POWER SYSTEM OPERATION CORPORATION LIMITED

New Delhi

Date: 17-09-2019

Subject: Requirements for Automatic Generation Control (AGC) Connecting Equipment at Power Plants

Sir / Madam,

Hon'ble Central Electricity Regulatory Commission (CERC) in the matter of Automatic Generation Control (AGC) implementation in India has issued the direction that all thermal ISGS stations with installed capacity of 200 MW and above and all hydro stations having capacity exceeding 25 MW excluding the Run-of-River Hydro Projects irrespective of size of the generating station and whose tariff is determined or adopted by CERC are directed to install equipment at the unit control rooms for transferring the required data for AGC as per the requirement to be notified by the National Load Despatch Centre (NLDC). The CERC Order 319/RC/2018 dated 28th August 2019 is available at http://www.cercind.gov.in/2019/orders/319-RC-2018.pdf

In this regard, the minimum requirements for AGC connecting equipment at power plants based on the experience of the AGC Pilot Project are hereby being issued by NLDC and is attached as **Annexe-1**. The list of plants identified for monitoring by NLDC as per CERC Order is attached as **Annexe-2**.

All the power plants are hereby requested to provide the infrastructure for meeting the specified requirements. Also, all the power plants are requested to take necessary action for arranging the communication (through redundant and alternate paths) from the existing nearest wideband communication node to the unit control room (where remote terminal unit would be located) through redundant fibre optic cables, in coordination with Central Transmission Utility (CTU).

It may please be noted that all the ISGS stations whose tariff is determined or adopted by CERC should be AGC-enabled **before 28th February 2020 as per the Order of the Hon'ble Commission**. Therefore, it is requested that the arrangements may kindly be completed by the power plants before **31st January 2020.**

Any queries may please be emailed to agcnldc@posoco.in

Sd/-

(Debasis De)
Executive Director
NLDC, POSOCO.

Annexe-1

General Requirements for Automatic Generation Control (AGC) Connecting Equipment at Power Plants

The following signals would be handled as a minimum in AGC. Apart from the below mentioned signals, some other power plant specific signals also might be needed on case to case basis. Hence, provision for expansion and spares may be included.

A) Analog Input data required per generating unit

1. Unit Load Set Point (ULSP)
2. Actual Generation MW
3. Unit Capability
4. RGMO/FGMO/Governor input to governor
5. Delta P (Acknowledgement/ feedback) = AGC Set Point – ULSP
6. Reactive Power Actual MVAR
7. AVR Voltage Set Point
8. Low Voltage (LV) side Actual Voltage
9. Generator Transformer (GT) Tap Position
10. Distribution Factor (fraction for distribution of AGC DeltaP in between the units of the power plant)

Additional Analog inputs from Hydro power plants

11. Minimum load at which unit can stably run after synchronization – Unit wise (P1) (in MW)
12. Forbidden zones or high cavitation zones - Unit-wise (From MW to MW) - P2 to P3
13. Maximum loading possible on unit (continuous) (P4)
14. Declared Energy for the day
15. Schedule Energy (Cumulative)
16. Water gross head (m)

Additional Analog inputs from Gas power plants

17. Reference exhaust gas temperature
18. Actual exhaust gas temperature

B) Digital Input data required per generating unit

1. Circuit Breaker Status on/off
2. Governor status on/off
3. AGC Local/Remote

Additional Digital inputs from Hydro power plants

4. Pumping Status on/off

C) Analog Output data required per generating unit

1. AGC Set Point
2. AGC Suspend Status – Digital/Analog Output per unit
3. SCED schedule

D) Hardware Specifications

Main CPU Card, Communication Card with communication controller, DB 9 serial interface ports (101), minimum two Ethernet ports (104) interface Tx / Rx. Firmware of communication protocol should be loaded.

The following hardware/software is needed as a minimum at the plant per unit:

a) Analog input card: 32-bit processor with at least 32 analog inputs /outputs per generating unit, with scope for expansion.

b) Analog output card: 32-bit processor at least 16 analog outputs per generating unit, with scope for expansion.

c) Digital input card: 32-bit processor with at least 8 digital inputs per generating unit, with scope for expansion.

d) Digital output card: 32-bit processor with at least 4 digital output signals per generating unit, with scope for expansion. (Provision can be useful for connecting digital devices in future)

e) Shall be capable of communicating over IEC 60870-5-104 protocol with RLDC/NLDC. Should be capable of reporting to multiple masters (at least 4) simultaneously over IEC 104.

f) Shall have the capability of programing /parametrization, performing microprocessor level calculations and accepting logic. RAM/ flash memory may be capable of handling complex codes. (Arithmetic and logical operations like +, -, *, /, if, else, while, do, OR, AND, NOT etc. would be needed)

g) Shall have the capability to acquire analog inputs of standard 4-20 mA current and 0-5 Vdc etc. or raise /lower command signals from AGC server / transducer etc.

h) Shall have GPS clock synchronisation facility as per the standard protocols.

i) Shall operate over the Standard DC input voltage of 24-60 V DC. Shall have the capability of automatic start up following restoration of power after an outage. Internal battery backup to hold data, date/time in SOE buffer memory is needed.

j) All Sequence of Events (SOE) shall be reported to RLDCs/NLDC.

k) Shall be capable of storing data on an external memory device.

l) Shall have communication interfaces via insert- able serial interface modules for Ethernet.

m) The associated system at power plants end shall be able to log / record the AGC signal / command from NLDC / RLDC (for the station before bifurcation) at an appropriate interval (say 2 sec or configurable) and shall integrate the AGC command over a period of 1 min, 5 min and 15 min period or user configurable period. The integrated value of AGC command will be stored in the data base with GPS time stamping.

n) Shall demonstrate capabilities to Plant/NLDC with an example setup.

E) Other associated hardware /cabling requirement

a) Line interface units (LIU), network switch along with ethernet ports, router cum firewall and patch cards as per the assessment & requirement.

b) Optical fibre cabling (through redundant and alternate paths) from the nearest wideband node up to the unit /plant control room. Shall ensure necessary equipment at wide band node switch yard for interfacing with the available ports of CTU/POWERGRID. Shall include necessary accessories to achieve communication redundancy at RTU and switchyard.

c) GPS clock with standard communication protocol for synchronisation.

d) PC and related software for entering distribution factor as well as storing /logging the data as mentioned in Sl. No. D (l).

F) Basic logics to be implemented at the power plant RTU

The basic logics given below may be implemented for safe operation. Apart from these, some other logics may need to be implemented on case to case basis.

a) DeltaP analog is calculated as, DeltaP = AGC Set Point – ULSP
b) For Distribution Factor Analog Input of 'n'units, check $\sum_{1}^{n}(Distribution\ Factor)$ = 1
c) Scheduled Energy (Cumulative MWh) for Hydro is calculated as $\sum_{t=1}^{96}(Scheduled\ MW/4)$
d) To detect communication failure and convert DeltaP analog output to zero
e) To detect AGC Suspend status and convert DeltaP analog output to zero
f) To detect AGC Local status and convert DeltaP analog output to zero

Annexe-2

List of power plants to be monitored by NLDC regarding AGC as per CERC Order 319/RC/2018

S.No.	Power Plant	Region	Thermal/ Hydro	Capacity (MW)
1	Costal Gujarat Power Ltd	WR	T	4150
2	Sasan Power Ltd	WR	T	3960
3	Kudgi STPS I	SR	T	2400
4	Ramagundam STPS - I & II	SR	T	2100
5	Korba STPS STG (I & II)	WR	T	2100
6	Singrauli STPS	NR	T	2000
7	Talcher STPS – II	SR	T	2000
8	SIPAT TPS Stg-I	WR	T	1980
9	Farakka STPS - I & II	ER	T	1600
10	Naptha Jhakri	NR	H	1500
11	Kahalgaon STPS – II	ER	T	1500
12	Indra Gandhi STPS	NR	T	1500
13	NTECL - Vallur TPS	SR	T	1500
14	Barh TPS	ER	T	1320
15	Mouda STPP Stage-II	WR	T	1320
16	Solapur Super Thermal Power Project	WR	T	1320
17	Vindhyachal-I	WR	T	1260
18	Maithon Power Limited	ER	T	1050
19	Tehri	NR	H	1000
20	Koldam	NR	H	1000
21	Talcher STPS – I	ER	T	1000
22	Rihand TPS Stage – III	NR	T	1000
23	Rihand TPS Stage – I	NR	T	1000
24	Rihand TPS Stage – II	NR	T	1000
25	NTPL - Tuticorin TPS	SR	T	1000
26	Simhadri STPS – II	SR	T	1000
27	Simhadri STPS – I	SR	T	1000
28	SIPAT TPS Stg-II	WR	T	1000
29	Vindhyachal-IV	WR	T	1000
30	Vindhyachal-III	WR	T	1000
31	Vindhyachal-II	WR	T	1000
32	Mouda STPP Stage-I	WR	T	1000
33	Dehar	NR	H	990
34	Dadri TPS Stage – II	NR	T	980
35	Kahalgaon STPS – I	ER	T	840
36	Dadri TPS Stage – I	NR	T	840
37	NLC TPS – II	SR	T	840
38	Dadri Gas	NR	T	830
39	Gadarwara STPP St-I	WR	T	800

S.No.	Power Plant	Region	Thermal/ Hydro	Capacity (MW)
40	Bhakra Right	NR	H	785
41	BongaigaonTPP	NER	T	750
42	Nabinagar Thermal Power Project	ER	T	750
43	Ratnagiri Gas	WR	T	664
44	Auraiya Gas	NR	T	663
45	Gandhar Gas	WR	T	657
46	Kawas Gas	WR	T	656
47	NLC TPS – I	SR	T	630
48	Bhakra Left	NR	H	594
49	Chamera-I	NR	H	540
50	Parbati III	NR	H	520
51	Teesta-V	ER	H	510
52	Farakka STPS – III	ER	T	500
53	Unchahar TPS Stage – IV	NR	T	500
54	NLC TPS - II Exp	SR	T	500
55	Ramagundam STPS – III	SR	T	500
56	Korba STPS STG (III)	WR	T	500
57	Vindhyachal-V	WR	T	500
58	NTPC-SAIL Power Company Pvt. Ltd	WR	T	500
59	Unchahar TPS Stage – I	NR	T	420
60	Unchahar TPS Stage – II	NR	T	420
61	NLC TPS - I Exp	SR	T	420
62	Anta Gas	NR	T	419
63	Koteshwar	NR	H	400
64	Pong	NR	H	396
65	Dulhasti	NR	H	390
66	MTPS Stage-II	ER	T	390
67	Chamera-II	NR	H	300
68	AGBPP – Kathalguri	NER	T	291
69	Dhauliganga	NR	H	280
70	Chamera-III	NR	H	231
71	Kopili	NER	H	200
72	Bairasiul	NR	H	180
73	Sewa-II	NR	H	120
74	Loktak	NER	H	105
75	Doyang	NER	H	75
76	Rangit	ER	H	60
77	Khandong	NER	H	50
78	Kopili-II	NER	H	25
	Total			**71484**