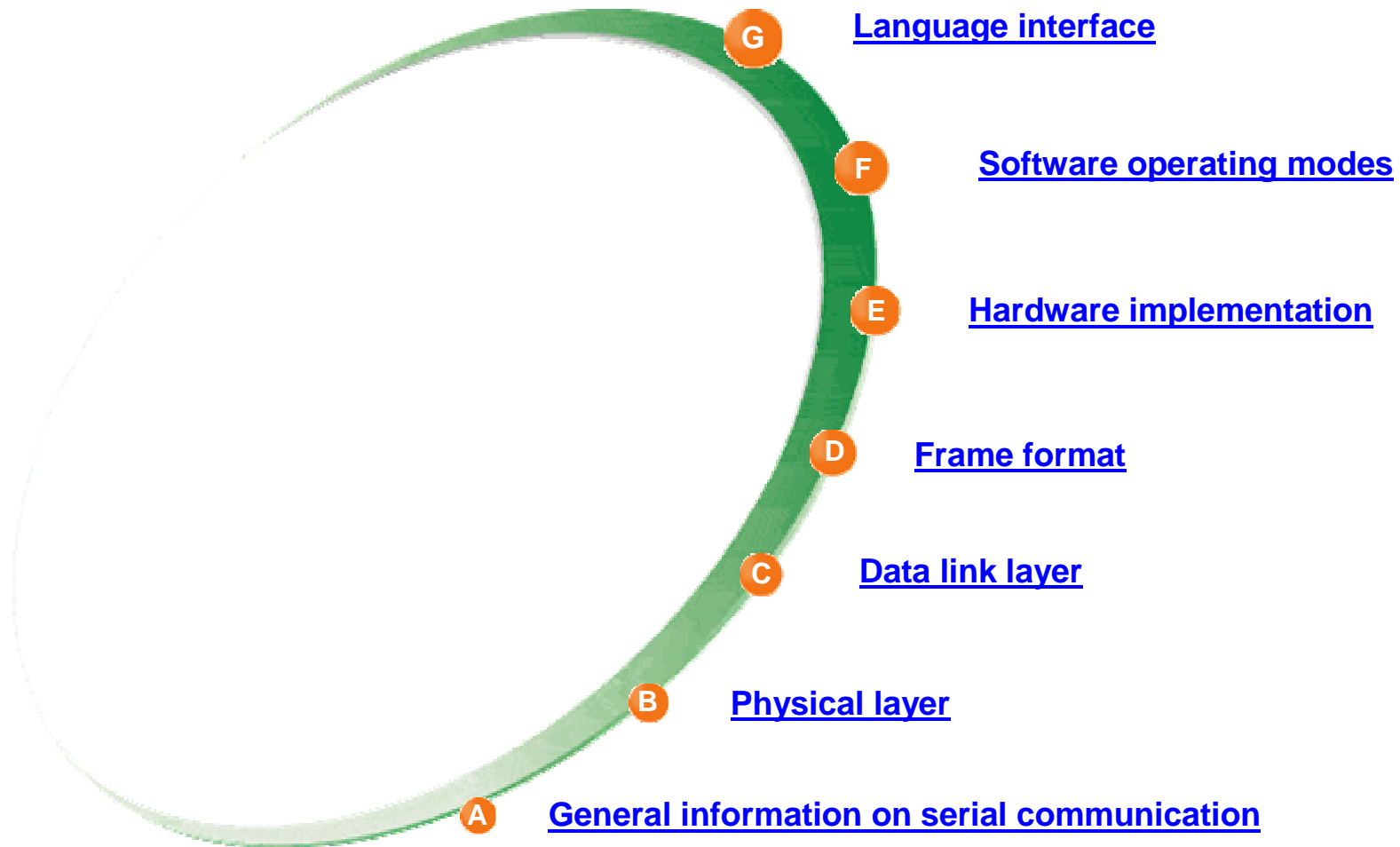
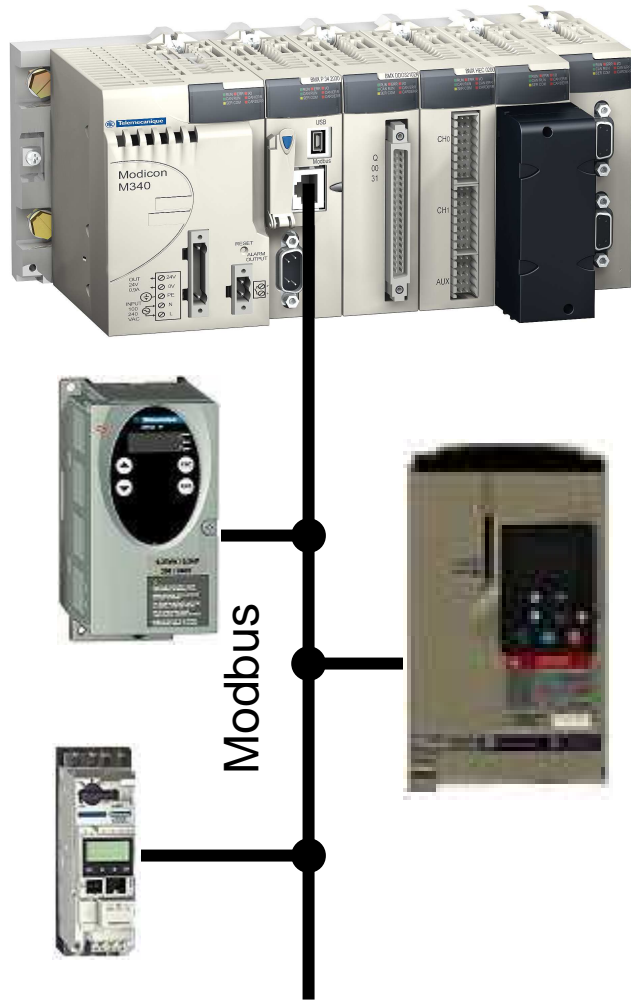


Modicon M340 : serial line



A - General information on serial communication

Serial line overview

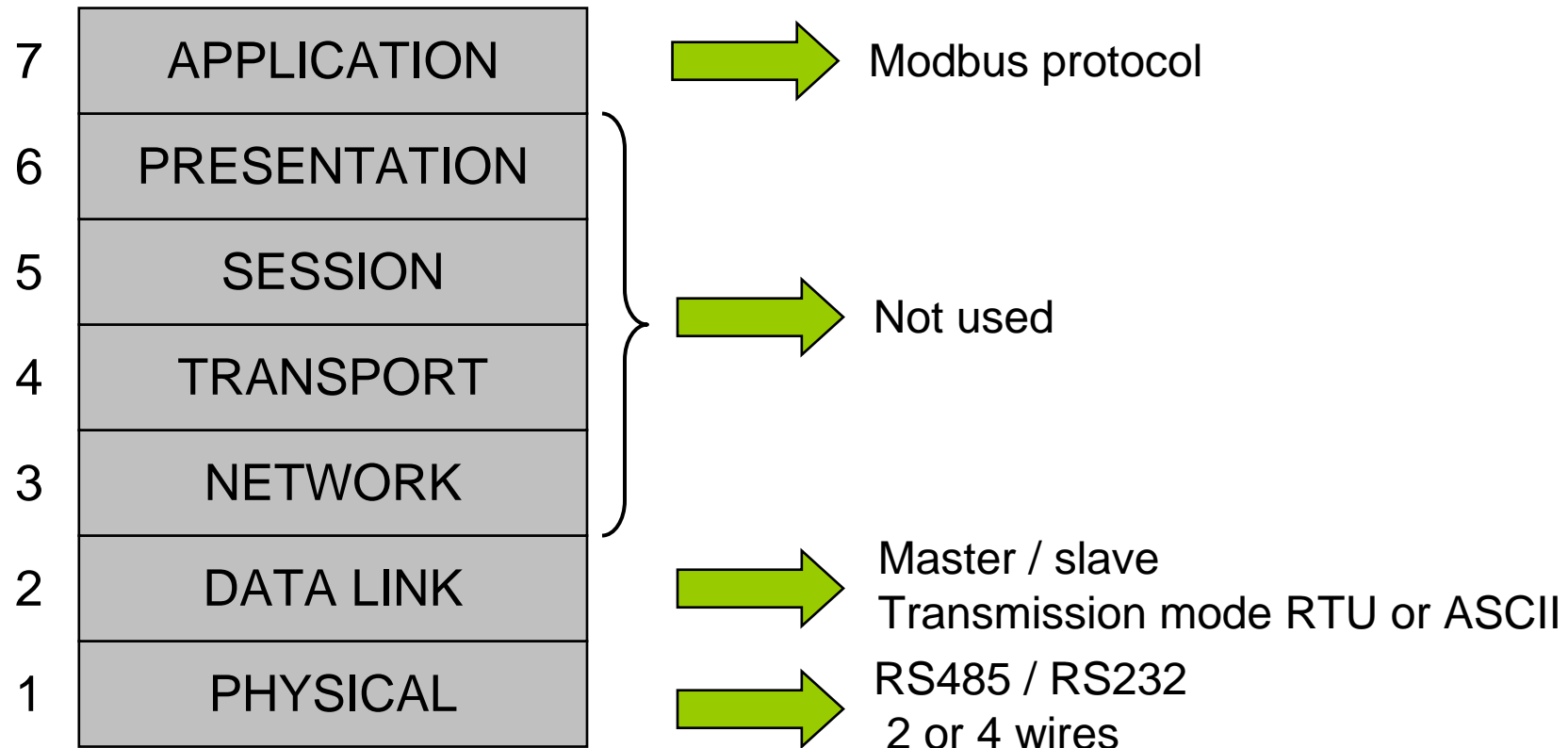


- Serial communication is used to **exchange data with equipments connected to the bus**
 - Modbus communication
 - Character mode communication
- Serial communication is **available on some processors** equipped with an integrated serial line
 - BMX P34 1000 / 2010 / 2020 processors
 - **Shielded** RJ 45 connector as physical interface
 - RS485 or RS232 serial line
 - **Power supply** for XBTN terminal or Modbus isolation tap (5V / 200 mA)
 - Use TWD XCA ISO **isolation tap** to isolate serial line

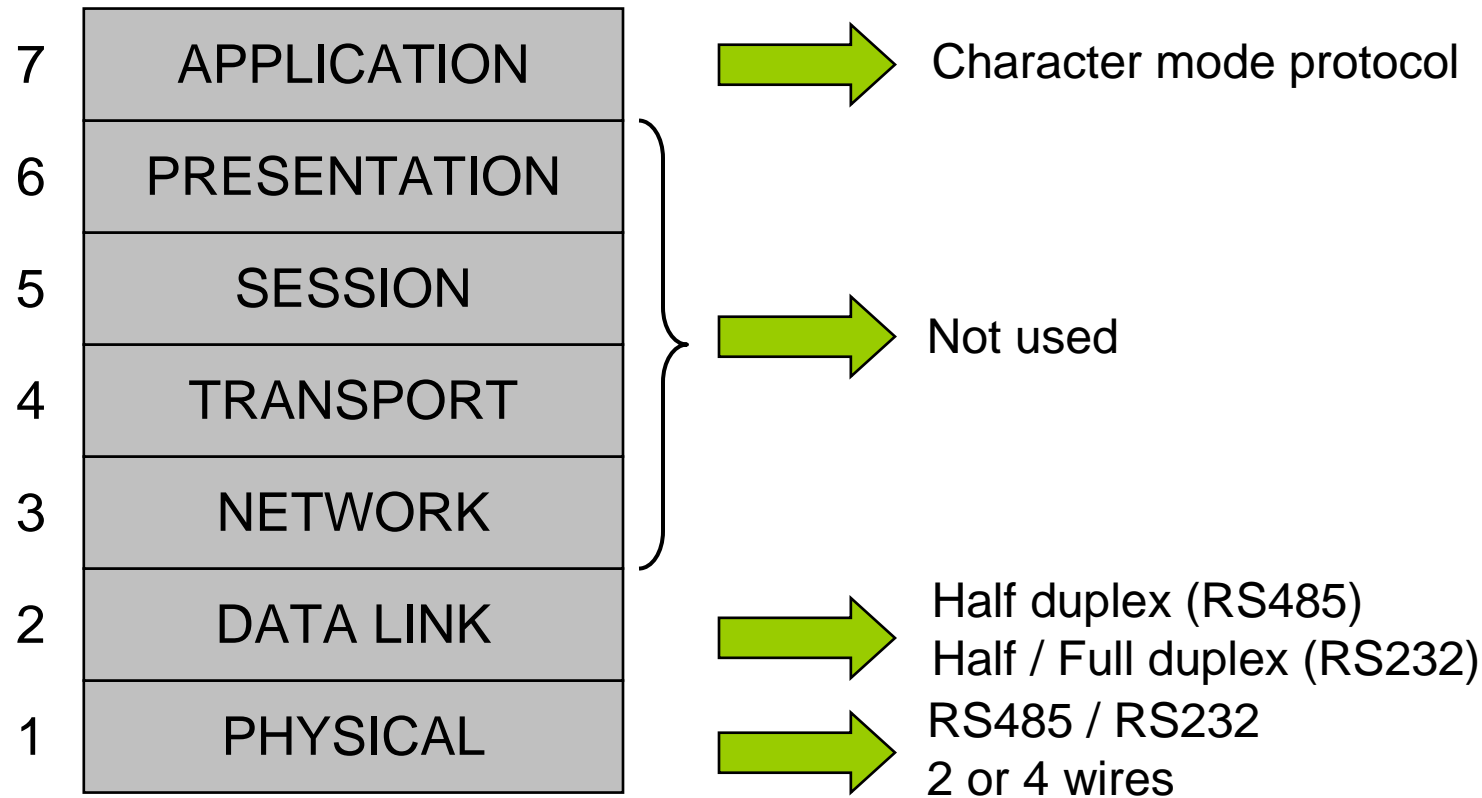
Characteristic of integrated channel

	Modbus	Character mode
Type	Master / slave	Half / Full duplex
Baud rate	19200 baud by default (300 - 19200 baud)	19200 baud by default (300 - 19200 baud)
Equipments	248 32 max per segment	248 32 max per segment
Bus length	Main trunk : 1000 m Drop : 40 m	Main trunk : 1000 m Drop : 40 m
Message size	256 bytes	1 Kbyte
Services	Words / bits reading Words / bits writing Diagnostic	Strings sending Strings receiving

Modbus and OSI model



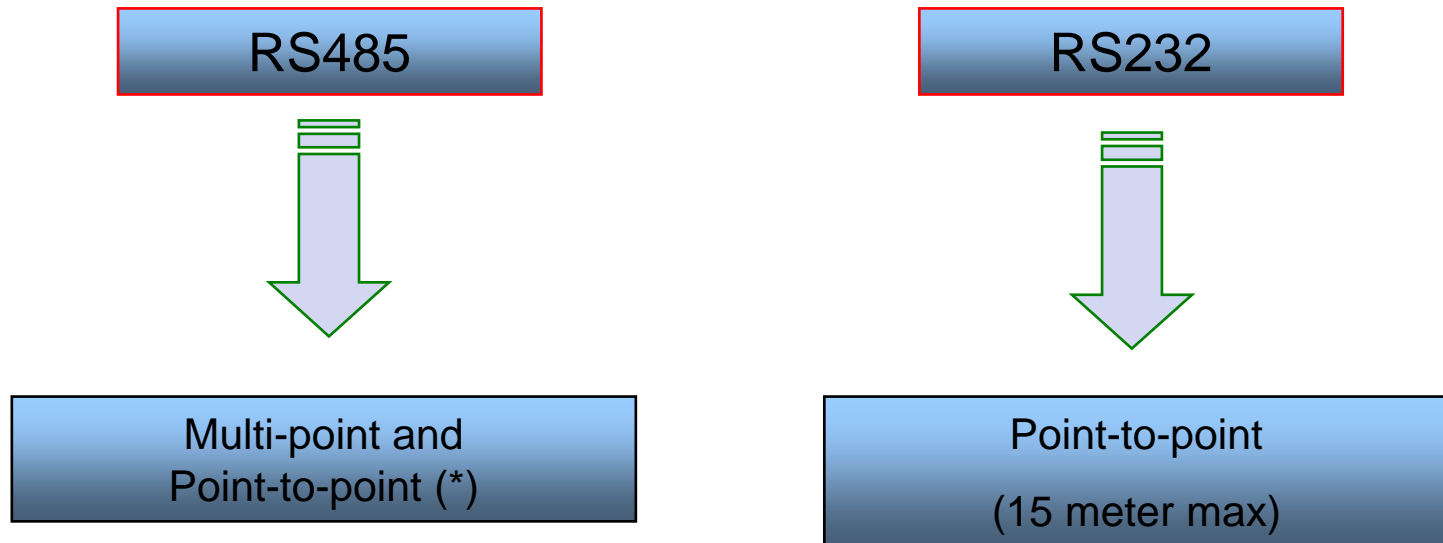
Character mode and OSI model



B - Physical layer

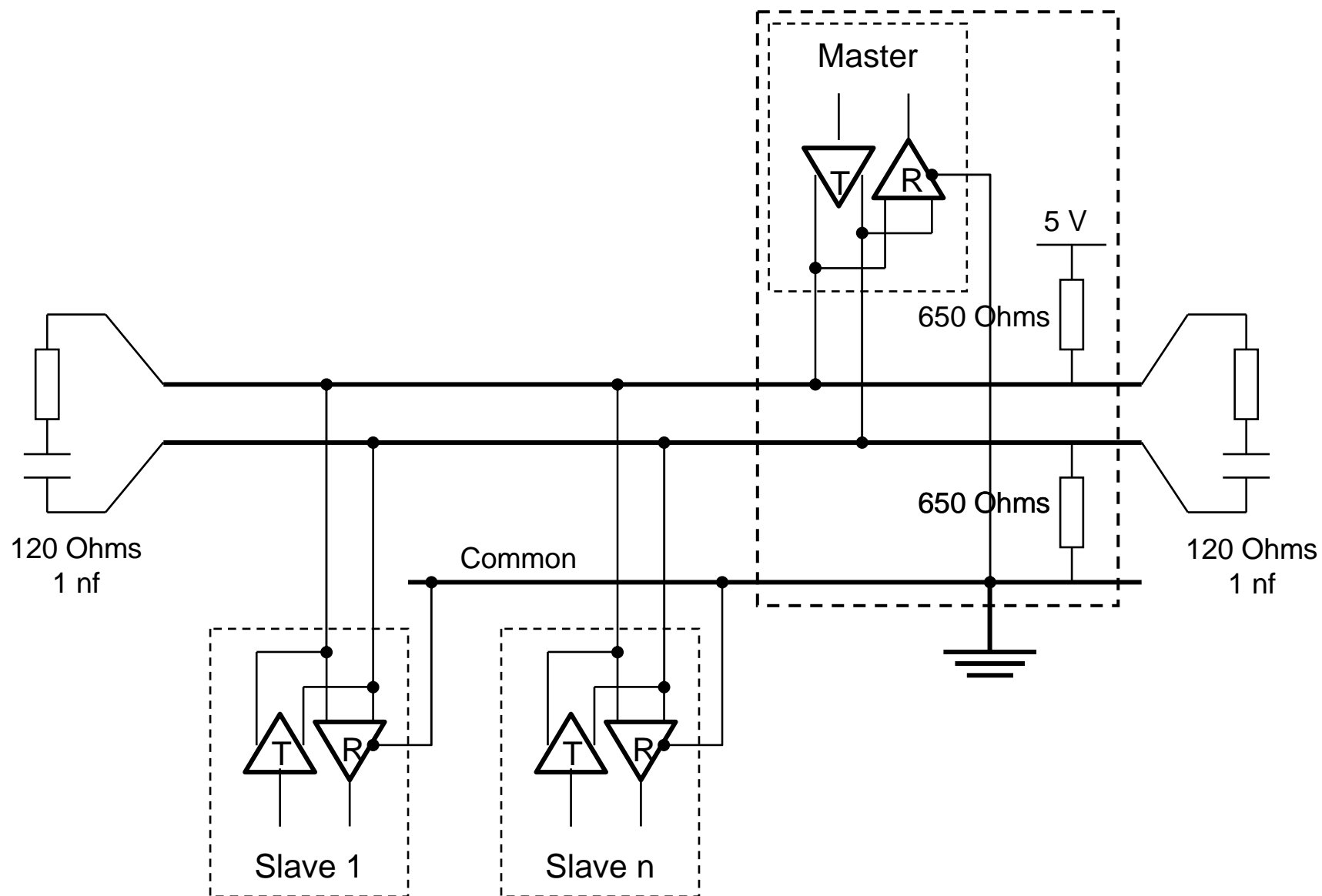
Electrical interfaces

- 2 standardized electrical interfaces

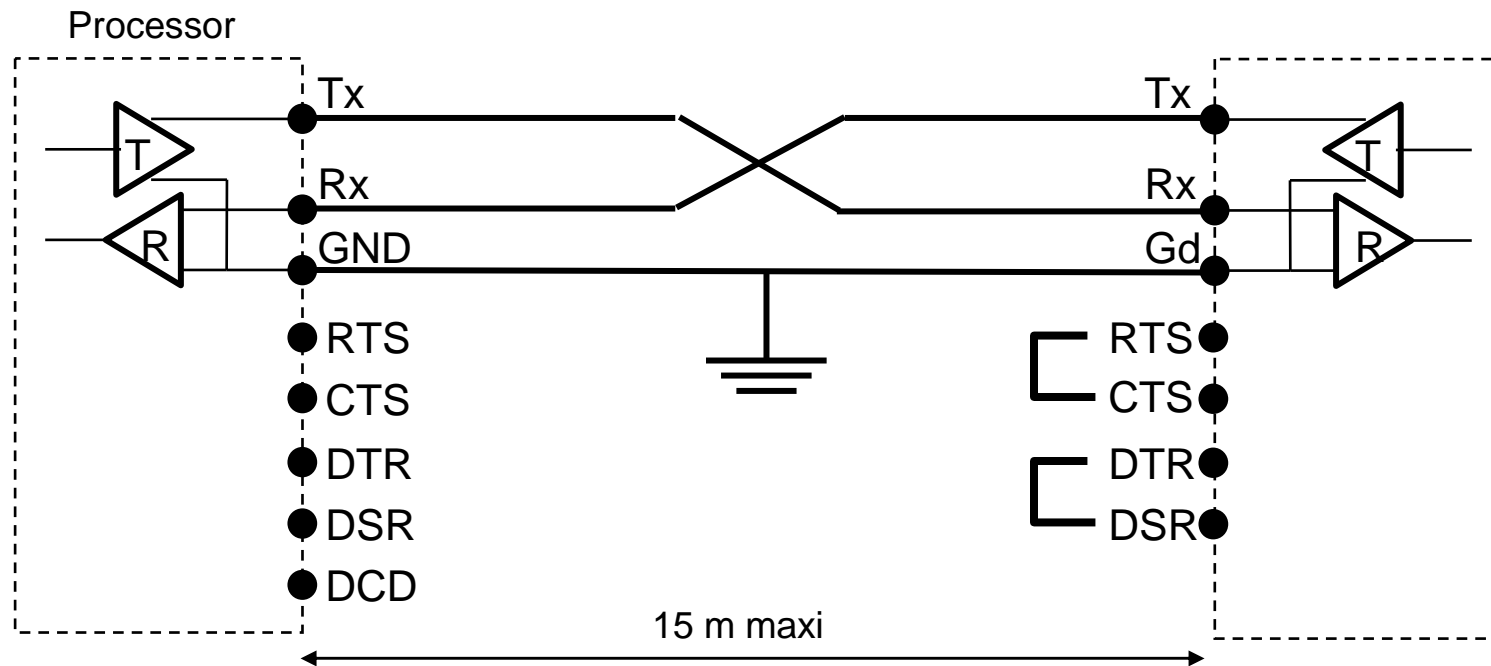


(*) Only point-to-point in character mode

RS485 2 wires electrical interface



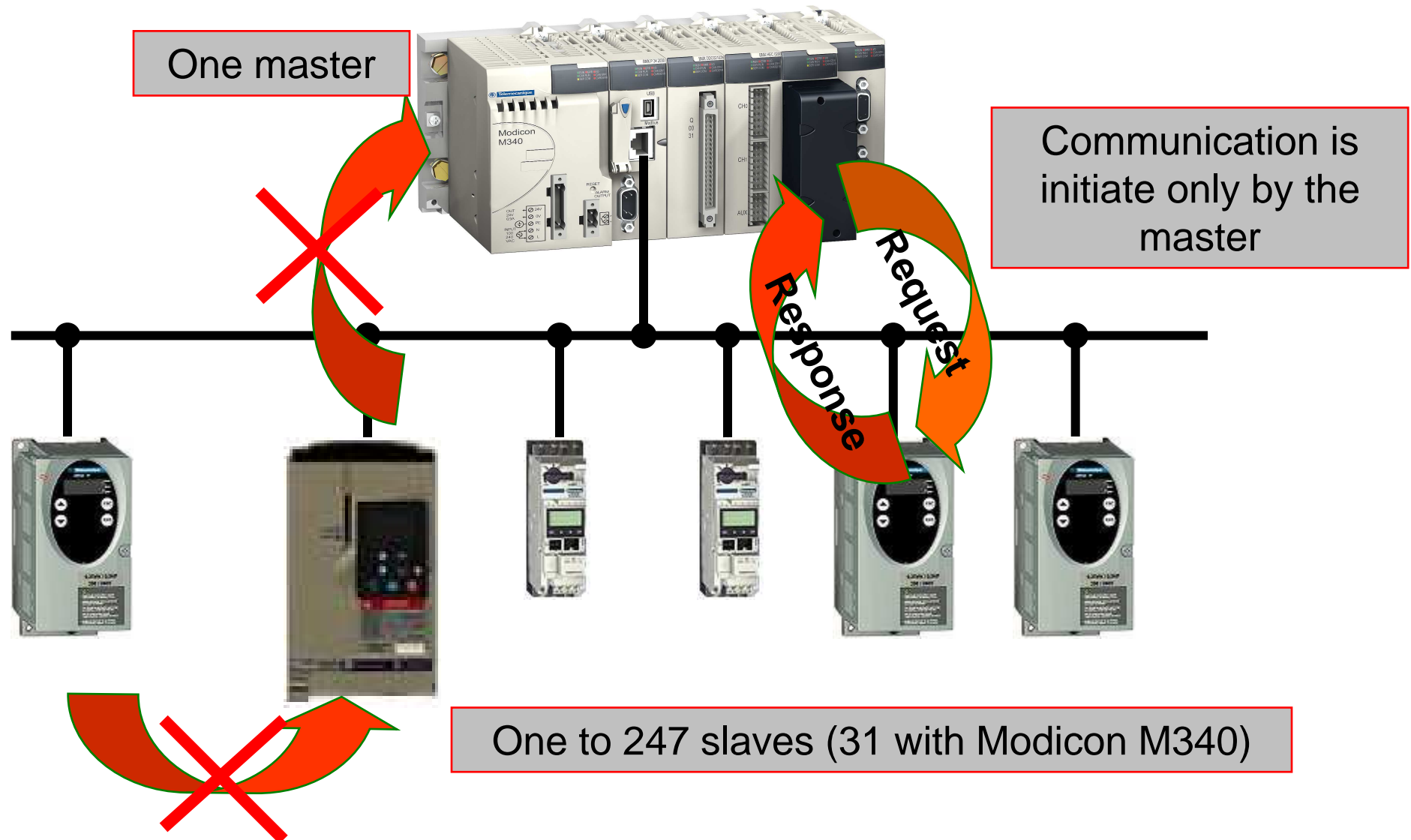
RS232 electrical interface



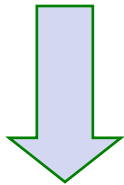
Strap RTS / CTS
and DTR / DSR

C - Data link layer

Master / slave principle

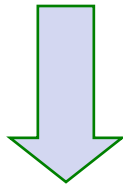


Modbus frame



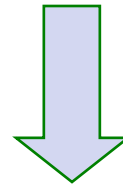
Identify the slave

*0 : broadcast mode
1 to 247 : slave
number in unicast
mode*



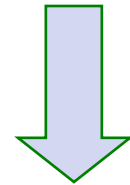
Action to perform

1 to 247



Data for action

*Depends on the
function code*



Validity check

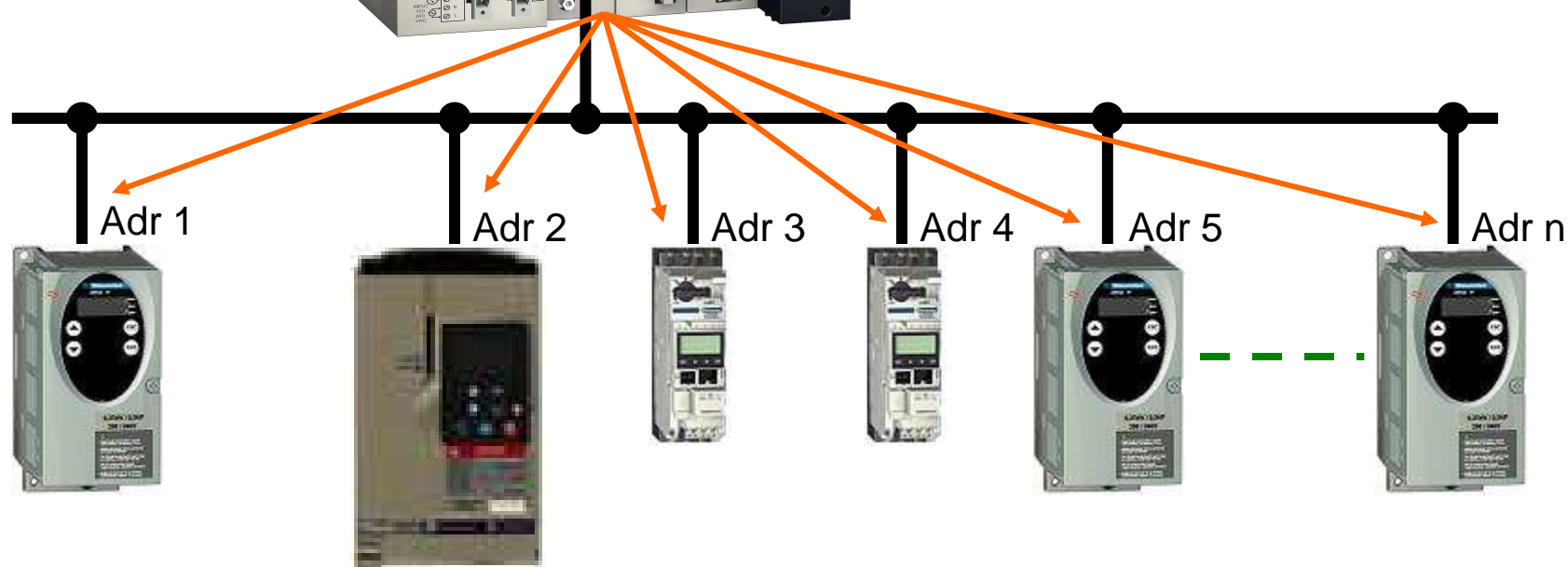
Note : broadcast mode is used only for write functions

Broadcast mode addressing (address 0)



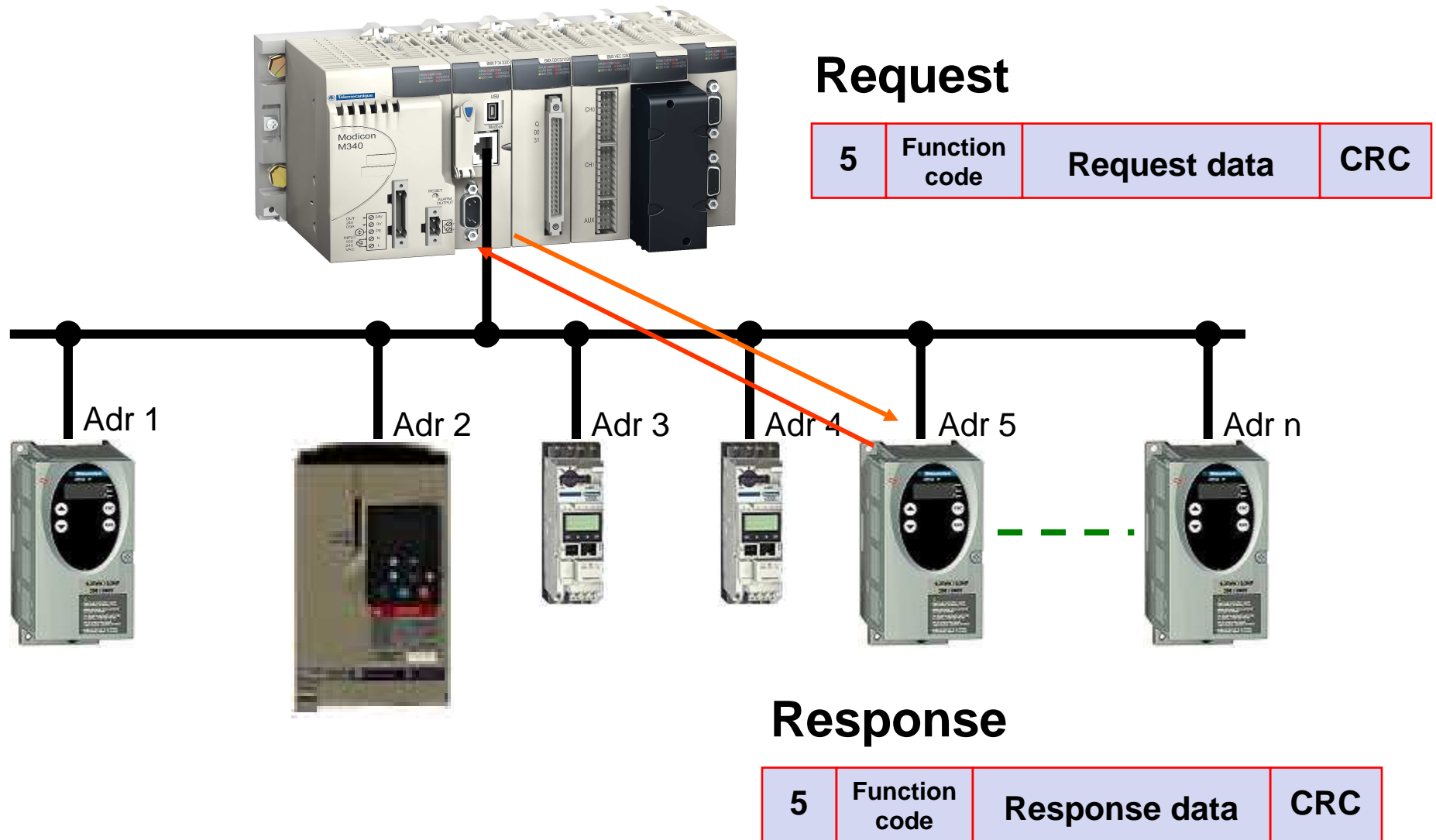
Request

0	Function code	Request data	CRC
---	---------------	--------------	-----

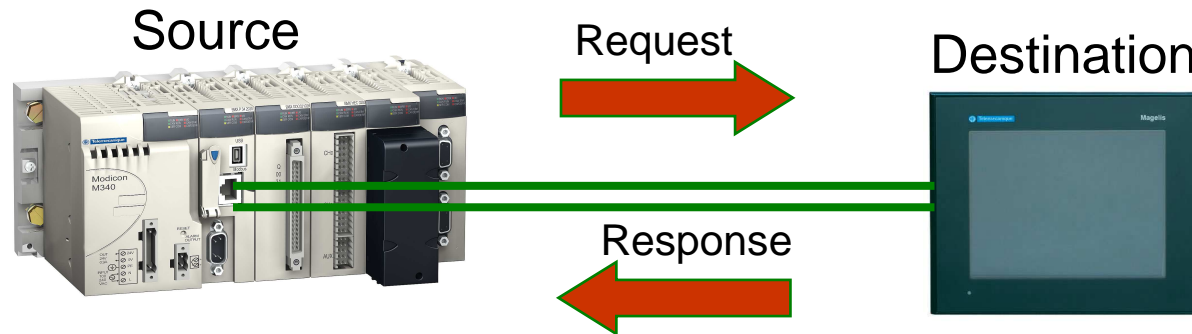


No response from slaves

Unicast mode addressing (address 1 to 247)



Half / Full duplex principle

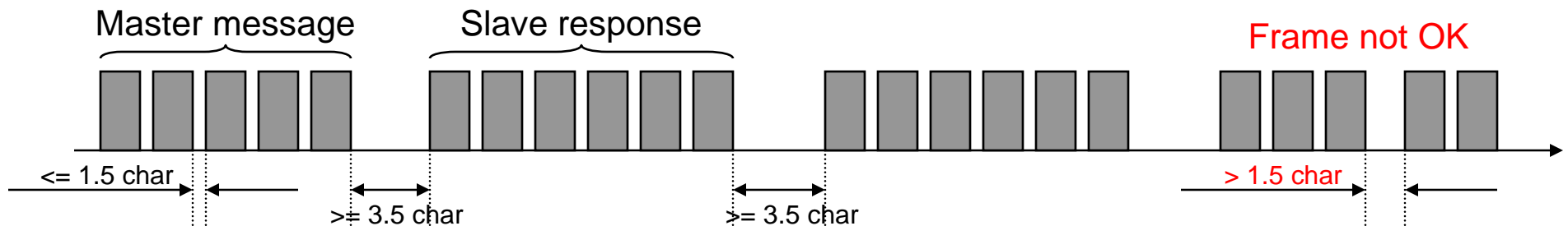
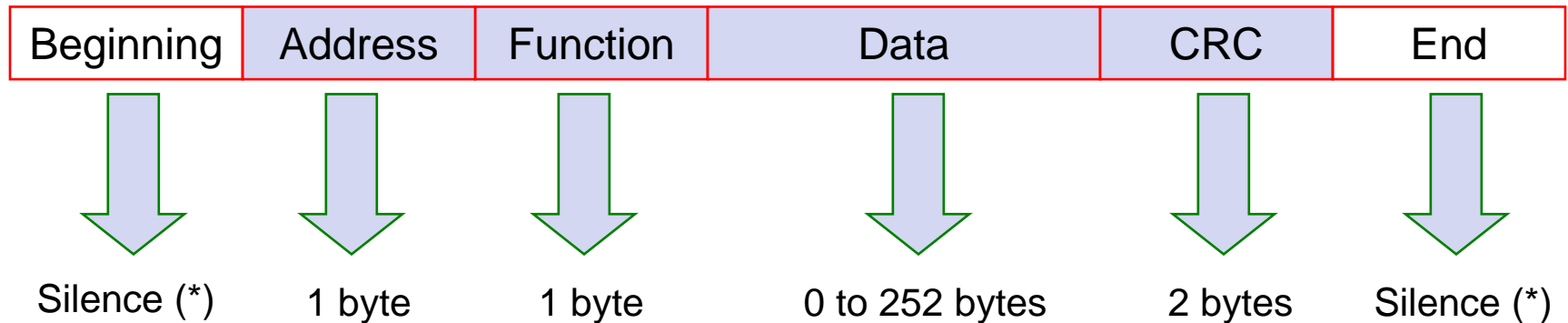


- Half duplex
 - Same medium for communication
 - Signals pass in both directions but not simultaneously
- Full duplex
 - Lines for transmission and reception are separated
 - Signals pass in both direction simultaneously
 - Response time is better than half duplex

D - Frame format

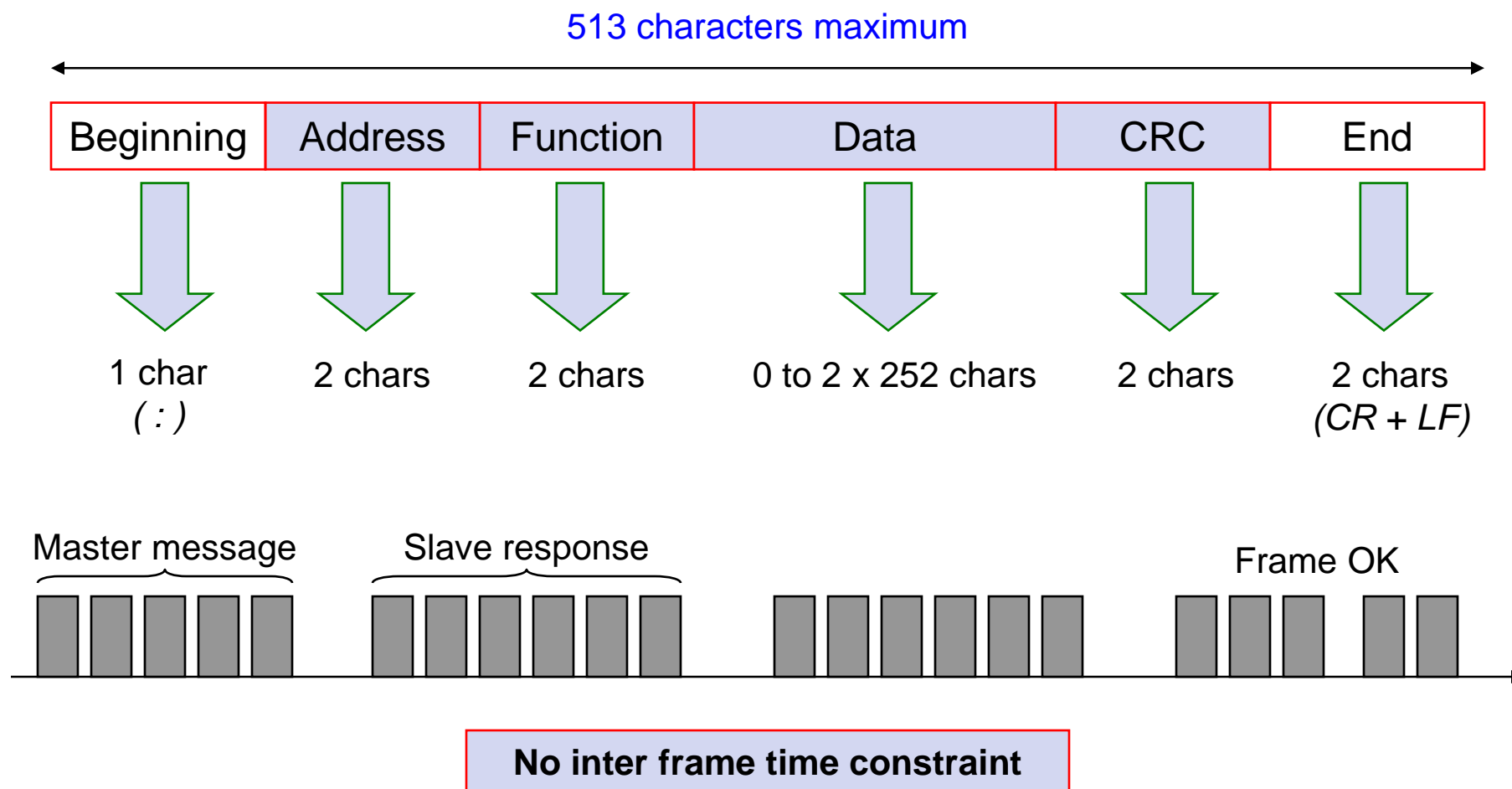
Frame format of Modbus RTU mode

256 bytes maximum

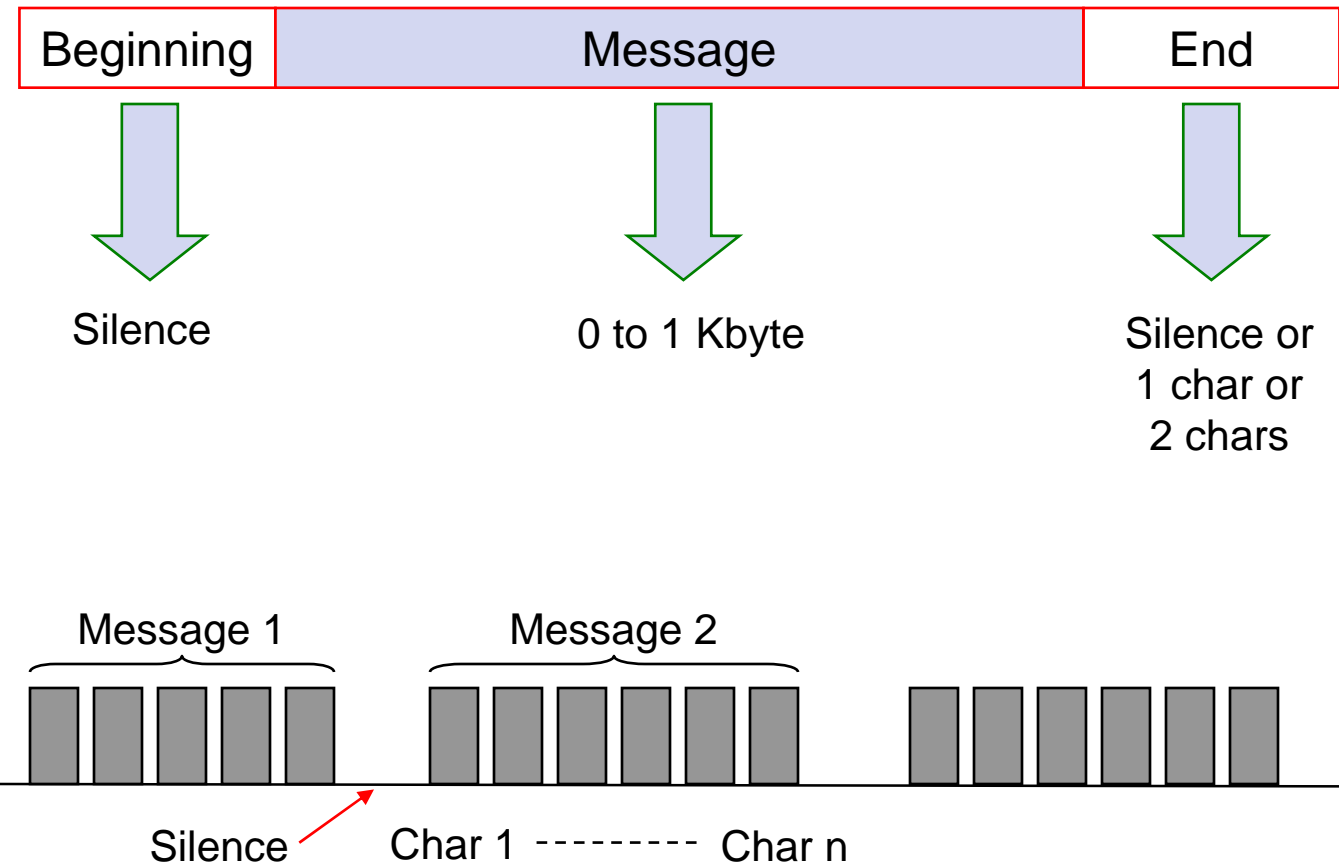


(*) : Silence is minimum 3.5 x time to transmit a character

Frame format of Modbus ASCII mode

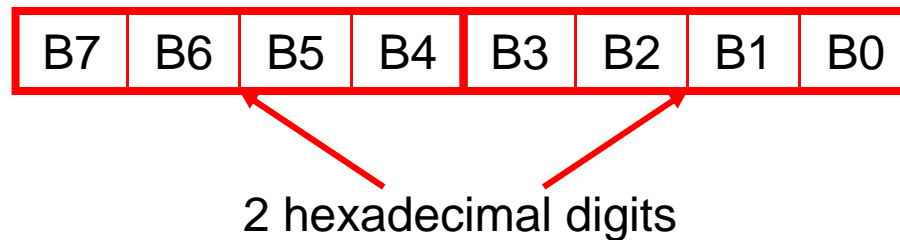


Frame format of character mode

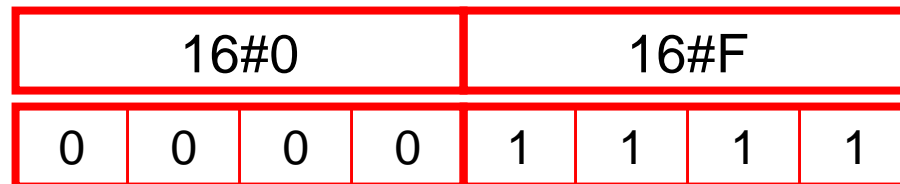


Data encoding on 8 bits

- Each **data** is encoded on **one byte**
 - Modbus RTU mode
 - Character mode

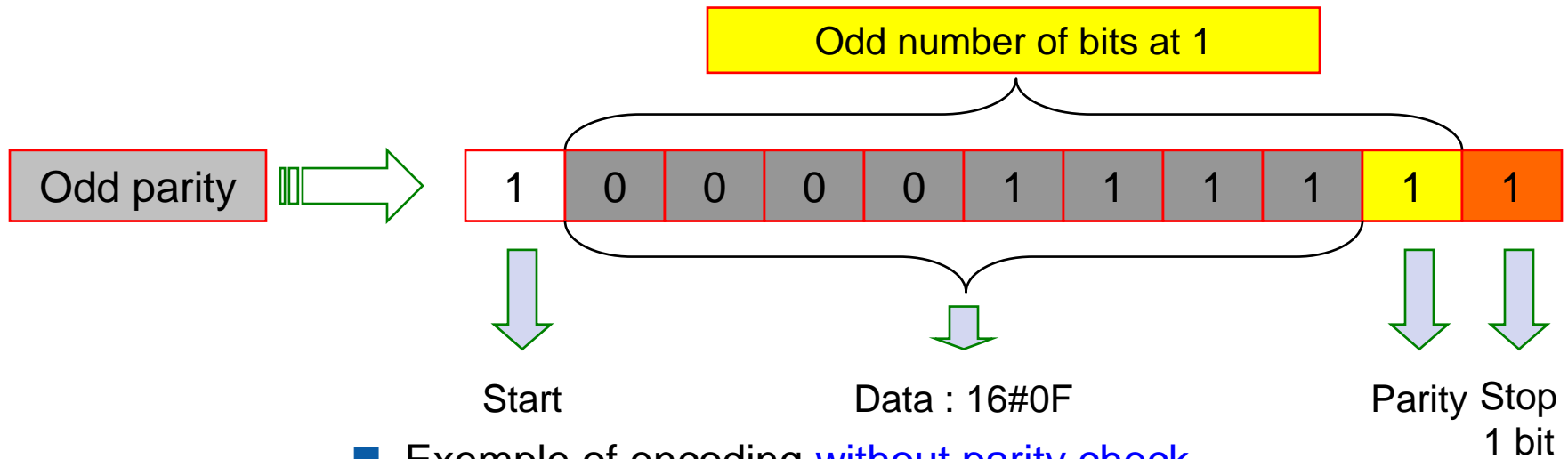


- Exemple : Modbus function code 15 (16#0F) = *Writing n bits*

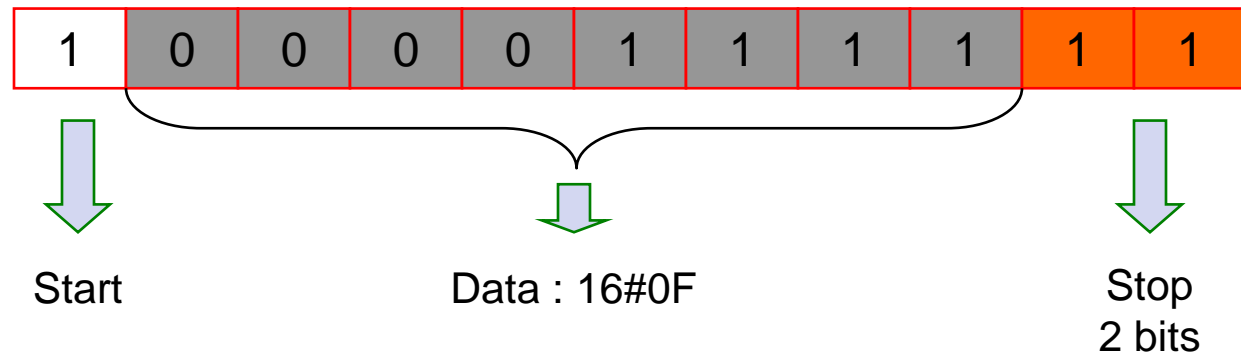


Character format with 8 bits of data

- Each **character** is encoded in **11 bits**
- Exemple of encoding **with parity check**

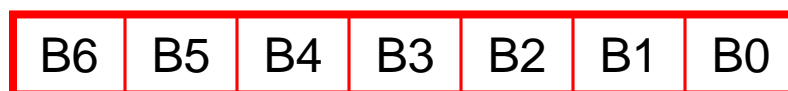


- Exemple of encoding **without parity check**



Data encoding on 7 bits

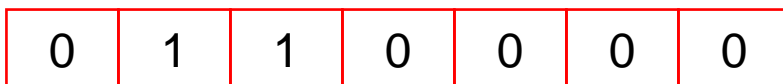
- Each **data** is encoded on 1 ASCII character (7 bits)
 - Modbus ASCII mode
 - Character mode



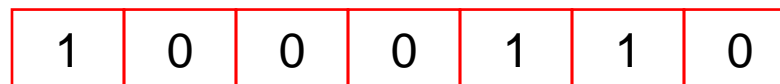
1 ASCII character

- Exemple : Modbus function code 15 (16#0F) = *Writing n bits*

ASCII code « 0 » = 16#30

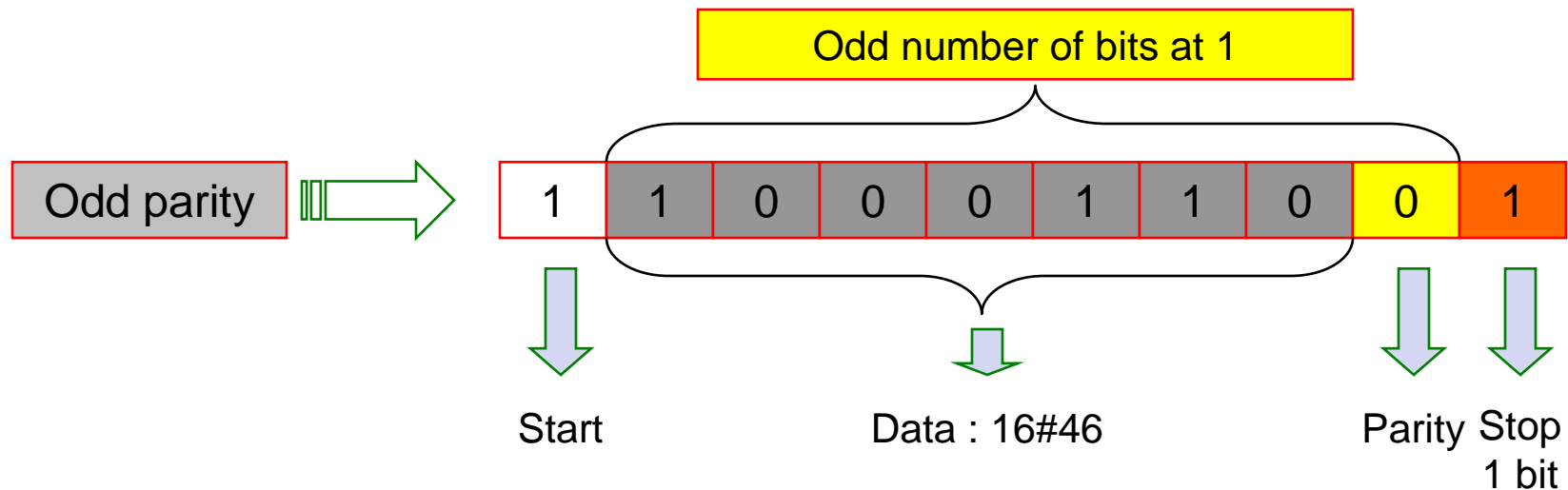


ASCII code « F » = 16#46

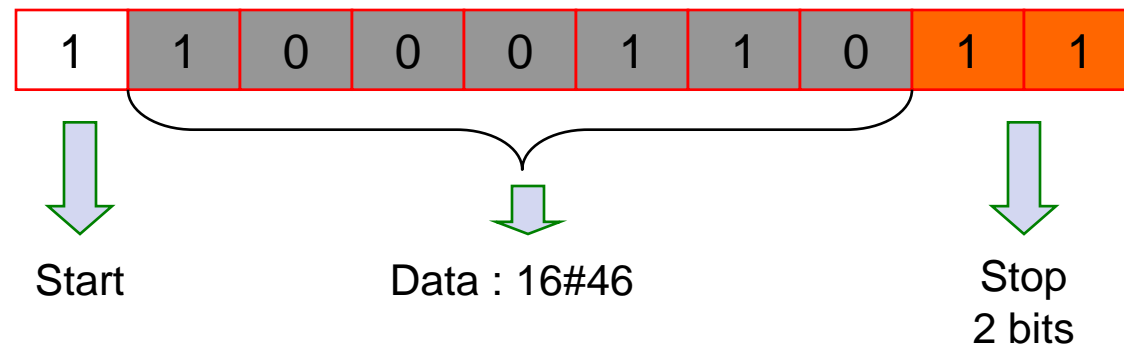


Character format with 7 bits of data

- Each **character** is encoded on 10 bits
- Exemple of encoding **with parity check**

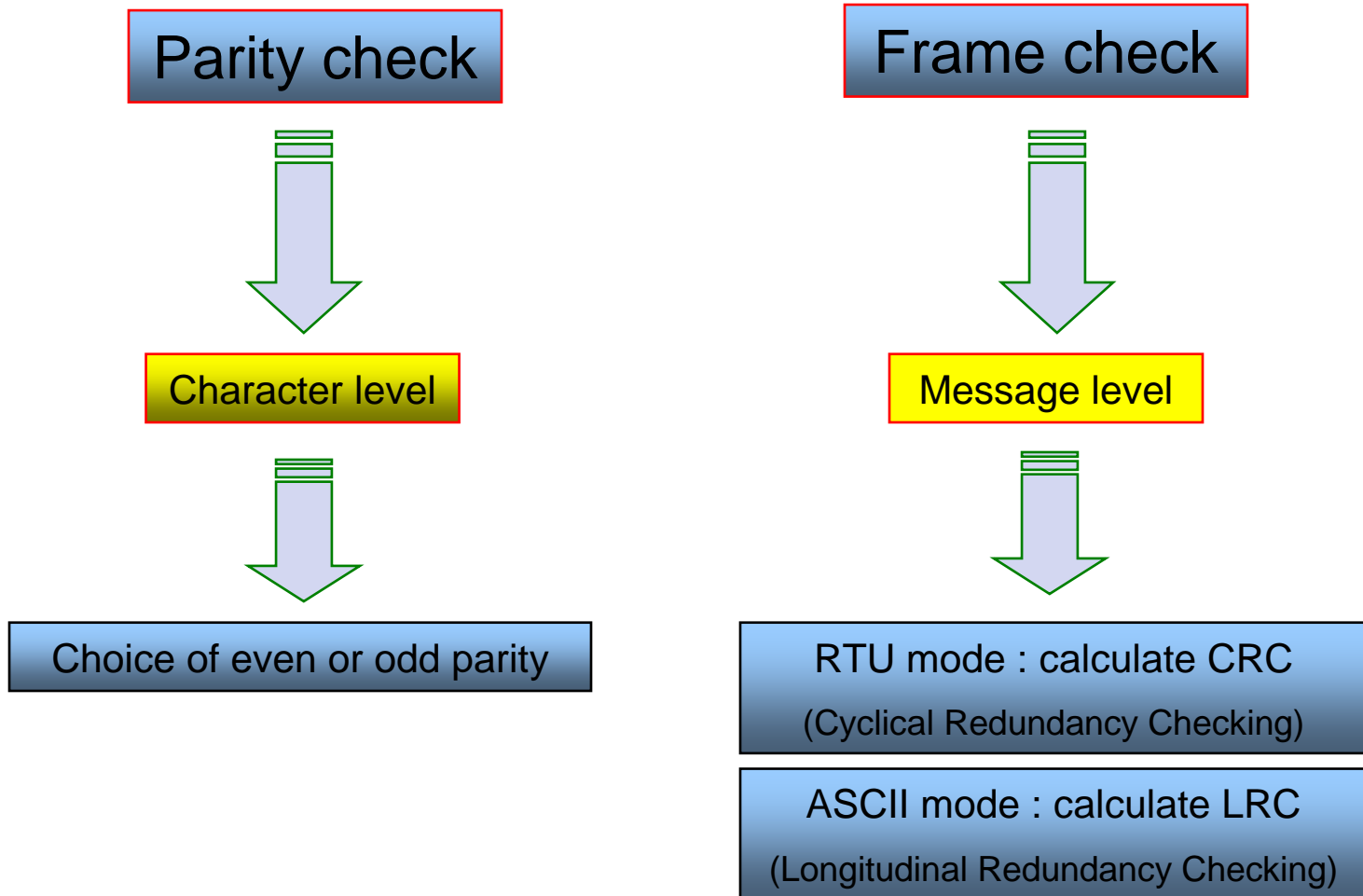


- Exemple of encoding **without parity check**



Transmission error checks

- 2 types of checks performed



E - Hardware implementation

Processors with an integrated serial line



■ Modules **BMX P34 1000 / 2010 / 2020**

■ Display panel (1)

- RUN and ERR for module status
- **SER COM** for serial line status

■ Integrated serial line (2)

- Modbus
- Character mode

■ Black color location ring (3)

Visual diagnostic of communication line

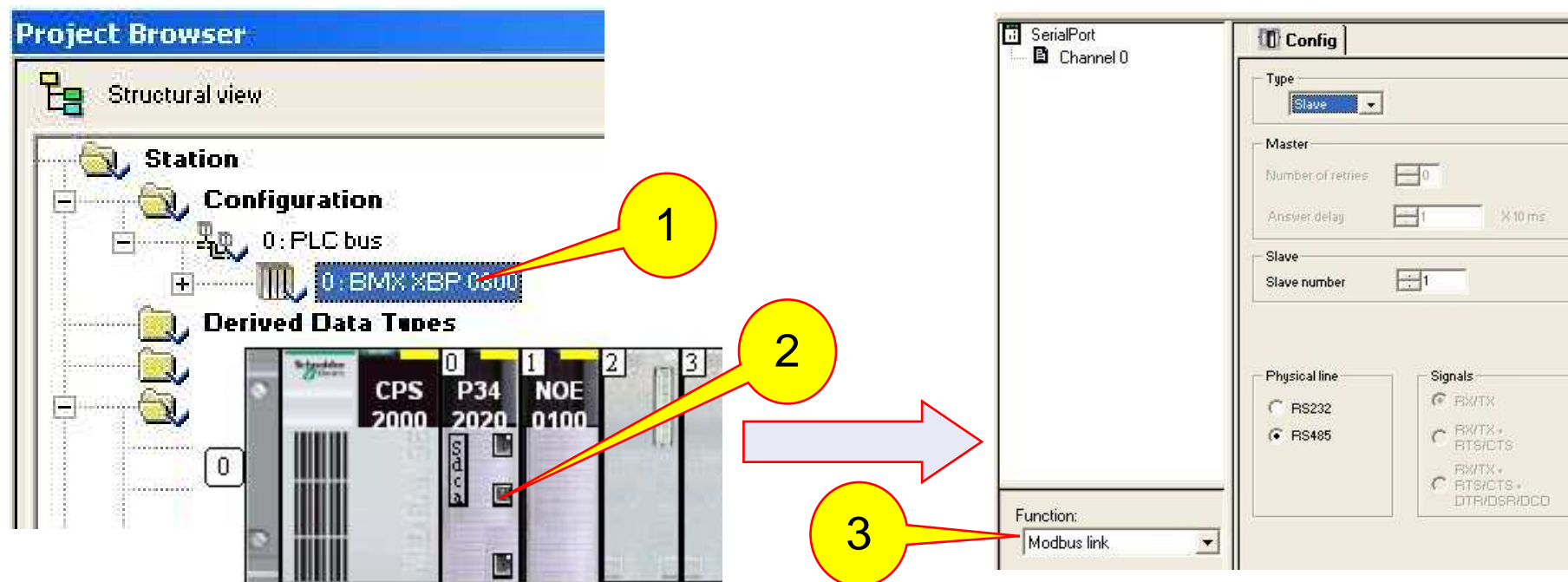
- Colors and flashing patterns of the LEDs indicate the status and operating condition of the serial line



Label	Pattern	Meaning
RUN	Green Flashing	Module is operating Autotest is running
ERR	Red Flashing	Module in default Configuration error or No equipment OK on the line
SER COM	Yellow Flashing	Communication OK One faulty equipment on the line

F - Software operating modes

Access to serial line configuration



- From structural view access to the **configuration editor** (1)
- Open the communication line (2)
- **Select the function** : Modbus link or character mode link (3)

User interface

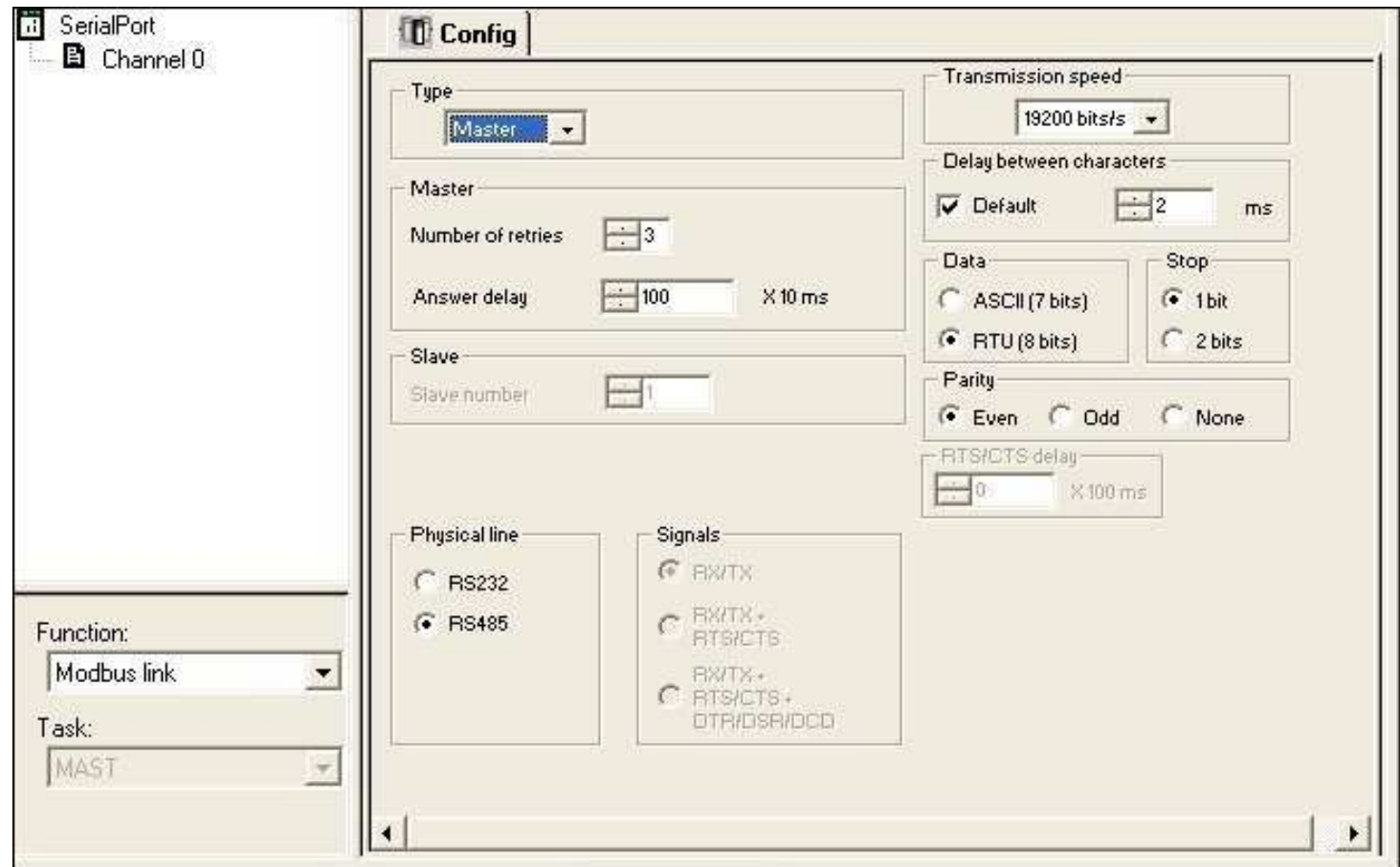
The screenshot shows the 'SerialPort' configuration window. On the left, a tree view shows 'SerialPort' and 'Channel 0'. The main area is titled 'Config' and contains several sections:

- Mode selection:** A list with 'Configuration', 'Debug', and 'Fault'. A callout points to this section.
- Configuration parameters:** A large section containing:
 - Type:** A dropdown menu set to 'Slave'.
 - Master:** Includes 'Number of retries' (set to 0) and 'Answer delay' (set to 1, with a multiplier of 10 ms).
 - Slave:** Includes 'Slave number' (set to 1).
 - Transmission speed:** A dropdown menu set to '19200 bits/s'.
 - Delay between characters:** A checkbox for 'Default' and a value of 2 ms.
 - Data:** Radio buttons for 'ASCII (7 bits)' and 'RTU (8 bits)' (selected).
 - Stop:** Radio buttons for '1 bit' and '2 bits'.
 - Parity:** Radio buttons for 'Even' (selected), 'Odd', and 'None'.
 - RTS/CTS delay:** A value of 0 with a multiplier of 100 ms.
- Physical line:** Radio buttons for 'RS232' and 'RS485' (selected).
- Signals:** Radio buttons for 'RX/TX', 'RX/TX + RTS/CTS', and 'RX/TX + RTS/CTS + DTR/DSR/DCD'.

At the bottom left, there are two dropdown menus: 'Function:' set to 'Modbus link' and 'Task:' set to 'MAST'. A callout points to these as 'General parameters'.

Callouts on the left side of the window identify the 'Module' (SerialPort) and 'Channel' (Channel 0).

Modbus master configuration screen



The image shows a software interface for configuring a Modbus master. On the left, a tree view shows 'SerialPort' and 'Channel 0'. Below this, 'Function' is set to 'Modbus link' and 'Task' is set to 'MAST'. The main 'Config' window has several sections: 'Type' is set to 'Master'; 'Master' section includes 'Number of retries' (3) and 'Answer delay' (100 x 10 ms); 'Slave' section includes 'Slave number' (1); 'Transmission speed' is 19200 bits/s; 'Delay between characters' is checked 'Default' (2 ms); 'Data' is set to 'RTU (8 bits)'; 'Stop' is set to '1 bit'; 'Parity' is set to 'Even'; 'RTS/CTS delay' is 0 x 100 ms; 'Physical line' is set to 'RS485'; and 'Signals' are set to 'RX/TX', 'RX/TX + RTS/CTS', and 'RX/TX + RTS/CTS + DTR/DSR/DCD'.

SerialPort
Channel 0

Config

Type
Master

Master
Number of retries: 3
Answer delay: 100 X 10 ms

Slave
Slave number: 1

Transmission speed: 19200 bits/s

Delay between characters
☒ Default 2 ms

Data
☐ ASCII (7 bits)
☒ RTU (8 bits)

Stop
☒ 1 bit
☐ 2 bits

Parity
☒ Even ☐ Odd ☐ None

RTS/CTS delay: 0 X 100 ms

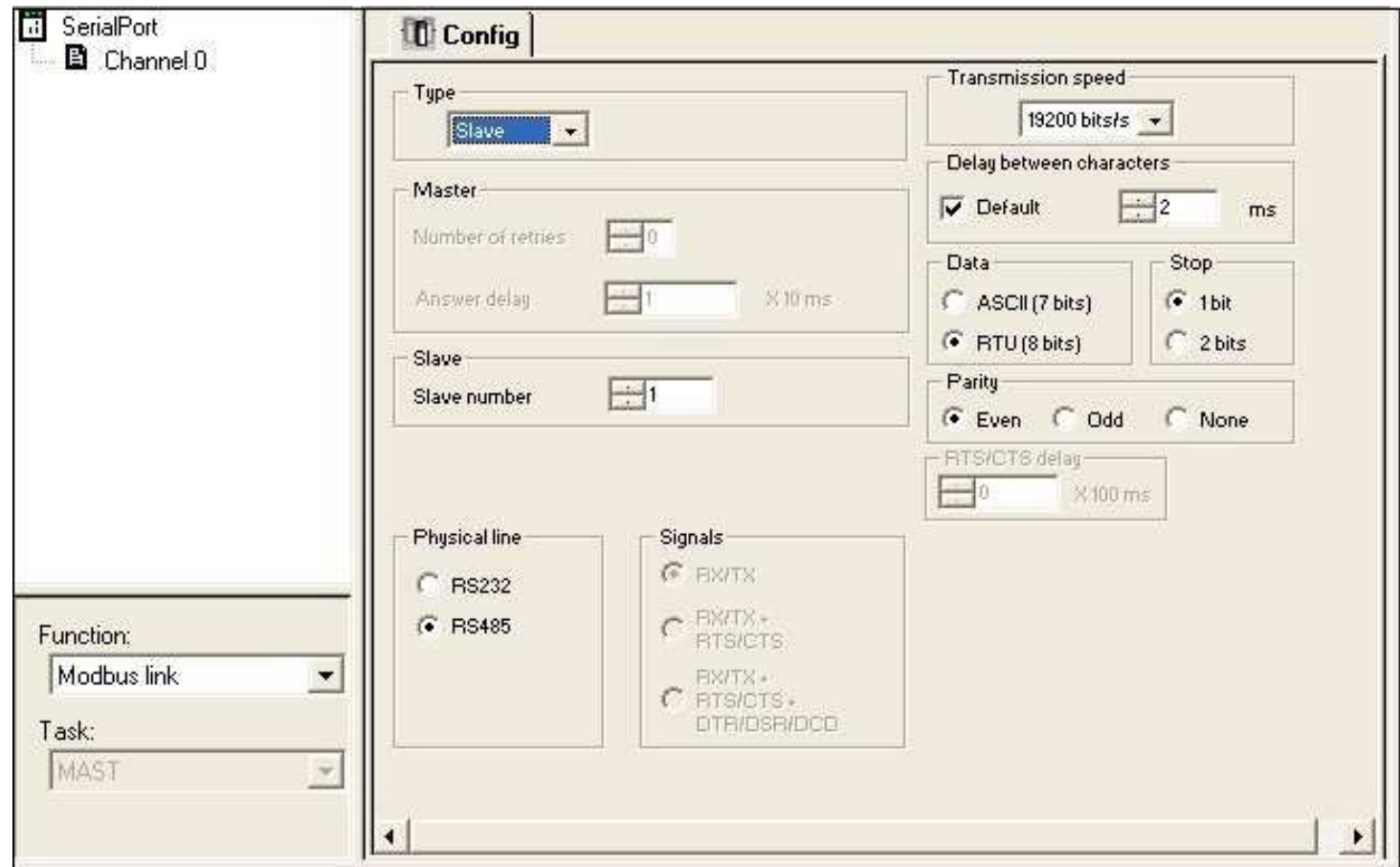
Physical line
☐ RS232
☒ RS485

Signals
☒ RX/TX
☐ RX/TX + RTS/CTS
☐ RX/TX + RTS/CTS + DTR/DSR/DCD

Function:
Modbus link

Task:
MAST

Modbus slave configuration screen



The image shows a software interface for configuring a Modbus slave. On the left, a tree view shows 'SerialPort' and 'Channel 0'. Below this, 'Function:' is set to 'Modbus link' and 'Task:' is set to 'MAST'. The main 'Config' window has several sections: 'Type' is set to 'Slave'; 'Master' section includes 'Number of retries' (0) and 'Answer delay' (1 x 10 ms); 'Slave' section includes 'Slave number' (1); 'Transmission speed' is 19200 bits/s; 'Delay between characters' is checked 'Default' (2 ms); 'Data' is set to 'RTU (8 bits)'; 'Stop' is set to '1 bit'; 'Parity' is set to 'Even'; 'RTS/CTS delay' is 0 x 100 ms; 'Physical line' is set to 'RS485'; and 'Signals' are set to 'RX/TX', 'RX/TX + RTS/CTS', and 'RX/TX + RTS/CTS + DTR/DSR/DCD'.

SerialPort
Channel 0

Config

Type: **Slave**

Master:

Number of retries: 0

Answer delay: 1 X 10 ms

Slave:

Slave number: 1

Transmission speed: 19200 bits/s

Delay between characters: ☒ Default 2 ms

Data: ☐ ASCII (7 bits) ☒ RTU (8 bits)

Stop: ☒ 1 bit ☐ 2 bits

Parity: ☒ Even ☐ Odd ☐ None

RTS/CTS delay: 0 X 100 ms

Physical line: ☐ RS232 ☒ RS485

Signals: ☒ RX/TX ☐ RX/TX + RTS/CTS ☐ RX/TX + RTS/CTS + DTR/DSR/DCD

Function: Modbus link

Task: MAST

Modbus debug screen

The image shows a software interface for Modbus debugging. It features a top status bar with 'Run', 'Err', and 'IO' indicators. Below this is a tabbed interface with 'Config', 'Debug', and 'Fault' tabs. The 'Debug' tab is active, displaying a 'Counters' section with a table of various error and status counts, each with a 'Reset Counters' button. A 'Function' dropdown menu is set to 'Modbus link', and a 'Task' dropdown menu is set to 'MAST'. Two callout boxes are present: one labeled 'Type of Modbus function' pointing to the 'Type' dropdown in the 'Counters' table, and another labeled 'Debugging counters' pointing to the 'Reset Counters' button.

Type of Modbus function

Debugging counters

Counters				
Type	Counters	Value	Counters	Value
Slave	Bus message count	0	Bus communication error	0
	Slave exception error count	0	Slave message count	0
	Slave no response count	0	Slave Nack count	0
	Slave busy count	0	Bus character overrun count	0

Reset Counters

Function: Modbus link

Task: MAST

Character mode configuration screen

SerialPort
Channel 0

Config

Stop on reception

Character 1

☐ Stop

☐ CR ☐ LF

☐ Character included

Character 2

☐ Stop

☐ CR ☐ LF

☐ Character included

Transmission speed

9600 bits/s

Stop on silence

☐ Stop ms

Data

☐ 7 bits ☒ 8 bits

Stop

☒ 1 bit ☐ 2 bits

Parity

☐ Even ☒ Odd ☐ None

RTS/CTS delay

X 100 ms

Physical line

☐ RS232 ☒ RS485

Signals

☒ RX/TX

☐ RX/TX + RTS/CTS

☐ RX/TX + RTS/CTS + DTR/DSR/DCD

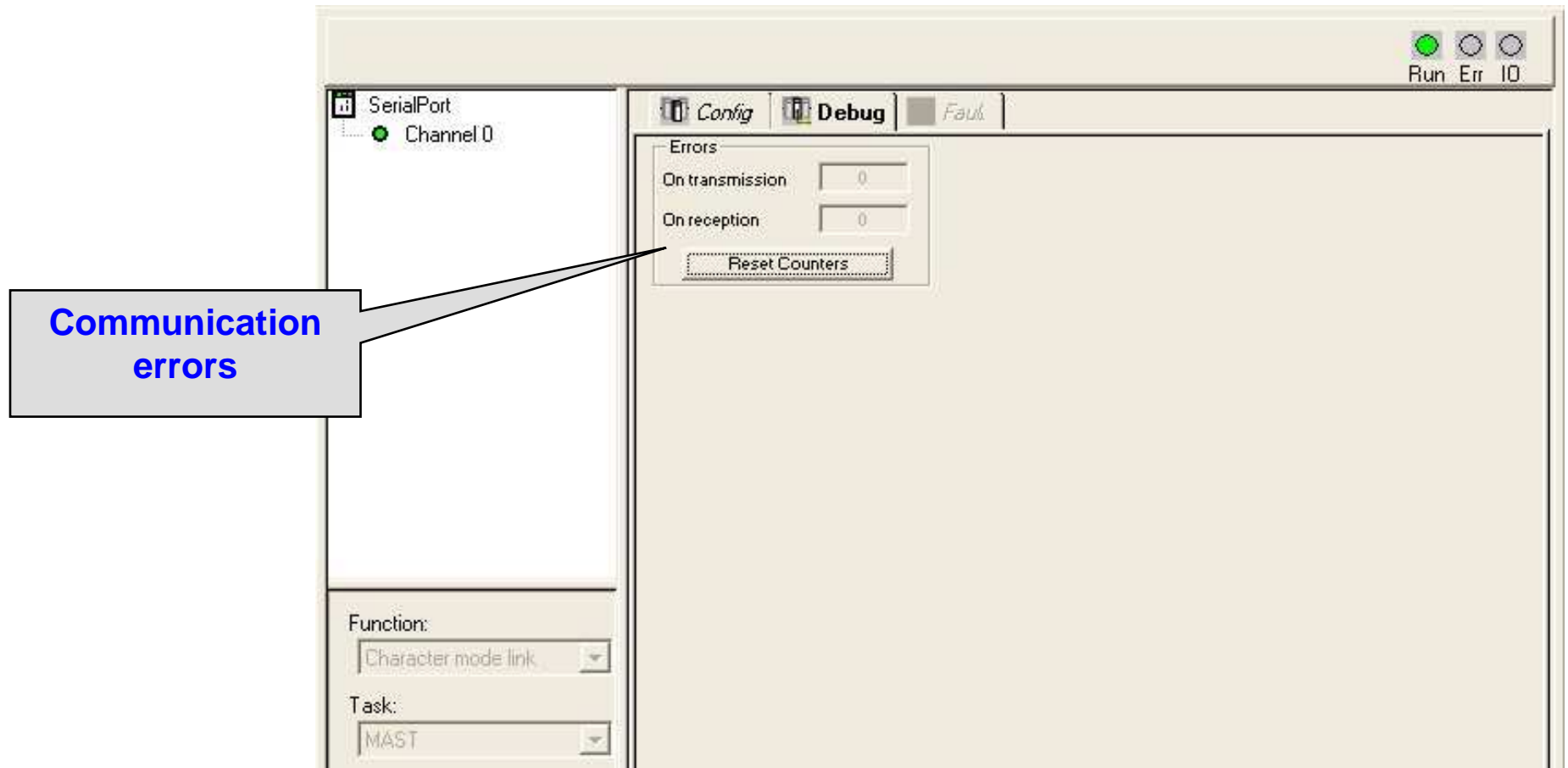
Function:

Character mode link

Task:

MAST

Character mode debug screen



G - Language interface

Modbus requests recognized by M340 server

Function code	Memory address	Meaning
01	%M	Read multiple output bits
02	%M	Read multiple input bits
03	%MW	Read multiple registers
04	%MW	Read multiple input registers
05	%M	Force single output bit
06	%MW	Write single register
15	%M	Write multiple output bits
16	%MW	Write multiple registers
23	%MW	Read / Write multiple registers

Modbus request used by M340 client

Function code	Memory address	Modbus request	Communication function
1	%M	Read output bits	READ_VAR
2	%M	Read input bits	READ_VAR
3	%MW	Read multiple registers	READ_VAR
4	%MW	Read multiple input registers	READ_VAR
15	%M	Write multiple output bits	WRITE_VAR
16	%MW	Write multiple registers	WRITE_VAR

IODDT for serial communication

■ 3 IODDTs

- T_COM_STS_GEN for all communication protocol
- T_COM_MB_BMX for Modbus communication
- T_COM_CHAR_BMX for character mode communication

Dynamic protocol switching

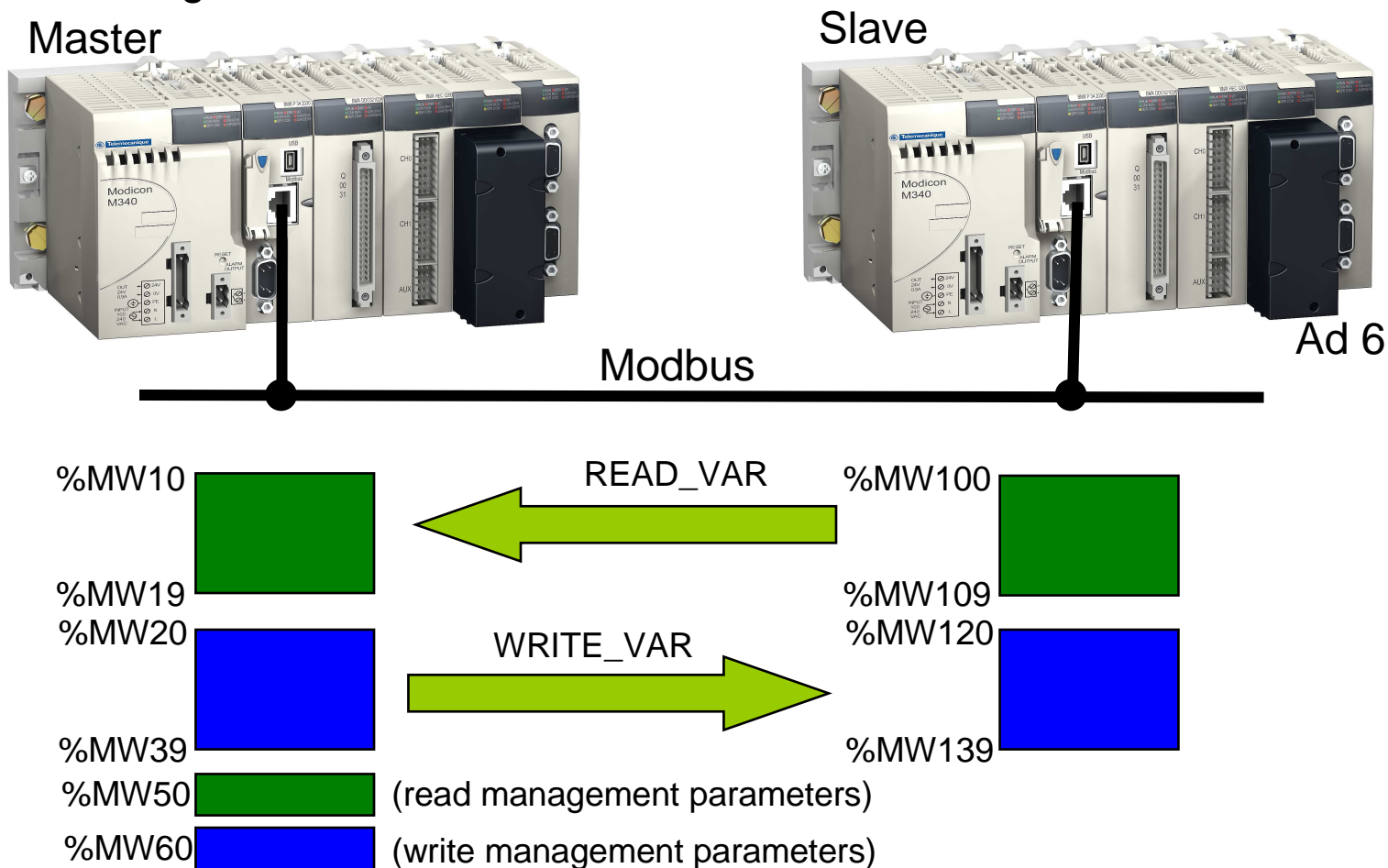
- Protocol used by serial communication can be changed dynamically, using [WRITE_CMD command](#)
 - Modbus master
 - Modbus slave
 - Character mode

- [WRITE_CMD \(%MWr.m.c.24.bit\)](#)
 - Bit 12 : current protocol is changed to Modbus master
 - Bit 13 : current protocol is changed to Modbus slave
 - Bit 14 : current protocol is changed to Character mode

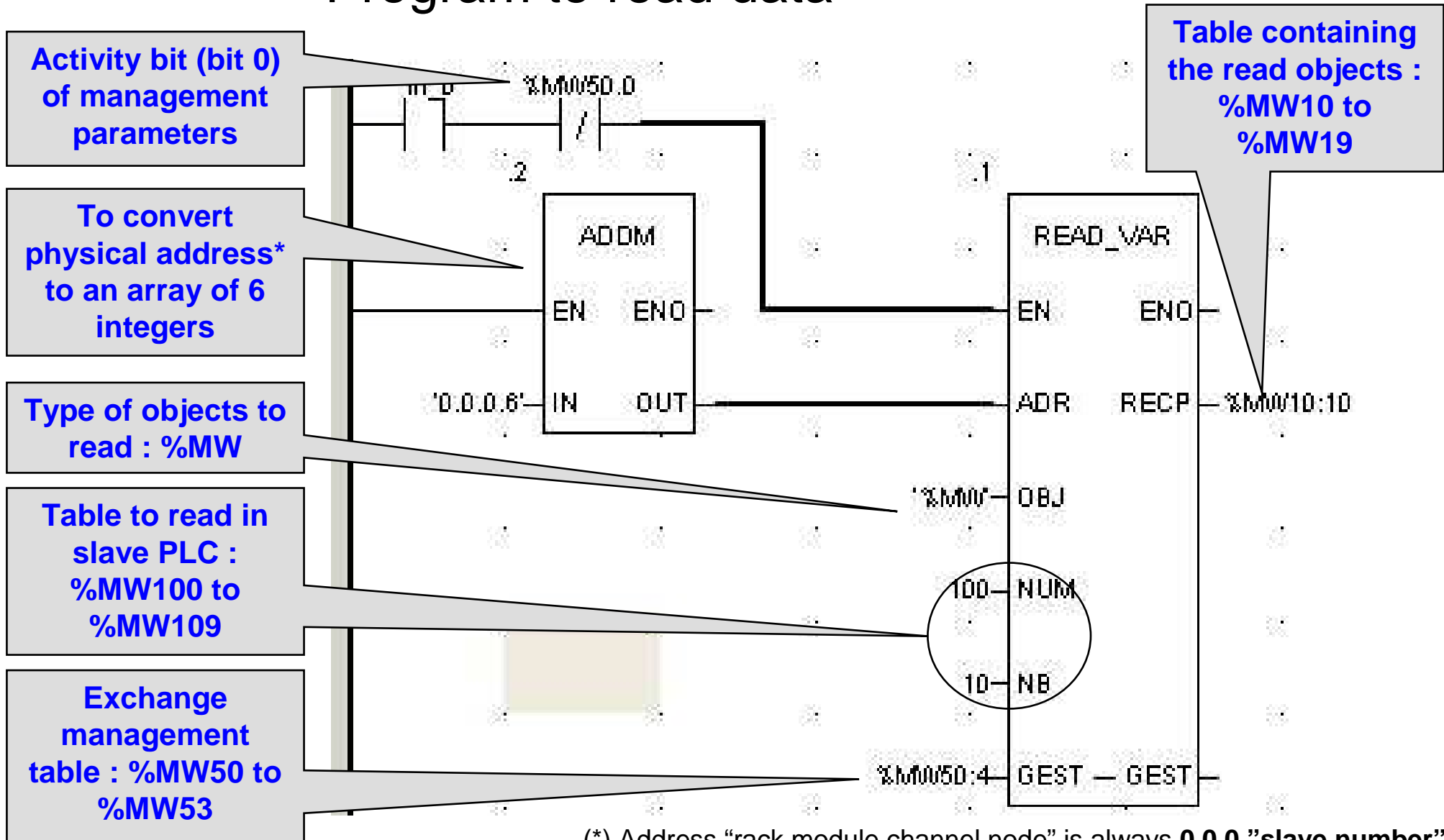
- For changes one protocol to another, initially configured the processor to [Modbus slave mode](#)

Example of Read / Write data

- The master PLC must communicate with slave 6 on Modbus to exchange data



Program to read data



(*) Address "rack.module.channel.node" is always **0.0.0."slave number"**

Program to write data

