MODEL DACTS701C

GENERATOR AUTO CONTROLLER

USER'S MANUAL

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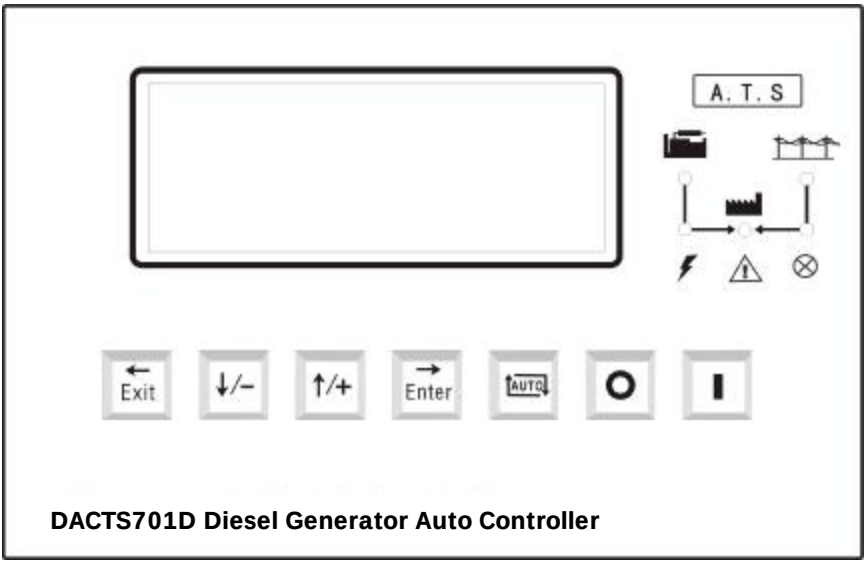
1. Description

The DACTS701D is a diesel generator automatic controller, it adopts a microprocessor for control, big and backlight LCD for display, feather-touch keys for operation. The controller is used to monitor the status of the diesel and the mains at real time, transfer the load between the diesel and mains and start and stop the diesel generator automatically. In addition, the controller provides automatic stop for failure and remote monitoring functions.

The controller features compact structure, advanced technique, high reliability, it can be used for various types of diesel generators and provides all necessary functions as an emergency power supply.

In order to correctly install, debug and operate the controller, for one thing, the operator should know well the operation and edit method for the parameters of DACTS701D. It is suggested that the operator will read carefully this user's manual to be well up in the technique parameters, theory and functions of the DACTS701D before operating the controller.



DACTS701D Diesel Generator Auto Controller

2. Features

- Monitoring the status of the mains and generator at real time
- Automatically start and stop the diesel generator
- Automatically control the ATS to transfer the load
- Automatically shut down the diesel generator on fault condition
- Monitoring the TRMS of voltage and current
- Display the cumulated electric energy of the diesel
- Configurable 5 digital inputs
- Configurable 4 relay outputs
- Provide RS485 communication
- Edit for parameter values by feather-touch keys
- Pc configurable via MS windows based software
- Optional Chinese and English display interface

3. Main technical parameters

3.1 power supply

DC7.0 ~ DC40.0V

3.2 consume eletricity

< 3W

3.3 analogue inputs

3.3.1 AC inputs

Generator voltage input:

- Single phase 2 wire: 15V AC-360V AC（ph-N）
- 3 phase 4 wire: 15V AC-360V AC（ph-N）

Load current input:

0 - 5A AC

Generator frequency input:

50 / 60Hz

Magnetic voltage input:

+/- 0.07V –70V peak

Magnetic frequency input:

10,000 Hz max.

3.3.2 Temperature input range:
0 - 120℃

3.3.3 Oil pressure input range:
0 -1000kpa

3.4 Digital inputs
Normal voltage range: 0-12V DC

3.5 Relay outputs
- Start relay output：10Amp, DC28V
- Fuel relay output：10Amp, DC28V
- Idle speed relay output：3Amp, DC28V
- Other relays output：5Amp, DC28V

3.6 Analogue outputs
AC voltage
- Display range： 0-660V AC
- Max. measure error： ±1%

AC current
- Display range： 0-5000A（CT 比率=5000：5）
- Max. measure error ： ±1%

Frequency
- Display range： 0-99Hz
- Max. measure error ： ±1%

Speed
- Max. measure error ： ±1%

Temperature
- Display range： 0-120℃
- Max. measure error ： ±2℃

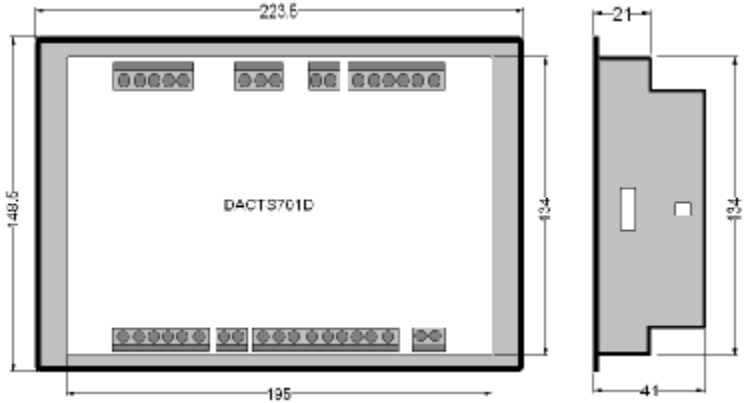
Oil pressure
- Display range： 0-1000kpa
- Max. measure error ： ±2%

Battery voltage
- Display range： 7-40 V DC
- Max. measure error ： ±1%

3.7 Dimensions

- Dimension：223.5（W）x 148.5（H）x 41（D）mm (overall)
  195（W）x 134（H）mm (back shell)
- Panel cut-out：197（W）x 135（H）mm

The controller is fitted into the cut-out with the fixing clips removed. These are then fitted from the rear. Connection is via the plug and socket connectors.



3.8 Working condition

- Working temperature：-20 ～ +60℃
- Storage temperature：-30 ～ +75℃
- Relative humidity：95%RH

3.9 Communication

RS485 communication mode，the controller provides 485+ and 485- terminals，communicating with the PC by a RS485 convertor.

4. Part function

4.1 LCD display

The LCD displays the parameters in 4 lines. When the controller is powered on, the LCD will display welcome page for controller type, serial number and software version, after 5 second, display the default page. The controller has 5 default pages, they are generator parameters page, mains parameters page, load parameters page, engine parameters page and system status page, the user can scroll the default page circularly by pressing [←] key, under normal display, the LCD display the mains parameters page, if you want to enter the system status page, press [↓] key, pressing [←] key will return to the default display page.

The LCD has backlight feature, within 1 hour, if no any operation to the keys, the LCD will turn dark, press any key can make it active.

Mains U-L 0 0 0 V Mains U-N 0 0 0 V Frequency 0.0Hz 2008-04-08 11:27:01	Default display page. The LCD display: mains wire voltage, mains phase voltage, mains frequency, current date and time of controller.
Gen U-L 0 0 0 V Gen U-N 0 0 0 V Freq 0.0Hz Speed 0 PRM Gen Energy 99999999kwh	Pressing [←] key will display: Generator wire voltage and phase voltage, frequency, engine speed, generator cumulated electric energy.
Load Monitor Mains Current 0 0 0 A Power 0.0KW 0.0KVA Power factor 1.00	Pressing [←] key will display: Load current, active power, apparent power, power factor. either the generator is in stop status, or the load is powered by the mains, the load status will show 'monitor Mains', once the load is transferred to generator, the load status will show 'monitor Gen,
Batt 25.0V Cool 20℃ Oil P 600KP Oil T 20℃ Fuel 93% Gen Runtime 10:20:35	Pressing [←] key will display: battery volts, coolant temperature, oil pressure, oil temperature, fuel level, total run time.
Status Mains low volt Low freq Gen ready Alarm	Pressing [←] key will display: engine status, generator status, mains status, alarm information. The left screen show: the generator is in ready status, the mains voltage and frequency are low, an alarm occurs.

4.2 Keys function

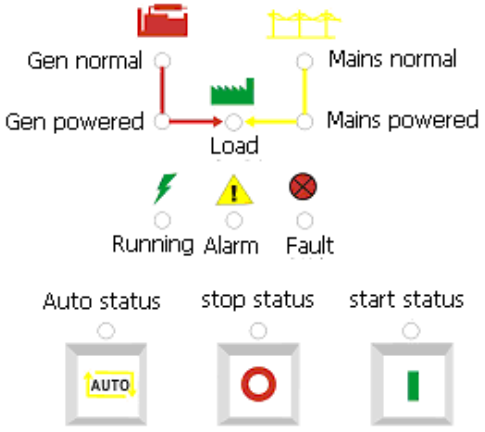
The seven membrane keys are used to control the DACTS701D, everything is done via the keys.

The function keys are as follows：

← Exit	Pressing this key will scroll the display page. The function of the [Exit] key is to 'back up', or exit from your current menu level to the previous level. It can also cancel an editing operation. If you do not wish to change the original value when you are editing a parameter value, press this key.
↓/−	Pressing this key will enter system status page. The function of this key is to view the **front** parameter item on the same level. The [-] key is used to **decrease** a numeric value when you are editing a value in the parameter setting status.
↑/+	Pressing this key, you will be prompted to input the password for accessing the controller. The function of this key is to view the **back** parameter item on the same level. The [+] key is used to **increase** a numeric value when you are editing a value in the parameter setting status.
→ Enter	The [Enter] key will take you to the next level menu each time it is pressed. It can also end an editing operation in the parameter setting status. When this key is pressed, the new value is written to EEPROM (memory), and the editing status is removed.

	Press this key, the controller will be placed in 'Auto' status, automatically stopping and starting the diesel generator are decided by the mains status or the 'remote start' input signal (if be configured).
	Pressing this key will stop the diesel generator if it is running, and the controller is placed in the 'stop' status, at the moment, even though the mains is abnormal, the generator can not be start automatically. If the generator is shut down because of generator fault, pressing this key will reset the alarm. Until the fault is removed and the controller is reset, the diesel generator may be started over again.
	The diesel generator will be started immediately when this key is pressed. If the mains is normal, the generator will run without load, and if the mains is abnormal and the generator is normal, the load will be transferred to the generator. Note that the diesel generator is forbidden to start if the 'remote reset' input is active (if be configured).

4.3 LED indication



Gen normal: if the generator voltage and frequency are normal, the LED lights on.

Mains normal: if the mains voltage and frequency are normal, the LED lights on.

Gen powered: While the load is powered by the generator, the LED lights on.

Mains powered: While the load is powered by the mains, the LED lights on.

Load: While the load is powered normally, the LED lights on.

Running: While the diesel generator is running normally, this LED lights on.

Alarm: When an alarm or a generator failure occurs, the Alarm′ LED will flash.

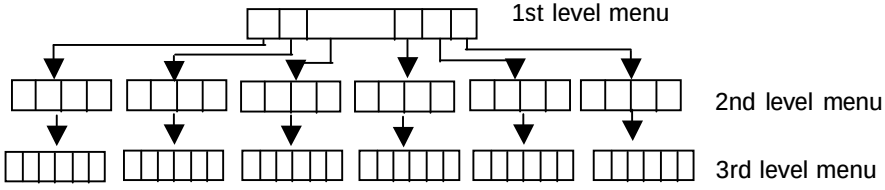
Failure: When a generator fault occurs, the LED lights on.

Auto: Press the [**Auto**] key, this LED lights on, indicating that the generator is in 'Auto′ status.

Stop: Press the [**O**] key, this LED lights on, indicating that the generator is attempting to stop.
Start: Press the [**I**] key, this LED lights on, indicating that the generator is attempting to start.

5. Parameter description

5.1 Menu structure



The 1st level menu consists of the following items:

- Analogue
- Delays
- System parameter
- Digital inputs
- Relay outputs
- Sensor adjust
- Fault records

In order to enter the menu system, you must provide the access password, just as if you were at the DACTS701D keypad. The password is four-digital and the factory default is '3333'.
Operation: Press the [↑] key while the default display page is shown, you will be prompted for a password, press the [+] key for three times until the LCD displays '3- - -', and then press the [enter] key to confirm it, at the moment, the LCD shows ' 0- - '. Repeat this operation for 3 times, you will get into the menu, if the password is wrong, the menu is not allowed to enter.

To select an item from the menu, use the [-] or [+] key, and press [enter] key when you want to progress to the next menu level. If you want to go back a level, press [exit].

5.2 Menu parameter

5.2.1 Analogues

- Battery Volts
- Coolant temperature
- Oil pressure
- Fuel level
- Oil temperature
- Oil pressure2
- Engine speed RPM
- Generator high voltage
- Generator low voltage
- Mains high voltage
- Mains low voltage
- Load current A
- Load current B
- Load current C
- Mains high frequency
- Mains low frequency
- Generator high frequency
- Generator low frequency
- Generator power

Select 'analogue' item, then press [enter] to progress the next level, by means of [+] and [-] keys to select the required parameter. If you want to edit the setting value, please [enter], continuously pressing [exit] key will quit and return the LCD default page.

Each analogue input channel has 2 configurable parameters: alarm up limit/stop valve, alarm down limit/alarm valve.

- Alarm up limit: this parameter value determines the point at which an analogue input is considered as a high fault, it is configurable.
- Alarm down limit: this parameter value determines the point at which an analogue input is considered as a low fault, it is adjustable.
- Stop value: this parameter value is used for pre-alarm function. When an analogue input over/under the stop value setting, a shutdown fault will occur.
- Alarm value: this parameter value is used for pre-alarm function. When an analogue input over/under the alarm value setting, an alarm will occur.

5.2.2 Time delays

- Crank time
- Crank rest time
- Bypass
- Remote start
- Cooling shutdown
- Fuel
- Pre-fuel
- Transfer fault
- Low oil pressure
- High coolant temperature
- Over speed
- Over generator frequency
- Over generator volts
- Low fuel level
- Current overload
- High oil temperature
- Low battery volts
- Speed up
- Speed down
- Idle speed
- Transfer
- Warm up
- Load no power

1) Time Delay crank time

The crank delay begins to time when the diesel generator is attempted to start, during the delay period, the controller automatically detects the start successful condition, if one condition is meet, the controller will consider that the diesel generator has been started successfully and the crank delay will be ended.

Start success condition:

One of the followings is achieved, the diesel generator will be considered to been started successfully.

- Ø The engine speed rises over the value of 'success speed' （configured in system parameter）
- Ø The generator output voltage rises over the value of 'success voltage'（configured in system parameter）
- Ø The generator output frequency rises over the value of 'success frequency'（configured in system parameter）
- Ø The oil pressure rises over the value of 'success pressure'（it is effective only when the pressure success in system parameter must be configured with 'monitor'）

2) Time Delay crank rest time

When the crank time delay ends, if the diesel generator can not be started successfully and the start number does not reach the setting value, the crank rest time begins, after this delay, again the crank time begins, the start number increases one.

3) Time delay bypass

After the generator has started successfully and the delay speed up has timed out, the delay bypass begins to time, during the delay period, the controller inhibits generator shutdown due to low oil pressure, high coolant temperature, over generator frequency and over generator voltage faults.

4) Time delay remote start

Once the mains turns abnormal, the remote start delay begins to time, after it has timed out, if the controller is in 'Auto' status, the generator is signaled to start, and the pre-fuel time delay is initiated.

5) Time delay cooling shutdown

When the 'mains powered' relay is energized, the delay begins to time, during the delay period, if the generator is running, it will be allowed to run without load until the delay times out. Following the cooling shutdown time delay, the generator is signaled to stop.

6) Time delay fuel

The delay is useful only when the configurable digital output is configured with energized to stop. Once generator is signaled to stop, the 'energized to stop' relay will be energized, until the delay times out, this relay is de-energized.

7) Time delay Re-fuel

The re-fuel delay begins to time once the 'remote start' delay ends, synchronously the pre-fuel relay is energized, after this delay times out, the diesel generator is started. The pre-fuel relay will be de-energized once the generator is running normally.

8) Time delay transfer fault

The time delay transfer fault will be effective only if the 'load monitor' in system parameter is configured with 'monitor.

This delay begins to time When the 'mains powered' relay or 'gen. powered' relay is energized, synchronously the load status is detected. During the delay period, if load potential is detected, the delay is reset. If no load potential is detected and the controller is in 'auto' or 'start' status, a transfer fault will occur.

9) Time delay low oil pressure

When the oil pressure drops below it's stop value, this delay begins to time, during this delay, if oil pressure turns normal, the delay will end.

10) Time delay high coolant temperature

When the coolant temperature rises over it's stop value, high coolant temperature delay begins to time, during this delay, if coolant temperature turns normal, the delay will end.

11) Time delay speed limit

When the engine speed rises over it's alarm up limit or drops below it's alarm down limit, the speed limit delay begins to time, during this delay, if engine speed turns normal, the delay will end.

12) Time delay frequency limit

When the generator frequency rises over the stop value of high generator frequency, or drops below the stop value of low generator frequency, the frequency limit delay begins to time, during this delay, if generator frequency turns normal, the delay will end.

13) Time delay Gen voltage limit

When the generator voltage rises over the stop value of generator high voltage, or drops below the stop value of generator low voltage, the Gen voltage limit delay begins to time, during this delay, if generator voltage turns normal, the delay will end.

14) Time delay low fuel level

When the fuel level drops below it's stop value, low fuel level delay begins to time, during this delay, if fuel level turns normal, the delay will end.

15) Time delay current overload

When any one phase current is above it's stop value, or the generator power is above it's stop value, the current overload delay begins to time, during this delay, if generator current or generator power turns normal, the delay will end.

16) Time delay high oil temperature

When the oil temperature rises over it's stop value, high oil temperature delay begins to time, during this delay, if oil temperature turns normal, the delay will end.

17) Time delay low battery volts

When the battery voltage drops below it's alarm down limit, the low battery volts delay begins to time, during this delay, if battery voltage turns normal, the delay will end.

18) Time delay speed up

After the idle speed ends, the speed up delay begins to time, during the delay, speed up relay is energized, until the speed up limit switch is closed, the speed up relay will be de-energized.

19) Time delay speed down

Before the diesel generator is stopped normally, the speed down delay has been initialized. When this delay times out, the fuel valve will be cut off. But on the emergency, the fuel valve is cut off immediately, the

speed down delay begins to time synchronously.

20) Time delay idle speed

After the diesel generator is started successfully, the idle speed delay begins to time, when this delay times out, the speed up delay will be initialized.

21) Time delay transfer

When the mains turns normal, and no mains transfer fault occurs, the transfer delay begins to time, after this delay ends, if the mains is still normal, the mains powered relay will be energized, and the generator powered relay will be de-energized.

22) Time delay warm up

After the diesel generator has been started and the time delay bypass ends, if the generator voltage and frequency are normal, the time delay warm up begins to time, during the delay period, the generator is running without load.

23) Time delay load no power

When the load is transferred between the mains and the diesel generator, this value decides the transfer action time of ATS.

Warning: this delay directly affects transfer time between one supply and another. Setting the delay to a large value may result in a considerable length of time with no power connected to the load.
Each of the time delays have one adjustable parameter：set. This parameter sets the initial value for the time delay, the delay has decrement of 0.1 second from this value to 0.The value of set can be modified by personnel.

In the time delay menu, select required modifying parameter, press [enter] key, at the moment, on the 3rd line right side of the LCD, the set value is shown, if you wish to modify the set value, please [enter] key, the background of set value turns light, adjust the value by means of pressing [-] and [+] keys, press [enter] key to confirm it, if you want to cancel the change, press [exit].

As an example, the following would be the procedure for changing the value of 'time delay bypass' set to 30.0 seconds：

1) On the default display page, press [↑] key, you are required to input the password (detailed operation see the foregoing section), finishing the password inputting, you can enter the menu system.

2) Press the [+] key, select 'Delays' item, then press [enter] key.

3) Press the [+] key until the 'Bypass' item is shown, and press [enter], the LCD will display 'set：15.0" on the right side'.

4) Press [enter], the background of '15.0' lights on.

5) Press [-] or [+] key to adjust the numerical value to 30.0, then press [enter] to confirm it.

6) You can press [exit] key to return to whatever level of menu you wish.

5.2.3 System parameter

- Convertor rate
- Flywheel gears
- Success frequency
- Success speed
- Success pressure
- Schedule days
- Schedule minute
- Schedule start
- Success voltage
- Press success condition
- Module address
- Baud rate
- Start numbers
- Powered allow
- Load monitor
- Coolant temp curve
- Oil pressure curve
- Fuel level curve
- Oil temperature monitor
- Fuel level monitor
- Digital input 1-4
- Digital output 1-5
- Language select
- Module time
- Set to default

1) CT rate (Convertor rate)

The external convertor should fit the max current of the generator, the correct setting for CT rate may make the controller display the actual current.

For example, the generator quipped a 500:5 convertor, the CT rate should be set to 500.

2) Flywheel gears

When you select the magnetic sensor to be the speed signal source, the engine speed should be counted by the flywheel gears.

3) Success frequency

The set value is used to judge if the diesel generator can be started successfully.

4) Success speed

The set value is used to judge if the diesel generator can be started successfully.

5) Success pressure

The set value is used to judge if the diesel generator can be started successfully. This parameter is noneffective if the pressure success condition is configured with 'not monitor'.

6) Schedule days

While the generator is in 'auto' status, the automatic start on schedule function are effective only if the schedule days value and schedule minute value are not '0'. This value decides the interval days that the diesel generator will be started automatically. For instance, the schedule days value is set to 7, then every seven days the diesel will be started automatically.

7) Schedule minute

This value decides the minutes the diesel generator runs for on schedule, if it is set to 0, the automatic start on schedule function is noneffective. For example, the schedule days value is set to 7, and the schedule minute value is set to 10, then every seven days the diesel will be started automatically, and after running for ten minutes, automatically it is stopped.

8) Schedule start

The value decides the clock the diesel generator is started automatically on schedule.

9) Success voltage

The set value is used to judge if the diesel generator can be started successfully.

10) Pressure success condition

Setting	Description
Not monitor	The 'success pressure' is not used for judging the diesel's successful start.
Monitor	The 'success pressure' is used to judge if the diesel is started successfully.

11) Address

For recognizing different controller in communication with PC, each controller should has exclusive address.

12) Baud rate

Setting	Baud rate
0	2400
1	4800
⩾2	9600

13) Start number

The controller offers a cycle option, providing from 1 to 8 crank cycles. If more than one number is selected, a rest period is inserted between crank attempts. The crank time and rest time are independently adjustable.

Setting	Start numbers
1	1
2	2
3	3
…	…
7	7
8	8

14) Powered allow

Setting	Description
Allow	Gen powered relay is allowed to energize.
Not allow	Gen powered relay is not allowed to energize.

15) Load monitor

Setting	Description
Not monitor	Not monitor the load potential during the ATS is transferring.
Monitor	Monitor the load potential during the ATS is transferring.

16) Coolant temperature curve

The serial numbers for coolant temperature curves, the factory default curve number is 1, the coolant temperature and relative resistance values are shown in ′sensor adjust′ menu.

17) Oil pressure curve

The serial numbers for oil pressure curves, the factory default curve number is 1, the oil pressure and relative resistance values are shown in ′sensor adjust′ menu.

18) Fuel level curve

The serial numbers for fuel level curves, the factory default curve number is 1, the fuel level and relative resistance values are shown in ′sensor adjust′ menu.

19) Oil temperature monitor

Setting	Description
Not monitor	The controller does not monitor the oil temperature analogue input.
Monitor	The controller monitors the oil temperature analogue input.

20) Fuel level monitor

Setting	Description
Not monitor	The controller does not monitor the fuel level analogue input.
Monitor	The controller monitors the fuel level analogue input.

21) Configurable digital output 1-4

The controller provides four configurable digital outputs, the user can select one of the following definitions to configure it, the relay′s on/off status is shown on the ‘relay outputs’ menu.

Setting	Description
Pre-fuel	For pre-lubricating the diesel generator
Energized to stop	Control the stop-electric magnet when the diesel generator is stopped.
Pre-heat	Pre-heat the diesel generator before starting
Pre-alarm	One channel of analogue input is between alarm value and stop value, the relay has an output.
Speed up	The relay has an output during 'speed up' delay.
Speed down	The relay has an output during the time delay 'speed down'.
Invalid	Noneffective

22) Configurable digital input 1-5

The controller provides five configurable digital outputs, the user can select one of the following definitions to configure it, the switch's on/off status is shown on the 'digital inputs' menu.

Setting	Description
Low fuel level	Low fuel level input signal
Low cool level	Low cool level input signal
Common alarm	Common alarm input signal
Common fault	Common fault input signal
Remote start	In 'Auto' status, this input signal can control the diesel's automatic start.
Remote reset	The diesel is forbidden to start when this input signal is closed.
Speed down limit	Used for stopping the speed up relay's output.
Speed up limit	Used for stopping the speed down relay's output.
Gen. powered	Indicating that ATS is on the generator side.
Mains powered	Indicating that ATS is on the mains side
Invalid	Noneffective

23) Language select

Setting	Description
English	Showing information in English
中文	Showing information in Chinese

24) Module time

The controller's current date and time, the setting can be changed. The setting sequence is year-month-day, hour: minute: second.

25) Set to default

Setting	Description
Analogue	Set all analogue setting to factory values.
Delays	Set all time delays to factory values.
System parameter	Set all system parameters to factory values.

5.2.4 Digital inputs

These parameters are used to view the external switch's status of the controller. If the switch is open, the show background is normal, otherwise, if the switch is closed, the show background lights on.

- Low oil pressure
- High coolant temperature
- Emergency stop
- Digital input 1-5（configuration see the No.22 in the system parameter menu）

5.2.5 Relay outputs

These parameters are used to view the internal relay's status of the controller. If the relay is open, the show background is normal, otherwise, if the relay is closed, the show background lights on.

- Fuel control
- Crank
- Generator powered
- Mains powered
- Failure
- Digital output 1-4（configuration see the No.21 in the system parameter menu）
- Idle speed

5. Parameter default settings

Parameter	Default	Range (suggestion)
Battery volts alarm up limit	28.0V	16～18V/28～32V
Battery volts alarm down limit	10.0V	8～10V/18～22V
Coolant temperature stop value	95℃	95～105℃
Coolant temperature alarm value	90℃	90～95℃
Oil temperature stop value	105℃	105～115℃
Oil temperature alarm value	95℃	95～105℃
Oil pressure stop value	120kpa	80～200 kpa
Oil pressure alarm value	150kpa	100～250 kpa
Fuel level stop value	20%	5%～20%
Fuel level alarm value	25%	10%～25%
Speed alarm up limit	1650RPM	1650～1950RPM
Speed alarm down limit	1410 RPM	1200～1410RPM
Gen/Mains high volts stop value	440V	430～460 V
Gen/Mains high volts alarm value	420V	420～440 V
Gen/Mains low volts stop value	320V	300～350 V
Gen/Mains low volts alarm value	340V	330～360 V
Load current A/B/C stop value	400A	Refer to engine
Load current A/B/C alarm value	390A	Refer to engine
Gen/Mains high freq. stop value	55.0Hz	54～58 Hz
Gen/Mains high freq. alarm value	53.0 Hz	52～55 Hz
Gen/Mains low freq. stop value	45.0 Hz	44～46 Hz
Gen/Mains low freq. alarm value	47.0 Hz	46～48 Hz
Generator power stop value	200kw	Refer to engine
Generator power alarm value	190s	Refer to engine
Crank time	6.0s	3.0～8.0s
Crank rest time	30.0s	5.0～60.0s
Bypass	15.0s	5.0～60.0s
Remote start	5.0s	1.0～60.0s
Cooling shutdown	30.0s	5.0～180.0s
Fuel	10.0s	5.0～15.0s
Pre-fuel	5.0s	5.0～15.0s
Transfer fault	30.0s	10.0～60.0s
Low oil pressure	3.0s	3.0～10.0s
High coolant temperature	10.0s	5.0～20.0s
Over speed	10.0s	2.0～20.0s
Over generator frequency	10.0s	2.0～60.0s
Over generator volts	15.0s	2.0～60.0s
Low fuel level	5.0s	5.0～20.0s

Current overload	10.0s	5.0～60.0s
High oil temperature	10.0s	5.0～20.0s
Low battery volts	15.0s	5.0～60.0s
Speed up	10.0s	0.0～120.0s
Speed down	30.0s	0.0～120.0s
Idle speed	10.0s	0.0～60.0s
Transfer	30.0s	5.0～120.0s
Warm up	5.0s	2.0～20.0s
Load no power	5.0s	0.0～5.0s
CT rate	500	30～5000
Flywheel gears	0 gear	0～255 gears
Success frequency	15.0Hz	10.0～20.0 Hz
Success speed	400RPM	300～600 RPM
Success pressure	300kpa	200～500 kpa
Schedule days	2 days	0～14 days
Schedule minute	2 minutes	0～15 minutes
Schedule start	8:00	24 hour system
Success voltage	40V	16～100 V
Press success condition	monitor	Monitor/not monitor
Module address	120	0～254
Baud rate	2（9600）	1/2/3/4
Start numbers	3	1～8
Powered allow	allow	allow/not allow
Load monitor	not monitor	Monitor/not monitor
Coolant temp curve	1	0～8
Oil pressure curve	1	0～8
Fuel level curve	1	0～8
Oil temperature monitor	monitor	Monitor/not monitor
Fuel level monitor	monitor	Monitor/not monitor
Digital output 1	Pre-fuel	Pre-fuel/ Energized to stop/Pre-heat/ Pre-alarm/Speed up / Speed down/ Invalid
Digital output 2	Energized to stop	
Digital output 3	Speed up	
Digital output 4	Speed down	
Digital input 1	Low fuel level	Low fuel level/ Low cool level/Common alarm/ Common fault/ Remote start/ Remote reset/ Speed down limit / Speed up limit/ Gen. Powered/Mains powered / Invalid
Digital input 2	Low cool level	
Digital input 3	Common alarm	
Digital input 4	Common fault	
Digital input 5	Invalid	

6. Sensor adjust

The curves of coolant temperature, oil pressure and fuel level sensors are described by resistance, the user may change the resistance to edit the curve for meeting different type of sensor.

The default oil pressure sensor curve (No.1)
oil pressure & resistance value

Pressure (Kpa)	0 Kpa	400 Kpa	800 Kpa	1000 Kpa
Resistance (Ω)	10Ω	89Ω	150Ω	176Ω

The default fuel level sensor curve (No.1)
Fuel level & resistance value

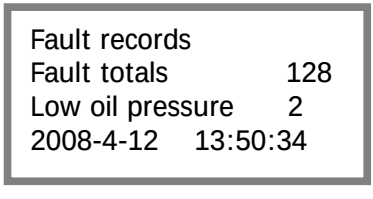
Fuel level (%)	0%	20%	40%	100%
Resistance (Ω)	35Ω	70Ω	104Ω	202Ω

The default coolant temperature sensor curve (No.1)
Coolant temperature & resistance value

Cool Temp (℃)	0	20	40	60	80	90	100	120
Resistance (Ω)	2052	820	330	150	72	52	38	22

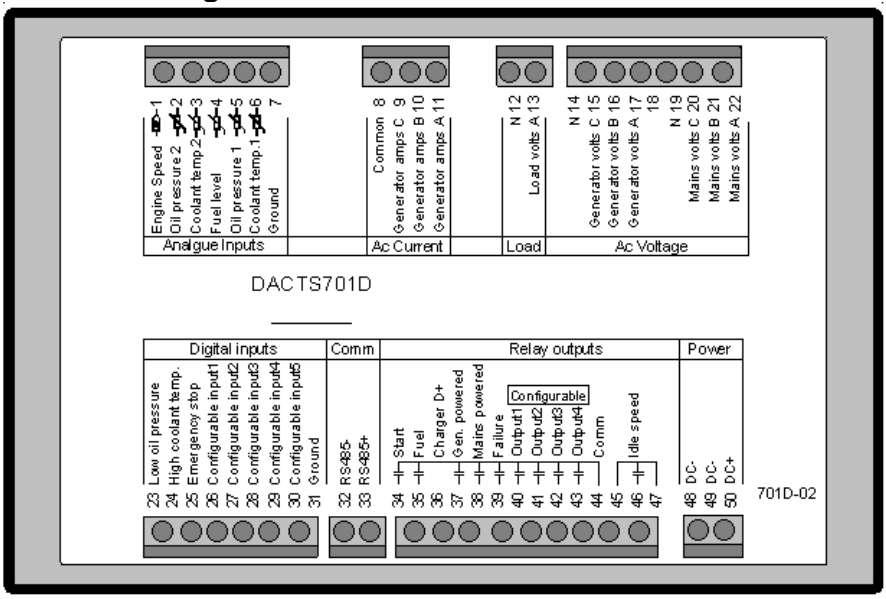
7. Fault records

The controller may contain 32 fault records, the last record is shown on the top line. Alarms only are shown on LCD, not are stored. Once the records are fully (max. 32 faults), the newest record will instead of the oldest one.



The left picture shown:
The diesel has total 128 fault records, the current record is No.2, the fault name is low oil pressure, generated time is 2008-04-12，13:50:34

8. Connecting terminals



Pin	Definition	Description
1	Engine speed	Connect to a magnetic sensor.
2	Oil pressure 2	Connect to a resistance oil pressure sensor. In general not using, it is used to detect the No.2 channel of oil pressure.
3	Coolant temp. 2 (oil temp.)	Connect to a resistance coolant temperature sensor. In general not using, it is used to detect the oil temperature or the No.2 channel of coolant temperature.
4	Fuel level	Connect to resistance fuel level sensor.
5	Oil pressure 1	Connect to a resistance oil pressure sensor.
6	Coolant temp. 1	Connect to a resistance coolant temperature sensor.
7	Ground	Sensor common return, connect to shell or battery negative.
8	Common	Common, connect to battery negative.

9	Gen. Amps C	Monitor the load current L3, connect to the current transformer.
10	Gen. Amps B	Monitor the load current L2, connect to the current transformer.
11	Gen. Amps A	Monitor the load current L1, connect to the current transformer.
12	N	
13	Load volts A	Input 220VAC
14	N	Connect to generator neutral output.
15	Gen. volts C	Connect to generator L3 output.
16	Gen. volts B	Connect to generator L2 output.
17	Gen. volts A	Connect to generator L1 output.
18	Not connected	-
19	N	Connect to mains neutral output.
20	Mains volts C	Connect to mains L3 output.
21	Mains volts B	Connect to mains L2 output.
22	Mains volts A	Connect to mains L1 output.
23	Low oil pressure	Connect to the alarm switch of the oil pressure sensor.
24	High cool temp.	Connect to the alarm switch of the coolant temperature sensor.
25	Emergency stop	Supply an emergency stop signal by an emergency pushbutton to the controller to de-energized the start、 fuel relays
26	Configurable input 1	The digital inputs that user can configured.
27	Configurable input 2	
28	Configurable input 3	
29	Configurable input 4	
30	Configurable input 5	
31	Ground	
32	RS485-	RS485 communication
33	RS485+	
34	Start	The start relay output, supply DC from terminal 44, 10Amp rated.
35	Fuel	The fuel relay output, supply DC from terminal 44, 10Amp rated.
36	Charger D+	Do not connect to ground.

37	Gen. powered	Control the external relay to transfer the ATS to generator side.
38	Mains powered	Control the external relay to transfer the ATS to mains side.
39	Failure	Connect to a external alarm facility.
40	Configurable output 1	The digital outputs that user can configured, 5Amp rated.
41	Configurable output 2	
42	Configurable output 3	
43	Configurable output 4	
44	Common	Connect to the DC+
45		Used to control the electron speed regulator to switch between idle speed and rated speed
46	Idle speed	
47		
48	DC-	DC negative input (battery negative)
49	DC-	DC negative input (battery negative)
50	DC+	DC positive input (battery positive)

9. Protection function

The controller provides alarm stop/pre-alarm function, during the diesel is running, the controller can detect the fault, then send an alarm or shutdown signal.

The alarm has two types: analogue alarm/pre-alarm, digital alarm.

l **Shutdown protection**: when the controller is detecting an alarm signal, the 'alarm' LED on the front panel will flash, a relative delay begins to time, during the delay, if the analogue out of limit returns normal, then the alarm LED will go out and the diesel keeps running normally. Otherwise, the diesel will be shut down once the delay ends, synchronously the alarm LED goes out, and the fault LED lights on, the LCD displays the fault detail.

About the digital alarm, when the external switch connecting to a digital input is closed, the controller will generate an alarm signal, the 'alarm' LED on the front panel will flash, a relative delay begins to time, during the delay, if the switch turns open, then the alarm LED will go out and the diesel keeps running normally. Otherwise, the diesel will be shut down once the delay ends, synchronously the alarm LED goes out, and the fault LED lights on, the LCD displays the fault detail.

l **Pre-alarm protection**: the controller provides pre-alarm function for some channels of analogue inputs. When one analogue input is been detecting out of it's alarm value, the 'alarm' LED on the front panel will flash, if the analogue input continue to be out of it's stop value, a relative delay begins to time, after the delay ends, the diesel will be shut down, synchronously, the alarm LED goes out, and the fault LED lights on, the LCD displays the fault detail.

Faults are shown on the below list:

No.	Fault	Description
1.		**High coolant temperature** (pre-alarm & digital alarm) When the controller detects the coolant temperature is above the coolant temperature->alarm value, the alarm LED will flash, LCD displays high cool temperature alarm, if the coolant temperature continues to rise over the coolant temperature->stop value, the high coolant temperature delay begins to time, after this delay, if coolant temperature does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays high cool temperature fault. When the external coolant temperature switch is closed, the controller will generate an alarm signal, the 'alarm' LED on the front panel will flash, the high coolant temperature delay begins to time, after the delay ends, if the switch remains closed, the diesel will be shut down, synchronously the alarm LED goes out, and the fault LED lights on, the LCD displays high cool temperature fault.
2.		**Low oil pressure** (pre-alarm & digital alarm) When the controller detects the oil pressure is below the oil pressure ->alarm value, the alarm LED will flash, LCD displays low oil pressure alarm, if the oil pressure continues to fall below the oil pressure->stop value, the low oil pressure delay begins to time, after this delay, if oil pressure does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays low oil pressure fault. When the external oil pressure switch is closed, the controller will generate an alarm signal, the 'alarm' LED on the front panel will flash, the low oil pressure delay begins to time, after the delay ends, if the switch remains closed, the diesel will be shut down, synchronously the alarm LED goes out, and the fault LED lights on, the LCD displays low oil pressure fault.
3.		**Configurable inputs** (digital alarm) If a configurable input has been configured as an alarm (eg. Low fuel level/low cool level/common alarm/common fault), the appropriate information will be displayed.

4.	**High oil temperature** (pre-alarm) When the controller detects the oil temperature is above the oil temperature->alarm value, the alarm LED will flash, LCD displays high oil temperature alarm, if the oil temperature continues to rise over the oil temperature->stop value, the high oil temperature delay begins to time, after this delay, if oil temperature does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays high oil temperature fault.
5.	**Low fuel level** (pre-alarm) When the controller detects the fuel level is below the fuel level ->alarm value, the alarm LED will flash, LCD displays low fuel level alarm, if the fuel level continues to fall below the fuel level ->stop value, the low fuel level delay begins to time, after this delay, if fuel level does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays low fuel level fault.
6.	**High speed** (shutdown) When the controller detects the engine speed is above the speed->alarm up, the alarm LED will flash, LCD displays high seed alarm, the speed limit delay begins to time, after this delay, if engine speed does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays high speed fault.
7.	**Low speed** (shutdown) When the controller detects the engine speed is below the speed->alarm down, the alarm LED will flash, LCD displays low speed alarm, the speed limit delay begins to time, after this delay, if engine speed does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays low speed fault.

8.	**Generator high frequency** (pre-alarm) When the controller detects the generator frequency is above the Gen high freq. ->alarm value, the alarm LED will flash, LCD displays high frequency alarm, if the generator frequency continues to rise over the Gen high freq. ->stop value, the generator frequency limit delay begins to time, after this delay, if generator frequency does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays high frequency fault.
9.	**Generator low frequency** (pre-alarm) When the controller detects the generator frequency is below the Gen low freq. ->alarm value, the alarm LED will flash, LCD displays low frequency alarm, if the generator frequency continues to fall below the Gen low freq. ->stop value, the generator frequency limit delay begins to time, after this delay, if generator frequency does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays low frequency fault.
10.	**Generator high voltage** (pre-alarm) When the controller detects the generator voltage is above the Gen high voltage ->alarm value, the alarm LED will flash, LCD displays high voltage alarm, if the generator voltage continues to rise over the Gen high voltage ->stop value, the generator volts limit delay begins to time, after this delay, if generator voltage does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays high voltage fault.
11.	**Generator low voltage** (pre-alarm) When the controller detects the generator voltage is below the Gen low voltage ->alarm value, the alarm LED will flash, LCD displays low voltage alarm, if the generator voltage continues to fall below the Gen low voltage ->stop value, the generator volts limit delay begins to time, after this delay, if generator voltage does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays low voltage fault.

12.	**Current overload** (pre-alarm) When the controller detects anyone phase of load current is above the load current A/B/C ->alarm value, the alarm LED will flash, LCD displays current overload alarm, if the load current continues to rise over the load current A/B/C ->stop value, the current overload delay begins to time, after this delay, if load current does not return normal, the diesel will be shut down, and the alarm LED goes out, the fault LED lights on, LCD displays current overload fault.
13.	**Low battery volts** (warning) When the controller detects the battery voltage is below the battery voltage ->alarm down, the alarm LED will flash, the low battery volts delay begins to time, after this delay, if battery voltage does not return normal, LCD displays low battery volts alarm.
14.	**High battery volts** (warning) When the controller detects the battery voltage is above the battery voltage ->alarm up, the alarm LED will flash, LCD displays high battery volts alarm.
15.	**Emergency stop** When the controller detects an emergency stop signal, it will send a stop command, the LCD will display emergency stop information.
16.	**Fail to start** Within the pre-set start numbers, if the diesel has not been started successfully, the controller will send a stop command, on the LCD the fail to start information is shown.

10. Operation modes

Manual operation

Manual start:

1. Press [**I**] key, the controller will send a start command, and a green LED above this key lights on, indicating that the diesel is in start status.
2. The pre-fuel delay begins to time, during this delay the pre-fuel/ pre-heat relay is energized (if be configured), after this delay ends, the fuel relay is energized.
3. The crank time delay is initiated, during the delay, the start relay is energized, synchronously the controller judges the start success condition of the diesel, if not succeed, the crank rest time is initiated, after this delay, crank time delay begins to time, and the diesel is attempted to start once again. If the diesel has not been started successfully within the start numbers setting, a fail to start fault will be displayed on the LCD.
4. If the diesel was started successfully, the idle speed delay begins to time, then after idle speed delay, speed up delay is initiated, the speed up relay is energized during the delay, after speed up delay ends, idle /rated speed relay is energized.
5. The bypass delay begins to time, after this delay times out, the controller begins to monitor the faults as low oil pressure, high coolant temperature, high/low generator voltage, high/low generator frequency.
6. Once the generator is running normally, the generator normal LED will light on, the warm up delay is initiated, during this delay the diesel is running without loading.
7. Once warm up delay times out, generator powered relay is energized, and the generator is running on loading, the generator powered LED lights on.

Manual stop:

1. Press [**O**] key, the controller will send a stop command, and a red LED above this key lights on, indicating that the diesel is attempted to stop.
2. The speed down delay is initiated, after this delay times out, the diesel is placed in standby status.

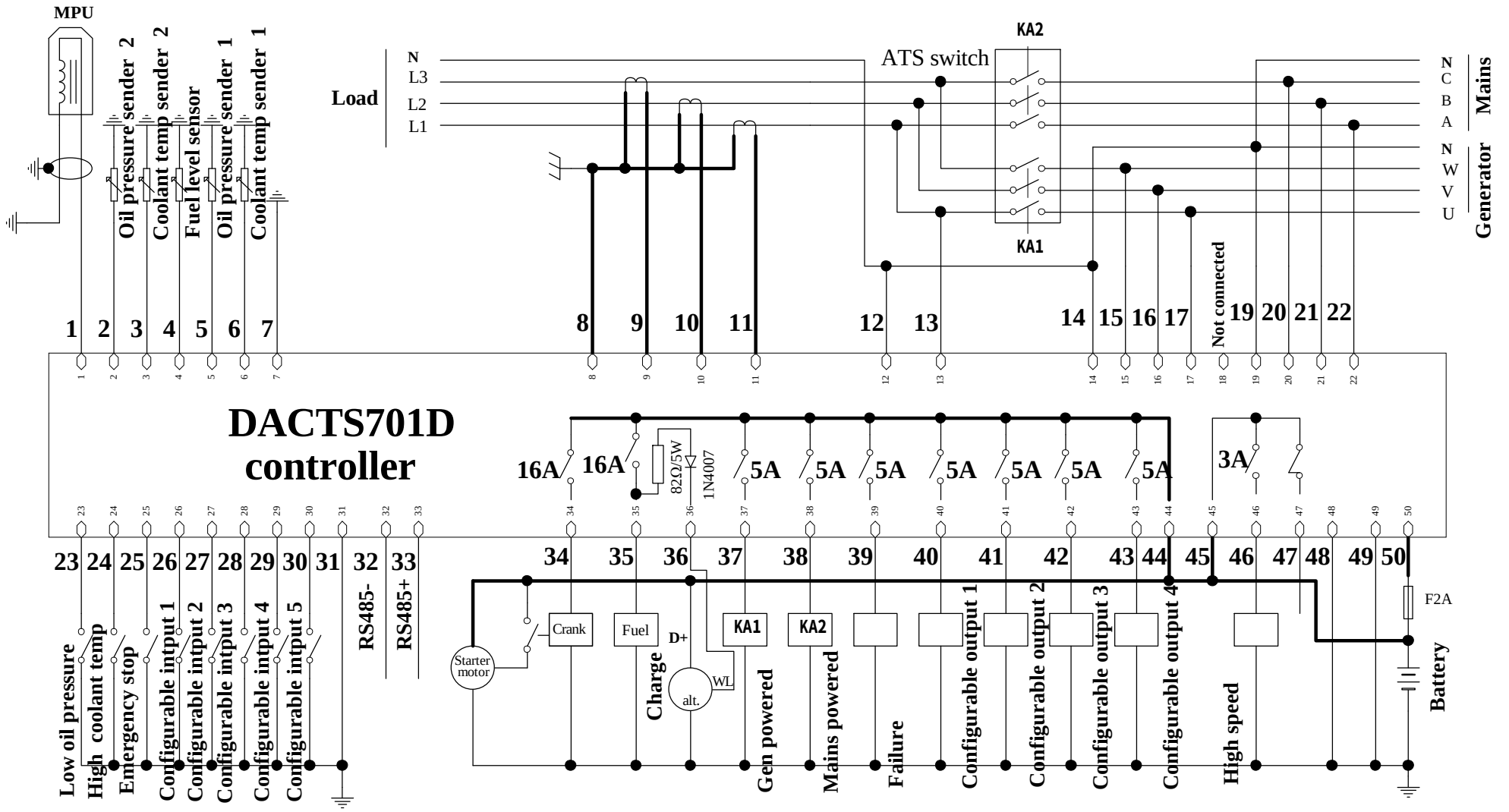
Automatic operation

Automatic start:

1. Press [**AUTO**] key, a yellow LED above this key will light on, indicating that the diesel is in auto status.
2. Once the mains is detected to be abnormal, such as the mains voltage is too low/ high, the mains frequency is too high/low, then the remote start delay begins to time.
3. If one digital input is configured with remote start, once this input is activated, the remote start delay also is initiated.
4. When remote start delay times out, the pre-fuel delay will be initiated, for the following process, please see manual start sequence 2～7.

Automatic stop:

1. In auto status, once the mains returns normal or the remote start input (if be configured) is deactivated, mains normal LED will light on, and the transfer delay is initiated, after this delay times out, the generator powered relay will be de-energized, the cooling shutdown and load no power delays begin to time, after the load no power delay times out, mains powered relay is energized, mains powered LED lights on.
2. During cooling shutdown delay, the diesel is running without loading until the delay times out.
3. After cooling shutdown delay, the speed down delay is initiated.
4. Once the speed down delay ends, the diesel is placed in standby status.



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