

Industrial Automation

(Automação de Processos Industriais)

PLC Programming languages

Structured Text - Networking

<http://users.isr.ist.utl.pt/~jag/courses/api1718/api1718.html>

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Structured Text

Networking (in Unity Pro)

Keywords: MODBUS, READ_VAR, WRITE_VAR

Modbus is a serial communications protocol originally published by Modicon (now Schneider Electric) in 1979 for use with its programmable logic controllers (PLCs). Simple and robust, it has since **become a de facto standard communication** protocol, and it is now a commonly available means of connecting industrial electronic devices.

Examples of Field Bus (IEC 61158) standards: MODBUS (Schneider), PROFIBUS (Field Bus type, Siemens), CAN bus (Controller Area Network, 1983 Robert Bosch GmbH), ...

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Modbus RTU — Binary representation of the data for protocol communication. Includes CRC. Modbus messages are framed (separated) by idle (silent) periods.

Modbus ASCII — Makes use of ASCII characters for protocol communication.

Modbus TCP/IP or Modbus TCP — Modbus variant for communications over TCP/IP networks, connecting over port 502.

RTU = Remote Terminal Unit

MTU = Main Terminal Unit

CRC = Cyclic Redundancy Check

TCP = Transmission Control Protocol

ASCII = American Standard Code for Information Interchange

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Modbus	Function type	Function name / Function code	
	Physical Discrete Inputs	Read Discrete Inputs	2
Bit access	Internal Bits or Physical Coils	Read Coils	1
		Write Single Coil	5

Structured Text*Networking (in Unity Pro) – READ_VAR*
Address:

ADDR(STRING)

ARRAY [0..5] OF INT

Type of object to read:

'%M' for reading internal bits

'%MW' for reading internal words

'%S' for reading system bits

'%SW' for reading system words

'%I' for reading input bits

'%IW' for reading input words

Address of first object to read:

The possible objects are of the DINT type (variables, constants, immediate value)

Number of consecutive objects to read:

The possible objects are of the INT type (variables, constants, immediate value)

Reception zone:

The reception zone is an integer array. The size of this array depends on the number of objects to read. This integer array can be located or not.

Report: The report is an array of 4 integers

Structured Text*Networking (in Unity Pro) – READ_VAR*

The screenshot shows the configuration window for the READ_VAR instruction. The window has a blue title bar with the text 'READ_VAR'. Below the title bar, there is a 'Parameters' section with the following fields:

Parameter	Field
Address:	[Text Field] [Icon] [Dropdown]
Type of Object to Read:	[Text Field] [Icon]
Address of first object to read:	[Text Field] [Icon] [Dropdown]
Number of consecutive objects to read:	[Text Field] [Icon] [Dropdown]
Reception zone:	[Text Field] [Icon] [Dropdown] [Text Field]
Report	[Text Field] [Icon] [Dropdown] [Text Field]

Challenge: how to make READ_VAR non-blocking in an operating system without using processes nor threads?

Structured Text *Networking (in Unity Pro)*

The screenshot shows the Unity Pro Help window. The left sidebar contains a tree view of the help content, with 'Example including execution check' selected under the 'READ_VAR: Reading variables' folder. The main content area displays the following text:

Example including execution check

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At a Glance
The following example illustrates the READ_VAR function with a management parameter check.

Programming the function
Programming in ST:

```
IF NOT %M21 AND %I0.1.2 THEN
    %MW210:4 := 0;
    %MW212 := 50;
    READ_VAR(ADDR('0.3.1.7'), '%MW', 20, 1, %MW210:4, %MW1701:1);
    SET %M21;
END_IF;
```

- the input bit %I0.1.2 controls the function,
- the internet bit %M21 is used to test the activity of the function,
- %MW210:4 := 0; initializes the management table to 0,
- MW212 := 50; initializes the timeout value to 5 seconds.

NOTE: READ_VAR(ADDR('0.3.1.7'), '%MW', 20, 1, %MW210:4, %MW1701:1); syntax must be used for Modicon M340 PLCs as ADDR function cannot be used by a Modicon M340 PLC.

Programming the exchange check
Programming in ST:

```
IF %M21 AND NOT %M210.0 THEN
    INC %MW214;
    IF %MW211 = 0 THEN
        INC %MW215;
    ELSE
        SET %Q0.2.2;
        INC %MW216;
        %MW217 := %MW211;
    END_IF;
END_IF;
```

- %MW214 counts the number of exchanges,
- %MW215 counts the number of correct exchanges,
- %MW216 counts the number of exchanges generating errors,
- %MW217 stores the error message,
- %Q0.2.2 indicates an exchange failure.

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