TSX PCM 00 2
Coupleur PC intégré   Page 3

F R A N C A I S

E N G L I S H

1

TSX PCM 00 2
Integral PC module   Page 29

Contents

E
N
G
L
I
S
H

Contents

E
N
G
L
I
S
H

1.1 Description

The TSX PCM 00 2 PC compatible module for Model 40 Series 7 modular PLCs offers the user an open structure for the development and integration of application programs under DR-DOS.

Thus the developer has a standard environment in which he can build micro-processing functions into his control system application.

The following types of application are suitable for integration in this PC compatible module :

- Special-purpose operator dialogue
- Local data storage
- Special-purpose communications
- Complex calculation and processing

E
N
G
L
I
S
H

1.2 Mechanical description

1.2-1 TSX PCM 00 2 module

This unit is in single module format and is composed of the following elements :

1   Metal case providing mechanical protection of the electronic circuits and protection against electromagnetic interference.

2   Socket for user memory cartridge.

3   User memory cartridge locking device.

4   Status LEDs (see section 3.4) :
   - RUN (green)
   - CPU (red)
   - MEM (red)

5   I/O status LED (red), illuminates when there is no terminal connected.

6   RESET button (can only be operated by a small sharp pointed object), is used to re-initialize the module.

7   26-pin female connector for attaching a display terminal or a TSX BMP 010 module.
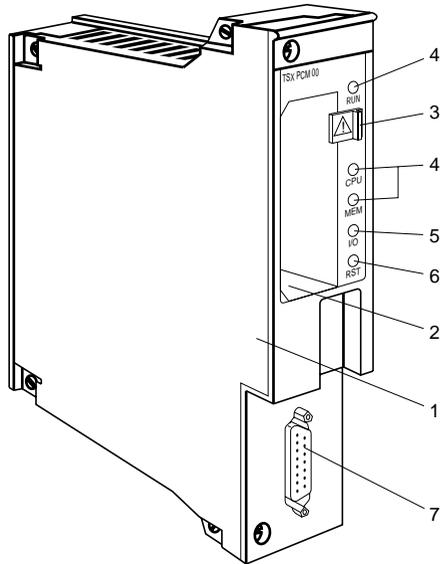
The rear panel of the module is equipped with a mechanical locating device which eliminates any risk of positioning error while installing or changing the module.

1.2-2 User memory cartridge

The user memory cartridge is identical to those used by PLC processors. It comprises :

1 Extraction tab, colour coded to indicate
   memory type :
   • RED   : RAM memory
   • BLACK : EPROM memory.

2 Opaque cover to protect the EPROM
   window.

3 Locating device.

4 Identification label.
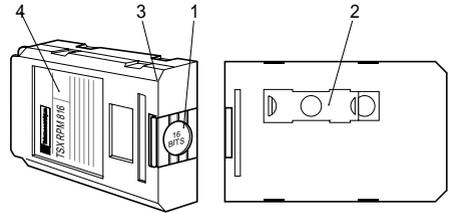
Two types of memory are used :

• **Battery-backed RAM memory** : this live memory may be loaded from a PC terminal **:**
  - in connected mode via the PLC processor,
  - in local mode using the TSX TPE 01 cartridge programmer.

  When the memory cartridge is not powered-up, data backup is maintained by a battery
  (5 weeks maximum).

• **EPROM memory** : this may be loaded from a PC terminal in local mode using the
  TSX TPE 01 memory cartridge programmer.
  Any writing of new data onto the cartridge requires that its previous contents are totally
  erased, using the TSX EPE 1 or 2 EPROM eraser.

The following cartridges can be mounted on the module.

Type	Reference	Capacity
RAM	TSX RAM 128 16	128 Kwords or 256 Kbytes
RAM	TSX RAM 256 16	256 Kwords or 512 Kbytes
RAM	TSX RAM 512 16	512 Kwords or 1 Mbyte
RAM	TSX RAM 1024 16	1024 Kwords or 2 Mbyte
EPROM	TSX RPM 128 16	128 Kwords or 256 Kbytes
EPROM	TSX RPM 256 16	256 Kwords or 512 Kbytes
EPROM	TSX RPM 512 16	512 Kwords or 1 Mbyte

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2.1 Choice of Module Position and Locating Device Code
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2.1-1 Available Module Positions

The TSX PCM 00 2 may be positioned in the PLC base rack according to the following table:

Rack	Rack Type	Available Positions and Maximum Number of Modules
Basic Rack with processor • TSX/PMX 47-40	TSX RKN 82 TSX RKN 52 TSX RKN 82W11	Positions 0 to 7: 1 Module max. (1)
Basic Rack with Processor • TSX/PMX 67 425/455 (V5)	TSX RKN 82 TSX RKN 52 TSX RKN 82W11	Positions 0 to 7: 2 Module max. (2)
Basic Rack with Processor • TSX/PMX 87 425/455 (V5) • TSX/PMX 87 410/420 (V4)	TSX RKN 82 TSX RKN 52 TSX RKN 82W11	Positions 0 to 7: 2 Module max. (2)
Basic Rack with Processor • TSX/PMX 107 425/455 (V5) • TSX/PMX 107 410/420 (V4)	TSX RKN 82F TSX RKN 82FD TSX RKN 82FW11	Positions 0 to 7: 4 Modules max. (2)
Extension Rack (Direct)	TSX RKE 8 TSX RKE 7 TSX RKE 8W11	None (3)
Extension Rack (Local or Remote)	TSX RKS 8 TSX RKS 8W11	None (3)
Extension Rack (Local or Remote)	TSX RKN 8 TSX RKN 5 TSX RKN 8W11	Any Position (2)

(1) No module with P47 400/405 processor.

(2) 1 module with P67 410/420 (V4) processor.

(3) Limited by the rack bus (simplified bus).

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2.1-2 Locating device coding

Code	**TSX PCM 00 2**
Mechanical 3 digit decimal code, defined by the three female locating keys at the rear of the module.	714
Program Code entered during I/O configuration (XTEL V5) (1)	714

(1) For an XTEL tool version prior to V5, the code to be entered is that of the family of PCM modules, that is 62.

2.2 Connections

2.2-1 Connecting the module

It is essential to connect or disconnect the module with the power off. Any attempt to make or modify connections while powered-up can result in permanent damage to the unit.

2.2-2 Connecting a display terminal

For this connection, a TSX CMMxx0 cable should be used (xx represents the length of the cable in metres : 03, 10, 30 or 40). The cable is designed to ensure proper connection of the video, keyboard and simplified serial lines.

Pupitre CPX xxx

TSX CMM xx0

_____
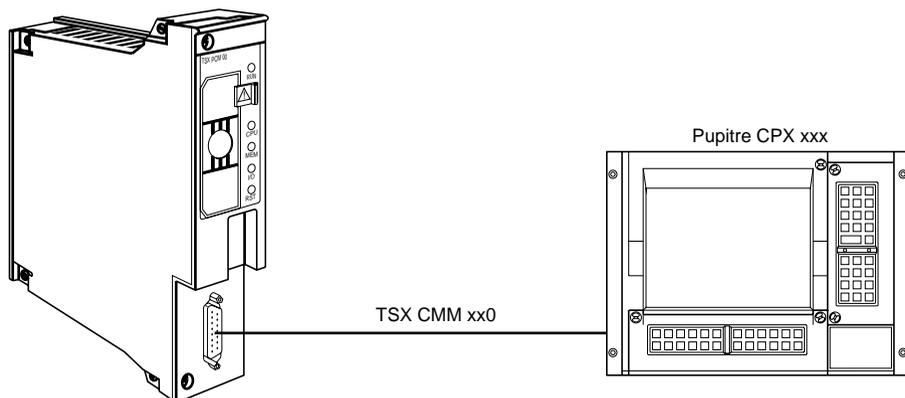
2.2-3 Connecting a standard peripheral

To connect a standard peripheral such as a monitor, keyboard, printer or modem, the TSX BMP 010 interface module must be used. The interface module may be located :

• In any position in a Series 7 PLC, using the power supply from the bus.

• In an XGS-R74 or XGS-R71 rack. In this case, the interface module must be connected to the mains supply from the front panel.

Locally sited interface module

As long as the TSX BMP 010 is not remotely sited, it may be connected to the module by a TSX CMB xxx cable. In this case the maximum distance allowed between the module and the operator dialogue module is 1.5 metres. This permits a full serial (modem) interface.

TSX BMP 010

TSX CMB xxx
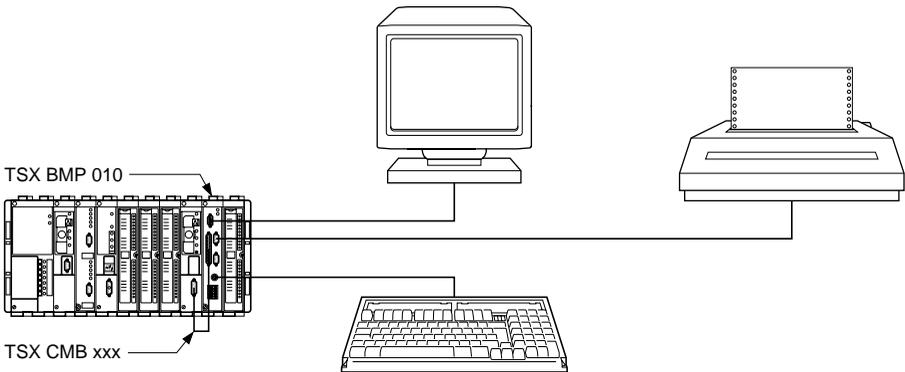
Remotely sited interface module

In order to remotely site the TSX BMP 010, it is necessary to use the TSX CMM xx0 cable (where xx = 03, 10, 30 or 40 metres). The remote connection of a modem is not supported.

TSX BMP 010

TSX CMM xx0

Mains supply

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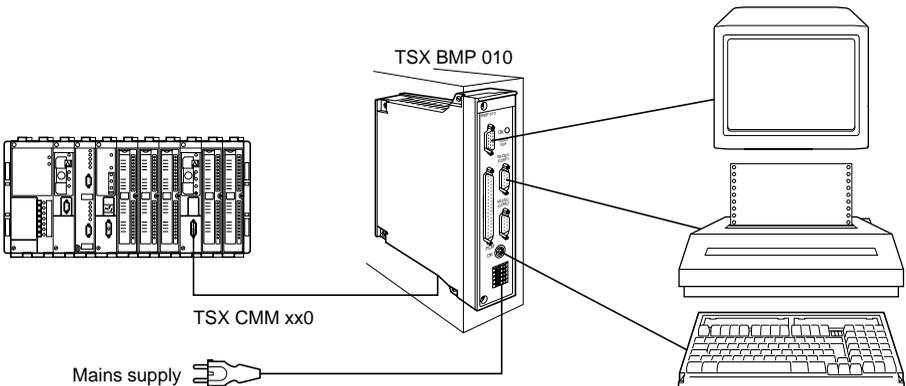
3.1 Hardware structure
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3.1-1 General

TSX PCM 00 2 modules are PC compatible. In common with all intelligent modules they directly access the complete bus in order to communicate with the PLC processor. For this, the module integrates :

• Bus interface.

• Shared memory.

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3.1-2 Hardware characteristics

Module	TSX PCM 00 2
Processor	80386 SX 25 MHz
Basic RAM memory Paged RAM memory (Standard EMS 4.0)	512K bytes 4 M bytes
BIOS ROM memory	128K bytes
System memory (SYSTEM DISK)	1M bytes
Application memory (RAM DISK)	2 Mb max cartridge
Keyboard interface	YES
Simplified isolated RS 232 serial link (printer)	COM 1
Complete non-isolated RS 232 serial link (modem)	COM 2
Video	VGA colour

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3.2 Software structure

The software structure of the module is similar to that of a PC compatible micro-computer.
Typically it comprises :

• A systems and services part, common to all the applications which can be executed on the module.

• An application part, which is the responsibility of the systems integrator, or an application specific to the Telemecanique range of products.

3.2-1 Operating system and services

This software is resident in the module and manages the hardware :

• **BIOS**
  The BIOS is located in the BIOS ROM memory and manages system start-up when the module is powered up (self-tests). In addition, it manages all the physical I/O such as keyboard, video, serial link, pseudo disks (SYSTEM/RAM DISK) and shared memory.

• **Operating system and utilities**
  This software is located in the system memory (SYSTEM DISK). It comprises the operating system DR DOS 5.0 and the DOPTOOLS utility (see later).

3.3 Module self-tests

Each time the module is powered up or initialized, it executes a series of self-tests :

• It executes the first tests which, in the case of a detected failure, stop the microprocessor, thus rendering the module inoperative :
  - Microprocessor test.
  - BIOS ROM memory test.
  - DMA and timers test.

• Providing the first series of self-tests execute without error, a second series is performed. Should a failure be detected, an error message is displayed and the microprocessor continues the tests. The tests comprise :
  - Determining the size of system RAM memory.
  - Video controller test.
  - Interrupt controller test.
  - RAM memory test.
  - Keyboard test.
  - System disk test.
  - Serial port test.
  - Shared memory (SMU) test.

If a screen is connected to the module, the progress of the tests is displayed as follows :

```
T e l e m e c a n i q u e PCM 00   V1.0 (C)   Copyright 1990-93


CPU clock.......:        10 MHz
Base Memory.....:        512 Kb OK


Video Mode......:        VGA - Color Display

Keyboard........:        OK

System Disk.....:        OK

Serial Port(s)..:        2

Smu.............:        OK
```

When the self-tests have been completed, the result is displayed on the LEDs on the front panel and stored in a status word (see section 5.4). Providing no errors have been detected during the self-tests, the BIOS "Bootstrap" loader executes and attempts to find the system "Boot" file either in the memory cartridge or in system memory. The first file found is then loaded into memory and executed to start up the system.

E
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G
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3.4 LED status
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In all operational phases of the module, the status of the LEDs indicates correct operation or a fault condition when applicable :

Phase	RUN	CPU	MEM	I/O	Description
Power-up	ON	ON	ON	ON	Module out of service (hardware fault)
Self-tests	OFF	OFF	OFF	OFF	Self-tests in progress
	OFF	ON	ON	ON	Self-test error
	OFF	OFF	OFF	ON	Module not connected to console or wrong monitor type.
Boot module execution	OFF	OFF	ON	OFF	Wrong cartridge type or defective cartridge
	ON	OFF	OFF	OFF	Module operational
DOS start-up Operation (*)	ON	OFF	OFF	OFF	Correct operation
	ON	OFF	ON	OFF	Cartridge absent or without application
	ON	ON	ON	ON	Module out of service
	ON	OFF	OFF	ON	Module not connected to console or wrong monitor type.

ON   : LED on
OFF : LED off

(*)   Management of the LEDs (except for the I/O LED) can be modified by the application part. In this case, it is the responsibility of the developer to document the status of these LEDs.

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4.1 Powering up

The cartridge can be formatted in one of two ways :

• **Cartridge formatted and non-bootable, called application or user cartridge,**
• **Cartridge formatted and bootable, called system cartridge**.

The operation of the module at power-up and at the end of the self-test phase is determined by the state of the cartridge.

• **If the cartridge is absent or not formatted**, the module will execute the self-test routines, then load into memory and execute the operating system found in system memory (SYSTEM DISK). The time, as read from the PLC, and the main user menu are displayed on the screen connected to the module. The user menu offers the following functions to the user :
  - Cartridge initialization.
  - Updating the time/date in the PLC and the module.
  - Executing an application.
  - Return to the operating system.

• **If an application cartridge (user cartridge) is present**, the module will execute the self-test routines, then load into memory and execute the operating system found in the system memory (SYSTEM DISK).
  Should there be no application program present in the cartridge, the time, read from the PLC, and the main user menu are displayed on the screen connected to the module. If an application is present in the cartridge, it is executed.

• **If a system cartridge is present**, the module will execute the self-test routines, then load into memory and execute the operating system found in the cartridge.

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4.2   DOPTOOLS permanent user services

4.2-1   General

In any of the following situations :

- Cartridge absent when module initialized
- Cartridge not formatted when module initialized
- No application program in the cartridge when module initialized
- Application stopped
- STARTUTI command called up by DOS (to start the permanent user services)

the user services display the following menu on the screen connected to the module :

```
10:40:00                    PCM 00                   06/07/92


                    Main menu


            F6:Cartridge Initialization
            F7:PLC Date and Time Initialization
            F8:Run Cartridge Application

            F3:Exit to DOS



          Copyright AEG SCHNEIDER AUTOMATION 1990-1995
```
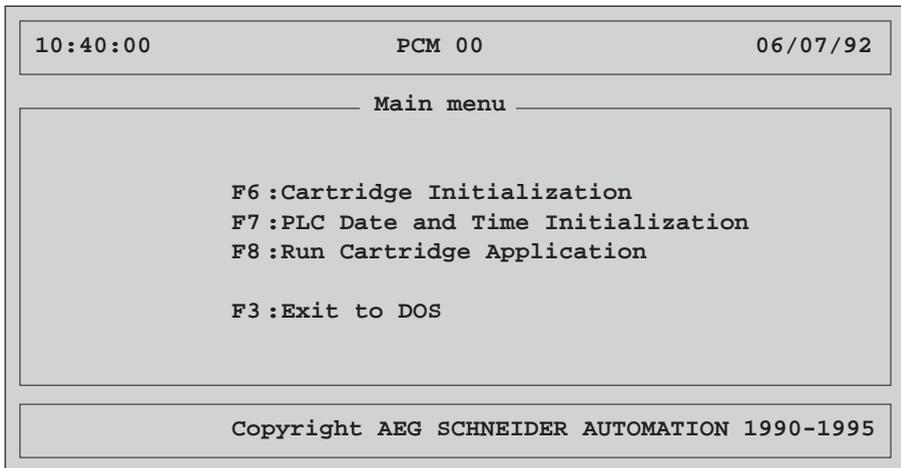
A band in the upper part of the screen displays the time and date read from the PLC at power-up but subsequently maintained by the module.
The central part of the screen indicates the main user accessible functions supported by the permanent services :

- Cartridge initialization.
- Modification of date/time
- Executing an application.
- Return to DOS.

In addition to these functions, monitoring of the message handling associated with the transfer of files with the PCM FTT integration software is also available.

<F6>   Accesses the cartridge initialization menu.

<F7>   Accesses the date/time update menu.

<F8>   Starts execution of the application.

<F9>   Permits return to DOS

4.2-2 Cartridge initialization

This screen, which is accessed by key **<F6>** in the main menu, is used to initialize a user cartridge (in the same way as a diskette) in order to install certain DOS files. This operation is obligatory the first time the cartridge is used.

```
10:41:00              PCM 00              06/07/92

           ┌──── Cartridge initialization menu ────┐
           │                                        │
           │                                        │
           │     F1 : User Cartridge Initialization │
           │     F10  :System Cartridge Initialization│
           │                                        │
           │     F3 : Return to main menu           │
           │                                        │
           └────────────────────────────────────────┘

           Copyright AEG SCHNEIDER AUTOMATION 1990-1995
```
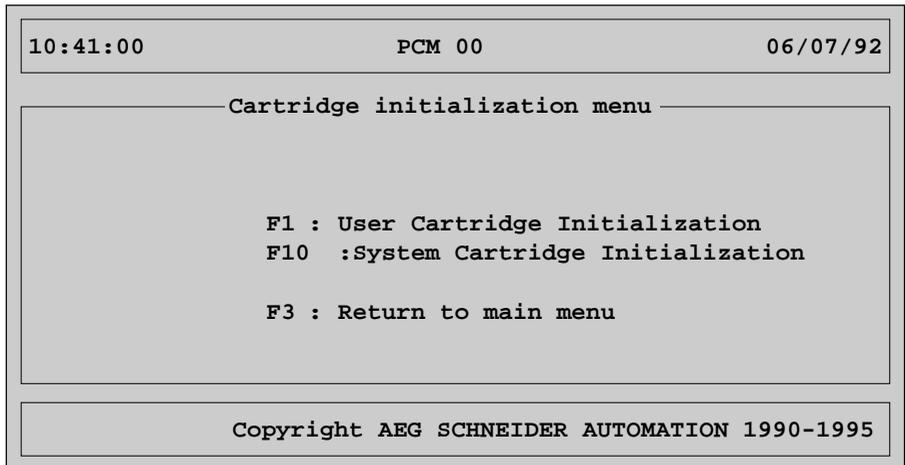
<F1> Enables the user to initialize (or format) an application cartridge. The following message is displayed on the screen :
WARNING ! This operation erases the whole cartridge !
Do you really want to continue (F9=Yes, Others=No) ?

> **<Any key other than F9>** aborts the initialization of an application cartridge.

> **<F9>** confirms and starts cartridge initialization. This is performed in two phases :

> **Physical formatting of the cartridge :** Consists of initializing each sector of the cartridge with the same data, then verifying it in order to update the File Allocation Table (FAT) with the bad sectors.
> As the initialization proceeds, the result of each operation is displayed track by track in the form of a horizontal bargraph.
> Should there be a track error, a message is displayed instead of the bargraph.

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Logical formatting of the cartridge : Consists of initializing the first sectors of the cartridge in the following way :

• Initializing the boot sector.

• Initializing the FAT sectors.

• Initializing the root directory sectors

• Creating a volume name (11 characters) to customize the cartridge :

DDDYYHHMMSS

```
                          ┌──── Seconds
                      ┌──────── Minutes
                  ┌──────────── Hours
              ┌──────────────── Year
          └────────────────── Day of the Year
```
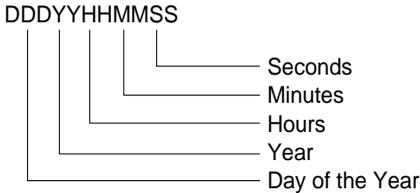
For example, 07291133022 corresponds to a cartridge formatted on the 72nd day of 1991 at 13.30 and 22 seconds.

The message *End Cartridge Initialization !* informs the user that cartridge formatting is finished.

There are two types of error which may occur during the cartridge initialization operation :

• Serious errors which require the operation to stop immediately : no cartridge present, EPROM cartridge, error in system tracks (tracks 0 and 1).

• Errors relating to one track : checksum error, sector not found, write or read error, etc. The track is declared unusable by DOS, which reduces the size of available memory in the cartridge accordingly.

DOS identification of the cartridge

• Cartridges ≥ 2 Mb
  A : represents the system disk,
  C : represents the cartridge (user cartridge or system cartridge).

• Cartridges < 2 Mb
  A : represents the bootable drive, either the system disk, or the cartridge (system cartridge),
  B : represents the other drive.

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<F10> Permits the user to initialize (or format) a system cartridge (bootable cartridge). The following message is displayed on the screen :

WARNING! This operation erases the whole cartridge !
Do you really want to continue (F9=Yes, Others=No)?

As for an application cartridge, the user is required to either confirm and start the formatting operation, or abort.
The procedure for formatting is identical to that for an application cartridge. The only difference consists of adding a boot sector and the DOS system files when the formatting is finished.

Error management is identical to that for the application cartridge.

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4.2-3   Changing the Date and Time

The date and time menu is accessed by **<F7>** in the main menu. It allows the user to
modify the date and time simultaneously in both the PLC and the module.

```
┌─────────────────────────────────────────────────────────────────────┐
│ 10:40:00                    PCM 00                        06/07/92   │
│                                                                       │
│  ┌────────────────── PLC Date and Time menu ──────────────────────┐  │
│  │                                                                  │  │
│  │          F6 :Setting Date and Time on PLC                        │  │
│  │                                                                  │  │
│  │          F3 :Return to main menu                                 │  │
│  │                                                                  │  │
│  │             MM DD YY HH MM SS                                    │  │
│  │             04 01 91 10 40 00                                    │  │
│  │ Use Left and Right Arrows to select fields, Up and Down Arrows to modify them │
│  └──────────────────────────────────────────────────────────────┘  │
│                                                                       │
│  ┌──────────────────────────────────────────────────────────────┐  │
│  │         Copyright AEG SCHNEIDER AUTOMATION 1990-1995             │  │
│  └──────────────────────────────────────────────────────────────┘  │
└─────────────────────────────────────────────────────────────────────┘
```

<←><→>
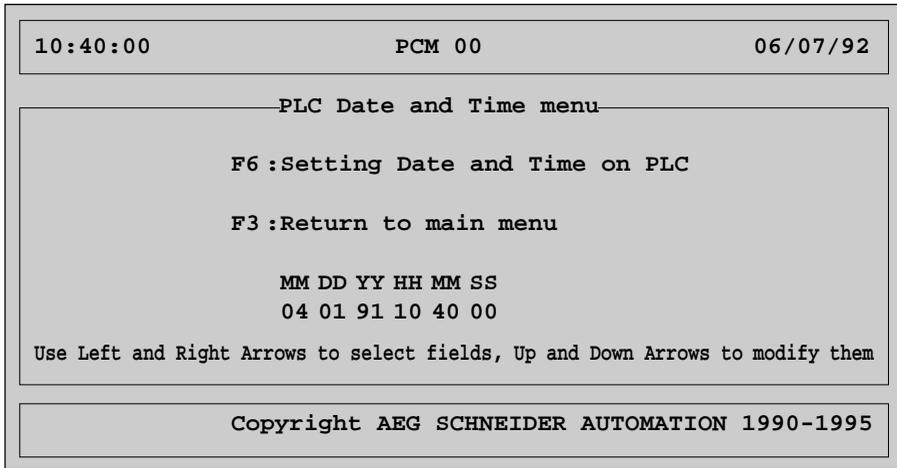
Selects the field to be modified

MM DD YY HH MM SS

                      Seconds
                  Minutes
              Hours
          Year
      Day
  Month

<↓><↑>
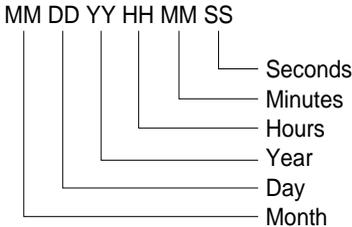
Increments or decrements the selected field.

<F6> Takes into account any changes to the date or time that may have been made.
The date/time update is performed simultaneously in both the PLC and the
module.
In the case of a fault, an error message is displayed on the screen.

<F3> Returns the user to the main menu without performing the date/time update in
either the PLC or the module.

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4.2-4 Starting the application

This function is accessed by key **<F8>** in the main menu and permits the user to exit from the permanent user services and start the application present in the cartridge, by executing the STARTAPP.BAT file.

The contents of the STARTAPP.BAT file are the responsibility of the systems integrator.

If the STARTAPP.BAT file is not present in the cartridge, an error message appears on the screen (see section 5 - Appendix).

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4.2-5 Return to the DOS operating system

This function is accessed by key **<F3>** in the main menu and permits the user to exit from the permanent user services and to return to the DR DOS 5.0 operating system, located in system memory. As soon as the DOS prompt becomes visible all the standard DOS functions (DIR, COPY, etc) are available.

In order to use all the available DOS commands, a full keyboard with 101 or 102 keys is required.

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4.2-6 Transferring files

When transferring files using the PCMFTT software, and if a display terminal is connected to the module, the screen associated with the transfer operation is displayed automatically, temporarily replacing the current display. At the end of the transfer, the previous screen is reactivated while retaining all data relative to the transfer.

It should be noted however, that transfer of files using the PCMFTT software can only be performed if the status of the module is compatible with file transfer operation. For example, if the user is in the process of initializing a cartridge, file transfer cannot be performed while the cartridge is being formatted.

```
10:40:00                    PCM 00                    06/07/92


                    ┌─────── Main menu ───────┐

             S10 : Abort Current Operation

Operation........:Uploading        Remote name : (OEM) PC-DOS
File name........:SYS.CT
File size........:992 bytes
Bytes transferred:496 (50%)

Status...........:Working


          Copyright AEG SCHNEIDER AUTOMATION 1990-1995
```
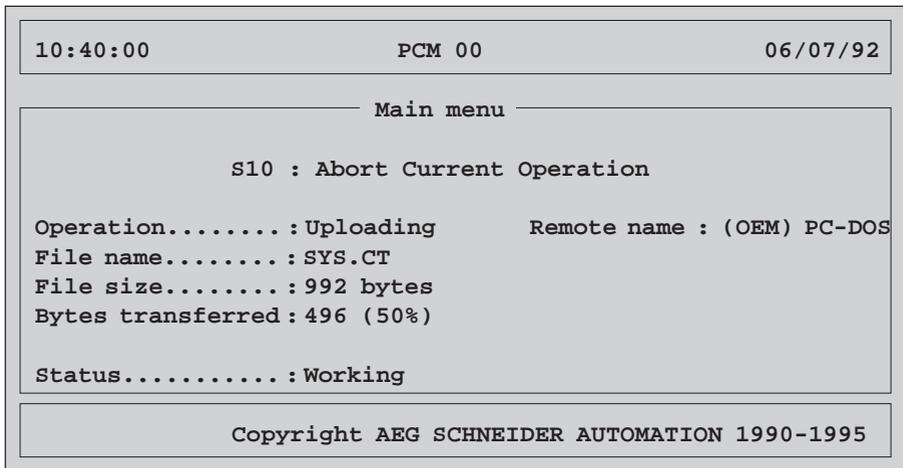
<S10> or **<Shift><F10>**
Stops the transfer of files from the module immediately.

Status messages displayed during file transfer operations are as follows :

- **Operation**, indicates the type of transfer in progress :
  - **Uploading** : reception of a file by the module,
  - **Downloading** : transmission of a file from the module.
- **Remote name**, indicates the name of the remote program which originated the transfer.
- **File name**, indicates the name of the transferred file.
- **File size**, indicates the size in bytes, of the transferred file.
- **Bytes transferred**, indicates the number of bytes already transferred and the percentage of bytes transferred relative to the size of the file. This information indicates how the operation is progressing.

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- **Status**, indicates the current status of the transfer :
  - **Working :** The transfer operation is in progress.
  - **End of Transfer OK :** The transfer has been completed successfully.
  - **Aborted by local operator :** The transfer has been aborted by the user pressing key S10.
  - **Aborted by remote operator :** The transfer has been aborted by PCMFTT.
  - **Local Error : <Error message>.**
  The transfer has been aborted because of a fault in the module, detailed in <Error Message>.
  This message (detailed as "unable to open file") is normally displayed at the initial transfer to a newly formatted cartridge
  - **Remote Error : <Error message>.**
  The transfer has been aborted because of a PCMFTT fault, detailed by <Error Message>.
  - **Communication interrupted :** The transfer has been aborted because of a communications failure between PCMFTT and the module.

**E
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G
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I
S
H**

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5.1 Error messages

5.1-1 PLC date/time read error messages

PLC CPU not available !
Impossible to access the PLC processor.

Timing on PLC CPU not available !
Date/Time read request not supported by PLC.

Communication not available !
Local access to SMU shared memory impossible.

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5.1-2 Cartridge formatting error messages

At the start of the formatting operation

Assigned or Substituted Unit !
Drive b: has been either re-assigned or substituted (a DOS ASSIGN or SUBST
command has previously been executed).
Formatting is stopped immediately.

No Cartridge !
There is no cartridge in the module.
Formatting is stopped immediately.

Invalid Cartridge Type !
The cartridge size is not recognized by the module.
Formatting is stopped immediately.

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During the physical formatting

Incorrect Initialization Parameters !
Formatting incompatibility at the BIOS level (an EPROM cartridge for example).
Formatting is stopped immediately.

Protected Cartridge !
The cartridge is an EPROM cartridge.
Formatting is stopped immediately.

Cartridge not ready !
This message appears if any attempt is made to extract the cartridge from the module during the formatting operation.
Formatting is stopped immediately.

Invalid system tracks !
Formatting error connected with the tracks containing the system sectors : tracks 0 and 1 for a non-bootable cartridge and tracks 0 to 12 for a bootable cartridge.
Formatting is stopped immediately.

During the transfer of system files to a bootable cartridge

Invalid system disk file !
Impossible to read the system files present on the system disk.
Formatting is stopped immediately.

Invalid cartridge file !
Impossible to write the system files to the cartridge.
Formatting is stopped immediately.

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5.1-3   Date/time update error message

PLC CPU not available !
Impossible to access PLC processor or Date/Time write request not supported by the PLC processor.

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5.1-4   Application execution error message

No application on the Cartridge!
The STARTAPP.BAT file is not present in the cartridge.

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5.2 Current consumption

Typical current consumption
  Average current consumption measured at an operating temperature $\theta_A = 25°C$

Maximum current consumption
  Calculated current consumption for operation of the module over the full operating temperature range of $\theta_A = 5°C$ to $55°C$

Voltage	Current consumption in mA	
	Typical	**Maximum**
+5 V	1650	2100
+12 V	20	30
TSX BMP 010 +5 V	270 (1)	300 (1)

(1) if a keyboard is connected to the module, make allowance for its own consumption.

**E
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G
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5.3   The TSX BMP 010 module

BMP 010

OK

VIDEO
VGA

RS 232C
(COM1)

RS 232C
(COM2)

PCM

KB

①

⊤ TSX PCM 00

1 TSX CMM xx0 (xx = 03,10,30,40)
    TSX CMB 0xx (xx = 03,10)

220 VCA   110 VCA

N   N

L   L

Modem

	COM1	COM2
1		DCD
2	RXD	RXD
3	TXD	TXD
4		DTR
5	GND	GND
6		DSR
7		RTS
8		CTS
9	BUSY	RI
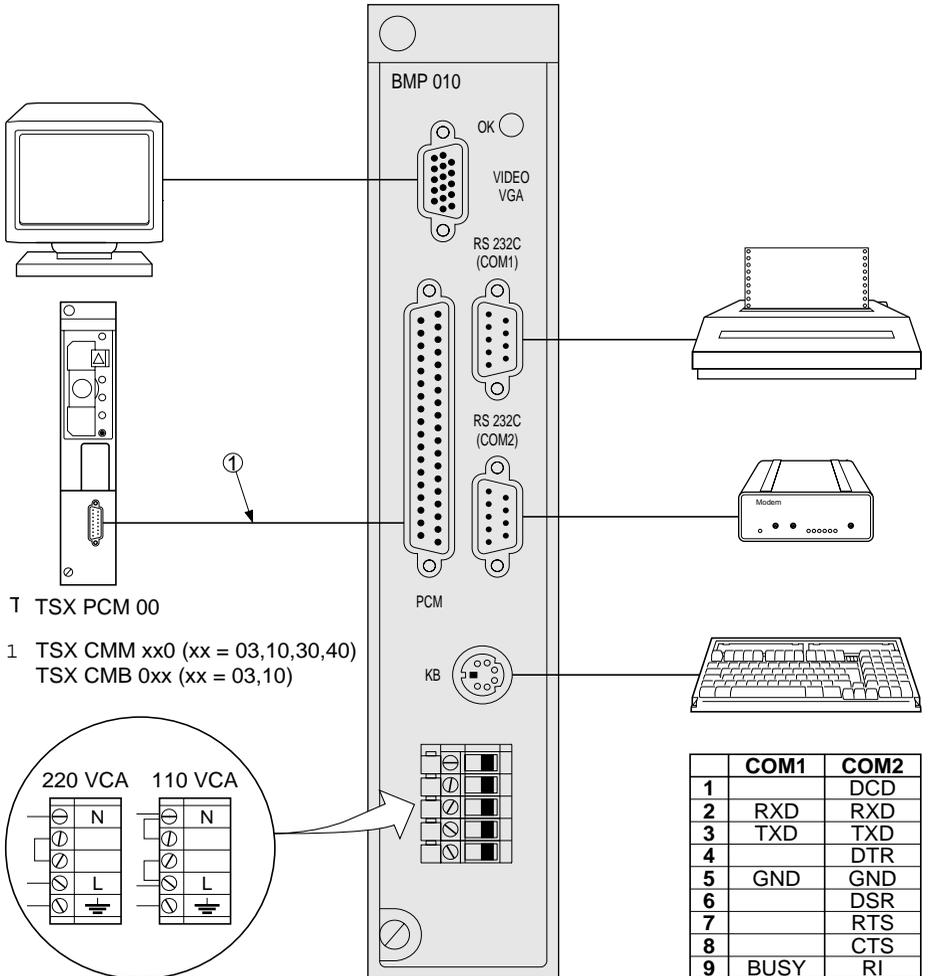
5.4 Discrete bits and register words

Addressing

Discrete Bits

I   x   y , i

Bit #
Position #
Rack #
Input: read by CPU

Register words

IW or OW x   y , i

Word #
Position #
Rack #
Ouput: written by CPU
Input: read by CPU
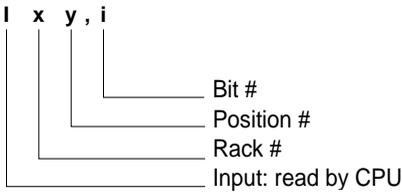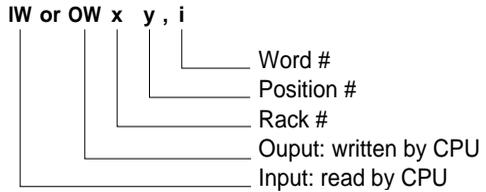
Discrete bits

All the discrete bits are free

Input register words

Standard status word

F E D C B A 9 8 7 6 5 4 3 2 1 0

IWxy,0
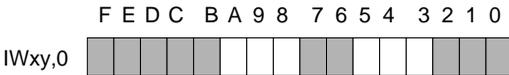
bit 3	1= module available
bit 4	1= general non-fatal error
bit 5	1= non-fatal error
bit 8	1= fatal error, SMU driver absent or module absent
bit 9	Reserved
bit A	1= console not connected, TSX BMP 010 module not connected or visual display unit not connected

Other register words : these are all free.