For 24 Hour Technical Support

Call: 1-800-332-1111

HIG 1.4-CE

Power Supply

User's Manual

P/N: HFP-7-P0101A103

January 2014

 Printed in the United States of America. This manual is supplied to enable the reader to safely install and operate the equipment described herein. Please read entire manual carefully prior to using your power supply. In the interest of providing continually improved equipment to our customers iTherm Technologies reserves the right to make product changes without notification or obligation.

CONTENTS

WARNING

SAFE OPERATIONAL PROCEEDURES AND PROPER USE OF THE EQUIPMENT ARE THE RESPONSIBILITY OF THE USER OF THIS SYSTEM.

This equipment produces potentially lethal high-voltage, high-current, and high-frequency (HF) power. You should read this entire manual and understand its content before you attempt to power or operate the equipment it describes to avoid personal injury or death. Follow all safety precautions. **Never defeat safety interlocks or unit grounding.**

iTherm Technologies provides information on its products and associated hazards but assumes no responsibility for the after-sale operation of the equipment or the safety practices of the owner or user.

SYMBOLS USED IN THIS MANUAL:

This symbol indicates a potential safety hazard to personnel or property.

This symbol indicates a warning that requires special attention.

To ensure years of dependable service all iTherm Technologies products are thoroughly tested prior to shipment. All parts and labor on the unit described herein carry iTherm's standard 1-year warranty. Additional information about the Terms and Conditions of Sale are listed in the quotation sent by iTherm to your procurement office.

THERE ARE NO USER SERVICEABLE PARTS IN THIS POWER SUPPLY. OPENING THIS UNIT MAY VOID YOUR WARRANTY. CALL ITHERM IF YOU HAVE ANY QUESTIONS ABOUT OUR PRODUCTS OR IF YOU REQUIRE ANY ASSISTANCE TROUBLESHOOTING. ALL CUSTOMER SUPPORT CALLS ARE OFFERED TO OUR CUSTOMERS AT NO CHARGE.

RETURNING UNITS FOR REPAIR

Prior to returning any unit for repair or replacement please contact iTherm Technologies. In many cases the problem can be resolved remotely without a need to return the unit. All customer service inquiries are available free of charge. Please be prepared to provide the serial number of the unit and a detailed description of the problem.

Should iTherm determine that your power supply requires service, an RMA number must be obtained prior to returning your unit to iTherm Technologies. An RMA can be easily obtained by contacting iTherm. Following our RMA process enables appropriate follow-up and rapid resolution for your repair.

CONTACT INFORMATION:

24 Hour Technical Support: 1.800.332.1111
www.iTherm.com/contact

Customer Service:
Toll free USA: 1.802.862.9976
Int'l: +1.802.862.9976
Fax: 1.802.864.3782

Shipping:
iTherm Technologies
85 Meadowland Drive
South Burlington, VT 05403
U.S.A.

POWER SUPPLY PARAMETERS

INPUT VOLTAGE: 110 – 240 VAC ± 10%.
50/60 Hz Single Phase.
NOTE: for maximum power output operate at 240 VAC.

INPUT CURRENT: 6 A Max.

INPUT PROTECTION: 6.3 A Slow-Blow Fuse; 240 VAC MOV.

OUTPUT POWER: 1000W maximum at 900V peak.
NOTE: Maximum available power depends upon coil parameters and load characteristics (see page 7 for more details).

OUTPUT FREQUENCY: 36-500kHz.
NOTE: Alternative coil configurations can be used to achieve a target frequency. Contact iTherm for custom coil options.

COOLING: Air-cooled via 3 high CFM auto-engaging fans. Air intake is on the bottom of the power supply, exhaust is at the rear panel.
NOTE: Sufficient clearance for the air intake is achieved with the unit's feet. Do remove the feet and do not restrict the airflow into or out of the power supply. Provide 2-3" clearance at the rear of the power supply to allow air to exit from the unit. Periodic cleaning of the air filters is required for efficient cooling and safe operation.

ENVIRONMENTAL RATING: IP 32.

THIS EQUIPMENT REQUIRES A CONNECTION TO EARTH GROUND. FAILURE TO CONNECT EARTH GROUND WILL RESULT IN A POTENTIALLY HAZARDOUS CONDITION.

COIL PARAMETERS

COIL INDUCTANCE: 0.6 H – 340 µH.

COIL RESISTANCE: 5 mΩ – 300 mΩ.

ELECTRICAL ISOLATION: Rated to 2kV.

ENVIRONMENTAL RATING: IP 30.

THE COIL CARRIES HIGH-FREQUENCY, HIGH-VOLTAGE, AND HIGH-CURRENT ELECTRICAL SIGNALS AND MAY PRESENT A SHOCK HAZARD. ALTHOUGH THE COIL IS ELECTRICALLY ISOLATED PHYSICAL CONTACT WITH THE COIL IS NOT PERMISSIBLE. ANY CONDUCTIVE OBJECTS CONTACTING THE COIL AND/OR COIL HOUSING SHOULD BE PROPERLY CONNECTED TO AN EARTH SAFETY GROUND.

USE ONLY HF COILS AND CONNECTORS SUPPLIED BY ITHERM TECHNOLOGIES IN ORDER TO ASSURE PROPER SAFETY RATING AND OPERATOR SAFETY. ALL CUSTOM COILS MUST BE APPROPRIATELY ELECTRICALLY INSULATED FROM CONTACT. ITHERM ASSUMES NO RESPONSIBILITY FOR UNIT FAILURE OR INJURIES/DEATH RESULTING FROM THE USE OF COILS NOT SUPPLIED BY ITHERM.

DO NOT ALLOW COIL LEADS TO BECOME EXCESSIVELY HOT. EXCESSIVE STIFFNESS IN THE COIL LEADS CAN BE A SIGN OF IMPENDING COIL FAULURE AND MAY AFFECT YOUR POWER SUPPLY. PROLONGED THERMAL CONTACT WITH THE FLUX CONCENTRATOR (WHERE APPLICABLE) CAN ALSO LEAD TO COIL FAILURE OR CHIPPING OF THE FERRITE.

A BRIEF OVERVIEW OF INDUCTION

iTherm's induction heating power supplies work by generating a strong, rapidly oscillating magnetic field that is produced from the passage of high voltage current through the coil. The shape and direction of this magnetic field is skillfully chosen and manipulated purposefully into the work-piece through the use of our customized flux concentrators and unique coil designs. When the magnetic field lines encounter an electrically conductive material (the work-piece) its energy is transferred into the work-piece by the creation of eddy currents that flow in opposition to the magnetic field. The internal resistance to the flow of these eddy currents within the work-piece material is the mechanism that produces heat.

IMPORTANT APPLICATION CONSIDERATIONS

- Inductive heating is only effective with materials that are electrically conductive.
- Inductive performance is crucially related to material selection of the work-piece and can vary greatly due to:
    - PERMEABILITY: The ability for a material 'conduct,' hence, support dense magnetic flux lines. This can vary from as low as >1 (copper, silver, lead) to just greater than 1 (aluminum, magnesium), or be as high as 250 - 5000 (cobalt, nickel, iron).
    - RESISTIVITY: The internal resistance of the material can have a large effect on how much heat is generated from the opposition to the flow of eddy currents within the material.
    - THERMAL MASS: Large pieces will take longer to heat than smaller pieces of the same material.
- Parasitic losses can occur as a result of application parameters such as:
    - PARTS PLACEMENT: Improper placement of the work-piece within the coil or large air gaps between the coil/flux concentrator and work-piece decreases magnetic coupling levels hence decreasing performance.
    - ADJACENT COUPLING: Metal fixturing within close proximity of the coil head or coil leads can respond inductively. This is especially true if the fixturing material has a higher permeability than the work-piece. In addition to potentially heating up, adjacent coupling will also decrease the efficiency of heating the work-piece.
    - THERMAL CONDUCTION: Thermally conductive fixturing in direct contact with the work-piece, or small active heating areas on larger work-pieces can act as heat sinks potentially increasing cycle time.
- Operating frequency can have an effect on heating response times in some applications. Operating frequency is dependent upon coil and load characteristics. Please contact iTherm for alternative coil configurations if a specific frequency response is required.

INTERFACE

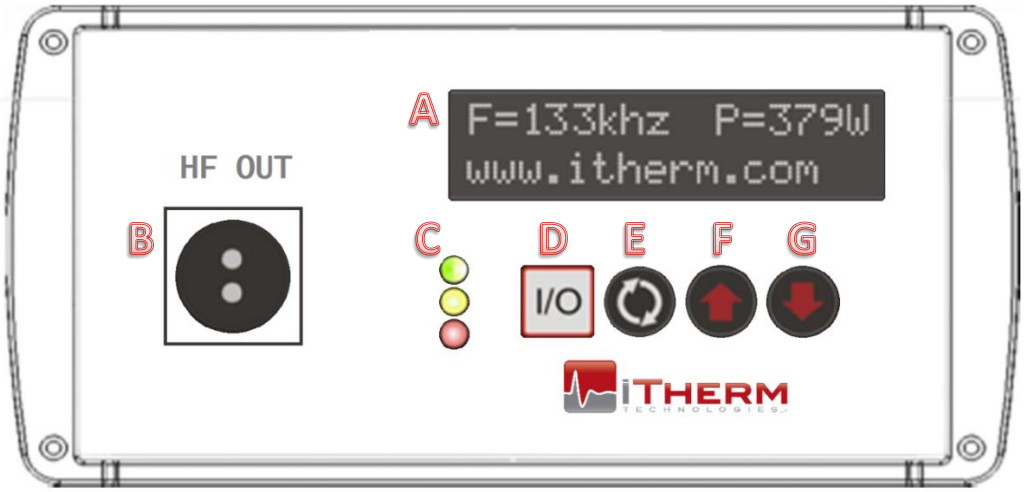

FIGURE 1: Front panel

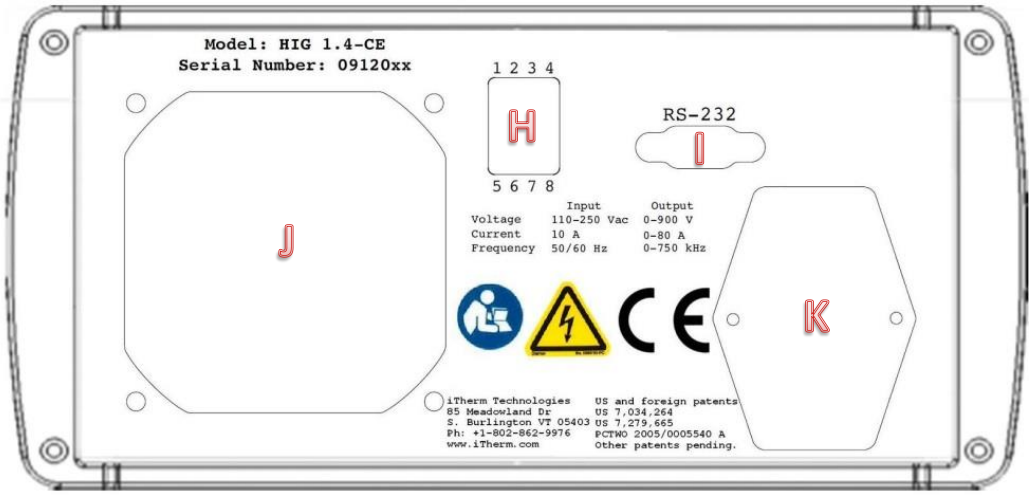

FIGURE 2: Rear panel

FIGURE 1 KEY		FIGURE 2 KEY	
A	Front LCD Display	H	I/O Communication Ports
B	HF Coil Connection	I	Serial Communication Port
C	Indicator Lights: Green = Running Yellow = Standby Red = Error	J	Cooling Fan Exhaust
D	I/O Button (Run Trigger)	K	Power Entry Module (Fused)
E	Mode Button		
F	Index Up		
G	Index Down		

POWER SUPPLY OPERATION

POWERING UP

Powering up the HIG 1.4 is easy. First ensure that the IEC320-C13 style power cord (supplied) is plugged firmly into the rear panel of the power supply and that the mains voltage supplied is within the limits specified in the *POWER SUPPLY PARAMETERS* section on page 5. The unit is then powered on by flipping the rear rocker panel switch upwards into the 'I' position.
NOTE: Information on the procedure for replacing the mains input fuse can be found in the *MAINTENANCE* section on page 14.

CONNECTING A COIL

To connect a HIG 1.4 compatible coil to the power supply simply insert the 2 prongs into the HF connector with the keyed channel in the up position and turn the outer ring ¼ turn clockwise until it locks into position. Follow the opposite procedure for removal of the coil.
NOTE: The power supply will automatically adjust to every coil connected.

ALWAYS ENSURE THAT THE POWER SUPPLY IS POWERED OFF BY MOVING THE ROCKER SWITCH ON THE REAR PANEL TO THE OFF POSITION BEFORE CONNECTING OR DISCONNECTING A COIL.

MODES OF OPERATION

This unit supports three modes of operation: Time Mode, Power Mode, and Temperature Mode. To cycle between modes simply press the mode button on the front panel until the desired mode is reached, cycling between modes is not permitted while the power supply is running. In each mode the LEDs on the front panel indicate the status of the power supply. Green indicates that the unit is running, yellow indicates that the unit is in standby, and red indicates that there is an error. Please consult the *TROUBLESHOOTING* section on page 15 if an error occurs.
NOTE: Custom run modes are available; please contact iTherm Technologies for details if alternate configurations are required.

DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE WORK-PIECE FROM THE COIL WHILE POWER IS RUNNING OR DRY FIRE THE COIL (CYCLE POWER WITHOUT THE WORK-PIECE PLACED IN THE COIL). DOING SO CAN POTENTIALLY DAMAGE THE EQUIPMENT AND MAY VOID YOUR WARRANTY.

POWER MODE

The top line of LCD will display 'Set Power' to indicate when the unit is in power mode. Power mode operates in open loop control such that a user specified power setting runs continuously until the power supply is prompted to stop. To use power mode:

1. Set the unit to the desired power output level using the ↑ and ↓ arrows.
2. Once the desired set point is achieved press the I/O button to deliver power to the coil. Note that while the machine is running the operator is free to use the ↑ and ↓ arrows to deliver more or less power in real time to the coil.
3. To stop the flow of power to the coil simply presses the I/O button once more.

NOTE: If more power is requested of the power supply than the power supply is able to deliver into that part (for reasons specified in the *IMPORTANT APPLICATION CONSIDERATIONS* on page 7) the power supply will automatically calibrate itself and run at the maximum allowable power once the I/O button is pressed. In this scenario the power supply operator will not be able to increase the output power setting.

TIME MODE

The top line of the LCD will display 'Set Time' to indicate when the unit is in time mode. Time mode operates much like power mode but in closed loop control such that the user specifies a runtime setting in addition to the already specified power setting. To use time mode:

1. Enter power mode and set the desired power output setting using the ↑ and ↓ arrows.
2. Once the desired power set point is achieved press the mode button once to cycle into time mode.
3. Use the ↑ and ↓ arrows to specify a desired run time.
4. Press the I/O button to deliver power to the coil. The time setting will automatically count down and stop the flow of power to the coil once the timer reaches zero. Note that while the machine is running the operator is free to use the ↑ and ↓ arrows to deliver more or less power in real time to the coil.
5. If the flow of power to the coil needs to be stopped prematurely, press the I/O button once to promptly do so. The timer will automatically reset and ready itself.

NOTE: If more power is requested of the power supply than the power supply is able to deliver into that part (for reasons specified in the *IMPORTANT APPLICATION CONSIDERATIONS* on page 7) the power supply will automatically calibrate itself and run at the maximum allowable power once the I/O button is pressed. In this scenario the power supply operator will not be able to increase the output power setting.

TEMPERATURE MODE

The top line of the LCD will display 'Set Temp' to indicate when the unit is in temperature mode. Temperature mode operates in closed-loop control such that the power supply will self-modulate its output power to achieve and maintain a user specified temperature set point. This requires an external feedback system. The standard external feedback system is an ungrounded K-type thermocouple or infrared thermocouple with K-type output connected to I/O pins 1 & 2 or 3 & 4 (see *INPUT OUTPUT (I/O) CONNECTORS* on page 12). To use temperature mode:

1. Press the mode button until temperature mode is reached.
2. Use the ↑ and ↓ arrows to enter the desired final temperature. To toggle between °C or °F quickly press and release the ↑ and ↓ arrows simultaneously.
3. Once the desired temperature set point is entered push the I/O button to start the flow of power to the coil.
4. Push the I/O button again to stop the flow of power to the coil.

NOTE: Custom options are available if a different temperature feedback system is required. Please contact iTherm Technologies for more information if a different feedback loop is necessary.

IF THE 'ACTUAL TEMP' IS AT OR ABOVE THE 'SET TEMP' ON THE LCD, POWER WILL NOT BE FLOWING THROUGH THE COIL EVEN IF THE GREEN LED IS ILLUMINATED. DO NOT MISTAKE THIS CONDITION WITH THAT OF STANDBY AS POWER WILL AUTOMATICALLY BEGIN TO FLOW ONCE AGAIN WHEN THE ACTUAL TEMPERATURE DROPS BELOW THE SET TEMPERATURE. IF A STANDBY CONDITION IS INSTEAD DESIRED PRESS THE I/O BUTTON ONCE TO STOP AUTOMATIC TEMPERATURE MODULATION AND VERIFY THAT THE YELLOW LED IS ILLUMINATED.

ANALOG MODE

Analog mode is a non-standard feature available on all HIG 1.4 power supplies. Analog mode offers the operator a way to control the power or temperature set point in real time (in their corresponding modes) using a 0-5 volt DC signal connected to I/O pins 3 & 4 on the rear panel. Enablement of this mode disables the temperature feedback capability of these two I/O pins (I/O pins 1 & 2 can still be used for temperature mode feedback). Please contact iTherm Technologies prior to ordering your power supply if you desire to have analog mode capability enabled. Existing power supplies can always be returned to iTherm in the future if the decision is made to retrofit the unit with analog mode capability.

EXTERNAL COMMUNICATION

INPUT OUTPUT (I/O) CONNECTORS

Communicating externally with the power supply is most easily accomplished using the green I/O connectors numbered 1 through 8 on the rear panel. To physically connect to this interface push on the orange tab above the wire insert on the connector plug and insert the stripped end of the communication wire into the corresponding wire hole and release the tab. When all necessary wires are installed, insert the connector plug into the correct set of keyed I/O ports. The functionality of each of the 8 I/O pins is as follows:

Pins 1 & 2:	These pins serve as the primary thermocouple feedback input required for closed loop operation of temperature mode or temperature monitoring in power mode. Only K-Type thermocouples are compatible with these ports. Pin 1 is used for the positive (+) lead and pin 2 is used for the negative (-) lead (for North American style coloring the yellow represents the (+) lead and red represents the (-) lead.
Pins 3 & 4:	These pins serve as the secondary (backup) pins for use with thermocouple feedback. As with pins 1 & 2, only K-type thermocouples are compatible. Pin 3 is used for the positive (+) lead and pin 2 is used for the negative (-) lead. **NOTE:** These pins can be substituted for Analog Mode inputs (page 11). Contact iTherm Technologies if you require analog mode capability for your application.
Pins 5 & 6:	These pins provide a normally open safety relay for monitoring that closes when current is flowing through the coil. This usually occurs when the power supply is running but will also occur during the load detect cycle that produces an invalid load error as a result of the load detection system current.
Pins 7 & 8:	These pins provide an external trigger such as a PLC or foot-pedal for activating or deactivating the programmed event when pin 7 is shorted to pin 8. This is analogous to pressing the I/O button on the front. **NOTE:** This functionality is edge triggered in time and temperature mode (trigger once to start the cycle, re-trigger once more to stop the cycle) and level triggered in power mode (power only flows so long as the short is maintained, releasing the trigger stops the flow of power to the coil).

ONCE THE POWER SUPPLY HAS BEEN TRIGGERED USING THE I/O PINS IT CAN ONLY BE UN-TRIGGERED BY THE SAME METHOD; TRIGGERING EXTERNALLY DEACTIVATES THE BUTTONS ON THE FRONT PANEL. TO USE THE FRONT PANEL AGAIN YOU MUST FIRST DEACTIVITE THE TRIGGERED EVENT WITH THE EXTERNAL TRIGGER.

SERIAL PORT

If additional control over the power supply is required beyond that of the I/O pins' functionality, the serial port is provided to allow the operator to full control of the power supply using a computer. Communication with this port requires a straight thru (not a null modem) DB9, RS-232 cable and a corresponding RS-232 port or USB adapter on the host computer. For a complete list of serial port commands please refer to *APPENDIX A: SERIAL PORT COMMAND LIST* on page 17.

In addition to offering full control of the power supply externally, the serial port can also be used to remotely reprogram the power supply. This is useful when a custom firmware installation is required or a firmware update is available as it negates the need to return the power supply to iTherm for service. In the event of a mandatory reprogramming of your power supply iTherm will provide you with 3 files necessary to complete the firmware change: boot.bat, 16-Bit Flash Programmer.exe, and s3.hex. The following steps will need to be followed to successfully reprogram your power supply:

1. Download and store all the aforementioned files into the same location on your hard drive (boot.bat points to s3.hex and 16-Bit Flash Programmer.exe).
2. Right click on boot.bat, select edit, and change COM3 to whichever port you are using for RS-232 communication. If you are unsure of the port number it can be obtained in the device manager. Save and close the file.
3. Make sure the RS-232 cable is connected to both the power supply and to the computer or USB adapter's serial port and that the power supply is off.
4. While holding down the I/O button, turn the power supply on. Leave I/O held for at least 3 seconds, the LCD screen on the power supply should be blank.
5. Release the I/O button and double click on boot.bat. A DOS window should open indicating that the power supply is being reprogrammed. Wait for it to finish, the window should close automatically. This will take roughly 30 seconds.
6. Unplug the RS-232 cable and restart the power supply, the version number should indicate the change or the custom setup should now be enabled.

ONCE THE HOST COMPUTER HAS ESTABLISHED COMMUNICATION WITH THE POWER SUPPLY THE UNIT CANNNOT BE CONTROLLED OR TRIGGERED/UN-TRIGGERED BY THE FRONT PANLE OR I/O PINS; TRIGGERING EXTERNALLY DEACTIVATES THE BUTTONS ON THE FRONT PANEL. TO USE THE FRONT PANEL OR I/O PINS AGAIN YOU MUST FIRST HALT COMMUNICATION WITH THE POWER SUPPLY AND HOST COMPUTER.

MAINTENANCE

All iTherm power supplies come equipped with an intelligent load detect system that automatically measures the coil and load characteristics every time power is cycled to the coil. Each time this occurs the power supply will adjust the modulation of the output pulse accordingly to deliver the correct amount of power requested by the current setting. This system negates the need for any scheduled calibration as calibration is automatically built into the machine's functionality.

CLEANING AIR FILTERS

Periodic cleaning of the air filters on the bottom of the power supply is required for efficient cooling and safe operation. The air filters on the bottom of the power supply should be vacuumed at least once a month or more depending upon the conditions of your production environment. Always ensure that the unit is off and that power is disconnected when vacuuming the air filters.

ADEQUATE AIRFLOW INTO AND OUT OF THE POWER SUPPLY IS ESSENTIAL FOR SAFE AND RELIABLE OPERATION OF THE UNIT. ALWAYS PROVIDE AT LEAST 2-3" OF CLEARANCE AT THE REAR EXHAUST TO ALLOW AIR TO EXIT. NEVER REMOVE THE FEET ON THE BOTTOM OF THE POWER SUPPLY ELSE THE AIR INTAKE WILL BE RESTRICTED.

REPLACING FUSE

Each power supply is equipped with an input protection fuse. Should the input protection fuse need to be replaced it can be located in the slide out compartment between the rear power switch and the AC mains input plug in the power entry module. The slide out compartment is also equipped with a spare fuse. Always ensure that the power supply is off and that the mains plug is disconnected prior to replacing the fuse.

EXERCISE CARE WHEN REMOVING THE BLOWN FUSE AS THE GLASS CASING CAN OFTEN BE CRACKED OR SHATTERED. IF THE REPLACEMENT FUSE BLOWS IMMEDIATELY WHEN THE POWER SUPPLY IS TURNED BACK ON OR POWER IS CYCLED TO THE COIL CONTACT ITHERM AS YOUR POWER SUPPLY MAY REQUIRE REPAIR. FOR CONTINUED PROTECTION AGAINST RISK OF FIRE REPLACE ONLY WITH A 20MM X 5MM SLOW-BLOW 6.3A 250 VAC RATED FUSE; FOR EXAMPLE LITTLE FUSE INC. PART NUMBER 021806.3HXP.

TROUBLESHOOTING

In the event of an error, the front LCD will display information regarding the nature of the error. The following table describes possible errors the power supply may encounter during operation and the corrective action required.

Error	Description of Cause	Corrective Action
LCD displays: “ERROR CONNECT COIL”	A coil has not been connected to the power supply or the coil has suffered an open circuit failure.	Check coil connection and coil continuity. Replace coil if faulty.
LCD displays: “ERROR INVALID LOAD”	A coil with an inductance outside the acceptable range is connected to the power supply. This error can also occur if the connected coil has become damaged.	Consider adding/removing turns or using a different coil. Check the coil for damage.
LCD displays: “ERROR INTERNAL OVERHEAT”	The temperature of the power supply’s internal components have reached their maximum permissible operating limit. The power supply will not operate until the power supply has cooled to an acceptable temperature.	Check fans for operation. Check air filters, clean if needed. Reduce power settings or duty cycle. Move power supply to a cooler environment.
Indicator lights and front display not on	Power is not reaching the unit or the unit is off.	Disconnect power and check source voltage. Check fuse, replace if needed.
Blank screen and LED light(s) illuminated	Partial reset of microcontroller.	Cycle mains power (reboot the machine).
Blank screen and LED light(s) illuminated	Partial reset of microcontroller.	Cycle mains power (reboot the machine).

INCLUDED IN SHIPMENT

NEMA 6-20 240V mains plug (qty. 1):

Plug Receptacle

I/O pin connectors, keyed (qty. 2):

This manual (qty. 1).

APPENDIX A: SERIAL PORT COMMAND LIST

HOST COMPUTER SETTINGS

To communicate with the RS-232 port on the power supply the following settings are necessary:

BAUD RATE: 115200

DATA BITS: 8

STOP BITS: 1

PARITY: None

CHECKSUM ALGORITHM

The protocol used in this application utilizes a single-byte binary checksum. The checksum is calculated as the remainder from the division of the sum of all preceding characters in the message by 256, i.e.

$$CS = \left(\sum_{i=0}^{n} Message[i] \right) \bmod 256$$

Equation 1: Checksum equation

In practice, the checksum is calculated by summing the values of all the message string bytes into a variable which is one byte wide ignoring any overflow that may occur.

INVALID CHECKSUM ACTION

If an invalid checksum is received with any of the commands that require echoing back the power supply will ignore the command and echo the received byte sequence to the host. If an invalid checksum is received with any other command (not requiring echo) the checksum will be ignored.

INVALID PARAMETER RECEIVED

If the power supply receives a command with an invalid parameter (for example, set maximum temperature > allowable maximum temperature or mode being changed while the power supply is running) the power supply will ignore the invalid parameter and echo with the value to be used (the most recent accepted valid value).

TEMPERATURE COMMUNICATION

Temperature communication supports both °C and °F for SetTemp and GetTemp however only reports temp in °C as part of the CurrentStatusStruct defined below.

ECHO

The following commands will be echoed: Set Temperature, Set Power, Set Time, Set PID Parameters, Set Output Frequency Modulation, Set TC Gain and Offset, Mode Power, Mode Time, Mode Temperature, Set Viper1-Viper 2 Mode.

DEFAULT VALUES

There are no constant power up default values for Time To Run, Temperature, and Power. Instead, the power supply stores the last valid values it knew before the run command was issued. These values are stored in the on-board non-volatile memory and are retrieved on power up and used as power up defaults. If the power supply has never run, (no valid values stored in the non-volatile memory) then the power supply will use the following values for the power up defaults:

Temp = 500°C
Time To Run = 0mSec
Power = 0W

Once again the parameter values are written to the non-volatile memory after Run command is issued. If the user entered new valid values and then turned the power supply off without sending the Run command, then those values will be "forgotten" on the next power up and previously stored values will be used instead.

VALID PARAMETERS

Every time that the new value for Time To Run, Temperature, or Power is sent to the power supply, that value is tested to be within the valid range. If the new value is found to be outside of the valid range then it's ignored and the most recent successfully entered value will be used instead. The valid range for the parameters is:

PARAMETER	MIN VALUE	MAX VALUE
Temperature	10 °C	500 °C
Time To Run	0 Sec	1800 Sec
Power	0 W	300 W

A special comment on the power setting: When in Viper2 mode of operation, every time the power supply is commanded to run it goes through the load identification phase and determines the maximum power setting it is capable of applying to that load. If the power supply is commanded to run at a higher setting than is possible for that load it will run at the maximum possible power setting that was determined during the load identification phase.

COMMAND LIST

COMMAND	COMMAND CHARACTER	COMMAND DATA BYTES (NOT COUNTING COMMAND CHARACTER & CHECKSUM)	RESPONSE	ECHO?
SetTempC	a	1 int = 2 bytes	Echo	Yes
GetTempC	b	2	1 int = 2 bytes	No
GetTimeToRun (mSec)	e	0	unsigned long int = 4 bytes, (mSec)	No
SetTimeToRun (mSec)	f	unsigned long int = 4 bytes, (mSec)	Echo	Yes
Start	h	0	Echo	Yes
Stop	i	0	Echo	Yes
ModeTemp	j	0	Echo	Yes
ModeTime	k	0	Echo	Yes
Handshake	o	0	1 byte = '!'	No
GetCurrentStatus	p	0	CurrentStatusStruct	No
Set Power	A	unsigned int = 2 bytes (Watts)	Echo	Yes
Get Power	B	0	unsigned int = 2 bytes (Watts)	No
Mode Power	D	0	Echo	Yes
Get TC Gain and Offset	J	0	Gain – float; Offset – short; 6 bytes	No
Set TC Gain and Offset	K	Gain – float; Offset – short; 6 bytes	Echo	Yes
Get PID Parameters	L	0	Three floats =12 bytes	No

COMMAND	COMMAND CHARACTER	COMMAND DATA BYTES (NOT COUNTING COMMAND CHARACTER & CHECKSUM)	RESPONSE	ECHO?
Set PID Parameters	M	3 floats =12 bytes	Echo	Yes
Get Output Frequency Modulation	N	0	Unsigned char = 1 byte	No
Set Output Frequency Modulation	O	Unsigned char = 1 byte	Echo	Yes
Get Viper 1 – Viper 2 mode	P	0	Unsigned char (Viper1 or Viper 2 mode); Unsigned short = 2 bytes (Pulse in uSec); Total of 3 bytes	No
Set Viper 1 – Viper 2 mode	Q	Unsigned char (Viper1 or Viper 2 mode); Unsigned short = 2 bytes (Pulse in uSec); Total of 3 bytes	Echo	Yes
Get Line Voltage Scaling Factor	R	0	Float = 4 bytes	No
Set Line Voltage Scaling Factor	S	Float = 4 bytes	Echo	Yes
Get Power Factor	T	0	Float = 4 bytes	No
Set Power Factor	U	Float = 4 bytes	Echo	Yes
Get Line Voltage	V	0	Short int = 2 bytes	No
Get analog input Gain and Offset	W	0	Gain – float; Gain and Offset – float; 8 bytes	No
Set analog input Gain and Offset	X	Gain – float; Offset – float; 8 bytes	Echo	Yes

COMMAND DESCRIPTIONS

Command:	Set Temperature In Celsius
Character:	a
Description:	Configures the temperature set point in degrees Celsius with a resolution of 0.25°C.
Valid Range:	10 – 500; If the parameter is set to less than 10°C then the temp setting is set to 10°C. If the parameter is set to more than 500°C the temp setting is wrapped around to 10°C
Construction:	The host will send a 4-byte message. The first byte is the character 'a' the second byte is the LSB of the temperature set point; the third bytes is the MSB of the temperature set point. The fourth byte is the checksum. The desired value must be multiplied by 4 prior to sending, see the example below.
Reply:	The power supply will echo back the command. If an invalid set point is transmitted the power supply will reply with the set point it is going to use. The reply construction is identical to the command instruction.
Example:	To enter a set point of 200.0 the host will send: 0x61 0x20 0x03 0x84; The power supply will reply with: 0x61 0x20 0x03 0x84.

Command:	Request Temperature Set Point in Celsius
Character:	b
Description:	Returns the current temperature set point in °Celsius.
Construction:	The host will send a 2-byte message. The first byte is the character 'b' and the second byte is the checksum.
Reply:	The power supply will reply with a 5-byte message. The first byte is an echo of the 'b' the second byte is the number of bytes remaining, 0x03, in the message including the checksum, the third byte is the LSB of the temperature set point, the fourth byte is the MSB of the temperature set point, and the fifth byte is the checksum.
Example:	To request the current temperature set point the host will send: 0x62 0x62; The power supply will reply with: 0x62 0x03 0xD0 0x07 0x3C; Decomposing the message we get the set point for the example is 500.0°C.

Command:	Get Time To Run
Character:	e
Description:	Returns the current timer set point in milliseconds.
Construction:	The host will send a 2-byte message. The first byte is the character 'e' and the second byte is the checksum.
Reply:	The power supply will reply with a 7-byte message. The first byte is an echo of the 'e' the second byte is the number of bytes remaining in the message including the checksum, 0x05. Bytes 3-6 are a double word containing the timer set point with the LSB in byte 3 and MSB in byte 6. The last byte is the checksum.

Example:	To request the current timer set point the host will send: 0x65 0x65; The power supply will reply with: 0x65 0x05 0xE8 0x03 0x00 0x00 0x55; Decomposing the message we get the set point for the example is 1000ms.
Command:	Set Time To Run
Character:	f
Description:	Configures the timer set point in milliseconds.
Valid Range:	0 – 1,800,000ms; If the parameter is set above 1,800,000ms then the temp setting is wrapped around to 0.
Construction:	The host will send a 6-byte message. The first byte is the character 'f', bytes 2-5 is the timer set point with LSB in byte 2 and MSB in byte 5. The sixth byte is the checksum.
Reply:	The power supply will echo back the command. If an invalid set point is transmitted the power supply will reply with the set point it is going to use. The reply construction is identical to the command instruction.
Example:	To set the time set point the host will send: 0x66 0xE8 0x03 0x00 0x00 0x51; The power supply will reply with: 0x66 0xE8 0x03 0x00 0x00 0x51; In the example we have configured the set point to 1,000ms.
Command:	Start
Character:	h
Description:	Turns the power supply on in the present set mode.
Construction:	The host will send a 2-byte message. The first byte is the character 'h' and the second byte is the checksum.
Reply:	The power supply will echo back the command.
Example:	To start the power supply the host will send: 0x68 0x68; The power supply will reply with: 0x68 0x68.
Command:	Stop
Character:	i
Description:	Turns off the RF output.
Construction:	The host will send a 2-byte message. The first byte is the character 'i' and the second byte is the checksum.
Reply:	The power supply will echo back the command.
Example:	To stop the power supply the host will send: 0x69 0x69; The power supply will reply with: 0x69 0x69.
Command:	Change to temperature mode
Character:	j
Description:	When issued before run command this command switches the power supply to temperature mode. The command has no effect if issued while the power supply is running; the power supply would echo back the

current mode.

Construction: The host will send a 2-byte message. The first byte is the character 'j' and the second byte is the checksum.

Reply: The power supply will echo back the current mode with checksum.

Example: To change to temperature mode the host will send:
0x6A 0x6A;
The power supply will reply with:
0x6A 0x6A.

Command: Change to time mode.

Character: k

Description: When issued before Run command this command switches the power supply to time mode. The command has no effect if issued while the power supply is running, the power supply would echo back the current mode.

Construction: The host will send a 2-byte message. The first byte is the character 'k' and the second byte is the checksum.

Reply: The power supply will echo back the current mode with checksum.

Example: To change to time mode the host will send:
0x6B 0x6B;
The power supply will reply with:
0x6B 0x6B.

Command: Handshake

Character: o

Description: It is highly recommended that the handshake command be used when establishing communication with the power supply. Being a single byte command it's guaranteed to be processed correctly once received. When establishing communication with the power supply the Host PC should stay in a loop sending the handshake command 'o' and waiting for a response '!'. No response is likely to indicate that the power supply is either not ready to process commands (turned off or coming out of reset) or the serial interface is not working due to a hardware issue. If the Host PC were to communicate with the power supply by sending any other command, for example, a two-byte Get Current Status command string 'pp', then a situation might arise when the power supply comes out of reset after the first character of the two-byte sequence has been sent. As a result, the power supply would only receive the second byte of the two-byte command string and thus the command-data protocol will be out of sync with the power supply waiting for the second character of the two-byte string.

Construction: The host will send a 1-byte message. The message will be only the 'o' character.

Reply: The power supply will respond a one byte message of '!'.

Example: To request the current temperature set point the host will send:
0x6f;
The power supply will reply with:
0x21.

Command: Set Power

Character: A

Description:	The set power command configures the power set point with a resolution of 1 watt.
Valid Range:	0 – 300W; If the parameter is set between 300 and 32767 then the power setting is maxed at 300. If the parameter is set between 32767 to 65535 then the power setting is wraparound to 0.
Construction:	The host will send a 4-byte message. The first byte will be the 'A' character, the second and third bytes contain the power set point with the LSB in byte 2 and the MSB in byte 3, the fourth byte is the checksum.
Reply:	The power supply will echo back the command. If an invalid set point is transmitted the power supply will reply with the set point it is going to use. The reply construction is identical to the command instruction.
Example:	To configure a set point of 150 Watts the host will send: 0x41 0x96 0x00 0xD7; The power supply will reply with: 0x41 0x96 0x00 0xD7.

Command:	Get Power Set Point
Character:	B
Description:	Returns the current power set point.
Construction:	The host will send a 2-byte message. The first byte will be the 'B' character and the second byte will be the checksum.
Reply:	The power supply will reply with a 5-byte message. The first byte is an echo of the 'B' character, the second byte is the number bytes remaining in the message, 0x03, bytes 3 and 4 contain the power set point with the LSB in byte 3 and MSB in byte 4, the last byte is the checksum
Example:	To retrieve the current power set point the host will send: 0x42 0x42; The power supply will reply with: 0x42 0x03 0x96 0x00 0xDB; This shows the current power set point is 150 W.

Command:	Change to power mode
Character:	D
Description:	When issued before Run command this command switches the power supply to power mode. The command has no effect if issued while the power supply is running; the power supply would echo back the current mode.
Construction:	The host will send a 2-byte message. The first byte is the character 'D' and the second byte is the checksum.
Reply:	The power supply will echo back the current mode with checksum.
Example:	To change to power mode the host will send: 0x44 0x44; The power supply will reply with: 0x44 0x44.

Command:	Get current status
Character:	p
Description:	Returns the current status of the power supply.
Construction:	The host will send a two byte message, the first byte will be the command 'p' and the second byte will be the checksum.

Reply: The power supply will reply with a 15 byte message. The first byte is an echo of the command 'p'. Bytes 3 and 4 contain the thermocouple value with the LSB in byte two. Bytes 5 and 6 contain the current power output from the generator in watts with the LSB in byte four. Bytes 7 to 10 contain the time set point in milliseconds. Bytes 11 and 12 contain the status bits. Bytes 13 and 14 contain the error bits and byte 15 is the checksum.

Example: To request the current status the host will send:
0x70 0x70;
The power supply will reply with:
0x70 0x0D 0x78 0x00 0x00 0x00 0xFF 0xFF 0x00 0x00 0xA6 0x00 0x00 0x04 0x9D;
Decomposing this example we see:

TC1 Value = 0x0078 = 120/4 = 30;
Power Output = 0x0000 = 0W;
Timer = 0x0000FFFF = 65535ms;
Current Status = 0x006A = 0b10100110.

BIT	STATUS
0	Running? 0 is not running 1 is running
1,2,3	Mode: 1 = Temperature 2 = not used 3 = Power 4 = Time
4	Green LED 0 = off 1 = on – Can be ignored
5	Yellow LED 0 = off 1 = on in Power Off – Can be ignored
6	Red LED 0 = off 1 = on – Can be ignored
7	Temperature Units 1 = °C 0 = °F
8-15	Not Used

Error Bits 0x0400 = 0b0000010000000000.

BIT	ERROR
0	Corrupted configuration structure in EEProm
1	Line voltage too low
2	Line voltage too high
3	Main Power Off
4	No Load Connected
5	Circuit Breaker Tripped (note no CB in NxThera Unit)
6	Control Board Overheat
7	Thermal Fuse 1 Trip
8	Thermal Fuse 2 Trip
9	Thermocouple 1 disconnected
10	Not used, will always be 1
11	Set power greater than maximum power
12	Invalid Load
13	Not used
14	Not used
15	Generic Error

No errors being reported in example.

Command: Get Thermocouple gain and offset
Character: 'J'

Description:	Returns the thermocouple gain and offset
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'J' and the second byte is the checksum = 'J'.
Reply:	The power supply will send a 9-byte message. The first byte is an echo of the 'J'; the second byte is the number of bytes remaining in the message, 0x07, including the checksum; the next four bytes are a float representing the gain (LSByte first); the 7th and 8th bytes are a short representing the thermocouple offset (LSByte first). And the 9th byte is the checksum. **NOTE:** The offset value is in quarters of deg C, see the example below.
Example:	To request the TC gain and offset the host will send: 0x4A 0x4A; If gain = 1.0 and offset = 1C then the power supply will reply with: 0x4A 0x07 0x00 0x00 0x80 0x3F 0x04 0x00 0x14; Decomposing the message we get the gain = 1.0 and offset = 1°C

Command:	Set Thermocouple gain and offset
Character:	'K'
Description:	Sets the thermocouple gain and offset (in Celsius with a resolution of 0.25°C)
Valid Range:	N/A
Construction:	The host will send an 8-byte message. The first byte is the character 'K'; the next four bytes are a float representing the gain (LSByte first); the 6th and 7th bytes are a short representing the thermocouple offset (LSByte first). And the 8th byte is the checksum.
Reply:	The power supply will echo back the command. The reply construction is identical to the command construction. If the checksum failed then the power supply will echo the message with the failed checksum and will not update the internally used parameters. If the power supply failed to store the new values in EEPROM then the power supply will change the internally used parameters to defaults (gain = 1 and offset = 0) and send them to the host. Contact iTherm in this case.
Example:	To set the TC gain =1.0 and offset = 1C the host will send: 0x4B 0x00 0x00 0x80 0x3F 0x04 0x00 0x0E; The power supply will reply with: 0x4B 0x00 0x00 0x80 0x3F 0x04 0x00 0x0E.

Command:	Get PID parameters
Character:	'L'
Description:	Returns the proportional, integral and derivative coefficients
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'L' and the second byte is the checksum = 'L'.
Reply:	The power supply will send a 15-byte message. The 1st byte is an echo of the 'L'; the 2nd byte is the number of bytes remaining in the message, 0x0D, including the checksum; the 3rd-6th bytes are a float representing the proportional coefficient (LSByte first); the 7th - 10th bytes are a float representing the integral coefficient (LSByte first); the 11th - 14th bytes are a float representing the derivative coefficient (LSByte first); and the 15th byte is the checksum.

Example:	To request the PID parameters the host will send: 0x4C 0x4C; If all coefficients are 1.0 then the power supply will reply with: 0x4C 0x0D 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x96; Decomposing the message, we get proportional coefficient – integral coefficient = derivative coefficient = 1.0.
Command:	Set PID parameters
Character:	'M'
Description:	Sets the PID parameters
Valid Range:	N/A
Construction:	The host will send a 14-byte message. The first byte is the character 'M'; the 2nd -5th bytes are a float representing the proportional coefficient (LSByte first); the 6th - 9th bytes are a float representing the integral coefficient (LSByte first); the 10th - 13th bytes are a float representing the derivative coefficient (LSByte first); and the 14th byte is the checksum.
Reply:	The power supply will echo back the command. The reply construction is identical to the command construction.
Example:	To set the proportional = integral = derivative coefficient to 1.0 the host will send: 0x4D 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x8A; The power supply will reply with: 0x4D 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0x8A.
Command:	Get output modulation frequency
Character:	'N'
Description:	Returns the output modulation frequency in Hz
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'N' and the second byte is the checksum = 'N'.
Reply:	The power supply will send a 4-byte message. The 1st byte is an echo of the 'N'; the 2nd byte is the number of bytes remaining in the message, 0x02, including the checksum; the 3rd byte is an unsigned char representing the output modulation frequency in Hz; and the 4th byte is the checksum.
Example:	To request the output modulation frequency the host will send: 0x4E 0x4E; If output modulation frequency is equal to 16 Hz then the power supply will reply with: 0x4E 0x02 0x10 0x60; Decomposing the message, we get output modulation frequency of 10Hz.
Command:	Set output modulation frequency
Character:	'O' (capital letter 'O')
Description:	Sets the output modulation frequency
Valid Range:	N/A
Construction:	The host will send 3 bytes. The first byte is the character 'O'; the 2nd byte is the output modulation frequency in Hz; the 3rd byte is the checksum.

Reply:	The power supply will echo back the command. The reply construction is identical to the command construction.
Example:	To set the output modulation frequency to 16 Hz the host will send: 0x4F 0x10 0x5F; The power supply will reply with: 0x4F 0x10 0x5F;

Command:	Get Viper1 – Viper 2 mode
Character:	'P' (capital letter 'P')
Description:	Returns Viper 1 vs. Viper 2 mode and the pulse length when running in Viper1 mode
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'P' and the second byte is the checksum = 'P'.
Reply:	The power supply will send a 6-byte message. The 1st byte is an echo of the 'P'; the 2nd byte is the number of bytes remaining in the message, 0x04, including the checksum; the 3rdbyte = 0x01 for Viper 1 mode or 0x02 for Viper2 mode; the 4th - 5th bytes are an unsigned short representing the pulse length in µsec; and the 6th byte is the checksum.
Example:	To request the mode the host will send: 0x50 0x50; If the power supply is in Viper 1 mode of operation and pulse length = 100µs then the power supply will reply with: 0x50 0x04 0x01 0x64 0x00 0xB9; Decomposing the message, we get Viper 1 with the pulse length =100µs. **NOTE:** If the power supply is in Viper 2 mode of operation then the host should ignore the pulse length field as it is irrelevant.

Command:	Set Viper1 – Viper 2 mode
Character:	'Q'
Description:	Sets Viper 1 vs. Viper 2 mode of operation and pulse length to be used when operating in Viper 1 mode. This command is ignored if sent while the power supply is running.
Valid Range:	Mode character = 1 or 2
Construction:	The host will send a 5-byte message. The first byte is the character 'Q'; the 2rd byte = 0x01 for Viper 1 mode or 0x02 for Viper2 mode; the 3rd –4th bytes are an unsigned short representing the pulse length in µsec; and the 5th byte is the checksum.
Reply:	The power supply will echo back the command. The reply construction is identical to the command construction.
Example:	To set the Viper 1 mode with pulse length =100µs the host will send: 0x51 0x01 0x64 0x00 0xB6; The power supply will reply with: 0x51 0x01 0x64 0x00 0xB6.

Command:	Get Line Voltage Scaling Factor
Character:	'R'
Description:	Returns Line Voltage Scaling Factor
Valid Range:	N/A

Construction:	The host will send a 2-byte message. The first byte is the character 'R' and the second byte is the checksum = 'R'.
Reply:	The power supply will send a 7-byte message. The 1st byte is an echo of the 'R'; the 2nd byte is the number of bytes remaining in the message, 0x05, including the checksum; the 3rd - 6th bytes are a 32-bit float representing the scaling factor; and the 7th byte is the checksum.
Example:	To request the line voltage scaling factor the host will send: 0x52 0x52; If the scaling factor is equal to 1.0, the power supply will reply with: 0x 52 0x05 0x00 0x00 0x80 0x3F 0x16.

Command:	Set Line Voltage Scaling Factor
Character:	'S' (capital 'S')
Description:	Sets Line Voltage scaling factor
Valid Range:	0.0 to 10.0
Construction:	The host will send a 6-byte message. The first byte is the character 'S'; the 2rd-5th bytes are a 32-bit float representing the pulse scaling factor; and the 6th byte is the checksum.
Reply:	The power supply will echo back the command. The reply construction is identical to the command construction.
Example:	To set the scaling factor to 1.0 the host will send: 0x53 0x00 0x00 0x80 0x3F 0x12; The power supply will reply with: 0x53 0x00 0x00 0x80 0x3F 0x12.

Command:	Get Power Scaling Factor
Character:	'T'
Description:	Returns Power Scaling Factor
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'T' and the second byte is the checksum = 'T'.
Reply:	The power supply will send a 7-byte message. The 1st byte is an echo of the 'T'; the 2nd byte is the number of bytes remaining in the message, 0x05, including the checksum; the 3rd - 6th bytes are a 32-bit float representing the scaling factor; and the 7th byte is the checksum.
Example:	To request the line voltage scaling factor the host will send: 0x54 0x54; If the scaling factor is equal to 1.0, the power supply will reply with: 0x 54 0x05 0x00 0x00 0x80 0x3F 0x18.

Command:	Set Power Scaling Factor
Character:	'U' (capital 'U')
Description:	Sets Power scaling factor
Valid Range:	0.0 to 10.0
Construction:	The host will send a 6-byte message. The first byte is the character 'U'; the 2rd-5th bytes are a 32-bit float representing the pulse scaling factor; and the 6th byte is the checksum.
Reply:	The power supply will echo back the command. The reply construction is identical to the command construction.

Example:	To set the scaling factor to 1.0 the host will send: 0x55 0x00 0x00 0x80 0x3F 0x14; The power supply will reply with: 0x55 0x00 0x00 0x80 0x3F 0x14.

Command:	Get Line Voltage
Character:	'V' (capital 'V')
Description:	Returns Line Voltage
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'V' and the second byte is the checksum = 'V'.
Reply:	The power supply will send a 5-byte message. The 1st byte is an echo of the 'V'; the 2nd byte is the number of bytes remaining in the message, 0x03, including the checksum; the 3rd - 4th bytes are a 16 bit integer representing the line voltage in Volts; and the 5th byte is the checksum.
Example:	To request the line voltage mode the host will send: 0x56 0x56; If the line voltage is equal to 240 V, the power supply will reply with: 0x56 0x03 0xF0 0x00 0x49.

Command:	Get analog input gain and offset
Character:	'W'
Description:	Returns the analog input gain and offset in mV
Valid Range:	N/A
Construction:	The host will send a 2-byte message. The first byte is the character 'W' and the second byte is the checksum = 'W'.
Reply:	The power supply will send an 11-byte message. The first byte is an echo of the 'W'; the second byte is the number of bytes remaining in the message, 0x09, including the checksum; the next four bytes are a float representing the gain (LSByte first); the next four bytes are a float representing the offset (LSByte first). And the 11th byte is the checksum.
Example:	To request the analog input gain and offset the host will send: 0x57 0x57; If gain = 1.0 and offset = 1mV then the power supply will reply with: 0x57 0x0B 0x00 0x00 0x80 0x3F 0x00 0x00 0x80 0x3F 0xE0; Decomposing the message we get the gain = 1.0 and offset = 1.0mV.

APPENDIX B: DECLARATION OF CE CONFORMITY

Declaration of Conformity

In accordance with ISO/IEC 17050

DoC#: 090601

iTherm Technologies
166 W Lakeshore Drive
Colchester, VT 05446 USA

Induction Heating Equipment Model HIG 1.4-CE is complaint with the CE directives and standards listed below.

Directives:

Electromagnetic Compatibility (2004/108/EC)
Low-Voltage (2006/95/EC)

Standards:

EMC: EN 61326-1:2006 Industrial
Safety: EN61010-1:2001, EN 60204:2006

This product was tested by an ISO 17025 accredited facility.
This manufacturer employs an internal production control system, which assures compliance between the manufactured products and the technical documentation.

BY: _____ Date: JUNE 30, 2009

Stefan Von Buren
Director of Operations
iTherm Technologies L.P.