# Operation on Modbus TCP network using PLC300

## CFW300-CETH

## Application Note

# CFW300-CETH Modbus TCP Application Note

Series: CFW300

Language: English

Document: 10006484168 / 01

Build 1960

Publication Date: 12/2019

The information below describes the reviews made in this manual.

| Version | Revision | Description |
|---|---|---|
| - | R00 | First edition |
| - | R01 | Adequacy to accessory version 3.0, with EtherNet/IP protocol. |

# 1 DESCRIPTION

This application note is intended to provide a description of how to program a CFW300 frequency converter with accessory CFW300-CETH to communicate in Modbus TCP network using PLC300.

This document is meant for trained personnel working with the described equipment and Modbus TCP network installation, besides a good knowledge of automation and programmable logic controllers, in particular about WPS software.

## 1.1 REFERENCE DOCUMENTS

This application note was developed based on the following documents and tools:

| Document | Version | Source |
|---|---|---|
| CFW300 User's Manual | 10003325037 / 04 | WEG |
| Micro Mini Drives Programming Manual | 10006257370 / 02 | WEG |
| CFW300 Ethernet User's Guide | 10006453196 / 01 | WEG |
| PLC300 Modbus TCP user's manual | 10002233461 / 00 | WEG |
| WPS | 2.50 | WEG |

## 1.2 ARCHITECTURE

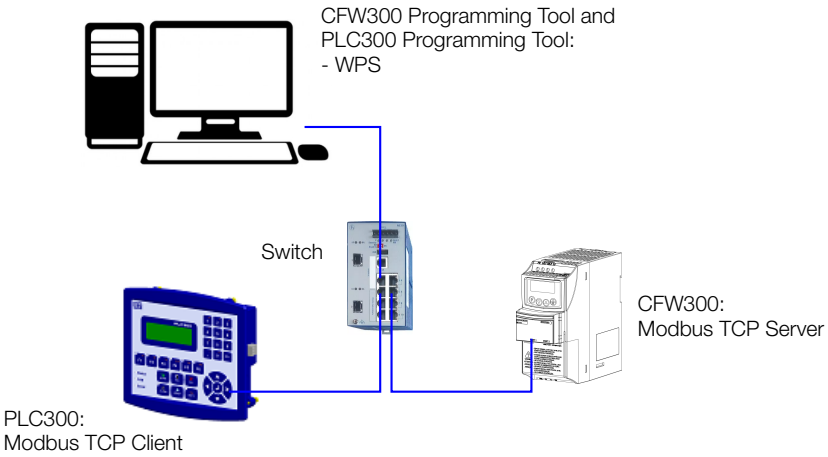



***Figure 1.1:*** *Network components for this application*

## 1.3 CFW300

- Equipment: CFW300 version 3.00.
- Accessory: CFW300-CETH.
- Programming tool: WPS version 2.50.

## 1.4 PLC300

- CPU: PLC300HP version 4.11.
- Programming tool: WPS version 2.50.

## 1.5 PASSIVE NETWORK COMPONENTS

For passive network components - cables, ethernet switch - we recommend using certified components for industrial applications. Please refer to the product documentation for information about the proper network installation.

# 2 IP ADDRESS AND NETWORK CONFIGURATION

To allow communication among the devices, they need to have an compatible IP address configuration. It means the IP address must be at the same range, according to network mask. For this example, we will use the following IP addresses:

- Static IP (not DHCP)
- Subnet mask: 255.255.255.0
- IP addresses: each device must have a different IP address.

  PC: 192.168.0.2

  PLC300: 192.168.0.10

  CFW300: 192.168.0.11 (as described at item 3).

## 2.1 PC IP ADDRESS CONFIGURATION

To configure this options at Windows platform, go to “Network Connections” and open “Properties” of the desired Ethernet interface:

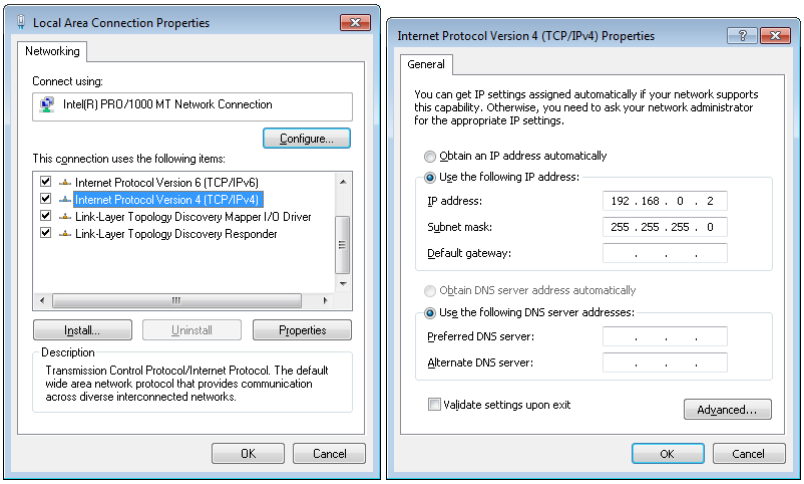



***Figure 2.1:*** *PC IP Address Configuration*

## 2.2 PLC300 IP ADDRESS CONFIGURATION

The IP address for PLC300 can be set via SETUP menu using PLC300 keypad. This can also be done using the Setup Configuration tool in WPS.

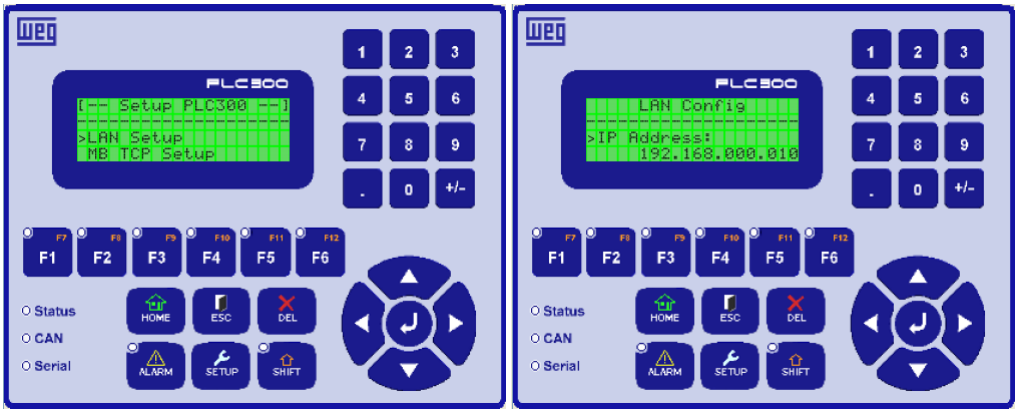



***Figure 2.2:*** *PLC300 IP Address Configuration*

# 3 SERVER CONFIGURATION - CFW300

This section describes the main configurations for CFW300 frequency converter operation with accessory CFW300-CETH in Modbus TCP network. Some of the described configurations are only available if CFW300-CETH accessory is properly installed.

Refer to the CFW300 programming manual for the necessary configurations related to other device functions, like motor configuration, protections, etc.

## 3.1 ETHERNET INTERFACE

For this application, the following configurations have been done via keypad to allow Ethernet communication to WPS:

- P850 IP Address Config: **0** (Parameters).
- P851 ... P854 IP Address: 192.168.0.**11**.
- P855 CIDR: 24 (255.255.255.0).
- P856 ... P859 Gateway: 0.0.0.0.

**NOTE!**
After changing these configurations, for the modification to be effective, the equipment must be turned off and then turned on again.

When communication configuration is done, it is also possible to create a WPS configuration and connect to it via Ethernet, to access the parameter list and configuration wizards:

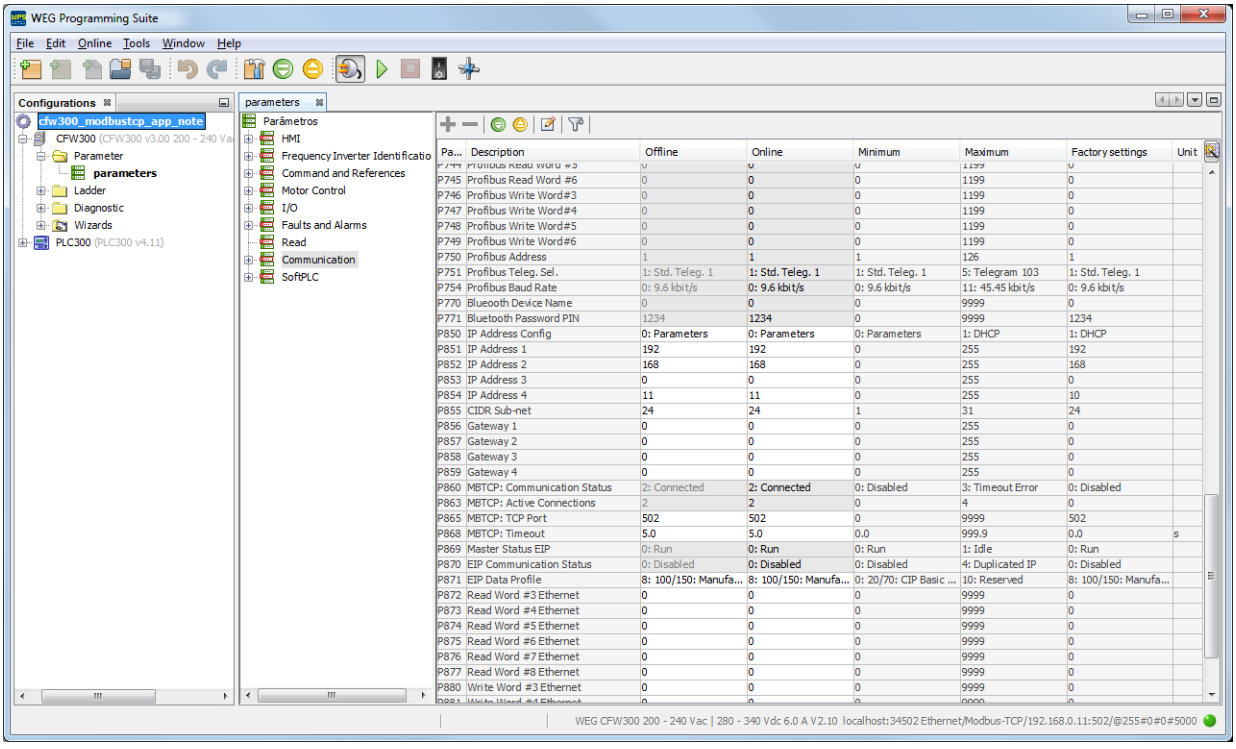



***Figure 3.1:*** *WPS - Parameter list*

## 3.2 LOCAL/REMOTE

CFW300 has two operation modes: local and remote. For each operation mode, it is necessary to define the source that it will use to receive commands, like start/stop, fault reset. For this application, considering CFW300-CETH accessory installed, the following control sources have been defined:

- Local: keypad will control CFW300 in local mode.
- Remote: CFW300-CETH will control CFW300 in remote mode.
- Local/Remote transition: the definition if the device is in local or remote mode will be controlled by CFW300-CETH commands (remote mode at power on).

Based on this, the following configurations have been programmed:

- P220 LOC/REM Selection Source: CO/DN/DP/ETH (REM). ❶
- P222 REM Reference Selection: CO/DN/DP/ETH. ❷
- P227 REM Run/Stop Selection: CO/DN/DP/ETH. ❸
- P226 REM FWD/REV Selection: CO/DN/DP/ETH (FWD). ❹
- P228 REM JOG Selection: CO/DN/DP/ETH. ❺

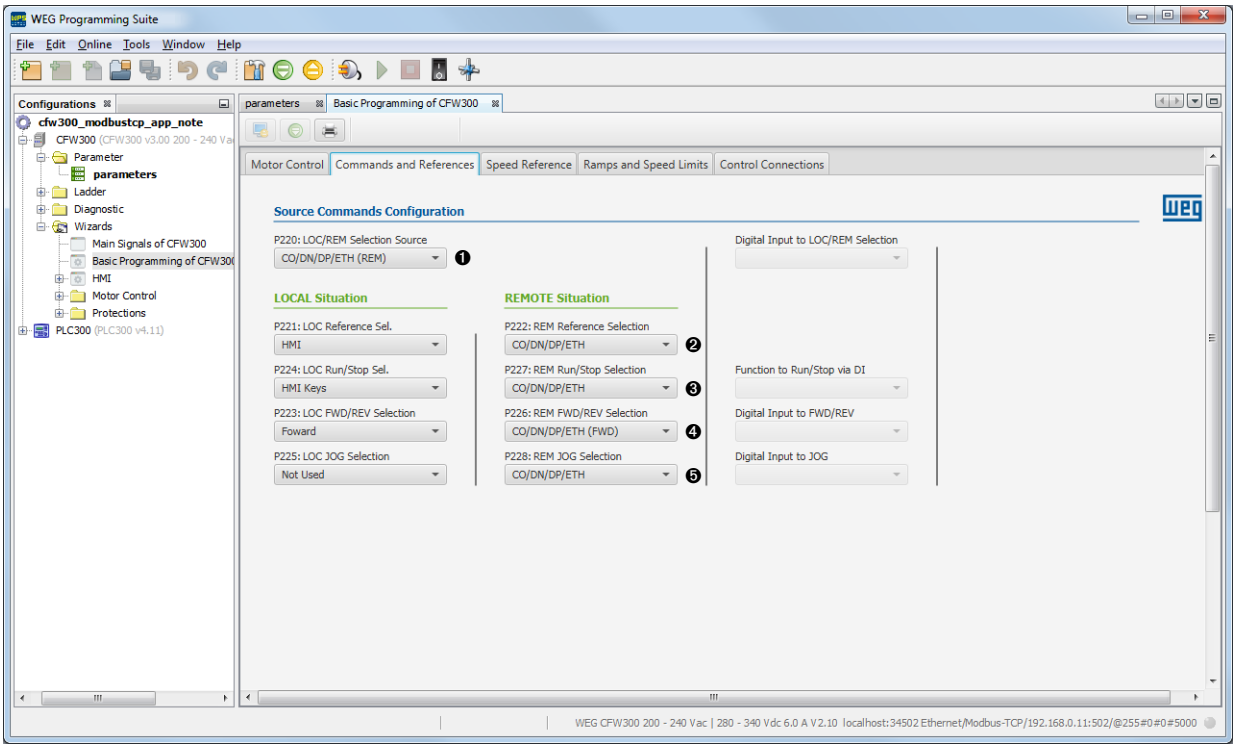



***Figure 3.2:*** *WPS - Local/Remote configuration*

## 3.3 COMMUNICATION ERROR

It is important to define the action CFW300 will take in case of communication error. For this application, a communication error will be detected based on Modbus TCP Timeout of 5.0 seconds - if device stops receiving Modbus TCP telegrams for a period longer than 5.0 seconds, it will indicate an alarm. If CFW300 was running the motor via network command, CFW300 should also perform a general disable.

Based on this, the following configurations have been programmed:

- P868 MBTCP Timeout: 5.0s.
- P313 Action for Communic. Error: 2 (General Disable).

# 4 CLIENT CONFIGURATION - PLC300

To configure and program PLC300 to communicate with CFW300, use WPS software. The main steps are described below.

## 4.1 CREATE WPS RESOURCE

Add a new resource for the PLC300 to the WPS Configuration. We will use this configuration to develop a ladder logic to send and receive Modbus TCP Client requests to CFW300.

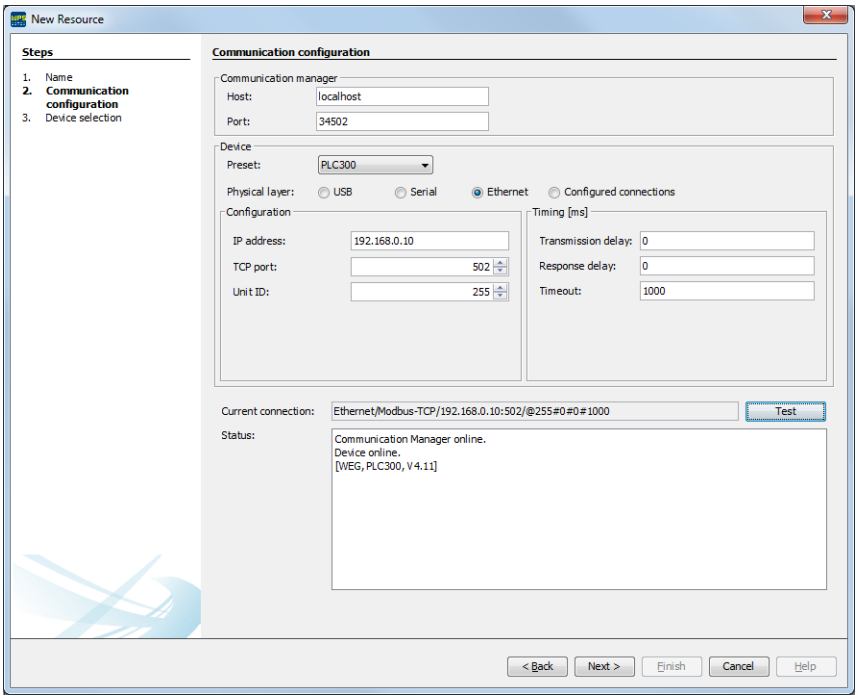



***Figure 4.1:*** *WPS - Add new resource*

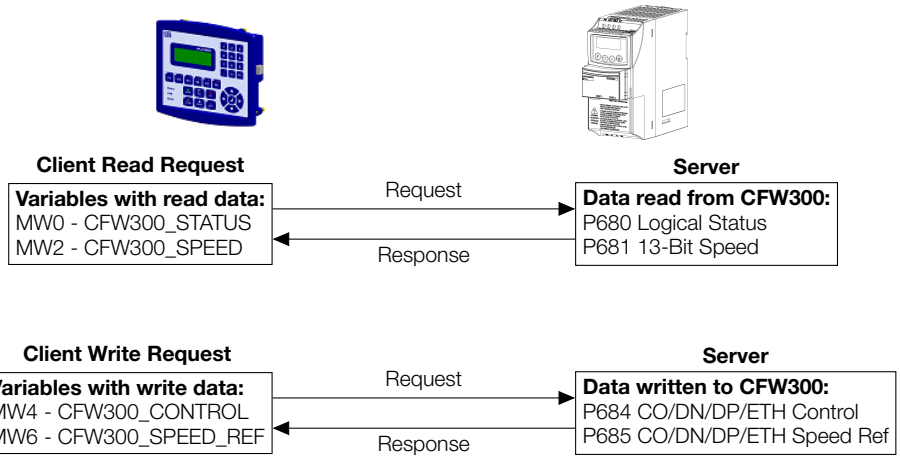
## 4.2 DATA ACCESS DEFINITION

For this application, CFW300 will exchange the following data with PLC300:

| CFW300 Parameters to Read | Holding Register Address | Size |
|---|---|---|
| P680 Logical Status | 680 | 16bit |
| P681 13-Bit Speed | 681 | 16bit |

| CFW300 Parameters to Write | Holding Register Address | Size |
|---|---|---|
| P684 CO/DN/DP/ETH Control | 684 | 16bit |
| P685 CO/DN/DP/ETH Speed Ref | 685 | 16bit |

After choosing the data, we will create PLC300 memory variables to link with these parameters.




These variables have been created as global variables, to use along the program:

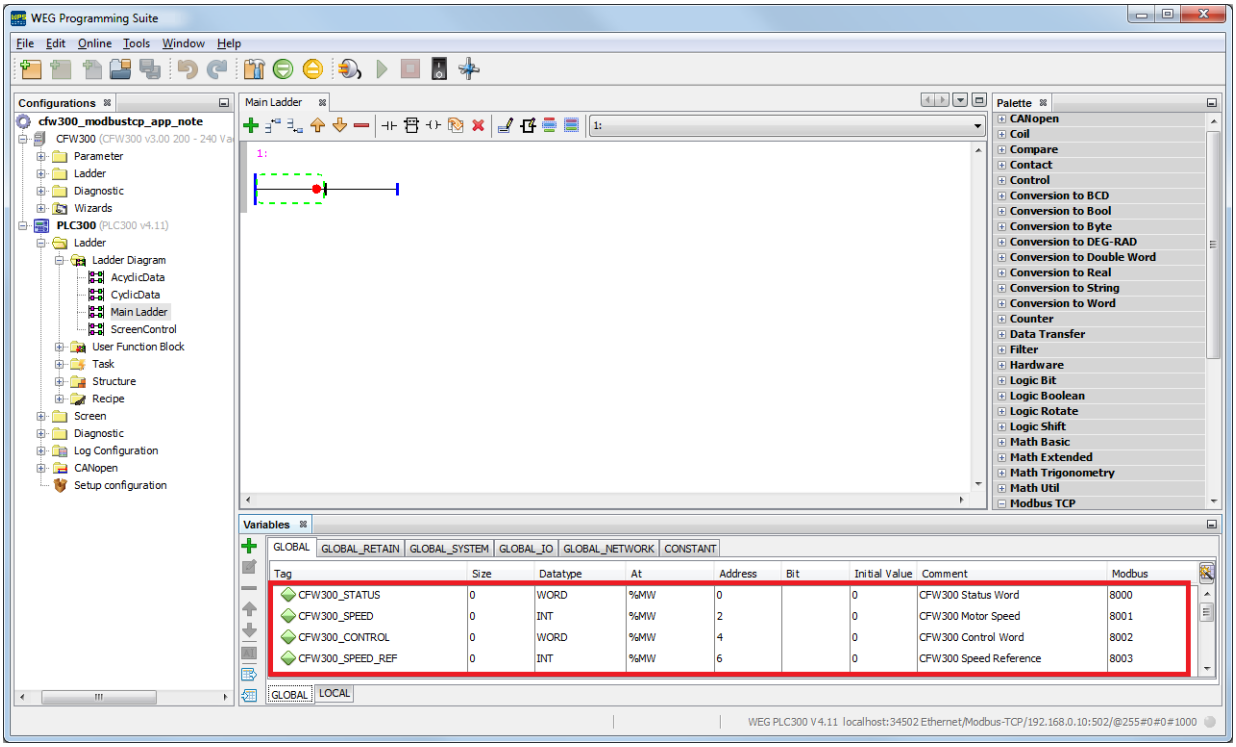



***Figure 4.2:*** *WPS - Create Variables*

## 4.3 CONFIGURE CLIENT TO READ/WRITE SERVER DATA

PLC300 uses ladder logic to create and send Modbus TCP requests. There are ladder functions to send read and write Modbus TCP requests, where it is possible to program the IP address, unit ID, port, function code and registers to access.

According to defined at item 4.2, it was programmed one ladder function to read data from CFW300, and other ladder function to write data to CFW300, with the following configuration:

- CFW300 Modbus TCP Server configuration:

  IP: 192.168.0.11;

  TCP Port: 502;

  Unit ID: 255;

- Read Words:

  Modbus Function: 03 - Read Holding Registers;

  Initial data address: 680 (Holding Register 680);

  Number of data: 2 registers (Logical Status and Motor Speed);

- Write Words:

  Modbus Function: 16 - Write Multiple Registers;

  Initial data address: 684 (Holding Register 684);

  Number of data: 2 registers (Control Word and Speed Reference);

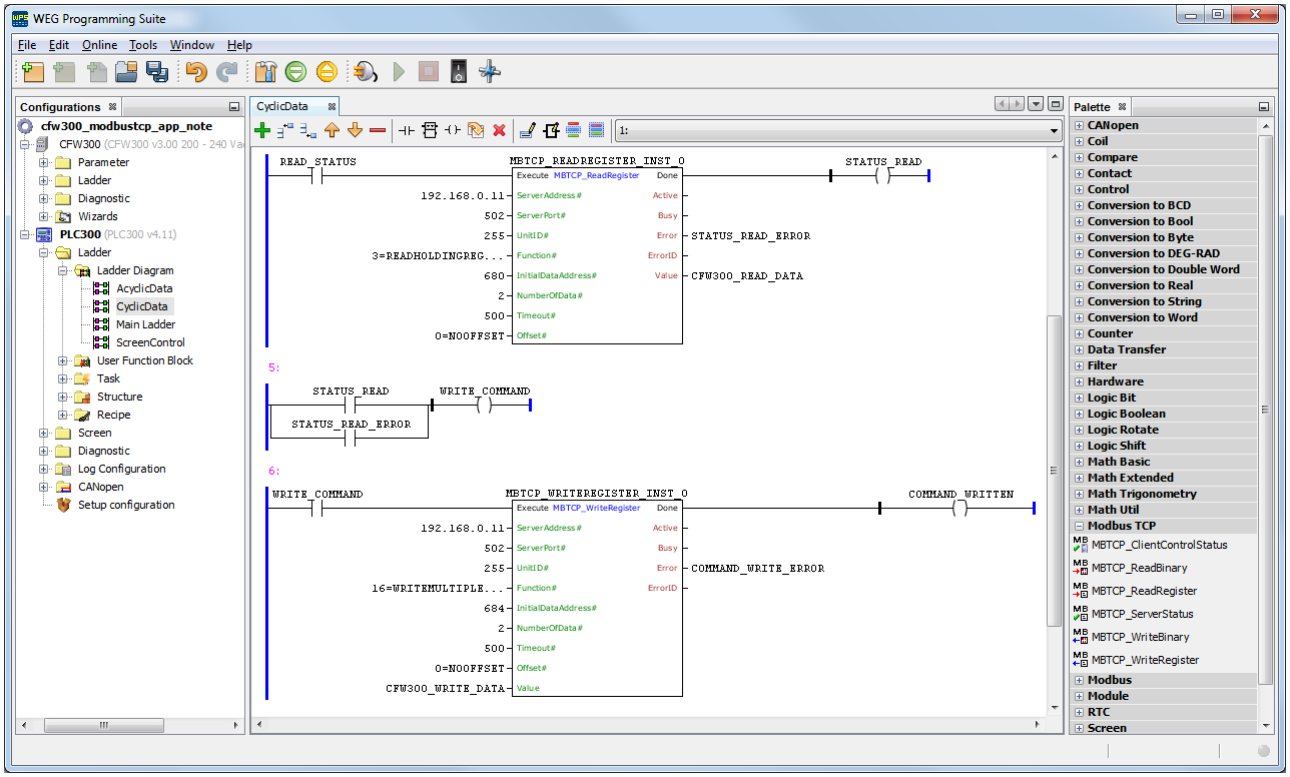



***Figure 4.3:*** *Ladder Logic to Read/Write Sever Data*

The read and write commands are only transmitted in a positive transition of the “Execute” input. So, it is necessary to create a logic to control this transition, and repeat it cyclically in order to keep transmitting data constantly. For this example, a timer function using “POLL_INTERVAL” variable, set to 1000ms, is the default time interval for triggering new requests.

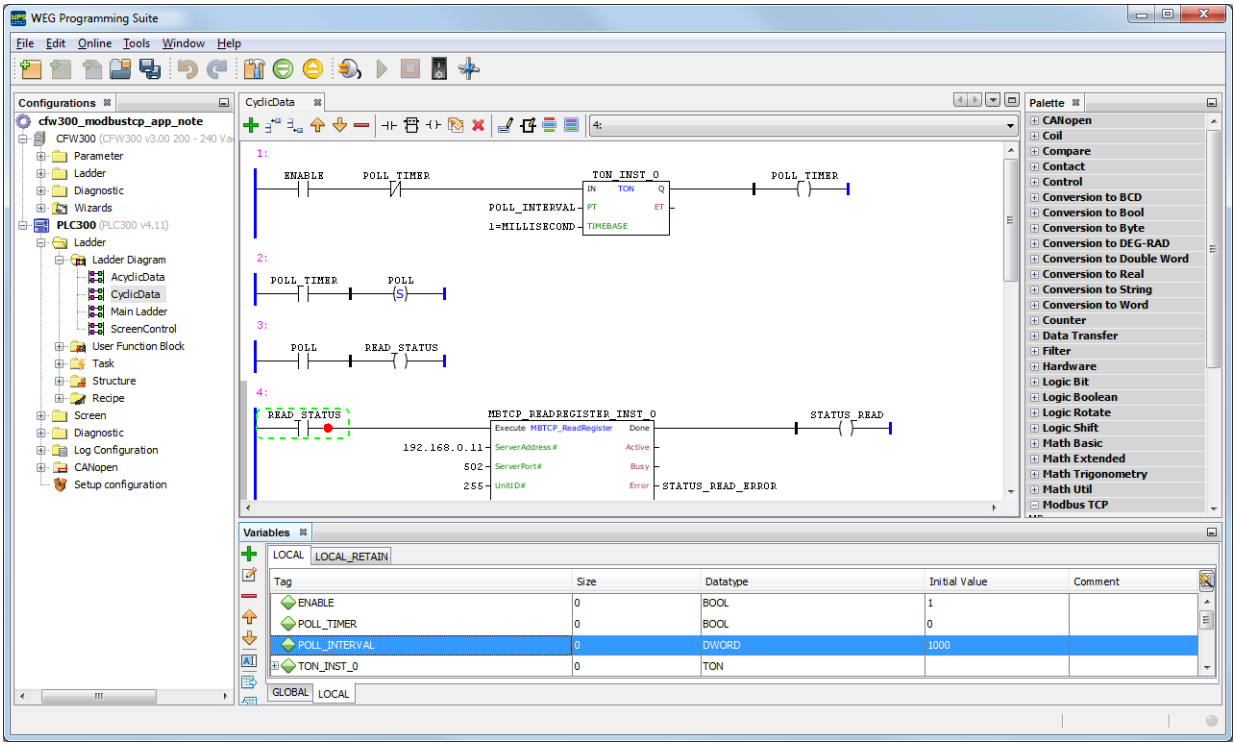



***Figure 4.4:*** *Logic for Timer Interval*

## 4.4 DOWNLOAD AND MONITOR CONFIGURATION

Once the configuration is finished, download it to PLC from the WPS software. Go to the "Download Resource" option under the "Online" menu. When PLC300 is running the program, it is possible to monitor the ladder to view requests result.

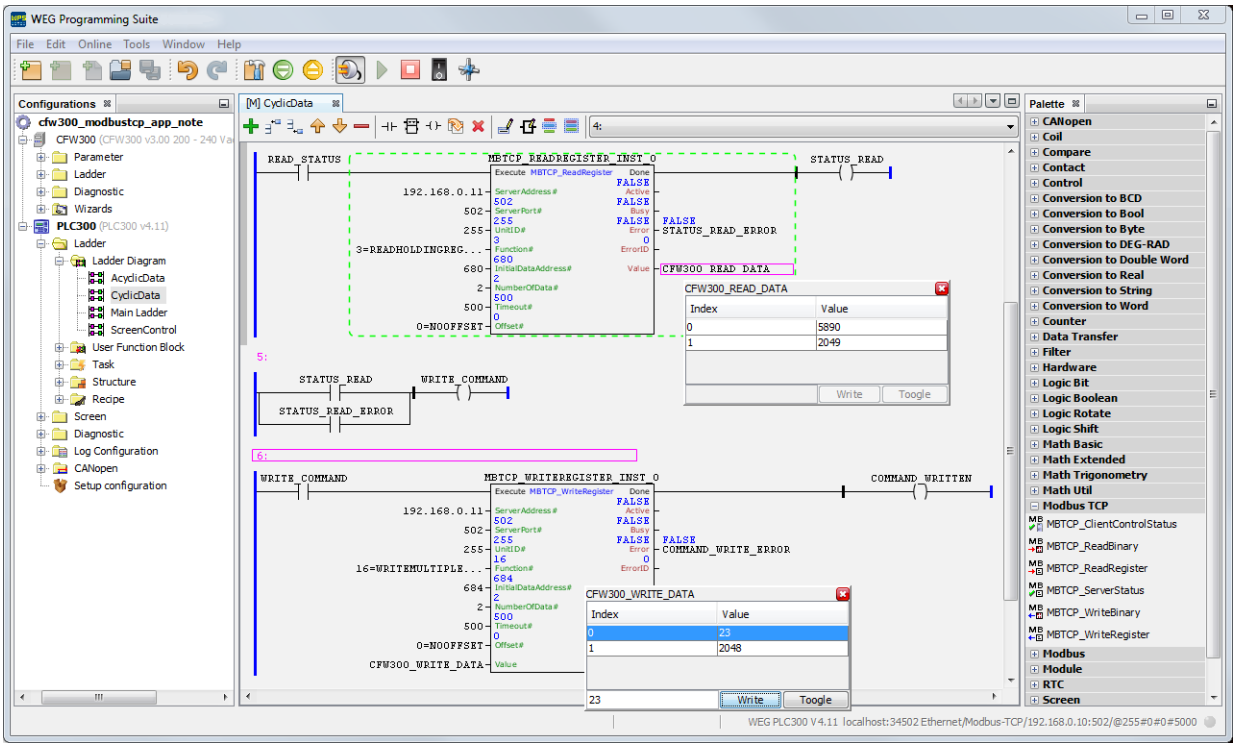



***Figure 4.5:*** *Online Monitoring*

# 5 CONTROL AND MONITORING

Once network configuration is done, use WPS to access device data. The main steps are described below.

## 5.1 VIEW AND EDIT READ AND WRITE DATA

Under the “Configurations” tab, right-click “cfw300_modbustcp_app_note/PLC300/Diagnostic/Monitoring Variable” and add a new file. Click at the plus sign, select the GLOBAL variables and press OK to add them to the monitoring file.

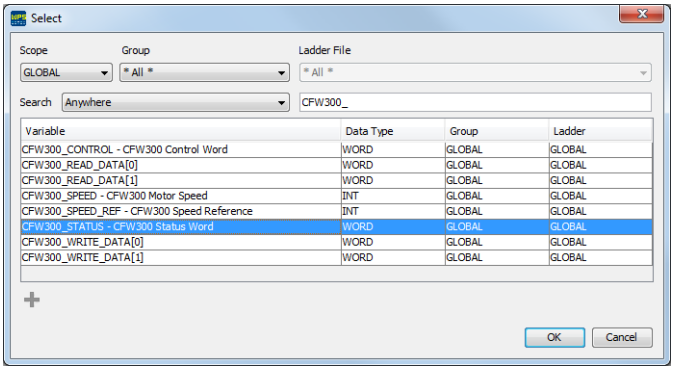



***Figure 5.1:*** *Monitoring Variable file*

It is now possible to check input and write output data directly at controller memory.

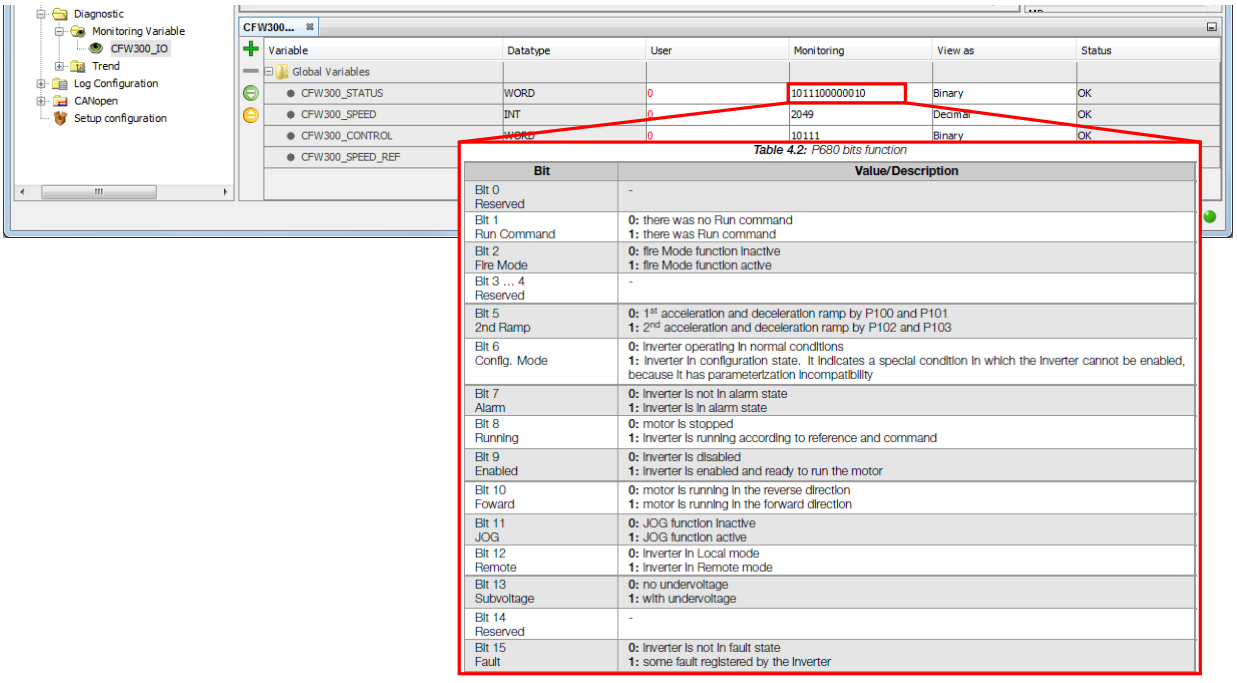



***Table 4.2:*** *P680 bits function*

| Bit | Value/Description |
|---|---|
| Bit 0<br>Reserved | - |
| Bit 1<br>Run Command | **0:** there was no Run command<br>**1:** there was Run command |
| Bit 2<br>Fire Mode | **0:** fire Mode function inactive<br>**1:** fire Mode function active |
| Bit 3 ... 4<br>Reserved | - |
| Bit 5<br>2nd Ramp | **0:** 1st acceleration and deceleration ramp by P100 and P101<br>**1:** 2nd acceleration and deceleration ramp by P102 and P103 |
| Bit 6<br>Config. Mode | **0:** Inverter operating in normal conditions<br>**1:** Inverter in configuration state. It indicates a special condition in which the inverter cannot be enabled, because it has parameterization incompatibility |
| Bit 7<br>Alarm | **0:** Inverter is not in alarm state<br>**1:** Inverter is in alarm state |
| Bit 8<br>Running | **0:** motor is stopped<br>**1:** Inverter is running according to reference and command |
| Bit 9<br>Enabled | **0:** Inverter is disabled<br>**1:** Inverter is enabled and ready to run the motor |
| Bit 10<br>Foward | **0:** motor is running in the reverse direction<br>**1:** motor is running in the forward direction |
| Bit 11<br>JOG | **0:** JOG function inactive<br>**1:** JOG function active |
| Bit 12<br>Remote | **0:** Inverter in Local mode<br>**1:** Inverter in Remote mode |
| Bit 13<br>Subvoltage | **0:** no undervoltage<br>**1:** with undervoltage |
| Bit 14<br>Reserved | - |
| Bit 15<br>Fault | **0:** Inverter is not in fault state<br>**1:** some fault registered by the inverter |

***Figure 5.2:*** *Read data, with highlight to the status word as described at CFW300 Modbus TCP documentation*

For inputs, as described at item 4.2, it is programmed to read the following information:

- CFW300_STATUS: value 5890 decimal (binary 0001 0111 0000 0010).
  - Bit 1 = 1 (run command).
  - Bit 8 = 1 (running).
  - Bit 9 = 1 (enabled).
  - Bit 10 = 1 (forward direction).
  - Bit 12 = 1 (at remote mode).
- CFW300_SPEED: value 2049 (≈ 1/4 motor nominal speed).

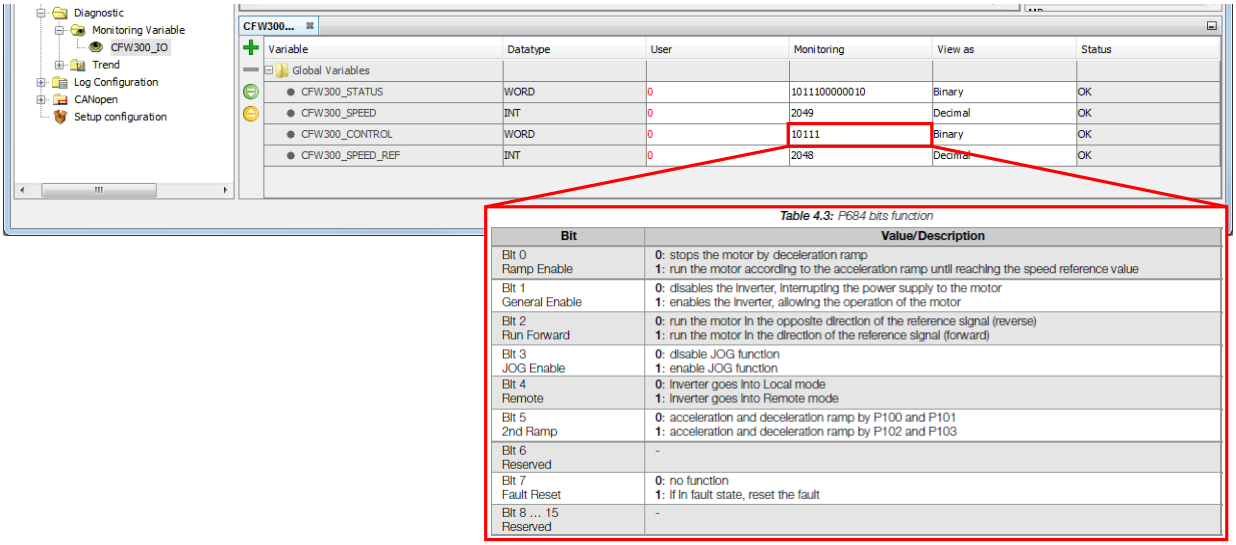



*Table 4.3: P684 bits function*

| Bit | Value/Description |
|---|---|
| Bit 0<br>Ramp Enable | 0: stops the motor by deceleration ramp<br>1: run the motor according to the acceleration ramp until reaching the speed reference value |
| Bit 1<br>General Enable | 0: disables the inverter, interrupting the power supply to the motor<br>1: enables the inverter, allowing the operation of the motor |
| Bit 2<br>Run Forward | 0: run the motor in the opposite direction of the reference signal (reverse)<br>1: run the motor in the direction of the reference signal (forward) |
| Bit 3<br>JOG Enable | 0: disable JOG function<br>1: enable JOG function |
| Bit 4<br>Remote | 0: inverter goes into Local mode<br>1: inverter goes into Remote mode |
| Bit 5<br>2nd Ramp | 0: acceleration and deceleration ramp by P100 and P101<br>1: acceleration and deceleration ramp by P102 and P103 |
| Bit 6<br>Reserved | - |
| Bit 7<br>Fault Reset | 0: no function<br>1: if in fault state, reset the fault |
| Bit 8 ... 15<br>Reserved | - |

***Figure 5.3:*** *Write data, with highlight to the command word as described at CFW300 Modbus TCP documentation*

For output, as described at item 4.2, it is programmed to write the following information:

- CFW300_CONTROL: value 23 decimal (binary 0000 0000 0001 0111).
  - Bit 0 = 1 (ramp enable).
  - Bit 1 = 1 (general enable).
  - Bit 2 = 1 (run forward).
  - Bit 4 = 1 (remote).
- CFW300_SPEED_REF: value 2048 (≈ 1/4 motor nominal speed).

## 5.2 LADDER LOGIC FOR ADDITIONAL DATA TRANSFER

Besides monitoring status data and writing control data, it is possible to create any other request to access server data.

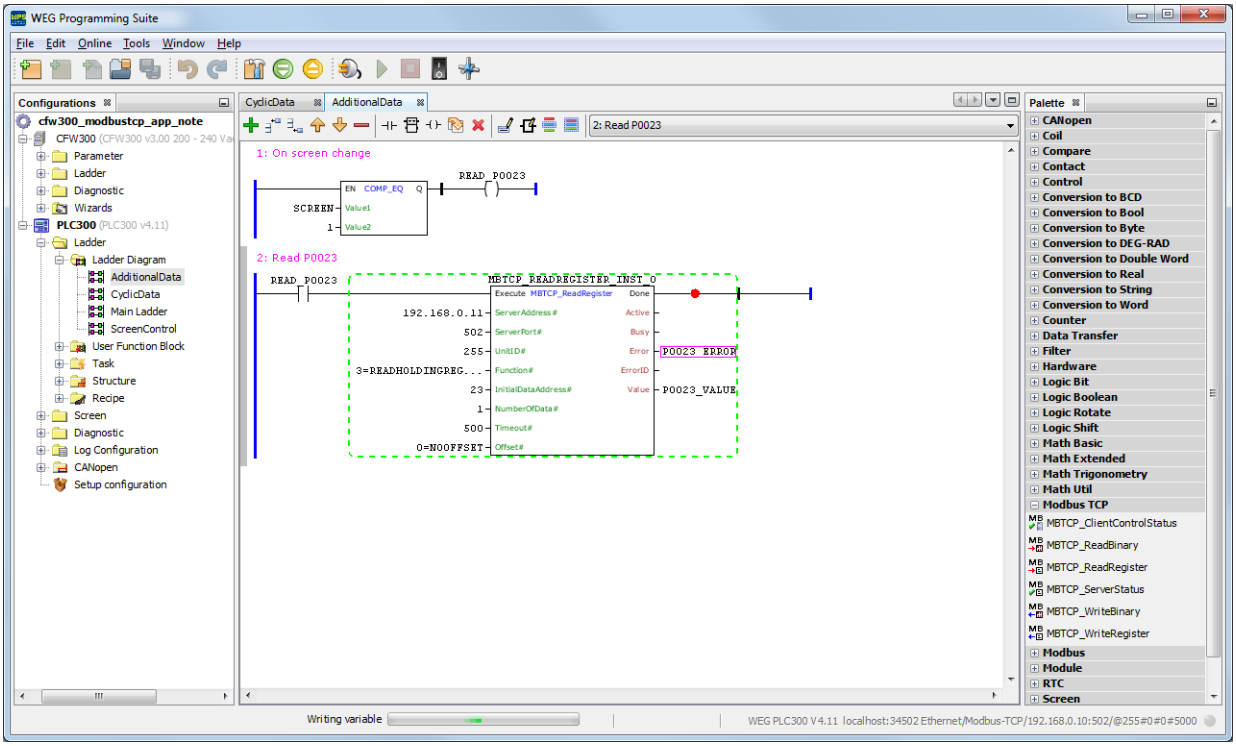



***Figure 5.4:*** *Additional message configuration*

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