人民伯朗特

人民对美好生活的向往
就是伯朗特奋斗的目标

BORUNTE Process Instruction

Borunte Remote Communication Protocol Manual

BRT–C–RC–HC–V1.1–RLS–1_YC–EN–2024.11.27

Z Tao = X Method + Y Tactics + 1 Tool
‖
Practical Philosophy + Yin's Economics + Regulations Governing Enterprises = Common Prosperity

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Practical Philosophy

‖

Self-discipline + Practical + Simplicity + All beings are equal

‖

BORUNTE goals:

BORUNTE's goal: Annual net profit $\geq$ 1 yuan

Step 1: Realize an annual operating income of over
RMB 1 trillion and obtain over 10,000 licensed invention patents.

Step 2: Realize an annual operating income of over
RMB 10 trillion and obtain over 100,000 licensed invention patents.

Step 3: Realize an annual operating income of over
RMB 100 trillion and obtain over 1,000,000 licensed invention patents.

+

Common Prosperity Methodology

BORUNTE: BORUNTE adopts "BOM pricing method", this is the people's longing for a better life, and also the goal that BORUNTE strives for.

Integrator: Place an order for 1000 sets BORUNTE products of a single model, then you can become the integrator of BORUNTE, you should complete the payment and delivery within 120 months. BORUNTE provide 50% rebate for integrator. And the rebate can be cashed if you place an order again and the order quantity must be greater than twice the number of rebates.

Supplier: The payment method is cash transfer for the current month, which is the reconciliation period from the 16th of the previous month to the 15th of this month. The cash transfer will be completed before the 25th of this month and under the premise of ensuring quality and the cost has priority, the supplier will become the primary supplier.

+

学习大使好榜样

$1 = C \frac{4}{4}$

"Yin's Economics"

The material world of common prosperity is chief daily necessities, while the spiritual world is additional items of life. In addition, BORUNTE 's "Practical Philosophy" is "harmony between heaven and humanity, and common prosperity", while in Ambassador Yin's "Yin's Economics", the philosophy is "negative gross profit margin and positive cash flow", which is "the unity of Taoism and invincibility". In other words, BORUNTE can achieve "eternal life".

If a person doesn't have it, they want to have it, but once they have it, they want more and worry about losing it. This is why you can have money, not more than me. But the unchanging pursuit of humanity for 5000 years is: you don't envy me for being richer than you, and I don't envy you for being richer than me. That is to say, in the market, earning is also what you should earn, and losing is also what you should lose. And the common prosperity can only be achieved by yourself. This is the market where all things grow, all flowers bloom, a thousand people and a thousand faces and stand firm for a thousand years. That is to say, Ambassador Yin is just a "small potato" in the market.

Integrator is people, and people can be integrator, supplier is people and people can be supplier. That is, what the people need, what the BORUNTE produce. That is to say, the people will never refuse the "negative gross profit margin positive cash flow" BORUNTE products. But the people will definitely worry about the "negative gross margin profit negative cash flow" BORUNTE products. That is the end of "negative gross profit margin positive cash flow" is "positive gross profit margin and positive cash flow" , which means that BORUNTE has achieved common prosperity under the innovative drive of "positive gross profit margin and positive cash flow".

The embryonic form of the BORUNTE's "black hole economy" with "negative gross profit margin and positive cash flow" has emerged, but at its end lies the "white hole economy" with "positive gross profit margin and positive cash flow". This is the formation of "Yin's economics" in "The Market Theory" and "Black and White Hole Economy", but its underlying logic is actually BORUNTE's "Practical Philosophy". That is to say, the theoretical innovation of "practical philosophy+Yin's economics=common prosperity" has been completed.

Regulations Governing Enterprises

On April 1, 2024, BORUNTE officially began the era of "Regulations Governing Enterprises"

One unity pervading all things=BORUNTE target: annual net profit>1 yuan=Integrator buying and selling BORUNTE product=Supplier quality and cost=Common Prosperity

1 tool=Regulations governing enterprise=Integrator buying and selling BORUNTE product=Supplier quality and cost

Safety Precautions

Before using this process package, please ensure that you thoroughly read and understand this specification and any accompanying materials. This specification categorizes safety precautions into "Danger," "Caution," "Mandatory," and "Prohibition."

 Caution: Mishandling may pose risks, possibly resulting in moderate injuries, minor accidents, or equipment malfunction.

 Prohibition: Actions that are strictly forbidden.

 Mandatory: Actions that must be strictly adhered to.

It should be noted that even items listed under "Caution" can have serious consequences depending on the situation. Hence, it is crucial to strictly adhere to all instructions.

 Danger: Mishandling may lead to deaths or severe accidents.

 Danger

☆**Press the emergency stop button on the demonstrator, confirm that main power supply of servo motor has been cut off, the motor is powered off and under braking system before operating the robot. Once the servo power is turned off, the teaching pendant will trigger an emergency stop alarm, the control cabinet's red alarm light will flash, and the buzzer will sound.** In an emergency, if the robot cannot be stopped promptly, it may result in personal injury or equipment damage.

Emergency Stop Button

☆**When servo power supply needs to be switched on after releasing emergency stop, remove the fault that triggers emergency stop before connecting the servo power supply.** Actions due to mishandling of the robot may result in serious injuries.

☆**Please follow the rules below when making** demonstration within the activity range of robot: Observe the robot from the front side

Follow the operation steps strictly

Consider contingency plans if the robot unexpectedly moves towards your location and ensure there is a designated escape route just in case.

Actions due to mishandling of the robot may result in serious injuries.

☆**Make sure there's no person within the motion range of robot and operator is in a safe position before starting the following operation:** Switch on power supply of robot control cabinet.

When programming the robot using the teaching pendant. During test runs.

In automatic mode.

Accidentally entering the robot's operational range or making contact with the robot may result in serious injuries. In case of abnormalities, immediately press the emergency stop.

 Caution

☆**Robot operations must be confirmed.**
The operator has received safety training
The operator has adequate understanding of the robot's movement characteristics.
The operator has sufficient knowledge of the robot's hazards
Do not operate after drinking

☆**Before using the robot teaching device, check the following points and address any anomalies promptly or take other necessary measures.**
Robot movement is normal
The origin is calibrated correctly
External auxiliary devices associated with the robot are functioning properly.

☆**Put the demonstrator back and fix it after use.**
If the teaching device is carelessly left on the robot, fixture, or ground, it may collide with the robot or fixture when the robot moves, potentially causing injury or equipment damage.
Prevent accidental dropping of the teaching device as it might cause unintended robot movement, leading to injury or equipment damage.

 Mandatory

Safety operating procedures
1.　All robot system operators should undergo the training on system in order to learn the safety protection measures and robot functions.
2.　Check if the robot and peripherals are normal before running the robot.
3.　Switch off power supply or press the emergency stop button before entering the operation area, even if the robot is not running.
4.　Assign a specific supervisor when robot is programming in working area, to make sure the robot can stop quickly in case of emergency.
5.　Do not wear gloves when the demonstrator inches robot. Low speed inching is preferred. Stop the robot effectively in case of a fault
6.　Master the position of emergency stop buttons on the robot and peripheral control equipment, in order to press them correctly in case of emergency
7. Never assume that when the robot is stopped, its program has finished. At that time, the robot may be waiting for an input signal to continue its movement

Contents

1. Communication settings
1.1 Network port connection

Connection port for the upper computer or client
Note: CAN1 and CAN2 are not network interfaces. Do not plug in incorrectly

1.2 Communication settings

Stop Mode -> Product Settings -> Communication Configuration -> Host Network Settings

Modbus TCP receive station number
If the host ID station number is incorrect, it will not receive information

Enable the network and select its purpose
Photography port: 9760
Modbus port: 502
Other: Other binding ports

Change the binding port based on the purpose

The network segments must be consistent, and the assigned ID number must be unique within the network. If communicating across network segments, use a router to handle the connection

Set the operating mode. When setting to client mode, the target address must be the address and port of the connected device. An incorrect setup will prevent communication
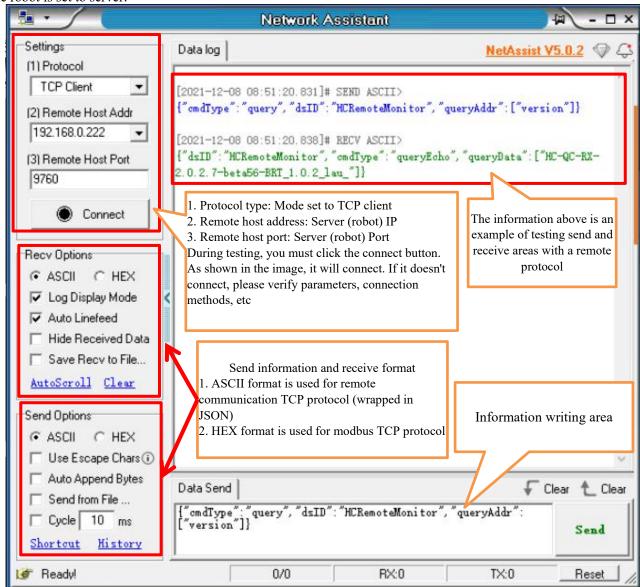
After setting the parameters, click confirm for the changes to take effect
Note: If there are no special requirements, the general communication mode is set to server!!!

1.3 Communication testing

Please use network debugging tools or similar software to verify if the settings are correct. Below is an example when the robot is set to server:

Network Assistant — NetAssist V5.0.2

Settings
(1) Protocol: TCP Client
(2) Remote Host Addr: 192.168.0.222
(3) Remote Host Port: 9760

[2021-12-08 08:51:20.831]# SEND ASCII>
{"cmdType":"query","dsID":"HCRemoteMonitor","queryAddr":["version"]}

[2021-12-08 08:51:20.838]# RECV ASCII>
{"dsID":"HCRemoteMonitor","cmdType":"queryEcho","queryData":["HC-QC-RX-2.0.2.7-beta56-BRT_1.0.2_lau_"]}

The information above is an example of testing send and receive areas with a remote protocol

1. Protocol type: Mode set to TCP client
2. Remote host address: Server (robot) IP
3. Remote host port: Server (robot) Port
During testing, you must click the connect button. As shown in the image, it will connect. If it doesn't connect, please verify parameters, connection methods, etc

Send information and receive format
1. ASCII format is used for remote communication TCP protocol (wrapped in JSON)
2. HEX format is used for modbus TCP protocol

Information writing area

Data Send:
{"cmdType":"query","dsID":"HCRemoteMonitor","queryAddr":["version"]}

Note: Set it up in the manner described above, ensuring network protocol settings correspond with robot settings. Once connected, communicate per protocol. If the robot's remote TCP protocol messages or modbus TCP data send and receive correctly, communication can be confirmed as normal
If there's no response, please confirm:

1. The sent information format is correct
2. The content of the information is correct
3. Whether the sent command is compatible with the version, etc

2. Preface

This guide instructs users on how to interact remotely using the communication format defined by Huacheng Robot System.

2.1 Revision record

Category: **A-** Add, **M-** Modify, **D-** Delete

Serial number	Version No.	Category type	Revision content	Date	Revised by	Reviewed by
5	A7	A	1. Modified document format	November 2, 2020	Cheng Guoxing	
4	A6	A	1. Merge visual communication description		Cheng Guoxing	
			2. Reorganize remote instruction manual			
3	A5	A	1. Add detailed description for remote commands		Cheng Guoxing	
			2. Add M-value status query			
			3. Add path acceleration/deceleration modification			
			4. Add tool switching and modification			
			5. Add workbench switching			
2	A4	A	1. Add detailed description for query fields		Cheng Guoxing	
1	A3	A	1. Update "cmdType" field to "reqType"		Cheng Guoxing	
			2. Updated query content, see address table section for details			
			3. Command table updated, see command table section for details			

2.2 Cautions

1. The previously used "dsID" field content (HCRemoteMonitor) is still compatible. All following documents have updated the "dsID" field, but the hand-control system version 2.0.0.0 and later will support both field contents.
2. The "cmdType" field used before to indicate command type is still compatible. All the following documents have updated the "cmdType" field to "reqType"
3. For the network port version on the motherboard and the hand-control version 2.0.2.1 and later, the content replied by reqType is the same as the sent content and is no longer distinguished

3. Frame format description

All communication frames are in JSON format. Each communication frame is a JSON object, starting with { and ending with }.

General field description as follows:
- dsID: Unique identifier
  - Visual information related: "www.hc-system.com.cam"
  - Basic remote monitoring related: "www.hc-system.com.RemoteMonitor"
  - Remote executor related: "www.hc-system.com.HCRemoteCommand"
- reqType: Command type
  - query: Remote query   "queryData", Query data group: "queryAddr"
  - command: Remote control   "cmdReply"
  - heartbreak: Heartbeat check
  - photo: Visual snapshot
  - AddPoints: Visual information   "dsData"
  - AddRCC: Add remote instruction   "cmdReply"
  - packID: Data packet address   "packID"

4. Basic remote monitoring description

This chapter introduces system status queries and simple action controls.

4.1 Query data format

Send the following JSON frame

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",              //Unique Identifier
    "reqType": "query",
    "packID": "0",              //The data packet ID is the same for both sending and replying, no reply if absent
    "queryAddr":["version", "curMold"]              //Address array
}
```

Reply with the following JSON frame

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",           //Unique Identifier
    "reqType": "query",
    "packID": "0",      //The data packet ID is the same for both sending and replying, no reply if absent
    "queryData":["v1.1", "default"]        //Address array
}
```

Available query address list

```
{
    "cmdType":"query",
    "dsID":"HCRemoteMonitor",
    "packID": "0",
    "queryAddr":
```

```
[
    "RemoteCmdLen"
]
}
```

4.1.1 Query remaining remote addresses

1. Version: Version number
2. curMold: Current mold number (Not supported by the main network version for now)
3. counterList: Counter ID list: ["0","2","5"]
4. counter-n: Counter information: ["id", "target", "current"]
5. curMode: Current mode: (0: None, 1: Manual Mode, 2: Automatic Mode, 3: Stop Mode, 7: Auto-running, 8: Step-by-Step, 9: Single Loop)
6. boardIONum: Total number of IO boards
7. input-n: 32-bit input status: (n starts from 0, 0: 1st-32nd input, 1: 33rd-64th input…)
8. output-n: 32-bit output status: (n starts from 0, 0: 1st-32nd output, 1: 33rd-64th output…)
9. axisNum: Total number of axes
10. axis-n: Axis position: (n starts from 0, 0:J1, 1:J2, 2:J3, 3:J4, 4:J5, 5:J6, 6:J7, 7:J8)
11. world-n: World coordinate position: (n starts from 0, 0:X, 1:Y, 2:Z, 3:U, 4:V, 5:W, 6:M7, 7:M8)
12. curAlarm: Current alarm code
13. curCycle: Current cycle (s)
14. lastCycle: Previous mode cycle (s)
15. machineName: Machine name
16. curTorque-n: Current torque: (Only in the main board's network version, 2580 represents 1x torque, n starts from 0, 0:J1, 1:J2, 2:J3, 3:J4, 4:J5, 5:J6, 6:J7, 7:J8)
17. curSpeed-n: Current speed (RPM): (Only in the main board's network version, n starts from 0, 0:J1, 1:J2, 2:J3, 3:J4, 4:J5, 5:J6, 6:J7, 7:J8)
18. curAccount: Current user (Not supported by the main network version for now)
19. origin: Origin status
20. moldList: Mold list: ["A1","A2","A5"]
21. isMoving: Is in moving state: (1 for moving, 0 for stationary)
22. M-n: 32-bit M status: (n starts from 0, 0: 1st-32nd M, 1: 33rd-64th M…)   206 master F1
23. RemoteCmdLen: Remaining remote command count   207beta25
24. Addr-n: (n ranges from 800-900) Query General Address Value   206masterF1
25. packID: Instruction number, consistent for send and reply, 206masterF1
26. toolCoord: Current tool, workbench, collaborative desk reply ["d1","d2","d3"], d1: Tool, d2: Workbench, d3: Collaborative desk 207beta91

Note: If it is indicated that the host computer network port can manually control the network port, please use it according to the indication.

4.2 Command data format

Send the following JSON frame

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",        //Unique Identifier
    "reqType": "command",
    "packID": "0",    //The data packet ID is the same for both sending and replying, no reply if absent
    "cmdData":["cmd", "d1","d2"...]      // Command data
}
```

Note: Reply as follows for JSON frame before **2.0.2.1/1.6.4**

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",        //Unique Identifier
    "reqType": "command",
    "packID": "0",     //The data packet ID is the same for both sending and replying, no reply if absent
    "cmdReply":["ok"]          // Command reply: Normally "ok", if an exception, ""
}
```

Note: Reply as follows for JSON frame after **2.0.2.1/1.6.4**

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",        //Unique Identifier
    "reqType": "command",
    "packID": "0",     //The data packet ID is the same for both sending and replying, no reply if absent
    "cmdReply":["cmd", "r1", "r2"]        // Command reply: "r1":"ok","err"; r2: Error message, only when r1 is "err"
}
```

4.2.1 Available control command list

1. actionStop: Immediately stop current action (Restart from the beginning)
2. actionPause: Pause current action (Restart from the current step)
3. actionSingleCycle: (Enter single loop)
4. startButton: Start button
5. stopButton: Stop button

6. switchMold: Switch mold: ("d1": Mold (Not supported by the main network version for now))

7. modifyCounter: Modify counter: ("d1": Counter ID, "d2": Current Value (-1 for no change), "d3": Target value (-1 for no change) (Target value cannot be changed in the main network version for now))

8. modifyOutput: Modify output point status: ("d1": Output Board ID (0-3: IO Board, 4-6: M Value (Not supported by the manual network version), 7: EUIO), "d2": Output Point ID, "d3": Output Status (0: OFF, 1: ON))

9. clearAlarmRunNext: Run next instruction after clearing alarm

10. clearAlarmContinue: Clear alarm and continue in automatic mode (During automatic operation)

11. modifyStackData: Stack modification (Host port version temporarily not supported): "d1":sID, "d2-d4": Stack interval x,y,z, "d5-d7": Count x,y,z

12. modifyGSPD: Modify global speed: ("d1": Speed)

13. rewriteData: Modify data: ("d1":addrs,"d2":value,"d3":savable)

14. rewriteDataList: Modify data block: ("d1":addrs,"d2":length,"d3":savable,"d4","d5","d6","d7",...)

15. modifyAccDec: Modify path acceleration and deceleration: ("d1": Acceleration time,"d2": Deceleration time), time data = time * 1000

16. switchTool: Switch tool number: ("d1": Tool number)

17. modifyTool: Modify tool details: ("d1": Tool number, d2: Tool X, d3: Tool Y, d4: Tool Z, d5: Tool RX, d6: Tool RY, d7: Tool RZ), tool data = tool * 1000

18. switchCoordinate: Switch workbench: ("d1": Workbench number)

19. clearAlarm: Reset and clear alarm   207beta57

Note: If it is indicated that the host computer network port can manually control the network port, please use it according to the indication.

5. Visual communication description

This chapter introduces interactions with the visual system.

5.1 Communication photography

The control system sends the following report:

```
{
    "dsID":"www.hc-system.com.cam",              // Note dsID
    "reqType":"photo",               // Command type: Photograph
    "packID": "0",                    //The data packet ID is the same for both sending and replying, no reply if absent
    "camID":0
}
```

If photography is successful, the following report should be returned:

```
{
    "dsID":"www.hc-system.com.cam",
    "reqType":"photo",               // Command type: Photograph
    "packID": "0",                    //The data packet ID is the same for both sending and replying, no reply if absent
    "camID":0,
    "ret":1
}
```

5.2 Reception of visual information

The visual system sends the frame as follows:

```
{
    "dsID":"www.hc-system.com.cam",
    "reqType":"AddPoints",                // If this field is missing, there won't be a reply, visual command
    "packID": "0",              //The data packet ID is the same for both sending and replying, no reply if absent
    "dsData":
    [
        {
            "camID":"0",
            "data":
            [
                {"ModelID":"0", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
                "Similarity":"0","Color":"0", "Rel":"0"},
                {"ModelID":"1", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
                "Similarity":"0","Color":"0", "Rel":"0"},
                {"ModelID":"2", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
                "Similarity":"0","Color":"0", "Rel":"0"},
                {"ModelID":"3", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
                "Similarity":"0","Color":"0", "Rel":"0"}
            ]
        }
        ,
        {
            "camID":"1",
            "data":
            [
                {"ModelID":"0", "X":"1.001","Y":"0.000","Z":"1000.001","U":"0.000","V":"0.000","Angel":"2.000",
```

```
        "Similarity":"0","Color":"0", "Rel":"1"},
        {"ModelID":"1", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
        "Similarity":"0","Color":"0", "Rel":"0"},
        {"ModelID":"2", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
        "Similarity":"0","Color":"0", "Rel":"0"},
        {"ModelID":"3", "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
        "Similarity":"0","Color":"0", "Rel":"0"}
      ]
    }
  ]
}
```

Field description:

- dsData: Camera data set, each set contains the following fields:
  - camID: Unique camera ID
  - data: Point data set. Each point includes location, color, recognition information, etc., with the following fields:
    * ModelID: Template ID, used to distinguish which template recognized the point
    * X: World coordinate X after robot-camera calibration
    * Y: World coordinate Y after robot-camera calibration
    * Z: World coordinate Z after robot-camera calibration
    * U: World coordinate Z after robot-camera calibration, not present in 4-joint robot
    * V: World coordinate V after robot-camera calibration, not present in 4-joint robot
    * Angel: World coordinate W after robot-camera calibration, U for 4-joint robot
    * Similarity: Similarity, range to be determined
    * Color: Color, range to be determined
    * Rel: Whether it's relative movement, 1 means relative

Reply frame as follows:

```
{
    "dsID":"www.hc-system.com.cam",            //Unique Identifier
    "reqType": "command",
    "packID": "0",                  //The data packet ID is the same for both sending and replying, no reply if absent
    "cmdReply":["AddPoints", "r1"]        // Command reply "r1": "Number of points"
}
```

6. Instructions for remote teaching

This chapter introduces programming via remote communication The framework template is as follows:

```
{
    "dsID":"www.hc-system.com.HCRemoteCommand",          // Or HCRemoteCommand
    "reqType":"AddRCC",              // If this field is missing, there won't be a reply
    "emptyList":"1",          // Whether to clear the remote list
    "packID": "0",            // Packet ID send and reply are the same, no reply if missing
    "instructions":
    [
      {
        "oneshot":"0",        // Execute once or not, 1: Execute once, 0: Execute continuously
        "action":"4",         // Action type 4: Free path, 10: Pose straight line, 17: Pose curve
        ...
      },
      {
        "oneshot":"0",        // Execute once or not, 1: Execute once, 0: Execute continuously
        "action":"4",         // Action type 4: Free path, 10: Pose straight line, 17: Pose curve
        ...
      },
    ]
}
```

Reply with the following JSON frame

```
{
    "dsID":"www.hc-system.com.HCRemoteCommand",              //Unique Identifier
    "reqType": "command",
    "packID": "0",              //The data packet ID is the same for both sending and replying, no reply if absent
    "cmdReply":["AddRCC", "r1"]            // Command reply r1, "ok" for normal, "err" for exceptions
}
```

Field description:

- emptyList:1: Clear existing data in the list, 0: Do not clear
- instructions: Set of instructions, each instruction is an object, different instruction types vary, general field descriptions are as follows:
  - oneshot: 1: Delete after current instruction execution, 0: Do not delete after execution
  - action: Instruction type, see below for specifics

6.1 Description of remote instruction types

Instructions，reqType   Version 206

6.1.1 Mechanical movement instructions   206 master F1

The actions are of the following types:
- 4: Free path
- 10: Posture linear
- 17: Posture curve The other fields are described as follows:
- m0-m7: Corresponds to joint or world coordinate positions, floating point
- m0_p-m7_p: (Curve end position coordinates)
- ckStatus: Movement axis mask, each axis has one bit. bits 1-8 correspond to axes 1-8. All 8 axes moving is 0xFF, the first 6 axes are 0x3F
- speed: Movement speed, accuracy of 0.1%
- delay: Delay before action, accuracy of 0.1s
- tool: Tool number (Not required for free movement)
- coord: Workbench number (Not required for free movement)
- smooth: Smoothness level, range 0-9

Example as follows:

```
{
    "dsID":"www.hc-system.com.HCRemoteCommand",          // Or HCRemoteCommand
    "reqType":"AddRCC",              //If this field is absent, no response will be given, remote command
    "emptyList":"1",                // Whether to clear the remote list
    "packID": "0",            // Packet ID send and reply are the same, no reply if missing
    "instructions":
    [
    {
        "oneshot":"0",              //Execute once? 1: Yes, 0: Continuous execution
        "action":"4",                    //Action type 4: Free Path, 10: Posture Linear, 17: Posture Curve
        "m0":"0.000",            //Position information
        "m1":"0.000",
        "m2":"0.000",
        "m3":"0.000",
        "m4":"-90.000",
        "m5":"0.000",
        "m6":"0",
        "m7":"0",

        "m0_p":"0.000",              // Position and posture curve point 2(m0−7_p) information, free path, posture straight line
        This section is not available.
        "m1_p":"0.000",
        "m2_p":"0.000",
        "m3_p":"0.000",
        "m4_p":"−90.000",
        "m5_p":"0.000",
        "m6_p":"0",
        "m7_p":"0",

        "ckStatus", 0xFF                        //Axis movement mask, 0X3F represents 6 axes
        "speed":"80.0",              //Speed
        "delay":"1.0",            //Delay
        "coord":"0",                    //Workbench number
        "tool":"0",                 //Tool number
        "smooth":"0"            //Smoothness level
    }
    ]
}
```

6.1.2 Switching workbenches   206 master F1

Field description:
- action: Always set to 800
- cnt_id: Workbench id

Example as follows:

```
{
    "dsID":"www.hc-system.com.HCRemoteCommand",          // Or HCRemoteCommand
    "reqType":"AddRCC",                      //If this field is absent, no response will be given
    "emptyList":"1",                //Clear remote list?
    "packID": "0",            //Packet ID is the same for both sending and response, no response if absent
```

```
"instructions":
[
    {
        "oneshot":"0",          // Execute once or not, 1: Execute once, 0: Execute continuously
        "action":"800",
        "cnt_id":"0"
    }
]
}
```

6.1.3 Output signal   206 master F1

Field description:

The actions are of the following types:

- action：
    - 200: General output
- type：
    - 0: General output Y
    - 5: Intermediate variable M
    - 7: EU output EUY
    - 100: Time output Y
- io_status: Output status
    - 0: Off
    - 1: On
- point：IOID
    - id: 0~32 corresponding to 010-047

Example as follows:

```
{
    "dsID":"HCRemoteCommand",                        //
    "reqType":"AddRCC",                    //If this field is absent, no response will be given
    "emptyList":"1",            //Clear remote list?
    "packID": "0",                        //Packet ID is the same for both sending and response, no response if absent
    "instructions":                //
    [
        {
            "oneshot":"0",                    //Execute once? 1: Yes, 0: Continuous execution
            "action":"200",                    //
            "type":"0",                //
            "io_status":"1",                //
            "point":"5",                //
            "delay":"1"            //Delay of 1s
        }
    ]
}
```

- action：
    - 204: Board output
- type：
    - 0: General output board Y0
    - 1: General output board Y1
    - 5: M board M0
    - 6: M board M1
- point: IOID // Each io occupies 2 bits, 0-15 bits, unsigned
    - 01: Disconnected
    - 10: Connected
- point2: IOID // Each io occupies 2 bits, 16-31 bits, unsigned
    - 01: Disconnected
    - 10: Connected

The values of point and point2 are as follows: for the control panel 0, Y010, Y012, Y020, Y25 are on, Y013, Y021, Y024 are off, and other IO are not controlled. The corresponding values are:

For point: "151388258" in hexadecimal is 00 00 10 01 00 00 01 10 00 00 00 00 01 10 00 10 (rightmost digit to leftmost digit): Y010, Y012, Y020, Y25 are on, Y013, Y021, Y024 are off, and other bits are not controlled.

For point2: "393222" in hexadecimal is 00 00 00 00 00 00 01 10 00 00 00 00 00 00 01 10 (rightmost digit to leftmost digit): Y030, Y040 are on, Y031, Y041 are off, and other bits are not controlled.

Example as follows:

```
{
    "dsID":"HCRemoteCommand",
    "reqType":"AddRCC",                        //If this field is absent, no response will be given
```

```
      "emptyList":"1",              //Clear remote list?
      "packID": "0",                      //Packet ID is the same for both sending and response, no response if absent
      "instructions":                     //
   [
   {
      "oneshot":"0",                           //Execute once? 1: Yes, 0: Continuous execution
      "action":"204",                      // Board output
      "type":"0",                          //          Output corresponding board
      "point":"10",                        // Example of board output Y010, Y011 connected
      "delay":"1"                          // Delay 1s
   }
   ]
   }
```

6.1.4 Wait for signal   206 master F1

Field description:
- action: Fixed at 100
- type：
    – 0-4: X is general input
    – 5-7: Represents M value
    – 8: EU input
    – 100: Pure delay
- point: Position, range 0-31
- io_status：
    – 0: Wait for disconnection
    – 1: Wait for connection
    – 2: Wait for rising edge
    – 3: Wait for falling edge
- limit: Time limit, precision 0.1s
- isUnlimit: 1 means unlimited time
Example as follows:

```
   {
      "dsID":"HCRemoteCommand",
      "reqType":"AddRCC",                  //If this field is absent, no response will be given
      "emptyList":"1",                     //Clear remote list?
      "packID": "0",                       //Packet ID is the same for both sending and response, no response if absent
      "instructions":
   [
   {
      "oneshot":"0",                 // Execute once or not, 1: Execute once, 0: Execute continuously
      "action":"100",
      "type":"0",
      "point":"0",
      "io_status":"1",
      "limit":"0",
      "isUnlimit":"0"
   }
   ]
   }
```

6.1.5 Stop action when signal is established   206 master F1

Field description:
- action: Fixed at 52
    //   Default X, need to add M, Y, EUX, EUY
- isUse: 1 for start detection, 0 for end
- ioNumber: General input point 0-31
- io_status: 0 for disconnected, 1 for connected. Example below:

```
   {
      "dsID":"HCRemoteCommand",
      "reqType":"AddRCC",                  // If this field is missing, there won't be a reply
      "emptyList":"1",                     //Clear remote list?
      "packID": "0",                       //Packet ID is the same for both sending and response, no response if absent
      "instructions":
   [
   {
      "oneshot":"0",                 //Execute once or not? 1: Execute once, 0: Execute continuously
      "action":"52",                 //          Fixed
      "isUse":"0",                   //          1 for start detection, 0 for end
      "ioNumber":"0",   //          Specified IO
      "io_status":"0"                //          0 for disconnected, 1 for connected
```

```
            }
        ]
    }
```

6.1.6 Use physical speed   207beta91

Field description:
- action: Fixed at 51
- isUse: 1 for use, 0 for disable
- speed: Taking 3 decimal places as an example, like: 1234 then speed is 1.234m/s

Example as follows:

```
{
    "dsID":"HCRemoteCommand",
    "reqType":"AddRCC",                    // If this field is missing, there won't be a reply
    "emptyList":"1",                       //Clear remote list?
    "packID": "0",                         //Packet ID is the same for both sending and response, no response if absent
    "instructions":
    [
        {
            "oneshot":"0",                 //Execute once or not? 1: Execute once, 0: Execute continuously
            "action":"51",                 //         Fixed
            "isUse":"1",                   //         1 for use, 0 for disable
            "speed":"1234"                 //         Speed is 1.234m/s
        }
    ]
}
```

7. Heartbeat message

If heartbeat monitoring is needed, send a heartbeat message to the motion control system at least every 10 seconds, otherwise, the motion control system will alarm. If not needed, do not send this message.

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",
    "reqType":"heartbreak"
}
```

8. Application examples

8.1 Remotely send the motion point

Commands can be sent as follows:

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",
    "reqType": "command",                      // Modify the values of addresses 800 801 802 803 804 805
    "cmdData":["rewriteDataList", "800","6","0", "10123", "20000", "3500", "45000", "30987", "40678"]
}
```

To modify the position of a single axis, commands can be sent as follows:

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",
    "reqType": "command",
    "cmdData":["rewriteData", "800", "10", "0"]              // Modify the value of address 800
}
```

8.2 Remote query status routine:

Send:

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",
    "reqType": "query",
    "queryAddr":["version", "curMold"]     // Query version number and current module number
}
```

Reply:

```
{
    "dsID":"www.hc-system.com.RemoteMonitor",
    "reqType": "queryEcho",
    "queryData":["v1.1", "default"]         //Address array
}
```

8.3 Visual sending point routine:

```
{
    "dsID":"www.hc-system.com.cam",
    "reqType": "AddPoints",
    "dsData":
    [
        {
            "camID":"0",
            "data":
```

```
[
    {"ModelID":"0",
    "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"123.123",
    "Similarity":"0","Color":"0", "Rel":"0"},
    {"ModelID":"0",
    "X":"888.001","Y":"1345.001","Z":"1000.001","U":"0.000","V":"0.000","Angel":"124.123",
    "Similarity":"0","Color":"0", "Rel":"0"}
    ]
    }
]
}
```

Reply:

```
{
    "dsID":"www.hc-system.com.cam",
    "reqType": "command",
    "cmdReply":["AddPoints", "2"]
}
```

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