



Ontrac Ethernet

Communication Module



Technical Manual

(For Actuators with Software Above Rev.3.2)



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summary

Ontrac actuators provide Ethernet communication with an Ethernet external standard interface, which allows Ethernet communication with the main controller through the interface to realize complete and rich functionality. This manual is intended to guide the user in the correct configuration and operation of the actuator with Ethernet communication. The Ethernet communication function of the actuator can realize remote control and monitoring, providing higher flexibility and convenience.

Ethernet Hardware Parameters

categorization	parameters	numerical value
hardware interface	Mesh specification	RJ45 、 10/100Mbps 、 Crosstalk Adaptive
Power supply parameters	Operating Current	150mA@5V
working environment	operating temperature	-40~85°C
	Operating humidity	5% ~ 95% RH
software parameter	network protocol	IP、TCP/UDP、ARP、ICMP、IPV4、HTTP
	IP acquisition method	static IP、DHCP
	domain name resolution	support sth.
	operating mode	TCP Server

OSI model

The stack layer of Ethernet refers to a set of protocols and standards used to implement data communication in a computer network. The stack layer of Ethernet is often referred to as the "Ethernet stack" and consists of multiple layers, each responsible for a different function. The following are typical stack layers for Ethernet:

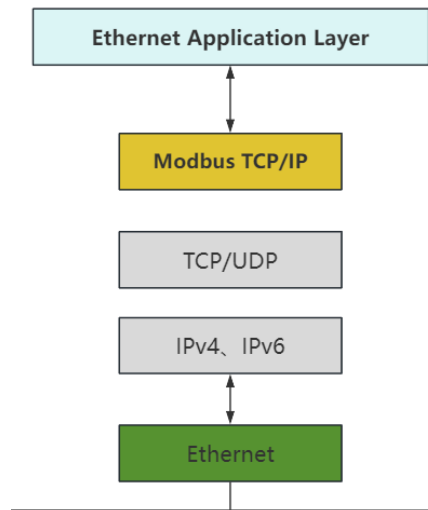


Figure 1 Modbus TCP Stack Layers

1. **Physical Layer:** The Physical Layer is the lowest layer of the Ethernet protocol stack and is responsible for defining the transmission medium, electrical characteristics and physical connections. It determines how bit streams are converted into voltage or optical signals and transmitted over cables or optical fibers.
2. **Data Link Layer (DLL):** The data link layer sits on top of the physical layer and is responsible for transmitting data frames from the physical layer to the target device and handling error detection and correction. The data link layer is also responsible for segmenting and reorganizing data, as well as defining frame formats and rules.
 - 2.1 **Logical Link Control (LLC) sublayer:** handles logical connection control at the data link layer and provides reliable data transmission services.
 - 2.2 **Media Access Control (MAC) sublayer:** handles media access control at the data link layer and manages data access on shared media.
3. **Network Layer:** The network layer sits on top of the data link layer and is responsible for transmitting data packets from the source host to the destination host, routing and addressing them via the Internet Protocol (IP). The network layer is also responsible for splitting data into smaller packets and providing error detection and correction.
4. **Transport Layer:** The transport layer sits on top of the network layer and is responsible for establishing reliable end-to-end communications between source and destination hosts. The transport layer provides protocols such as Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) for segmenting, reassembling, and transferring data.
5. **Application Layer:** The application layer is located above the transport layer and is the highest layer of protocols. It provides the protocols used by various applications, such as File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), and Simple Mail Transfer Protocol (SMTP), to implement specific network applications.

These layers form the stack layers of Ethernet, each with different functions and responsibilities. By working together at these levels, Ethernet enables reliable and efficient data communication.

Ontrac Ethernet Signaling

Ontrac offers a wide range of software and hardware products. The hardware products include Multitrac and the Easytrac family of actuators. Ontrac provides a wide range of options for controlling these actuators and one of them is the serial communication options through the use of an optional communications board called the Ontrac Modbus Module (OMM). The OMM works with both Multitrac and Easytrac actuators. The (OMM) performs the tasks of network interface, it collects data from the actuator and it issues commands from the master controller to the actuator.



Figure 2 Family of Ontrac Actuators

The Ontrac Modbus Module (OMM) provides a serial connection to the actuator for data transfer. Through the OMM the actuator can receive commands, settings and configurations and can transmit a wide selection of status information. The exact commands are based on the actuator - Easytrac or Multitrac - and can be .

Ontrac offers Modbus RTU protocol communications at a baud rate up to 38.4kbits/s. The factory default speed is 9.6kbits/s giving a 1.5km maximum distance between nodes.

Ontrac Ethernet

As can be seen from the above description, Ontrac has a very mature, stable, efficient and secure Modbus RTU communication mode. Ontrac Modbus communication uses half-duplex (two-wire) RS-485 at the physical layer and the Modbus RTU protocol to exchange data and transmit control signals between the actuator and the Modbus-enabled host system via the

data highway. Modbus is also available in other forms, including MODBUS TCP/IP. Modbus TCP (also known as Modbus TCP/IP) is a variant of the Modbus communication protocol designed specifically for Ethernet-based networks, allowing devices to communicate over a TCP/IP network. The Modbus protocol itself is an application-layer protocol used to exchange data in industrial automation and control systems, and Modbus TCP encapsulates it on top of the TCP/IP protocol. on top of the TCP/IP protocol for use in an Ethernet environment.

Key Features and Working Principles of Modbus TCP

Based on TCP/IP protocol

- Modbus TCP transmits data over the TCP/IP protocol, which means it can leverage existing Ethernet infrastructure, including switches, routers, and wireless networks.
- TCP (Transmission Control Protocol) ensures the reliability of data transmission and guarantees the integrity of data packets through acknowledgement and retransmission mechanisms.

Standard Modbus message structure

- Modbus TCP retains the basic message structure of the Modbus protocol, including function codes, data addresses, and data fields. The only difference is the addition of an MBAP (Modbus Application Protocol) header.
- The MBAP header contains fields such as transaction identifier, protocol identifier, length, and unit identifier

Client side-server model

- In Modbus TCP, communication uses a client-side-server model. The client side (e.g. a PLC or SCADA system) initiates the request, and the server (e.g. a remote I/O module or other automation device) responds to the request.
- Each Modbus TCP connection has a unique Internet Protocol Address and port number (the default port number is 502).

Support multiple function codes

- Modbus TCP supports a variety of function codes for reading and writing data registers, coils, discrete inputs, etc. For example, function code 01 is used to read coil status, function code 03 is used to read hold registers, etc.

Datagram

Message parsing

The message format is as follows.

| MBAP Header | Function code | Data |
| Header | PDU |

The MBAP header contains the following sections.

- Transaction ID
- Protocol ID
- Length
- UnitID

id	Name	Lengths	Clarification
1	Transaction ID transaction identification	2 bytes	Sequence number of the message, usually plus 1 for each communication, used to distinguish between different messages
2	Protocol ID protocol identifier	2 bytes	00 00 for modbus- tcp
3	Length	2 bytes	Unit length + length of PDUs
4	UnitID	unit identifier	1

Registers and Function Codes

There are four types of modbus operation objects: coil registers, discrete input registers, input registers, and holding registers.

Register Type	data type	Type of access	function code
coil register	bit	Read and Write	01H 05H 0FH
Discrete Input Register	bit	Read	02H
input register	2 bytes(word)	Read	04H
holding register	2 bytes(word)	Read and Write	03H 06H 10H

Coil registers and discrete input registers are byte-based registers that can store only switching variables. Coil registers are readable and writable, while discrete input registers are read-only.

The Input Register and Holding Register are 2 byte registers that can store discrete variables. The Holding Register is readable and writable, while the Input Register is read only. Commonly used function codes function as follows.

function code	functionality
0x01	Read single or multiple coil registers
0x02	Read Discrete Input Register
0x03	Read Holding Register
0x04	Read Input Register
0x05	Write Individual Coil Registers
0x06	Write Single Holding Register
0x10	Write Multiple Holding Registers
0x0F	Write multiple coil registers

Ontrac Ethernet User Interface

Ontrac brand actuators provide a standard Ethernet interface, through which the user can access the variable signals of the actuator to the host computer system for operation, the following is a physical diagram of the standard Ethernet interface of Ontrac brand actuators.

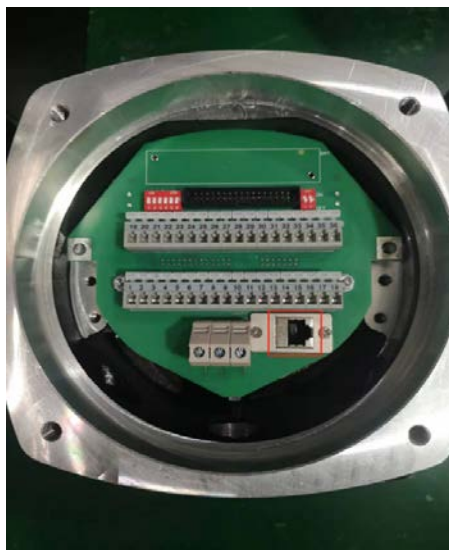


Figure 3 Modbus TCP Port for Multitrac

Physical property

Structure:

The RJ-45 connector is part of the 8P8C (8 Position 8 Contact) modular plug and socket.

The plug and socket have 8 pins each for transmitting data.

Appearance:

The plug is rectangular in shape, usually made of plastic, and has eight metal contacts inside.

The socket is fixed to the network device and has 8 corresponding contact points for connecting the plug.

Pin Definitions

The RJ-45 interface has eight pins, each with a specific function, and the following are common pin configurations:

10BASE-T and 100BASE-TX configurations:

pin number	code	color
1	Tx+	white-orange color
2	Tx-	orange (color)
3	Rx+	greenish white
4	-	Blue
5	-	white-blue
6	Rx-	green
7	-	white-brown
8	-	brown

1000BASE-T configuration: (full duplex communication using all four pairs of wires)

pin number	code	color
1	BI_DA+	white-orange color
2	BI_DA-	orange (color)
3	BI_DB+	greenish white
4	BI_DC+	Blue
5	BI_DC-	white-blue
6	BI_DB-	green
7	BI_DD+	white-brown
8	BI_DD-	brown

Configuration and Connectivity

We will configure the parameters of the Ethernet network port at the factory, and you need to configure the communication parameters correctly according to the parameters described below when you use it.

Configuration

- Modify the system's Ethernet ipv4 address to match the device's static IP.
Factory default device IP:
IP address: 192.168.0.7

Subnet mask: 255.255.255.0

default gateway: 192.168.0.1

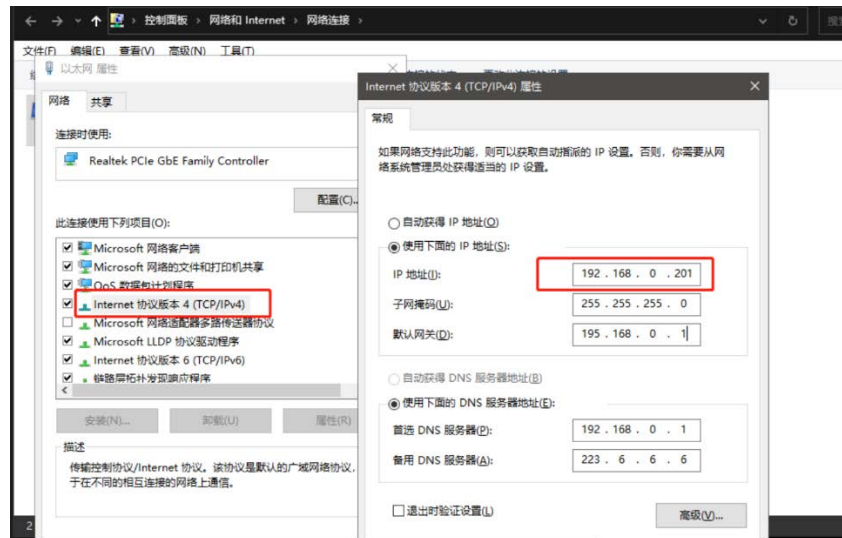


Figure 4 System network segment setting

NOTE: This step is especially important, if the device and the control host are not in a network segment, it will not be able to communicate successfully.

- Use the USR--M0 software to see how the actuator device is communicating with the host computer, and here you can see some basic configurations of the network port, and you can modify and save these configurations.

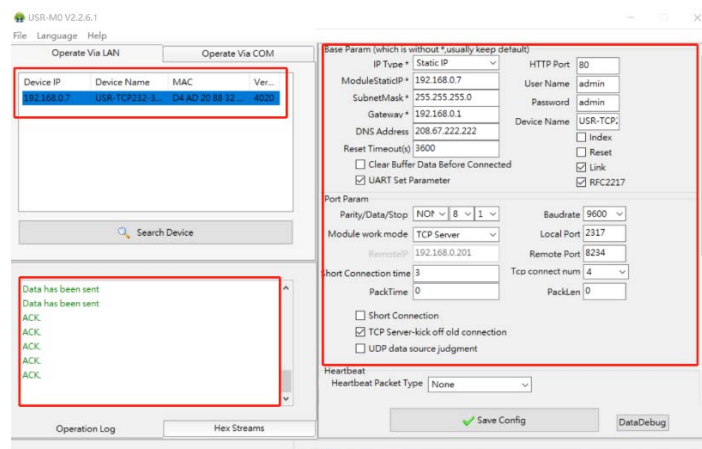


Figure 5 Modbus TCP Basic Information and Configuration

Connectivity

The next step is to be able to view information and manipulate variables on the device from the host computer. The next step will be to demonstrate Ontrac actuator Ethernet communication using the Modbus Poll example.

Communication Parameters:

Connection: Modbus TCP/IP

IP Address or Node Name: 192.168.0.7

Server Port: 2317

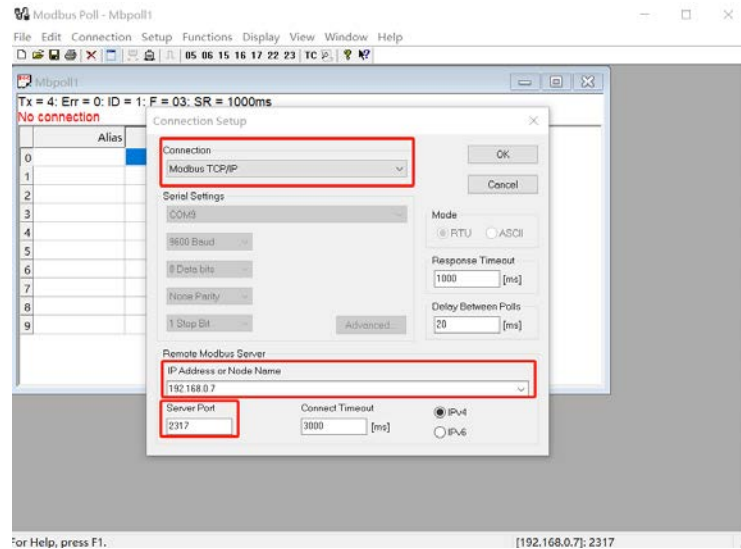


Figure 6 Modbus Poll Connecting to Modbus TCP Interface
After a successful connection you can operate on the actuator variables.

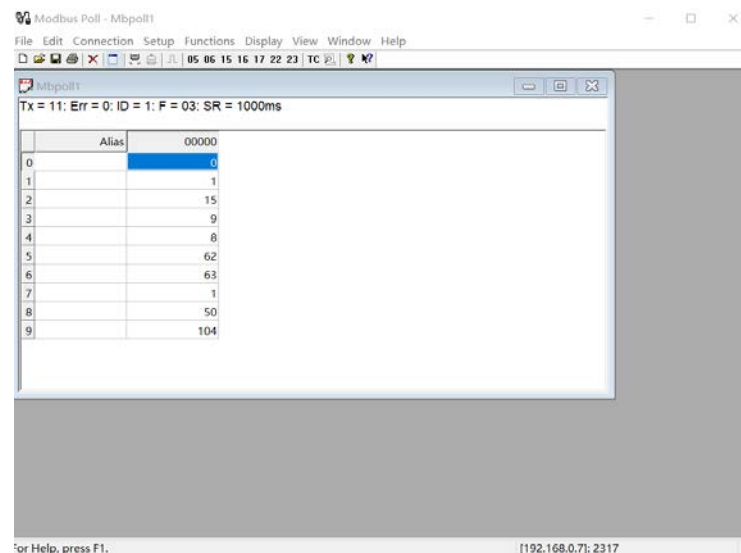


Figure 7 Modbus Poll Software Modbus TCP Variable Operator Interface The table of executor variables is shown below.

Address Table (Writable Register) for the Multitrac Actuator and the Function Code 10H for reading the Instruction Register (HOLDING-REGISTER).

Register Address (Hexadecimal Number)	Parameter Name	Unit	Default	Corresponding Menu Position	Meaning
110H	Torque_O			P1.1	The percentage of switch off torque for valve opening
111H	Torque_C			P1.2	The percentage of switch off torque for valve closing

112H	SPEED_O			P1.3	Percentage of valve opening speed
113H	SPEED_C			P1.4	Percentage of valve closing speed
114H	CUTOFF_O			P1.5	Switch off mode for "OPEN" direction
115H	LIMIT_O			P1.6	Switch off position for "OPEN" direction
116H	CUTOFF_C			P1.7	Switch off mode for "CLOSE" direction
117H	LIMIT_C			P1.8	Switch off position for "CLOSE" direction
120H	OPER_KEY			P2.1	Local operation button Responding mode set up
121H	Digital_INP			P2.2	Set up for remote on/off control signal response mode
122H	START_O			P2.4	Set up for increasing effective torque for "OPEN" direction
123H	START_C			P2.5	Set up for increasing effective torque for "CLOSED" direction
124H	SLAVE_ADD			P2.6	Set up Profibus address
125H	Modbus_ADD			P2.7	Set up Profibus DP with slave redundancy
150H	BE1_S			P7.1	BE1 input setting
151H	BE2_S			P7.2	BE2 input setting
152H	BE3_S			P7.3	BE3 input setting
153H	BE4_S			P7.4	BE4 input setting
154H	VALVE_1P			P7.5	Intermediate valve position indication 1
155H	VALVE_2P			P7.6	Intermediate valve position indication 2
160H	BA1_S			P8.1	BA1 setting
161H	BA2_S			P8.2	BA2 output setting
162H	BA3_S			P8.3	BA3 output setting
163H	BA4_S			P8.4	BA4 output setting
164H	BA5_S			P8.5	BA5 output setting
165H	BA6_S			P8.6	BA6 output setting
166H	BA7_S			P8.7	BA7 output setting
167H	BA8_S			P8.8	BA8output setting
280H	ANO_POL			P3.9	Analog output polarity setting
281H	ANI_SET			P3.10	Actuator's responding mode when the analog input signal is lost
282H	ANI_POS			P3.11	
283H	ANI_REF			P3.12	Analog input signal range selection
284H	ESD_POS			P3.13	ESD valve's target position setting
285H	MODE			P3.3	Control mode selection
286H	Analog Resolution			P3.8	Dead-zone adjustment

0500H	PositionSV(H)			/	Operation control setting value
0501H	PositionSV(H)			/	

Address Table (R/W) for Multitrac Actuator and the Function 03H for reading the Instruction Register (HOLDING-REGISTER)

Register Address (Hexadecimal Number)	Parameter Name	Unit	Default	Corresponding Menu Position	Meaning	R/W
110H	Torque_O			P1.1	The percentage of switch off torque for valve opening	R/W
111H	Torque_C			P1.2	The percentage of switch off torque for valve closing	R/W
112H	SPEED_O			P1.3	Percentage of valve opening speed	R/W
113H	SPEED_C			P1.4	Percentage of valve closing speed	R/W
114H	CUTOFF_O			P1.5	Switch off mode for "OPEN" direction	R/W
115H	LIMIT_O			P1.6	Switch off position for "OPEN" direction	R/W
116H	CUTOFF_C			P1.7	Switch off mode for "CLOSE" direction	R/W
117H	LIMIT_C			P1.8	Switch off position for "CLOSE" direction	R/W
120H	OPER_KEY			P2.1	Local operation button Responding mode set up	R/W
121H	Digital_INP			P2.2	Set up for remote on/off control signal response mode	R/W
122H	START_O			P2.4	Set up for increasing effective torque for "OPEN" direction	R/W
123H	START_C			P2.5	Set up for increasing effective torque for "CLOSED" direction	R/W
124H	SLAVE_ADD			P2.6	Set up Profibus address	R/W
125H	Modbus_ADD			P2.7	Set up Profibus DP with slave redundancy	R/W
150H	BE1_S			P7.1	BE1 input setting	R/W
151H	BE2_S			P7.2	BE2 input setting	R/W
152H	BE3_S			P7.3	BE3 input setting	R/W

153H	BE4_S			P7.4	BE4 input setting	R/W
154H	VALVE_1P			P7.5	Intermediate valve position indication 1	R/W
155H	VALVE_2P			P7.6	Intermediate valve position indication 2	R/W
160H	BA1_S			P8.1	BA1 setting	R/W
161H	BA2_S			P8.2	BA2 output setting	R/W
162H	BA3_S			P8.3	BA3 output setting	R/W
163H	BA4_S			P8.4	BA4 output setting	R/W
164H	BA5_S			P8.5	BA5 output setting	R/W

Error and Alarm Registers

The table below shows the error and alarm registers for the Multitrac Modbus Communication module. The content of the registers can be read using the 03 function. Examples of these request and functions are shown in subsequent sections.

Address	Register Content															
0x0400-0x0401	ERROR SIGNALS (0x0401)								ERRORS SIGNAL (0x0400)							
	RELAY	AUXPOWER	BLOCK_C	BLOCK_O	VOL_UNDR	VOL_OVER	IPM_FLT	TORQUE_C	TORQUE_Q	END_POS	HANDWHL	TEMP_ELC	TEMP_MOT	PHASE	BV_EXCPT	ELECTR
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
0x0402-0x0403	ERROR SIGNALS (0x0403)								ERROR SIGNALS (0x0402)							
	----	----	----	----	----	----	----	----	----	----	----	----	ACT_INT	24_EXCPT	HALL_SEN	MOT_LINE
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
ACT_INIT: Actuator Initialization Failure																
0x0404-0x0405	ALARM SIGNALS (0x0405)								ALARM SIGNALS (0x0402)							
	----	VOL_UNDR	VOL_OVER	AC_PHASE	ACT_TYPE	SETPOINT	LOAD_EXC	STEP/SH	CNT_TRQ	24-VOLT	TEMP_ELC	TEMP_MOT	TORQUE_C	TORQUE_O	BAT_EMPTY	BAT_CHAN
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00

Troubleshooting

In general, most problems associated with Modbus-enabled actuators are caused by wiring errors and are easy to test and fix. And are easy to test and fix. One of the issues that needs to be checked is wiring. The technician needs to verify that the network cable is connected to the correct actuator terminals.

Proper wiring diagrams are available from Cloudtrac. Each Ontrac actuator comes with a permanent QR code. Permanent QR Code. Simply scan the QR (Quick Response) code on the actuator to connect to Cloudtrac. you can connect to Cloudtrac. the cloud provides specific information about your actuator.

Broken cables are also a source of errors, which can result in signals not reaching the device, as well as causing undesirable effects such as noise and reflections. Any form of commissioning that involves exchanging cables or changing any electrical connections or changing any electrical connections should only be carried out after the actuator has been de-energized.

If communication problems persist after verifying the electrical connections, verify that the system connection, IP address and node, and Server Port are correct. and match the settings in the known working actuator. Also check that the Ethernet ipv4 address matches the static IP of the device.

If communication problems persist, contact the Ontrac Technical Support team via the support page on the website ([.](#)). Contact the Ontrac Technical Support team via the support page on the website (www.ontracactuators.com). Support personnel will request information about the actuator and provide assistance as necessary. and provide assistance as necessary.

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