CFW500 Modbus Register Mapping

Overview

This document provides the Modbus register mapping for the WEG CFW500 frequency inverter used in the winding machine control system. All three rollers (Rolo 1, 2, and 3) use identical parameter structures but are accessed via different Modbus node addresses.

Connection Details

- **Protocol**: Modbus RTU
- **Node Addresses**:
  - Rolo 1: Node = 1
  - Rolo 2: Node = 2
  - Rolo 3: Node = 3
- **Channel**: 2 (configured in PLC)
- **Baud Rate**: Typically 9600 or 19200 (verify in inverter settings)
- **Data Format**: 8-N-1 (8 data bits, No parity, 1 stop bit)

Register Address Convention

CFW500 uses a direct mapping where parameter Pxxxx corresponds to Modbus holding register address xxxx.

Example: P0134 → Holding Register 134

Function Codes Used

Function Code	Description	Usage in Project
3	Read Holding Registers	Read parameters and monitoring data
6	Write Single Register	Write individual parameters
16	Write Multiple Registers	Write consecutive parameters

Critical Parameters

P0100 - Control Type

Parameter	Address	Type	Range	Description	Units
P0100	100	UINT	0-5	Motor control method	-

Values:

- 0 = V/f (Scalar)
- 1 = VVW (Vector Voltage/Frequency)
- **2 = Vector Sensorless** ← Used in this project
- 3 = Vector with Encoder

- 4 = Vector with Resolver
- 5 = Direct Torque Control

Project Configuration: Set to 2 (Vector Sensorless) for optimal torque control.

Speed Limits

Parameter	Address	Type	Range	Description	Units	Scaling
P0133	133	UINT	0-60000	Minimum Speed	0.01Hz	÷100
P0134	134	UINT	0-60000	Maximum Speed	0.01Hz	÷100

Notes:

- Values stored as 0.01 Hz units
- Example: 6000 = 60.00 Hz
- Project limits: 0-100 Hz (validated before writing)

Torque Limits

Parameter	Address	Type	Range	Description	Units	Scaling
P0169	169	UINT	0-2000	Maximum Torque	0.1%	÷10
P0170	170	UINT	0-2000	Minimum Torque	0.1%	÷10

Notes:

- Values stored as 0.1% units
- Example: 1000 = 100.0%
- Project limits: 0-200% (validated before writing)
- P0170 typically set to 0 in this application

Enable/Disable Parameter

Parameter	Address	Type	Range	Description	Units
P0498	498	UINT	0-1	Parameter Change Enable	-

Values:

- 0 = Parameter changes disabled
- 1 = Parameter changes enabled

Notes:

- Must be set to 1 before modifying drive parameters
- Automatically handled by verification logic

Monitoring Parameters

Real-time Operating Data

Parameter	Address	Type	Range	Description	Units	Scaling	Read Cycle
P0002	2	UINT	0-60000	Output Frequency	0.1Hz	÷10	10s
P0003	3	UINT	0-65535	Output Current	0.1A	÷10	10s
P0009	9	UINT	0-2000	Motor Torque	0.1%	÷10	10s
P0409	409	UINT	Variable	Additional Parameter 1*	Variable	Variable	10s
P0410	410	UINT	Variable	Additional Parameter 2*	Variable	Variable	10s

Notes on P0409 and P0410: The exact function of these parameters depends on CFW500 configuration and firmware version. Consult your specific inverter manual for:

- Detailed function and description
- Appropriate scaling factor
- Valid value range
- Units of measurement

Common possible uses:

- Inverter temperature
- DC bus voltage
- Active/reactive power
- Additional operational states

Additional Useful Parameters (Not Currently Implemented)

The following parameters may be useful for future system expansion:

Parameter	Address	Type	Range	Description	Scaling	Units	Access
P0001	1	UINT	0-65535	Motor Speed	×1	RPM	Read Only
P0004	4	UINT	0-65535	Output Voltage	×1	V	Read Only
P0005	5	UINT	0-60000	Input Frequency	×0.01	Hz	Read Only
P0006	6	UINT	0-65535	DC Link Voltage	×1	V	Read Only
P0007	7	UINT	0-200	Inverter Temperature	×1	°C	Read Only
P0011	11	UINT	Bitmap	Inverter Status	Bitmap	-	Read Only
P0220	220	UINT	0-9999	Acceleration Time	×0.1	s	Read/Write
P0221	221	UINT	0-9999	Deceleration Time	×0.1	s	Read/Write

Parameter Access Sequence

Write Sequence (On HMI Change)

1. **Step 0**: Write P0134 (Max Speed)
2. **Step 1**: Write P0133 (Min Speed)
3. **Step 2**: Write P0169 (Max Torque)
4. **Step 3**: Write P0170 (Min Torque)
5. **Step 4**: Write P0498 (Enable/Disable)

Notes:

- Sequential execution with retry logic (max 3 attempts)
- Only triggered when HMI values change
- Avoids unnecessary writes to inverter

Read Sequence (Every 10 seconds)

Monitoring Cycle:

1. **Step 1**: Read P0009 (Torque)
2. **Step 2**: Read P0002 and P0003 (Frequency and Current) - consecutive read

P0409/P0410 Cycle (separate, also every 10 seconds):

1. **Step 1**: Read P0409 and P0410 - consecutive read

Notes:

- ModbusBusy flag ensures sequential access
- Each operation includes retry logic
- Consecutive registers read together for efficiency

Verification Sequence (Every 10 seconds)

1. **Step 1**: Read P0100, verify and force to 2 if different
2. **Step 2**: Read P0134/P0133, verify and force if different
3. **Step 3**: Read P0169/P0170, verify and force if different

Purpose: Ensures critical parameters remain at desired values even if changed externally.

Data Scaling Examples

Speed Conversion

```
HMI Value (Hz) → Inverter Value
60.00 Hz × 100 = 6000 (0x1770)

Inverter Value → Display Value
6000 ÷ 100.0 = 60.00 Hz
```

Torque Conversion

```
HMI Value (%) → Inverter Value
100.0% × 10 = 1000 (0x03E8)

Inverter Value → Display Value
1000 ÷ 10.0 = 100.0%
```

Current Conversion

```
Inverter Value → Display Value
245 ÷ 10.0 = 24.5 A
```

Error Handling

Retry Mechanism

- **Maximum Retries**: 3 attempts per operation
- **Retry Counter Variables**:
  - WriteRetryCount_roloX
  - ReadRetryCount_roloX
  - ReadRetryCount_P0409_P0410_roloX ← Separate retry counter for P0409/P0410
  - VerificationRetryCount_roloX

Error Flags

Flag	Description	Recovery
WriteError_roloX	Write operation failed after retries	Cleared after 30s of success
ReadError_roloX	Read operation failed after retries	Cleared after 30s of success
CommunicationOK_roloX	Overall communication status	Updated on each operation

Error Recovery

- **Recovery Time**: 30 seconds (ERROR_RECOVERY_TIME)
- **Mechanism**: Automatic flag clearing after sustained successful communication
- **Implementation**: Uses TON timer per roller

Communication Timing

Timer Configuration

Timer	Period	Purpose
ReadTimer	10s	Triggers P0009, P0002, P0003 read

Timer	Period	Purpose
ReadTimer_P0409_P0410	10s	Triggers P0409, P0410 read
VerificationTimer	10s	Triggers parameter verification
SpeedTorqueAlarmTimer	5s	Delay for speed-torque alarm
ErrorRecoveryTimer	30s	Error flag auto-clear delay

Bus Arbitration

- **Global Flag**: `ModbusBusy` (shared across all three rollers)
- **Purpose**: Prevents simultaneous Modbus operations
- **Usage**: Checked before any read/write operation
- **Released**: After each operation completes

Alarm Logic

Speed vs Torque Monitoring

Condition: `TorquePercentScaled > 20.0% AND OutputFreqScaled < (TorquePercentScaled × SPEED_TORQUE_RATIO)`

Parameters:

- **Threshold**: 20% torque
- **Ratio**: 0.5 Hz/% (configurable via SPEED_TORQUE_RATIO constant)
- **Delay**: 5 seconds before alarm activation
- **Purpose**: Detect motor stall or insufficient power conditions

Example:

```
If Torque = 80%
Expected Minimum Speed = 80% × 0.5 = 40 Hz
If Actual Speed < 40 Hz for 5 seconds → SpeedTorqueAlarm = TRUE
```

Integration Notes

PLC Side (Connected Components Workbench)

1. **Function Blocks Used**: `MSG_MODBUS`
2. **Data Types Required**:
    - `MODBUSLOCPARA` (Local configuration)
    - `MODBUSTARPARA` (Target configuration)
    - `MODBUSLOCADDR` (Address array)
3. **Array Size**: Minimum 2 elements for consecutive reads

HMI Side (PanelView 800)

1. **Input Variables** (from HMI):

   - `TorqueMax_roloX` (UINT, 0.1% units)
   - `SpeedMax_roloX` (UINT, 0.1 Hz units)
   - `SpeedMin_roloX` (UINT, 0.1 Hz units)

2. **Display Variables** (to HMI):

   - `TorquePercentScaled_roloX` (REAL, %)
   - `OutputFreqScaled_roloX` (REAL, Hz)
   - `OutputCurrentScaled_roloX` (REAL, A)
   - `P0409Scaled_roloX` (REAL, units TBD)
   - `P0410Scaled_roloX` (REAL, units TBD)

3. **Status Indicators**:

   - `CommunicationOK_roloX` (BOOL)
   - `WriteError_roloX` (BOOL)
   - `ReadError_roloX` (BOOL)
   - `SpeedTorqueAlarm_roloX` (BOOL)

Safety Limits

Enforced in PLC Logic

Parameter	Minimum	Maximum	Units
Speed	0.0	100.0	Hz
Torque	0.0	200.0	%

Implementation: Values clamped before conversion to inverter units.

Troubleshooting Guide

Common Issues

1. **Communication Timeout**

   - Check physical RS-485 connection
   - Verify node address configuration
   - Check baud rate settings
   - Ensure only one device using Modbus at a time

2. **Parameter Not Writing**

   - Verify P0498 is set to 1 (enabled)
   - Check if inverter is in local control mode
   - Verify parameter is not locked by another function

3. **Incorrect Values**

- Verify scaling factors in code match manual
- Check data type conversions (UINT to REAL)
- Ensure proper bounds checking before write

4. **Frequent Retries**

- Increase communication timeout if needed
- Check for electrical noise on RS-485 lines
- Verify proper cable termination

5. **P0409/P0410 Unexpected Values**

- Consult specific CFW500 manual for parameter definitions
- Check inverter firmware version
- Adjust scaling according to actual parameter function

Future Expansion

To add new parameters to the system:

1. **Identify Parameter**: Consult CFW500 manual for number and function
2. **Add Variables**: Create raw (UINT) and scaled (REAL) variables
3. **Create MSG_MODBUS**: Instantiate new function block
4. **Add to Cycle**: Integrate into appropriate read cycle
5. **Implement Retry**: Add specific retry counter
6. **Update HMI**: Create display/input screens as needed

Reference Documents

- **WEG CFW500 User Manual**: Parameter definitions and electrical specifications
- **WEG CFW500 Parameters Manual**: Firmware-specific parameter details
- **WEG CFW500 Modbus Manual**: Detailed register mapping and protocol specifications
- **Connected Components Workbench Help**: MSG_MODBUS function block documentation
- **Modbus RTU Specification**: Protocol details and timing requirements

Version History

Version	Date	Changes
1.0	2025-10	Initial documentation
2.0	2025-10	Added verification cycle, retry logic, alarm monitoring
2.1	2025-10	Corrected timer periodicities to 10s
2.2	2025-10	Added P0409/P0410 monitoring with separate 10s cycle, list of useful parameters for future expansion

Last Updated: October 2025 Project: Perfil Bobinadeira - Winding Machine Control System Changelog: Added P0409/P0410, useful parameters list for future expansion, bus arbitration details