# Gripper Product Operation Manual

## Articulated Gripper

### CAN Version

# Preface

Thank you for purchasing and using the Raybot articulated gripper.

This manual introduces the usage methods, precautions, and other information of the articulated gripper. Relevant users, commissioning personnel, and maintenance personnel must read it carefully before operation.

If you need to learn about other products of our company, please feel free to contact us.

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# Revision History

| Date | Version | Description |
| --- | --- | --- |
| 20260206 | V1.0 | Initial version, documenting operation and command-related instructions |

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# Usage Precautions

## Unboxing

1. Please unpack in layers in order. Violent striking to unpack is strictly prohibited.
2. Please check the checklist to verify whether the gripper name is correct, whether the accessories are complete, and whether there is any damage on the surface of the equipment and its accessories. If there are any problems, do not install it and contact our company in a timely manner.

## Test Usage

1. Do not plug or unplug the power cord and communication cable while powered on. Ensure that the power indicator is off before performing wiring and maintenance on the equipment.
2. It is strictly prohibited to disassemble any device or accessory of the equipment while powered on, otherwise there is a risk of electric shock.
3. Failure to ground the gripper housing may cause charge accumulation on the housing, affecting the normal operation of the gripper, and even causing personal injury; the wiring cables must comply with the corresponding wire diameter and shielding requirements, and the shielding layer of the shielded cable must be reliably grounded.
4. Please conduct a risk assessment before use, and take appropriate measures to ensure personal safety and equipment safety.
5. Set appropriate position limits, speed limits, current limits, etc. Exceeding the limits may damage the gripper and even threaten personal safety.
6. To prevent unexpected accidents, please perform a no-load trial run of the gripper.
7. The gripper is a precision device. Do not strike the gripper forcefully with a hammer or similar tools. Please handle with care to prevent damage such as cracks caused by the gripper falling off the table surface.
8. During the operation of the gripper, the surface may become very hot. Please take note of protection. When the surface temperature exceeds 40°C, avoid prolonged contact to prevent low-temperature burns. When the surface temperature exceeds 85°C, avoid touching to prevent minor burns.

## Storage

1. Please refer to the manual for strict requirements on transportation and storage temperature and humidity, and avoid direct sunlight, strong magnetic fields, strong electric fields, strong vibration, and other locations. Recommended temperature -20°C~60°C, relative humidity ⩽85% (no condensation).
2. Avoid storing the gripper for more than 3 months. If the storage time is too long, please take more stringent protective measures and necessary inspection and maintenance.
3. Please pack the gripper strictly before transportation. It is strictly prohibited to transport it together with equipment that may affect it.

# After-sales Policy

This product strictly implements the following after-sales services in accordance with the "Law of the People's Republic of China on the Protection of Consumer Rights and Interests" and the "Product Quality Law of the People's Republic of China":

- For any user who purchases this product, if quality problems occur within 7 days, return and exchange service is available. When returning or exchanging, a valid purchase voucher and returned invoice should be provided, and the returned product should have intact functions, no appearance damage, and complete accessories.
- For any user who purchases this product, free warranty service is provided within one year from the day following the signing for receipt. If there is man-made damage, man-made disassembly, etc., warranty service will not be provided. If after testing it is confirmed that the gripper needs replacement parts, the seller and the customer shall negotiate whether to purchase repair parts additionally.
- From the day following the signing for receipt, within 7 to 15 days, if quality problems occur with the product, exchange service is available after confirmation. When exchanging, a valid purchase voucher and returned invoice should be provided, and the returned product should have intact functions, no appearance damage, and complete accessories.
- The following situations are not covered by the warranty

> 1. Burning of the gripper caused by installation and connection of other control equipment not in accordance with the requirements of the user manual.
> 2. Use exceeding the specifications or standards shown in the user manual (such as incorrect gripper parameter settings).
> 3. Storage method and working environment exceeding the specified range of the user manual (such as contamination, salt damage, condensation, etc.).
> 4. Product damage caused by abnormal working conditions (such as falling, impact, liquid ingress, severe impact, etc.).
> 5. Product damage caused by force majeure (natural disasters, fire, flood, etc.).
> 6. Damage to the gripper caused by the user disassembling the product on their own.
> 7. Exceeding the warranty period provided by the after-sales policy.
> 8. Unable to provide a valid purchase voucher.

In the event of a gripper failure, you must contact the sales team at the first instance to obtain a solution. The user shall not disassemble or maintain the articulated gripper for any reason, otherwise the warranty service will be terminated.

# Gripper Overview

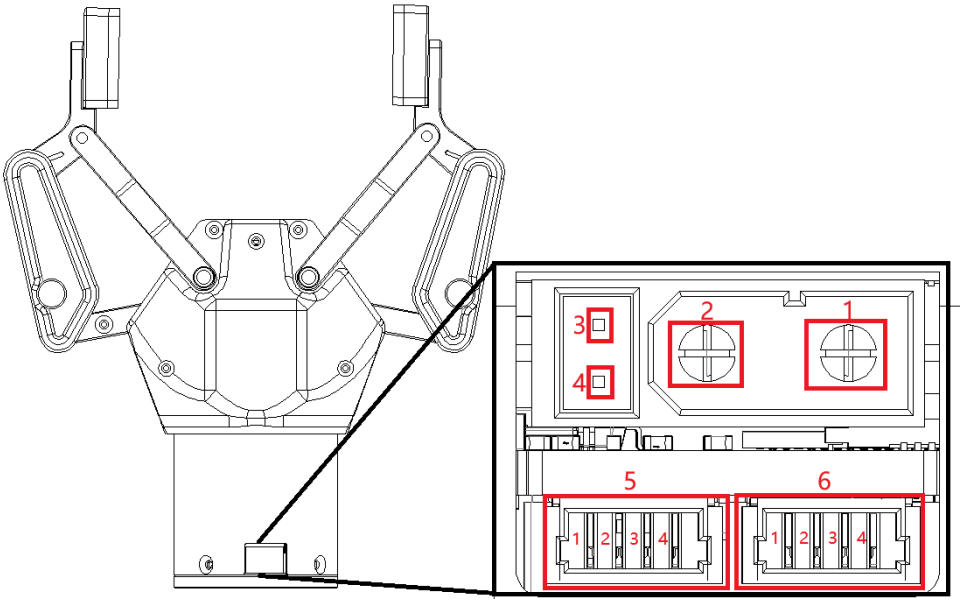
The articulated gripper has two adaptive parallel mechanical joint fingers (hereinafter referred to as joint fingers). Each joint finger consists of multiple linkage mechanisms and a spring. This design simplifies the control method of grasping, enabling the joint fingers to automatically adapt to the shape of the objects they grasp.

**Force and Position Controllable**: The gripper can be programmatically adjusted for clamping position and clamping force value. During gripper operation, the clamping force is related to the set value.

**Multiple Communication Methods**: The gripper body uses the standard CAN2.0 communication protocol for control and the EtherCAT communication protocol for control.

**Clamping Detection**: During the clamping process, a combination of force control and position control is adopted.

# Interface Definition




| No. | Interface Definition | Interface Description |
|---|---|---|
| 1 | DC+ | 24~48V power positive |
| 2 | DC- | 24~48V power negative |
| 3 | CAN_L | CAN network signal |
| 4 | CAN_H | CAN network signal |
| 5 | 1.R+ 2.R- 3.T+ 4.T- | EtherCAT input interface |
| 6 | 1.R+ 2.R- 3.T+ 4.T- | EtherCAT output interface |

# Host Computer

For all functions of the host computer, please refer to this document:

上位机使用说明书--V3驱动.pdf

To download the host computer software, click the link below:
https://cloud-1251007531.bcdn8.com/maita0712/uploads/20251120/MYACTUATOR_%E8%B0%83%E8%AF%95%E8%BD%AF%E4%BB%B6_V4.0_20250704.zip

# CAN Command Description

## Parameters

- Bus interface: CAN
- Baud rate: 1Mbps

## Message Format

- Identifier: Single gripper command send: 0x140 + ID(1~32)
- Frame format: Data frame
- Frame type: Standard frame
- DLC: 8 bytes

## Gripper ID Setting

The host sends this command to set and read the CAN ID. Communication ID uses 0x300, and all devices on the bus will receive and process this command. When modifying, please note whether multiple devices are connected, as this may simultaneously modify the IDs of multiple devices to the same value.
The host sends this command to set and read the CAN ID, with the following parameters.

1. Read/Write flag ReadWriteFlag is of bool type, 1 for read, 0 for write;
2. CANID, size range (#1~#32), uint16_t type (synchronized with host computer function), device identifier 0x140 + ID(1~32).

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x79 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Read/Write flag | ReadWriteFlag |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | CANID | 0x01~0x20 |

Gripper reply parameters are as follows.

1. The gripper replies to the host after receiving the command, in the following two situations:

2. Set CANID, range 1-32, returns the original command;

3. Read CANID, reply parameters are as follows.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x79 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Read/Write flag | ReadWriteFlag |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | CANID | 0x01~0x20 |

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x300 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x300 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x01 |

## Initialize Gripper

The host sends this command to initialize and set the gripper zero position. It is used to recalibrate the gripper and return to the zero position. Do not control the gripper during initialization. The initialization time is about 1-5 seconds. Please perform control after initialization is complete. **Note: This operation is required each time upon power-on**

The host sends this command to initialize and set the gripper zero position, with the following parameters.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x65 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

Gripper reply parameters are as follows.

The gripper replies to the host after receiving the command. The reply data with status byte 0x00 is sent first, and after homing is complete, a reply data with status byte 0x01 will be automatically sent to indicate that initialization is complete.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x65 |
| DATA[1] | Status byte | 0x00/0x01 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**Note:**

**During the initialization process, the maximum position is being searched. If the position is obstructed during this process, an incorrect maximum position will be identified, causing the gripper to not open to the actual maximum position when opening.**

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0x65 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x65 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Wait for initialization to complete, then another reply command will be sent:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x65 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

## Force Control Position Closed-loop

The host sends this command to control the opening and closing stroke of the gripper.

Control value **Stroke percentage**, uint8_t type, value range 0~100, where 0 is the closed state and 100 is the fully open state. In units of percentage of maximum stroke, the gripper stroke direction is determined by the difference between the target percentage and the current percentage. The maximum stroke of the gripper is limited by the maximum positive angle in the host computer.

Control value **Speed percentage** limits the maximum speed of the gripper opening and closing, uint8_t type, value range 0~100, corresponding to the percentage of the rated speed as the actual rotation speed. The speed of the gripper is limited by the rated speed in the host computer.

Control value **Maximum torque** limits the maximum torque of the gripper output shaft, uint8_t type, value range 0~255, in units of percentage of rated current, i.e., 1% * rated current / LSB. If the given current is greater than the stall current, the force control mode is not enabled. The maximum torque current of the gripper is limited by the gripper stall current value in the host computer.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0xAA |
| DATA[1] | Maximum torque | 0x01~0xFF |
| DATA[2] | Speed percentage | 0x00~0x64 |
| DATA[3] | Stroke percentage | 0x00~0x64 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

Gripper reply parameters are as follows.

The gripper replies to the host after receiving the command. This frame data

contains the following parameters.

1. Gripper temperature (int8_t type, 1°C/LSB);
2. Gripper torque current value iq (int16_t type, 0.01A/LSB);
3. Gripper output shaft rotation speed (int16_t type, 1dps/LSB);
4. Gripper set maximum torque maxTorque (uint8_t type, value range 0~255);
5. Gripper stroke percentage Itinerary (uint8_t type, value range 0~100);

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0xAA |
| DATA[1] | Gripper temperature | (uint8_t)(temperature) |
| DATA[2] | Torque current low byte | (uint8_t)(iq) |
| DATA[3] | Torque current high byte | (uint8_t)(iq>>8) |
| DATA[4] | Gripper speed low byte | (uint8_t)(speed) |
| DATA[5] | Gripper speed high byte | (uint8_t)(speed>>8) |
| DATA[6] | Maximum torque | (uint8_t)(maxTorque) |
| DATA[7] | Stroke percentage | (uint8_t)(Itinerary) |

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0xAA | 0x0A | 0x64 | 0x00 | 0x64 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0xAA | 0x32 | 0x00 | 0x00 | 0x00 | 0x00 | 0x0A | 0x64 |

## Read Gripper Error Status

The host sends this command to read the current gripper temperature, voltage, and error status flags.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x9A |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

After receiving the command, the gripper replies to the host. This frame data contains the following parameters:

1. Gripper temperature (int8_t type, unit 1°C/LSB);
2. Voltage (uint16_t type, unit 0.1V/LSB);
3. Error flag errorState (uint16_t type, where each bit represents a different gripper status).

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x9A |
| DATA[1] | Gripper temperature | (uint8_t)(temperature) |
| DATA[2] | MOS temperature | (uint8_t) (motorMOStemperature) |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Voltage low byte | (uint8_t)(voltage) |
| DATA[5] | Voltage high byte | (uint8_t)(voltage>>8) |
| DATA[6] | Error status low byte | (uint8_t)(errorState) |
| DATA[7] | Error status high byte | (uint8_t)(errorState>>8) |

The System_errorState status table of system abnormal status values is as follows:

| System_errorState Value | Status Description |
|---|---|
| 0x0002 | Gripper stall |
| 0x0004 | Low voltage |
| 0x0008 | Overvoltage |
| 0x0010 | Phase current overcurrent |
| 0x0040 | Power limit exceeded |
| 0x0080 | Calibration parameter write error |
| 0x0100 | Overspeed |
| 0x0800 | Drive board MOS overtemperature |
| 0x1000 | Gripper overtemperature |
| 0x2000 | Encoder calibration error |

When multiple errors occur simultaneously, the error status bits will be displayed cumulatively. For example, if the number 0x0016 appears, it represents the sum of 0x0002+0x0004+0x0010, meaning that the gripper currently has three errors: stall, low voltage, and phase current overcurrent.

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0x9A | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x9A | 0x32 | 0x00 | 0x01 | 0xE5 | 0x01 | 0x04 | 0x00 |

## Gripper Reset Command

The host sends this command to reset the system program.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x76 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

After receiving the command, the gripper will reset and will not return a command.

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0x76 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

## Read Gripper Current Running Data

The host sends this command to read the current gripper temperature, rotation speed, and encoder position.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x9C |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

Gripper reply parameters are as follows.

The gripper replies to the host after receiving the command. This frame data contains the following parameters.

1. Gripper temperature (int8_t type, 1°C/LSB);
2. Gripper torque current value iq (int16_t type, 0.01A/LSB);

3. Gripper output shaft rotation speed (int16_t type, 1dps/LSB);

4. Gripper set maximum torque maxTorque (uint8_t type, value range 0~255);

5. Gripper stroke percentage Itinerary (uint8_t type, value range 0~100);

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x9C |
| DATA[1] | Gripper temperature | (uint8_t)(temperature) |
| DATA[2] | Torque current low byte | (uint8_t)(iq) |
| DATA[3] | Torque current high byte | (uint8_t)(iq>>8) |
| DATA[4] | Gripper speed low byte | (uint8_t)(speed) |
| DATA[5] | Gripper speed high byte | (uint8_t)(speed>>8) |
| DATA[6] | Maximum torque | (uint8_t)(maxTorque) |
| DATA[7] | Stroke percentage | (uint8_t)(Itinerary) |

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0x9C | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x9C | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

## Gripper Stop Command

The host sends this command to turn off the gripper output and simultaneously clear the gripper running status, exiting all closed-loop modes.

| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Command byte | 0x80 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

The gripper replies to the host, with the frame data being the same as sent by the host.

Example:

Send command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x141 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

## Gripper Clamped Object Drop Auto-reply

When the gripper is in the clamping state, if the clamped object falls, the gripper will automatically reply with this command.

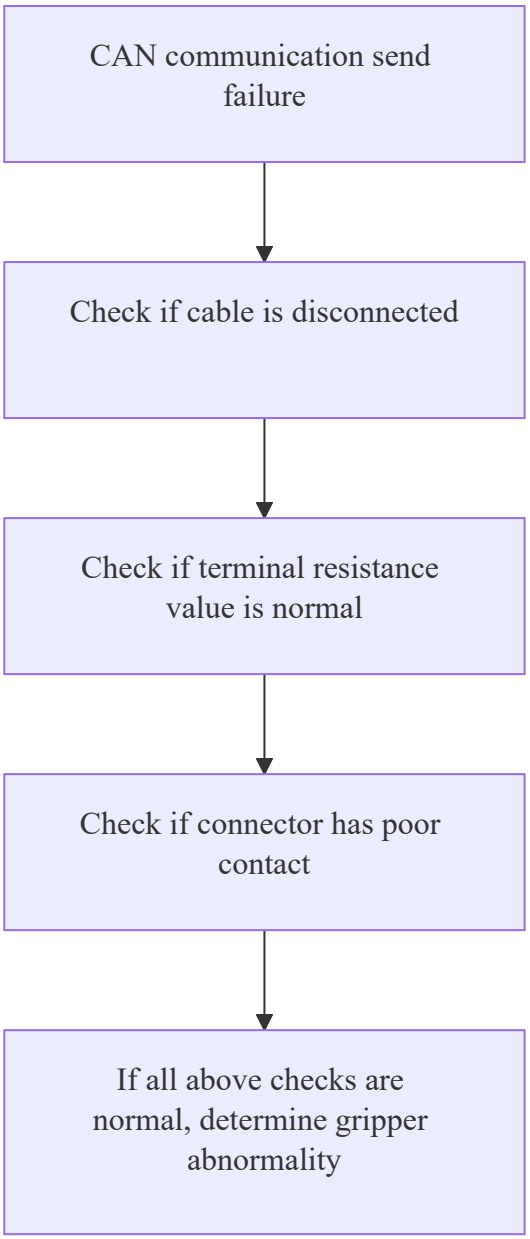
| Data Field | Description | Data |
|---|---|---|
| DATA[0] | Fixed | 0x01 |
| DATA[1] | Fixed | 0x10 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

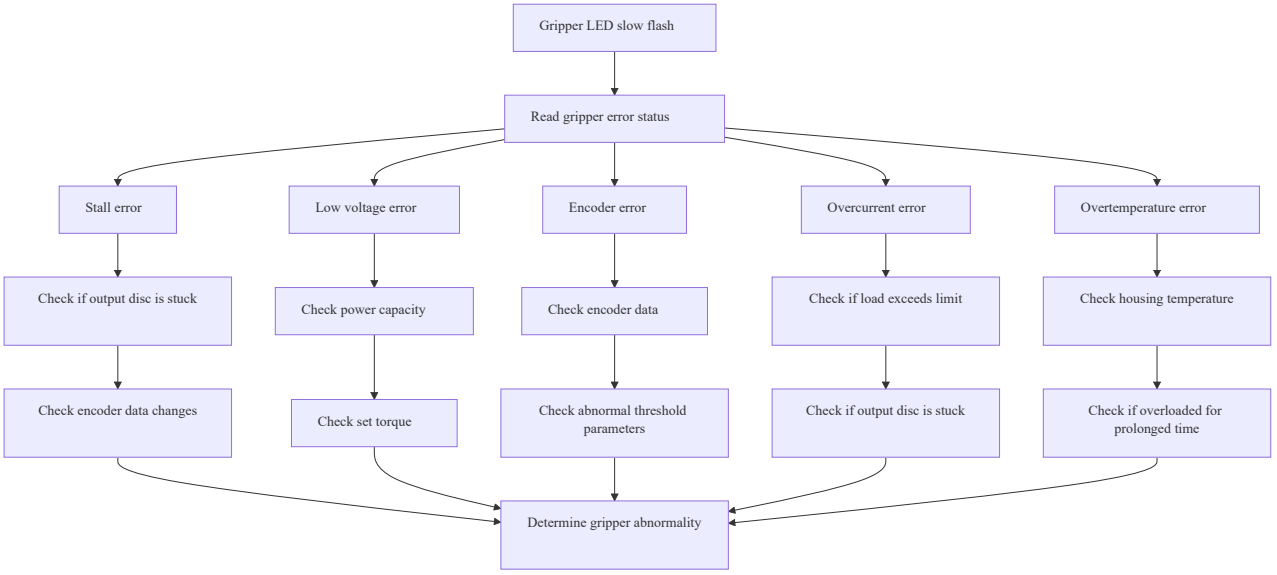
Example:

Auto-reply command:

| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x241 | 0x01 | 0x10 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

# Common Fault Troubleshooting and Handling Methods



# Periodic Inspection

The steps for periodic inspection of the gripper are as follows:

1. The movement of the fingers must be symmetrical and smooth: test the stroke by opening the fingers, the fingers must return to the initial starting position by themselves; check whether the gripper has any stuttering or jittering during operation.
2. Finger rubber wear must not affect clamping. If the wear is severe and affects the gripper's ability to grasp objects, please replace the finger pads.
3. Check for collision damage. If there is any damage, please contact technical support.
4. Check all screws for rust or damage. If any, please replace them.

**Note**

**· Before performing any operation on the gripper, please first turn off the robot and clamping power.**

**· Cleaning personnel must wear anti-static wristbands and other anti-static measures to avoid damaging electronic components.**