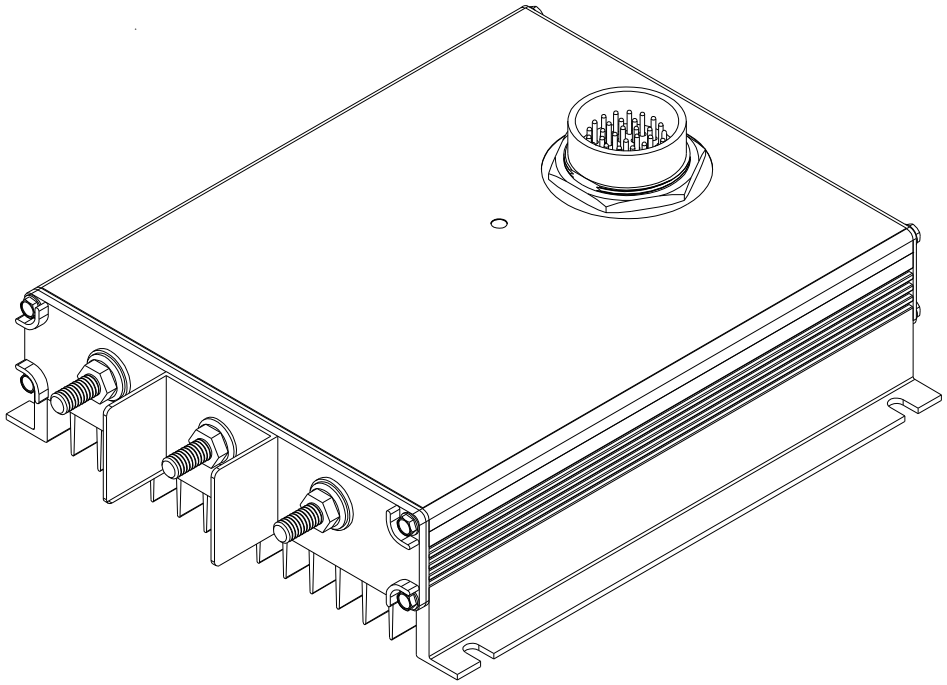
PMEC-12/24

Power Management and Engine Start Controller



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Notes

Introduction

Thank you for purchasing Vanner's *PMEC-12/24 Power Management and Engine Start Controller,* commonly referred to as IdleWATCH™. The IdleWATCH™ is an idle reduction system that helps fleets meet the industry's no-idle regulations in addition to reducing fuel consumption and exhaust emissions.

We are confident that you will be very pleased with its performance because Vanner products are designed and manufactured by skilled professionals using the highest standards in workmanship. With minimum maintenance and care, you can be assured of many years of trouble free service.

General Description

While enabled, the Vanner IdleWATCH™ constantly monitors the state of charge (SOC) and state of health (SOH) of a vehicle's auxiliary batteries for the purpose of automatically controlling loads and starting the engine to recharge the batteries. This enables a worker to run 12V or 24V loads, without the engine running, without the worry of discharging the batteries.

When the auxiliary batteries are discharged to a user configurable "engine on" state of charge, the IdleWATCH™ sends a signal to a remote starter* to start the engine and recharge the batteries. Fast idle mode* will be employed during the recharge cycle if it is necessary. Once the battery's "engine off" state of charge is achieved, the IdleWATCH™ will automatically turn the engine off.

The IdleWATCH™ is J1939 CAN (Controller Area Network) enabled and is fully configurable over a J1939 compliant network. (Reference the *Vanner CAN Interface User Manual* for configuration instructions.)

A typical IdleWATCH™ system consists of the following;

1) PMEC-12/24
    a) Main power and control circuitry housed in an anodized aluminum extrusion
    b) 33 position Deutsch panel mounted connector for vehicle I/O and CAN communications
    c) Three 5/16 studs for main 100A – 12 or 24V input and two 50A switched outputs
2) Panel Mounted Remote
    a) Enables and disables IdleWATCH™ system
    b) Dash mounted
3) Current Sensor (VSS-C80/600 or VSS-C80)
    a) Toroid style current sensor
    b) One or more current sensors may be required depending on system configuration
4) Battery Voltage and Temperature Sensor (VSS-VT)
    a) Stud mounted sensor for monitoring battery voltage and temperature

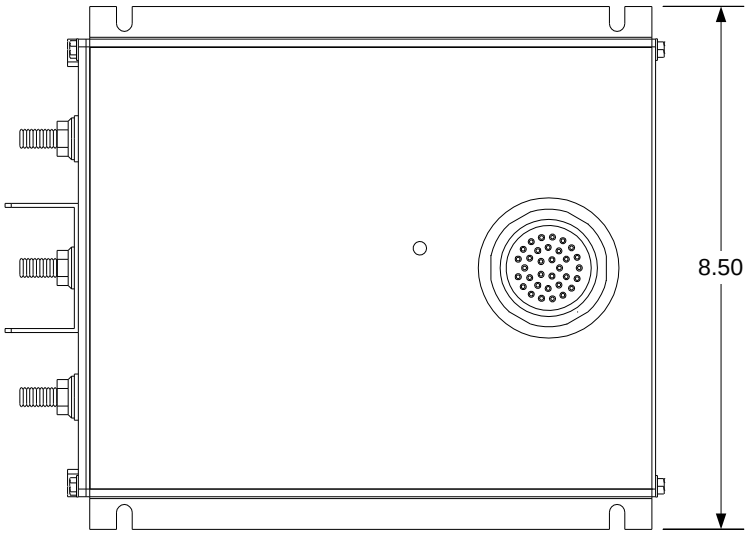
- **Note:** The vehicle remote starter and fast idle controls are not part of the IdleWATCH™ system. They are aftermarket accessories that are controlled by output signals from the IdleWATCH™.

Specifications

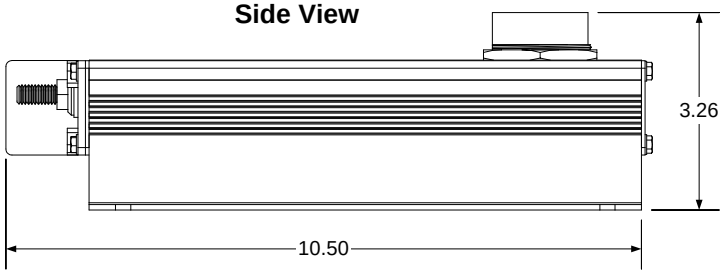
PMEC-12/24 Power Management and Engine Start Controller	
Model Number	PMEC-12/24
Input Voltage Range (VDC)	8 – 32
Efficiency (Peak)	91%
Max Input Current (AMPS)	100
Output Voltage Range (VDC)	8 - 32
Max Output Current (AMPS)	2 x 50
Max Ripple Voltage (mV)	<100mV RMS
Standby Current (Milliamps)	<20mA @ 24V, <40mA @ 12V
Cooling Method	Convection
Operating Temp.	-40°C to +60°C (-40°F to 140°F)
Storage Temp.	-40°C to +85°C (-40°F to 185°F)
Serviceable	Internal components to be serviced by Vanner personnel only.
Environmental Considerations	Anodized aluminum enclosure provides protection against salt, fungus, dust, water, fuel vapors and all fluids associated with commercial and off-highway vehicle operations. IP55 Rated.
Mounting Location	Mount on a flat surface close to the batteries to permit short cable runs. Location should be protected from battery acid and gases.
Weight (lbs.)	5 lbs (2.3kG)

Dimensional Specifications
(All Dimensions are in Inches)

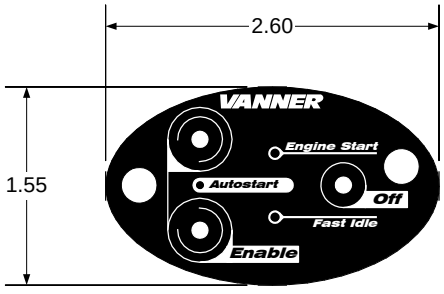
.Top View



Side View



Panel Mounted Remote



Theory of Operation

Battery Monitoring

The primary function of the PMEC is battery monitoring. The monitoring algorithm analyzes battery voltage, current, and temperature inputs, and calculates/estimates the SOC (State of Charge), SOH (State of Health), SOCach (Achievable State of Charge based on SOH and temperature of battery), U (Estimated Time to Run), and Up (Estimated Time to Run adjusted by SOH and temperature of battery) of the battery.

Battery Profile

The characteristics of a battery differ by type, manufacturer, and capacity. It is critical to use the appropriate battery profile for accurate battery monitoring. Currently, eight different battery profiles are stored in the PMEC software:

(1) East Penn 8A31DT
(2) East Penn 8A31DT x 2 (two batteries connected in parallel)
(3) Deka 7T31
(4) Deka 7T31 x 2 (two batteries connected in parallel)
(5) Deka Dominator 8G31
(6) Deka Dominator 8G31 x 2 (two batteries connected in parallel)
(7) Lifeline GPL-8DL
(8) Lifeline GPL-8DL x 2 (two batteries connected in parallel)

Note: See "Key Sense and System Voltage Level Configuration" on page 7 for series and parallel setting for 12V and 24V systems.

Select the proper profile to match the vehicle battery for optimal estimations. If the vehicle battery parameters differ from the above profiles, the Vanner CAN interface software allows the user to enter battery parameters via CAN bus. Please reference the *Vanner CAN Interface User Manual* which is available at http://www.vanner.com/vp/manuals.htm. Alternatively, the user can send the battery parameters to Vanner and let Vanner load the new battery profile into the software. A list of battery parameters used by the software is shown in Table 1.

Table 1: List of battery parameters used by PMEC software

No	Symbol	Description
1	Nj	Number of cells in battery
2	Nb	Number of batteries connected in parallel
3	Ef0_60	Charging efficiency when SOC is between 0-60%
4	Ef60_80	Charging efficiency when SOC is between 60%-80%
5	Ef80_90	Charging efficiency when SOC is between 80%-90%
6	Ef90_95	Charging efficiency when SOC is between 90%-95%
7	Ef95_100	Charging efficiency when SOC is between 95%-100%
8	C	Peukerts Amp-hour rating of battery
9	n	Peukerts number of battery
10	Tc	Temperature constant of battery
11	Tr	Rated temperature of battery
12	Ve	Endpoint voltage of battery
13	thC	Charge current threshold
14	thD	Discharge current threshold
15	thBC	Boost charge current threshold

16	thS	Start current threshold
17	thCS	Cold start current threshold
18	BCC	Battery cranking current
19	Ahr	Amp-hour rating of battery
20	Chr	C rating for Ahr

Engine Control

Engine control is turned on if the "Auto Start" function is enabled from the remote control by pressing and holding the two enable keys for three seconds (see illustration of remote on page 4).

Engine control is based on the battery SOC estimated from the battery monitoring module, the battery charging current, and some predefined parameters that are outlined in Table 2. These engine control parameters can be configured via Vanner's CAN interface software. Please reference the *Vanner CAN Interface User Manual* which is available at http://www.vanner.com/vp/manuals.htm.

Table 2: List of Engine Control Parameters used by PMEC software

No	Symbol	Description
1	SOC_EngineOn	SOC setpoint to turn on engine
2	SOC_EngineOff	SOC setpoint to turn off engine
3	SOC_LoadOff	SOC setpoint to turn off all loads
4	TopOffChargeEnable	Top off charge enable control
5	TopOffChargeCycles	Number of charge/discharge cycles to top off charge
6	AltMaxVoltage	Maximum alternator voltage
7	FastIdleCurrent	Charging current setpoint for fast idle control

When "Auto Start" is enabled, the engine control logic is as follows;

- ✓ If battery SOCach < *SOC_EngineOn* then start engine.
- ✓ If battery SOC > *SOC_EngineOff* then stop engine.
- ✓ Every *TopOffChargeCycles* charge/discharge cycle allows a top off charge (100% SOC, or 2 hours beyond *SOC_EngineOff*) if *TopOffChargeEnable* is enabled.
- ✓ If the average charge current is less than *FastIdleCurrent* and alternator voltage is 0.5V lower than *AltMaxVoltage* then fast idle is enabled.
- ✓ If alternator is > 0.5V below *AltMaxVoltage* at full voltage and charge current is lower than *FastIdleCurrent* then fast idle is disabled unless that results in low charge current.

When Auto Start is enabled, the time to turn on the engine is also estimated by the battery monitoring subroutine. The number of charge/discharge cycles before the next top off charge is also updated.

Load Control Parameters

Table 3 lists several load control parameters that can be configured via Vanner's CAN interface software. Please reference the *Vanner CAN Interface User Manual* which is available at http://www.vanner.com/vp/manuals.htm.

Table 3: List of Engine Control Parameters used by PMEC software

No	Symbol	Description
1	LoadALimit	Load A current limit
2	LoadBLimit	Load B current limit
3	LoadRestartTime	Time to restart load after over current

Load Control

There are two load outputs, labeled as Load A and Load B.

Both loads will be shut off if the battery SOC is less than *SOC_LoadOff*, which can be set through the CAN bus.

Each load will be shut off if the corresponding load current is higher than its *Load?Limit*, which can be set through the CAN bus. (Here '?' denotes either A or B.)

Loads are also controlled based on the status of the following inputs:

- Park Switch
- Hood Switch
- Auto Start
- Ignition
- Key Sense

When ignition is off and Auto Start is enabled, both Load A and Load B are turned on. When key is in or hood is open, Auto Start will be disabled. When ignition is on but transmission is still on park, both Load A and Load B will be turned off. When ignition is on and transmission is out of park (driving mode), Load B will be turned on while Load A is turned off.

Note: A zero to sixty second user configurable time delay, *LoadBOffDelay*, is present to delay Load B turning off after putting the transmission in park.

Key Sense and System Voltage Level Configuration

Key sense signal can be configured via CAN bus. It can be configured as

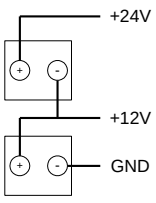
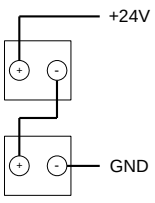
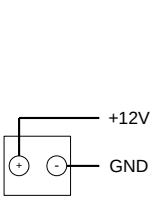
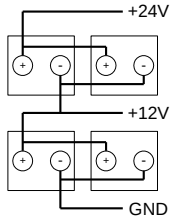
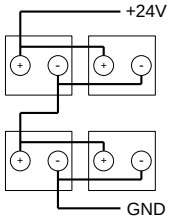
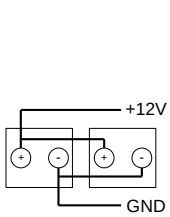
- Active High
- Active Low
- Not Available

If key sense is not available, ignition switch status will be used to control and Auto Start and Loads.

System voltage level can be configured via CAN bus. The available configurations are

- Single 12V – with only 12V battery and loads
- Single 24V – with two 12V batteries connected in series. Only 24V loads are used
- Dual 24V/12V – with two 12V batteries connected in series. Both 24V loads and 12V loads are available

Note: Do NOT change Nj (number of cells per battery) from 6 to 12 for 24V system. Choose appropriate system voltage level instead. Reference the table below to assist with selecting the proper battery parameter profile for your battery configuration.

Configuration						
Profile	0,2,4,6	0,2,4,6	0,2,4,6	1,3,5,7	1,3,5,7	1,3,5,7
Nj	6	6	6	6	6	6
Nb	1	1	1	2	2	2
Voltage Level	24/12V Dual	24V Single	12V Single	24/12V Dual	24V Single	12V Single

Saving of Battery Data at Power Down

An unmaskable external interrupt will be triggered when the ignition signal to the PMEC drops below 9V. In this interrupt service routine, all PMEC/battery parameters and battery status information is saved into non-volatile memory – FRAM. The saved data is read out at power up and used to continue battery monitoring. By doing this, the battery monitor can always start from the previous state instead of restarting from the default state.

In case the saved data is corrupted for any reason, software will load default values and start from the default state.

Factory reset sets all parameters and battery state data to their default values.

CAUTION: Do not reset IdleWATCH™ parameters to factory defaults while the truck is running or the batteries are discharged. Inaccuracies in battery states will be introduced that will adversely affect system performance.

CAN Communication

J1939 CAN communication is supported by the PMEC. The following CAN messages are handled;

- Heartbeat
- PMEC status
- Battery voltage and current
- Load current
- Battery status
- Read and set PMEC/battery parameters
- DM1 messages
- Data logging
- CAN bootloader

Please refer to the *Vanner PMEC CAN Specification* for details.

Data Logging

Battery and PMEC status information can be logged in two RAM chips (if populated) at a user-specified rate. The logged data will be lost if the ignition signal to the PMEC is turned off but it can be read out before that via CAN bus. The PMEC dashboard in the Vanner CAN Interface provides this reading function.

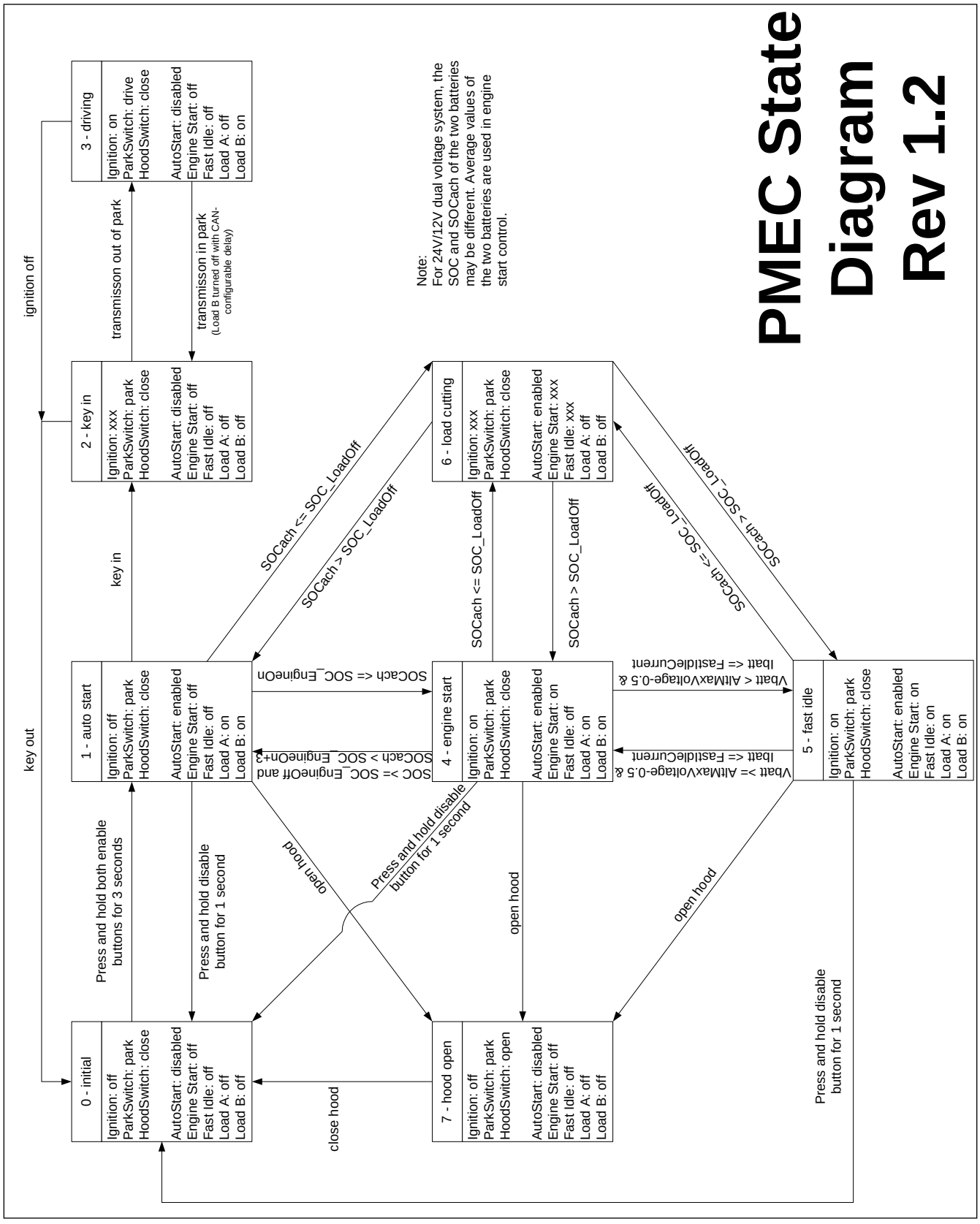
The maximum number of records that can be logged and read is 16384. Battery and PMEC status data can be displayed and saved to a text file via the PMEC dashboard. The text file can be imported later into Microsoft Excel for analysis.

The user can specify the data logging speed (interval in seconds between two data records) and length (number of data records to log). The logging speed can be chosen from 1 record per second to 1 record per hour. The corresponding logging interval is 1 through 3600 (seconds). The logging length can be 1 through 16384. Data logging will stop when the specified number of records is logged. The user can specify a length greater than 16384 to enable continuous data logging. Please note that even in continuous mode, a maximum of 16384 data records can be logged into the RAM chip. However, when this number is reached, new data will overwrite the old data to continue logging.

Short Circuit – Thermal – ESD (Electrostatic Discharge) – Overvoltage Protection

The PMEC utilizes smart FET power switching devices that have short circuit, over-temperature, ESD and overvoltage protections built in.

State Diagram - Graphical



State Diagram - Descriptive

0 - Initial

This state represents the condition the vehicle will be in prior to any human interaction.

1 – Auto Start

This state represents the condition the PMEC will be in after enabling AutoStart functionality upon arrival at a job site. In order for AutoStart functionality to be enabled, the following vehicle conditions must be met;

1. Ignition in "off" position (no key present)
2. Gear selector in park position
3. Hood closed

PMEC States

As long as the battery SOC is >= SOC_EngineOFF, the engine will not start.
Both Load A and Load B will be switched "on".

2 – Key In

This state represents the condition the PMEC will be in when the following vehicle conditions are met;

1. Key in barrel
2. Ignition in either "on" or "off" position
3. Gear selector in park position
4. Hood closed

PMEC States

AutoStart functionality is disabled
Both Load A and Load B will be switched "off"

3 – Driving

This state represents the condition the PMEC will be in while the vehicle is being driven. The following are the vehicle conditions in this state;

1. Ignition in "on" position
2. Gear selector out of park
3. Hood closed

PMEC States

AutoStart functionality is disabled
Load A will be switched "off"
Load B will be switched "on"
Note: Load B turned off with CAN-configurable delay (0 – 60 Seconds)

4 – Engine Start

This state represents the condition the PMEC will be in while the engine is running during a battery recharge cycle. The engine will start if the state of charge achievable (SOCach) is less than or equal to the state of charge engine on (SOC_EngineON) setting. The following are the vehicle conditions in this state;

1. Ignition in "on" position
2. Gear selector in park position
3. Hood closed

PMEC States
AutoStart is enabled
Engine Start is on (LED on dash mounted remote will be on)
Loads A and B will be switched "on"

5 – Fast Idle

This state represents the condition the PMEC will be in while the engine is running in the fast idle mode during a battery recharge cycle. The engine will enter the fast idle mode if the battery voltage (Vbatt) is less than the alternator maximum voltage (AltMaxVoltage) – 0.5 and the battery current (Ibatt) is less than or equal to the fast idle current (FastIdleCurrent) setting. The following are the vehicle conditions in this state;

1. Ignition in "on" position
2. Gear selector in park position
3. Hood closed

PMEC States
AutoStart is enabled
Engine Start is on (LED on remote will be on)
Fast idle mode is active (LED on remote will be on)
Loads A and B will remain "on"

6 – Load Cutting

This state represents the condition the PMEC will be in while in the "load cutting" mode. The "load cutting" mode can be entered from any of three modes, "auto start", "engine start" and "fast idle". If the state of charge achievable (SOCach) value is less than or equal to the state of charge load off (SOC_LoadOff) value, the PMEC will automatically turn loads A and B off to accelerate the recharging of the batteries. Once the state of charge achievable (SOCach) value is greater than the state of charge load off (SOC_LoadOff) value, the PMEC will return to the appropriate state. The following are the vehicle conditions in this state;

1. Ignition in "on" or "off" position
2. Gear selector in park position
3. Hood closed

PMEC States
AutoStart is enabled
Engine Start is either on or off depending on state it was in prior to entering "load cutting" mode
Fast idle mode is active (LED on remote will be on)
Loads A and B will be switched "off"

7 – Hood Open

This state represents the condition the PMEC will be in upon opening the hood while it is in state 1, 4 or 5. The following are the vehicle conditions in this state;

1. Ignition in "off" position
2. Gear selector in park position
3. Hood open

PMEC States
AutoStart is disabled
Engine Start is off
Fast idle is off
Loads A and B will be switched "off"

Upon closing the hood, the PMEC state will return to the initial settings found in state 0.

Disabling AutoStart

AutoStart functionality can be disabled by pressing and holding the "Off" button for one second. The "Off" button is located on the panel mounted remote. Upon disabling AutoStart, the PMEC state will return to the initial settings found in state 0.

Turning Ignition Off and/or Returning Gear Selector to Park

If the ignition is turned off and the key removed from the ignition while in state 2, the PMEC will return to the initial settings found in state 0.

If the gear selector is returned to park, the ignition turned off and the key removed while in state 3, the PMEC will return to the initial settings found in state 0.

Note: This assumes that vehicle is provisioned with key sense circuitry.

Installation Instructions

These symbols are used to note procedures that if not closely followed could lead to loss of life or damage to equipment or property due to electrocution.

Electrocution hazard exists

Fire hazard exists

A potentially dangerous condition

Explosive hazard exists

Corrosive hazard exists

Do not exceed the specified torque of 120 in-lbs. *when connecting cables to the terminal posts (+24, GND, +12) during installation of all the PMEC Models. Torque values higher than specified may damage the product, reduce performance, and/or create hazardous conditions. Products damaged by improper torque are not covered by the warranty.*

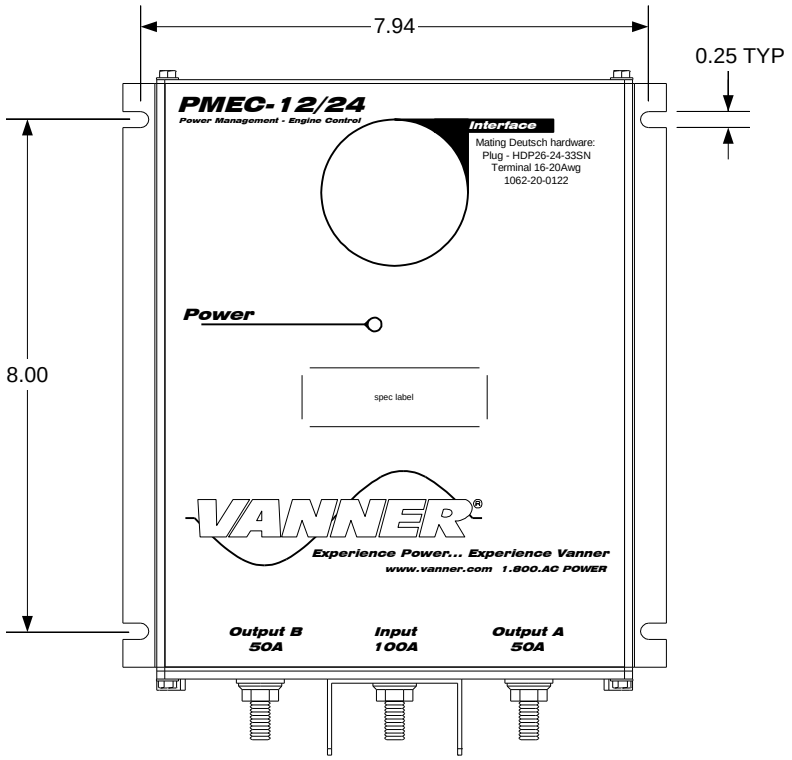
Do not connect more than one conductor per terminal post on the Vanner PMEC*. Multiple wires and cables may overstress internal components, resulting in poor performance or creating hazardous conditions. Products damaged by the installation of multiple conductors per post are not covered by the warranty.*

Fault protection devices must be installed between the PMEC and the power source (battery*). A fault protection device would be any fuse or circuit breaker properly rated for the maximum DC current obtainable. This advisory is in accordance with SAE, NEC and UL, for mobile power applications. Install per applicable codes or within 18" of the battery. See Wire and Fuse Sizing Chart on page 15 of this manual or contact Vanner at 1-800-227-6937 or pwrsales@vanner.com if assistance is needed in sizing fault protection devices.*

Caution: This equipment tends to produce arcs and sparks during installation. To prevent fire or explosion, compartments containing batteries or flammable materials must be properly ventilated. Safety goggles should always be worn when working near batteries

Mounting Location –The *PMEC* may be mounted in any orientation, on a flat mounting surface suitable to support the *PMEC* during application. Do not mount in zero-clearance compartment that may result in the *PMEC* overheating. Locate so that contact by people is unlikely.

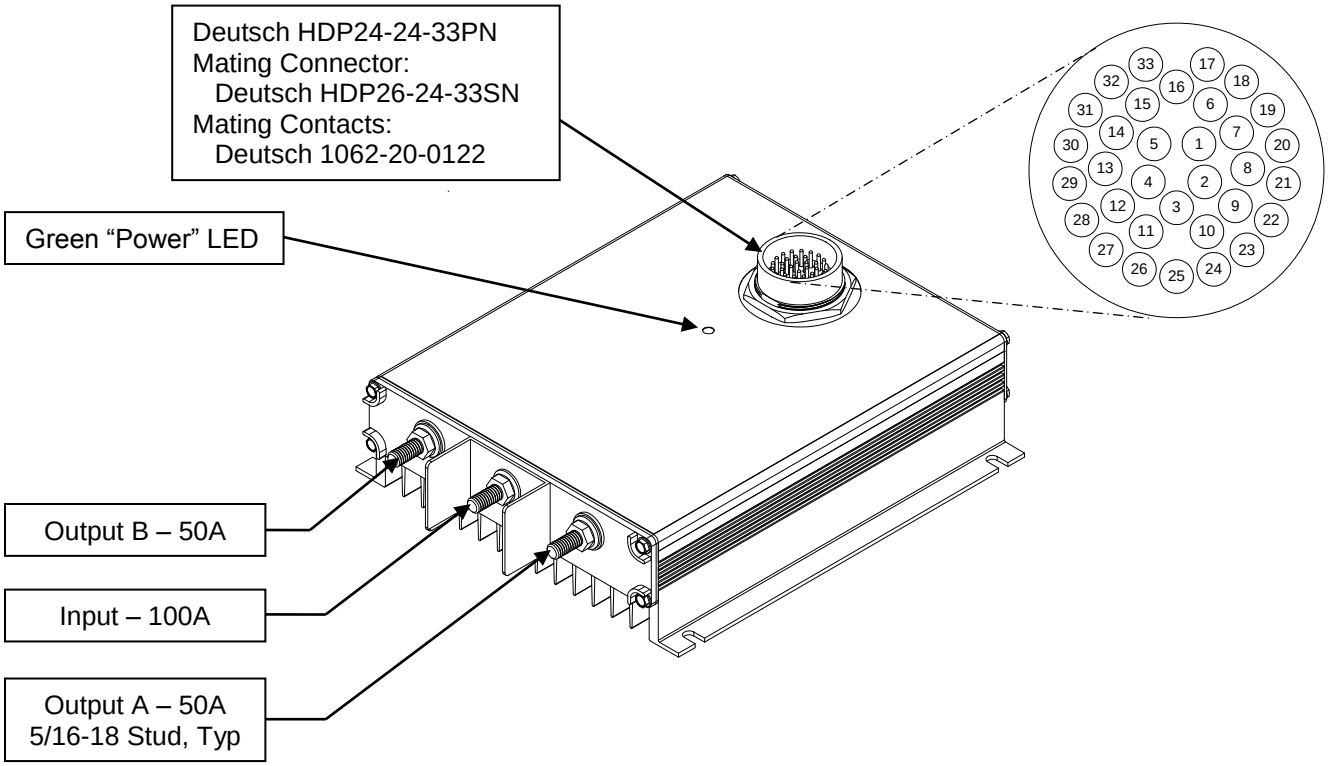
Mounting Dimensions
(Top View – Dimensions are in Inches)



Environmental Protection – Your *PMEC* has been designed to withstand direct exposure to rain and moisture. The *PMEC* has also been tested for exposure to direct pressure spray, but continual exposure to direct pressure spraying may reduce the *PMEC* serviceable life. Any damage due to water contamination is covered by Vanner only through the terms of our factory warranty.

Wiring Sequence– The *PMEC* is internally protected for reverse polarity. The wiring sequence is not an issue with the *PMEC* product.

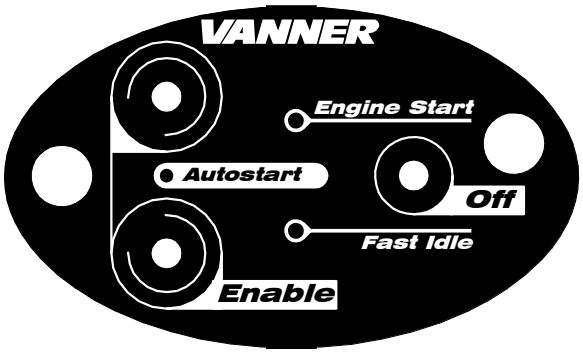
PMEC-12/24 Input/Output Definitions



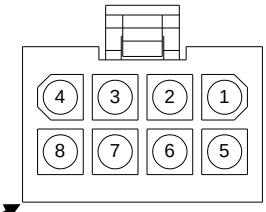
Deutsch 33 Position Pin Assignments				
Pin	**Description**		**Pin**	**Description**
1	CT12V – Low		18	CT24V – Sensor Gnd
2	CT12V – High		19	CT24V - +5V Supply
3	CT12V – Sensor Gnd		20	Hood Switch
4	Fast Idle (Remote Indicator)		21	CAN Low
5	Engine Start (Remote Indicator)		22	CAN Shield
6	12V Battery Temp Sensor Ground		23	CAN High
7	12V Battery Temp Sensor +5V Supply		24	Remote Switch Disable
8	Park Switch		25	+5V Remote Supply
9	CT12V - +5V Supply		26	Key Sense
10	Remote Switch Enable		27	Power Ground
11	Remote Ground		28	Power Ground
12	Auto Start Enabled (Remote Indicator)		29	Auto Start Enabled
13	Fast Idle		30	Engine Start
14	Sense Negative		31	Ignition (12V or 24V)
15	12V Battery Temp Sensor +12V		32	12V Battery Temp Sensor
16	CT24V – Low		33	+24V Sense
17	CT24V – High			

Color Legend
12V Current Sensor Leads
Remote Leads
Voltage and Temperature Sensor Leads
24V Current Sensor Leads
CAN Communication Leads
Vehicle I/O

PMEC-12/24 Remote Input/Output Definitions



Connector on Rear of Remote



Tyco 1-794065-0
Mating Connector:
Tyco 770579-1
Mating Contacts:
Tyco 171639-1

Remote Pin Assignments	
Pin	Description
1	+5V
2	Ground
3	Switch Enable
4	Spare
5	Switch Disable
6	Auto-Start Enable
7	Engine Start
8	Fast Idle

Remote Functionality

The PMEC remote serves as a status indicator in addition to allowing the user to enable auto start functionality. The auto start feature is enabled by simultaneously pressing and holding the two "Enable" buttons, approximately three seconds, on the left side of the remote. When the auto start feature is enabled, the "Autostart" LED will turn on.

The "Engine Start" LED turns on when the "Engine Start" signal is received from the PMEC.

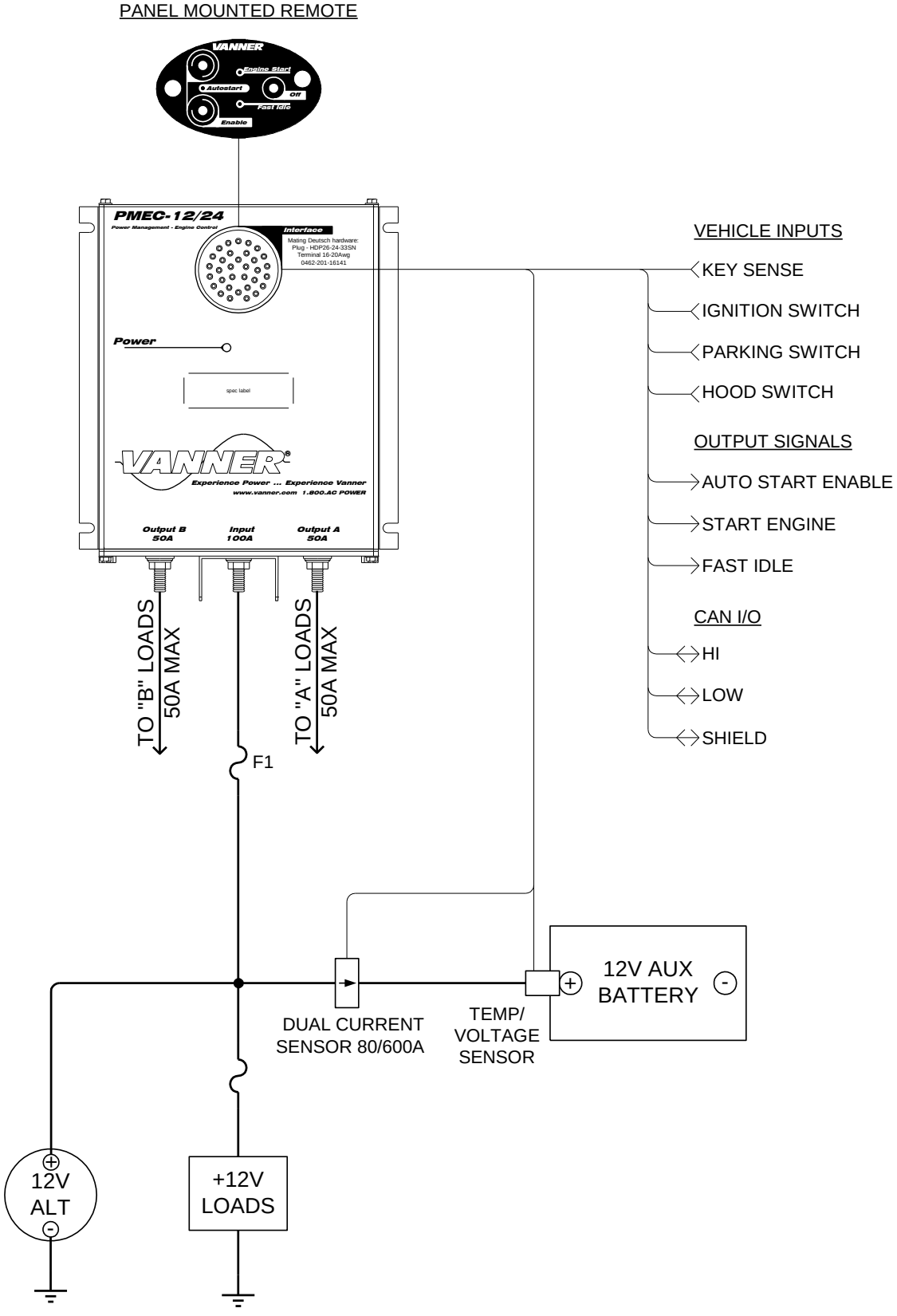
The "Fast Idle" LED turns on when the "Fast Idle" signal is received from the PMEC.

The auto start feature is disabled by simply pressing the "Off" button on the right side of the remote. The green "Autostart" LED will turn off.

The following are conditional inputs that will also disable the auto start feature;
1. Inserting key in ignition (if key sense option is present)
2. Ignition on
3. Moving transmission out of park
4. Opening the hood

Typical Application/Wiring

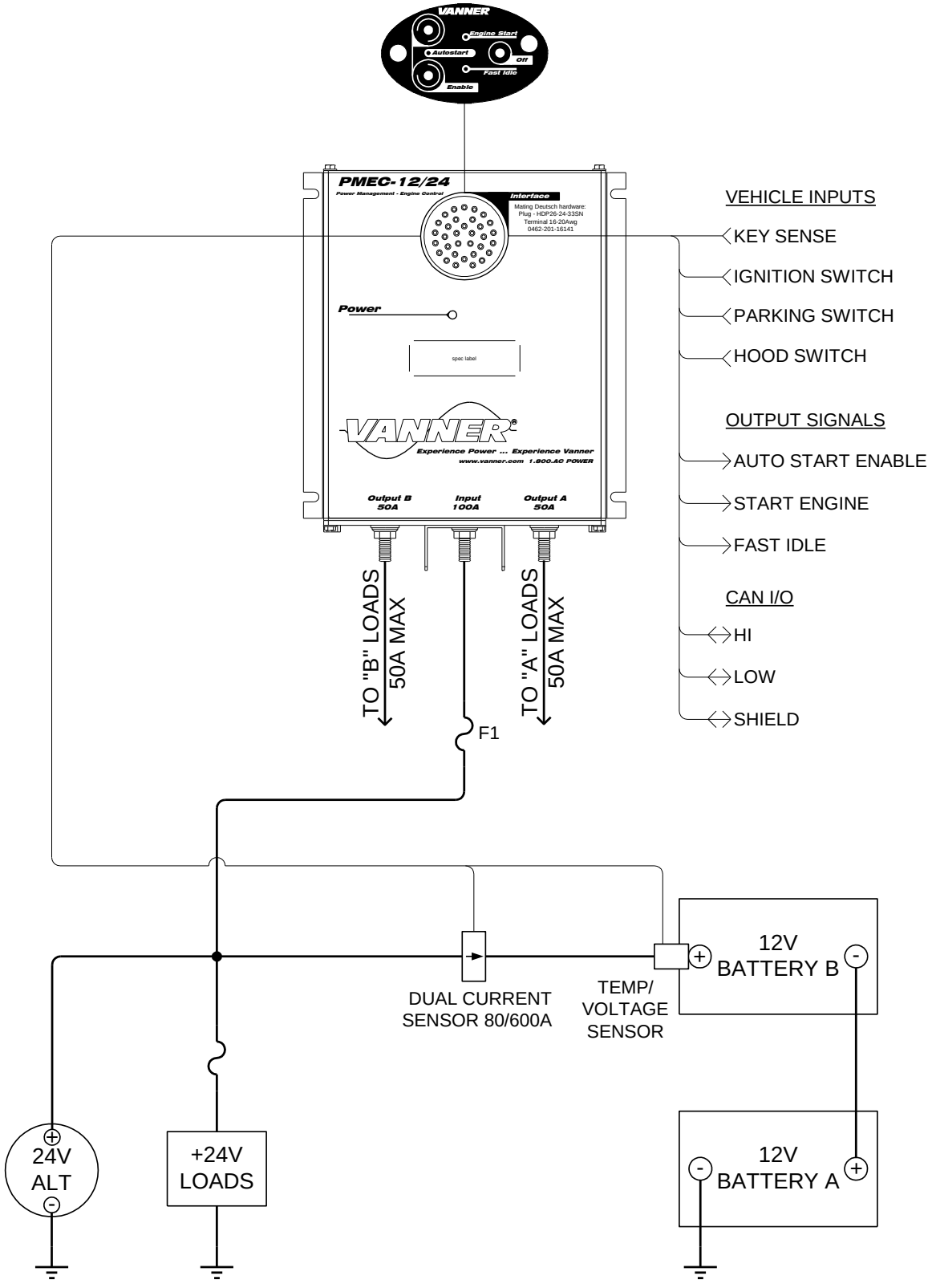
12V Auxiliary Battery with 12V Loads



Typical Application/Wiring

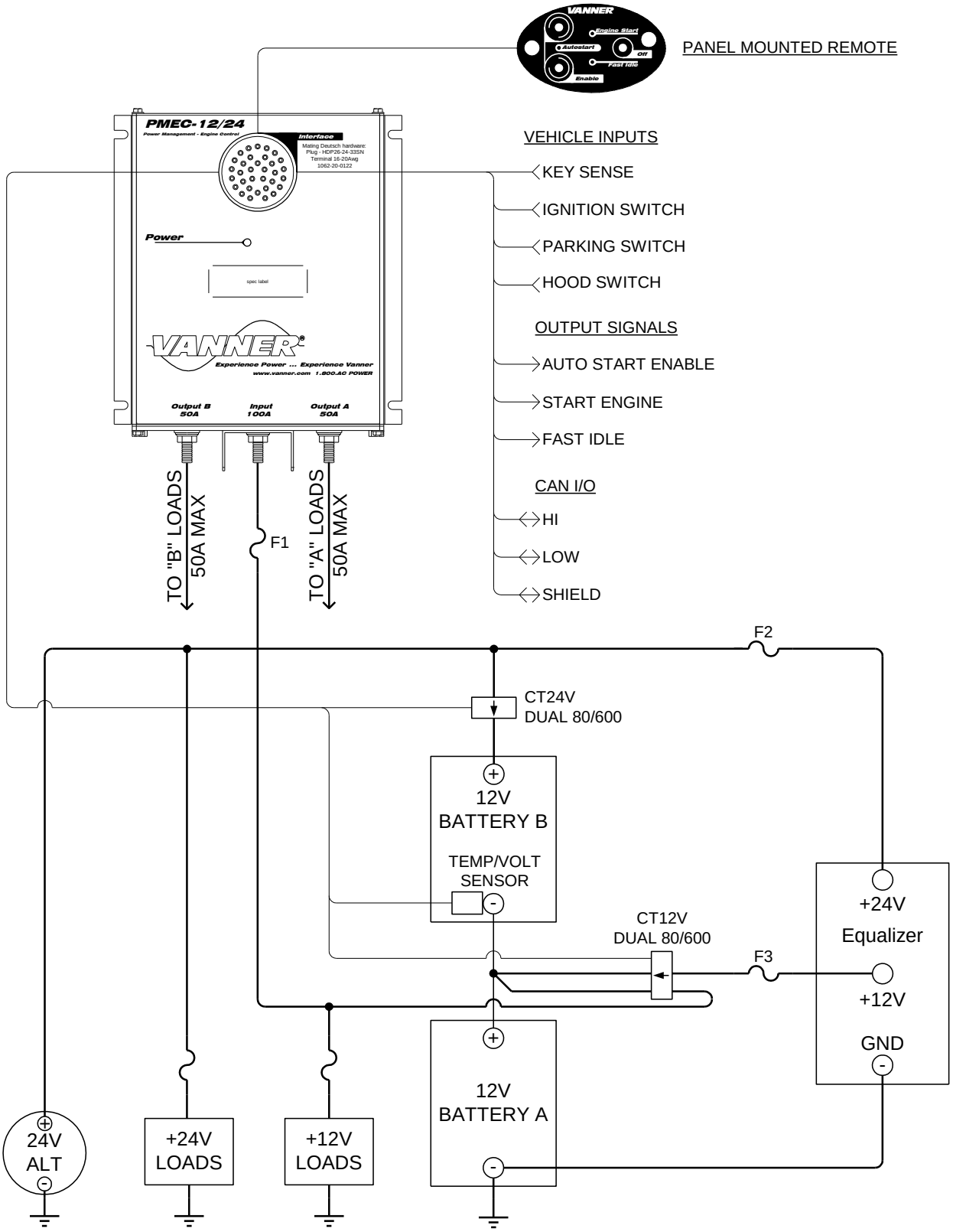
24V Auxiliary Batteries with 24V Loads

PANEL MOUNTED REMOTE



Typical Application/Wiring

24V Auxiliary Batteries with 12V Loads Requiring a Battery Equalizer



PMEC-12/24 I/O Definitions and Functionality

1. **CT12V - Low:** Low range current sense signal (0 – 80A) on 12V battery
2. **CT12V - High:** High range current sense signal (0 – 600A) on 12V battery
3. **CT12V – Sensor Ground:** Ground to current sensor
4. **Fast Idle (Remote Indicator):** Signal to remote for visual indication engine is in fast idle mode
5. **Engine Start (Remote Indicator):** Signal to remote for visual indication during engine starting and running.
6. **12V Temp Sensor Ground:** Ground to voltage and temperature sensor
7. **+5V (Temp Sensor Supply):** Power to voltage and temperature sensor
8. **Park Switch:** Parking switch input from vehicle – ground when transmission is in park/neutral
9. **CT12V +5V Supply:** Power to 12V current sensor
10. **Remote Switch Enable:** Signal from remote enabling Engine Auto Start functionality
11. **Remote Ground:** Ground to remote
12. **Auto Start Enabled (Remote Indicator):** Signal to remote for visual indication that "Auto Start" functionality is enabled
13. **Fast Idle:** Signal to vehicle controls enabling fast idle – ground when fast idle is commanded
14. **Sense Negative:** Battery negative (ground) terminal for voltage sensing
15. **Sense +12V:** Battery positive terminal for voltage sensing – integral to temperature sensor
16. **CT24V - Low:** Low range current sense signal (0 – 80A) on 24V battery
17. **CT24V - High:** High range current sense signal (0 – 600A) on 24V battery
18. **CT24V – Sensor Ground:** Ground to current sensor
19. **CT24V +5V Supply:** Power to 24V current sensor
20. **Hood Switch:** Hood switch input from vehicle – ground when hood is open
21. **CAN Low:** Low signal connection for CAN bus
22. **Can Shield:** Shield connection for CAN bus
23. **CAN High:** High signal connection for CAN bus. CAN bus used for system configuration with Vanner CAN interface software.
24. **Remote Switch Disable:** Signal from remote disabling Engine Auto Start functionality
25. **+5V Remote Supply:** Power to remote
26. **Key Sense:** 12/24V detection of key presence configurable as active hi, lo or not available
27. **Power Ground:** Battery negative (ground) terminal for power
28. **Power Ground:** Battery negative (ground) terminal for power
29. **Auto Start Enabled:** +12/24V 5A output signal for visual or audible indication that Auto Start functionality is enabled
30. **Engine Start:** Signal to vehicle controls to start engine – ground when engine start is commanded
31. **Ignition (12V or 24V):** 12 or 24V signal from ignition
32. **12V Battery Temp Sensor:** Temperature signal from battery temp sensor
33. **+24V Sense:** +24V signal from battery

Note: The PMEC I/O is a panel mounted Deutsch connector P/N: HDP24-24-33PN. Use Deutsch P/N: HDP26-24-33SN with Deutsch P/N: 1062-20-0122 socket contacts for the mating connector. The accepted wire size for the sockets is 16, 18 or 20 AWG with an insulation outside diameter of .075 – .125".

Wire Size and Temperature Rating

Cables connecting the *PMEC* to the batteries should be sufficiently sized to prevent unwanted voltage drop. Vanner recommends the voltage drop should be no greater than 0.5 between the PMEC's +12/24 volt terminal and the battery +12/24 volt terminal. In most installations, the *PMEC's* terminals should be wired directly to the battery terminals (reference fault protection) to prevent voltage drop that could occur in switch contacts, connections, and long wire runs. Since the PMEC can be operated in temperatures up to 60ºC, use wire rated at least 90ºC. See the Wire and Fuse Size Chart below.

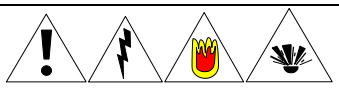
PMEC Wire and Fuse Size Chart

Wire Size AWG	Ring Terminal AMP or UL recognized equal	Max wire length, in feet, between *PMEC* and battery to keep voltage drop under 0.5 volts. The chart assumes wire carries no other load and wire temperature is below 80ºC.
		PMEC-12/24
#4	33470	15.9
#2	322870	25.7
#1	321867	31.6

Fuse Designation	Current Rating	Vanner Part # Fuse	Vanner Part # Fuse Holder
Fuse F1	125 Amp	013912	013780
Fuse F2	*	*	*
Fuse F3	*	*	*

* Note: Fuse F2 and Fuse F3 are dependent on the current rating of the equalizer. Please contact Vanner at **1-800-AC POWER (1-800-227-6937)** to properly size the equalizer and fuses for your system.

Troubleshooting



CAUTION

Servicing of electrical systems should only be performed by trained and qualified technical personnel.

Equipment Required

VoltMeter having 0.01 volt resolution. (Fluke Model 87 Multimeter recommended).
Clamp-on current meter (Fluke Model 36 Clamp-on Meter recommended).
USB to CAN adapter module - PEAK System's PCAN-USB IPEH-002021 or
Vector's CANcaseXL V2.0 w/CANpiggy 1050mag installed
Laptop computer with Vanner CAN interface software.

Vanner Repair Service

Vanner offers a quick turn-around factory repair service. Send the unit to the address on last page with a note instructing us to repair it. Include your name, phone number, shipping address (not a P.O. Box Number), and your purchase order number.

Trouble Shooting Guide for *PMEC*

PMEC-12/24 Trouble Shooting Guide:

In the event the Vanner PMEC does not work properly, the following need to be reviewed / validated;

1. Is voltage present at the 100A input terminal? This can be verified with a voltmeter or by checking that the green "Power" led is lit.
2. Is the I/O wiring installed correctly? (Reference pin-out assignments on page 15.)
3. Is the current sensor installed in the proper orientation? (Reference wiring diagrams on pages 17 - 19.)
4. Is the voltage / temperature sensor installed on the proper battery terminal? (Reference wiring diagrams on pages 17 - 19.)
5. Are the fuse voltage and current ratings correct?

Notes

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