MULTI-FUNCTION CONTROL

BKA101-N1

USER'S MANUAL

B.K.A

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1. INTRODUCTION

1.1. Overview

The control is designed with RTU built-in.

BKA101-N1 is capable of DNP3.0, MODBUS™ and IEC60870-5-101, IEC60870-5-104 Communication and designed to adopt Distribution Automation System (DAS).

BKA101-N1 can achieve Data of Distribution line by interfacing information with Master Station, such as Fault sensing, Equipment monitoring etc.

BKA101-N1 consists of two processors DSP and CPU. DSP measures Analogues (Current/ Voltage) by fast calculation and CPU controls a lot of EVENTs and Communication information.

BKA101-N1 has 8 programmable INPUTs and 6 OUTPUTs. BKA101-N1 has 10 Analogue Inputs for metering currents and voltages and has 4 Communication ports for DNP3.0, MODBUS™, IEC60870-5-101,104 and Interface Software.

BKA101-N1 has 6 programmable lamps on User Interface Panel and it is able to indicate internal or external events by using lamps.

BKA101-N1 is operated by Programmable Logic. There are 6 BANKs and each BANK can be selected and provide different Logic.

Auto Sectionalizer and Tie Point Switch Control are already built in BKA101-N1 for Loop Automation.

BKA101-N1 measure, save and manage Current, Voltage, Power, Energy, Demand, Frequency.

In order to perform the fault indication function, line voltage and current signal filtered with analog filter and digital DFT full-cosin filter is used.

BKA101-N1 records the waveform of Current/Voltage, and the user can set recording point.

1.2. Features

- Fault Indication
  - Display Fault phase, Fault current, Occurred time
  - Sensing Permanent Fault, Temporary Fault
- Metering
  - Current A, B, C, G, RG
  - Voltage AN, BN, CN, AB, BC, CA, RN, SN, TN, RS, ST, TR
  - Frequency
  - Power
  - Energy
  - Demand
  - Harmonics - Option
  - Voltage and current unbalance - Option

- Communication
  - Front Panel PORT1 RS232 Serial Port : Interface software
  - Side panel PORT2 RS232 Serial Port : DNP 3.0, MODBUS and IEC60870-5-101 Protocol
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  - System status(RUN, RESET) Lamp
  - AC Supply, Charge Lamp
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  - Local / Remote Operation
  - User Key 1~4

- Maintenance
  - Number of Restart
  - Number of Switch Operation
  - Number of Permanent Fault detected
  - Number of Temporary Fault detected
  - Number of Supply Outage occurred and accumulated time
  - Number of Sag occurred
  - Number of Swell occurred
  - Number of Unbalance occurred -Option

- LCD Display: 20 × 4 line

2. TECHNICAL SPECIFICATIONS

2.1. Inputs and Outputs

Systems

- 3phase-3wire or 3phase-4wire Systems
- ABC/ACB phase rotation

Frequency

- 50/60㎐ system

Power Input

- AC Voltage Input: 24Vac (+10%,-15%)
  - Normal Power : 7W
  - Max. Power : 200W
- Battery : 24V18AH

Power Output

- PW1
  - Nominal Voltage : 24Vdc (18 ~ 36Vdc)
  - Normal Power : 30W
  - Max. Power : 150W(5sec)
- PW2
  - Nominal Voltage : 24Vdc (18 ~ 25Vdc)
  - Normal Power : 40W
  - Max. Power : 60W(60sec)

Current Transformer Inputs (CT: Current rate)

- Current Inputs IA,IB,IC and IG
- Phase(IA, IB, IC) Input Current Rate
  - 1A Input Current
    - 1A Nominal
    - 2A Continuous
    - 20A 1 second
    - Burden : 0.13VA(1A)
  - 5A Input Current – Option
    - 5A Nominal
    - 10A Continuous
    - 100A 1 second
    - Burden : 0.13VA(5A)

- Ground(IG) Input Current Rate
  - 0.05A Input Current
    - 0.05A Nominal
    - 0.6A Continuous
    - 20A 1 second
    - Burden : 0.002VA(0.05A)
  - 1A Input Current – Option
  - 5A Input Current – Option

Voltage Divider Inputs (VD)

- Max. Input Voltage : 5V
- Burden : 2e-6VA
- System Voltage: 15kV, 27kV, 38kV

Voltage Transformer Inputs (VT) – OPTION

- Voltage Inputs 6 Channel
  - Source Voltage 1 VA,VB,VC
  - Source Voltage 2 VR,VS,VT
- Voltage Ratings : Phase-Neutral Continuous < 150Vac
  - 0.6VA(150Vac), 0.2VA(120Vac), 0.05VA(67Vac)

Inputs

- Inputs 8 Channel
- Dry Contact Input Type
- Operating current : < 20mA

Output Contacts

- Outputs 6 Channel
  - 300Vac / 350Vdc Varistor for differential surge protection
- 2A Continuous
- Operate / Release time: < 5ms at +20℃(+68°F)
- IGBT Outputs : OUT1,OUT2
- Relay Outputs : OUT3~OUT6
- Maximum operating power for IGBT Outputs

(L/R=7ms)	125Vdc	5A
	48Vdc	15A
	24Vdc	30A

- Maximum operating power for Relay output

(L/R=7㎳)	125Vdc	0.1A
	48Vdc	0.8A
	24Vdc	3A
(cosΦ=0.4)	250Vac	3A
	125Vac	5A
resistive	250Vac	8A
	30Vdc	8A

2.2. Type Withstand Tests

Dielectric Strength

- CT inputs, VT inputs, Control Power inputs, Opto-isolated inputs and Relay outputs: 2㎸(60㎐) for 1 minute.

Surge Withstand Capability

- IEEE C37.90.1 – 2002 IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- IEEE C37.90.2 – 1995 IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
- IEEE C62.45 – 1992 IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
  - Power supply, Current, Voltage: 6㎸(1.2×50㎲), 3kA(8×20㎲)
  - Inputs, Outputs: 4㎸(1.2×50㎲), 2㎄(8×20㎲)

Control Operating Temperature

- Operating range: -40℃ ~+70℃(-40°F ~+158°F)
- LCD: -20℃ ~+70℃(-4°F ~+158°F) – standard
- VFD (Vacuum Fluorescent Display): -40℃ ~+85℃(-40°F ~+185°F) – option

2.3. Metering Accuracy

The harmonic components of current and voltage are removed from the input voltage and current parameters, so all measurements based on these quantities respond to the fundamental components only except the measurement of harmonics.

Table 2-1. Metering Accuracy(1/2)

Measurements	Parameters	Unit	Accuracy	Range
CURRENT	Phase A RMS Current Phase B RMS Current Phase C RMS Current Phase G RMS Current Phase RG RMS Current	A	±1% of 2×CT	20×CT
VOLTAGE	A–N (A–B) RMS Voltage B–N (B–C) RMS Voltage C–N (C–A) RMS Voltage R–N (R–S) RMS Voltage S–N (S–T) RMS Voltage T–N (T–R) RMS Voltage	kV	±1%	–
SYMMETRICAL COMPONENTS	I1, I2, 3I0 V1, V2, 3V0	A kV	±1% of 2×CT ±1%	–
POWER FACTOR	Phase A, B, C 3Φ Phase	Rate	±0.02	–1.000 to 1.000
3ΦREAL POWER	Phase A, B, C 3Φ Phase	MW	±2%	–32.000 to 32.000
3ΦREACTIVE POWER	Phase A, B, C 3Φ Phase	MVar	±2%	–32.000 to 32.000
3ΦAPPARENT POWER	Phase A, B, C 3Φ Phase	MVA	±2%	–32.000 to 32.000
WATT-HOURS	Phase A, B, C 3Φ Phase	MWH	±2%	–32000 to 32000
VAR-HOURS	Phase A, B, C 3Φ Phase	MVarH	±2%	–32000 to 32000
DEMAND	Phase A/B/C/RG Current A/B/C, 3Φ Real Power A/B/C, 3Φ Reactive Power	A MW MVar	±2% ±2% ±2%	–

Table 2-1. Metering Accuracy(2/2)

Measurements	Parameters	Unit	Accuracy	Range
FREQUENCY	A-N (A-B) Source Voltage R-N (R-S) Load Voltage	Hz	±0.02	40.00~70.00
HARMONICS	1^{st}~7^{th} Harmonic of Current 1^{st}~7^{th} Harmonic of Voltage THD of Current THD of Voltage	–	±1% ±1% ±3% ±3%	0% to 100% 0% to 100% 0% to 100% 0% to 100%
UNBALANCE	Voltage unbalance(V2/V1) in source side Voltage unbalance(V2/V1) in load side Current unbalance(I2/I1)	%	±2% ±2% ±2%	0% to 999% 0% to 999% 0% to 999%

If the VT connection type is set to delta, all single phase voltage quantities are displayed as zero.

2.4. Function Setup Elements

BASIC FUNCTION

FI Pickup Current

Phase / Residual Ground / NEG Seq' Pickup Level

Phase	0:OFF, 10 to 1600 in steps of 1A
Residual Ground	0:OFF, 10 to 1600 in steps of 1A
Ground	0:OFF, 4 to 160 in steps of 1A (prior to Ver 1.11)
	0:OFF, 2 to 160 in steps of 1A (from Ver 1.11)
NEG Seq'(option)	0:OFF, 10 to 1600 in steps of 1A
Dropout Level	96 to 98% of Pickup
Pickup Level Accuracy	± 5%

FI Setting Time

Permanent / Temporary	1 to 180 in steps of 1 sec
Timing Accuracy	± 5%
Type I delay	0.03 to 180.00 in steps of 0.01sec

FI Inrush Time

Phase / Residual Ground / Ground	0.1 to 3.0 in steps of 0.1 sec (prior to Ver 1.11)
	0.1 to 30.0 in steps of 0.1 sec (from Ver 1.11)
NEG Seq'(option)	0.1 to 3.0 in steps of 0.1 sec (prior to Ver 1.11)
	0.1 to 30.0 in steps of 0.1 sec (from Ver 1.11)
Timing Accuracy	± 5%

NEQ' Voltage(47)

Voltage1 Pickup Level	0:OFF, 0.00 to 1.25 in steps of 0.01 xVT
Voltage2 Pickup Level	0:OFF, 0.00 to 1.25 in steps of 0.01 xVT
V1 Time Delay	0.00 to 600.00 in steps of 0.01 sec
V2 Time Delay	0.00 to 600.00 in steps of 0.01 sec
Dead Voltage Maximum	0.00 to 1.25 in steps of 0.01 xVT
Live Voltage Minimum	0.00 to 1.25 in steps of 0.01 xVT
Pickup Level Accuracy	± 5%

Synchronism Check(25)

Pickup Angle ………………………………………… 0:OFF, 1 to 100 in steps of 1 deg
Dead Voltage Maximum ………………………….…... 0.00 to 1.25 in steps of 0.01 xVT
Live Voltage Minimum ……….……………….......... 0.00 to 1.25 in steps of 0.01 xVT
Sync Phase ……………………………………….. R(AB),S(CB),T(AC),ALL

FI Type Select*

Type Select..…………………………………………IV,I

M-Oper TD

Time delay..……………………………………….0.00 to 600.00 in steps of0.01sec

DEMAND FUNCTION

Phase / Residual Ground / NEG Seq' Pickup Level
  Phase …………………………………………… 0:OFF, 10 to 1600 in steps of 1A
  Residual Ground ……………………………….. 0:OFF, 10 to 1600 in steps of 1A
  NEG Seq'(option) ………………………………. 0:OFF, 10 to 1600 in steps of 1A
Dropout Level ……………………………….…..….. 96 to 98% of Pickup
Pickup Level Accuracy …………………………… ± 5%

UNDER VOLTAGE-1 / 2 FUNCTION

Pickup Level ………………………………………. 0.00 to 1.25 in steps of 0.01 xVT
Dropout Level ……………………………………... 102 to 105% of Pickup
Minimum Voltage …………………………………. 0.00 to 1.25 in steps of 0.01 xVT
Time Delay ………………………………………. 0.00 to 600.00 in steps of 0.01 sec
Active Phases ……………………………………… Any One/Any Two/All Three
Timing Accuracy ..………………………………… ± 5%

OVER VOLTAGE-1 / 2 FUNCTION

Pickup Level ………………………………………. 0.00 to 1.25 in steps of 0.01 xVT
Dropout Level ……………………………………... 95 to 98% of Pickup
Active Phases ……………………………………… Any One/Any Two/All Three
Time Delay ………………………………………. 0.00 to 600.00 in steps of 0.01 sec
Timing Accuracy …………………..……………… ± 5%

UNDER/OVER FREQUENCY FUNCTION

UV Pickup Level ………………………………………. 40.00 to 60.00 in steps of 0.01 Hz
OV Pickup Level ………………………………………. 40.00 to 70.00 in steps of 0.01 Hz
Time Delay ……………………………………………. 0.00 to 600.00 in steps of 0.01 sec
Dropout Level ………………………………………….. ±0.02 Hz
Level Accuracy ………………………………………… ± 0.02 Hz,
Timing Accuracy ……………………………………….. ± 5%
Min.V(×VT) ……………………………………………. 0.00 to 1.25 in steps of 0.01 xVT
Min.I(A) ………………………………………………… 10 to 1600 in steps of 1A

LOOP CONTROL

Auto Sectionalizer Control

Auto Sectionalizer Operate Count ………………… 1 to 4 in steps of 1
Auto Sectionalizer Reset Time Delay ……………. 0.00 to 300.00 in steps of 0.01 sec
Auto Sectionalizer Open Time Delay ……………. 0.00 to 300.00 in steps of 0.01 sec

Tie Point Switch Control

Tie VRS ………………………………………………. SV1, SV1&SV2, SV2
Tie Operate Count ……………………………………. 1 to 4 in steps of 1
Tie Reset Time Delay ………………………………… 0.00 to 300.00 in steps of 0.01 sec
Tie Close Time Delay ………………………………... 0.00 to 300.00 in steps of 0.01 sec
Tie Open Time Delay ………………………………... 0.00 to 300.00 in steps of 0.01 sec
Tie Dead Voltage 1 Delay …………………………… 0.00 to 300.00 in steps of 0.01 sec
Tie Dead Voltage 2 Delay …………………………… 0.00 to 300.00 in steps of 0.01 sec

USER LOGIC TIMER

User Logic Timer 1 ~ 8 Pickup Time ……………….. 0.01 to 600.00 in steps of 0.01 sec
User Logic Timer 1 ~ 8 Dropout Time …………….... 0.01 to 600.00 in steps of 0.01 sec

SET GROUP CHANGE*

Function ………………………………………………….. DISABLE, ENABLE
Time Interval …………………………………………..... 10 to 180 in steps of 1 min
Timing Accuracy ……………………………………….. ± 5%

USER SET FUNCTION

EUSF1	DISABLE, ENABLE
EUSF2	DISABLE, ENABLE
EUSF3	DISABLE, ENABLE
EUSF4	DISABLE, ENABLE
EUSF5	DISABLE, ENABLE
EUSF6	DISABLE, ENABLE
EUSF7	DISABLE, ENABLE
EUSF8	DISABLE, ENABLE
EUSF9	DISABLE, ENABLE
EUSF10	DISABLE, ENABLE
EUSF11	DISABLE, ENABLE
EUSF12	DISABLE, ENABLE

POWER QUALITY - Option

Detect Function of Supply Outage	DISABLE, ENABLE
Supply Outage Duration	5 to 600 in steps of 1 sec
Detect Function of Sag	DISABLE, ENABLE
Sag Pickup Level	0.30 to 0.95 in steps of 0.01 xVT
Sag Duration	1 to 60 in steps of 1 cycle
Detect Function of Swell	DISABLE, ENABLE
Swell Pickup Level	1.05 to 1.25 in steps of 0.01 xVT
Swell Duration	1 to 60 in steps of 1 cycle
Detect Function of Voltage Unbalance	DISABLE, ENABLE
Voltage Unbalance Pickup Level	1 to 100 in steps of 1%
Detect Function of Current Unbalance	DISABLE, ENABLE
Current Unbalance Pickup Level	1 to 100 in steps of 1%
Current Unbalance Duration	0.1 to 60.0 in steps of 0.1 sec
Limit Current to Detect Current Unbalance	1 to 630 in steps of 1A
Level Accuracy	± 5%

COLD LOAD PICKUP

CLPU Use? ..………………………………………. NO,YES

CLPU Multi' ……………………………………… OFF,1.0 to 5.0 in steps of 0.1

CLPU Time(m) …………………………………… 1 to 720 in steps of 1 minute

LIVE LOAD BLOCK

Function …………………………………………….. DISABLE, ENABLE

Pickup Level ………………………………………. 0.00 to 1.25 in steps of 0.01 xVT

Dropout Level ……………………………………... 102 to 105% of Pickup

Minimum Voltage …………………………………. 0.00 to 1.25 in steps of 0.01 xVT

Time Delay ………………………………………. 0.00 to 600.00 in steps of 0.01 sec

Timing Accuracy ..…………………………………. ± 5%

2.5. EVENT Recorder

Fault Event

- Trigger Source
  - Current A, B, C, RG, G, NEQ(option)
  - Fault detect : Temporary fault, Permanent fault
  - Detect direction : Forward, Reverse direction
  - Fault Sequence
- Trigger Time : every 1/4 cycle
- Storage capacity : Last 512 events

Cycle Event

- Trigger Source
  - Fault wave capture point
  - Fault current
- Sample Rate : 16 sampling per 1cycle.
- Trigger Position : 1 to 15cycle
- Storage capacity : Last 32 events with 30cycles

System Event

- Trigger Source
  - 52A contact
  - Input/Output status change
  - Front panel control
  - AC power supply
  - External control
  - External input status
  - System alarm
  - Sleep mode
  - V1(Source), V2(Load)
  - Power Quality detect
- Trigger Time : every 10㎳
- Storage Capacity : Last 2048 events

Diagnostic Event

- Trigger Source
  - SYSTEM POWER : ±12V, +5V
  - A/D Converter : A/D Fail, Reference Voltage1, Reference Voltage 2
  - MEMORY : PROM, SROM, FROM, DPRAM, SRAM, DSPRAM
  - SETTING : GLOBAL SET, BANK1~6
  - WATCH-DOG Restart
  - DO Failure
  - RTC Failure
- Trigger Time : every 10㎳
- Trigger type : Pickup and Dropout
- Storage Capacity : Last 512 events

Power Quality Event

- Trigger Source
  - Trigger elements : Source, Load
- Trigger Time : every 10㎳
- Trigger type : supply outage occurrence, sag occurrence, swell occurrence, voltage unbalance occurrence, current unbalance occurrence

- Storage Capacity : Last 512 events

Switching Event

- Trigger source
  - Switch CLOSE(MANUAL/LOCAL/REMOTE)
  - Switch OPEN(MANUAL/LOCAL/REMOTE)
  - Earth Close(ECLOSE)
  - Earth Open(EOPEN)
- Trigger Time : every 10㎳
- Storage capacity : Last 100 events

Set Change Event

- Trigger source
  - Global setting change
  - SETBANK1 setting change
  - SETBANK2 setting change
  - SETBANK3 setting change
  - SETBANK4 setting change
  - SETBANK5 setting change
  - SETBANK6 setting change
- Trigger Time : every 10㎳
- Storage capacity : Last 100 events

Load Profile

- Trigger Source
  - Demand Current(A, B, C, RG)
  - Demand Real Power(A, B, C, 3Φ)
  - Demand Reactive Power(A, B, C, 3Φ)
  - Demand Energy - Positive Watthour(3Φ)
  - Power Factor(3Φ)
- Trigger Time : 5, 10, 15, 20, 30, 60minute
- Storage Capacity : Last 5120 Events.

2.6. Maintenance

Counter

- Number of System restart : 0 ~ 65,534
- Number of Operation : 0 ~ 65,534
- Number of permanent fault : 0 ~ 65,534
- Number of temporary fault : 0 ~ 65,534

Power Quality

- Supply Outage
  - Supply Outage Counter : 0 to 60,000
  - Supply Outage Time : 0 to 9,999 hours
- PQ Counter - Option
  - Sag Counter : 0 to 60,000
  - Swell Counter : 0 to 60,000
  - Voltage Unbalance(Source Side) Counter : 0 to 60,000
  - Voltage Unbalance(Load Side) Counter : 0 to 60,000
  - Current Unbalance Counter : 0 to 60,000

2.7. Communications

PORT1

- Port Type : RS232
- Port Setting : 57600bps, No Parity, 8 Data bit, 1 Stop bit
- Purpose : Interface Software

PORT2

- Port Type : RS232
- Port Setting : 1200~19200bps, No Parity, 8 Data bit, 1 Stop bit
- Purpose : DNP 3.0, MODBUS™ or IEC60870-5-101 Protocol

PORT3 – Option

- Port Type : RS485 or RS232
- Port Setting : 1200~19200bps, No Parity, 8 Data bit, 1 Stop bit
- Purpose : DNP 3.0, MODBUS™ or IEC60870-5-101 Protocol

PORT4 – Option

- Port Type : RJ45, 10BASE-T/100BASE-T
- Purpose : DNP 3.0, MODBUS™ or IEC60870-5-104 Protocol

2.8. Monitoring

Trip Count Limit

Limit ………………………………………………........ OFF, 50 to 10000 in steps of 1

Contact Wear Set

Function ………………………………………........ OFF, ALARM

PickUp(%) ……………. ………………………… 0.0 to 50.0 in steps of 0.1%

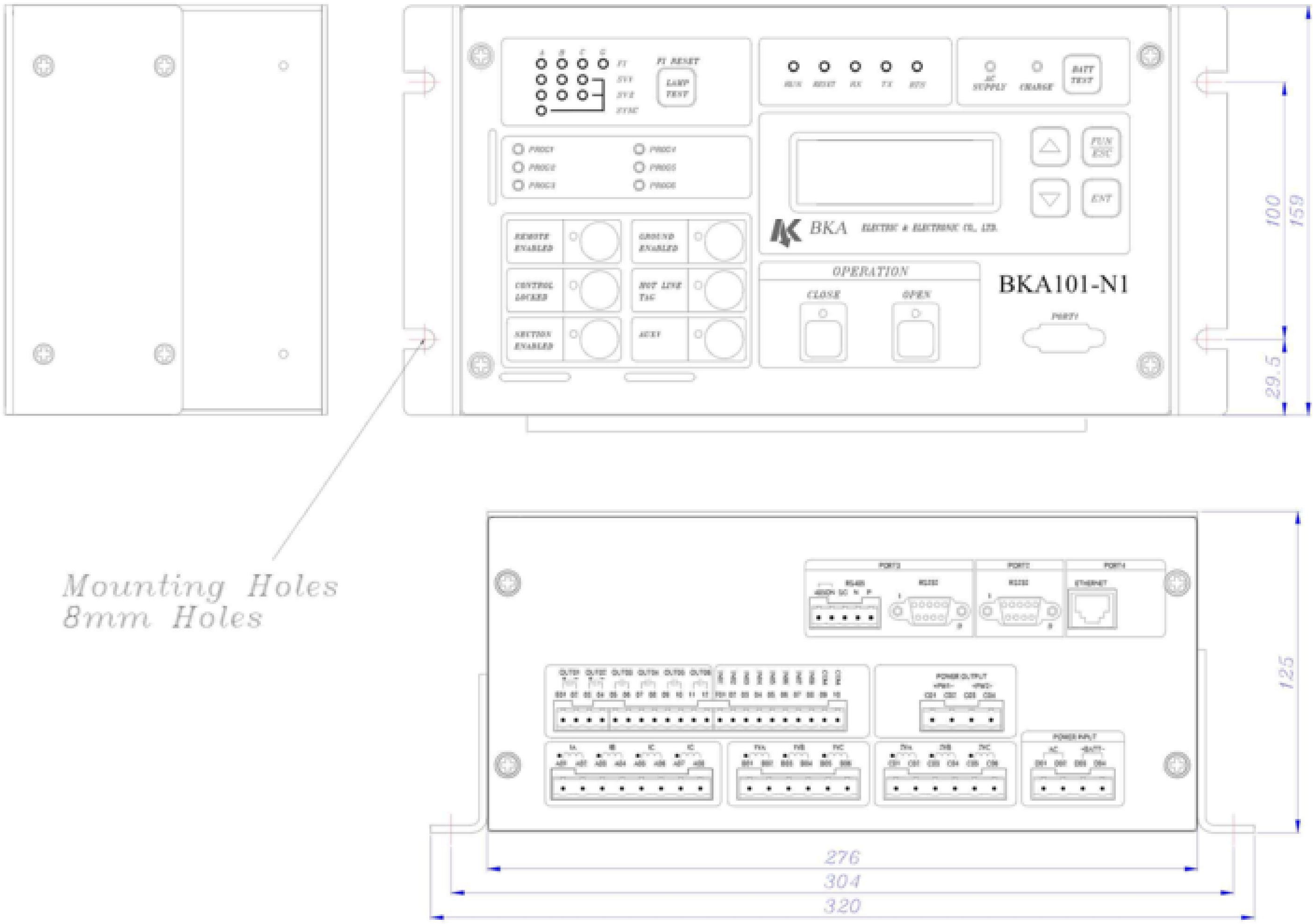


Figure 3-1 Dimensions and Mounting Plan(BKA101-N1 Type)

- ***Figure 3-1. Dimensions and Mounting Plan(BKA101-N1 Type)"*** show BKA101-N1 dimension and fixing points.
- ***BKA101-N1*** fixing volt is M6, and there are 4 spots.
- ***BKA101-N1*** case is able to be fixed under/above a plate by using fixing arms(***"Figure "Figure 3-1. Dimensions and Mounting Plan(BKA101-N1 Standard Type)"***).
- It has 4 fixing spots and it is useful to coordinate spots to place BKA101-N1 appropriately.

3.2. Earth Wiring Diagram

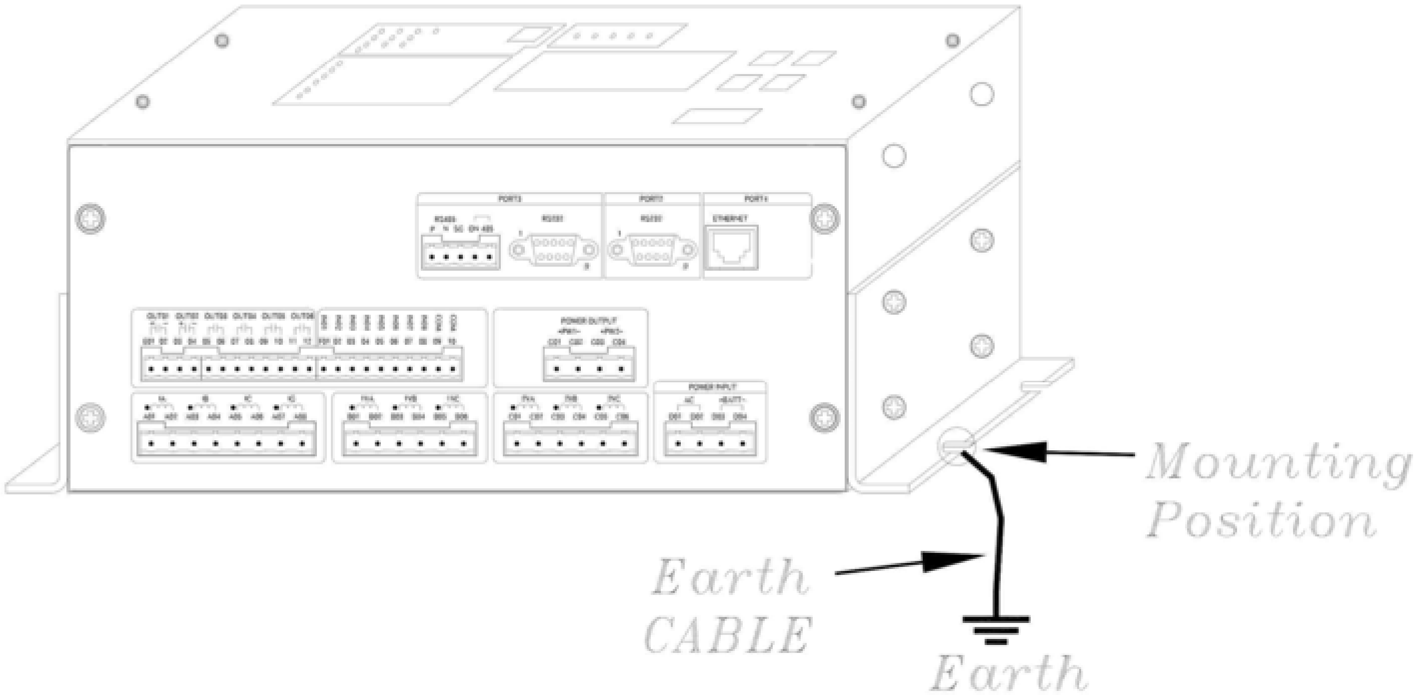


Figure 3-2. Earth Wiring Diagram

- Earth is connected at one of 4 mounting spot.
- 3.5㎟ is used for Earth cable.

3.3. Board Ground

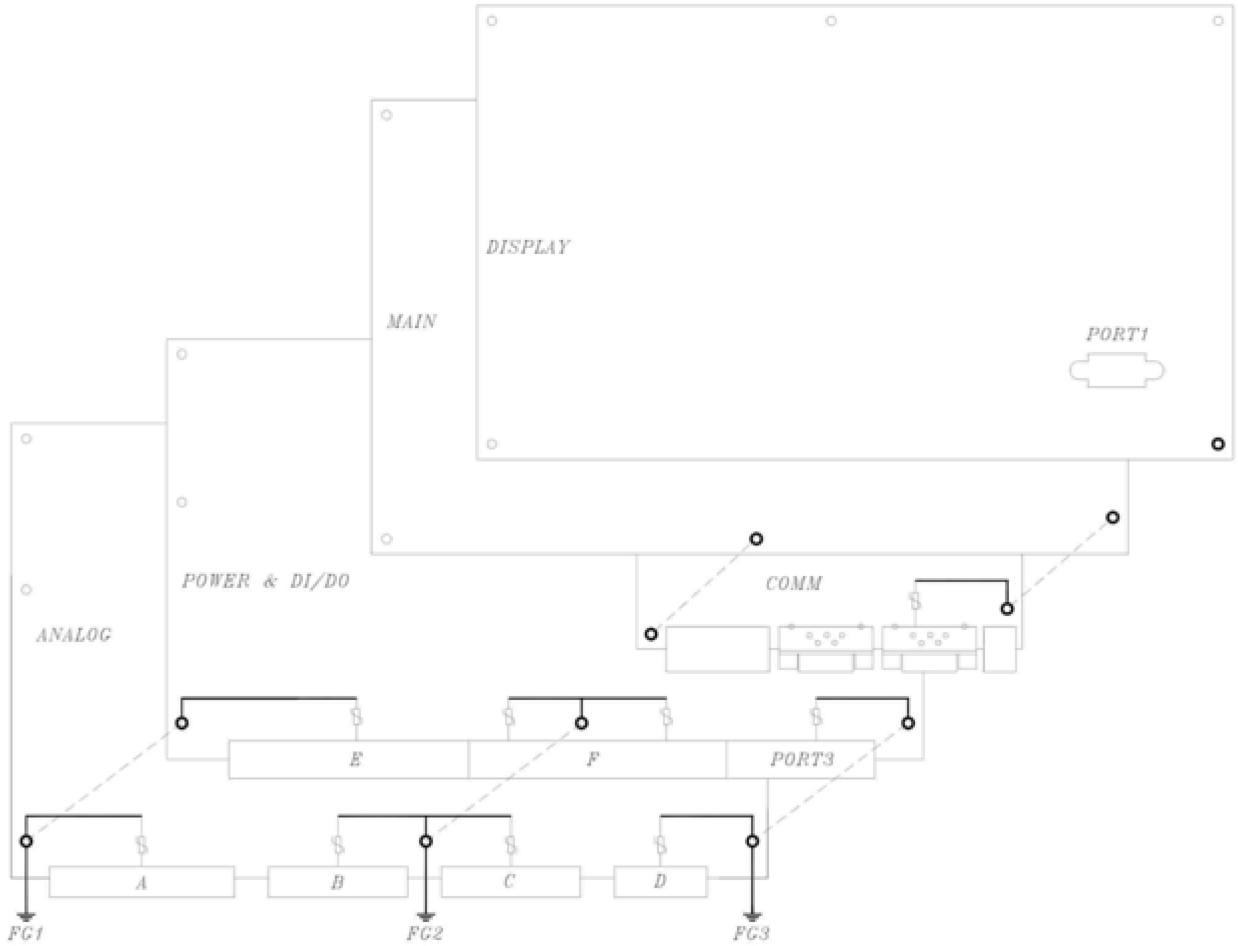


Figure 3-3. Board Ground

- ***"Figure 3-3. Board Ground"*** shows board ground of BKA101-N1 Module, FG1, FG2, and FG3.
- It is grounded by connecting board with its Case.

3.4. Battery Protection

Battery protection is to protect the battery from over-discharge by disconnecting the battery from the control circuit when AC power is lost and before the battery is completely discharged. CPU measures the battery voltage and when the battery is below 21 volts, timer is operated and after 10 minutes, Latch Relay is set to disconnect the battery circuit.

The power consumption of the disconnected circuit is below 100uA and PULSE circuit monitors the voltage. PULSE circuit sends PULSE SIGNAL to reset Relay when the DC24V LINE voltage is rapidly increased over 6 volts.

On Power Down status, if the external power is re-supplied or the Power Switch is changed from OFF to ON, Control Module is operated as normal.

When AC Power is not supplied, in order to operate it by Power Switch, OFF for 5 seconds and turn it ON. When it is turned ON without Battery, it is Power downed after 10 minutes.

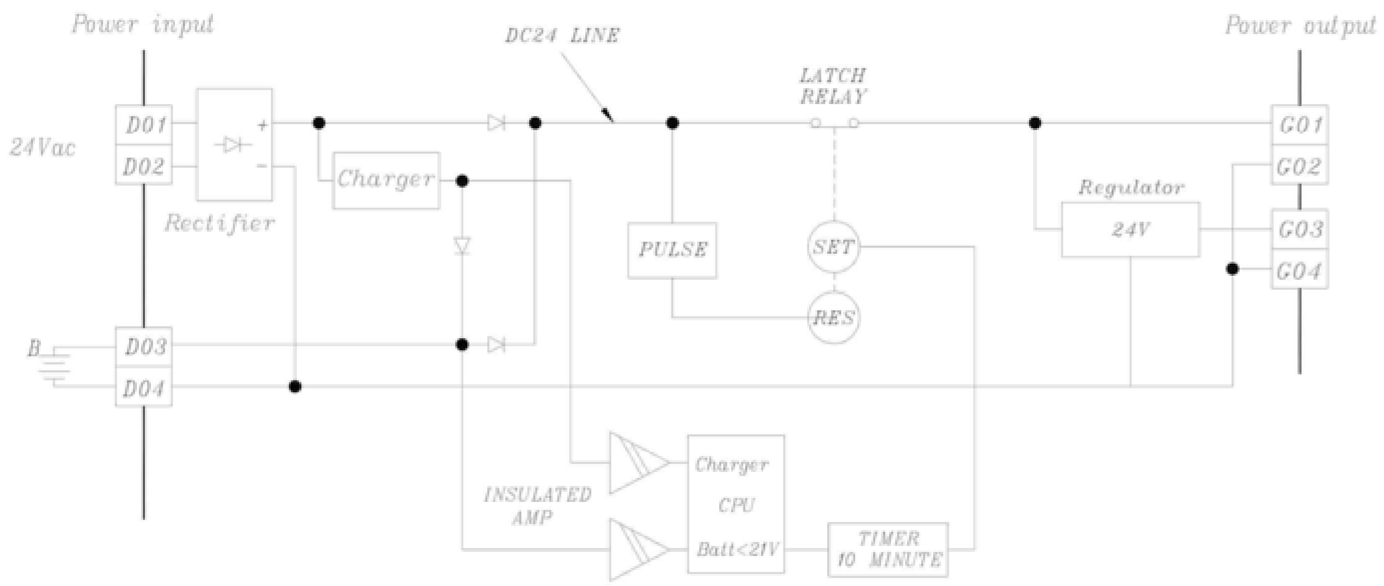


Figure 3-4. Power line and Power protection

Table 3-1. Battery Specs

Nominal capacity	24V/17A (12V×2pcs)
Service life Time	5 years
Battery Connector(CN11)	Molex Connector 3191-2R
Controller run time	48hours
Recharge Time	SOC: ~80%/ 15hours

3.5. Charge Circuit

Charger uses current-control-circuit to prevent sudden-recharge and use voltage-steady-circuit to prevent over-recharge.
Charge inspection use 24Vac the same power as Control Module has.

- **Charge Voltage:** 27.5Vdc (±0.5V)
- **Charge Current:** 300㎃dc (±50㎃dc)

3.6. Typical Wiring Diagram

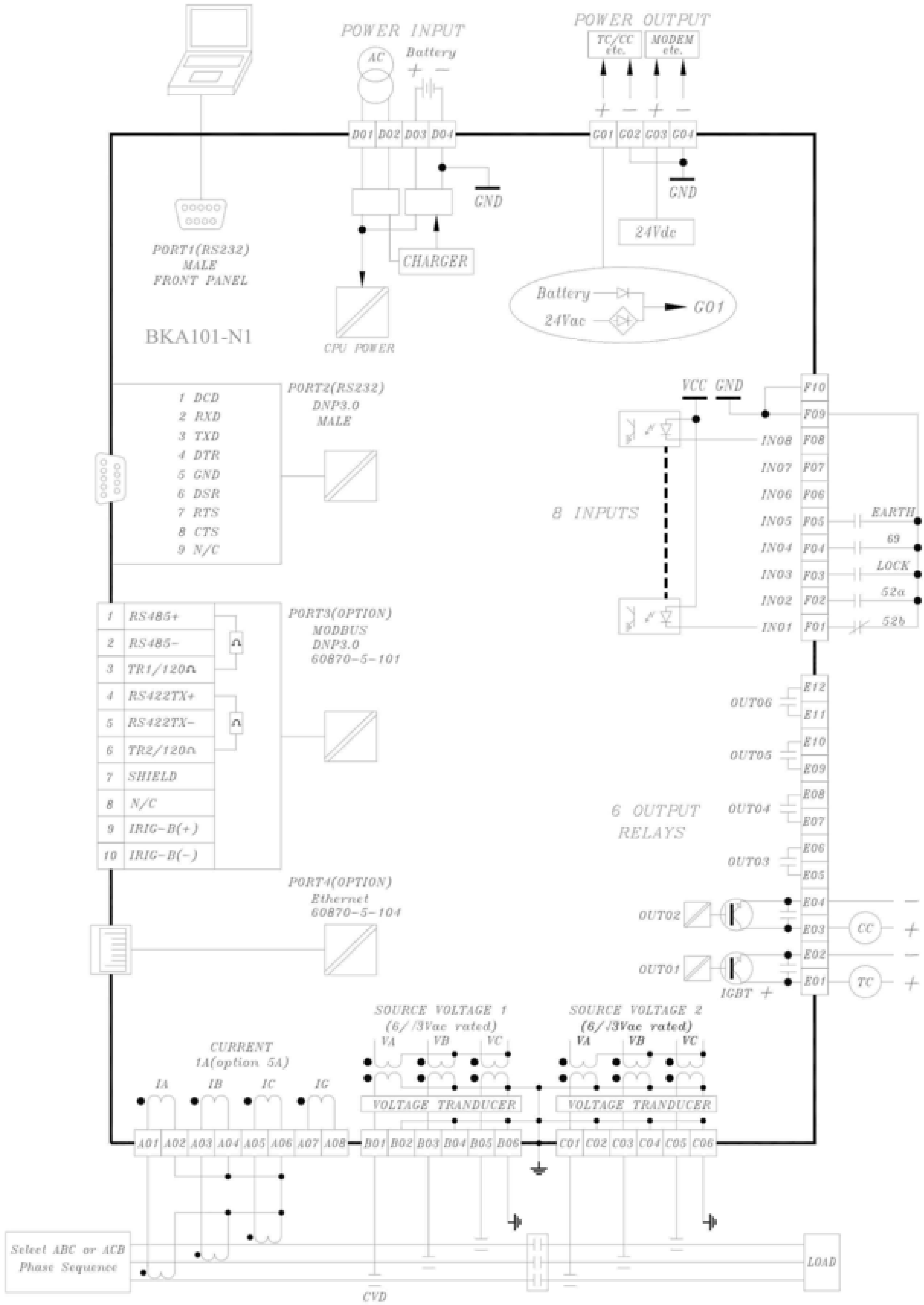


Figure 3-5. Typical Wiring Diagram

4. USER INTERFACE PANEL

User interface Panel provides following features;

- Control status
- System status
- Measured values
- Stored Events data in BKA101-N1
- Display or change Setting values

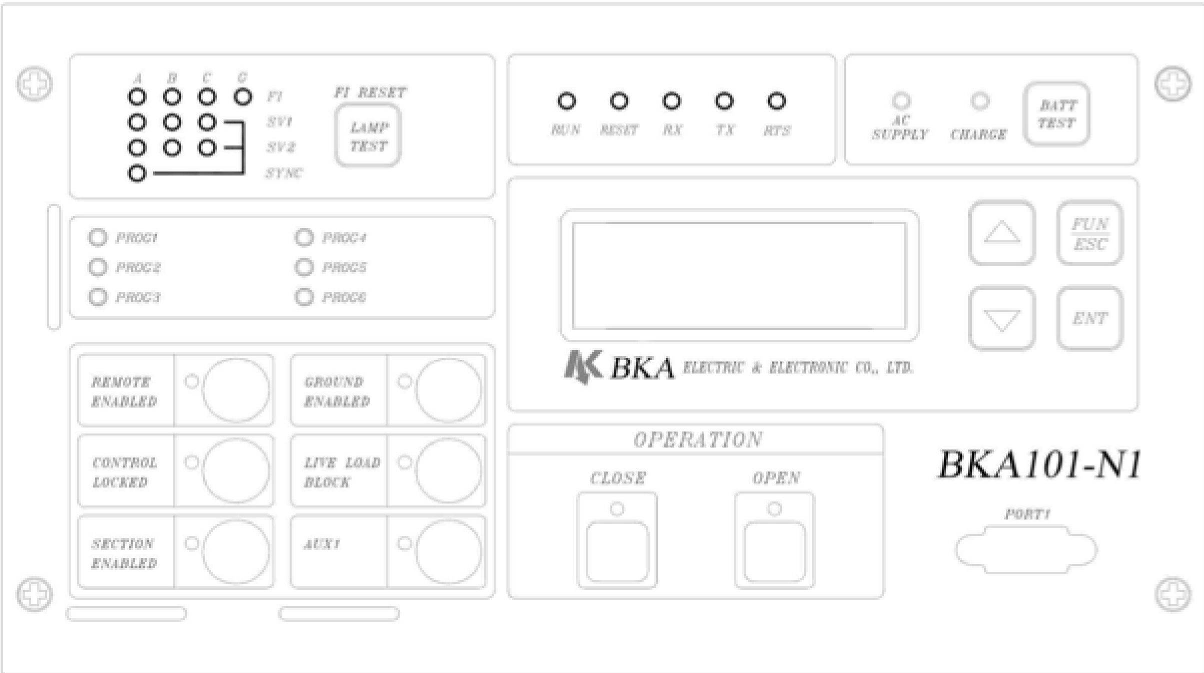


Figure 4-1. User Interface Panel (BKA101-N1 type)

4.1. Construction

User Interface Panel consists of 7 sections as below;

- Fault Section
- System Diagnostic & Communication Status Section
- Battery Test Section
- User Programmable Lamp Section
- Menu Control Section
- Local Control Section
- Operation Section

4.1.1. Fault Section

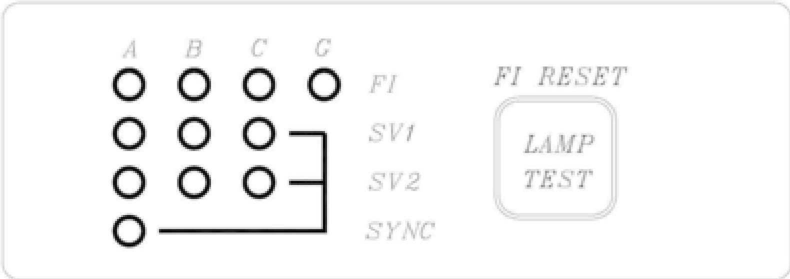


Figure 4-2. Fault Section

Fault Indication Lamp

- FI (A, B, C, RG) : Faulted phase lamp is on
- Related Setting Menu
  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ FI Pickup Current"
  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ FI Setting Time"

Source Voltage Lamp

- Changes the purpose of the lamp to the SV LED TYPE.(Open-V, Live-V)
- SV1 (A, B, C)
  Open-V : Lamp lights on when Source Voltage is Open Phase Voltage and Negative Voltage.
  Live-V : Lamp lights on when Source Voltage is alive.
- SV2 (A, B, C)
  Open-V : Lamp lights on when Load Voltage is Open Phase Voltage and Negative Voltage.
  Live-V : Lamp lights on when Load Voltage is alive.
- Related Setting Menu
  "Global Setting \ Cobtrol Setup \ Others \SV Led Type"
  "Setbank Setting \ Primaryset Bank \ Basic Function \ NEQ' Voltage(47)"
  "Setbank Setting \ Primaryset Bank \ Basic Function \ Live Load Block"

Synchrocheck Lamp

- SYNC : When phase of Source Voltage & Load Voltage are not matching, lamp is on.
- Related Setting Menu
  "Setbank Setting \ Primaryset Bank \ Basic Function \ Synchrocheck"

Lamp Test & FI Reset Button

- Testing lamp, by pressing button, all lamp are on.
- After testing lamp, FI Lamp is off.

4.1.2. System Diagnostic & Communication Status Section

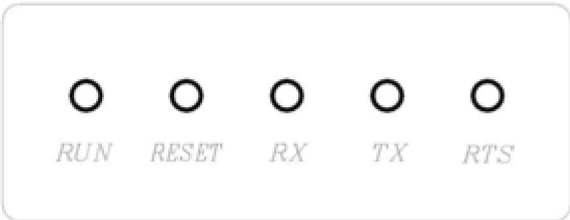


Figure 4-5. System Diagnostic & Communication Status Section

System Diagnostic

- RUN : Lamp blinks on normal status.
- RESET : If system is malfunction, lamp is on.

Communication Status

- RX : Lamp is on when BKA101-N1 is receiving data.
- TX : Lamp is on when BKA101-N1 is sending data.
- RTS : Lamp is on when BKA101-N1 is on waiting status to CTS signal.

4.1.3. Battery Test Section

Figure 4-4. Battery Test Section

AC Supply Lamp

- Status of supplying the external AC Power.
- AC INPUT Connector D01, D02 is input to Side panel for AC Power.

Charge Lamp

- When AC supply is not provided, Battery status is indicated, when AC supply is provided, the charge circuit status is indicated.
- The battery status is indicated on Battery test.

Batt Test Button

- This is to test battery automatically. It takes 3 seconds and user can verify through.
- LCD displays during battery load testing.

```
[BATTERY TEST MODE]
LOAD[V]:      24.00
CHARGE[V]:    27.00
STATUS :   B-OK C-OK
```

The Status of Battery and Charger are displayed on LCD by pressing BATTERY TEST KEY.

LOAD(V) : On Test, Battery is disconnected from the charge circuit and connect the battery with load resistor and check the battery and 1.2 ampere. Load resistor shall be connected with AC supply.

CHARGE(V) : Display the voltage of charge circuit.

STATUS : Display Battery status and charge circuit status.

- B-OK : When the battery voltage is between 21V ~ 28V
- B-HI : When the battery voltage is over 28V
- B-DF : When the battery voltage is between 15V ~ 21V
- B-LO : When the battery voltage is below 15V
- C-OK : When the charge circuit is between 25V ~29V
- C-HI : When the charge circuit is over 29V
- C-LO : When the charge circuit is below 25V

⚠ **NOTE :** All information above are provided for remote mode.

4.1.4. User Programmable Lamp Section

Figure 4-4. User Programmable Lamp Section (** BKA101-N1 **Type)

- PROG1 ~ 6: Programmable lamps, user can select and indicate internal logic or external event.
- It is useful for user to figure BKA101-N1 operation status.
- It is programmable by ***Interface Software***.
- Please refer to ***Interface Software User's Manual*** for Logic change or details of Logic.

PROG1 : In case of BKA101-N1 type, the lamp is turned ON when loop control function (SEC or TIE) is enabled.
In case of BKA101-N1 type, the lamp is turned ON when auto sectionalizer function(SEC) is enabled.

PROG2 : In case of BKA101-N1 type, no logic mapped, the lamp is always OFF.
In case of BKA101-N1 type, the lamp is turned ON when tie function(TIE) is enabled.

PROG3 : The lamp is ON at "Close Block" state due to the live voltage on both sides of the source and load.

PROG4 : At IN03 of input points gets signals, the lamp is turned ON.
IN03 is connected to Low pressure status.

PROG5 : At IN04 of input points gets signals, the lamp is turned ON.
IN04 is connected to Switch Lock status.

PROG6 : At IN06 of input points gets signals, the lamp is turned ON.
IN06 is connected to Door Open status

4.1.5. Menu Control Section

Figure 4-6. Menu Control Section

Menu Control Keys

BKA101- N1 has 4 buttons for LCD display as shown in the following table.

Table 4-1. Menu Control Keys

BUTTON	DESCRIPTION
 FUNCTION / ESC	• Move to Main Menu from Initial Logo. • Move to previous Menu. • During change set value, by pressing this button the set value return to previously saved value.
 ENTER	• Select a menu(an item from menu). • Save a changed set value. ⚠ **CAUTION:** To complete changing a set value, user needs to confirm, ***" SETTING VALUE SAVE and press ENTER key save"*** Screen, and press **[ENTER]** key. If user skips ***"*. Save Setting"*** and moves to Main menu, changing new set value is not saved.
 UP	Move to upper menu or increase a set value. All menu levels are constructed as circle. Top menu is next to bottom menu. As well as, Max. set value is next to Min. set value.
 DOWN	Move to down menu or decrease a set value. All menu levels are constructed as circle. Top menu is next to bottom menu. As well as Max. set value is next to Min. set value.

Communication Port

To connect ***Interface Software*** for communication

- Collect and print all events of BKA101-N1
- Collected events can be saved as a file
- Measured data can be verified by Graph
- Capable of changing set values
- Pin 2 : RXD
- Pin 3 : TXD
- Pin 5 : GND
- Pin 1,4,6,7,8,9 : Not connected

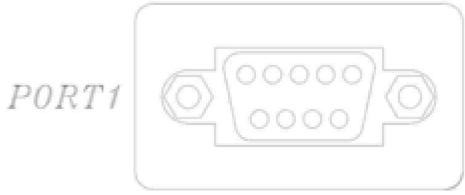


Figure 4-7 . Port 1

4.1.6. Local Control Section

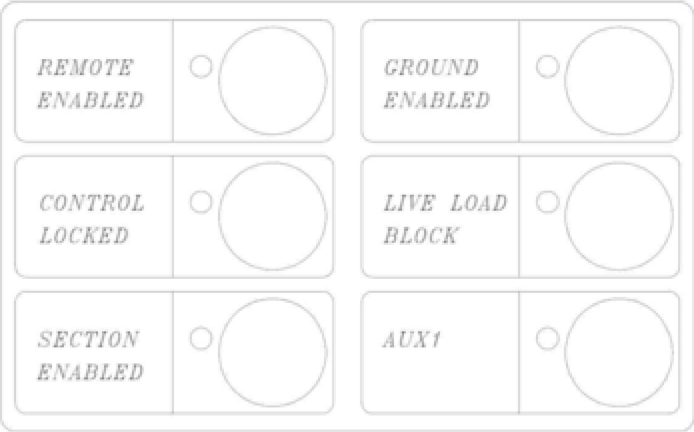


Figure 4-8 . Local Control Section

BKA101-N1 provides "User Set Key" function. By changing PLC from **Interface software**, User can set the function of key. So four remaining buttons except "Remote enabled" key and "Control Locked" key are functional button that depend on User. Four keys are provided with default functions (Section, Ground, Hot Line Tag, AUX1). The push-button toggles Enable/Disable.

Remote Enabled

- When Remote Enabled LED is on, all remote functions are enabled.

Control Locked

- When Control Locked LED is on, all functions in operation section and all functions in Local Control Section are locked. These can be unlocked by pressing the Control Locked push-button.

User Key 1 (Section Enabled)

- When Section Enabled LED is ON, loop control function enabled.
  Ex) ELOOP = EUKF1 (Factory Default PLC)

User Key 2 (Ground Enabled)

- When Ground Enabled LED is ON, the ground over-current elements is enabled. The enabled ground can be disabled by pressing the Ground Enabled push-button on the front panel.
  Ex) EGFI = EUKF2 (Factory Default PLC)

User Key 3 (Live Load Block)

- When Live Load Block LED is on, the Live Load Block function is enabled.
  Ex) ELLB = EUKF3 (Factory Default PLC)

User Key 4 (AUX1)

- AUX Function Key.

Each Key has a inherent logic (EUKF1-4) from PLC, User can set the function of Key .

ex) If User wants Loop function Enable/Disable by the User Key1, Loop Function logic (ELOOP) is the same as EUKF1 from USER PLC.

- EUKF1 = ELOOP

If user wants to use User Key2,

- EUKF2 = ELOOP

⚠ **NOTE :** Even though Control Locked function is locked, Lamp Test, Battery Load Test and Menu Control Section can be normally operated.

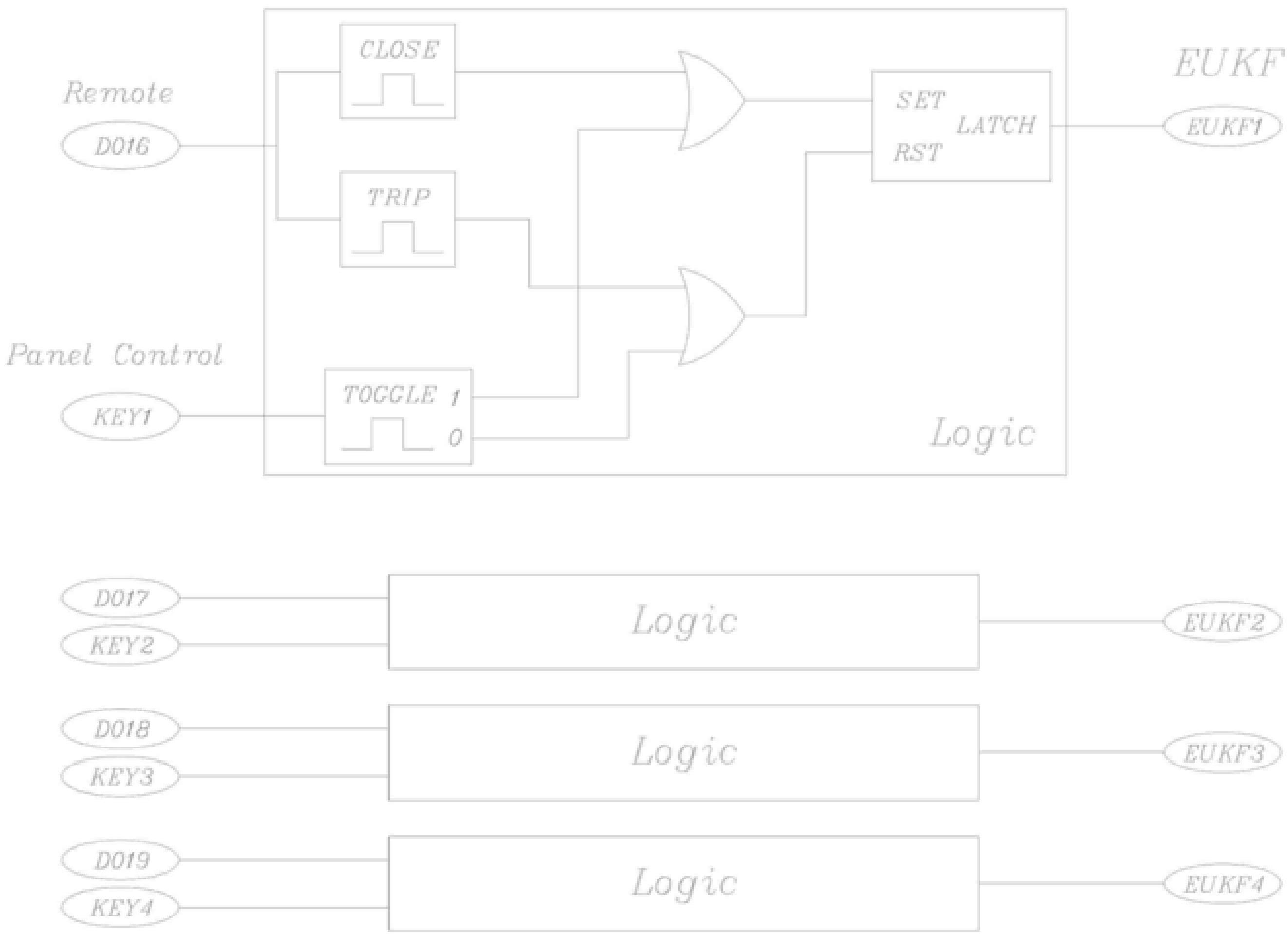


Figure 4-9 .User set key logic diagram

4.1.7. Operation Section

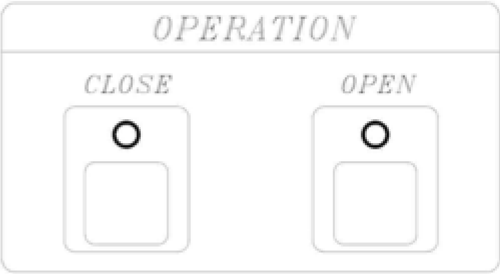


Figure 4-10. Operation Section

Close

- Pressing CLOSE push-button sends a close signal.

Open

- Pressing OPEN push-button sends a trip signal.

Position Lamp

- Indicate status of 52A contact.

5. SIDE PANEL

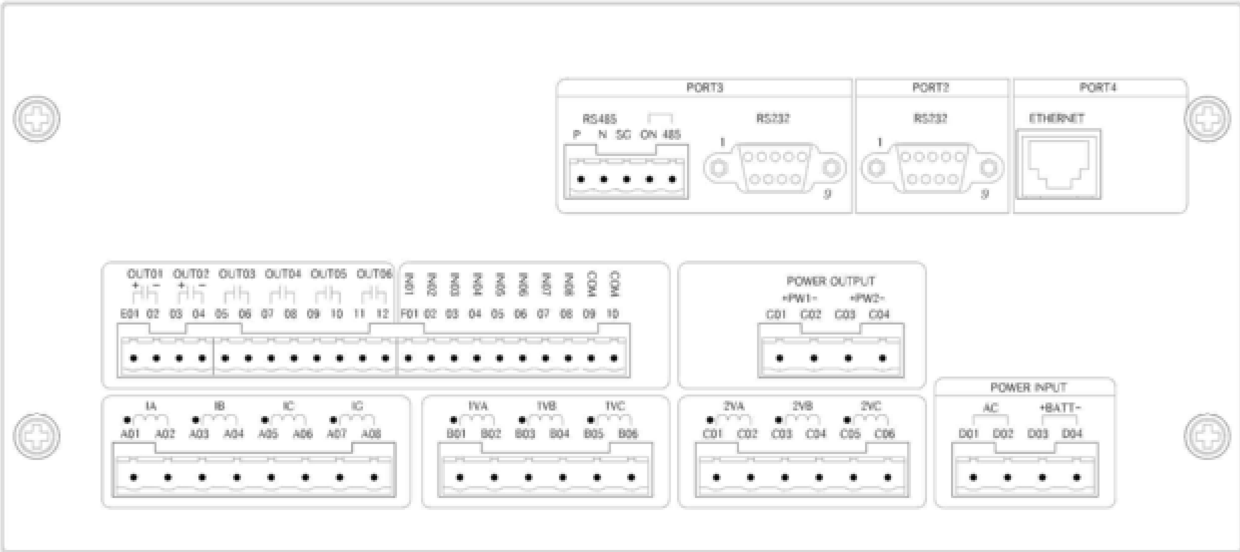


Figure 5-1. Side Panel(Standard Type)

- Wire can be connected to CONNECTOR of SIDE PANEL by using (-) screwdriver.
  (-) screwdriver width shall be less than 3㎜.

- Remove the coating of cable length of 8㎜ Side panel connector for user should be connected to wire size AWG24 to 12.

5.1. Construction

Side Panel consists of 7 sections as below;

- CURRENTS
- VOLTAGES
- OUTPUTS
- INPUTS
- POWER OUTPUT
- POWER INPUT
- COMMUNICATION

5.1.1. Currents

Connector Type BONAB STLZ 960-8

IA Phase A Current
IB Phase B Current
IC Phase C Current
IG Ground Current

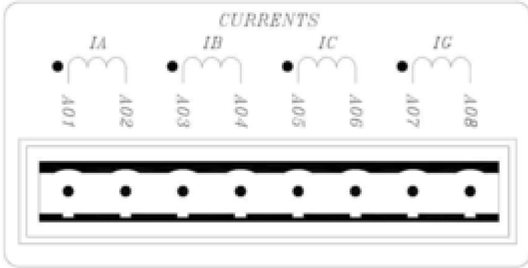


Figure 5-2. Currents Input Connector

Input Rating Please refer to ***"2.1. Inputs and Outputs"*** for more details.

- Be careful when IG Current Input is connected.
- Rated Input current of IG is not high enough. When a single phase test, if larger current than rated current, can damage IG input.
- If larger current than rated current is requested to go through, IG shall be disconnected.
- Current Input Connection shall be in accordance with Voltage Input.

3P4W Currents Input Wiring

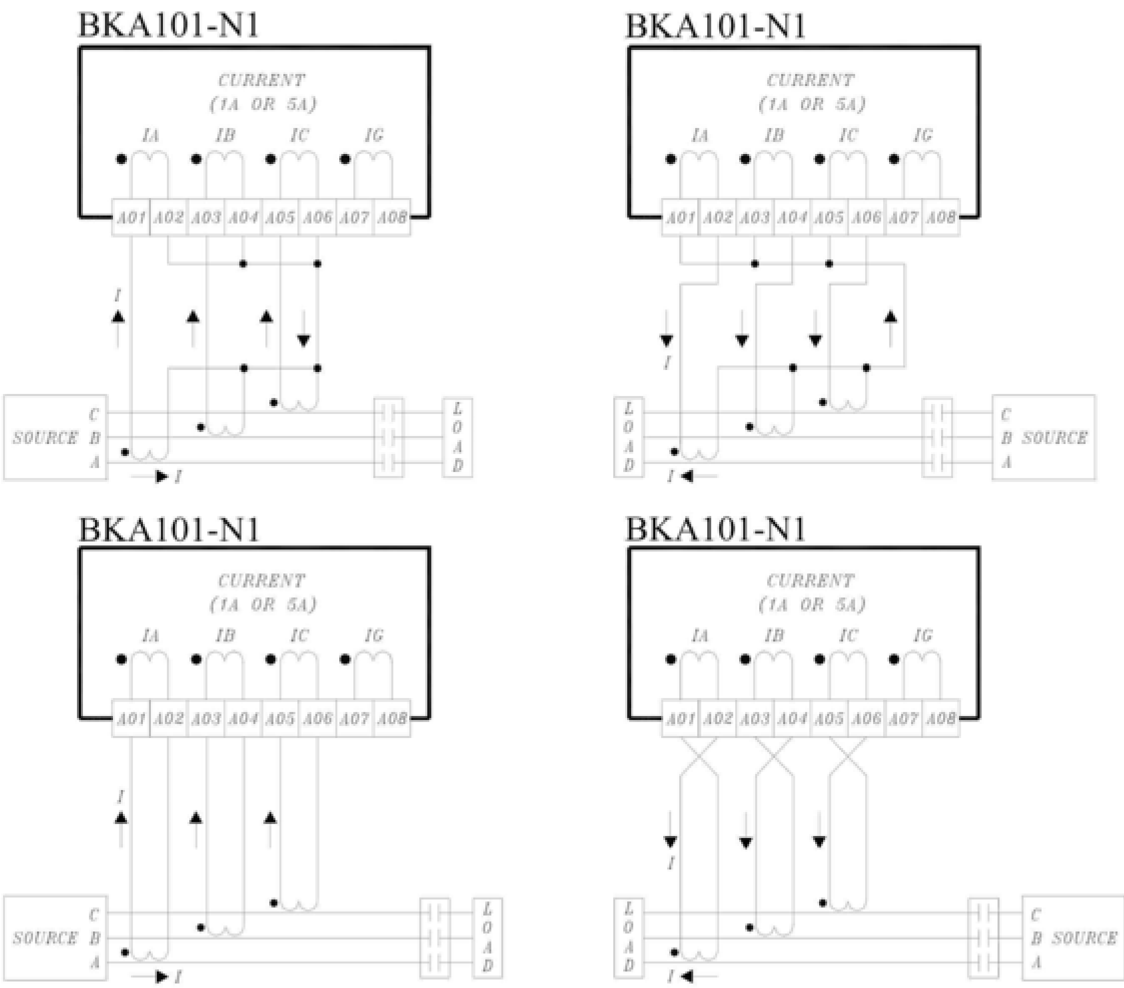


Figure 5-3. 3P4W Currents Input Wiring

- Where Ground current is large such as Earthing System, do not connect IG.
- Left side drawing is when User System and Source/Load side of BKA101-N1 are matching. Right side drawing is when Source/Load side are not matching.
- Phase Sequence order is A, B, C. If User System phase sequence order is A, C, B, it can be changed in program.

3P3W Currents Input Wiring

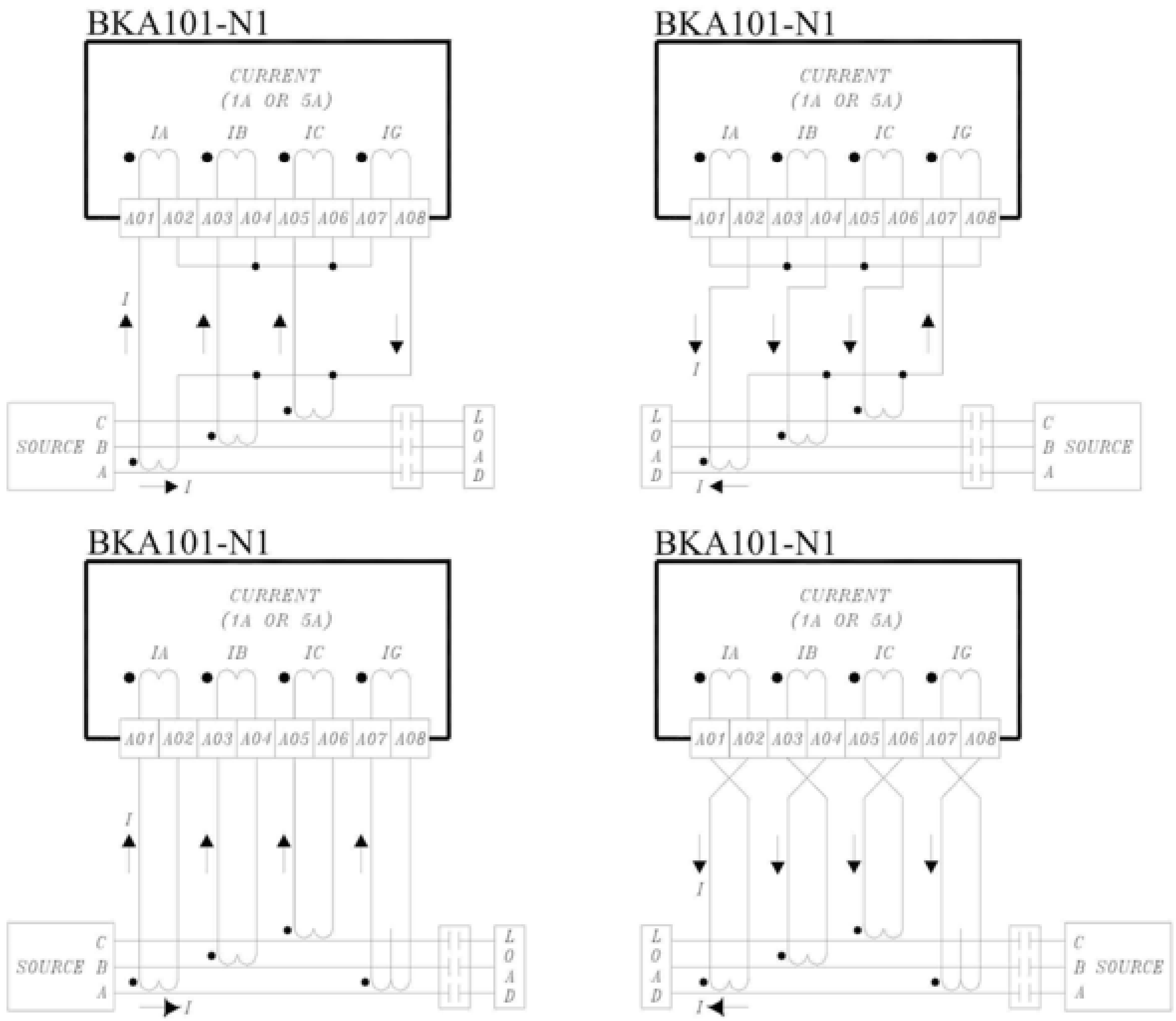


Figure 5-4. 3P3W Currents Input Wiring

- Where Ground current is small such as Non Earthing System, connect IG.
- IG is designed to sense Sensitive Ground Current. It shall be confirmed to be used.
- Left side drawing is when User System and Source/Load side of BKA101-N1 are matching and right side drawing is when Source/Load side are not matching.
- Phase Sequence order is A, B, C. If User System phase sequence order is A, C, B, it can be changed in program.

5.1.2. Voltages

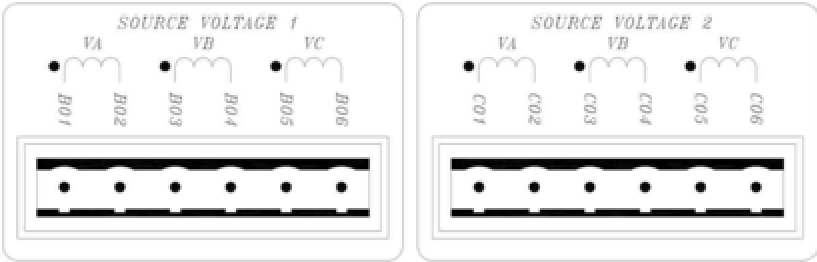


Figure 5-5. Voltage Input Connector

Source Voltage 1 Input

Connector Type	BONAB STLZ 960-6
VA	Phase A Voltage
VB	Phase B Voltage
VC	Phase C Voltage

Source Voltage 2 Input

Connector Type	BONAB STLZ 960-6
VA	Phase A Voltage
VB	Phase B Voltage
VC	Phase C Voltage

Input Rating Please refer to ***"2.1. Inputs and Outputs"*** for more details.

- Connect Source Voltage 1 to Source side of User System and connect Source Voltage 2 to Load side of User System.
- Phase sequence order is A, B, C. If User System Phase Sequence order is A, C, B, it can be changed in program.
- Current Input Connection shall be in accordance with Voltage Input order.

VD Input Wiring

- Typical wiring diagram of Voltage Divider.

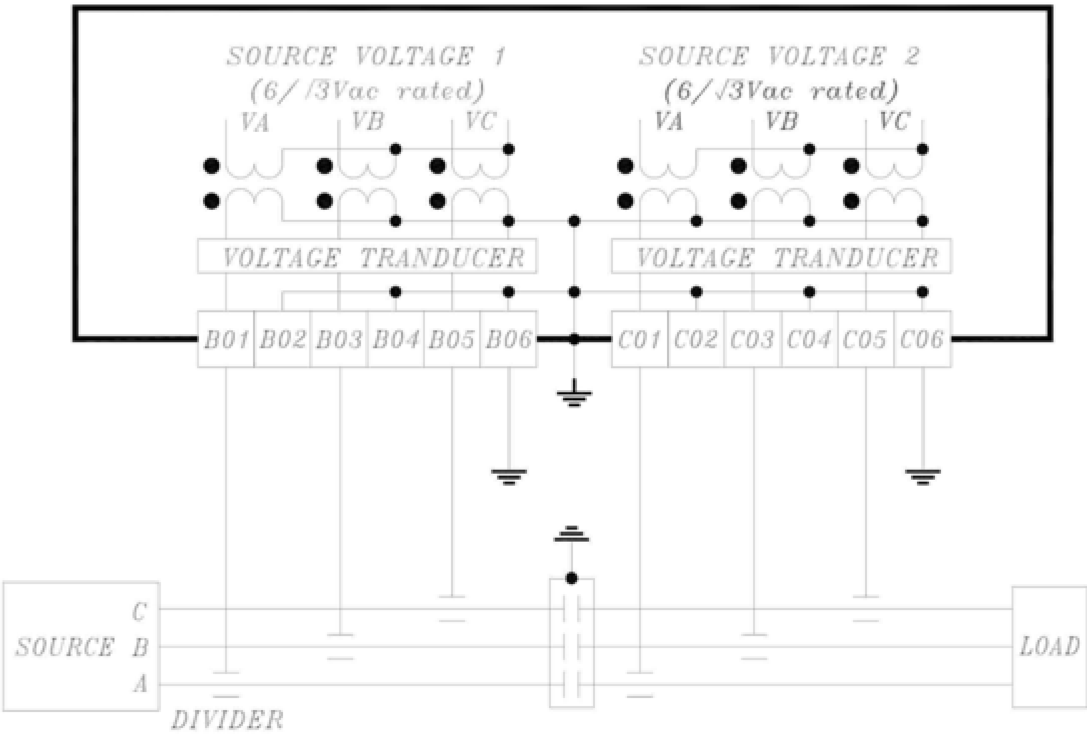


Figure 5-6. VD Input Wiring

3P4W Voltage Transformer Input Wiring

- Typical wiring diagram when User System and Source/Load side of User System are matching.

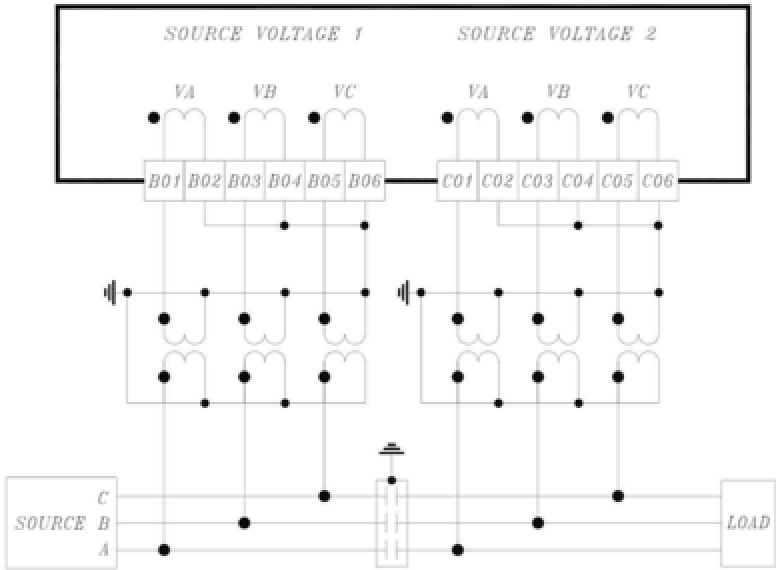


Figure 5-7. 3P4W Voltage Transformer Input Wiring

3P3W Voltage Transformer Input Wiring

- Typical wiring diagram when User System and Source/Load side of User System are matching

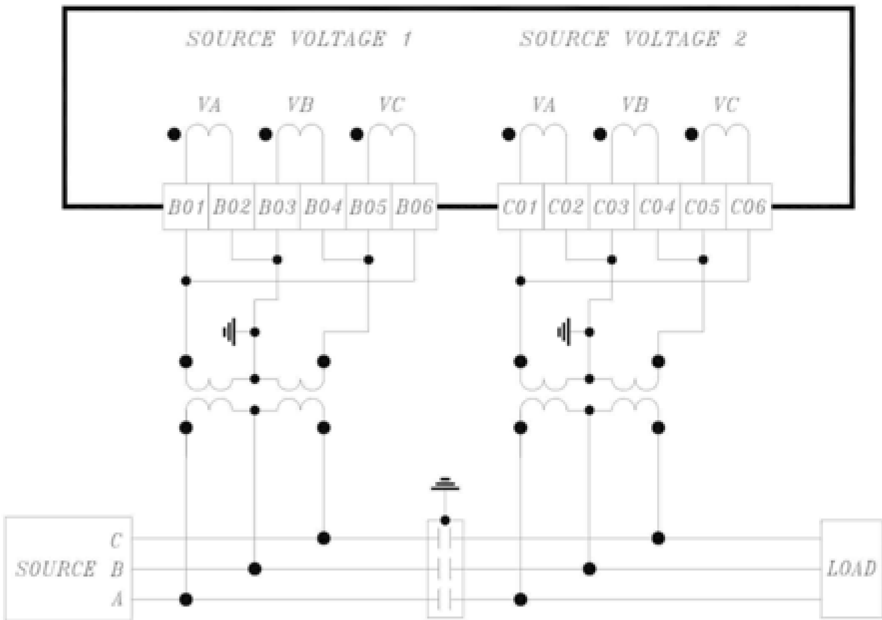


Figure 5-8. 3P3W Voltage Transformer Input Wiring

5.1.3. Outputs

<u>**Connector Type**</u> BONAB STLZ 950-4
BONAB STLZ 950-8

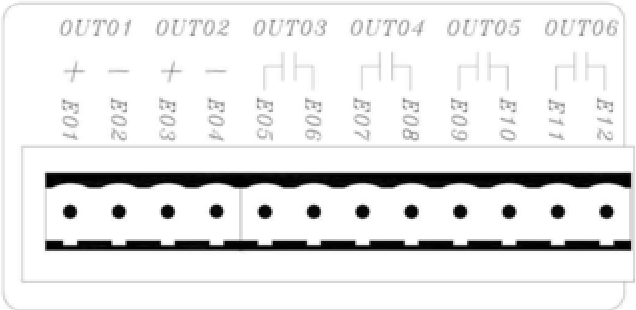


Figure 5-9. Outputs Connector

- OUTPUTS consists of 2 channels of IGBT and RELAY CONTACT.(OUT1,OUT2)
- OUTPUTS consists of 4 channels of RELAY CONTACT.(OUT3~6)

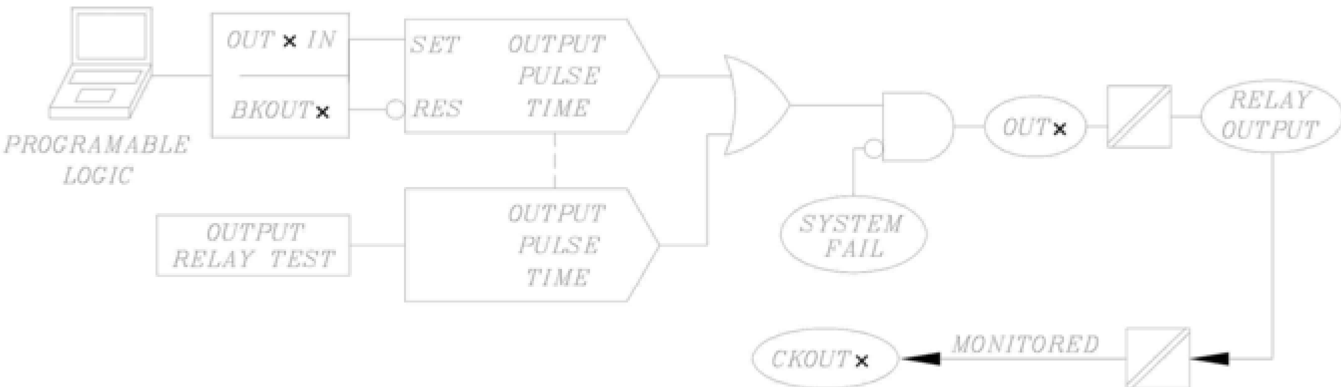


Figure 5-10. Outputs Logic Diagram

- **Programmable Logic**
  - It is programmable by ***Interface Software***.

- **Output Pulse Time Set**
  - OUT01 ~ OUT06 are available to be set individually in ***"MAIN MENU \ GROLBAL SETTING \ SYSTEM SETUP \ OUTPUT PULSE TIME"***.

5.1.4. Inputs

<u>**Connector Type**</u> BONAB STLZ 950-10

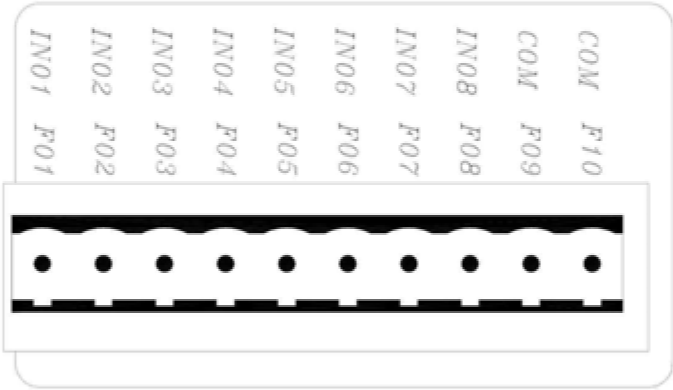


Figure 5-11. Inputs Connector

- F09, F10 are common and they are internally connected in BKA101-N1
- INPUT consists of 8 Channels of Dry contact.

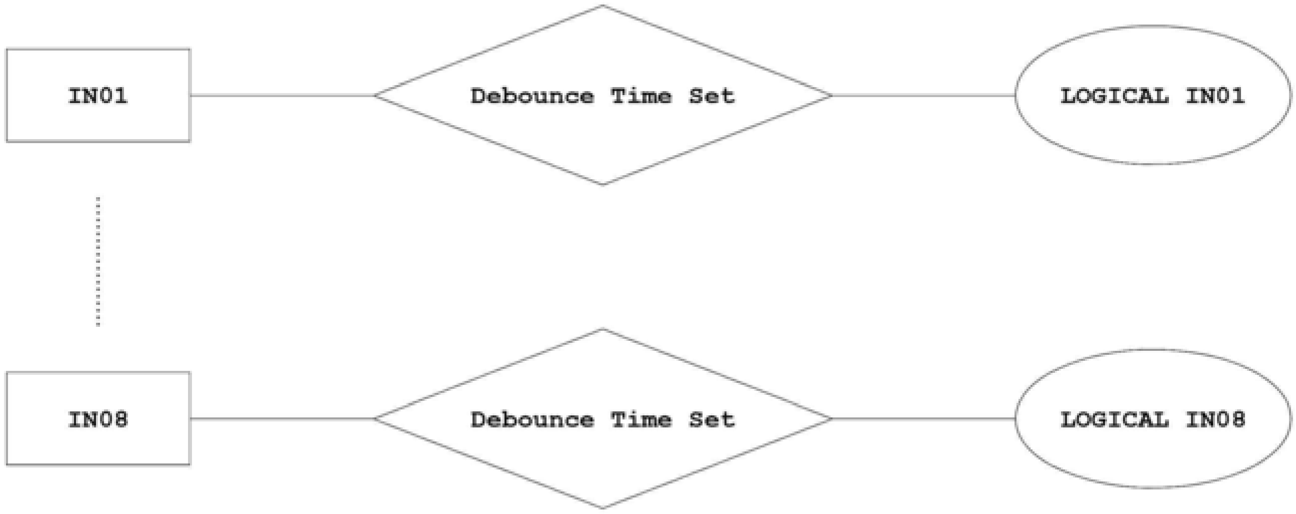


Figure 5-12. Inputs Logic Diagram

- Logical IN01~IN08 :
  - It is programmable by ***Interface Software***.

- Debounce Time :
  - IN01 ~ IN08 is available to be set individually in ***"MAIN MENU \ GROLBAL SETTING \ SYSTEM SETUP \ INPUT DEBOUNCE"***.

5.1.5. Power Output

Connector Type BONAB STLZ 960-4

PW1 G01	24Vdc
PW1 G02	(-)
PW2 G03	24Vdc
PW2 G04	(-)

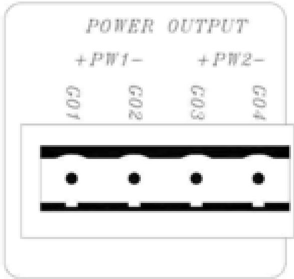


Figure 5-13. Power Output Connector

- For more details of PW1 and PW2, please refer to ***"2.1. Inputs and Outputs"***.

5.1.6. Power Input

Connector Type BONAB STLZ 960-4

AC D01	24Vac
AC D02	24Vac
BATT D03	Battery(+)
BATT D04	Battery(-)

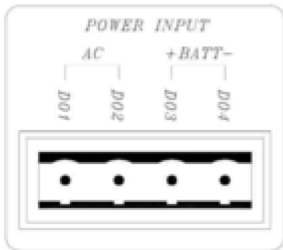


Figure 5-14. Power Input Connector

- For more details of PW1 and PW2, please refer to ***"2.1. Inputs and Outputs"***.

5.1.7. Communications

BKA101-N1 has four ports for communication.

PORT1

Connector Type DB9P MALE

Positions User Interface Panel

Purposes Interface Software

Cable CC201

Table 5-1. Port1

Pin	Signal	Description
1	N/C	No Connection
2	RXD	Receive Data
3	TXD	Transmit Data
4	N/C	No Connection
5	GND	Ground
6	N/C	No Connection
7	N/C	No Connection
8	N/C	No Connection
9	N/C	No Connection

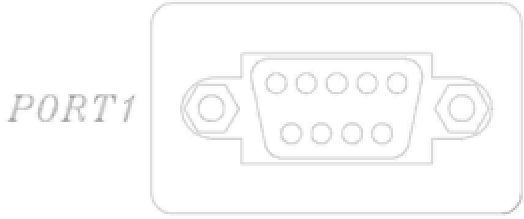


Figure 5-15. PORT1

Communication Cable – CC201

BKA101-N1 to DCE 9 Wire Cables

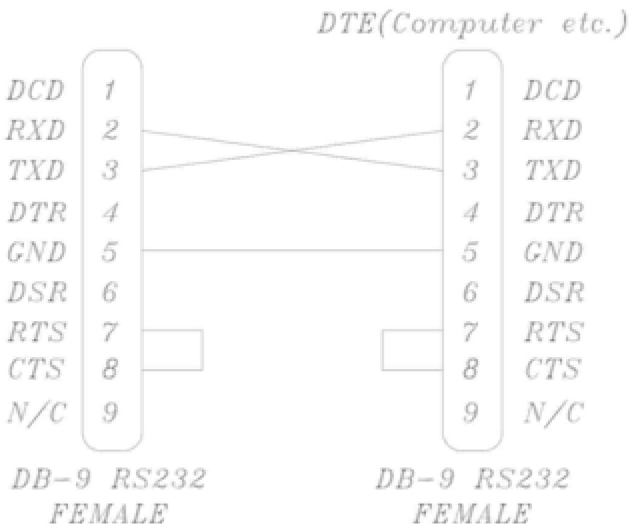


Figure 5-16. Cable CC201

PORT2

Connector Type DB9P MALE
Positions Side Panel
Purposes DNP
Cable CC202, CC203

Table 5-2. Port2

Pin	Signal	Description
1	DCD	Data Carrier Detect
2	RXD	Receive Data(IN)
3	TXD	Transmit Data(OUT)
4	DTR	Data Terminal Ready(OUT)
5	GND	Ground
6	DSR	Data Set Ready(IN)
7	RTS	Request To Send(OUT)
8	CTS	Clear To Send(IN)
9	N/C	No Connection

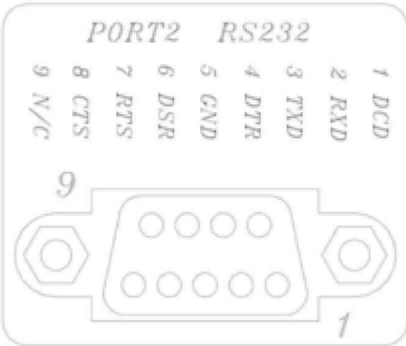


Figure 5-17. PORT2

Communication Cable – CC202

BKA101-N1 to DCE 9 Wire Cables

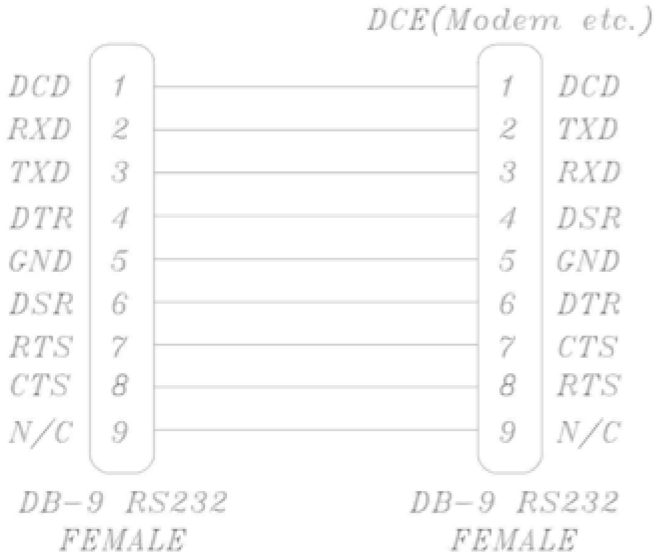


Figure 5-18. Cable CC202

Communication Cable – CC203

BKA101-N1 to DCE 9 Wire Cables

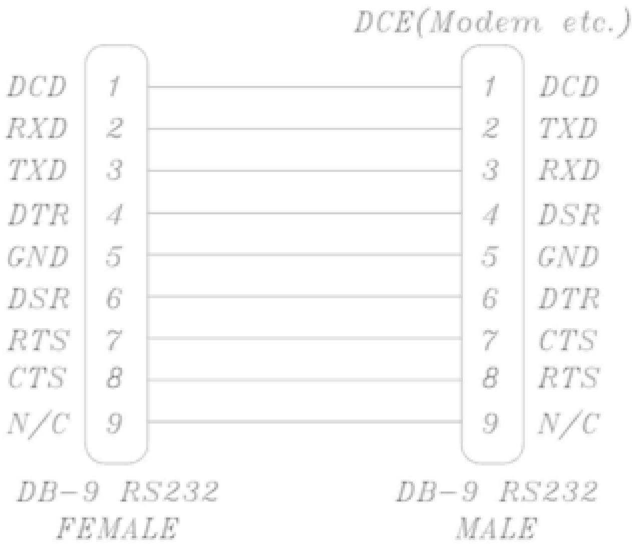


Figure 5-19. Cable CC203

PORT3

Connector Type BONAB STLZ 950-10

Positions Side Panel

Purposes DNP 3.0, MODBUS™ and IEC60870-5-101

Table 5-3. Port3

RS485 Pin	Description
1	P
2	N
3	SG(Cable Shield)
4	485 ON
5	485 ON
. RS232 Pin is the same as port2	

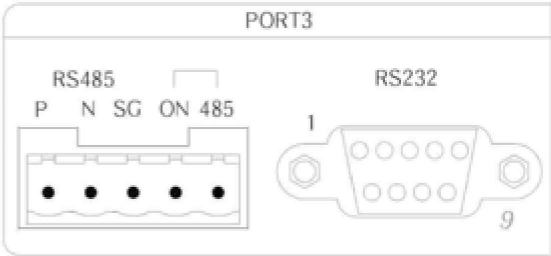
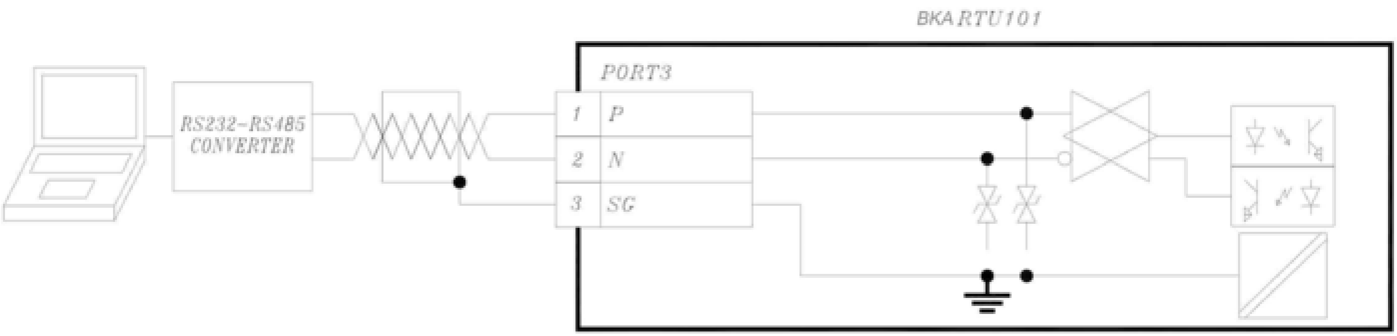


Figure 5-20. PORT3

1) PORT3 provides RS-485 communication and uses Digital power and insulated power of CPU Part for surge protection. Each terminal is Anti-Over-voltage.
2) To minimize the noise of communication line, Terminal Resistor is used in the both ends of the line and Twisted Shied Cable is advisable for connecting cable.
3) In order to use RS-485, the Pin1 and Pin2 of RS485 Port should be connected.

Wiring Diagram



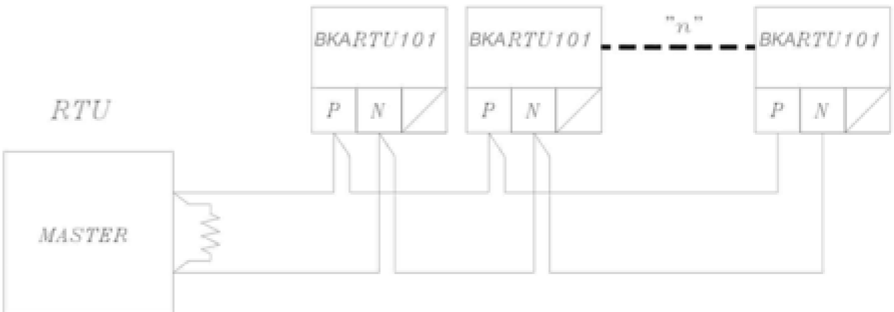


Figure 5-21. RS485 Wiring diagram

PORT4(Option)

Connector Type RJ45, 10BASE-T/100BASE-T

Positions Side Panel

Purposes DNP 3.0, MODBUS™ and IEC60870-5-104

Table 5-4. Port4

Pin	Wire Color	10Base-T Signal 100Base-TX Signal
1	White/Green	Transmit+
2	Green	Transmit-
3	White/Orange	Receive+
4	Blue	Unused
5	White/Blue	Unused
6	Orange	Receive-
7	White/Brown	Unused
8	Brown	Unused

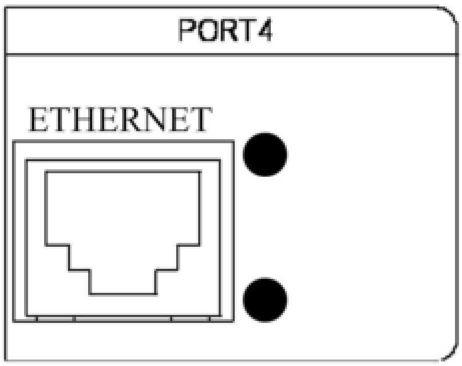


Figure 5-22.

1) PORT4 is RS-45 and consists of 8 pins. The composition is same as '*Table 5-4. Port4*'.
2) PORT 4 provides 10 BASE-T /100 BASE-T ethernet and 100M LED (Top) and LINK/ACT LED (Bottom) are in the top of both sides. 100M LED shows data transfer rate and LINK/ACT LED shows cable connection and communication status. Refer to '*Table 5-5. LED Description*' for more details.

Table 5-5. LED Description

LED	Status	Description
100M	Green	100Mbps Data rate
	OFF	10Mbps Data rate
LINK/ACT	Flash	Data transmitting or receiving
	Green	LAN connection is O.K
	OFF	LAN connection is not established

6. LCD DISPLAY

- 20 × 4 Character Display(LCD or VFD : Vacuum Fluorescent Display).
- All menus are arranged in rotation Algorithm.

6.1. Menu Structure Tree

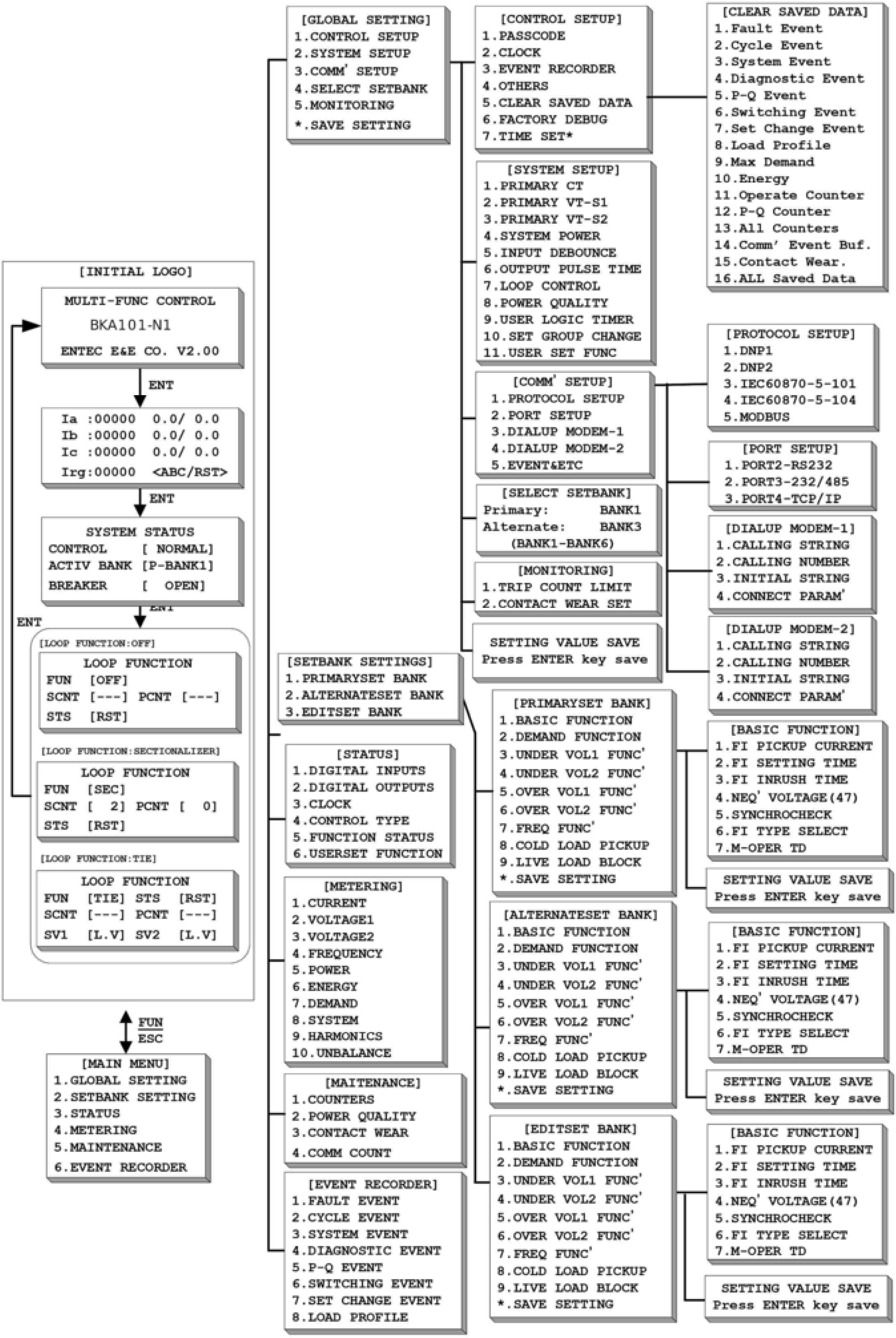


Figure 6-1. Menu Structure Tree (BKA101-N1 Type)

6.2. Initial Logo

Display the main information of BKA101-N1

- INITIAL LOGO appears after powering on Control and initializing System.
- Please press the [**ENT**] key to select an INITIAL LOGO.

Table 6-1. Initial Logo(1/2)

INITIAL LOGO	
MULTI-FUNC CONTROL BKA101-N1 BKA E&E CO. V2.00	**System Name :** MULTI-FUNC CONTROL BKA101-N1 **Manufacturer :** BORNA KELID Electric & Electronic Co. Ltd **Control Firmware Version :** 2.00
Ia : 0A 0.0/ 0.0 Ib : 0A 0.0/ 0.0 Ic : 0A 0.0/ 0.0 Irg: 0A <ABC/RST>	Display the main information of system. **Ia,Ib,Ic :**Each phase current value is displayed of SIDE PANEL(A,B,C)[A]. Each phase voltage is displayed of SIDE PANEL (A, B,C/R,S,T). **Irg :** Display Residual Ground of Input current at Current Inputs(IA, IB, IC) of SIDE PANEL.
SYSTEM STATUS CONTROL [NORMAL] ACTIV BANK [P-BANK1] BREAKER [OPEN]	Display the main information of system. **CONTROL:** Displays Warning an error occurs in BKA101-N1 1and the error information is stored in ***"DIAGNOSTIC EVENT"***. **ACTIVE BANK :** Select the Active Set BANK. BANK 1 ~ BANK 6 **BREAKER :** Display the current status of breaker. • CLOSE : Displays Circuit Breaker is closed. • OPEN : Displays Circuit Breaker is opened. • TROUBLE : It is displayed in case of Contact information is incorrect or cable connection is not completed.
Type Select = OFF LOOP FUNCTION FUN [OFF] SCNT[2] PCNT[0] STS [RST]	**FUN :** Set for Sectionalizer function(OFF /SEC / TIE) **SCNT :** Display the set operate counter(1 ~ 4) **PCNT :** Display the present operate counter(0 ~ 4) **STS :** • RUN : In the Operating of Sectionalizer Function • RST : Reset status • O.L : Open Lockout Status

Table 6-1. Initial Logo(1/2)

<table>
<tr><th colspan="2">INITIAL LOGO</th></tr>
<tr><td>Type Select = SEC

LOOP FUNCTION
FUN [SEC]
SCNT[2] PCNT[0]
STS [RST]</td>
<td>FUN : Set for Sectionalizer function(OFF /SEC / TIE)
SCNT : Display the set operate counter(1 ~ 4)
PCNT : Display the present operate counter(0 ~ 4)
STS :
• RUN : In the Operating of Sectionalizer Function
• RST : Reset status
• O.L : Open Lockout Status</td></tr>
<tr><td>Type Select = TIE

LOOP FUNCTION
FUN [TIE] STS [RST]
SCNT[2] PCNT[0]
SV1 [L.V] SV2 [L.V]</td>
<td>FUN : Set for Tie function(OFF /SEC / TIE)
STS :
• RUN : In the Operating of Tie Function
• RST : Reset status
• OPN : After Open order
• CLS : After Close order
SCNT : Display the set operate counter(1 ~ 4)
PCNT : Display the present operate counter(0 ~ 4)
SV1, SV2 : Display the status of Source Voltage 1, 2
• L.V : Live Line Voltage
• D.V : Dead Line Voltage</td></tr>
</table>

6.3. Main Menu

Move from Initial screen to [**MAIN MENU**] when you press [**FUN/ESC**]

Table 6-2. Main Menu

INITIAL LOGO \ MAIN MENU	
[MAIN MENU] 1.GLOBAL SETTING 2.SETBANK SETTING 3.STATUS 4.METERING 5.MAINTENANCE 6.EVENT RECORDER	**1.GLOBAL SETTING** Insert User System information (Hardware, Communication) to get correct information and check saved information. **2.SETBANK SETTING** Among 6 BANKs, change or check a selected BANK information from ***"GLOBAL SETTING"*** menu. **3.STATUS** Display the operation status of Digital Input/Output, Current Time and Control Type. **4.METERING** Display the measured value of Current, Voltage, Frequency, Power, Energy, Demand, System, Harmonics(option) and Unbalance(option). **5.MAINTENANCE** Display the numbers of System Restart and Operation and fault counts as well as the time and times of outage and sag, swell or unbalance event. **6.EVENT RECORDER** Display and manage Operation status of System and History.

6.4. Global Setting

Global Setting Menu consists of 5 sub-menus.

```
  [GLOBAL SETTING]
1.CONTROL SETUP
2.SYSTEM SETUP
3.COMM' SETUP
4.SELECT SETBANK
5.MONITORING
*.SAVE SETTING
```

6.4.1. Control Setup

Control Setup Menu consists of 7 sub-menus.

```
   [CONTROL SETUP]
1.PASSCODE
2.CLOCK
3.EVENT RECORDER
4.OTHERS
5.CLEAR SAVED DATA
6.FACTORY DEBUG
7.TIME SET
```

1. Passcode

Table 6-3. Passcode Setting

MAIN MANU \ GLOBAL SETTING \ CONTROL SETUP \ PASSCODE	
①	**Change the User Password to save changed value.**
ENTER PASSCODE 0000	1) Type current Passcode. If Passcode is correct screen ③ appears.
② ENTER PASSCODE INVALID	2) If invalid Passcode was typed, screen ② appears and then screen ① appears again. (Manufacturer presets Passcode of 0000).
③ [PASSCODE] ENTER NEW PASSCODE 1234 PRESS <ENT> TO SAVE	3) If Passcode is correct, type a new Passcode and press [**ENT**] key. Confirmation message appears as ***"PRESS <ENT> TO SAVE"***.
④ [PASSCODE] ENTER PASSCODE 1234 PASSCODE SAVED: 1234	4) Press [**ENT**] key to save changed Passcode.
	Passcode has range of 0000 ~ 9999. Use [▲] [▼] [**ENT**] key to choose a number.

2. Clock

Table 6-4. Clock Setting

MAIN MANU \ GLOBAL SETTING \ CONTROL SETUP \ CLOCK

```
  [CURRENT TIME]
2011/07/05 20:02:38
  <SETTING TIME>
2011/07/05 20:05:15
```

```
  SET TIME SAVE
2011/07/05 20:02:38

  SAVE <ENTER>
```

```
   SAVE TIME
   SUCCESS!
```

Set the current Date and Time.

1) Press [**ENT**] to select and change settings.
2) Use [▲][▼] Keys to change a number and press [**ENT**] Key to move to next.
3) Press [**ENT**] Key to save after changing all values.

3. Event Recorder

Event Recorder Menu consists of 4 sub-items.

```
  [EVENT RECORDER]
Cycle Event:     ON
Len' of Pre T:    8
Load Profile:    ON
L.P save time(m):15
```

1) Cycle Event

Range	OFF, ON
Default	ON
Step	~

- Cycle waveform record function can be set ON/OFF by user.

2) Len' of Pre T

Range	0 ~ 14 cycle
Default	8
Step	1

- This Menu is to save waveform in Cycle Event.
- User sets the length of pre-trigger before Trigger.
- Ex) If set "4", it saves the waveforms 4 cycles before Trigger and 11 cycles after Trigger.

3) Load Profile

Range	OFF, ON
Default	ON
Step	~

- Select whether or not to save LOAD PROFILE(Average load current during set time).

4) L.P save time(m)

Range	5, 10 , 15 ,20, 30, 60 minute
Default	15
Step	~

- Set an interval time of storing LOAD PROFILE.

4. Others

Others Menu consists of 7 sub-items.

```
      [OTHERS]
Panel sleep(m):    5
Demand Method:   THM
Demand Time(m):    5
Switch Count:      0
Time DISP' Type:YMD
BT Time(day):    OFF
#SV LED TYPE: Open-V
```

1) Panel sleep(m)

Range	0(OFF), 1 ~ 100minute
Default	5
Step	1

- Display ***"PANEL SLEEP"*** if there is no key input during set time, LCD backlight is off and Initial Logo displays.
- ***"PANEL SLEEP"*** is discharged when you press [**ENT**] Key.

2) Demand Method

Range	THM, ROL
Default	THM
Step	~

- Setting for Demand calculation method.
  - **THM :** Calculated by Thermal Exponential demand.
  - **ROL :** Calculated Rolling demand.

3) Demand Time(m)

Range	5, 10, 15, 20, 30, 60 minute
Default	5
Step	~

- Setting an interval time of Demand Calculation.
- Enter the time required for a steady state current to indicate 90% of the actual value in case of thermal mode.

4) Switch Count

Range	0 ~ 65535
Default	0
Step	1

- Set OPERATE Counter initial value in ***"MAIN MENU \ MAINTENANCE \ COUNTERS"***.
- After setting, Counter shall be reset in ***"GLOBAL SETTING \ CONTROL SETUP \ CLEAR SAVED DATA \ Counter"***.

5) Time Disp' Type

Range	YMD, MDY
Default	YMD
Step	~

- It is to set Date Display for all related Menus.
- In case of setting "YMD", it displays in turn Year / Month / Date and in "MDY" type, it displays in turn Month / Date / Year.

6) BT Time(day)

Range	OFF,1~7day
Default	OFF
Step	1

- Select the period for automatically checking the battery status.

7) SV LED TYPE

Range	Open-V , Line-V
Default	Open-V
Step	~

- This setting is related to the SV1,SV2 lamp in panel.
- Open-V : Lamp turns on when phase loss.
- Line-V : Lamp turns on if the load side voltage is to be alive.

5. Clear Saved Data

Table 6-5. Clear Saved Data Setting

MAIN MANU \ GLOBAL SETTING \ CONTROL SETUP \ CLEAR SAVED DATA	
[CLEAR SAVED DATA] 1.Fault Event 2.Cycle Event 3.System Event 4.Diagnostic Event 5.P-Q Event 6.Switching Event 7.Set Change Event 8.Load Profile 9.Max Demand 10.Energy 11.Operate Counter 12.P-Q Counter 13.All Counter 14.Comm' Event Buf. 15.*Contact wear. 16.ALL Saved Data	**Clear Saved Data** Select item for clearing and then press **[ENT]** button. If procedure of clearing is completed, the message, ***"EVENT CLEAR SUCCESS"*** is shown. • Fault Event • Cycle Event • System Event • Diagnostic Event • P-Q Event • Switching Event • Set Change Event • Load Profile • Max Demand • Energy • Operate Counter • P-Q Counter • All Counter • Comm' Event Buf. • Contact wear. • ALL Saved Data
[CLEAR EVENT] EVENT CLEAR SUCCESS [CLEAR EVENT] !! WAIT !! [CLEAR EVENT] EVENT CLEAR SUCCESS	**Clear All Saved Data** Select "***16.All Saved Data***" for clearing all saved events. Select this item and then press **[ENT]** button, the message, ***"!! WAIT !!"*** is shown. If procedure of clearing is completed, the message, ***"EVENT CLEAR SUCCESS"*** is shown. ⚠ **NOTE :** It is recommended to have Backup data because Cleared (Deleted) data can't be recovered.

6. Factory Debug

Menu for manufacturer's managing purpose.

7. TIME SET

TIME SET Menu consists of 3 sub-items.

```
      [TIME SET]
GMT Sign:          -
GMT Hour:          0
GMT Min:           0
```

1) GMT Sign

Range	+, -
Default	+
Step	~

■ Set GMT time and the local time off-set direction. Local time is faster than GMT time, select '+', otherwise, select '-'.

2) GMT Hour

Range	0 ~ 23 hours
Default	1
Step	0

■ Set the hour difference between local time and GMT.

3) GMT Min

Range	0 ~ 59 min
Default	1
Step	0

■ Set the minute difference between local time and GMT.

⚠ **NOTE**

iran Local time is +3:30 hour faster than UTC time, set it as follows (+3:30);

Sing : +, Hour : 3, Min : 30

⚠ **NOTE**

If the setting values associated with GMT are set up incorrectly, the problems can be happened as follows.

- If the "Reference Time Type" is set to be GMT, the time of the internal clock in BKA101-N1 can be changed incorrectly at time synchronization.
- If the time type of the DNP communication event is set to be GMT, the time of event transmitted is not correct.

6.4.2. System Setup

System Setup Menu consists of 11 sub-menus.

Input Hardware information of User System and it is used for Metering, FI.

```
   [SYSTEM SETUP]
1.PRIMARY CT
2.PRIMARY VT-S1
3.PRIMARY VT-S2
4.SYSTEM POWER
5.INPUT DEBOUNCE
6.OUTPUT PULSE TIME
7.LOOP CONTROL
8.POWER QUALITY
9.USER LOGIC TIMER
10.SET GROUP CHANGE
11.USER SET FUNC
```

1. Primary CT

- This Setting group is critical for all Function Menu that have settings specified in multiples of CT rating.
- Secondary nominal current can be ordered, PHASE has 1A and 5A and GROUND has 0.05A, 1A, 5A.
- When Primary CT Ratio is 1000: 1, input 1000.
- When Primary CT Ratio is 600: 5, input 120.
- Primary CT Menu consists of 2 sub-items.

```
   [PRIMARY CT]
PHA CT Ratio:   1000
GND CT Ratio:   1000
```

1) PHA CT Ratio

Range	50 ~ 1200
Default	1000
Step	1

■ Enter the phase Primary CT Ratio.

2) GND CT Ratio

Range	50 ~ 1200
Default	1000
Step	1

■ Enter the ground Primary CT Ratio.

2. Primary VT-S1

- To measure Source Voltage 1, set 2nd Nominal Voltage, VT Ratio.
- PRIMARY VT-S1 Menu consists of 2 sub-items.

```
   [PRIMARY VT-S1]
VT 2nd(v):       4.00
VT Ratio:      3897.1
```

1) VT2nd(v)

Range	1.00 ~350.00 V
Default	4
Step	0.01

■ Enter Secondary Nominal Voltage(V).

■ This setting is the voltage across the VT secondary winding when nominal voltage is applied to the primary.

■ Default value is 4.

2) VT Ratio

Range	10.0 ~ 6500.0
Default	3897.1
Step	0.1

■ Enter the VT primary to secondary turns-ratio with this setting.

- Input Phase-Neutral voltage in VT 2nd(v)
- Input PT Ratio in VT Ratio

■ VT 2nd(v) = User system Rated($V_{\Phi\text{-}N}$) / PT primary($V_{\Phi\text{-}N}$) × PT secondary($V_{\Phi\text{-}N}$)

■ VT 2nd(v) = User system Rated($V_{\Phi\text{-}\Phi}$) / PT primary($V_{\Phi\text{-}\Phi}$) × PT secondary($V_{\Phi\text{-}\Phi}$)

- When you use the same system as ***"Table 6-6. VT Ratio Calculation"***, VT 2nd(v) and VT Ratio is calculated as follows;

■ VT 2nd(v) = (11kV / 27kV × 4V) =1.63

■ VT Ratio = (27kV / $\sqrt{3}$) / 4 = 3897.1

Table 6-6. VT Ratio Calculation

Control Voltage Transducer Ratio : 27kV / $\sqrt{3}$: 4V
User System Rated : $V_{\Phi\text{-}\Phi}$ = 11kV

Table 6-7. VT Ratios of Switch Control

Line-Line Voltage (User system)	Wye connection		Delta connection	
	VT 2nd (v)	VT Ratio	VT 2nd (v)	VT Ratio
10kV	1.48	3897.1	$4/\sqrt{3} = 2.309$	3897.1
11kV	1.63	3897.1	$4.4/\sqrt{3} = 2.540$	3897.1
15kV	2.22	3897.1	$6/\sqrt{3} = 3.464$	3897.1
20kV	2.96	3897.1	2.566	3897.1
22kV	3.26	3897.1	2.822	3897.1
24kV	3.56	3897.1	3.079	3897.1
25kV	3.70	3897.1	3.207	3897.1
27kV	4.00	3897.1	$6/\sqrt{3} = 3.464$	3897.1

Use of External PT by User

- Wye connection Type

User System Rating: $V_{\Phi\text{-}\Phi} = 11$kV
PT Rated: 11kV / $\sqrt{3}$: 1.63V, then VT 2nd(v) and VT Ratio is calculated as follows;

⇩

VT 2nd(v) : 1.63
VT Ratio: (11kV / $\sqrt{3}$) / 1.63 = 3897.1

- Delta connection Type

User System Rating: $V_{\Phi\text{-}\Phi} = 11$kV
When PT Rated: 10kV: 2.82V, then VT 2nd(v) and VT Ratio are calculated as follows;

⇩

VT 2nd(v) : 2.82
VT Ratio: 11kV / 2.82V = 3897.1

3. Primary VT-S2

- To measure Source Voltage 2, set 2nd Nominal Voltage, VT Ratio.
- The same Menu structure as ***"2. Primary VT -S1"***.

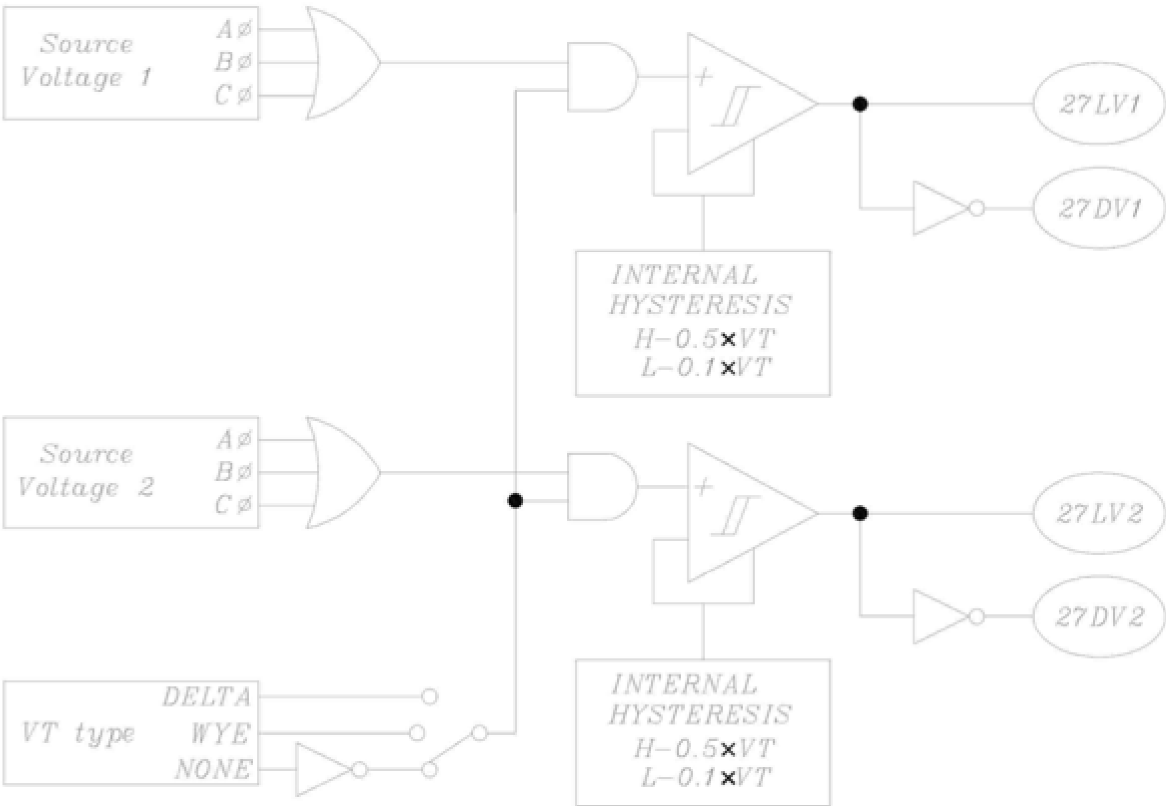


Figure 6-3. Live Voltage and Dead Voltage Logic Diagram

4. System Power

System Power Menu consists of 3 sub-items.

```
   [SYSTEM POWER]
Frequency:          50
Phase Rotation:    ABC
VT Type:           WYE
Phase Combi':      abc
Install Dir':     S->L
```

1) Frequency

Range	50, 60 ㎐
Default	50
Step	~

- Select the nominal power system frequency.
- This value is used as a default to set the optimal digital sampling rate.

2) Phase Rotation

Range	ABC, ACB
Default	ABC
Step	~

- Select the phase rotation of the power system.

3) VT Type

Range	NONE, WYE, DELTA
Default	WYE
Step	~

■ Enter None if line VTs are not to be used.

- **NONE:** VT uninstalled.
  If used, external PT by user, enter the VT connection made to the system as Wye or Delta.
- **WYE:** Install wye type.
- **DELTA:** Install type delta.

4) Phase Combination

Range	abc, cab, bca, acb, bac, cba
Default	abc
Step	~

■ Put real phase of power system to a bushing or a terminal of a control device. As example, if setting value is cab, it means that bushing A is connected with phase C and bushing B is connected with phase A.

5) Install Direction

Range	S->L, L->S
Default	S->L
Step	~

■ Check the source side of power system when a device is installed. During operating after the installation, only this setting is changed to convert a load side(SV1) to a source side(SV2) or reversely.

In order to get details relevant to the connection, refer the following figure and table.

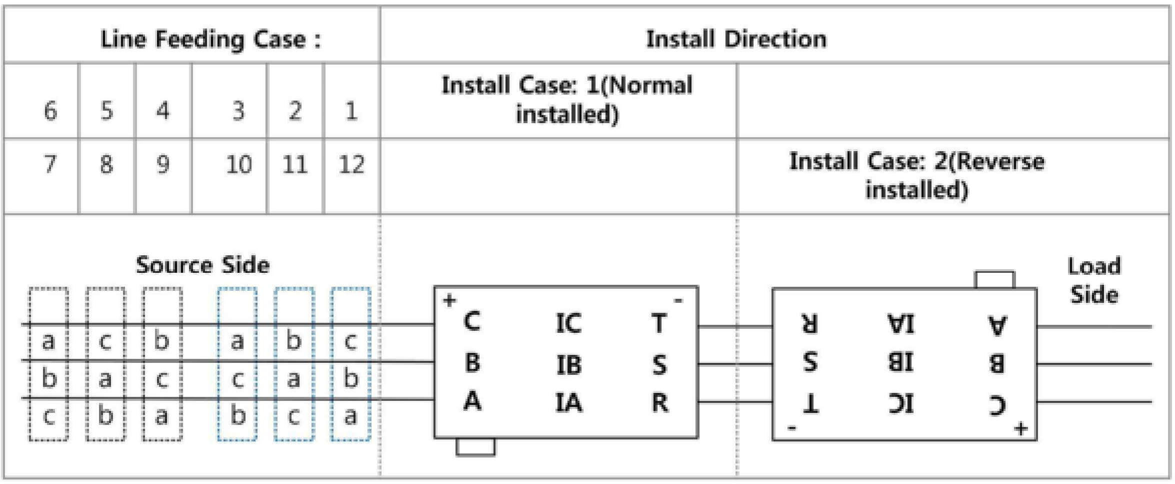


Figure 6-4. Phase Connection

Table 6-8. Phase Connection & Display Mapping Table

Line feeding / Bushing Terminal		Recommend Setting: Phase Combination	Recommend Setting: Install Direction	Phase Mapping Result: LCD/INDEX Display : Source V(Load V) / Current	Phase Mapping Result: Bushing/Controller Terminal
Case 1 :	abc / ABC	abc	Source->Load	Va(Vr)/Ia	A(R)/IA
				Vb(Vs)/Ib	B(S)/IB
				Vc(Vt)/Ic	C(T)/IC
Case 2 :	cab / ABC	cab		Va(Vr)/Ia	B(S)/IB
				Vb(Vs)/Ib	C(T)/IC
				Vc(Vt)/Ic	A(R)/IA
Case 3 :	bca / ABC	bca		Va(Vr)/Ia	C(T)/IC
				Vb(Vs)/Ib	A(R)/IA
				Vc(Vt)/Ic	B(S)/IB
Case 4 :	acb / ABC	acb		Va(Vr)/Ia	A(R)/IA
				Vb(Vs)/Ib	C(T)/IC
				Vc(Vt)/Ic	B(S)/IB
Case 5 :	bac / ABC	bac		Va(Vr)/Ia	B(S)/IB
				Vb(Vs)/Ib	A(R)/IA
				Vc(Vt)/Ic	C(T)/IC
Case 6 :	cba / ABC	cba		Va(Vr)/Ia	C(T)/IC
				Vb(Vs)/Ib	B(S)/IB
				Vc(Vt)/Ic	A(R)/IA
Case 7 :	abc / RST	abc	Load->Source	Va(Vr)/Ia	R(A)/IA
				Vb(Vs)/Ib	S(B)/IB
				Vc(Vt)/Ic	T(C)/IC
Case 8 :	cab / RST	cab		Va(Vr)/Ia	S(B)/IB
				Vb(Vs)/Ib	T(C)/IC
				Vc(Vt)/Ic	R(A)/IA
Case 9 :	bca / RST	bca		Va(Vr)/Ia	T(C)/IC
				Vb(Vs)/Ib	R(A)/IA
				Vc(Vt)/Ic	S(B)/IB
Case 10 :	acb / RST	acb		Va(Vr)/Ia	R(A)/IA
				Vb(Vs)/Ib	T(C)/IC
				Vc(Vt)/Ic	S(B)/IB
Case 11 :	bac / RST	bac		Va(Vr)/Ia	S(B)/IB
				Vb(Vs)/Ib	R(A)/IA
				Vc(Vt)/Ic	T(C)/IC
Case 12 :	cba / RST	cba		Va(Vr)/Ia	T(C)/IC
				Vb(Vs)/Ib	S(B)/IB
				Vc(Vt)/Ic	R(A)/IA

5. Input Debounce

Input Debounce consists of 8 sub-items.

```
 [INPUTS DEBOUNCE]
Input 1:        0.02
Input 2:        0.02
Input 3:        0.02
Input 4:        0.02
Input 5:        0.02
Input 6:        0.02
Input 7:        0.02
Input 8:        0.02
```

1) Input 1

Range	0.01 ~ 9.99 sec
Default	0.02
Step	0.01

- Enter debounce time to prevent chattering in Input 1.

2) Input 2 ~ Input 8 : the same as Input 1 above.

6. Output Pulse Time

Output Pulse Time Menu consists of 6 sub-items.

```
[OUTPUT PULSE TIME]
Output 1:       2.00
Output 2:       2.00
Output 3:       2.00
Output 4:       2.00
Output 5:       0.02
Output 6:        0.02
```

1) Output 1

Range	0.00(BUFF), 0.01 ~ 99.99 sec
Default	2
Step	0.01

- Set the Maximum operation time of Relay Output and, output during set time.
- When you set 0.05, output for 50ms.
- Default time is 2sec, but in order to control AS, Load Break Switch, the operation time is different. Please check ***"Appendix A. Menu Description & Default Setting"***.

2) Output 2 ~ Output 6 : the same as Output 1 above.

7. Loop Control

The purpose of using Loop Control is to keep the normal operation by isolating Fault Area as to cooperate with Recloser or C/B when a fault has occurred.

- Auto Sectionalizer(AS)
  - AS trips due to Fault current and Line Voltage.
  - When a fault has occurred in the load side of AS, C/B trips and High Voltage line becomes Dead line Voltage(DV). Due to the number of Count, AS trips(is opened).

- Tie point Switch(TS)
  - TS is located at Open point and is used for bi-directional(reversed line direction) operation.
  - TS is operated due to Line Voltage.
  - Either Source side or Load side of TS, becomes Dead line Voltage(DV), TS operates(is closed) depending upon the number of count.
  - When the source side and Load side become Dead line Voltage(DV), TS is automatically opened.
  - TS must be cooperated with BORNA KELID ALBORZ Sectionalizing Recloser.
  - To prevent further fault, TS shall be operated after BORNA KELID ALBORZ Sectionalizing Recloser trips and disconnects a fault area.
  - BORNA Sectionalizing Recloser is automatically opened when Source side and Load side become Dead line Voltage(DV) and it has the automatic closing function called Looping control function When High Voltage line becomes Live line Voltage(LV).

Loop Control consists of 11 sub-items.

```
   [LOOP CONTROL]
Type Select:     OFF
Sec Oper' Cnt:     2
Sec RS Delay:  10.00
Sec OP Delay:   0.00
Tie VRS:         SV1
Tie Oper' Cnt:     2
Tie RS Delay:  10.00
Tie CL Delay:  30.00
Tie OP Delay:   2.00
Tie DV1 Dly:    1.00
Tie DV2 Dly:    1.00
```

1) Type Select

Range	OFF, SEC, TIE
Default	OFF
Step	~

- **OFF :** Loop control off.
- **SEC :** Select for Auto Sectionalizer.
- **TIE :** Select for Tie point Switch.

2) Sec Oper' Cnt

Range	1 ~ 4
Default	2
Step	1

- Sec Oper' Cnt (Sectionalizer operate counter) : Setting menu for Auto Sectionalizer.
- After sensing a fault current, High Voltage line becomes Dead line Voltage(DV), 1 is counted and sense another fault, the count accumulate as 2.
- When the count reaches a set value, ***"Sec OP Delay"*** Timer is operated.
- When the count is over the set value, ***"Sec OP Delay"*** Timer is reset and not operated.
- Counter is reset by ***"Sec RS Delay"*** Timer or by manual closing.

3) Sec RS Delay

Range	0.00 ~ 300.00 sec
Default	10.00
Step	0.01

- Sec RS Delay (Sectionalizer reset time delay) : Setting menu for Auto Sectionalizer.
- It is the Timer to reset a count value in ***"Sec Oper' Cnt"***.
- When Auto Sectionalizer is closed, if Source side or Load side becomes Live Voltage (LV), Timer reset ***"Sec Oper' Cnt"***.

4) Sec OP Delay

Range	0.00 ~ 300.00 sec
Default	0.00
Step	0.01

- Sec OP Delay (Sectionalizer open time delay) : Setting menu for Auto Sectionalizer.
- The timer is operated by ***"Sec Oper' Cnt"***, and after a set time, Auto Sectionalizer is opened.
- The timer is reset if High Voltage Line becomes LV during counting Time, and it is also reset when the counter is over ***"Sec Oper' Cnt"*** set value.

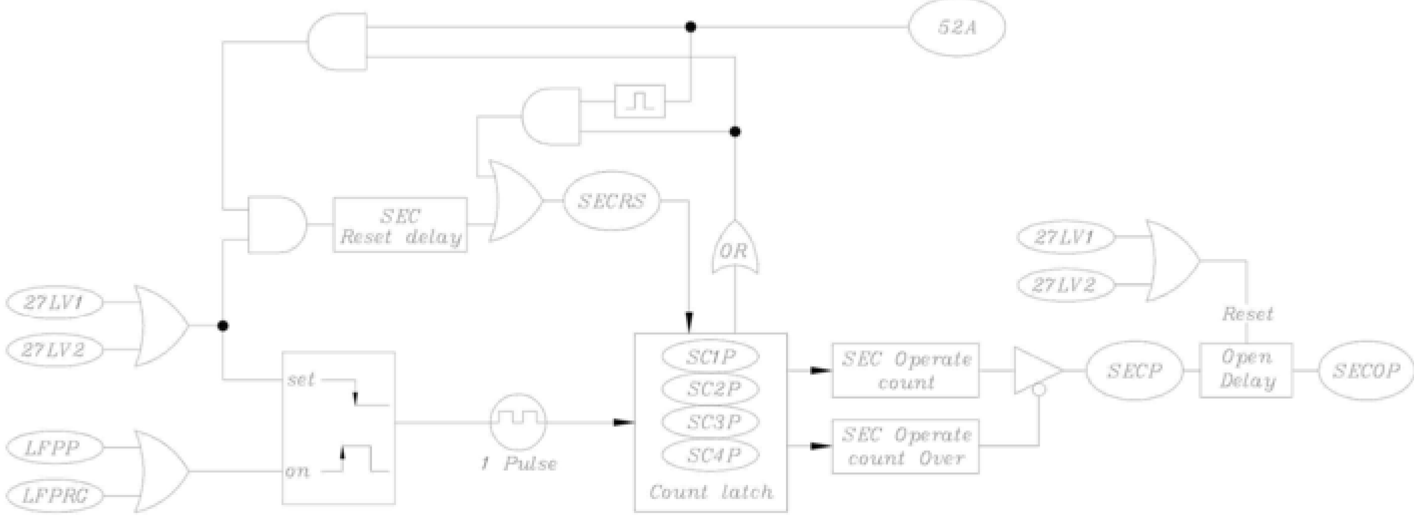


Figure 6-5. Sectionalizer Logic Diagram

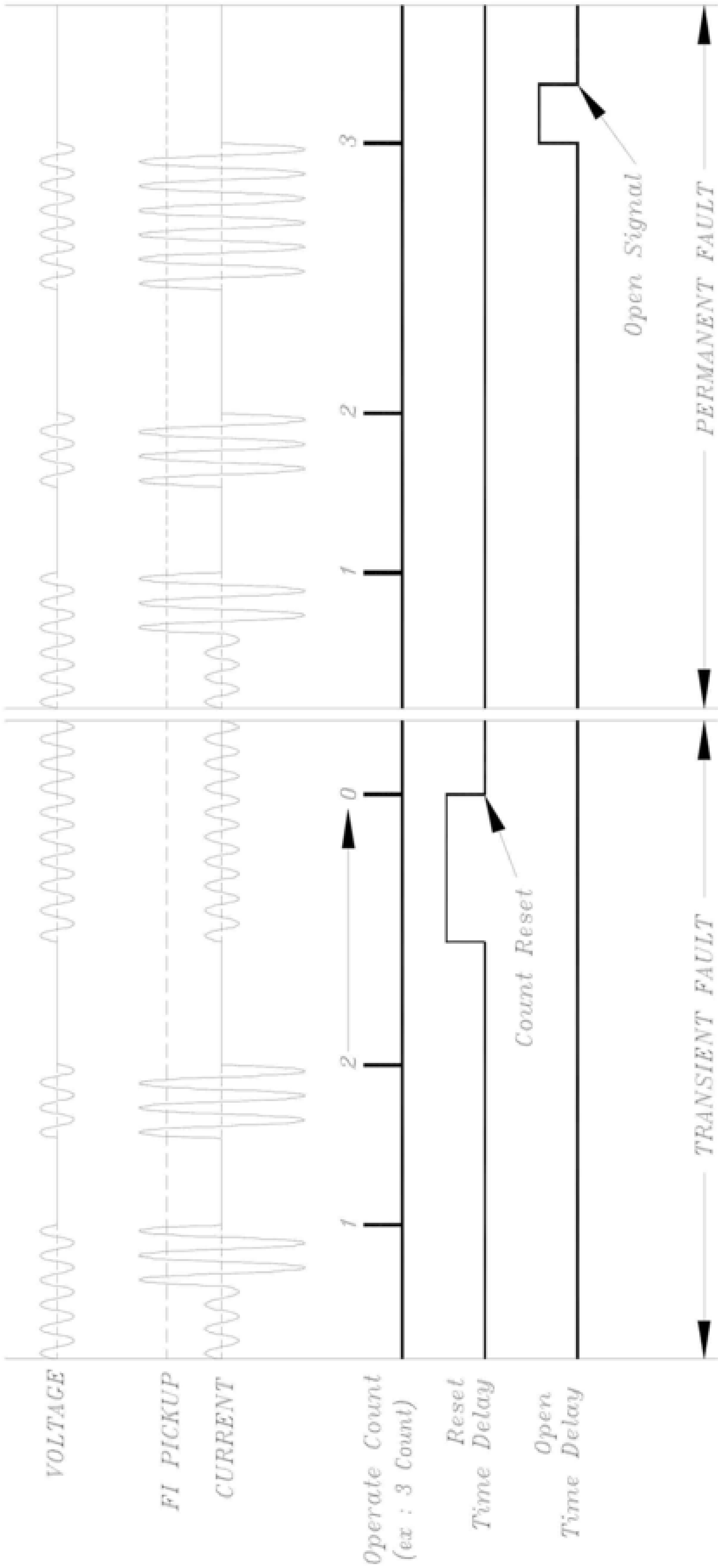


Figure 6-6. Sectionalizer Algorithm

5) Tie VRS

Range	SV1,SV2,SV1&SV2
Default	SV1
Step	~

- Tie VRS (Tie Point Switch Voltage Response Side) : Setting menu for Tie Point Switch.
- ***"Tie Oper' Cnt"*** is operated due to Dead line voltage in selected direction.
- SV1: It is operated depending upon Source voltage1.
- SV2: It is operated depending upon Source voltage2.
- SV1&SV2: It is operated depending upon SV1&SV2.

6) Tie Oper' Cnt

Range	1 ~ 4
Default	2
Step	1

- Tie Oper' Cnt (Tie operate counter) : Setting menu for Tie Point Switch.
- Source and Load side are Live Voltage status. When one of the sides becomes Dead line Voltage, it counts 1, and it repeats once again, it accumulates the count for 2.
- The voltage that Selected side in ***"Tie VRS"***, shall be Dead line Voltage and the other line shall be Live line Voltage.
- The counter reaches a set value, ***"Tie CL Delay"*** Timer is operated.
- The counter is over the set value, ***"Tie CL Delay"*** Timer is reset and not operated.
- The counter is reset by ***"Tie RS Delay"*** Timer or manual trip.
- Dead line Voltage can be determined after ***"Tie DV1 Dly, Tie DV2 Dly"*** Timer is finished.

7) Tie RS Delay

Range	0.00 ~ 300.00 sec
Default	10.00
Step	0.01

- Tie RS Delay (Tie reset time delay) : Setting menu for Tie Point Switch.
- It is the timer to reset a count value in ***"Tie Oper' Cnt"***.
- Timer is operated when Source side and Load side are all Live line Voltage with Tie Point Switch opened, and it reset ***"Tie Oper' Cnt"***.

8) Tie CL Delay

Range	0.00 ~ 300.00 sec
Default	30.00
Step	0.01

- Tie CL Delay (Tie close time delay) : Setting menu for Tie Point Switch.
- The timer is operated due to ***"Tie Oper' Cnt"***, and after a set time, Tie Point Switch is closed.
- During the counting, if Source and Load side become Live line Voltage or Dead line Voltage, the timer is reset. And when the counter is over a set value of ***"Sec Oper' Cnt"***, the timer is reset.
- DV is determined after ***"Tie DV1 Dly, Tie DV2 Dly"*** Timer is finished.

9) Tie OP Delay

Range	0.00 ~ 300.00 sec
Default	2.00
Step	0.01

- Tie OP Delay (Tie open time delay) : Setting menu for Tie Point Switch.
- The timer is operated when Source and Load sides become Dead line Voltage, and after a set time, Tie Point Switch is opened.
- DV is determined after ***"Tie DV1 Dly, Tie DV2 Dly"*** Timer is finished.

10) Tie DV1 Dly

Range	0.00 ~ 300.00 sec
Default	1.00
Step	0.01

- Tie DV1 Dly (Tie dead voltage 1 delay) : Setting menu for Tie Point Switch.
- Source Voltage 1 becomes Dead Voltage, after a set time, it is figured as Tie Dead Voltage.
- Dead Voltage: Lower than the setting value of DVMax-1P(xVT) at NEQ' Voltage(47) function.
- Live Voltage: Higher than the setting value of LVMin-1P(xVT) at NEQ' Voltage (47) function.

11) Tie DV2 Dly

Range	0.00 ~ 300.00 sec
Default	1.00
Step	0.01

- Tie DV2 Dly (Tie dead voltage 2 delay).
- Source Voltage 2 becomes Dead voltage, after a set time, it is figured as Tie Dead Voltage.
- Dead Voltage: Smaller than the setting value of DVMax-1P(xVT) at NEQ' Voltage(47) function.
- Live Voltage: Higher than the setting value of LVMin-1P(xVT) at NEQ' Voltage (47) function.

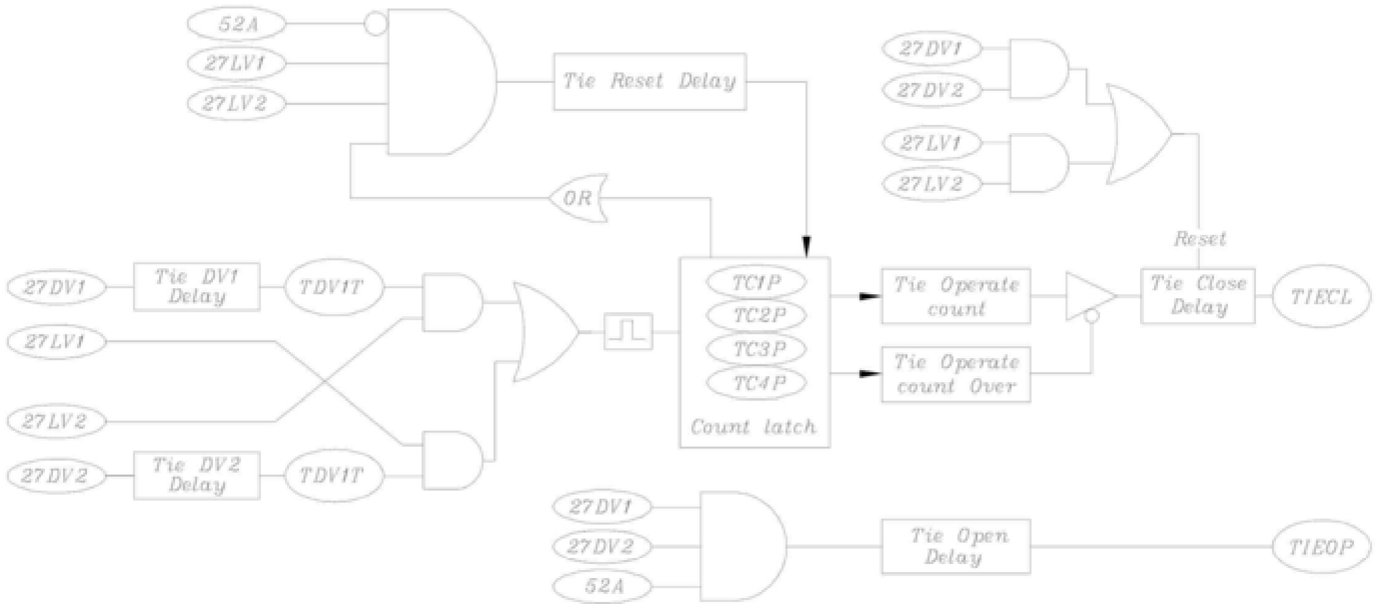


Figure 6-7. Tie Logic Diagram

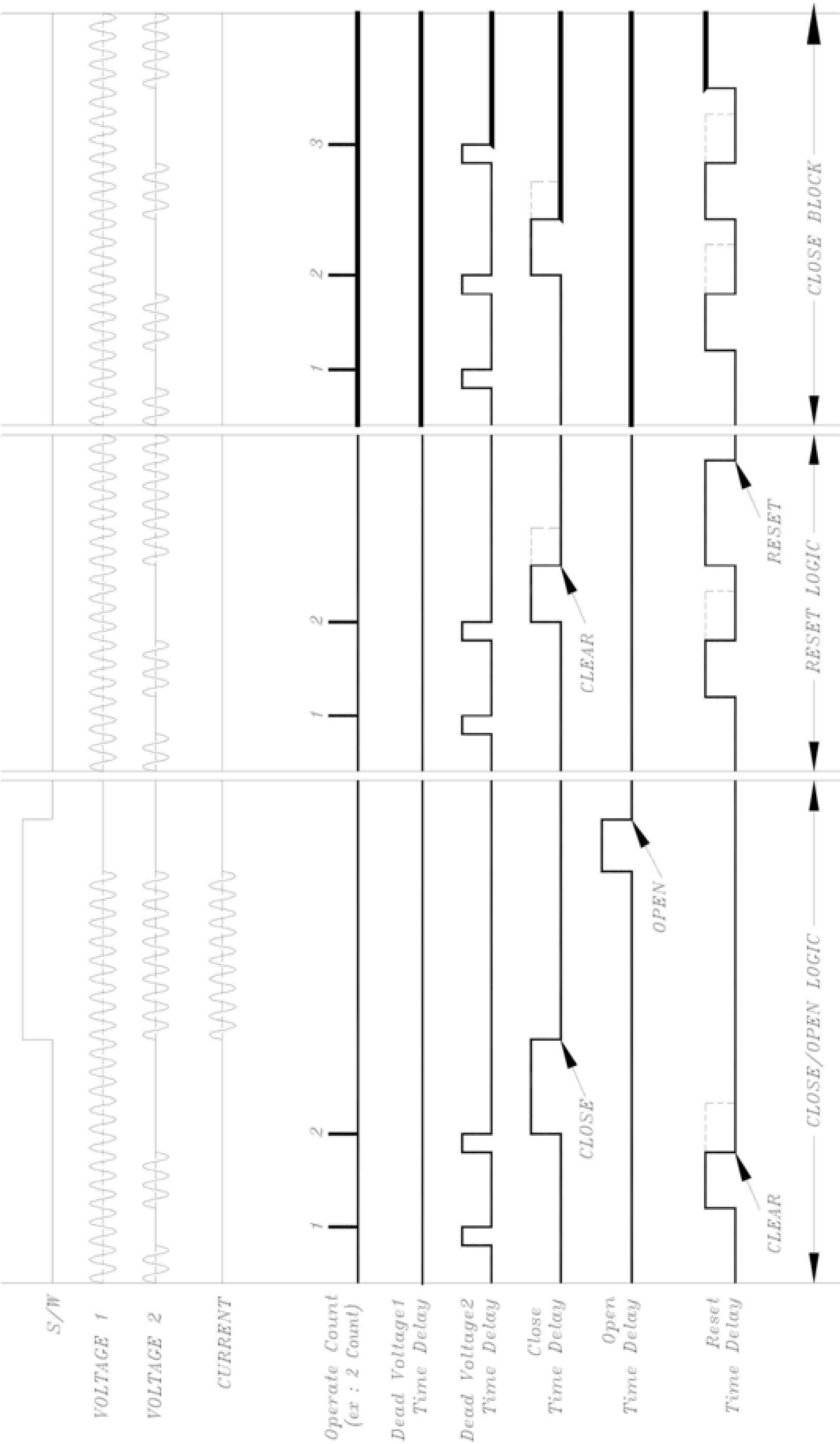


Figure 6-8. Tie Algorithm

8. Power Quality

Power Quality consists of 8 sub-items.

```
   [POWER QUALITY]
S-O Func:      ENABLE
S-O Duration:      20
SAG Func:     DISABLE
SAG Pickup:      0.80
SAG Duration:       5
SWL Func:     DISABLE
SWL Pickup:      1.20
SWL Duration:      20
UBI Func:     DISABLE
UBI Pickup:        30
UBI Duration:     4.0
UBI Limit:         10
UBV Func:     DISABLE
UBV Pickup:        30
UBV Duration:     4.0
```

1) S-O Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the supply outage function.
  - **DISABLE:** Supply Outage function inactive.
  - **ENABLE:** Supply Outage function active.

2) S-O Duration

Range	5~600 sec
Default	20
Step	1

- Supply Outage Duration.
- The timer is operated when outage detected on Source or Load side.
- Duration is determined after Supply Outage finished.

3) Sag Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the sag function.
  - **DISABLE:** Sag function inactive.
  - **ENABLE:** Sag function active.

4) Sag Pickup

Range	0.30 ~ 0.95 × VT(secondary nominal voltage)
Default	0.80
Step	0.01

- Set a detect level of Voltage sag(low voltage) for Power Quality.
- Detect level is set by multiplying a set value in here to source side rated voltage.

5) Sag Duration

Range	1~60 cycle
Default	5
Step	1

- Set a detect time for voltage sag(voltage low).

6) Swell Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the swell function.
  - **DISABLE:** Swell function inactive.
  - **ENABLE:** Swell function active.

7) Swell Pickup

Range	1.05 ~ 1.25 × VT(secondary nominal voltage)
Default	1.20
Step	0.01

- Set a detect level of Voltage swell(high voltage) for Power Quality.
- Detect level is set by multiplying a set value in here to source side rated voltage.

8) Swell Duration

Range	1~60 cycle
Default	5
Step	1

- Set a detect time for voltage swell(voltage high).

9) UBI Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the current unbalance function.
  - **DISABLE:** Current unbalance function inactive.
  - **ENABLE:** Current unbalance function active.

10) UBI Pickup

Range	1 ~ 100%
Default	30
Step	1

- Set a detect level of current unbalance for Power Quality.
- Current unbalance is calculated by following formula.

  - $UI_{rate} = \frac{I_2}{I_1} \times 100$

11) UBI Duration

Range	0.1 ~ 60.0 sec
Default	4.0
Step	0.1

- Set a detect time of current unbalance.

12) UBI Limit

Range	0 ~ 630A
Default	10
Step	1

- Set the minimum current value to detect the current unbalance element. If load current is smaller this level, then current unbalance status point does not maked.

13) UBV Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the voltage unbalance function.
  - **DISABLE:** Voltage unbalance function inactive.
  - **ENABLE:** Voltage unbalance function active.

14) UBV Pickup

Range	1 ~ 100%
Default	30
Step	1

- Set a detect level of voltage unbalance for Power Quality.
- Voltage unbalance is calculated by following formula.

$$- \; UV_{rate} = \frac{V_2}{V_1} \times 100$$

9. User Logic Timer

It has 8 Timers and they are used in Programmable Logic.

Timer Operation do delay operation during PU set time. And it is finished after DO delay time.

```
 [USER LOGIC TIMER]
UTimer1-PU:      1.00
UTimer1-DO:      1.00
UTimer2-PU:      1.00
UTimer2-DO:      1.00

UTimer8-PU:      0.90
UTimer8-DO:      0.01
```

1) UTimer1-PU

Range	0.01 ~600.00 sec
Default	1.00
Step	0.01

- Timer has input signal, set delay time for Pickup.

2) UTimer1-DO

Range	0.01 ~600.00 sec
Default	1.00
Step	0.01

- Setting a delay time from input signal disappearing till Dropout.

3) UTimer2-PU ~ UTimer8-PU

- The same Menu as UTimer1-PU function.

4) UTimer2-DO ~ UTimer8-DO

- The same Menu as UTimer1-DO function.

10. SET GROUP CHANGE

Sometimes, Switch can be installed reversely against Power Flow(supply). In this case, it is necessary to change Protection setting. BKA 101-N1 has two option to help in this situation.

BKA101-N1 has two options Primary Setting and Alternate Setting. And these settings can be selected automatically by "SET GROUP CHANGE" function.

```
 [SET GROUP CHANGE]
Function:    ENABLE
Time interval:   10
```

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Set whether to use Setting Group Change.

2) Time interval

Range	10 ~180 sec
Default	30
Step	1s

■ If power flow is changed for this set time, setting group is changed.

Applying rules

- This function is operated when Power line system is in normal condition. During fault detecting (Pickup status) or in fault condition, it does not work.
- This function shall be operated when 3 phase voltages are more than 50% of rated and at least 1 phase has more than 10% of rated current.

11. USER SET FUNCTION

BKA101-N1 has PLC(Programmable Logic Control) for user. PLC can select the 12 function that a user needs in ***Interface software***. In this menu, set whether to use the function (EUSF1~EUSF12) .

```
[USER SET FUNCTION]
EUSF1 :     DISABLE
   :
EUSF12:     DISABLE
```

1) EUSF1~12

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Set whether to use User SET Function.

Each User Function has a inherent logic (EUSF1-12) from PLC, User can set the function .

ex) If User wants Hot Line Tag Enable/Disable by the User Set Function 1(EUSF1), Hot Line Tag logic (EHLTAG) is the same as EUSF1 from USER PLC.

- EUSF1 = EHLTAG

If user wants to use User Set Function2,

- EUSF2 = EHLTAG

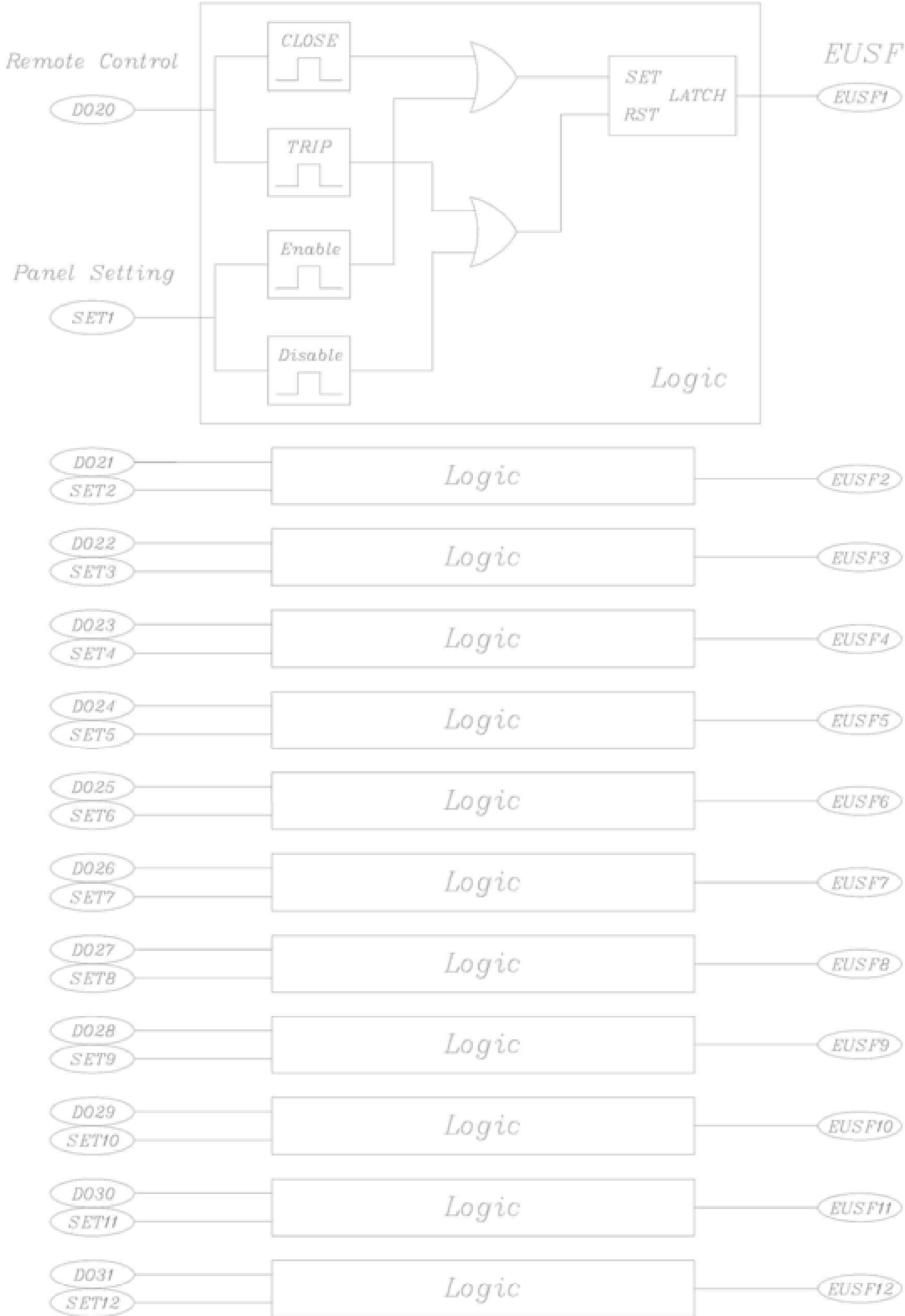


Figure 6-9.User set Function logic diagram

6.4.3. Comm' Setup

BKA101-N1 has four ports for communication.

The BKA101-N1 has the front panel RS232 port, the side panel RS232 port, the side panel RS485 port(or RS232 port) and the side panel Ethernet port.
Communication port settings are available as follows in ***"Table 6-9. Communication Ports setting of BKA101-N1 "***.

Table 6-9. Communication Ports setting of BKA101-N1

Port	Type	Speed	Parity bit	Data bit	Stop bit	Location
PORT1	RS-232	57600 bps	No parity	8	1	User Interface Front Panel
PORT2	RS-232	1200 - 19200 bps	No parity	8	1	User Interface Side Panel
PORT3	RS485 or RS232	1200 - 19200 bps	No parity	8	1	User Interface Side Panel
PORT4	RJ45	10BASE-T/100BASE-T				User Interface Side Panel

PORT1(RS232)
A port to interface with **Interface Software**.

PORT2(RS232) – Option
The Port2 is a port for a serial communication for MODBUS, DNP3.0 or IEC60870-5-101 protocol. A user can select the protocol and configure the Port2 for the selected protocol by changing baud rate and/or other settings for the Port2.

PORT3(RS485 or RS232) – Option
The Port3 is a port for a serial communication for MODBUS, DNP3.0 or IEC60870-5-101 protocol. A user can select the protocol and configure the Port3 for the selected protocol by changing baud rate and/or other settings for the Port3.
The Port3 type of BKA101-N1 is a fixed RS485 port. However, the Port3 type of BKA101-N1 can be selected as RS485 or RS232 by a user. In order to use RS485 port for BKA101-N1 , the Pin1 and Pin2 of RS485 should be connected.

PORT4(RJ-45) – Option
The Port4 is an Ethernet port for TCP/IP communication (10 BASE-T /100 BASE-T speed) for Modbus, IEC60870-5-104 or DNP3.0 Protocol. A user can select the protocol and configure the Port4 for the selected protocol by changing its settings.

⚠ **NOTE:** If a setting related with communication is changed and then saved, the changed setting is applied after rebooting.

```
    [COMM' SETUP]
1.PROTOCOL SETUP
2.PORT SETUP
3.DIALUP MODEM-1
4.DIALUP MODEM-2
5.EVENT&ETC
```

1. Protocol Setup

Protocol Setup consists of 5 sub-items.

```
  [PROTOCOL SETUP]
1.DNP1
2.DNP2
3.IEC60870-5-101
4.IEC60870-5-104
5.MODBUS
```

BKA101-N1 supports DNP3, MODBOUS, IEC60870-5-101 and IEC60870-5-104 Communication protocols. Each protocol setting detail is as below.

DNP3.0

BKA101-N1 can be programmed for communication using the DNP3 through communication port2, port3 or port4. For details, refer to ***"DNP3 Protocol Technical Manual"***.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PROTOCOL SETUP"*** to select setting for DNP3 Protocol. Setting items of "DNP1" and "DNP2" menu are same as following.

1) Function

Range	DISABLE, ENABLE
Default	DNP1 : DISABLE
	DNP2 : DISABLE
Step	~

■ Select DNP Slave1 or Slave2.
 - **DISABLE:** DNP1 or DNP2 Protocol is not used.
 - **ENABLE:** DNP1 or DNP2 Protocol is used.

2) Use Port

Range	P2-232, P3-232, P3-485, P4-TCP
Default	DNP1 : P2-232
	DNP2 : P2-232
Step	~

■ Select the Use Port of Control.

3) Master Addr'

Range	0 ~ 65519
Default	60000
Step	1

■ Enter the master station address.

4) Slave Addr'

Range	0 ~ 65519
Default	DNP1 : 1 DNP2 : 2
Step	1

■ Enter the slave1 or slave2 (BKA101-N1) address.

5) D/L Confirm

Range	NO, YES, SOME
Default	SOME
Step	~

■ Choose whether Data Link Confirm is used or not.

- **NO :** Never confirm request.
- **YES :** Always confirm request.
- **SOME :** Data link confirmation is only requested when the response contains more than one frame.

■ When Data Link Confirm use-setting, it shall be set as Host setting. If the setting is different from Host setting, the communication may be failed due to Data Link Reset.

6) D/L Retries

Range	0~255
Default	2
Step	1

■ Enter the number of retries that will be issued for given data link layer.

7) D/L Timeout

Range	1 ~ 255 sec
Default	55
Step	1

■ Set a waiting time between Data Link Frame transfer till to receive Data Link Confirm(ACK) of Master. If there is no Data Link Confirm receiving and Data Link retry is available, BKA101-N1 will send Data Link Frame again.

8) A/L Retries

Range	0~ 255
Default	1
Step	1

■ Select the number of retries that will be issued for a given application link layer.

9) A/L Timeout

Range	1 ~ 255 sec
Default	55
Step	1

■ Set a waiting time for Slave Application to receive A/L Confirm(ACK) from Master Application, in case that Confirm is requested during Data transfer from Slave Application to Master Application.

10) SBO Time

Range	1 ~ 255 sec
Default	15
Step	1

■ Set a time interval between Select Function and Operate Function.

■ If no operation command during set time, Select command is cancelled.

11) Multi Inter

Range	0.01 ~ 300.00 sec
Default	0.10
Step	0.01

■ Enter a time delay between frames when Multi-frame replies.

12) Tx Delay

Range	0.00(OFF), 0.01 ~ 300.00 sec
Default	0.05
Step	0.01

■ The setting does not apply to communication and is not indicted from version 1.14 of BKA101-N1

13) PowUp Unsol

Range	DISABLE, ENABLE
Default	ENABLE
Step	~

- Select the unsolicited mode.
  - **DISABLE :** Unsolicited response is not transmitted at power on.
  - **ENABLE :** Unsolicited response is transmitted at power on.

14) Unsol Time

Range	0 ~ 255 sec
Default	5
Step	1

- Set a delay time of reporting, in case Unsolicited mode event occurred.

15) Unsol Type

Range	NOTRIG, PERIOD
Default	NOTRIG
Step	~

- Set a type to configure a method to send event data.
  - **NOTRIG:** If there is no more event occurrence during setting ***"Unsol Time"*** after the last event occurs, the event data is transmitted.
  - **PERIOD:** Unsolicited message is sent to a master with whole event data occurring after setting ***"Unsol Time"*** starting and elapsing when the first event occurs.

16) Class 1

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select whether to send Unsolicited Response or not to master in case that Event is occurred in Class1.

17) Class 2

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select whether to send Unsolicited Response to master in case Event is occurred in Class2.

18) Class 3

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Select whether to send Unsolicited Response to master in case that Event occurred in Class3.

19) Master IP Oct1

Range	0~255
Default	192
Step	1

■ Select the IP Address for DNP1 or DNP2 Communication.

20) Master IP Oct2

Range	0~255
Default	168
Step	1

■ Select the IP Address for DNP1 or DNP2 Communication.

21) Master IP Oct3

Range	0~255
Default	72
Step	1

■ Select the IP Address for DNP1 or DNP2 Communication.

22) Master IP Oct4

Range	0~255
Default	2
Step	1

■ Select the IP Address for DNP1 or DNP2 Communication.

23) TCP/UDP Select

Range	TCP, UDP
Default	TCP
Step	~

■ Select TCP or UDP.

24) TCP Port

Range	0~65535
Default	20000
Step	1

■ Set TCP port number.

25) UDP Port

Range	0~65535
Default	20000
Step	1

- Set UDP port number.

26) K-Alv Check Tm

Range	0(OFF),1~600 sec
Default	10
Step	1

- Set the Time period that checks the communication connecting status during the idle status.

27) Fragment Size

Range	64~2048
Default	2048
Step	1

- Set the size of DNP fragment.

28) Time Req(m)

Range	0(OFF), 1 ~ 30000 min
Default	1440
Step	1

- Set Time Sync in order to synchronize internal system clock with time received from master station.

IEC60870-5-101

BKA101-N1 can be programmed for communication using the IEC60870-5-101 through communication port2 or port3.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PROTOCOL SETUP"*** to select setting for IEC60870-5-101.

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the IEC60870-5-101 Protocol.
  - **DISABLE :** IEC60870-5-101 Protocol was not used.
  - **ENABLE :** IEC60870-5-101 Protocol was used.

2) Use Port

Range	P2-232, P3-232, P3-485, P4-TCP
Default	P2-232
Step	~

- Select a port to use IEC60870-5-101 communication.

3) Link Addr

Range	0~65535
Default	1
Step	1

- Enter the slave address for IEC60870-5-101 communication.

4) ASDU Addr

Range	0~65535
Default	1
Step	1

- Enter the Application Service Data Unit Address.

5) Cyclic Period

Range	1~60000 sec
Default	60
Step	1

- Enter the Cyclic Period.
- It is to set interval time between Point set for Cyclic.

6) Event Period

Range	0~255 sec
Default	15
Step	1

- Enter the delay time before events are sent.
- Single event or several events occur and then if new event is not generated during the delay time, the event(s) already generated is(are) sent to a Master.

7) Retries

Range	0~ 255
Default	0
Step	1

- Enter the Data retires number.

8) Conf. Timeout

Range	1 ~ 255 sec
Default	15
Step	1

- Enter the wait time till receive the Data Confirm (ACK) of master after transfer the Data. If there isn't the Confirm during this setting time and Data retries is available, BKA101-N1 transfers the Data again.

9) Max Poll Tim

Range	1 ~ 255 sec
Default	60
Step	1

- Enter the Data Polling period time.

10) ADSU Addr Size*

Range	1 ~ 2
Default	2
Step	1

- Enter the size of cause of transmission.

11) Link Confirm*

Range	NEVER, ALWAYS
Default	ALWAYS
Step	~

- Enter the Link layer confirm mode.

12) Link Addr Size*

Range	1 ~ 2
Default	2
Step	1

- Enter the size of link address.

13) Rx Frame Size*

Range	0 ~ 261
Default	261
Step	1

- Enter the maximum size of received frame.

14) Rx Frame TO*

Range	0(OFF), 1 ~ 255 sec
Default	15
Step	1 sec

- Enter the maximum amount of time to wait for a complete frame after receiving the frame sync.

15) Tx Frame Size*

Range	0 ~ 261
Default	261
Step	1

- Enter the maximum size of transmitted frame.

16) COT Size*

Range	1 ~ 2
Default	1
Step	1

- Enter the size of cause of transmission.

17) IOA Size*

Range	1 ~ 3
Default	2
Step	1

- Enter the size of information object address.

18) One Ch Response*

Range	NO, YES
Default	NO
Step	~

- This allows to send one character response instead of a fixed length NACK when no response data available.

19) Fram Repet' TO*

Range	0(OFF), 1 ~ 255 sec
Default	30
Step	1 sec

- Enter the time out for repetition of frames(or incremental application layer timeout).

20) Select Timeout*

Range	0(OFF), 1 ~ 255 sec
Default	5
Step	1 sec

- Enter the period after a previously received select will timeout.

21) CMD Termination*

Range	NO, YES
Default	YES
Step	~

- Select whether to send Activation Termination upon completion of commands other than set point commands.

22) CSE Termination*

Range	NO, YES
Default	YES
Step	~

- Select whether to send Activation Termination upon completion of set point commands.

23) Clock Sync' Evt*

Range	NO, YES
Default	YES
Step	~

- Select whether to generate spontaneous clock synchronization events.

⚠ **NOTE :** The above set values marked with * are indicated from version 1.14 of BKA101-N1

IEC60870-5-104

BKA101-N1 can be programmed for communication using the IEC60870-5-104 through communication port4.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PROTOCOL SETUP"*** to select setting for IEC60870-5-104.

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Set an use of IEC60870-5-104 communication.

- **DISABLE :** IEC60870-5-104 Protocol was not used.
- **ENABLE :** IEC60870-5-104 Protocol was used.

2) ASDU Addr

Range	0~65535
Default	1
Step	1

■ Enter Application Service Data Unit Address.

3) Cyclic Period

Range	1~60000 sec
Default	60
Step	1

■ Setting the Cyclic Period.

■ It is to set interval time between Point set for Cyclic.

4) Timeout(t0)

Range	1 ~ 255 sec
Default	120
Step	1

■ Select the Timeout for connection establishment.

5) Timeout(t1)

Range	1 ~ 255 sec
Default	15
Step	1

■ Select the Timeout for send or test APDUs.

6) Timeout(t2)

Range	1 ~ 255 sec
Default	10
Step	1

- Select the Timeout for acknowledgements in case of no data message (t2<t1).

7) Timeout(t3)

Range	1 ~ 255 sec
Default	20
Step	1

- Select the Timeout for sending test frame in case of a long idle state.

8) Event Period

Range	0~255 sec
Default	5
Step	1

- Select the delay time before events are sent.
- Single event or several events occur and then if new event is not generated during the delay time, the event(s) already generated is(are) sent to a Master.

9) TCP Port

Range	0~65535
Default	2404
Step	1

- Set the TCP Port of BKA101-N1 for IEC60870-5-104 Protocol communication.

10) Rx Frame Size*

Range	0 ~ 261
Default	261
Step	1

- Enter the maximum size of received frame.

11) Tx Frame Size*

Range	0 ~ 261
Default	261
Step	1

- Enter the maximum size of transmitted frame.

12) Select Timeout*

Range	0(OFF), 1 ~ 255 sec
Default	5
Step	1 sec

- Enter the period after a previously received select will timeout.

13) CMD Termination*

Range	NO, YES
Default	YES
Step	~

- Select whether to send Activation Termination upon completion of commands other than set point commands.

14) CSE Termination*

Range	NO, YES
Default	YES
Step	~

- Select whether to send Activation Termination upon completion of set point commands.

15) Clock Sync' Evt*

Range	NO, YES
Default	YES
Step	~

- Select whether to generate spontaneous clock synchronization events.

MODBUS - Option

BKA101-N1 can be programmed for communication using the MODBUS through communication port2, port3 or port4.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PROTOCOL SETUP"*** to select setting for MODBUS Protocol.

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Set whether to use MODBUS communication or not.
  - **DISABLE :** MODBUS Protocol is not used.
  - **ENABLE :** MODBUS Protocol is used.

2) Use Port

Range	P2-232, P3-232, P3-485, P4-TCP
Default	P3-485
Step	~

- Select MODBUS communication port.

3) Slave Addr

Range	1~254
Default	1
Step	1

- Enter the Modbus address.

4) Tx Delay

Range	0.000 ~ 0.500 sec
Default	0.005
Step	0.001

- Delay time of sending Real data after RTS Signal is on.

5) TCP/UDP Select

Range	TCP, UDP
Default	TCP
Step	~

- Select MODBUS TCP or UDP.

6) TCP Port

Range	0~65535
Default	502
Step	1

■ Setting MODBUS TCP port number.

7) UDP Port

Range	0~65535
Default	502
Step	1

■ Setting MODBUS UDP port number.

2. Port Setup

Place the curser on ***"2. PORT SETUP"*** in COMM' SETUP menu, press [ENT] button to move into this menu. BKA101-N1 communication port and related elements are set in this menu and it has sub-menu as below.

```
   [PORT SETUP]
1.PORT2-RS232
2.PORT3-232/485
3.PORT4-TCP
```

PORT2-RS232

BKA101-N1 side panel PORT2 and related elements are set.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PORT SETUP"*** to select setting for PORT2.

1) Line Speed

Range	1200,2400,4800,9600,19200 bps
Default	19200
Step	~

■ Setting the baud rate for PORT2.

2) Parity Bit*

Range	NONE, ODD, EVEN
Default	NONE
Step	~

■ Select whether to use Parity Bit.

3) Data Bit*

Range	7, 8
Default	8
Step	1

- Select the the Data Bit.

4) Stop Bit*

Range	1, 2
Default	1
Step	1

- Select the the Stop Bit.

5) Line Type

Range	DIALUP, 2-WIRE, 4-WIRE
Default	4-WIRE
Step	~

- Select a modem for communication.
  - **DIALUP :** Dial-Up1 modem is used.
  - **2-WIRE :** 2 wire private line is used and continuously Carrier is monitored to control data flow by DCD(Data Carrier Detect).
  - **4-WIRE :** 4 wire private line is used and RTS(Request To Send) and CTS(clear to Send) signal are used to control data flow.

6) CTS Function

Range	OFF, ON
Default	ON
Step	~

- Select whether to use CTS signal or not.
  - **OFF :** Regardless of CTS signal, transfer a data.
  - **ON :** After confirming CTS signal is Asserted, transfer a data.

7) DCD Function

Range	OFF, ON
Default	OFF
Step	~

- Set whether to use DCD signal.
  - **OFF :** Regardless of DCD signal, transfer a data.
  - **ON :** After confirming DCD signal is Deasserted, transfer a data.

8) RTS Function

Range	OFF, ON, AUTO
Default	AUTO
Step	~

- Set whether to use RTS Function and the mode.
  - **OFF :** RTS signal of BKA101-N1 is always OFF(Deassert).
  - **ON :** RTS signal of BKA101-N1 is always ON(Assert).
  - **AUTO :** On requesting data transfer to Modem, after RTS signal of is on and after data transfer completion, RTS signal of BKA101-N1 is off.

9) CTS Chk Out

Range	1~255 sec
Default	5
Step	1

- Set a waiting time that waits Modems confirmation on RTS signal which informs that BKA101-N1 is ready to transfer a data. If there is no CTS response within a set time, RTU confirms CTS Fail and does not transfer the data.
- It is available if 'CTS Function' setting is ON.

10) DCD Timeout

Range	0~60000 msec
Default	5000
Step	1

- Set a delay time of DCD signal check which determines modem status before sending RTS signal in 2 wire communication type. After a set time, if DCD signal is ON, BKA101-N1 does not transfer the data and treat it as DCD Fail.
- It is available if ***'DCD Function'*** setting is ON.

11) TX Post Dly

Range	0~60000 msec
Default	50
Step	1

- Set the delay time of RTS OFF after data transmission.

12) TX Pre Dly

Range	0~60000 msec
Default	50
Step	1

- Set the delay time of starting transmission after CTS signal is received.

PORT3-RS232/485

The same setting as "***PORT2-RS232***".

PORT4-TCP/IP

Related elements with PORT4 in side panel of BKA101-N1 are set.

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ PORT SETUP"*** to select setting for PORT4.

1) IP Addr'1

Range	0~255
Default	192
Step	1

- Select the IP Address for BKA101-N1

2) IP Addr'2

Range	0~255
Default	168
Step	1

- Select the IP Address for BKA101-N1

3) IP Addr'3

Range	0~255
Default	7
Step	1

■ Select the IP Address for BKA101-N1

4) IP Addr'4

Range	0~255
Default	31
Step	1

■ Select the IP Address for BKA101-N1

5) Gateway Addr'1

Range	0~255
Default	211
Step	1

■ Setting the Gateway Address for BKA101-N1

6) Gateway Addr'2

Range	0~255
Default	226
Step	1

■ Setting the Gateway Address for BKA101-N1

7) Gateway Addr'3

Range	0~255
Default	42
Step	1

■ Setting the Gateway Address for BKA101-N1

8) Gateway Addr'4

Range	0~255
Default	131
Step	1

■ Setting the Gateway Address for BKA101-N1

9) Subnet mask 1

Range	0~255
Default	255
Step	1

■ Select the Subnet Mask Address for BKA101-N1

10) Subnet mask 2

Range	0~255
Default	255
Step	1

■ Select the Subnet Mask Address for BKA101-N1

11) Subnet mask 3

Range	0~255
Default	255
Step	1

■ Select the Subnet Mask Address for BKA101-N1

12) Subnet mask 4

Range	0~255
Default	0
Step	1

■ Select the Subnet Mask Address for BKA101-N1

13) K-Alv' Func

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Select whether to use or not the Ethernet communication connecting status check function.

14) K-Alv' Idle T

Range	1~255 sec
Default	4
Step	1

■ If idle status is maintained during the setting time, check the communication connecting maintainance status.

15) K-Alv' Interval

Range	1~255 sec
Default	2
Step	1

■ After checking the communication connecting status, if there isn't any reply during the setting time, check the status again.

16) K-Alv' Retry

Range	1~255
Default	1
Step	1

- Check the communication connecting maintainance status as much as the setting number. If there isn't a respond, take as communication fail and close the communication connection.

3. Dialup Modem-1

Place the curser on ***"3.DIALUP MODEM-1"*** in COMMUNICATION menu, press [ENT] button to move into this menu.

BKA101-N1 can support dialup modem communication, Hayes-compatible, through Port2 and Port3 when their port types are both RS232.

The configuration of the Port2 for use of dialup modem can be set on the menu ***"3.DIALUP MODEM-1"***. For the configuration of the Port3, it can be set on the menu ***"4.DIALUP MODEM-2"***. Refer to ***"Configuration for Dialup Modem"*** for more information about the configuration of Port2 and Port3 for the dialup modem communication.

DIALUP MODEM 1 and DIALUP MODEM 2 have the same elements as below.

```
  [DIALUP MODEM-1]
1.CALLING STRING
2.CALLING NUMBER
3.INITIAL STRING
4.CONNECT PARAM'
```

Configure modem with AT commands

Before using of Modem connected with BKA101-N1, following setting shall be confirmed.

- **Configure port speed(must be done)**

Set DNP communication speed the same as the speed between BKA101-N1 and Modem, and set DNP communication speed slower than the speed between modems.

- **Configure answer mode(frequently)**

The modem will answer an incoming call on the second ring using the command **ATS0=2**.

- **Configure Data Carrier Detect(must be done)**

Data Carrier Detect should follow the presence or absence of a calling modem.

The AT command is **AT&C1**.

■ **Configure Data Terminal Ready(must be done)**

Data Terminal Ready should control the modem. If DTR is high, the modem is ready to receive calls. If DTR is low, the modem should not receive any more calls and should hang up any existing call.

The AT command is **AT&D2**.

■ **Configure Data Set Ready (must be done)**

Data Set Ready should verify the modem. DSR is always ON.

The AT command is **AT&S0**.

■ **Configure no CONNECT messages (must be done)**

A Hayes AT-style modem usually outputs a message when a call is received. For example:

```
CONNECT 9600
```

The modem has a "quiet mode" that disables these messages.

The AT command is **ATQ1**. There will be no OK printed in response to this command.

■ **Configure no echo of commands (must be done)**

Echoing commands can confuse the console, so turn off command echoing.

The AT command is **ATE0**.

■ **Configure silent connection (must be done)**

Most modems have a speaker. By default this is connected whilst a modem is connecting and negotiating a common protocol and speed. This is very useful for a dialing modem, as it prevents a human being accidentally repeatedly called. The speaker can be annoying on answering modems. The AT command is **ATM1**.

Operation functions when to use Dialup Modem

■ **Transmitting a DNP3.0 Packet**

Check DCD is asserted(Check Online).

The Communication packet is transmitted.

> ⚠ **NOTE :** Dial when DCD is Deasserted.

■ **Receiving a DNP3.0 Packet**

Check DCD is asserted(Check Online).

The Communication packet is transmitted.

> ⚠ **NOTE :** If DCD is Deasserted, receiving is not working.

■ **Calling**

The user should insert an order for Reset.

Wait 0.5 second.

Make a phone call by using Calling String and Calling Number.

Check DCD is Asserted.

⚠ **NOTE :** Dial connection waiting time is depending on " Data Link Timeout" set by the user.

■ **Hang up**

DTR Line is deasserted.

Wait 2 seconds.

DTR Line is asserted.

Wait 2 seconds.

⚠ **NOTE :** BKA101-N1 will hang up the modem after a delay of 30 seconds with no valid packet received or transmitted.

Short Message Service (SMS) Support (Option)

SMS function is provided for communication based on the dialing modem to send messages of significant events occurrences to the phones or other communication devices whose phone numbers are assigned to BKA101-N1 for SMS function by the Interface Software.

Maximum 5 phone numbers are able to be assigned for receiving SMS and maximum 6 events on a signal message per one phone number can be sent at a time. The total maximum events for each a phone number are 48 events.

Following information are included in a single message for SMS.

■ **Device Name:**

This is the device name sending a short message.

■ **Point index Description:**

This point index description to indicate which event occurs is described with maximum 5 characters and it is the same with the point index used for DNP. In order to figure out what this description means, see the DNP point table.

■ **Point Index Value:**

This indicates the current status value of the point where an event occurs.

⚠ **NOTE :** The current SMS function supports to send a message only for Binary Input event.

Configuration for Dialup Modem

Table 6-10. Configuration for Dialup Modem

Setting Item	Description	Step	Initial Value	
			DIAL 1	DIAL 2
Calling String	Calling Method (ATD, ATDT, ATDP)	-	ATD	
Calling Number	Master Station Phone Number (16Digits number)	-	-	
Initial String	AT Commands for Initialized (30 digits(Alphabet capital or symbol)	-	AT&C1 Q1 E0 M0 &D2 +CRM=129	
Cmd Res' TO	Dial AT Commands Response Timeout (0 ~ 255 sec)	1sec	2sec	2sec
Connect TO	Dial Modem Connection Timeout(0 ~ 255 sec)	1sec	30sec	30sec
Idle Time	Dialup Modem Idle Time(0 ~ 255 sec)	1sec	60sec	60sec
SMS Use (Option)	Enable or Disable SMS Function(Disable, Enable)	-	DISABLE	DISABLE
SMS TIME (Option)	SMS Response Waiting Time(0~255 sec)	1sec	5sec	5sec
SMS Type (Option)	Define to send single or multiple event(s) per SMS message(SINGEL, MULTI)	-	MULTI	MULTI

CALLING STRING

In order to set "Calling String", move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP / DIAL MODEM1 or DIAL MODEM2/ CALLING STRING"***.

1) CALLING STRING

Range	ATD,ATDT,ATDP
Default	ATD
Step	~

- Setting to use Dial-Up modem use. Select a dial string one among them.
  - **ATD :** Default Dial Type(Already set in modem(Default Dial type)
  - **ATDT :** Tone Dial
  - **ATDP :** Pulse Dial

CALLING NUMBER

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ DIAL MODEM1 or DIAL MODEM2/ CALLING NUMBER"***.

1) CALLING NUMBER

Range	~
Default	~
Step	~

- Insert calling number to call to [Modem(Master station) phone number].
- Total 16 digits maximum for dialing number.

INITIAL STRING

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ DIAL MODEM1 or DIAL MODEM2/ INITIAL STRING"***.

1) INITIAL STRING

Range	~
Default	AT+FCLASS=0
Step	~

- Modem can be initialized by inserting total 30 digital strings.
- BKA101-N1 should be reset before making a phone call (connection).

⚠ **NOTE :** Continuous double Space or '/' shall ingnor next String..

CONNECT PARAM'

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP/ DIAL MODEM1 or DIAL MODEM2/ CONNECT PARAM'"***.

1) Cmd Res' TO

Range	0~255 sec
Default	2
Step	1

- Set the Command response waiting time.
- If there is no response from a modem during setting time, it is considered as a communication failure after the setting time and the status of modem failure is maintained.

2) Connect TO

Range	0~255 sec
Default	30
Step	1

- Set the Modem connection waiting time.
- If there is no connection during setting time, it is considered as a connection failure after the setting time, the status of modem failure is maintained.

3) Idle Time

Range	0~255 sec
Default	60
Step	1

- Set the Modem connection close time.
- During setting time, the connection is closed after the setting time.

4) SMS Use (Option)

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Enable or disable Short Message Service(SMS) function.

5) SMS Time (Option)

Range	0~255 sec
Default	5
Step	1

- SMS Time is a waiting time to wait for response after a short message of SMS is sent.

6) SMS Type (Option)

Range	SINGLE, MULTI
Default	MULTI
Step	~

- Single or Multiple type is supported for SMS message.
- Single type is to send one event's information(max. 25 characters) including description and the occurring time of event in one SMS message.
- Multiple type is to send maximum 4 events' information(max. 11 characters respectively) including only description of each event in one SMS message.

4. Dialup Modem-2

The same Menu structure as ***"3. Dialup Modem-1"***.

5. Event&ETC

Move to ***"MAIN MENU/ GLOBAL SETTING/ COMM' SETUP / EVENT&ETC "***.

```
      [EVENT&ETC]
AI Evt Method:  OFF
SKIP at Fault:  YES
Fault 'I' Evt:  YES
BI Queue Size:  256
BI Evt Mode:    ALL
AI Queue Size:  256
AI Evt Mode:    ALL
CI Queue Size:  256
CI Evt Mode:    ALL
AI 'V' Unit:    10V
AI 'P' Unit:    10K
Daily Max I:DISABLE
Daily Energ:DISABLE
Time Syn' Ref:LOCAL
Evt Time Type:LOCAL
```

1) AI Evt Method

Range	OFF,TH,DB,BOTH
Default	OFF
Step	~

- Select the Analog Event Type. This setting value is applied only to the AI point with vitalized "Event Active" in DNP point map.
  - **OFF :** AI Point Event doesn't occur.
  - **TH :** Event occurs when the AI Point data is over or less than Threshold value.
  - **DB :** Event occurs when the AI data change value is over the Deadband value.
  - **BOTH :** TH and DB are both used.
- Use BKA101-N1 interface software to set "Event Active" enable or disable of AI point and the Threshold value and Deadband value.

2) Skip at Fault

Range	NO,YES
Default	YES
Step	~

- Determine whether Threshold and Deadband AI event is generated during Fault pickup.

3) Fault 'I' Evt

Range	NO, YES
Default	YES
Step	~

■ Fault Current occurrence time of each sequence is when no voltage detected after experiencing Fault Current.

- **NO :** Don't send all Fault Current Sequence to Event.
- **YES :** Send all Fault Current Sequence to Event.

4) BI Queue Size

Range	32,64,128,256
Default	256
Step	~

■ Set the Binary Queue Size.

5) BI Evt Mode

Range	ALL, LAST
Default	ALL
Step	~

■ Set the Binary Event Mode.

- **ALL :** All status is buffed for the same point.
- **LAST :** Only last event is buffed for the same point.

6) AI Queue Size

Range	32,64,128,256
Default	256
Step	~

■ Set the Analog Queue Size.

7) AI Evt Mode

Range	ALL, LAST
Default	ALL
Step	~

■ Set the Analog Event Mode.

- **ALL :** All status is buffed for the same point.
- **LAST :** Only last event is buffed for the same point.

8) CI Queue Size

Range	32,64,128,256
Default	256
Step	~

- Set the Counter Queue Size.

9) CI Evt Mode

Range	ALL, LAST
Default	ALL
Step	~

- Set the Counter Event Mode.
  - **ALL :** All Counter is buffed for the same point.
  - **LAST :** Only last event is buffed for the same point.

10) AI 'V' Unit

Range	1V, 10V
Default	10V
Step	~

- Set the data format of AI(Analog Input) points associated with a voltage.
  - **1V:** 1V per 1count of transmitted data. If a voltage magnitude is 13.2kV, the corresponding AI point transmits 13200.
  - **10V:** 10V per 1count of transmitted data. If a voltage magnitude is 13.2kV, the corresponding AI point transmits 1320.

11) AI 'P' Unit

Range	1K, 10K
Default	10K
Step	~

- Set the data format of AI(Analog Input) points associated with a power.
  - **1K:** 1K per 1count of transmitted data. If active power is 660kW, the corresponding AI point transmits 660.
  - **10K:** 10K per 1count of transmitted data. If active power is 660kW, the corresponding AI point transmits 66.

12) Daily Max I

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Select whether to transfer the AI event about daily max. load current.

◆ **DISABLE :** Daily Max. Load Current is not recorded as event.

– **ENABLE :** Daily Max. Load Current is recorded as event.

13) Daily Energy

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Select whether to transfer the AI event about energy at midnight.

– **DISABLE :** Daily Energy is not recorded as event.

– **ENABLE :** Daily Energy is recorded as event.

14) Time Syn' Ref

Range	LOCAL, GMT
Default	LOCAL
Step	~

■ Set Reference Time Type. It signifies the time data type when Time Synching with the master station.

*. **NOTE)** This setting is set to be GMT and the setting values associated with GMT(in "TIME SET" menu) are set up incorrectly, the time internal clock in BKA101-N1 can be changed incorrectly at time synchronization.

15) Evt Time Type

Range	LOCAL, GMT
Default	LOCAL
Step	~

■ Set the time type for event recorders in DNP Communication.

*. **NOTE)** This setting is set to be GMT and the setting values associated with GMT(in "TIME SET" menu) are set up incorrectly, the time of event transmitted is not correct.

6.4.4. Select Setbank

BKA101-N1 has 6 Setting Menu BANKs which can be changed individually.

Select Setbank Menu consists of 3 sub-menus.

```
  [SELECT SETBANK]
Primary:       BANK1
Alternate:     BANK2
Edit:          BANK3
```

BANK in Primary and Alternate Menu is applied to system and BANK in Edit Menu is not applied to System.

BKA101-N1 is operated by selected in Primary and Alternate Bank. Alternate Bank is only applied, when power flow is reverse, by 'SET GROUP CHANGE' function.

Edit Bank can select a Bank except currently in use, and edit any information.

1) Primary

Range	BANK1, BANK2, … , BANK5, BANK6
Default	BANK1
Step	~

- Select a Bank of Primary setting group..
- It is available to change values in ***"MAIN MENU \ SETBANK SETTING \ PRIMARYSET BANK"***.

2) Alternate

Range	BANK1, BANK2, … , BANK5, BANK6
Default	BANK1
Step	~

- Select a bank of Alternate setting group.
- It is available to change values in ***"MAIN MENU \ SETBANK SETTING \ ALTERNATESET BANK"***.

3) Edit

Range	BANK1, BANK2, … , BANK5, BANK6
Default	BANK3
Step	~

- Select BANK that is not selected in Active Menu.
- It is available to change values in ***"MAIN MENU \ SETBANK SETTING \ EDITSET BANK"***.

6.4.5. Monitoring

Monitoring Menu consists of 2 sub-menus.

```
    [MONITORING]
1.TRIP COUNT LIMIT
2.CONTACT WEAR SET
```

1. TRIP COUNT LIMIT

Trip Count Limit Menu consists of 1 sub-menus.

```
[TRIP COUNT LIMIT]
LIMIT:         4000
```

1) LIMIT

Range	OFF, 50~10000
Default	4000
Step	~

- ■ Set a number to alarm when Switch operation number meets this set.

2. CONTACT WEAR SET

Contact wear set Menu consists of 5 sub-menus.

```
[CONTACT WEAR SET]
Function:         OFF
Pickup(%):       20.0
A Wear Set:    100.00
B Wear Set:    100.00
C Wear Set:    100.00
```

1) Function

Range	OFF, ALARM
Default	OFF
Step	~

- ■ Select whether to use Switch contact wear monitoring

2) Pickup(%)

Range	0.0~50.0%
Default	20
Step	0.1%

■ Set a pickup value to alarm when Switch contact wear reaches set value..

3) A Wear Set

Range	0.00 ~ 100.00 %
Default	100.00
Step	0.01%

■ It is to set Switch phase A contact wear value in BKA101-N1

4) B Wear Set

Range	0.00 ~ 100.00 %
Default	100.00
Step	0.01%

■ It is to set Switch phase B contact wear value in BKA101-N1

5) C Wear Set

Range	0.00 ~ 100.00 %
Default	100.00
Step	0.01%

■ It is to set Switch phase C contact wear value in BKA101-N1

6.4.6. Save Settings

To save all changed values, steps are as follows;

Move to ***"MAIN MANU \ GLOBAL SETTING \ SAVE SETTING"*** and follow each step as below.

Table 6-11. Save Settings

MAIN MANU \ GLOBAL SETTING \ SAVE SETTINGS	
① SETTING VALUE SAVE Press ENTER key save ② SAVE SETTING SUCCESS! ③ Setting Data Does Not Changed	To save all changed values, press **[ENT]** key in screen ①. If changed value is saved successfully, ② appears. If there is no change value and select ***"x.Save Setting",*** screen ③ is displayed. ⚠ **NOTE :** Changed set value is applied if the changed set value is saved. If changed set value saving is cancelled, previous value is remained.

6.5. Setbank Setting

BKA101-N1

```
 [SETBANK SETTINGS]
1.PRIMARYSET BANK
2.ALTERNATESET BANK
3.EDITSET BANK
```

Selected BANK is changed in ***"GLOBAL SETTINGS \ SELECT SETBANK"*** menu.

6.5.1. Primaryset Bank(N1)

```
  [PRIMARYSET BANK]
1.BASIC FUNCTION
2.DEMAND FUNCTION
3.UNDER VOL1 FUNC'
4.UNDER VOL2 FUNC'
5.OVER VOL1 FUNC'
6.OVER VOL2 FUNC'
7.FREQ FUNC'
8.COLD LOAD PICKUP
9.LIVE LOAD BLOCK
*.SAVE SETTINGS
```

1. Basic Function

```
  [BASIC FUNCTION]
1.FI PICKUP CURRENT
2.FI SETTING TIME
3.FI INRUSH TIME
4.NEQ' VOLTAGE(47)
5.SYCHROCHECK
6.FI TYPE SELECT
7.M-OPER TD
```

FI PICKUP CURRENT

Phase, Residual Ground and Negative sequence can be set individually and set FI operation current.

1) Phase

Range	0 (OFF), 10~1600A
Default	500
Step	1

■ Phase Fault Detect Min. Pickup Current is set.

2) Residual GND

Range	0(OFF), 10~1600 A
Default	250
Step	1

■ Residual Ground Fault Detect Min. Pickup Current is set.

3) Ground

Range	0(OFF), 4~160 A (Applicable for lower than Ver 1.11)
	0(OFF), 2~160 A (Applicable for Ver 1.11 or higher)
Default	OFF
Step	1

■ Ground Fault Detect Min. Pickup Current is set.

4) NEG Seq'(option)

Range	0(OFF), 10~1600 A
Default	500
Step	1

■ Negative sequence Fault Detect Min. Pickup Current is set.

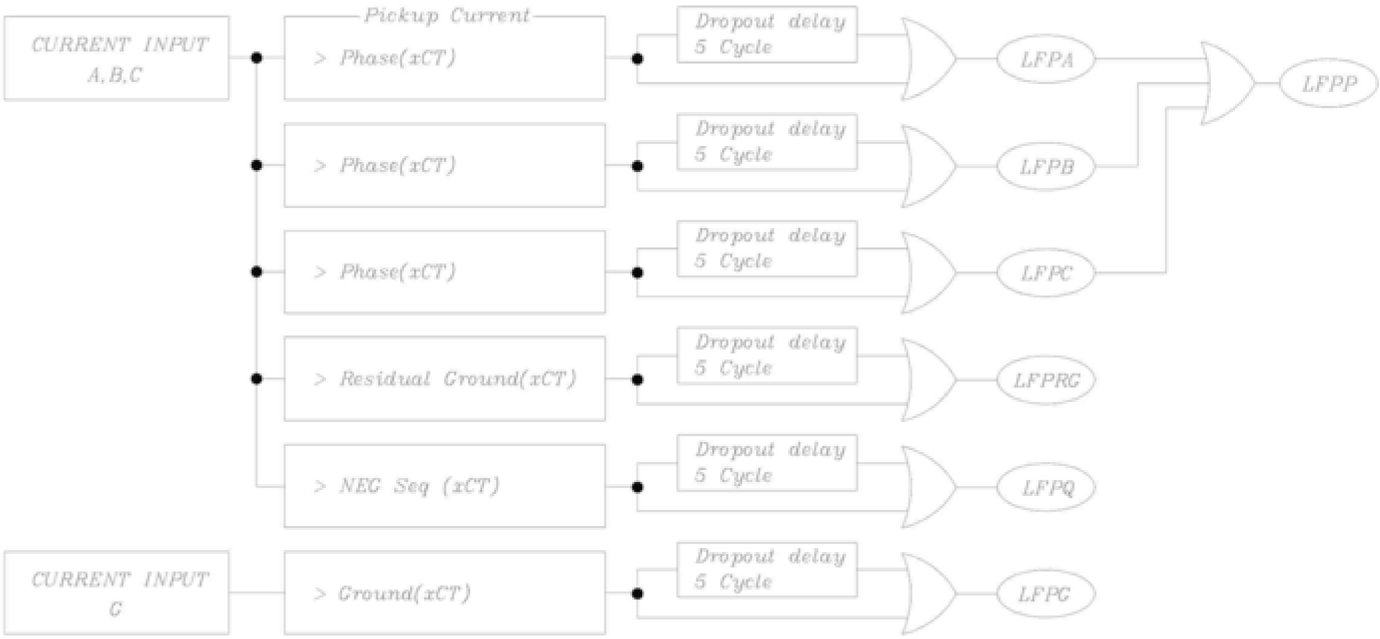


Figure 6-10. Fault Pickup Logic Diagram

FI SETTING TIME

1) Permanent

Range	1~ 180 sec
Default	20
Step	1

- After a set time, Permanent FI is set.

2) Temporary

Range	1~ 180 sec
Default	2
Step	1

- After a set time, Temporary FI is set.

3) Type I delay

Range	0.03~ 180 sec
Default	0.03
Step	0.01

- After a set time, if Temporary is set.
- In case of FI type is "I", If the fault current flows over setting time, FI is set.

※ **FI type : IV This type is supported by both of BKA101-N1**

Fault Indicator has PERMANENT mode and TEMPORARY mode, it operates depending upon a fault of Current and Voltage.

After a Line fault(C/B Trip), Fault Indicator is ready to operate. After C/B connection, if the fault disappears, Temporary FI operates after a certain time and Permanent FI is RESET.

After C/B connection, if the fault remains(C/B TRIP), after a certain time, it is figured as permanent fault, Permanent FI operates and Temporary FI is reset.

PERMANENT mode shall have enough Permanent Set Time considering cycle of C/B reclosing.

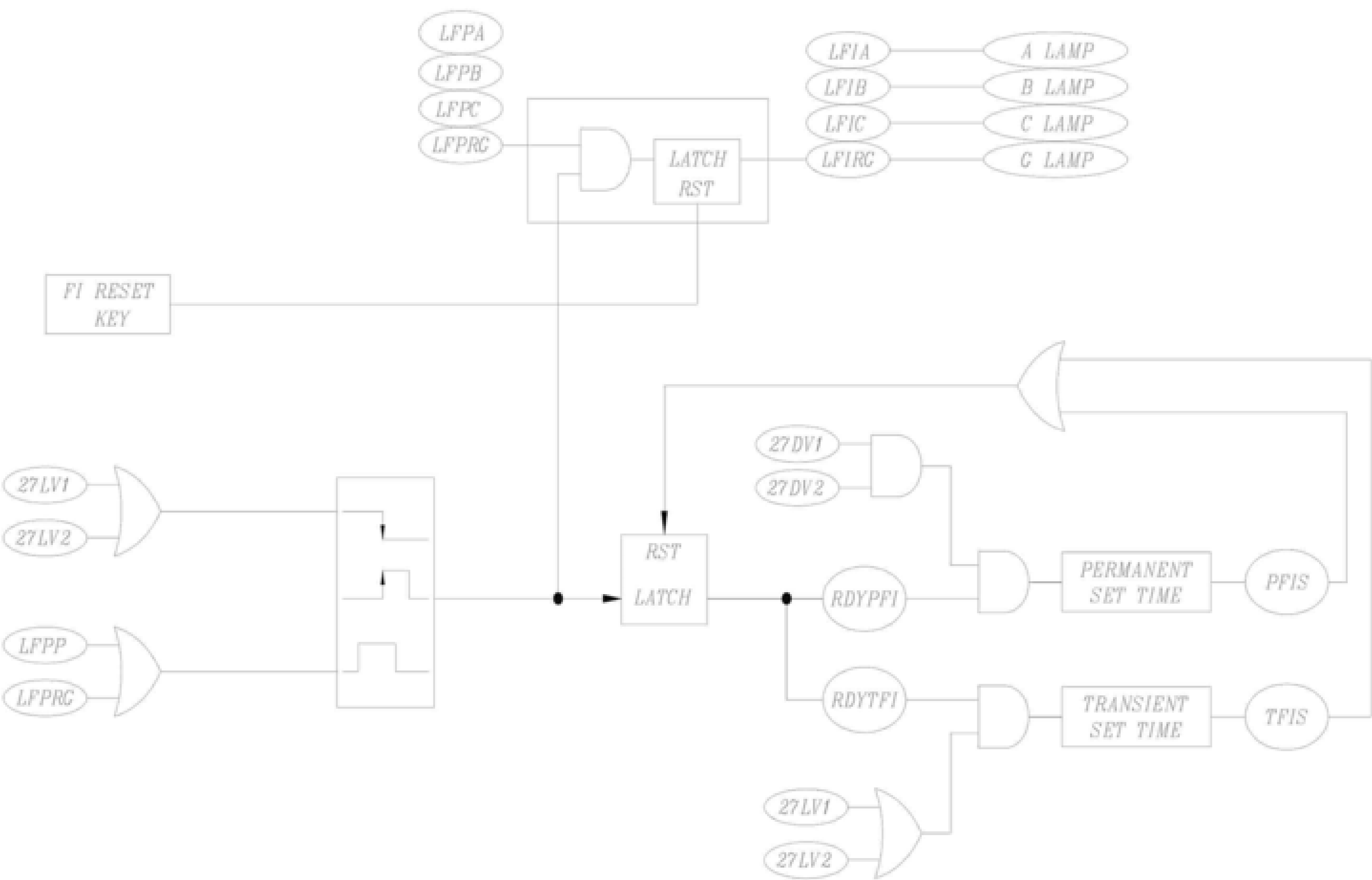


Figure 6-11. Fault Indication Logic Diagram

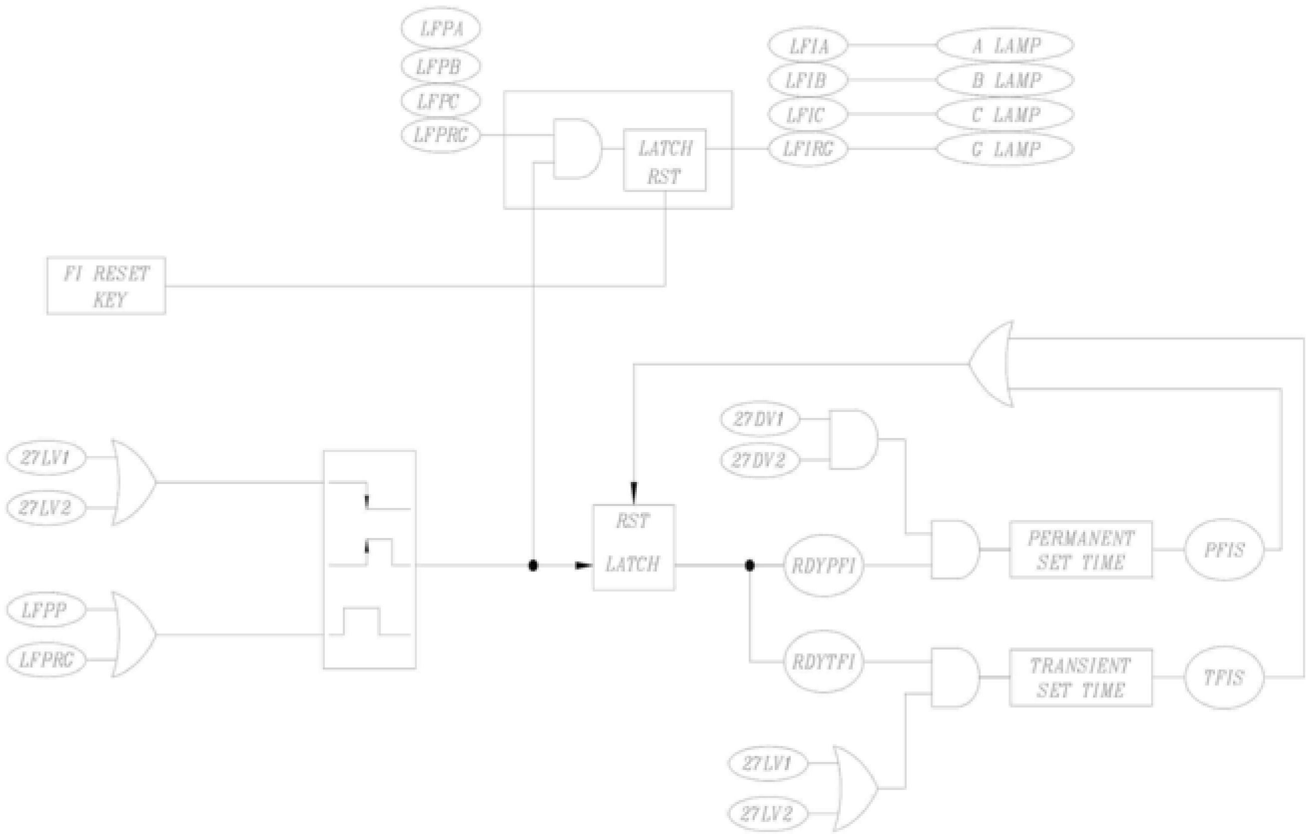


Figure 6-12. Fault Indication Algorithm(FI type : VI)

Fault Indicator operates depending upon a fault Current and fault duration.

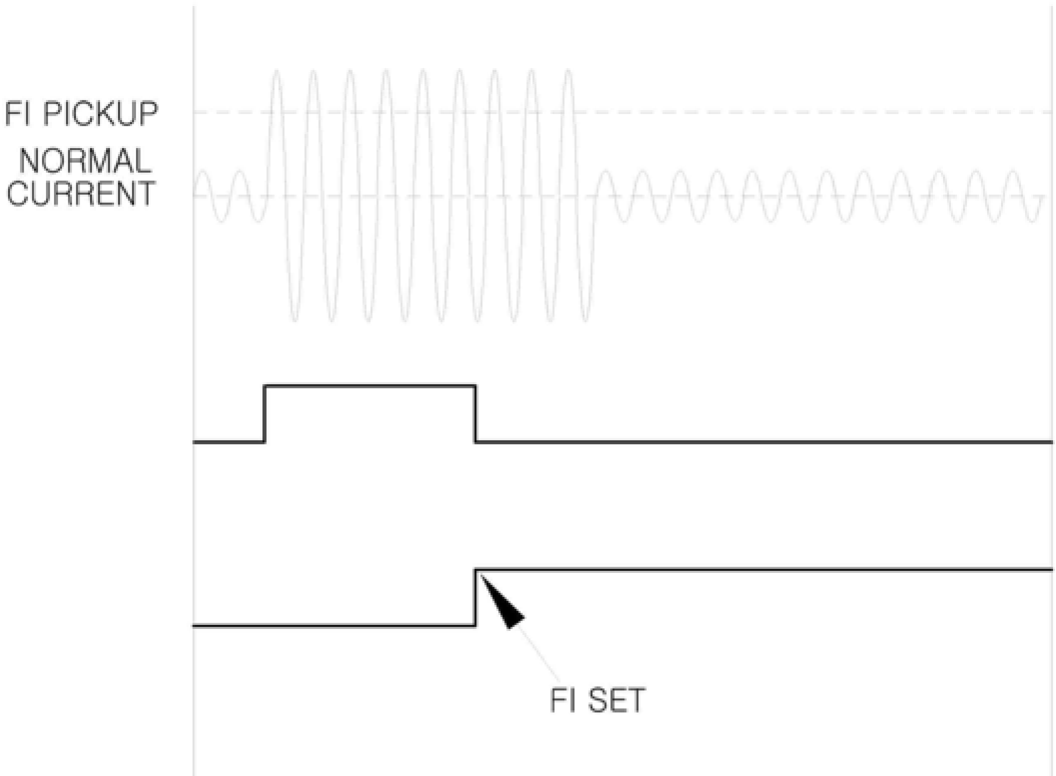


Figure 6-13. Fault Indication Algorithm(FI type : I)

FI INRUSH TIME

BKA101-N1 has inrush restraint function to prevent the malfunction by inrush current produced due to the switch closing(local/remote) after the fault occurrence. Inrush restraint function setting can be set separately in phase, residual ground and negative sequence.
Inrush current block time is applied when both source side and load side become hot line status from dead line status. During the applied time, does not detect fault about phase, residual ground or negative sequence.

1) Phase

Range	0.1~3.0 sec (Applicable for lower than Ver 1.11)
	0.1~30.0 sec (Applicable for Ver 1.11 or higher)
Default	2.0
Step	0.1

- Inrush Current block time of Phase is set.

2) Residual GND

Range	0.1~3.0 sec (Applicable for lower than Ver 1.11)
	0.1~30.0 sec (Applicable for Ver 1.11 or higher)
Default	2.0
Step	0.1

- Inrush Current block time of Residual Ground is set.

3) Ground

Range	0.1~3.0 sec (Applicable for lower than Ver 1.11)
	0.1~30.0 sec (Applicable for Ver 1.11 or higher)
Default	2.0
Step	0.1

- Inrush Current block time of Ground is set.

4) NEG Seq'

Range	0.1~3.0 sec (Applicable for lower than Ver 1.11)
	0.1~30.0 sec (Applicable for Ver 1.11 or higher)
Default	2.0
Step	0.1

- Inrush Current block time of negative sequence is set.

NEQ' VOLTAGE(47)

Sense Open Phase voltage and Negative voltage.

1) V1 PU-3P(xVT)

Range	0(OFF), 0.00 ~ 1.25
Default	OFF
Step	0.01

- When Negative Sequence Voltage of Source Voltage 1 is over a set value, 47Q is checked after Time Delay(V1 TD).
- Ex) When 2nd Nominal voltage : 100V and setting value is 0.25,
  Pickup Voltage : 100V × 0.25 = 25V

2) V1 TD

Range	0.00 ~ 600.00 sec
Default	0.00
Step	0.01

- Set Time Delay to figure out 47Q of Source Voltage 1.

3) V2 PU-3P(xVT)

Range	0(OFF), 0.00 ~ 1.25
Default	OFF
Step	0.01

- When Negative Sequence Voltage of Source Voltage 2 is over a set value, 47Q is checked after Time Delay(V2 TD).

4) V2 TD

Range	0.00 ~ 600.00 sec
Default	0.00
Step	0.01

- Set Time Delay to figure out 47Q of Source Voltage 2.

5) DVMax-1P(xVT)

Range	0.00 ~ 1.25
Default	0.50
Step	0.01

- Set a Dead line maximum voltage value.
- When each phase voltage of Source Voltage 1(2) is over a set value and lower than LV, it is figured as Open Phase voltage.

6) LVMin-1P (xVT)

Range	0.00 ~ 1.25
Default	0.85
Step	0.01

- Set a Live line minimum voltage value.
- Each phase voltage of Source voltage 1(2) is lower than a set value and over DV, it is figured as Open Phase voltage.

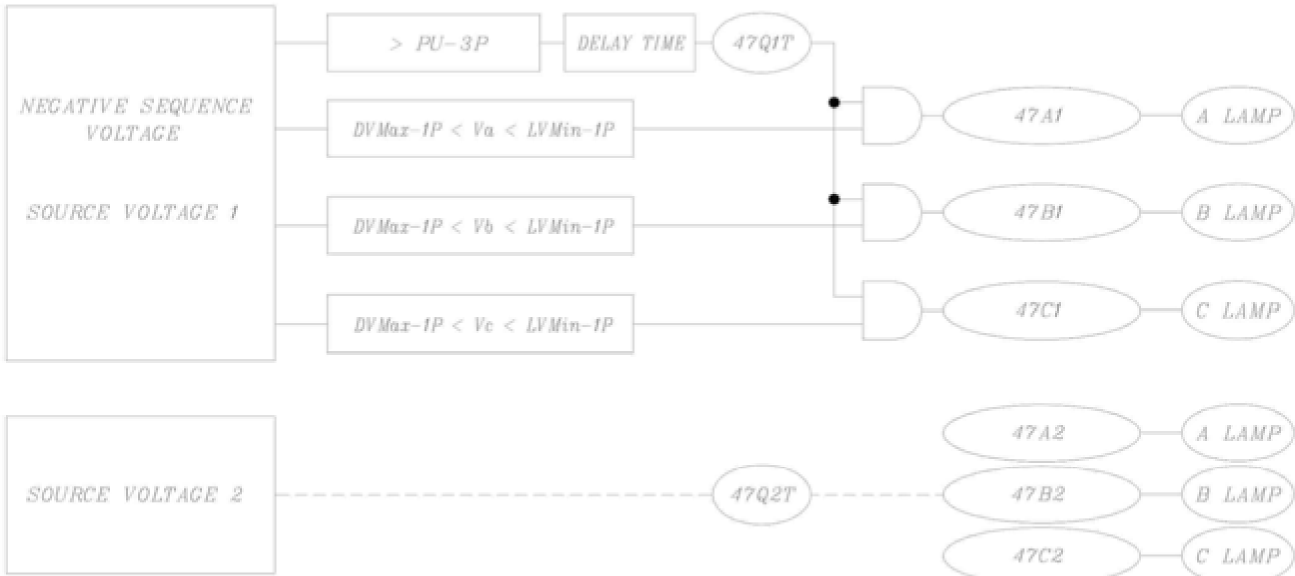


Figure 6-14. Negative Sequence Voltage(47) Logic Diagram

SYNCHROCHECK

Check Phase difference between Source Voltage 1 and Source Voltage 2.

1) Pickup Angle

Range	0(OFF), 1~100 deg
Default	15
Step	1

- Enter the maximum angle difference of the synchronism voltages.
- An angular differential between the synchronism voltage angles below this value is within the permissible limit for synchronism.

2) D.V.Max(xVT)

Range	0.00 ~ 1.25
Default	0.50
Step	0.01

- Enter the dead line maximum voltage for synchronism check.
- Used to prevent the synchronism check element for voltage below this level.

3) L.V.Min(xVT)

Range	0.00 ~ 1.25
Default	0.85
Step	0.01

- Enter the live line minimum voltage for synchronism check.
- Used to activate the synchronism check element for voltage over this level.

4) Sync Phase

Range	R(AB),S(CB),T(AC),ALL
Default	R(AB)
Step	~

- Select the synchronism check phase on Source Voltage 2.

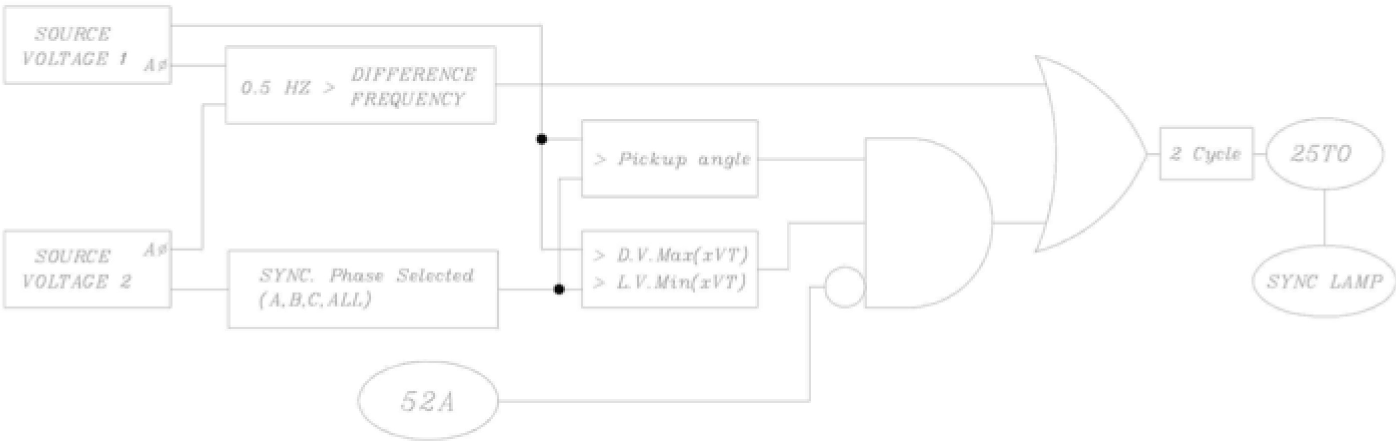


Figure 6-15. Synchrocheck Logic Diagram

FI TYPE SELECT

Select type to detect Fault.

1) Type select

Range	IV, I
Default	IV
Step	~

- Select the type of Fault detection.
- IV : If zero-voltage state after experiencing a fault currents, fault detection.
- I : The fault current flows more than the set time(Type I delay), and fault detection.
  "MAIN MENU/ SETBANK SETTING/ PRIMARYSET BANK/ BASIC FUNCTION/ 2. FI SETTING TIME/ Type I delay"

M-OPER TD

Time delay setting when manual operation

1) Time delay

Range	0.00~600.00 sec
Default	0.00
Step	0.01

- Set the time delay.

2. Demand Function

```
  [DEMAND FUNCTION]
Function:     DISABLE
PHA PU(A):        600
R-G PU(A):        300
NEQ PU(A):        600
```

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the Demand Function.
  - **DISABLE :** the feature is not operational.
  - **ENABLE :** the feature is operational.

2) PHA PU(A)

Range	0(OFF), 10~1600 A
Default	600
Step	1

- Set the Pickup value of Phase.

3) R-G PU(A)

Range	0(OFF), 10~1600 A
Default	300
Step	1

- Set the Pickup value of Residual Ground.

4) NEQ PU(A)

Range	0(OFF), 10~1600 A
Default	600
Step	1

- Set the Pickup value of Negative Sequence.

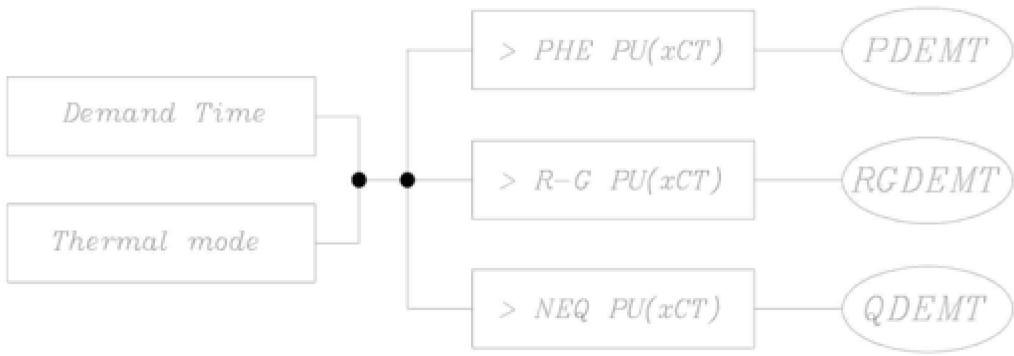


Figure 6-16. Demand Function Logic Diagram

- Demand Time :
  Set in ***"GLOBAL SETTING \ CONTROL SETUP \ OTHERS \ Demand Time"*** Menu.

3. Under Vol1 Func'

Set Under voltage function considering Source Voltage 1.

```
 [UNDER VOL1 FUNC']
Function:    DISABLE
Pickup(xVT):    0.70
Time Delay:     5.00
Min. V(xVT):    0.10
Pickup Type:      1P
```

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

■ Select the Under VOL1 Function.

- **DISABLE :** the feature is not operational.
- **ENABLE :** the feature is operational.

2) Pickup(xVT)

Range	0.00 ~ 1.25
Default	0.70
Step	0.01

■ Enter the pickup value as a fraction of the secondary nominal voltage.

■ For example, if the secondary nominal voltage is **100V**, and an alarm is required whenever the voltage goes below **70V**, enter (70/100) = **0.70** × VT for the pickup.

3) Time Delay

Range	0.00 ~ 600.00 sec
Default	5.00
Step	0.01

■ After Pickup, a set time later, Under voltage operates.

4) Min. V(xVT)

Range	0.00 ~ 1.25
Default	0.10
Step	0.01

■ Enter the minimum voltage for the under voltage.

■ Used to prevent the under voltage element for voltage below this level. Setting to 0.10 xVT will allow a dead line to be considered a trip condition.

5) Pickup Type

Ranged	1P, 2P, 3P
Default	1P
Step	~

■ Select the type of phase required for operation.

Figure 6-17. Under Voltage Logic Diagram

4. Under Vol2 Func'

- Set Under Voltage Function considering Source Voltage 2.
- The same Menu as ***"Under Vol1 Func'"***.

5. Over Vol1 Func'

Set Over Voltage Function considering Source Voltage 1.

```
  [OVER VOL1 FUNC']
Function:     DISABLE
Pickup(xVT):     1.20
Time Delay:      5.00
Pickup Type:       1P
```

1) Function

Range	DISABLE, ENABLE
Default	DISABLE
Step	~

- Select the Over Voltage1 Function.
  - **DISABLE :** the feature is not operational.
  - **ENABLE :** the feature is operational.

2) Pickup(xVT)

Range	0.00 ~ 1.25
Default	1.20
Step	0.01

- Enter the pickup value as a fraction of the secondary nominal voltage.
- For example, if the secondary nominal voltage is **100V**, and an alarm is required whenever the voltage exceeds **120V**, enter **120 / 100 = 1.20** for the pickup.

3) Time Delay

Range	0.00 ~ 600.00
Default	5.00
Step	0.01

- After pickup, a set time later, Overvoltage operates.

4) Pickup Type

Ranged	1P, 2P, 3P
Default	1P
Step	~

- Select the type of phase required for operation.

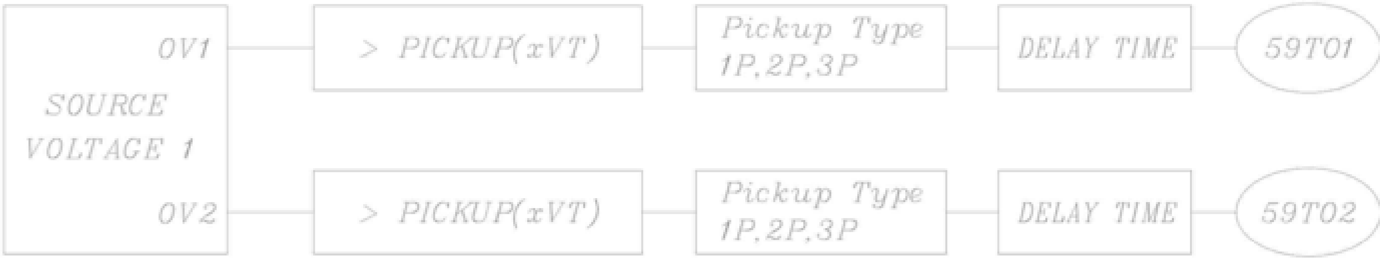


Figure 6-18. Overvoltage Logic Diagram

6. Over Vol2 Func'

- Set Over Voltage Function considering Source Voltage 2.
- The same Menu as ***"Over Vol1 Func'"***.

7. Freq Func'

Set Frequency Protection Function.

```
     [FREQ FUNC']
Function:     DISABLE
Under Pu(Hz):   55.00
Under TD:        5.00
Over Pu(Hz):    65.00
Over  TD:        5.00
Min. V(xVT):     0.10
Min. I(A):         10
```

1) Function

Range	DISABLE, UNDER, OVER, BOTH
Default	DISABLE
Step	~

■ Select the Frequency Function.

- **DISABLE :** Either Under Frequency or Over Frequency is not operational.
- **UNDER :** Under Frequency function is operational.
- **OVER :** Over Frequency function is operational.
- **BOTH :** Both Under Frequency and Over Frequency functions are operational.

2) Under Pu(Hz)

Range	40.00 ~ 60.00 Hz
Default	55.00
Step	0.01

■ Enter the level of which the under frequency element is to pickup.

■ For example, if the system frequency is 60Hz, and load shedding is required at 55.00 Hz, enter 55.00 for this setting.

3) Under TD

Range	0.00 ~ 600.00 sec
Default	5.00
Step	0.01

- Select the Under Frequency Time Delay.

4) Over Pu(Hz)

Range	40.00 ~ 70.00 Hz
Default	65.00
Step	0.01

- Enter the level of which the over frequency element is to pickup.
- For example, if the system frequency is 60Hz, and load shedding is required at 65.00 Hz, enter 65.00 for this setting.

5) Over TD

Range	0.00 ~ 600.00 sec
Default	5.00
Step	0.01

- Select the Under Frequency Time Delay.

6) Min. V(xVT)

Range	0.00 ~ 1.25
Default	0.10
Step	0.01

- Enter the minimum voltage required to allow the under frequency element to Operate.

7) Min. I(A)

Range	10~1600A
Default	10
Step	1

- Enter the minimum value of current required for any phase to allow the Over Frequency element to operate.

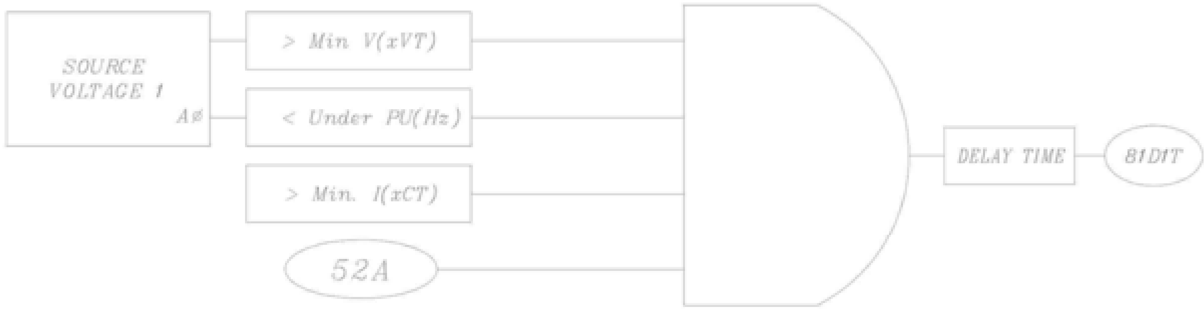


Figure 6-19. Under Frequency Logic Diagram

Figure 6-20. Over Frequency Logic Diagram

8. Cold Load Pickup

The cold load pickup function is used to prevent the switch from incorrectly operating caused by the restoration of load supply or the cold load current of load side. BKA101-N1 provides "Cold Load Pickup" to prevent protection elements from operating wrong by the cold load current caused by applying voltage to a transformer, a reactor or a long-distance line.

Cold Load Pickup

In the state of cold load, this type is used to restrain the operation of protection functions to over current occurring by change of load (the close of a switch on long-distance line, incoming heavy load etc.). This function to restrain protection functions rises or drops the pickup level of time overcurrent element during certain time (E-CLP time) defined by a user.

Over Current Pickup Level Step Up

At power loss (a Switch is opened or a load current is 0A), the current of Over Current Pickup is risen as follows.

$$Operational\,Cold\,Load\,Multi' = 1 + \left(\frac{Without\,Supply\,Time}{E - CLP\,Time} \times (E - CLP\,Multi' - 1) \right)$$

As example, when E-CLP Multi and E-CLT Time are set to be 3.0 and 60min respectively, over 30 min after power loss, the applied cold load multiple is 2. If the minimum working currents set to be 200A, the current of Over Current Pickup becomes 400A, twice as much as the minimum working current. In addition, after 60 min, the cold load multiple is fixed to be 3.

Over Current Pickup Level Step Down

If power is restored (manual closed or restoration of load current (over 2A)), the current of Over Current Pickup is dropped with the same speed when rising until the cold load multiple becomes

When E-CLP Multi and E-CLP Time are set to be 3.0 and 60 min respectively, the graph of the cold load multiple in ***"Figure 6-21. Cold Load Multiplier"*** is shown as follows.

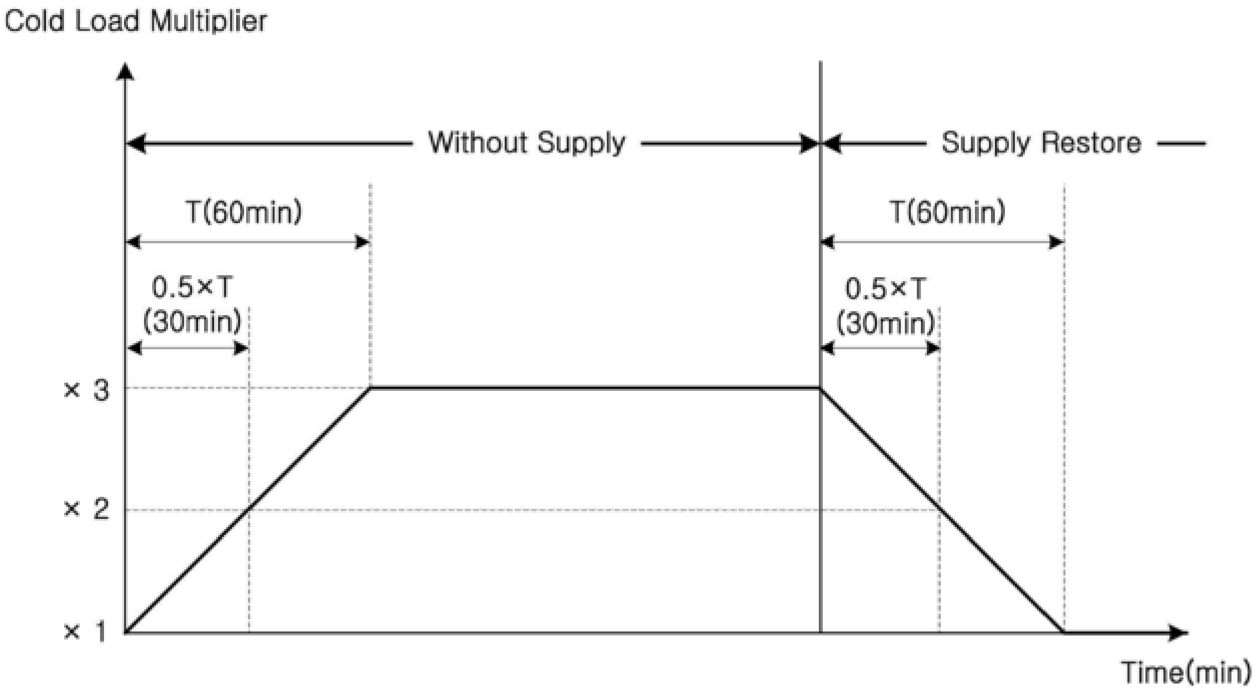


Figure 6-21. Cold Load Multiplier

Set Cold load pickup Function.

```
 [COLD LOAD PICKUP]
CLPU Use?:        NO
CLPU Multi:      OFF
CLPU Time(m):     10
```

1) CLPU Use?

Range	NO, YES
Default	NO
Step	~

- Set whether to use CLPU Function.

2) CLPU Multi

Range	OFF, 1.0~5.0
Default	OFF
Step	0.1

- Set the multiple of cold load. If 1.0 is set, the cold load multiple is not applied and the setting of minimum working current is always applied for overcurrent pickup current.

3) CLPU Time(m)

Range	1 ~ 720min
Default	10
Step	1min

- Set the cold load time. During this set time, the overcurrent pickup level is risen or dropped.

9. Live Load Block

It is to block Switch closing if the load side is live line.

```
 [LIVE LOAD BLOCK]
Function:   DISABLE
Pickup(xVT):   0.30
Time Delay:    1.00
```

1) Function

Range	ENABLE, DISABLE
Default	DISABLE
Step	~

■ Select whether to use Live load block function.

2) Pickup(xVT)

Range	0.10~0.90
Default	0.30
Step	0.01

■ Set pickup level of live line.

3) Time Delay

Range	0.01~600.00sec
Default	1.00
Step	0.01s

■ Set a time to detect live line in load side. The live line is determined if load side voltage is more than pickup level for this set time.

*. Save Setting

The same Menu as ***"6.4.5. Save Settings"*** function.

6.5.2. Editset Bank

The same Menu structure as ***"6.5.1. Activeset Bank***, ***Primaryset Bank*"**.

6.5.3. Alternateset Bank

The same menu structure as ***"6.5.1. Activeset Bank***, ***Primaryset Bank*"**.

6.6. Status

Setbank Setting Menu consists of 6 sub-menus.

```
       [STATUS]
1.DIGITAL INPUTS
2.DIGITAL OUTPUTS
3.CLOCK
4.CONTROL TYPE
5.#FUNCTION STATUS
6.#USER SET FUNCTION
```

6.6.1. Digital Inputs

Display an operation status of IN1 ~ IN16 of SIDE PANEL.
Display OPEN if there is a signal at Inputs otherwise display CLOSE.

Use [▼][▲] button to next value.

```
  [DIGITAL INPUTS]
INPUT 1:          LOW
INPUT 2:         HIGH
INPUT 3:          LOW



INPUT 16:         LOW
```

6.6.2. Digital Outputs

Display an operation status of OUT1 ~ OUT8 of SIDE PANEL.
Display OPEN during outputting, otherwise CLOSE.

Use [▼][▲] button to next value.

```
  [DIGITAL OUTPUTS]
OUTPUT 1:         LOW
OUTPUT 2:         LOW


OUTPUT 8:         LOW
```

6.6.3. Clock

Display the current Date and Time.

```
   [CURRENT TIME]

2011/07/05  20:02:38
```

6.6.4. Control Type

1) Display Hardware information
   For more details, please refer to Ordering Guide in ***"Appendix D. Ordering Guide"***.
2) Display CPU Firmware Version of Main Board and Communication Board, and DSP Firmware Version.

```
   [CONTROL TYPE]
20-8000-0000-xx-1050
MPU: 1.05  DSP: 1.00
CPU: 2.00
```

6.6.5. Function Status

```
[FUNCTION STATUS]
EPFI        DISABLE
EGFI        DISABLE
ESYNC       DISABLE
EVOLT       DISABLE
EFREQ       DISABLE
EALTGR      DISABLE
EDEM        DISABLE
ECLP        DISABLE
ELLB        DISABLE
EHLTAG      DISABLE
EPQM        DISABLE
EASGC       DISABLE
ECHGDSW     DISABLE
ELOOP       DISABLE
```

Display each Function status information.

1) **EPFI :** Enable Phase Fault Indication
- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ FI Pickup Current\Phase"

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ Neq' Voltage(47)"

2) **EGFI :** Enable Ground Fault Indication
- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ FI Pickup Current\Residual GND"

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ FI Pickup Current\Ground"

3) **ESYNC :** Enabled Synchronism Check Function
- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ Synchrocheck"

4) **EVOLT :** Enable Voltage Monitoring Function
- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Under Vol1 Func or Under Vol2 Func or Over Vol1 Func or Over Vol2 Func"

5) **EFREQ :** Enable Frequency Monitoring Function
- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Freq Func"

6) **EALTGR :** Enabled Alternate Setbank

- Use the toggle button that setting PLC logic.

7) **EDEM :** Enable Demand Current Monitoring

- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Demand Function"

8) **ECLP :** Enable Cold Load Pickup

- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Cold Load Pickup"

9) **ELLB :** Enable Live Load Block Function

- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Live Load Block"

10) **EHLTAG:** Enable Hot Line Tag Function

- Related setting menu

  "Setbank Setting \ Primaryset Bank or Alternatset Bank \ Basic Function \ Synchrocheck"

11) **EPQM :** Enable Power quality Monitoring Function

- Related setting menu

  "Global Setting \ System Setup\Power Quality"

- Related Function

  Supply Outage, SAG, SWELL, Unbalance Current, Unbalance Voltage.

12) **EASCG :** Enable Auto Setting Group Change

- Related setting menu

  "Global Setting \ System Setup\Set Group Change"

13) **ECHGDSW :** Enable Change Power Flow Direction

14) **ELOOP :** Enable Loop Function

- Related setting menu

  "Global Setting \ System Setup\Loop Control"

6.6.6. User Set Function

1) Display user set function information

- Refer to ***"Menu 6.4.2.11 User set Function"*** .

```
[USER SET FUNCTION]
EUSF1  :     DISABLE
EUSF2  :     DISABLE
EUSF3  :     DISABLE
EUSF4  :     DISABLE
EUSF5  :     DISABLE
EUSF6  :     DISABLE
EUSF7  :     DISABLE
EUSF8  :     DISABLE
EUSF9  :     DISABLE
EUSF10  :    DISABLE
EUSF11  :    DISABLE
EUSF12  :    DISABLE
```

6.7. Metering

- Metering Menu measure below elements and display.
  - Current
  - Voltage
  - Frequency
  - Power
  - Energy
  - Demand
  - System (Power & Temperature)
  - Harmonics
  - Unbalance

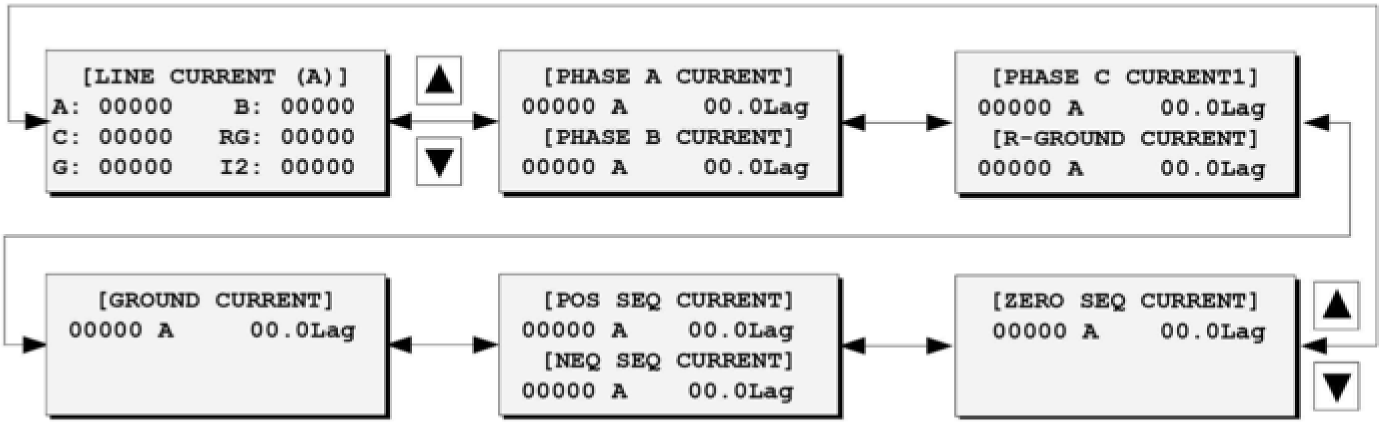
- Metering Menu consists of 10 sub-menus.

```
      [METERING]
1.CURRENT
2.VOLTAGE1
3.VOLTAGE2
4.FREQUENCY
5.POWER
6.ENERGY
7.DEMAND
8.SYSTEM
9.HARMONICS
10.UNBALANCE
```

6.7.1. Current

<u>Metering Elements</u>

A	Displays the measured phase A RMS current and phasor(A, Lag)
B	Displays the measured phase B RMS current and phasor(A, Lag)
C	Displays the measured phase C RMS current and phasor(A, Lag)
RG	Displays the measured residual ground RMS current and phasor(A, Lag)
G	Displays the measured ground RMS current and phasor(A, Lag)
I1	Displays the calculated positive sequence RMS current and phasor(A, Lag)
I2	Displays the calculated negative sequence RMS current and phasor(A, Lag)
I0	Displays the calculated zero sequence RMS current and phasor(A, Lag)



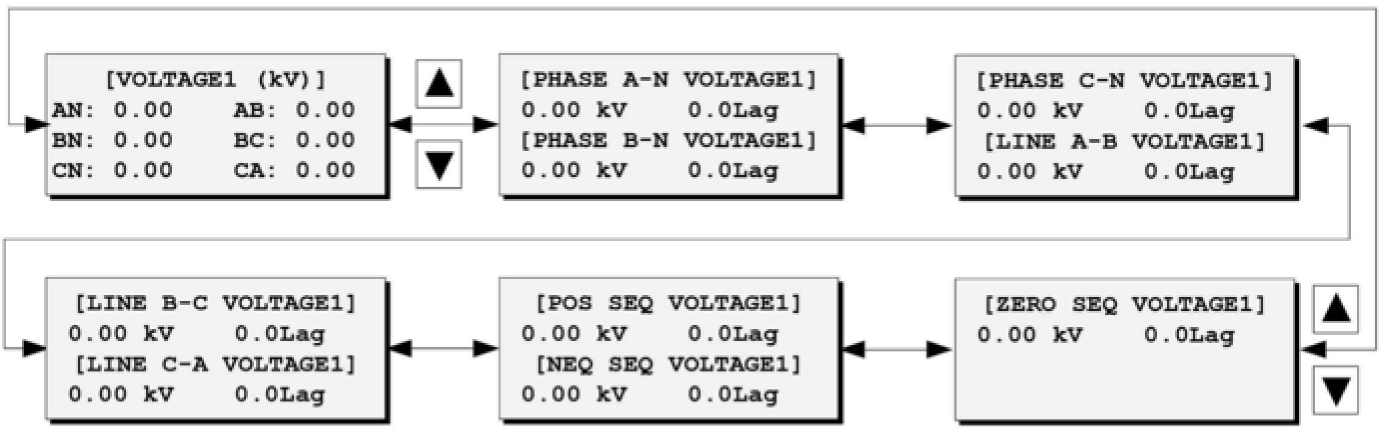
Use **[▲] [▼]** keys to move to next value.

6.7.2. Voltage1

Measure a voltage of Source Voltage 1.

<u>Metering Elements</u>

- **VA-N** Displays the measured A-N RMS voltage and phasor(kV, Lag)
- **VB-N** Displays the measured B-N RMS voltage and phasor(kV, Lag)
- **VC-N** Displays the measured C-N RMS voltage and phasor(kV, Lag)
- **VA-B** Displays the measured A-B RMS voltage and phasor(kV, Lag)
- **VB-C** Displays the measured B-C RMS voltage and phasor(kV, Lag)
- **VC-A** Displays the measured C-A RMS voltage and phasor(kV, Lag)
- **V1** Displays the calculated positive sequence RMS voltage and phasor(kV, Lag)
- **V2** Displays the calculated negative sequence RMS voltage and phasor(kV, Lag)
- **V0** Displays the calculated zero sequence RMS voltage and phasor(kV, Lag)



Use **[▲] [▼]** keys to move to next value.

6.7.3. Voltage2

Measure a voltage of Source Voltage 2.

The same Menu as ***"6.7.2. Voltage1"*** function.

6.7.4. Frequency

<u>Metering Elements</u>

1) Source Voltage1 Frequency(㎐)
2) Source Voltage2 Frequency(㎐)

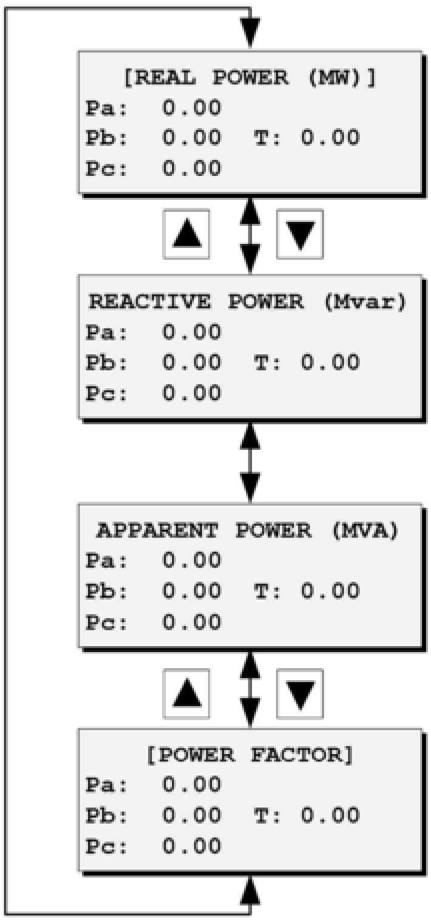
```
   [FREQUENCY (Hz)]
S1:             0.00Hz
S2:             0.00Hz
```

Use **[▲] [▼]** keys to move to next value.
Frequency is measured at Phase A.

6.7.5. Power

<u>Metering Elements</u>

1) Real Power(㎿)
2) Reactive Power(Mvar)
3) Apparent Power(MVA)
4) Power Factor (%)

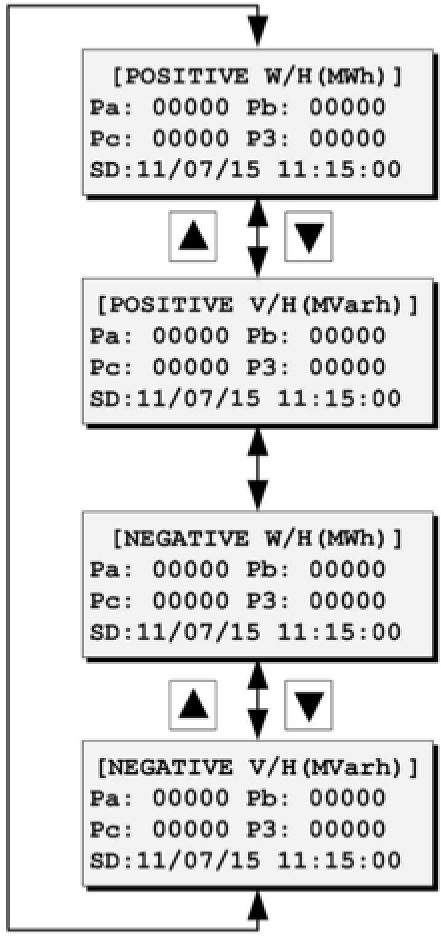


Use **[▲] [▼]** keys to move to next value.

6.7.6. Energy

<u>Metering Elements</u>

1) Positive Watthour(MWh)
2) Positive Varhour(Mvarh)
3) Negative Watthour(MWh)
4) Negative Varhour(Mvarh)

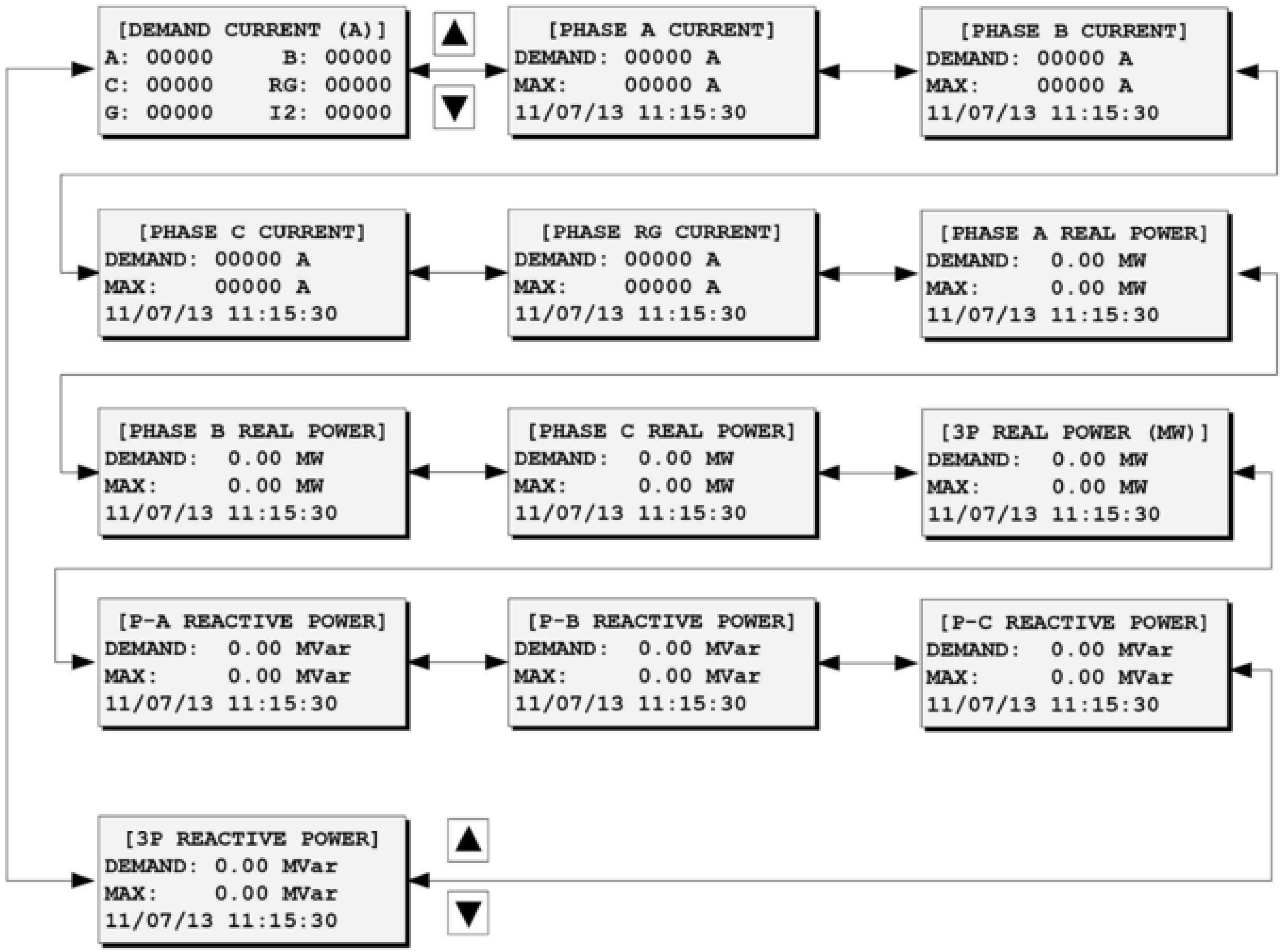


Use **[▲] [▼]** keys to move to next value.

6.7.7. Demand

<u>Metering Elements</u>

1) Actual & Maximum Demand Current A, B, C, RG (A)
2) Actual & Maximum Demand Real Power Phase A, B, C, 3P(MW)
3) Actual & Maximum Demand Reactive Power P-A, P-B, P-C, 3P(Mvar)



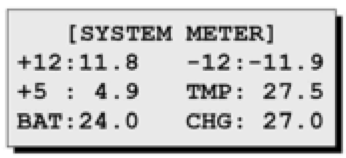
Use **[▲] [▼]** keys to move to next value.

> ⚠ **NOTE :** Present Demand value is calculated by a thermal mode and the Max value is calculated according to the demand mode set in ***"GLOBAL SETTING \ CONTROL SETUP \ OTHERS \ Demand Method"***.

6.7.8. System

<u>Metering Elements</u>

1) Board Power(+12, -12, +5V)
2) Temperature(℃)
3) Battery Voltage
4) Charger Circuit Voltage



6.7.9. Harmonics

Metering Elements

1) 1st~7th Harmonic of Current
2) 1st~7th Harmonic of Voltage
3) THD of Current
4) THD of Voltage

```
     [HARMONICS]
>1.THD
 2.Current-A
 3.Current-B
 4.Current-C
 5.Voltage-A
 6.Voltage-B
 7.Voltage-C
```

1. THD

This menu is to display the total harmonic distortion of current and voltage.

```
[Total Har' Dis'(%)]
 Ia :     0 Va :     0
 Ib :     0 Vb :     0
 Ic :     0 Vc :     0
```

2. Current-A

This menu is to display the 1st~7th harmonic and THD of current through phase A.

```
  [HARMONIC - Ia]
 [1st]      0A   100%
 [2nd]      0A     0%
 [3rd]      0A     0%
```

[▲] [▼]

```
  [HARMONIC - Ia]
 [4th]      0A     0%
 [5th]      0A     0%
 [6th]      0A     0%
```

[▲] [▼]

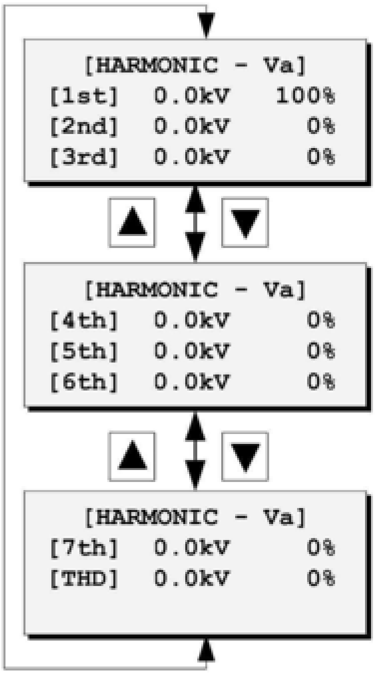
```
  [HARMONIC - Ia]
 [7th]      0A     0%
 [THD]      0A     0%
```

Use **[▲] [▼]** keys to move to next value.

⚠ **NOTE :** Current-B(C) is the same Menu as ***"Current-A"*** function.

3. Voltage-A

This menu is to display the 1st~7th harmonic and THD of voltage in phase A.



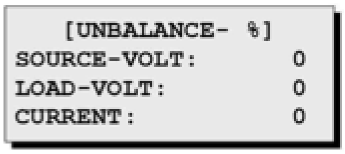
Use **[▲] [▼]** keys to move to next value.

⚠ **NOTE :** Voltage-B(C) is the same Menu as ***"Voltage-A"*** function.

6.7.10. Unbalance

Metering Elements

1) Voltage unbalance(V2/V1) – Source Side
2) Voltage unbalance(V2/V1) – Load Side
3) Current unbalance(I2/I1)

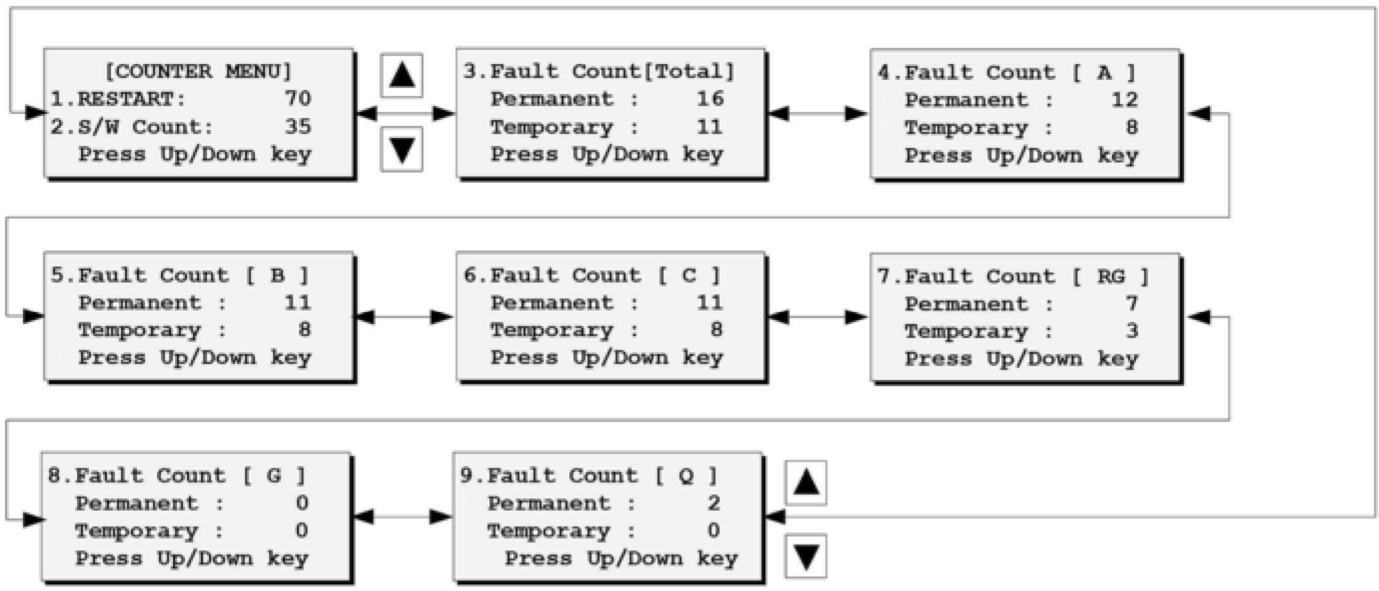


6.8. Maintenance

Maintenance Menu consists of 4 sub-menus.

```
   [MAINTENANCE]
1.COUNTERS
2.POWER QUALITY
3.CONTACT WEAR
4.COMM COUNT
```

6.8.1. Counters



1. **RESTART :** Display a number of System Restart.

2. **S/W Count :** Display a number of 52A operation inside of Logic.

3. **Fault Count[Total]**
   - **Permanent:** Display a number of Permanent Fault.
   - **Temporary:** Display a number of Temporary Fault.

4. **Fault Count[A(B,C)]**
   - **Permanent:** Display a number of Permanent Fault of Phase A, B, C separately.
   - **Temporary:** Display a number of Temporary Fault of Phase A, B, C separately.

5. **Fault Count[RG(G,Q)]**
   - **Permanent:** Display a number of Permanent Fault of Residual GND, GND, Negative Sequence.
   - **Temporary:** Display a number of Temporary Fault of Residual GND, GND, Negative Sequence.

6.8.2. Power Quality

Move to ***"MAINTENANCE / POWER QUALITY"*** to confirm fault count.

<table>
<tr><th colspan="2">MAINTENANCE / POWER QUALITY</th></tr>
<tr>
<td>
<pre>
  [SUPPLY OUTAGE]
 T-Time   T-Cnt
S: ①   ②
L: ③   ④
</pre>
▲ ▼
<pre>
[PQ COUNT] SAG SWELL
A phase: ①   ②
B phase: ①   ②
C phase: ①   ②
</pre>
▲ ▼
<pre>
[PQ COUNT] UNBALANCE
SOURCE-VOLT: ①
LOAD-VOLT :   ②
CURRENT   :   ③
</pre>
</td>
<td>
Number of fault is displayed. This COUNT menu consists 2 pages. Use [▼][▲] button to move to next value.

SUPPLY OUTAGE
① It indicates the time of outage on a power source side. The time of outage is displayed as hour/minute/second.
② It indicates the number of times of outage on a power source side.
③ It indicates the time of outage on a load side. The time of outage is displayed as hour/minute/second.
④ It indicates the number of times of outage on a load side.

PQ COUNT(SAG, SWELL)
① It indicates the counter of sag of A, B, C phase.
② It indicates the counter of swell of A, B, C phase.

PQ COUNT(UNBALANCE)
① It indicates the number of voltage unbalance on a source side.
② It indicates the number of voltage unbalance on a load side.
③ It indicates the number of current unbalance.
</td>
</tr>
</table>

6.8.3. Contact Wear

<table>
<tr><th colspan="2">MAINTENANCE / CONTACT WEAR</th></tr>
<tr>
<td>
<pre>
[CONTACT WEAR]
1.CONTACT A : 100.00
2.CONTACT B : 100.00
3.CONTACT C : 100.00
</pre>
</td>
<td>DisplaySwitch contact wear in percentage.</td>
</tr>
</table>

6.8.4. Comm Count

MAINTENANCE / COMM COUNT

```
    [COMM-DNP1]  1/6
RX Message:        0
RX Message:        0
Unsol Tx  :        0
```

```
    [COMM-DNP1]  2/6
RX CRC Err:        0
Tx RETRY  :        0
SBO TO    :        0
```

```
    [COMM-DNP1]  3/6
D Conf TO :        0
A Conf TO :        0
```

```
    [COMM-DNP2]  4/6
RX Message:        0
RX Message:        0
Unsol Tx  :        0
```

```
    [COMM-DNP2]  5/6
RX CRC Err:        0
Tx RETRY  :        0
SBO TO    :        0
```

```
    [COMM-DNP2]  6/6
D Conf TO :        0
A Conf TO :        0
```

Indicates the counter information of DNP3.0 protocol. This COUNT menu consists 6 pages. Use [▼][▲] button to move into sub-menu.

COMM-DNP1(1/6)

- **Rx Message:** Indicates the total number of received message of DNP3.0 Slave1.
- **Tx Message:** Indicates the total number of transferred message of DNP3.0 Slave1.
- **Unsol Tx:** Indicates the total number of transferred Unsol message of DNP3.0 Slave 1.

COMM-DNP1(2/6)

- **Rx CRC Err:** Indicates the total number of CRC error message of DNP3.0 Slave 1.
- **Tx Message:** Indicates the total number of resend messange of DNP3.0 Slave1.
- **SBO TO:** Indicates the SBO Time-out number of DNP3.0 Slave 1.

COMM-DNP1(3/6)

- **D Conf TO:** Indicates the Data Link confirm Time-out number of DNP3.0 Slave1.
- **A Conf TO:** Indicates the Application Link Confirm Time-out number of DNP3.0 Slave1.

COMM-DNP2(4~6/6)

Indicates the communication counter of DNP3.0 Slave2. The composition counter is same as DNP3.0 Slave 1.

6.8.5. Event Recorder

Manage and display System operation status or History.

Event Recorder Menu consists of 8 sub-menus.

```
  [EVENT RECORDER]
1.FAULT EVENT
2.CYCLE EVENT
3.SYSTEM EVENT
4.DIAGNOSTIC EVENT
5.P-Q EVENT
6.SWITCHING EVENT
7.SET  CHANGE  EVENT
8.LOAD PROFILE
```

6.8.6. Fault Event

When a fault occurs, record and display 512 events of fault phase, fault current, fault occurred time etc.

Table 6-12. Fault Event Description

MAIN MENU / EVENT RECORDER / FAULT EVENT	

`[① - ②]FAULT EVENT`
`A:   ③④⑤ B:`
`C:          RG:`
`        ⑥`
 	
Ex>
 	
`[001-TF]FAULT EVENT`
`A:  397P     B:    0`
`C:     0     RG: 399P`
`11/07/13    16:23:35`
	① No: Order of recorded fault event is displayed. Max. 256 events are displayed.
	② Sequence No : Sequence order (1~4) is displayed in 1 Fault.
	■ 1~4 Sequence order before the final fault is displayed.
	■ In case of final fault, fault type is displayed.
	- Permanent FI : PF
	- Temporary FI : TF
	③ Fault current per each phase, unit A
	④ Final Result
	■ ex1) Permanent FI.
	- Events before the final fault are indicated as Fault(F) in the fault occurred phase.
	- The final fault event is indicated as Permanent Fault(P).
	■ ex2) Temporary FI.
	- Events before the final fault are indicated as Fault(F) in the fault occurred phase.
	- The final fault event is indicated as Temporary Fault(T).
	⑤ Fault Current Direction
	■ Forward : f
	■ Reverse : r
	■ Fault current direction of final fault event is not indicated.
	⑥ Event occurrence time : Year/Month/Day Hour:Minute:Second.

1. Trigger Source

- Current A, B, C, RG, G, NEG
- Fault detect : Temporary Fault, Permanent Fault
- Detect direction : Forward, Reverse direction
- Fault Sequence

2. Trigger Time

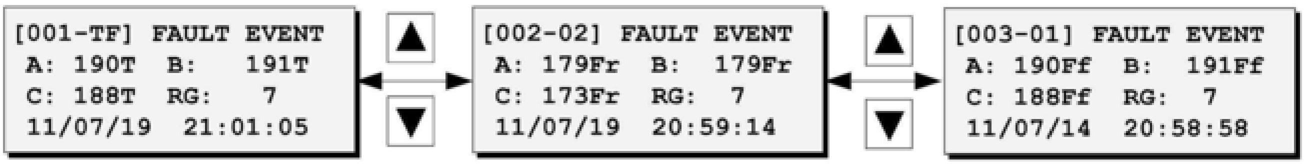
- Every 1/4 cycle

3. Storage Capacity

- The capacity of storage is last 256 events.

4. Related Setting Menu

- Stored Value Clear
  Select ***"1.Fault Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.



Previous stored information is displayed by pressing [▼] Key, and next stored information is displayed by pressing [▲] Key. [NO-001] is the latest information stored.

6.8.7. Cycle Event

In case of Fault, Cycle Event records 32 events.

Fault cycle summary is displayed on LCD screen.

Recorded Cycle waveforms can be showed by the interface software.

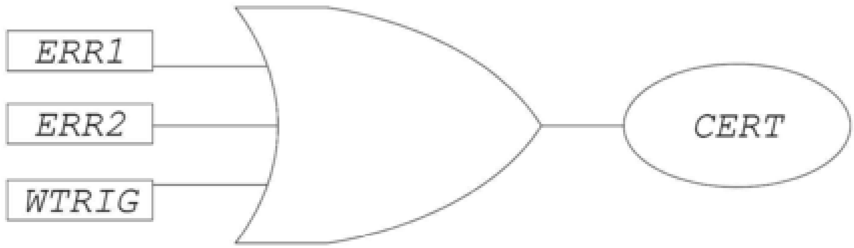


Figure 6-22. Cycle Event Recorder Trigger Logic Diagram

Table 6-13. Cycle Event Description

MAIN MENU / EVENT RECORDER / CYCLE EVENT	
[NO-①] ② A: ③ B: ③ C: ③ RG: ③ ④ Ex> [NO-01] ERR2 A: 0 B: 0 C: 0 RG: 0 11/07/13 16:23:35	① No: Order of recorded cycle event is displayed. Max. 32 events are displayed. ② Cycle Event Trigger ■ ERR1 : Fault Pick up trigger ■ ERR2 : Since the fault current zero-voltage trigger ■ ERR1&ERR2 : Fault Pick up & zero-voltage trigger ■ #WTRIG : User function Set trigger ③ Fault current each phase, unit A ④ Event occurrence time : Year/Month/Day Hour:Minute:Second

1. Trigger Source

- Fault wave capture point
- Fault current

2. Trigger Time

- 16 sampling per cycle.

3. Storage Capacity

- The capacity of storage is last 32 events.

4. Related Setting Menu

- ON/OFF Setting

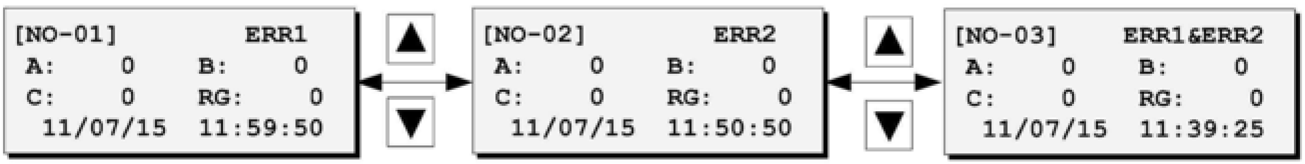
  "GLOBAL SETTINGS \ CONTROL SETUP \ EVENT RECORDER"

- Pre-Trigger length setting

  "GLOBAL SETTINGS \ CONTROL SETUP \ EVENT RECORDER"

- Stored Value Clear

  Select ***"2.Cycle Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.



Previous stored information is displayed by pressing [▼] Key, and next stored information is displayed by pressing [▲] Key. [NO-01] is the latest information stored.

6.8.8. System Event

Record and display the maximum 2048 of System status changed.

Table 6-14. System Event Description

MAIN MENU / EVENT RECORDER / SYSTEM EVENT	
[NO-0001] GLSETCHG STATUS : HI/ASSERT DATE : 11/07/15 TIME : 19:51:58	Confirm in ***"MAIN MENU / EVENT RECORDER / SYSTEM EVENT"***.

1. Trigger Source

- 52A contact
- Input/Output status change
- Front panel control
- AC power supply
- External control
- External input status
- System alarm
- Sleep mode
- V1(Source), V2(Load)
- Power Quality detect

⚠ **NOTE :** Refer to ***"Appendix B. Logic Bit Attributes & Description"*** for more details about trigger source.

2. Trigger Time

- Every 10㎳

3. Storage Capacity

- Last 2048 events

4. Related Setting Menu

- Stored Value Clear

  Select ***"3.System Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.

```
[NO-0001] GLSETCHG       ▲    [NO-0002] OPST           ▲    [NO-0003] CLST
 STATUS : HI/ASSERT    ◄──►    STATUS : HI/ASSERT    ◄──►    STATUS :LO/DEASSERT
 DATA:   11/07/15              DATA:   11/07/15              DATA:   11/07/15
 TIME:   09:00:03        ▼     TIME:   08:00:02        ▼     TIME:   08:00:01
```

Previous stored information is displayed by pressing [▼] Key, and next stored information is displayed by pressing [▲] Key. [NO-001] is the latest information stored.

6.8.9. Diagnostic Event

Record and display the maximum 512 of Diagnostic Events of System.

Table 6-15. Diagnostic Event Description

MAIN MENU / EVENT RECORDER / DIAGNOSTIC EVENT	
[NO-001] SELFTOK STATUS : HI/ASSERT DATE : 11/07/15 TIME : 19:51:58	Confirm in ***"MAIN MENU / EVENT RECORDER / DIAGNOSTIC EVENT"***.

1. Trigger Source

- SYSTEM POWER : ±12V, +5V
- A/D Converter : A/D Fail, Reference Voltage1, Reference Voltage 2
- MEMORY : PROM, SROM, FROM, DPRAM, SRAM, DSPRAM
- SETTING : GLOBAL SET, BANK1~6
- WATCH-DOG Restart
- DO Failure
- RTC Failure

> ⚠ **NOTE :** Refer to ***"Appendix B. Logic Bit Attributes & Description"*** for more details about trigger source.

2. Trigger Time

- Every 10ms

3. Storage Capacity

- Last 512 events

4. Related Setting Menu

- Stored Value Clear

  Select ***"4.Diagnostic Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.

```
[NO-001]  SELFTOK         [NO-002]      SELFTOK         [NO-003]   SELFTOK
 STATUS : HI/ASSERT   ▲   STATUS : HI/ASSERT       ▲     STATUS : HI/ASSERT
 DATA:   11/07/15   <-->   DATA:   11/07/15       <-->   DATA:   11/07/15
 TIME:   00:00:03     ▼    TIME:   00:00:02         ▼    TIME:   00:00:01
```

Previous stored information is displayed by pressing [▼] Key and next stored information is displayed by pressing [▲] Key.

6.8.10. P-Q Event

BKA101-N1 always monitors the voltages on both power source side and load side, and records the data of power outage in order to analyze the cause when the outage is detected on either side. When the outage is detected, BKA101-N1 records the outage time and duration. Besides, it also records the occurrence time and duration of sag and swell events and unbalance events.

Table 6-16. P-Q Event Description

MAIN MENU / EVENT RECORDER / P-Q EVENT	
[NO-①] ② DT: ③ DATE : ④ TIME : ⑤ Ex> [NO-001] OUTAGES DT:0000h 00m 00s 00c DATE : 11/07/15 TIME : 00:00:00	① Displays the order of the event occurrence and events from the most recent event to the oldest event. Total 512 events can be stored. ② Displays the event type. − OUTAGE-S : power supply side outage − OUTAGE-L : load side outage − SAG-A(B,C):A(B,C) phase sag. − SWL-A(B,C):A(B,C) phase swell. − UBL-SV : Voltage Unbalance on source side − UBL-LV : Voltage Unbalance on load side − UBC : Current Unbalance ③ Displays the duration of outage as in hour/minute/second and cycle added. ④ Displays the time of outage, sag, swell or unbalance detected. ⚠ **NOTE :** It does not record outage or sag/swell event if the power of BKA101-N1 was off during the outage.

1. Trigger Source

- Trigger elements : V1(Source), V2(Load)

2. Trigger Time

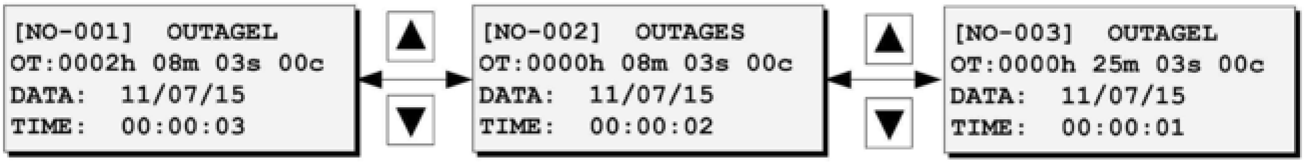
- Every 10㎳

3. Storage Capacity

- Last 512 events

4. Related Setting Menu

- Setting
  "GLOBAL SETTINGS \ SYSTEM SETUP \ POWER QUALITY"
- Stored Value Clear
  Select ***"5.P-Q Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.



Previous stored information is displayed by pressing [▼] Key and next stored information is displayed by pressing [▲] Key.

6.8.11. Switching Event

Record and display the switch status and control mode.

Table 6-17. Switching Event Description

MAIN MENU / EVENT RECORDER / SWITCHING EVENT	
[NO-001]SWITCH EVENT STATUS : OPEN CONTROL: LOCAL 11/07/15 19:51:58	Confirm in ***"MAIN MENU / EVENT RECORDER / SWITCHING EVENT"***.

1. Trigger Source

- Switch CLOSE(MANUAL/LOCAL/REMOTE)
- Switch OPEN(MANUAL/LOCAL/REMOTE)
- Earth Close(ECLOSE)
- Earth Open(EOPEN)

2. Trigger Time

- Every 10㎳

3. Storage Capacity

- Last 100 events

4. Related Setting Menu

- Stored Value Clear

  Select ***"6.Switching Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.

```
[NO-001]SWITCH EVENT        ▲      [NO-002]SWITCH EVENT        ▲      [NO-003]SWITCH EVENT
STATUS : OPEN                      STATUS : CLOSE                     STATUS : OPEN
CONTROL: LOCAL            ◄──►     CONTROL: LOCAL            ◄──►     CONTROL: LOCAL
 11/07/15   19:51:58        ▼       11/07/15   19:41:58        ▼       11/07/15   16:51:58
```

Previous stored information is displayed by pressing [▼] Key and next stored information is displayed by pressing [▲] Key.

6.8.12. Set Change Event

Record and display the maximum 100 of Set Change Events of System.

Table 6-18. Set Change Event Description

MAIN MENU / EVENT RECORDER / SET CHANGE EVENT	
[NO-001] SET CHANGE TARGET : GLOBAL DATA : 11/07/15 TIME : 19:51:58	Confirm in ***"MAIN MENU / EVENT RECORDER / SET CHANGE EVENT"***.

1. Trigger Source

- Global setting change
- SETBANK1 setting change
- SETBANK2 setting change
- SETBANK3 setting change
- SETBANK4 setting change
- SETBANK5 setting change
- SETBANK6 setting change

2. Trigger Time

- Every 10㎳

3. Storage Capacity

- Last 100 events

4. Related Setting Menu

- Stored Value Clear

  Select ***"7.Set Change Event"***, in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.

[NO-001] SET CHANGE TARGET : GLOBAL DATA : 11/07/15 TIME : 00:00:03	▲ ◄──► ▼	[NO-002] SET CHANGE TARGET : SETBANK1 DATA : 11/07/15 TIME : 00:00:02	▲ ◄──► ▼	[NO-003] SET CHANGE TARGET : SETBANK2 DATA : 11/07/15 TIME : 00:00:01

Previous stored information is displayed by pressing [▼] Key and next stored information is displayed by pressing [▲] Key.

6.8.13. Load Profile

Store and display the Demand value.

Table 6-19. Load Profile Description

MAIN MENU / EVENT RECORDER / LOAD PROFILE	
① CURRENT (A) [0001] A: 0 B: 0 C: 0 RG: 0 11/07/13 16:23:35 ② REAL POW(MW) [0001] A: 0 B: 0 C: 0 3P: 0 11/07/13 16:23:35 ③ REAC POW(Mvar)[0001] A: 0 B: 0 C: 0 3P: 0 11/07/13 16:23:35 ④ PF&ENERGY-3P [0001] PF (%) : 99.9 MWh: 49 11/07/13 16:23:35	Confirm in ***"MAIN MENU / EVENT RECORDER / LOAD PROFILE"***. To see previous value, press **[▲]** key. To see next value, press **[▼]** key. On screen ①, use **[ENTER]** key to see ②, ③, ④ screen in turn.

1. Trigger Source

- Demand Current(A, B, C, RG)
- Demand Real Power(A, B, C, 3Φ)
- Demand Reactive Power(A, B, C, 3Φ)
- Demand Energy - Positive Watthour(3Φ)
- Power Factor(3Φ)

2. Trigger Time

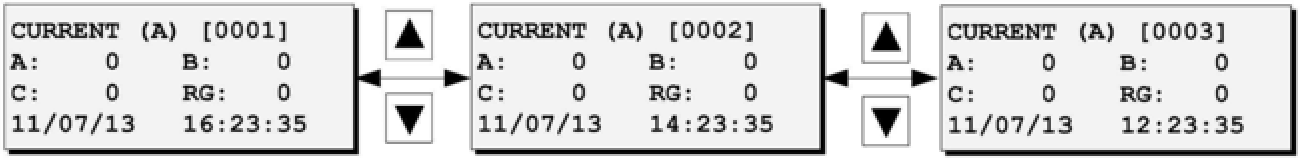
- 5, 10, 15, 20, 30, 60minute

3. Storage Capacity

- Last 5120 events

4. Related Setting Menu

- ON/OFF Setting
  "GLOBAL SETTINGS \ CONTROL SETUP \ EVENT RECORDER"
- Recording Time Interval Setting
  "GLOBAL SETTINGS \ CONTROL SETUP \ EVENT RECORDER"
- Stored Value Clear
  Select ***"8.Load Profile"*** in ***"GLOBAL SETTINGS \ CONTROL SETUP \ CLEAR SAVED DATA"*** to clear the stored value.



Previous stored information is displayed by pressing [▼] Key and next stored information is displayed by pressing [▲] Key.

> ⚠ **NOTE :** The value shown in ***"Load Profile"*** is calculated according to the demand mode set in ***"MAIN MENU/GLOBAL SETTING/CONTROL SETUP/OTHERS"***.

7. LOOP CONTROL APPLICATION

7.1. Auto Sectionalizer Loop Control

Table 7-1. Auto Sectionalizer loop control

SETTING	CB1	RC1	AS1	AS2	AS3
SECTIONALIZER					
Type Select	-	-	SEC	SEC	SEC
Sec Oper' Cnt	-	-	3	2	3
Sec RS Delay	-	-	10.00	10.00	10.00
Sec op Delay		-	0.00	0.00	0.00
CB AND RECLOSER			-	-	-
Operate count	2 Trip Lockout	4 Trip Lockout	-	-	-

※. CB(Circuit breaker), RC(Recloser), AS(Auto Sectionalizer)

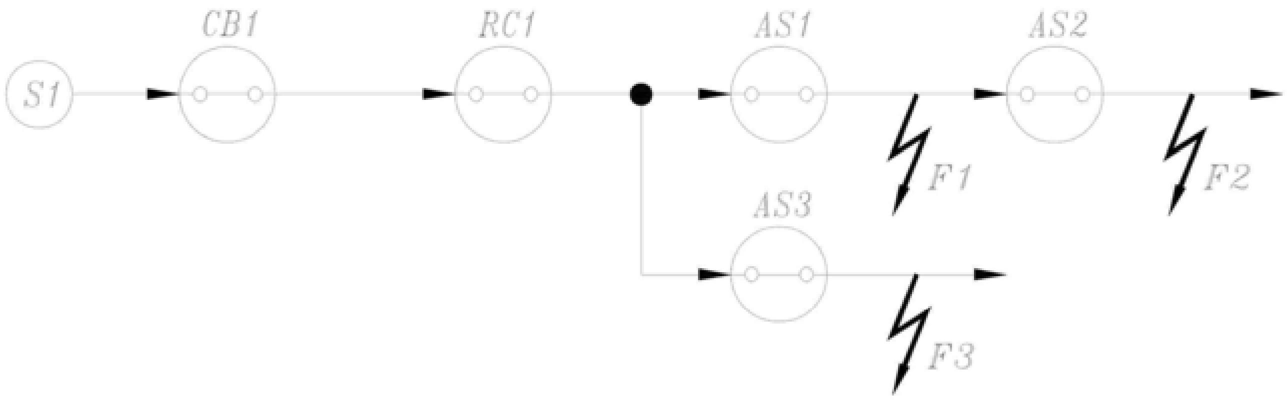


Figure 7-1. Auto Sectionalizer loop control

PRECAUTIN 1 for SETTING

1) AS is an automatic opening equipment when Dead Line Voltage. When ***"Sec OP Delay"*** time is provided, the opening time of AS shall be faster than RC1 or CB1 minimum 0.3 sec.
2) ***"Sec OP Delay"*** time of AS is better to set 0 second for Instantaneous Trip(Open).
3) Auto Sectionalizer Instantaneous Opening time : <80ms
4) Entec Recloser reclose time : Minimum 0.5sec

PRECAUTION 2 for SETTING

1) ***"Sec Oper' Cnt"*** setting of AS1 shall be higher than AS2 when AS1 and AS2 are in series connection as Auto Sectionalizer.

Loop control with F1 Fault

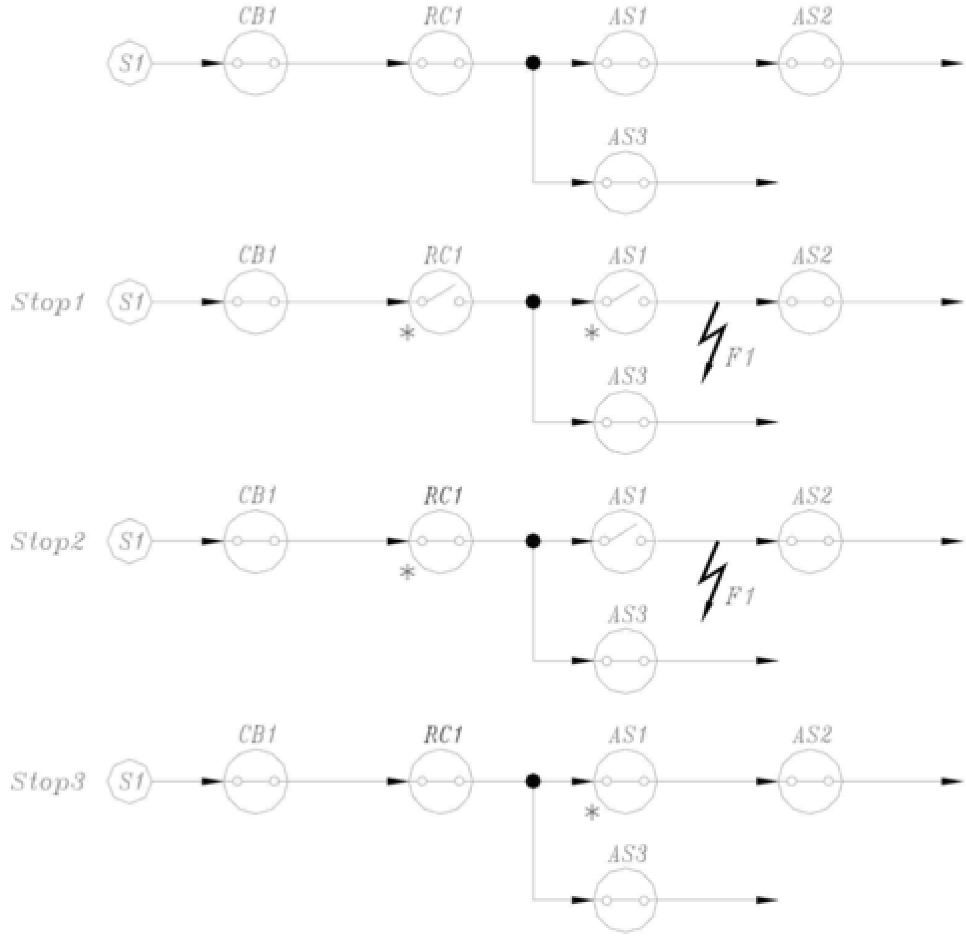


Figure 7-2. Loop Control with F1 Fault

Step1 : At F1 location, when Permanent Fault occurs, RC1 conducts reclosing cycle.
AS1 counts ***"Sec Oper'Cnt"*** when Dead line Voltage after sensing a Fault.
When RC1 trips three times, it reaches ***"Sec Oper'Cnt"*** set value (3). Then F1 location is disconnected after ***"Sec OP Delay"*** Timer is finished.
AS2, AS3 is not operated because they did not sense the fault.

Step2 : AS1 is opened and RC1 is closed after Reclosing 3 times.
RC1 is closed after AS1 disconnect F1 location, and keep the rest of line normal.

Step3 : After removing the Fault, manually (local or remote) close AS1 and recover High Voltage line.

Loop control with F2 Fault

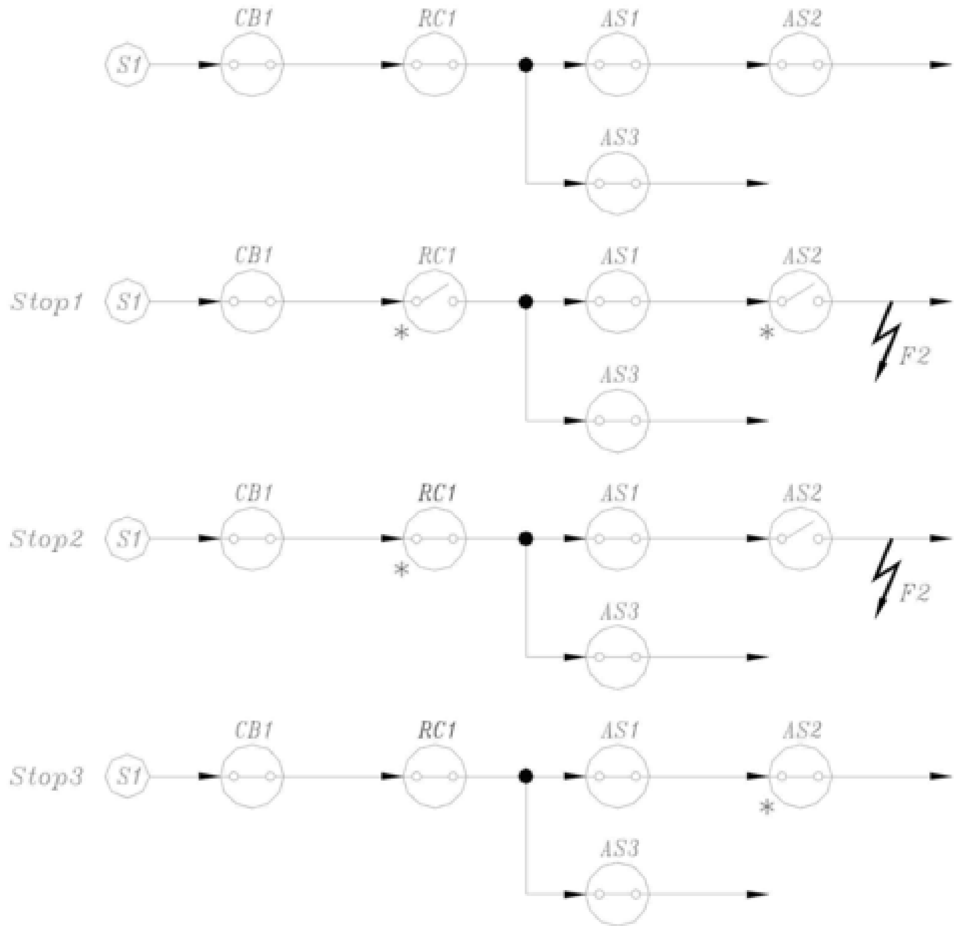


Figure 7-3. Loop Control with F2 Fault

Step1 : At F2 location, when Permanent Fault occurs, RC1 conducts reclosing cycle.
AS2 counts ***"Sec Oper'Cnt"*** when Dead line Voltage after sensing a Fault.
When RC1 trips two times, it reaches ***"Sec Oper' Cnt"*** set value (2).
Then F2 location is disconnected after ***"Sec OP Delay"*** Timer is finished.
AS1 is not operating because that ***"Sec Oper' Cnt"*** is set for 3
AS3 is not operated because AS3 did not sense the fault.

Step2 : AS2 is opened and RC1 is closed after two times of reclosing.
RC1 is closed after AS2 disconnect F2 location, and keep the rest of line normal.

Step3 : After removing the Fault, manually (local or remote) close AS2 and recover High Voltage line.

Loop control with F3 Fault

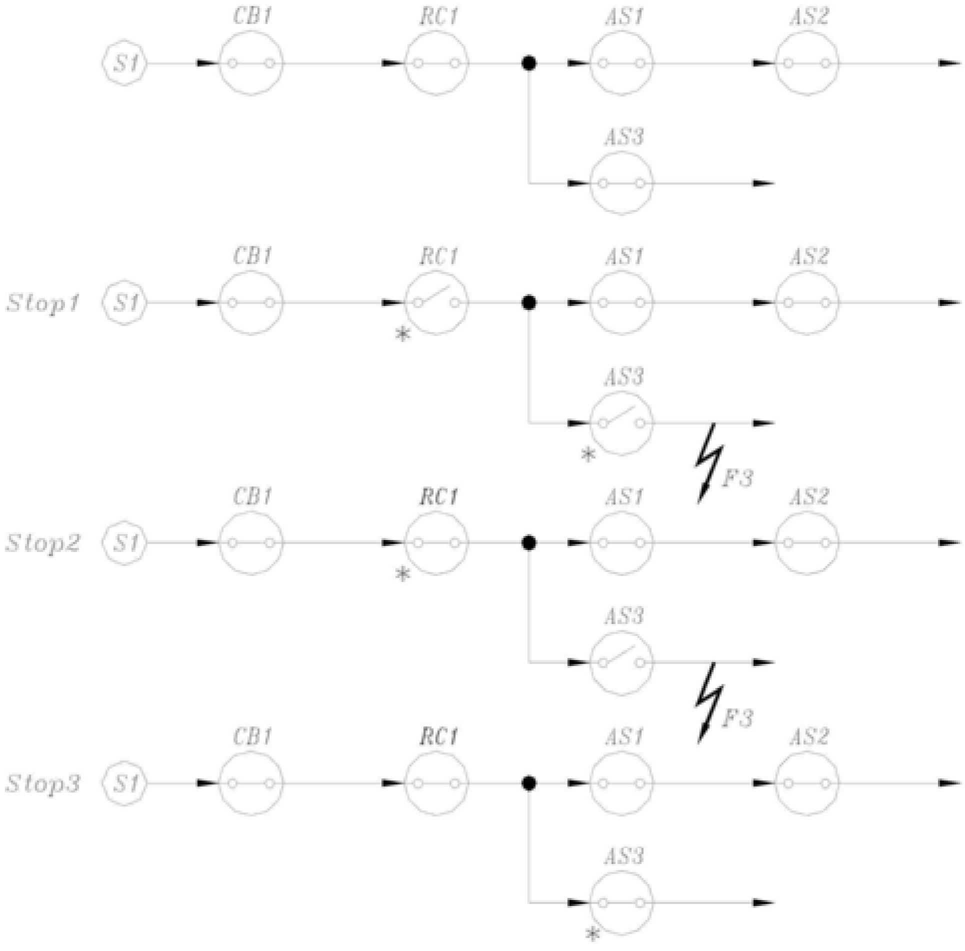


Figure 7-4. Loop Control with F3 Fault

Step1 : At F3 location, when Permanent Fault occurs, RC1 conducts reclosing cycle.
AS3 counts ***"Sec Oper' Cnt"*** when Dead line Voltage after sensing a Fault.
When RC1 trips three times, it reaches ***"Sec Oper' Cnt"*** set value (3). Then F3 location is disconnected after ***"Sec OP Delay"*** Timer is finished.
AS1, AS2 are not operating because that they did not sense the fault.

Step2 : AS3 is opened and RC1 is closed after three times of reclosing.
RC1 is closed after AS3 disconnect F3 location, and keep the rest of line normal.

Step3 : After removing the Fault, manually (local or remote) close AS3 and recover the High Voltage line.

7.2. Tie Point Switch Loop Control

Table 7-2. Tie Point Switch Loop Control

SETTING	CB1,2	SR1,2	AS1,2	TS1
SECTIONALIZER				
Function	-	-	SEC	TIE
Sec Oper' Cnt	-	-	3	-
Sec RS Delay	-	-	10.00s	-
Sec op Delay	-	-	0.00s	-
Tie VRS	-	-	-	SV1 & SV2
Tie Oper' Cnt	-	-	-	2
Tie CL Delay	-	-	-	30.00s
Tie OP Delay	-	-	-	5.00s
Tie DV1 Dly	-	-	-	1.00
Tie DV1 Dly	-	-	-	1.00
CB AND RECLOSER				
Recloser Operate count	2 Trip Lockout	4 Trip Lockout	-	-

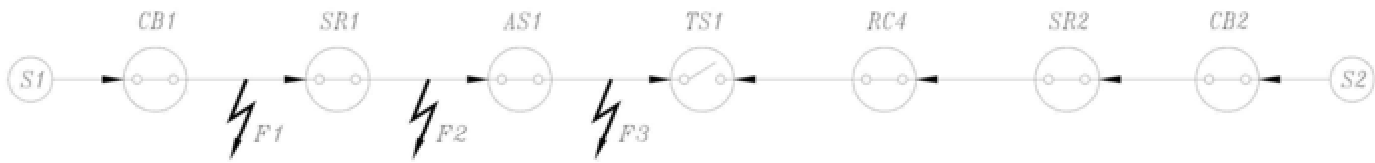


Figure 7-5. Tie Point Switch Loop Control

※. CB(Circuit breaker), RC(Recloser), AS(Auto Sectionalizer), TS(Tie Point Switch)

PRECAUTION for SETTING

1) TS1 must cooperate with BORNA Sectionalizing Recloser.
2) TS1 shall be operated when F1 is occurred in the Source side of SR, and shall be set for not operating when F2, F3 occur in Load side.
3) To prevent further fault, TS1 shall be operated after BORNA Sectionalizing Recloser trips and disconnects a fault area.
4) BORNA Sectionalizing Recloser is automatically opened when Source and Load side become Dead line Voltage (DV), and automatically closed when Source side and Load side become Live line Voltage (LV).
5) The count number of SR1 and AS1 shall be larger than the count number of TS1.
6) ***"Tie Oper' Cnt"*** of TS1 is set 2, AS1 shall be set 3, and SR1 shall be set 4 to cooperate with AS1.
7) TS shall not be closed when a fault occurs between SR1 and TS1. If ***"Tie Oper' Cnt"*** of TS1 is set to 2, Close delay time shall be set to longer than 5 seconds which is 2 times of SR1 reclosing time.

Loop control with F1 Fault

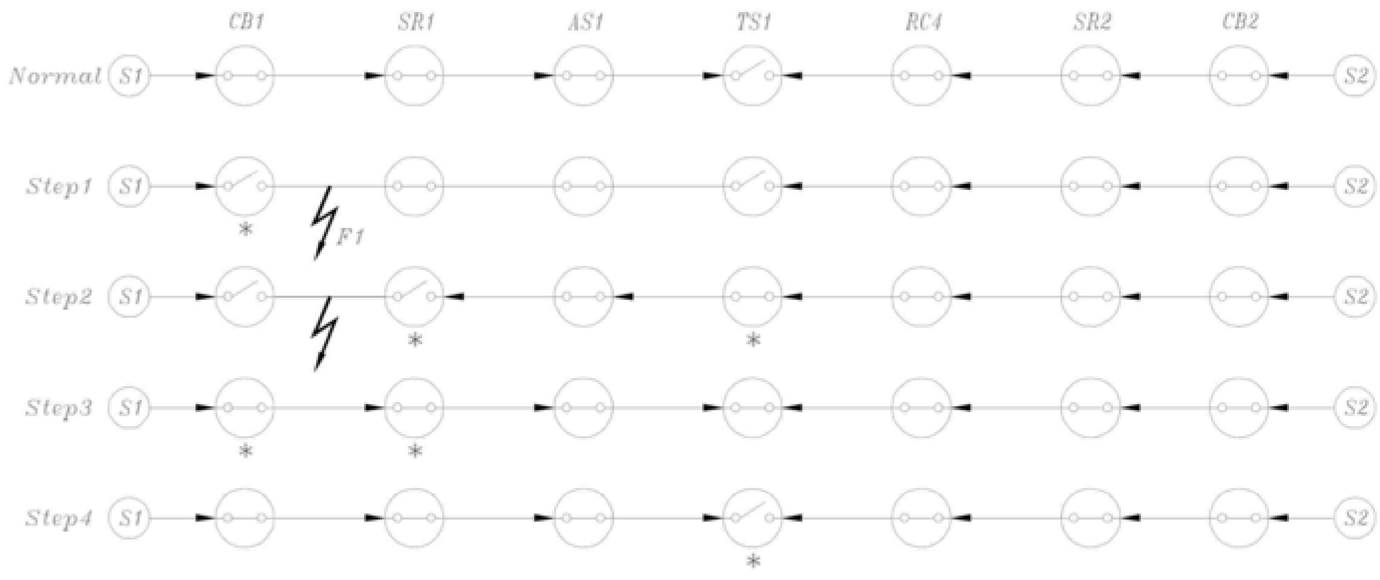


Figure 7-6. Loop Control with F1 Fault

Step1 : At F1 location, when Permanent Fault occurs, CB1 locked out after conducting reclosing cycle.

Step2 : SR1 counts Dead line Voltage time till a set time, then automatically opens (disconnects) F1 location.

"Tie Oper' Cnt" is set 2. When CB1 trips two times, ***"Tie CL Delay"*** is run and after 30 seconds, TS1 is closed.

F1 is disconnected and the rest of High Voltage line shall be operated to the opposite direction.

Step3 : After removing the fault, close CB1 manually (local or remote), SR1 is automatically closed after a setting time.

Step4 : Open TS1 manually (local or remote) and recover High Voltage line.

Loop control with F2 Fault

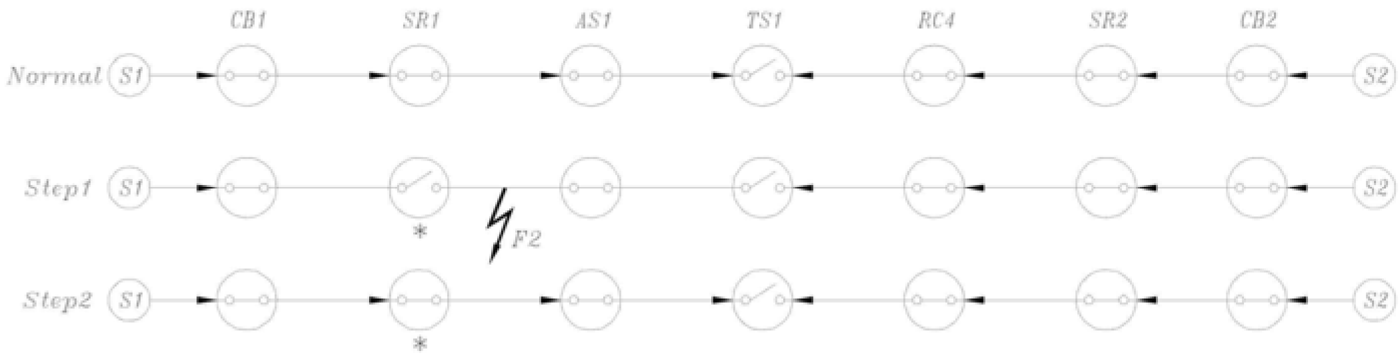


Figure 7-7. Loop Control with F2 Fault

Step1 : At F1 location, when Permanent Fault occurs, CB1 locked out after conducting reclosing cycle.
If SR1 trips two times, TS1 counts 2 and Close delay time is ran.
While Close delay time of TS1 is operating, SR1 becomes Live line Voltage by reclosing, and Close delay time is reset.
If SR1 trips three times, TS1 counts 3, it is more than ***"Tie Oper' Cnt"*** 2, so that Close delay time doesn't run.
When SR1 trips 4 times and locked out, TS1 counts 4. Close delay time doesn't run.

Step2 : Open SR1 manually (local or remote) and recover High Voltage line.

Loop control with F3 Fault

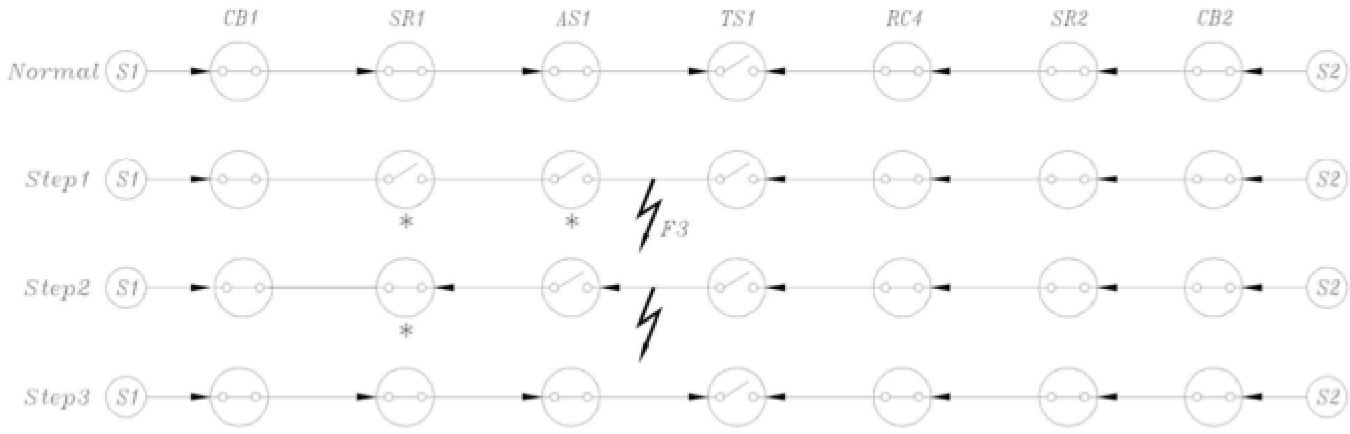


Figure 7-8. Loop Control with F3 Fault

Step1 : At F3 location, when Permanent Fault occurs, SR1 trips 4 times and locked out after conducting reclosing cycle.

If SR1 trips two times, TS1 counts 2 and Close delay time runs.

While Close delay time of TS1 is operating, SR1 becomes Live line Voltage by reclosing, and Close delay time is reset.

If SR1 trips three times, AS1 is automatically opened, TS1 counts 3, and it is more than ***"Tie Oper' Cnt"*** 2, so that Close delay time doesn't run.

Step2 : After AS1 disconnects with F3, SR1 is reclosed and keeps the rest of High Voltage line normal.

Step3 : After removing the fault, close AS1 manually (local or remote) and recover High Voltage line.