



User Manual

Digital control system for generators



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Scope of this document

This document addresses the electronic control of asynchronous generators with digital control system made by Fischer Panda. It is an operator's manual strictly applying to electronic control unit and HMI (user interface). For any questions related to the diesel engine, fuel system, cooling system ... see the generator manual. This document will address manual operation of the system only. Alternatively the generator may be remotely operated via its NMEA2000 communication port. For understanding how this works see document "NMEA 2000 interface on GP170", most recent release number.

System components

The system is built of two components:

- Graphic panel, part number GP1702, commonly referred to as "panel". Provides HMI and also NMEA2000 connectivity. The entire control system is accessed via this device.
- Control, monitoring and load sensing device, part number VCS171, commonly referred to as "VCS" (VCS= Voltage Control System). This component performs the entire generator and diesel engine monitoring and control along with sensing the output current and voltage.

Power supply

The entire assembly will work within a voltage range of 12...36 V DC. Power is supplied to the VCS only which in turn feeds the other devices. Usually the system is fed from the generator starter battery. Generator AC output voltage as well as output current is potential free from this power supply with insulation strength of 4000V.

As required by NMEA2000 standard the panel has a potential free NMEA 2000 port working within the limits specified by applicable standards (9...16V). Load equivalency of this port is 1.

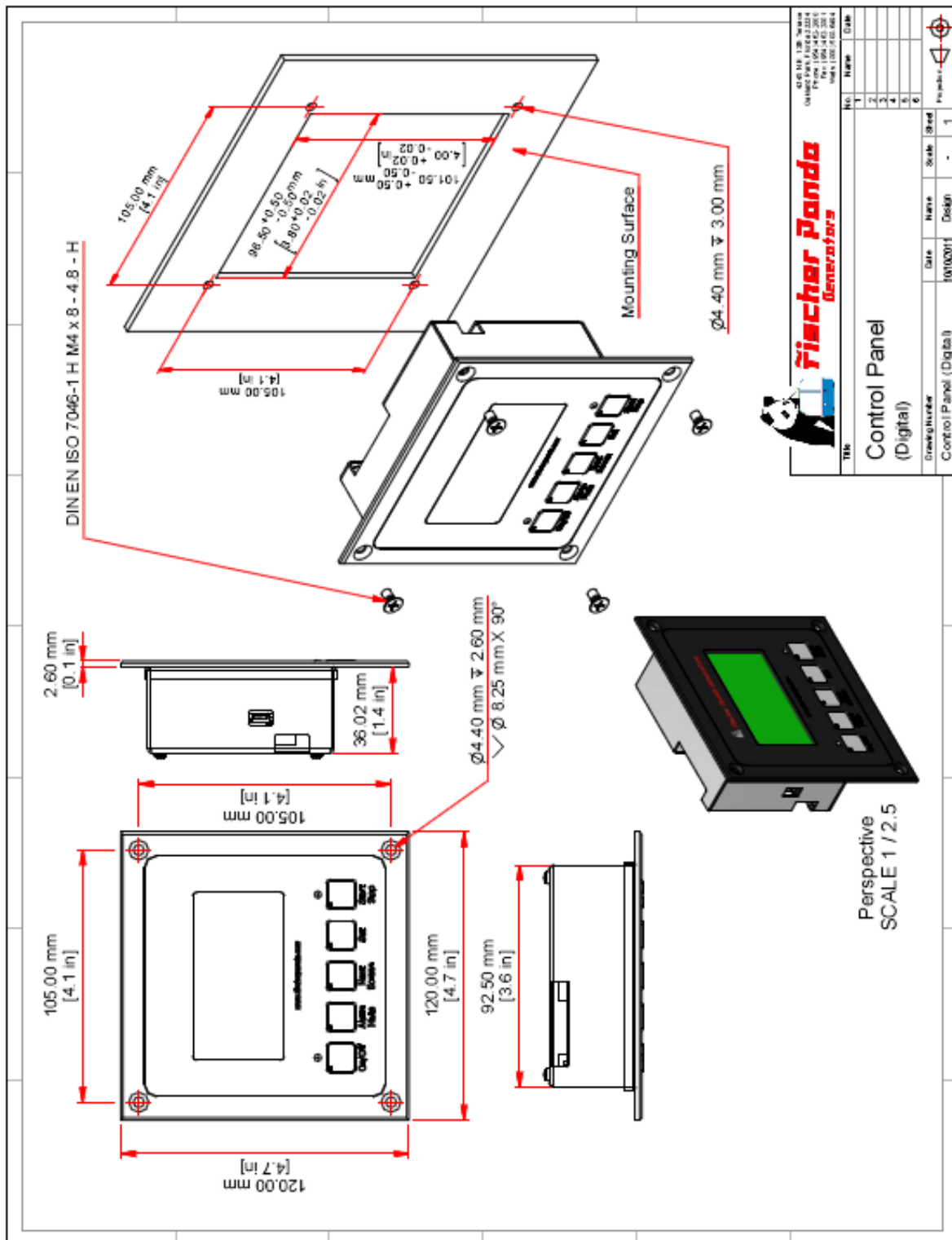
Dimensions

Panel GP170

The panel may be mounted in a wall, bulkhead or boat's operation panel. See [Figure 1: Panel dimensions](#) (next page) for required mounting space. All panel connectors are on the rear side.

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Fischer Panda Generators		
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No.	Name	Größe
1		
2		
3		
4		
5		
6		
Title: Control Panel (Digital)		Drawing Number: Control Panel (Digital)
Date:	10/10/2011	Design
Scale:	-	1

Figure 1: Panel dimensions



Buttons on panel front side:



Figure 2: Panel, front side

LEDs on panel faceplate:

- D1, above button S1: Shows whether entire system is powered on (when on) or not (LED off).
- D2, above button S5: Shows generator status:
 - When off: Generator is stopped
 - When on: Generator is running
 - When blinking: Generator is transitioning from start to stop or vice versa

Buttons on panel faceplate:

- S1: Used to manually power up or down entire system
- S2: Turns off acoustic alarm
- S3: Flips to next screen
- S4: Various assignments. Read this manual to learn about.
- S5: Manually start / stop the generator.

Note: During special interaction (reading log data, programming the VCS, ...) buttons S2 to S5 may also have other functions assigned. Read this manual to learn about.

VCS 171:

The VCS is mounted inside the generator capsule. It is contained within a box on the service side of the generator. The VCS171 is mounted inside the box below.

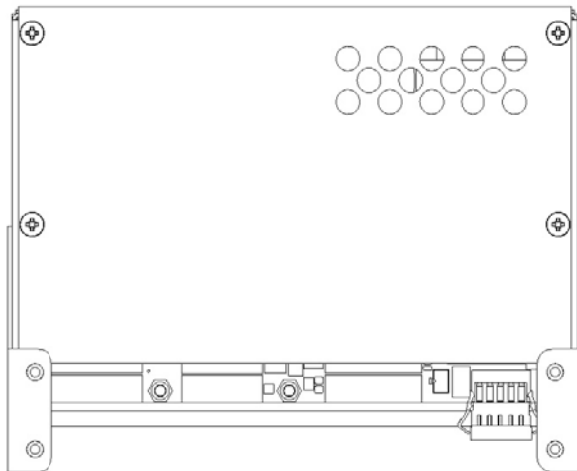


Figure 3: VCS171 Mounting Box



Electrical connections

Panel GP170

All panel connectors are on the rear side and are of the type header (board) with mating jack (cable). The cable connector always is the female connector.

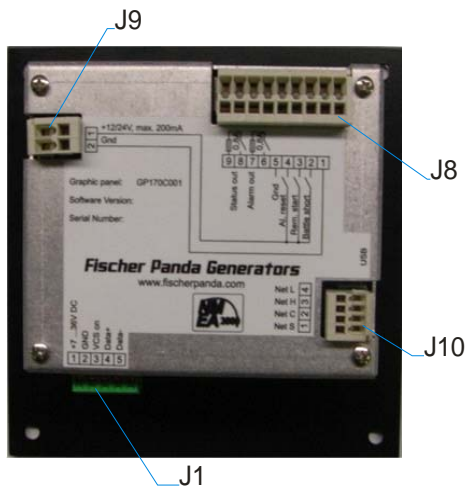


Figure 4: Panel rear side; connector assignment

Connector J1 has screw clamps suitable for wires up to 0.75mm²/AWG 18.

Connector J10 has spring loaded terminals for wires up to 0.5mm²/AWG22. To unlock the spring connector insert a screwdriver in the inner slot. Now the wire may be inserted in the outer slot.

Fischer Panda offers drop cables that match into J10 header with MICRO-C or MINI-C connector, pinning according to NMEA 2000 hardware specification. Contact Fischer Panda if such cables are required.

Connectors J8 and J9 have spring loaded terminals for wires up to 0.75mm²/AWG18. To unlock the spring connector insert a screwdriver in the inner slot. Now the wire may be inserted in the outer slot.

Cable length, cable type and usage restrictions (GP170)

J10: Cable type and cable length limitations as defined in NMEA 2000 standard apply.

J9/J8: J9 serves as power supply for digital inputs on J8. It must not be used as a common power supply or junction point. See wiring diagram for more specific example on how to wire these. Maximum cable length very much depends on the type of switching device that is used and is recommended not to exceed 300 feet.

J1: This is the serial data link to the VCS, includes power supply and a signal that triggers the VCS on/off. Maximum cable length is 300feet; Cables longer than 30 feet shall be shielded with shield connected to supply ground on one end. Cable shall be at least 5x0.75mm² / AWG 18.



VCS171

Below sketch shows the control device VCS171, its connectors with the first pin number. See wiring diagram in Appendix for wiring details.

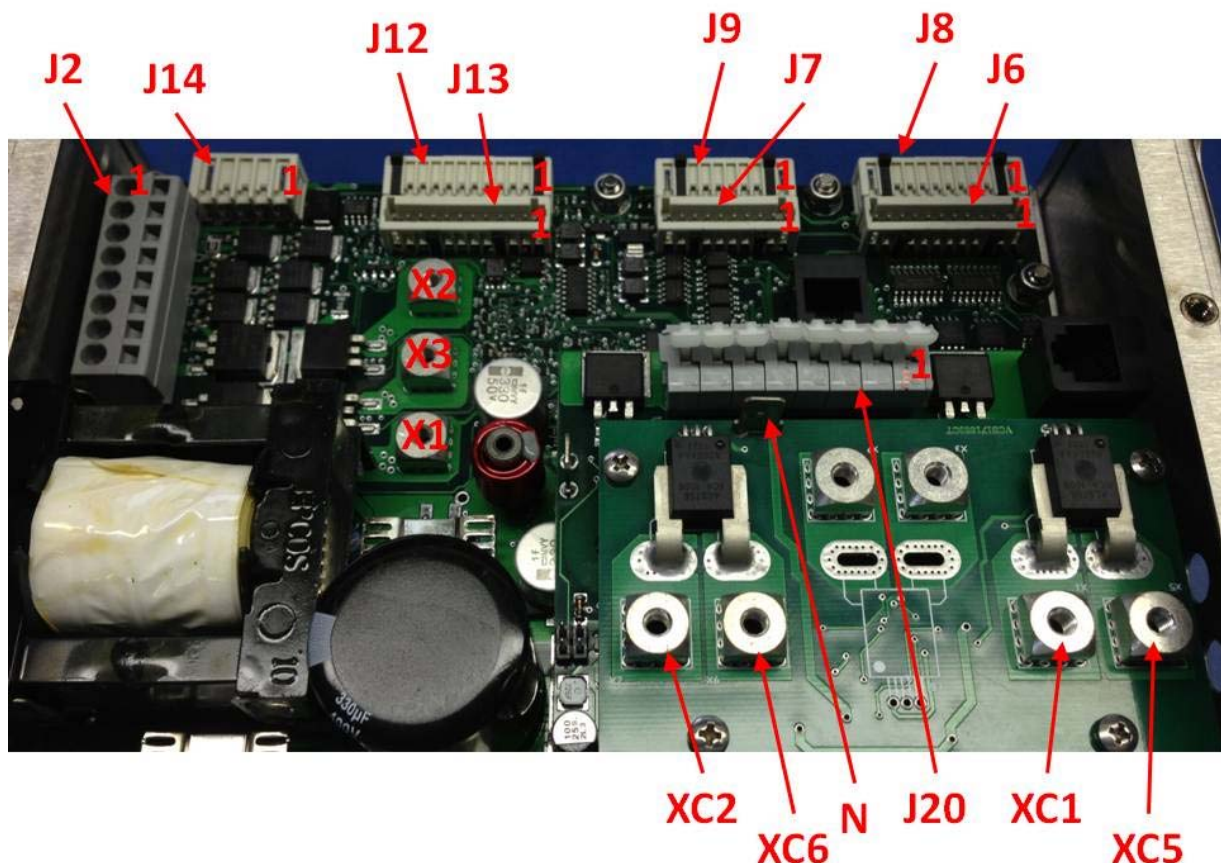


Figure 5: VCS171 Connector Labeling

Wiring the system, linking components

Generators are shipped ready wired for usage. After installing the panel it needs to be connected to the VCS (plug in J1 on the panel). Connecting the panel and the generator output usually is the only electrical connection that needs to be done in the field. All components come ready wired with the generator. It is beyond the scope of this document to give a detailed description on wiring details. See the wiring diagram for a complete schematic of generator and control system wiring.



Operating the system

Power up / power down, main displays

The entire system may be powered on or off by either manual or remote access. Note the panel needs different firmware and thus changing between the two modes will require the panel to be swapped.

Manual power on / off

To power the system up or turn it off simply press button S1, On/Off on the panel. Doing so will toggle the actual status. When powered up manually the system may also be powered down remotely via its NMEA2000 interface. For details see document “NMEA 2000 interface on GP170”, most recent release number.

Remote power on / off

The system may be remotely powered up by jumping pins 1 and 3 on connector J1 of the panel. It is recommended to use a switch or relay contact for this. No other potential must be connected to these contacts!

Power to the entire system is on as long as this contact / switch is closed.

Remote power down via NMEA2000 will not work on panels prepared for remote power up.

Also during some special operations (programming the VCS, resetting to default) the VCS may require a power cycle. Panels prepared for remote power on are not capable of power cycling the VCS. Whenever a power cycle is required the panel instead now will prompt the user to perform this.

Initial display:

Once powered up the green LED above button S1 On/Off turns on, indicating power up status. The panel will show the initial screen:



Figure 6: Initial panel display

The part number as well as the serial number of the device will be shown. The serial number is part of the unique manufacturer ID in NMEA 200 communication. It is set by Fischer Panda and may not be changed.



Software version is also displayed. At the time of writing this document it is 004.010.002 for panels prepared for remote power up and 004.001.0002 for panels prepared for manual power up.

After showing the initial display for around 3 seconds the panel will flip to the first out of 4 selectable displays. The user now may cycle between the 4 main displays by pressing S3. These are the readings provided:

Display 1: Electrical readings

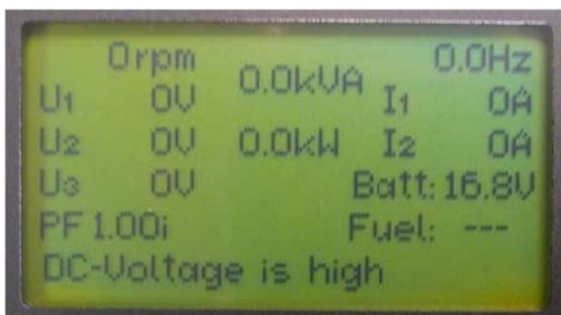


Figure 7: Display 1, generator output

Notes to display 1:

- Battery voltage is low accuracy reading
- Active power is calculated based on power factor on leg 1
- Any analog value being shown as "----" indicates either that input is currently disabled or the sensor is broken / not connected

Display 1 will show:

- Generator speed, calculated based on frequency of AC output
- Frequency, sensed on input L1/N (CT board)
- Voltages U1, U2 and U3: These are the voltages sensed on L1 to N, L2 to N and L1 to L2 (Inputs on CT board). This applies in 120/240V output configuration only. When set and wired for 120V output only, U2 and U3 will be copied from U1
- Output current I1 and I2: Currents sensed through CT1 and CT2 (CT board)
- Power factor sensed on leg 1 (U1/I1); i=>inductive, c=>capacitive
- Fuel tank level. Will be displayed as vertical bar-graph when sensor is enabled and connected.
- Active and apparent power output
- Starter battery voltage (supply voltage of the VCS)

Display 2: Temperature and oil pressure readings:

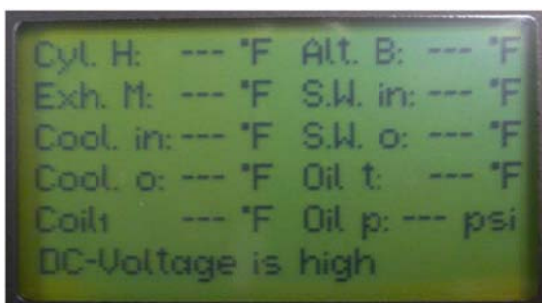


Figure 8: Display 2, temperatures and oil pressure

Notes to display 2:

- Temperature reading may be in °C or Fahrenheit, pressure reading may be psi or bar, see [Display 4: Panel settings](#) (next page)

Display 2 will show:

- Cyl. H: Cylinder head temperature
- Exh. M: Exhaust manifold temperature
- Cool. in/o: Coolant temperature at engine inlet/outlet
- Coil: Coil temperature. The higher reading out of the two coil temperature sensors will be displayed
- Alt. B: Alternator bearing temperature
- S.W.in / o: Temperature at sea water inlet / outlet
- Oil t: Engine oil temperature
- Oil p: Engine oil pressure



Display 3: Miscellaneous readings:

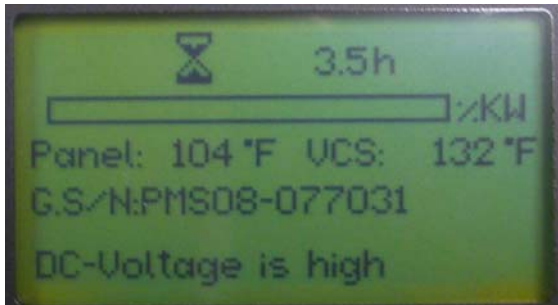


Figure 9: Display 3, power output, miscellaneous

Display 3 will show:

- Total operating time (number near the sand glass)
- Temperature inside the panel and on the VCS board
- Relative power output of the generator (based on nominal generator power programmed in the VCS)
- Generator serial number, as programmed in the VCS

Display 4: Panel settings



Figure 10: Display 4, panel settings

Display 4 is used to adjust panel options. The user may adjust the blinking line of the above display. To do so, press S2 **and hold it down**. Now press S3 to either flip between metric or US-Standard setting (affects temperature and pressure readings) or to increment panel backlight or contrast. Panel backlight and contrast may be incremented from 0 to 10. The next increment after 10 sets the number back to zero.

To set the next selectable option in blinking mode press S4

Panel address is an option for asynchronous generators not having the NMEA interface implemented and may be ignored here.

To leave this display simply press S3 without holding S2 pressed the same time. Now [Display 1: Electrical readings](#) will be displayed again.

Notes to panel settings in display 4:

1. Whatever settings were selected, they will not be stored in EEPROM until this display is left (S3 pressed). As long as this display is active the panel assumes further user action will take place and waits for it. Powering down with this display on will not save any of the most recent panel settings.
2. This display shall not be the primary selection while operating the generator for two reasons:
 - a. LED D2 (above button S5, run/stop indicator) is not updated as long as this display is active.
 - b. Clear Messages sent by the VCS will not be displayed while this display is active.

None of the above two items will affect generator monitoring or voltage regulation but the user may not be updated in time. NMEA2000 communication works constantly, regardless of what display is active.

Clear text messaging

Further to the readings described above (4 displays) the panel also may display some messages in clear text. Such messages will be displayed in the bottom line of the panel but not while display 4/panel

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settings is selected. If more than one message is active the panel will cyclically show all messages with an update rate of approx. 0.5 seconds. Above displays 1-3 always showed a high starter battery voltage (message "DC-Voltage is high" at the bottom of the display).

Clear text messages may be either some kind of information, warnings or alarm messages. Alarm messages are displayed in inverse printing (dark ground, light text). Alarm messages usually will trigger an emergency shutdown of the generator and prevent it from restart as long as such message is active.

In some extreme conditions (over-cranking) the panel will show a warning message over the entire screen and not permit any other action but power down the system. In any such extreme condition the user will be prompted to power down.

Acoustic alarm, alarm output, alarm mute

Whenever an additional clear text message becomes active the acoustic alarm will be triggered, unless it has been disabled in the VCS settings. This will cause an acoustic signal to be generated in the panel and the contact output "Alarm out" (panel, connector J8, pins 6 and 7) to be closed. This contact is rated max 48V DC/ max 1A resistive and fused inside the panel. The alarm may be turned off by either:

- Pressing S2, Alarm Mute, on the panel front side
- Apply +10...36V on input "Al reset" (panel, connector J8, pin4) with reference to panel connector J8, pin 1. Input resistance for this +10...36V signal is 1.5k Ω . Power supplied on panel connector J9 may be used with an external switch/relay contact for this purpose.

The alarm will now stay mute until another clear text message becomes active. If a message becomes inactive and then active again, the alarm will be retriggered.

Disabling the acoustic alarm in the VCS will disable both, panel beeper and relay output. Alarm mute input will be ignored in such case.



Operating the generator

Start / stop the generator

The generator may be started/stopped in 3 different ways:

- Via NMEA 2000 interface: For details see document “NMEA 2000 interface for AGT generators on GP170”, most recent release number.
- Manually by pressing button S5, Start / Stop. Doing so will toggle the actual generator status
- Via remote input: Apply +10...36V on input “Rem. start” (panel, connector J8, pin3) with reference to panel connector J8, pin 1. Input resistance for this +10...36V signal is 1.5kΩ. Power supplied on panel connector J9 may be used with an external switch/relay contact for this purpose. The generator will start and stay on as long as this signal is active (+10...36V applied to J8/pin1). The panel will indicate this by showing the clear text message “remotely operated”.

The generator may be stopped either via NMEA200 interface, manually by pressing button S5, Start/Stop, or – if it was started by remote input – by disengaging the remote input switch/ relay contact.

Although it may also be stopped by powering down the system, it is strongly recommended not to do this! This creates a very high thermal and mechanical stress on the engine and generator.

Demand mismatch

Starting by remote start input and stopping manually (or by NMEA2000 interface) will trigger a demand mismatch. The manual (or NMEA 2000) stop command is assigned a higher priority since this could be an emergency stop. Now the generator will stop, although the remote start input signal is still active. The generator will stay locked up in demand mismatch until the remote start input is disengaged. Demand mismatch status will trigger a clear text message.

Successful start

Generator start is considered successful once engine speed is above 750rpm. Now the LED D2 (on top of button S5, Start/Stop) will turn solid on, the generator enters idle speed and after idle time is over it will start voltage / current regulation (see [Running the generator](#)). Generator status (on/off) may also be retrieved from contact output “Status out” on panel connector J8, pins 8 and 9. This contact is rated max 48V DC/ max 1A resistive and fused inside the panel. It will be closed as long as generator speed is above 750rpm.

Unsuccessful start

The VCS will crank the engine until engine start has been detected but not longer than a certain time (set in the VCS settings). If the engine does not start within that cranking time the VCS will give up and trigger a clear text message (“start attempt failed”). To unlatch from status, follow the procedure below:



Unlatching from emergency stop or unsuccessful start lock-up

- Manually by pressing button S5. The clear text message now will become inactive. Applies only if the generator was started manually or via NMEA 2000 interface.
- Via NMEA 2000 interface. For details see document “NMEA 2000 interface for AGT generators on GP170”, most recent release number. Applies only if the generator was started manually or via NMEA 2000 interface.
- Remotely by disengaging the remote start input. Applies only if the generator was started by remote start input.

Over-cranking

Over-cranking is considered after four consecutive unsuccessful starts. This may be a very critical situation as it may lead to water ingestion to the engine and permanent damage. Over-cranking will cause the panel to lock up. A warning display will be shown, not allowing the user any other operation but powering down.

It is strongly recommended not to just power cycle the system and retry starting! Do not ignore warnings given by the system. Contact Fischer Panda if in doubt about further required actions.

Emergency shutdowns

Certain operating conditions may cause an emergency shutdown (see below, [What is monitored](#)). After such emergency shutdown the control system is locked up and may be unlocked by following the procedure:

Unlatching from emergency stop or unsuccessful start lock-up

- Manually by pressing button S5. The clear text message now will become inactive. Applies only if the generator was started manually or via NMEA 2000 interface.
- Via NMEA 2000 interface. For details see document “NMEA 2000 interface for AGT generators on GP170”, most recent release number. Applies only if the generator was started manually or via NMEA 2000 interface.
- Remotely by disengaging the remote start input. Applies only if the generator was started by remote start input.

The generator will not restart as long as the condition that triggered the shutdown is active (high temperature, overvoltage...). Some exemptions may apply; see below, [What is monitored](#) for details.

Emergency shutdowns may continuously be disabled by engaging the battle short input on the panel rear side.

It is strongly recommended not to do so! This is for extreme urgencies only and could possibly lead to severe damage on engine, generator and/ or other equipment!



Running the generator

How generator control works

While running the generator the control system monitors voltage and current and regulates generator speed based on these. The control system will try to maintain the output voltage within the specified limits (see [Figure 22: Control settings page I](#) , [Figure 23: Control settings page II](#) and [Figure 24: Control settings page III](#)). During voltage control the VCS will not exceed frequency limits entered in VCS program memory ([Figure 22: Control settings page I](#)Figure 22: Control settings page I). Overloading the generator (too high power demand or too high current per coil) will end up with an emergency shutdown. Depending on whether the warning or shutdown limit is exceeded different delay times for such shut-down may apply.

What is monitored

This is a complete list of inputs that the control system is capable of monitoring. Some of them may not be enabled in certain applications. Some digital inputs (switches) and analog inputs may be disabled in software; Temperature inputs which are not required are disabled by setting the warning and alarm level to 255°C / 450°F.

[Table 1: Analog inputs processed by control system](#) shows all analog inputs of the control system, shows if a reading of that input is provided on the panel (R) and if a warning (W) and alarm(A) level may be programmed for that input. It will further show if that input is monitored continuously (C) or if it is monitored while the generator is running only (table entry is O). Exceeding warning levels will trigger a clear text message. Exceeding alarm level will trigger an emergency shutdown. Different delays apply for such emergency shutdown (see [Figure 20: Delay times for warnings/ emergency stop](#) and [Figure 17: Oil and sea water pressure and speed settings](#)). A fixed delay of 2 seconds applies to all over-temperatures

Those inputs which are monitored while the generator is on only behave different:

- Reading will be supplied continuously, regardless of whether the generator is running or not; Will be '---' (invalid reading) for oil pressure;
- While the generator is running, readings above (below) alarm (shutdown) level will cause a shutdown. Unlike with continuously monitored inputs such shutdown will not prevent restarting the generator. The generator may be restarted, after it has been unlatched (see [Unlatching from emergency stop or unsuccessful start lock-up](#)) but after a certain time delay after start that input must come back to normal, otherwise a shutdown is triggered again.
- While the generator is off (and unlatched from any previous shutdown) these readings will not trigger an alarm message, although warning and /or alarm level may be exceeded.

For better understanding take oil pressure as an example:

- With the generator stopped oil pressure is low. This will not trigger an alarm since it is very normal for the oil pressure to be low as long as the engine is not running.
- Low oil pressure is an alarm that will stop the engine, but will not inhibit an engine start.

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- Once started the oil pressure must be above shutdown limit within a certain time, otherwise an emergency shutdown will be triggered.

Table 2: Binary (digital) and miscellaneous inputs processed by control system shows binary inputs of the control system. There is no warning associated with a binary input. Such input may be active or not active; and if active it may just trigger a clear text message (M) or a shutdown (S). It may be continuously monitored (C) or while the generator is running only (table entry O).

Table 1: Analog inputs processed by control system

Analog input	R	W	A	C
Main AC output voltage	X	X	X	X
Main AC output current	X	X	X	X
Total active power output	X	X	X	X
Frequency of AC output	X	X		X
Power factor on Leg 1	X			
Starter battery voltage	X	X	X	X
Cylinder head temperature	X	X	X	X
Exhaust manifold temperature	X	X	X	O
Coolant temperature @ engine inlet	X	X	X	X
Coolant temperature @ engine outlet	X	X	X	X
Generator winding (coil) temperature	X	X	X	X
Engine oil temperature	X	X	X	X
Alternator bearing temperature	X	X	X	X
Sea water temperature @ inlet	X			
Sea water temperature @ outlet	X			
Engine oil pressure	X	X	X	O
Sea water pressure	X	X	X	O
Rectifier diodes temperature		X	X	
Tank Level	X	X		
VCS board temperature	X			
Temperature sensed inside the panel	X			

Table 2: Binary (digital) and miscellaneous inputs processed by control system

Binary input	R	A	C	Location
Al. reset			X	Panel
Remote start	X		X	Panel
Battle short	X		X	Panel
Oil pressure switch		X	O	VCS
Engine speed	X	X	X	VCS
External stop	X	X	O	VCS
Water leakage	X		X	VCS
Coolant level	X		X	VCS
Oil level	X		X	VCS
Air intake filter monitor	X		X	VCS



Operating time	X		O	VCS
----------------	---	--	---	-----

Special features of Fischer Panda Control System

Any activity mentioned hereunder may be either performed manually via the panel or via NMEA2000 interface. This document addresses only manual operation of the system. For performing such special feature via NMEA2000 interface see document “NMEA 2000 interface on GP170”, most recent release number. None of the actions described in this chapter may be performed while the engine is running. Access is denied by the panel and the VCS during engine operation.

Accessing /altering control settings

The control system needs some data to perform speed regulation, monitoring and control of the generator system as described above. These data is stored in the VCS (not in the panel!) and is called program data throughout this document. Fischer panda Generators has a basic data set for each generator type which then may be altered according to some specific customer requirements (enable/disable certain options; alter warning/shutdown limits...). A copy of the program data that was loaded into the VCS memory is kept on the records for every generator shipped by Fischer Panda Generators.

Altering program data may be performed either by a reset to default or by changing specific program data (programming the VCS).

Reset to default

The VCS holds two copies of programming data in two different memory locations. One of these copies is used for normal operation and may be altered by the user while the other one serves as factory default. According to their usage these program data is called “default data” or “normal data”. When performing a “reset to default” the VCS will overwrite the normal program data with the content of the default program data. Certain fields in the normal data will not be overwritten (or, more precisely, are not even mirrored in the default program data):

- Operating time
- VCS serial number
- Generator serial number
- External stop message
- Access code for low level security

Performing a reset to default

To perform such reset to default, while the engine is stopped – and while one of displays 1-3 is active (not display 4, panel setting; this will not work) - press button S2, hold it pressed and then press button S3. Now the screen below will show up:

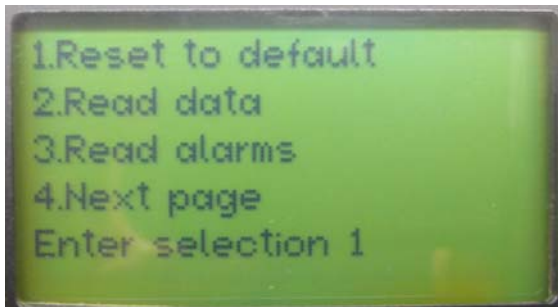


Figure 11: Selection menu, first page

This menu offers 3 options plus transfer to next page. Upon first call the default selection is 1 (reset to default) with digit 1 blinking. Press button S5, Start/Stop to initiate reset to default.

The VCS will now perform the reset to default and the panel will show this display:

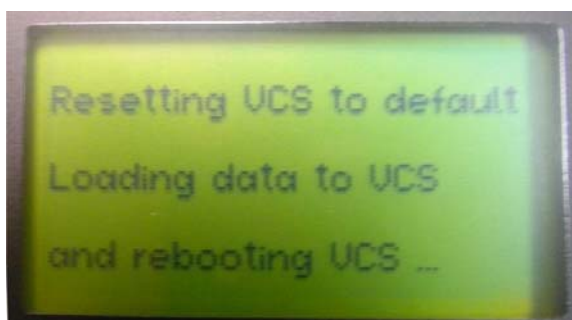


Figure 12: Panel confirming reset to default

No further user action is required. The VCS will perform the reset to default and reboot with default settings. Reboot is similar to power up. After rebooting the normal program data will be loaded (which now contains factory default settings).

Changing specific program data (programming the VCS)

This action requires several steps. It is strongly recommended not to alter any settings, unless all consequences are well known. Check with Fischer Panda if in doubt.

To enter programming mode, follow steps mentioned under [Performing a reset to default](#); this will then again lead to first page of selection menu being displayed (see [Figure 11: Selection menu, first page](#)).

Select option 4:

- increase blinking number by pressing button S3;
- when blinking digit 4 is shown press button S5;

Now the panel will show selection page 2:

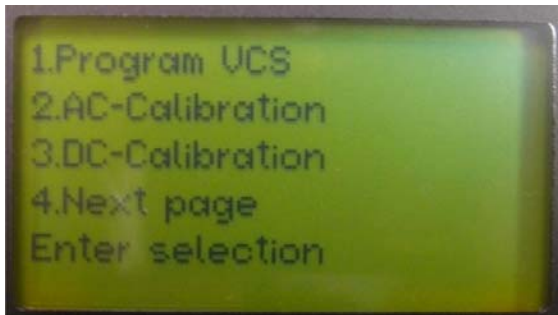


Figure 13: Selection menu, second page

Ensure that under “Enter selection” (bottom line) option1 (program VCS) is selected and press S5.

How to alter / enter any settings

Throughout the entire programming process some simple button assignment need to be used:

- The blinking item (number, character or word) may be modified by pressing S3. Doing so will show next available option. In case of numbers this will be the next higher digit (after digit 9 a rollover to 0 takes place).
- Digits may only be incremented (not decremented). To get to a lower digit, keep incrementing the actual digit; once it reaches 9 upon the next increment it will roll over to 0
- Any number of more digits may be modified digit by digit. First set the desired digit in blinking mode, then increment it (see above)
- To set the digit left to the blinking one into blinking mode press S2. To set the digit right to the blinking one in blinking mode, press S4
- Any number or option selected via S2/S3/S4 may be accepted by pressing S5
- If the selected number is outside the valid range it will not be accepted. Instead the panel will expect a valid number to be entered.

After selecting option 1 on second selection page (see [Figure 13: Selection menu, second page](#)) this display will show up:

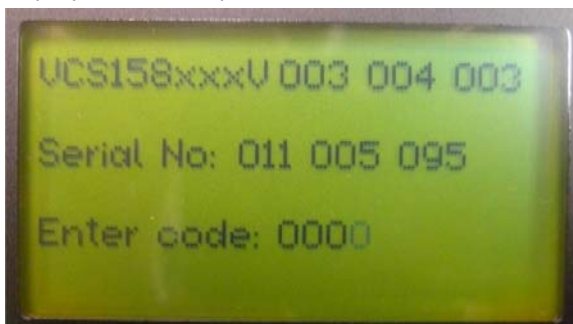


Figure 14: Start VCS programming

This display will show VCS software version (3.004.003 in this case) and VCS serial number. To proceed with programming enter the code as described above.

Access code for low level security is 4711.

After entering this code the first programming page will be displayed.

Note: 3 non-successful consecutive attempts to enter the code will cause the system to shut down. It may restarted regularly with no restrictions



Display pages shown during programming



Figure 15: Temperature settings I

This display shows temperature limits (warnings and shutdowns). Limits are displayed and programmed either Display 4: Panel settings). Once in programming mode there is no way to change units.

Limits (warnings and shutdown level) accessible in this display:

in imperial or metric units, whichever was selected prior to entering programming mode (see Display 3 will show:

- Total operating time (number near the sand glass)
- Temperature inside the panel and on the VCS board
- Relative power output of the generator (based on nominal generator power programmed in the VCS)
- Generator serial number, as programmed in the VCS

- Cool. In: Coolant temperature at inlet to the engine
- Cool. O: Coolant temperature at outlet from the engine
- Oil t. Engine oil temperature
- Cyl. H: Cylinder head temperature

Any page with programming data may be either skipped by pressing S2 or settings may be altered by pressing S5. Pressing S5 will put the rightmost digit of the first number in blinking mode; in this particular case coolant inlet temperature warning actually set to 110°C. Now this number may be altered (see [How to alter / enter any settings](#)) or accepted by pressing S5. After being accepted the next number is set into blinking mode and so on, going through the whole page. Once finished with the last number, the user may now proceed to next page by pressing S2 or again press S5 and perform additional settings in this page.

The VCS stores metric values only, which, if required, are translated by the panel. Therefore some small rounding errors may be visible.

Pressing S2 will lead to the next programming display:

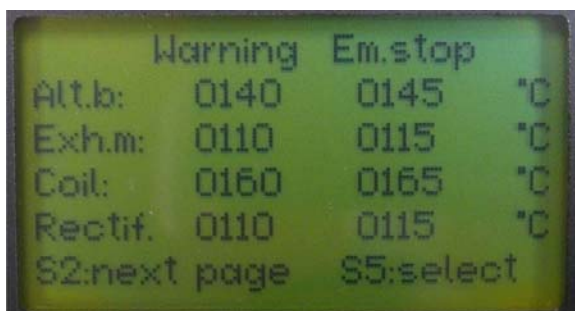


Figure 16: Temperature settings II

Limits displayed in this screen:

- Alt. b: Alternator bearing temperature limits.
- Exh.m: Exhaust manifold temperature limits.
- Coil: Coil temperature limits (whatever is entered here will apply to both coil sensors).
- Rectif. Rectifier temperature limits.

Again temperature limits may be altered (press S5) or next screen may be loaded by pressing S2.

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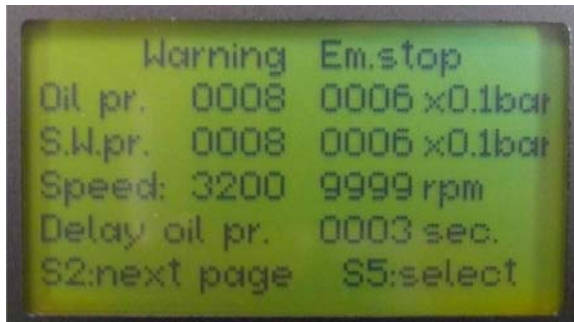


Figure 17: Oil and sea water pressure and speed settings

Limits displayed in this screen:

- Oil pr. Oil pressure reading provided by analog sensor. Limits entered hereunder will be ignored if analog oil pressure sensor is not enabled or broken (disconnected or short-circuited).
- S.W.pr. Sea water pressure. Above mentioned restrictions on sensor apply.
- Speed: Engine speed limit. On standard asynchronous generators engine speed is always calculated based on frequency. Some special applications use a speed pick-up sensor.

Note, in this particular case engine over-speed shut-down is disabled by setting the limit to 9999

To disable any alarm or shutdown:

- For temperatures: Set the limit to 255°/491F
- For Pressure sensors: Disable that sensor
- For speed sensor / speed calculation: Set limit to 9999
- For tank sensor: Set limit to 0%

Sensors providing invalid output (sensor in short-circuit or not connected) will not be monitored. These sensors will not trigger any warning and/or shutdown. Sensors being disabled will also not trigger any shutdown/warning, regardless what limits are set for that sensor and/ or what the actual reading of that sensor.



Figure 18: Main output voltage and battery voltage

Limits set in this screen:

- AC high: Main AC output voltage high limit (either leg).
- AC low: Main AC output voltage low limit (either leg).
- DC high: DC voltage (starter battery, VCS supply) high limit.
- DC low: DC voltage (starter battery, VCS supply) low limit.

Note:

- There is no shutdown limit associated to low battery voltage.
- Unit is 1/10 of a Volt
- Certain shutdown delays apply (see [Figure 20: Delay times for warnings/ emergency stop](#))

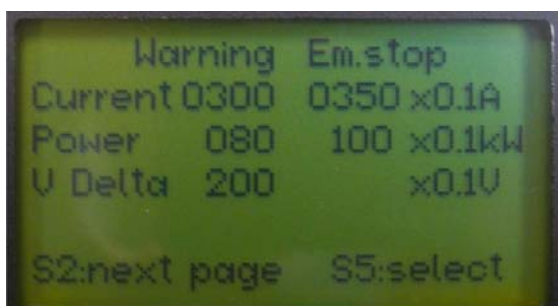


Figure 19: Power and current output

Limits shown in this screen:

- Current Maximum current drawn out of any generator leg..
- Power Maximum output power.
- V Delta Maximum voltage difference between the two generator legs (usually caused by unbalanced load)

Note:

- Units are 1/10Amp for current and 100W for power
- There is no shutdown limit associated to V Delta
- Certain time delays apply for shutdown.
- Extended usage above warning may also trigger shutdown (see [Figure 20: Delay times for warnings/ emergency stop](#)).



Figure 20: Delay times for warnings/ emergency stop

This screen shows time delays for shutdowns. Any shutdown will be triggered if the shutdown limit (in case of power output and current: Warning level as well) exceeds the limit continuously for at least the time given herein.

- Delay I Time delay applicable for current limits
- Delay P Time delay applicable for power output limits
- Delay Vmax Time delay applicable for high-limit on AC voltage output (either leg).
- Delay Vmin Time delay applicable for low-limit on AC voltage output (either leg)

Note: Be aware of units (minutes for warning limits current and power, seconds for shutdown limits current, power, and low voltage and 0.1 second for over-voltage)



Figure 21: Resistance for tank sensor and alarm level

This screen shows resistance settings for tank sensor and alarm limit for low-level alarm and some generator specifics:

- Tank full: Resistance of sensor at full tank. Unit is 0.5Ω.
- Tank empty: Resistance of sensor at empty tank. Unit is 0.5Ω.
- Tank alarm: Low level tank alarm in units of 0.5%
- Poles: Number of poles of the backend. Fischer Panda standard backends have 2 poles.
- Act. Back:

Refers to starting procedure: Prior to cranking, the throttle is brought to idle and then for a certain time back up. This certain time is set here. This setting has an influence on what speed the generator will start.

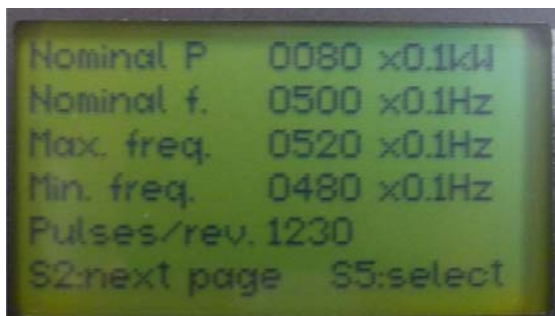


Figure 22: Control settings page I

This screen shows some of the generator control settings:

- Nominal P: Nominal generator power. Used to calculate the bar-graph indication (see [Figure 9: Display 3, power output, miscellaneous](#)). Unit is 100W.
- Nominal f. Nominal generator frequency. Unit is 0.1Hz
- Max. freq. Maximum frequency. Unit is 0.1Hz
- Min. freq. Minimum frequency. Unit is 0.1Hz
- Pulses/rev. Pulses per revolution. Required only on special applications using a speed pick-up-sensor.

Note: The actuator will always keep generator speed within the frequency limits entered in this screen.

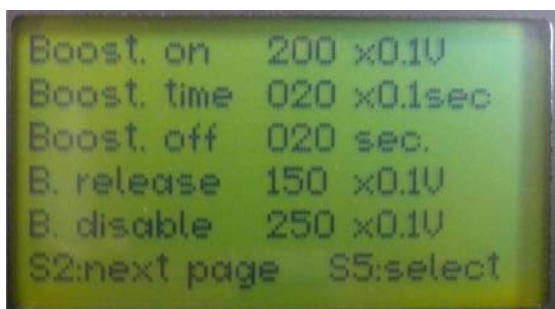


Figure 23: Control settings page II

This screen shows settings for booster capacitors. Booster capacitors are engaged in case of voltage drops / high load surge, to provide higher excitation current. For details see generator manual.

- Boost. on Booster capacitors will be engaged if output AC voltage falls below this limit
- Boost. time Time (in units of 100ms) the booster will stay engaged
- Boost off Minimum time (in sec.) booster will stay disengaged
- B. release Minimum voltage after power up that will enable the booster.
- B. disable Maximum voltage during boosting that will immediately cut off actual booster cycle.

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Figure 24: Control settings page III

Settings in this screen control the actuator:

- AC-Voltage This is the target voltage (unit is 0.1V). The VCS will regulate the generator to provide this output.
- P.length The actuator motor works with a pattern of pulses and gaps between pulses. This is the length of such pulse in units of 10ms.
- P.gap This is the length of a.m. gaps in units of 10ms
- P.strength Strength of actuator pulses, ranging 0...10%
- Deviaton AC Maximum voltage deviation that will not trigger an actuator response



Figure 25: Speed, cranking time and idling time

This screen holds speed and time settings:

- Idle speed Speed that is regulated right after powering up. This is used to warm up the generator
- Nom. Speed This is the speed that will be regulated after idling period. At this speed the control system will expect the voltage to built up and will then switch over to voltage regulation.
- Idle time Duration of idling period
- Crank time Maximum cranking time. If the engine does not start within this time a "start attempt failed"-message will be issued

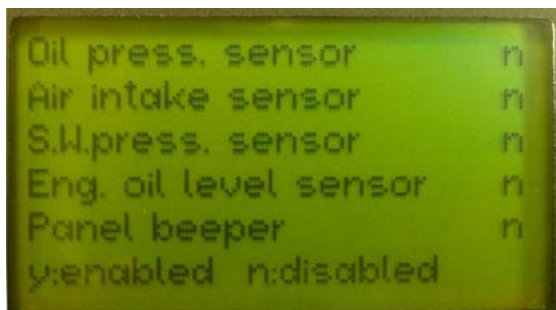


Figure 26: VCS options to be enabled/disabled, page I

This screen is used to disable various functions / sensors:

- Oil press. sensor: Enables/disables analog oil pressure sensor
- Air intake sensor: Enables/disables differential pressure sensor on air filter.
- S.W.press. sensor: Enables/disables analog sea water pressure sensor
- Eng. Oil level sensor: Enables/disables engine oil level sensor
- Panel beeper: Enables/disables acoustic alarm in panel(s)

Note:

To enable/disable any of the above press button S5. Now the upper "n" (oil press. sensor) will start blinking and may be flipped to "y" by pressing S3. Accept any setting by S5. When done with this page, hit S2 to get to the next page.

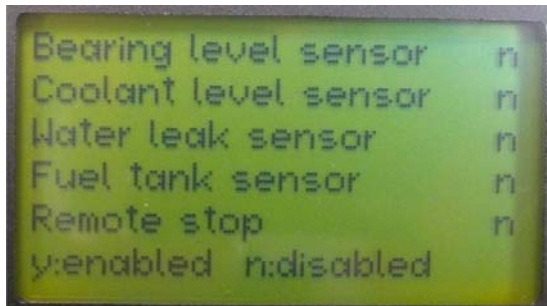


Figure 27: VCS options to be enabled/disabled, page II

This screen again shows some options that may be enabled/disabled. Operation is as explained above.

- Bearing level sensor: Enables/disables sensor for bearing oil level
- Coolant level sensor: Enables/disables coolant level sensor
- Water leak sensor: Enables/disables water leak sensor
- Fuel tank sensor: Enables/disables fuel level sensor
- Remote stop: Enables/disables remote stop input



Figure 28: Last page in programming mode

This is the last page in programming sequence. Unlike with prior pages the user now may not skip this by pressing S2. Pressing S5 is required here to adjust final options:

- Phases: Select between 120/240V or 3~
- Coils set in: Select between series (120V and 240V output) or parallel (120V output only)
- Rpm sensor: Select between disabled (standard) or enabled
- Coils used: Select between "all" (usually 120/240V and 3~ generators) or "one" (usually 50Hz single phase generators)

After adjusting settings as required the "no" in line with "Save to VCS" will start blinking. To store the recent settings in the VCS flip this to "yes" and hit S5. To go over the settings again, leave this on "no" and hit S5. Now the display as shown in [Figure 15: Temperature settings I](#) will be shown and the programming sequence restarts from there.

After programming the VCS the panel will cause a power cycle and the VCS will return into normal operation. No user interaction is required for this.

Low level security access gives access to normal program data (not default!) and will also not allow access to operating time.

Reading log data

Understanding the concept of logging data

The VCS records all data described in [Figure 7: Display 1, generator output](#) , [Figure 8: Display 2, temperatures and oil pressure](#) , and [Figure 9: Display 3, power output, miscellaneous](#) plus all (if any) pending clear text message(s). Two reasons may trigger recording of one such data set:

- Any shutdown
- Based on time, each time the operation time counter increments (every 6 minutes).

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Thus such recording will take place while the generator is running only. The VCS has two distinct memory regions that are used for data logging:

- One that holds logging data recorded during an emergency shutdown. This is called the alarm memory.
- One that holds logging data recorded timely, every 6 minutes. This is called the history data memory.

Data recorded during an emergency stop of the generator is recorded in the alarm memory while data recorded on a timely basis is stored in the history data memory.

The VCS memory gives space for a total of 64 alarm data sets and for a total of 104 history data sets. This allows the operator to trace back generator status/operation mode for more than 11 hours and for the last 64 emergency shutdowns. Note that an over-crank event is NOT an emergency stop (the generator never ran!) and thus will not trigger an alarm recording.

Alarm data and history data is stored in circular buffers. Once the buffer is full the next data set will overwrite the oldest one and so on. Each buffer has a tag counting 0 to 103 for history data and 0 to 63 for alarm data.

The highest tag does not necessarily hold the most recent data set; once the buffer has overflowed this will change. Right before the first overflow the highest tag for history data will be 103 and will hold the most recent data. But right after the first (or any subsequent) overflow the most recent data now will be under tag 0.

The data sets stored during such log process (either history or alarm data) may be retrieved by using the panel or via the NMEA 2000 port of the panel. Whenever retrieving such log data the VCS will detect any attempt to read from a memory location that does not hold valid data (will only happen prior to first overflow of circular buffers!). This is called an invalid memory access and will cause the VCS to reset and revert to normal operation, similar to powering it up.

Retrieving log data

To access log data manually via the panel press button S2, hold it down and then press button S3. This is the same procedure as mentioned to above under [Performing a reset to default](#) and will end up in showing [Figure 11: Selection menu, first page](#). This will only work while the generator is stopped and the panel is showing display 1, 2, or 3,

Selecting 2 will access history data memory, while selecting 3 will access alarm data memory. From this point on the process is the same for both, history data and alarm data, so it will be described once only.

Upon selecting data access (history or alarm data), this display may show up, right at the first attempt to retrieve data or at some later access to log memory:



Figure 29: Invalid memory access

This indicates an invalid memory access. If it happens the first time when accessing any log memory (history or alarm) this shows there is nothing logged. Any invalid memory access will be followed by the next screen ([Figure 30: Terminating data log reading.](#))

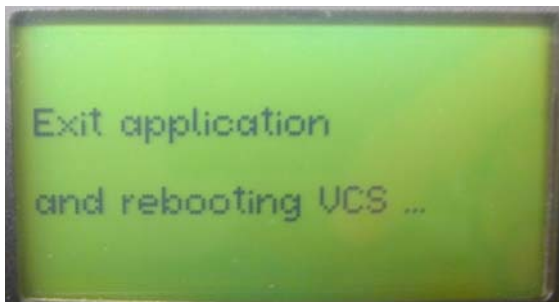


Figure 30: Terminating data log reading.

The system will reboot now and power up normally.

Log memory reading will terminate as soon as an invalid memory access occurs. If the circular buffer that is accessed has overflowed at least once, then log memory is endless. After reading alarm memory (history memory) data set #0, the next data set transfer will again upload alarm data set 63 (history data set 103).

Whenever there is at least one logged data set this display will show up when uploading it:

Valid data detected in log memory. Data set no. 16 (tag of that data set, ranges 0..103 for history data and 0..63 for alarm data) has been uploaded.

This may be viewed by pressing S3 or previous data set (#15) may be uploaded by pressing S4

Note: Data set 16 does not necessarily indicate a total of 16 data sets available. If this was an alarm memory access and the circular buffer has overflowed, then a total of 64 data sets is available. To find out, continue reading next set, until either data set 63 is retrieved or an invalid memory access occurs.

Figure 31: Data set ready to be displayed

After uploading a data set Log data may be viewed by pressing button S3, or previous data set may be uploaded by pressing S4 (see above [Figure 31: Data set ready to be displayed](#)). Viewing that data set (pressing S3), will cause Display 1 (see [Figure 7: Display 1, generator output](#)) to be displayed with the readings taken from the uploaded log memory. If any clear text message(s) were active while that data



set was logged it will be displayed. Active messages will be updated circularly with an update rate of approx. 0.5 seconds. Pressing S3 again now will change to display #2 (see [Figure 8: Display 2, temperatures and oil pressure](#)) and then to display #3 (see [Figure 9: Display 3, power output, miscellaneous](#)) and then again to the selection display shown in [Figure 31: Data set ready to be displayed](#). Now again the user may show this data set (again press S3) or upload the previous one.

Panel temperature sensed inside the panel and not part of any logged data set which is logged and stored in the VCS. That is why on display#3 panel temperature is always displayed as '---' (=unknown) while viewing log data.

Reading log memory will stop as soon as the first invalid memory access occurs (attempt to read empty log memory). It may also stopped manually by powering down the panel either by pressing S1 (or NMEA2000 interface) if started manually or by powering down via remote switch if remote power up is used. There is one additional way to revert to normal display mode using NMEA 2000 communication but not by manual access.

Messages displayed by the panel

As mentioned in chapter 2, [Operating the system](#), the control system is constantly monitoring the generator and any unusual condition is displayed in clear text. This applies to warnings as well as shutdown messages. Note: the generator will not start as long as any such out of the range condition is active.

The below [Table 3: Panel messages](#) lists all clear text messages, shows the message type (A = Alarm, will trigger shutdown; W=Warning; I=just for information) and where it is generated. Shutdown messages are displayed in inverse printing (light characters on dark ground).

Table 3: Panel messages

No.	Message text	Type	Origin	Description
1	AC-Voltage is low	W,A	VCS	Voltage on main output is lower than warning (=W) or shutdown (=A) limit. In 120/240V configuration either leg may trigger this message.
2	AC-Voltage is high	W,A	VCS	Voltage on main output is lower than warning (=W) or shutdown (=A) limit. In 120/240V configuration either leg may trigger this message.
3	No excitation	W	VCS	Will be generated during start-up if output AC voltage does not built up after adjusting the generator to nominal speed.
4	Rectifier temp. is high	W,A	VCS	Will be triggered if rectifier heat sink temperature is higher than warning (=W) or shutdown (=A) limits.
5	Current output is high	W,A	VCS	Will be generated if current output is higher than limits set up under warning (=W) or shutdown (=A).
6	Frequency out of range	W	VCS	Will be generated if AC output frequency is not within programmed limits.
7	Power output is high	W,A	VCS	Will be generated if output power is above warning (=W) or shutdown (=A) limit.
8	Coil temperature is high	W,A	VCS	Will be generated if the temperature sensed on generator coil is above warning (=W) or shutdown (=A) limit.

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9	Cool w. in temp. is high	W,A	VCS	Will be generated if the temperature sensed on cooling water inlet is above warning (=W) or shutdown (=A) limit. Note that "Inlet" refers to the engine (i.e. engine inlet and thus heat exchanger outlet)
10	Cool w. out temp. is high	W,A	VCS	Will be generated if the temperature sensed on cooling water outlet is above warning (=W) or shutdown (=A) limit. Note that "outlet" refers to the engine (i.e. engine outlet and thus heat exchanger inlet)
11	Oil temp. is high	W,A	VCS	Will be generated if the temperature sensed on engine oil temp. sensor is above warning (=W) or shutdown (=A) limit.
12	Cyl. head temp is high	W,A	VCS	Will be generated if the temperature sensed on cylinder head is above warning (=W) or shutdown (=A) limit.
13	Bearing temp. is high	W,A	VCS	Will be generated if the temperature sensed on alternator bearing is above warning (=W) or shutdown (=A) limit.
14	Exh.m. tem. Is high	W,A	VCS	Will be generated if the temperature sensed on exhaust manifold is above warning (=W) or shutdown (=A) limit. Will be triggered only after the engine was started and has passed idling period. This is to allow engine start even if exhaust manifold got heated up from previous start. Shutdown or warning will be triggered if temperature is still above limits after idling period.
15	Engine speed is high	W,A	VCS	Will be triggered if engine speed is sensed higher than warning (=W) or shutdown (=A) level.
16	Oil pressure is low	W,A	VCS	Will be triggered if oil pressure is sensed lower than warning level (W). Shutdown (=A) may be triggered by either analog sensor output reading less than shutdown limit or by binary oil pressure switch. Note that some time delay applies to this reading. Right after start-up oil pressure monitoring is disabled for a programmable time. This is to allow the generator to start and build up oil pressure prior to monitoring it
17	Nominal speed	I	VCS	Used for military applications only.
18	Oil pressure switch	A	VCS	Shows that oil pressure switch triggered a shutdown. Could be additionally to message 16.
19	Battery voltage is low	W	VCS	Starter battery voltage is lower than low level warning limit
20	Battery voltage is high	W,A	VCS	Starter battery voltage is higher than high level warning (+W) or shutdown (=A) limit.
21	Actuator failure	W	VCS	Indicates a problem with engine actuator. Requires service by Fischer Panda
22	Start attempt failed	W	VCS	Shows that engine did not start (engine speed >750rpm could not be detected during entire cranking period).
23	Load is unbalanced	W	VCS	Voltage difference between leg 1 and leg 2 is above limit
24	Tank level is low	W	VCS	Tank level below warning level
25	Unexpected stop	W	VCS	Will be triggered if the VCS detects an engine stop (speed signal < 750rpm) during normal operation. Usually this points to a fuel supply problem or manual interference. Once triggered the VCS will complete the stop procedure and latch it. See Unlatching from emergency stop or unsuccessful start lock-up about how to unlatch.
26	Check sea water	W,A	VCS	Sea water pressure is less than warning (=W) or shutdown (=A) level. Note: Sea water pressure is monitored after completing idle period only.
27	Engine oil level is low	W	VCS	Engine oil level below threshold (triggered by binary sensor input)
28	Backend oil level is low	W	VCS	Backend oil level below threshold (triggered by binary sensor input)
29	Coolant level is low	W	VCS	Coolant level is below threshold (triggered by binary sensor input)
30	Check air filter	W	VCS	Differential pressure on air filter is too high (triggered by binary sensor input). Air filter may be clogged up.
31	Invalid program data	A	VCS	Program data set stored in the VCS is not valid
32	Invalid AC calibration data:	A		AC calibration data stored in the VCS is not valid.
33	Invalid DC calibration data	A	VCS	DC calibration data stored in the VCS is not valid.



34	Check sea water filter	A	VCS	Shows a too high temperature difference between sea water inlet and sea water outlet (usually caused by sea water filter being clogged). Note: This option needs to be enabled in the VCS and is limited to generators that read sea water temperature (not a standard option)
35	Remotely operated	I	Panel	Shows the generator was started / is preparing to start due to a remote input start request.
36	Battle-short is active	I	Panel	Show that battle short on the panel is active
37	Demand mismatch	I	Panel	Shows that demand mismatch has occurred. See Demand mismatch about how to resolve this.

Trouble shooting guidance

Some common errors that have shown up in the past are listed below with some suggestion where to look next. In case of any problems, prior to contacting Fischer Panda generators please have this data at hand:

- Generator serial number: See [Figure 9: Display 3, power output, miscellaneous](#);
- VCS serial number and software version. You may have to attempt programming to get this information; see [Figure 14: Start VCS programming](#);
- What message(s) is (are) displayed in the panel.

Usually by having the above information at hand a Fischer Panda Service staff members will be able to give a very precise instruction on further trouble shooting or even clearly identify the reason of a problem.

Some common problems encountered in the past:

- System will not power up
 - Check Power supply to the VCS (X1).
 - Check ground connections
- System will turn off as soon as cranking gear is engaged
 - Check starter battery voltage and capacity. Voltage needs to be above 7 V continuously to start the engine and keep the control system alive
- Panel will display initial display (see [Figure 6: Initial panel display](#)) forever, without ever advancing to generator display
 - Check whether you got the right panel for the type of power up (remote or manual , see [Power up / power down, main displays](#))
 - If multiple panels are used: Check if the power supply on the main panel (the one that connects to CAN bus AND to the VCS) is turned on.

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- Generator will start immediately, as soon as panel is turned on
 - Check the remote start input; it may be activated. You'll see also the message "remotely operated"
- Unexpected stops happen again and again
 - Check the fuel supply system (fuel pump, fuel filter). The generator may not get enough fuel causing the speed to collapse
- Generator will not start but report "unknown" messages on the panel, such as "Fire boy" or "safety stop" or "external stop"
 - Check the external stop input. It may be enabled in the VCS (see [Figure 26: VCS options to be enabled/disabled, page I](#)) and activated (circuit is open).
- Generator will shut down sporadic due to oil pressure low, although everything seems to be fine
 - Check connections on the VCS board. Some connectors may not be plugged in correct.
- After maximum cranking time the panel will show "start attempt failed" although the cranking gear did not crank at all
 - Again check connectors on VCS board

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Revision History

Date	Release #	Comments
07/31/2013	001	Initial document

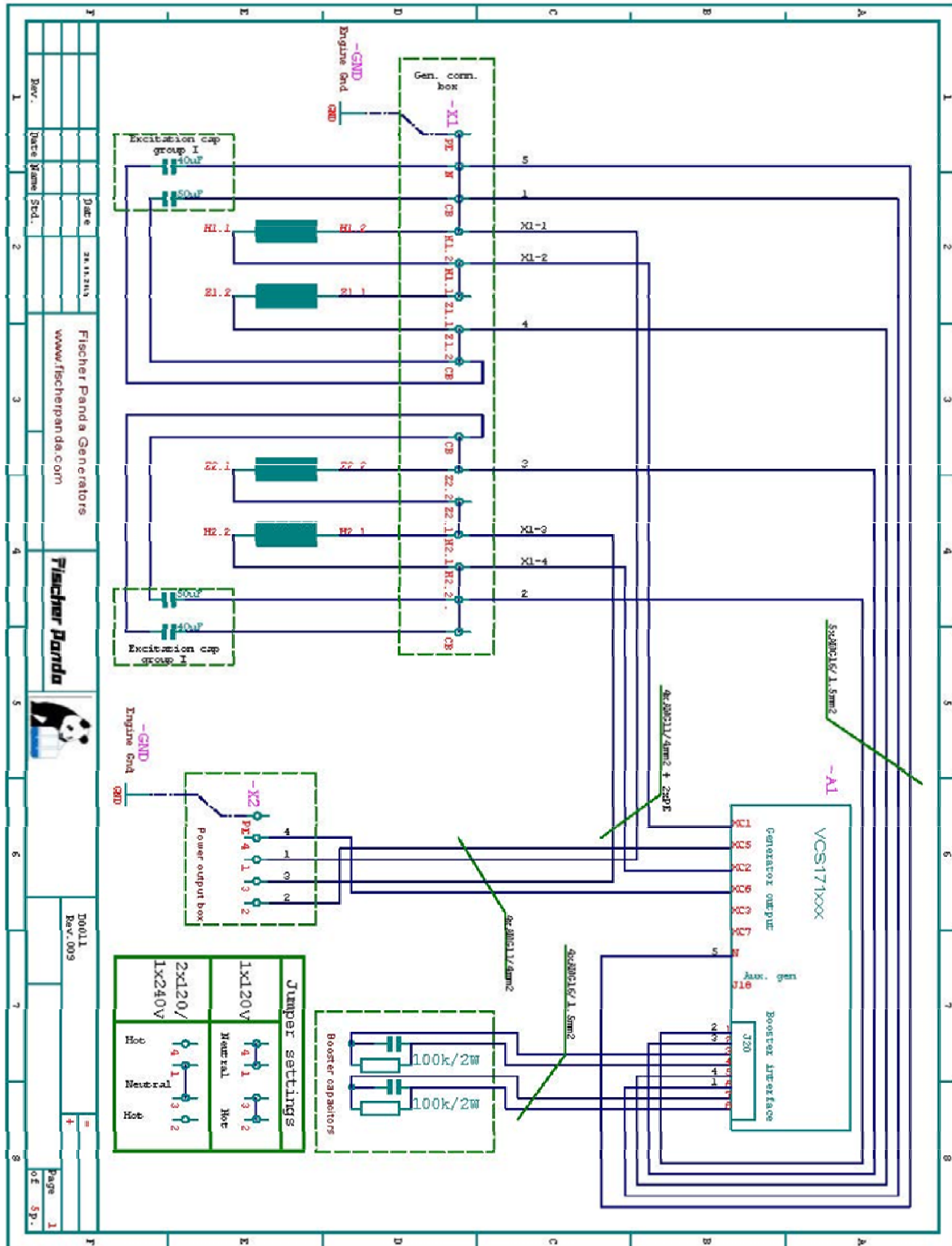
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Appendix 1: VCS171 Wiring Diagram

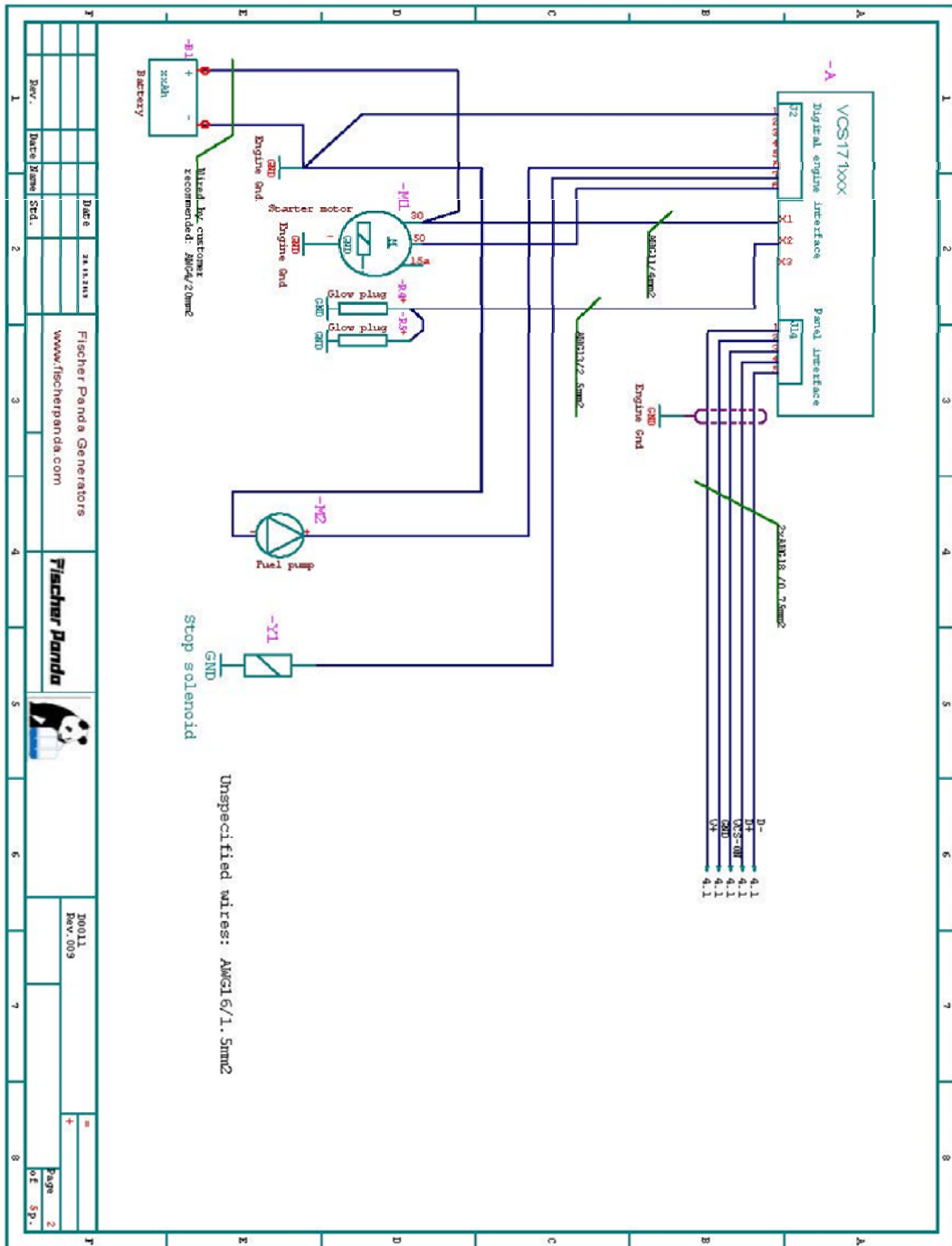
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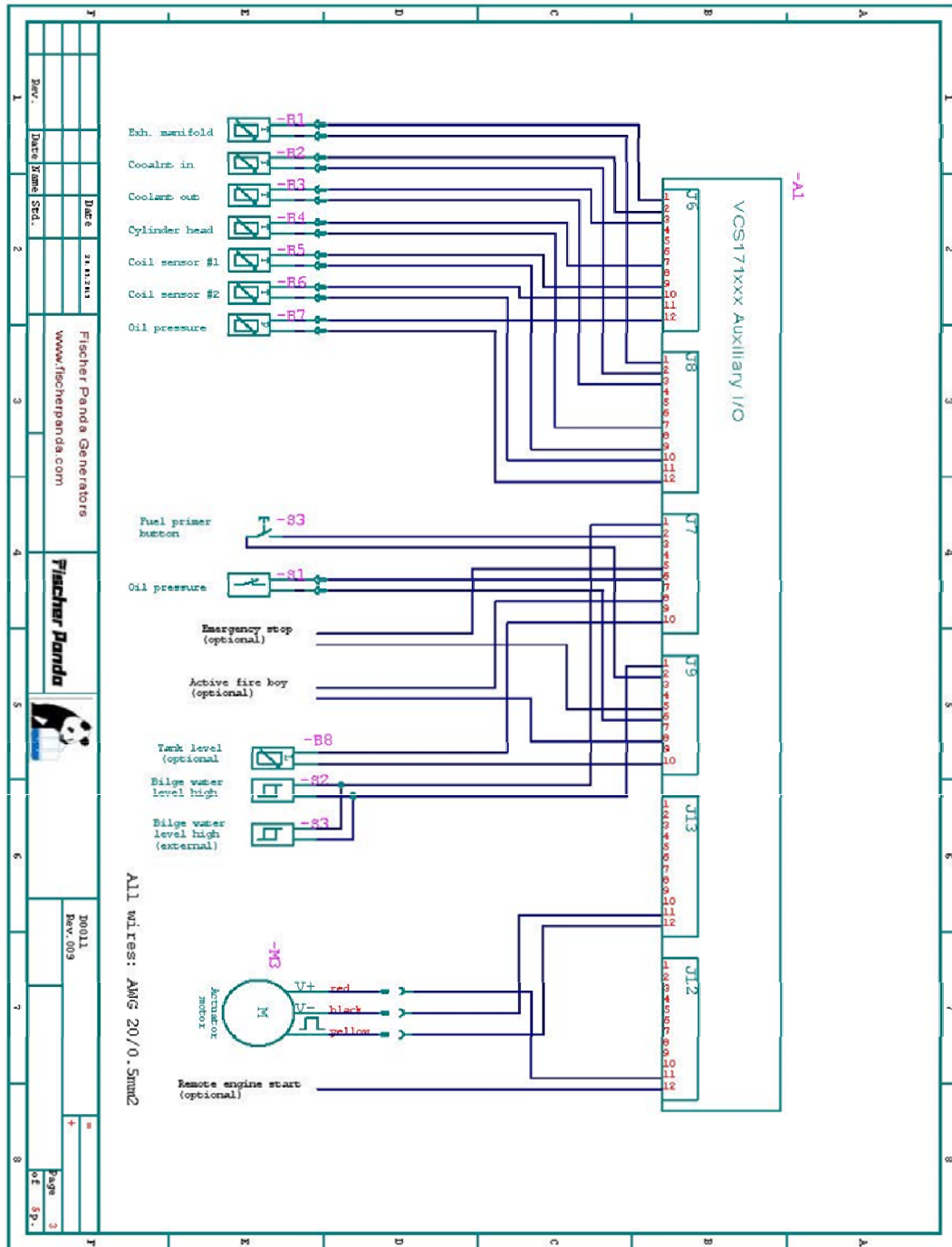


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User Manual

Digital control system for generators

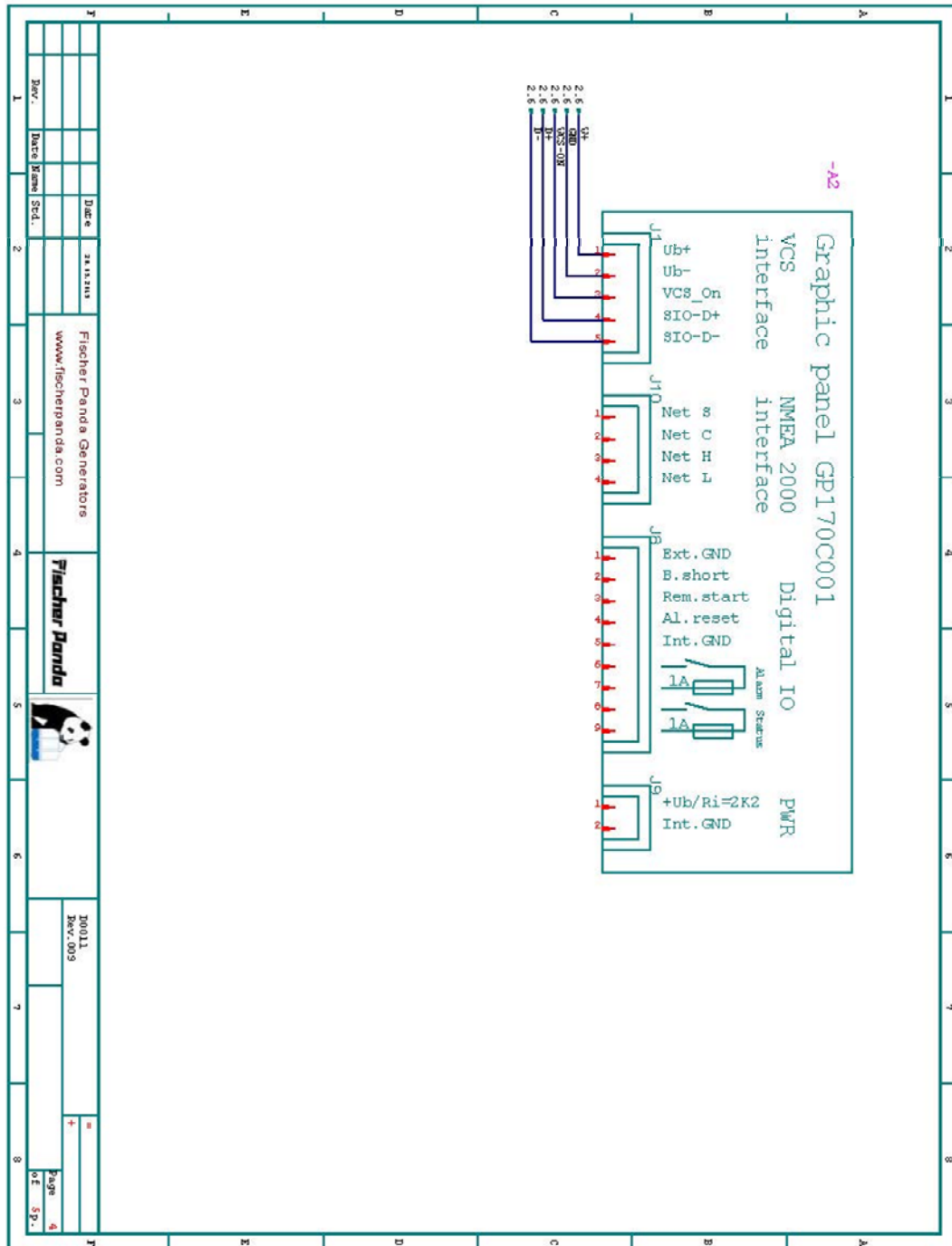


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		Design revision history					
Date	Description	Revision	Name				
11/26/2012	PE wiring generators to terminal modified, cables reorganized	002	Paul Shull				
12/03/2012	Battery charger removed	003	Paul Shull				
12/04/2012	Wipe gauges modified, signal interfacing modified	004	Paul Shull				
12/05/2012	Wipe gauges modified	005	Paul Shull				
01/09/2013	Wiring booster capacitors changed	006	Paul Shull				
02/08/2013	Wipe coils (sensing leads & booster) added	007	Paul Shull				
03/21/2013	Optional wiring added/modified. Main output modified	008	Paul Shull				
05/20/2013	Tank and water sensor added. Gen. connection modified	009	Paul Shull				

Rev.	Date	Drawn	Checked	Approved	Fischer Panda Generators www.fischerpanda.com			Fischer Panda				I00011 Rev. 008		Page 5 of 5 p.	
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