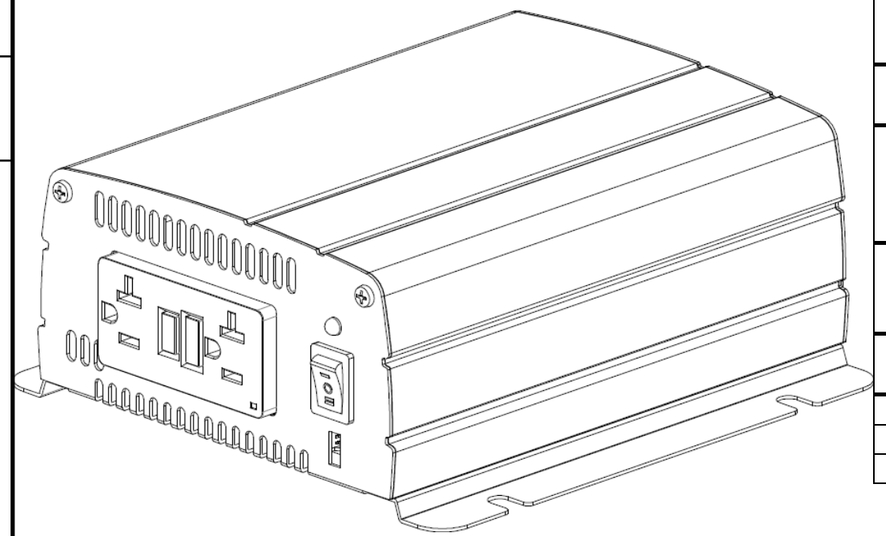
PURCHASED COMPONENT KEY FEATURES

DESCRIPTION OF REQUIREMENTS
DIMENSIONAL REQUIREMENTS (AS SHOWN ON DRAWING) **N/A**
LOAD/RATING REQUIREMENT **N/A**
MATERIAL REQUIREMENT **N/A**
PACKAGING REQUIREMENT **N/A**
Manual with specs attached.

TS Series
400 Watt
Pure Sine Wave Inverter



Electrical	Specification Item	Model No. TS12-400	Model No. TS24-400
Input Characteristics	Voltage	12VDC	24VDC
	Input Over-Voltage Protection①	16.0 ± 0.3VDC	32 ± 0.5VDC
	Input Under-Voltage Protection	10.5 ± 0.3VDC	21 ± 0.5VDC
	Voltage Range	10.5~16.0VDC	21~32VDC
	No Load Current	< 1A @12VDC	< 0.5A @24VDC
	Power Saving Mode	< 0.2A @12VDC	< 0.1A @24VDC
Output Characteristics	Continuous Output Power	400 W (± 3%)	
	Surge Power (3Sec)	< 600 W	
	Frequency	50 / 60 Hz ± 0.5% (Dip Switch Selectable)	
	Output Voltage	100 / 110 / 115 / 120 VAC (± 5%) (Dip Switch Selectable)	
	Efficiency (Typ.).	88%	89%
	Short-Circuit Protection	1 Sec Shutdown	
	Output Waveform	Pure Sine Wave (THD < 5%@ Normal Load) ²	
Signal and Control	LED Indicator	Red / Orange / Green LED	
	Remote Control Terminal	2-port Green terminal (for inverter ON / OFF)	
Protection	Input Protection	Over / Under Voltage, Reverse Polarity (Internal Fuse)	
	AC Output Protection	Short-Circuit, Overload	
	Others	Over / Under Temperature Protection (by Heat sink Temperature +80℃/-25℃)	
Environment	Operating Temp.	-20°C ~40°C③	
	Storage Temp.	-30°C~70°C	
	Storage Temp. & Humidity	10 ~95% RH	
Safety & EMC	Safety Standards	Certified UL 458	
	EMC standards	Certified FCC class B	
Dimension(WxHxD)		7.02 X 2.99 X 8.20 inch	
Weight		3.70 lb	
Cooling		Temperature & Load Controlled cooling Fan	

PRINTED DOCUMENT IS UNCONTROLLED

TOLERANCES & INSPECTION

UNLESS OTHERWISE SPECIFIED

ALL BEND ANGLES ARE 90 DEGREES

ALL DIMENSIONS ARE IN INCHES.

REFERENCE DIMENSIONS (X.XXX) DO NOT REQUIRE INSPECTION

FEATURES	HOLES/SLOTS	ANGLES
0.0 = ± .125	0.0 = ± .062	0° = ± 2°
0.00 = ± .062	0.00 = ± .031	0.0° = ± 1°
0.000 = ± .031	0.000 = ± .015	

Material Thickness: per ASTM Std.
Weld Callouts per AWS

RELEASE & REVISIONS

INITIAL ECN: 24460

CURRENT ECN: 24460

ECN DESCRIPTION:

RELEASE VARIOUS INVERTER KITS

REVISED BY: **MJF**

PURCHASED COMPONENT

REFERENCED SUPPLIER AND/OR MANUFACTURER
Vanner

REFERENCED SUPPLIER AND/OR MANUFACTURER PART NUMBER
TS12-400

COLOR (ONLY LIST IF COLOR SPECIFIC)

COMODITY ITEM (Y/N) (YES = ALL DIMENSIONS AND NOTES ARE REFERANCE)
(NOTE: DIMENSIONS AND FEATURES MAY VARY FOR A COMODITY ITEM.)
NO

PART / PRODUCT IDENTIFICATION

ADRIAN STEEL®

ADRIAN STEEL COMPANY
906 JAMES STREET, ADRIAN, MI 49221

REVISION LEVEL **A**

MAT'L USED:

DESIGNED BY: **MJF**

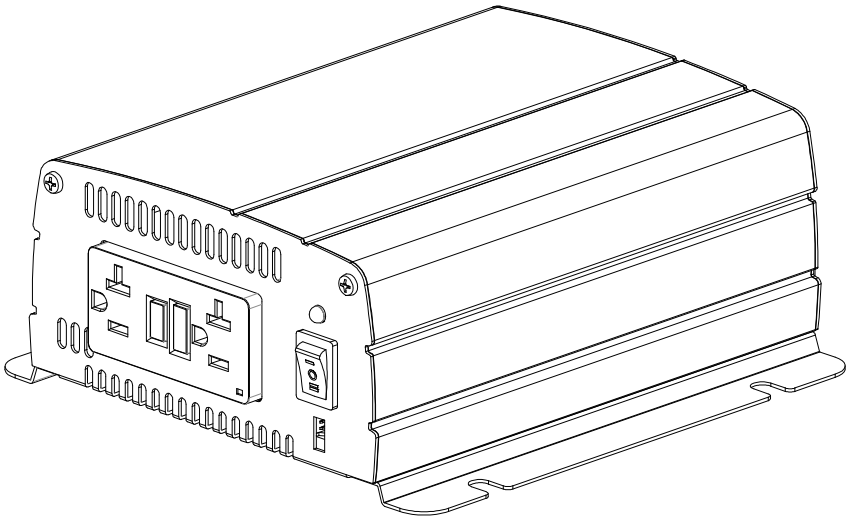
DESCRIPTION: **INV TS12-400**

WEIGHT (Lbs.): **6**

SEGMENT CODE: **EIN**

PART NUMBER: **63789**

TS Series
400 Watt
Pure Sine Wave Inverter



Models

TS12-400 TS24-400

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1. Safety Instructions

1-1. General Safety Precautions

Warning! Before using the Inverter, read the safety instructions.

- Do not expose the inverter to rain, snow, spray or dust. To reduce the risk of fire hazard, do not cover or obstruct the ventilation openings and do not install the inverter in a zero-clearance compartment.
- To avoid the risk of fire and electric shock, make sure that the existing wiring is in good electrical condition, and the wire size is not undersized.
- This equipment contains components which can produce arcs or sparks. To prevent fire or explosion do not install in compartment containing batteries or flammable materials or in location which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.
- Depending on the user scenario, the AC output of the inverter may require user installed breaker or fuse. In AC output hardwire application, AC socket will not been provided. The inverter incorporates standard AC short circuit protection.
- An over current protection at the time of installation shall be provided by others for the AC output circuit.
- Additional breakers suitable for 20 A branch circuit protection shall be provided for the GFCI receptacles.
- The following precautions should be taken when working on the inverter:
  Step 1 Remove watches, rings, or other metal objects
  Step 2 Use tools with insulated handles
  Step 3 Wear rubber gloves and boots

1-2. Other Safety Notes

- Upon receipt, examine the carton box for damage. If you have found any damage on the carton box please notify Vanner.
- Do not operate near water or in excessive humidity.
- Do not open or disassemble the inverter, and warranty may be voided.
- The DC side connections should be firm and tight.
- Grounding: Reliable grounding should be maintained.
- Do not drop a metal tool on the battery. The resulting spark or short-circuit on the battery or on the other electrical part may cause an explosion.
- Install the inverter in a well-ventilated area. Do not block the front air vents, or the rear air exhausts of the unit.
- Wiring: Adequate input power must be supplied to the inverter for proper use; correct wiring sizes must be ensured.
- Mount the inverter such that the fan axis is horizontal.
- Do not operate the inverter close to combustible gas or open fire.
- Do not operate appliances that may feed power back into the inverter.
- Temperature: The inverter should be operated in an ambient temperature range of -25° to 40° otherwise the output efficiency may be affected. Air flow to the inverter must not be blocked.

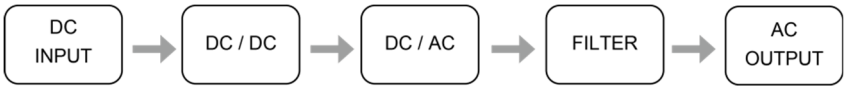
2. Functional Characteristics Introduction

2-1. System

The unit is a highly reliable DC-AC inverter system, designed with advanced power electronic and microprocessor technology offering the following features:

- Pure sine wave output waveform O/P voltage THD < 5 %
- Intelligent software for power management
- Loading and temperature controlled cooling fan
- Dry contact terminal
- Advanced Protection Features
  - Input over/under voltage protection
  - Internal over temperature protection
  - Input reverse polarity protection (Fuse)
  - Output overload protection
  - Output short circuit protection

2-2. Block Diagram



2-3. Electrical Specification

2-3-1. TS12-400, TS24-400 Specification

Electrical	Specification Item	Model No. TS12-400	Model No. TS24-400
Input Characteristics	Voltage	12VDC	24VDC
	Input Over-Voltage Protection①	16.0 ± 0.3VDC	32 ± 0.5VDC
	Input Under-Voltage Protection	10.5 ± 0.3VDC	21 ± 0.5VDC
	Voltage Range	10.5~16.0VDC	21~32VDC
	No Load Current	< 1A @12VDC	< 0.5A @24VDC
	Power Saving Mode	< 0.2A @12VDC	< 0.1A @24VDC
Output Characteristics	Continuous Output Power	400 W (± 3%)	
	Surge Power (3Sec)	< 600 W	
	Frequency	50 / 60 Hz ± 0.5% (Dip Switch Selectable)	
	Output Voltage	100 / 110 / 115 / 120 VAC (± 5%) (Dip Switch Selectable)	
	Efficiency (Typ.).	88%	89%
	Short-Circuit Protection	1 Sec Shutdown	
	Output Waveform	Pure Sine Wave (THD < 5%@ Normal Load) ②	
Signal and Control	LED Indicator	Red / Orange / Green LED	
	Remote Control Terminal	2-port Green terminal (for inverter ON / OFF)	
Protection	Input Protection	Over / Under Voltage, Reverse Polarity (Internal Fuse)	
	AC Output Protection	Short-Circuit, Overload	
	Others	Over / Under Temperature Protection (by Heat sink Temperature +80℃/-25℃)	
Environment	Operating Temp.	-20°C ~40°C③	
	Storage Temp.	-30°C~70°C	
	Storage Temp. & Humidity	10 ~95% RH	
Safety & EMC	Safety Standards	Certified UL 458	
	EMC standards	Certified FCC class B	
Dimension(WxHxD)		7.02 X 2.99 X 8.20 inch	
Weight		3.70 lb	
Cooling		Temperature & Load Controlled cooling Fan	

Table 1. TS12-400/TS24-400 Specification.

Note :

① Voltage range：Please refer to Figure 1

② Normal load Condition：Vin =12.5V/25V, Vo=100/110/115/120 VAC 80% Full load (PF=1.0)

③ Operating temperature：Please refer to Figure 2

2-3-2. Temperature performance

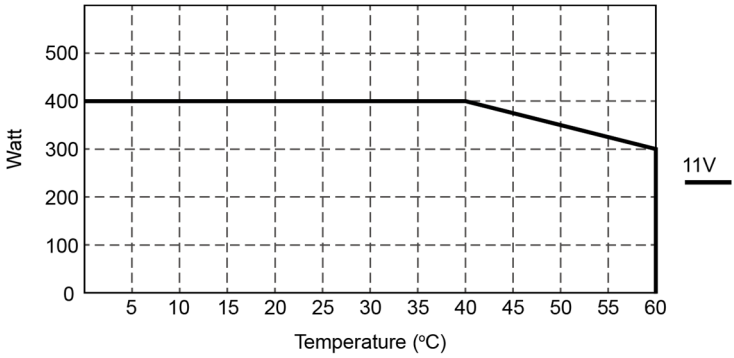


Figure 1. TS 400W
Output power vs. temperature

2-4. Mechanical Drawings

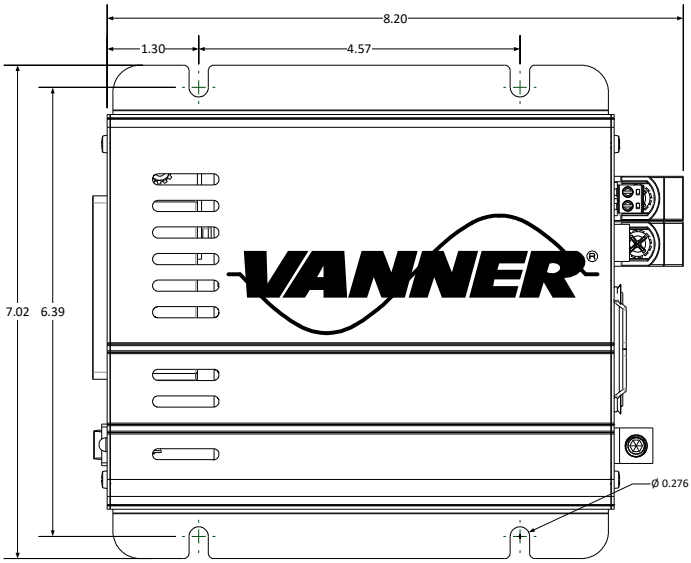


Figure 2. TS series drawing (Top View)

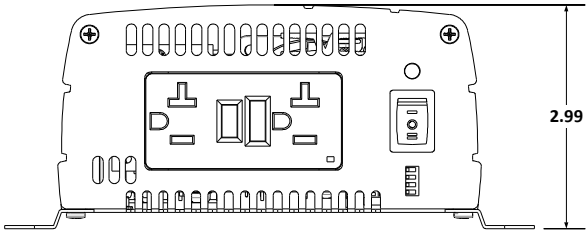


Figure 3. TS series drawing (AC output/Front View)

3. Installation and Maintenance

3-1. AC Output Side (Front Panel) Introduction

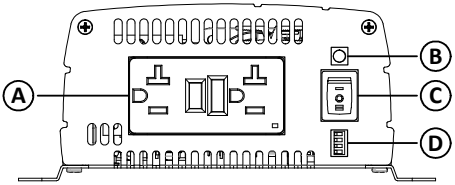


Figure 4. TS 400W AC output panel view

Model	TS Series
Ⓐ	AC output socket
Ⓑ	LED Indicator
Ⓒ	ON / OFF / Remote Main switch
Ⓓ	Function switch

Table 2. TS Series AC output side introduction

3-1-1. Main Switch

The 3-stage switch is for turning on, turning off and remote mode.

3-1-2. LED Indicator

Inverter status to display fault condition.

3-1-2-1. LED signal

Status	LED Signal	Description
Normal or Power ON	———————	LED lights in solid green
Over load	- - - - - - - - - - - - - - -	LED fast blink with two long beeps
Over / Under temp. (Heat sink temp. over 80℃ or under -20℃)	— — — — —	LED slow blink
Over current / Over load (AC output short-circuit and over load)	———————	LED lights in solid red with one short beeps
Over voltage (Input DC voltage over spec.)	- - - - - - - - - - - - - - -	LED fast blink

Status	LED Signal	Description
Under voltage (Input DC voltage under spec.)	— — — — —	LED slow blink with one long beeps &two short beeps

Table 3. Inverter LED Status Indicator

3-1-3. Function Switch

Figure 5. DIP switch ON/OFF position

3-1-3-1. Function Switch Definition

Dip Switch	Function
S1	Voltage select
S2	Voltage select
S3	Frequency Select
S4	Power saving ON/OFF

Table 4. Function Switch Definition

3-1-3-2. Output voltage selection (S1&S2)

Output voltage	S1	S2
100V	0	0
110V	0	1
115V	1	0
120V	1	1

Table 5. Function Switch definition: output voltage selection

Note! 100V series can be selected between 100/110/115/120VAC

3-1-3-3. Output Frequency Selection (S3)

Frequency	S3
50Hz	0
60Hz	1

Table 6. Function Switch definition: Output Frequency selection

3-1-3-4. Power Saving Selection (S4)

Saving function	S4
Power Saving OFF	0
Power Saving ON	1

Table 7. Function Switch definition: Power Saving selection

3-1-3-5. Power Saving Load

Model	Input Saving Power	Saving Wake up
TS 400W	<20 W	>30 W

Table 8. Power saving setting range (Min)

3-2. DC Input Side (Rear Panel) Introduction

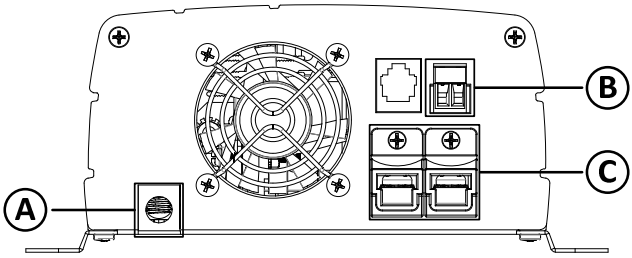


Figure 6. TS 400W DC input panel view

Model	TS Series
A	Chassis ground
B	Remote control green terminal
C	DC input connector

Table 9. TS Series DC input side introduction

3-2-1. Chassis Ground

Must be connected to earth ground prior to making any other connections to the equipment.

3-2-2. Remote Control Green Terminal

Remote inverter control green terminal may be used to control the inverter from a remote POS switch or source to Vin (position 2).

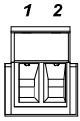


Figure 7. Remote control terminal

3-2-3. DC Input Cables

Model Number	**TS12-400**	**TS24-400**
Wire Size	MAX Distance from battery to inverter in feet (Total circuit length is 2 times the distance.)	
12	NR	5.0
10	4.5	8.0
8	7.5	13.0
6	12.0	20
4	19.5	20
Fuse Rating	50 Amp	30 Amp
Fuse Part Number	09873	014632
Fuse Holder Part Number	014633	

Table 10. TS Series Wiring Cable diameter and Inline Fuse

Note! Batteries are capable of providing very large currents in case of short circuit. The fuse should be as close to the positive battery terminal as possible.

3-3. Maintenance

Make sure that the fan vents are not blocked.

Use a vacuum cleaner to remove any dust from the fan area
When cleaning the case or front panel, use a soft, dry cloth, only. If the case or front panel is very dirty, use a neutral, non-abrasive detergent. Do not use alcohol or ammonia based solutions.

Regular service, and relocation of the inverter, should be performed by a qualified service technician. Avoid spilling liquid on the inverter.

4. Operation

4-1. Connecting the DC cable

Connect DC input terminals to 12V / 24V battery or other DC power source [+] is positive, [-] is negative. Reverse polarity connection can blow the internal fuse and may damage the inverter permanently.

Warning! Make sure that all the DC connections are tight (torque to 9 – 10 ft-lbs, 11.7 – 13 Nm). Loose connections could result in overheating and can be a potential hazard.

Warning! The recommended inline fuse should be installed as close to the battery positive terminal as possible (within 18.0") failure to use a fuse on the "+" cable running between the inverter and battery may cause damage to the cable / inverter and will void warranty.

4-2. Connecting the input power

Before making the DC input side connections, the main switch must be at "OFF".

4-3. Connecting the loads

Calculate the total power consumption of the output load. Make sure that the total power consumption does not exceed the rated power.

If the total power consumption over the rated power of the inverter, remove the non-critical: loads until the total power consumption is below the rated power.

4-4. Switch ON Inverter

Set the power switch to the "ON" position. The inverter will carry out self-diagnosis and, the LED's will also appear various colors.
Set the power switch to the "OFF" position. The inverter stops and all the lights that are on will go off.

4-5. Protection Mechanism

Model	Over Voltage (DC)		Under Voltage	Under Voltage	
	Shutdown	Restart	Alarm	Shutdown	Restart
12V	16.5V ± 0.3V	14.5V± 0.3V	10.5V ± 0.3V	10.5V ± 0.3V	12.5V± 0.3V
24V	33V ± 0.5V	29V ± 0.5V	21V± 0.5V	21V ± 0.5V	25V ± 0.5V

Table 11. Protection Mechanism

Model	Over temperature protection	
	Shutdown	Restart
12V	80°C	60°C
24V		

Table 12. Over Temperature Protection Mechanism

Vanner Incorporated
4282 Reynolds Drive
Hilliard, Ohio 43026
Ph: 800-AC POWER
Ph: 614-771-2718
Fax: 614-771-4904
www.vanner.com

Manual P/N: D918919-A
January 2018