CFW500 Modbus RTU Register Mapping Documentation

Overview

This document provides detailed mapping of CFW500 inverter parameters used in the polymer profiling machine control system. All registers are accessed via Modbus RTU protocol with the following configuration:

- **Protocol**: Modbus RTU
- **Baud Rate**: Configured in Micro850 channel settings
- **Parity**: None (typical for industrial applications)
- **Data Bits**: 8
- **Stop Bits**: 1
- **Node Addresses**: 1, 2, 3 (one per roller/inverter)

Register Addressing Convention

- All addresses are holding registers (function code 3 for read, 16 for write)
- CFW500 parameter PXXXX maps to Modbus register XXXX
- Example: P0009 (Torque) = Register 9

Parameter Mapping Table

Monitoring Parameters (Read-Only)

Parameter	Register	Description	Scaling	Units	Data Type	Update Rate
P0002	2	Output Frequency	×0.1	Hz	UINT	1 second
P0003	3	Output Current	×0.1	A	UINT	1 second
P0009	9	Motor Torque	×0.1	%	UINT	1 second

Control Parameters (Read/Write)

Parameter	Register	Description	Scaling	Units	Data Type	Default	Range
P0100	100	Control Type	1:1	-	UINT	2	0-5
P0133	133	Minimum Speed Reference	×0.01	Hz	UINT	0	0-SpeedMax
P0134	134	Maximum Speed Reference	×0.01	Hz	UINT	6000	SpeedMin-6500
P0169	169	Maximum Torque Limit	×0.1	%	UINT	1500	0-2000
P0170	170	Minimum Torque Limit	×0.1	%	UINT	0	-2000-0

Parameter	Register	Description	Scaling	Units	Data Type	Default	Range
P0498	498	Parameter Save	0/1	-	UINT	0	0-1

Control Type (P0100) Values

- **0**: V/F Control
- **1**: V/F with Encoder
- **2**: Vector Sensorless (Used in this application)
- **3**: Vector with Encoder
- **4**: V/F Quadratic
- **5**: V/F with Encoder Quadratic

Scaling Details

Frequency Parameters (P0133, P0134)

- **HMI Input**: Real number in Hz (e.g., 60.0 Hz)
- **Scaling**: Multiply by 100 to get UINT (e.g., 60.0 × 100 = 6000)
- **CFW500 Storage**: UINT representing 0.01 Hz units
- **Formula**: `Register_Value = HMI_Value × 100`

Torque Parameters (P0169, P0170)

- **HMI Input**: Real number in % (e.g., 150.0%)
- **Scaling**: Multiply by 10 to get UINT (e.g., 150.0 × 10 = 1500)
- **CFW500 Storage**: UINT representing 0.1% units
- **Formula**: `Register_Value = HMI_Value × 10`

Monitoring Parameters (P0002, P0003, P0009)

- **CFW500 Output**: UINT in scaled units
- **HMI Display**: Divide by 10 for real values
- **Formula**: `Display_Value = Register_Value ÷ 10`

Communication Protocol Details

Read Operations

- **Function Code**: 3 (Read Holding Registers)
- **Single Register**: ElementCnt = 1
- **Multiple Registers**: ElementCnt = 2 (for consecutive parameters)

Write Operations

- **Function Code**: 6 (Preset Single Register) for single parameters
- **Function Code**: 16 (Preset Multiple Registers) for consecutive parameters
- **ElementCnt**: Number of registers to write

Error Handling

- **Timeout**: System retries failed operations up to 3 times
- **Error Flags**: Separate tracking for read/write/verification errors
- **Recovery**: Automatic error clearing after 30 seconds of successful communication

Application-Specific Usage

Roller Control Logic

Each roller (rolo1, rolo2, rolo3) implements identical control logic:

1. **Periodic Monitoring**: Reads P0002, P0003, P0009 every 1 second
2. **Parameter Validation**: HMI inputs clamped to safe ranges before scaling
3. **Change Detection**: Only writes parameters when HMI values differ from inverter values
4. **Verification**: Checks critical parameters every 10 seconds and forces correction if needed

Safety Limits

- **Speed Range**: 0.0 - 100.0 Hz (configurable via SPEED_MAX_LIMIT)
- **Torque Range**: 0.0 - 200.0% (configurable via TORQUE_MAX_LIMIT)
- **Inter-Lock**: SpeedMin ≤ SpeedMax enforced automatically

Troubleshooting

Common Issues

1. **Communication Timeout**: Check Modbus wiring, baud rate, and node addresses
2. **Parameter Not Updating**: Verify HMI value differs from current inverter value
3. **Invalid Values**: Check scaling calculations and HMI input ranges

Diagnostic Parameters

- Monitor `CommunicationOK_roloX` for overall communication status
- Check retry counters (`WriteRetryCount_roloX`, etc.) for communication quality
- Review error flags for specific failure modes

References

- CFW500 User Manual - Modbus RTU Communication
- Allen Bradley Micro850 Controller - Modbus Master Configuration
- IEC 61131-3 Structured Text Programming Guidelines

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