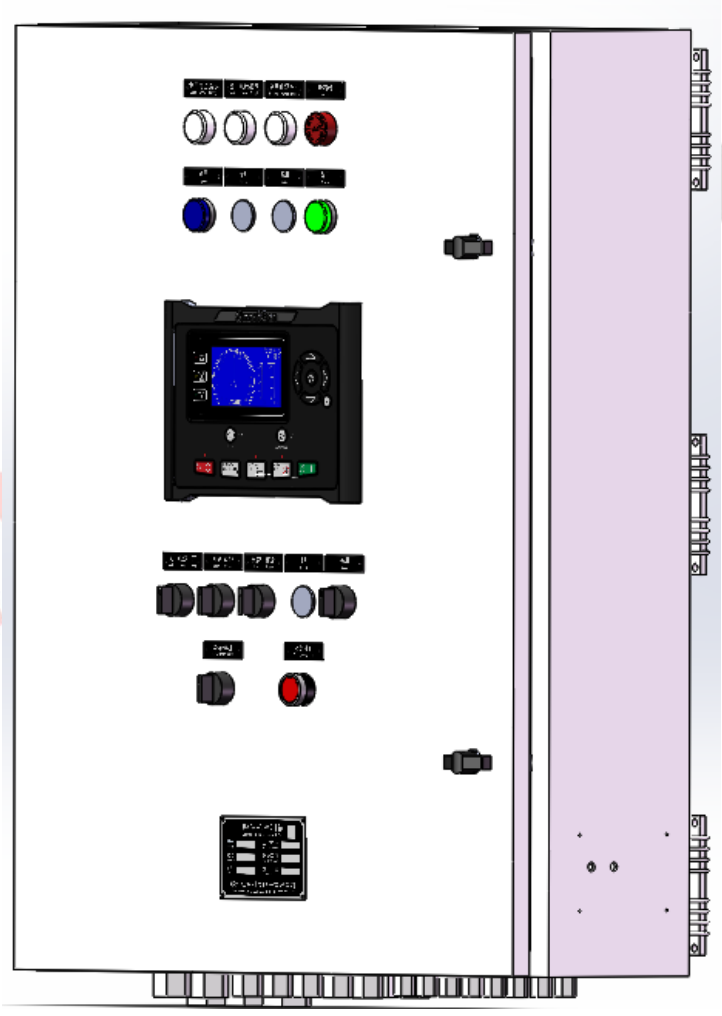
MGCP100B-2

DIESEL ENGINE CONTROL BOX

USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.

Chinese trademark

SmartGen English trademark

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Table 1 - Software Version

Date	Version	Content
2021-07-05	1.0	Original release.

CONTENTS

1. OVERVIEW

MGCP100B-2 (C160) Diesel Engine Control Box (hereinafter "control box") is an electronic measurement and control system for engine work condition, which is mainly composed of box, HMC9000A diesel engine controller, electronic GOV (provided by genset manufacturer), shock absorber, etc.

The control box integrates digitization, intelligentization and network technology which is used for automation control and monitoring system of single diesel engine to achieve local and remote control start/stop, data measurement, alarm protection and "three remote" (remote control, remote measurement, remote communication) functions. The controller can remotely monitor engine via CANBUS to expand remote monitoring module HMC9800RM or remote control box.

The design of this product meets the quality certification of CCS and has obtained the certificate.

2. PRODUCT CHARACTERISTICS

MGCP100B-2 (C160) diesel engine control box (hereinafter "control box") is mainly composed of box, HMC9000A diesel engine controller, RPU560A redundant protection unit, AIN8 analog input module, HEP300 electronic potentiometer, HMP300 power integrated protection module, DOUT16B digital output module, electronic GOV (provided by genset manufacturer), BACM2420A charging module, BAC2408 charging module, shock absorber, etc. As the invisible champion of China's industry, it has good reliability and stability, high measurement accuracy, small size, convenient operation, installation and maintenance among similar products. It is mainly used for medium-sized ship diesel engine control system.

3. TECHNICAL PARAMETERS

Table 2 - Technical Parameters

No	Item	Content	Measurement Accuracy	Display Range
1	Working Voltage	DC18.0V~35.0V, continuous power supply (only suit for 24V system)	-	-
2	Speed Sensor	1.0V to 24V (RMS) reluctance pulse signal	-	0~3000r/min
4	Temperature Sensor	Three-wire resistance output	±0.15°C	-20°C~+150°C
5	Oil Pressure Sensor	Two-wire current output 4mA-20mA	-	0~1MPa
6	Case Dimension	820mm×680mm×200mm	-	-
7	Installation Dimension	810mm×630mm	-	-
8	Working Conditions	Temperature: (-25~+70)°C Relative Humidity: (20~93)%	-	-
9	Storage Condition	Temperature: (-25~+70)°C	-	-
10	Protection Level	IP44	-	-
11	Weight	45kg	-	-

4. FUNCTIONS AND WORK FLOW

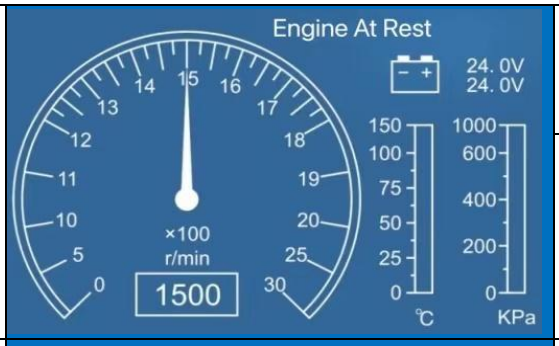
4.1 DISPLAY FUNCTION

The control box can display engine data and running status via HMC9000A controller. It mainly includes main interface display and measured data display on controller LCD.

The main interface display includes tachometer display, thermometer display, oil pressure gauge display, battery voltage display and engine status display. It is shown as table 3 and table 4.

Through “Page Up/Down” keys, measured data interface displays engine, alarm, event log and others. Status page includes working status and power status (mainly includes speed, water temperature, oil temperature, oil level, oil pressure, battery voltage, accumulated running time and start times).

Table 3 - Main Interface Display

<table>
<tr><td rowspan="2">First Screen</td><td colspan="2" rowspan="2"> 
</td><td>Simulated speed meter (0-3000r/min)</td><td colspan="2">Engine status</td></tr>
<tr><td>Speed value</td><td colspan="2">Battery voltage
Water temp display (0-150°C)
Oil pressure display (0-1000kPa)</td></tr>
<tr><td rowspan="4">Second Screen</td><td colspan="2">Status Engine</td><td>Status</td><td colspan="2">Engine</td></tr>
<tr><td colspan="2" rowspan="2">Engine Status Engine Speed
Normal Running 1500r/min
Power Status Coolant Temp
Lead Power Normal ++++°C ++++°F
Standby Power Normal Oil Temp
++++°C ++++°F</td><td>Engine status</td><td colspan="2">Engine speed</td></tr>
<tr><td>Power status</td><td colspan="2">Coolant temperature</td></tr>
<tr><td>1500r/min</td><td>Normal Running</td><td></td><td colspan="2">Oil temperature</td></tr>
<tr><td rowspan="4">Third Screen</td><td colspan="2">Status Alarm</td><td>Speed</td><td colspan="2">Running status/Alarm display</td></tr>
<tr><td colspan="2" rowspan="2">Engine Status No Alarm
Normal Running
Power Status
Lead Power Normal
Standby Power Normal</td><td>Status</td><td colspan="2">Alarm page</td></tr>
<tr><td>Engine Status</td><td colspan="2">Alarm content</td></tr>
<tr><td>1500r/min</td><td>Normal Running</td><td>Power status</td><td colspan="2">Alarm content</td></tr>
<tr><td rowspan="3">Fourth Screen</td><td colspan="2">Status Event Log</td><td>Speed</td><td colspan="2">Running status/Alarm display</td></tr>
<tr><td colspan="2" rowspan="2">Engine Status 01/05
Normal Running Shutdown Alarm
Power Status Speed Sig Loss Alarm
Lead Power Normal 2020-12-11 13:14:09
Standby Power Normal 02/05
Shutdown Alarm
Speed Sig Loss Alarm</td><td>Status</td><td colspan="2">Alarm record page</td></tr>
<tr><td>Engine status
Power status</td><td colspan="2">Alarm times/totals
Alarm name
Alarm reason
Alarm time</td></tr>
<tr><td></td><td colspan="2">Alarm times/totals
Alarm name</td></tr>
</table>

	2020-12-11 12:13:08			Alarm reason Alarm time
	1500r/min	Normal Running	Speed	Running status/Alarm display
Fifth Screen	Status	Others	Status	Others
	Engine Status Normal Running Power Status Lead Power Normal Standby Power Normal	Module Date and Time 2020-12-13 14:58 Input Port Status 1 2 3 4 5 6 7 8 9 A B C D E F G H I Output Port Status	Engine status Power status	Module time Input port status Output port status
	1500r/min	Normal Running	Speed	Running status/Alarm display
Sixth Screen	Status	About	Status	About
	Engine Status Normal Running Power Status Lead Power Normal Standby Power Normal	Software Version 5.1TM Hardware Version 1.0	Engine status Power status	Software version Hardware version
	1500r/min	Normal Running	Speed	Running status/Alarm display

Table 4 - Controller Information Display

After pressing Enter key for 3s, it will enter into select interface of Parameter Setting and Controller Information.	Return Parameter Setting Controller Information	After selecting controller information, press Enter key to controller information interface.
First Screen	Return Module Setting Timer Setting Engine Setting Sensor Setting Input Ports Setting Output Ports Setting	This screen can manually set controller information. Press  or  can select information needed to set.
Second Screen	Return >DOUT16(1) Setting >DOUT16(2) Setting	This screen can set controller's expand output port. Press  or  can select expand output module 1, 2.

Third Screen	Return 1. AIN8 Setting	This screen can set controller's analog input module information. Press ▲ or ▼ can select analog input module information.

4.2 CONTROL FUNCTION

Control box can control engine start, stop, alarm protection and others in local/remote control mode.

With remote monitoring interface, control box can remotely control engine start/stop and mute alarms. All parameters and records are real-time displayed on the screen of remote monitoring controller.

Remote monitoring controller can only control the engine in remote control mode, other control keys are inactive except for emergency stop key in local mode.

4.2.1 CONTROLLER PANEL

Controller panel is shown as below:

Fig. 1 - Controller Panel

4.2.2 KEYS FUNCTION

Controller panel keys function is shown as below.

Table 5 - Keys Function Description

Icon	Key	Description
	Stop	Stop running engine in local mode; Press it again can stop the engine quickly in stopping process.
	Start	Press it to start engine in local mode.
	Alarm Reset	Press it can reset alarms if alarm information shows on the screen.
	Self-Check	Press it, then system will enter into self-check mode. All threshold alarms can be tested without adding speed.
	Home	Press it to return to the main screen.
	Lamp Test	Press it to test panel LED indicators and display screen.
	Alarm Mute	Can remove controller's audible alarm.
	Up/Increase	1. Screen scroll; 2. Move up cursor and increase value in setting menu.
	Down/Decrease	1. Screen scroll; 2. Move down cursor and decrease value in setting menu.
	Left	1. Page scroll; 2. Left move cursor in setting menu.
	Right	1. Page scroll; 2. Right move cursor in setting menu.
	Set/Confirm	1. Press it for more than 3 seconds to enter the parameter configuration menu; 2. Confirm the setting information in setting menu.
	Esc	1. Return to the first screen; 2. Return to the previous level menu in setting menu.

CAUTION! Factory default password is "01234", operator can change the password to prevent others changing configurations randomly. Please remember the password clearly after changing. In case that you forget it, please contact company personnel and feedback all information in ABOUT page to service personnel.

4.3 DESCRIPTION OF CONTROL BOX INDICATORS AND MODULES

1) Lead Power Indicator: illuminates when lead power is available.
2) Standby Power Indicator: illuminates when standby power is available.
3) Buzzer: when controller detects fault signals, buzzer makes a beeping sound and flashes. Press “Alarm Mute” key can remove the sound.
4) AC Power Indicator: illuminates when AC power is available.
5) Charging Indicator: illuminates when the battery is charged by the charger.
6) Water Heater Indicator: illuminates when water heater is working.
7) Power Switch: control DC power supply. Turn right to power on, and display screen illuminates, then modules start to self-check. Sound-light alarms will be initiated if alarm signals occur or parameters reach to alarm limit value, otherwise, the screen displays normal parameters and status.
8) Local/Remote Control Knob: used for switching local mode and remote control mode. In local mode, control box can start/stop engine, and transfer between idle and rated speed; in remote control mode, control box can start/stop engine through remote control module or remote start/stop signals.
9) Idle/Rated Speed Knob: used for switching engine in idle speed or rated speed.
10) Water Heating On-off Knob: it is in “off” position under normal condition. When the water heater is required to work, it is in “on” position and water heater indicator illuminates.
11) Speed Raise/Drop Knob: it is a three-position automatic reset switch. It is in middle position under normal condition. When it turns left, speed drop command is active, the speed is adjusted to lower limit; when it turns right, speed raise command is active, the speed is adjusted to upper limit.
12) Emergency Stop Key: press this key when emergency occurs, emergency stop outputs and engine will stop immediately.
13) AIN8 analog input module is 8-way analog input module, each sensor input on the module can be configured as PT100 resistance input, (4-20)mA current input and (0-5)V voltage input. The measured data is transmitted to the main controller via CANBUS, and main controller’s alarm threshold corresponding to each sensor of AIN8 module can be configured. When the alarm condition is reached, corresponding sensor alarm information will be displayed on the main controller. It should be noted that this module must be used with main controller.
14) HMP300 power integrated protection module integrates digitization, intelligentization and network technology, can measure genset voltage, current, power, frequency data and output corresponding actions when abnormal situations occur. All parameters can be adjusted from front panel or LINK port via PC. CANBUS port enables it to connect HMC9000/HMC6000 module to simultaneously measure and display power and engine data. It is suitable for 3P4W, SP3W, 1P2W, 2P3W power with 50Hz/60Hz system.
15) RPU560A redundant protection unit can autonomously maintain the engine running and protect it. The module is connected to HMC9000/HMC6000 via CANBUS port. All data and alarm information can be checked on the master module. It has two working modes, one is applied to synchronously protect engine normal running with master module, another is applied to automatically maintain and protect engine normal running after master module is inactive. It has 4-way programmable digital fault shutdown input, 5-way relay output, emergency stop and override mode input port that is suitable for marine main propulsion, main genset, emergency units or pump units.

NOTE:

1) Emergency stop key can’t be used in non-emergency situation.

2) **Factory default password is 01234 which can be changed by operators for avoiding changing master module settings by other people. Please clearly remember the password after changing. In case that you forget it, please contact SmartGen's service personnel.**

Please refer to HMC9000A diesel engine controller user manual for more details about controller parameter setting.

4.4 WORK FLOW

4.4.1 LOCAL MODE

After the “local mode” is active, start/stop operation will be carried out by pressing keys on the controller.

4.4.2 LOCAL START SEQUENCE

- After pressing 

key, preheat relay outputs (if configured), “Preheat Delay XX s” information will be displayed on LCD;
- After the preheat delay expired, the fuel relay is energized, and one second later, starting relay outputs. If the engine fails to crank during the “Crank Time”, fuel relay and starting relay stop output; then “Crank Rest Time” begins and wait for the next crank attempt;
- If the engine fails to crank during set crank attempts, controller will issue crank failure signal, and meanwhile crank failure alarm will be displayed on LCD;
- In case of successful crank attempt, “Safety On Delay” begins. As soon as this delay is over, “Start Idle Delay” is initiated (if configured);
- After the start idle delay expired, it will enter “High-speed Warming Up Delay” (if configured), meanwhile detect speed, water temperature and oil pressure. When it is over, it will enter “Engine Normal Running”;
- When the high-speed warming up delay expired, if engine speed and oil pressure are normal, engine will run normally; otherwise, controller will send shutdown alarm. (Engine shutdown alarm will be displayed on LCD).

4.4.3 LOCAL STOP SEQUENCE

- After pressing 

key, “Stop Delay” begins;
- After stop delay expired, “Stop Idle Delay” is initiated (if configured) and idle relay is energized;
- Once the stop Idle delay expired, “ETS Solenoid Hold” begins. ETS relay is energized while fuel relay is de-energized and complete stop is detected automatically;
- Once the ETS solenoid hold expired, “Fail to Stop Time” begins. Complete stop is detected automatically;
- Engine enters “Standby” after its complete stop. Otherwise, controller enters stop failure and sends stop failure warning (If engine stops successfully after stop failure alarm, it enters “Standby” and stop failure warning will be removed by pressing Reset key).

4.4.4 REMOTE CONTROL MODE

After the “remote control mode” is active, remote control operations can be carried out.

4.4.5 REMOTE START SEQUENCE

- When the "Remote Start Input" is active, it enters “Start Delay”;

- "Start Delay" countdown will be displayed on LCD;
- When start delay is over, preheat relay outputs (if configured), "Preheat Delay XX s" will be displayed on LCD;
- After preheat delay, fuel relay outputs for 1s, and then starting relay outputs; if the engine fails to crank within the "Crank Time", fuel relay and starting relay stop output; then "Crank Rest Time" begins and wait for the next crank attempt;
- If the engine fails to crank during set crank attempts, controller will issue crank failure signal, and crank failure alarm will be displayed on LCD;
- In case of successful crank attempt, "Safety On Delay" timer begins. As soon as this delay is over, "Start Idle Delay" is initiated (if configured);
- After the start idle delay expired, it will enter "High-speed Warming Up Delay" (if configured), meanwhile detect speed, water temperature and oil pressure. When it is over, it will enter "Engine Normal Running";
- When the high-speed warming up delay expired, if engine speed and oil pressure are normal, engine will run normally; otherwise, controller will send shutdown alarm. (Engine shutdown alarm will be displayed on LCD).

NOTE: If remotely monitor the controller's startup, there is no start delay after pressing Start key, other steps are the same as the above input port start sequence.

4.4.6 REMOTE STOP SEQUENCE

- When remote/auto stop signal is active, "Stop Delay" begins;
- After stop delay expired, "Stop Idle Delay" is initiated (if configured) and idle relay is energized;
- Once the stop Idle delay expired, "ETS Solenoid Hold" begins. ETS relay is energized while fuel relay is de-energized and complete stop is detected automatically;
- Once the ETS solenoid hold expired, "Fail to Stop Time" begins. Complete stop is detected automatically;
- Engine enters "Standby" after its complete stop. Otherwise, controller enters stop failure and sends stop failure warning (If engine stops successfully after stop failure alarm, it enters "Standby" and stop failure warning will be removed by pressing Reset key).

NOTE: If remotely monitor the controller's stop, there is no stop delay after pressing Stop key, other steps are the same as the above input port stop sequence.

5. INSTALLATION AND APPLICATION

5.1 INSTALLATION AND WIRE CONNECTION

5.1.1 INSTALLATION

The control box is wall-mounted with 4 steel shock absorbers and M6 screw hole on its back. It is fixed and installed with M6 bolt and installation dimension is 810mm×630mm. The installation location should be chosen in a place with less vibration to avoid direct heat transfer or close thermal radiation from the exhaust system. Strong impact on the box and high voltage shock should be avoided during installation. It is shown as Fig 2.

Unit: mm

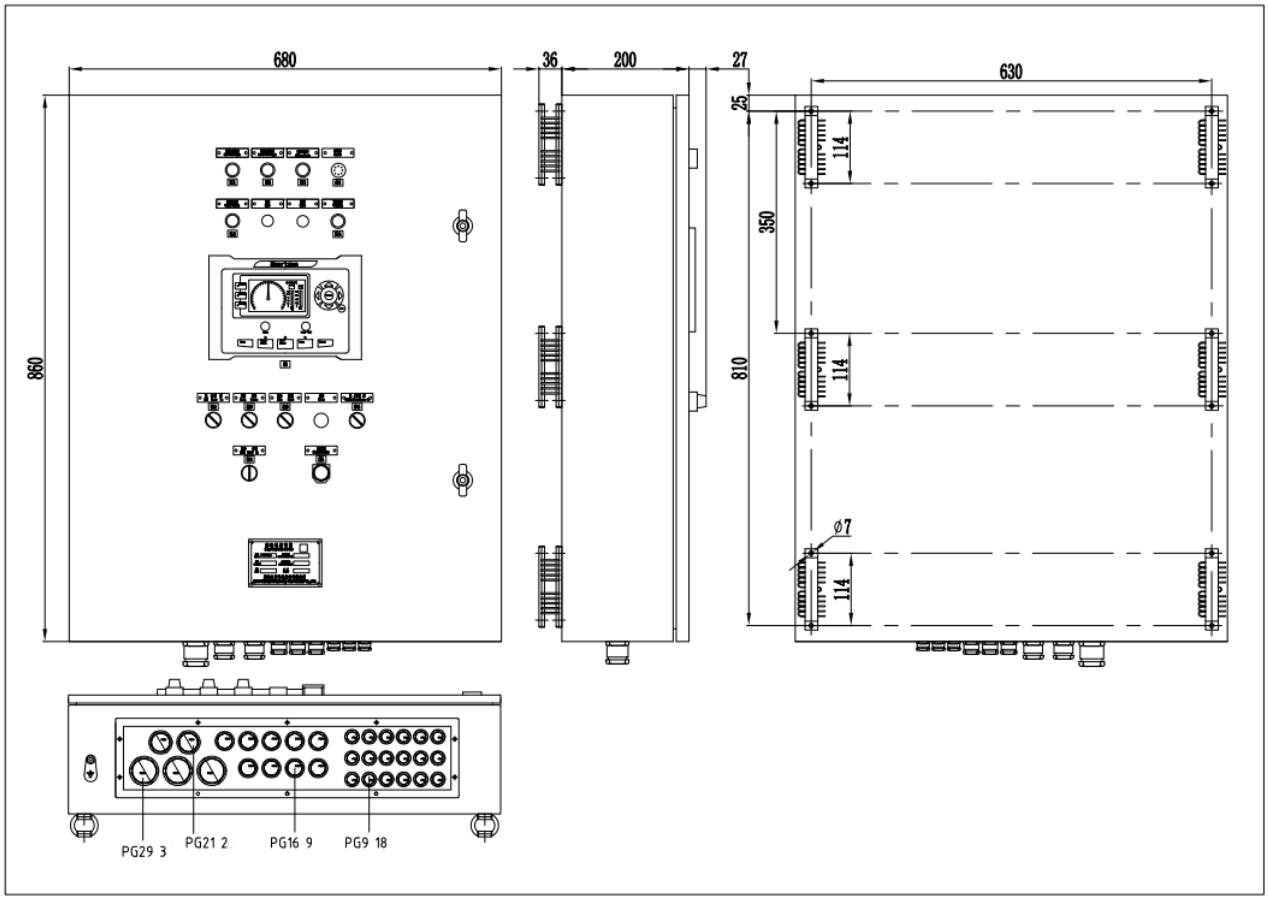


Fig. 2 - Control Box Installation Dimension

5.1.2 OTHER EXTERNAL WIRINGS

Control box's external wirings can be connected according to attached terminal wiring diagram. Please pay attention to avoid incorrect connection (don't need to connect the unused terminals). It is shown as following pictures.

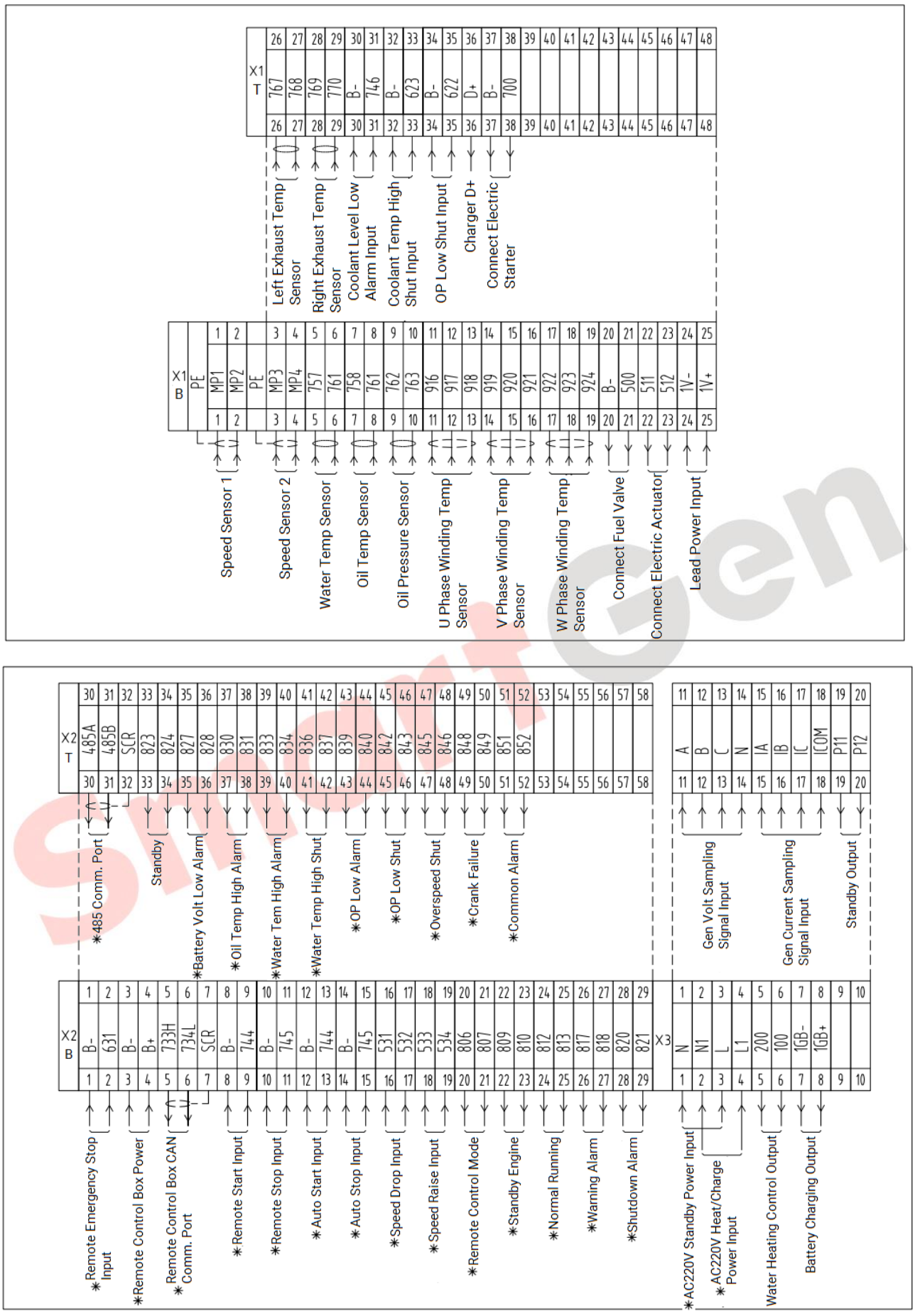


Fig.3 - External Wiring Diagram

NOTE: Engine wires should be fixed properly and far away from the high temperature positions. If it is unavoidable, heat insulation measures should be taken to keep system running from the effect of wire burning in the high temperature environment.

5.1.3 SPEED SENSOR INSTALLATION

The speed sensor is installed on the shell of engine flywheel teeth. When installing, sensor should be turned to external edge of teeth, then turned back with 1/2 or 3/4 circle to make the gap between sensor and external edge of teeth be 0.5mm~1.5mm. Finally tighten the fixing nut.

NOTE: The sensors equipped with control box have been connected with wire harness which normally adopt plugs. So users should un-tie the harness before installation, and fix it after sensor completely installed. Pay special attention to temperature and pressure sensors whose inserts are easily deformed. Regard the wider insert as fixed point and plug in. If the insert is misplaced, do not forcefully plug in to avoid bending or breaking off!

5.2 OPERATION AND USE

5.2.1 CHECK BEFORE USE

a) User should check whether all components are complete and connections are tightened or not before first use or after maintenance;
b) If no errors, turn on the power supply, controller display screen will illuminate;
c) Before starting, make sure that the engine has no leakage of oil, water and gas, and meets the starting conditions;
d) The signal cable should be wired separately from the power cable to avoid electromagnetic interference, while not touching the exhaust pipe and other high-temperature parts;
e) Sensors and control box connectors should be checked frequently for oil and water erosion and loosening and falling off.

5.2.2 LOCAL OPERATION PROCEDURES

5.2.2.1 START

a) Turn on “Power” switch and the controller display screen illuminates and displays all parameters;
b) Press the green “Start” key, engine will start according to the set program and display all parameters;
c) After idle running for a while, manually turn right the “Idle/Rated Speed” key to change engine from idle running to rated speed running.

5.2.2.2 STOP

a) Press the red “Stop” key, engine starts to stop until it stops completely;
b) Turn off the “Power” switch.

5.2.3 REMOTE CONTROL OPERATION PROCEDURES

5.2.3.1 START

a) Turn on the “Power” switch, the display screen will illuminate, turn right the “Local/Remote Control” knob to the remote control position, and the controller will display “Remote Control Mode”;
b) In the remote control mode, after “Remote Start” or “Auto Start” command is active, the engine starts according to the set program, the display screen shows the parameters, and automatically

turns to normal running.

5.2.3.2 STOP

a) After engine unloading, “Remote Stop” or “Auto Stop” command is active, engine starts to stop until it stops completely;
b) Turn off the “Power” switch.

NOTE:

a) Confirm engine has starting conditions before start!
b) Forbid to repair components in running!
c) Forbid to disconnect batteries in running!
d) Forbid to casually press Stop or Reset keys in running!

6. ALARM PARAMETERS

When the unit is in normal running, the controller can obtain data from the speed sensor, pressure sensor, temperature sensor and exhaust temperature sensor and display it in real-time on the screen. When the controller detects data that does not meet normal running conditions according to the set alarm parameters, it will issue the corresponding warning/shutdown alarm. The specific alarm parameters are shown in the following table.

Table 6 - Alarm Parameters

No.	Parameter	Alarm Value	Stop Value
1	Speed Sensor 1	-	≥1725RPM
2	Speed Sensor 2	≥1650RPM	-
3	Water Temp. Sensor	≥96°C (delay 3s)	≥106°C (coil, delay 1s)
4	Oil Temp. Sensor	≥119°C (delay 3s)	
5	Lubricating OP Sensor	≤1.5bar (delay 3s)	≤0.8bar
6	Left/Right Exhaust Temp. Sensor	≥550°C	-
7	Lead/Standby Power Voltage	≤22V	-

7. MAINTENANCE

a) When the control box is stored separately, it must be placed in a dry place, and there is no corrosive medium in the air;
b) Control box should be locked to prevent dust and other matters from entering the box;
c) Check the fasteners and terminals regularly to prevent looseness. If the wiring is loosened, the wiring should be aligned;
d) Regularly remove the dust and dirt at each conductive contact to ensure good electrical contact.

8. TROUBLESHOOTING

When the control box doesn't work, firstly check external connections (including power lines, whether they are corroded, loosening, fell off and power is normal or not) according to attached electrical schematic and terminal wiring diagrams. Then check the control box according to the table below.

Table 7 - Troubleshooting

Symptoms	Possible Solution
Control box no response with power	Check power supply connection; Check control box power switch connection wires;
Starter no response	Check starting batteries; Check starter connections and power lines; Check starter;
Failed to start	Check fuel circuit and connections, starting power supply; Check speed sensor and connections; Refer to diesel engine user manual for more details;
Loss of speed signal	Check whether the wire of speed sensor is loosening;

Symptoms	Possible Solution
High oil temperature alarm after crank	Check oil temperature sensor and its connections; Check cooling device;
High water temperature alarm after crank	Check water temperature sensor and its connections;
Diesel engine shutdown alarm	Check fuel system and cooling system according to the control box alarm information; Refer to diesel engine user manual for more details;
Control box emergency stop	Check emergency stop button is loosening or not; Check emergency stop input is configured correctly or not; Check emergency stop input port B-.

9. PACKING LIST

Table 8 - Packing List

No.	Name/Model	Quantity
1	MGCP100B-2 Diesel Engine Control Box	1
2	HMC9800RM Remote Control Box	1
3	Key	2
4	Certificate	1
5	MGCP100B-2 (C160) User Manual	1
6	HMC9000A User Manual	1
7	MGCP100B-2 (C160) YL Electrical Schematic Diagram	1