# ModbusTCP 卡操作手册

# Operation Guide of ModbusTCP

## 操作手册（中文）

感谢您使用本公司 ModbusTCP 卡产品，在产品使用前，请认真阅读本指南.

## Operation Guide （ENGLISH）

Thank you for using the ModbusTCP products. Please read this guide carefully before using the products.

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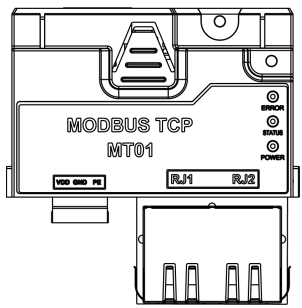
# 中文

## 1. 概述

首先感谢您使用本公司变频器，并选用本公司 ModbusTCP 现场总线扩展卡，以下简称 MT01 卡。

MT01 卡是 ModbusTCP 现场总线适配卡。该卡安装在本公司变频器上，提高通讯效率，便于实现变频器组网功能，变频器作为从站接受现主站的控制。MT01 适用于本系列全功率段产品。

在使用本产品前，请认真阅读本指南。




功能特点：

- 总线通信速率达到 100Mbit/s，通讯周期短；
- 组网拓扑结构灵活，MT01 支持所有类型的拓扑结构：链式、总线型、树型或星型等；其中 MT01 作为 ModbusTCP 服务器，主站作为客户端。
- 扩展卡直接安装在扩展卡插槽上，无需外部供电，安装方便。

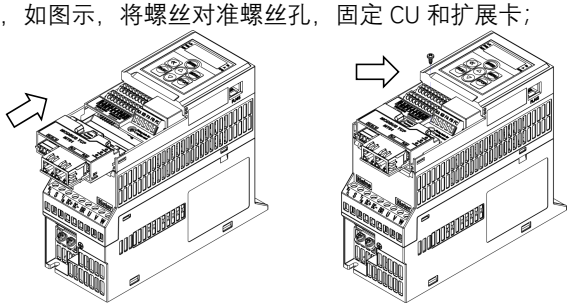
## 2. ModbusTCP 卡安装说明

安装步骤：

- 检查扩展卡附件包中包含：ModbusTCP 卡、可插拔端子*1、螺丝*1、说明书；
- 如下图示安装扩展卡：

  步骤 1，将扩展卡沿着底部导轨推进 CU 底部，扩展卡的端子与 CU 端子对插到底，两个螺丝孔对齐；

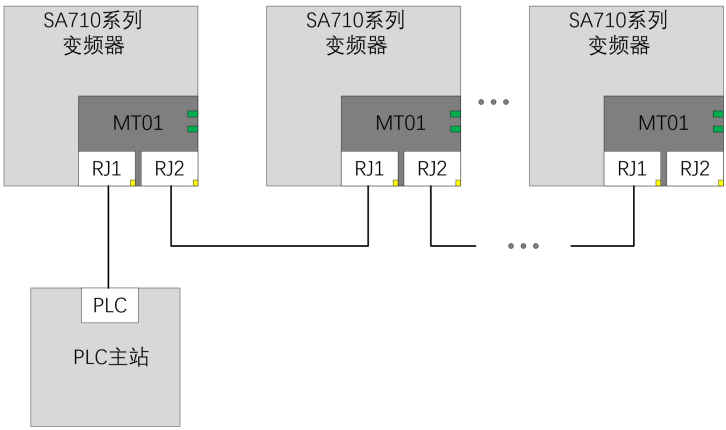
  步骤 2，如图示，将螺丝对准螺丝孔，固定 CU 和扩展卡；



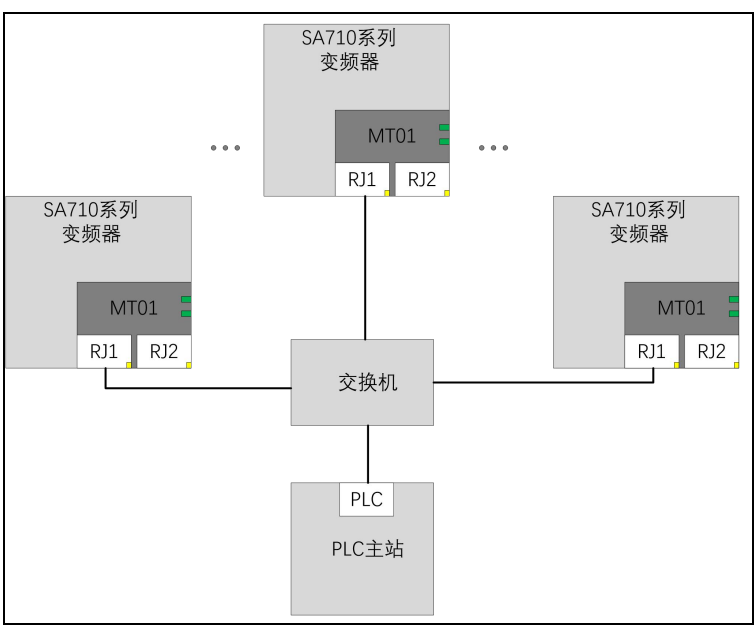
# 3. 电气连接

MT01 模块采用标准以太网 RJ45 插座与 ModbusTCP 主站连接，其引脚信号定义与标准以太网管脚一致，交叉线及直连线均可。

1) 链式组网电气

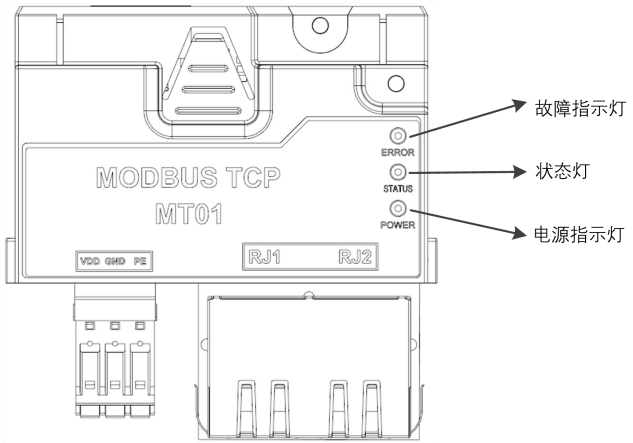



2) 星型组网电气连接



## 4. 状态指示灯和接口说明

MT01 扩展卡可以通过 2 个状态指示灯追踪总线通信故障，诊断故障说明见下表：




| 指示灯 | 颜色 | 状态说明 |
|---|---|---|
| ERROR | 红灯常亮 | ModbusTCP 通讯断连 |
| | 红灯闪烁 | MT01 与变频器通讯异常 |
| | 红灯熄灭 | 通讯正常 |
| STATUS | 绿灯常亮 | 正在传输通讯报文 |
| | 绿灯闪烁 | 正在传输通讯报文 |
| | 绿灯熄灭 | 无通讯报文传输 |
| POWER | 绿灯常亮 | 扩展卡上电正常 |
| | 绿灯熄灭 | 扩展卡电源异常或者变频器未上电 |
| **接口** | **端子或信号** | **说明** |
| ModbusTCP 通讯接口 | RJ1 | 通讯接口 1 |
| | RJ2 | 通讯接口 2 |
| 独立供电接口 | VDD | 外部 24V 供电，24V+/5%;<br>当变频器断电时可由该端口供电，保证 MT01 不掉站; |
| | GND | 电源地 |
| | PE | 大地 |

## 5. 参数表

| 参数号 | 参数名称 | 解释 |
|---|---|---|
| 1001 | IP Address[0] | IP 地址。<br>例如, 192.168.0.1 设置如下参数:<br>1001: 192，1002: 168,<br>1003: 0，1004:1 |
| 1002 | IP Address[1] | |
| 1003 | IP Address[2] | |
| 1004 | IP Address[3] | |
| 1005 | IP Address Mask[0] | IP 地址掩码。<br>例如, 255.255.255.0 设置如下参数:<br>1005：255，1006：255,<br>1007：255，1008：0 |
| 1006 | IP Address Mask[1] | |
| 1007 | IP Address Mask[2] | |
| 1008 | IP Address Mask[3] | |
| 1009 | Gateway address[0] | 网关地址。<br>例如,192.168.0.241 设置如下参数:<br>1009：192，1010：168,<br>1011：0，1012：241 |
| 1010 | Gateway address[1] | |
| 1011 | Gateway address[2] | |
| 1012 | Gateway address[3] | |

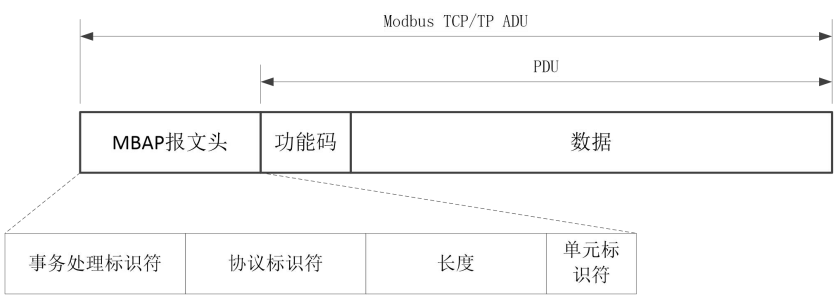
## 6. 技术规格

| 项目 | 规格 |
|---|---|
| 通讯连接器 | RJ45 × 2 |
| 以太网标准 | IEEE 802.3/802.3u |
| 物理层 | 10Base-T/100Base-TX |
| 传输媒介 | 超五类双绞屏蔽线 |
| 网络协议 | Modbus TCP |
| 最大客户端数 | 6 个 |
| 通信端口 | 502 |

## 7. 协议说明

### 7.1. 协议格式

MT01 的 ModbusTCP 协议格式如下图所示:



说明:

| 字段 | | 长度 | 说明 |
|---|---|---|---|
| MBAP 报文头 | 事务处理标识符 | 2 | Modbus 请求/响应事务处理的识别 |
| | 协议标识符 | 2 | 0=Modbus 协议 |
| | 长度 | 2 | 随后字节的数量 |
| | 单元标识符 | 1 | 串行链路或其他总线连接的远程从站的识别 |
| 功能码 | | 1 | Modbus 协议功能码 |
| 数据 | | 2*N | 变频器参数地址、参数个数及参数值等 |

7.2. 协议功能码

| 功能码 | 功能描述 | 意义 |
|---|---|---|
| 0x03 | 读保持寄存器 | 读取变频器参数和运行状态等 |
| 0x06 | 写单个保持寄存器 | 写单个变频器参数 |
| 0x10 | 写多个保持寄存器 | 写多个寄存器 |

7.3. 寄存器地址定义

本说明中的寄存器地址从 0 开始计算。

7.3.1.变频器参数和寄存器地址转换规则

变频器参数都映射为 Modbus TCP 寄存器。变频器参数的读写特性、范围仍然遵循使用变频器说明书中的说明。变频器参数和 Modbus TCP 寄存器之间的转换关系如下：寄存器地址 = 参数号 – 1。例如：

- 参数 P0-30（预置设定值 0）的寄存器地址为：30 - 1 = 29 (0x001D)
- 参数 P9-11（直流母线电压）的寄存器地址为：911 - 1 = 910(0x038E)

注意：第 8 组和第 9 组参数为只读参数。变频器不支持一次读写多个参数。

7.3.2.其他寄存器地址说明

除了变频器参数映射为 Modbus TCP 寄存器外，变频器内还额外定义了部分寄存器方便用户控制变频器运行。

| 寄存器地址 | 说明 | R/W |
|---|---|---|
| 9999(十六进制 270F) | 控制命令 | W |
| 10000(十六进制 2710) | 运行频率（0~Fmax，单位 0.01Hz） | W |

7.3.3.寄存器 9999 控制命令说明

| 位 | 说明 |
|---|---|
| 位 7~0（启停控制等） | 0x00：无功能（保持原状态不变）<br>0x01：正转运行<br>0x02：反转运行 |

| 位 | 说明 |
| --- | --- |
| 位 7~0（启停控制等） | 0x03：点动正转运行<br>0x04：点动反转运行<br>0x05：停止<br>0x06：自由停车<br>0x07：故障复位<br>0x08：清除命令（清除所有运行及停止指令） |
| 位 11~8（多段速选择） | 0000B：P0-30（预置设定值 0）<br>0001B：P0-31（预置设定值 1）<br>…<br>1111B：P0-45（预置设定值 15） |
| 位 13~12（加减速时间选择） | 00B：加减速 1<br>01B：加减速 2<br>10B：加减速 3<br>11B：加减速 4 |
| 位 14 | 保留 |
| 位 15 | 1B 使能 Bit8~13； 0B 禁能 Bit8~13 |

7.3.4.通讯比例值

在 Modbus TCP 通信中，通信数据是用十六进制表示的，而十六进制无法表示小数。比如希望设置参数 P5-08 = 61.5，需要将 61.5 放大 10 倍变为整数 615，这样就可以用十六进制的 0x0267（十进制 615）表示 61.5。

将一个非整数乘以一个倍数得到一个整数，这个倍数称为通讯比例值。

通讯比例值是以参数表里的“设定范围”或者“出厂值”里的数值的小数点位数为参考依据的。如果小数点后有 n 位小数，则通讯比例值 m 为 10 的 n 次方。

例如参数 P0-30 范围“-100.00~100.00”，出厂值 0.00，则其有 2 位小数，通讯比例值为 100。如果用 Modbus TCP 通讯读取该参数为 150，则实际 P0-30 值为 150 ÷ 100 = 1.5。如果想设置该参数为 12.5，则需要先放大 100 倍变成整数 1250（0x04E2）后再发送。

7.3.5.错误消息回应

在通信过程中可能存在错误操作，例如有些参数为只读，但上位机发送了一条写指令，此时变频器将会回复一条错误报文。错误报文格式如下：

| MBAP报文头 | 功能码 | 错误码 |
| --- | --- | --- |

错误报文功能码 = 请求功能码 + 0x80

| 错误码 | 说明 |
| --- | --- |
| 0x01 | 非法功能码，该功能码在变频器中没有实现。 |
| 0x02 | 非法寄存器地址，请求的寄存器地址无效。 |
| 0x03 | 非法寄存器数量范围，读写多个寄存器时请求操作的寄存器数量超出范围。 |
| 0x04 | 操作失败 |

## 8. 故障描述与处理

| 类型 | ERR0R | STATUS | POWER | 对应处理措施 |
| --- | --- | --- | --- | --- |
| 1 | 红灯慢闪 | X | X | 内部故障 |
| 2 | 红灯常亮 | X | X | ModbusTCP 通讯异常 |
| 3 | X | 绿灯闪 | X | ModbusTCP 通讯正常 |
| 4 | X | X | 绿灯亮 | MT01 电源正常 |
| 5 | X | X | 绿灯不亮 | MT01 电源异常或者未上电 |

# ENGLISH

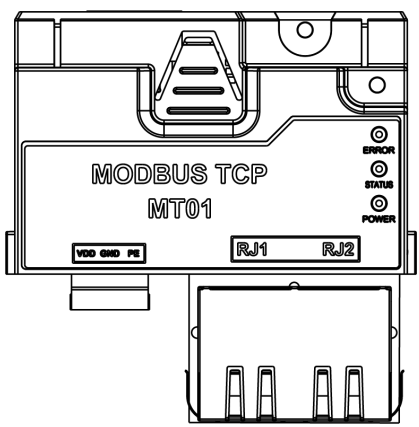
## 1.Summary

First of all, thank you for choosing our company's frequency converter and for selecting our company's Modbus TCP fieldbus option card, hereinafter referred to as the MT01 card.

The MT01 card is a Modbus TCP fieldbus option card. This card is installed on our company's frequency converter to improve communication efficiency and facilitate the implementation of networked functions for the frequency converter. The frequency converter is controlled by the master station as a slave station.

The MT01 card is suitable for our full power range products in this series-.

Please read this guide carefully before using this product.




Features:

- The bus communication rate reaches 100Mbit/s, the communication cycle is short.
- Flexible networking topology, MT01 supports all types of topologies: chain, bus, tree or star, etc, where MT01 functions as the Modbus TCP server and the master station as the client.
- The option card is directly installed on the option card slot, no external power supply is required, and the installation is convenient.

## 2.MT01 Installation

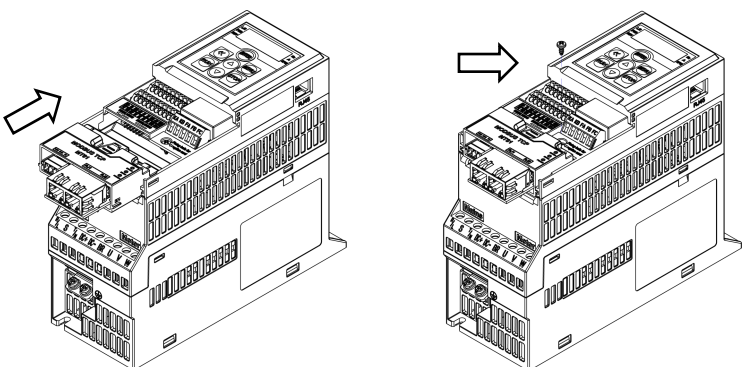
Installation steps:

1) Check the option card accessory package contains: Modbus TCP card,pluggable terminal *1, screw *1, manual;

2) Install the option card as shown below:

Step 1. Push the option card along the bottom rail into the bottom of the CU. Then terminals of the option card are inserted into the bottom of the CU terminal, and the two screw holes are aligned;

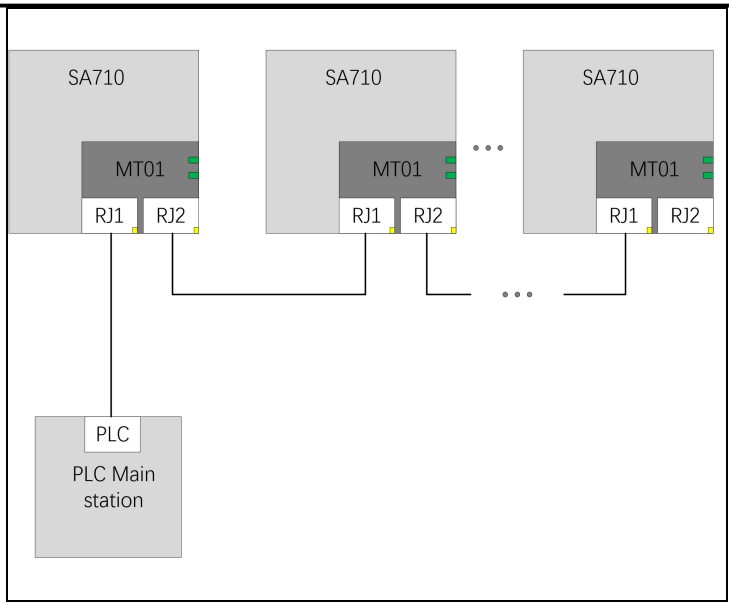
Step 2. as the picture shows, align the screws with the screw holes to fix the CU and the Modbus TCP card.



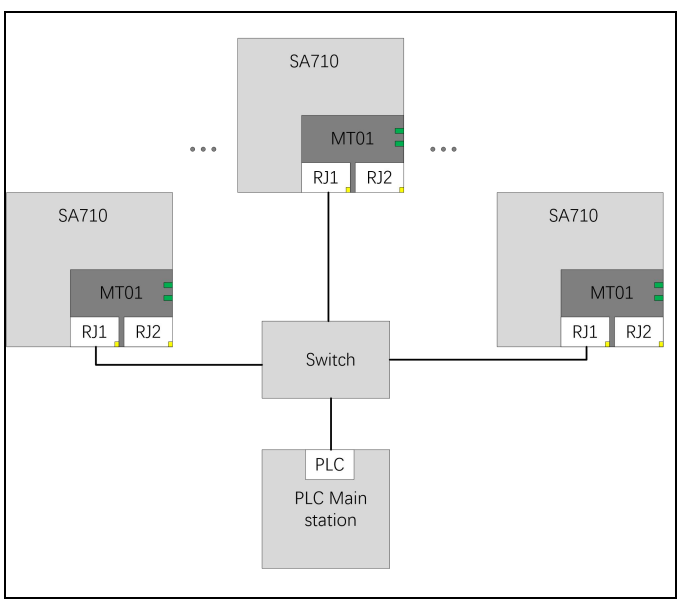
## 3.Electrical Connections

The MT01 module uses a standard Ethernet RJ45 socket to connect to the MODBUS TCP master station, and its pin signal definition is the same as the standard Ethernet pin, cross-wire and straight-wire are both available.

1) Chain network electrical connection

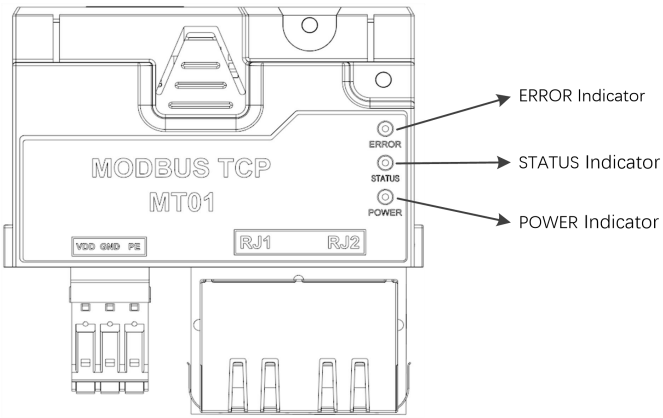



2) Star network electrical connection



# 4 .Status Indicator Description

MT01 expansion card can track bus communication failures through 2 status indicators. The diagnosis failure description is shown in the following table:




| Indicator light | Color | Status description |
|---|---|---|
| ERROR | Red light is always on | ModbusTCP communication error |
| | Red light is flashing | Internal fault |
| | Red light is off | Communication is normal |
| **STATUS** | Green light is always on | Communication messages in progress |
| | Green light is flashing | Communication messages in progress |
| | Green light is off | No communication message transmission |
| POWER | Green light is always on | The expansion card is powered on normally |
| | Green light is off | The power supply of the expansion card is abnormal or the inverter is not powered on |
| **Interface** | **Terminals or signals** | **Explanation** |
| ModbusTCP Communication interface | RJ1 | Communication interface1 |
| | RJ2 | Communication interface2 |

| Interface | Terminals or signals | Explanation |
|---|---|---|
| Independent power supply interface | VDD | Translation: External 24V power supply, 24V+/5%;<br>When the frequency converter is powered off, it can be powered by this port to ensure that MT01 does not lose connectivity |
| | GND | Power ground |
| | PE | Ground |

## 5.Related Parameters

| Parameter Number | Parameter Name | Comments |
|---|---|---|
| 1001 | IP Address[0] | IP address.<br>E.g,192.168.0.1 set the following parameters:<br>1001: 192, 1002: 168,<br>1003: 0, 1004:1 |
| 1002 | IP Address[1] | |
| 1003 | IP Address[2] | |
| 1004 | IP Address[3] | |
| 1005 | IP Address Mask[0] | IP address mask.<br>E.g,255.255.255.0 set the following parameters:<br>1005: 255, 1006: 255,<br>1007: 255, 1008: 0 |
| 1006 | IP Address Mask[1] | |
| 1007 | IP Address Mask[2] | |
| 1008 | IP Address Mask[3] | |
| 1009 | Gateway address[0] | Gateway address.<br>E.g,192.168.0.241 set the following parameters:<br>1009: 192, 1010: 168,<br>1011: 0, 1012: 241 |
| 1010 | Gateway address[1] | |
| 1011 | Gateway address[2] | |
| 1012 | Gateway address[3] | |

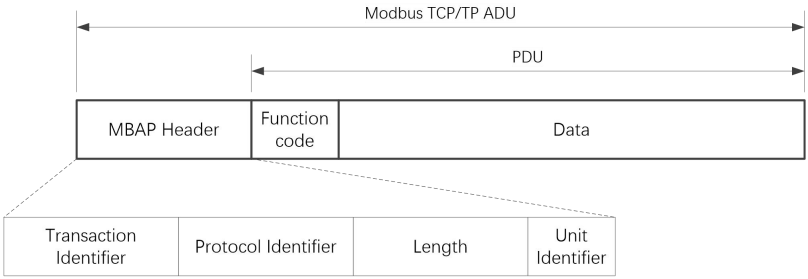
## 6.Technical Specifications

| Type | Specifications |
|---|---|
| Communication connector | RJ45 × 2 |
| Network standard | IEEE 802.3/802.3u |
| Physical layer | 10Base-T/100Base-TX |
| Cable Type | Category 5e shielding 100M |
| Protocol | Modbus TCP |
| Maximum number of clients | 6 |
| Port | 502 |

# 7.Protocol Description

## 7.1.Protocol Format

ModbusTCP frame format of MT01 is shown as the figure below:




**Specification:**

| Field | | Length | Description |
|---|---|---|---|
| MBAP Header | Transaction Identifier | 2 | Identification of a MODBUS Request / Response transaction. |
| | Protocol Identifier | 2 | 0 = MODBUS protocol |
| | Length | 2 | Number of following bytes |
| | Unit Identifier | 1 | Identification of a remote slave connected on a serial line or on other buses. |
| Function code | | 1 | Modbus function code |
| Data | | 2*N | Frequency Converter Parameter Address, Number of Parameters, and Parameter Values, etc. |

## 7.2.Function Code

| Function code | Description | Meaning |
|---|---|---|
| 0x03 | Read Holding Registers | Read drive functional parameters and running status parameters |
| 0x06 | Preset Single Register | Over-write individual drive functional parameters |
| 0x10 | Preset Multiple Registers | Over-write multiple Registers |

## 7.3.Register Address Definition

All the following register addresses are started from 0.

7.3.1.The Rules of Register Address of the Parameter Number

The parameters can be mapping to Modbus TCP register address. The read and

write characteristics and ranges of frequency converter parameters still follow the instructions provided in the frequency converter manual.The rules of register address of the parameter number are shown below:

**Register address = Parameter number – 1**

**For example:**

The register address of P0-30 is 30 - 1 = 29 (0x001D)

The register address of P9-11 is 911 - 1 = 910(0x038E)

**Attention:**

Parameters Group 8 and 9 are Read-only.

The Drive don't support write or read multiple parameters at a time.

7.3.2.Other Register Addresses Specification

In addition to parameter is mapped to Modbus registers, there are some additional registers within the drive which can be used to control the drive, monitor the drive's status.

| Register address | Specification | R/W |
|---|---|---|
| 9999 | Control command | W |
| 10000 | Frequency command （0~Fmax, unit 0.01Hz） | W |

7.3.3.Register 9999 specification

| Bit | Specification |
|---|---|
| Bit 7~0(run/stop control etc.) | 0x00: No function (Keep the original state unchanged)<br>0x01: Run forward<br>0x02: Reverse<br>0x03: Jog<br>0x04: Jog reverse<br>0x05: Stop<br>0x06: Coast<br>0x07: Reset<br>0x08 : Clear command (Clear all running and stopping instructions) |
| Bit 11~8(Preset value select) | 0000B:P0-30(Preset Value 0)<br>0001B: P0-31(Preset Value1)<br>…<br>1111B: P0-45(Preset Value 15) |

| Bit | Specification |
|---|---|
| Bit 13~12(Ramp time select) | 00B: Ramp 1<br>01B: Ramp 2<br>10B: Ramp 3<br>11B: Ramp 4 |
| Bit 14 | Reserved |
| Bit 15 | 1B: Enable Bit8~13 function<br>0B: Disable Bit8~13 function |

7.3.4.Communication ratio values

The Communication data is expressed by hexadecimal in actual application and there is no radix point in hexadecimal. For example, if you want to set P5-08 = 61.5, 61.5 can be magnified by 10 times into 615. So hex 0x0267 (615) can be used to express 61.5.

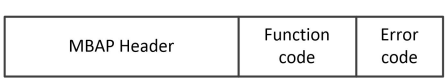
A non-integer can be timed by a multiple to get an integer and the integer can be called communication ratio values.

The communication ratio values are referred to the radix point of the setting range of default value in the functional parameter list. If there are radix point n, then the communication ratio value m is 10^n.

7.3.5.Error message

There may be errors in the communication process, for example, some parameters are read-only, but the PC/PLC sends a written directive, the drive will return an error message.

Error message data frame format is shown as the figure below:




Error message function code = requirements function code + 0x80

| Error code | Specification |
|---|---|
| 0x01 | Function code error, the drive does not support this kind of function code. |
| 0x02 | The register address is invalid. |
| 0x03 | The value exceeds the upper limit of the parameter. |
| 0x04 | Operation error. |

## 8.Fault Description And Disposal

| Type | ERR0R | STATUS | POWER | Corresponding measures |
|---|---|---|---|---|
| 1 | Red light flashing slowly | X | X | Internal fault |
| 2 | Red light is always on | X | X | ModbusTCP communication abnormality |
| 3 | X | Green light flashing | X | ModbusTCP communication is normal |
| 4 | X | X | Green light on | MT01 power supply is normal. |
| 5 | X | X | Green light off | MT01 power supply is abnormal or not powered on |

■ Innovate for more | win forever

■ Industry intelligence | Energy saving | Green power

**Quanzhou Factory**

Address:3# Zixin Road, Jiangnan Hi-Tech Industrial Park, Quanzhou, Fujian, China

Tel：0595-24678267 Fax：0595-24678203

**Service Network**

Website：www.savch.net

**Qualification**

Received ISO9001 and CE recognition



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