The different versions of the TSX SCM module

The different versions of the TSX SCM module are identified by a label affixed to the right hand side of the module. Module software versions are shown as V followed by the software version number.

This manual describes configuration and programming of asynchronous data link modules operating in character string mode only:

. TSX SCM 20xy software version V1.3 or higher,
. TSX SCM 21xy software version V1.0 or higher,
. TSX SCM 22xy in half-duplex character string mode.

These modules are designed for use with TSX 47-20/30, TSX 67 and TSX 87 Programmable Controllers.

A detailed description of improvements made to the software of the TSX SCM 20xy module since the release of previous versions (software versions prior to V1.3) is given in the Appendix.

The use of certain TSX SCM modules (those compatible with Uni-Telway, Modbus ®, Pyromat ® protocols), requires additional information not given in this manual. When using these modules refer to the appropriate Programming Manual.

Contents

TSX SCM 2. Half/Full Duplex character mode programming manual

1 Introduction

1.1 Description

General

TSX SCM Serial Communication Modules are intelligent modules that comprise two asynchronous serial links that can be used with TSX 47-20, TSX 67 and TSX 87 Programmable Controllers. These modules are designed to provide dialog and communications functions between PCs and their environment:

- Standard peripherals: printer, display terminal, adjustment terminal,
- Inter PC communication,
- Communication with a supervisory or production control computer,
- Data transmission between heterogeneous equipment (numerical controllers, variable speed drives, weighing indicators, etc.).

Functions

TSX SCM modules comprise two asynchronous serial links that are completely separate and can be programmed for speed, transmission format and operating mode. Each data link includes a transmission channel and a reception channel.

The complete exchange of character strings in half-duplex or full-duplex modes is entirely controlled by the module. Only data exchange initialization needs to be programmed through the PC processor.

The different line adaptors available allow data transmission using the most common standards:

- RS 232 C simplified (2 signals),
- RS 232 C, (6 signals),
- RS 232 C Modem (9 signals),
- RS 422 A / RS 485, point-to-point and multipoint,
- 20 mA current loop for point-to-point and multipoint modes.

Simplicity of operation

A TSX SCM module fitted with its adaptors includes the line power supply and the appropriate line adaptor circuit.
The configuration mode and the associated software functions are comprehensive and simple to program.

Safety of operation

Most of the adaptors provide electrical isolation between the line and internal voltages and have a grounding circuit that provides effective shielding against interference.
The module and the terminal block can be inserted or removed under power (when the PC is stopped).

Self-Testing

Whenever the module is powered-up, a series of internal self-tests are performed. These include looping back the transmissions to the receiver stage of the module and repeating this for each channel.
Any operating fault is shown by indicators on the front panel of the module and a message is sent to the PC processor.

1.2 Hardware presentation

The TSX SCM 2.. module is a standard sized module that operates on the complete I/O bus of a TSX Series 7 PC and in a location reserved for intelligent I/O modules.

The module comprises:

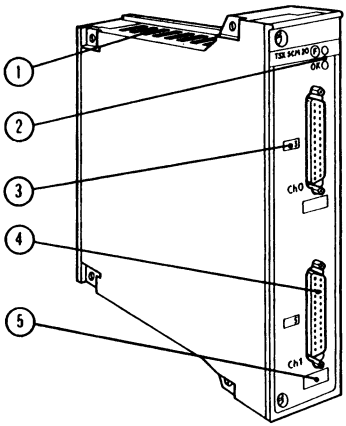
1) A metal case to protect the module electronics and provide protection against radiated electrical noise.

2) Two indicator lights:
A green "OK" light indicating normal operation,
A red "F" light indicating a module fault.

3) Two slot-in label locations, used to indicate the type of line adaptor fitted to each of the two channels.

4) Two sockets for 25-pin D-type connectors.

5) Two blank labels available for the user's identification.



Locating devices and configuration codes

The back panel of the module is fitted with coded locating devices.

- The standard factory coded locating devices prevent any risk of error when installing or changing a module,
- The optional user-coded locating device can be used to distinguish between modules of the same type that have a different hardware or software configuration, that are fitted with different line adaptors, or that use different operating parameters.

Summary of hardware and software configuration codes used

TSX 47-20 PC:	TSX SCM 2...	hardware code	= 69
		software code	= 63
TSX 67/87 PC:	TSX SCM 20..	software and hardware code:	696
	TSX SCM 21..	software and hardware code:	697
	TSX SCM 22..	software and hardware code:	698

2 Operation

2.1 Character string mode

Principle

The TSX SCM module has two asynchronous serial links identified as Channels 0 and 1.

Each channel is fitted with a line adaptor. The adaptor ensures that transmissions are made according to a recognized industry standard (RS-232-C, RS-422-A, current loop, etc.). A description of the different adaptors available, their hardware specifications and connection information is provided in the TSX SCM Installation Manual.

The programming of module serial links is the same regardless of the type of line adaptor fitted. Special programming is required only for certain control signals that are specific to each adaptor. For further details refer to Section 6 of this manual.

Character string mode

The TSX SCM module is a specialized dialog and communication module that reduces the workload of the PC processor. The module's microprocessor and dedicated software process the character strings for each channel. Processing comprises sending words (Wi or CWi) from a character table in the PC memory or receiving words (Wi).

Depending on the type of TSX SCM module used (*), the following types of communication can be used:
HALF DUPLEX: at a given time the module is either transmitting or receiving a character string, but not both.
FULL DUPLEX: character string transmission and reception can be carried out simultaneously.

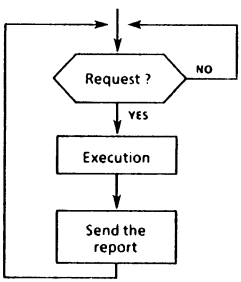
An exchange must be initiated by program (a request sent to the module). Once this is done the exchange is entirely controlled by the module.

(*) Refer to the Appendix.

Operation of a channel

The two channels of a module are completely separate and can be programmed to operate simultaneously.

The principle of operation for a channel is shown in the flow-chart opposite.



A request is a character string processing command (transmission and/or reception) requested by the user program and sent with the parameters required for its execution.
The module informs the user program that execution is complete, by sending a report. The report comprises information on how the exchange was conducted.

Character string mode

List of requests

The WRITE CONFIGURATION request allows the module channels to be configured. Configuration comprises defining the transmission speed, character format, etc.

The TRANSMISSION/RECEPTION WITH/WITHOUT REPORT, WITH/WITHOUT TIME-OUT request is available on TSX SCM 21xy modules for use when programming exchanges.

On TSX SCM modules without this request, the following requests can be used:

- TRANSMISSION WITH TIME-OUT, WITH REPORT,
- TRANSMISSION WITHOUT TIME-OUT, WITH REPORT,
- TRANSMISSION WITHOUT TIME-OUT, WITHOUT REPORT,
- RECEPTION WITH TIME-OUT,
- RECEPTION WITHOUT TIME-OUT,
- TRANSMISSION/RECEPTION WITH TIME-OUT,
- TRANSMISSION/RECEPTION WITHOUT TIME-OUT.

Additional requests can be used to provide a detailed analysis of faults and their location, for module identification, etc. (refer to Sub-section 6.3).

Example of a request

Reception with time-out.

This request sets one channel of a TSX SCM module to receive a preset number of characters within a given length of time (time-out). The parameters to enter are:
- Module address and channel number,
- Request code number,
- Number of characters to be received,
- Storage table address,
- Time-out value.

On receiving this type of request, the module ensures that it is executed in full, separately from the user program which can continue to execute other functions during this time. The module will:
- Receive and count the characters received,
- Control transmission errors,
- Control the time-out function.

Once the request has been executed by the module (character count reached or time-out) the module sends a report to the user program, indicating:
- That the characters received have been transferred to the PC memory,
- The number of characters received,
- Transmission errors (if any),
- Time-out (if any).

The analysis of this data allows the user program to react accordingly and adjust processing if required (e.g. request a repeat transmission).

2.2 Dialog with the PC

Dialog modes

The dialog between a user program in a TSX 47-20 or TSX 67/87 PC and a TSX SCM module uses:

- Discrete I/O bits,
- Register words (16 bit words),
- Messages (16 bit word tables).

Discrete I/O bits I/Oxy,i

When a TSX SCM module is used, discrete I/O bits are assigned to the line adaptor control signals (separate from the transmission and reception signals).
Writing a discrete output bit sets the corresponding signal to 0 or to 1.
Reading a discrete input bit gives the status of the corresponding control signal.

The meaning of each discrete I/O bit depends on the type of line adaptor fitted to each module channel. (Refer to Sub-section 5.1).

Registers IW/OWxy,i

The input registers, that can only be accessed in read mode, are "status words" that provide data on whether the module and each of its channels is operating correctly.

The output registers, that can be accessed in read and write modes are "command words" that can be used to reinitialize the module after a power break or to stop an exchange on one of the module's channels (refer to Sub-section 5.2). The bits in these register words can also be accessed in both read and write modes (OWxy,i,j).

Messages

Programming a request requires larger data exchanges between the user program and the module. Data is exchanged as messages or 16 bit word tables sent in both directions:

- Sending a request and its parameters to the module,
- Report reception by the user program.

These exchanges are programmed through a Text block.
Text block parameter TXTi,M must be initialized with the module address (rack and slot number) followed by the appropriate channel number. Initialization can be carried out:

- By the user program, or
- When configuring the Text block (except when a TSX T607 terminal equipped with a software version prior to V3.0 is used).

Once the exchange is complete the user will receive two reports (TXTi,V and TXTi,S). For a detailed description of the Text block, refer to the appropriate programming manuals for the PC being used.

3.1 Configuration principle

Presentation

A module is configured by sending it the basic information required for the operation of its two channels.

The configuration of a module channel is defined by programming and each channel can be configured separately. The channels cannot operate if their configuration has not been defined (there is no configuration by default).

The configuration of a channel must define:

- The type of software function to be executed: half-duplex or full-duplex character string processing,
- The physical transmission characteristics: character format, transmission speed,
- The various operating parameters: use of automatic echo control, XON/XOFF protocol control, back-space, etc.

Access to the configuration

The configuration of a module channel is entirely programmable from the PC processor. To configure a channel, use a Text block to send a "write configuration" request along with the configuration parameters.

If a power break occurs, the configuration of each channel is saved in the RAM memory of the module for the life of the battery back-up (at least 3 weeks). Sending a "write configuration" request is recommended on power return (power break indicated by SY0 and SY1). This eliminates any problems that may be caused by hardware changes being made to the modules during the power break (e.g. module replacement or exchange).

Bits IWxy,1,3 and IWxy,1,B provide information on the module configuration status of each channel:

- State 1 = channel configured,
- State 0 = channel not configured, or configuration lost.

For additional information on register words refer to Sub-section 5.2.

Notes

TSX SCM modules can operate with only one channel configured.

- The modules will also retain their configuration if they are removed under power (with the PC stopped).
- The "read configuration" request allows the user program in the PC to read the module configuration (refer to Sub-section 6.3).
- If required by the application, a channel can be reconfigured during program execution. Sending a new configuration to the module automatically replaces and erases the previous one.

3 Configuration

3.2 Defining the parameters

General

The layout of the parameter tables transmitted to the module is shown below. The tables contain for each channel:

. 8 memory words (16 bytes) in half-duplex,

. 9 memory words (18 bytes) in full-duplex.

These words can be internal words (Wi) or constant words (CWi).

The coding used is BCD (Binary Coded Decimal) for values (time-out, etc.) and Hexadecimal for codes (requests, etc.).

Half-duplex

F E D C	B A 9 8	7 6 5 4	3 2 1 0
0 (Function)	No. of bits	Parity	Stop bits
Transmission speed (Baud rate)			
Trans. echo	Transmission time-out echo		
Rec. echo	Auto-LF	Xon-Xoff	Back-Space
Val-ERC-1	ERC-1-incl.	Val-ERC-2	ERC-2-incl.
Definition of ERC - 1		Definition of ERC-2	
Val-ETC-1	ETC-1-incl.	Val-ETC-2	ETC-2-incl.
Definition of ETC-1		Definition of ETC-2	

Full-duplex

F E D C	B A 9 8	7 6 5 4	3 2 1 0
1 (Function)	No. of bits	Parity	Stop bits
Transmission speed (Baud rate)			
0	DTR control	Xon-Xoff (Rec.)	Echo type
Rec. Echo	Auto-LF	Xon-Xoff (Trans)	Back-Space
Val-ERC-1	ERC-1-incl.	Val-ERC-2	ERC-2-incl.
Definition of ERC-1		Definition of ETC-2	
Val-ETC-1	ETC-1-incl.	Val-ETC-2	ETC-2-incl.
Definition of ETC-1		Definition of ETC-2	
SILENCE BETWEEN CHARACTERS			

Key: ERC = End of Reception Character,
ETC = End of Transmission Character,
INCL. = Included.

Defining the parameters

Defining the parameters

Function: specifies the channel operating mode.

0	Half-duplex character string
1	Full-duplex character string

Number of bits: defines the format of the characters exchanged over the line.

7	7 bit characters
8	8 bit characters

Parity: defines whether or not a parity bit is used.

0	no paritiy
1	odd parity
2	even parity

Number of stops: number of stop bits used to define a character.

1	1 stop bit
2	2 stop bits

Important Note: The last three parameters listed above define the transmission format, which is linked to the possibilities of the UART of the module.
Only the eight possibilities listed below are available on each channel, to the exclusion of all others:

- 7 bits + even parity + 1 stop bit
- 7 bits + odd parity + 1 stop bit
- 7 bits + even parity + 2 stop bit
- 7 bits + odd parity + 2 stop bit
- 8 bits + even parity + 1 stop bit
- 8 bits + odd parity + 1 stop bit
- 8 bits + 1 stop bit
- 8 bits + 2 stop bit

Example: B'0802' defines half-duplex operation with 8 bits, no parity bit and 2 stop bits.

Transmission speed (baud rate): the transmission speed is coded in 4 figure BCD (the coding for 19200 baud is H' 1920')

The transmission speeds that can be used for each channel are listed opposite. However, the following restrictions apply if both channels are used simultaneously:

CH.0	19200	-	9600	-	4800	-	2400	
	1200	-	600	-	300	-	150	
CH.1	19200	-	9600	-	4800	-	2400	
	1200	-	600	-	300	-	75	

- A 19200 baud data link on one channel limits the other channel to a maximum transmission speed of 4800 baud,
- A 9600 baud data link on one channel limits the other channel to a maximum transmission speed of 9600 baud.

Transmission-Echo:
(Half duplex only)

0	echo inhibited
1	echo validated

After each character is sent, the module waits for an echo until time-out:

- If the echo is received before time-out and is correct, the next character is sent,
- If not, the character is sent again and 3 more tries are made. If this is unsuccessful, a fault bit is set and the request is interrupted.

Defining the parameters

Transmission time-out echo:
(Half-duplex only)
This signal is sent only if the transmission echo is validated.

1 to 999 time base increments.

The time-out value is coded in 3 figure BCD.
A 50 millisecond time base is used.

Reception echo:
Any character received by the module while executing a reception request is immediately sent back over the line as an echo.

0	echo inhibited
1	echo validated

In full-duplex if a transmission request is sent by the PC to a channel that is already being used for reception with echo, the reception echo is interrupted. Once the transmission request has been executed, the echo can restart in two different ways (see Echo Type).

Auto-LF:
Whenever a carriage return character (CR = H'0D') is sent, the module automatically sends a line feed character (LF = H'0A').

0	auto-LF inhibited
1	auto-LF validated

This function also applies to reception requests with echo.

Xon-Xoff (T):
These two characters, are often used to indicate when a printer or any other peripheral is busy.

0	Xon-Xoff transmission inhibited
1	Xon-Xoff transmission validated

During execution of a transmission request, the module interrupts character transmission when XOFF is received. Transmission restarts when XON is received. (This control function only applies to transmission).

XON = H'11'

XOFF = H'13'

Back-space:
This character corresponds to moving the cursor to the left when executing a reception request, the module controls this function as follows:

0	back-space inhibited
1	back-space validated

- With Back-space inhibited, BS characters received are stored like all other characters,
- With Back-space validated, when a BS character is received during the execution of a reception request with echo, the module does not store it and the previous character is deleted. The module generates the following three characters: Back-space (ASCII code H'08'), then space (ASCII code H'20') and back-space again (ASCII code H'08').

Defining the parameters

DTR control:
In Full-duplex mode only, this signal is used when the module is connected to a Modem.

Type of DTR control	
0	by user programm
1	automatic by channel 1

It is available on pin 20 of the 25 pin connector on the front of the module. This signal can be used in two different ways:

1: The signal is automatically controlled by the TSX SCM 2.. module in full-duplex mode, therefore the signal cannot be directly accessed by the PC processor. When the signal (on pin 20) is at 0, the module is ready to receive, when it is at 1, the Modem is not ready to receive (refer to the XON-XOFF parameter).

0: The signal is controlled by the user program through the discrete I/O interface (refer to Sub-section 5.1). When the signal is at 0 the Modem is forced to connect to the line, when it is at 1, the Modem is forced to disconnect from the line.

XON-XOFF (R):
These two characters are used to control the level of traffic through the reception buffer of a TSX SCM module used for full-duplex communication.

0	Xon-Xoff inhibited
1	Xon-Xoff validated

When the PC processor sends a "Read N characters" request, as soon as the number of characters to be received on the line is reached, the module sends an XOFF character and the message is sent to the user memory. When the next Read request is received, an XON character is transmitted. This procedure allows messages of more than 256 characters to be received by synchronizing the transmitter to the XON-XOFF characters sent by the module.

Note : When XON-XOFF is validated, the Modem DTR signal remains active. Even when XON-XOFF is inhibited, receiving the requested number of characters sets the DTR signal to 1. If this signal is connected to the CTS (Clear to Send) line on the transmitting device (e.g. a Modem), transmission to the TSX SCM 2.. module is inhibited. (This only applies to modules equipped with SCA 1 or SCA 3 adaptors).

ECHO TYPE:
In full-duplex communication with the reception-echo configured, if a write request is sent while reception is in progress, the echo is interrupted.

0	restart from the interrupted character
1	restart from the first character received

It will restart in one of two ways, when the write request is completed:

. Echo restart from the interrupted character (Echo-Type = 0), or
. Echo restart from the first character received (Echo-Type = 1).

Example: In this example, the upper case letters show the characters sent by the channel after transmission or reception with echo. The lower case letters show the characters received by the channel during transmission, for which no echo was sent. As an example the message "Read" will be interrupted by the transmission of the message "Write".

	Echo-Type = 0	Echo - Type = 1
Reception	REad	REad
Transmission	WRITE	WRITE
Echo	RE AD	RE READ

3 Configuration

Defining the parameters

End of reception

A reception request can end on the reception of a specific character. The following parameters enable up to two stop characters to be defined.

VAL-ERC-1/VAL-ERC-2:
The validation codes for each of the two end of transmission characters.

0	end character inhibited
1	end character validated

ERC-1-INCL/ERC-2-INCL:
This parameter determines whether the end character is included in the reception table or not.

0	end character not included
1	end character included

DEFINE ERC-1/DEFINE ERC-2:
These 2 bytes are used to define the values of the end of reception characters.

H'00' to H'FF' for 8 bit characters
H'00' to H'7F' for 7 bit characters

End of transmission

A Transmission request can end when a specific character is found in the transmission table. Up to two stop characters can be defined.

VAL-ETC-1/VAL-ETC-2:
The validation codes for each of the two end of transmission characters.

0	end character inhibited
1	end character validated

ETC-1-INCL/ETC-2-INCL:
This parameter determines whether or not each end of transmission character is transmitted or not.

0	end character not included
1	end character included

DEFINE ETC-1/DEFINE ETC-2:
These 2 bytes are used to define the values of each of the end of transmission characters.

H'00' to H'FF' for 8 bit characters
H'00' to H'7F' for 7 bit characters

End of message

SILENCE BETWEEN CHARACTERS:
(Full-duplex only) A period of silence is used to detect the end of a message when no characters are detected on the line for a set period of time.

0 to 9999 in BCD

The duration of the period of silence is expressed in numbers of characters and takes a value between 1 and 9999 (in BCD). Silence period detection is inactive if the value is set to 0000.

3.3 Writing the configuration

Description

The configuration is programmed through a Text block that sends the module a table of predefined parameters. A report is sent back in the variable TXTi,V in a TSX 67/87 and TXTi,R in a TSX 47-20.

Initialization TXTi,M TXTi,C TXTi,L

The user program must:

Initialize the Text block transmission table with the configuration parameters (8 or 9 memory words depending on the type of module and the channel used). Initialization must be done by program if the Text block was defined with a transmission table located in the internal memory Wi zone. If the transmission table is in the constant memory CWi zone a terminal must be used.

Initialize the following Text block variables:

. TXTi,M : module address and channel number,

. TXTi,C : request code = H'0040',

. TXTi,L : length of the table for transmission to the module = 16 or 18 bytes.

These variables can be initialized either by program or by configuration if the TSX T607 terminal is equipped with software version V3.0 or higher.

Start the exchange with Text block inputs S, O and I at 1 (in Ladder language) or with EXCHG TXTi in Literal language.

At the end of the exchange (bit TXTi,D at 1 and TXTi,E at 0), analyse the report (TXTi,V or R).

Report for TXTI,V TSX 67/87 TXTi,R for TSX 47

The report is only significant at the end of a correct exchange (bit TXTi,D at for TSX 67/87 1 and TXTi,E at 0).

The report value can be:

. H'00FE' : correct configuration, accepted and stored by the module.

. H'00FD' : incorrect configuration, rejected by the module.
the channel is not configured.
any previous configuration is lost.

Causes : . parameters that exceed the limits,
. variable TXTi,L is not equal to 16 or 18.

Number of bytes received TXTi,S

. TXTi,S = 0 on configuration write request.

Writing the configuration

Example

To configure channel 0 of the TSX SCM 20 module located in rack 0, slot 7, in half-duplex communication.

Text block TXT0 is defined as a CPL type Text block with direct addressing and the transmission table is located at address CW0 (there is no reception table).

The configuration is sent on request (B10 set) or on power return (B0 reset to 0 by SY0 or SY1) and module available (IW7,0,3 = 1).

Constant words CW0 to CW7 contain the following values:

CW0 = B'0802': 8 bits - no parity bit, 2 stop bits,
CW1 = B'9600': 9600 baud,
CW2 = B'0000': no transmission echo,
CW3 = B'1001': reception echo and back space control,
CW4 = B'1000': 1 end of reception code, not included,
CW5 = H'0D00': the stop code is character H'OD' (carriage return),
CW6 = B'0000': no end of transmission code,
CW7 = B'0000': insignificant here as CW6 = 0.

The different Text block parameters can be initialized by configuration (except on a TSX T607 terminal with a software version lower than V3.0).

TXT0,M = H'0700': module address and channel number.

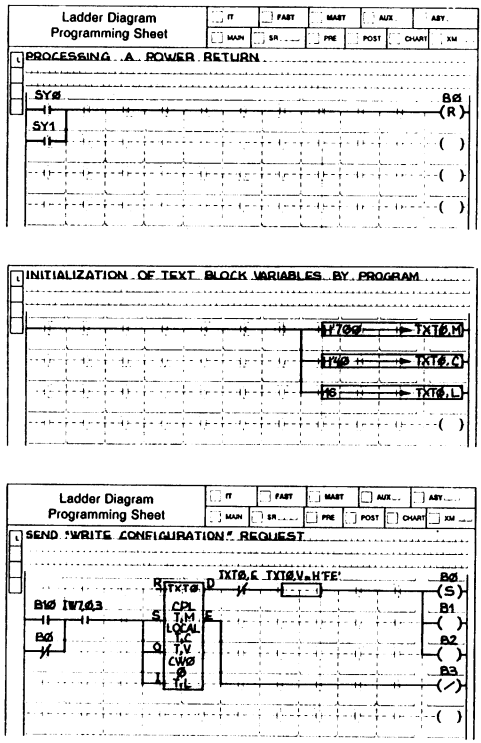
TXT0,C = H'0040' : write configuration" request code.

TXT0,L = 16: length of the configuration table to send to the module. (half-duplex = 16 bytes).

The exchange is started when bit B0 goes to 1 or a power return occurs and if the module is available (IW7,0,3).

When the exchange is completed, one of the three bits listed below goes to 1 and can be used to direct the program accordingly:

B1 = 1: configuration is correct,
B2 = 1: parameter error,
B3 = 1: exchange error on the bus.



If this occurs, check TXT0,S to determine the type of error.

4.1 Half-duplex transmission requests

General

The transmission requests (0, 1, 2) enable transmission, on one channel of the module, of a table of up to:

. 254 characters in a TSX 67/87,

. 30 characters in a TSX 47-20.

For requests 0 and 1, the exchange is started by EXCHG TXTi or by setting Text block inputs S, I and O to 1. Request 2 is started by OUTPUT TXTi (S and O at 1).
These requests do not use the Text block reception table.

Transmission with time-out and report (TXTi,C = H'0000')

The time out:

value is coded in BCD from 0 to 9999 with a time base of 100 ms.

Wi or CWi

Transmission table format

Time-out	
2nd Character	1st Character
4th Character	3rd Character
etc	

The time-out countdown starts from the time the first character is actually sent by the module.

Text block parameters

. Request TXTi,C	TXTi,C = H'0000'
. Variable TXTi,L	This variable is initialized by program or by configuration, with the **number of bytes** contained in the transmission table (including the two bytes that give the time-out value). The value is between 3 bytes and the maximum allowed.
. Address TXTi,M	Contains the module address and the channel number.
. Type of exchange	Transmission/Reception, started by: EXCHG or setting I, O and S to 1.
. End of exchange	TXTi,D = 1 as soon as the request is sent to the module.
. Report TXTi,V or R	Refer to Sub-section 4.5.
. Variable TXTi,S	TXTi,S = 0 for this transmission request.

Transmission without time-out, with report (TXTi,C = H'0001')

The characteristics of this type of transmission are the same as the previous request except that in this case no time-out is used, therefore:

. The transmission table only contains the characters to be sent (TXTi,L = 1) up to the maximum allowed),

. Report TXTi,V or R = .H'00FD' will not occur.

Half-duplex transmission requests

Transmission without time-out, without report (TXTi,C = H'0002')

The transmission table only contains the characters to be sent.

Wi or CWi

Table format

2nd Character	1st Character
4th Character	3rd Character
etc	

Text block parameters

- Request TXTi,C — TXTi,C = H'0002'
- Variable TXTi,L — This variable is initialized by program or by configuration with the **number of bytes** contained in the transmission table. The value is between 1 byte and the maximum allowed.
- Address TXTi,M — Contains the module address and the channel number.
- Type of exchange — Transmission only:
  In Ladder language: Inputs O and S = 1, I = 0
  In Literal language: Output TXTi.
- End of exchange — TXTi,D = 1 as soon as the request is sent to the module, and not when the request is executed by the module. This bit therefore cannot be used to link several transmissions together.
- Variables TXTi,S, TXTi,V, TXTi,R — Do not apply to this request.

Half-duplex transmission requests

Transmission example without time-out, with report

When input I14,F is set to 1, the message "P1 FAULT" is sent on channel 0 of the module. The module is located at address 07 (rack 0, slot 7) and no transmission time-out is used.

The transmission table starts at word 150 and only contains the 10 characters to be transmitted.

W150

1	P
space	space
A	F
L	U
Space	T

In this example, Text block parameters are initialized by program:

The configuration of Text block 2 is:

```
TXTi NETWORK TYPE  ADDR   ADDR    RECEPT A  T     M       L      C
                   MODE   BUFFER  LENGTH
 2   LOCAL   CPL   DIR    W150      0          H'00FF'   0    H'0000'
```

Writing the configuration corresponds to the example described in Sub-section 3.3.

TXT2,M = H'0700' module address and channel number,

TXT2,C = H'0001' request code for "Transmission without time-out, with report",

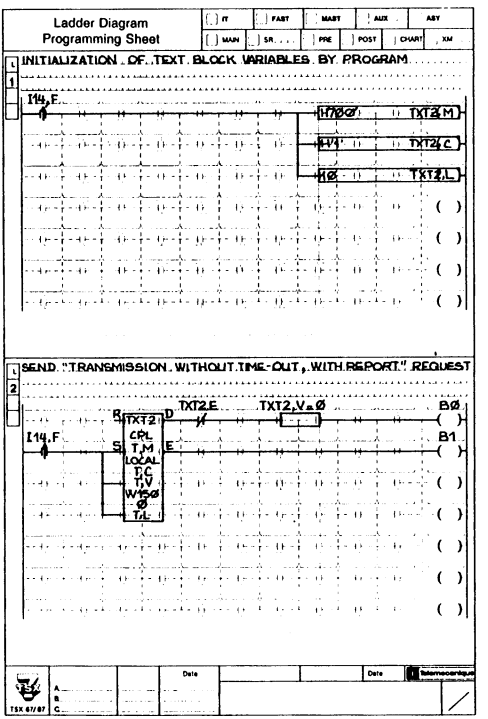
TXT2,L = 10 total number of bytes to transmit.

When input bit I14,F goes to 1, the rising edge starts the exchange and changes Text block outputs D and E to 0.

At the end of the exchange either bit B0 or bit B1 goes to 1:

B0 = request executed

B1 = exchange error.



4.2 Half-duplex reception requests

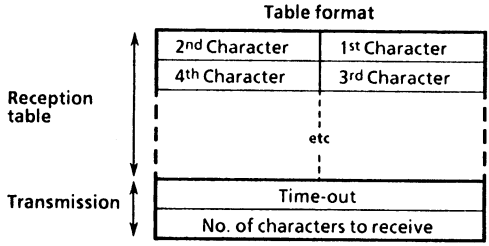
General

The reception requests (3 and 4) enable reception on one channel of a table of up to:
- 254 characters in a TSX 67/87,
- 30 characters in a TSX 47-20.

Depending on the programming language used, the exchange is started by EXCHG TXTi or by setting Text block inputs S, I and O to 1.

Reception with time-out (TXTi,C = H'0003')

The time-out value: is coded in BCD from 0 to 9999, with a time base of 100 ms.



The user defines a 4 byte transmission table that includes the time-out value and the number of characters to be received in the reception table. The characters received are transferred to the reception table at the end of the exchange. The layout of the reception table is shown above. Its start address (ADDR BUFFER) is defined when the Text block is configured.

The reception table defined when the Text block is configured must be large enough to hold the requested characters (RECEPT LENGTH). If not, the request is terminated when the number of characters received reaches the preset number of characters. If the storage capacity of the reception table is less than the number of characters received, all characters received before the capacity limit is reached will be stored, but any characters received after the limit has been reached will be lost.

Text block parameters

. Request TXTi,C	TXTi,C = H'0003'
. Variable TXTi,L	TXTi,L = 4
. Address TXTi,M	Stores the module address and channel number
. End of exchange	TXTi,D = 1 when the request has been executed
. Report TXTi,V or R	Refer to Sub-section 4.5.
. Variable TXTi,S	Refer to Sub-section 4.5.

Reception without time-out (TXTi,C = H'0004')

The characteristics of this request are the same as the previous one except that no time-out is used.
- Variable TXTi,L = 2. The transmission table will only accept a word initialized with the number of characters to be received.

4.3 Half-duplex transmission/reception requests

General

The transmission/reception requests (5, 6, 7) enable a single request to be sent to the module to execute a transmission request **followed** by a reception request. The transmission and reception tables contain a maximum of:

. 254 characters in a TSX 67/87,

. 30 characters in a TSX 47-20.

Depending on the programming language used, the exchange is started by EXCHG TXTi or by setting inputs S, I and O to 1.

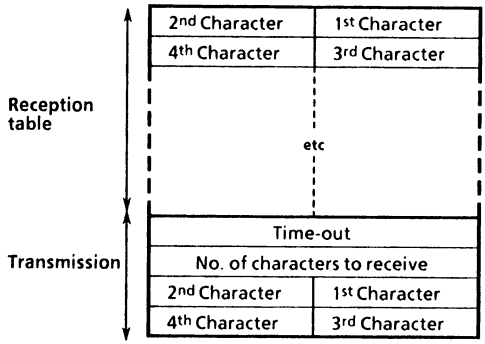
Note that the channel programmed to execute one of these requests is operating only in HALF-DUPLEX, it switches to reception only when transmission is complete.

Transmission/Reception with time-out and report (TXTi,C = H'0005')

The time-out value: is coded in BCD from 0 to 9999, with a time base of 100 ms.

The time-out applies to the entire request, transmission followed by reception.

Table format



Text block parameters

. Request TXTi,C	TXTi,C = H'0005'
. Variable TXTi,L	Initialized with the number of bytes stored in the transmission table (including the 4 bytes that define the time-out value and the number of characters to be received). This value is between 5 bytes and the maximum allowed,
. Address TXTi,M	Stores the module address and channel number,
. End of exchange	TXTi,D = 1 when the request is executed,
. Report TXTi,V or R	Refer to Sub-section 4.5,
. Variable TXTi,S	Refer to Sub-section 4.5.

Half-duplex transmission/reception requests

Transmission/reception without time-out (TXTi,C = H'0006')

The characteristics of this request are the same as those of the previous request except that no time-out is used:

- The transmission table does not contain a time-out value
- Variable TXTi,M must be initialized with a value between 3 bytes and the maximum allowed.

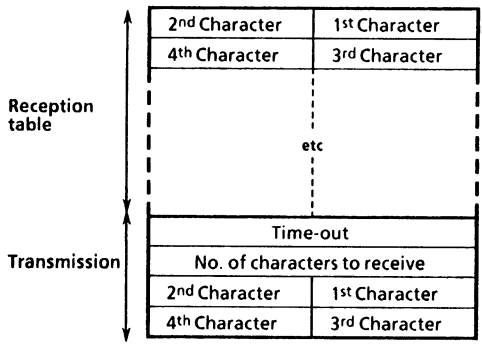
Transmission and/or reception with/without, time-out, with report TXTi,C = H'0007'

This request combines all of the functions of the requests described previously in a single request: transmission and/or reception, with or without report, with or without time-out (requests 0 to 6). This request is available on the TSX SCM 21xy module operating in character string mode on channel 0 (half-duplex) or on channel 1 (half-duplex or full-duplex).

The write and read operations use a standard write/read request.

The time-out value: is coded in BCD from 0 to 9999, with a time base of 100 ms.

Table format



Transmission table parameters

The transimission table parameters define the type of request used.

If the time-out value is 0, the request uses no time-out,

If the time-out value is not 0, the request a time-out.

If the number of bytes to be received = 0: write request,

If the number of bytes to be received is not 0 and TXTi,L = 4: read request,

If the number of bytes to be received is not 0 and TXTi,L > 4:write/read request

The transmission and/or reception tables must be large enough to contain all the characters to be transmitted or received.

Text block parameters

. Request TXTi,C	TXTi,C = H'0007'
. Address TXTi,M	Stores the module address and channel number.
. End of exchange	TXTi,D = 1 when the request is executed.
. Report TXTI,V or R	Refer to Sub-section 4.5.
. Variable TXTi,S	Refer to Sub-section 4.5.

4.4 Full-duplex transmission/reception requests

General

Full-duplex operation is only available on channel 1 of the TSX SCM 21xy module.
The full-duplex transmission/reception request (7) enables **simultaneous** transmission and reception, with or without time-out, with or without report, started by a single request.

The transmission and reception tables contain a maximum of:

. 254 characters in TSX 67/87, or

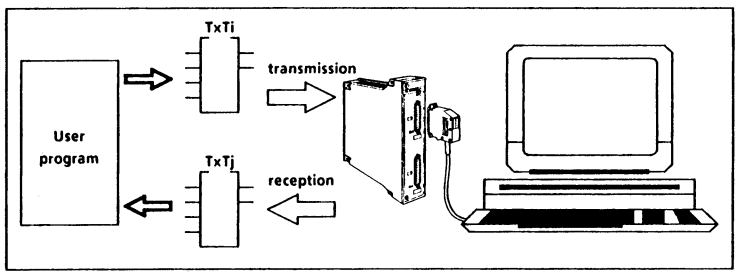
. 30 characters in TSX 47-20.

Depending on the programming language used, the exchange is started by EXCHG TXTi or by setting Text block inputs S, I and O to 1.

The module channel is validated to await message reception as soon as the configuration has been sent. The characters received are stored in a buffer with a maximum capacity of 254 bytes. Any additional characters are lost. Register bit IWxy,2,0 indicates an overflow.

When the module receives a "Read n characters" request, with n not more than the maximum number of characters allowed, if a message has already been stored in the module buffer, it is sent to the data memory of the PC. If no message is ready, the channel waits for the n characters to be received or for the end character (ERC-1 or ERC-2 that can be a carriage return for example) defined when the module was configured.
During this time any write requests received on the same channel are accepted and executed.

Two Text blocks are required to dialog with a TSX SCM module:



Reception table (TXTi,C = H'0007')

The time-out value: is coded in BCD from 1 to 9999, with a time base of 100 ms.

Setting the value to 0 defines a reception request without time-out.

Table format

Reception table	2nd Character	1st Character
	4th Character	3rd Character
	etc	
Transmission	Time-out	
	No. of characters to receive	

Full-duplex transmission/reception requests

Reception Text block parameters

Text block parameters can be initialized either by program or by configuration (except on a TSX T607 terminal equipped with a software version prior to V3.0).

. Request TXTi,C	TXTi,C = H'0007'
. Variable TXTi,L	TXTi,L = 4
. Address TXTi,M	Stores the module address and channel number,
. Type of exchange	Transmission/reception, started by EXCHG or setting I, O and S to 1.
. End of exchange	TXTi,D = 1 when the request is executed.
. Report TXTi,V or R	Refer to Sub-section 4.5.
. Variable TXTi,S	Refer to Sub-section 4.5.

Transmission table (TXTi,C = H'0007')

The time-out value: is coded in BCD from 1 to 9999, with a time base of 100 ms.

Setting a value of 0 defines a reception request without time-out.

Wi or CWi

Table format

Time-out			
0	0	0	0
2nd Character		1st Character	
4th Character		3rd Character	
etc			

Transmission Text block parameters

The Text block parameters can be initialized either by program or by configuration (except on a TSX T607 terminal equipped with a software version prior to V3.0

. Request TXTi,C	TXTi,C = H'0007'
. Variable TXTi,L	Initialized with the number of bytes stored in the transmission table including the 4 bytes that give: . the time-out value, . the word (initialized with a value of 0) that follows the time-out.
. Address TXTi,M	Stores the module address and channel number.
. Type of exchange	. Transmission/reception with report, started by EXCHG or setting I, O and S to 1.
. End of exchange	TXTi,D = 1 when the request is executed.
. Report TXTi,V or R	Refer to Sub-section 4.5.
. Variable TXTi,S	TXTi,S = 0.

4.5 Report-status word

General

Once the module has executed a request, it informs the user program by sending:

. a report: TXTi,V or TXTi,R,

. a status word: TXTi,S

An analysis of this data allows the user program to direct processing accordingly.

Report TXTi,V, TXTi,R

After an exchange, this word contains a code written by the module or the system, that shows whether the exchange was valid. This word can only be read and takes one of the following values:

. **H'0000'**: stop on reaching the number of characters,

. **H'0001'**: stop on the first stop character,

. **H'0002'**: stop on the second stop character,

. **H'0003'**: stop on silence between characters (full-duplex only),

. **H'3F/FE/71/77/7A'**: correct exchange (applies to additional requests only),

. **H'FD'** : incorrect exchange:

- time-out reached,
- time not coded in BCD,
- erroneous parameters.

Status word TXTi,S

This word can only be read and contains:

. The number of bytes received by the Text block (1 to 254 maximum) during a correct exchange (TXTi,E = 0),

. An error code that occurs at the end of an incorrect exchange (TXTi,E = 1). This code takes one of the values listed below:

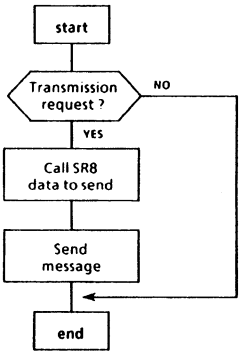
- **1**: exchange in progress was cancelled by reset,
- **2**: transmission table length error,
- **3**: power break occurred during the exchange,
- **4**: module fault,
- **5**: parameter error or too many active Text blocks,
- **6**: message received was longer that planned,
- **10**: incorrect addressing with an indirect Text block.

4.6 Full-duplex transmission/reception example

The program below provides an example of a request used for full-duplex dialog.

Organization

The main program (master task) controls the transmission of the configuration on channel 1 of the module at address 02 and enables dialog on this channel.




```
< Init SCM 02 on power-up.
  (B125 → channel 1)
! IF SY0+SY1 THEN RESET B125


< Configure SCM 02. channel 1 if the
  module is available
! IF NOT B125.IW2,0,3 THEN CALL SR17


< Call dialog subroutine
  (SR5=transmission; SR7=reception)
! IF B125 THEN CALL SR5; CALL SR7


! EOP
```

Definition of Text blocks :

- TXT0 → reception,
- TXT1 → configuration,
- TXT7 → transmission.

```
CONFIGURATION : TEXT
NUMBER OF TEXT BLOCKS N : 20

TXTi NETWORK TYPE ADDR  ADDR    RECEPT A T   M       L     C
                  MODE  BUFFER  LENGTH
 0   LOCAL   CPL  DIR   W1000      5      H'0201'   4  H'0007'
 1   LOCAL   CPL  DIR   W1260      0      H'0201'  18  H'0040'
 .   ....    ...  ...   .....      .      .......  ..  .......
 .   ....    ...  ...   .....      .      .......  ..  .......
 7   LOCAL   CPL  DIR   W2510      0      H'0201'   0  H'0007'
```

Definition of constant words :

The configuration parameters are defined in constant words CW48 to CW56, with the following characteristics:

- character format : 8 bits, no parity, 2 stop bits,
- transmission speed : 9600 baud,
- back-space control,
- XON-XOFF control on transmission.

Full-duplex transmission/reception example

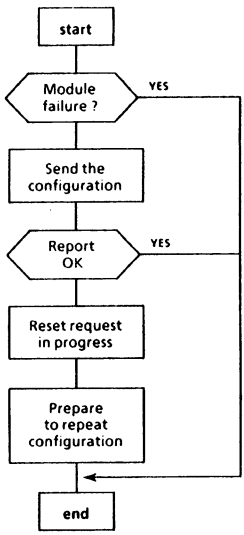
```
CONFIGURATION: CONSTANT WORDS

CW NB CONFIGURED: 500
```

CONSTANT	VALUE	CONSTANT	VALUE
CW32	=H'0802'	CW48	=H'1802'
CW33	=H'9600'	CW49	=H'9600'
CW34	=0	CW50	=0
CW35	=H'0011'	CW51	=H'0011'
CW36	=0	CW52	=0
CW37	=0	CW53	=0
CW38	=0	CW54	=0
CW39	=0	CW55	=0
CW40	=0	CW56	=0
CW41	=0	CW57	=0
CW42	=0	CW58	=0
CW43	=0	CW59	=0
CW44	=0		

Configuration Subroutine 17

As a precaution, the configuration is sent on each power return. This function is controlled by SR17. The configuration table is located after CW48, its values are listed above.




```
° <* SR17 controls the operation of
°    channel 1 of SCM 21xy (address 2)*
°
° <  TXT1 is used to send the
°    configuration parameters
°
° <  If the module has failed:
°    quit here.
° !  IF  IW2,0,8 THEN RESET B125;RET
°
° <  Send the configuration data with
°    time-out. (timer 7=0.5 sec)
° !  IF  NOT B126 THEN RESET TXT7;
°    RESET TXT0; RESET TXT1;
°        CW48[9]→W1260[9]; EXCHG TXT1;
°        SET B126;
°        5 →T7,P;PRESET T7; START T7;
°        RESET B127
°
° <  Positive report?
° !  IF  TXT1,D.[TXT1,V=254] THEN SET B125;
°    RET
°
° <  No response from the channel; then
°    reset any request in progress
° !  IF  T7,D.NOT B127 THEN SET OW2,1,9;
°    SET OW2,1,A;SET B127;RET
°
° <  End reset channel and retry
°    configuration
° !  IF  B127 THEN RESET OW2,1,9;
°    RESET OW2,1,A;RESET B126;RESET B127
°
° !  EOP
```

Note : . OW2,1,9 is the request bit for transmission/reception reset.
. OW2,1,A is the request bit for transmission request reset.
. The reset bits take effect on the rising edge.

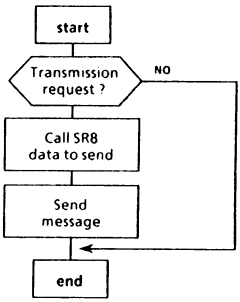
Full-duplex transmission/reception example

Transmission Subroutine 5

Subroutine 5 (SR5) controls transmission. Transmission is made without time-out and through Text block TXT7.

The transmission table (located after W2510) contains:
- the first two words (with a value of 0), a total of 4 bytes,
- the characters to be transmitted.

The actual characters and the number of characters (stored in W111) for transmission are left to the operator to determine. The exchange is controlled by SR8.

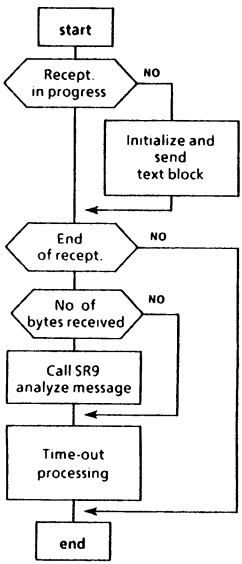



```
° < SCM 21 (full-duplex)
°   Uses TXT7 for transmission.
°
°
°
° < Transmission (code 7)-
°   (SR8:preparation of the message for
°   transmission)
° ! IF  B128. TXT7,D THEN
°   0→W2510[2];CALL SR8;4+W111→TXT7,L;
°   EXCHG TXT7;RESET B128
°
° ! EOP
```

Note : B128 is the transmission command.

Reception Subroutine 7

Subroutine 7 (SR7) controls the reception of a 5 byte message (W1131) with a 10 second time-out. Reception is carried out by Text block TXT0. Characters are received starting at address W1000 (defined on configuration). It is up to the user to analyse the message and locate it in SR9.




```
° < SCM21(full-duplex)
°   Uses TXT0 for reception.
°
°
°
° < 5 byte reception request.
° ! IF  TXT0,D.B129 THEN
°   B'100'→W1130;5→W1131;EXCHG TXT0;
°   SET B129
°
° < Await end of reception.
° ! IF  NOT TXT0,D THEN RET
°
°
°
° < 5 bytes received.
°   (SR9 : received message analysis)
° ! IF  [TXT0,V=0] THEN CALL SR9;SET B129
°
°
° < Time-out?
° ! IF  [TXT0,V=253] THEN SET B129
°
°
°
° !EOP
```

5.1 Defining the discrete I/O bits

Description

The discrete I/O interface of the TSX SCM modules allows the user program to control the transmissions in progress on each channel.

This interface contains:

. **8** input bits: Ixy,8 to Ixy,F
These show the state of the input signals to the line adaptors.

. **8** output bits: Oxy,0 to Oxy,7,
These bits enable the positioning of the line adaptor output signals to 0 or 1.

For both input and output modes, the first 4 bits are assigned to the channel 0 line adaptor and the next 4 bits to the channel 1 line adaptor.

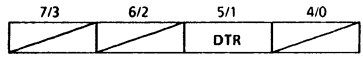
The meaning of the discrete bits is specific to each adaptor. Some bits are not just copied by the module but directly affect the operation of the channel.

The assignment of the 4 I/O bits and their effect on operation is shown below for each type of adaptor.

A signal is active at logic state 0 and inactive at logic state 1.
For SCA1 and SCA3 adaptors, the CTS and CD signals are controlled by the module. The other available signals must be controlled by the user program. The RTS signal is automatically controlled by the channel.

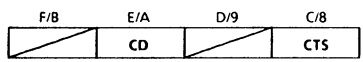
SCA 1 Adaptor (RS-232 C 6 signals)

O Output bit



DTR = Data Terminal Ready.
This output signal does not affect channel operation and is used to control a modem (or peripheral) connected to the adaptor.

I input bits



CTS = Clear To Send: Logic state 1 (inactive signal) on this input in hibits the transmission circuit.

CD = Carrier Detection: Logic state 1 (inactive signal) on this input inhibits the reception circuit.

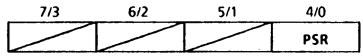
When these signals are not wired, pull-up resistors included in the adaptor set them to logic state zero.

5 Discrete bits and register words

Defining the discrete I/O bits

SCA2 Adaptor (Current loop)

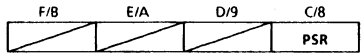
O Output bits



PSR = Phase of Signal Reception
0 = used in multipoint mode,
1 = used in point-to-point mode.

The state of this bit inverses the current loop reception circuit logic. This bit has to be set by the program depending on whether the loop is used in the point-to-point or multipoint modes.

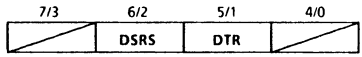
I Input bits



This bit is the image of output bit PSR.

SCA3 Adaptor (RS-232 - Modem)

O Output bits



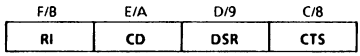
DTR = Data Terminal Ready

This output signal does not affect channel operation and is used to control the modem connected to the adaptor.

DSRS = Data Signal Rate Selection
0 = the channel operates at configured speed.
1 = the channel operates at half the configured speed.

When the modem used has this feature, this signal can be used to reduce the modem speed when repeated transmission errors are detected.

I Input bits



CTS = Clear To Send: Logic state 1 locks the transmission circuit.
DSR = Data Set Ready: No effect on channel operation.
CD = Carrier Detection: Logic state 1 locks the reception circuit.
RI = Ring Indicator: No effect on channel operation.

Caution : When these signals are not used, they are all pulled-up to 1 by the line adaptor. Therefore the transmission and reception circuits are locked.

SCA4 Adaptor (RS-422A/R-485)

This adaptor has no transmission control signals. The transmitter validation signal used with RS-485 is controlled by the transmission protocol. This ensures user transparent changeover to high impedance mode by the transmitter

SCA5 Adaptor (RS-232 - simplified)

This adaptor has no transmission control signals, only transmission and reception lines.

5.2 Defining the register words

Description

The TSX SCM module register interface comprises:

- Input registers: These are read-only status words that contain data on the operation of the module and each of its channels.
- Output registers: These are read/write words that contain the acknowledgement and reset commands for the exchanges on the channels.

Input register IWxy,0 (TSX SCM 20, 21 and 22)

This status word, common to all TSX SCM modules, provides data on overall module operation. The bits are significant when they are at state 1.

Bit	Function	Description
0	Not assigned	
1	Not assigned	
2	Reset in progress	Message system reset in progress, clears messages in progress on both channels.
3	Module available	Indicates the end of the self-tests and consequently that the module is available.
4	General fault	This bit goes to 1 whenever a fault appears. It is the OR routing for bits 5, 6, 7, 8.
5	Blocking fault	A module RAM extension fault.
6	Module fault	A fault that appears when the module serial link self-tests are run every time the module is powered-up.
7	Application fault	A fault that appears when a request is executed on one of the module channels: Parity error in receive, time-out, no echo, incorrect echo, etc.
8	Blocking fault	RAM, EPROM or module internal logic fault. This fault permanently inhibits the module which must be replaced. This state is indicated by the F indicator on thefront of the module.
9	Module self-test in progress	Every time it is powered-up, the module runs a series of self-tests, indicated by this bit. The module is not available and cannot be programmed while the tests are in progress.
A	Not assigned	
B	Module not configured	This bit is at 1 when none of the channels are configured. At 1 this bit indicates that at least one channel has been configured.
C	Module in RUN mode	A request is being executed by one of the channels.
D	Reserved	
E	Not assigned	
F	Not assigned	

5 Discrete bits and register words

Defining the register words

Input register IWxy,1 (TSX SCM 20)

This word stores the status data for each channel.

Bit	Function	Description
0	Not assigned	
1	RUN/STOP Channel 0	0 if the channel is stopped (awaiting a request). 1 if the channel is running (executing a request).
2	Transmission/ Reception Channel 0	This bit is only significant when the channel is running. 0 if reception is in progress on the channel 1 if transmission is in progress on the channel
3	Configuration Channel 0	0 if the channel is not configured 1 if the channel is configured (Character string).
4 5 6	Adaptor code Channel 0	The type of adaptor fitted to the channel is coded in these three bits: 001 = SCA1 adaptor (RS-232-C - 6 signals) 010 = SCA2 adaptor (Current loop) 101 = SCA3 adaptor (RS-232 - Modem) 011 = SCA4 adaptor (RS-422-A/RS-485) 000 = SCA5 adaptor (RS-232-C simplified) 111 = No adaptor
7	PWF	This bit is common to both channels. At 1, this bit indicates that the module is unable to transfer data from a channel to the PC memory (processor fault, PC or task stopped, etc.).
8	Not assigned	
9	RUN/STOP Channel 1	Identical to bit 1 for Channel 1
A	Transmission/ Reception Channel 1	Identical to bit 2 for Channel 1
B	Configuration Channel 1	Identical to bit 3 for Channel 1
C D E	Adaptor code Channel 1	Identical to bits 4, 5, 6 for Channel 1
F	PWF	This bit is common to both channels. At 1 it indicates a power return on the PC but is provided for information only. It must be reset by OWxy1,F to in order to indicate a subsequent power return.

Input register IWxy,1 (TSX SCM 21 Full-duplex)

The only bits that differ from the TSX SCM 20 are:

Bit	Function	Description
9	RUN/STOP Channel 1 réception	0 if the channel is stopped (awaiting a request). 1 if the channel is running (executing a request).
A	RUN/STOP Channel 1 transmission	0 if the channel is stopped (awaiting a request). 1 if the channel is running (executing a request).

Defining the register words

Input register IWxy,2 (TSX SCM 21 Full-duplex)

Overflow IWxy,2,0

Only bit 0 of this word is used. When this bit changes from 0 to 1, it means that another character has been received, although the reception buffer was full. This character is lost, but it will still be stored in input register, IWxy,3.

This bit is reset to 0:

- On the rising edge of bit OWxy,1,8 (overflow reset),
- When the reception buffer is reset to 0 (bit OWxy,1,B set to 1),
- When a read/write request is processed,
- When the module is reconfigured,
- When the message system is reset (bit OWxy,0,2 set to 1).

Input register IWxy,3 (TSX SCM 21 Full-duplex)

Last character received

This register contains the last character received, even when the reception buffer is full.

This register is reset to 0:

- When a read/write request is processed,
- When the module is reconfigured,
- When the message system is reset to 0 (bit OWxy,0,2 set to 1).

Input register IWxy,4 (TSX SCM 21 Full-duplex)

Number of bytes received

This register shows the number of bytes stored in the reception buffer (between 1 and 256). The register is incremented each time a new character is stored in the buffer. It is updated on each read request.

This register is reset to 0:

- When a read/write request is processed,
- When the reception buffer is reset to 0 (bit OWxy,1,B set to 1),
- When the module is reconfigured,
- When the message system is reset to 0 (bit OWxy,0,2 set to 1).

Note: If reception echo is configured, receiving a back-space character (ASCII code H'08') will decrement this register.

5 Discrete bits and register words

Defining the register words

Output register OWxy,0 (TSX SCM 20, 21 and 22)

Message system reset OWxy,0,2

Only bit 2 of this word is used. Setting this bit to 1 resets the entire message system to 0 for both module channels.

Output register OWxy,1 (TSX SCM 20)

Bit	Function	Description
0	Not assigned	
1	Reset exchange Channel 0	Stops and cancels the request in progress, loss with of all related data. Must be followed by a Text block reset
2	Not assigned	
3	Not assigned	
4	Not assigned	
5	Not assigned	
6	Not assigned	
7	Not assigned	
8	Not assigned	
9	Reset exchange Channel 1	As bit 0 for Channel 1
A	Not assigned	
B	Not assigned	
C	Not assigned	
D	Not assigned	
E	Not assigned	
F	PWF Ack	Optional PWF acknowledgement after a PC power break (resets IWxy,1,F to 0)

Output register OWxy,1 (TSX SCM 21 Full-duplex)

Only the bits listed below are different than those of the TSX SCM 20 module:

Bit	Function	Description
8	Reset overflow	Resets the to 0 the bit indicating that a new character was received although the reception buffer was full (IWxy,2,0)
9	Reset exchange	Allows an exchange to be reset on a read or read/write request.
A	Reset exchange	Allows an exchange to be reset on a write request.
B	Reset buffer	Setting this bit to 1 resets the reception buffer to 0.

Important note

Certain TSX SCM modules with specific functions (full-duplex, Modbus®, Pyromat®, Uni-Telway communications protocols, etc.) can also be configured for use in half-duplex character string mode. In this case, the register words used are identical to those used by the TSX SCM 20 module.

Resetting the Acknowledgement or Reset bits to zero is up to the user program.

6.1 Self-tests

Self-tests on power-up

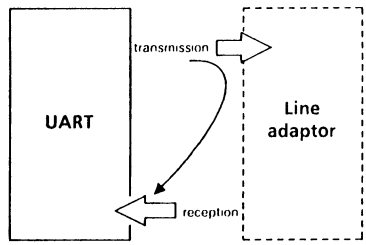
Each time a TSX SCM module is powered-up, it runs a self-test sequence that comprises:

- A checksum test of the module micro-program,
- A test of all RAM memories used by the microprocessor,
- A test of the logic and the shared memory that enables the exchange of data with the PC processor.

Blocking fault :

- Any fault found by these tests is recorded by bit IWxy,0,8 (blocking fault) and shown by the F indicator on the front panel. The module becomes permanently blocked.

- The transmission/reception line test for each channel is done by looping the lines back to the UART (by-passing the adaptor).
- On channel 1 only, the test signals are checked by looping back the following signals applying the principle described above: DTR to CD and RTS to CTS.



Module fault :

If a fault is found during these tests it is recorded by bit IWxy,0,6 (module fault) but the module is not blocked.
Fault bit Ixy,S is set to 1 when bit IWxy,0,6 or bit IWxy,0,8 is set to 1.

Important note : During the entire self-test phase, the user program should not access the module. Bits IWxy,0,3 and IWxy,0,9 indicate that a self-test is in progress.

Continuous self-test

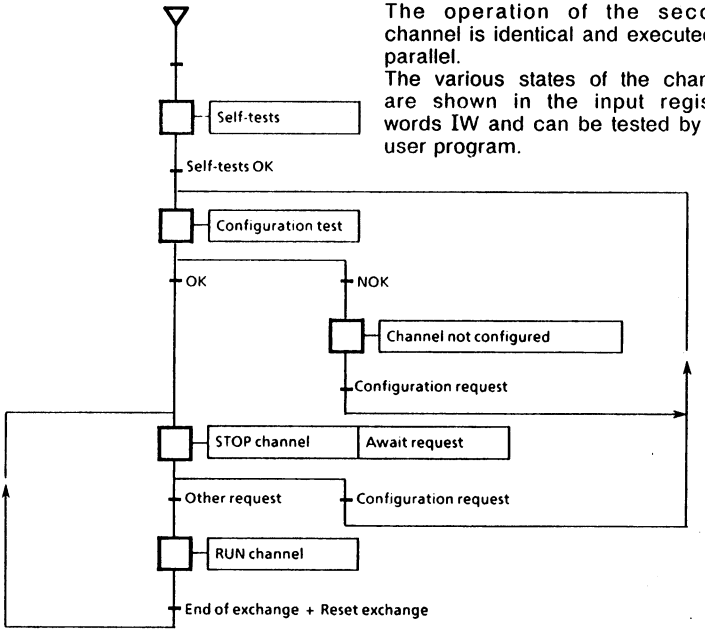
The program checksum and module RAM tests are also run continuously, when the module is idle. These tests are user transparent and do not affect module operation.

If a failure occurs, a blocking fault is generated with the same effects as described above.

6.2 Operating modes

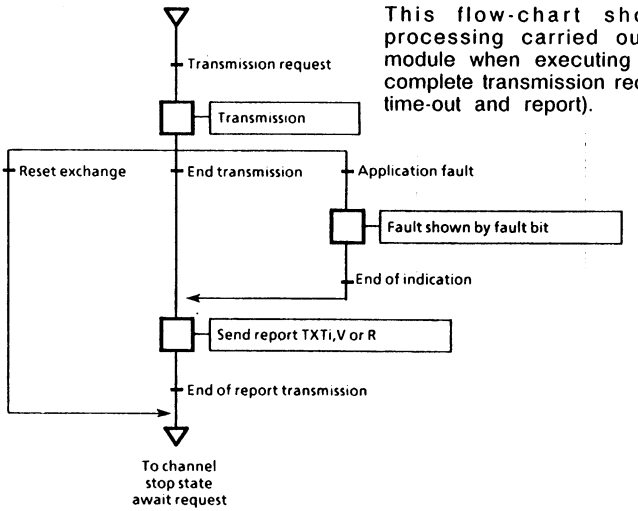
Overall flow-chart

The status flow-chart opposite shows the operation of only one channel of the module.



The operation of the second channel is identical and executed in parallel.
The various states of the channel are shown in the input register words IW and can be tested by the user program.

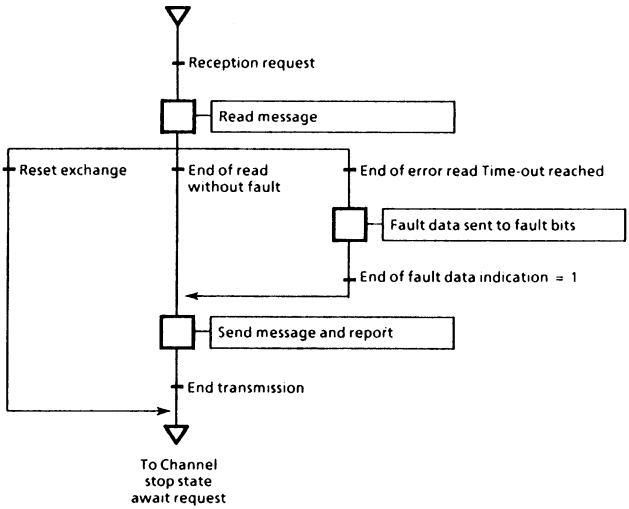
Transmission request flow-chart



This flow-chart shows the processing carried out by the module when executing the most complete transmission request (with time-out and report).

Operation modes

Reception request flow-chart



Transmission/reception request flow-chart

The flow-chart for this request is a combination of the two previous charts. The report is generated only once, after execution of the Read request.

Power break

When a power break occurs, the PC power supply generates the PWF (power failure) signal before the supply voltages drop. The module then abandons the execution of any request that is in progress and stores the configuration of the channels in the RAM memory. Any data in the module buffers will be lost.

On power return after the self-test phase, the module automatically awaits a new request. The module sets bit IWxy,1,F to 1, informing the user that a power break occurred. This bit is only present for information and the user program may have to repeat the request that was in progress when the power break occurred in order to recover lost data. To show a subsequent power break, bit IWxy,1,F must be reset to 0. This bit is reset by setting OWxy,1,F to 1.

Module removal under power

TSX SCM modules can be inserted or removed under power (with the PC stopped) without being damaged. However, removing the module causes:

- the I/O LED on the front of the PC to come on,
- system bit SY10 to be reset to 0.

6 Additional programming information

6.3 Additional requests

The additional requests described below are not specific to a single channel but apply to the entire module.

. Address TXTi,M contains the module address followed by 63.

Example: TXTi,M = H'0263'

Reading the fault bits (TSX SCM 20)

This request outputs 6 bytes to the reception table. These 6 bytes list any faults recorded in register IWxy,0.

. Request code	TXTi,C	= H'47'
. variable	TXTi,L	= 0
. transmission table		= not used
. Reception table		= at least 6 bytes

At the end of the exchange:

. number of bytes received	TXTi,S	= 6
. report	TXTi,V	= H'77'

Table organization is described below:

1st word

Blocking faults	Blocking fault
0 : Reprom checksum fault	**8** : Insignificant
1 : Ram fault	**9** : Insignificant
2 : Logic circuit fault	**A** : Insignificant
3 : Reserved	**B** : Insignificant
4 : Reserved	**C** : Insignificant
5 : Reserved	**D** : Insignificant
6 : Reserved	**E** : Insignificant
7 : Reserved	**F** : Insignificant

2nd word

Module faults channel 0	Module faults channel 1
0 : Transmission/reception loop-back fault	**8** : Transmission/reception loop-back fault
1 : Insignificant	**9** : DTR/CD loop-back fault
2 : Insignificant	**A** : RTS/CTS loop-back fault
3 : Insignificant	**B** : Insignificant
4 : Insignificant	**C** : Insignificant
5 : Insignificant	**D** : Insignificant
6 : Insignificant	**E** : Insignificant
7 : Insignificant	**F** : Insignificant

3rd word

Application faults channel 0	Application faults channel 1
0 : Incorrect echo after 3 tries	**8** : Incorrect echo after 3 tries (*)
1 : No echo after 3 tries	**9** : No echo after 3 tries (*)
2 : Time-out fault on READ request	**A** : Time-out fault on READ request
3 : Time-out fault on WRITE request	**B** : Time-out fault on WRITE request
4 : Time-out fault on WRITE/READ request	**C** : Time-out fault on W/R request
5 : Reception parity fault	**D** : Reception parity fault
6 : Insignificant	**E** : Insignificant (*)
7 : PWF without init during exchange	**F** : PWF w/out init. during exch. (*)

(*) Different indications given by TSX SCM 21, see next page.

Additional requests

Reading the fault bits (TSX SCM 21)

Only the following bits are different from those in the TSX SCM 20 module:

3rd word
Application faults channel 1

8 : insignificant
9 : insignificant
E : format fault in reception
F : overload fault in reception

Resetting the module

This request completely resets the module. It erases the configuration of both channels and the recorded faults, and executes a restart equivalent to powering-up the module (refer to the flow charts for the operating modes).

. Request code	TXTi,C	= H'44'
. Variable	TXTi,L	= insignificant
. Transmission and reception table		= not used
. Message	TXTi,S	= 0
	TXTi,V	= H'FE'

Writing the "application name"

This request allows the user to memorize a string of up 20 characters in the module to identify the application. If a power break occurs, these characters are saved in the same way as the configuration.

. Request code	TXTi,C	= H'49'
. Variable	TXTi,L	= 1 to 20
. Transmission table		= contains the characters,
. Reception table		= not used,
. Message	TXTi,S	= 0
	TXTi,V	= H'FE'

Reading the "application name"

This request allows the user to read the character string that was memorized by the previous request. This request systematically returns 20 characters to the reception table.

. Request code	TXTi,C	= H'4A'
. Variable	TXTi,L	= insignificant
. Transmission table		= not used
. Reception table		= 20 bytes
. Message	TXTi,S	= 20
	TXTi,V	= H'7A'

6 Additional programming information

Additional requests

Identification

This request identifies the module version. It systematically returns 27 characters to the reception table.

. Request code	TXTi,C	= H'0F'
. Variable	TXTi,L	= 0
. Transmission table		= not used
. Reception table		= not less than 27
. Report	TXTi,S	= 27
	TXTi,V	= H'3F'

Reading the configuration

This request allows the module configuration to be read. The reception table should contain at least:

. 16 bytes for a Half-duplex character string configuration,
. 18 bytes for a Full-duplex character string configuration.

. Request code	TXTi,C	= H'41'
. Variable	TXTi,L	= 0
. Transmission table		= not used
. Reception table		= not less than 16 or 18
. Report	TXTi,S	= 16 or 18
	TXTi,V	= H'71'

6.4 Fault processing

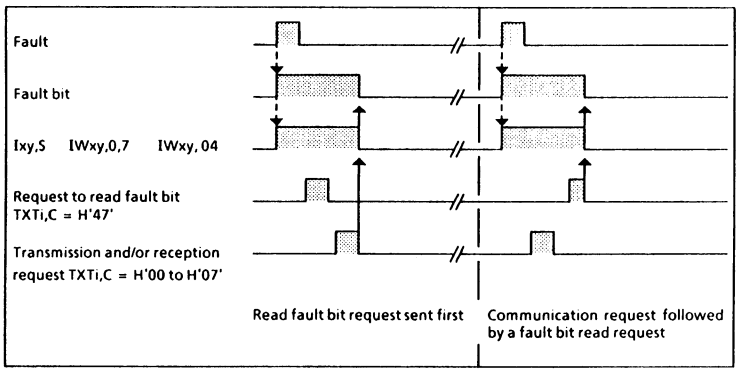
Any fault detected by the TSX SCM module during self-testing or request execution is indicated in input register IWxy,0 (bits 4 to 8).

- **A blocking fault** (IWxy,0,8) permanently inhibits the module and stops the user program from accessing the module through the Text block. This fault is caused by a hardware failure and requires replacement of the module.

- **A module or application fault** (IWxy,0,6 ou IWxy,0,7) recorded in register IWxy,0 does not inhibit access to the module. The user program can continue to access the module and its requests will be accepted and executed.

However, for fault bits to be significant, they must be reset or cleared after they have been processed or analyzed.

The principle of resetting fault bits is illustrated in the example below:



Note : When an I/O fault occurs on a TSX 47-20, a TSX T407 terminal in the Diagnostic mode can be used and will show a terminal block fault on the TSX SCM module that generated the I/O fault.
This fault data should be interpreted by accessing the register words and the fault bits.

7 Appendix

7.1 Software version compatibility

The various module software versions

Improvements have been made to the new TSX SCM software versions, V1.3 and higher.

List of improvements

. Additional bits	IWxy,0,2 IWxy,0,3 IWxy,1,7	OWxy,0,2
. Deleted bits	IWxy,1,0 IWxy,1,8	OWxy,1,0 OWxy,1,8

. Application faults no longer set bit Ixy,S to 1 and system bit SY10 to 0,
. Acknowledging a power failure (PWF) by setting OWxy,1,F on power return is no longer necessary,
. Acknowledging a CPU failure (CPUF) when no further data exchanges with the module are possible because of a data overflow condition is no longer required.
. Module operation on power return has been changed.

Additional bits

IWxy,0,2 : Report indicating that the message system has been reset to 0,
IWxy,0,3 : Module available,
IWxy,1,7 : CPUF common to both channels,
OWxy,0,2 : Setting the message system to 0 (Text block exchanges).

Compatibility
The new software versions remain compatible with the previous software versions on condition that bit OWxy,0,2, that was previously not used, is not set to 1 in the application.

Deleted bits

IWxy,1,0 : CPUF channel 0
IWxy,1,8 : CPUF channel 1
These two bits are replaced by a common bit : IWxy,1,7

OWxy,1,0 : CPUF acknowledgement Channel 0
OWxy,1,8 : CPUF acknowledgement Channel 1
These two bits are not replaced as CPUF acknowledgement is no longer required.

Power return

On power return, or if the module is removed and then replaced under power, the module retains its configuration and will automatically await a new request. No acknowledgement of this condition by OWxy,1,F is required with software version V1.3 or higher. Acknowledgement is still required with previous versions of the module software.

Fault bit Ixy,S

With software version V1.3 or higher (TSX SCM 20), fault bit Ixy,S no longer indicates application faults. It is therefore necessary to test bit IWxy,0,7.

Discrete I/O bits

With software version V1.3 or higher (TSX SCM 20), the module automatically controls the signals for:
. transmitter validation (VE) with an SCA 4 adaptor,
. request to send (RTS) with SCA 1 and SCA 3 adaptors.

7.2 ASCII code

b4 ↓	b3 ↓	b2 ↓	b1 ↓	Line ↓ / Column →	b7 → 0	b6 → 0	b5 → 0	0	1	2	3	4	5	6	7
0	0	0	0	0				NUL	DLE	SP	0	@	P	\	p
0	0	0	1	1				SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2				STX	DC2	"	2	B	R	b	r
0	0	1	1	3				ETX	DC3	#	3	C	S	c	s
0	1	0	0	4				EOT	DC4	$	4	D	T	d	t
0	1	0	1	5				ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6				ACK	SYN	&	6	F	V	f	v
0	1	1	1	7				BEL	ETB	'	7	G	W	g	w
1	0	0	0	8				BS	CAN	(	8	H	X	h	x
1	0	0	1	9				HT	EM	)	9	I	Y	i	y
1	0	1	0	A				LF	SUB	*	:	J	Z	j	z
1	0	1	1	B				VT	ESC	+	;	K	[	k	{
1	1	0	0	C				FF	FS	,	<	L	\	l	:
1	1	0	1	D				CR	GS	-	=	M	]	m	}
1	1	1	0	E				SO	RS	.	>	N	^	n	~
1	1	1	1	F				SI	US	/	?	O	_	o	DEL

7 Appendix

7.3 Module versions

Asynchronous serial communication modules.

Module program version	Type of adaptor channel 0	channel 1	Ref. No.
. **Channel s 0 and 1 Half-duplex Character string**	RS232C isolated	RS232C isolated	TSX SCM 2011
	RS232C isolated	20mA current loop	TSX SCM 2012
	RS232C isolated	RS232C modem	TSX SCM 2013
	RS232C isolated	RS422A/RS485	TSX SCM 2014
	20mA cur. loop	20mA current loop	TSX SCM 2022
	RS422A/RS485	RS422A/RS485	TSX SCM 2044
	RS232C simpl.	RS232C simpl.	TSX SCM 2055
. **Channel 0 Half-duplex Character string**	RS232C isolated	RS232C isolated	TSX SCM 2211
	RS232C isolated	20mA current loop	TSX SCM 2212
	RS232C isolated	RS232C modem	TSX SCM 2213
	RS232C isolated	RS422A/RS485	TSX SCM 2214
. **Channel 1 : soft. config.** - **Half-duplex Character string**	20mA cur. loop	20mA current loop	TSX SCM 2222
. **Modbus® or Pyromat® protocol**	RS232C/RS422A/ RS485	RS422A/ RS485	TSX SCM 2244
. **Channel 0 Half-duplex Character string**	RS232C isolated	Uni-Telway (*)	TSX SCM 2116
	RS422A/ RS485 isolated	Uni-Telway(*)	TSX SCM 2146
	RS232C isolated	RS232C isolated	TSX SCM 2111
. **Channel 1 : soft. config. Uni-Telway Full-duplex char. string Half-duplex char. string**	RS232C isolated	20mA current loop	TSX SCM 2112
	RS232C isolated	RS232C modem	TSX SCM 2113
	20mA cur. loop	20mA current loop	TSX SCM 2122

(*) In Half-duplex character string mode, Channel 1 is configured for RS422A/RS485 isolated (Full-Duplex cannot be used).

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