

Contents

MANUAL	1
Summary	1
PRIMARY FUNCTIONS	2
TECHNICAL DATA.....	2
STRUCTURE AND CONNECTION.....	3
1 FACIES:.....	3
2 FRONT PANEL:.....	4
3 VIEW OF REAR PANEL	5
Signal	6
Terminal code.....	6
Signal type	6
PESET PARAMETERS:.....	9
1 RUNNING.	13
2 TEST:	14
3 HOW TO USE THE TEST MODULE:	17
CONNECTING BETWEEN SID-2CM AND COMPUTER	18
1 HARDWARE CONNECTION:.....	18
2 SETTING OF THE DEVICE:	18
*SID-2CM with operating remote control.....	18

MANUAL

Summary

SID-2CM is the eighth generation of synchronizing equipment produced by SID Co.,LTD. in China. SID-2 products from SID are used for automatic synchronization of generators with power lines and for paralleling of synchronous lines. They are designed for fully automatic operation .

SID-2CM is a important intelligent terminal of power stations distributing control system (DCS), operators can learn about the details on paralleling not only at the local but also control cabin with it.

The outstanding character of the device is that it can cause to reach synchro-conditions within the shortest time with a good control quality and at the same time seizes the first paralleling chance.

Synchronizing equipment are used in power stations where a generator needs to be paralleled with a power line or in substations to parallel two synchronous lines.

Power circuit breaker can only be closed if voltage at both ends is synchronous. If it is not ,it will cause a disturbance in the power system, trip the breaker, shock the generator and unit transformer. In extreme cases, it can damage both.

SID-2 guarantees a safe and reliable synchronization whether as a monitoring element for manual paralleling or as an independent fully-automatic synchronizing unit.

SID-2 cover the following areas of application:

- 1 Automatic synchronization and paralleling of generators whit power lines, see Fig. 1 below
- 2 Automatic paralleling for synchronous and asynchronous lines and busbars, see Fig.2 below
- 3 Monitoring (Synchrocheck) of automatic or manual paralleling of power liens, generators and volatage-free lines (dead bus),see Fig 3 below

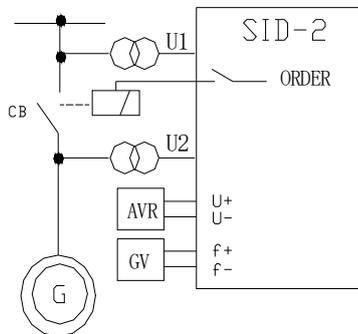


fig.1 Automatic synchronizing and paralleling

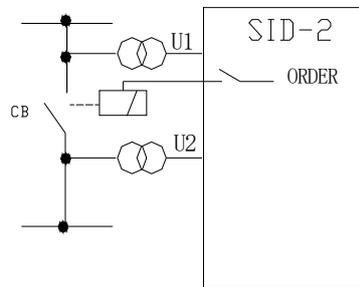


fig.2 Paralleling of power lines

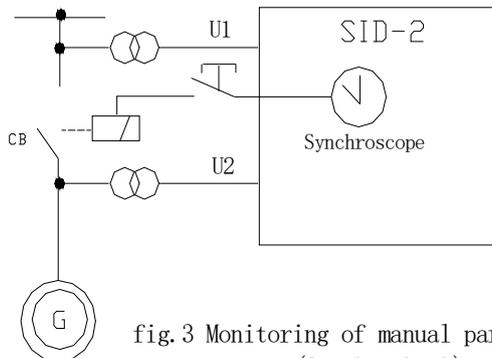


fig.3 Monitoring of manual paralleling (Synchrocheck)

Legend:

- U1 System/busbar voltage
- U2 Generator voltage
- CB Circuit breaker
- G Generator
- AVR Automatic voltage regulator
- GV Governor
- ORDER Paralleling commands
- f+, f- Frequency adjusting commands

PRIMARY FUNCTIONS

- 1 There are twelve channels to be used for 1-12 units power generator or power lines paralleling in a device, type and attribute of paralleling can be distinguished.
- 2 Setting parameters: breaker time; Allowable voltage differential; over voltage protecting value; Allowable frequency difference value; frequency control coefficient; voltage control coefficient; Allowable power angle; Incomer and busbar TV rated voltage; shift busbar TV phase angle; low voltage lock values on both sides of paralleling point; single side or both sides no-voltage operating; synchroscope function; Control pulse width for same frequency; breaker name .
- 3 The device can ensure the first zero phase differential appearing to be seized while differential paralleling (between generator and busbar or two synchronous lines.) and make paralleling without impacting;
- 4 The device can make a fast paralleling of generators through the way it can leads frequency differential and voltage differential into the Allowable range according to the theory of fuzzy control;
- 5 When paralleling will begin at once only if the power angle and the voltage difference are less than the allowable values when paralleling between synchronous lines, otherwise , there must be a wait and signal, whether it was differential frequency or identical frequency can be distinguished by the device automatically;
- 6 The device can make self-test when running timely and automatically, it can also alarm and display if error;
- 7 Alarming when TV open-circuit and locking the operation of synchronizing and non-voltage closing;
- 8 An acceleration control instruction can be given automatically when frequency is identical during the process of paralleling of generators in order to cancel the identical frequency condition. Paralleling of anti-power will be never appeared surely if necessary;
- 9 The device will display these data – real measuring time a breaker circuit takes when closing and the last eight real measuring values recorded in every channel after accomplishing the paralleling in order to make certain the accuracy of the time it takes when breaker closing. The time for breakers' closing will not be recorded when it is identical frequency paralleling.
- 10 Communication accesses and communication agreements will be provided between the device and the host computer (RS-232, RS-485) , in order to meet the requirements the device will be admitted into the DCS system.
- 11 The device can work even though under an awful conditions owing its methods of complete and strict insulation ways on electromagnet and photo electricity;
- 12 AC or DC can be as power supply of the device and the device can adapt itself to 48V—220V AC or DC power supply automatically;
- 13 Checking and testing can be made directly without any other apparatus because the module demanded is already in the device;
- 14 One side or both sides no-voltage close breaker can be accomplished according to the instructions from the host computer; or both sides no-voltage close breaker from operating the front panel switch..
- 15 To be used as a intelligent synchroscope.

TECHNICAL DATA

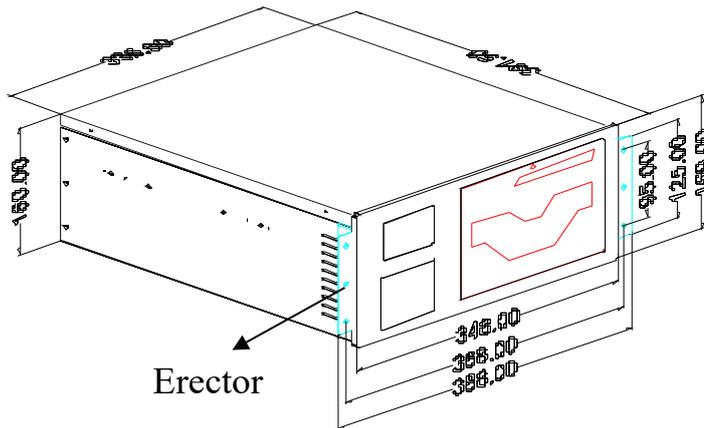
- 1 TV secondary voltage values on both sides of the breaker for paralleling should be 100V or $100/\sqrt{3}$ v or that one is line voltage the other phase voltage; TV voltage on system side can

be set an turn phase angle at all parallel points respectively, no separate transformers for insulating and turn phase angles are required.

- 2 All digital input are normally open type connection point, such as parallel point choice, remote reset, auxiliary contact of breakers, and so on;
- 3 Normally open type contact of petty electromagnet relays can be used for controlling signals of digital output, capacity of the contact is 220V AC 5A or 220V DC 0.5A;
- 4 Two communication port, one is RS-232, the other is RS-485;
- 5 Power supply should be 48-220VAC or DC, maximum power consumption is 20W;
- 6 Insulating: weak current circuit to earth: 500V 50Hz for one minute; power current circuit to earth: 2000V 50Hz for one minute; between weak current circuit and power current circuit: 1000V 50/60Hz for one minute;
- 7 Ambience of operation: A: temperature ranges: (1) operation :0 to +50°C; (2): transport/storage: -20 to +70°C; B: maximum humidity: 90%;

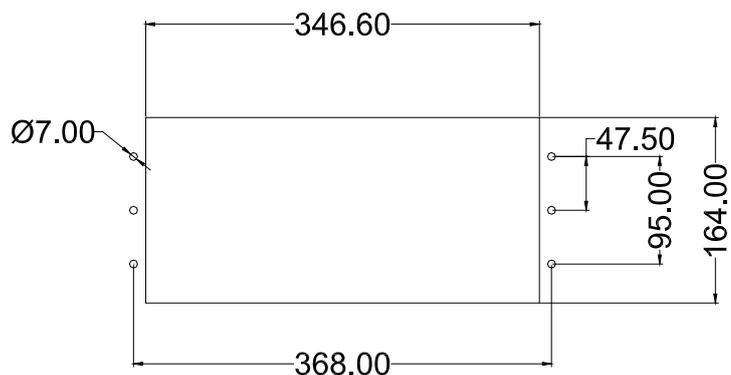
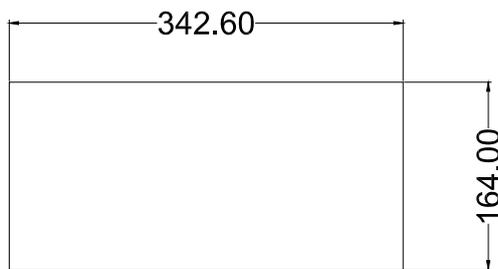
STRUCTURE AND CONNECTION

1 FACIES:



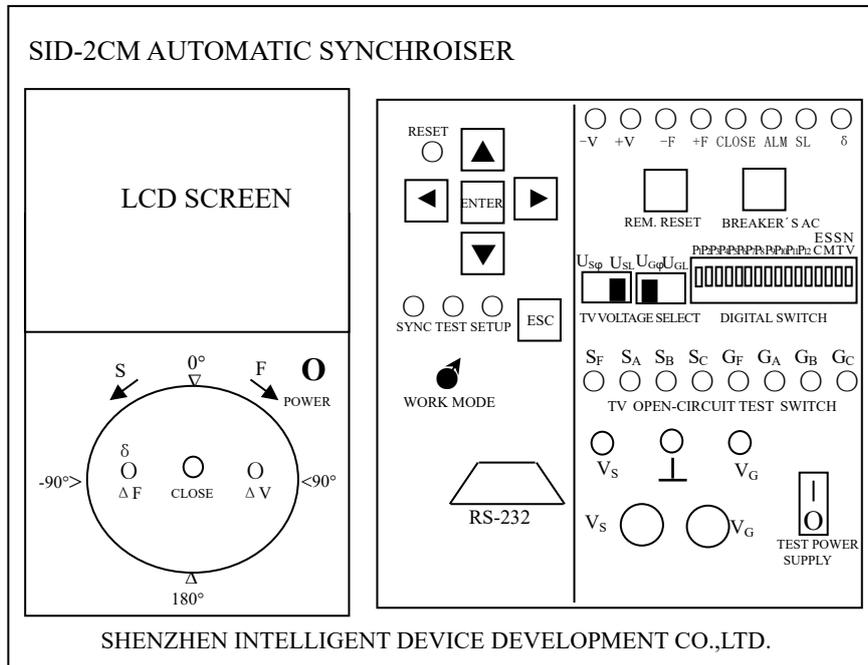
1 No erector

2 To take erector



2 FRONT PANEL:

see figure below;



There is a LCD on top left of the panel. It is used for displaying the menu, parameter set, codes of parallel point, frequency and voltage of the busbar, frequency of generator, voltage of generator, time for breaker's closing and other information.

An indicator composed of LED for displaying synchronization is at bottom left of the panel, including the phase differential of voltage between the system and the other during the process of paralleling. Indicator lights for frequency differential, power angle and voltage differential will turn into green or red with it's values over top limit or under threshold during differential frequency paralleling. The indicator light for frequency differential will turn into red or be off with the values over top limit or under threshold during synchronous paralleling, and indicator lights for power angle and voltage differential will turn into orange with the values over limit. The indicator for closing will be on (red) during the whole process of closing.

Middle part of the panel is a cover. There are three indicator lights and a switch for choosing running mode under the cover. Red, green or yellow light indicates respectively working, testing or setting mode the device is in: working mode means paralleling; testing mode means testing about the device or whole system, setting mode means adjusting parameters and inquiring data.

Functions of seven keys on top of the switch as follows:

key	description
▲ and ▼	To set parameters
◀ and ▶	To select a menu or change value of parameters
ENTER	To select functions or save value of parameters
ESC	To go back from present operation mode
RESET	To reset the program.

Test module is located on the right of the panel. It includes some parts for indicating and operating. The functions of the test module include forming TV

secondary voltage on both sides of paralleling device, simulating signals of input switch value related and displaying the state device output control signals related are.

key	description
REM.RESET	To simulate reset instructions from the remote control cabin.
BREAKER'S AC	To indicate whether the breaker is closing or not and measure breaker closing time for takes through simulating the auxiliary contact of breakers at paralleling points.

There are 12 parallel point switch used for simulating synchronous switch state of 12 points. The point is using if the switch is up; EC,SM, PO, NV means both sides non-voltage closing ,respectively synchroscope, TV open-circuit, signals side no- voltage closing and valid when it is up.

The eight switches of SF, SA, SB,SC,GF,GA,GB,GC are used for insulating TV open-circuit of paralleling points in the breakers. It means off when the switch is up. SF test switch before side fuse wire of system; SA, SB, SC: test switch of three phases TV open-circuit; GF: test switch before fuse wire of paralleling side; GA, GB, GC: test switch of three phases TV open-circuit on incomer side.

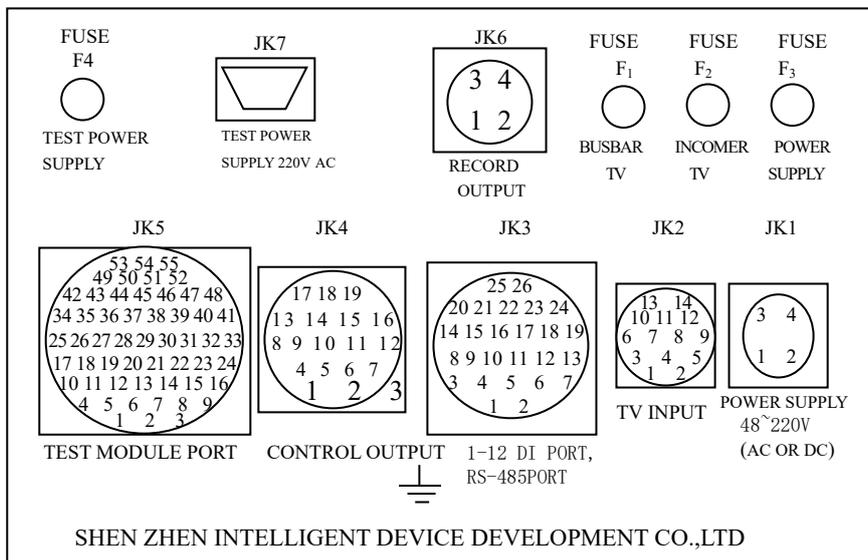
Vs and VG potentiometer are used to adjust TV secondary voltage located on input presenting system and generator side when testing the device. Values of voltage between Vs and VG and public point respectively can be measured with a AC voltage meter. TV secondary voltage will be presented U_L (line) U_ϕ (phase) by choosing TV secondary voltage switch.

RS-232 is a serial communication port. It is a D type plug with ninepins for connecting with RS-232 of the notebook PC directly. RS-485 port on the back of the device can also be used for connecting with remote upper computer.

There are seven indicator lights for displaying states of the relays, on the top right of the panel, they are decrease voltage relay (green), increase voltage (red), decelerate speed relay (green), accelerate speed relay (red), closing relay (red), alarm relay(yellow), closing lock relay(yellow).

Parameter reset in locale is allowed and can't misoperation because SL relay cut off breaker closing output-circuit automatically when the device is working in “**SETUP**” mode.

3 VIEW OF REAR PANEL



There are some connection plug for exterior, please see the figure and see relevant tables for the meaning of the pins.

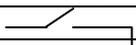
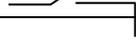
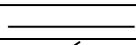
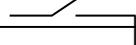
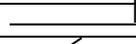
No mistakes will appear because the types of the six aero-plug are different. The number of parallel points up to twelve in the SID-2CM is to meet the requirement of not only middle or small power station but also standby one another among several synchronizers in a power station. That up to twelve sets of parameter for twelve ; different paralleling points can be stored in one device make twelve unit synchronous device to be exchanged directly without adjusting again. The aero-plug makes exchange convenient as well.

One side of every parallel point's synchronous switch connection point is connected with 1-8 and 20-23 pin of JK3 respectively, and the other side is connected to +24V of the seventeenth pin V0+. After shunting, the fifteenth pin, connected with the cabin, is for protecting RS-485 port from electricity. It is necessary for the three phases voltage and the neutral point of both sides to be connected the parallel point. The synchronous device can ensure security when both side no-voltage closing or single side no-voltage closing by avoiding misoperation caused by TV open-circuit. However, no these operation if there is no-voltage closing, i.e. it is unnecessary to connect JK2-1,2,...14 with electricity under the condition. JK3-24 and JK3-25 is two digital input made certain again before doing single side or both sides no-voltage closing.

This socket is used for connection between sockets JK5 and JK2, JK3, JK4 in order to make the all signals from internal test module in the device handed through the special lines. 220VAC power source should be supplied to socket JK7 and JK1 when testing.

Pulsating voltage at the socket and output closing contact of the device are useful for recording wave of synchronizing.

Table of JK1、JK2、JK3、JK4、JK5、JK6 socket PIN

Signal	Terminal code	Signal type
Busbar TV secondary neutral wire (or phase B)	JK2-6	AC
Busbar TV secondary phase wire	JK2-4	AC
Incomer TV secondary neutral wire (or phase B)	JK2-5	AC
Incomer TV secondary phase wire	JK2-3	AC
Incomer TV phase A	JK2-7	AC
Incomer TV phase B	JK2-8	AC
Incomer TV phase C	JK2-9	AC
Incomer TV neutral wire	JK2-1	AC
Incomer TV lead of fuse	JK2-14	AC
Busbar TV phase A	JK2-10	AC
Busbar TV phase B	JK2-11	AC
Busbar TV phase C	JK2-12	AC
Busbar lead of fuse	JK2-13	AC
 Raise voltage (-)	JK4-5	
 Raise voltage (+)	JK4-14	
 Closing breaker (-)	JK4-1	
 Closing breaker (+)	JK4-12	
 Raise speed (-)	JK4-2	
 Raise speed (+)	JK4-13	
 Lower speed (-)	JK4-16	
 Lower speed (+)	JK4-3	
 Lower voltage (-)	JK4-4	
 Lower voltage (+)	JK4-18	

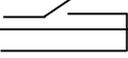
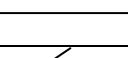
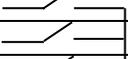
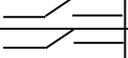
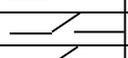
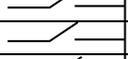
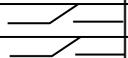
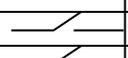
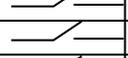
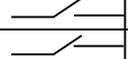
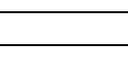
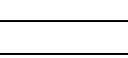
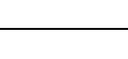
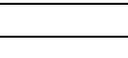
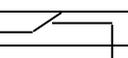
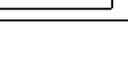
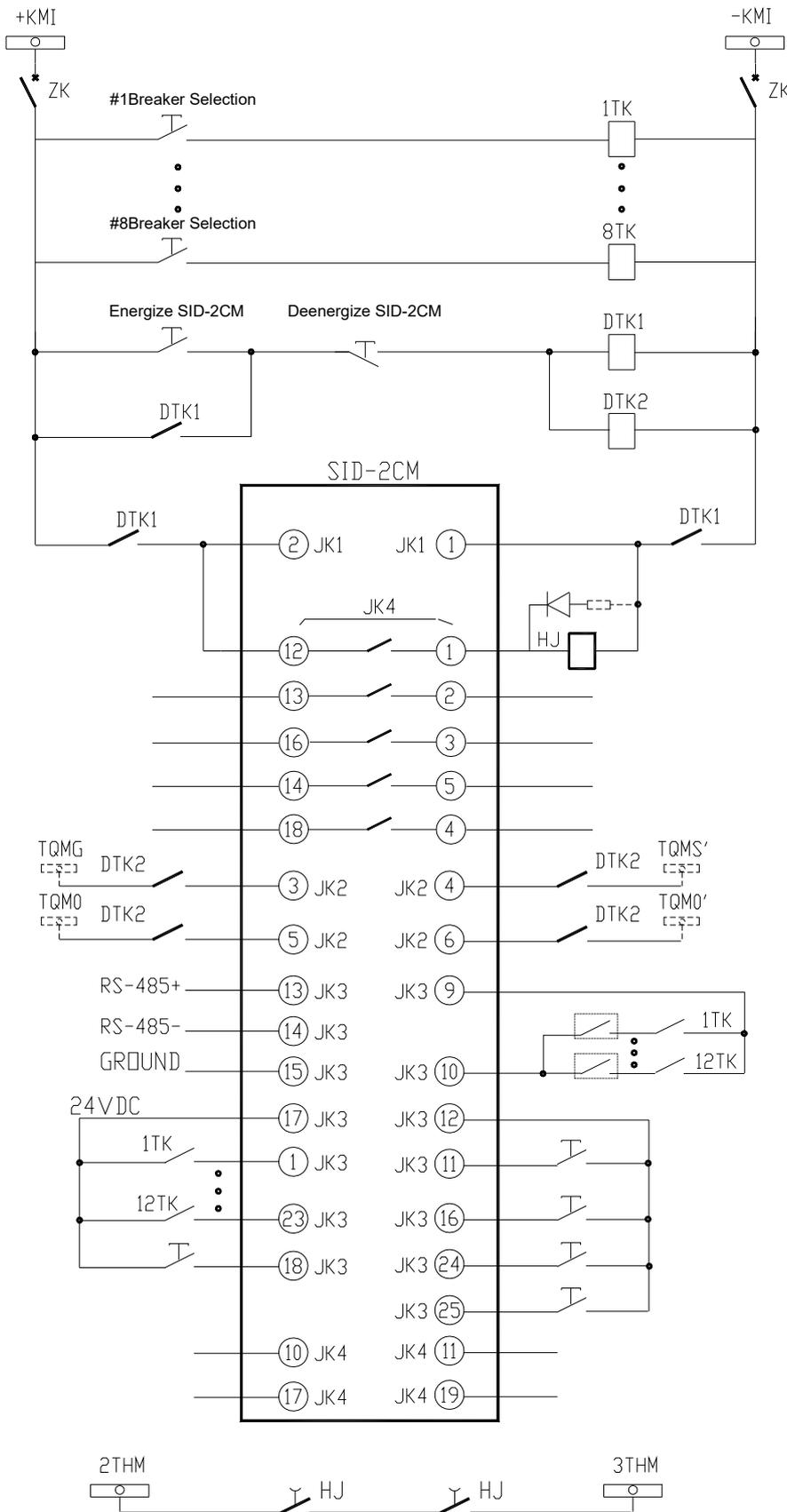
	Alarm	JK4-10	
	Alarm	JK4-17	
	Power off	JK4-11	
	Power off	JK4-19	
	Power supply (-)	JK4-18	DC
	Select 1# breaker	JK3-1	
	Select 2# breaker	JK3-2	
	Select 3# breaker	JK3-3	
	Select 4# breaker	JK3-4	
	Select 5# breaker	JK3-5	
	Select 6# breaker	JK3-6	
	Select 7# breaker	JK3-7	
	Select 8# breaker	JK3-8	
	Select 9# breaker	JK3-20	
	Select 10# breaker	JK3-21	
	Select 11# breaker	JK3-22	
	Select 12# breaker	JK3-23	
	Breaker's auxiliary contact	JK3-9	
	Breaker's auxiliary contact	JK3-10	
	Remote reset	JK3-11	
	Remote reset	JK3-12	
	Phase meter function	JK3-16	
	Start synchronizing	JK3-18	
	Single side no-voltage operate	JK3-24	
	+24V common	JK3-17	
	RS-485+	JK3-13	Digital
	RS-485-	JK3-14	Digital
	Shield ground	JK3-15	
	Power supply	JK1-2	AC or DC+
	Power supply	JK1-1	AC or DC-
	Pulsating voltage	JK6-1	AC
	Pulsating voltage	JK6-2	AC
	Closing contact	JK6-3	
	Closing contact	JK6-4	

Fig3.1 Typical application scheme for the SID-2CM Automatic synchroniser

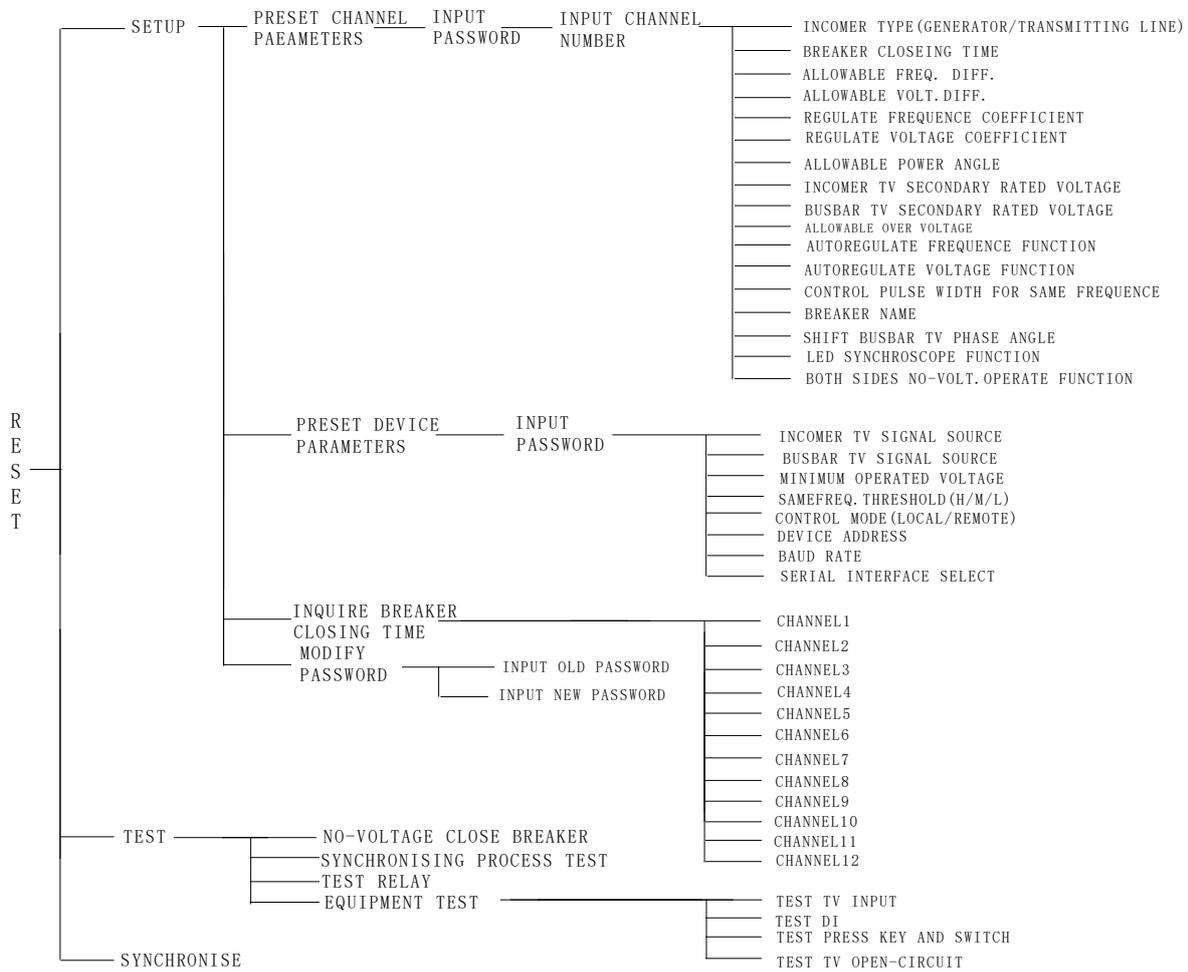


DC or AC Power source	
Air switch	
Select Breaker Relay	
Electrify synchroniser with DC power	
Electrify synchroniser with VT	
Auxiliary supply AC or DC	
CB Close Command	
Speed raise	
Speed lower	
Voltage raise	
Voltage lower	
Generator or Line VT	Bus VT
RS-485 field bus	Breaker auxi-contact
Internal 24V Supply	
Breaker Selection Input	Reset
	Synch.meter
Start up Synchronizing sequence	Single side no voltage confirm
	Both sides no voltage confirm
Alarm	Power Off

CB Closing Relay

INSTRUCTION FOR USE

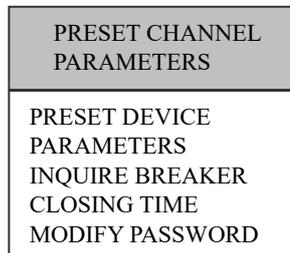
RESET PARAMETERS:



including parameters of device and channels.

To enter parameter setting: there are two ways: one, turn switch to ‘**SYNC**’ (the indicator will be on) when system is power on, and then press ‘**RESET**’; another one: turn switch to ‘**SYNC**’ directly when power off.

The first: enter preset menu, the screen display as following:



Press “▲” or “▼” to select item, then press ‘**ENTER**’ to enter the next program.

1)PRESET CHANNEL PARAMETERS:

There is a group of independent parameter to every channel, such as, paralleling type of synchronous point (generator or lines), closing time for breaker, Allowable frequency differential, Allowable voltage differential, control coefficient for frequency, control coefficient for voltage, TV voltage rating value on incomer side and on busbar side, protective value for over-voltage, automatic adjusting frequency, automatic adjusting voltage, control pulse width for samc,breaker name busbar TV phase angle, single side no-voltage operate function,both sides no-voltage operate function, synchroscope function and so on; The Allowable power angle should be in loop-type

system need to be paralleled.

The first; enter preset menu, then press “▲” or “▼” until preset channel parameter is highlighted, then press ‘ENTER’, the display shows:

```

INPUT PASSWORD
    0000
    
```

To enter any four-digits number or letter (originally, ‘0000’ is the preset value), then press ‘ENTER’ to enter parameter setting of channels, the display shows:

```

INPUT CHANNEL
NUMBER PLEASE:
    1
    
```

To press “▲” or “▼” to enter the number of a channel (1-12), then press ‘ENTER’ to enter the first page of parameter setting, otherwise press “ESC” to exit from the menu.

```

INCOMER TYPE
    XXXXX
BREAKER CLOSING TIME
    XXXms
ALLOWABLE VOLT. DIFF.
    ±XX%
ALLOWABLE VOLT. DIFF.
    +XX%
    
```

Type of object: one is generator, another one is power line, and the breakers should be as a loop- type line during synchronizing.

Breaker closing time : the breaker closing time beginning from receiving close instruction and ending till the breaker close completed.

Allowable frequency differential and Allowable voltage differential:

They are both differential between incomer side and busbar side, ‘±’ means that paralleling will begin no matter the differential is positive or negative, ‘+’ means that paralleling can’t begin until the value on incomer side is more than that on busbar side.

Press“◀”or“▶” to select one of parameters, and press “▲”or“▼” to change it’s value, then to press ‘ENTER’ to store all values after changing. The display shows ‘saver’. display from page two to five as follows:

The second page:

```

REGULATE FREQUENCE
COEFFICIENT
    X.XX
REGULATE VOLTAGE
COEFFICIENT
    X.XX
ALLOWABLE POWER ANGLE
    XX°
    
```

Note: Allowable power angle is only useful when objects of synchronous paralleling appear same frequency.

The quality of adjusting to frequency and voltage depend on the value of regulate coefficient. The more the value, the faster the adjusting, however, it will not stable if the value is too much. So the values of the two coefficients will be adjusted according to the quality of automatic adjust frequency and voltage in locale after the generator is on.

The third page:

INCOMER TV SECONDARY
RATED VOLTAGE
XXXV

BUSBAR TV SECONDARY
RATED VOLTAGE
XXXV

TV secondary voltage: measuring value of the secondary voltage in practice when the primary voltage is rating value.

Busbar TV secondary rated value is an average value.

Voltage supplied to paralleling point in synchronous device can be line voltage on one side and phase voltage, on another side or both line voltage or phase voltage.

The fourth page:

ALLOWABLE OVER- VOLT.
XXX%

AUTOREGULATE
FREQUENCY FUNCTION
YES/NO

AUTOREGULATE
VOLTAGE FUNCTION
YES/NO

The fifth page

CONTROL PULSE WIDTH
FOR SAME FREQUENCY
XXX

BREAKER NAME
XXXX

SHIFT BUSBAR TV
PHASE ANGLE
XXXXX

Protective value for over-voltage is a percentage in rating voltage value that the Allowable over-voltage value of generator is; autoregulate frequency function YES/NO and autoregulate voltage function YES/NO: it is 'YES' if need to adjusting value, otherwise it is 'NO'.

Control pulse width of same frequency adjusting is a digit without unit. The value of the positive pulse width of same frequency adjusting depends on it. Despite whether the 'autoregulate frequency function' is chosen or not, the control of same frequency adjusting is only decided by 'control pulse width of same frequency' with ranges from 5-90.

Breaker name of parallel point is a four-digit number, which is digit or letter and generally is the code of the breaker. The busbar TV phase angle replaces the phase transformer and can be set 30° lead, 0° , or 30° lag. The result is the busbar TV phase angle is changed.

The sixth page

SINGLE SIDE NO-VOLT.
OPERATE FUNCTION
YES/NO

BOTH SIDES NO-VOLT.
OPERATE FUNCTION
YES/NO

LED SYNCHROSCOPE
FUNCTION
YES/NO

Single side no-voltage can't be executed automatically until the parameter of channels 'single side no-voltage operate' is 'YES' and the signal of digital input meaning no-voltage operation is already sent to JK3-24, and then, the device will perform normal paralleling if the value of TV voltage on both ends of paralleling points are more than that of low voltage lock.

Bath sides no-voltage can't be executed automatically until the parameter of channels 'Both sides no-voltage 'is 'YES' and the signal of Digital input meaning no-voltage operation is already sent to JK3-25.

There must be two conditions simultaneously when single side no-voltage operate in case of contingency: one is the parameter of channels is 'single side no-voltage operate', another is there must be a switch signal from

exterior to the device marking the finish of single side no-voltage operation. This switch is also used as the STK switch witch used to short-circuit contact of the synchrocheck relay TJJ. The closing can't be accomplished before the contact has been shorten for contact of the TJJ cut off the switch on control circuit when no-voltage operate.

The device can be only used as a synchroscope meter after follow operation is done. First , to send JK3-16 a switch signal instruction(in order to close the connection point) by automatic synchronous mode switch controlled by host computer or manual operation and a choice signal on paralleling point. Second, the adjusting parameter of “ LED synchroscope” should be ‘ YES’, however, only such parameter as voltage difference, frequency difference phase state can be displayed under this condition.

Whether it is necessary or not to perform control voltage and frequency when manual operate depends on whether the automatic adjusting voltage or frequency is chosen when setting the channel in order to break down the same frequency state when a generator needs to be paralleled with busbar.

2)PRESET DEVICE PARAMETERS:

The device parameters be used by every channel (parallel point) together.

To enter reset device parameter: enter setting menu, press “▲” or “▼” to choose ‘preset device parameters’, then enter the password before press ‘ENTER’, the display will show the first page of preset device parameters if the password is right, and then to make certain where the signal sent by synchroniser comes from. ‘exterior’ means real TV signal , ‘interior’ means adjustable frequency signal caused by synchroniser .both test cable and test module power supply should be connected when adjusting.

The first page:

INCOMER TV SIGNAL SOURCE INTERIOR/EXTERIOR
BUSBAR TV SIGNAL SOURCE INTERIOR/EXTERIOR

The step of parameter preset is similar to the channels parameter setting .

The second page:

MINIMUM OPERATED VOLTAGE	XX%
SAMEFREQ THRESHOLD	HIGH/MIDDLE/LOW
CONTROL MODE	LOCAL/REMOTE
DEVICE ADDRESS	XX

Minimum operated voltage is a percentage of rated voltage.

Control mode: local / remote: to control in locale or control cabinet.

Device address: the device hung on the local bus (RS485), ranging from 1-99.

The third page :

BAUD RATE XXXX
SERIAL INTERFACE SELECT RS232/RS485

Baud rate: 300/1200/2400/4800/9600. these values should be the same one as that of host computer.

Serial interface select:: RS 232 or RS 485;

These values should be valid only after the device be reset;

The device will enter the step of ‘ wait for a while, it is initializing’ if there are some invalid data caused by something, and will back to ‘ set menu’ after initializing, then, all parameters should be entered again.

3) INQUIRE BREAKER CLOSING TIME:

The first, to press ‘**ENTER**’ after entering the ‘Inquire breaker closing time’ menu, The closing time is calculated according to the TV signals on both ends when paralleling of a generator, not from the measuring by the auxiliary contact of the breaker.

The display shows as follows after entering ‘Inquire breaker closing time ’

Channel 1:

NO 1 means the time for the first closing, NO 2. means the time for the second closing, and so on. The value displayed depends on which channel us chosen by press “▲” or “▼” , press ‘**ESC**’ to exit from inquiring.

Time for closing will not be measured when same frequency paralleling.

4) TO CHANGE PASSWORD:

Enter ‘Modify password’ menu: the display will show input old password, input new password, the password should be a four-digits number or letter. First, to enter the old password, second, to enter the new password. It will be valid if the old password is right. Otherwise, the display shows ‘old password error’ and then return to the main menu.

1 RUNNING.

To enter the working mode of synchronous paralleling by turn the switch to ‘**SYNC**’, signals for close will be output when the synchronous conditions is reached if the TV signals is from exterior, otherwise the close-circuit will be cut off automatically if signals from inner.

There are two ways to enter the program of synchronous paralleling. One--turn the switch to ‘**SYNC**’ after electricity comes to the device, and then press ‘**RESET**’ to enter the program. Another way--turn the switch to ‘**SYNC**’ before electricity comes, and then enter the program after the electricity comes.

Control mode: control mode should be chosen when preset device parameters. One is local control; it will immediately enter the program of paralleling after switching on if it is local control; another one is remote control, it will enter the program of paralleling after receiving the starting instruction from host computer, and at the same time, ‘remote’ will be shown on the right of the screen.

It is necessary to reset the device and channel’s parameters and select an paralleling point before entering ‘**SYNC**’ mode.

Data from RAM and EEPROM should be checked up by device after entering ‘**SYNC**’, and then paralleling points and CMOS relay for closing during the course. Some information will be shown as follow:

1) RAM ERROR:

2) EEPROM ERROR:

3) PARAMETERS ERROR: data from EEPROM exceed the limit,

4) NO BREAKER SELECT SIGNAL: means no breaker be chosen;

5) SELECTED BREAKER MORE ONE: The breakers be chosen more than one.

6) BREAKER IS COLSED: this information should be shown when breaker is closing during same frequency paralleling.

7) TV OPEN-CIRCUIT: one or several line is open-circuit on both sides.

8) WAITING START SIGNAL: wait for the start command from DCS .

It will be process of paralleling after passing self-check the display shows:

XXXX	REMOTE
Fs	xx.xxxx -i + δ
Fg	xx.xxxx -i
Vs	xxx.x
Vg	xxx.x
Tc	xxx

The first row 'XXXX' is the name of breaker; Fs: busbar frequency; Fg: generator frequency; Vs : busbar voltage; Vg: generator voltage; Tc : breaker closing time in practice and not be shown until closing. '-i': using signal from inner, '-o': using signals from exterior; 'Fg' can be adjusted by pressing "▲" or "▼" when using signals from inner.

'+ δ ': Busbar TV voltage lag 30 degrees in angle; '- δ ': Busbar TV voltage lead 30 degrees in angle; '+ δ ' or '- δ ': no change on signals;

State is shown in the last row, the information as follows:

- 1)VOLTAGE HIGH: 'Vg' is higher than 'Vs' and over the Allowable voltage difference;
 - 2)VOLTAGE LOW: 'Vg' is lower than 'Vs' and under the Allowable voltage difference;
- Whether to adjust voltage or not depends on the setting of 'autoregulate voltage' on parameter resetting of channels when above-mentioned conditions appear. However, no adjusting when 'autoregulate voltage' is 'no';
- 3)FREQUENCY HIGH: 'Fg' is higher than 'Fs' and over the Allowable frequency difference;
 - 4)FREQUENCY LOW: 'Fg' is lower than 'Fs' and under the Allowable frequency difference; whether to adjust frequency or not depends on the setting of 'autoregulate frequency' on parameter resetting of channels when above-mentioned conditions appear. However, no adjusting when 'autoregulate frequency' is 'no'. In addition to, there is also no adjusting even though the frequency of generator is less than 49Hz or higher than 51Hz.
 - 5)SAME FREQUENCY: there is no difference or a very little difference between Fs and Fg; the device will adjust Fg higher than Fs under this condition in order to break this state.
 - 6)INCOMER UNDER-VOLTAGE: the device is locked when the value of Vg is less than that of lock-voltage reset in device.
 - 7)BUSBAR UNDER-VOLTAGE: the device is locked for the value of Vs is less than that of lock-voltage reset in device.
 - 8)OVER VOLTAGE: The value of Vg is higher than that of over-voltage protecting and the device will decrease the voltage continuously;
 - 9) δ EXCEED LIMIT: paralleling will stop if power angle is more than permissible value during loop-type system synchronous paralleling.
 - 10) Δ V EXCEED LIMIT : paralleling will stop if voltage difference is higher than the permissible value during synchronous paralleling;

Breaker closing time will be shown if there is a change in the auxiliary contact of breaker, otherwise 'breaker unclosing' will be shown after paralleling. The breaker closing time is an approach when fake synchronizing and it will be the accurate one when paralleling of different frequency.

2 TEST:

Local testing: testing on software and hardware of the device can be done.

Turn 'switch' to 'TEST' to enter test mode, then the display shows:

NO-VOLTAGE CLOSE BREAKER SYNCHRONISING PROCESS TEST TEST RELAY EQUIPMENT TEST
--

1) LOCAL TESTING

Preparation for safety should be done before testing.

NO-VOLTAGE CLOSE BREAKER: The breaker closes one time a second if there is no voltage on both ends in order to check whether the breaker is right or not.

Select 'NO-VOLTAGE CLOSE BREAKER' and press '**ENTER**', the testing will be done.

SYNCHRONISING PROCESS TEST: the testing will be done as same as the operation in practice of paralleling except that the close-circuit is locked by relay SL;

TEST RELAY: the testing is used for checking whether the out-connection cables are right or not by testing whether accelerating speed, deceleration speed, increasing voltage, decreasing voltage, close lock and alarm-relay would work or not. To enter 'TEST RELAY' menu, the display shows:

TESTING RELAY
XX RELAY

Press **esc** stop test

Press "**▲**" to scroll for decreasing voltage, increasing voltage, decelerating speed, accelerating speed, at the same time, '-V, +V, -F, +F, SW, ALM, SL', will be shown relevantly in the order and the relevant indicator light on the front panel will be on. The relay doesn't work if the indicator is off.

The JK4 plug to local relay should be connected to the JK4 socket in the rear panel and the JK4 plug to test cables should be off in order to test.

2) EQUIPMENT TEST

'EQUIPMENT TEST' includes testing frequency, voltage, angle, channels of paralleling points, switches, TV open-circuit, and so on.. Turn on the device after connecting the special testing cables and power line of testing module and switching on. After enter setting menu, select 'EQUIPMENT TEST' and press '**ENTER**'.

TEST TV INPUT
TEST DI
TEST PRESS KEY
AND SWITCH
TEST TV OPEN-
CIRCUIT

① TEST TV INPUT

Two parameters of device related: busbar and generator signal sources. Signals should be 50Hz voltage one from exterior or variable frequency one from inner. There will show '-i' on the left of 'Fs' or 'Fg' if it is from inner, otherwise '-0' will be shown..

Busbar signals will be turned an angle (-30° , 0° , 30°) according to the parameter of 'SHIFT BUSBAR TV PHASE ANGLE' when a generator need to paralleled be chosen and busbar signals is from exterior.

Testing frequency, voltage, angle.

After enter 'EQUIPMENT TEST' menu, the display will show as follows if select 'TEST TV INPUT'.

TESTING TV INPUT

Fs	xx.xxx	-o + δ
Fg	xx.xxx	-i
Vs	xxx.x	xxxx
Vg	xxx.x	xxxx

Press **esc** to stop test

Busbar frequency is shown on the left of Fs;

Incomer frequency is shown on the left of Fg;

The voltage values of busbar and data collected by A/D on the right of Vs.

The voltage values of generator and data collected by A/D on the right of Vg;

Angle is displayed in the synchroscope for showing phase in the way of light.

To decrease or increase frequency by pressing “▲” or “▼” if signals is from inner.

To change voltage of busbar or generator by turning the knob of Vs or Vg on the front panel, and the new values will be shown on the screen.

To press ‘ESC’ for exiting the test and go back to setting menu.

② TEST DI

The steps to enter ‘TEST DI’ are similar to those of entering ‘TEST RELAY’.

TESTING DI			
P1	P2	P3	P4
P5	P6	P7	P8
P9	P10	P11	P12
SM	ST	NV	

The relevant input will be chosen when putting the digital switch on the front panel up.

③ TEST PRESS KEY AND SWITCH

Whether these keys and switches are ok or not will be confirmed through the testing, including “▲”, “▼”, “◀”, “▶”, ‘ESC’, ‘ENTER’ and switch work mode on the front panel.

The steps to enter ‘TEST PRESS KEY AND SWITCH’ are similar to that of entering ‘TEST RELAY’.

The display shows as follows after entering the ‘TEST PRESS KEY AND SWITCH’.

TESTING PRESS KEY AND SWITCH □□ ×× STATUS Press esc to stop test

Turn the switch to set work mode. ‘W’, ‘T’, or ‘S’ will be shown in xx. Press “▲”, “▼”, “◀”, “▶”, ‘ENTER’ they will be shown in □□. Testing will be stopped after pressing ‘esc’, and it will go back to the last menu.

④ TEST TV OPEN-CIRCUIT

To enter ‘TEST TV OPEN-CIRCUIT’, the display shows as follows:

TESTING TV OPEN-CIRCUIT BUSBAR TV OPEN-CIRCUIT INCOMER TV OPEN-CIRCUIT

These switches to test TV open-circuit, such as Sf, Sa, Sb, Sc, Gf, Ga, Gb, Gc, located on the bottom of test-module, simulate the input TV voltage on both ends of paralleling points. It means open-circuit when putting the switch up and the display in reversal.

3 HOW TO USE THE TEST MODULE:

A test module is supplied in the device of SID-2CM for testing and checking, which can handed all kinds of signals to the socket of JK2, JK3 and JK4 through the JK5 located on the rear of the device. These are four plugs in the connection line. They are JK2 with fourteen pins, JK3 with 26 pins, JK4 with 19 pins, JK5 with 55 pins. Not only should these plugs be connected but two power lines with 220V AC should be connected to JK7 socket and JK1 socket respectively when testing.

In order to simulate that the device is power off, there may be a switch with the line of JK1 socket in series and the 220V AC power supply from JK7 socket is controlled by the switch at the right bottom of the front panel.

TV voltage values on both ends of incomer and busbar can be adjusted with the potentials of V_s and V_G at right bottom of the panel. Whether the adjusting values shown on the display related to voltage is accordance with values measured in practice or not can also be checked with potentials of V_s and V_G .

Twelve digits turn-code switch on the top of the test module panel can be used to simulate the synchronous switch at locale and check whether there is correct, such as no paralleling points or more than two paralleling points appear simultaneously. The device switch of TV voltage on the left can be used to make certain whether there is line voltage or phase voltage of TV voltage on busbar and incomer.

The keys of 'remote reset' and 'auxiliary contact' on the top of the test module are used to check whether the device can receive reset instruction from remoteness and what situation the breaker auxiliary contact is, the key of auxiliary contact can measure the breaker closing time and confirm the breaker is on the state. The state of decreasing voltage, increasing voltage, decelerating speed, accelerating speed, lock, alarm and close lock relay can be display with the seven indicator lights in an order from left to right. It means running when the relevant light is on.

The frequency of generator can be changed by pressing "▲" or "▼" when the generator signal source be preset to 'inner' during testing of the device. However, it can't be adjusted when the signal source of 'inner' is from busbar.

PRESET PARAMETER RANGE AND STEP SIZE

NO	Parameter designation	Range	Stepsize
1	Breaker time	0-999ms	±1ms
2	Allowable freq.diff.	0.1-1.0HZ	± 0.01HZ
3	Allowable volt.diff.	0%-20%UN	± 1%
4	Regulate freq.coeff	0.05-0.99	± 0.01
5	Regulate volt.coeff	0.05-0.99	± 0.01
6	Allowable power angle	0-80°	± 1
7	Incomer TV Rated voltage	40-120V	± 1V
8	Busbar TV Rated voltage	40-120V	± 1V
9	Generator Allowable overvoltage Rated	110%-130%UN	± 1%
10	Autoregulate freq.Function	YES/NO	
11	Autoregulate volt.Function	YES/NO	
12	Control pulse width for same freq.	5-90	± 1
13	Breaker name	0000-9999. AAAA-ZZZZ	0-9、A-Z
14	Incomer TV signal source	INT./EXT.	
15	Basbar TV signal source	INT./EXT.	
16	Minimum operated voltage	50%-90%UN	±1%
17	Control mode	Local/Remote	
18	Device Address	1-99	±1
19	Baud Rate	300/1200/2400/4800/9600	
20	Serial Interface select	RS485/RS232	
21	Shyft busbar TV phase angle	Lend30° .0° .leg30°	30°
22	Samefreq. threshold	High/middle/low	

CONNECTING BETWEEN SID-2CM AND COMPUTER

The device can be communicated with computer by the connection of RS-232 or RS-485. The work mode switch should be turn to ‘SYNC’ when no one on duty, thus, the device can be communicated with the computer after it received the signals from computer and the instruction of ‘start synchronous’ from power source, and then off duty after paralleling accomplished if it receives the instruction of ‘cut off synchronous device’ from computer or not.

1 HARDWARE CONNECTION:

The connection of RS-232 is on the front panel of the device. The device can be connected with a PC directly or with a notebook PC by a RS-232 communication cable, however, the length of the communication cable should be less than 15 meters.

Several synchronous device or even other devices with RS-485 connection can be connected with the local bus by the bus of RS-485 of one computer. The length of RS-485 in the device is from 13,14,15 pin of the JK3 socket on the back-panel. A communication cable of RS-232, a part to change connection from RS-232 to 485 and its power supply, a bus should be necessary when using the connection of RS-485.

There should be extra changes for this set of parts beyond the device if necessary.

See fig below about the connection of hardware.

2 SETTING OF THE DEVICE:

Baud rate of the serial connection should be set in accordance with that of up-device when communication between serial connection and up-device, the NO. of the device should be set too, and using connection of RS-232 or RS-485 should be chosen. Setting should be according to the instructions for use in the fourth chapter.

The device of SID-2CM can be controlled by up-device through RS-485 local or a relay with cables. There are two ways to control:

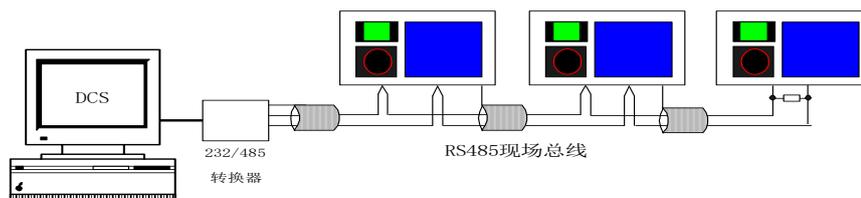
- 1) the device power off.

To turn the device power on through the relay of up-device, the device would work. To cut off the power source to the device by up-device after paralleling completed.

- 2) the device power on:

to reset the device in a way of short closing with relay of up-device, then, the device would work and stop after paralleling completed and show the time for breaker’s closing measured in practice all along.

*SID-2CM with operating remote control



SID-2CM

Automatic Synchroniser



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