Remote Output Control Function Test Methods

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Table of Contents

I. Scope (of a document) ····· 1
II. Certification Tests ····· 1
II.I Scope of the Tests ····· 1
II.IIConformity Determination ····· 1
III. Terminology ····· 1
IV. Test Methods ····· 3
1. Remote output control verification test ····· 6
1.1 Output accuracy confirmation test ····· 6
1.2 Output control test ····· 7
1.3 Communication Interruption Test ····· 7
1.4 Input power surge verification test (narrowly defined PCS) ····· 8
1.5 Confirmation test of narrowly defined PCS stoppage by upper-level communication equipment ····· 8
1.6 Verification test of constant clip operation by narrowly defined PCS ····· 9
2. Remote output control verification test (broadly defined PCS specification verification) ····· 10
2.1 Functional verification test by simulated schedule server ····· 10
2.1.1 Control resolution verification test ····· 10
2.1.2 Output increase/decrease time verification test ····· 11
2.1.3 Contract Capacity Conversion Verification Test ····· 11
2.1.4 Contracted capacity conversion value rewriting prevention (security) verification test ····· 12
2.1.5 Upper Limit Clip Judgment and Output Control Operation Verification Test ····· 13
2.1.6 Input power surge verification test ····· 15
2.1.7 Surplus Purchase Control Accuracy Verification Test ····· 15
2.1.8 Update schedule reading confirmation test ····· 17
2.1.9 Control Days Verification Test ····· 18
2.1.10 Forward Direction Clock Tampering Countermeasure Verification Test ····· 20
2.1.11 Delayed Direction Clock Tampering Countermeasure Verification Test ····· 20
2.1.12 Test for Confirmation of Retention of Timekeeping Function during Power Failure ····· 21
2.1.13 Verification test of operation stoppage due to loss of time information ····· 22
2.1.14 Output controller built-in clock accuracy verification test ····· 22
2.1.15 Clock Synchronization Confirmation Test ····· 23
2.1.16 Communication failure verification test from upper system ····· 23
2.2 Confirmation of connection test data with utility server ····· 25
2.2.1 Connection check during normal operation (normal sequence) ····· 25
2.2.2 Connection Confirmation Test for Abnormal Operation (Abnormal Sequence) ····· 25
2.3 Priority Confirmation Test for ECHONET Output Control Commands ····· 26
Appendix Figure I: Power Conditioner Test Circuit with Remote Output Control Function (In case of multiple DC inputs) ····· 30
[Attachment] Explanation of Remote Output Control Confirmation Test ····· 34

Remote Output Control Function Test Methods

Introduction: This test method is to be used in conjunction with individual test methods for grid interconnection protection devices, etc. for the applicable power supply system.

I. Scope (of a document)

This test method is based on the "Technical Specifications for PCS with Output Control Function" (JEMA website, New Energy System/Distributed Generation System page) jointly prepared by the Japan Photovoltaic Energy Association (JPEA), the Japan Electrical Manufacturers' Association (JEMA), and the Federation of Electric Power Companies of Japan. (JEMA), and the Federation of Electric Power Companies of Japan (FEPC).

II. Certification Tests

II.I Scope of the Tests

The test is a formal test conducted on the test article of the remote output control device.

The scope of the test also includes other parts of the remote output control device as well as equipment that may affect the judgment.

II.II Conformity Determination

All applicable tests specified in this test method and individual test methods shall be conducted to determine conformity to the requirements. However, JET may, at its own discretion, omit the implementation of tests for items for which there is test data issued by a third-party certification body in connection with its certification, etc., or for items for which conformity to the requirements can be determined by examining the product.

III. Terminology

The contents described in the General Rules shall be followed. Terminology shall, in principle, conform to the "Grid Interconnection Rules" (JEAC9701) and "Technical Specifications for PCS with Output Control Function" (Federation of Electric Power Companies of Japan, Japan Electrical Manufacturers' Association, Japan Photovoltaic Association). In addition, the following content shall be added.

Narrowly defined power conditioner (Narrowly defined PCS)

It is equipped with a function to receive output control signals from the output controller and control the effective power to be transmitted to the power system (grid) according to the control signals.

The narrowly defined PCS is described as "power conditioner (narrowly-defined)" in "Technical Specifications of PCS with Output Control Function".

Broadly defined power conditioner (Broadly defined PCS)

A power conditioner (PCS) consisting of an output controller and a narrowly defined PCS. It is equipped with a function to receive a control schedule from the utility server and control the output of the narrowly defined PCS.

Note that the broadly defined PCS is described as "power conditioner (broadly-defined)" in "Technical Specifications of PCS with Output Control Function.

Output Control Unit

A device that receives control schedules from a utility server and outputs control signals to a narrowly defined PCS. Control schedules are classified into fixed schedules and updated schedules

Fixed Schedules

It is a schedule that registers the control output for the generating facility in 13-month or monthly units, with a maximum of 400 days of control output in 30-minute units.

Schedule of updates

The fixed schedule is updated according to supply and demand conditions and consists of change times (in 30-minute units) and control output values.

Partial control

Operation mode in which control output can be specified in 1% increments relative to rated output and controlled by partial output.

Clip Controls

This is a rescue measure for power generation facilities installed prior to the enactment of the output control system. It is applied to power generation facilities of less than 10 kW, which are exempted from output control only when the installed capacity increases due to the replacement of narrowly defined PCS. This measure is applied to power generation facilities of less than 10 kW.

Contracted capacity conversion

A function that allows the output controller to set the solar panel capacity and PCS capacity, convert the output control volume from the contracted capacity base to the PCS capacity base, and command the narrowly defined PCS.

Maximum power received

A term described as the standard power of 100% in the remarks column of "3.3 Surplus Purchase Control" in the "Technical Specifications for PCS with Output Control Function, etc. (under 66kV)" etc. presented by the General Transmission and Distribution Utility.

The maximum value (in kilowatts) of reverse power flow, which is determined in advance through consultation between the power producer, etc. and the general transmission and distribution utility.

This value is described as "contract capacity" in this test method.

Generation output and other control functions

Type of control method for surplus purchase control.

A function to control reverse power flow = 0 (no projection to the grid) as described in "3.3 Surplus Power Purchase Control" of "Technical Specifications for PCS with Output Control Function (under 66kV)" etc., which are conventionally presented by general transmission and distribution companies.

Generation output, etc." refers to generation output and storage battery output (reverse power flow output from generation facilities, etc. to the power grid).

Reverse power flow amount control function

Type of control method for surplus purchase control.

A function to control the reverse power flow at the interconnection point to less than the output control value (output upper limit) [%], which is described in addition to the conventional method in "3.3 Surplus purchase control" in the "Technical Specifications for PCS with Output Control Function (under 66kV)" etc. presented by general transmission and distribution companies from June 2023.

ECHONET output control commands

Indicates "power generation power limit settings 1 and 2," "power sales power limit settings" and "output control settings 1 and 2," which are defined as properties of the residential photovoltaic power generation class specification described in the ECHONET Device Objects Detailed Requirements.

In cases where an output control property is newly added to the residential photovoltaic power generation class specification and affects the remote output control function of the power company, the added property is also included.

IV. Test Methods

In this section, a narrowly defined PCS is referred to as a "narrowly-defined PCS", while a broadly-defined PCS is referred to as a "broadly defined PCS" or simply "PCS".

A narrowly defined PCS should have the following settings

1. The safety confirmation process at startup and the time to prevent power-on for a certain period of time after power is restored should have settings that can be shortened for testing purposes.
2. The PCS should have a function to output the gate block status as an electric signal.

The output controller shall

1. The output controller shall be able to confirm the time information controlling the schedule of the output controller. It is desirable to be able to check the time information in seconds.
2. To reduce test time, the output controller should have the ability to change the internal time information of the

output controller.

3. In communication with the utility server, it should be able to produce logs showing the status (normal or abnormal) of power plant ID registration confirmation, update schedules, and access to and acquisition of fixed schedules.
4. It is desirable to have a function to confirm the schedule loaded inside the output controller.
5. To reduce test duration, the system should have a function to count down the update flags of the fixed schedule.
6. Measures shall be taken to prevent accidental changes to parameters other than those set at the time of interconnection (parameters related to time, rated capacity, output change time, capacity conversion function, and upper limit clip function) that affect judgment criteria such as output level, output change time, PCS stop time, and schedule acquisition conditions in this test.
7. Submit specifications that include the following:
   a. Parts type such as crystal oscillator and RTC that determines the time accuracy of output control.
   b. Information on the method of commanding output to narrowly defined PCS (communication method, % or kW command, etc.), method of controlling output change time (narrowly defined PCS is autonomous, output controller gives sequential instructions, etc.), whether the command differs depending on power factor, communication frequency, etc.
   c. If the remote output control device is composed of multiple devices, the division of functions among the devices (e.g., possession of time information as a standard for output control, backup function in the event of power failure, connection function to the power server, security function against various parameter changes, schedule storage function, etc.)
   d. Setting procedures for various procedures when first installed, such as output change time, capacity conversion factor, upper limit clip value, etc.
   e. How to realize security and user clock tampering prevention functions for contracted capacity conversion counts when there are multiple user interfaces (e.g., by web server, by dedicated application, etc.).
   f. A list of all parameters other than those mentioned above that can be set in the mode for setting parameters to be set at the time of interconnection, and that affect the judgment criteria such as output level, output change time, PCS stop time, and schedule acquisition conditions for this test, and the set values shall be submitted.
   g. The output controller program and all parameters described in the previous item shall be uniquely managed by a software control number. However, parameters to be set at the time of interconnection shall be excluded.

Output control command value monitors (when used for testing) shall

1. have a unique name that allows identification
2. submit documents clearly indicating the communication method (physical layer and protocol) and communication name information
3. the system analyzes and displays the communication between the output control device and the narrowly defined PCS. In principle, the system is a separate device from the upper-level communication device (output control device) and does not receive the setting information of the upper-level communication device (output control device), such as schedules and command set values.
4. The output control command value monitor log is a communication log between the narrowly defined PCS and the upper-level communication device (output control equipment) that is captured by the output control command value monitor, and it should be possible to examine the time, communication interval, and command contents of the output control equipment during communication. It is also desirable to know the actual time of actual communication.
5. In principle, communication logs shall record the contents of all communications, and shall be saved without omission or processing.

   In principle, the log file shall be in a format that can be processed, such as a text file.

6. In principle, submit documents that allow understanding of the contents of all communication logs.
   For communications related to output control, the description should show how the time of the output controller at the time of communication, communication interval, command contents, etc. can be calculated by processing which part of the communication.
   For communications not related to output control, a detailed explanation of the protocol is not necessary.
7. If the narrowly defined PCS is stopped by a stop command, the log must show the stop command

Standard test conditions are shown below. For each test item, only the parts that differ from the standard test conditions are described.

[Standard test conditions]

A. The test circuit shall be the circuit connection shown in Appendix Figure I. The AC power supply shall be operated at the rated voltage and frequency. The line impedance shall be short-circuited.
B. The power meter shall be configured as follows
   Data update rate: For 1.1 and 1.2, 2.1.1, and 2.1.2: 200ms, other: 1 s (200 ms is also acceptable), averaging: off Filtering: off
C. The power factor of the PCS shall be set to the specified power factor. The settings of the protective relay and other protective devices shall be the factory default values (as described in the application for certification).
D. 100% command is given. However, if the command is specified in a fixed schedule, etc., the command shall follow that specification. For PCSs that have an output control function using ECHONET output control commands, a100% instruction shall be given.
E. Set the output change time to 5 minutes.
F. The DC power source shall operate the DC energy source for solar cells only. To maximize the output, the DC simulated power source for the photovoltaic cells shall be set to the maximum amount of solar radiation. In cases where the rated output cannot be produced due to the operation of storage batteries, etc., the test shall be conducted using masks of operation, etc., after consultation with the applicant for certification.
G. Turn on SW_{LD} and set the load so that the PCS has the output indicated in the previous section.
H. For products with a reverse power flow control function or a power output control function, the ACCT for reverse power flow control in Appendix Figure I shall be changed to the PCS output end as necessary. (If it can be confirmed that the judgment is made correctly, this function may be masked if necessary.)

[Remarks]

1. When the output level is used as a judgment criterion, an 5% tolerance of the maximum specified output is allowed against the measured output value. However, while an error is allowed, arbitrarily setting the output to a higher level is not permitted.
2. The criterion "output shall be less than or equal to 5% of the maximum specified output of the PCS" shall be read as "less than or equal to 150W" if the value of 5% of the maximum specified output is less than 150W. However, for microinverters for AC modules to which a large number of units are connected, the test shall be conducted under conditions where the total rated power output is at least 3 kW.
3. Translated with DeepL.com (free version) The judgment criteria for the time related to output shall allow an error of 5% of the output change time. As a condition for starting measurement, "within 5 minutes at the longest" shall be "within 5 minutes and 15 seconds (5 minutes + 5%) at the longest".
4. The output level measurement shall be the average output over a 5-minute period, unless otherwise stated. However, except for Sections 1.1 and 2.1.1, if it is clear that the average output for 5 minutes is not different from the average output for 1 minute, the measurement time may be reduced to 1 minute.

If the maximum power tracking control causes the output to drop for a short period of time, the measurement may be made excluding that portion.

5. The output of a broadly defined PCS controlled by remote output control is simply described as "output" except when a distinction needs to be made.
6. The specification shall specify whether the 100% criteria for changing the power factor is the specified output at that power factor or the maximum specified output within the power factor range.
7. The meaning of "give XX% command" means "give a command corresponding to XX% of the power command value" and is not limited to "%" commands to narrowly defined PCS.
8. Arbitrarily increasing the output to higher than the power command value is not allowed. Even if the criteria for conformance are met, if JET determines that the output is arbitrarily controlled at a higher level, it may result in nonconformance.

1. Remote output control verification test (narrowly defined PCS specification verification)

This test applies to DC energy sources that can be connected and include solar cells.

1. The control commands of the upper-level communication device shall be the same as those of the output control device. The output control device may be used for the upper-level communication device. In that case, "upper-level communication device" in the test method shall be read as "output control device.
2. The communication method (physical layer, protocol) between the output controller and the narrowly defined PCS shall be specified for each certification applicant.

   If multiple communication methods (physical layer, protocol) exist, a list of their names (named by the certification applicant) shall be submitted. Furthermore, tests shall be conducted for each communication method, if necessary.
3. When a broadly defined PCS specification verification test (hereinafter referred to as the "broadly defined PCS test") is conducted by a device that can check command values from a high-level communication device to a narrowly defined PCS (hereinafter referred to as the "output control command value monitor"), this test shall be used to confirm whether the command values specified in the test and those given to the narrowly defined PCS from its high-level communication device match the specifications.

1.1 Output accuracy confirmation test

[Test Objective].

This test shall confirm that the narrowly defined PCS is capable of outputting power with the required accuracy for the commands of the output controller. The specification requires that any output from 0 to 100% can be set in 1% increments, and the allowable output error shall be within ±5% of the maximum specified power.

[Test conditions]

Standard test conditions shall apply.

However, paragraph (F) shall be changed to the following contents.

F. For DC power sources that are not capable of reverse power flow, such as storage batteries, only solar cells shall be used. For those that are capable of reverse power flow, such as storage batteries, all DC energy sources capable of reverse power flow shall be operated after consultation with the certification applicant. In addition, the amount of solar radiation of the DC simulated power source for the solar cells shall be set so that the output is maximized. In cases where the rated output cannot be produced due to the operation of storage batteries, etc., the test shall be conducted by masking the operation, etc., after consultation with the applicant for certification.

[Measurement method]

A. Give a 50% command.
B. After the output has stabilized, measure the output for 5 minutes.
C. For those whose storage batteries are capable of reverse power flow and the output of the storage batteries alone is less than 50% of the rated output, give a command that results in 50% of the output of the storage batteries alone, and measure the output for 5 minutes after the output has stabilized.
D. If multiple communication methods (physical layer and protocol) exist between the output controller and narrowly defined PCS, in principle, the above test shall be performed for all combinations of them.

However, this shall not apply if it is clear from the specifications or other documents that differences in communication methods (physical layer, protocol) do not affect the test results.

[Judgement criteria]

A. Output shall stabilize within 5 minutes after command value transmission.

B. The output value tolerance against the command value for all individual measuring points over a 5-minute period shall be within ±5% of the maximum specified output.

C. When the broadly defined PCS test is conducted using the output control command monitor, the command value specified by the above measurement method shall match the command value displayed on the output control command monitor. Check the log of the output control command monitor.

D. When the measurement method paragraph C is implemented, the judgment criteria in paragraph B shall be met for the commanded value.

1.2 Output control test

[Test Objective]

This test confirms that the narrowly defined PCS can control the output change time with the required accuracy for the commands of the output controller. The specification requires that any output change time of 5 to 10 minutes can be specified in 1-minute increments, and that the allowable time tolerance is within ±5% of the output change time.

[Test conditions]

Standard test conditions shall apply.

[Measurement method]

A. In the 100% command operating state, be in the same situation as the situation when it is time for the output controller to give a 0% command.

B. Measure the time from when the command is given until the output falls below 5%.

C. After the output is stabilized, the output is measured.

D. Establish the same situation as the situation when it is time for the output controller to give a 100% command.

E. Measure the time from when the command is given to when the output is greater than 95%.

F. After the output has stabilized, measure the output.

G. Set the output change time to 10 minutes and conduct the above test. However, only one combination of power factor and frequency is required.

H. If multiple communication methods (physical layer and protocol) exist between the output controller and narrowly defined PCS, in principle, the above test shall be performed for all combinations of them. However, this shall not apply if it is clear from the specifications, etc. that differences in communication methods (physical layer, protocol) do not affect the test results.

[Judgement criteria]

A. From the time when the 0% command is given to the time when the output changes from 95% or more, the time shall fall within the range of 95% ± 5% of the output change time. For products that are controlled by a constant control step and the control step is 5% or more of the maximum specified output, the time from the time when the 0% command is given until the output power changes from 5% or more to 0% shall fall within the range of ±5% of the output change time.

B. Output tolerance during 0% operation shall be within ±5% of the maximum specified output. Note that those that are resolvable at 0% output shall also be acceptable.

C. From the time when the 100% command should be sent to the time when the output changes from 95% or more to 100%, the time shall fall within the range of 95% ±5% of the output change time. For products that are controlled by a constant control step method and the control step is 5% or more of the maximum specified output, the time from the time when a 100% command should be sent on the schedule to the time when the output changes from 95% or less to 100% shall be within the range of ±5% of the output change time.

D. Output fluctuation shall be within ±5% of the maximum specified output at 100% output.

E. For products controlled by a constant control step, the control step shall be 10% or less (the number of steps shall be 10 or more), and the output tolerance shall be within ±5% of the maximum specified output

at 0% output.

F. When broadly defined PCS testing is conducted using the output control command value monitor, the command value indicated by the above measurement method shall match the command value displayed on the output control command value monitor. This shall be confirmed by the log of the output control command value monitor.

1.3 Communication Interruption Test

[Test Objective]

This test shall confirm that the communication path between the narrowly defined PCS and the output control device may be disrupted, and that the device can stop the output without continuing to follow the output control command if the communication is interrupted due to a wire break or other cause. The test shall be conducted with all devices that may be affected by this test connected.

[Test conditions]

Standard test conditions shall apply.

[Measurement method]

A. Communication between the upper-level communication equipment and narrowly defined PCS shall be blocked. The method of blocking communication shall be decided upon consultation with the applicant.

B. Measure the time between the interruption of communication between the upper communication device and the narrowly defined PCS and the gate blocking.

C. If there are multiple communication methods and multiple means of communication between the upper-level communication device and the narrowly defined PCS, the above test shall, in principle, be performed for all of them (physical layer and protocol). However, this shall not apply if it is clear from the specifications, etc. that differences in communication methods (physical layer and protocol) do not affect the test results.

[Judgement criteria]

A. The gate should be blocked immediately after communication is interrupted. The switchgear may be opened.

B. The time until the gate is blocked shall be within 5 minutes regardless of the communication timing. For products whose output change time is controlled by the narrowly defined PCS side, this criterion shall be satisfied regardless of the output change time.

[Remarks]

The specification shall be satisfied regardless of the frequency of communication; it should stop within 5 minutes minus the communication interval.

1.4 Input power surge verification test (narrowly defined PCS)

[Test Objective]

This test shall confirm that the output power can be maintained in accordance with the output control command even if the input power of the narrowly defined PCS fluctuates.

[Test conditions]

Standard test conditions apply.

The "100%" in paragraph (D) may be changed to "50%".

[Measurement method]

A. Give 50% command value.

B. Adjust the DC power supply setting to ensure that the output is 5% to 15% of the specified output and maintain it at the output corresponding to the input level until it stabilizes.

C. Increase the output of the DC power supply to a state where it is capable of outputting the specified output.

The rate of change of the DC power supply output shall be set within about 10 seconds.

D. After the output reaches 50% and is stable, perform the measurement.

[Judgement criteria]

A. Output shall stabilize within 2 minutes and 30 seconds after a sudden change in input level.

B. The average output power shall be within ±5% of the maximum specified output power relative to the output command value.

1.5 Confirmation test of narrowly defined PCS stoppage by upper-level communication equipment (narrowly defined PCS)

This test is applicable when there is a mechanism to stop a narrowly defined PCS from a higher-level communication device by a stop command, and the stop command can be confirmed by the output control command value monitor, and the broadly defined PCS test is conducted by the output control command value monitor. If there are multiple communication and shutdown means between the output control device and narrowly defined PCS, a list of their names (named by the certification applicant) shall be submitted.

[Test Objective]

In this test, when the output controller sends a "stop command" to the narrowly defined PCS as specified in the specifications, such as when time information is lost or schedule information is exhausted, the output control command monitor confirms that the stop command is as specified in the specifications and that the narrowly defined PCS can be stopped. If the broadly defined PCS test includes a requirement to stop the broadly defined PCS, and if it is confirmed in this test that the stop command is in accordance with the specification, it will be confirmed by the output control command value monitor log that the broadly defined PCS can be stopped.

[Test conditions]

Standard test conditions shall apply.

[Measurement method]

A. A stop command is given to the narrowly defined PCS from a higher-level communication device.

B. Measure the time from when the command is given to when the output goes to 0%.

C. If there are multiple means of communication and shutdown between the output controller and the narrowly defined PCS, the above test shall, in principle, be performed for all such combinations of communication and shutdown means.

[Judgement criteria]

A. The time from when the stop command is sent to when the output goes to 0% must be within 1 minute.

B. When a broadly defined PCS test is conducted by monitoring the output control command value, a stop command shall be sent to the narrowly defined PCS from a high-level communication device, followed by an indication that a stop command has been sent.

1.6 Verification test of constant clip operation by narrowly defined PCS

This test is applicable to PCS used in power generation facilities with an installed capacity of less than 10 kW and narrowly defined PCS by itself that has a constant clip function.

[Test conditions]

Standard test conditions shall apply.

However, paragraph (H) shall be changed to the following contents.

H. The PCS shall be set to be always clipped at the narrowly defined PCS rated output before replacement (the capacity authorized for the facility when not subject to output control).
The PCS shall be set so that the capacity of the facility becomes larger when the narrowly defined PCS is replaced. (The capacity before replacement is, for example, 80% of the rated output.)
In addition, no upper-level communication device (output control device) shall be connected.

[Measurement method].

Operate the PCS and measure the output.

[Judgment criteria]

Output shall be within ±5% of the maximum specified output of the PCS before replacement.

[Remarks]

1. In the case of constant clip operation for both narrowly defined PCS only and output controllers, the test is also performed in Section 2.1.5.
2. According to "Supplementary Explanation for Development of PCS with Output Control Function" Upper

Limit Clip Operation (2/3) published by JEMA, the constant clip operation by narrowly defined PCS is not allowed to be used together with the surplus purchase control (reverse power flow control function or generation output control function).

If the revision of the document allows the combined use with the generation output control function, the test shall be conducted in accordance with 2.1.5.3 Confirmation test of the constant clip operation.

2. Remote output control verification test (broadly defined PCS specification verification)

This test applies to DC energy sources that can be connected and include solar cells.

2.1 Functional verification test by simulated schedule server

The output control characteristic verification test in this item is conducted using a simulated server.

Standard test conditions shall be used.

In this section, the capacity of the solar panels is set by converting based on the specified output of the PCS (hereinafter referred to as "Pp").

The initial conditions are:

・Solar panel capacity = 1.0 Pp.

Furthermore, when testing with an output command value monitor, the test can be conducted with an output controller, output command value monitor, and simulated server.

[Remarks]

The remarks follow the remarks in the standard test conditions.

In addition, the following remarks shall be added.

1. The date [yyyy/mm/dd] of the schedule shown in the test may be set for each test item to the extent that it does not affect the test.
   However, for tests using a fixed schedule, the month and date shall not be changed.
   Furthermore, the schedule and the month and date of the output controller shall be consistent for the test.
2. The time may be reduced by changing the time of the output controller.
3. The method of determining the change of time and the completion of acquisition of a fixed schedule may be implemented upon consultation with the certification applicant.
4. After the start of measurement, the only permitted operations on the output controller other than those described in the measurement method are time correction to shorten the test time and acquisition of various types of information.

2.1.1 Control resolution verification test

This test is applicable when any of the following conditions applies to each output controller

- When 1.1 Output Accuracy Confirmation Test has not been conducted with this communication method and means, and when a test to control by an output command value other than this item is not conducted.
- When the command from the output controller differs depending on the power factor, and when the power factor has not been tested in the past.・In the case where an output control command value monitor is used in the specification verification test of a broadly defined PCS, and the output control command value monitor to be used is not verified in the specification verification test of a narrowly defined PCS.
- When the output level cannot be controlled by the PCS alone, but is measured sequentially by the output controller for closed-loop control.
- When the output control command value monitor is used in the specification verification test of broadly defined PCS, and the output control command value monitor to be used has not been verified in the specification verification test of narrowly defined PCS.

[Test Objective]

In addition to the objectives already described in "1.1 Output Accuracy Verification Test," the purpose of this test is to verify that the narrowly defined PCS can be correctly controlled by the new communication method and means when they are added.

[Test conditions]

Standard test conditions shall apply.

[Measurement method].

The [measurement method] in Section 1.1 shall be applied. However, if the operating state of the storage battery remains the same, paragraph (C) shall not apply.

If the command from the output controller differs depending on the power factor, and if the power factor has a power factor that has not been tested in the past, it is sufficient to conduct a test for the power factor that has not been tested.

[Judgment Criteria]

Follow the [Judgment Criteria] in Section 1.1.

2.1.2 Output increase/decrease time verification test

This test is applicable when one of the following conditions applies to each output control device.

The parts of the implementation requirements that differ from those in Section 2.1.1 are underlined.

- When the output controller controls the output change time.
- When 1.2 Output control test has not been conducted by this communication method and means, and the output change time is not confirmed by a test in which control is performed by output command values other than those in this item.
- When the command from the output controller differs depending on the power factor and the power factor has not been tested in the past.
- When the output level cannot be controlled by the PCS alone but is measured sequentially by the output controller for closed-loop control.
- When the output control command value monitor is used in the specification verification test for a broadly defined PCS, and the output control command value monitor using this output controller has not been verified in the specification verification test for a narrowly defined PCS.

[Test Objective]

In addition to the objectives already described in Section 1.2 Output Control Test, the purpose is to confirm that the narrowly defined PCS can be correctly controlled by the new communication method and means when they are added.

[test conditions], [measurement method], and [judgment criteria] shall be in accordance with 1.2 Output control test.

Note that if the commands from the output controller differ depending on the power factor, and if the power factor has a power factor that has not been tested in the past, it is sufficient to conduct a test for the power factor that has not been tested.

2.1.3 Contract Capacity Conversion Verification Test

[Test Objective.]

Since the contract capacity is selected as the smaller capacity of the solar panel capacity or PCS specified output, the contract capacity conversion function is used when the solar panel capacity is smaller than the PCS specified output to confirm that output control can be performed correctly on the condition that the contract capacity is 100% of the power command.

Furthermore, with the expansion of non-firm correspondence, the technical specifications were revised after June 2023 to take into account the characteristics of the power source type to be supported, and in addition to the case of “controlling the generation output, etc.” as surplus purchase control, the case of “controlling the reverse power flow at the interconnection point” is now allowed. In addition, the concept was unified based on the idea that the reference value of 100% in the case of such operation should be the maximum power received, which is the maximum value of the reverse power flow (see definition of terms; in this test method, it is referred to as contract power).If a fixed load that always consumes more than a certain amount of power is recognized, the contract power will be smaller than the PCS specified output.

[Test Conditions]

Standard test conditions shall be applied.

However, item G shall be changed to the following.

Item H shall not be applied.

G. For products with a reverse power flow control function or a power generation output control function,

connect a load of approximately 10% of the rating between the ACCT for reverse power flow control and the PCS as shown in Appendix Figure I. For all products, if the AC power supply cannot absorb all of the power of the PCS, set the load at an appropriate location as necessary to allow operation at maximum output.

2.1.3.1 Contract capacity conversion verification test (for solar panel capacity = 0.8Pp)

~~[Test conditions]~~

~~Standard test conditions shall apply.~~

[Measurement method]

A. Set the contract capacity = 0.8Pp.

   For products that do not set the contract capacity but set the solar panel capacity, the contract capacity shall be read as the solar panel capacity.

B. For equipment compatible with contract capacity conversion (extended type), output power shall be measured in a situation where a 100% command is given.

C. Give a 99% command and measure the output power after the output changes.

D. Give a 50% command and measure the output power after the output changes.

[Judgment Criteria]

A. For equipment compatible with contract capacity conversion (extended type), the output at solar panel capacity = 0.8Pp and power command value = 100% shall be 100% of the contract capacity (80% of the rated output of the PCS).

B. The output at the 99% command is 99% of the contracted capacity (79.2% of the rated output of the PCS).

C. The output at 50% command shall be 50% of the contracted capacity (40% of the rated output of the PCS).

   In all of the above criteria, the accuracy shall be within ±5% of the contracted capacity.

   In addition, if both of the following conditions are satisfied:

   - "Contracted capacity conversion is performed by the output controller," and
   - If both of the following conditions are satisfied: "It is confirmed that the output control command value monitor is displaying the correct value in the remote output control confirmation test (narrowly defined PCS specification confirmation)", the output control command value monitor log may be used to confirm the value.
   - For products with power output and other control functions.

   If all of the listed conditions are satisfied, it may be confirmed by the output control command value monitor log.

[Remarks]

The solar panel capacity setting must be able to be set without error.

The solar panel capacity or facility capacity can be set directly, and the setting method should be clear in the setting manual, etc.

The output change time shall also operate correctly according to the contracted capacity.

2.1.3.2 Contract capacity conversion verification test (for solar panel capacity = 1.2 Pp)

~~[Test conditions]~~

~~Standard test conditions shall apply.~~

[Measurement method]

A. Set the solar panel capacity = 1.2 Pp。

   For products that do not set the solar panel capacity but set the contract capacity, this test shall not be required for models that cannot set the contract capacity to a value exceeding 1.0 Pp.

B. After a 99% command is given and the output changes, products with a reverse power flow control function shall measure the amount of reverse power flow at the receiving point, and products with a power generation output control function shall measure the output.

C. After a 50% command is given and output changes, products with a reverse power flow control function shall measure the amount of reverse power flow at the receiving point, and products with a power generation output control function shall measure the output.

[Judgment Criteria]

A. The output at 99% command shall be 99% of the rated output of the PCS.

B. The output at 50% command shall be 50% of the rated output of the PCS.

In addition,
If both of the following conditions are satisfied, the output control command value monitor log may be used to confirm the results:

- "The contracted capacity conversion is performed by the output controller."
- "When it is confirmed that the output control command monitor displays the correct value in the remote output control verification test (narrowly defined PCS specification verification)."
- For products with power output and other control functions.

If all of the listed conditions are satisfied, it may be confirmed by the output control command value monitor log.

2.1.4 Contracted capacity conversion value rewriting prevention (security) verification test

[Confirmation Method]
Confirm in the specifications, etc. that the contracted capacity conversion value cannot be rewritten by general user operations.
[Judgment criteria]
All user interfaces shall be equipped with a fixed value setting mode, service mode, password-protected mode, etc.
[Remarks]
When there are multiple user interfaces, check each user interface.

2.1.5 Upper Limit Clip Judgment and Output Control Operation Verification Test

【Common Items】

This test applies to PCSs used in power generation facilities with an installed capacity of less than 10kW and products that have an upper limit clip function in combination with an output controller.
The upper limit clip function is a mechanism that in the case of a power generation facility that was certified before the revision of the scheme and is not subject to output control, if the facility's capacity is likely to increase due to the replacement of a narrowly defined PCS, and if the facility's capacity remains below 10 kW after the increase, and if the power command is 100%, the facility is free to output power up to the rating of the certified capacity increased by the re-certification of the facility. On the other hand, when a command value other than 100% is received, or when no power command is received, the output is reduced to the certified capacity before the increase when not subject to output control.
There are two ways to implement the upper limit clip function: "Upper limit clip operation that switches the output to either the capacity increased by the re-certification or the capacity before the increase when output control is not applied," and "Constant clip operation that always sets the output to the capacity before the increase when output control is not applied," and both of these methods are available. Tests shall be conducted in all cases of operation.
The settings for each case may be implemented upon consultation.
In the case of a facility originally subject to output control, or in the case of an increase in facility capacity due to an increase in solar panels, normal output control will be used.

In the "Supplementary Explanation for the Development of PCS with Output Control Function" published by JEMA, the explanation of the setting method is as follows

Pattern (i) : Setting and display of PCS rating and PV module capacity in the last state before the scheme revision and in the latest state

Pattern (ii) : Setting and display of the upper limit clip value (certified capacity in the last state before the scheme revision)

Pattern (iii) : Setting and display of the last status before the scheme revision, the certified capacity of

the latest equipment and the target of expansion (PCS or PV)

The above three types of examples are described, and the setting method shall be easy to understand, such as following the above examples.
If this function is provided, the certification applicant shall provide technical specifications on how to set and check the upper limit clip operation.

1) Upper limit clip operation based on the output control schedule.
This method checks the control operation for four conditions, which are a combination of "whether the equipment was subject to output control or not before the equipment change" and "whether the reason for the increase in equipment capacity was solar cell capacity" or "whether the equipment capacity was narrowly defined PCS capacity".
   ①. When the capacity of a power generation facility that is not subject to output control becomes large due to the replacement of a narrowly defined PCS (upper limit clip operation)
   ②. When the capacity of a power generation facility subject to output control becomes large due to the replacement of a narrowly defined PCS. (Normal output control operation)
   ③. When the capacity of power generation equipment not subject to output control becomes large due to an increase in solar panel capacity (normal output control operation)
   ④. When the capacity of a power generation facility subject to output control becomes large due to an increase in the capacity of its solar panels (Normal output control operation))
2) The system shall perform constant clip operation regardless of the output control schedule.
(Constant clip shall be performed in connection with a narrowly defined PCS in configurations that require an output control device and other tests.)

2.1.5.1 Upper limit clip operation verification test

【2.1.5 Common Items 1) Case 1)】

[Test Conditions]

Standard test conditions shall apply.

However, items G and H shall be changed to the following content.

G. For products with a reverse power flow control function or a power output control function, connect a load of approximately 10% of the rating between the ACCT and the PCS for reverse power flow control as shown in Appendix Figure I. Connect a load of approximately 10% of the rating between the ACCT and the PCS. For all products, set the load at the output end of the AC power supply to achieve the specified output.

H. The broadly defined PCS shall be set up so that the equipment capacity becomes large by replacement of the original output control non-preemptive, narrowly defined PCS. (Capacity before replacement is, for example, 80% of the specified output)

[Measuring method].

Give a 99% command and measure the output after the output changes.

[Judgement criteria]

The average output power shall be within ±5% of the maximum specified output power of the PCS before replacement with respect to the output command value.

In addition, the

- Upper limit clip control is being performed by the output controller.
- When it is confirmed that the output control command value monitor displays the correct value in the 1. Remote output control verification test (narrowly defined PCS specification verification)

If both conditions are satisfied, this may be confirmed by the output control command value monitor log.

[Remarks]
Upper limit clip operation is a system that is allowed on the premise of the generation output and other control functions if the system has surplus purchase control and is not allowed in combination with the reverse power flow control function.

2.1.5.2 Upper Limit Clip Judgment Confirmation Test

【2.1.5 Cases of Common Items 1) ②, ③, ④】

This test shall be applied when the "broadly defined PCS" determines that the upper limit clip operation is applied or not applied, such as setting methods (i) and (iii) described in the "Supplementary Explanation for the Development of PCS with Output Control Function", setting both the status before the scheme revision and the latest status.

[Test Conditions]

Standard test conditions shall apply.

However, paragraphs G and H shall be changed to the following content.

G. For products with a reverse power flow control function or a power generation output control function, connect a load of approximately 10% of the rating between the ACCT and PCS for reverse power flow control as shown in Appendix Figure I. For all products, set the load at the output end of the AC power supply to achieve the specified output.

H. The PCS shall be set as follows: (All of the following conditions shall be tested.)

- Subject to output control, narrowly defined PCS replacement with a larger capacity (2.1.5 Common items 1) ②)
- Setting where the installed capacity becomes large due to an increase in the solar panel capacity (2.1.5 Common items 1) ③)
- Subject to output control, setting where the installed capacity becomes large due to an increase in solar panel capacity (2.1.5 Common items 1) ④)

[Measurement method]

0% command is given, and after the output changes, the reverse power flow at the receiving point is measured for products with a reverse power flow control function or power generation output control function, and the output is measured for products without a reverse power flow control function or power generation output control function.

[Judgment Criteria].

Reverse power flow or output is less than or equal to 5% of the maximum specified output of the PCS.

In addition,

Upper limit clip control is being performed by the output controller.

When it is confirmed that the output control command value monitor displays the correct value in "1. Remote output control confirmation test (narrowly defined PCS specification confirmation)".

If both conditions are satisfied, this may be confirmed by the output control command value monitor log.

[Remarks]

This test is designed to confirm that upper limit clip operation is not allowed, and that normal output control operation is achieved. Judgment criteria shall be applied according to each function for the presence or absence of the reverse flow control function or the generation output etc. control function.

.

2.1.5.3 Constant Clip Operation Verification Test

【Cases of Common Matter 2)】

[Test Conditions]

Standard test conditions shall apply.

However, paragraphs G and H shall be changed to the following content.

G. For products with a reverse power flow control function or a power generation output control function, connect a load of approximately 10% of the rating between the ACCT and PCS for reverse power flow control as shown in Appendix Figure I. For all products, set the load at the output end of the AC power supply to achieve the specified output.

H. The PCS shall be set to be constantly clipped at the narrowly defined PCS rated output (facility-approved capacity when not subject to output control) prior to replacement. The PCS shall be set so that the capacity of the facility becomes larger when the narrowly defined PCS is replaced (The capacity before replacement is, for example, 80% of the rated output.)

[Measurement method].

Give a 100% command and measure the output after the output changes.

[Judgment Criteria]

The average output power shall be within ±5% of the maximum specified output power of the PCS before replacement with respect to the output command value. In addition: The upper limit clip control is performed by the output controller.

- The upper limit clip control is performed by the output controller.
- When it is confirmed that the output control command value monitor displays the correct value in the 1. Remote output control verification test (narrowly defined PCS specification verification).

  If both conditions are satisfied, the output control command value monitor may be checked by logging the output control command value monito。

[Remarks]

1. In the case of constant clip operation for both the narrowly defined PCS only and with the output controller, the tests in Section 1.6 shall also be performed. In addition, if no test has been performed in Section 1.6 "Confirmation of constant clipping by narrowly defined PCS", the constant clipping test by narrowly defined PCS shall be performed in this test section.
2. In “Supplementary Explanation for Development of PCS with Output Control Function” Upper Limit Clip Operation (2/3) published by JEMA, in the case of having surplus purchase control in constant clip operation with output control device, the system is approved on the premise of control function of generation output etc. and is not allowed to be used together with the reverse flow control function.

2.1.6 Input power surge verification test

This test is performed when the output level cannot be controlled by the PCS alone and is measured sequentially by the output controller for closed-loop control:

The [test purpose], [test conditions], [measurement method], and [judgment criteria] shall be in accordance with 1.4 Input power surge verification test (narrowly defined PCS).

2.1.7 Surplus Purchase Control Accuracy Verification Test

(Former name: Reverse Current Prevention & Prevention Accuracy Verification Test)

This test is not applicable when the system only has the same value of the PCS output control command value and the generation output limit value.

If multiple reverse power flow detectors (combination of current sensor and measurement circuit) can be set, each reverse power flow detector shall be checked individually.

[Test Objective.]

To confirm that even if the product has a surplus purchase control function (Reverse power flow control function or power generation output control function) that allows generation of power for its own consumption and the load's power consumption decreases or the amount of power generated increases rapidly, the amount of power generated will not exceed the commanded value or the amount for its own consumption for products with a generation output etc. control function, and the amount of reverse power flow for products with a reverse power flow control function will not exceed the commanded value.

[Remarks]

The judgment criterion regarding the response speed in this test is that the operating time shall be 5 minutes or less for any output change time setting from 5 to 10 minutes. For control of surplus purchase, output change according to the output change time setting need not be applied in order to minimize power fluctuations at the

receiving point as much as possible.

2.1.7.1 Operation verification test at reduced surplus purchased load

[Test conditions]
Standard test conditions shall apply.
However, paragraph (E) shall be changed to the following. Paragraphs (G) and (H) shall not apply.

E. Set the output change time to 10 minutes.

[Measurement method]

A. 20% command is given.

B. Turn on switches SW_{CB}, SW_{LN}, and SW_{LD}, respectively, to operate the PCS.

C. After the PCS is in rated operation or at maximum output after shifting to the reverse power flow prevention control mode, the load shall be reduced from 100% to about 10%.

D. After changing the load, measure the time until the reverse power flow rate at the receiving point becomes 25% for products with the reverse power flow rate control function and the output for products with the generation output control function.

E. After the output has stabilized, the reverse power flow rate at the receiving point shall be measured for products with the reverse power flow rate control function, and the output shall be measured for products with the generation output control function.

F. Set the load back to 100% again and measure the time until the PC power is at 25%. Set the load back to 100% again, and when the PCS is in rated operation, the communication between the reverse power flow detector and the output controller shall be disconnected. Note that if the same communication method (physical layer and protocol) is used, this test should be checked with only one type of reverse current flow detector. However, if there are multiple communication methods (physical layer and protocol) between the reverse current detector and the output controller, this test shall be performed for all communication methods.

G. After communication is interrupted, the product with a reverse power flow control function shall measure the reverse power flow rate at the receiving point, and the product with a generation output control function shall measure the change in output.

[Judgement criteria]

A. The time between the change in load and the reverse power flow or output falling below 25% shall be as short as possible, but not more than 5 minutes at the maximum.

B. Reverse power flow or output shall be 20% when output is stabilized.

C. The output of the PCS shall be less than or equal to the output according to the command value within 5 minutes after the communication between the reverse power flow detector and the output controller is disrupted.

[Remarks]

1. With the expansion of non-firm support, the technical specifications were revised after June 2023 to take into account the characteristics of the power source types to be supported, and in addition to “controlling power output, etc.” as surplus purchase control, “controlling reverse water flow rate at the interconnection point” is also allowed. In accordance with this change, the measurement method was written differently according to the control method.
2. The communication interruption test for the reverse power flow detection unit should be conducted when a communication method such as wireless that may cause interruption is used, or when the wiring for communication from the reverse power flow detection unit to the power conditioner can be touched by the user, or when there is a possibility of disconnection.

2.1.7.2 Operation verification test for increased surplus purchased input power

[Test conditions]
Standard test conditions shall apply.
However, change the contents of E, G, and H to the following.

E. Set the output change time to 10 minutes.

G. The load shall be approximately 20% of the PCS specified output.
H. Record in advance the settings of the DC power supply that can maintain 5% to 15% of output.

[Measurement method]
A. 0% command is given.
B. Turn on switches SWCB, SWLN, and SWLD, respectively.
The DC power supply shall be capable of maintaining 5% to 15% output.
PCS shall be operated.
C. After the PCS has been operated according to the input level, the DC power supply shall be set to an output that allows the PCS to operate at its rated level.
D. After the output of the DC power supply is changed, measure the change in output.

[Judgement criteria]
A. The time between the sudden increase in input power and the time when the reverse power flow at the receiving point becomes 5% or less shall be as short as possible, but not more than 5 minutes at the maximum.
B. When the power at the receiving point stabilizes, the average reverse power flow at the receiving point shall be less than 5% of the maximum specified output of the PCS.

2.1.8 Update schedule reading confirmation test

(Former name: Online Control Communication Frequency Verification Test)

[Test purpose]

Read the sequentially distributed update schedule according to the specifications and confirm that control is performed according to the latest update schedule.

[Test condition]

Standard test conditions shall apply.

However, add section "I".

I. Set up an update schedule A and a fixed schedule on the simulated schedule server. In addition, be prepared to set up Update Schedules B and C. Note that all dates should be set to the same date.

Update schedule	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	Next access
A	10% (0x0A)	20% (0x14)	30% (0x1E)	50% (0x32)	60% (0x3C)	70% (0x46)					10:30
B			30% (0x1E)	40% (0x28)	50% (0x32)	70% (0x46)	80% (0x50)	90% (0x5A)			11:52
C					60% (0x3C)	100% (0x64)	100% (0x64)	100% (0x64)	100% (0x64)	100% (0x64)	12:30
Fixed schedule	←yyyy/mm/1 e.g.2022/1/1				25% (0x19)			【yyyy+1】/【mm+1】/1 → e.g.2023/1/31			—

No command data in gray hatched areas

Multiple overlap tests will be conducted in accordance with current output control technology specifications. The maximum amount of overlap should be 335 frames (the maximum number of data in the update schedule 336 minus the minimum number of non-overlapping data 1).

[Measurement method]

A. Start the output controller and load the updated schedule A and fixed schedule D.
B. Set the current time of the output controller to a time before 10:00 of the set date and confirm that the output has stabilized.
C. Measure the change in output from 10:00.
D. Set update schedule B on the simulated schedule server and have it read the output controller's update schedule B at the next access time.

E. Set update schedule C on the simulated schedule server and load update schedule C of the output controller at the next access time.

F. After 12:00, measure the stable output level after the output change.

G. Perform the test in all formats (for batch and split) that the fixed schedule supports.

[Judgement criteria]

A. After 10:00, the output after the output change shall be 10%.

B. After 10:30, the output after the output change shall be 20%.

C. After 11:00, the output after the output change shall be 30%.

D. After 11:30, the output after the output change must be 40%.

E. After 12:00, the output after the output change shall be 60%.

If it is confirmed that the output control command value monitor displays the correct value in the 1. remote output control verification test (narrowly defined PCS specification verification), the display may be used for verification.

[Remarks]

The time may be reduced by setting the time. The method of changing the time may be implemented after consultation with the certification applicant. ~~Note that the schedule is different from the previous testing method, and an additional clause "E" has been added to the Judgement criteria.~~

2.1.9 Control Days Verification Test

There are two types of fixed schedule data structures that can be obtained: batch (for 13 months) and split (for 1 month), and the corresponding schedule differs depending on the model.

The simulated power plant ID should be an ID with a checksum of "0".

[Test purpose]

When the fixed schedule is updated, the fixed schedule is read at night when there is no solar radiation, the output is output according to the command values after the start of solar radiation on the next day, the system is controlled according to the updated fixed schedule, and the system stops when the schedule is exhausted.

[Test condition]

Standard test conditions shall apply.

In addition, add section I.

I. Set up an update schedule A and a fixed schedule B on the simulated schedule server.
In addition, prepare to set up Update Schedule C and Fixed Schedule D (Fixed Schedule D may be set up in advance).

~~**Update Schedule A**~~

~~Control date and time: yyyy/[mm + 1]/1 09:00 (*e.g.* 2/1/2018), control rate: 50%, 40%, 30%, next time: yyyy/[mm + 1]/1 09:30 (*e.g.* 2/1/2018)~~

~~**Fixed Schedule B**~~

~~Control date and time: yyyy/mm/1 00:00 (*e.g.*: 2018/ 1/ 1),Control rate: 5%,5%,. .5%,5%)~~
~~(For 13 months (for batch) or 1 month x 13 (for split))~~

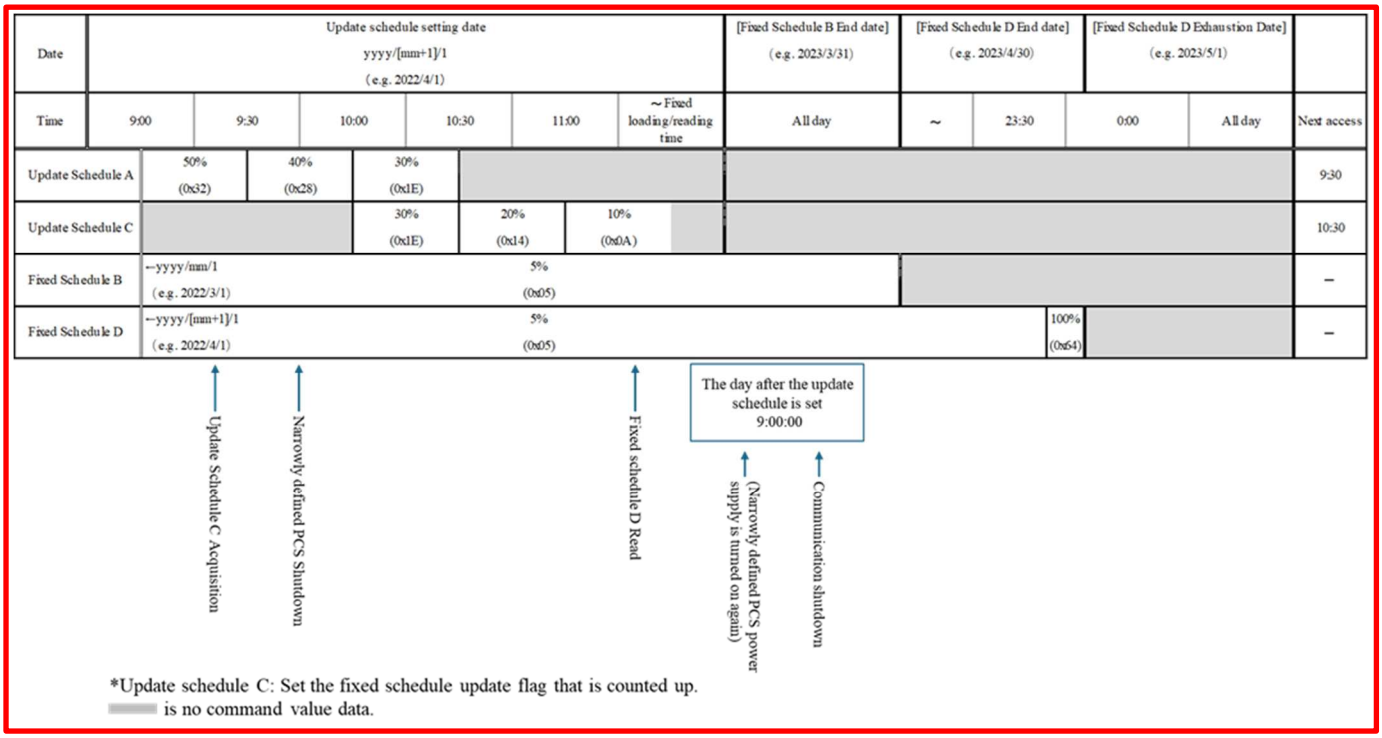
~~**Update Schedule C (Fixed schedule update flags counted up)**~~

~~Control date and time: yyyy/[mm + 1]/1 10:00 (*e.g.* 2018/ 2/ 1), control rate: 30%, 20%, 10%, next time: yyyy/[mm + 1]/1 10:30 (*e.g.* 2018/ 2/ 1)~~

~~**Fixed schedule D**~~

~~Control date/time: yyyy/[mm + 1]/1 00:00 (*e.g.* 2018/ 2/ 1) ,Control rate: 5%,5%. .5%,100%)~~

~~(For 13 months (for batch) or 1 month x 13 (for split))~~



[Measurement method]

A. Start the output controller and load update schedule A and fixed schedule B. Update schedule C and fixed schedule D with the fixed schedule update flag counted up in the simulated schedule server by the next access time.

B. After the output controller accesses the simulated schedule server and completes obtaining the updated schedule C, the DC input shall be interrupted and the time of the output controller shall be set to the time when the updated fixed schedule D can be obtained (e.g., before "yyyy/[mm + 1]/1 21: 10" (*e.g.* 2/ 1/2018)).

C. After the output controller accesses the simulated schedule server and completes obtaining the fixed schedule D, set the time of the output controller to a time before "yyyy/[mm + 1]/2 9: 00" (*e.g.* 2018/ 2/ 2).

D. Turn on the DC input at the setting where the PCS can provide the specified output.

E. Shut down the communication between the output controller and the simulated schedule server and maintain it until the output stabilizes at the command level.

F. Check the operation of the PCS after the output has stabilized.

G. Set the time of the output controller to a time before "[yyyy + 1]/[mm + 1]/dd[last day of month] 23: 30" (*e.g.* 2019/ 2/28).

H. Verify the operation of the PCS in the final data of the fixed schedule.

I. Test the fixed schedule in all formats (for batch and split) to which it corresponds.

[Judgement criteria]

A. Within 30 minutes after the communication between the output controller and the simulated schedule server is interrupted, the output shall stabilize and the output shall be 5% of the specified output.

B. The output should change from 5% to 100% of the specified output from "[yyyy + 1]/[mm + 1]/dd[last day of month] 23: 30" (*e.g.* 2019/ 2/28).

C. Output shall be set to 0% within 10 minutes and 30 seconds (10 minutes + 5%) from the time "$[yyyy+1]/[mm+2]/1\ 0{:}00$" ($e.g. 3/1/2019$) of the output controller.

Note that those that resolve at 0% output are also acceptable.

If it has been confirmed that the output control command value monitor displays the correct value in the 1. remote output control verification test (narrowly defined PCS specification verification), the display may be used for verification.

However, if a mechanism to stop the system due to schedule exhaustion has not been confirmed in previous tests, a test on the system is required.

[Remarks]

The mechanism for setting the output to 0% after schedule exhaustion shall also be described in the specifications, such as setting the command value from the output controller to 0%, or the mechanism for stopping the system, such as communication breakdown.

2.1.10 Forward Direction Clock Tampering Countermeasure Verification Test

(Former name: Clock tampering countermeasure verification test (for settings and advances that exceed the clock adjustment tolerance))

This test is performed on products that have the ability to manually change the clock in the normal mode that can be set by the user.

If the product does not have the ability to manually change the clock in the normal mode that can be set by the user, service personnel must be able to change the clock manually.

This test assumes no communication function or communication function but no communication.

[Test condition]

Standard test conditions shall apply.

However, paragraph A shall be changed to the following:

A. The test circuit shall be the circuit connection shown in Appendix I. This test may be performed only with the output controller.

In addition, add paragraphs "I" through "K".

I. The test shall be conducted with the communication between the simulated schedule server and the output controller disconnected.

J. The test shall be conducted in a normal mode that can be configured by the user.

K. The current time of the output controller shall not exceed the day during the test.

[Measurement method]

A. Check the current time of the output controller.

B. Manually advance the clock 10 minutes from the time in (A) to check the current time of the output controller.

C. Manually advance the clock by 1 minute from the time in (B) to check the current time of the output controller.

[Judgement criteria]

A. 10-minute clock change shall be reflected normally.

B. A clock change of 1 minute after a 10-minute clock change shall be invalid.

[Remarks]

This test shall confirm that the clock cannot be changed beyond 10 minutes when an ordinary user can change the clock within 10 minutes; if the number of clock changes per day is limited and the above Measurement Method cannot be performed, it shall be confirmed that the clock cannot be changed beyond 10 minutes on another day.

If there are multiple user interfaces, check for each user interface.

2.1.11 Delayed Direction Clock Tampering Countermeasure Verification Test

(Former name: Clock tampering countermeasure verification test (for settings and delays exceeding the allowable range of clock adjustment))

This test is performed on products equipped with a manual clock change function.

This test assumes that there is no communication function, or that there is a communication function, but communication is disabled.

[Test condition]

Standard test conditions shall apply.

However, paragraph A shall be changed to the following content.

A. The test circuit shall be the circuit connections shown in Appendix I.

This test may be performed with the output controller only.

In addition, add paragraphs "I" through "K".

I. The test shall be performed with the communication between the simulated schedule server and the output controller is disconnected.

J. The test shall be conducted in a normal mode that can be configured by the user.

K. The current time of the output controller shall not cross the day during the test.

[Measurement method]

A. Check the current time of the output controller.

B. Manually set the clock back 10 minutes from the time in (A) to verify the current time of the output controller.

C. Manually set the clock back 1 minute from the time in (B) to verify the current time of the output controller.

[Judgement criteria]

A. A 10-minute clock change shall be reflected normally.

B. A clock change of 1 minute after a 10-minute clock change shall be invalid.

[Remarks]

Same as section 2.1.10.

2.1.12 Test for Confirmation of Retention of Timekeeping Function during Power Failure

(Former name: Test to confirm measures against clock loss (Confirmation of retention of timekeeping function during power failure))

This test assumes that there is no communication function, or that there is a communication function, but communication is not possible.

Under conditions where time synchronization via communication is not possible, it shall be confirmed that a power failure of 5 minutes or less does not result in loss of time information and stoppage of operation.

The following tests shall be conducted on products that continue to operate under conditions where communication with the utility company's server is not possible.

For products that do not continue operation when communication with the power company server is not possible, confirm that they do not start up or stop within 5 minutes after startup, even if the startup operation is performed when communication is not possible, according to the specifications of the output control device.
Confirm with the specifications that setting the time of the output controller in a situation where communication is not possible does not continue operation.

[Test condition]

Standard test conditions shall apply.

However, paragraph A shall be changed to the following content.

A. The test circuit shall be the circuit connection shown in Appendix I.

The AC power supply shall be operated at the rated voltage and frequency.

The line impedance shall be short-circuited.

This test may be performed only with the output controller.

In addition, add paragraph "I".

I. Set to normal mode, which can be configured by the user.

[Measurement method]

A. Match the current time of the output controller with the server time and shut down communication between the output controller and the NTP.

B. B. Shut down the power supply to the output controller; for equipment powered by the PCS, shut down the DC and AC power supply to the PCS.

C. C. After 300 seconds have elapsed since power was shut down, power shall be resupplied to the output controller, and the difference between the current time of the output controller and the server time shall be checked.

[Judgement criteria]

After the power is restored, the difference between the current time of the output controller and the server time shall be within ±15 seconds.

[Remarks]

The time of power supply interruption to the output control device shall be confirmed by the power supply current waveform, or by logs that show that the output control device is stopped, such as no response from the output control device both after the power supply interruption and at least 5 minutes after the time when the power supply interruption was confirmed.

2.1.13 Verification test of operation stoppage due to loss of time information

(Former name: Communication Failure etc. Clock Loss Countermeasure Confirmation Test (Confirmation of operation stoppage in case of clock information loss))

This test is conducted on products that may interrupt the power supply to components that maintain time information, such as real-time clocks, during operation.

This test assumes that there is no communication function, or that there is a communication function but communication is not possible.

[Test condition]

Standard test conditions shall apply.

However, paragraph E is changed to the following content.

E. Set the output change time to 10 minutes.

Also, add paragraph "I".

I. This is performed with the communication between the simulated schedule server and the output controller disconnected.

[Measurement method]

A. Check the current time of the output controller.

B. Give 100% command.

C. Disappear the time information of the output controller. The means of losing the time information may be implemented upon consultation with the certification applicant.

D. Check the output.

E. Check the mechanism to stop the PCS when the time information is lost (e.g., sending a PCS stop command when the time information is lost, disrupting communication with the PCS, and stopping when communication is lost).

[Judgement criteria]

A. After the time information is lost, the output should be 0%. The one that resolves at 0% output is also acceptable.

B. Duration of time before output falls below 5% shall be as short as possible, but not more than 5 minutes at the

maximum.

If the stop mechanism has completed the narrowly defined PCS stop confirmation test by a 1.5 higher-level communication device than the output controller, it may be confirmed with a stop command being sent out after the time information is lost.

The time between the time information loss and the sending of the stop command shall be as short as possible, but no longer than 4 minutes at the maximum.

When stopping due to missing schedule information due to time information loss, communication breakdown, etc., it shall be confirmed in the specifications, etc., that the time including the respective detection time shall be less than 5 minutes.

[Remarks]

The certification applicant shall provide the capability or fixture to discharge the internal battery of the product that holds the time information.

In addition, this test shall be satisfied regardless of the output change time setting.

Furthermore, a mechanism to set the output to 0% after the loss of time information (e.g., communication is interrupted) shall be described in the specifications.

2.1.14 Output controller built-in clock accuracy verification test

(Former name: Communication failure, etc. Clock accuracy verification test)

This test assumes no communication function or communication function, but communication is not possible.

[Confirmation Method]

Check the frequency margin of error in the data sheets of the components, etc.

[Judgement criteria]

Clock error shall be within ±60 seconds/month (22.4 ppm or less in a 31-day month), which can be verified by data sheets of components, etc.

2.1.15 Clock Synchronization Confirmation Test

(Former name: Communication failure, etc. Clock verification test)

This test is designed for products that use a communication function with the upper system.

[Test condition]

Standard test conditions shall apply.

However, paragraph A shall be changed to the following content.

A. The test circuit shall be the circuit connections shown in Appendix I.

This test may be performed with the output controller only.

[Confirmation Method]

A. Check the technical specifications.

B. Set the time of the output controller to a time different from the current date and time. The time as well as the date and year must be different.

C. Synchronize the output controller with the simulated schedule server.

[Judgement criteria]

A. The time of synchronization must be specified in the technical specifications.

B. It must be possible to confirm that the synchronization with the clock information of the simulated schedule server is confirmed by logs, etc.

2.1.16 Communication failure verification test from upper system

2.1.16.1 Confirmation test for transition to a fixed schedule

For products with a communication function with the upper system

[Test purpose]

Ensure that the system is controlled according to the fixed schedule when the update schedule cannot be obtained due to communication disruption.

[Test condition]

Standard test conditions shall apply.

[Measurement method]

A. Communication with the simulated schedule server causes the output controller to read the following schedule information.

Update schedule control date and time: $yyyy/mm/dd\ 10:00$ $(e.g.\ 2019/\ 1/\ 1)$, ~~control rate: 20%, 40%, next time: yyyy/mm/dd 10:30 (e.g. 2019/ 1/ 1)~~

~~**Fixed schedule**~~

~~Annual schedule Control date/time: yyyy/mm/01 00:00 (e.g. 2019/1/1) (13 months (for batch) or 1 month (for installment))~~

~~Control rate: 80% for all%~~

Time	10:00	10:30	11:00	~	23:00	23:30	0:00	~	Next access
Update Schedule	20% (0x14)	40% (0x28)							10:30
Fixed Schedule	←yyyy/mm/1 80% (0x50)								–

No command data in gray hatched areas

B. Disconnect communication between the simulated schedule server and the output controller.

C. Set the clock on the output controller to a time before "$yyyy/mm/dd\ 10:00$" ~~$(e.g.\ 1/1/2019)$~~; at 10:00, the output shall be at 80%.

D. Check the output.

[Judgement criteria]

A. After 10:00, the output after the output change shall be 20%.

B. After 10:30, the output after the output change should be 40%.

C. After 11:00, the output after the output change should be 80%.

In addition,

(1) Contract capacity conversion is performed by the output controller.

(2) When it is confirmed that the output control command value monitor is displaying the correct value in the remote output control verification test (narrowly defined PCS specification verification).

If both of the conditions in (1) and (2) are satisfied, it may be confirmed by the log of the output control command value monitor.

2.1.16.2 Fixed schedule exhaustion stop verification test

For products with a setting function that does not perform the communication function with the upper system

[Test purpose]

Ensure that the system stops when the fixed schedule is exhausted in an environment with no communication.

[Test condition]

Standard test conditions shall apply.

[Measurement method]

A. The following schedule information shall be set on the output controller by means provided by the certification applicant.

Fixed schedule annual

B. Annual schedule control date/time: yyyy/mm/1 00:00, Control rate: 80% for all

C. Measure the operating output according to the fixed schedule.

D. Set the time of the output controller to the time before the fixed schedule is exhausted.

E. Check the output change after the fixed schedule is exhausted.

[Judgement criteria]

A. The output shall be 80% when the fixed schedule is in operation.

B. 0% output when the fixed schedule runs out.

In addition, those that are disconnected at 0% output are also acceptable.

In addition,

(1) Contract capacity conversion is performed by the output controller.

(2) When it is confirmed that the output control command value monitor displays the correct value in "1. Remote output control confirmation test (narrowly defined PCS specification confirmation)".

If both conditions are satisfied, it may be confirmed by the log of the output control command value monitor.
However, if the mechanism for stopping the system due to schedule exhaustion depends on narrowly defined PCS unit performance, the system must be tested.

[Remarks]

The mechanism for setting the output to 0% after schedule exhaustion shall also be described in the specifications, such as setting the command value from the output controller to 0%, or the mechanism for stopping the system, such as communication breakdown.

2.2 Confirmation of connection test data with utility server

~~### 2.2.1 Connection check during normal operation (normal sequence)~~

~~This test may be omitted if the contents of this test can be confirmed in "2.2.2 Connection Confirmation Test for Abnormal Operation".~~

~~[Test purpose]~~

~~Confirmation of communication upon successful completion of reception~~

~~[Confirmation Method]~~

~~A. Establish a connection with the utility server.~~

~~B. Communicate using the provisional power plant ID and the official route certificate.~~

~~C. The following test data (transmission/reception logs, etc.) shall be recorded and submitted upon successful completion of the reception. Table 2.6 Result of confirmation of registration of annual fixed schedule or monthly fixed schedule, update schedule, and temporary power plant ID~~

~~[Judgement criteria]~~

~~A. Power Plant ID registration confirmation must be successful.~~

~~B. Fixed schedule can be downloaded successfully.~~

~~C. Update schedule can be downloaded successfully.~~

This test is not performed because it can be verified in section 2.2.2.

2.2.2 Connection Confirmation Test for Abnormal Operation (Abnormal Sequence)

[Test purpose]

Confirmation of communication when receiving process is completed after retrying due to abnormality, etc.

[Confirmation Method]

A. Establish a connection with the utility server.

B. Communicate using the provisional power plant ID and the official route certificate.

C. Record and submit the following test data (transmission/reception log, etc.) when the reception process is completed after retrying due to an abnormality, etc. Table 2.6 of the "Transmission Specifications for the Schedule Information Distribution System for PCS with Output Control Function (less than 66kV) (Power Plants)," the annual fixed schedule or monthly fixed schedule, updated schedule, and the result of the registration check for the temporary power plant ID.

[Judgement criteria]

From the submitted test data (sending/receiving logs, etc.) at the time of communication errors, three types of transmission files shall be carefully examined:

A. For products with a power station ID registration confirmation function, if a response error occurs from the power server during power station ID registration confirmation, automatic re-try shall not be performed. Furthermore, when the communication becomes normal, the registration confirmation can be performed correctly by manual re-try.

B. If the fixed schedule cannot be downloaded successfully, it should be able to be downloaded successfully by retrying.

C. If the update schedule cannot be downloaded successfully, it must be able to be downloaded successfully by retrying.

2.3 Priority Confirmation Test for ECHONET Output Control Commands

Applies to broadly defined PCSs that possess the ECHONET output control command (see Glossary of Terms).

[Test purpose]

In broadly defined PCSs that possess the ability to control outputs using ECHONET output control commands, ensure that commands from remote output control take priority over output control using ECHONET output control commands.

[Test condition]

Standard test conditions shall apply.

However, paragraph E shall be changed to the following content.

E. Set the output change time to 10 minutes.

In addition, add paragraphs "I" through "K".

I. PCS setup shall be implemented as follows:
When the ECHONET output control command is a % indication of the facility's certified capacity.
(Output control setting 1)
Solar panel capacity = 0.8Pp
When the ECHONET output control command is other than a % indication of the capacity certified by the facility.
(Power generation power limit setting 1, etc.)
Solar panel capacity = 1.0Pp

J. Set fixed schedule B and updated schedule A on the output controller.

The date and time shall be the last day of the fixed schedule.

~~- Update Schedule A~~

~~(Control date and time: [yyyy + 1]/mm/dd[end of month] 22:00 (e.g.2019/1/31), Control rate: 100,100,10%, Next time: [yyyy + 1]/[mm + 1]/1 23:00) (e.g.2019/2/1)~~

~~- Fixed Schedule B~~

~~(Control date and time: yyyy/mm/1 00: 00 (e.g.: 2018/ 1/ 1) ,Control rate: (For 13 months (for batch) or 1 month x 13 (for division)) 100%,100%,...100%,70%))~~

Time	22:00	22:30	23:00	23:30	0:00	~	Next Access
Update Schedule A	100% (0x64)	100% (0x64)	10% (0x0A)				23:00
Fixed Schedule B	←yyyy/mm/1		100% (0x64)	70% (0x46)			–

ECHONET commands (%)

←90 - Approx. 22:55
←80 - Approx. 23:04
←70 - After. 23:09
←90 - Approx. 23:33
←80 - After. 23:36
←90 - After. 00:00
←50 - After output stopped.

K. Set the current time of the output controller to 22:45 on the last day of the fixed schedule.

[Measurement method]

A. Create an ECHONET output control command list to control output.

B. Cut off communication with the simulated server. However, ECHONET output control commands should still be received.

C. After confirming that the output is 100%, send one type of ECHONET output control command to the PCS for 90% output.

D. After sending the ECHONET output control commands, measure the time over which the change in output can be confirmed.

E. Confirm that the output has changed according to the instructed value.

F. One type of ECHONET output control command is sent to the PCS for 80% output, taking into account the time measured in paragraph (D), so that the output level is below 70% and above 20% during the output change by the 10% command, and the output change starts in the area where the output is changing.

G. Check the state of change in output until output stabilizes.

H. Send one type of ECHONET output control command to the PCS so that the output changes to 70%, taking into account the time measured in paragraph (D), so that the output starts to change during the time when it is stable at 10% output.

I. After the 70% ECHONET output control command is sent, check the output status until it is confirmed that the output is not changing.

J. Send one type of ECHONET output control command to the PCS so that the output is 90%, considering the time measured in paragraph (D), while the output is changing due to the 70% command, so that the output starts changing in the area where the output is changing more than 20% and less than 60%.

K. Check the state of output change during the period until the output stabilizes.

L. Send one type of echo-net output control command to the PCS so that the output becomes 80%, taking into account the time measured in paragraph (D), so that the output starts to change during the time when the output is stable at 70% output.

M. After sending the ECHONET output control command of 80%, check the output until it is confirmed that the output does not change.

N. Set the time before schedule depletion and confirm that the output is stable at 70%.

O. Send one type of ECHONET output control command to PCS so that the output will be 90%, taking into account the time measured in paragraph (D), so that the output starts to change in the middle of the

output change due to the outage caused by schedule exhaustion after 0:00.

For products whose output changes abruptly, the ECHONET command shall be sent as short a time as possible after schedule depletion.

P. Check the output until the output reaches 0%.

Q. After the output reaches 0%, send one type of ECHONET output control command to PCS so that the output reaches 50%.

R. Check the output after that.

S. Perform paragraphs C through R for all ECHONET output control commands listed in paragraph A. Note that the solar panel capacity setting shall be the setting shown in Test condition B.

[Judgement criteria]

A. The output shall be 90% in accordance with the ECHONET output control command. After the ECHONET output control command is sent, the output shall be 90% in accordance with the ECHONET output control command.

B. The state of output change during the period from the start of output change by the 10% command until output stabilizes shall be unaffected by the ECHONET output control command.

C. The output shall maintain 10% until it is confirmed that the output does not change after the ECHONET command is sent while the output is stabilized at 10% output.

D. The state of output change during the period between the start of output change by the 10% command and the stabilization of output shall not be affected by the ECHONET output control command.

E. The output shall maintain 70% during the period until it is confirmed that the output does not change after the ECHONET command is sent while the output is stabilized at 70% output.

F. The output shall be maintained at 70% output for 10 minutes and 30 minutes after the schedule is depleted. The output shall be set to 0% within 10 minutes and 30 seconds (10 minutes + 5%) after schedule depletion. Those that disconnect at 0% output shall be acceptable.

G. The output shall be maintained at 0% output. The output shall not be changed by subsequent ECHONET output control commands.

H. The output shall not be changed by subsequent ECHONET output control commands. The power command schedule shall not be changed after the test is completed. If the schedule information stored in the output control device cannot be shown, the specification shall not be changed.

If it is not possible to show the schedule information, it shall be shown in the specifications or other documents that the power command schedule is not rewritten.

[Remarks]

1. If the Measurement method paragraph E cannot be confirmed, it is assumed that the test has not been performed successfully.
2. Since "Output control setting 1" of the ECHONET output control command is described as "% indication for facility certified capacity," it should also be checked whether the facility certified capacity is correctly obtained.
3. When the ECHONET output control command to be sent is specified by "W", the W value that results in a given % value of output is transmitted.
4. If there is any uncertainty about the indicated value of the ECHONET output control command, it shall be decided after consultation with the certification applicant.

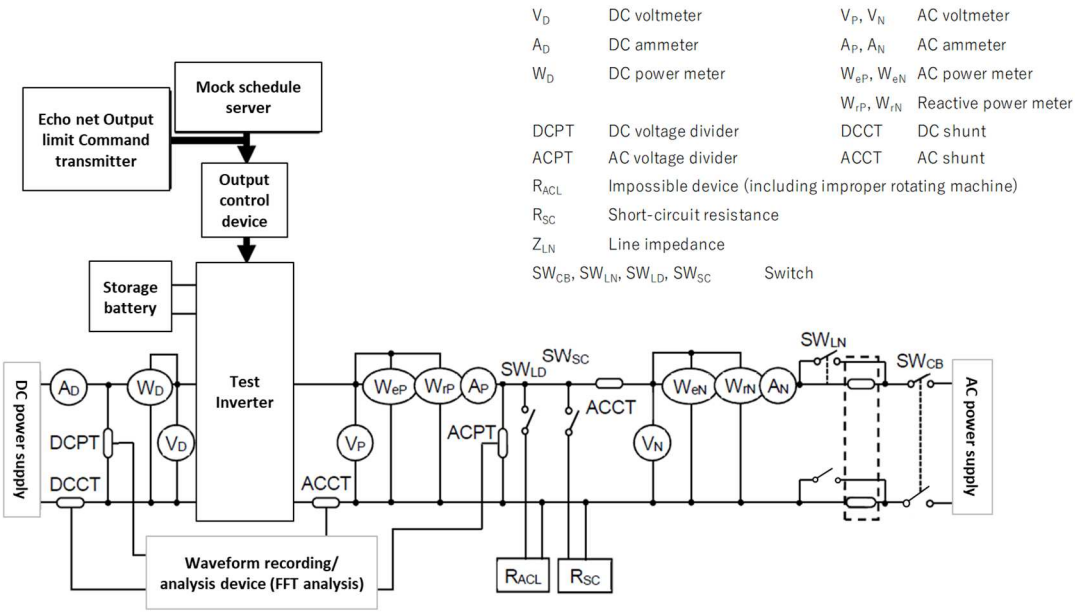
5. If the time required for the output to change after the ECHONET output control command is transmitted is not constant, the timing of the measurement shall be determined in consultation with the certification applicant.
6. If there are issues in conducting the test, the test method shall be determined in consultation with the certification applicant.

Supplementary Provisions

This test method shall apply to products applied for after the effective date of the test method cover date (the specific effective date will be posted on the "Notices" page of the website).

However, if there is an applicable date in the Supplementary Provision of each individual test method, that date shall take precedence.

APPENDIX



Appendix Figure I: Power Conditioner Test Circuit with Remote Output Control Function (in case of multiple DC inputs))

[Attachment] Explanation of Remote Output Control Confirmation Test

[Scope of Certification]
The scope of certification for narrowly defined PCS and broadly defined PCS shall be as shown in the figure below.

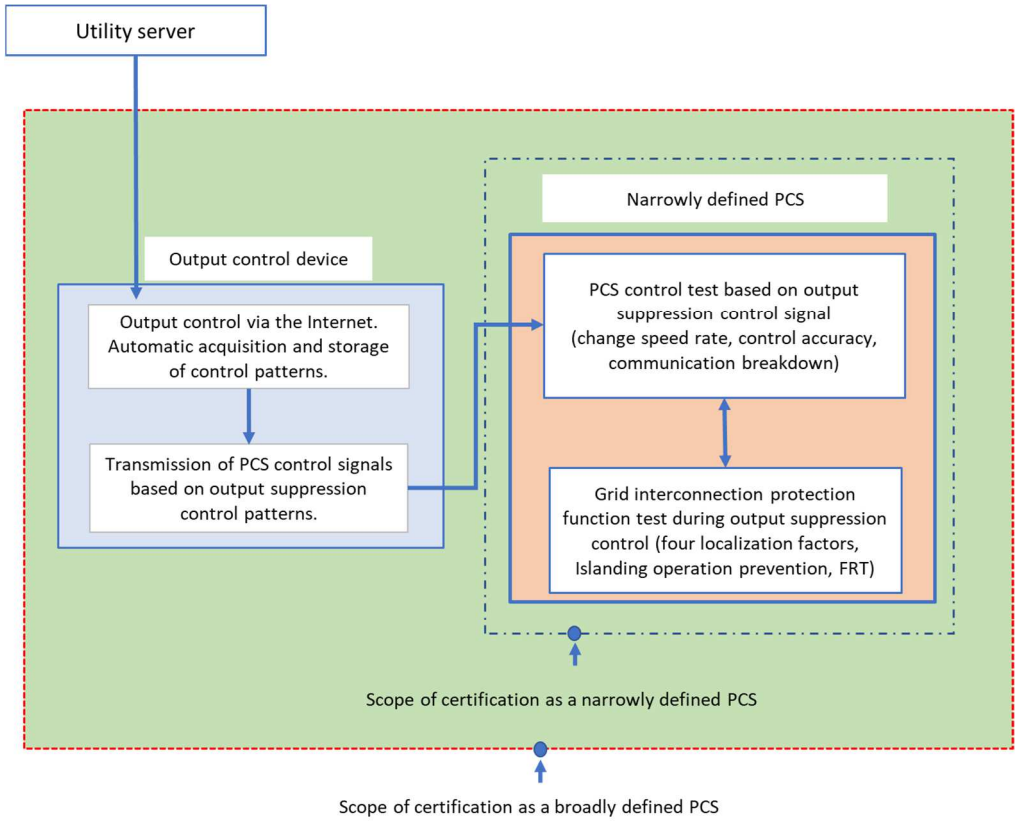


Figure 1 Scope of Certification for Power Conditioners

【Concept of output accuracy】
Set the power meter settings as follows, obtain the csv data, and graph the data in Excel or other software.
No deviation from ±5% of the maximum specified output over the period of measurement (1,500 data).
Data update rate: 200 ms
Averaging processing: off
Filtering: off

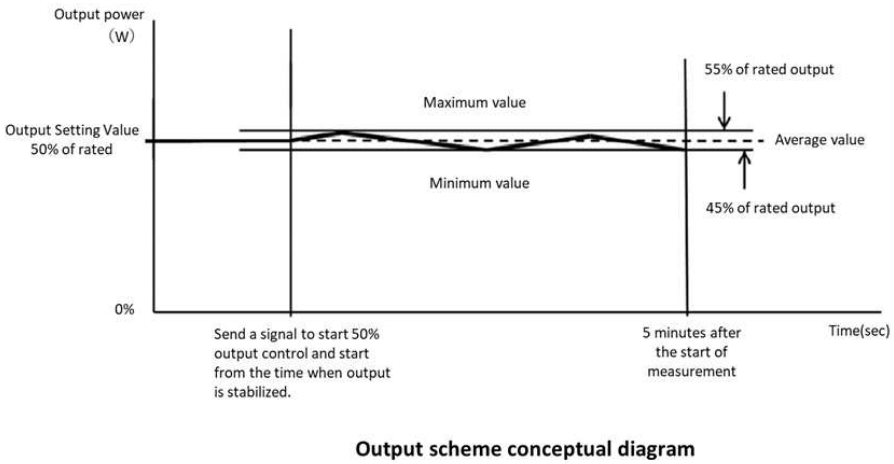


Figure 2 Conceptual diagram of output accuracy

[Concept of output control]

Set the power meter settings as shown below, obtain the csv data, and graph the data in Excel or other software. The following figure shows the measured period (e.g., 1,500 pieces of data when the control time is 5 minutes).

Data update rate: 200 ms

Averaging processing: off

Filtering: off

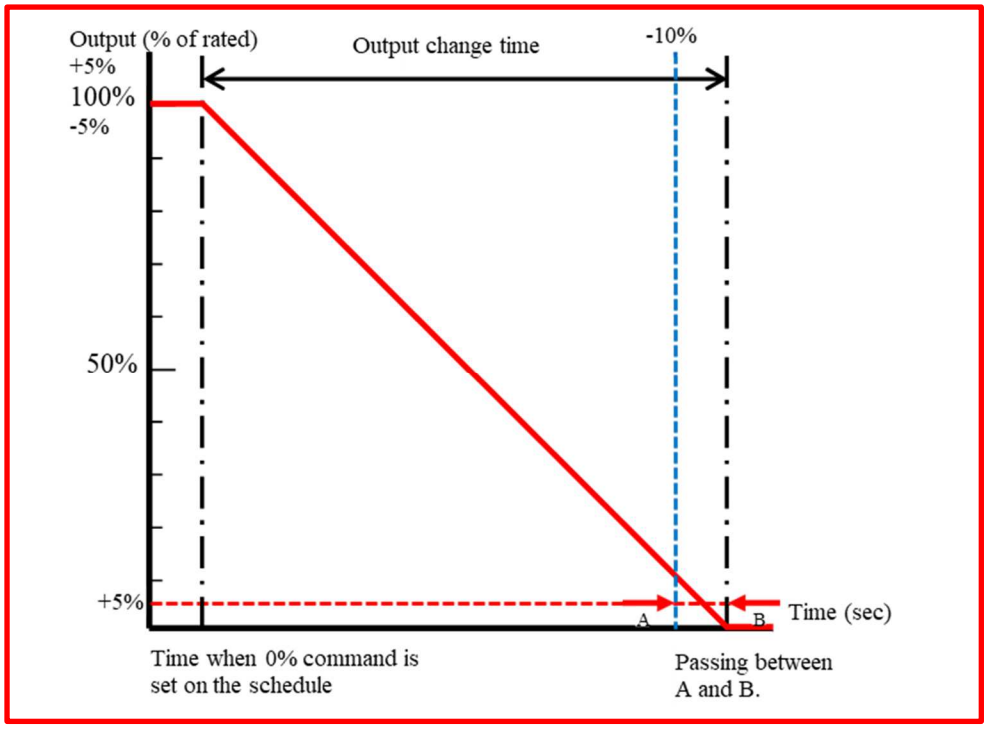


Figure 3 Example of linear control from 100% to 0%

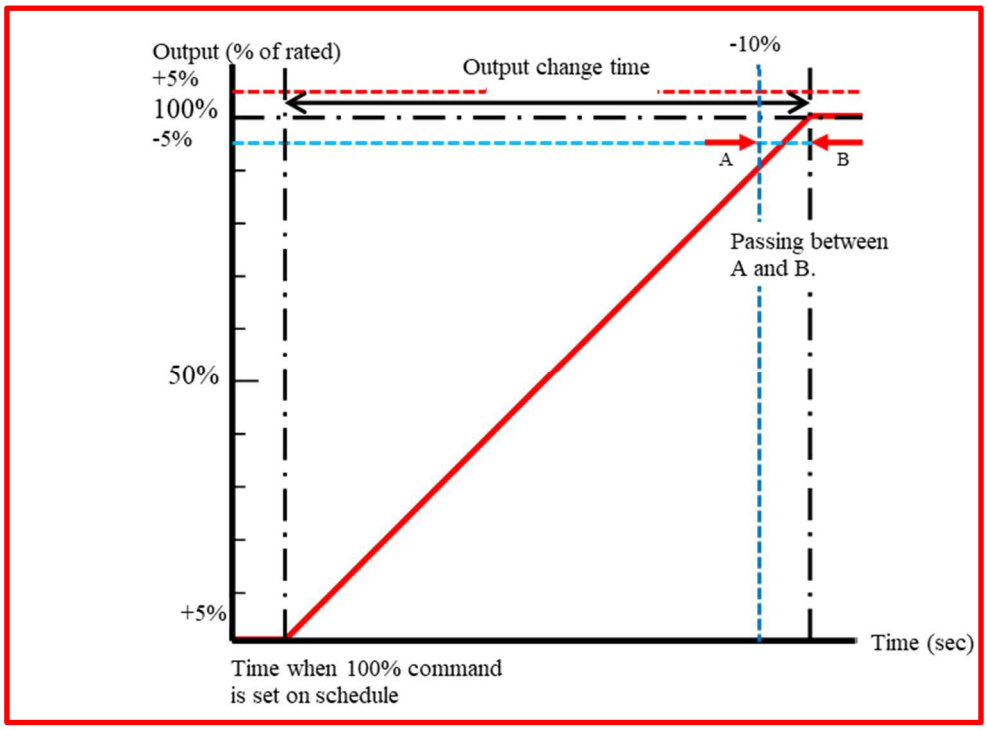


Figure 4 Example of linear control from 0% to 100%

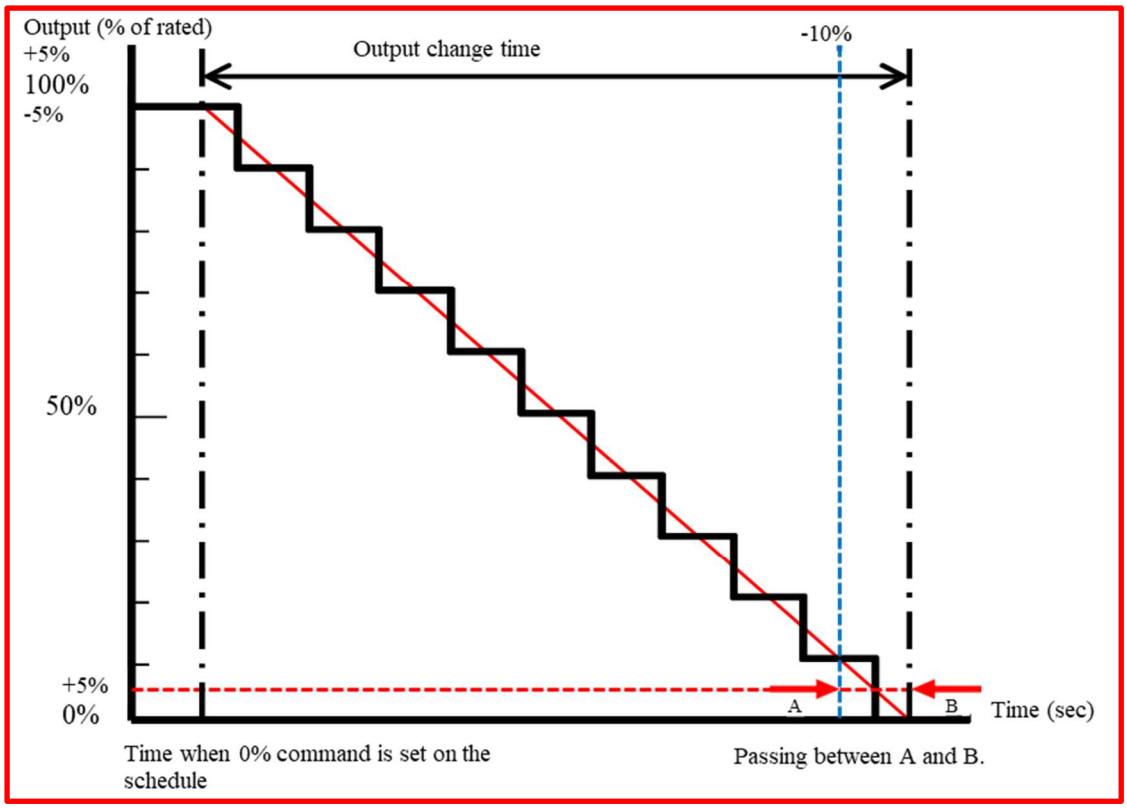


Figure 5 Example of step control from 100% to 0%

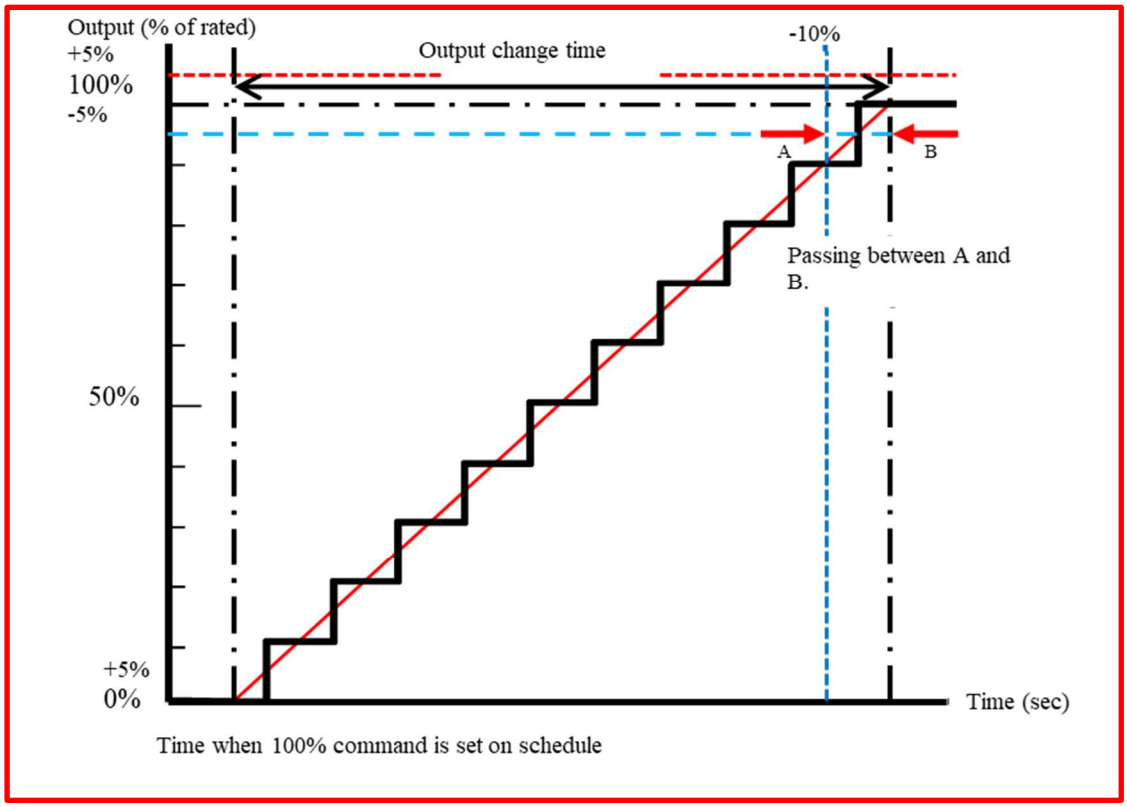


Figure 6 Example of step control from 0% to 100%

In addition, judgments that were allowed in the previously presented drawings are also acceptable. However, it is preferable to control according to Figures 5 and 6 if possible.

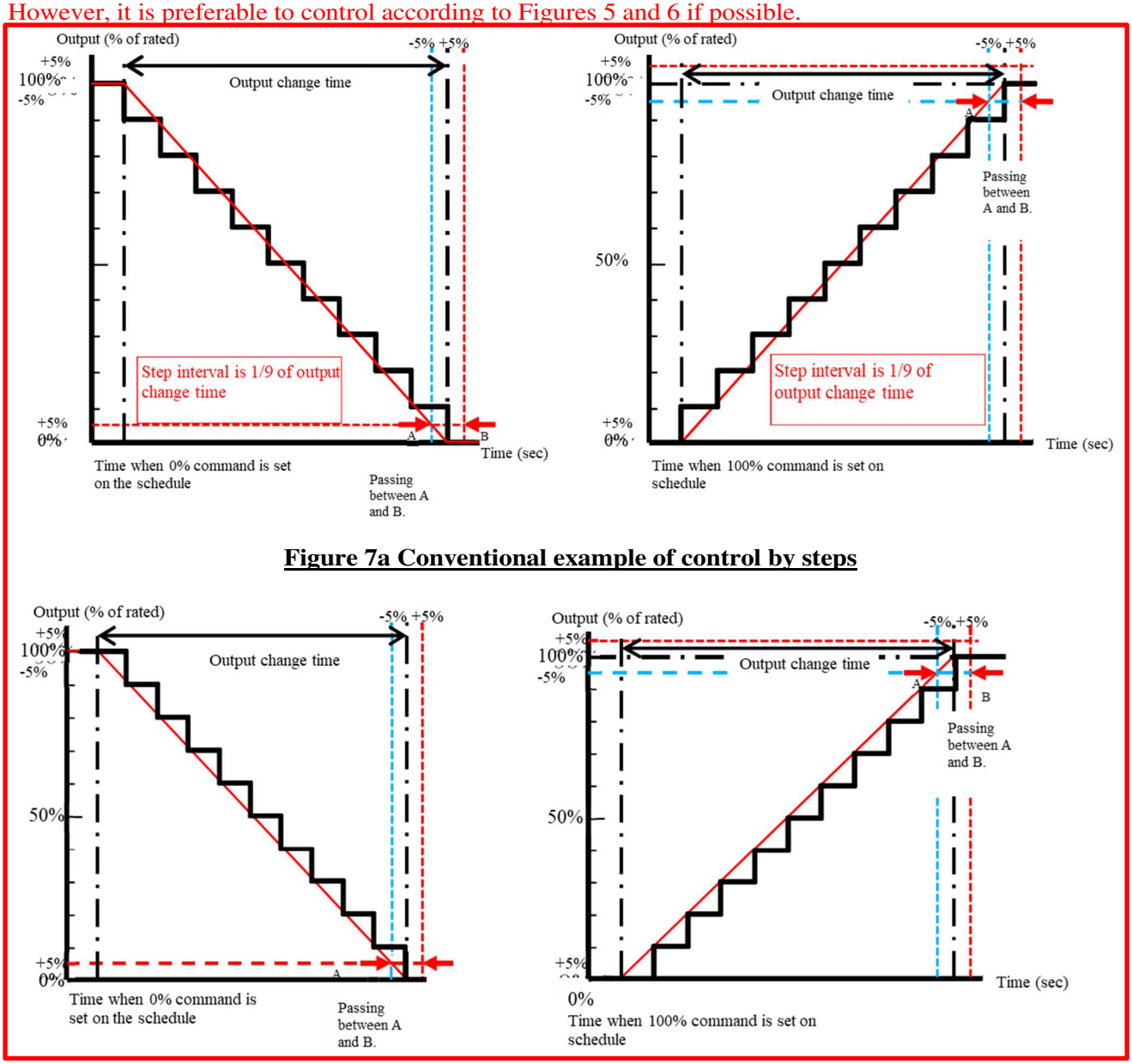


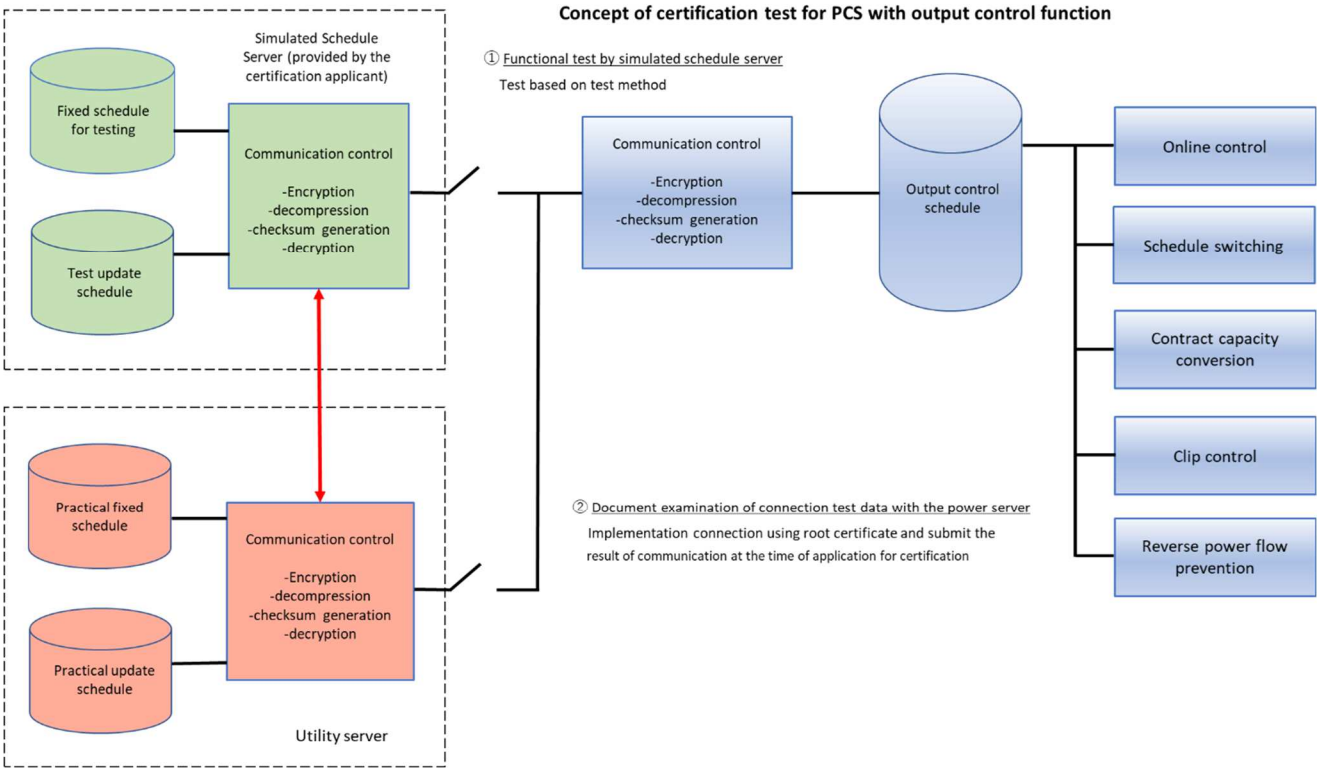
Figure 7a Conventional example of control by steps

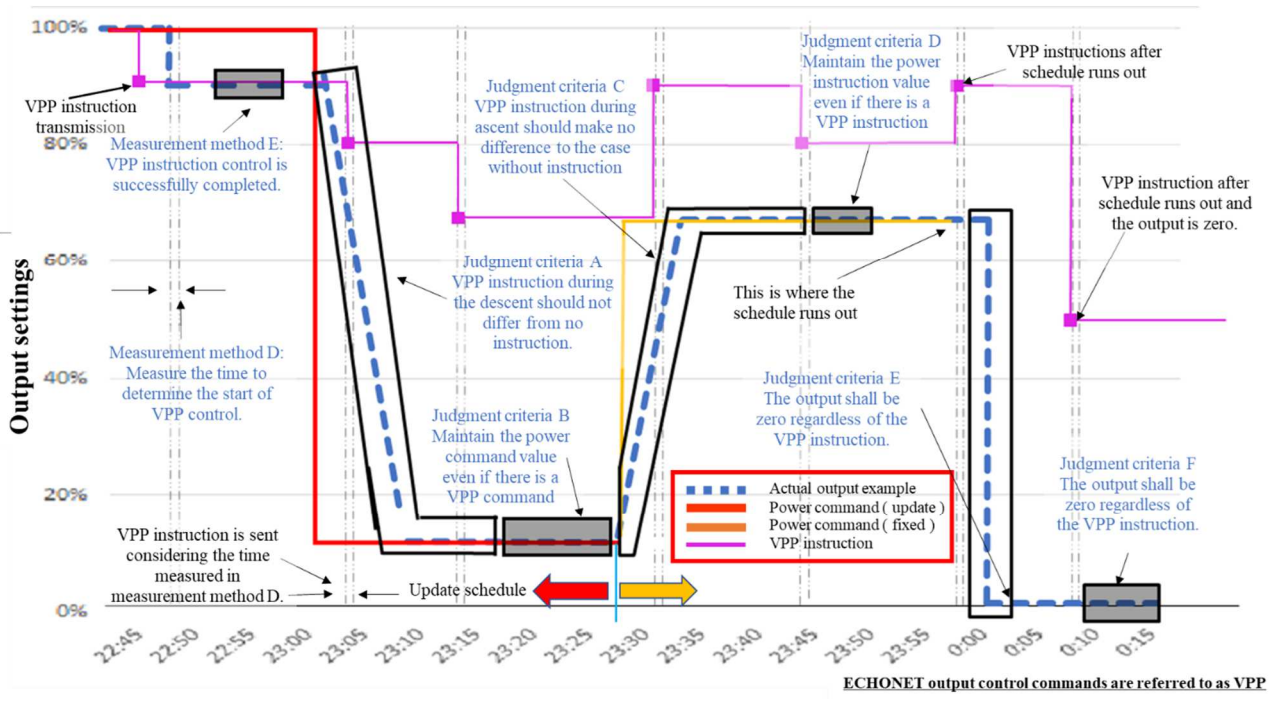
Figure 7b Conventional example of control by steps

[Narrowly defined PCS requirements]

Output Control Setting Range	0-100%, 1% step
Output Accuracy	Within ±5% of rated output
Control time to suppression command value	100% → 0%: within 5mins 0% → 100%: within 5mins If the control time can be set with a view to "Broadly Defined," it can be set in 1-minute increments and within ±5% of the set time.
Communication interruption detection time	within 5mins
Display of communication interruption detection time	Depends on manufacturer's specifications

Figure 7 Broadly defined PCS certification test concept





Test operation example of priority confirmation test for Echonet output control command