Preface

The TSX SCG 113 serial communication module supports the same functions as TSX SCM 20/21/22 modules in full-duplex (channel 1) character string mode. Experienced users of these modules will find differences in the following areas:

- Connecting the module,
- Only two TSX SCG 113 modules can be installed in a Micro-PLC,
- Configuration is lost in the event of a power break,
- Status word TXTi,S,
- Register words IWn,0 and IWn,1,
- Restrictions on use.

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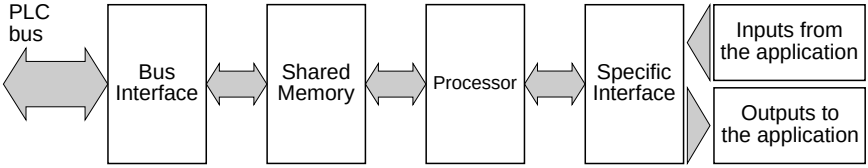
1.1 Intelligent Modules

1.1-1 General

Intelligent modules for TSX Series 7 PLCs have their own processors and internal software which enable them to process their specific function independently of the central processing unit (CPU) in the PLC. This simplifies the user program and the setting up procedure required when installing the module.
The structure of intelligent module exchanges is detailed below.

Intelligent module exchange structure



An intelligent module comprises:

- A bus interface that uses the standard communication modes for exchanges between the PLC processor and the intelligent module:
  - discrete interface,
  - register interface,
  - message interface.
- A shared memory unit (SMU) where data that can be accessed by both the processor and the module is stored,
- A processing unit that comprises a dedicated processor and the specific module firmware,
- The specific I/O for the module.

The pre-programmed functions imbedded in the module can be accessed by the user for setting specific parameters. Implementation of intelligent modules requires the use of PL7-2 programming languages. For more information, refer to the appropriate programming language manual.

1.2 The TSX SCG 113 Intelligent Module

1.2-1 Description

General

The TSX SCG 113 module is a dedicated serial communication module for TSX 17–20 Micro-PLCs fitted with a TSX P17 20FC or FD Micro-software cartridge. It comprises a single asynchronous serial link that is used to dialog by exchange of character strings between the Micro-PLC and its environment.
The asynchronous serial link comprises a transmission and a reception gate for full duplex transmission to RS-232C standards with Modem command signal support (9-signals). The transmission rate and the characteristics of the data frame are user configurable.

The exchange is initialized by the user and programmed through the PLC processor. The entire data exchange is fully controlled by the module.

Simplicity of operation

The module includes the line power supply and the appropriate line adaptor circuit. The configuration mode and the associated software functions are comprehensive and easy to program. The module supports exchanges of data by text block.

Safety of operation

The line is electrically isolated from internal PLC voltages and a grounding circuit provides effective shielding against the electrical interference likely to be encountered in an industrial environment.

Self-Testing

Whenever the module is powered-up, a series of internal self-tests are performed on the RAM and EPROM memories.
Any operating fault is shown by indicators on the front panel of the module and a message is sent to the PLC processor.

1.2-2 Hardware Presentation

The TSX SCG 113 module is a small size module that comprises:

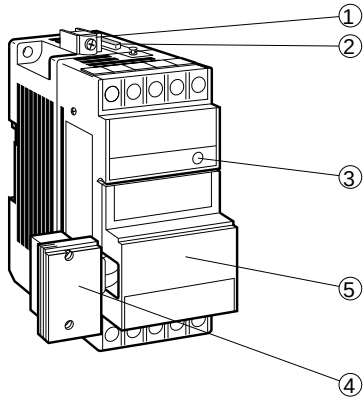
① Ground terminal,

② Socket for 15-pin Sub-D connectors for connecting the 9 signal line,

③ Two indicator LEDs:
- A green "RUN" LED indicating that the module is powered-up and operating normally,
- A red "I/O" LED indicating an I/O bus fault. The NET and ADR LEDs are not used.

④ A 9-pin bus connector and cable for connecting the module to the bus,

⑤ A 9-pin bus connector for connecting the next module to the bus via the TSX SCG 113 module.



The module configuration code is 63.

1.2-3 Functional Presentation

The TSX SCG 113 module can send, receive and simultaneously send and receive (in full duplex mode) ASCII character strings. Its functional characteristics are:

- Maximum number of characters sent/received by each request: 30,
- Data exchange rate: 150 to 19200 bits/sec.,
- Even, odd or no parity bit,
- 1 or 2 stop bits,
- Message reception is stopped by: an end character, message length overrun or a time-out,
- Send and receive data flow is controlled by XON-XOFF protocol or RTS/CTS control signals.

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2.1 Character String Mode

The TSX SCG 113 module is a specialized dialog and communication module that reduces the workload of the PLC processor. The module's microprocessor and dedicated firmware process the character strings and controls two types of exchanges comprising sending words (Wi or CWi) from a character table in the PLC memory or receiving words (Wi) that are stored as characters in a table in the PLC memory.

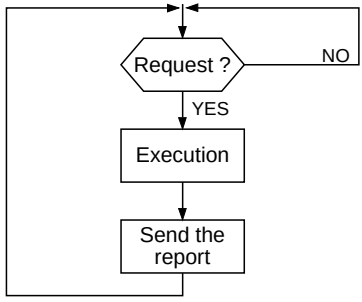
Full-duplex character string exchanges where transmission and reception are performed simultaneously are supported. These exchanges must be initiated by the application program that controls the text block and sends the request to the module. Once the request is sent, it is entirely controlled by the module.

Operation of a channel

The principle of operation for the 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.



2.1-1 Requests

Two requests are used during normal operation of the module:

- The Configuration request (H'40') (refer to section 3) that is used to configure the module, and
- The full-duplex transmission/reception request (H'07') (refer to section 4) that enables:
  - Message Transmission with or without a time-out,
  - Message Reception with or without a time-out,
  - Message Transmission/Reception with or without a time-out.

The module always sends an exchange confirm.

Note: Additional requests can be used to provide a detailed analysis of faults and their location, for module identification, etc. (refer to sub-section 4.4).

Example of a request: Reception with time-out.

This request sets the module to receive a preset number of characters within a given length of time (time-out). The parameters to enter are:

- Module address,
- Request code number,
- Number of characters to receive,
- 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.

2.2 Dialog with the PLC and Peripheral

2.2-1 General

The dialog between a user program in the TSX 17-20 and the TSX SCG 113 module takes place via the:

- Discrete interface, I/Ox,i addressing x = module number,
- Register interface, I/OWx,i addressing i = see below,
- Message interface (request interpreter).

Dialog between the module and a peripheral (Modem) uses all of the signals required for automatic connection of an asynchronous Modem to the telephone line.

- Signals for establishing or interrupting connection:
  - RI (Ring Indicator). A ring or call indicator signal has been sensed on the line by the Modem,
  - DTR (Data Terminal Ready). Connects the Modem to the line,
  - DSR (Data Set Ready). Indicates that the Modem is ready to send data.
- Signals for initializing the transmission:
  - RTS (Request To Send). Forces the Modem to transmission mode and to send the carrier,
  - CTS (Clear To Send). Indicates that the Modem is ready send data.
- Signals used during transmission:
  - RXD (Data Reception),
  - TXD (Data Transmission),
  - RLSD (Received Line Signal Detector) or CD (Carrier Detector). This signal is used to check normal transmission progression.
- Other control signals:
  - DSRS (Data Signal Rate Selector). This signal controls the data signal rate from the Modem.

Note:

By default all signals are inactive. When the module is connected to a Modem (using a TSX CBN 050 cable), it is essential that all of these signals be controlled. If the module is connected to a peripheral via a TSX CBP 050 cable, the signals are automatically controlled.

2.2-2 Discrete Interface

The discrete I/O bits I/Ox,i are assigned to the peripheral control and command signals by the module.

Reading a discrete input bit indicates the state of the corresponding control signal. Writing a discrete output bit sets the corresponding signal to 0 or 1.
The discrete I/O bits are assigned as follows:

Discrete input bits

Input bit	Description
Ix,0	CTS = Clear To Send (logic state 1 sets the transmission circuit).
Ix,1	DSR = Data Set Ready (does not affect channel operation).
Ix,2	RLSD = Received Line Signal Detector.
Ix,3	RI = Ring Indicator (does not affect channel operation).
Ix,4 to Ix,23	Not used

Discrete output bits

Output bit	Description
Ox,0	Not used.
Ox,1	DTR = Data Terminal Ready: connects the device (this output signal does not affect channel operation, but is used to control the Modem connected to the channel).
Ox,2	DSRS = Data Signal Rate Selector (at 0 the channel is set to operate at the configured speed, at 1 it operates at half the configured speed).
Ox,3 to Ox,15	Not used.

Note: The 24 input bits and 16 output bits are systematically exchanged between the TSX 17-20 PLC and the TSX SCG 113 module. As the module software only controls 8 input bits and 8 output bits, the other bits are sent to the PLC at 0.

2.2-3 Register Interface

Input registers IWx,0 to IWx,7

These registers can only be accessed in read. They provide information on module operation.

Input register IWx,0

Bit	Function	Description
0 1	Not used	
2	Reset in progress	Message system reset in progress.
3	Module ready	Indicates that all general and specific self-tests are complete and that the module is now ready.
4	General fault	This bit is set to 1 if an application fault occurs (identical to bit 7).
5	Not used	
6	Not used	
7	Application fault	Request execution fault, reception parity error, time-out error.
8	Blocking fault	No 12V supply or difference in availability of the 12V supply to the module and the 5V supply used by the PLC. Check that both of these supplies are available at the same time, then reset this bit using SY0 or SY1. RAM, REPROM, or module internal logic fault. This fault permanently inhibits (blocks) the module and requires replacement of the module. The RUN indicator is off and the I/O indicator is on.
9	Module self-test	Each time the PLC is powered-up, the module runs a self-test sequence that is indicated by this bit. During this phase, the module is not ready and cannot be configured or used.
A	Not used	
B	Module not configured	This bit is at 1 when the module is not configured
C	Module in RUN	A request other than a write configuration request is being executed
D	Reserved	
E F	Not used	

Input register IWx,1

Bit	Function	Description
0	Not used	
1	Reception Run/Stop	0 if the channel is Stopped, 1 if the channel is Running.
2	Transmission Run/Stop	0 if the channel is Stopped, 1 if the channel is Running.
3	Module configured	0 if the channel is not configured, 1 if the channel is configured.
4 5 6	Adaptor code	101 = RS-232 Modem adaptor.
7 to E	Not used	
F	PWF failure	At 1, this bit indicates a power return. It must be reset (using OWx,1,F) before a new power return will be indicated

Input register IWx,2: Overflow
Only bit 0 of this word is used (IWx,2,0). This bit changes from 0 to 1 when a new character was received while the reception buffer was full (256 bytes max.). The last character received is lost but it will still be copied to input register IWx,3.

This bit is reset to 0:

- On a rising edge of bit OWx,1,0 (overflow reset),
- When the reception buffer is reset to 0 (bit OWx,1,3 set to 1),
- When a read/write request is processed,
- When the message system is reset to 0 (bit OWx,0,2 set to 1),

Input register IWx,3: last character received
This register stores the last character received even when the reception buffer is full.

This register is initialized at 0:

- When processing a write/read request,
- When reconfiguring the module,
- When resetting the message system to 0 (setting bit OWx,0,2 to 1).

Input register IWx,4: Number of bytes received
This register gives the number of bytes stored in the reception buffer. It is incremented each time a new character is stored in the buffer and updated by each read request.
When an overflow occurs, it will retain as many bytes as possible up to a maximum of 256 bytes.

This register is initialized at 0:
- When processing a write/read request,
- When resetting the reception buffer to 0 (setting bit OWx,1,3 to 1),
- When reconfiguring the module,
- When resetting the message system to 0 (setting bit OWx,0,2 to 1).

Note: If reception echo is configured, reception of a backspace character (ASCII code H'08') will decrement the register.

Output register OWx,0: Reset message system
Only bit 2 of this word is used (OWx,0,2). When it is set to 1, the message system is reset.

Output register OWx,1

Bit	Function	Description
0	Reset overflow	When this bit is set to 1, bit IWx,2,0 (reception buffer overflow bit) is reset to 0.
1	Reset Read and Read exchange	When this bit is set to 1, any Read or Write/Read Write/ requests in progress are stopped and cancelled and all related data is lost. This command must be followed by a text block reset.
2	Reset Write exchange	When this bit is set to 1, any Write requests in progress are stopped and cancelled and all related data is lost. This command must be followed by a text block reset.
3	Reset buffer	If this bit is set to 1, the reception buffer is reset to 0.
4 to E	Not used	
F	Acknowledge PWF	Setting this bit to 1 resets the system after a power-break (resets IWx,1,F to 0). This bit is optional.

Remember

It is up to the user program to reset Acknowledgement or Reset bits to 0.

2.2-4 Message Interface

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 parameters TXTi,C and TXTi,M must be initialized with the request code and module address. Initialization can be carried out by the user program, or when configuring the text block.

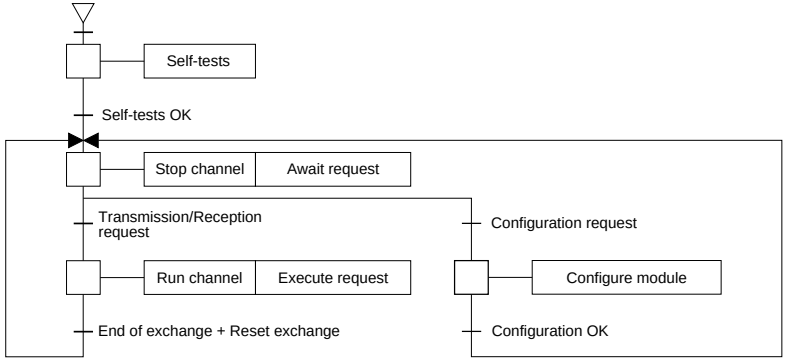
Once the exchange is complete the user will receive two reports or confirms (TXTi,R and TXTi,S). For a detailed description of the text block, refer to the appropriate PL7–2 programming manual.

2.3 Module Operating Modes

2.3-1 Description

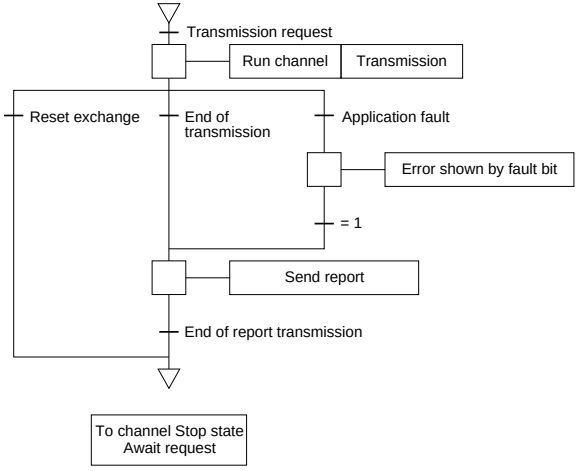
General Flow-chart

The status flow-chart shown below illustrates the operation of the TSX SCG 113 module. The various module states are given in the IW input registers and made available to the user program.

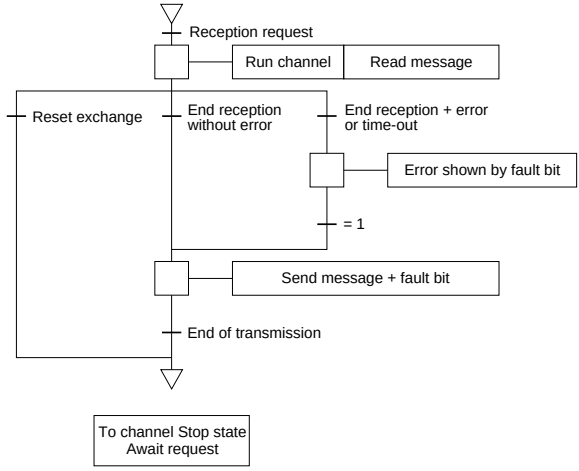


Transmission request flow-chart

This flow-chart illustrates the processing performed by the module when it executes a transmission request (with time-out and report).



Reception request flow-chart



Reception/Transmission request flow-chart

This request combines the previous two requests. A single report is generated once the read request has been executed. It can be visualized by combining the Transmission and Reception flow-charts.

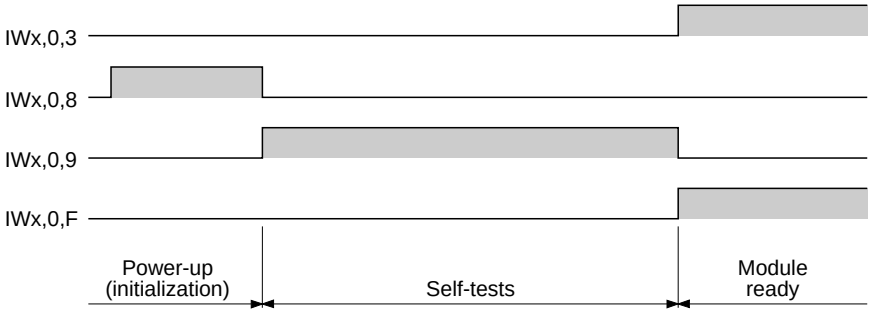
2.3-2 Module Reaction to a Power Break/Return

The module does not have a backed-up memory. It looses its configuration when the power supply to the PLC is interrupted.

It is therefore necessary to configure the module:

- On a cold restart (SY0 = 1),
- On a hot restart (SY1 = 1) when the power supply reserve is exhausted,
- Each time the PLC is connected/disconnected.

Power return
Each time the module is powered-up, bit IWx,0,8 (Blocking fault) is forced to 1 by the PLC. After approximately 300 ms, the discrete, register and message interfaces in the module are activated and the module self-tests can start (IWx,0,8 = 0 and IWx,0,9 = 1). Once the self-tests are complete (approx. 1 second later), the Module ready (IWx,0,3) and PWF failure (IWx,1,F) bits are set to 1 to indicate that the module can be accessed in message mode.
The PWF bit can be acknowledged, but this is not mandatory.



Note: The 12V module supply and the 5V PLC supply may react differently to a power break. This can cause the loss of the configuration without bits SY0 and SY1 changing state. This makes it preferable to test bit IWx,1,F (PWF failure) in addition to testing SY0 and SY1.

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3.1 Configuration Principle

Presentation

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

The configuration of the module is defined by programming as the module does not have non-volatile memory for saving configuration data. The module will use its default configuration if no other program is defined (refer to sub-section 3.3).

The configuration of the module must define:

- The type of software function to be executed,
- The physical transmission characteristics: character format and transmission speed,
- The various operating parameters: use of XON/XOFF protocol, automatic echo control, etc.

3.1-1 Accessing the Configuration

The configuration of a module channel is entirely programmable from the application program in the PLC. 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 is lost. Sending a "write configuration" request is therefore required each time the module is powered-up or after a power-break (SY0, SY1, IWx,1,F).

Bit IWxy,1,3 gives information on the module configuration:

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

Note:

- The "read configuration" request allows the user program in the PLC to read the module configuration,
- 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.

3.2 Parameters

3.2-1 Defining the Parameters

The layout of the parameter tables transmitted to the module is shown below. The table comprises nine 16-bit words.

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Function: 1				Nbr. of bits				Parity				Stop bits			
Transmission speed (baudrate)															
0				RTS/DTR				XON - XOFF (Rx)				Echo Type			
Reception echo				Auto-LF				XON - XOFF (Tx)				Back-Space			
VAL - CFR 1				ERC-1-INCL				VAL-ERC-2				ERC-2-INCL			
Define ERC-1								Define ERC-2							
VAL-ETC-1				ETC-1-INCL				VAL-ETC-2				ETC-2-INCL			
Define ETC-1								Define ETC-2							
Silence between characters															

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

Function: Defines the channel operating mode:
- 1 = Full-duplex character string.

Number of bits: Defines the format of the characters exchanged on the line:
- 7 = 7 bit characters,
- 8 = 8 bit characters.

Parity: Defines whether or not a parity bit is used:
- 0 = no parity,
- 1 = odd parity,
- 2 = even parity.

Stop bits: Defines the number of stop bits used to define a character:
- 1 = 1 stop bit,
- 2 = 2 stop bits.

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 selections listed below are available, 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 bits,
- 7 bits + odd parity + 2 stop bits,
- 8 bits + even parity + 1 stop bit,
- 8 bits + odd parity + 1 stop bit,
- 8 bits + 1 stop bit,
- 8 bits + 2 stop bits.

Transmission speed (Baudrate): The transmission speed is coded in 4 figure BCD (the coding for 19200 baud is B'1920').
The transmission speeds that can be used are:

- 19200, 9600, 4800, 2400, 1200, 600, 300 and 150 bps.

RTS/DTR: This signal is used when the module is connected to a Modem:

- RTS/DTR = 0: The DTR signal is controlled by the user program through bit Ox,1:
  - Ox,1 = 0 forces the Modem to connect to the line,
  - Ox,1 = 1 forces the Modem to disconnect from the line.

  The RTS signal is automatically controlled by the module.
- RTS/DTR = 1: The DTR and RTS signals are automatically controlled by the module, therefore the signal cannot be directly accessed by the PLC application program.

XON-XOFF (RX): These two ASCII characters are used to control the level of traffic through the reception buffer of the module:

- 0 = XON/XOFF (reception) inhibited,
- 1 = XON/XOFF (reception) enabled.

If this parameter is enabled, when the PLC user program 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 sent. This procedure allows messages of more than 256 characters to be received by synchronizing the transmitter to the XON and XOFF characters sent by the module.

Note: When XON-XOFF is enabled, the Modem RTS signal remains active. Even when XON-XOFF is inhibited, receiving the requested number of characters sets the RTS signal to 1 if RTS/DTR = 1 is selected (see above). If this signal is connected to the CTS (Clear to Send) line on the transmitting device (e.g. a Modem), transmission to the module is inhibited. Reception of the next read request will reset transmission from the remote device by resetting the RTS signal to 0.

Echo Type: If reception-echo is configured and if a character write request is sent while reception is in progress, the echo is interrupted. It will restart in one of two ways:
- Echo-Type = 0: Echo restart from the interrupted character,
- Echo-Type = 1: Echo restart from the first character received.

Reception Echo: Any character received by the module while executing a reception request is immediately sent back over the line as an echo. If a transmission request is sent by the PLC 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 above):
- 0 = reception echo inhibited,
- 1 = reception echo enabled.

Auto-LF: Whenever a carriage return character (CR = H'0D') is sent, the module automatically sends a line feed character (LF = H'0A'). This function also applies to reception requests with echo:
- 0 = Auto-LF inhibited,
- 1 = Auto-LF enabled.

XON-XOFF (TX): These two ASCII characters can be used to indicate when a device (e.g. a printer or any other peripheral is busy:
- 0 = XON -XOFF (transmission) inhibited,
- 1 = XON -XOFF (transmission) enabled,

During execution of a transmission request, the module interrupts character transmission when XOFF (H'13') is received. Transmission restarts when XON is received (H'11').

Back-Space: This character moves the cursor one space to the left:
- 0 = Back-Space inhibited,
- 1 = Back-Space enabled.

When executing a reception request, the module controls this function as follows:
- With Back-Space inhibited, Back-Space characters received are stored like all other characters,
- With Back-space enabled, when a Back-Space 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 three characters: Back-Space (ASCII code H'08'), then Space (ASCII code H'20') and Back-Space again (ASCII code H'08').

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

- VAL-ERC-1/VAL-ERC-2: The validation codes for each of the two end of transmission characters are:
  - 0 = End character inhibited,
  - 1 = End character enabled.
- 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 using the parameters listed below:

- 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 enabled.
- ETC-1-INCL/ETC-2-INCL: This parameter determines whether or not each end of transmission character is sent or not:
  - 0 = End character not sent,
  - 1 = End character sent.
- DEFINE ETC-1/DEFINE ETC-2: These 2 bytes are used to define the values of the end of transmission characters:
  - H'00' to H'FF' for 8-bit characters,
  - H'00' to H'7F' for 7 bit characters.

Silence Between Characters: Once at least one character has been received, 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. 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 0.

Important:

> When Silence Between Characters is configured, the XON-XOFF (RX), XON–XOFF (TX) and Reception Echo parameters must be inactive. If not, the configuration request will be refused.

3.3 Default Configuration

Each time the module is powered-up, it reverts to the default configuration.

The default parameters are:

- Function = 1 (Full-Duplex),
- Number of bits = 8,
- Parity = 1 (odd parity),
- Number of stop bits = 1,
- Binary dataflow = B'9600' (9600 bps),
- All other parameters = 0.

Note: When a power break occurs or after the module has been disconnected from the PLC, the user defined configuration is lost and the default configuration is used.

3.4 Loading the Configuration

The configuration is loaded through a text block that sends the module a table of predefined parameters. A report is sent back to acknowledge reception. If a power break occurs, the configuration must be loaded again, once the module is ready (IWx,0,3 = 1) after being powered-up and completing its self-tests.

3.4-1 Entering the Data

Initializing the text block

The user program must:

- Initialize the text block transmission table with the configuration parameters (refer to sub-section 3.2-1). This operation must be performed by program if the text block was defined with a transmission table located in the internal memory Wi field or by terminal if the transmission table is in the constant memory CWi field.
- Initialize the following text block variables:
  - TXTi,M: module address followed by 00,
  - TXTi,C: request code = H'0040',
  - TXTi,L: transmission table length =18 bytes.

These parameters can be set either by program or by configuration.

- Start the exchange with text block inputs S, O and I at 1,
- At the end of the exchange, analyze the report.

Analyzing the report

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

Therefore the report value can be:

- H'00FE': Correct configuration, accepted and stored by the module,
- H'00FD': Incorrect configuration, rejected by the module. **The module is no longer configured as all previous configurations are lost.**

  Probable causes of configuration failure are:
  - Parameters that are out of bounds,
  - Variable TXTi,L is not equal to 18,
  - Silence between characters is configured with XON-XOFF (TX), XON–XOFF (RX) or Reception Echo selected.

When a write configuration request is received, TXTi,S (number of bytes received) = 0.

3.5 Configuration Example

To configure the module at address 3, use text block TXT0 defined as a CPL type text block with direct addressing and the transmission table at address CW0 (there is no reception table).

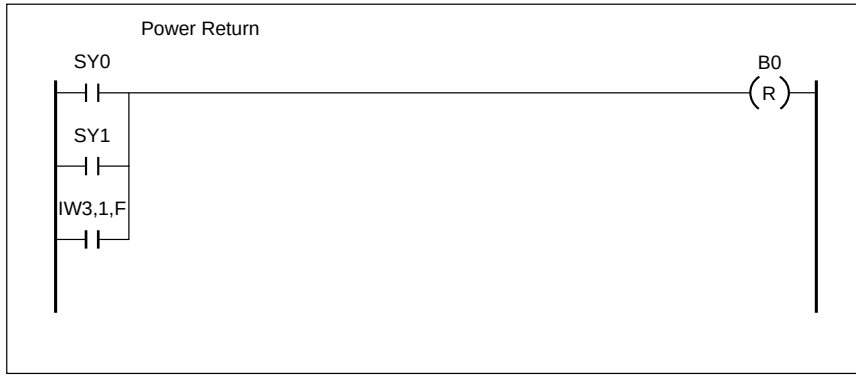
The configuration is sent on request (B10 set) or on power return (B0 reset to 0 by SY0 or SY1 or IW3,1,F) and module ready (IW3,0,3 = 1).

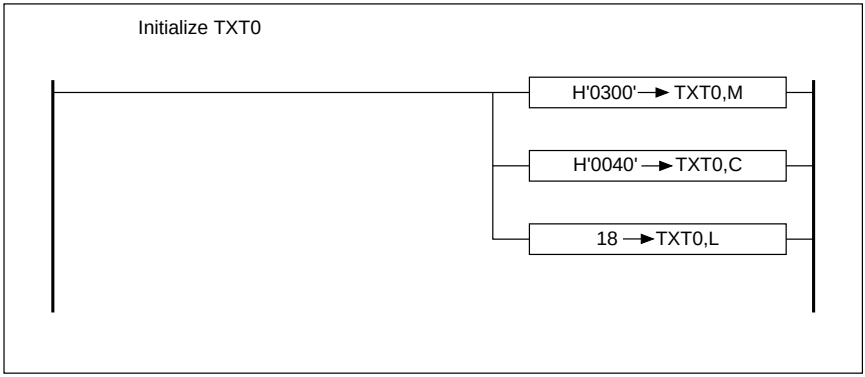
Constant words CW0 to CW8 contain the following values:

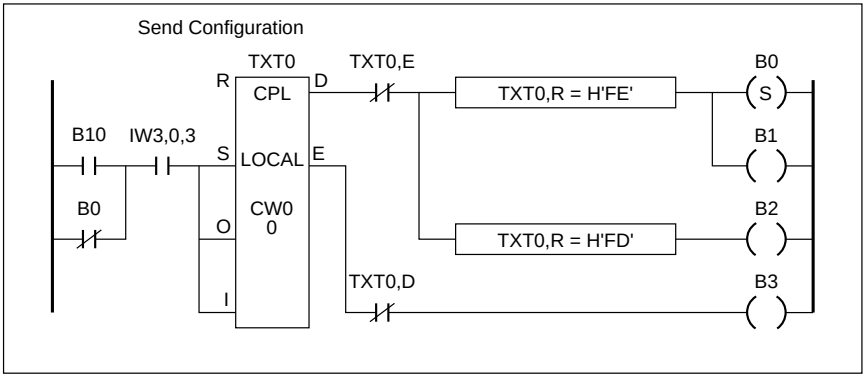
CW0 = H'1802': 8 bits, no parity, 2 stop bits,
CW1 = H'1200': 1200 bps,
CW2 = H'0000': Restart echo from the interrupted character,
CW3 = H'0101': Automatic line return,
CW4 = H'0000': No stop reception code,
CW5 = H'0D00': Ignored as CW4 = 0,
CW6 = H'0000': No end of transmission code,
CW7 = H'0000': Ignored as CW6 = 0,
CW8 = H'0000': Silence between characters is ignored.

The parameters for text block TXT0 are:
- TXT0,M = H'0300': Module address 03,
- TXT0,C = H'0040': Write configuration request,
- TXT0,L = 18: Send 9 words.

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.




Initialize TXT0
H'0300' → TXT0,M
H'0040' → TXT0,C
18 → TXT0,L


Send Configuration
TXT0
R
CPL
D
TXT0,E
TXT0,R = H'FE'
B0
S
B10
IW3,0,3
S
LOCAL
E
B1
B0
CW0
0
O
TXT0,R = H'FD'
B2
TXT0,D
B3
I

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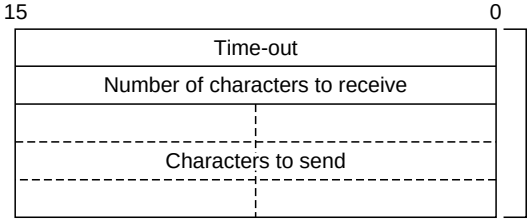
4.1 Full-Duplex Transmission/Reception Requests

4.1-1 General

The full-duplex transmission/reception request (Request code H'07') enables simultaneous transmission and reception operations, defined by the text block parameters and the format of the assigned buffer:



Number of characters to receive	TXTi,L	Type of request
0	> 4	Write request
> 0	= 4	Read request
> 0	> 4	Read/Write request

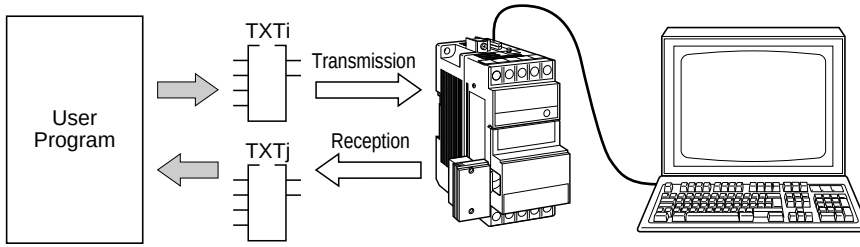
The exchange is started by setting text block inputs S, I and O to 1.

TSX 17-20 Micro-PLC transmission tables have a maximum capacity of 30 bytes.

The characters received are stored in a buffer with a maximum capacity of 256 bytes. Any additional characters are lost. Register bit IWxy,2,0 indicates an overflow.

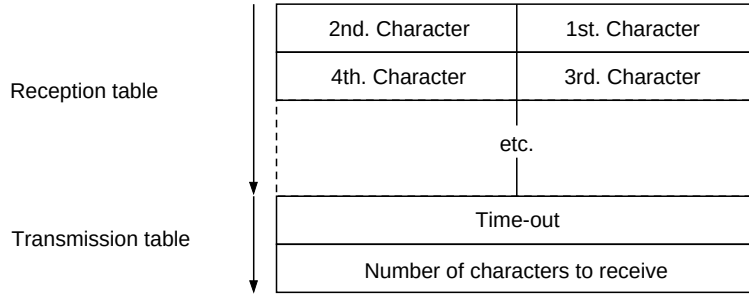
When the module receives a "Read n characters" request, with n not greater than 30, the module waits for the n characters to be received or for the end character (ERC-1 or ERC2) defined when the module was configured. If a message has already been stored in the reception buffer of the module, it is sent to the data memory of the PLC.
During this time any write requests received on the same channel are accepted and performed.

Two function blocks must be used support dialog between the module and the PLC.



4.1-2 Reception Request

Time-out: Coded in BCD from 1 to 9999 (100 ms time base). A 0 value defines reception without a time-out.
Number of characters to receive: 30 bytes max.



Reception text block parameters

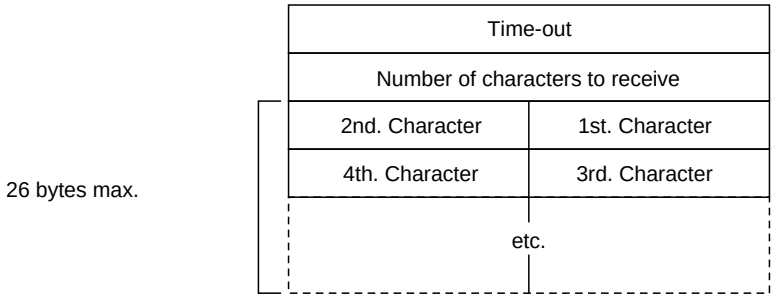
The parameters can be set by program or by configuration.

- TXTi,C = H'0007' : request code,
- TXTi,L = 4 : transmission table length,
- TXTi,M = H'0x00' : module address and channel number,
- S, I & O= 1 : transmission/reception exchange,
- TXTi,D = 1 : end of exchange (request executed),
- TXTi,R : report (refer to sub-section 4.2),
- TXTi,S : status word (refer to sub-section 4.2).
- reception table : Wi [n] with
  - table address : Wi
  - length of the reception table : n bytes.

4.1-3 Transmission Request

Time-out: Coded in BCD from 1 to 9999 (100 ms time base). A 0 value defines reception without a time-out.

Number of characters to receive: 0 (write request).



Transmission text block parameters

The parameters can be set by program or by configuration.

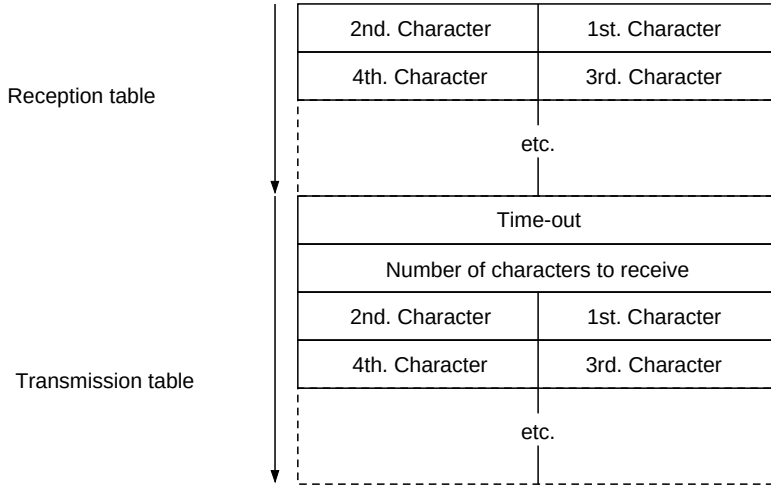
- TXTi,C = H'0007' : request code,
- TXTi,L = 4 : transmission table length (time-out, number of bytes to receive and list of bytes to send),
- TXTi,M = H'0x00' : module address and channel number,
- S, I & O = 1 : transmission with report,
- S & O = 1 : transmission without report,
- TXTi,D = 1 : end of exchange (request executed),
- TXTi,R : report (refer to sub-section 4.2),
- TXTi,S : status word (refer to sub-section 4.2).

4.1-4 Transmission/Reception Request

Only one text block is required to establish dialog between the module and the PLC. This half-duplex request first transmits, then receives characters.

Time-out: Coded in BCD from 1 to 9999 (100 ms time base).

Number of characters to receive: 30 bytes max.



Text block parameters

The parameters can be set by program or by configuration.

- TXTi,C = H'0007' : request code,
- TXTi,L : transmission table length
- TXTi,M = H'0x00' : module address and channel number,
- S, I & O = 1 : transmission/reception exchange,
- TXTi,D = 1 : end of exchange (request executed),
- TXTi,R : report (refer to sub-section 4.2),
- TXTi,S : status word (refer to sub-section 4.2).
- reception table : Wi [n] with
  - table address : Wi
  - length of the reception table : n bytes.

4.2 Report - Status Word

4.2-1 General

Once the module has executed a request, it informs the user program by sending a report and a status word.
An analysis of this data allows the user program to direct programming accordingly.

4.2-2 Report

The report word TXTi,R 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'0' : stop on reaching the number of characters,
- H'1' : stop on the first end character,
- H'2' : stop on the second end character,
- H'3' : stop on silence between characters,
- H'3F/FE/71/77/7A' : correct exchange (additional requests),
- H'FD' : incorrect exchange,
  - time-out,
  - time value not encoded in BCD,
  - wrong parameters.

4.2-3 Status Word

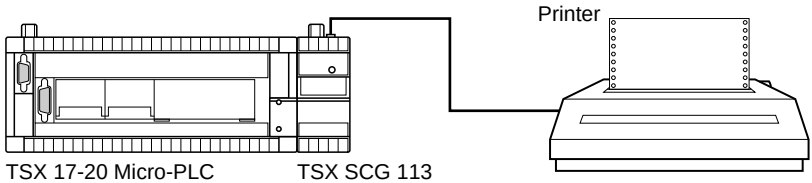
Status word TXTi,S can only be read and contains:

- The number of bytes received by the text block in the reception table during a correct exchange (TXTi,E = 0),
- An error code after an incorrect exchange (TXTi,E = 1). This code takes one of the values listed below:
  - 1 : exchange in progress cancelled by Reset,
  - 2 : transmission or reception table length error,
  - 3 : exchange error,
  - 6 : incorrect buffer address,
  - 11 : text block type not supported.

4.3 Programming Example

The module is used to record application faults on a log print-out.

The TSX 17-20 Micro-PLC that the module is connected to is fitted with a TSX P17 20 FD (with real-time clock) micro-software cartridge.



Module configuration

The default configuration does not support connection of the module to the printer. It is therefore necessary to load a different configuration.

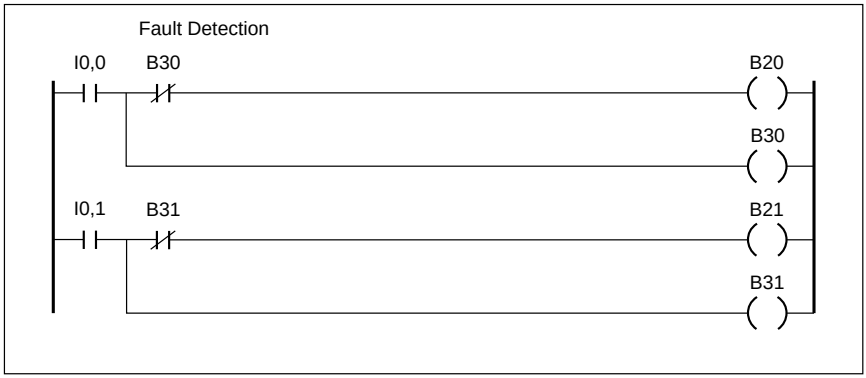
The printer parameters (7 data bits, no parity, 2 stop bits, 1200 bps) determine the contents of configuration words CW0 to CW8 (refer to sub-section 3.5).

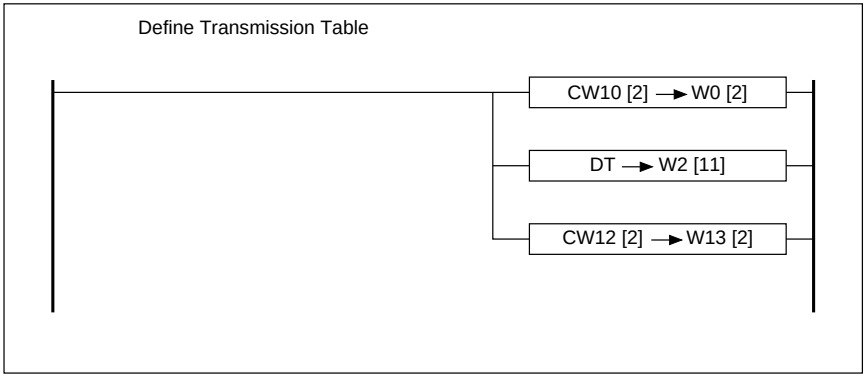
Recording a fault

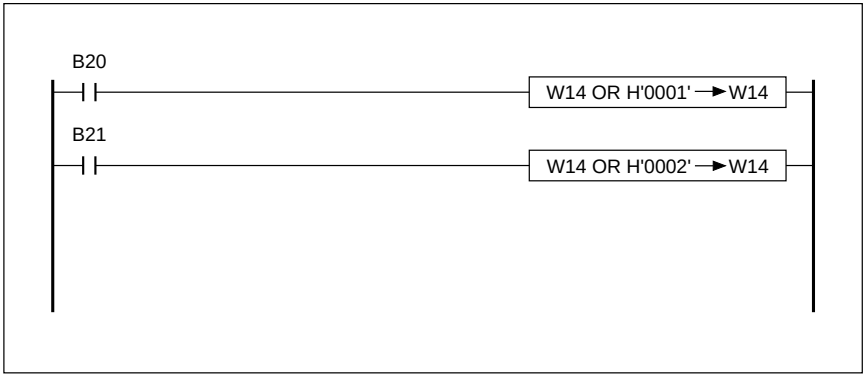
Faults 1 and 2, indicated by setting bits B20 and B21 respectively to 1, will be logged to the print-out with the time and date of their occurrence. Text block TXT1 will be used for this purpose.

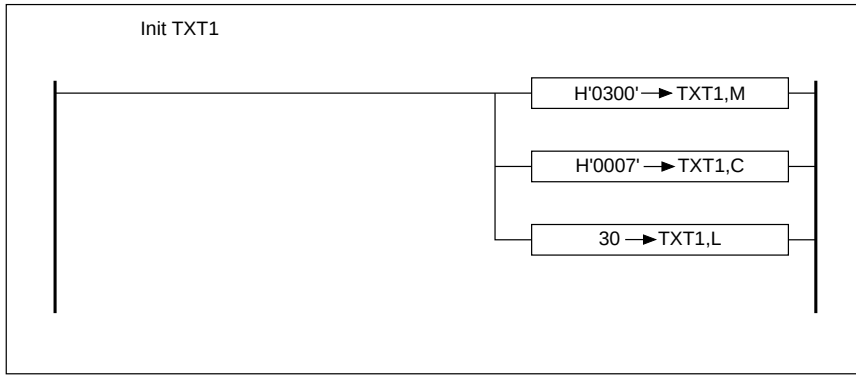
The parameters of text block TXT1 are:
- TXT1, M = H'0300',
- TXT1,C = H'0007',
- TXT1,L = 30,
- Reception table address = W0, length = 0.

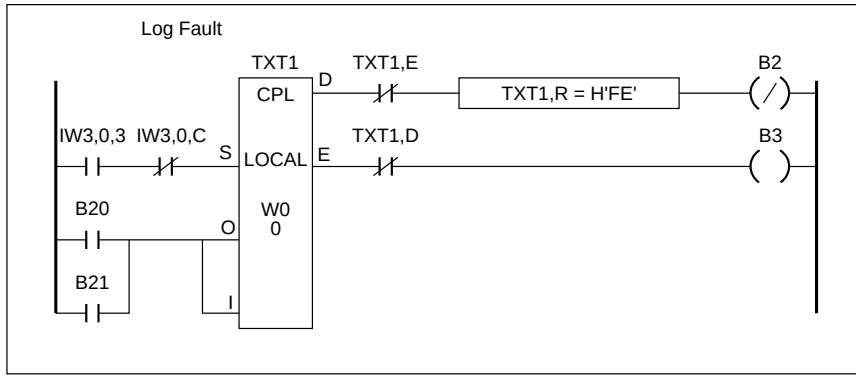
Transmission table definition:
- CW10 → W0 = B'0000' (transmission without time-out),
- CW11 → W1 = H'0000' (no characters to receive),
- W2 to W12 (time and date),
- CW12 → W13 = H'442F',
- CW13 → W14 = H'0D fault number'.

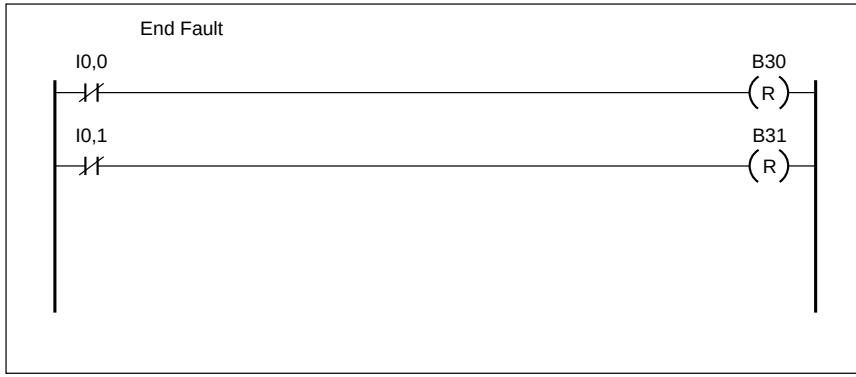

Fault Detection
I0,0
B30
B20
B30
I0,1
B31
B21
B31


Define Transmission Table
CW10 [2] → W0 [2]
DT → W2 [11]
CW12 [2] → W13 [2]


B20
W14 OR H'0001' → W14
B21
W14 OR H'0002' → W14


Init TXT1
H'0300' → TXT1,M
H'0007' → TXT1,C
30 → TXT1,L


Log Fault
TXT1
CPL
D
TXT1,E
TXT1,R = H'FE'
B2
IW3,0,3
IW3,0,C
S
LOCAL
E
TXT1,D
B3
B20
O
W0
0
B21
I


End Fault
I0,0
B30
R
I0,1
B31
R

4.4 Additional Programming Information

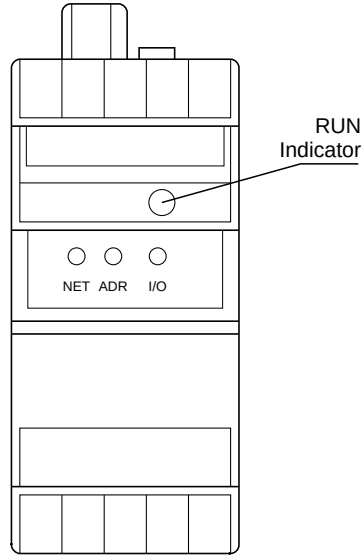
4.4-1 Fault Processing

Any fault detected by the module can be determined by program. There are two types of fault that can occur: **blocking faults** that inhibit the module and stop the application program and module or **application faults** that do not inhibit the module.

A fault is indicated by the indicator LEDs on the module, by status word or by the fault bit strings.

Indicator LEDs

Type of fault	RUN LED (Green)	I/O LED (Red)
No fault	On	Off
Blocking fault	Off	On
Application fault	On	Off



Status words

Fault bit	Fault
IWx,0,4	General fault or store general fault (as IWx,0,7).
IWx,0,7	Application fault or store application fault.
IWx,0,8	Blocking fault.

Fault bit string

This string of 48 bits is internal to the module and can be accessed by the message interface (text block). They can be used to precisely locate a fault and acknowledge an application fault. Bits IW,x,0,4 and IW,x,0,7 are set to 0 when:

- A fault ends, if it has been acknowledged by reading the fault bits,
- The fault bits are read, if the fault has ended.

The table opposite lists the fault bits and the faults they represent.

- Fault bits

Fault bit	Fault
0	EPROM checksum fault
1	RAM fault (internal or external)
2	12V supply fault
3 to 33	Not used
34	Time-out fault on read request
35	Time-out fault on write request
36	Time-out fault on read/write request
37	Reception parity fault
38 to 47	Not used

4.4-2 Self-Tests

Each time the module is powered-up, the module runs a self-test sequence that comprises a test of the RAM memory used by the microprocessor and a checksum test of the module micro-program.

Blocking fault
Any fault identified by these tests is stored by bit IWx,0,8 (blocking fault) and the RUN indicator is extinguished to indicate the fault. The module is permanently inhibited.

Note: During the entire self-test phase, the user program should not access the module. Bits IW,0,3 and IWx,0,9 indicate that the module is ready and can be tested.

4.4-3 Additional Requests

In addition to the configuration and operation requests, the requests listed below enable the application program to exchange various information with the module. They use a CPL type text block.

Request function	TXTi,C (Hex.)	TXTi,M (Hex.)	TXTi,R (Hex.)	Number of bytes written	Number of bytes read
Read configuration	41	0x00	71/FD	0	18
Read fault bits from the string	47	0x63	77/FD	0	6
Write application name	49	0x63	FE/FD	1 to 20	0
Read application name	4A	0x63	7A/FD	0	1 to 20
Read module version	0F	0x63	3F/FD	0	27

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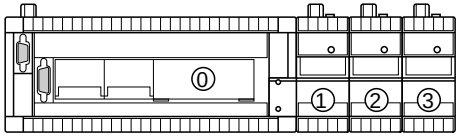
5.1 Installing the Module

The TSX SCG 113 module can only be used with a TSX 17-20 Micro-PLC equipped with a TSX P 17-20 FC (no real-time clock) or TSX P 17-20 FD (with real-time clock) micro-software cartridge.

The connection between the Micro-PLC or the extension block preceding the module on the bus is made via the built-in cable. This means that the module is always located to the right of the preceding module.

Among extension modules, it can be installed as first second or third extension.



A maximum of two intelligent modules (TSX SCG 113 or TSX SCG 116) can be connected to a Micro-PLC

Note:

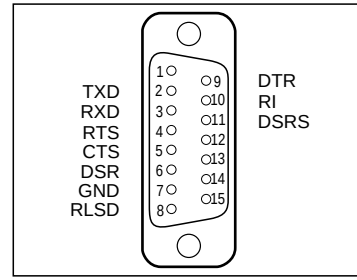
The last extension block or intelligent module in a Micro-PLC configuration must be fitted with a TSX 17 ACC10 terminator. The terminator is supplied separately.

For more information on the installation of extension modules (mounting, dimensions, etc.), refer to the TSX 17 Micro-PLC Installation Manual (TSX D11 000E).

5.2 Connecting to a Peripheral or a Modem

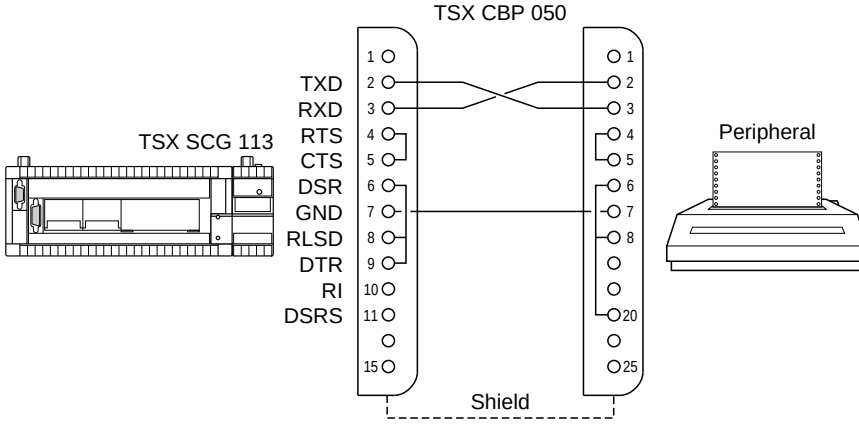
5.2-1 General

To connect the module to a peripheral or to a Modem, the 15-pin female connector located on the top part of the module is used. The pin arrangement for this connector is shown opposite.



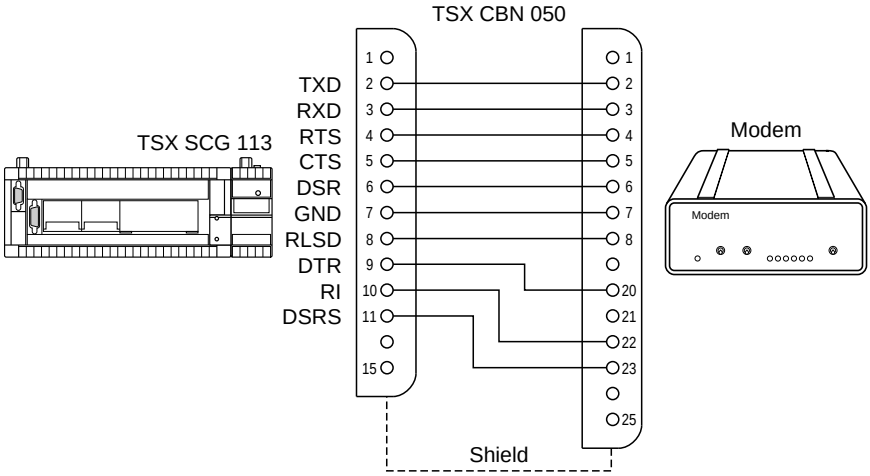
5.2-2 Connecting to a Peripheral

To connect the module to a standard two signal peripheral with a 25-pin connector, use a 5 meter TSX CBP 050 cable. This cable is fitted with a 15-pin male connector for connecting to the module and a 25-pin male connector for connecting to peripherals accepting DTE type connection (printers, keyboard/display terminals, regulators, etc.).



5.2-3 Connecting to a 9 Signal Modem

To connect the module to a 9 signal modem using a 25-pin connector, use a 5 meter TSX CBN 050 cable. This cable is fitted with a 15-pin male connector for connecting to the module and a 25-pin male connector for connecting to the DCE type connection Modem.



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6.1 ASCII Code Table

				b7	0	0	0	0	0	0	0	0
				b6	0	0	0	0	1	1	1	1
				b5	0	0	1	1	0	0	1	1
				b4	0	1	0	1	0	1	0	1
b3	b2	b1	b0	Column → / Line	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

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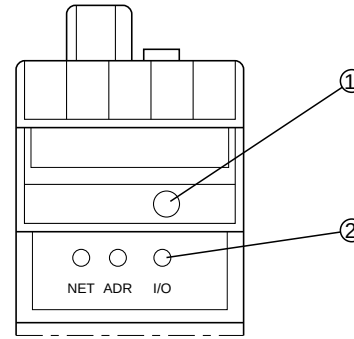
6.3 Quick Reference Guide

Indicator LEDs

① Green LED: Module powered-up and operating correctly

② Red LED: I/O bus fault.

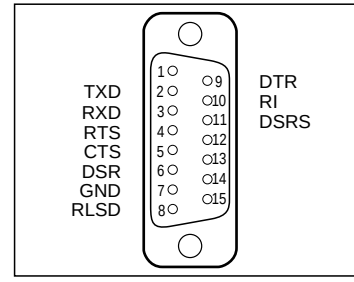


General characteristics

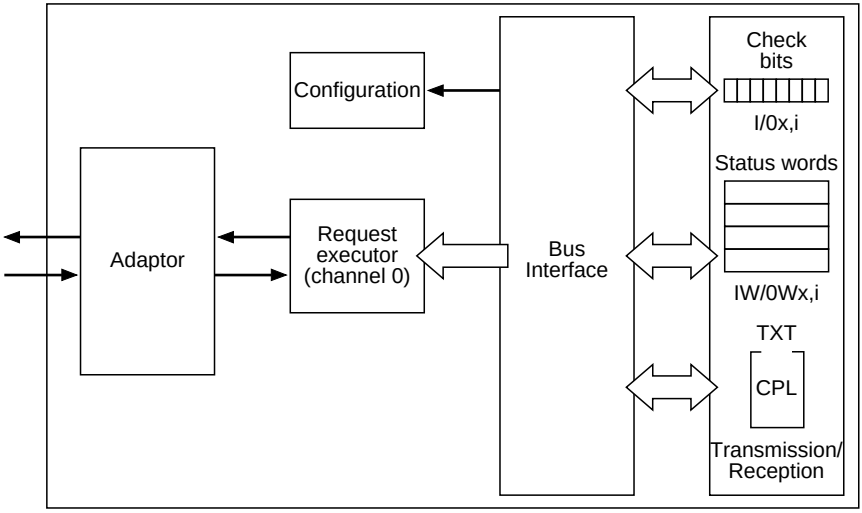
- **Installation:**
  - TSX 17-20 with TSX P17 20 FC or FD cartridge,
  - Up to 3 modules or extension blocks per PLC,
  - Up to 2 intelligent modules (TSX SCG 113 or 116) per PLC configuration (addresses 1 to 3),
  - The last module in the configuration must be fitted with a TSX 17 ACC10 terminator.
- **Software configuration code : 63**
- **Reaction to a power-break (of more than the autonomy of the PLC supply) and power-return:**
  - User configuration lost,
  - Restart with the default configuration.

Connection to a peripheral or a Modem

TXD : Transmitted Data,
RXD : Received Data,
RTS : Request To Send,
CTS : Clear To Send,
DSR : Data Signal Rate,
GND : 0V (Ground),
RLSD : Received Line Signal Detector,
DTR : Data Terminal Ready,
RI : Ring Indicator,
DSRS : Data Signal Rate Selection.



Exchange flow-chart



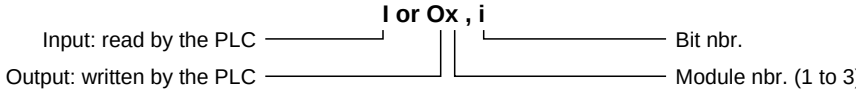
Message interface: standard requests

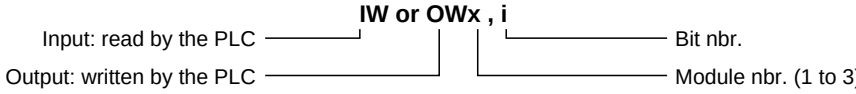
Request function	TXTi,C (Hex.)	TXTi,M (Hex.)	TXTi,R (Hex.)	Number of bytes written	Number of bytes read	Module state
Write configuration	40	0x00	FE/FD	18	0	STOP
Full-duplex Write/Read	07	0x00	0/1/2/ 3/FD	4 to 30	0 to 30	RUN
Read configuration	41	0x00	71/FD	0	18	RUN/STOP
Read fault bits from the string	47	0x63	77/FD	0	6	RUN
Write application name	49	0x63	FE/FD	≤20	0	RUN/STOP
Read application name	4A	0x63	7A/FD	0	≤20	RUN/STOP
Read module version	0F	0x63	3F/FD	0	27	RUN/STOP

Message interface: transfer characteristics

- Read/Write CPL type text block,
- TXTi,M = H'0x..' where x = module number,
  .. = channel 00 or 63.
- TXTi,C = request code,
- TXTi,R = report returned by the module,
  FD = transfer correct.
- TXTi,S = number of bytes received by transfer (if transfer OK),
  error code (if transfer error):
  - 1 : exchange in progress cancelled by Reset,
  - 2 : transmission or reception table length error,
  - 3 : exchange error,
  - 6 : incorrect buffer address,
  - 11 : text block type not supported.

Addressing

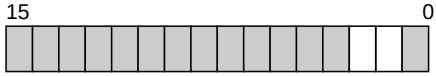




Discrete input bits

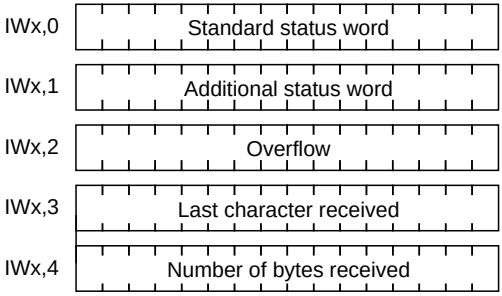
Ix,0	CTS = Clear To Send
Ix,1	DSR = Data Set Ready
Ix,2	RLSD = Received Line Signal Detect
Ix,3	RI = Ring Indicator

Discrete output bits

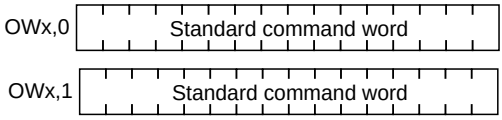


Ox,1	DTR = Data Terminal Ready
Ox,2	DSRS = Data Signal Rate Select

Input register words (words read by the PLC)

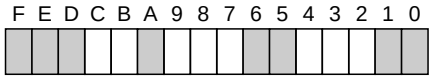


Output register words (words written by the PLC)



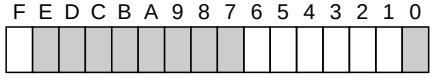
Input register words: sent by the module and read by the PLC

IWx,0 Standard status word



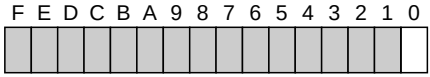
2	1 = Reset message system.
3	1 = Module ready.
4	1 = General fault or store fault.
7	1 = Application fault.
8	1 = Blocking fault.
9	1 = Self-tests in progress.
B	1 = Module not configured, 0 = Module configured.
C	1 = Module running, 0 = Module stopped.

IWx,1 Additional status word



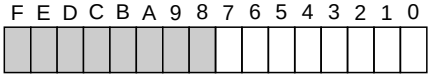
1	Reception Run/Stop: • 0 = Channel stopped, • 1 = Channel running.
2	Transmission Run/Stop: • 0 = Channel stopped, • 1 = Channel running.
3	0 = Module not configured, 1 = Module configured.
4/5/6	Adaptor code = 101
F	1 = Power return

IWx,2 Overflow

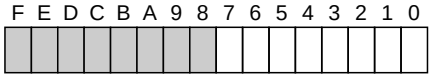


0	1 = Overflow (reception buffer full)

IWx,3 Last character received

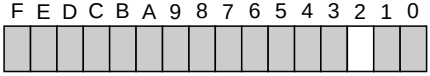


IWx,4 Number of bytes received



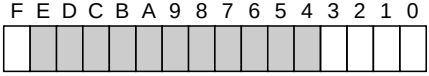
Output register words: sent by the PLC and read by the module

OWx,0 Reset message system



2	1 = Reset message system.

OWx,1



0	1 = Reset overflow bit IWx,2,0.
1	1 = Read or Write/Read exchange reset in progress,
2	1 = Write exchange reset in progress,
3	1 = Reset reception buffer,
F	1 = Acknowledge failure after power-return.

Configuration

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Function: 1				Nbr. of bits				Parity				Stop bits			
Transmission speed (baudrate)															
0				RTS/DTR				XON - XOFF (Rx)				Echo Type			
Reception echo				Auto-LF				XON - XOFF (Tx)				Back-Space			
VAL - CFR 1				ERC-1-INCL				VAL-ERC-2				ERC-2-INCL			
Define ERC-1								Define ERC-2							
VAL-ETC-1				ETC-1-INCL				VAL-ETC-2				ETC-2-INCL			
Define ETC-1								Define ETC-2							
Silence between characters															

Function
- 1 = Full-duplex character string.

Number of bits
- 7 = 7 bit characters,
- 8 = 8 bit characters.

Parity
- 0 = no parity,
- 1 = odd parity,
- 2 = even parity.

Stop bits
- 1 = 1 stop bit,
- 2 = 2 stop bits.

Transmission speed (Baudrate)
- 19200, 9600, 4800, 2400, 1200, 600, 300 and 150 bps.

RTS/DTR
- RTS/DTR = 0: The DTR signal is controlled by the user program.
  - DTR (Ox,1) = 0 forces the Modem to connect to the line,
  - DTR (Ox,1) = 1 forces the Modem to disconnect from the line.
- RTS/DTR = 1: DTR is automatically controlled by the module.
  In all cases, the RTS signal is automatically controlled by the module.

XON-XOFF (RX)
- 0 = XON/XOFF inhibited,
- 1 = XON/XOFF enabled.

Echo Type
- Echo-Type = 0: Echo restart from the interrupted character,
- Echo-Type = 1: Echo restart from the first character received.

Reception Echo
- 0 = reception echo inhibited,
- 1 = reception echo enabled.

Auto-LF
- 0 = Auto-LF inhibited,
- 1 = Auto-LF inhibited

XON-XOFF (TX)
- 0 = XON -XOFF inhibited,
- 1 = XON -XOFF enabled,

Back-Space
- 0 = Back-Space inhibited,
- 1 = Back-Space enabled.

VAL-ERC-1/VAL-ERC-2
- 0 = End of reception character inhibited,
- 1 = End of reception character enabled.

ERC-1-INCL/ERC-2-INCL
- 0 = End of reception character not included,
- 1 = End of reception character included.

DEFINE ERC-1/DEFINE ERC-2
- H’00' to H’FF’ for 8 bit characters,
- H’00' to H’7F’ for 7 bit characters.

VAL-ETC-1/VAL-ETC-2
- 0 = End of transmission character inhibited,
- 1 = End of transmission character enabled.

ETC-1-INCL/ETC-2-INCL
- 0 = End of transmission character not sent,
- 1 = End of transmission character sent.

DEFINE ETC-1/DEFINE ETC-2
- H’00' to H’FF’ for 8 bit characters,
- H’00' to H’7F’ for 7 bit characters.

Silence Between Characters
- 1 to 9999 (in BCD).