Wilmore® ELECTRONICS CO., INC.

USER MANUAL

Series 1720 and 1760
DC-to-DC Converter

SERIES 1720 and 1760
200 Watt and 400 Watt
DC-to-DC Converters

This User's Information Manual is applicable for the following Models:

- Series 1720 200-Watt Converters
- Series 1720 400-Watt Converters
- Series 1760 200-Watt Converters
- Series 1760 400-Watt Converters

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FOR ALL MODELS WITH M5 OPTION ONLY:

This User's Information manual provides general guidance regarding the installation and operation of this dc-to-dc power converter, along with maintenance, warranty and contact information. It does not discuss features, programming and connectivity of the inverter's Network Communications Interface. For complete information on the setup and use of this feature…

Please Download the
NETWORK COMMUNICATIONS INTERFACE
User's Information Manual at

https://wilmoreelectronics.com/support/#DOWNLOAD

CAUTION!

To avoid equipment damage during installation…

1) Prior to installing the converter, verify that its front-panel input power switch (a "rocker-arm" circuit breaker) is in the OFF position, indicated by a wedge-shaped section of the rocker arm protruding from the front panel and exposing white plastic in the rocker assembly. If the converter does not appear to be turned off, push against the word "OFF" printed on the switch face to expose the white plastic indicator before making any connections to the converter.

2) Safe installation practice dictates that the DC input line connections should be de-energized at the DC source prior to connecting to the converter input. Verify that this is the case before making any connections to the converter. Once these input connections are made and the converter's input power switch has been verified to be in the OFF position, the DC input lines can be energized.

… do not "hot plug" or apply an energized connection to a "turned on" converter.

I. General Description

These dc-to-dc power converters provide an isolated and regulated output from station batteries or other widely fluctuating voltage sources. They are available with a digital output voltmeter and ammeter (Model 1760), or without meters (Model 1720). The input voltage range for each version is listed in Table 1. The maximum rated output current can also be found in Table 1, and it is a continuous duty rating at 50°C ambient temperature (60°C for 200-Watt models) and free air convection cooling. The converter output is galvanically isolated from the input source and chassis and, therefore, may be connected as either a positive or a negative output.

A Network Communications Interface option (M5) allows the user to monitor several key aspects of the converter's operation via a web interface, SNMPv.1 (Simple Network Management Protocol), or serial terminal port (see the separate Network Communications Interface user's information manual for additional information, available from Wilmore's website at https://wilmoreelectronics.com/support/#DOWNLOAD See Figure 2 for additional information)

This converter is electronically protected against overloads, short circuits, and converter-induced output overvoltages. Recovery to normal operating conditions is automatic upon removal of an overload or short-circuit fault. Following an overvoltage shutdown, input power to the converter must be removed for approximately 30 seconds and then reapplied to resume converter operation. Protection against accidental reversal of the input-voltage polarity during installation is provided by a shunt diode working in conjunction with the front-panel circuit breaker.

The operating efficiency of these converters exceeds 80 – 85% for most of the output load range. An approximation of input current for a specific input voltage and output load current can be determined as follows, using the efficiency rating in Table 1 on the next page:*

$$\text{Input Current} = \frac{(\text{Output Voltage})\ (\text{Output Current})}{(0.85)\ (\text{Input Voltage})}$$

Note that this converter is a constant-output-power device, i.e., with a constant load, the input current and input voltage are inversely proportional. This means that the maximum input current is drawn at the minimum input voltage.

*This approximation applies for output load currents equal to or greater than 20% of maximum rated load current. For loads less than 20% of the maximum rating, linearly decrease the input current from its calculated value at 20% load to X milliamperes (in Table 1) at no load.

TABLE 1

MODEL	INPUT VOLTAGE RANGE (VDC)	OUTPUT VOLTAGE (VDC)	MAXIMUM OUTPUT CURRENT (A)	EFFICIENCY (%)	X (see paragraph above)
1720/1760-13-24-8	10.5 - 16.0	24	8	80	350 mA
1720/1760-13-24-15	10.5 - 16.0	24	15	80	500 mA
1720/1760-13-48-4	10.5 - 16.0	48	4	85	350 mA
1720/1760-13-48-7.5	10.5 - 16.0	48	7.5	85	500 mA
1720/1760-24-13-15	21 - 29	13	15	85	150 mA
1720/1760-24-13-30	21 - 29	13	30	85	300 mA
1720/1760-24-24-8	21 - 29	24	8	85	150 mA
1720/1760-24-24-16	21 - 29	24	16	85	300 mA
1720/1760-24-48-4	21 - 29	48	4	85	150 mA
1720/1760-24-48-8	21 - 29	48	8	85	300 mA
1720/1760-24-130-1.5	21 - 29	130	1.5	90	180 mA
1720/1760-24-130-3	21 - 29	130	3	90	350 mA
1720/1760-48-13-15	42 - 58	13	15	85	75 mA
1720/1760-48-13-30	42 - 58	13	30	85	200 mA
1720/1760-48-24-8	42 - 58	24	8	85	100 mA
1720/1760-48-24-16	42 - 58	24	16	85	200 mA
1720/1760-48-48-4	42 - 58	48	4	85	100 mA
1720/1760-48-48-8	42 - 58	48	8	85	200 mA
1720/1760-48-130-1.5	42 - 58	130	1.5	90	110 mA
1720/1760-48-130-3	42 - 58	130	3	90	230 mA
1720/1760-130-13-15	105 - 145	13	15	85	75 mA
1720/1760-130-13-30	105 - 145	13	30	85	100 mA
1720/1760-130-24-8	105 - 145	24	8	85	50 mA
1720/1760-130-24-16	105 - 145	24	16	85	100 mA
1720/1760-130-48-4	105 - 145	48	4	85	50 mA
1720/1760-130-48-8	105 - 145	48	8	85	100 mA
1720/1760-130-130-1.5	105 - 145	130	1.5	90	57 mA
1720/1760-130-130-3	105 - 145	130	3	90	95 mA

II. Installation and Operation

Note: If this converter is equipped with standard options as described in the subsequent section titled "Optional Features", please read the applicable portion of that section AND the following information before installing the converter.

Connection and operation of Series 1720/1760 converters are almost entirely self-explanatory from the front- and rear-panel markings on each unit.

A combination circuit breaker and ON/OFF switch is provided on the front panel for input power. Its rocker handle is flush with the front panel while in the ON position to guard against unintentionally turning the circuit breaker OFF through incidental contact. In addition, a front-panel LED indicates the presence (ON) of proper output voltage (Model 1720 only). Alternatively, the front-panel meters (Model 1760 only) provide a visual indication of the output voltage and load current.

CAUTION: Always verify that the input power source has been turned OFF before inserting or removing input/output wiring or connectors.

All electrical connections to the converter are located on the rear panel. Power connections are made via two-part (i.e. header and plug) connectors. Input and output cabling can be connected to the converter without separating the plug from the header. Alternately, the plug may be removed from the converter by disengaging its mounting-flange screws, and the cabling can be connected to the plug prior to re-engaging it with the header on the converter's rear panel (be sure to re-engage the mounting-flange screws as well). The positive and negative terminals on each power connector are clearly marked, and deliberate caution should be exercised to avoid polarity mistakes. To connect the power cables, simply strip 3/8" – 1/2" from one end of each cable and insert into the appropriate connector wire clamp. Tighten the wire-clamp screw securely and, if using stranded wire, check to make sure that all wire strands have been captured by the wire clamp.

Both the input and the output of the converter are dc-isolated from the chassis and from each other. A connection to chassis ground is provided that accepts lugs for use with #8 hardware.

Suggested wire sizes for input and output cabling are shown in Table 2 on the next page and are listed by model number. It is desirable that these cables be kept as short as possible, and, if their length must exceed 10 feet, it may be desirable to use larger wire. See Figure 2 for additional information.

Good installation practice for power conversion equipment dictates that an input fuse or circuit breaker should be located at the power-source end of the cables feeding the equipment. The type and rating of such devices are largely dependent on local and/or national codes and installation variables such as cable routing and wire gauge. Wilmore cannot anticipate these variables and consequently does not recommend specific fuse or circuit breaker values (See Table 2 for ratings of front-panel circuit breakers). However, it is important to note a few operating characteristics of this unit that may affect an installer's choice of protection devices.

1) As mentioned previously, this unit is a constant-power device; that is, it draws its maximum input current at its minimum input voltage.

2) As with essentially all electronic equipment with significant input capacitance, the unit will draw an initial peak current many times its normal operating current for a very brief period (a few milliseconds or so) when power is initially applied. Consequently, instantaneous-trip circuit breakers or non-time-delay fuses may be activated by normal power-up events and are not recommended.

3) Following the brief capacitor-charging current described above, the unit will exhibit a "soft-start" characteristic that limits its input current to approximately that of its full load current (see Section I for

specific load current information) as the circuit reaches its normal operating mode. Consequently, and even though the user's application may only require a fraction of the unit's power rating, the input circuit breaker or fuse must be sized to accommodate the full-load input current to avoid nuisance tripping.

TABLE 2

MODEL	INPUT CABLE (AWG)	OUTPUT CABLE (AWG)	INPUT CIRCUIT BREAKER RATING (A)*
1720/1760-13-24-8	10	14	35
1720/1760-13-24-15	8	10	60
1720/1760-13-48-4	10	16	35
1720/1760-13-48-7.5	8	14	60
1720/1760-24-13-15	12	10	20
1720/1760-24-13-30	8	8	35
1720/1760-24-24-8	12	14	20
1720/1760-24-24-16	8	10	35
1720/1760-24-48-4	12	16	20
1720/1760-24-48-8	8	14	35
1720/1760-24-130-1.5	12	16	20
1720/1760-24-130-3	8	16	35
1720/1760-48-13-15	14	10	10
1720/1760-48-13-30	12	8	20
1720/1760-48-24-8	14	14	10
1720/1760-48-24-16	12	10	20
1720/1760-48-48-4	14	16	10
1720/1760-48-48-8	12	14	20
1720/1760-48-130-1.5	14	16	10
1720/1760-48-130-3	12	16	20
1720/1760-130-13-15	18	10	5
1720/1760-130-13-30	16	8	10
1720/1760-130-24-8	18	14	5
1720/1760-130-24-16	16	10	10
1720/1760-130-48-4	18	16	5
1720/1760-130-48-8	16	14	10
1720/1760-130-130-1.5	18	16	5
1720/1760-130-130-3	16	16	10

*These are delay-trip breaker ratings that Wilmore uses to allow inrush current without causing nuisance tripping upon initial power-up. See previous paragraphs concerning installer's choice for protection devices.

III. Optional Features

These models of dc-to-dc power converters are provided with one of two factory-installed options. The presence of either of these options is indicated by a suffix in the converter model number, which is silk-screened on the rear panel. The options are available in two configurations, designated M3 or M5. In addition, the suffix "401" indicates that the dc-input and the dc-output connectors have been replaced with barrier strip terminal blocks. A brief description of the two standard option configurations follows.

M3: Paralleling Diode, Auxiliary Contacts, and Proportional Load Sharing

This configuration is provided for applications in which the outputs of two or more "M3" configured converters are paralleled to provide fault-tolerant redundancy and/or additional output power capability. For example, three M3-type converters can be paralleled to power a load capable of being powered by only two converters. The three converters will share the load current, and if any one converter becomes inoperable, the two remaining converters will power the load.

This option includes:

1) An integral power diode wired in series with the converter's output terminal. In the event of a loss of output from one converter, the remaining converter(s) continues to power the load without potential adverse effects from the diode-isolated nonfunctioning converter.

2) An internal circuit that monitors the converter's output preceding the isolating diode and indicates output status via a single-pole, double-throw "Form C" contact arrangement brought out to a connector on the rear panel. This is a two-part (i.e. header and plug) connector and, as with the power connectors described previously in section II, wiring connections can be made without separating the plug from the header. Alternately, the plug may be removed from the converter, and the cabling can be connected to the plug prior to re-engaging it with the header. This plug is held in place by a friction lock – to remove it from the header, grasp the plug firmly and pull it straight out from the rear panel. To connect signal wires to this connector, simply strip approximately ¼" from one end of each wire and insert into the appropriate connector wire clamp. Tighten the wire-clamp screw securely and, if using stranded wire, check to make sure that all wire strands have been captured by the wire clamp. For system wiring flexibility, access to both normally-open and normally-closed contacts is provided (see Figure 2). "Normal" condition means that the converter is ON and proper output voltage is present.

3) Integral circuitry which allows two or more paralleled converters with the "M3" configuration to proportionally share the system load current.

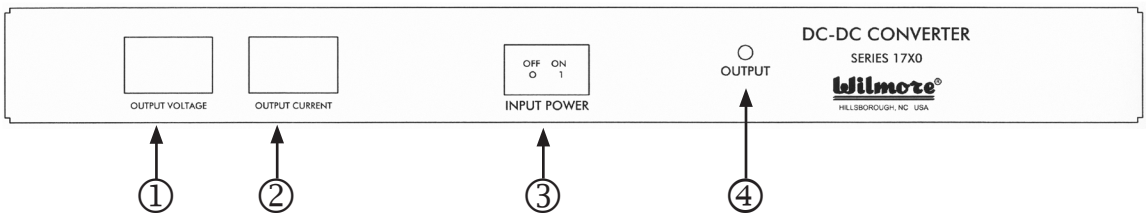
No special set-up procedures are needed when installing converters with the "M3" configuration. Simply connect the converters' output positive (+) terminals to the system load positive (+) using cables of similar length and correct wire size (see wire chart in previous section titled "INSTALLATION AND OPERATION"). Similarly, connect the converters' output negative (-) terminals to the system load negative (-). Upon power-up, the front-panel LED on each converter will indicate that the output voltage is present.

M5: Paralleling Diode, Auxiliary Contacts, Proportional Load Sharing and Ethernet Connectivity ("Network Communications Interface")

This configuration provides a paralleling diode, auxiliary contacts and balanced load sharing (as described in the M3 section above). In addition, it provides Ethernet connectivity.

The Network Communications Interface allows the user to monitor several key aspects of the converter's operation via a web interface, SNMPv.1 (Simple Network Management Protocol), or serial terminal port [see the separate Network Communications Interface user's information manual for additional information, available from Wilmore's website at https://wilmoreelectronics.com/support/#DOWNLOAD (see Figure 2 for additional information)].

FIGURE 1. FRONT PANEL (shown without mounting brackets)



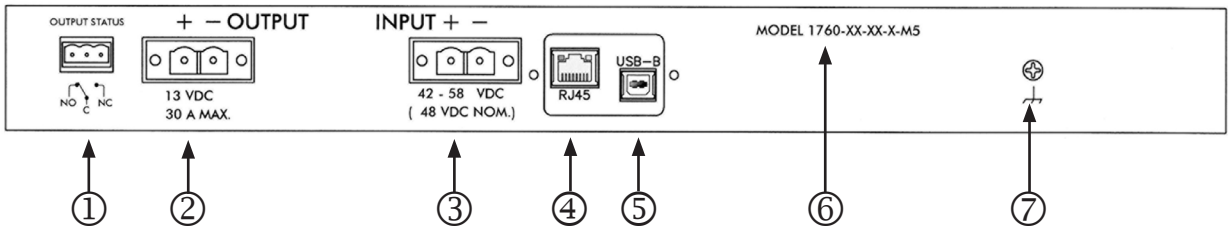
① **OUTPUT VOLTAGE METER (Model 1760 only)**: Displays the voltage in volts (±3% meter accuracy) appearing at the output terminals *unless* the unit is equipped with an integral output paralleling diode (see Section III. OPTIONAL FEATURES), in which case this meter displays the voltage on the "converter side" of the diode, not the "load side" appearing at the output terminals.

② **OUTPUT CURRENT METER (Model 1760 only)**: Displays the current in amperes (±3% meter accuracy) being drawn by the load

③ **DC INPUT CIRCUIT BREAKER**: This is a combination DC input switch and circuit breaker, provided in the positive (+) input line.

④ **OUTPUT POWER INDICATOR (Model 1720 only)**: This green LED indicates the presence of proper output voltage.

FIGURE 2. REAR PANEL (shown without plugs attached)



① **OUTPUT STATUS CONNECTOR (M3 and M5 Versions Only)**: This three-position connector provides access to a set of Form C relay contacts. These contacts are provided for remote indication of an improper output (often referred to as a "converter fail alarm"). The maximum DC voltage and power ratings for these contacts are 125Vdc and 30 watts, respectively.

② **DC OUTPUT CONNECTOR**: Connections for DC output power are provided via a two-part (plug and header) connector.

③ **DC INPUT CONNECTOR**: Connections for DC input power are provided via a two-part (plug and header) connector.

④ **RJ45 ETHERNET PORT (M5 Versions Only)**: Used for network connectivity. A properly configured IPv4 Ethernet connection is required to access the web interface, monitor via SNMPv.1 (Simple Network Management Protocol), or query the web service API (Application Programming Interface). For additional information, see separate Network Communications Interface user's information manual, available from Wilmore's website as a download.

⑤ **USB 2.0 TYPE B PORT (M5 Versions Only)**: Used for initial setup and configuration of the communications interface (requires Wilmore's configuration application). Also allows you to query specific information via the serial terminal console. See separate Network Communications Interface user's information manual, available from Wilmore's website as a download.

⑥ **MODEL NUMBER**: This is the complete model number of the inverter, including any standard or special factory-assigned modification codes.

⑦ **CHASSIS GROUND TERMINAL**: Connection to chassis ground is provided for use with #8 hardware.

IV. Maintenance Information

Other than preventing dust and debris accumulation on internal components and external surfaces of the converter, no periodic maintenance should be required.

A damaged or malfunctioning unit should be returned to Wilmore for repair. Multiple-component cascade failures in power conversion circuitry can greatly complicate trouble-shooting procedures, and factory technicians familiar with the circuitry can locate the problem quickly, explore adjacent circuitry for stressed or damaged components, and subject the converter to a thorough retest.

Wilmore maintains a **Return Material Authorization** system in order to efficiently track your inbound shipment and expedite its repair and return to you. Before shipping material for repair to Wilmore, please call (919) 732-9351 or email *info@wilmoreelectronics.com* and request an **RMA Number** for your shipment. If possible, please provide the complete model number of the equipment, its serial number, and a brief description of the problem. Place this **RMA Number** on the outside of the package and ship prepaid to:

WILMORE ELECTRONICS CO., INC.
607 U.S. 70A East
P.O. Box 1329
Hillsborough, NC 27278

V. Limited Warranty

Wilmore Electronics Company, Inc. warrants this product to be free from defects in material and workmanship for one (1) year after delivery to the original purchaser. During this period, a defective product for which an authorization to return the product has been given, shall be returned to Wilmore freight prepaid. The products will be repaired, replaced, or credit allowed only if the defect, after examination by Wilmore, is determined to be a defect in material or workmanship. If this returned product is determined by Wilmore to have suffered from user misuse or abuse or to have been opened or modified without written instructions from Wilmore, or if the date of receipt of a request for return authorization exceeds the 1-year warranty period, the warranty is null and void. In such cases, Wilmore will determine the cost of repair, quote this price to the purchaser, and continue as advised by the purchaser.

The sole obligation of Wilmore and the purchaser's exclusive remedy under this or any other warranty, expressed or implied, is the repair or replacement of a defective product as provided above, or the issuance of credit in an amount not to exceed the contract price for the product deemed to be defective. Wilmore makes no warranty of merchantability or fitness for a particular use. Wilmore shall not be responsible for incidental or consequential damage, whether or not foreseeable, caused by defects in this product. There are no other warranties which shall extend the description above.