

REGULATION

Automatic Synchronizer for Generator

NP860
NP870

NP860 & NP870 perform synchronization and paralleling of generators with electrical network. NP860 features a speed adjustment function. NP870 adds a voltage adjustment function. These two devices also include CB time compensation allowing paralleling without phase shift.

As well as the usual protection functions, NP800 relays provide monitoring, measurement and recording of the electrical quantities of the network. The relays can be set by the RS232 port, or remotely using the RS485 port. Reading, measurement and recording are all available locally or remotely.



Multifunction
Measurement
Recording / event log
Disturbance recording
Local MMI

Common functions

- Regulating device - [90]
- Synchrocheck for manual paralleling - [25]
- Anticipated closing time of the paralleling circuit breaker [TA]
- Dead Busbar paralleling
- Adjustment of the phase shift between GE and BB measurements (Step up transformer adaptation)
- Network & Generator rated voltage

Speed adjustment (NP860-NP870)

- \pm speed order
- Boost pulsing
- "Black-start" mode from V1.50

Voltage adjustment (NP870)

- \pm U order

Multi-groups management function (NP870)

- 4 settings tables available for management of 4 generators



CEE Relays Ltd

CHARACTERISTICS NPRG860 - NPRG870

Auxiliary Supply

- Auxiliary supply ranges
- Typical burden
- Memory backup

19 to 70 – 85 to 255 / Vdc or Vac 50 or 60 Hz
6 W (CC), 6 VA (CA)
72 hours

Analogue Inputs

- Phase voltage inputs

- Frequency (50Hz or 60Hz)

Un: 55 to 120 V
input impedance > 80 K Ω
continuous rating 240 V, short duration withstand 275V - 1 min
measurement from 3 to 240 V
VT setting: primary value from 100 V to 30 kV
measurement: 45-55 Hz or 55-65 Hz
measurement: 30-70 Hz (*from V1.50*)

Digital Inputs (4 for NPRG860, 8 for NPRG870)

- Polarizing voltage

- Level 0
- Level 1
- Burden

20 to 70 Vdc, range 19 to 70 V
37 to 140 Vdc, range 85 to 255 V
< 10Vdc range 19 to 70 V – < 33Vdc range 85 to 255 V
> 20Vdc range 19 to 70 V – > 37Vdc range 85 to 255 V
< 15 mA

Relay Outputs (3* for NPRG860 + 1 WD, 7 for NPRG870 + 1 WD)

- Relays A*, B*, E, F

- Relays C*, WD, D, G

double contact NO, permanent current 8 A
closing capacity 12 A / 4 s
short circuit current withstand 100 A / 30 ms
breaking capacity DC with L/R = 40 ms: 50 W
breaking capacity AC with cos ϕ = 0.4: 1250 VA
changeover contact, permanent current 16 A
closing capacity 25 A / 4 s
short circuit current withstand 250 A / 30 ms
breaking capacity DC with L/R = 40 ms: 50 W
breaking capacity AC with cos ϕ = 0.4: 1250 VA

Characteristics of the function [90]

- Accuracy of voltage measures
- Setting of voltage difference: $\pm\Delta U$
- Voltage difference accuracy
- Setting of angular difference: $\Delta\phi$
- Angular difference accuracy
- Setting of frequency difference: $\pm\Delta F$
- Frequency difference accuracy
- Setting of rate of frequency change: $\Delta F/dt$
- Rate of frequency change accuracy
- Threshold of amplitude U GE mini
- Threshold accuracy
- Closing time of the paralleling CB (TA)
- Anticipatory max (limitation / TA)
- Accuracy of the time delays
- Accuracy of displayed measures

3% of Un
thresholds +/- : 1% to 15% Un, with step of 1% Un
 $\pm 5\%$ of the set value
thresholds +/- : 1 $^\circ$ to 20 $^\circ$, with step of 1 $^\circ$
 $\pm 2\%$
thresholds +/- : 0.01 to 1.5 Hz, with step of 0.01 Hz
 $\pm 2\%$
thresholds +/- : 0.01 to 0.2 Hz/s, with step of 0.01 Hz/s
 $\pm 2\%$
50 to 100% Un, with step of 1%
2% of Un
0 ms to 600 ms, with step of 10 ms
1 to 20 $^\circ$, with step of 1 $^\circ$
 $\pm 2\%$ or 20 ms
3% from 3 to 240 V

Characteristics of the function [25]

- Accuracy of voltage measures
- Setting of voltage difference: $\pm\Delta U$
- Voltage difference accuracy
- Setting of angular difference: $\Delta\phi$
- Angular difference accuracy
- Setting of frequency difference: $\pm\Delta F$
- Frequency difference accuracy
- Setting of rate of frequency change: $\Delta F/dt$
- Rate of frequency change accuracy
- Time lag before authorisation
- Accuracy of the time delays
- Accuracy of displayed measures

3% of Un
thresholds +/- : 1% to 15% Un, with step of 1% Un
 $\pm 5\%$ of the set value
thresholds +/- : 1 $^\circ$ to 20 $^\circ$, with step of 1 $^\circ$
 $\pm 2\%$
thresholds +/- : 0.01 to 1.5 Hz, with step of 0.01 Hz
 $\pm 2\%$
thresholds +/- : 0.01 to 0.2 Hz/s, with step of 0.01 Hz/s
 $\pm 2\%$
0 ms to 1 s, with step of 0.1 s
 $\pm 2\%$ or 20 ms
3% from 3 to 240 V

CHARACTERISTICS NPRG860 - NPRG870

Adjustment of the phase shift between GE and BB measurements

- GE voltage / BB voltage 0 to 360°, with step of 1°

Network rated voltage configuration

- Setting range 100 V to 30 kV

Speed adjustment (NPRG 860/NPRG 870)

- Interval of the pulses $\pm f$ 0 to 30 s ; 0 to 250 s (*from V1.50*), with step of 1 s
- Mini duration time of the pulses $\pm f$ 0 to 0.5 s, with step of 0.1 s or 0.01 s (*from V1.50*)
- Pulses width +f (*from V1.50*) 0 to 100% of interval of pulses $\pm f$, with step of 1%
- Proportional gain ($KFP\pm^*$) $\pm f$ 0 to 200, with step of 1
- Derivative gain for ($KFD\pm^{**}$) $\pm f$ 0 to 100, with step of 1
- Boost pulsing time-delay 10 to 200 s, with step of 1 s
- Accuracy of the time delay $\pm 2\%$ or 20 ms
- Duration of the pulses +f (boost pulsing) 0.5 to 10 s ; 0.01 to 2 s (*from V1.50*), with step of 0.5 s
- Orders stop if paralleling ok YES/NO

*: 5 Hz correspond to 20 s

** : 1 Hz/s correspond to 200 s

** : 1 Hz/s correspond to 2 s (*from V1.50*)

Voltage adjustment (NPRG870)

- Interval of the pulses $\pm U$ 0 to 30 s ; 0 to 250 s (*from V1.50*), with step of 1 s
 - Mini duration time of the pulses $\pm U$ 0 to 0.5 s, with step of 0.1 s or 0.01 s (*from V1.50*)
 - Pulses width +f (*from V1.50*) 0 to 100% of interval of pulses $\pm U$, with step of 1%
 - Proportional gain ($KUP\pm^*$) $\pm U$ 0 to 100, with step of 1
- *: 10% de U correspond to 5 s

Dead Busbar paralleling (NPRG 870)

- Dead busbar paralleling enabled by dedicated DI or setting software
- Info dead busbar paralleling enabled HMI, dedicated DI, communication and setting software
- Busbar voltage detection threshold 10% to 50% U_n , with step of 1% U_n
- Threshold accuracy 2% of U_n
- Setting of frequency difference thresholds F< and F>: 0 to 1 Hz, with step of 0.1 Hz
- Angular accuracy / frequency difference $\pm 2\%$
- Setting of voltage difference thresholds U< and U>: 1 to 10% U_n , with step of 1% U_n
- Voltage difference accuracy $\pm 5\%$ of the set value
- Time lag before paralleling 1 to 5 s, with step of 0.5 s
- Accuracy of the time delay $\pm 2\%$ or 20 ms

Digital inputs assignment

- Input 1 paralleling of dead bus line
- Input 2 auto mode
- Input 3 order function enabled
- Input 4 synchrocheck mode
- Input 5 (NPRG870 only) selection generator 1
- Input 6 (NPRG870 only) selection generator 2
- Input 7 (NPRG870 only) selection generator 3
- Input 8 (NPRG870 only) selection generator 4

Digital output assignment

- Relay A +f order
- Relay B - f order
- Relay C paralleling order
- Relay D (NPRG870 only) generator selection fault
- Relay E (NPRG870 only) +U order
- Relay F (NPRG870 only) - U order
- Relay G (NPRG870 only) paralleling of dead bus line enabled

Signalling LEDs assignment

- LED 1 auto mode activated
- LED 2 paralleling of dead bus mode activated
- LED 3 slip control
- LED 4 paralleling order

Setting

- Display English, French, Spanish, Italian
- Configuration and operating software compatible with Windows® 2000, XP, Vista and 7
English, French, Spanish, Italian

CHARACTERISTICS NPRG860 - NPRG870

MODBUS® Communication (option)

- Transmission
- Interface
- Transmission speed

asynchronous series, 2 wires
RS 485
300 to 115 200 bauds

Disturbance recording

- Number of recordings
- Total duration
- Pre fault time

4
170 cycles per recording (12 samples / cycle)
adjustable from 0 to 170 cycles

Climatic withstand in operation

- Cold exposure
- Dry heat exposure
- Damp heat exposure
- Temperature variation with specified variation rate

IEC / EN 60068-2-1: class Ad, -10 °C
IEC / EN 60068-2-2: class Bd, +55 °C
IEC / EN 60068-2-3: class Ca, 93 % HR, 40 °C, 56 days
IEC / EN 60068-2-14: class Nb, -10 °C à +55 °C, 3 °C/min

Storage

- Cold exposure
- Dry heat exposure

IEC / EN 60068-2-1: class Ad, -25 °C
IEC / EN 60068-2-2: class Bd, +70 °C

Electrical safety

- Ground bond test current
- Impulse voltage withstand

IEC / EN 61010-1: 30 A
IEC / EN 60255-5: 5 kV MC, 5 kV MD
except outputs TOR, 1 kV MD
except RS485, 3 kV MC

- Dielectric withstand: 50Hz

IEC / EN 60255-5: common mode 2 kV_{rms} – 1 min
differential outputs mode TOR 1 kV_{rms} – 1 min
(open contact type)
IEC / EN 60255-5: 500 V_{cc} - 1 s: > 100 MΩ
IEC / EN 60255-5: rated insulation voltage: 250 V
pollution degree: 2
overvoltage category: III

- Insulation resistance
- Clearances and creepage distances

Enclosure safety

- Degrees of protection provided by

IEC / EN 60529: IP51, with front face enclosures (IP code)

Immunity – Conducted disturbances

- Immunity to RF conducted disturbances
- Fast transients
- Oscillatory waves disturbance 1 MHz

IEC / EN 61000-4-6: class III, 10 V
IEC / EN 60255-22-4 / IEC / EN 61000-4-4: class IV
IEC / EN 60255-22-1: class III, 2.5 kV MC, 1 kV MD
except RS485, class II, 1 kV MC
IEC / EN 61000-4-5: class III
IEC / EN 60255-11: 100% 20 ms

- Surge immunity
- Supply interruptions

Immunity – Radiated disturbances

- Immunity to RF radiated fields

IEC / EN 60255-22-3 /
IEC / EN 61000-4-3: class III, 10 V/m
IEC / EN 60255-22-2 /
IEC / EN 61000-4-2: class III, 8 kV air / 6 kV contact
IEC / EN 61000-4-8: class IV, 30 A/m permanent,
300 A/m 1 to 3 s

- Electrostatic discharges

- Power frequency magnetic field and immunity test

Mechanical robustness - energised

- Vibrations
- Shocks

CEI / EN 60255-21-1: class 1, 0.5 Gn
IEC / EN 60255-21-2: class 1, 5 Gn / 11 ms

Mechanical robustness - not energised

- Vibrations
- Shocks
- Bumps
- Free falls

IEC / EN 60255-21-1: class 1, 1 Gn
IEC / EN 60255-21-2: class 1, 15 Gn / 11 ms
IEC / EN 60255-21-2: class 1, 10 Gn / 16 ms
IEC / EN 60068-2-32: class 1, 250 mm

Functionalities

- 2 ranges of auxiliary supply
- Storage of lack and the restoration of the auxiliary voltage (events recorded)
- Configuration and parameter setting by off-line / on-line PC
- Reading and recording of configuration by PC
- Measurement of electrical quantities:
 - Phase voltages U_{GE} , U_{BB}
 - Frequency F_{GE} , F_{BB}
 - Voltage difference ΔU ($U_{GE} - U_{BB}$)
 - Angular difference $\Delta\phi$
 - Angular difference $\Delta\phi$ compensate (NPRG870)
 - Frequency difference ΔF ($F_{GE} - F_{BB}$)
 - Rate of frequency change $\Delta F/dt$ (Hz / s)
 - CB closing time (ms)
 - Phi anticipatory ($^\circ$)
- Display expressed in primary values
- 4 setting groups for management of several selectable groups remotely by logical input (NPRG870 only)
- "Black-start" mode for starting with no speed
- Setting software compatible with Windows® 2000, XP, Vista and 7
- User interface with access to all functions
- Time stamping of internal events with 10ms resolution
- Time stamping of digital inputs with 10ms resolution
- Event recording: 250 locally recorded events, 200 saved in case of loss of the auxiliary supply
- Local / remote events acknowledgment
- Disturbance recording according to Comtrade® format: storage of 4 recordings of 170 periods.
- Remote setting, remote reading of measurements, alarms and parameters settings
- Remote reading of disturbance recording and events log
- Self-diagnosis: Memories, output relays, A/D converters, auxiliary supply, cycles of execution of the software, hardware anomaly

Options

- Communication by Modbus® RS 485
- Communication by Modbus® RS 485 with redundancy (NPRG870 only)

Functional diagram

(For Synchrocheck and manual paralleling, Dead Busbar paralleling and Multi-groups management function, see NP800 application guide)

