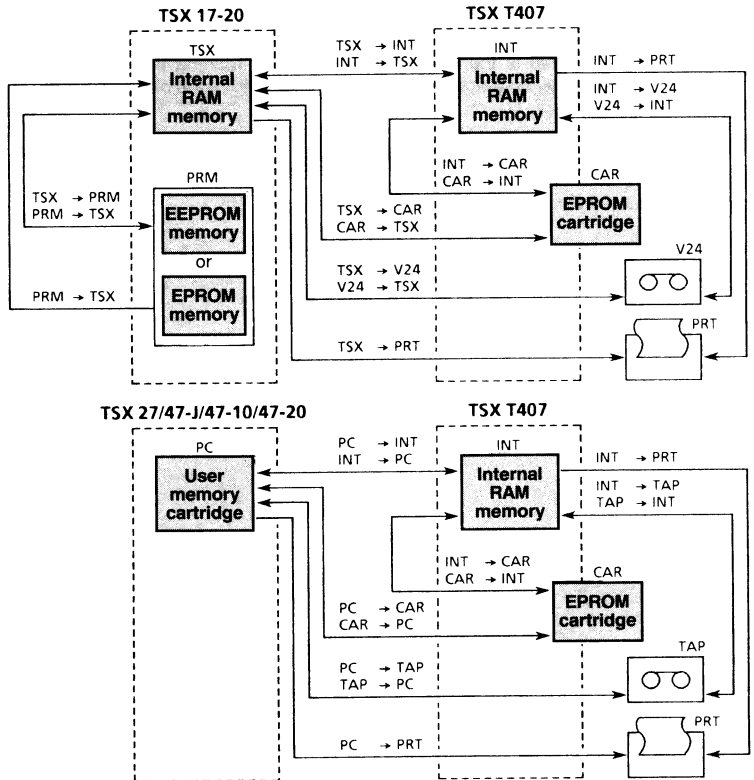
**[PRT]** Printer.



If the destination memory is the cartridge in the TSX 27/47-J/47-10/20 or the internal RAM of the TSX 17-20, the PLC must be stopped. (If it is running, a menu appears with a STOP key so that it can be stopped).

**CAUTION: The TSX 17 ACC6 adapter can only receive EPROM cartridges, erasable by UV light.**

### Transfer mode flowchart



# 8. Transfer Mode

## Presentation of the Mode (Cont'd.)

---

### Changing the cartridge in the terminal

If the cartridge in the terminal is defined as the source or destination memory, a menu appears which enables the language cartridge in the terminal to be replaced by a user cartridge.

Open the cartridge cover on the terminal and remove the language cartridge.

Then insert the user cartridge and close the cover.

```
TRANSFER      STOP
CAR -->       TSX  CPY
ABO:abort
* change cart.
ABO      GO
```

**[ABO]** Cancels an ongoing transfer. Reinstall the language cartridge to go to another operating mode.

```
TRANSFER      STOP
CAR -->       TSX  CPY
ABO:abort
ABO      GO
```

**[GO]** Starts the transfer. The message "please wait" appears.

If the transfer is correct, the end of the transfer is indicated by the message "finished". If it is not correct, an error message appears indicating the type of fault.

When the transfer is finished, reinstall the language cartridge in the terminal. The terminal is then reinitialized and, after running the self-tests, the Mode Selection Display appears so that another operating mode can be selected.

# 8. Transfer Mode

## 8.2 Executing the Different Transfers

### Transfers to or from the user cartridge in the terminal

TSX 17-20: CAR ↔ TSX or CAR ↔ INT

- CAR
- TSX
- INT

Selects the source memory.  
Selects the destination memory.

```
TRANSFER          STOP  
TSX --> CAR      TYPE ?  
CPY :copy         + PROT  
VFY :verifying  
PROT:protection  
CPY VFY PROT
```

Select one of the following operations:

**[CPY]** Copies the source memory into the destination memory and verifies that the two memories are identical.

**[VFY]** Simply verifies that the two memories are identical (without making a transfer).

After selecting one of these two operations, remove the language cartridge from the terminal, install the user cartridge (using the TSX 17 ACC6 adapter) and then press **[GO]** to execute the operation.

**[PROT]** In the case of a TSX → CAR transfer, this key can be used **before pressing [GO]** to protect the destination cartridge. Once the cartridge is protected, it cannot be read, written or transferred. Only the parameters are accessible in the Adjust mode.

**Note:** If the user also wants to protect the internal RAM of the TSX, a CAR →TSX transfer must be made after the TSX → CAR transfer.

TSX 27/47-J/47-10/20: CAR ↔ PC or CAR ↔ INT

- CAR
- PC
- INT

Selects the source memory.  
Selects the destination memory.

```
TRANSFER          STOP  
CAR --> PC        TYP?  
CPY:copy  
VFY:verifying  
CPY VRF
```

Select one of the following operations:

**[CPY]** Copies the source memory into the destination memory and verifies that the two memories are identical.

**[VFY]** Simply verifies that the two memories are identical (without making a transfer).

After selecting one of these two operations, remove the language cartridge from the terminal, install the user cartridge, and then press **[GO]** to execute the operation.

# 8. Transfer Mode

## Executing the Different Transfers (Cont'd.)

Transfer between two internal RAM memories or between an internal RAM and the user cartridge in the PLC

TSX 17-20: TSX ↔ INT or TSX ↔ PRM

TSX

INT

PRM

Select the source memory.

Select the destination memory.

```
TRANSFER          STOP
PC  -->  PRM TYPE ?
CPY :copy
VFY :verifying
PROT:protection
CPY VFY PROT
```

Select one of the following operations:

**[CPY]** Copies the source memory into the destination memory and verifies that the two memories are identical.

**[VFY]** Simply verifies that the two memories are identical (without making a transfer).

After selecting one of these two operations, press **[GO]** to execute the operation.

**[PROT]** In the case of a TSX → PRM transfer, this key can be used **before pressing [GO]** to protect the destination cartridge. Once the cartridge is protected, it cannot be read, written or transferred. Only the parameters are accessible in the Adjust mode.

TSX 27/47-J/47-10/20: PC ↔ INT

PC

INT

Select the source memory.

Select the destination memory.

```
TRANSFER          STOP
PC  -->  INT  TYP?
CPY:copy
VFY:verifying
CPY VRF
```

Select one of the following operations:

**[CPY]** Copies the source memory into the destination memory and verifies that the two memories are identical.

**[VFY]** Simply verifies that the two memories are identical (without making a transfer).

After selecting one of these two operations, press **[GO]** to execute the operation.

# 8. Transfer Mode

## Executing the Different Transfers (Cont'd.)

### Transfer to a tape recorder

TSX 17-20 micro-PLC : TSX → V24 or INT → V24

TSX 27/47-J/47-10/20: PC → TAP or INT → TAP

(TSX) (PC)  
(INT)  
(U24) (TAP)

Select the source memory.

Select the destination memory.

```

TRANSFER          STOP
INT -->  U24  TYPE ?
CPY :copy
UFY :verifying
PROT:protection
CPY UFY PROT
    
```

**[CPY]** Permits the transfer of the source memory to tape.

Enter the name of the program (16 characters max.) and press <ENT>.

```

TRANSFER          STOP
INT -->  U24  CPY
program name :
█
CPY UFY PROT
    
```

Set the tape recorder to record and press **[GO]**. To cancel the recording, press **[ABO]**.

```

TRANSFER          STOP
INT -->  U24  CPY
ABO:abort
GO :tape ready ?
ABO GO
    
```

### Transfer from a tape recorder

TSX 17-20 micro-PLC : V24 → TSX or V24 → INT

TSX 27/47-J/47-10/20: TAP → PC or TAP → INT

(U24) (TAP)  
(TSX) (PC)  
(INT)

Select the source memory.

Select the destination memory.

```

TRANSFER          STOP
TAP -->  PC  TYP?
CPY:copy
UFY:verifying
CPY URF
    
```

**[CPY]** Permits the transfer of the tape to the destination memory.

Set the tape recorder to playback and press **[GO]**. To cancel the playback, press **[ABO]**.

```

TRANSFER          STOP
TAP -->  PC  CPY
ABO:abort
GO :tape ready ?
ABO GO
    
```

# 8. Transfer Mode

## Executing the Different Transfers (Cont'd.)

### Transfer to a printer

TSX 17-20 micro-PLC : TSX → PRT or INT → PRT  
 TSX 27/47-J/47-10/20 : PC → PRT or INT → PRT

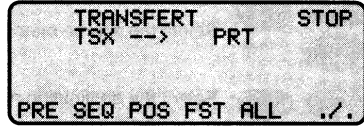
**TSX** **PC**

**INT**

Select the source memory.

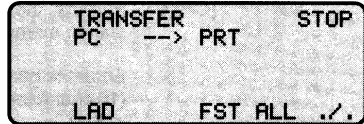
**U24** **TAP**

Select the destination (printer).



The following soft keys are displayed :

**[LAD]** Permits printing of the Master task.



**[FST]** Permits printing of the Fast task.

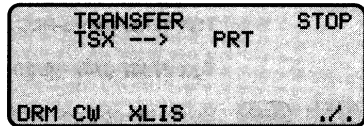
**[PRE]** Permits printing of the Pre-processing module.

**[SEQ]** Permits printing of the Sequential (Grafcet) module.

**[POS]** Permits printing of the Post-processing module.

**[ALL]** Permits printing of all of the program.

**[DRM]** Permits printing of the configurations of the drum controllers.

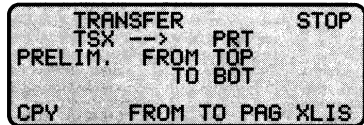


**[CW]** Permits printing of the contents of constant words.

**[XLIS]** Permits printing of the list of variables used.

The selection of **LAD, FST, PRE, SEQ or POS** calls up the following soft keys :

**[FROM]** Permits entry of the label number at which printing is to start.



**[TO]** Permits entry of the label number at which printing is to end.

**[XLIS]** Permits printing of the list of variables used in the selected module.

In all cases, the following two keys can be used :

**[CPY]** Starts the printout without pagination.

**[PAG]** Starts the printout with pagination of the printed document.

# 9. Adjust Mode

## 9.1 Presentation of the Mode

---

### General

This mode enables the operator to modify the values of the data objects in the program. It does not permit any modification of the program itself, but allows adjustments to be made to the operation of the automated system by modifying the data. The Adjustment mode enables the operator to:

- Display, modify and force I/O bits and certain system bits,
- Display and modify the contents of internal words, register words and function block parameters,
- Display constant words and Telway 7 common words (the number and contents of constant words can be modified in the Program mode - see Section 4.4).
- Display the active times of Grafcet steps.
- Display and modify the current time and date of the real-time clock available in the TSX 17-20 equipped with the TSX PA 20 FB optional software cartridge.

### Accessing the mode

**ADJ**

Gives access to the mode and displays the following soft keys:

**[BIT]** Permits modification and forcing of bits.

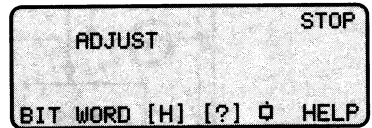
**[WORD]** Permits modification of words (except constant words).

**[H]** Permits modification of the real-time clock (TSX 17-20 only).

**[?]** Permits modification of function blocks.

**[□]** Permits display of the active times of Grafcet steps.

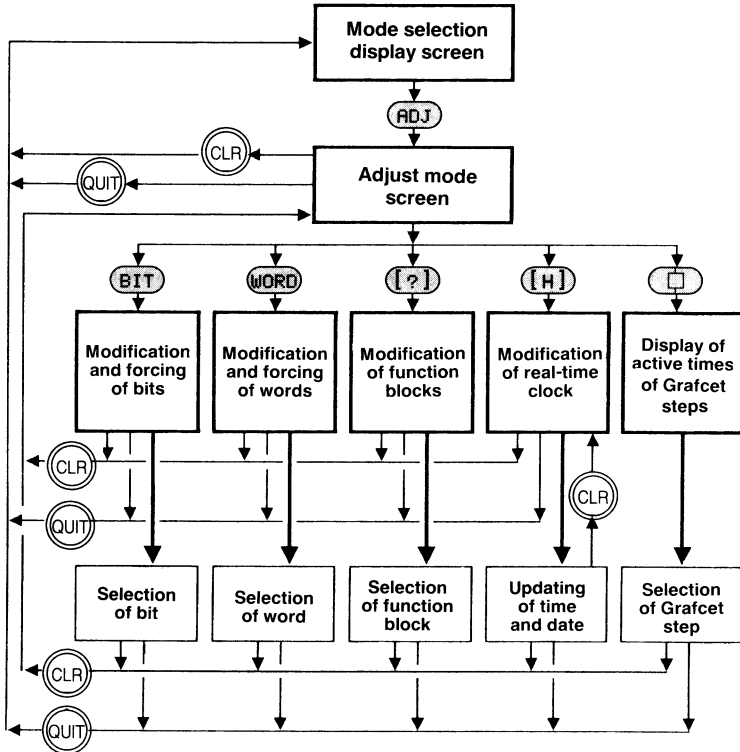
**[HELP]** Displays the functions of the soft keys.



# 9. Adjust Mode

## Presentation of the Mode (Cont'd.)

Adjust mode flowchart



## 9.2 Modifying and Forcing Bits

**[BIT]** Permits the modification and forcing of bits.

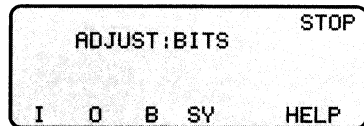
**[I]** Inputs bits.

**[O]** Output bits.

**[B]** Internal bits.

**[SY]** System bits.

**[HELP]** Displays the type and syntax of the bits.



When any of the 4 'bit' keys above is pressed, the cursor appears at the top of the screen so that the address of the bits can be entered. When <ENT> is pressed to validate the entry, the next screen display appears.

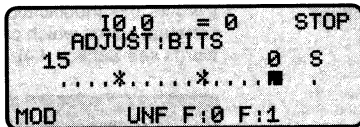


# 9. Adjust Mode

## Modifying and Forcing Bits (Cont'd.)

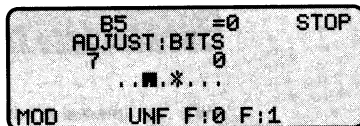
### I/O bits:

An I/O bit is always displayed with the 15 other bits of the I/O module. If it is an 8-point I/O module, the unused bits (8 to F) are automatically reset to 0 on each scan cycle.



### Internal bits and system bits:

The internal bits and system bits are always displayed in groups of 8.



**[MOD]** Changes the state of the bit indicated by the cursor. **When the program is running, the bit is reset to its true state on the next scan cycle.**

**[UNF]** Unforces the bit indicated by the cursor.

**[F: 0]** Forces the bit indicated by the cursor to 0. The bit remains forced to 0 until it is unforced.

**[F: 1]** Forces the bit indicated by the cursor to 1. The bit remains forced to 1 until it is unforced.

<←> <→> Moves the cursor along the line of bits displayed.

<↑> <↓> Displays the preceding or following group of bits.

. Indicates that the bit is at state 0.

\* Indicates that the bit is at state 1.

F Indicates that the bit above this letter has been forced (the state to which it is forced is indicated by . or \*).

All I/O bits and internal bits can be forced. As soon as any bit is forced, the letter "F" appears in the top left corner of the screen.

If the program is reinitialized (by SY0 = 1 or by pressing **[INI]** in the Debug mode), all forcings and modifications made in the Adjust mode are cancelled.

### Forcing of outputs:

- TSX 27/47 V ≥ 3: outputs can be forced only when the PLC is running.
- TSX 17 or TSX 27/47 V < 3: outputs can be forced when the PLC is running; **or when it is stopped if SY8 has been reset to 0.**

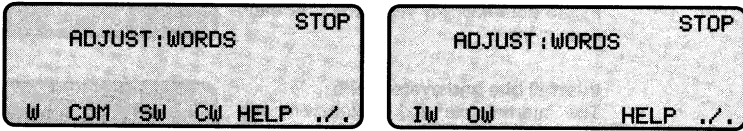
**Reminder:** When the PLC is stopped and SY8 = 1 (which is its normal state by default) all the outputs are reset to 0.

# 9. Adjust Mode

## 9.3 Modifying Words

**WORD**

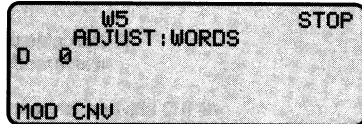
Permits the modification of all the words stored in the user memory, except for constant words which can be displayed but not modified (for modification of constant words see Section 4.4).



- [W] Internal words.
- [COM] Telway 7 common words.
- [SW] System words.
- [CW] Constant words (display only).
- [HELP] Displays the type and syntax of the words.
- [IW] Input register words of intelligent modules.
- [OW] Output register words of intelligent modules.

When any of the "word" keys above is pressed, the cursor appears at the top of the screen so that the address of the word can be entered. When <ENT> is pressed to validate the entry, the next screen display appears.

- [MOD] Permits modification of the value of the word in the code displayed.



- [CNV] Successive pressures on this key convert the value of the word into the following codes:
  - Binary, preceded by the letter **L**,
  - Hexadecimal, preceded by the letter **H**,
  - Message, preceded by the letter **M**,
  - Decimal, preceded by the letter **D** (code by default).

# 9. Adjust Mode

## 9.4 Modifying the Current Time and Date (TSX 17-20 with Clock option only)

**H**

This key displays:

- The current day, date and time,
- The date and time of the last stop (STP),
- The code of the last stop, (e.g. 1).

```
Friday STOP
18 March 1988
09h 34mn 17.0s
STP 16 March 1988
1 14h 49mn 32.0s
MOD
```

**[MOD]** Permits modification of the current day, date and time, and displays the following soft keys:

```
Friday STOP
18 March 1988
09h 34mn 17.0s
STP 16 March 1988
1 14h 49mn 32.0s
MOD
```

**[DAY]** Successive pressures on this key display the days of the week.

```
Friday STOP
18 March 1988
09h 34mn 17.0s
STP 16 March 1988
1 14h 49mn 32.0s
DAY DAT MON YEAR ./.
```

**[DAT]** Calls up the cursor so that the days of the month can be entered.

**[MON]** Successive pressures on this key display the months of the year.

**[YEAR]** Calls up the cursor so that the year can be entered.

**[HH]** Calls up the cursor so that the hour can be entered (00 to 23).

**[MN]** Permits entry of the minutes (00 to 59).

**[SS]** Permits entry of the seconds (00 to 59).

```
Friday STOP
18 March 1988
09h 34mn 17.0s
STP 16 March 1988
1 14h 49mn 32.0s
HH MN SS ./.
```

### Last stop codes :

- 1 - PLC set to STOP,
- 4 - Power break.

**Reminder:** In the case of a power break, the real-time clock continues to operate :

- without back-up battery: from 1 hour minimum to 48 hours maximum (depending on the configuration, etc.),
- with back-up battery: more than 1 year.

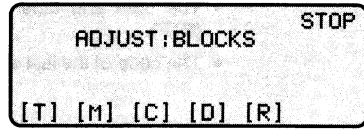
# 9. Adjust Mode

## 9.5 Modifying Function Blocks

[?]

Permits modification of the function blocks, if they were declared modifiable (YES) when they were entered in the Program mode.

- [T] Timer:
- 0 to 31 in TSX 17-20,
  - 0 to 15 in TSX 27, 47-J and 47-10/20.



- [M] Monostable: 0 to 7.

- [C] Counter:
- 0 to 31 in TSX 17-20,
  - 0 to 15 in TSX 27/47-J/47-10/20.

The counter C31 is the Fast Counter/timer (FC).

- [D] Drum controller: 0 to 7.

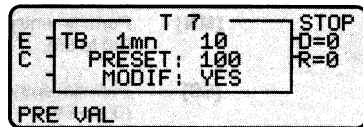
- [R] Register: 0 to 3.

Pressing any of these keys calls up the cursor so that the address of the function block to be modified can be entered. When the address is validated by pressing <ENT>, the display below appears:

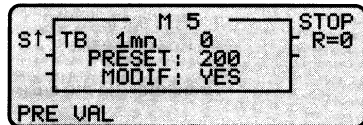
- [PRE] Permits modification of the preset value (if MODIF: YES).

- [VAL] Permits modification of the current value (if MODIF: YES).

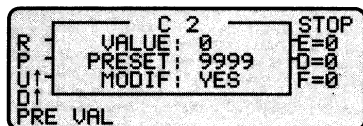
### Timer



### Monostable



### Counter

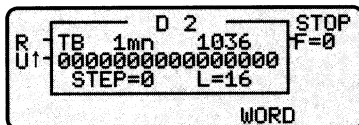


# 9. Adjust Mode

## Modifying Function Blocks (Cont'd.)

Drum controller (not modifiable, display only):

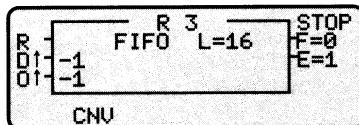
The elements of the active step are displayed (command bit states, time base, etc.).



**[WORD]** Permits the display of another step. To return to the active step, press <CLR>.

Register (not modifiable, display only):

The values of the input words and output words are displayed in decimal code.



**[CNU]** Permits the display of these values in another code: Binary (L), Hexadecimal (H), Message (M), Decimal (D).

The letter of the code displayed is shown at the left of the function block.

## 9.6 Displaying Grafcet steps

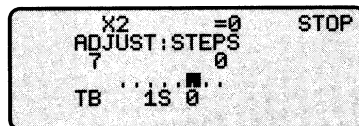


Permits the display of a group of 8 Grafcet steps and the active time of each step.

Pressing this key calls up the cursor so that the address of a step can be entered. The steps are displayed in groups of 8:

. indicates an inactive step,

\* indicates an active step.



The active time (TB) of the step indicated by the cursor is shown at the bottom of the screen.



Moves the cursor along the group of steps.



Displays the preceding or following group of steps.

# 10. Debug Mode

## 10.1 Presentation of the Mode

This mode enables the operator to test and debug the program by executing it step by step or cycle by cycle and displaying its evolution in real time.

### Accessing the mode

**DBG**

Accesses the mode (the terminal must be connected to the PLC).

**[INI]** Initializes the program.

**[R/S]** Starts or stops execution of the program.

**[D]** Permits the real-time display of the active step of a drum controller and the insertion of a breakpoint.

**[PRG]** **If the program is written in Ladder language:** Displays the start of the Master task (LAD) and permits the insertion of a breakpoint on a contact network.

**If the program is written in Grafcet language:**

**[PRE]** Displays the start of the Pre-processing module and permits the insertion of a breakpoint.

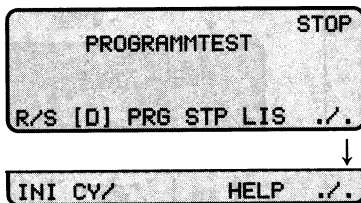
**[POS]** Displays the start of the Post-processing module and permits the insertion of a breakpoint.

**[SEQ]** Displays the start of the Sequential processing module and permits the insertion of a breakpoint on a step.

**[CY/]** Permits the execution of the program cycle by cycle.

**[LIS]** Permits the real-time display of the states of 8 predefined bits and the values of 4 predefined words.

**[STP]** Displays the list of active Grafcet steps.



### Status zone display

The status zone in the top left corner of the screen shows the following information:

**STOP** Program stopped.

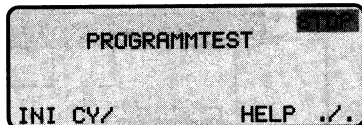
**RUN** Program running.

**/CY** Execution cycle by cycle.

**/L** Breakpoint inserted on a contact network.

**/□** Breakpoint inserted on a Grafcet step.

**/D** Breakpoint inserted on a drum step.



**S/CY** Stopped at start of cycle.

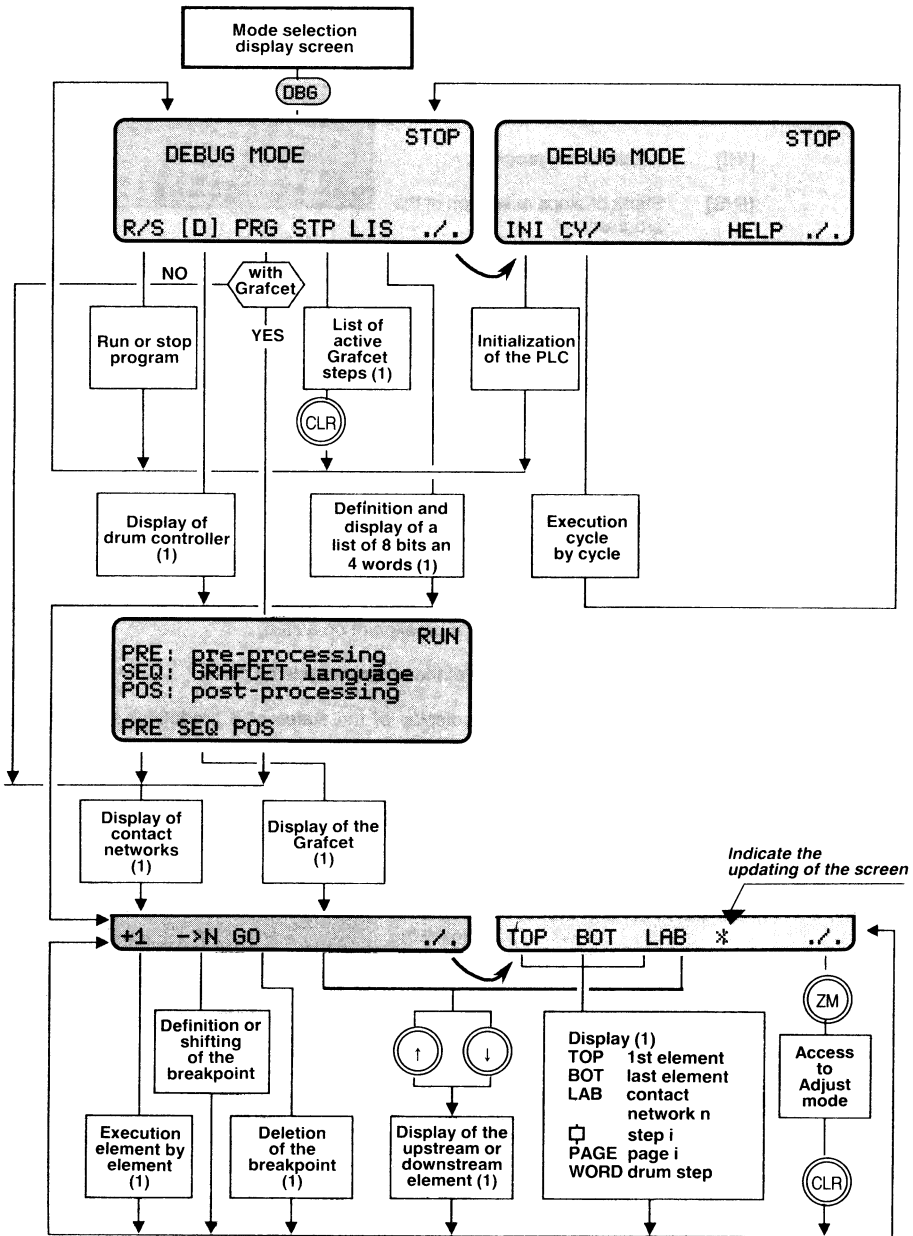
**S/L** Stopped at a breakpoint on a contact network.

**S/□** Stopped at a breakpoint on a Grafcet step.

**S/D** Stopped at a breakpoint on a drum step.

# 10. Debug Mode

## 10.2 Debug Mode Flowchart



(1) Displayed in real-time if the PLC is running

# 10. Debug Mode

## 10.3 Initializing the Program

**INI**

Requests the initialization of the program, which must be confirmed by **[YES]**. Initialization is recommended after creating or modifying the program and has the same consequences as a cold restart, i.e.:

- SY0 set to 1,
- I/Oxy,i - Bi - Wi - COMi,j - Xi,V and Di,V reset to 0,
- Mi,V - Ci,V - Ri,I and Ri,O reset to 0,
- Ti,V and TXTi,j set to their preset values,
- Functions blocks reset to the values defined in the Program mode (any values that were modified in the Adjust mode are lost),
- Initialization of the Grafcet and resetting to step 0 of the drums,
- Cancellation of forcings and breakpoints,
- Acknowledgement of I/O faults,
- The program scan is reset to the start of its cycle (i.e. before the acquisition of the input states).

The values in the real-time clock of the TSX 17-20 are preserved.

If initialization is requested while the program is running, after being initialized as described above, execution of the program restarts at the start of the scan cycle.

## 10.4 Starting and Stopping the Program

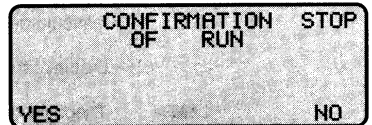
**R/S**

This key controls the execution of the program (RUN/STOP) and must be used to start the program (except in the TSX 17-20 which has a special input (I0,0) that can be configured as a RUN/STOP input).

**Note:** After creating or modifying a program, it is recommended to initialize the program (by **[INI]**) before requesting RUN

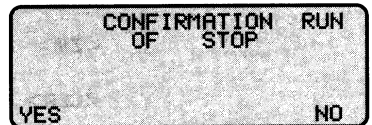
The RUN or STOP request must be confirmed as follows:

**[YES]** Confirms and executes the RUN or STOP request.



In the case of a STOP request, the program is stopped at the end of its scan cycle (see Note below).

**[NO]** Cancels the RUN or STOP request.



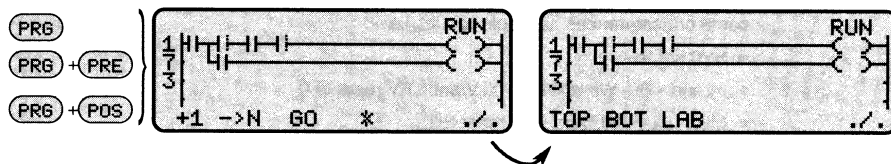
**Note:** When the program is stopped and SY8 = 1 (which is its normal state by default) all the outputs are reset to 0. If SY8 has been reset to 0, the output states are saved (see Section 9.2 - Modifying and Forcing Bits).



# 10. Debug Mode

## 10.5 Real-Time Display of the Program

Real-time display of contact networks



On the Debug mode menu press **[PRG]**.

If the program is written in Ladder language, the first contact network of the Master task is displayed.

If the program is written in Grafcet language, the soft keys **[PRE]**, **[POS]** and **[SEQ]** appear. Press **[PRE]** or **[POS]** to display the first contact network of the selected module.

In the contact network, a conductive input or an active output is displayed in solid lines, whereas the right side of a non-conductive input or an inactive output is displayed in dotted lines.

Function block outputs are displayed in their true states, with dotted lines for outputs at 0 and solid lines for outputs at 1.

An output is not active unless the element on its left is conductive, whereas the state of an input is independent of the states of the elements on its left.

The contents of an operation or comparison block can be displayed in real-time by pressing **<ZM>**, positioning the cursor on the block concerned, and pressing **<ZM>** a second time.

The following keys are available:

**[+1]** **[→N]** **[GO]** See Section 10.8 - Inserting a Breakpoint.

**[TOP]** Displays the first contact network.

**[BOT]** Displays the message "End of program", access to the last contact is obtained by pressing **<↑>**.

**[LAB]** Permits entry of a label number. After validation by **<ENT>**, the associated contact network is displayed.

**<←>** **<↓>** Displays the preceding or following contact network.

**<ZM>** Displays the address of the graphic element indicated by the cursor (contact, coil, function block).

**<ZM>** Accesses the Adjust mode so that the element can be modified.

**<CLR>** Returns to the display of the contact network.

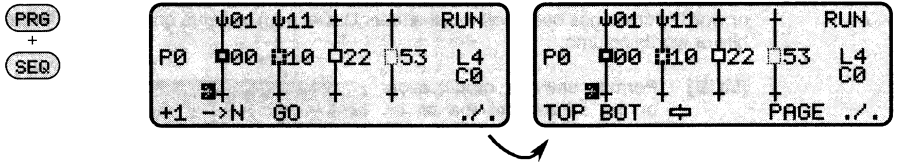
\* When the star at the bottom of the screen is:

- Flashing: The contact network displayed is being executed and its variables are being updated,
- Steady: The contact network displayed is not being executed (due to a jump instruction) and its variables are not being updated.

# 10. Debug Mode

## Real-Time Display of the Program (Cont'd.)

### Real-time display of Grafcet charts



On the Debug mode menu press **[PRG]**, then press **[SEQ]** to display the top of first page containing a Grafcet chart.

The active steps are shown with a solid line and the inactive steps with a dotted line. The following keys are available:

**[+1] [-N] [GO]** See Section 10.8 - Inserting a Breakpoint.

**[TOP]** Displays the first page containing a Grafcet chart.

**[BOT]** Displays the last page containing a Grafcet chart.

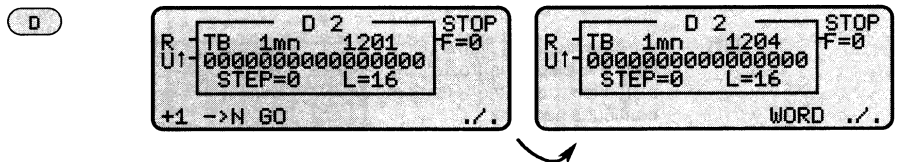
**[ ]** Permits entry of a step number. After validation by **<ENT>** the step is displayed.

**[PAGE]** Permits entry of a page number. After validation by **<ENT>**, the top left corner of the page is displayed (the first 3 lines of the first 3 columns).

**<↑> <↓>** These keys can be used to move the screen "window" over the page (up or down and left or right).

**[ZM]** Displays the contact network (action or condition) associated with the step or transition indicated by the cursor.

### Real-time display of a drum controller



On the Debug mode menu, press **[D]** and enter the number of the required drum. After validation by **<ENT>**, the screen displays the number of the active step, the states of the command bits, and the time base.

**[+1] [-N] [GO]** See Section 10.8 - Using a breakpoint.

**[WORD]** Permits entry of a new step number, so that the states of the command bits can be displayed.

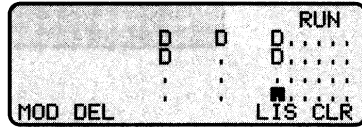
# 10. Debug Mode

## 10.6 Real-time Display of a List of Predefined Variables

**LIS**

When this key is pressed (on the Debug mode menu) it permits the definition of up to 8 bits and/or 4 words whose states or values will be displayed in real-time. After a bit or word address has been defined, the letter D (Defined) appears on the screen in the bits or words column.

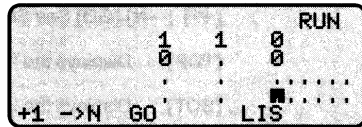
**[MOD]** Permits entry or modification of the address of the bit or word in the position indicated by the cursor.



**[DEL]** Deletes from the list the predefined bit or word in the position indicated by the cursor.

**[CLR]** Deletes, after confirmation, all the predefined bits and words in the list.

**[LIS]** Displays the states or values of all the bits and words in the list.



**[LIS]** Returns to the preceding screen to permit modification of the list.

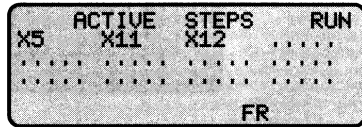
**[+1] [->N] [GO]** See Section 10.8 - Inserting a Breakpoint.

## 10.7 Real-time Display of Grafcet Steps

**STP**

When this key is pressed (on the Debug mode menu) the list of active Grafcet steps is displayed in real-time, in ascending order.

**[FR]** Freezes the list of active steps. Only the display is frozen; the execution of the Grafcet continues normally.



**[DFR]** Defreezes the list of active steps, which then continue to be displayed in real-time.

# 10. Debug Mode

## 10.8 Inserting a Breakpoint

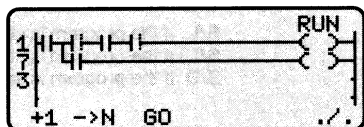
A breakpoint can be inserted anywhere in the application program (except in the Fast task) on any of the following elements:

- A contact network (LAD, PRE or POS),
- A Grafcet step (SEQ),
- A drum step (D).

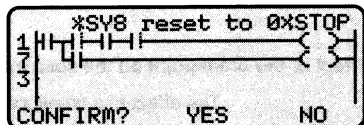
### Defining the breakpoint

Call up the program module in which the breakpoint is to be inserted (LAD, PRE, POS, SEQ or D). In the case of a drum, the program must be stopped, otherwise the program can be running or stopped.

[→N] Requests entry of the number of the contact network, Grafcet step or drum step on which the breakpoint is desired.



The display opposite then appears to permit confirmation or cancellation of the breakpoint request.



This display also shows the message "SY8 reset to 0" to remind the user of the influence of system bit SY8:

- If SY8 has already been set to 0, the output states will be saved when the program is stopped,
- If SY8 is still at 1 (which is its normal state by default), the output states will be reset to 0 when the program stops.

**Note:** In the TSX 17-20 this display does not appear if SY8=1, in this case the desired number can be entered directly and validated by <ENT>.

[YES] Confirms the breakpoint request. The number of the desired element can then be entered and validated by <ENT>. **This confirmation has no effect on the state of SY8.**

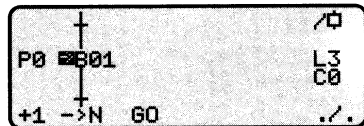
[NO] Cancels the breakpoint request and returns to the preceding screen. (If necessary, the user can then go to the Adjust mode and change the state of SY8 by <QUIT> [ADJ] [BIT] [SY] ...).

After validation of the breakpoint by <ENT>, two cases can occur:

- **If the PLC is stopped:**

The element concerned is displayed with, in the top left corner of the screen:

- /L If the breakpoint is on a contact network,
- /□ If the breakpoint is on a step (the step symbol is replaced by a B).
- /D If the breakpoint is on a drum.



If the PLC then receives a RUN command, the effect of the breakpoint is the same as described on the next page.

# 10. Debug Mode

## Inserting a Breakpoint (Cont'd.)

---

- If the PLC is running:

Execution of the program stops on the element on which the breakpoint has been inserted, as follows:

- Contact network: immediate stop (unless the contact network is not scanned due to a jump instruction).
- Grafcet step: execution stops when the step becomes active and after the actions associated with the step have been executed.
- Drum step: execution stops when the step becomes active and after the associated command bits have been executed.

The PLC status zone in the top left of the screen displays:

**S/L** If the program is stopped on on a contact network,

**S/□** If the program is stopped on a Grafcet step,

**S/D** If the program is stopped on on a drum step.

## Effect of the breakpoint on the scan cycle

The effect of a breakpoint on the scan cycle is as follows:

- **Breakpoint on a contact network:** Scanning of the Ladder language program module concerned (LAD, PRE or POS) stops immediately. The updating of the inputs and outputs depends on the type of PLC and on the state of system bit SY8:

**In the TSX 17-20: The inputs continue** to be updated. The outputs are updated if SY8 = 0, or are reset to 0 if SY8 = 1.

**In the TSX 27/47: The inputs are no longer** updated. The outputs are updated if SY8 = 0, or are reset to 0 if SY8 = 1.

- **Breakpoint on a Grafcet step:** Scanning of the individual Grafcet chart containing the breakpoint is stopped when the step concerned becomes active (its associated actions are executed). The other Grafcet charts (if any) and program modules (PRE, POS) continue to be scanned and executed.
- **Breakpoint on a drum step:** Scanning of the individual drum containing the breakpoint is stopped when the step concerned becomes active (its associated command bits are executed). The other drums (if any), the rest of the program module concerned, and the other modules (if any - PRE, POS) continue to be scanned and executed.

**Note:** The insertion of a breakpoint does not stop the updating of the active time values of Grafcet steps Xi,V and drum steps Di,V, or of the current values of timers Ti,V.

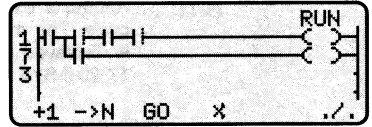
# 10. Debug Mode

## Inserting a Breakpoint (Cont'd.)

### Execution element by element

The application program can be executed element by element by proceeding as follows:

**[+1]** Moves the breakpoint onto the next element, which is then executed as follows:



- If it is a contact network, it is executed immediately.
- If it is a Grafcet step or a drum step, it is executed as soon as the upstream conditions become true.

### Execution of part of the program

A particular part of the application program can be executed by moving the breakpoint as follows:

**[→N]** Permits entry of the number of the element on which the new breakpoint is desired.

**<ENT>** Validates the entry and executes the part of the program between the old breakpoint and the new one as follows:

- If the old breakpoint was on a contact network, the part of the program between the old breakpoint and the new one is executed immediately.
- If the old breakpoint was on a Grafcet step or a drum step, the part of the program between the old breakpoint and the new one is executed when the transition conditions become true.

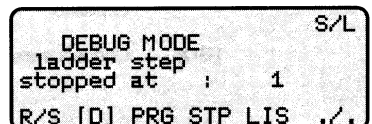
### Deleting a breakpoint

**[GO]** Deletes the breakpoint. If the program was in the RUN mode when the breakpoint was first inserted, it continues to be scanned and executed normally.

### Breakpoint reminder display

If a breakpoint has already been inserted in the application program, the display below appears as soon the Debug mode is selected.

This display indicates the type of breakpoint and the number of the element on which the breakpoint has been inserted.



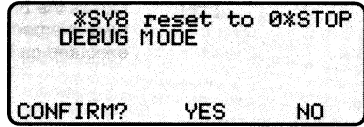
# 10. Debug Mode

## 10.9 Executing the Program Cycle by Cycle

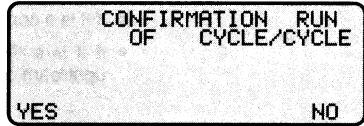
**CY/**

This key enables the operator to execute the program cycle by cycle, and to display the evolution of variables (except Grafcet steps) during each cycle. It has the effect of entering a breakpoint at the start of the cycle.

**[CY]** Requests execution cycle by cycle. The message opposite is displayed (except with TSX 17-20 if SY8 is at state 1)

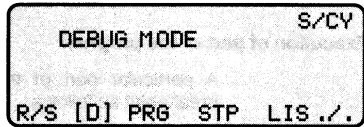


**[YES]** Calls up the confirmation display opposite.



**[NO]** Returns to the first Debug mode menu (so that SY8 can be reset if necessary).

**[YES]** Confirms the request, stops the program if it is running and displays the screen opposite.



**[NO]** Returns to the first Debug mode menu.

### Displaying the evolution of variables cycle by cycle

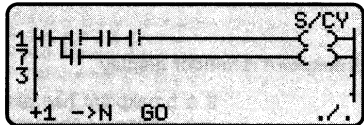
To display the evolution of the variables in a contact network or drum cycle by cycle, on the menu above select the program module (PRG, PRE or POS), then select the desired element by pressing **[LAB]** or **[D]** and enter its number. The evolution of Grafcet steps cannot be displayed.

**Note:** The soft key **[→N]** cannot be used to enter the desired element.

### Execution cycle by cycle

**[+1]** Executes one cycle each time it is pressed. To access this key from the menu above:

For a Ladder program, press **[PRG]** to obtain the menu opposite.



For a Grafcet program, press **[PRG]** and then **[PRE]** or **[POS]** to obtain the menu opposite.

**[GO]** Cancels execution cycle by cycle and returns to normal operation.

# 11. Diagnostic Mode

## 11.1 Presentation of the Mode

This mode enables the operator to detect and analyze any faults that may occur in the PLC and its I/O modules. The PLC to be tested can be connected to the terminal either directly or through a Telway 7 network (except for the TSX 17 and 27).

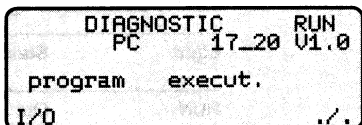
### Accessing the mode



Gives access to the Diagnostic mode and displays the following soft keys:

[I/O] Displays the I/O configuration and the status of the I/O modules.

[./.] Displays the status of the indicator lights on the front of the PLC.



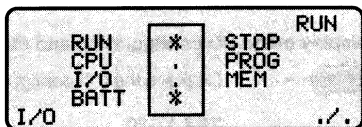
## 11.2 Diagnostic Displays

### Display of TSX 17-20 indicator lights



Displays the screen opposite if the terminal is connected to a TSX 17-20 micro-PLC.

The states of the indicator lights are given in the table below.



### TSX 17-20 indicator lights

Light	State	Representation on the screen	Meaning
RUN - STOP	On	* steady	program running
	Flashing	* flashing	program stopped
CPU - PROG	Out	.	processor OK
	On	*	watchdog fault
I/O - MEM	Out	.	I/O and memory OK
	On	* steady	I/O fault
	Flashing	* flashing	memory fault
BATT	Out	.	battery OK
	On	*	battery fault or battery absent



# 11. Diagnostic Mode

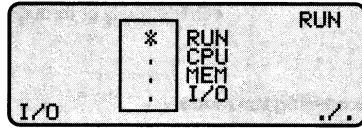
## Diagnostic Displays (Cont'd.)

Display of TSX 27/47-J/47-10/47-20 indicator lights



Displays the screen opposite if the terminal is connected to a TSX 27/47-J/47-10/47-20.

The states of the indicator lights are given in the table below.



### TSX 17-20 indicator lights

Light	State	Representation on the screen	Meaning
RUN	Out	.	program stopped
	On	*	program running
CPU	Out	.	processor OK
	On	*	processor fault
MEM	Out	.	memory OK
	On	*	memory fault
I/O	Out	.	I/O modules OK
	On	*	I/O module fault

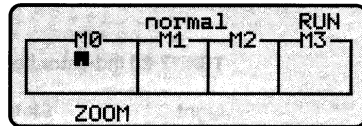
### Display of the I/O configuration and status



Displays the I/O configuration and the status of the I/O modules.

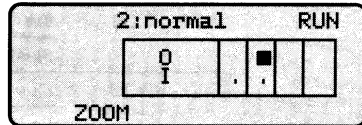
#### TSX 17-20

The basic micro-PLC (M0) and the 3 possible I/O extension modules (M1, M2, M3) are displayed.



#### TSX 27

The maximum configuration (80 I/O) is displayed, with the outputs on the upper line and the inputs on the lower line.

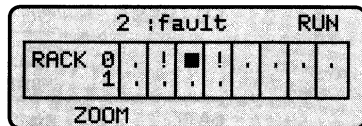


#### TSX 47-J/47-10/47-20

The two racks of the maximum configuration are displayed:

Rack 0: upper line,

Rack 1: lower line



The state of each I/O module present is represented as follows:

- . module in normal operation,
- ! module defective.

Use the cursor control keys to position the cursor on any module that is defective and then press **[ZOOM]** to obtain the diagnosis.



# 11. Diagnostic Mode

Notes

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# 12. Network Mode

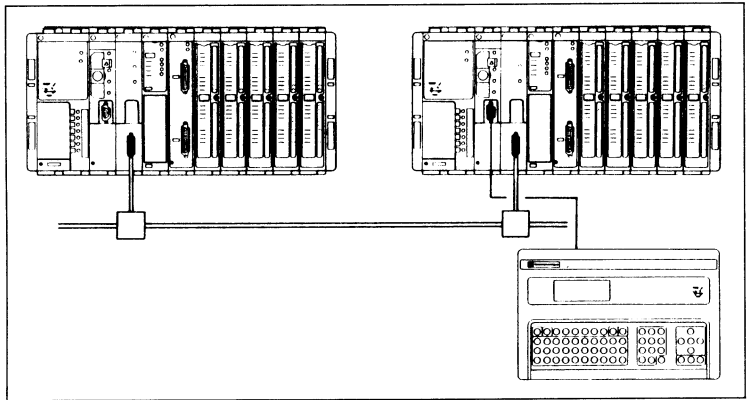
## 12.1 Presentation of the Mode

### General

The Network mode enables the TSX T407 terminal to be logically connected to any TSX 47 PLC (TSX 47-J/47-10/47-20) on a Telway 7 network. The use of this network is entirely transparent and imposes no restrictions on the operation of the terminal. Consequently all the operating modes of the terminal can be used (PRG, DBG, DGN, etc.).

The Telway 7 network can interconnect up to 16 PLCs, each station being referenced by X,Y:

- X being the number of the network (always 0 with the TSX 47),
- Y being the number of the station on the network (0 to 15). This number is configured during installation by the wiring of the network coupler module.



### Accessing the mode

**NET**

Accesses the Network mode and displays the following soft keys and information:

**[NEW]** Permits definition of a new logical connection.

**[HOME]** Returns to the original connection (logical connection = physical connection).

**[DGN]** Permits diagnostics of the network.

**physical conn:** Number of the station (X,Y) to which the terminal is physically connected by its cable.

**logical conn:** Number of the station (X,Y) to which the terminal is logically connected by its communication dialogue.

```
INTER PC MODE    RUN
physical conn: 0,6
logical conn : 0,2
connection:
NEW HOME        DGN
```

**Note:** Access to the Network mode is not possible unless the terminal is connected to a PLC equipped with a TSX MPT 10 network module. The program can be running or stopped.

# 12. Network Mode

## 12.2 Station Selection and Diagnostics

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### Selecting a new logical connection

**NEW**

Permits the selection of a new logical connection.

**[NET]** Permits modification of the network number (but which is always 0 with the TSX 47).

**[STN]** Permits modification of the station number (0 to 15), so as to establish a new logical connection with another station.



```
NEW CONNECTION          RUN
NET: network
STN: station
NET STN
```

When **[NET]** or **[STN]** is pressed, the cursor appears in the line concerned to permit entry of the new number.

After entering the new station number, press **<ENT>** to validate the entry, then press **<QUIT>** to obtain the Mode Selection Display so that the desired operating mode can be selected (PRG, DBG, ADJ, etc.).

When the logical connection of the terminal is different from the physical connection, this is indicated to the operator by the blinking of the information shown in the PLC status zone in the top right corner of the LCD display (RUN, STOP, etc.).

When the terminal is switched off, it automatically returns to its first logical connection (logical connection = physical connection).

### Station reservation

A station cannot be logically connected to two terminals, since each terminal exclusively reserves the station to which it is logically connected (except in the Adjust mode). Consequently, a terminal cannot dialogue with a PLC that has already been reserved by another terminal (except in the Adjust mode).

# 12. Network Mode

## Station Selection and Diagnostics (Cont'd.)

### Network diagnostics

**DGN**

Pressing this key enables the operator to study four diagnostic displays as follows:

**First display:** The first display indicates, on the top line, the station that is logically connected to the terminal, and underneath, the other stations present on the network.

The numbers 0 to F represent the 16 possible stations.

\* Indicates that the station is connected to the network.

**M** Is displayed in the bottom left of the screen when the cursor is positioned on the floating master station.

**COM:** 8 or 0 indicates in bytes the number of common words (4 or 0) assigned to the station indicated by the cursor.

[./] Calls up the second display.

**Second display:** This shows the number of messages transmitted or received by the station, and the following soft keys and information:

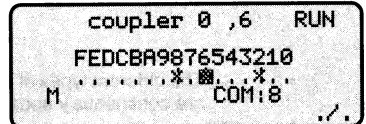
**[CLR]** Resets to 0 the values displayed on the screen.

[./] Calls up the next display.

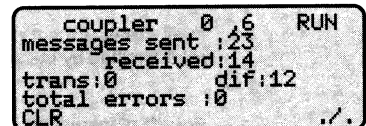
**trans:** Indicates the number of messages having passed through this station if it is a junction with another network (always 0 with the TSX 47).

**dif:** Indicates the number of messages broadcast to all the other stations.

**total errors:** Indicates the number of errors detected by this station. The types of errors are detailed in the next display.



```
coupler 0 ,6 RUN
FEDCBA9876543210
.....*.*.*.*.*
M .....*.*.*.*.*
COM:8
```



```
coupler 0 ,6 RUN
messages sent :23
received:14
trans:0 dif:12
total errors :0
CLR
```

# 12. Network Mode

## Station Selection and Diagnostics (Cont'd.)

**Third display:** This display shows the different types of errors and the following soft keys:

- [CLR]** Resets to 0 all the error values displayed.
- [./.]** Calls up the next display.

```
coupler0 ,5 RUN
error types
ovr:0 fra:0
par:0 bcc:0
ovf:0 bus:0
CLR ./.
```

The different types of errors that can occur in the network are as follows (the numbers are continuously updated and shown in real-time).

- ovr:** Overrun. Number of times that this station has been unable to receive a message because the network is overloaded.
- par:** Parity. Number of messages received by this station with parity error.
- ovf:** Overflow. Number of messages lost because of input buffer overflow (input buffer memory capacity exceeded).
- fra:** Framing. Number of messages incorrectly configured (framing error).
- bcc:** Block control check. Number of messages received with a checksum error.
- bus:** Number of messages not transmitted to the CPU of this station because of a fault in the bus between the network coupler and the processor.

In all cases (except ovf: Overflow error), a message received with an error code is retransmitted by the sender (three attempts are made).

**Fourth display:** This display permits an analysis of the message traffic. It shows the percentage of the total message traffic that each station has exchanged with the station to which the terminal is physically connected.

- [CLR]** Resets to 0 all the values displayed.
- [./.]** Returns to the first diagnostic display.

```
traffic analys RUN
0 : 12%1 : %2 : %3 : %
4 : %5 : 22%6 : %7 : %
8 : %9 : 25%10 : %11 : %
12 : %13 : %14 : %15 : %
CLR ./.
```

# A1 Appendix 1: Module Configuration Codes

## A1.1 Modules for TSX 47-J/47-10/47-20

### Discrete I/O modules

Ref. No.	Type	Code
<b>Discrete input modules</b>		
DET 8 12	8 inputs 24VDC	32
DET 16 12	16 inputs 24VDC	56
DET 32 12	32 inputs 24VDC	56*
DET 8 13	8 inputs 48VDC	33
DET 16 13	16 inputs 48VDC	58
DET 8 02	8 inputs 24VAC	34
DET 8 03	8 inputs 42/48VAC	35
DET 16 03	16 inputs 48VAC	59
DET 16 04	16 inputs 110/120VAC	59
DET 8 05	8 inputs 220/240VAC	37
DET 8 24	8 inputs 110VDC/115VAC	36
DET 4 66	4 inputs NAMUR (prox. det.)	39
<b>Discrete output modules</b>		
DST 16 12	16 outputs 5/12/24VDC	53
DST 8 82	8 outputs 24VDC 2A	23
DST 16 82	16 outputs 24VDC 0.5 A	53
DST 24 82	24 outputs 24VDC 400mA	53*
DST 32 92	32 outputs 24VDC 100mA	53*
DST 4 17	4 outputs 24/48VDC 2A	04
DST 8 17	8 outputs 24/48VDC 500mA	29
DST 8 04	8 outputs 110/120VAC 2A	21
DST 16 04	16 outputs 110/120VAC 1A	55
DST 8 05	8 outputs 220/240VAC 2A	22
DST 8 35	8 relay outputs 24/240VAC	24
DST 16 35	16 relay outputs 24/240VAC	52

### Special modules

<b>Analog modules</b>		
ADT 2 01	2 thresholds, high level	45
ADT 2 02	2 thresholds, thermocouple	46
ADT 2 03	2 thresholds, temp. probe	47
AST 2 00	2 outputs, 8 bits, isolated	54
<b>Counting and positioning module</b>		
AXT 2 00	2 counting inputs, 2kHz	57
<b>Telway 7 network module</b>		
MPT 10	Network coupler module	12

\* The corresponding slot in the odd-numbered rack must also be configured with this code, even if the rack is not physically present.



# A1 Appendix 1: Module Configuration Codes

## A1.2 Intelligent Modules

### Intelligent modules

Ref. No.	Type	Code
<b>2-channel serial communication modules</b>		
SCM 20 ●●	Channels 0 and 1: Half-duplex	63
SCM 21 ●●	Channel 0: Half-duplex 1: Half-duplex, Full-duplex or Uni-Telway protocol	63
SCM 22 ●●	Channel 0: Half-duplex 1: Half-duplex, Full-duplex, Modbus or Pyromat protocol	63
<b>Analog input modules</b>		
AEM 4 11	4 inputs, high level	63
AEM 4 12	4 inputs, thermocouple	63
AEM 4 13	4 inputs, temp. probe	63
AEM 8 11	8 inputs, high level	63
<b>Rapid counting module</b>		
CTM 100	1 rapid counting channel, 40kHz	63
<b>Fast I/O module</b>		
DMR 1652	Multifunction fast I/O coprocessor with 8 inputs and 8 outputs	62

## A1.3 Modules for TSX 17-20

Module	Code
34 or 40 point I/O extension module	15
20-point I/O extension module	14
8-point input extension module	8
6-point output extension module	4
4-point analog input module	27
2-point analog output module	21

# A2 Appendix 2: Error Messages

## A2.1 Self-test Error Codes

---

### Self-test codes

The self-tests are executed automatically as soon as the terminal is powered up. If a fault is detected, one of the following codes appears in the top left corner of the LCD screen:

Code	Type of fault	Remedial action
!K	One or more keys are depressed (Keyboard)	Check that nothing is pressing on the keyboard, then press <OFF>/<ON>.
!H	Defective language cartridge (Header)	Replace the language cartridge, then press <OFF>/<ON>.
!A	Cartridge absent or not compatible (Absent)	Install a compatible cartridge, then press <OFF>/<ON>.
!C	The cartridge housing cover is not closed (Cover)	Close the cover, then press <OFF>/<ON>.
!S	Checksum error in language cartridge (Software)	Replace the language cartridge, then press <OFF>/<ON>.
!V	The software versions of the terminal and its language cartridge are not compatible. (Version).	The first display of the Terminal Mode shows the software index number; use a language cartridge with a compatible number.
!B	Internal RAM back-up battery discharged or defective (Battery).	Leave the terminal powered up, then press <OFF>/<ON>. If the fault persists, replace the battery.
!R	Checksum error in the internal RAM of the terminal (RAM)	Replace the terminal.
!E	Checksum error in the internal EPROM of the terminal (EPROM)	Replace the terminal.

---

If none of these codes appears, but the "TEST" display remains present for more than 10 seconds: check the cables, connections and power supply, then press <OFF>/<ON> **twice**.

If the fault persists, or if the error codes !B, !R or !E appear, contact Telemecanique or your equipment supplier.

# A2 Appendix 2: Error Messages

## A2.2 Error Messages Common to All Modes

<b>Error message</b>	<b>Probable cause</b>
* Incompat. PC language	Incompatibility of version between the user program and the language cartridge.
* PC reserved	The PC is already reserved by a another Telway 7 station.
* Request refused	Request refused by PC: <ul style="list-style-type: none"><li>- the PC is already reserved by another Telway 7 station</li><li>- the variable requested does not exist.</li></ul>
* No exchange with PC	The terminal cannot dialogue with the PC. Either the terminal is in the LOCAL mode, or the processor in the PC is faulty.
* Line fault	Line fault between the PC and the TSX T407 terminal.
* Chip error	Impossible request: the TSX T407 0 cannot operate in the LOCAL mode, but only in the CONNECTED mode.
* Exchange error	Exchange error with the PC. The ongoing operation is cancelled. Restart the operation. If the error persists, return to the Mode Selection Display.
* Label	An error of syntax has occurred during the entry of a contact network label.
* Beyond limits	The number of the variable is beyond the limits of the system.
* Inexistent	The label requested does not exist in the user program.
* Incompatible software	Incompatible software index.
* Memory full	The user memory cartridge is full.
* Module not recognized	The terminal cannot dialogue with this module because the software is not compatible.
* Number	An error of syntax has occurred during the entry of a number.

## A2 Appendix 2: Error Messages

### Error Messages Common to All Modes (Cont'd.)

<b>Error message</b>	<b>Probable cause</b>
* Not executable	The user cartridge in the PC is not executable or is not initialized. If it is a RAM memory, clear the memory (CLM).
* No internal RAM	The terminal is a TSX T407 0 which operates in the CONNECTED mode only.
* No reply	Message lost on the Telway 7 network: <ul style="list-style-type: none"><li>- the station selected does not exist,</li><li>- the network is overloaded,</li><li>- fault in the network, (see network diagnostics).</li></ul>
* Cannot program	The PC to which the terminal is connected cannot be programmed (it is incompatible with the TSX T407).
* PC refuses	Refusal of the PC during an exchange: <ul style="list-style-type: none"><li>- the PC is no longer reserved,</li><li>- fault in the PC memory.</li></ul> Return to the Mode Selection Display and restart the exchange.
* Ladder error	Error of Ladder language syntax: <ul style="list-style-type: none"><li>- absence of label,</li><li>- program element or link not powered,</li><li>- right power rail not supplied by an output or arithmetic block.</li></ul>
* Condensing	The procedure of condensing the program is in progress.
* Incompat. terminal	The terminal and its associated cartridge cartr. are not compatible (type of keyboard).
* Too many jumps	The maximum number of jumps (42) has been reached.

## A2 Appendix 2: Error Messages

### A2.3 Program Mode

<b>Error message</b>	<b>Probable cause</b>
* Prom cartridge	The user memory cartridge is an EPROM and cannot be programmed.
* I/O config	I/O bit not compatible with the module (in the case of a software configuration).
* Assignment	Incorrect assignment of an operand in an operation block (write protected operand)
* Please wait	Processing of the last entry is in progress and requires time for compiling, memory organization, transfer, etc.
* Label exists	This label already exists and therefore cannot be used again.
* Contact name	Incorrect assignment of an input contact (e.g. to a word type variable).
* Word name	Incorrect assignment of an operand in a comparison or operation block.
* Output name	Incorrect assignment of an output (write protected or word type variable).
* Invalid jump	It is not possible to jump to the same contact network.
* Jump undefined	It is not possible to jump to a contact network (label) that is not defined.

# A2 Appendix 2: Error Messages

## A2.4 Transfer Mode

---

<b>Error message</b>	<b>Probable cause</b>
* Change cartridge	The cartridge must be changed to start the transfer.
* Finished	Transfer process finished.
* Abort	Transfer process cancelled by the operator.
* Transfer error	Transfer error found during automatic checking.
* Cannot transfer	The transfer is impossible if: <ul style="list-style-type: none"><li>- The source is the internal RAM of the terminal and the size of the destination cartridge in the PC or the terminal is smaller than the source memory.</li><li>- The source is the PC and there is a language cartridge or an incompatible cartridge in the terminal.</li><li>- The source is the terminal and there is a EPROM cartridge or an incompatible cartridge in the PC.</li><li>- The source is the PC and there is an uncleared EPROM cartridge in the terminal.</li><li>- The size of the source memory &gt; the size of the destination memory.</li><li>- The size of the source memory &lt; the size of the destination memory, if the source is not the PC.</li><li>- The size of the source memory &lt; the size of the destination memory, if the source is not the terminal.</li><li>- The size of the source memory &lt; the size of the destination memory and the transfer is of the type VRF.</li></ul>

---

# A2 Appendix 2 : Error Messages

## A2.5 Adjust Mode

---

<b>Error message</b>	<b>Probable cause</b>
* Define bit	During the display of a list of variables of 8 bits and 4 words, the terminal is awaiting the definition of a bit.
* Define word	During the display of a list of variables of 8 bits and 4 words, the terminal is awaiting the definition of a word.
* Incorrect	Incorrect syntax during the entry of a variable.
* Module fault	Indicates that the I/O bit concerned belongs to a faulty module.

---

## A2 Appendix 2: Error Messages

### A2.6 Debug Mode

<b>Error message</b>	<b>Probable cause</b>
* Stop	The PC is stopped.
* Stopped at...	The PC is temporarily stopped at a breakpoint number ...
* Stop at...	The PC will stop at breakpoint number...
* Cycle step	Indicates that the PC is operating cycle by cycle.
* Drum step	Indicates that the PC is operating drum step by drum step.
* Next step	Indicates that the PC is operating Grafcet step by Grafcet step.
* Ladder step	Indicates that the PC is operating Ladder network by Ladder network.
* SY8 reset to 0	System bit SY8 is reset to 0, i.e. output states are maintained when PC stops.
* No program	No program has been written.
* Imp (stop)	Action impossible since the PC is stopped.
* Imp (cycle)	Action impossible since the PC is operating cycle by cycle.
* Imp (not stopped)	Action impossible since the breakpoint has not been reached.
* Imp (RUN)	Action impossible in normal operation (RUN) without a breakpoint.
* Ladder	Abnormal operation in Ladder network by Ladder network mode: initialize the PC.
* Drum	Abnormal operation in drum step by drum step mode. Initialize the PC.
* Cycle	Abnormal operation in cycle by cycle mode. Initialize the PC.
* Imposs.	The action or operation requested is not possible in the Debug Mode.



# A2 Appendix 2: Error Messages

## A2.7 Diagnostic Mode

<b>Error message</b>	<b>Probable cause</b>
* Connected	Indicates that the station that has been addressed is connected to the network.
* Not connected	Indicates that the station that has been addressed is not connected to the network.
* Station refuses	The station refuses to dialogue with the terminal.
* Reserved by term.	Station already reserved by a terminal.
* Absent	Absence of user cartridge in PC.
* Not execut	The user cartridge is not executable or is not initialized.
* Executable	The user cartridge is executable.
* Stopped at exec. error	The PC is stopped on an error of execution.
* Stopped at stop point	The PC is stopped on a breakpoint.
* Fault	I/O system: defective module (this is the OR of all I/O faults).
* Normal	I/O system: normal module.
* Absent	I/O system: module absent.
* Faulty	I/O module: defective module (appears in the space "plugged in" when the status word of the module cannot be read due to an I/O bus failure).
* Normal mode	I/O module: normal operation.
* No terminal block	I/O module: no terminal block.
* Incompatible	I/O module: the module is incompatible with the PC.
* Wrong module	I/O module: the module does not conform to the software configuration.
* No module config'd	I/O module: no module has been configured at this location.

## A2 Appendix 2: Error Messages

### Diagnostic Mode (Cont'd.)

---

<b>Error message</b>	<b>Probable cause</b>
* IOR out of service	I/O module: the IOR bus signal has not been detected.
* External fault	I/O module: fault bit generated by the module (fuse ...)
* Term. block fault	I/O module: defective terminal block.
* Not readable	I/O module: the module cannot be read either because it is a special module (network coupler, etc.), or because of a bus error, parity error, or /ACK./B./D.

---

# A2 Appendix 2: Error Messages

## A2.8 Grafcet Language Error Messages

<b>Error message</b>	<b>Probable cause</b>
* Not possible here	The moving of an element (step, transition, connector) to this position is not possible.
* Convergence exceeded	There are more than 4 elements (steps or transitions) upstream of the convergence.
* Divergence exceeded	There are more than 4 elements (steps or transitions) downstream of the divergence.
* Already created	A step with this number has already been created.
* Maximum reached	The maximum number of connectors (84), steps (96), or transitions (128) has been reached.
* Incorrect	The entry of the element concerned is incorrect.
* Beyond limits	The number of the step is too great (>96).
* Inexistent	The step searched for does not exist.
* Connector defined twice	A connector with this number has already been entered.
* This page is empty	Validation of an empty memory page.
* Neither step nor trans.	Validation of a memory page containing neither a step nor a transition.
* No upstream element	The alternation step - transition - step has not been observed.
* No downstream element	The alternation step - transition - step has not been observed.
* No source connector	Disparity between the number of source connectors and the number of destination connectors : a source connector is missing.
* No destination connector	Disparity between the number of source connectors and the number of destination connectors : a destination connector is missing.
* Remaining pages not val.	There remain memory pages that have not been validated.

## A2 Appendix 2: Error Messages

### Grafcet Language Error Messages (Cont'd.)

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<b>Error message</b>	<b>Probable cause</b>
* Grafcet not executable	The Grafcet that has been entered contains inconsistencies and is not executable.
* Memory full	The program memory is saturated.
* Trans. cond. not defined	The condition associated with the transition has not been entered (sequential processing section).
* Action not defined	The action associated with the step has not been entered (sequential processing section)

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# A2 Appendix 2: Error Messages

Notes

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# TSX T407 PL7-2 Operating modes

Notes

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