WD551 cloud connection procedure

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Table of contents

Overview

The WD551 has the following two functions that provide the device's own information (cumulative usage time / version number, etc.) and measured values with the built-in sensor (temperature / ambient light, etc.) to the outside.

- **Control command**
  - function allows you to obtain information by sending commands over the WD551's LAN and R S-232C paths.
  - Suitable for linking with systems operating on-premises.

- **Cloud connection (Microsoft Azure IoT connection)**
  - The ability for the WD551 to automatically upload information over the Internet to Microsoft Azure IoT.
  - Suitable for linking with systems operating in the cloud.

How to use control commands

In addition to acquiring information from the WD551, control commands are also used to change settings. Even when using it with a cloud connection, the environment for using the control commands is required because the settings are made in advance using the control commands. Control commands use LAN and R S-232C routes.

Things to prepare

- **For LAN path**
  - A communication tool for sending commands, such as a PC with a LAN function.

- **For R S-232C path**
  - A communication tool for sending commands, such as a PC with an R S-232C terminal.

For details on control commands, connection method with WD551, and communication settings, refer to the command reference "External Control NEC LED Monitor (WD Series)".

Operation procedure with control commands

To link WD551 information to a system operating on-premise, the method of obtaining information using control commands is suitable.

List of available information and commands

The main information and commands that can be obtained with control commands are as follows.

sensor	command	Parameters	unit	value	Error value
Human Sensor	CTL-CA41. Get Sensor Data	Presence	-	Exists = 1, does not exist = 0	-1
temperature	CTL-CA41. Get Sensor Data	Ambient Temperature	℃	-100.0 ~ 1 00.0	-1000.0
Humidity	CTL-CA41. Get Sensor Data	Ambient Humidity	%	0.0 ~ 1 00.0	-1.0
Air quality	CTL-CA41. Get Sensor Data	Ambient CO2	ppm	0.0 to 1 0000.0	-1.0
Ambient light	CTL-CA41. Get Sensor Data	Ambient Light	lx	0.0 to 1 00000.0	-1.0

Operation procedure with cloud connection

At the start of operation : Cloud side

Connection form to the cloud

WD551 supports the following forms.

- Device connection
    - o via Microsoft Azure IoT Hub Device Provisioning Service (DPS) Connect to IoT Hub.
    - o Direct connection to Microsoft Azure IoT Hub ("IoT Hub").
- Device authentication
    - o Authentication with X.509 certificates.
    - o Authentication with a symmetric key.

Cloud preparation

Cloud services are made available. The resources you will need follow. Please refer to the Microsoft website for instructions and other information.

- IoT Hub (required)
- DPS (only when operating using DPS)

Certificate creation and registration

- There are two ways to authenticate a device: using an X.509 certificate or using a symmetric key.
- When using an X.509 certificate, it is necessary to create a certificate for each device, register the certificate and private key on the device, and register the certificate on the server (the procedure will be described later).
    - o Certificates only support self-signed certificates.
    - o Please refer to the Microsoft website for creating a certificate.
- "NEC-WD551- [Serial Number]" in the place where you specify the device ID.

At the start of operation : WD551 side

Write the setting information etc. for connecting the WD551 to the IoT Hub with the control command. Make the settings according to the following order.

1. Disable cloud services : It is necessary to stop the cloud service function when setting the cloud.

command	Parameters
CTL-CA43-00. Set Cloud Service	Disable

2. Initialize cloud settings : Reset the cloud settings to the initial state before making various settings.

command	Parameters
CTL-CA3D. Delete Cloud Connection Config	none

3. Connection settings to IoT Hub: There are two ways to connect to IoT Hub, one is to use DPS and the other is to connect directly to IoT Hub. Make the following settings for each.
- o When using DPS
  - ▪ connection method to " DPS " .
  - ▪ ID scope of DPS to the setting on the cloud.

setting	command	Parameters
Connection method	CTL -CA3B. Write Could Connection Config	configType / "DPS"
DPS ID scope	CTL -CA3B. Write Cloud Connection Config	provisioningIdScope / Settings on the cloud

- o When connecting directly to the IoT Hub
  - ▪ connection method to " IoT Hub " .
  - ▪ IoT Hub to the setting on the cloud (primary connection string of IoT Hub) .

setting	command	Parameters
Connection method	CTL -CA3B. Write Cloud Connection Config	configType / "IoT Hub"
I oT Hub connection string	CTL -CA3B. Write Cloud Connection Config	connectionString / Settings on the cloud

4. Authentication settings : There are two methods for authentication with DPS and IoT Hub, one is to use an X.509 certificate and the other is to use a symmetric key. Make the following settings for each.

- For authentication by X.509 certificate
  - Security type to "X509" .
  - Register the client certificate.
  - Register the private key.

setting	command	Parameters
Security type	CTL -CA3B. Write Cloud Connection Config	securityType / "X509"
certificate	CTL -CA3B. Write Cloud Connection Config	certificate / Prepared client certificate
Private key	CTL -CA3B. Write Cloud Connection Config	privateKey / prepared private key

- For authentication with symmetric key
  - Security type to "SymmetricKey" .
  - Change symmetry key to cloud settings.

setting	command	Parameters
Security type	CTL -CA3B. Write Cloud Connection Config	securityType / "SymmetricKey"
Target key	CTL -CA3B. Write Cloud Connection Config	symmetricKey / Settings on the cloud

[Caution] Divided transmission of large data

- Since the Write Cloud Connection Config command has an upper limit on the data size that can be sent at one time, if the data size exceeds 213 bytes, it is necessary to divide it into 213 bytes and send it by specifying the sequence number. I have. See the command reference for details.

5. Registration of root certificate

o A root certificate must be installed on the WD551 in order for the WD551 to connect to the IoT Hub and DPS. The WD551 comes with a "Baltimore CyberTrust Root" root certificate installed at the time of shipment. This expiration date is the end of August 2023, so you can continue to use it until this expiration date.

o After September 2023, it should be replaced with "DigiCert Global G2". "DigiCert Global G2" will be available from February 15, 2023, so please install it on WD551 between February 15, 2023 and the end of August.

- DigiCert Global G2 can obtain the root certificate from the following.
  - https://www.digicert.com/kb/digicert-root-certificates.htm

command	Parameters
CTL-CA3B. Write Cloud Connection Config	r ootCertificate / Prepared root certificate

6. Enable cloud services

o Change the cloud service setting to "Enable".

command	Parameters
CTL-CA43-00. Set Cloud Service	Enable _

7. Reboot WD551

o To reflect the above settings and enable the cloud connection function, restart WD551 (DC OFF).

During operation

The Internet connection is required to connect the WD551 to the cloud.

- Communication protocol uses MQTT, and an environment where communication can be performed on port 8883 is required.
- HTTP proxy is not supported.

The information that can be obtained from the telemetry information of IoT Hub

Sensor value : Latest information				
Item name	**Key**	**Unit**	**Value**	**Error value**
Human Sensor	presence	-	Exists = 1, does not exist = 0	-1
Temperature	ambientTemperature	℃	-100.0〜100.0	-1000.0
Humidity	ambientHumidity	%	0.0〜100.0	-1.0
eCO2 level	ambientCO2	ppm	0.0〜10000.0	-1.0
Ambient light	ambientLight	lx	0.0〜100000.0	-1.0
Cumulative power-on count	cumulativePowerCycles	-	0〜	-1
Cumulative usage time	cumulativeUsageHours	hours	0.0〜	-1
Power status	power	-	On = 1 , Screen off = 0	-1

Sensor value : Information between the previous report and this report				
Item name	**Key**	**Unit**	**Value**	**Error value**
Number of times a person was detected （1 minute interval）	countsPresenceExist	-	0〜	-1
Average temperature	averageAmbientTemperature	℃	-100.0〜100.0	-1000.0
Average humidity	averageAmbientHumidity	%	0.0〜100.0	-1.0
Average eCO2 level	averageAmbientCO2	ppm	0.0〜10000.0	-1.0
Average ambient light	averageAmbientLight	lx	0.0〜100000.0	-1.0
Number of power-on times	countsPowerOn	-	0〜	-1
Number of motion sensor errors	errorCountsPresence	-	0〜	-1
Number of ambient light sensor errors	errorCountsAmbientLight	-	0〜	-1
Number of temperature sensor errors	errorCountsAmbientTemperature	-	0〜	-1
Number of humidity sensor errors	errorCountsAmbientHumidity	-	0〜	-1
Number of air quality sensor errors	errorCountsAmbientCO2	-	0〜	-1
Cumulative power-on count error count	errorCountsCumulativePowerCycles	-	0〜	-1
Cumulative usage time error count	errorCountsCumulativeUsageHours	-	0〜	-1

Information that can be obtained from the device twin of IoT Hub

The device twin properties.reported below.

Item name	Key
Serial number	serialNumber
Firmware version (overall)	firmwareVersion
MCU	otherFirmwareVersions .MCU
Sensor hub	otherFirmwareVersions . sensorHub
Touch sensor	otherFirmwareVersions .touch
Camera	otherFirmwareVersions .camera
Microphone	otherFirmwareVersions . MIC
PD1	otherFirmwareVersions . PDC1
PD2	otherFirmwareVersions . PDC2
DTH1	otherFirmwareVersions . DTH1
DTH2	otherFirmwareVersions . DTH2
SOC	otherFirmwareVersions . SOC

Change the transmission interval of telemetry information

The telemetry information transmission interval can be set from 10 to 120 minutes.

● When using control commands : Use the following commands to make changes.

Command	Data
CTL-CA40-00. Set Transmission Interval	10～120 (minutes) (in 10 minute increments)

● When using IoT Hub : Change the following information on the device twin.

Key	Data
properties.reported.minimumReportingInterval	10～120 (minutes) (in 10 minute increments)

Notes

● If you add a property to the device twin during operation, restart WD551.

The end of operation

To end the operation, follow the steps below.

1. Disable cloud service configurations : Execute the following command.

Command	Parameters
CTL -CA43-00. Set Cloud Service	Disable

2. Delete cloud connection configurations : To delete the configuration information, execute the following command.

Command	Parameters
CTL -CA3D. Delete Cloud Connection Config	none

Notes

- Uses the information acquired at the sensor position (upper part of the screen) mounted on this unit . Therefore, it may not match the value of the indoor environment in which this unit is installed.

- Air quality sensor / eCO2 level : The air quality sensor installed in the WD551 measures TVOC (total volatile organic compounds). The eCO2 (equivalent CO2) level is the carbon dioxide equivalent value converted based on the TVOC value. Especially in an environment with a lot of volatile substances such as alcohol, the carbon dioxide concentration may differ significantly.

- The contents of this document are subject to change without notice.