

014



## Series BD electric transmitters

Installation and Operation Instruction V1.4

Acrel Co . , Ltd.

# DECLARATION

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This company reserve power of revision of product specification described in this manual, without notice. Before ordering, please consult local agent for the latest specification of product.

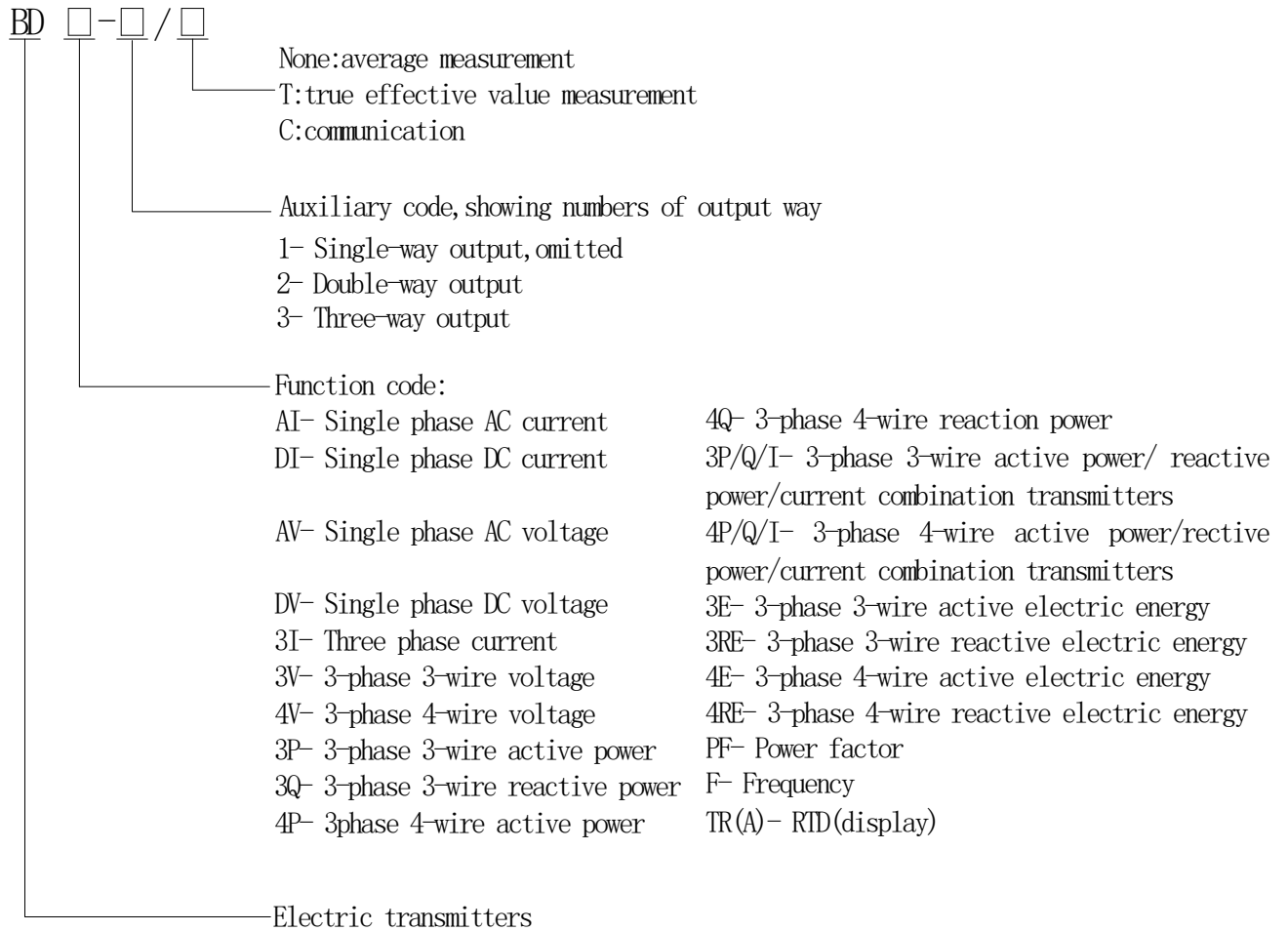
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## 1 General

Series BD electric transmitters is a device which can isolate and transmit electric parameters, such as current, voltage, frequency, power, power factor, into linear DC analog signal or digital signal. It meet the requirements of National standard GB/T13850-1998, IEC-688.

## 2 Type explanation



### 3General technical condition

Technical parameters		Value
Accuracy class		0.5、0.2
Input	Nominal value	Current AC、DC 1A、5A; Voltage AC、DC 100V、300V、500V.etc
	Overload	Continual 1.2 times, Instantaneous current 10 times/5s; Instantaneous voltage 2 times/30s;
	Consumption	$\leq 0.3VA$ Current input; Voltage input, $\leq 0.3VA(100V/h)$ , $\leq 0.6VA(300V/h)$ , $\leq 1VA(500V/h)$
	Frequency	$50 \pm 5Hz$ , $60 \pm 5Hz$
Output	Normal value	DC:4-20mA、0-20mA, 0-5V, 0-10V.etc(And so on)
	Load resistance	Current output $\leq 600 \Omega$ Voltage output $\geq 1000 \Omega$
	Ripple content	$<0.5\%$ peak value
Response time		$\leq 400ms$
Power supply	Voltage	AC85-265V、DC100-350V
	Consumption	AC current, voltage $\leq 3VA$ , Power $\leq 4VA$
Insulation resistance		$\geq 100M \Omega$
Isolation voltage		Among input//output//power supply $2.0kV/1min$ , 50Hz
Temperature modulus		$\leq 200ppm/^{\circ}C$
Environment	Temperature	工作(Work): $-10^{\circ}C \sim +55^{\circ}C$ Storage: $-25^{\circ}C \sim +70^{\circ}C$
	Humanity	$\leq 90\%RH$ , (In the place without dew and corrosive gas)
	Altitude	$\leq 2000m$
Fix mode		TS35 Rail, or fix to cubicle with bolt

## 4 Type of products

### 4.1 Current, voltage transmitters

#### ■ Usage

Measure current, voltage signal, isolate and transmit analog signal output.

#### ■ Specification

BD-AI AC current transmitters

BD-DI DC current transmitters

BD-AV AC voltage transmitters

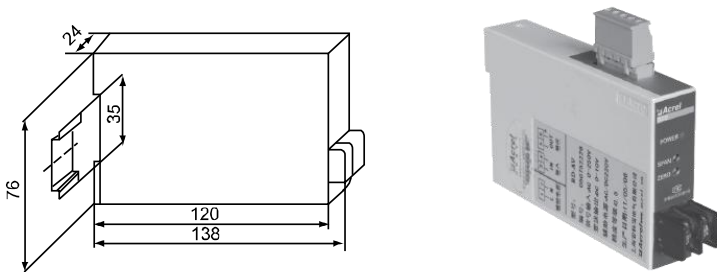
BD-DV DC voltage transmitters

BD-AI/C AC current transmitters  
With communication function

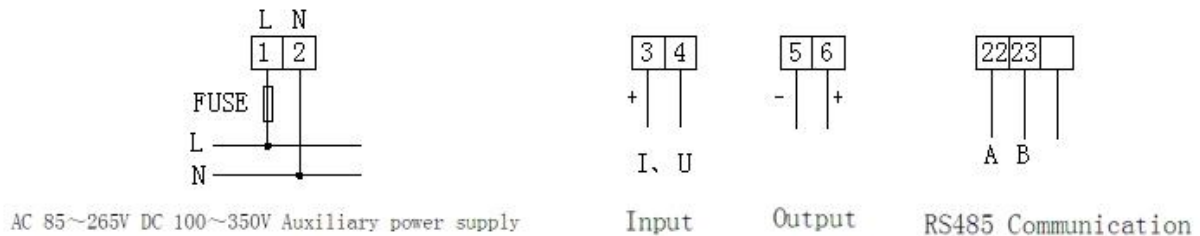
BD-AV/C AC voltage transmitters  
With communication function

Note: BD-AI/T, BD-AV/T adopts effective value measuring circuit, and can measure various sine wave or non-sine wave correctly.

#### ■ Outline dimension



#### ■ Wiring



#### ■ Order example

E.g. Type: BD-AI

Auxiliary power supply: AC220V/50Hz

Input: 5A

Output: 4~20mA

Note: Only instrument BD-AI、BD-AV with RS485 communication function。

### 4.2 Three-phase current, voltage transmitters

#### ■ Usage

Measure three-phase current or voltage, isolate and transmit 3-channel analog output.

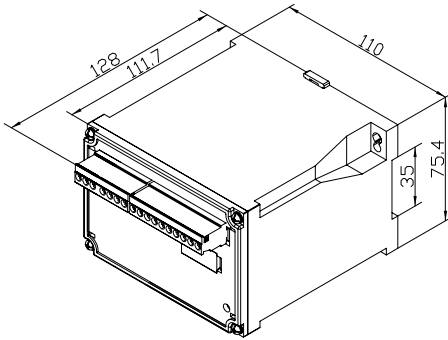
#### ■ Specification

BD-3I3 Three-phase current transmitters

BD-3V3 Three-phase 3-wire voltage transmitters

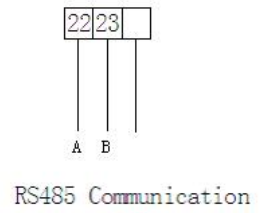
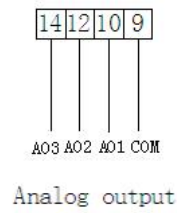
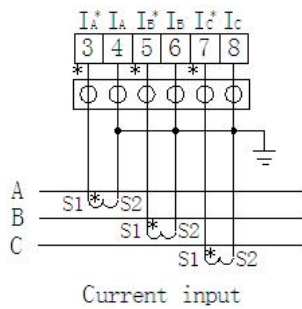
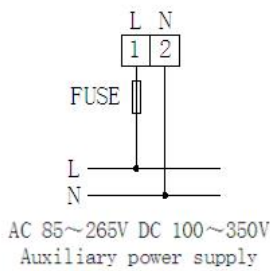
BD-4V3 Three-phase 4-wire voltage transmitters

■ Outline dimension

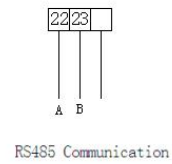
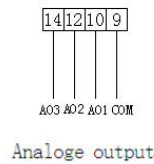
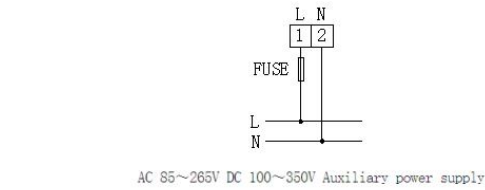
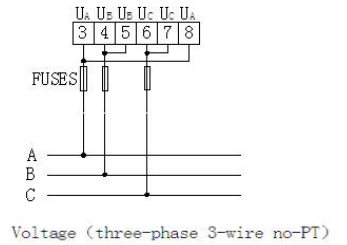
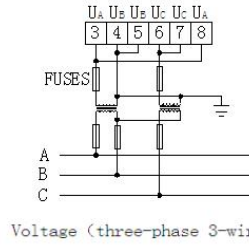
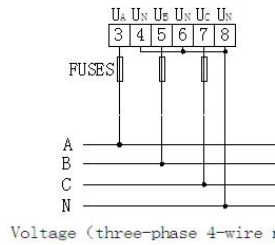
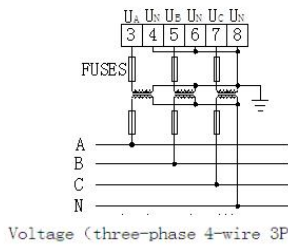


■ Wiring

Current transmitters



Voltage transmitters



■ Order example

E.g. Type: BD-3I3

Auxiliary power supply: AC220V/50Hz

Input: 5A

Output: 3-channel 4~20mA

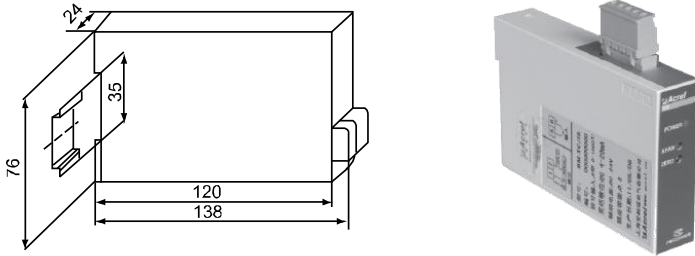
4.3 RTDtransmitters

■ Usage

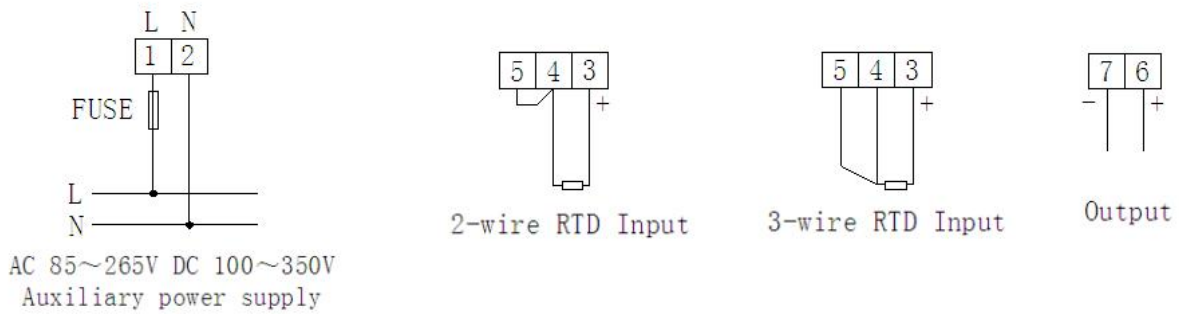
The module have features of power supply by output circuit, RTD input, 4~20mA signal output to be isolated from 2000V, fitted with surge protection circuit , so fits for foul environment.

- Specification  
BD-TR/I, BD-TR/V

- Outline dimension



- Wiring



- Order example

E.g. Type: BD-TR/I

Auxiliary power supply: AC220V/50Hz

Input: PT100 0~200°C

Output: 4~20mA

#### 4.4 Intelligent temperature transmitters

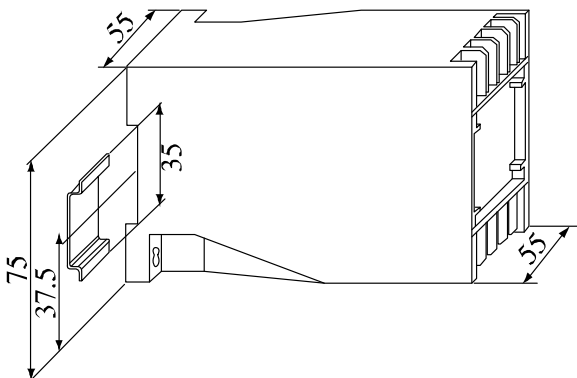
- Usage

RTDinput and temperature display function, isolate and transmit into standard analog output (4-20mA or 0-20mA or 0-5V or 0-10V). It can directly connect pointer digital display meters, and matches with automation meters (PLC), kinds of A/D converter, computer system.

- Specification

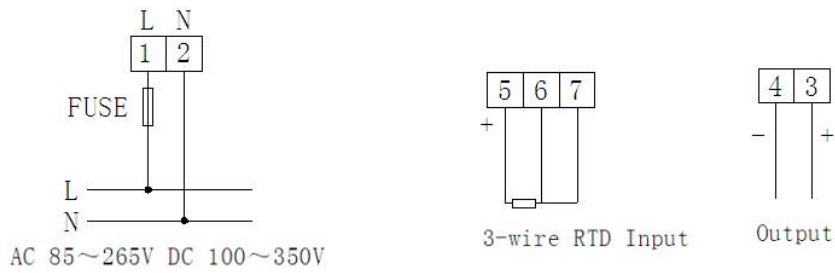
BD-TRA intelligent temperature transmitters

- Outline dimension





## ■ Wiring



## ■ Order example

E.g. Type: BD-TRA

Auxiliary power supply: AC220V/50Hz

Input: PT100 0~200°C

Output: 4~20mA

## 4.5 Power transmitters

### ■ Usage

Measure active power, reactive power, isolate and transmit analog output.

### ■ Specification

BD-3P Three-phase 3-wire active power transmitters

BD-3Q Three-phase 3-wire reactive power transmitters

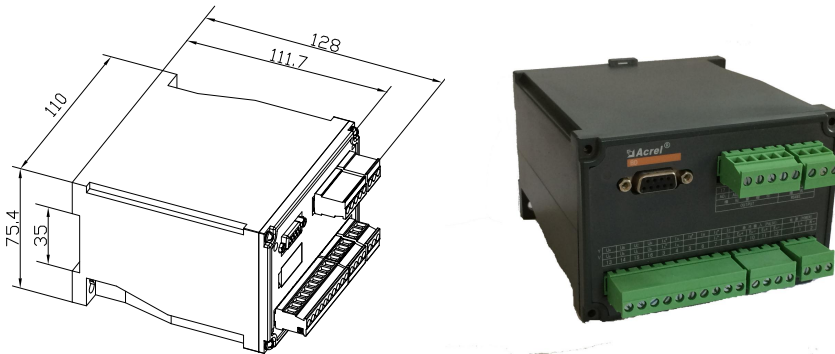
BD-3P/Q/I Three-phase 3-wire active power/reactive power/current combination transmitters

BD-4P/Q/I Three-phase 4-wire active power/reactive power/current combination transmitters

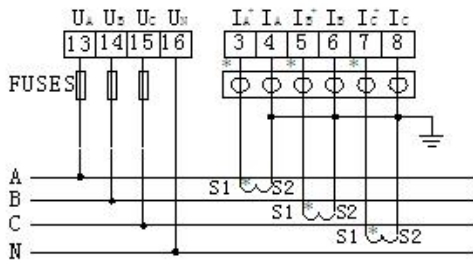
BD-4P Three-phase 4-wire active power transmitters

BD-4Q Three-phase 4-wire reactive power transmitters

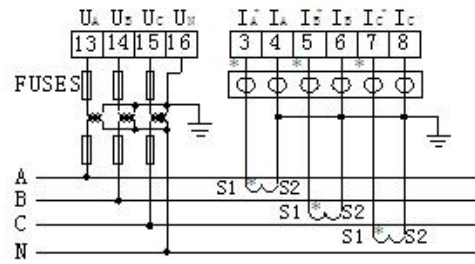
## ■ Outline dimension



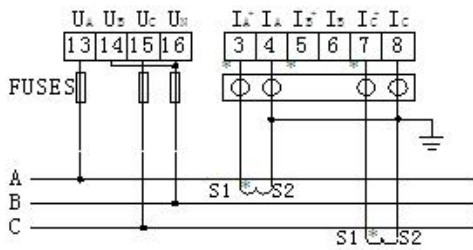
■ Wiring



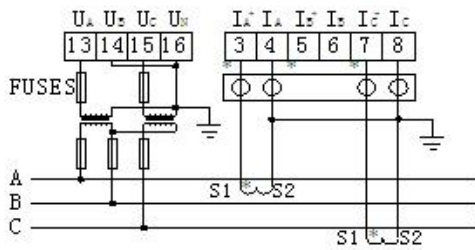
Three-phase 4-wire 3CT



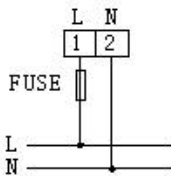
Three-phase 4-wire 3PT, 3CT



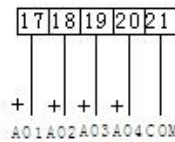
Three-phase 3-wire 2CT



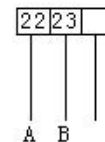
Three-phase 3-wire 2PT, 2CT



Auxiliary power supply



P/Q/I Analog output



RS485 Communication

■ Order example

E.g. Type: BD-3P

Auxiliary power supply: AC220V/50Hz

Input: Current/5A Voltage/100V Power/866W

Output: 4~20mA corresponds 0~866W

4.6 Power factor transmitters

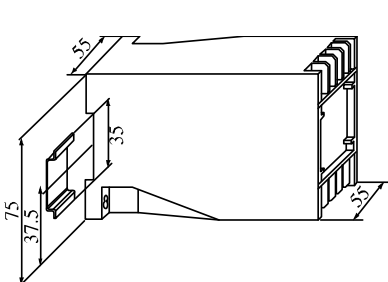
■ Usage

Measure power factor of single, three-phase system, isolate and transmit into DC signal output. It is used for information input of telemechanism, computer, automation control system. It is widely used in electric power system.

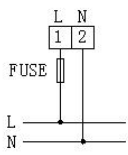
■ Specification

BD-PF

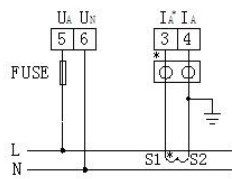
■ Outline dimension



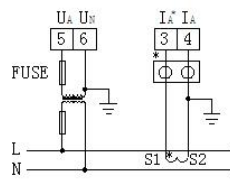
■ **Wiring**



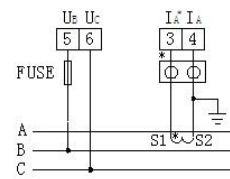
AC 85~265V DC 100~350V  
Auxiliary power supply



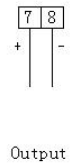
Single phase 1CT



Single phase 1PT, 1CT



Three-phase



Output

■ **Order example**

E.g. Type: BD-PF

Auxiliary power supply: AC220V/50Hz

Input: Current/5A Voltage/100V

Output: 4~20mA corresponds 0~1

4.7 Frequency transmitters

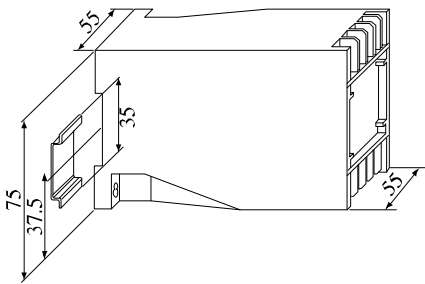
■ **Usage**

Measure frequency, transmit frequency into linear DC signal output, then isolate and deliver to telemechanics device, computer and so on.

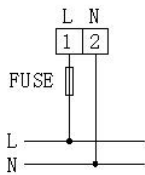
■ **Specification**

BD-F

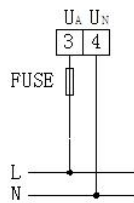
■ **Outline dimension**



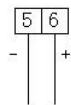
■ **Wiring**



AC 85~265V DC 100~350V  
Auxiliary power supply



Input



Output



RS485 Communication

■ **Order example**

E.g. Type: BD-F

Auxiliary power supply: 220V/50Hz

Input: 100V

Output: 4~20mA Corresponds 45~50~55Hz

## 4.8 Multi-electrical parameters digital transmitters

### ■ Usage

Transmit kWh value of electric power system into high linear pulse. It has RS485 communication interface, adopts Modbus protocol, and exports three-phase current, voltage, active power, reactive power, frequency, power factor, active energy reactive energy and so on. 1~4 channel analog optional, two channel electric energy pulse output.

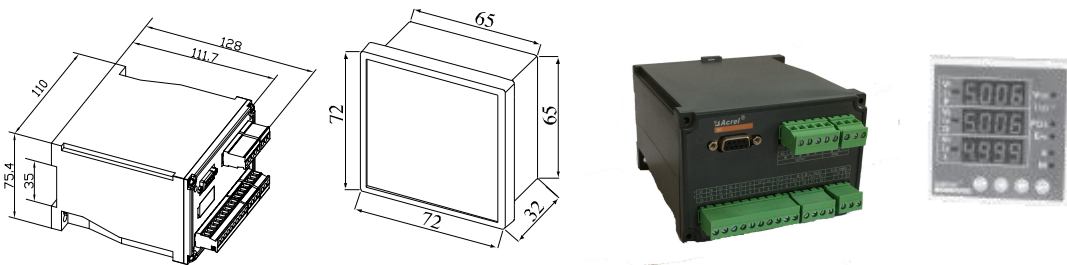
### ■ Specification

BD-3E Three-phase 3-wire Multi-electrical parameters digital transmitters

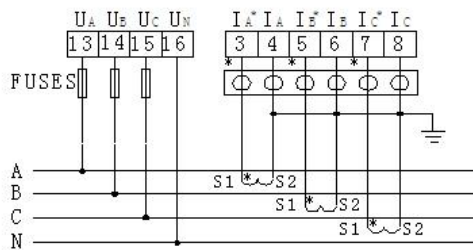
BD-4E Three-phase 4-wire Multi-electrical parameters digital transmitters

BD-4EA Combined multi-functional power meters

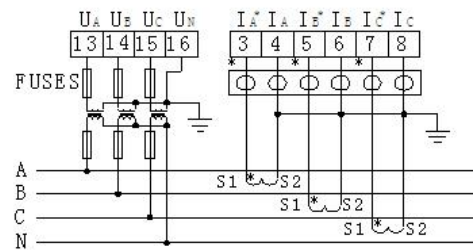
### ■ Outline dimension



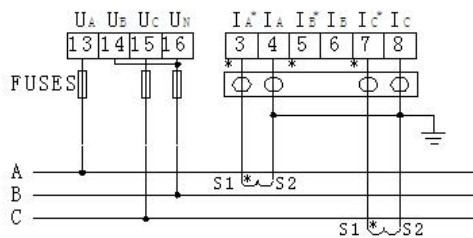
### ■ Wiring



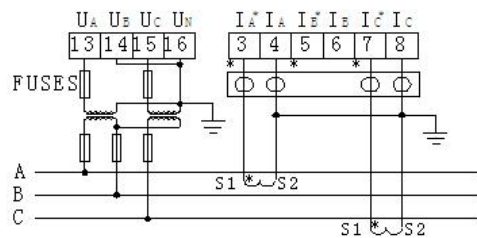
Three-phase 4-wire 3CT



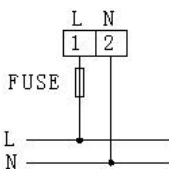
Three-phase 4-wire 3PT, 3CT



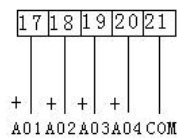
Three-phase 3-wire 2CT



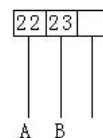
Three-phase 3-wire 2PT, 2CT



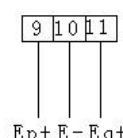
Auxiliary power supply



P/Q/I Analog output



RS485 Communication



Electric energy pulse

E.g. Input signal is AC 100V 5A, 4-channel transmitting output corresponding relation

Transmitting output	Measuring object	Corresponding relation
AO1	P	4-20mA corresponds to 0-866W
AO2	Q	4-20mA corresponds to 0-866var
AO3	Ia	4-20mA corresponds to 0-5A
AO4	PF	4-20mA corresponds to 0-1

■ Order example

E.g. Type: BD-3E

Auxiliary power supply: 220V/50Hz

Input: Current/5A Voltage/100V Power/866W

Output: 40000 pulse/kWh

Note: DT 80-E single-phase active electric energy meters are mainly suitable in the outlet circuits of low voltage draw-out cubicles such as GCK, GCS, MNS etc., particularly used for position with electrical components layout in more compact condition. It consists of BD-4E for acquiring and treating signal, displays. BD-4E is mounted onto the inner guide rail, the display is mounted onto the face plate of cubicle. Its function is identical with that of ACR 220E

## 5 Operating guide

After as per description and correct connection, switching-on working power supply, then enter the measuring condition.

### 5.1 View Status (View current, voltage, power and electric energy and frequency)

Under measuring condition click corresponding function key, switching View orderly: voltage V, frequency, current I, power PQS, power factor, switching input/output status, active electric energy  $E_q$  and reactive electric energy  $E_q$  and time.

■ voltage display primary side value, unit: V, when primary side voltage reached preset bound, display unit convert as kV.

■ current display primary side value, unit: A, when primary side current reached preset bound, display unit convert as kA.

■ power display primary side value, active power unit: W, reactive power unit: Var, when power value reached preset bound, display unit convert as kW or MW and kVar or MVar, when connection mode as four wire three phase, if active power or power factor of one phase is negative value, it is possible that connection of current inlet and outlet of this phase is just reversal.

■ display electric energy as secondary side value, electric energy display unit only as kWh, when display electric energy, it should be expressed with two decimal points, i.e. with accuracy to 0.01 kWh.

### 5.2 Operation character Description

Character	Textual description	Character	Textual description
PASS	Password	InCt	Current network
Addr	Address	In-I	Input current range
bAUd	Baud rate	Ct	Current magnification
UnEt	Voltage network	Tr-x(x=1,2,3,4)	Transmitting output setting
L3.3	Three phase three wire	SYS	System setting
L3.4	Four wire three phase	CodE	Setting password
In-U	Input voltage range	CLr.E	Electric energy zero clearing
Pt	Voltage magnification		

### 5.3 System setting mode

#### 5.3.1 Enter/Exit system setting mode

Under normal condition, meter is in normal working condition, press down SET and ENTER, will enter system setting mode, before enter system setting mode, firstly, enter correct password PASS (generally, the deliver setting is 0001).

Method of enter password:

(1) press SET, then press ENTER again to enter pressing password condition;

(2) press left/right direction key, decrease/increase number up to correct password (Press down left/right direction key+ ENTER key at the same time can implement decrease/increase the hundreds'digit/tens'digit number);

(3) Press ENTER, to confirm data entered system setting mode.

■ If pressing correct password, then entering system setting mode.

■ Meter's deliver default password setting is 0001.

■ Under system setting mode, at any time, click SET continuously, can exit system setting mode and inquire: save setting? (press ENTER to save, and press SET for Don't Save, press other key to continue setting) then return to measuring condition.

■ Under system setting mode, each item is stored in storage, after successful setting, before next setting, it is always valid.

#### 5.3.2 Operation under system setting mode

Under system setting mode, SET key is used for return to previous menu, left key and right key is used for switching setting item or changing the content to be setting, ENTER is used for confirm the item to be setting. System setting mode have following primary setting items: Communication Address setting and Baud rate setting (Addr, bAUd), input signal condition setting, transmitting output setting (tr-1~tr-4), password (Code) and zero clearing (CLr.E) setting (SYS).

#### 5.3.3 Transmitting output setting

For common grid 26 electric parameters(UA、UB、UC、UAB、UBC、UCA、IA、IB、IC、PA、PB、PC、P total、QA、QB、QC、Q total、PFA、PFB、PFC、PF、SA、SB、SC、S total、F), the analog transmitting output can mostly isolate 4 items to transmit output DC signal of 4~20mA.

Display				Meaning
9	10	11	12	Setting serial number
tr-1	tr-2	tr-3	tr-4	Transmit setting symbol and ordinal number
102	102	102	102	The first left bit is transmitting selection, 4-20mA output=1; the third, the fourth bit is transmitting quantity selection, 01 represent UA, 02 represent UB.....26 represent frequency (Sort above 26 electric parameters as sequence 1~26)
5000	5000	5000	5000	20mA corresponding to displayed value, take highest four-digit integers (ignoring decimal point) with 0 occupy lacking bit. Example: current 600A/5A, when 600A corresponding to 20mA, setting=6000; For setting power, as 10k/100V, 600A/5A, four wire three phase, then 100% power is $10kV \times 600A \times \sqrt{3} = 1039.2kW$ , Value=1039; For three phase three wire then $10kV \times 600A \times \sqrt{3} = 1039.2kW$ , Value=1039

## 6 Communication guide

### 6.1 Communication

This chapter mainly describes how to use software through communication port to operate and control this transmitter. To grasp content in this chapter, you should have enough knowledge accumulation of MODBUS protocol, read and familiar with all content of this manual, and full understanding of functions and application concept of this product.

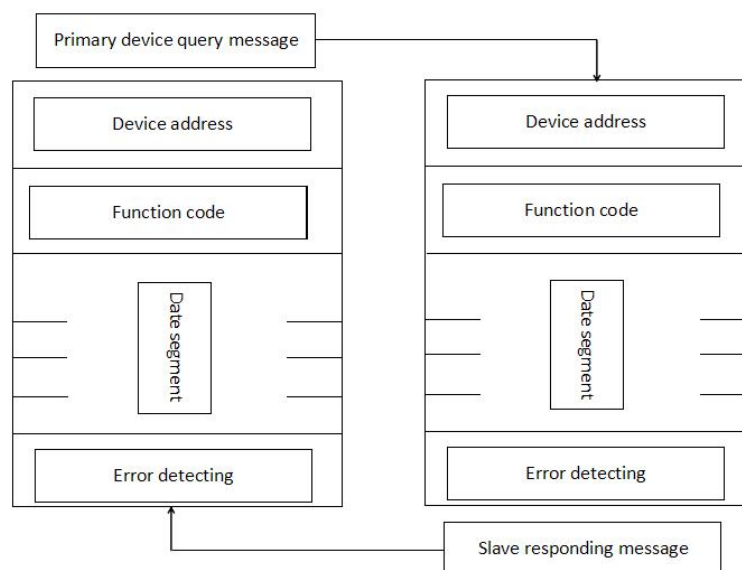
This section covers: MODBUS protocol compendium, expounding communication apply formatting, details for applying this machine and parameter address table.

### 6.2 MODBUS protocol compendium

BD-3E(A)/BD-4E(A) multiple electric parameters combined transmitter use MODBUS-RTU communication protocol, MODBUS protocol define detailedly: check code, data sequence etc., these are necessary content for specific data exchange. MODBUS protocol use master/slave responding connection (half-duplex) on one communication line, this means on one separated communication line, signal transmit in opposite directions. Firstly, master computer signal addressed only one terminal device (slave), then, the reply signal sent by terminal device transmit to the master in opposite directions.

MODBUS protocol only allow communication between the master (PC, PLCetc.) and terminal device, but not allow data exchange between independent terminal devices, so, each terminal device does not occupy communication line in the initialization, only respond query signal reach to the computer.

### 6.3 Query-respond period



Master - slave query-respond period table

#### 6.3.1 Query

The functional code of query message tells the selected slave device to implement what function. Data segment included any additional message implemented function by slave device. For example: functional code03 demand slave device to read holding register and return their content. The data segment must include message to be telling to slave device: the register starting read and register quantity to be read. Error detecting domain provide slave device with one method to verify the message content is correct or not.

### 6.3.2 Respond

If slave device produce one normal respond, the functional code of respond message is enquiring the respond of functional code of query message. The data segment include data collected by slave device: such as register value or condition. If error occur, functional code will be revised to indicate that the respond message is wrong, while the data segment include code describing this error message. Error detecting domain allow primary device to confirm message content is usable or not.

### 6.4 Transmission mode

Transmission mode refer to one series of independent data structure, and limited regulation used for transmission data in one data frame, the transmission mode compatible with MODBUS protocol-RTU mode is defined as follows:

Bit of each byte:

- One start bit
- Eight data bit, least significance bit first transmitting
- Non-Parity bit
- 1 stop bit

Error detecting (Error checking)

CRC (cyclic redundancy check)

### 6.5 Protocol

When Data frame reach terminal device, enter addressed device by a simple "port" this device remove Data frame "envelope" (data head), read data, if there is no error, executing task requested by data, then, add the new produced data in the obtained "envelope", return the data frame to the transmitter. Returned responding data include following content: slave terminal address (Address), executed command (Function), requested data produced by executing command (Data) and one CRC check code (Check). If any error occur, no successful responding or returning one error indication frame.

#### 6.5.1 Protocol

Address	Function	Data	Check
8-Bits	8-Bits	$N \times 8$ -Bits	16-Bits

#### 6.5.2 Address domain

Address domain is located at beginning of frame, composed of one byte (8 bit binary system domain), decimal system is 0~255, in the ACR meters, just 1~247 is used, other address is Reserved. these bits indicate terminal device address specified by users, this device will receive the connecting host computer data. Every terminal device has its only one address, only the addressing terminal is responding enquiry including this address. When terminal is Transmitting one responding, the responding slave address data tell host computer that which terminal is communicating with it.

#### 6.5.3 Function domain

Function domain tell the addressed terminal to execute what function. Below table list: function domain used in this Series meters, and their meaning and function.

Code	Meaning	Action
03	Read data register	Obtain current binary value of one or multiple register
16	Preset multi-register	Set binary value into a series of multiple register



#### 6.5.4 Data domain

Data field is including the data needed by terminal for executing specific function, or the collected data when terminal is responding enquiry. Content of these data may be value, reference address or setting value. For example: The function domain tell terminal to Read one register, the data field need to specify the starting register and Read how many data, the built-in address and data have different content depending on type and slave computer.

#### 6.5.5 Error check field

This field allows the error in checking and transmitting of host computer and terminal. Due to electric noise and other interfere, when one group of data is transmitting from one device to another device, on the transmitting line, some change may be produced. The error check can enable the host computer or terminal not responding those changed data, so, safety, reliability and efficiency of system are upgraded. It used 16 bit Cyclic Redundancy Check (CRC16).

#### 6.6 Method to create error check code (CRC)

Error check (CRC) domain occupy 2 byte, including one 16 bit binary system value. CRC value is calculated by transmission device, then attached to the data frame, the receiving device, while receiving, it calculates the CRC value again, then comparing it with the receiving CRC domain value, if these two values is not equal, it shows a error occurs.

When operating, firstly, preset one 16-bit register as All-1, then continuously operating each byte 8 bit of Data frame and current value of this register, only every 8 data bit of each byte to participate in forming CRC the start bit and stop bit and usable parity bit have no affect on the CRC. When forming CRC, every 8 data bit of each byte and content of register carry out exclusive or operation, then shift the result to the low bit the high bit is filled with 0, shift out the least significant bit (LSB) is shifted out and tested, if it is 1, this register and one preset fixed value (0A001H) carry out one exclusive or operation, if the least significant bit is 0, no treating is needed.

The above said processing is performed repeatedly, until finishing shift operation for 8 times, after the last bit (8th bit) is shifted, the next 8 bit byte and register current value carry out exclusive or operation, after all byte of data frame have been treated, the result final value is CRC value.

Flow for forming one CRC:

1. Preset one 16 bit register as OFFFHH (All-1), called as CRC register.
2. 8 bit of data frame first byte and low byte of CRC register carry out exclusive or operation, then save its result back to CRC register.
3. Right shift CRC register for one bit, the most significant bit is filled with 0, the least significant bit is shifted out and tested.
4. If the least significant bit is 0, Repeat the third step (next shift); If the least significant bit is 1, CRC register and preset fixed value specified (0A001H) carry out exclusive or operation.
5. Repeat the third step and the fourth step until shift for 8 times, the complete 8 bit is done.
6. Repeat the second step to the fifth step to treat next 8 bit until all the byte is treated.
7. The CRC register final value is CRC value.

Besides, there is another CRC calculation method by preset table, its main feature is fast calculating speed, but large saving space is needed, please refer to related data.

#### 6.7 Communication apply format expound

Example used in this section possibly adopt format shown in below diagram, (digital as Hex).

Addr	Fun	Data start Reg hi	Data start Reg lo	Data # of Regs hi	Data # of Regs lo	CRC16 lo	CRC16 hi
01H	03H	00H	00H	00H	03H	05H	CBH

### 6.7.1 Read data (function code03)

#### Query data frame

This function allows user to obtain data and system parameter collected and recorded by device. The data number every requested by host computer have no limit, but must not exceed the defined Address range.

Below example is three basic data collected from reading No.01 slave (each Address of data frame occupy 2 byte) UA、UB、UC, thereinto UA's Address is 0025H, UB's Address is 0026H, UC's Address is 0027H.

Addr	Fun	Data start Reg hi	Data start Reg lo	Data # of Regs hi	Data # of Regs lo	CRC16 lo	CRC16 hi
01H	03H	00H	25H	00H	03H	14H	00H

#### Respond data frame

Respond include: slave Address, function code, data number and CRC error check.

Below example is result of reading UA、UB、UC(UA=082CH, UB=082AH, UC=082CH) respond.

Addr	Fun	Byte count	Data1 hi	Data1 lo	Data2 hi	Data2 lo	Data3 hi	Data3 lo	CRC16 lo	CRC16 hi
01H	03H	06H	08H	2CH	08H	2AH	08H	2CH	94H	4EH

#### Error indicating code

If the Address requested by host computer is inexistence, then return to Error indicating code: FFH.

### 6.7.2 Preset multi- register (function code16)

#### Query data frame

Function code16 allow user to change content of multiple register, system parameter in this transmitter, write in electric energy quantity with this function number. For the host computer, the most data number once written in is 16 (32byte).

Below example is that preset No.01 slave absorptive active electric energy (Positive active electric energy) EP\_imp as 178077833wh. Hex as 0A9D4089H. EP\_imp Address is 003FH, 0040H, EP\_imp occupy 32 byte, total of 4 bytes.

Addr	Fun	Data start reg hi	Data start reg lo	Data #of regs hi	Data #of regs lo
01H	10H	00H	3FH	00H	02H

Value hi	Value lo	Value hi	Value lo	CCRC lo	CRC hi
0AH	9DH	40H	89H	38H	91H

#### Respond dataframe

Normal Respond for request of preset single register is that after register value is changed, respond the machine Address, function number, Data start Address, data number, CRC check code. Shown as below diagram.

Addr	Fun	Data start reg hi	Data start reg lo	Bytecount	CRC16 lo	CRC16 hi
01H	10H	00H	3FH	04H	0DH	33H

#### Error indicating code

If the Address requested by host computer is inexistence, or data number is not correct, then return to Error indicating code: FFH.

### 6.8 Rpplication details and parameter Address table of combined multiple electric parameters transmitter

Measured value of this transmitter is read-out by 03 command of Modbus-RTU communication protocol.

The congruent relationship between communication value and actual value are shown as below diagram:(Agreed

on Val\_t as communication read-out value, Val\_s as actual value)

Applicable parameter	Congruent relationship	Unit
Voltage value UA、 UB、 UC	$Val_s=(Val_t/10000)*(10^{DPT})$	(V)
Current value IA、 IB、 IC	$Val_s=(Val_t/10000)*(10^{DCT})$	Ampere(A)
Power Value PA、 PB、 PC、 PS、 QA、 QB、 QC、 QS	$Val_s=(Val_t/10000)*(10^{DPQ})$	Watt(w) var(var)
Electric energy quantity primary side value EpI、 EpE、 EqL、 EqC	$Val_s=Val_t*PT*CT$	Watt-hour(wh) Var-hour(varh)
Power factor Value PFA、 PFB、 PFC、 PFS	$Val_s=Val_t/1000$	No-unit
Frequency FR	$Val_s=Val_t/100$	Hertz(Hz)

Example: UA's communication Read-out Value is 08C6H(2246), DPT is 5, then UA's actual Value

$$Va=(2246/10000)*(10^5)=22.46KV.$$

IA's communication Read-out Value is 0FA0H(4000), DCT is 3, then IA's actual Value

$$Ia=(4000/10000)*(10^3)=400.0A.$$

BD-3E(A)/BD-4E(A) Multiple electric parameters combined transmitter parameter Address table

Follows are system parameters Address area: 03H function code Reading, 10H function code writing				
Address	Parameter	Read/Write	Data range	Data Type
0000H	Protective password	R/W	0001~9999	word
0001H High byte	Communication Address	R/W	0001~0247	word
0001H Low byte	Communication Baud rate	R/W	0~3 corresponding to 38400、 19200、 9600、 4800bps	
0002H	Control word	R/W	8 <sup>th</sup> bit-connection mode(0-four wire three phase, 1-three phase three wire); 7 <sup>th</sup> bit-input voltage range(0-400V, 1-100V); second bit-input current range(0-5A, 1-1A)	word
0003H	PT Transformation ratio	R/W	1~9999	word
0004H	CT Transformation ratio	R/W	1~9999	word
0005H-0022H	Reserved			
0023H high byte	Decimal point U(DPT)	R		word
0023H low byte	Decimal point I(DCT)	R		
0024H high byte	Decimal point PQ(DPQ)	R		word
0024H low byte	Symbol PQ	R		
0025H	Phase voltage UA	R	0~65535	word
0026H	Phase voltage UB	R	0~65535	word
0027H	Phase voltage UC	R	0~65535	word
0028H	Line voltage UAB	R	0~65535	word
0029H	Line voltage UBC	R	0~65535	word
002AH	Line voltage UAC	R	0~65535	word
002BH	Current IA	R	0~65535	word
002CH	Current IB	R	0~65535	word
002DH	Current IC	R	0~65535	word

002EH	Phase splitting active power PA	R	-32768~32768	Integer
002FH	Phase splitting active power PB	R	-32768~32768	Integer
0030H	Phase splitting active power PC	R	-32768~32768	Integer
0031H	Total active power P	R	-32768~32768	Integer
0032H	Phase splitting reactive power QA	R	-32768~32768	Integer
0033H	Phase splitting reactive power QB	R	-32768~32768	Integer
0034H	Phase splitting reactive power QC	R	-32768~32768	Integer
0035H	Total reactive power Q	R	-32768~32768	Integer
0036H	Phase splitting power factor PFA	R	-1000~1000	Integer
0037H	Phase splitting power factor PFB	R	-1000~1000	Integer
0038H	Phase splitting power factor PFC	R	-1000~1000	Integer
0039H	Total power factor PF	R	-1000~1000	Integer
003AH	Phase splitting Apparent power SA	R	0~65535	Word
003BH	Phase splitting Apparent power SB	R	0~65535	Word
003CH	Phase splitting Apparent power SC	R	0~65535	Word
003DH	Total Apparent power S	R	0~65535	Word
003EH	Frequency FR	R	4500~6000	Word
003FH-0040H	Absorptive active electric energy EP_imp secondary side	R/W	0~999999999	Dword
0041H-0042H	Release active electric energy EP_exp secondary side	R/W	0~999999999	Dword
0043H-0044H	Inductive reactive electric energy EQ_imp secondary side	R/W	0~999999999	Dword
0045H-0046H	Capacitive reactive electric energy EQ_exp secondary side	R/W	0~999999999	Dword
0047H-0048H	Absorptive active electric energy EpI primary side	R		Fword
0049H-004AH	Release active electric energy EpE primary side	R		Fword
004BH-004CH	Inductive reactive electric energy EpL primary side	R		Fword
004DH-004EH	Capacitive reactive electric energy EpC primary side	R		Fword

Instructions:

1 Data type: "BYTEV"=one byte; "word"=16 bit unsigned integer; "Integer"=16 bit signed integer; "Dword"=32 bit unsigned integer; "Fword"=32 bit floating point numbers.

2 Read/Write Properties: "R"=Read only, Read parameter use 03H Command; "R/W"= Readable/Writable, Write system parameter use 10H Command. Prohibit write in Address, which is not listed or without writable properties.

3 Baud rate setting range: 4800 bps, 9600 bps, 19200 bps, 38400 bps. Settings outside this range are not allowable. If setting go beyond this range is write-in, transmitter can enable the default Baud rate: 38400 bps.

4 Electric energy primary side value adopt floating point variable data type. It use sign bit to show number sign, use biased exponent and mantissa to show larger and smaller numbers. Data format adopted by transmitter is IEEE754, with 24 bit precision, high bit of mantissa is always "1", thus, Don't Save, bit distribution is shown as following:

- a) 1 bit as sign bit;
- b) 8 bit exponents bit;

c) 23 bit mantissa.

Sign bit is the highest bit, mantissa is the lowest 23 bit, the description based on byte is shown as follows:

Address	+0	+1	+2	+3
Content	SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

Thereinto, S: Sign bit, 1 shows negative, 0 shows positive;

E: biased exponent (in two bytes) biased 127;

M: 23 bit mantissa, its highest bit is "1".

For example:

Read-out 0 10001110 100 1011 1010 1100 0000 0000B

0 shows sign bit, "1"negative, "0"positive;

10001110=gage index, set it to a, a is decimal system, a=142;

100 1011 1010 1100 0000 0000 is computing mantissa, set it to b, b is decimal system, b=4959232.

Computing formula:

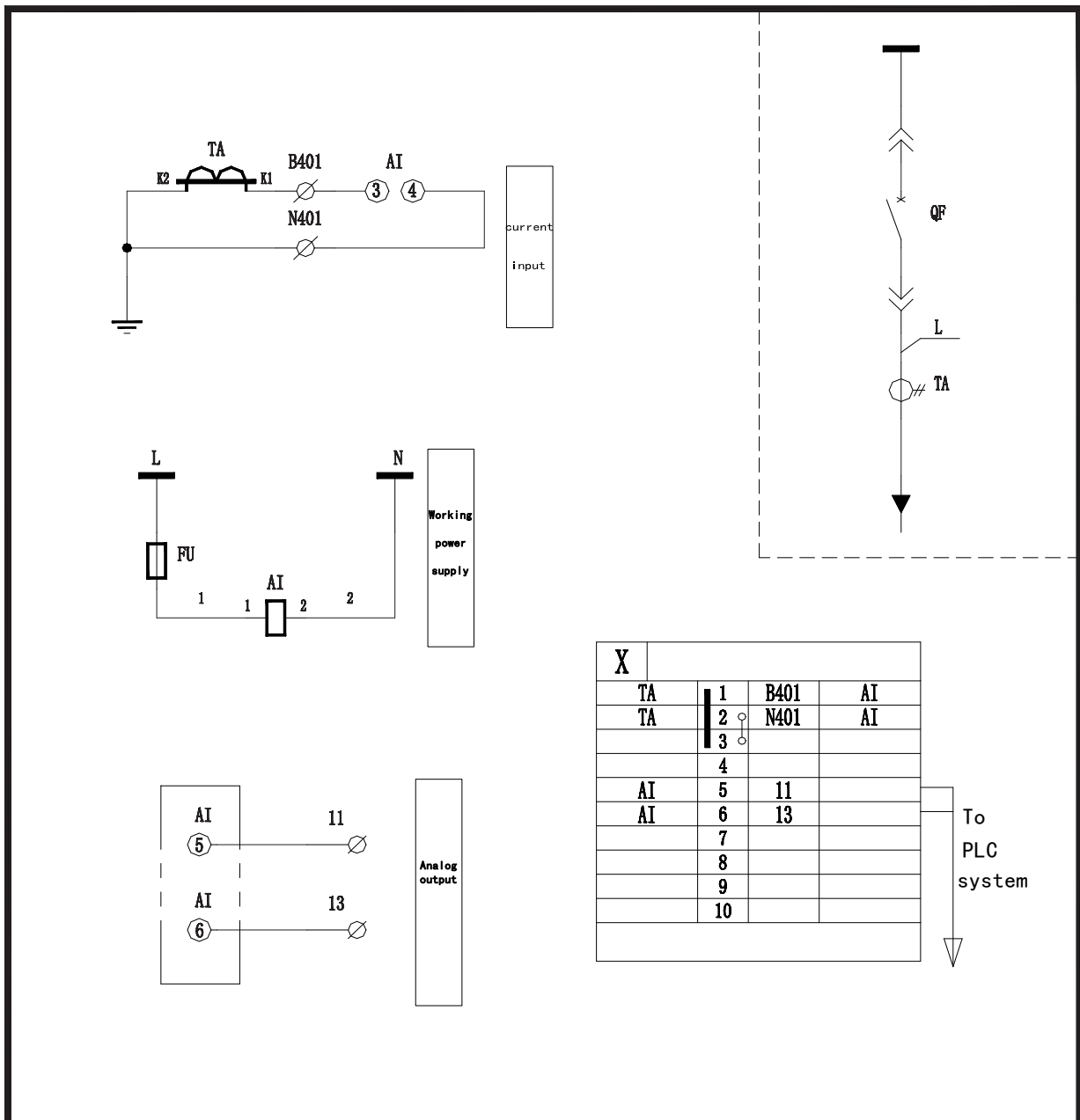
$$\text{Primary side electric parameters} = (-1)^S \times 2^{(E-127)} \times \left(1 + \frac{M}{2^{23}}\right)$$

Computed result:

$$= (-1)^0 \times 2^{(142-127)} \times \left(1 + \frac{4959232}{2^{23}}\right) = 52140$$

7Order example

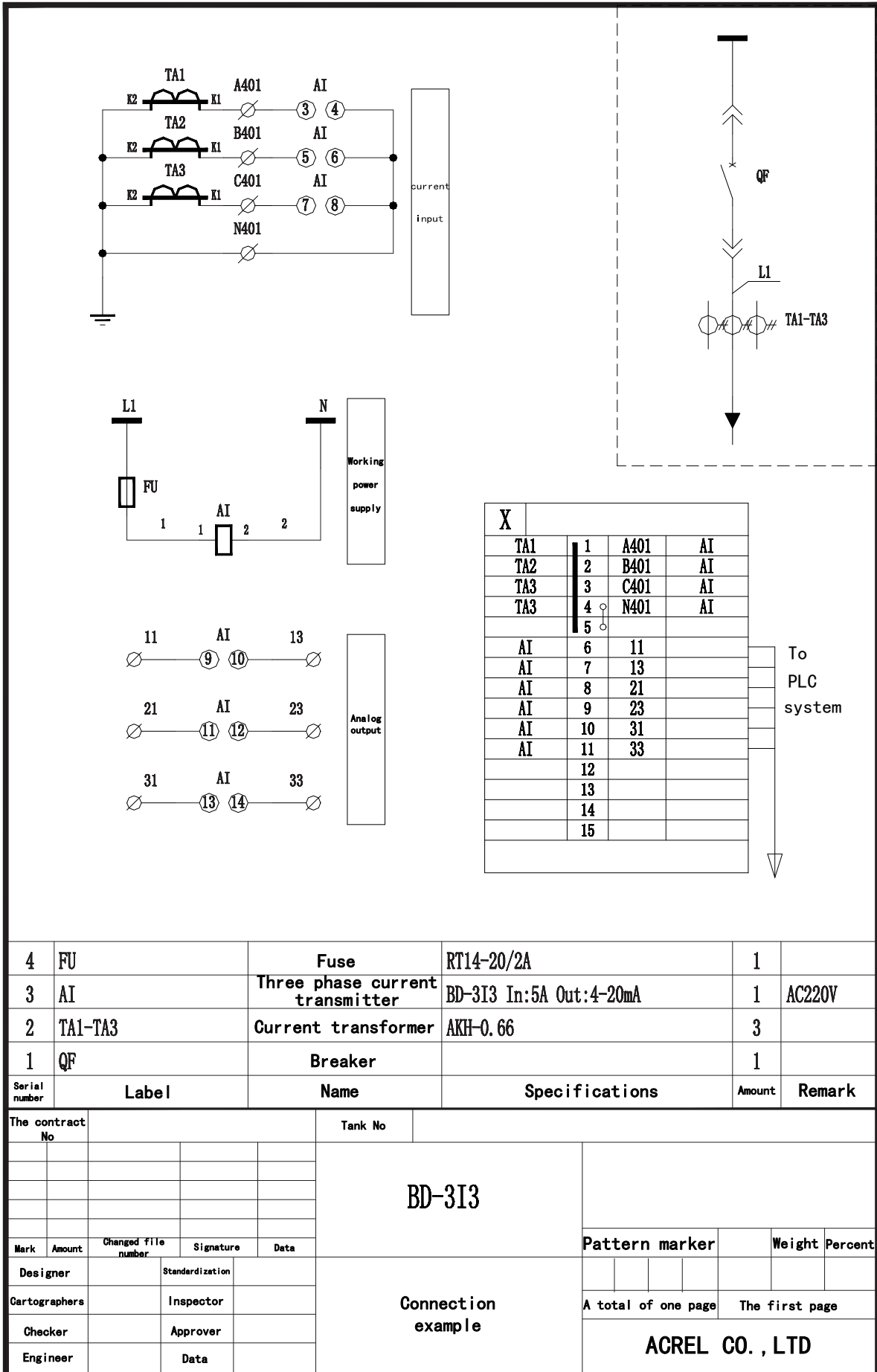
7.1 BD-AI Connection example



4	FU	Fuse	RT14-20/2A	1	
3	AI	Single phase current transmitter	BD-AI In:5A Out:4-20mA	1	AC220V
2	TA	Current transformer	AKH-0.66	1	
1	QF	Breaker		1	
Serial number	Label	Name	Specifications	Amount	Remark

The contract No		Tank No		<b>BD-AI</b>				
Mark	Amount	Changed file number	Signature			Data		
Designer		Standardization				Pattern marker	Weight	Percent
Cartographers		Inspector				A total of one page		The first page
Checker		Approver		<b>ACREL CO., LTD</b>				
Engineer		Data						
<b>Connection example</b>								

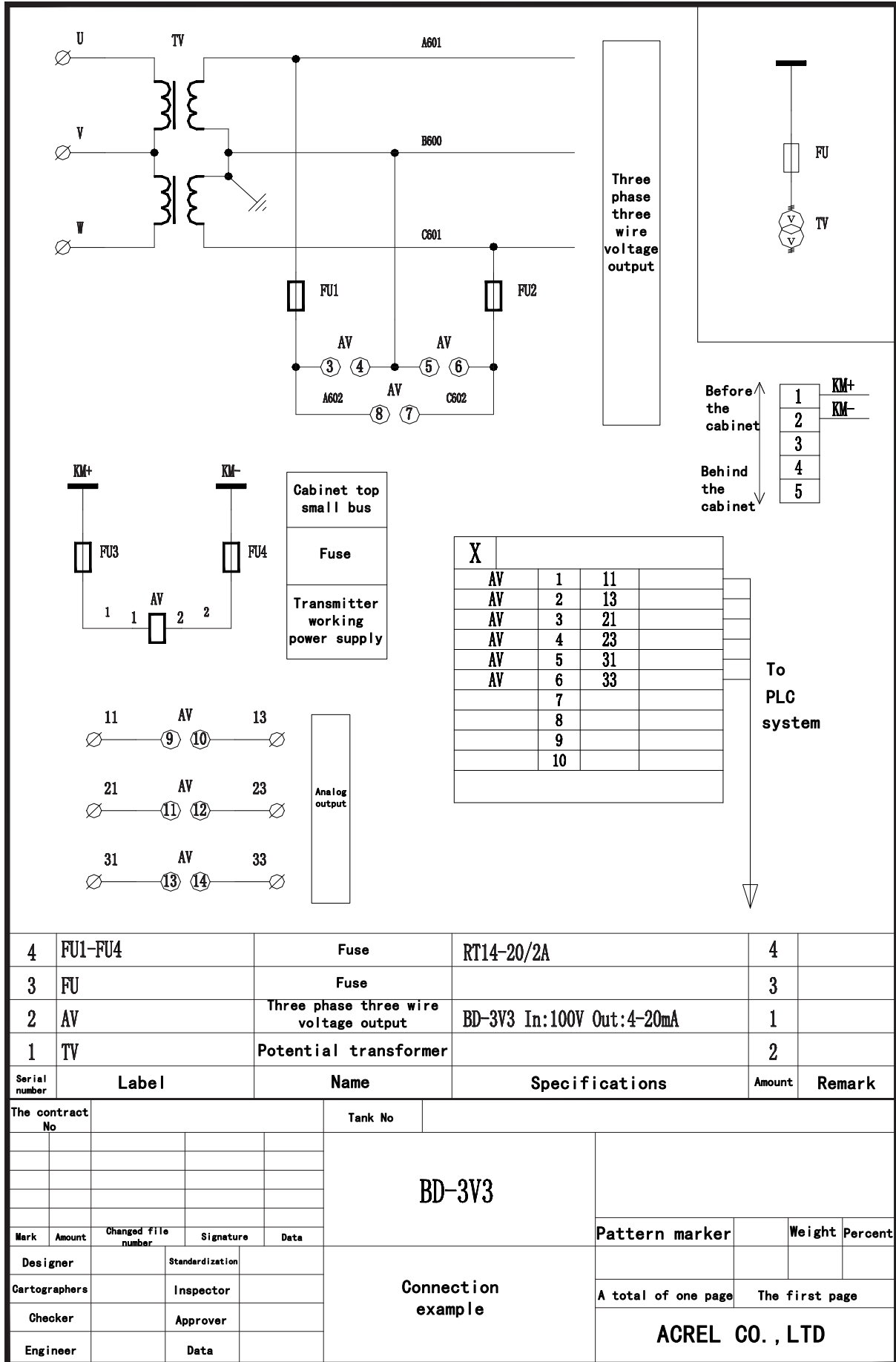
7.2 BD-3I3 Connection example



4	FU	Fuse	RT14-20/2A	1	
3	AI	Three phase current transmitter	BD-3I3 In:5A Out:4-20mA	1	AC220V
2	TA1-TA3	Current transformer	AKH-0.66	3	
1	QF	Breaker		1	
Serial number	Label	Name	Specifications	Amount	Remark

The contract No		Tank No		<b>BD-3I3</b>				
Mark	Amount	Changed file number	Signature			Data		
Designer		Standardization				Pattern marker	Weight	Percent
Cartographers		Inspector				A total of one page		The first page
Checker		Approver		<b>ACREL CO., LTD</b>				
Engineer		Data						
<b>Connection example</b>								

7.3 BD-3V3 Connection example

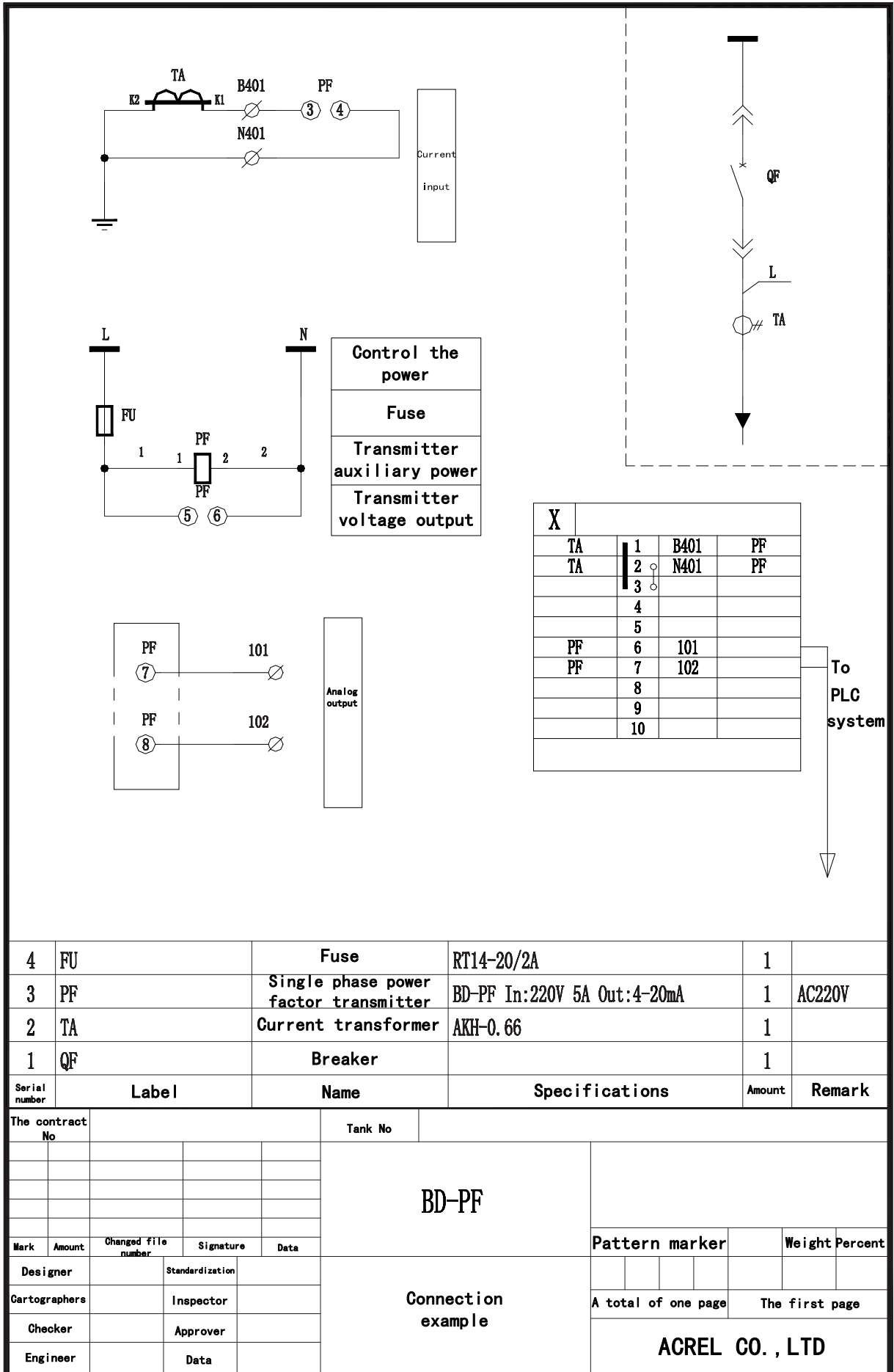


4	FU1-FU4	Fuse	RT14-20/2A	4	
3	FU	Fuse		3	
2	AV	Three phase three wire voltage output	BD-3V3 In:100V Out:4-20mA	1	
1	TV	Potential transformer		2	
Serial number	Label	Name	Specifications	Amount	Remark

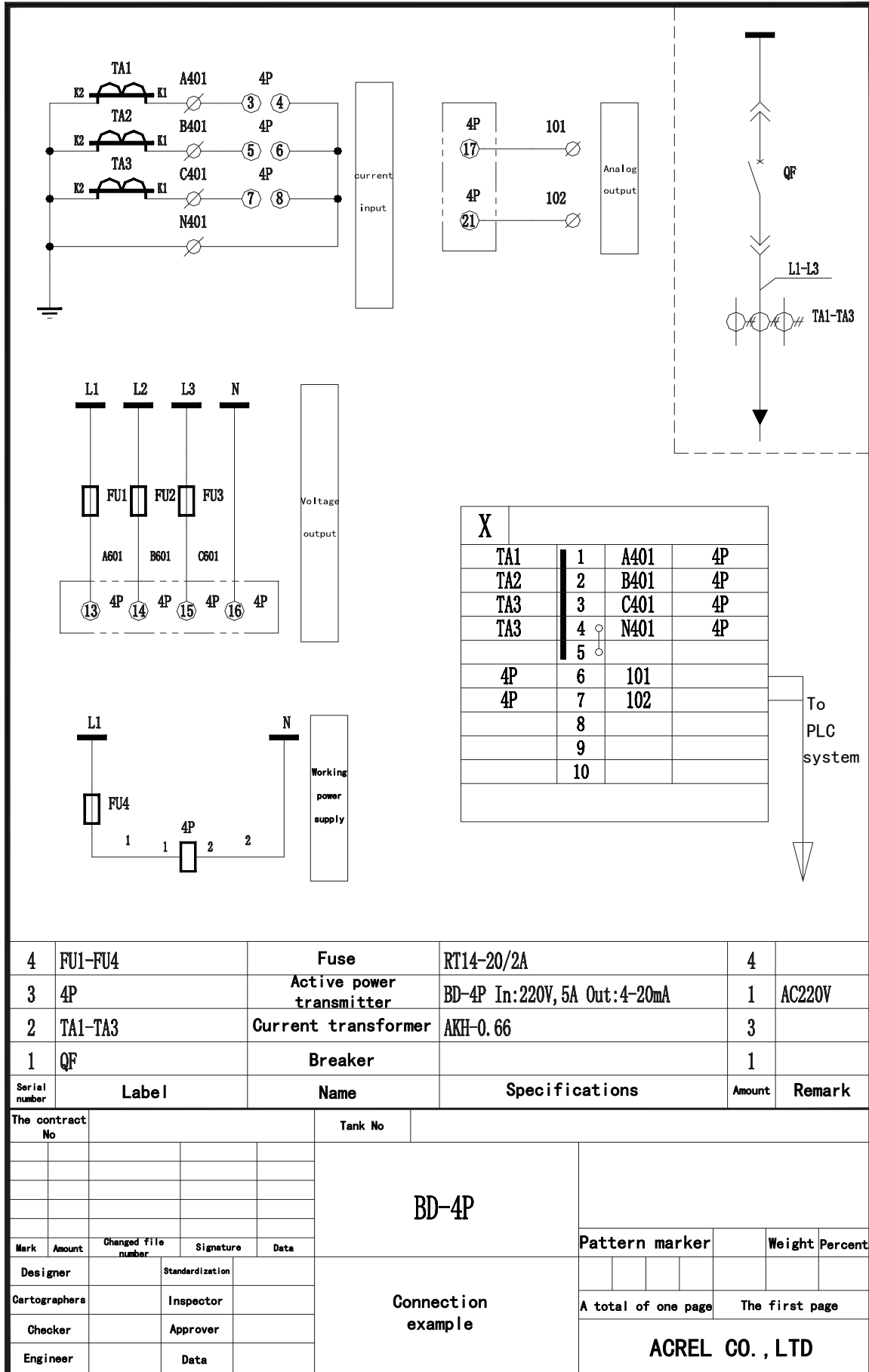
The contract No		Tank No		<b>BD-3V3</b>							
Mark	Amount	Changed file number	Signature					Data	Pattern marker	Weight	Percent
Designer		Standardization						<b>Connection example</b>		A total of one page    The first page	
Cartographers		Inspector								<b>ACREL CO., LTD</b>	
Checker		Approver									
Engineer		Data									



7.4 BD-PF Connection example



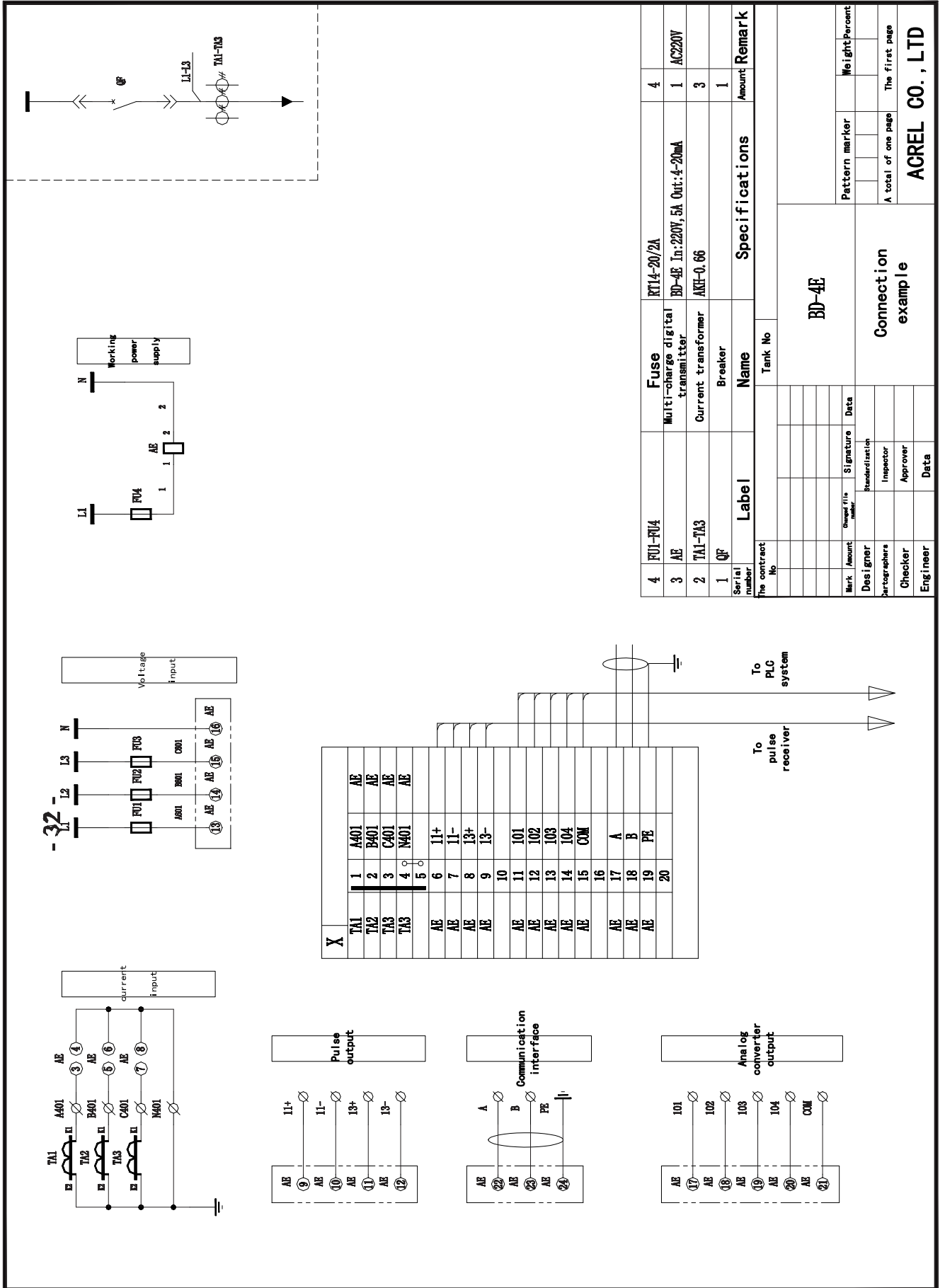
7.5 BD-4P Connection example



Serial number	Label	Name	Specifications	Amount	Remark
4	FU1-FU4	Fuse	RT14-20/2A	4	
3	4P	Active power transmitter	BD-4P In:220V, 5A Out:4-20mA	1	AC220V
2	TA1-TA3	Current transformer	AKH-0.66	3	
1	QF	Breaker		1	

The contract No		Tank No					
				<b>BD-4P</b>			
Mark	Amount	Changed file number	Signature	Data	Pattern marker	Weight	Percent
Designer		Standardization					
Cartographers		Inspector			A total of one page		The first page
Checker		Approver			<b>ACREL CO. , LTD</b>		
Engineer		Data					

7.6 BD-4E Connection example



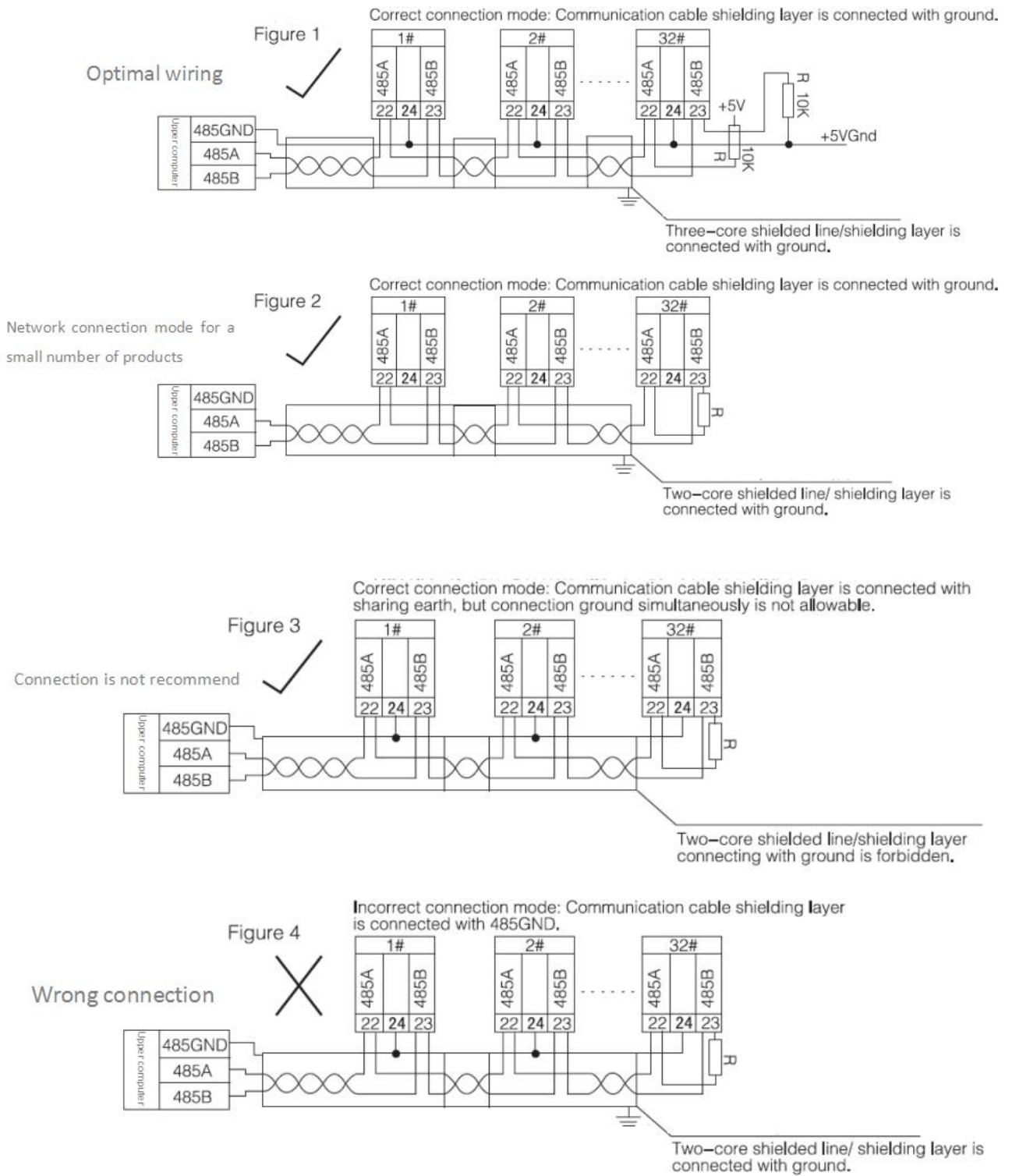
X

1	A401	AE
2	B401	AE
3	C401	AE
4	N401	AE
5		
6	11+	
7	11-	
8	13+	
9	13-	
10		
11	101	
12	102	
13	103	
14	104	
15	COM	
16		
17	A	
18	B	
19	PE	
20		

4	FU1-FU4	Fuse	RT1A-20/2A	4	
3	AE	Multi-charge digital transmitter	BD-4E In:220V, 5A Out:4-20mA	1	
2	TA1-TA3	Current transformer	AKH-0.66	3	
1	QF	Breaker		1	
Serial number		Label		Specifications	
The contract No.		Name		Amount	
		Tank No		Remark	
		BD-4E			
Mark		Amount	Contract No.	Signature	Data
Designer		Standardization	Inspector	Approver	Data
Checker		Connection example		Pattern marker	
Engineer		ACREL CO., LTD		Weight/Percent	
		A total of one page		The first page	

## 7.7 Connected mode in communication

Four Connection mode in communication section are shown as following:



Recommendation of adding matched resistance between A, B of the last meter, the rated resistance range is  $120\ \Omega \sim 10k\ \Omega$ .