Equipment used in the reception
and execution of remote monitoring/control commands for RES & CHP stations connected or to be connected to the HEDN
with an installed capacity exceeding four hundred kilowatts
Version 3 – 20/12/2024

DOCUMENT INFORMATION

NAME	Equipment for receiving and applying remote monitoring/supervisory control commands for RES & CHP Stations that are connected or are connecting to the Hellenic Electricity Distribution Network with installed power over four hundred kilowatts (400 kW)
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NOTIFICATION

Revision History Version 3.0

Version:	Chapter	Change description
3.0	2.1.1	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.2.2	Text correction - The word "client" was added
3.0	2.2.6.1	The duration was changed & extra text was added.
3.0	2.2.6.2	The duration was changed & the setting feature was added.
3.0	2.2.14.3	Text correction - §2.2.8 changed to §2.2.9
3.0	2.2.14.5	Clarifications were added
3.0	2.2.17	New text was added - Extra text on the command dispatch mechanism
3.0	2.4.3 iii	New text was added - Clarification on the procedure to be followed when a command is sent from another operator
3.0	2.4.3 **v**	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.4.3 vi	Text correction - Specify command runtime
3.0	2.4.3 vii	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.4.3 ix	Addition of new text - Clarification on the duration of the set point execution
3.0	2.4.4	Improvements to the text for better understanding
3.0	2.4.5	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.5.4.3	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.5.6.4	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.5.8	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.7.1 1	Addition of clarifications
3.0	2.7.1 v	Text correction - "Command execution confirmation signal" was changed to "command receipt confirmation signal"
3.0	2.7.2111	Improvements to the text for better understanding of the signal of the earthing
3.0	3.3	Addition of reference to the Test Protocols
3.0	3.3.2 - Table 3B - S/N:.15	Improvements to the text for better understanding of the signal of the earthing
3.0	3.3.2 - Table 3B - S/N: 32-35	Correction - "Confirmation of Command Completion" was changed to "Command Receipt Confirmation"
3.0	3.3.3 - Table 4 - S/N:15	Improvements to the text for better understanding of the signal of the earthing
3.0	3.3.3 - Table 4 - S/N: 32-35	Correction - "Confirmation of Command Completion" was changed to "Command Receipt Confirmation"
3.0	4.2	Changes to the finding point of the Solemn Declaration and the Protocols
3.0	4.4	Addition of common/RTU & link address
3.0	4.5	References to the IP of SCADA
3.0	4.6	Addition of text regarding the use of multiple subnet masks
3.0	4.7	Addition of text regarding the default gateway
3.0	5.2	Text correction - §2.2.8 changed to §2.2.9

Description of Basic Terms

Abbreviation	Description
Station	RES & CHP stations connected or to be connected to the HEDN with an installed capacity exceeding four hundred kilowatts (400 kW).
Equipment	Suitable equipment for the connection of RES & CHP stations to the Remote Control and Management System of the Distribution Network (SCADA/DMS of HEDNO) for the reception of remote monitoring signals and the execution of control commands, in accordance with Law No. 5106/2024 (Government Gazette 63/A/01.05.2024), Article 111.
Producer	Station Owner
FoSE	Aggregator
TE	Telecommunication Equipment which includes a suitable router for the interconnection of the Equipment with the SCADA/DMS system of HEDNO
TM	Technical Manager
MVR	Middle Voltage Representative
ICB	Interconnection Circuit Breaker
MV	Medium Voltage
LV	Low Voltage

Contents

1. Introduction

The purpose of the document is to list the technical requirements of the equipment for the connection of RES & CHP stations (hereinafter referred to as "Station") connected or to be connected to the HEDN with an installed capacity exceeding four hundred kilowatts (400 kW)to the Remote Control and Management System of the Distribution Network (SCADA/DMS of HEDNO) for the reception of remote monitoring signals and the execution of control commands, in accordance with Law 106/2024 (Government Gazette 63/A/01.05.2024), Article 111.

A prerequisite is the presence of suitable equipment (hereinafter referred to as 'Equipment') at the Station's premises, which may include, but is not limited to, the following:

- Remote Terminal Unit (RTU).
- Programmable Logic Controller (PLC).
- Power Plant Controller (PPC).

1.1 The necessary Telecommunication Equipment (TE) which includes a suitable router for interconnection with the SCADA/DMS system of HEDNO is specified in a separate document.

1.2 The following are the requirements for the proper programming and configuration of the equipment for signal transfer, state and measurement monitoring, as well as for receiving commands from the SCADA/DMS of HEDNO, pertaining to the total energy produced by the Station, rather than per cluster or inverter.

1.3 The Producer is responsible for both the supply and maintenance of the Equipment. They may, however, be entrusted to a Technical Manager (TM).

1.4 If the Station is serviced by a private MV grid (not HEDNO), the Representative of this MV grid (MVR) may also handle the operation of the Station for reasons of maintenance and proper operation of the private MV grid.

1.5 It should be noted that the equipment supports the requirements of the interconnection of the Stations with the SCADA/DMS of HEDNO. Any additional equipment that may be required for the management of the Station by the Generator (or a third party, such as the Aggregator or the MVR) and/or to adapt to the requirements and regulations governing the Station, is not within the scope of this document.

1.6 Any third party (such as an MVR, a TM or an Aggregator) that will intervene, operate or regulate for its own reasons the operation of the Station, must do so without in any way interfering with the communication of the Equipment with the SCADA/DMS system of HEDNI, except in the cases defined in §2.2.14.

2. Equipment and Operational Requirements

2.1 Remote control and remote monitoring of the Station

2.1.1 HEDNO must be capable of remotely controlling and monitoring the Station, as defined by legislation and as required to ensure the stability of the System and the proper operation of the Network.

This remote control and remote monitoring will be carried out by sending commands and receiving signals from the SCADA/DMS of HEDNO and must include:

- The ability to control the opening of the Automatic Disconnection Switch of the Station.
- Monitoring the location of the ICB and its Earth.
- The control of the active power output of the Station.
- The possibility of an immediate full cut of the power of the Station
- The monitoring the status of the Station by sending a series of electricity indications and measurements.
- Verification of the completion of each command sent by HEDNO, which will indicate precisely the time of its execution.
- The notification of the execution of commands received from another entity (Aggregator, Representative, Owner, etc.).

The Equipment should also support the exchange of signals associated with the following capabilities, even if they are not supported by the Station's devices and general electronic power generation equipment[1]. These features may be utilized in the future to comply with legislative requirements and to ensure the safe operation of both the Network and the Country's Electricity System. Therefore, it is requested that these features be immediately implemented on the equipment level and that verification is provided regarding the exchange of the relevant signals with the HEDNO's SCADA/DMS during the communication tests.

- Ability to control the Station's reactive power output / power factor /voltage
- Ability of control when supporting frequency via the LFSM-O, FSM, LFSM-U modes as per the RfG Requirements for Generators).

2.2 General

2.2.1 The Equipment shall be include an Ethernet communication port compliant with the 100 Base-TX standard, featuring a female RJ-45 connector. This port shall be used for communication with the SCADA/DMS system of HEDNO via the IEC 60870-5-104 protocol. In addition, the Equipment shall have all required ports for communication with the devices and equipment (inverter, protection relay, PDD, etc.) of the Plant and/or possibly DI/DO cards for simple cable connections, in order to control them in response to the commands received from the SCADA/DMS system of HEDNO and send all necessary measurements and statuses, as specified in this document.

2.2.2 As per IEC 60870-5-104, the Equipment will be a server (slave) and the SCADA/DMS of HEDNO will be a client (master).

[1] This document includes general requirements for all RES irrespective of power, technology, installation date, if it is required to comply with the respective NC-RfG provisions or not, etc. Individual Station capabilities will be leveraged in the future depending on the case.

2.2.3 The Equipment should have the ability to make future decisions following some programmable logic. Consequently, the Equipment should either already include or be capable of incorporating the functions of an embedded Programmable Logic Controller (PLC) in the future. This means that it must have built-in PLC capabilities or be adaptable for future PLC units, enabling it to perform logic functions based on predefined flow charts, make decisions according to the commands it receives, the station's operating status, and the programmed instructions.

- This feature is not required to be implemented at this stage. It is expected to be required in the future for the purpose of supporting the potential dispatch of commands from multiple representation operators or managers (Aggregator, Producer or TM, MVR etc.) or automatically limiting the injection power of the Station when the latter cannot communicate with the SCADA/DMS system of HEDNO.

2.2.4 The Equipment is designed to be scalable, meaning it can be expanded with additional input/output (I/O) units, electrical measurements, or upgraded to higher computing power and/or enhanced measurement accuracy. This flexibility ensures it can meet any future needs arising from the rapid growth of energy production from RES and the increasing technical challenges to the proper operation and stability of the electricity grid and the Site's system

2.2.5 The Equipment must be powered by an appropriate uninterruptible power supply system (UPS) to ensure uninterrupted power supply, as well as the router, in case of loss of the power supply for at least two (2) hours. The existing UPS at the station can serve as an uninterruptible power supply system, provided it meets the power requirements of both the equipment and the TE.

2.2.5.1 If the router is located in a different area, and is not powered by the same UPS system as the Equipment, it has its own separate uninterruptible power.

2.2.5.2 It is obvious that any other telecommunication or network equipment used to connect the Equipment to the router must also be powered by UPS for at least two (2) hours.

2.2.6 Whenever loss of communication with the SCADA/DMS system is detected, the Equipment triggers a reset of the TE (router) causing a temporary interruption and reset of its power supply. This shall be performed by the Equipment, after successive communication failures with the SCADA/DMS system of HEDNO.

2.2.6.1 The period of time that the loss of communication occurs before the first restart will be 30 minutes (half an hour).

- To expedite the required tests for completing the respective Protocol (see §4), it is recommended

(though not required) to allow for a temporary determination of a significantly lower value for the extra time during the initial reset.

2.2.6.2 After the first reset, if communication with the SCADA/DMS system of HEDNO remains lost, subsequent resets will occur every three hours. This interval may be adjusted, in consultation with HEDNO, to a period between 30 minutes and 3 hours.

2.2.7 During any loss of communication with the SCADA/DMS system, the Equipment, and consequently the Station, should continue to comply with the last operating settings that were set prior to the loss of communication.

2.2.8 For the restart of the TE. the existence and control of a suitable electrical component (e.g. relay) is required for the management (ON/OFF) of its power supply.

o. Please note that if the TE has not been placed near the Equipment, e.g. due to failure of coverage of the mobile telephony network, then the reset command of the TE must be transferred in a suitable manner to the area where the TE is located. The same are must accommodate a suitable electrical component for the management (ON/OFF) of its power supply.

2.2.9 If it is decided that the loss of communication is fault of the Producer, HEDNO may disconnect the Station by own means.

2.2.10 The Equipment must have as Sync Master (Time Server) the IEC 60870-5-104 protocol with which it will communicate with the SCADA/DMS system of HEDNO. Under no circumstances should a NTP server or a GPS be used.

2.2.11 The Equipment must be durable and reliable, capable of operating in industrial-type and harsh environments.

2.2.12 The equipment must be installed in a protected environment, safeguarding it from natural elements and unauthorized interference by third parties.

2.2.13 The Station Owner and their Technical Manager are responsible for the proper operation and good condition of the Equipment.

2.2.14 The Equipment should be capable of being controlled either locally or remotely (local/remote). The Equipment will normally operate in remote control mode.

2.2.14.1 If for any reason (maintenance, tests etc), the Equipment is set in local mode, the Station will be able to operate based on the last command given to the Equipment when it was in remote mode.

2.2.14.2 In local mode, no command received from the SCADA/DMS system will be executed.

2.2.14.3 Before activating local mode, HEDNO must be informed and consulted on the duration and start time. Activating local mode without the agreement of HEDNO may result in penalties corresponding to those for loss of communication (see §2.2.9).

2.2.14.4 When resetting the Equipment to remote mode, the Station should follow the last operating settings even if these were obtained while the Equipment was in local mode.

2.2.14.5 An exception to the above paragraph *(§2.2.14.4)* is the operation of the ICB. While the equipment is in local mode, any commands to open the ICB will be rejected and will not be executed upon returning to remote mode.

- The Technical Manager will determine the duration of the pulse of the command to open the ICB (S/N: 46) based on the time required for the opening.

2.2.15 The selection of appropriate Equipment is the responsibility of the Station Owner or their Technical Manager. It is not the intention of HEDNO to recommend or confirm the suitability or otherwise of Equipment of a particular type or manufacturer.

2.2.16 The Equipment will be tested for its correct operation, as well as communication with the rest of the Station's equipment and with the SCADA/DMS system of HEDNO, based on specific test protocols to be provided by HEDNO.

2.2.16.1 These protocols must be delivered fully completed and signed as attachments together with the Declaration of Conformity under article 111 of Law 5106/2024 (see §4) which will also be issued by HEDNO.

2.2.17 The mechanism for sending commands to the Equipment should follow the "Direct Execute" configuration.

2.3 Control of the Automatic Disconnect Switch (ADC) of the Station

In general, HEDNO does not intend to open the Interconnection Circuit Breaker (ICB) of the Station. However, it reserves the right to do so in exceptional cases to prevent islanding in the Network and to ensure the safety of people, the environment, and technical equipment.

2.3.1 The ICB must be capable of being opened via command. Therefore, the command "Open" *(S/N:46)* must be executed.

2.3.2 The location of the ICB must be shared with HEDNO via the status of signal *S/N:13.*

2.4 Control of Active Power Output

2.4.1 The control of active power is carried out by sending analog commands (set-point type as per ASDU) from the SCADA/DMS of HEDNO. The analogue commands for active power control are of two types:

i. The set-point percentage (0 - 100%), which represents the maximum power injection into the network. A value of -1 indicates that this set-point is canceled, allowing the station to inject power freely.
ii. Fixed size set point (kW) (From 0 to the maximum injection power in the Network in kW). A value of -1 indicates that this set-point is canceled, allowing the station to inject power freely.
iii. The maximum injection power of the Station is determined on the basis of the Final Connection Offer and current Legislation. It is the sole responsibility of the Producer to comply with the value of the maximum injection power in accordance with the above.

2.4.2 It shall be at the discretion of HEDNO to choose to send a command of one of the above two types/command control types. In general, only one of the two types will be sent. If both set-point types have been sent (but not simultaneously) and both set-point types remain active, the following case applies (§2.4.3).

2.4.3 The execution of the active power control commands by the SCADA/DMS system of HEDNO shall comply with the following:

i. The Stations shall have the capability to receive and execute analog commands (percentage or fixed value set-point) to control Active Power up to the maximum power injected into the Network (see §2.4.1 ii).

ii. The present active power injection power of the Station shall not exceed the active power command activated at any time. If the respective station equipment fails to implement the specified set value, it shall automatically select a lower value. A higher value must never be selected.

iii. In the case of separate commands being sent simultaneously, either by HEDNO, another operator, or the Producer themselves, the command resulting in a lower active injection power shall take precedence and be executed. Namely, the command that leads to a greater limitation of power prevails and is executed.
The same logic must be followed regardless of whether the other Operator's command is given through the Equipment or is executed in any other way. That is, the Equipment should be able to recognize if a corresponding command has been given by a third party at the Station and, based on which command results in higher power limitation, determine whether to execute it or follow the command from HEDNO.

When the command that leads to higher limitation is deactivated, the other command that leads to lower limitation should be executed (if it remains active).

iv. This will also apply in the case where HEDNO has sent (and is active at the same time) commands of both types (*percentage and value specific*). The limitation of the Station's total active injection power should be achieved immediately, and in any case within the time specified in Table 1.

v. The Station shall send to the SCADA/DMS of HEDNO a confirmation of receipt of the command (S/N:32) as soon as it is received, thus much sooner than the time specified in Table 1.

vi. In less than the time specified in Table 1, the Station must have fully completed the execution of the command received. Accordingly, HEDNO expects that the corresponding measurements (S/N: 1-10), confirming the correct execution of the command, will be updated and sent within the same time frame.

vii. If the command is not correctly executed within the specified time, then HEDNO reserves the right to disconnect the Station from the electricity network for the purpose of ensuring the safety and reliability of the country's electricity system.

viii. The time specified in Table 1 will be calculated from the moment the command is sent by the SCADA system of HEDNO and not from moment the Equipment sends the signal confirming receipt of the command.

ix. The power injected by the Station shall remain throughout the duration of the execution of the specific set point within the limits set by it.

2.4.4 If the command for immediate full cut *(S/N: 47)* of the injection of the Station is executed, this shall prevail against all set-point types (percentage and fixed value) that have been determined by HEDNO or other operator, and the Station shall reset its injection immediately, in the time specified in Table 1. If the immediate full cut command is deactivated, the previous set point shall be applied if it remains active.

Table 1: Time of implementation of production limitation (active power).

Production Type	Time of implementation of production limitation (active power).
Photovoltaic	1 minute
Other	3 minutes*

For stations that are not photovoltaic, the above time of three minutes can be extended to five minutes, subject to consultation with HEDNO and provision of the corresponding technical justification.

2.4.5 The digital command confirmation signals (S/N:32-35) will be signals sent once by the Equipment to the SCADA/DMS system via IEC 60870-5-104 after each receipt of a corresponding command.

HEDNO shall not send a new control command for the active power output in a time less than that specified in Table 1 above.

2.5 Control of Reactive Power / cosφ Power Factor

2.5.1 The equipment shall be capable of receiving and executing analog commands to control the reactive power or cosφ power factor at a frequency of not more than once per minute. The execution of these commands by the Station is expected to be enabled in the future.

2.5.2 HEDNO should be responsibly informed about the maximum reactive power injection capacity (kVAr) available at the Station and the limits of the cosφ, by filling in the appropriate fields in the Declaration of Conformity.

2.5.3 The execution of analog reactive power control command in kVAr requires the activation of the reactive power setting function by sending the relevant command *(S/N: 48)*.

2.5.4 The reactive power regulation values will range between +60% and -60% of the maximum power injection of the Station into the Network.

2.5.4.1 A positive sign indicates inductive infusion, while a negative sign indicates capacitive infusion.

2.5.4.2 If a value exceeds the Station's capacity, the Station will adjust it to match its capacity.

2.5.4.3 Even in the above case, a command receipt confirmation from the Equipment *(S/N:34)* must be provided.

2.5.4.4 The execution of the set-point command regarding the reactive power requires that the reactive power determination mode has been activated*(S/N:48)* and that value 1 has been given to the command determining the mode of the station *(S/N:* 60). If either of the above is not true, the command is NOT executed.

2.5.5 An additional option is the setting of the reactive power in relation to the voltage at the point of connection to the Network, according to the voltage-reactive power characteristic U(Q) predefined by the Operator. To activate this setting, value 4 must be specified in the Station setting command (S/N: 60) and the command controlling the voltage must also be activated (S/N: 50).

2.5.6 The power factor setting values will range from 0.85 to 1.0.

2.5.6.1 A positive sign indicates inductive infusion, while a negative sign indicates capacitive infusion.

2.5.6.2 cosφ value= 0 indicates that the cosφ set-point has not been activated.

2.5.6.3 If a value exceeds the station's capacity, the station will adjust it to fit within its capacity.

2.5.6.4 Even in this case, a confirmation of receipt of the command from the Equipment *(S/N:35)* must be provided.

2.5.6.5 The execution of the set-point command regarding the cosφ power factor requires that the reactive power determination mode has been activated *(S/N:60)*.

2.5.7 The determination of the reactive power output of the Station (either in kVAr or via cosφ) is achieved immediately, and in any case within one (1) minute at the latest.

2.5.8 The Station must send to the SCADA/DMS of HEDNO a confirmation of receipt of the command immediately. Within one (1) minute maximum, the respective measurements *(S/N:1-10)* shall be updated and sent.

2.5.9 An additional option is the adjustment of cosφ as a function of active power (cosφ=f(P)), which is activated with command S/N:49. In the future, the f(p) curve or the corresponding set-point type analog control command will be specified. To activate this setting, value 4 must also be specified in the Station setting command(S/N:60.

2.6 Support of frequency

The Equipment shall support the exchange of signals for the activation of LFSM-O, FSM, LFSM-U functions according to the RfG (Requirements for Generators).

These may be required to be implemented as commands to the Station Inverters in the future *(S/N: 51-53)*.

2.7 Digital Signals from the Equipment

2.7.1 *General*

i. Loss of communication with any equipment (inverter etc) of the Station *(S/N: 18)*. The equipment must be able to detect the loss of proper communication with any station component, whether it be the inverter, datalogger, station PLC, or plant PLC. Consequently, the measurements, status etc. sent to HEDNO will be treated as accurate if *S/N:18* is inactive.

ii. Equipment control status (local/remote) *(S/N:16.*

iii. Equipment good condition diagnosis mode *(S/N:31.*

iv. Determination of active power, reactive power, cosφ and determination of mode based on the cosφ=f(P) curve or the U(Q) curve of the Station by another operator *(S/N: 36-40)*.

v. Signals confirming the receipt of the command (from HEDNO) to determine active power (% or kW), immediate full cut of the Station, reactive power and cosφ *(S/N: 32-35)*.

vi. Signals confirming the LFSM-O, FSM, LFSM-U type modes as per RfG *(S/N: 41-43)*.

vii. Identification of Station Mode Status (reactive power setting, cosφ setting, cosφ setting based on the cosφ = f(P) curve, reactive power setting based on the U(Q) curve) *(S/N: 12)*.

2.7.2 *Sending of Indications from the Relay (Protection Signals) and the location of the Interconnection Circuit Breaker (ICB).*

The Station will immediately send a series of indications regarding the status of the Protection Relay and the location of the Interconnection Circuit Breaker (ICB):

i. Interconnection Circuit Breaker status (ICB Status) (Open/Close) *(S/N:13)*.

II. Interconnection Circuit Breaker control status (Local/Remote) *(S/N:14)*.

III. ICB Earthing System Status (ES Status) (Open/Close) *(S/N: 15)*.

iv. Relay Status *(S/N:17.*

v. Decoupling protection alarms:
   a. Phase overcurrent faults *(S/N: 19-21)*.
   b. Earth faults, if available. *(S/N: 22-24)*.
   c. Overvoltage *(S/N: 25)*.
   d. Undervoltage *(S/N:26.*
   e. Overfrequency *(S/N:27.*
   f. Underfrequency *(S/N:28.*
   g. Homopolar voltage protection, if available *(S/N:29)*.
   h. RoCoF, if available *(S/N:* 30).

   When completing the Declaration of Conformity (see §4.1) the activation limits of the above (a-h) must be filled in responsibly.

2.8 Command signals to the production station

a. Command for opening the station's ICB (Open) *(S/N: 46)*.
b. Maximum allowable active power (set-point) in kW *(S/N: 56)*.
c. Maximum allowable active power (set-point) % *(S/N: 57)*.
d. Command for immediate full cut of the Station's injection power (Active & Reactive) *(S/N: 47)*.
e. Analog set-point signal (discrete integer value) of command for setting reactive power *(S/N:58.*
f. Analogue set-point signal (discrete decimal value) of command setting the cosφ power factor *(S/N:59)*.
g. Commands to activate/deactivate the operation of the Station in the modes of reactive power control, cosφ based on the cosφ=f(P) or reactive power setting based on the U(Q) curve *(S/N: 48-50)*.
h. Commands to activate/deactivate the operation of the Station in LFSM-O, FSM, LFSM-U modes *(S/N: 51-53)*.
i. Command for determining the mode of operation of the Station in terms of reactive power/cosφ/voltage setting *(S/N:* 60).

2.9 Sending of Measurements

2.9.1 The Station, via the Equipment, shall have the capability to continuously update and transmit measurements of active power, reactive power, power factor, frequency, as well as current and voltage per phase *(S/N: 1-10)*.

2.9.2 Also, if possible, the present generation capacity of the installed equipment of the Station, e.g. reduced generation capacity due to inverter failure (depends on the condition of the equipment and not on meteorological data) *(S/N: 11)*.

2.9.3 The total fault for all measurements must currently be less than 1.5% at nominal magnitudes, except for frequency, which must be less than 0.06%. HEDNO reserves the right to require an increase in measurement accuracy in the future.

2.9.3.1 Taking measurements is mandatory and must be done from a point on the station's MV, not from the LV. Indicatively, the protection relay could be used to provide the above measurements to the Equipment.

2.9.4 The process of taking all measurements shall incorporate filtering techniques, both at the hardware and software level, to ensure sufficient stability and limited variations in the measured quantities.

2.9.5 The transmission to SCADA/DMS for each measured quantity will be implemented at regular intervals and only when it changes more than the D threshold specified in Table 2, in which case it will be sent immediately.

Table 2: Definition of time intervals and limits for direct transmission of measurements

Size	**Time interval**	**Limit of change of measurement for immediate dispatch (D / deadband)**
Voltage	15 min	100V (for nominal voltage: 20KV) or 0.5% of nominal
Current	15 min	5% of the nominal
Power	15 min	5% of the nominal
Frequency	15 min	0.15Hz or 0.3% of nominal
Power Factor	15 min	**0.03**

Note: The appropriate cycle timer for the 15 minutes should be implemented.

3. Equipment Programming Requirements

3.1 General

The General Interrogation (GI) process will be carried out by the SCADA/DMS system and should be supported by the Equipment. During this process the SCADA/DMS system collects all information (Status Data, Updated Measurements etc.) from the equipment. After each loss of communication the General Interrogation (GI) procedure will be activated.

3.2 Signals and Indications

The addresses of all signals/indications/commands exchanged between the SCADA/DMS and the Plant are listed in *Table 4*.

The exact list of signals may be adjusted by HEDNO during the testing phase of the Plant Equipment, in consultation with the Producer.

3.3 Equipment Timings

In Tables *3A* & *3B* below, all general timing and type settings of the equipment variables are listed according to IEC 60870-5-104.

The specific timing settings may be modified in consultation with the Producer, if and when required, in order to optimize the response of the Equipment.

3.3.1 Table 3B General timing settings

Parameter	Default value	Remarks	Required value
t0	30s	Time out of connection establishment	30s
t1	15s	Time out of send or test APDUs	15s
t2	10s	Time out for acknowledge in case of no data messages t2 < t1	10s
t3	20s	Time out for sending test frames in case of a long idle state	20s
Maximum number of outstanding I format APDUs k and latest acknowledge			
Parameter	Default value	Remarks	Required value
k	12 APDUs	Maximum difference for the receive number to send state variable	12 APDUs
w	8 APDUs	Latest acknowledge after receiving w I-format APDUs	8 APDUs
Port number			
Parameter	Value	Remarks	Required Value
Port number	2404	Shall not be changed, unless it is dictated by HEDNO	2404

3.3.2 *Table 3B: Signals Standardization*

S/N	Type Based on ASDU	Description
	Measurements	
1	M_ME_NB_1	Active Output Power
2	M_ME_NB_1	Reactive Output Power
3	M_ME_NB_1	Output Current A (Phase 1)
4	M_ME_NB_1	Output Current B (Phase 2)
5	M_ME_NB_1	Output Current C (Phase 3)
6	M_ME_NB_1	Output Voltage A (Phase 1) Polar
7	M_ME_NB_1	Output Voltage B (Phase 2) Polar
8	M_ME_NB_1	Output Voltage C (Phase 3) Polar
9	M_ME_NB_1	Output Frequency
10	M_ME_NA_1	Power Factor
11	M_ME_NB_1	Production Capacity (If the Plant has this feature)
12	M_ME_NB_1	Recognition of the operational status of the Plant
	Digital Signals	
13	M_DP_NA_1	ICB Status.
14	M_SP_NA_1	ICB Control Status
15	M_DP_NA_1	ICB Earth Switch Status
16	M_SP_NA_1	Equipment Control Status
17	M_SP_NA_1	Relay Status
18	M_SP_NA_1	Loss of Communication with some production equipment e.g. Inverter
19	M_SP_NA_1	Overcurrent fault indication phase 1 / Total
20	M_SP_NA_1	Overcurrent fault indication phase 2
21	M_SP_NA_1	Overcurrent fault indication phase 3
22	M_SP_NA_1	Fault indication to earth phase 1 / Total
23	M_SP_NA_1	Earth fault indication phase 2
24	M_SP_NA_1	Earth fault indication phase 3
25	M_SP_NA_1	Overvoltage Indication
26	M_SP_NA_1	Undervoltage Indication
27	M_SP_NA_1	Overfrequency Indication
28	M_SP_NA_1	Underfrequency Indication
29	M_SP_NA_1	Homopolar voltage protection
30	M_SP_NA_1	RoCoF

31	M_SP_NA_1	Status of diagnosis of the good condition of the Equipment
32	M_SP_NA_1	Active Power Set-point Command Receipt Confirmation
33	M_SP_NA_1	Direct Cut-Off Command Receipt Confirmation
34	M_SP_NA_1	Reactive Power Set-point Command Receipt Confirmation
35	M_SP_NA_1	Set-point cosφ Command Receipt Confirmation
36	M_DP_NA_1	Execution of active power commands provided by third operators
37	M_DP_NA_1	Execution of reactive power commands provided by third operators
38	M_DP_NA_1	Execution of cosφ set-point commands provided by third operators
39	M_DP_NA_1	Execution of cosφ adjustment function commands based on a cosφ = f(P) curve provided by third operators.
40	M_DP_NA_1	Application of a reactive power control function command based on a U(Q) curve given by third operator.
41	M_SP_NA_1	LFSM-O mode enabled
42	M_SP_NA_1	FSM function enabled
43	M_SP_NA_1	LFSM-U mode enabled
44	M_SP_NA_1	Confirmation of Backup Activation
45	M_SP_NA_1	Confirmation of Activation of Second Backup Mode
	Control Commands	
46	C_DC_NA_1	ICB location check
47	C_DC_NA_1	Command for immediate full cut-off of the Plant's injection power (Active & Reactive)
48	C_SC_NA_1	Command for activating - deactivating reactive power set-point
49	C_SC_NA_1	Command for activating - deactivating the cosφ adjustment mode based on the cosφ=f(P) curve
50	C_SC_NA_1	Command for activating - deactivating the power regulation mode based on the U(Q) curve
51	C_SC_NA_1	Command for activating - deactivating the LFSM-O mode
52	C_SC_NA_1	Command for activating - deactivating the FSM mode
53	C_SC_NA_1	Command for activating - deactivating the LFSM-U mode
54	C_SC_NA_1	Command for activating - deactivating the standby mode
55	C_SC_NA_1	Command for activating - deactivating the second standby mode
	Set-point commands	
56	C_SE_NB_1	Maximum allowable active power set-point in kW
57.	C_SE_NB_1	Maximum allowable active power set-point %

58	C_SE_NB_1	Reactive Power Set-point: Reactive Power Set-point
59	C_SE_NA_1	Set-point cosφ: Set-point cosφ
60	C_SE_NB_1	Plant operational mode set-point command

3.3.3 Table 4: Table of IEC 60870 – 5 – 104 signals

Measurements							
S/N	IEC 60870 - 5 - 104 Addresses	Type	Description	Status	Units	Item	REMARKS
1	501	ME	Active Output Power		kW	Required	
2	502	ME	Reactive Power Output		±kVAr	Required	Positive = inductive, Negative = capacitive.
3	503	ME	Output Current A (Phase 1)		A	Required	
4	504	ME	Output Current B (Phase 2)		A	Required	
5	505	ME	Output Current C (Phase 3)		A	Required	
6	506	ME	Output Voltage A (Phase 1) Polar		kV	Required	
7	507	ME	Output Voltage B (Phase 2) Polar		kV	Required	
8	508	ME	Output Voltage C (Phase 3) Polar		kV	Required	
9	509	ME	Output Frequency		Hz	Required	
10	510	ME	Power Factor		±0-1	Required	Positive = inductive, Negative = capacitive.
11	511	ME	Production Capacity (If available from Plant)		%	Pending*	See §2.9.2
12	512	ME	Recognition of the operational status of the Plant	Reactive	0	Pending*	Other values are not acceptable
				Operational State of the Reactive Power Setting	1		
				Operational State of the cosφ Power Factor Setting	2		
				Operational State of the cosφ setting based on the cosφ=f(p) curve	3		
				Operational State of the curve-based reactive power setting U(Q)	4		

Digital Signals							
S/N	IEC 60870 - 5 - 104 Addresses	Type	Description	Status	Units	Item	REMARKS
13.	100.	DP	ICB Status	Undetermined	00	Required	
				Open	01		
				Closed	10		
				Undetermined	11		
14.	101.	SP	ICB Control Status	Remote	0	Required	
				Local	1		
15.	102.	DP	ICB Earth Switch Status	Undetermined	00	If available	
				Open	01		
				Closed	10		
				Undetermined	11		
16.	103.	SP	Equipment Control Status	Remote	0	Required:	When the Equipment is in Local state it means that commands are not accepted *§2.2.13.2*
				Local	1		
17	104	SP	Relay Health Status	Standard	0	Required	
				Damaged	1		
18	105	SP	Loss of Communication with some production equipment e.g. Inverter	Deactivated	0	Required	
				Activated	1		
19	106	SP	Overcurrent fault indication phase 1 / Total	Deactivated	0	Required	CB tripped - Overcurrent phase 1 or all phases
				Activated	1		
20	107	SP	Overcurrent fault indication phase 2	Deactivated	0	If available	CB tripped - Overcurrent phase 2
				Activated	1		
21	108	SP	Overcurrent fault indication phase 3	Deactivated	0	If available	CB tripped - Overcurrent phase 3
				Activated	1		
22	109	SP	Fault indication to earth phase 1 / Total	Deactivated	0	If available	CB tripped - Earth Fault phase 1 or all phases
				Activated	1		
23	110	SP	Earth fault indication phase 2	Deactivated	0	If available	CB tripped - Earth Fault phase 2

				Activated	1		
24	111	SP	Earth fault indication phase 3	Deactivated	0	If available	CB tripped - Earth Fault phase 3
				Activated	1		
25	112	SP	Overvoltage Indication	Deactivated	0	Required	
				Activated	1		
26	113	SP	Undervoltage Indication	Deactivated	0	Required	
				Activated	1		
27	114	SP	Overfrequency Indication	Deactivated	0	Required	
				Activated	1		
28	115	SP	Underfrequency Indication	Deactivated	0	Required	
				Activated	1		
29	116	SP	Homopolar voltage protection	Deactivated	0	If available	
				Activated	1		
30	117	SP	RoCoF	Deactivated	0	If available	
				Activated	1		
31	118	SP	State of diagnosis of the good condition of the Equipment	Standard	0	Required	About any malfunctions of the Equipment itself
				Damaged	1		
32	119	SP	Active Power Set-point Command Receipt Confirmation	No verification	0	Required	**
				Confirmation	1		
33	120	DP	Direct Cut-Off Command Receipt Confirmation	Undetermined	00	Required	**
				No verification	01		
				Confirmation	10		
				Undetermined	11		
34	121	SP	Reactive Power Set-point Command Receipt Confirmation	No verification	0	Pending*	**
				Confirmation	1		
35	122	SP	Set-point cosφ Command Receipt Confirmation	No verification	0	Pending*	**
				Confirmation	1		
36	123	DP		Deactivated	00	Required	

			Execution of active power command provided by third operators (see 1.6)	FoSE	01		Activation of a signal indicating the a command to set the operation of the Plant has been received from a third operator. In the event that a corresponding command is provided by a third operator, the command that results in a smaller amount of active power output.
				MV Representative.	10		
				Owner	11		
37	124	DP	Execution of a reactive power set-point command provided by a third operator 1.6)	Deactivated	00	Pending*	Activation of a signal indicating the a command to set the operation of the Plant has been received from a third operator.
				FoSE	01		
				Representative	10		
				Owner	11		
38	125	DP	Execution of command for setting the cosφ provided by a third operator (see § 1.6)	Deactivated	00	Pending*	Activation of a signal indicating the a command to set the operation of the Plant has been received from a third operator.
				FoSE	01		
				MV Representative.	10		
				Owner	11		
39	126	*DP*	Execution of an operational command for setting cosφ based on a cosφ = f(P) curve provided by a third operator. § 1.6).	Deactivated	00	Pending*	Activation of a signal indicating the a command to set the operation of the Plant has been received from a third operator.
				FoSE	01		
				MV Representative.	10		
				Owner	11		

40	127	DP	Execution of a reactive power set-point command based on a U(Q) curve provided by a third operator (see § 1.6).	Deactivated	00	Pending*	Activation of a signal indicating the a command to set the operation of the Plant has been received from a third operator.
				FoSE	01		
				MV Representative.	10		
				Owner	11		
41	128	SP	LFSM-O mode enabled	Deactivated	0	Pending*	
				Activated	1		
42	129	SP	FSM function enabled	Deactivated	0	Pending*	
				Activated	1		
43	130	SP	LFSM-U mode enabled	Deactivated	0	Pending*	
				Activated	1		
44	131	SP	Confirmation of Backup Activation	Deactivated	0	Pending*	
				Activated	1		
45	132	SP	Confirmation of activation of second backup mode	Deactivated	0	Pending*	
				Activated	1		

Control Commands							
S/N	IEC 60870 - 5 - 104 Addresses	Type	Description	Status	Units	Item	REMARKS
46	201	DC	ICB location check	Unchanged	00	Required	
				Open	01		
				Unchanged	10		
				Unchanged	11		
47	202	DC	Command for immediate full cut-off of the Plant's injection power (Active & Reactive)	Unchanged	00	Required	The injection current should be close to zero.
				Right to join	01		
				Immediate Full Cut-Off	10		
				Unchanged	11		
48	203	SC	Command for activating - deactivating reactive power set-point	Deactivated	0	Pending*	
				Activated	1		
49	204	SC	Command for activating - deactivating the cosφ adjustment mode based on curve cosφ=f(P)	Deactivated	0	Pending*	
				Activated	1		
50	205	SC	Command for activating - deactivating voltage control based on the U(Q) curve	Deactivated	0	Pending*	
				Activated	1		
51	206	SC	Command for activating - deactivating LFSM-O according to RfG	Deactivated	0	Pending*	
				Activated	1		
52	207	SC	Command for activating - deactivating FSM according to RfG	Deactivated	0	Pending*	
				Activated	1		
53	208	SC	Command for activating - deactivating LFSM-U according to RfG	Deactivated	0	Pending*	
				Activated	1		
54	209	SC	Command for activating - deactivating backup	Deactivated	0	Pending*	
				Activated	1		
55	210	SC	Command for activating - deactivating second standby	Deactivated	0	Pending*	
				Activated	1		

Set-point Commands							
S/N	IEC 60870 - 5 - 104 Addresses	Type	Description	Status	Units	Item	REMARKS
56	301	SE	Maximum allowable active power set-point in kW		kW	Required	From 0 to the maximum allowable injection power at the Network. A value of -1 means that this command is not enabled.
57	302	SE	Maximum allowable active power set-point %		%	Required	0-100. A value of -1 means that this command is not enabled
58	303	SE	Reactive Power Set-point: Reactive Power Set-point		kVAr	Pending*	Varies between +60% and -60% (cosφ ≥ 0.85) of the maximum injection power of the Plant. Positive = inductive, Negative = capacitive. A value of 0 means that it has not been activated.
59	304	SE	Set-point cosφ: Set-point cosφ			Pending*	Analog set-point signal, range of values -0.85 to 1 and 1 to 0.85 (positive = inductive, negative = capacitive). A value of 0 means that it is not activated
60	305	SE	Plant mode setting command.	Deactivated	0	Pending*	Other values not acceptable
				Operational State of the Reactive Power Setting	1		
				Operational State of the Power Factor Setting	2		
				Operational State of the cosφ Setting based on the cosφ=f(p) curve	3		
				Operational State of voltage control based on the U(Q) curve	4		

* "Pending" under the Item column means that it should be included, even if it is not currently supported by the Plant's devices or general electronic equipment. HEDNO may request the activation of the corresponding feature at a future date. It is therefore requested that this is applied on the Equipment now and that the exchange of the corresponding signals with SCADA/DMS is confirmed during the communication tests.

** See. *§2.4.5*

4. Control Procedure

4.1 Together with the submission of the Solemn Declaration of Conformity in accordance with Law 5106/2024 (GG 63/A/01.05.2024) Article 111, Paragraph 4, a signed and fully completed Test Protocol must also be enclosed, as required for the confirmation of the Declaration of Conformity. All of the above are required for the continuation of the procedure.

4.2 The Declaration of Conformity and the Test Protocol are included in the "Remote monitoring and remote control for production stations" page of HEDNO's website. Additional useful information and necessary clarifications on these issues will be posted there.

4.3 HEDNO will determine the time of execution of the necessary tests and checks of the correct connection of the Equipment to HEDNO's SCADA/DMS system. During these tests, the physical presence of the Technical Manager and the Producer at the site of the Station are required.

4.4 HEDNO shall specify with regard to the IEC 60870-5-104 protocol the IP and Common/RTU address of the Equipment during the Procedure of Control and Connection to the SCADA/DMS system of HEDNO. Note that the Link Address of the Equipment shall always take the value zero (0).

4.5 The Equipment should be appropriately configured to avoid providing a specific IP to the master or client (SCADA) during upstream communication, i.e. to send through port 2404 without the requirement to share a specific IP. If this is not possible, the specific IP should be requested during the Procedure of Control and Connection to the SCADA/DMS system of HEDNO.

4.6 The Equipment that will be used for receiving and implementing the remote monitoring/control commands of RES & CHP stations is required to be able to use multiple subnet masks in its network interface (ethernet) in order to be properly interconnect to the Operator's network. In practice, the internal network to which the equipment will be connected will use a /29 subnet with a mask of 255.255.255.248.

4.7 The Equipment must have as default gateway the IP of the device at the Producer's end (Fortigate Router). This IP will be provided. Any other communication required shall be carried out using specific routing rules (static routes).

5. Change of mode and maintenance of remote control and remote monitoring equipment of the RES Electricity Generation System

5.1 Change of mode

5.1.1 The Producer may be required to apply changes in the mode of operation of the RES or CHP Station in order to comply with any revised requirements of Legislation, the Transmission and Distribution and/or the Electricity Market Regulations. In such cases, all changes must be carried out in consultation with HEDNO and the modified mode should be re-tested.

5.1.2 Prior to conducting such an operational check, the Producer or its Technical Manager should send a detailed list of changes they are going to apply.

5.2 Equipment maintenance

To ensure the proper operation of the Station and, by extension, the safety and reliability of the HEDN, the Producers and/or their Technical Managers undertake to carry out, at regular intervals determined by the manufacturers' specifications, preventive maintenance of the Station's equipment. During the preventive maintenance process, both on the hardware and software of the Equipment, the Generators and/or their Service Providers shall communicate and inform HEDNO.

During the maintenance procedure, the Producer and/or the Technical Manager is requested to confirm correct operation for the following equipment/modes:

a. Correct operation of the protection relay and the ICB (including Earth) of the Station and sending of the corresponding indications to the SCADA/DMS system of HEDNO.
b. Correct sending and updating of local measurements in the SCADA/DMS system of HEDNO.
c. Receipt and correct execution of all commands from the SCADA/DMS system of HEDNO.

In particular, if a cyberattack on the equipment is suspected, Producers and/or their Technical Managers must take all necessary actions to ensure the proper operation of the equipment and prevent or limit the attack's spread. They must also immediately inform HEDNO so that appropriate measures can be taken.

The maintenance and/or repair of the Station's equipment may be required by HEDNO following the detection of a technical problem and/or deviation from its normal operation. In such cases, the Producer or their Technical Manager is obliged to take all necessary actions to remove the technical problem and/or deviation within the time limit provided by HEDNO. In the event of failure to remedy the technical problem in time, HEDNO may impose penalties equivalent to those referred to in
§2.2.9 on loss of communication.