GCU-3000 *Ver1.0*

Automatic Engine Control and Protection Module Operators Manual

ISO 9001
ETC

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SECTION 1 : INTRODUCTION

The GCU-3000 is an integrated modular Automatic Generator Control & Protection unit with the largest LCD screen in the market. It is suitable for use on all conventional generator applications. The module uses easy to recognize icons and powerful software to protect the generators. The GCU-3000 makes the complicated simple by providing an easy to install and easy to Program Generator Controller.

To simplify installation you can program the GCU directly from the front panel without complicated computer setup. After programming, all the new settings are recorded into the internal (EEPROM) and protected from erasure.

The main advantages of using the GCU-3000 are：
● Integrated design including an emergency stop button, AVR control, fuses, and positive outputs
● Large easy to see LCD screen
● Programmable start cycles
● Programmable idle speed timer
● Programmable cool down timer
● Maintenance notifications
● Engine block heater control
● Digital temperature sensor included
● High precision oil pressure sensor included
● Full monitoring and protection

LCD information includes the following：
● Full phase AC voltage monitoring
● Full phase AC line voltage monitoring
● Full phase load current monitoring
● KVA output
● Frequency
● Hour Meter
● Battery voltage Indicator
● Oil pressure readings in Psi or Bar
● Temperature in C or F
● Universal Failure Warning icons

The module includes a front panel emergency stop button and a built in potentiometer (VR) to adjust the Automatic Voltage Regulators (AVR) directly from the front panel. It also comes with all AC and DC fuses and relays for quick installation and operation.

When a generator failure occurs, the built in warning buzzer and LCD graphic display, gives you the reasons for the warnings instantly. In addition, it provides a remote failure-warning signal to the control room; to also notify the maintenance personnel. It also incorporates a Failure Event Log program, which records the previous 15 failures; then you can read the log directly from the front panel screen.

The engine block heater control is also integrated into the GCU using its build in digital temperature sensor. The generator is then able to maintain smooth and good starts in the coldest weather.

Maintenance personnel can obtain; Engine Temperature, Battery voltage and hours of operation at any time by pressing the Mute Button. Even with the engine off.

GCU Monitoring and Protects：
● High engine temperature protection
● Low oil pressure protection
● Over & Under speed protection
● Full phase AC over & Under voltage and loss of phase monitoring
● Full phase load current monitoring
● Battery over & under voltage monitoring
● Low Fuel Level Monitoring
● Temperature & Pressure Sensor Failure
● Magnetic Pick-up (MPU) Failure

The GCU also reserves two extra inputs for future expansion.

1.1 Panel Layout

Icon							
Function	Down Arrow	UP Arrow	Auto	Off	Manual	Pen	Mute

1.2 Front Panel Layout

1.3 Unit Dimensions (Measurement : mm)

1.4 Panel Cut-out (Measurement : mm)

SECTION 2 : OPERATION

2.1 Summary

The GCU has 3 main control buttons :
1. Auto
2. Manual
3. Off

In addition, we have the (UP Arrow), (Down Arrow), (Pen Button) and the (Mute Button). Everything you need to operate the generator is on the front panel.

2.2 AUTO

In AUTO, the generator starts & stops automatically under the control of the remote start signal. (Usually from an ATS)

Press the AUTO key and notice the screen flashes (AUTO). When the control receives a remote start signal the flashing stops and the start sequence begins.

First the Pre-Heat timer is activated and (Pr.Ht) shows up on the screen. (However, if the Pre-Heat timer is set to 0 (See setting Line 41) then the system omits the pre-heat countdown and proceeds to crank start. If it fails to start the first time, it tries to (restart) three times after a 5 seconds rest.

The starter cranking time is factory pre-set for 6 seconds (See settings Line. 43). When cranking (Strt) shows on the screen. If the engine fails to start, the system goes back to Pre-Heat and tries again. If it fails to start within the preset number of tries, then the system declares a start failure with a flashing FAIL signal comes up on the screen together with the sound alarm. The GCU also sends out the warning output.

The starter motor stops cranking when any of the condition below is established, in order to prevent damage to the starter and flywheel ring gear.

- Oil pressure builds up and oil pressure sensor is activated
- Oil pressure sensor sees more than 25Psi
- AC voltage
- The AC Frequency reaches 20% of the rated Frequency
- MPU sensing 20% of rated speed (needs to be pre-set).

The GCU can also provide idle speed. Once started the system enters into idle speed operation and the word (Idle) appears on the screen. The idle speed can be cancelled if the genset does not need it. See setting reference Line 50 and set countdown timer to 00 to cancel.

After starting, the GCU implements a 30 sec grace period to confirm that speed, oil pressure, voltage and all other parameter are normal. If the generator fails to reach normal operational parameters, the GCU sends a shutdown signal and FAIL appears on the screen. But if all parameter are reached and stabilized, the GCU proceeds to Warm Up, and once the countdown ends, the genset connects the load, and activates all protections.

(If the generator has no load contactor then this step is omitted.)

If the remote start signal disappears during operation, the load contactor disconnects. The no load Cool-down is initiated and on the screen the word **COOL** appears and the Cool-down times out. If the remote signal returns during Cool-down, The GCU once again connects to load contactor and goes back to normal operations.

Once the Cool-down ends, the GCU executes a stop countdown and stops the generator on either "energize to start" or "energize to stop". In addition, the word **Stop** appears on the screen.

NOTICE
When the generator is on Cool-down the protection system remains in effect and if any failure occurs, the module bypasses the countdown and shutdown the generator immediately.

2.3 Manual

In **MANU** (manual), the start command is initiated by pushing the **MANU** button on the front panel. After the generator starts the, GCU automatically, connect the load. To stop press **OFF** or **AUTO** and the generator executes the normally pre-programmed shut-down.

In manual, the procedure is the same as in AUTO.

2.4 Off & Reset

Pushing the **OFF** button represents a shutdown command or a **RESET**. If **OFF** is selected during normal genset operation, the generator proceeds to shut-down disconnecting the load contactor, executes a Cool-down without load, and stops.

If the system senses a major failure during normal operation, it immediately stops the genset; and after it comes to a complete stop, the failure is showed on the screen. The service personnel can use this information to conduct service and repair accordingly. If there are more than two failures, all of the failures are shown on the screen. And by pressing **OFF** again, the failure notices are erased and the GCU is **RESET**.

SECTION 3 : SYSTEM SETTING & OPERATION

> **NOTICE**
> **Before proceeding to system setting, you must install correctly all the wirings connection and connect the Battery.**

3.1 DC Input Power

GCU works with a wide range of battery power inputs from 9 to 36VDC, and the GCU is protected from any incorrect DC voltage input and connections.

## 3.2 System Setting (Programming)

There are 68 lines of programming. You must adjust each line according to the generator type and protection requirements.

You can preprogram the GCU-3000 away from the generator just by using a small power supply.

To enter Line-by-Line programming, first press **(OFF)** and then press the **(UP Arrow)(Down Arrow) (Pen)** and **(MUTE)** buttons together for 4 seconds.
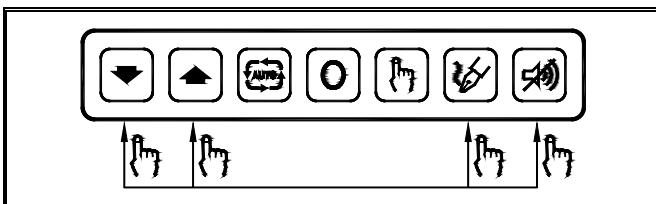
The software version appears for 2 seconds, followed by the word **(Prog)** for 4 seconds, and then the screen shows the Line number and value entered for that line (See illustration below).
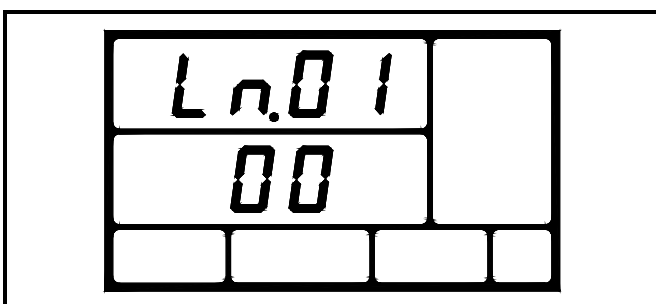
(Ln.01) indicates Line.1, and (00) representing the entered value. You press **(UP Arrow)** or **(Down Arrow)** to change the value. Each time you press the Pen Button we move to the next Line. If the setting is left unattended for 30 seconds or if the last Line 68 is reached the word **END** indicates that you finished and all modified values are saved.
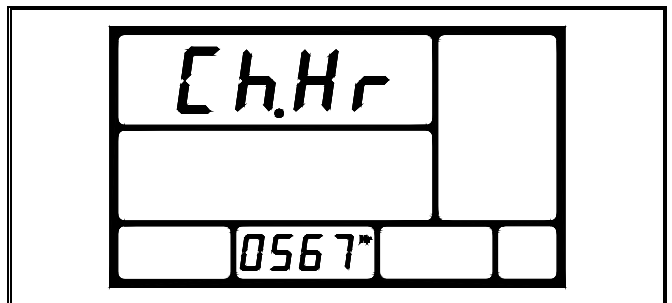
To end programming at any time press the **(OFF)** and **(Pen)** Buttons together for 4 seconds until the **END** appears.

To restore factory setting at any time press **(AUTO)** and **(Pen)** Buttons together for 4 seconds until the word **(Au.PO)** appears.

3.3 The Hour Meter

The **(Hour-Meter)** is the total accumulation of the generator operating hours stored in memory. The GCU never erases or resets the hour meter to zero.

However, to set a new value on the hour-meter memory, enter programming mode and before the word **(Prog)** disappears from the screen (about 4 seconds), press the **(OFF)** button for 4 seconds, the panel should now read **(Ch.Hr)**, see the illustration below. The (0567Hr) displays the current accumulated operation hour stored in memory.

Now press **(UP Arrow)** or **(Down Arrow)** button to change the hour reading. By holding down the button you increase the scrolling speed.

To **END** at any time press the **(OFF)** and **(Pen)** Buttons together for 4 seconds or until the word **END** appears on the screen or just leave all keys alone for 10 seconds.

3.4 AC Voltage & Current Setting

The voltage and current reading are set at the factory. However, when the generator operates in heavy inductive or capacitive loads, the waveform distortion causes minor voltage differences.

If you need to correct the voltage or amperage readings, on the GCU enter System Setting lines (3), (4), (10), and (11) and increase or decrease the values. Remember that the high/low voltage and load current protections utilize these new values for shutdown, and overload protection, etc.

3.5 Over-load Protection Setting

GCU provides Over-load Protection from the amperages calculated in the GCU.

To set the overload protection each unit value is equal to 50 Amps, for example: If you enter 20 then the Over current protection value equals to 20 times 50A or 1000A.

When the GCU senses a temporary generator over-load, it starts the timer and waits for the over load to disappear within the time allocated. If the generator over-load is longer than the time allocated, the GCU executes the Protection shutdown, showing Over-load failure on the screen.

The GCU has two types of over-load protections.
● **Stop** : For immediate shutdown.
● **Warning** : Does not stop the generator but, Shows the failure message on the screen and sends out the trip signal output. It is up to the operator to then stop the generator.

For Over-load Protection related settings refer to chapter 3.15 system setting lines (12), (13), (14), (15).

ATTENTION

The GCU uses the internal current reading to calculate over-load protection, you need to pay special attention to these settings they cannot exceed the CT rated value, otherwise field saturation on the CT causes the system to compute incorrect values and loose Over-load Protection.

For example, If the CT ratio is 1000/5, then the over load current setting cannot exceed 1000Amps.

3.6 Shutdown Override

Override Start & Stop We use this feature to manually start and stop a newly assembled genset, without annoying shutdowns. Giving you time to set and adjust the AC voltage speed, oil pressure shutdowns, etc.

Before entering shutdown override, you should complete all wiring connections and perform a Line-by-Line check, confirming that all systems are working. Then, enter Line (67) and select shutdown override. Also define the type of engine shutdown system you are using on Line 48 before activating Shutdown Override.

In override, the manual icon appears on the screen.

To crank and start the engine press and hold the **(MANU)** button, to stop the engine, press and hold the **(AUTO)** button. (The starter is activated only when you hold the button down and the same is true to stop the engine).

Once all adjustment and setting are completed, you need to set the system back to normal. To return to normal presses the **(OFF)** button, the GCU stops the generator and automatically resets back to normal operation.

For manual override, go to System Setting Line (67).

ATTENTION

Under manual override, the GCU cancels all protections, and if a failure occurs while in override operation, the system does not shutdown the engine. Therefore, it is strongly recommended that manual override be used only for adjustment and servicing the generator.

3.7 Magnetic Pick-up (MPU) Setting

The MPU **(Magnetic Pick-up)** is the sensing device installed on the flywheel bell housing, which detects the engine RPM according to the frequency generated by the flywheel ring gear. Most generators with electronic speed controllers use a MPU.

MPU operational frequency range：100 Hz – 10K Hz

To program the MPU, Manually start the engine and run at rated speed (50 Hz or 60 Hz) by holding the governor actuator by hand, Then quickly press the Pen Button, and read the MPU frequency, and when (Au.Po) appears on the screen the MPU programming is complete.

If the system detects that the MPU frequency is below 100 Hz, this is considered a MPU failure and the (FAIL) message appears up on the screen, and the MPU signal failure icon appears on the screen, confirming procedure failure. At this point, you should check for incorrect wiring or bad contacts. Repeat the setup procedure after the cause of the failure has be identified and corrected.

If the system detects the MPU frequency above 10 K Hz, then it considers it as MPU failure and the (FAIL) message appears on the screen, and at the same time the Over speed failure icon appears on the screen, confirming a programming failure. At this point, you should first check the MPU for, incorrect wiring or a bad installation. Repeat the setup procedure after the correcting the problem.

Note : 10 to 15 Vac open circuit is about the right output voltage for a MPU measured directly into a digital voltmeter with the engine running at rated speed 50 or 60 Hz.

Some Electronics Speed Controllers or Governors do not allow sharing the MPU with other devices. If a MPU is required for over-speed protection we recommend an extra independent Magnetic Pick-up or a dual coil (MPU) If the GCU is programmed to use an MPU, and the MPU is defective or open or its, unable to read the MPU, the system shutdown the engine and the MPU signal failure icon appears on the screen.

For MPU related settings refer to chapter 3.15 System Setting lines (1), (16), (17), (18), (19), (20), (44).

3.8 The Additional Inputs Alarm1 & Alarm2

The GCU is equipped with 2 spare inputs to add two extra protections.

To set Alarm1 & Alarm2 go to chapter 3.15 System Setting Lines (56), (57), (58), (59), (60), (61).

3.9 Setting the Service Reminder

The maintenance icon on the screen is a reminder to the service personal that it is time to carry out maintenance on the generator. When setting the service timer, each unit entered is equal to 10hrs, for example if entering 20 is equal to 20 x 10Hrs = 200 Hrs.

After completing maintenance, you need to clear the record and set a future maintenance point. See System Setting Line (68).

For Service & Maintenance related settings refer to System Setting Lines (62), (68).

3.10 Screen Viewing

You can freeze the screen parameter or leave them to cycling one by one. When cycling, each parameter paused for 2 seconds, but pressing the **(UP Arrow)** button, you can select either AC Voltage or AC Current readings, also pressing the **(Down Arrow)** key permits you to cycle though the phases, The Hour meter, Battery Voltage, Hz, engine temperature measurement in C or F and oil press measurement in Psi or Bar.

When using the **(UP Arrow)** and **(Down Arrow)** keys to select specific parameters, the selected value freezes for 30 seconds and if the system is left unattended it automatically return to cycling.

For Panel related settings refer to chapter 3.15 Setting Lines (63), (64), (65).

3.11 Engine Idle Operation Function

You can idle the generator automatically before working at full load.

For Idle Operation related settings refer to chapter 3.15 System Setting Line (50).

3.12 Digital Temperature Sensor (Optional)

You can install the most accurate temperature sensor available on the market. It greatly improves accuracy from traditional thermal sensors.

Digital Temperature Sensor accuracy：-55 to +125 ˚C +/- 2 ˚C

Temperature Display Unit：˚C or ˚F

3.13 Ceramic Capacitive Oil Pressure Sensor (Optional)

The Ceramic Capacitive Oil Pressure Sensor is most the most accurate oil pressure sensor available on the market. It greatly improves the accuracy from traditional oil pressure sensors.

Ceramic Capacitive Oil Pressure Sensor accuracy：0 to 120 Psi +/- 2.5%

Oil Pressure measurements in Psi or Bar

ATTENTION

The GCU uses a special Digital Temperature Sensor and a Ceramic Capacitive Oil Pressure Sensor. Do not replace with any others. If you have, any questions concerning the sensors contact our technical staff.

3.14 The Event Log

Use the Failure Event Log to assist the service personnel identify and determine the cause of a problem. To retrieve the event log from memory go to Line 66 and set **(YES)** The GCU retains the last 15-recorded failures in memory. Pressing the **(UP Arrow)** our **(Down Arrow)** recalls the events and the time of the event. To end the program press the **(OFF)** key, or leave the system unattended for 10 seconds and the system automatically closes the program and the word **END** pops up on the screen.

The diagram below is an example of the Failure Event Log :
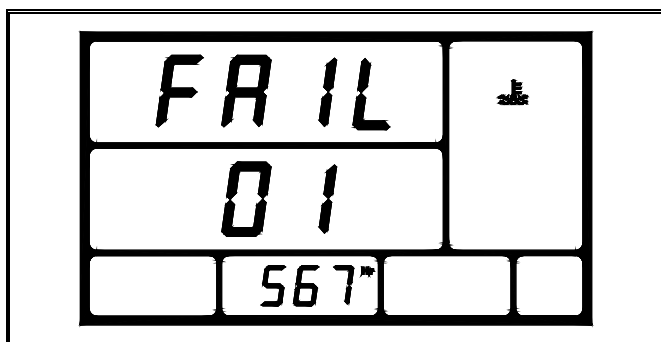
The **(FAIL)** and **(01)** represent the event log screen (is the memory lines 1 to 15), the **(567 Hr)** represents the hour when the failure occurred and the Overheat icon represents the cause of the failure.

For Failure Event Log related settings refer to chapter 3.15 system setting Line (66).

3.15 Communication With PC (KCU-XX)

The GCU with the optional USB / RS485 and Ethernet remote communications modules, can easily read all the real time information and remote control the local device via communication interface modules. There are 3 different purpose interface modules show as below :

WARNING

You can remotely control the gcu and the attention the generator can start at anytime.

Place a visible sign "DANGER!" "This generator can start up at any time!" next to the generator and install a warning buzzer or flash warning light. Unwarned or unscheduled remote start scan result in serious injury or death. When performing service and maintenance, always disconnect the remote signal input to the generator.

Free App developed by Kutai Electronics to enables you to remotely monitor and operate generator via portable mobile device. Software currently available with Apple iOS5.1 and Android Ver.2.3.3 system and above. Other operating system software will be available at a later time.

Free software can be downloaded from App Store or Google Play by simply key in " Kutai " and hit search.

KCU-01 – USB interface module
KCU-02 – RS-485 interface module
KCU-03 – Ethernet interface module

For remote communication settings, See setting Line (69), (70), (71).

When the item (69) set to 00, then user can read all the real time information from the controller only. But when it set to 01, it allow remote control from PC also.

The items (70), (71) are for when KCU-02 RS485 interface module is used only, others do not apply.

For information that is, more detailed refer to the KCU-XX manual.

NOTE
When using the KCU-02 to make a closed LAN connection A different controller address setting must be programmed and the Baud rate setting must be the same.

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REMOTE COMMUNICATION ASSEMBLY

3.16 CANBus J1939 Transducer KCU-04 (Optional)

The KCU-04 module is used with CPU equipped engines using the J1939 CAN Bus protocol. It is connected to any one of the four slots on the back of the GCU-3000 controller.

For J1939 related settings refer to Setting Line (21).

Installing the KCU-04 provides the GCU with the following information.

- Temperature reading in ˚C or ˚F
- Oil Pressure reading in Psi or Bar
- High temperature warning and shut-down alarm
- Low oil Pressure warning and shut-down alarm
- Over-speed warning and shut-down alarm
- Under-speed warning and shut-down alarm
- Low fuel level warning and shut-down alarm

When you connect the KCU-04 module the GCU disables the High Temperature, Low Oil Pressure and Low Fuel Level protections automatically and all related programming lines are automatically eliminated. You don't need to install any of sensors, this information now comes from the CAN Bus, and protections relegated to the engine CPU. The GCU's job is to show warning, alarm and shutdown messages using the universal icons on the front panel.

The GCU does not disable its own over speed and under speed protection, Both of GCU and the engine CPU will shut-down the generator for over speed.

3.17 System Setting Line-by-Line Programming Table

NO.	DESCRIPTION	SETTING	FACTORY PRE-SET
1	Frequency (60 or 50 Hz)	00 → 60 Hz 01 → 50 Hz	**00**
2	How is the generator wired? (3Ø 4W, 3Ø 3W, 1Ø 3W or 1Ø)	00 → 3Ø 4W 01 → 3Ø 3W 02 → 1Ø 3W 03 → 1Ø	**00**
3	Correct the Voltage reading on the display (If needed) Add or subtract the amount on line 4 to your reading	00 → Do not correct 01 → Add volts from line 4 02 → Deduct volts from line 4	**00**
4	Volts reading display correction (If needed)	01 – 99 V	**05 V**
5	(Faulty voltage) protection time delay	00 – 99 sec (0 – Do not Protect)	**15**
6	Set Under-Voltage protection	08 – 47 (80 – 470V)	**18(180V)**
7	Under voltage protection Warning or Shutdown	00 → Warning 01 → Shutdown	**01**
8	Set Over-Voltage protection	11 – 50 (110 – 500V)	**25(250V)**
9	Over-voltage protection Warning or Shutdown	00 → Warning 01 → Shutdown	**01**
10	Correct Amps reading on the display (If needed) Add or subtract the amount on line 11 to your reading	00 → Do not correct 01 → Add amps from line 11 02 → Deduct amps from line 11	**00**
11	Amps reading display correction (If needed)	01 – 99 A	**05 A**
12	Set the (CT) Example : 5 if you use a 100/5 CT for current reading (Choosing the wrong CT will give you a erroneous current reading)	01 → 25/5 02 → 50/5 03 → 60/5 04 → 75/5 05 → 100/5 06 → 150/5 07 → 200/5 08 → 250/5 09 → 300/5 10 → 400/5 11 → 500/5 12 → 600/5 13 → 750/5 14 → 800/5 15 → 1000/5 16 → 1200/5 17 → 1500/5 18 → 1600/5 19 → 2000/5 20 → 3000/5	**05**
13	Over-load protection activation time delay	00 – 99 sec (00 – Option Cancelled)	**00**

NO.	DESCRIPTION	SETTING	FACTORY PRE-SET
14	Setting the over-load protection (One unit is equal 50 amps) Example : 20 units is equal to 1000A overload protection 20 * 50A = 1000A	01 – 60 (50 – 3000A)	**02(100A)**
15	Over-load protection Warning or Shutdown	00 → Warning 01 → Shutdown	**00**
16	Over-speed / Under-speed protection activation time delay	00 – 99 sec (0 – Option Cancelled)	**05**
17	Magnetic Pick-up (MPU) used with the GCU-3000?	00 → NO 01 → Yes	**00**
18	RPM info taken from the generator or MPU	00 → AC Hz 01 → MPU	**00**
19	Over-speed protection setting	51 – 75 Hz	**65 Hz**
20	Under-speed protection setting	40 – 59 Hz	**55 Hz**
21	Use the Oil (OPS-01) pressure sensor or get info from J1939 (KCU-04) transducer	00 → (None) 01 → OPS-01 Sensor 02 → J-1939 + KCU-04	**01**
22	Oil pressure reading in Psi or Bar	00 → Psi 01 → Bar	**00**
23	If the (OPS-01) Oil pressure sensor fails do I want a Warning or a Shutdown	00 → Warning 01 → Shutdown	**01**
24	Low oil pressure protection activation time delay	02 – 99 sec	**10**
25	Use the (OPS-01) sensor to detect low oil pressure	00 → NO 01 → Yes	**01**
26	Low oil pressure warning setting	Psi : 00 – 99 45 Psi = 3 Bar	**45 Psi**
27	Low oil pressure Shutdown setting	Psi : 00 – 99 14.5 Psi = 1 Bar	**15 Psi**
28	Backup oil pressure switch sender installed? NO (Normal Open) or NC (Normal Close)	00 → Installed but Not Used 01 → NO 02→ NC	**00**
29	Is the (TS-03 temperature sensor installed?	00 → No 01 → Yes	**01**
30	Temperature display (You can change from C to F under operation)	00 → Centigrade 01 → Fahrenheit	**00**
31	If the temperature sensor (TS-03 fails do I want a Warning or a Shutdown	00 → Warning 01 → Shutdown	**00**
32	High temperature protection activation time delay	02 – 99 sec	**05**
33	Use the temp sensor to detect high Coolant Temperature	00 → NO 01 → Yes	**01**
34	High temperature warning setting (Every unit is equal to 5 Degree Centigrade)	10 – 20 units 18 = 194 F	**18 (90 ˚C)**
35	High temperature shutdown setting (HIGH / HIGH) (Every unit is equal to 5 degree C)	10 – 24 units 21 = 221 F	**21 (105 ˚C)**
36	Is the (OPS-01) temp sensor used to control the block heater	00 → NO 01 → Yes	**00**
37	Block heater max temp OFF setting	00 – 50 ˚C	**25 ˚C**
38	Additional Temp switch type sensor installed NO (Normal Open) or NC (Normal Close)	00 → Not installed 01 → NO 02 → NC	**00**
39	Battery under voltage protection setting	08 – 23 Vdc	**08 Vdc**
40	Battery over voltage protection setting	13 – 35 Vdc	**32 Vdc**
41	Pre-heat timer setting	00 – 99 sec	**06**
42	Start attempt	01 – 09 Start Attempts	**03**
43	Cranking timer setting	2 – 30 sec	**06**
44	Magnetic Pick-up (MPU) used for verify engine start	00 → No 01 → Yes	**00**
45	Oil pressure sensor disengages starter (At 25 Psi)	00 → No 01 → Yes	**00**

NO.	DESCRIPTION	SETTING	FACTORY PRE-SET
46	Additional oil pressure switch sensor to confirming engine start	00 → No 01 → Yes	**00**
47	Set activation timer for the energize stop solenoid (Time needed to pull the energize to stop Solenoid)	02 – 99 sec	**10**
48	Method used to stop the engine (Energize to Stop or Energize to Start)	00 → Energize to stop 01 → Energize to start	**00**
49	Cool-down timer	00 – 60 min	**00**
50	Idle timer (Used only if governor capable)	00 – 60 min	**00**
51	Time in Warm up before connecting load contactors	00 – 99 sec	**10**
52	Activate the warning buzzer	00 → NO 01 → Yes	**01**
53	Fuel level indicator switch sender type NO (Normal Open) or NC (Normal Close)	00 → Not used 01 → NO 02 → NC	**00**
54	Low fuel level activation time delay	02 – 99 sec	**10**
55	Low fuel level Warning or Shutdown	00 → Warning 01 → Shutdown	**00**
56	Defined Alarm1 (switch type) NO (Normal Open) or NC (Normal Close)	00 → Do Not use Alarm1 01 → NO 02 → NC	**00**
57	Alarm1 activation time delay	02 – 99 sec	**10**
58	Alarm1 Warning or Shutdown	00 → Warning 01 → Shutdown	**00**
59	Defined Alarm2 (switch type) NO (Normal Open) or NC (Normal Close)	00 → Do Not use Alarm2 01 → NO 02 → NC	**00**
60	Alarm2 activation time delay	02 – 99 sec	**10**
61	Alarm2 Warning or Shutdown	00 → Warning 01 → Shutdown	**00**
62	Service and maintenance reminder (Every unit is equal to 10 hrs) 20 x 10hr is a 200 hr reminder	00 – 99 (00 – No Service reminder)	**00**
63	Voltage and Amps display setting	00 → Fixed Display 01 → Cycle Display	**01**
64	Also display each phase to Neutral (L1-N, L2-N, L3-N) In 4W 3Ø (Phase systems)	00 → NO 01 → Yes	**01**
65	Display only Hour Meter, Battery Volts, or Hertz at one time or cycle though all readings	00 → Hour meter 01 → Battery voltage 02 → Hertz 03 → Display all values	**02**
66	To retrieve the last 15 Failure event from memory program this line to Yes and press the Pen button	00 → NO 01 → Yes	**00**
67	Override shutdowns & start and stop the engine manually Useful when servicing the generator	00 → Normal 01 → Manual	**00**
68	Erase service log and maintenance warning signal and reset service timer	00 → NO 01 → Yes	**00**
69	Enable R486 remote control by KCU-XX module	00 → NO 01 → Yes	**00**
70	KCU-02 module address setting	00 → None 01 – 99	**00**
71	KCU-02 baud rate setting	01 → 115200 02 → 57600 03 → 38400 04 → 19200 05 → 14400 06 → 9600 07 → 4800 08 → 2400 09 → 1200	**03**

SECTION 4 : FAILURE WARNING DESCRIPTION

4.1 Failure Signal Reference Table

GCU-3000 is equipped with a large highly illuminating LCD screen were all of the failure notices are graphically and audible indicated with the built in failure warning alarm.

Universal Failure Icons Reference Table

WARNING SIGNAL	DESCRIPTION	EXECUTION
⏱	Start failure	Stop
🐢	Under speed	Stop
🦌	Over speed	Stop
✋	Emergency stop	Stop
♨	Coolant overheat	Stop or Warning
🛢	Lubricant under Pressure	Stop or Warning
A↑~	Overload	Stop or Warning
V↓~	Ac under voltage	Stop or Warning
V↑~	Ac over voltage	Stop or Warning
⊟+	Dc under voltage	Warning
🖳	Sensor failure	Stop or Warning
⚡	MPU signal failure	Stop
⛽	Low fuel level	Stop or Warning
♨	Block Heater	
🛠	In manual	
🕐	Service maintenance	Warning
!1	You Defined 1	Stop or Warning
!2	You Defined 2	Stop or Warning

4.2 Warning

When the GCU detects a problem during operation, but the situation do not pose immediate danger to the genset or the operating personnel, the GCU gives you a warning not a shutdown

With a Warning, the genset continues normal operation and provides power to the load. The warning message(s) continue to flash on the screen and the failure Signal / Alarm output is activated. The warning is automatically reset once the failure is corrected.

4.3 Shutdown

When a major failure is detects and it poses immediate danger to the genset and its personnel, the system shut-down immediately, the failure is noted on the screen activating the alarm. After the failure(s) are cleared, press the (OFF) button to confirm and reset the failure warning notice(s).

SECTION 5 : SPECIFICATION

ITEM	SPECIFICATION
DC input	9 – 36 Vdc
AC input	15 – 500 Vac (Ph-Ph)
AC frequency	50 – 60 Hz
MPU Signal Strength	+/- 2 to 70V Peak
MPU Input Frequency	100 – 10,000 Hz
Start signal	10 Amp @ 12/24 Vdc
Stop signal	10 Amp @ 12/24 Vdc
pre-heat signal	2.5 Amp @ 12/24 Vdc
Accessory "ON" Output	2.5 Amp @ 12/24 Vdc
System Operating Signal	2.5 Amp @ 12/24 Vdc
Failure Warning signal	2.5 Amp @ 12/24 Vdc
Preheat Signal	2.5 Amp @ 12/24 Vdc
Block Heater Signal	2.5 Amp @ 12/24 Vdc
Overload Signal	2.5 Amp @ 12/24 Vdc
Idle Control Conductor Capacity	1.0 Amp @ 12/24 Vdc
DC Fuse	15 Amps (F4)
AC Fuse	1.0 Amps (F1– F3)
AC Voltage Potentiometer	1000 ohms
System Inactive Power Consumption	Below 7W
Operating Temperature	-20 to +60 ˚C
Relative Humidity	Below 95%
CT capacity	Above 2.5VA
Secondary Rated Current	5A
Weight	1341 g +/- 2%

# SECTION 6 : TERMINAL & WIRING DESCRIPTION

6.1 Connection Detail

| PIN No.	DESCRIPTION	ATTENTION
1	AC Input (L1)	Connect to AC Input Phase R
3	AC Input (L2)	Connect to AC Input Phase S
5	AC Input (L3)	Connect to AC Input Phase T
7	AC Neutral Input (N)	Connect to AC Input Phase N
8	Battery Positive (+V)	Connect to battery positive (12/24V)
9	Battery Negative (−V)	Connect to battery negative
10	CT Secondary for (L3)	Connect to Secondary Phase T (L3) Monitoring CT
11	CT Secondary for (L2)	Connect to Secondary Phase S (L2) Monitoring CT
12	CT Secondary for (L1)	Connect to Secondary Phase R (L1) Monitoring CT
13	CT (COMM) Terminal Input	Connect to External CTs Common Position
14	Starter Motor Signal Output	Connect to Starter Motor. Supply (+V) (Max. rated output 10 Amp)
15	Fuel Solenoid Signal Output	Connect to Fuel Solenoid or Fuel Valve Control. Supply (+V) (Max. rated output 10 Amp)
16	Overload Alarm Signal Output	Used to Trip the AC Output Breaker. Supply (+V) (Max. rated output 2.5 Amp)
17	Panel Illumination Output	Connect to the Panel Lamp (Max. rated output 2.5 Amp)
18	Normal Operation Auxiliary Output	Connect to the Operation Indication Lamp (Max. rated output 2.5 Amp)
19	Failure Signal Output	Used to Control External Alarm Buzzer. Supply (+V) (Max. rated output 2.5 Amp)
20	Preheat Signal Output	Used to Control the Internal Heater. Supply (+V) (Max. rated output 2.5 Amp)
21	Warm up Contactor Control Output	Connect to Warm up Contactor (Max. rated output 2.5 Amp)
22	You defined signal Input 2	Negative Input When Action
23	You defined signal Input 1	Negative Input When Action
24	Low Fuel signal Input	Connect to Fuel Level Switch
25	High Coolant Temperature Signal Input	Connect to Coolant Temperature switch
26	Low Oil Pressure Signal Input	Connect to oil pressure switch
27	Remote Start Signal Input	Connect to A.T.S or remote start terminal
28	Remote Start Signal Input	Connect to A.T.S or remote start terminal
29	Magnetic Pick-up Input	Connect to Magnetic Pick-up to monitor speed
30	Magnetic Pick-up Input	Connect to Magnetic Pick-up to monitor speed
31	Idle Speed Control Signal Output (CO.)	Connect to Electronic Governor for idle speed control
32	Idle Speed Control Signal Output (NC.)	Connect to Electronic Governor for idle speed control
33	Idle Speed Control Signal Output (NO.)	Connect to Electronic Governor for idle speed control
34	Block Heater Output	Connect to Block Heater (Max. rated output 2.5 Amp)
35	Voltage Potentiometer Output	Connect to Automatic Voltage Regulator (GAVR)
36	Voltage Potentiometer Output	Connect to Automatic Voltage Regulator (GAVR)

6.2   Wiring Diagram

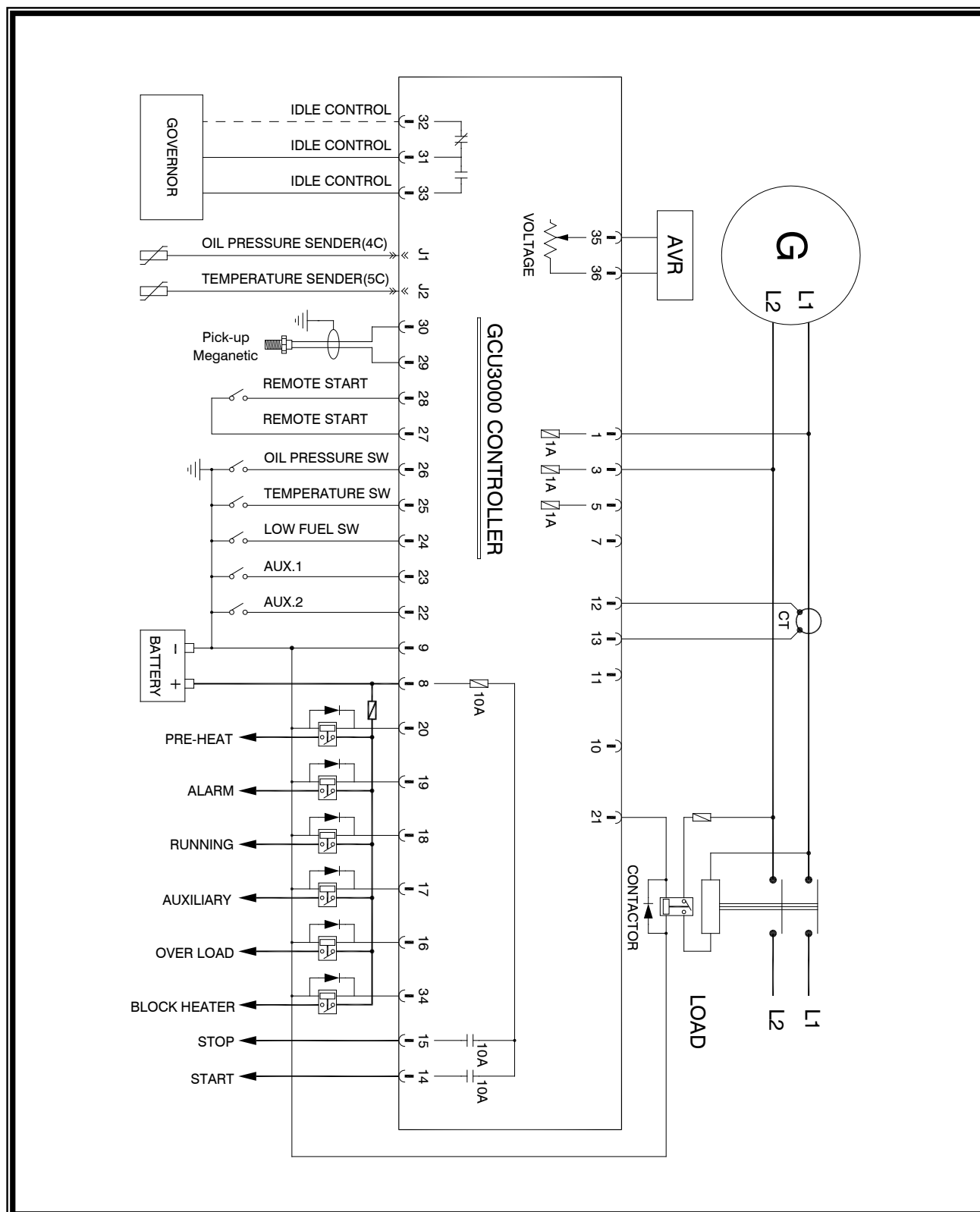### 6.2.1 3 Phase 4 Wires System Wiring Diagram
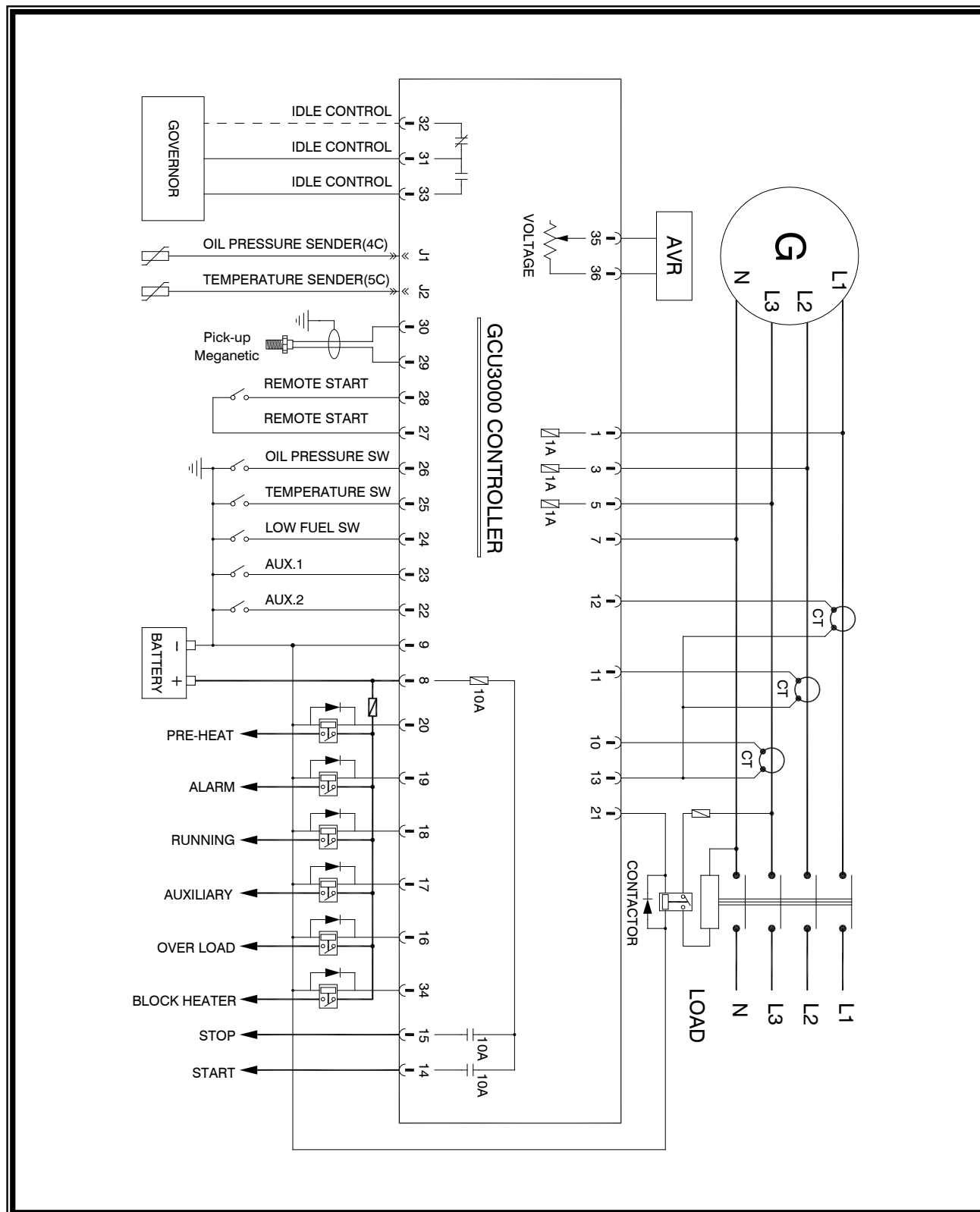
6.2.2 3 Phase 3 Wires System Wiring Diagram
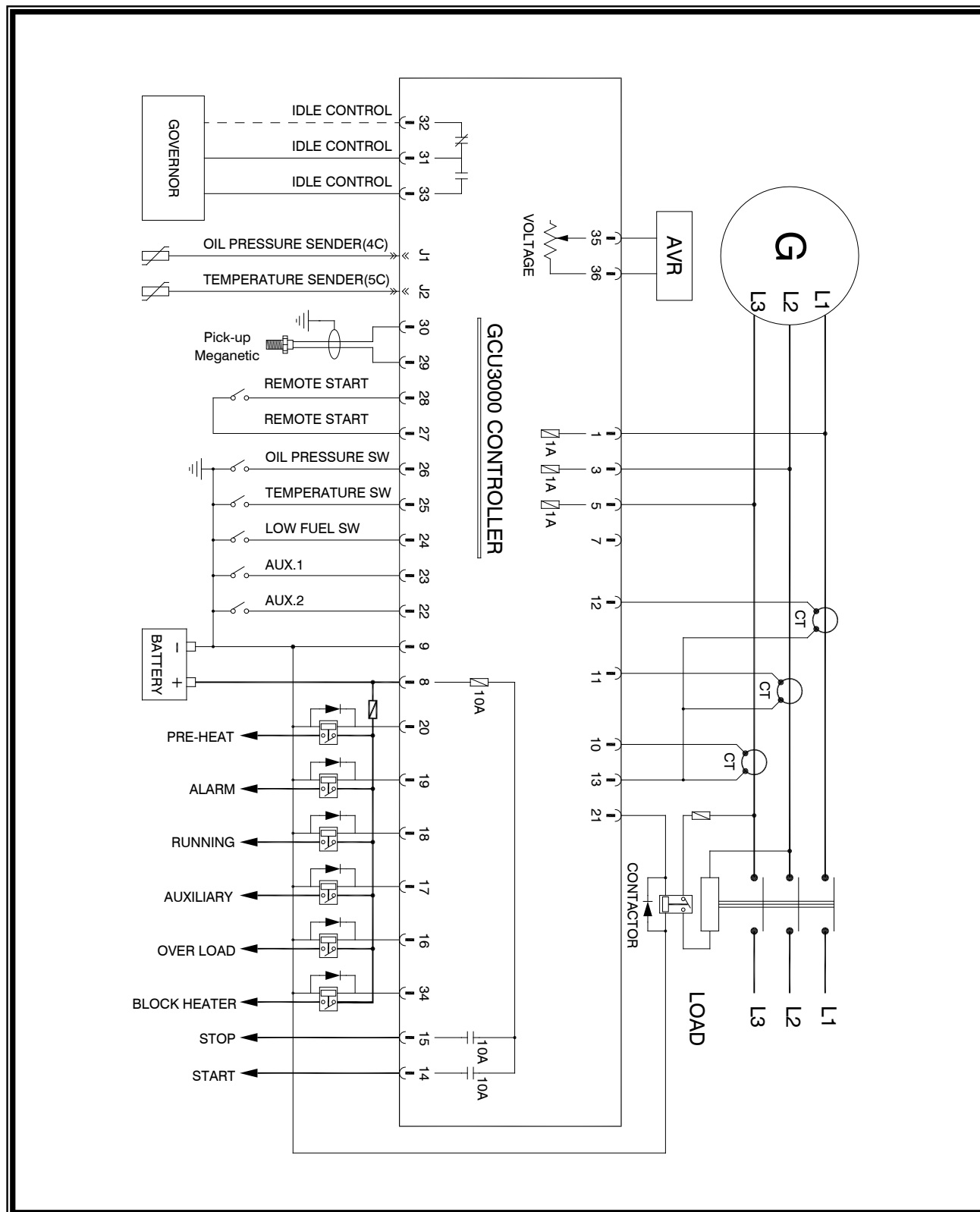
6.2.3 1 Phase 3 Wires System Wiring Diagram
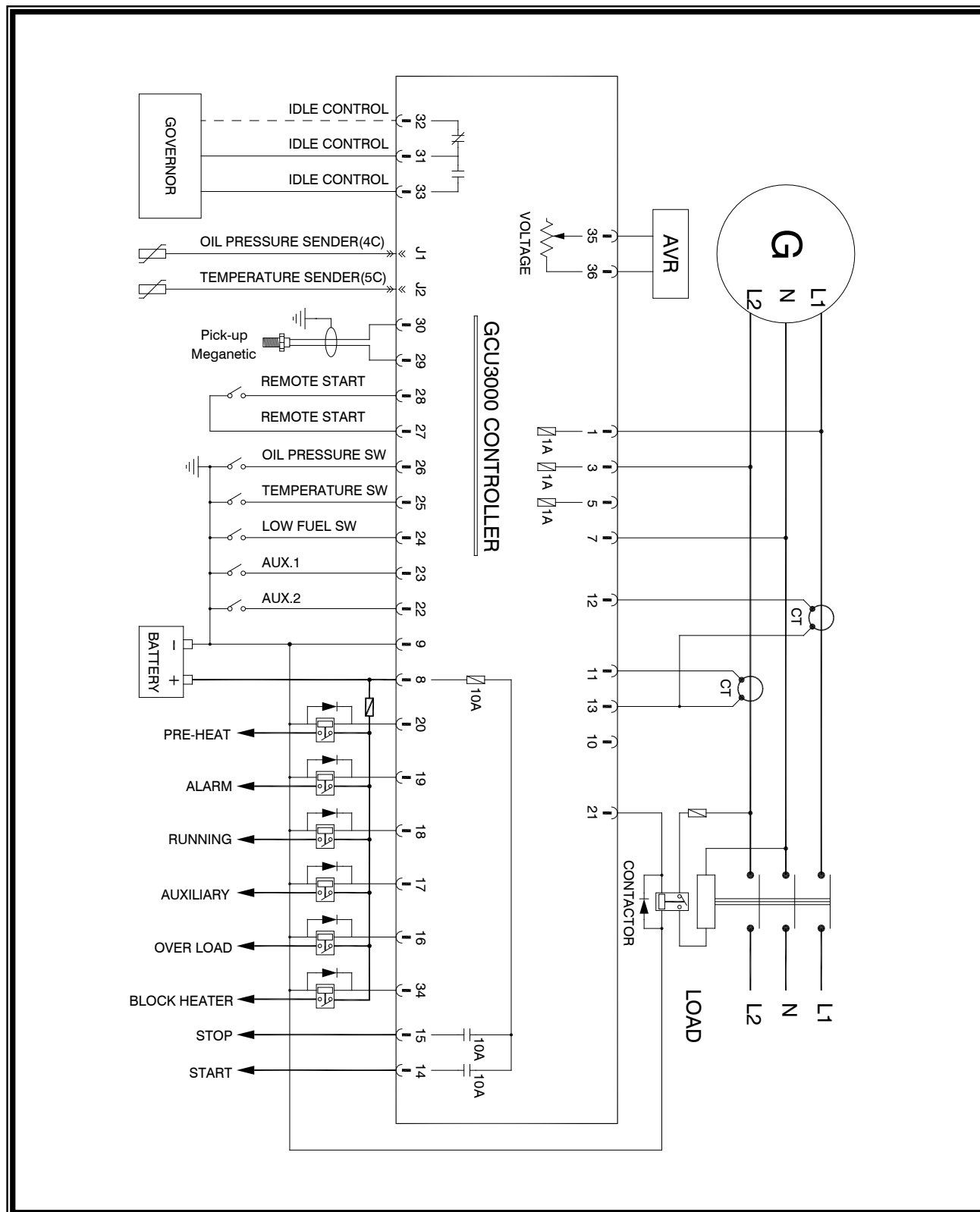
6.2.4 Single Phase System Wiring Diagram

SECTION 7 : TROUBLESHOOTING

SYMPTOM	SYMPTOM CONFIRMATION	EXECUTION
Connected to battery, but GCU does not respond	• Check battery, If voltage is < 9 Vdc • Check the battery positive and negative connection for reversed connection • Test DC connection terminal for bad contact • Check DC input protection fuse (F4) • None of the above	• Change battery • Correct error • Correct error • Change fuse • Change another GCU-3000
GCU responds normally, but the starter motor does not respond	• Check battery, If voltage is < 9 Vdc • Check the starter motor circuit for incorrect connection • Test start output terminal for bad contact • Check if the starter motor assisting relay comply with the battery requirement • Check starter motor assisting relay	• Change battery • Correct error • Correct error • Change starter motor assisting relay
Start motor responds normally, but fails to start, panel appears start failure	• Check fuel level • Check stop settings • Check governor and actuator • Check if fuel solenoid for jamming	• Add fuel • Reset to correct stop settings • Change governor or actuator • Change fuel solenoid
Starter motor disengages immediately during cranking, can not start successfully	• Check battery, If voltage is < 9 Vdc • Check Starter motor circuit • Check for poor contact from the start signal terminal • Check oil pressure sensor	• Change battery • Correct error • Correct error • Change suitable oil pressure switch or cancel oil pressure switch to confirm start
starts successfully, but starter motor does not disengage	• Check AC voltage (5 − 500 Vac) • Check AC input protection fuse (F1, F2, F3) • Check for AC open circuit • Check oil pressure switch operation • Check starter motor operation	• Change AVR • Change fuse • Correct error • Change to suitable oil pressure switch • Change starter motor
When starter does not respond, GCU executes stop	• Check oil pressure switch for NO, NC setting • Check oil pressure switch operation • Check oil pressure sensor operation	• Correct internal setting • Change oil pressure switch • Change GCU exclusive oil pressure sensor
preheat does not respond	• Check Preheat timer if equal to "0 Zero" • Check for preheat wiring open circuit	• Correct internal setting • Correct error
MPU does not respond	• Check MPU operation • Check open circuit in wiring • Check MPU signal strength if below +/- 2V	• Change MPU • Correct error • Change MPU
Remote start signal initiated under AUTO, but does not start	• Check if energize to start and energize to stop setting • Check remote start input signal • Check for starter motor open circuit • Check start signal output	• Correct internal setting • Correct error • Correct error • Correct error

SYMPTOM	SYMPTOM CONFIRMATION	EXECUTION
Emergency signal does not erase, can not be started	• Check emergency stop button operation • Check for wiring open circuit	• Change emergency stop button • Correct error
Temperature can not be read under operation	• Check temperature sensor type • Check for temperature sensor open circuit • Check if temperature sensor setting turned off • None of the above	• Change GCU exclusive temperature sensor • Correct error • Correct internal setting • Change GCU exclusive temperature sensor
Oil pressure can not be read under operation	• Check oil pressure sensor • Check for open circuit • Check system setting if oil pressure sensor deselected • Non of the above	• Change GCU exclusive oil pressure sensor • Correct error • Correct internal setting • Change GCU exclusive oil pressure sensor
Frequency can not be read under operation	• Check AC voltage (5 − 500 Vac) • Check AC input protection fuse (F1, F2, F3)	• Change AVR • Change fuse
Under normal operation. The GCU load current value differs to the actual measured current value	• Check internal CT if comply with the external CT ratio • Check external CT secondary if ratio equals to 5A • Check external CT circuit • Check system setting internal current reading and adjustment setting if correct	• Correct CT ratio setting • Change secondary CT to value : 5A ratio CT • Correct error • Correct internal setting
Module appears overload failure during operation	• Check system setting if overload failure setting is reasonable • Check internal CT if comply with the external CT ratio • Check external CT secondary if ratio equals to 5A • Check system setting if overload failure confirmation time is too short	• Correct internal setting • Correct CT ratio setting • Correct internal setting • Correct internal setting
Module appears low oil pressure warning during operation	• Check lubricant level • Check oil pressure switch operation • Check NO or NC setting • Check oil pressure sensor operation • Check for wiring open circuit	• Add lubricant to correct level • Change oil pressure switch • Correct internal setting • Change GCU exclusive oil pressure sensor • Correct error
Module appears high Coolant Temperature warning during operation	• Check temperature • Check Coolant Temperature switch operation • Check temperature sensor operation • Check for wiring open circuit	• Correct error • Change Coolant Temperature switch • Change GCU exclusive temperature sensor • Correct error

SYMPTOM	SYMPTOM CONFIRMATION	EXECUTION
Module appears over voltage or under voltage warning during operation	• Check AC voltage • Check over voltage and under voltage setting • Check for AC open circuit • Check AC power input protection fuse (F1, F2, F3)	• Change AVR • Correct internal setting • Correct error • Change fuse
Module appears over speed or under speed warning during operation	• Check governor and actuator operation • Check MPU operation • Check AC power input protection fuse (F1, F2, F3) • Check 50/60 Hz RPM setting • Check over speed or under speed setting	• Change governor or actuator • Change MPU • Change fuse • Correct internal setting • Correct internal setting
can not shut off successfully when switching to OFF during operation	• Check cool down setting if over delayed • Check stop timer setting if too short • Check if energize to start and energize to stop setting • Check for stop open circuit • Check governor and fuel solenoid operation	• Correct internal setting • Correct internal setting • Correct internal setting • Correct internal setting • Change governor or fuel solenoid
Single phase system Voltage valued normal, but module appears under voltage failure warning	• Check system phase setting (1 Phase or 3 Phase) • Check under voltage setting • Check AC power input protection fuse (F1, F2, F3)	• Correct internal setting • Correct internal setting • Change fuse
Contactor can not execute, under normal operation	• Check idle speed timer setting for over delay • Check load contactor • Check wiring for open circuit	• Correct internal setting • Change load contactor • Correct error