AS7341 Spectral Sensor Device Communication Protocol Documentation

1. Device Basic Information

- **Device Name**: AS7341_Sensor_Device
- **Device Type**: Spectral_Sensor
- **Firmware Version**: 2.0.0
- **Communication Protocol**: TCP + UDP

2. Communication Port Configuration

Port	Protocol	Purpose	Direction
6677	TCP	Target server connection, data stream control	Bidirectional
6688	TCP	Command server, device control	Bidirectional
6699	UDP	Data stream transmission	Device → Host

3. Command Format

All commands are in JSON format and sent via TCP port 6688.

3.1 Basic Command Structure

```
{
  "command": "value",
  "parameter": value
}
```

4. Device Control Commands

4.1 Data Stream Mode Control

Enter Data Stream Mode

```
{"dataStream": true}
```

Exit Data Stream Mode

```
{"dataStream": false}
```

4.2 Data Stream Transmission Control

Set Continuous Transmission Mode

```
{"streamMode": "continuous"}
```

Set Fixed Count Transmission Mode

```
{
  "streamMode": "fixed",
  "streamCount": 100
}
```

Set Transmission Count Separately

```
{"streamCount": 50}
```

Pause Data Stream Transmission

```
{"streamPause": true}
```

Resume Data Stream Transmission

```
{"streamPause": false}
```

Reset Transmission Count

```
{"streamReset": true}
```

Set Transmission Interval

```
{"streamInterval": 200}
```

- Minimum interval: 400ms
- Unit: milliseconds

4.3 Device Hardware Control

AS7341 LED Control

```
{"as7341Led": true}
```

```
{"as7341Led": false}
```

AS7341 LED Brightness Setting

```
{"as7341Brightness": 15}
```

- Range: 1-20

UV LED Control

```
{"uvLed": true}
```

```
{"uvLed": false}
```

UV LED Brightness Setting

```
{"uvBrightness": 10}
```

- Range: 1-20

Buzzer Control

```
{"buzzer": true}
```

```
{"buzzer": false}
```

4.4 System Commands

Get Device Status

```
{"getDeviceStatus": true}
```

Device Reboot

```
{"reboot": true}
```

5. Response Mechanism

5.1 Command Response Format

All commands receive JSON format responses:

```
{"response": "OK"}
```

Or error responses:

```
{"response": "ERROR: error_message"}
```

5.2 Response Timing

- Responses are returned immediately after command processing
- Responses are returned via the original TCP connection
- Non-blocking queue mechanism is used to avoid affecting UDP data streams

6. Data Stream Format

6.1 UDP Data Stream Format

Sent via UDP port 6699, JSON format:

```
{
  "t": 1234567890,
  "d": [415, 230, 180, 320, 280, 195, 165, 210],
  "c": 1502,
  "sc": 10
}
```

Field Description:

- `t` : Timestamp (milliseconds)
- `d` : Spectral data array [F1, F2, F3, F4, F5, F6, F7, F8]
- `c` : Total packet count
- `sc` : Current stream count (fixed count mode only)

6.2 Data Stream Statistics

Statistics output via serial port every 500 packets:

```
UDP Packet Count: 500 (10/10)
```

7. Device Status Information

7.1 Automatic Transmission Triggers

Device status is automatically sent in the following situations:

1. When target server (6677) connection is established
2. When receiving `{"getDeviceStatus": true}` command
3. When device parameters change (LED, brightness, etc.)

7.2 Device Status Format

```
{
  "type": "deviceStatus",
  "device": "AS7341_Sensor_Device",
  "timestamp": 178162,
  "status": {
    "as7341_led": true,
    "as7341_bright": 1,
    "uv_led": false,
    "uv_bright": 20,
    "buzzer": false,
    "sensor": true,
    "stream_mode": "fixed",
    "stream_paused": true,
    "packet_count": 33,
    "interval": 100,
    "current_count": 10,
    "target_count": 10,
    "remaining": 0
  }
}
```


Status Field Description:

- `as7341_led` : AS7341 LED on/off status
- `as7341_bright` : AS7341 LED brightness (1-20)
- `uv_led` : UV LED on/off status
- `uv_bright` : UV LED brightness (1-20)
- `buzzer` : Buzzer on/off status
- `sensor` : Sensor initialization status
- `stream_mode` : Data stream mode ("continuous" | "fixed")
- `stream_paused` : Data stream pause status
- `packet_count` : Total packet count
- `interval` : Data stream interval (ms)
- `current_count` : Current stream count
- `target_count` : Target stream count
- `remaining` : Remaining count

8. Connection Status Notifications

8.1 Connection Established Notification

```
{
  "type": "connection",
  "status": "connected",
  "device": "AS7341_Sensor_Device",
  "timestamp": 1234567890,
  "ip": "192.168.1.100",
  "rssi": -65,
  "status": {
    "as7341_led": true,
    "as7341_bright": 12,
    "uv_led": true,
    "uv_bright": 8,
    "buzzer": true,
    "sensor": true
  }
}
```


8.2 Connection Disconnected Notification


```
{
  "type": "connection",
  "status": "disconnected",
  "device": "AS7341_Sensor_Device",
  "timestamp": 1234567890,
  "status": {
    "as7341_led": true,
    "as7341_bright": 12,
    "uv_led": true,
    "uv_bright": 8,
    "buzzer": true,
    "sensor": true
  }
}
```


9. Completion Notifications

9.1 Data Stream Completion Notification

```
{
  "type": "streamComplete",
  "device": "AS7341_Sensor_Device",
  "timestamp": 135964,
  "total_packets": 24,
  "stream_mode": "fixed",
  "target_count": 10,
  "actual_count": 10,
  "status": "completed"
}
```


10. Error Handling

10.1 Common Error Responses


```
{"response": "ERROR: JSON parse failed"}
{"response": "ERROR: Cannot enter data stream mode"}
{"response": "ERROR: Invalid stream count"}
{"response": "ERROR: Interval too small"}
{"response": "ERROR: Sensor read failed"}
```


10.2 Error Handling Mechanism

- Invalid commands return error responses
- Sensor read failures trigger retries
- Network disconnections automatically reconnect (max retries: 3)

11. Usage Examples

11.1 Complete Workflow

```
// 1. Get device status
{"getDeviceStatus": true}

// 2. Configure device parameters
{
  "as7341Led": true,
  "as7341Brightness": 15,
  "uvLed": false,
  "streamInterval": 200
}

// 3. Enter data stream mode
{"dataStream": true}

// 4. Set fixed count transmission
{
  "streamMode": "fixed",
  "streamCount": 100
}

// 5. Pause transmission
{"streamPause": true}

// 6. Modify parameters and resume
{
  "as7341Brightness": 10,
  "streamPause": false
}

// 7. Exit data stream mode
{"dataStream": false}
```

11.2 Quick Start Data Stream

```
{
  "dataStream": true,
  "streamMode": "continuous",
  "as7341Led": true,
  "as7341Brightness": 10,
  "streamInterval": 300
}
```

12. Important Notes

1. **Connection Order**: Recommended to establish TCP connection first, then send control commands
2. **UDP Stability**: TCP responses use queue mechanism to avoid affecting UDP data streams
3. **Command Frequency**: Avoid sending commands at high frequency (minimum interval recommended: 100ms)
4. **Data Stream Interval**: Minimum interval 400ms, smaller intervals may cause data loss
5. **Network Requirements**: Ensure ports 6677, 6688, 6699 are accessible
6. **Timeout Handling**: Command connection timeout is 30 seconds, automatic disconnection after timeout
7. **Error Recovery**: Device automatically attempts reconnection, host should handle connection interruptions

13. Serial Debug Information

Device outputs debug information via serial port (baud rate 115200):

- Command reception and processing status
- Data stream statistics (every 500 packets)
- Connection status changes
- Error information

14. Version History

- v2.0.0: Support for data stream modes, device control, status queries
- Added continuous and fixed count transmission modes
- Optimized network communication stability
- Non-blocking response mechanism

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