KISS-488™ User Guide

2026-04-30

Keep

It

Simple

Stupid!

For use with KISS-488 Firmware Rev 2.64 or later

DISCLAIMER: KISS-488 is a technical support device for laboratory instruments, and as such the end user is ultimately responsible for the safe and appropriate application of this device in a given environment. Neither Hx Engineering, LLC nor its partners, distributors, or suppliers shall be liable for any damages from whatever cause. The sole remedy shall be to replace a device which was defective when shipped from Hx Engineering, LLC.

Grateful thanks to beta testers Chas Gilmore and Cliff Nazelli whose extensive recommendations from their vast experience greatly enhanced this product!

Technical support is most readily available via email to Support@HxEngineering.com.

Preface

Differences between versions 1 & 2

- Version 2 hardware adds a standard USB/serial port. All other features are available on version 1 hardware by loading the latest firmware version.
- Version 2 supports a ProLogix-compatible command set, for Controller mode only (Device mode is not supported). Supported via either TelNet or USB/serial.
- Improved Control page, allowing the user to name each string of commands and displaying the most recent reply to each command individually.
- Instrument Search function now automatically sets the address field to the detected address, notes whether found or not, and moves any KISS-488 addresses out of the way.
- Graph page automatically displays the most recent capture until the user selects an older file.
- Commands for screen capture and data logging are moved to the Control page.
- Minor streamlining of web pages.
- Improved response times.
- Version info, IP address and MAC address available via USB/serial port and via TelNet.
- Bootloader can now be used without changing the PC's IP address.
- Version 2 firmware is backward compatible with Version 1 hardware, implementing all the new improvements except the USB serial port.
- Timeouts now allow a custom message, including a null message which changes the timeout mechanism to be more compatible with Prologix.
- LED flashes the IP address in yellow if unable to connect to the network.
- Screen captures now include the ability to capture and save .TXT and .CSV files.
- Spy mode added, to monitor the IEEE-488 bus under another Controller.
- Version 1 hardware is contained within a cast metal backshell of the IEEE-488 connector. Version 2 hardware is contained within a rectangular plastic backshell.

1) Intro to IEEE-488

Much confusion surrounds the nomenclature for the IEEE-488 bus. Originally a simple byte-parallel bus with simple handshaking, other protocols and requirements have been added atop the various implementations, and manufacturers have also introduced their own terminology. The following glossary hopes to dispel more confusion than it creates. Throughout this manual we will refer generically to the IEEE-488 bus except where necessary to be more specific. History and technical references are available via Wikipedia and other Internet sources.

IEEE-488

IEEE-488 is the original spec, although often used generically (as in this manual) to refer to later incarnations.

IEEE-488.1

The .1 suffix specifically refers to the original spec, with only an electrical and mechanical specification, and no logical specification riding atop that spec.

IEEE-488.2

The .2 suffix refers to the IEEE-488.1 bus, plus specified commands required to be supported by all instruments claiming compliance with this standard. Such commands are in ASCII text, and typically begin with an asterisk (*). Some commands are only for execution, some commands query particular information, and some commands have both query and execution forms. The query forms are usually distinguished by the presence of a trailing question mark (?). These commands are very generic, such as *CLS to clear status and *IDN? to request instrument identification. Commands are not case-sensitive.

SCPI

Standard Commands for Programmable Instruments is a language specification and superset of the commands specified for IEEE-488.2. Technically SCPI could be implemented on serial, TelNet, or other byte-serial media, but it is most commonly used on IEEE-488.2. Commands are typically somewhat verbose, with very specific rules as to what abbreviations are allowable. Such rules are violated by some manufacturers. Some commands require one or more parameters, which can be numeric, textual, etc. The reply to a query command is typically in a format that can be sent back to the same command as a parameter to later restore that particular setting. The SCPI standard specifies a number of standard commands for common instrument functions, but actual real-world use of nearly any instrument will require reference to the programming manual for the instrument. Such a manual also normally contains additional details relating to the SCPI spec, such as punctuation, methods of chaining commands together, etc.

GPIB

General Purpose Interface Bus is a term applied by some manufacturers to refer to any or all incarnations of the IEEE-488 bus.

HPIB

Hewlett Packard Interface Bus is the term applied by the Hewlett-Packard company, later known as Agilent and still more recently as Keysight.

Addressing Protocol

On the IEEE-488 bus, one device is designated as the system controller. The system controller can delegate the active control authority to another device, but can always reclaim control authority via the IFC (Interface Clear) line.

The active controller sends out addressing commands. These commands typically designate one device (possibly itself) as a talker and one or more devices as listeners. For example, when sending a command such as `*IDN?`, the controller will address itself as Talker and the instrument as Listener, send the 5 characters of the command followed by a terminator (see below), and then address itself as Listener and the instrument as Talker. The instrument will buffer its response until addressed to talk, at which time the buffered data will be issued on the bus and received by the Listener.

At the completion of the transaction, the active controller may issue an Untalk and an Unlisten command, leaving the bus in a quiescent state until the next transaction.

2) Physical Connection

WARNING

The IEEE-488 interface of KISS-488 provides up to 1500 Vrms isolation for up to one minute between the Ethernet cable and the instrument into which it is plugged. However, the KISS-488 power supply ground and USB ground are common to the instrument's IEEE-488 ground. If you power the unit from your computer via the USB cable, the computer should be plugged into the same circuit or power strip as the instrument. If you choose to use any other 5V source with a similar connector (not recommended), you are responsible to ensure appropriate galvanic isolation between KISS-488 and any connected devices.

Plug It In

Remove those big clunky IEEE-488 cables from the back of your instrument and insert KISS-488 directly into the instrument's IEEE-488 connector. Gently plug a USB cable into the USB-B-mini connector on KISS-488, and then plug other end of the USB cable into a computer running from the same wall outlet or power strip as your instrument. Connect a standard Ethernet (RJ-45) cable between KISS-488 and a network hub, switch or router, or use a Crossover cable to connect directly to a PC.

Note that in the interest of the KISS principle, there should be only one KISS-488 on the 488 bus, and only one instrument on that bus. The intent is to plug KISS-488 directly to the back of the instrument, and go from there with USB and/or Ethernet cabling. An IEEE-488 cable can be used to allow arbitrary placement of KISS-488, but it's strictly a one-to-one connection on the 488 side. It is possible under some circumstances to connect two or more instruments using standard IEEE-488 cables, but driving such an arrangement with KISS-488 violates the electrical specifications of the IEEE-488 bus and reliable operation is not guaranteed.

Inquire via email to sales@hxengineering.com regarding bulk purchases of KISS-488 units where multiple instruments need to be connected.

3) Logical Connection

Finding the IP address of an embedded web server lacking a local display can be a challenge. KISS-488 provides a number of ways to determine this address, depending on your operating environment. They are listed below from the simplest to the most complex, and the more complex methods are needed only if earlier ones are not usable in your environment.

Note that some anti-virus products require exceptions to allow KISS-488 through the protective shield. Avast products in particular have been noted to have difficulty with embedded web servers similar to KISS-488. KISS-488 uses only standard Ethernet TCP protocols, but your protection software may require that you set up an exception to allow traffic to and from KISS-488, either by its NetBIOS name as set by the user, or by its specific IP address. For this reason and others, you will likely wish to lock down the IP address of KISS-488, either by an entry in your DHCP server's assignment table, or via the KISS-488 configuration page.

Note also that KISS-488 will normally use a "non-routable" IP address, suitable for use on a local network and not accessible outside that network. Home and small business routers typically assign addresses such as 192.168.x.x or 172.16.x.x. Large business routers often use 10.x.x.x. If no DHCP server is available, KISS-488 will assign itself an AutoIP address in the 169.254.x.x range. These addresses are visible through a hub or switch, but usually not on the far side of a router without special arrangements.

Serial Port

Most operating systems will automatically assign a communications port to KISS-488 when plugged in. Under Windows you can go to Control Panel / Device Manager / Ports to see the assigned COMn port number. If in doubt, keep Device manager open when plugging in KISS-488; the new port that appears will be the correct port. Advanced users can further configure Device Manager to assign a specific port number if desired. Regardless, the assigned port number will remain the same if unplugged and later reconnected, unless some intervening action makes the port number unavailable.

Note that you can also use Microsoft's USB Viewer Utility ("USBView.Exe") on a PC to examine the configuration of the USB side of KISS-488, which should appear with a Manufacturer of "HxEngineeringLLC" and a Product of "KISS-488", as well as a serial number matching that on the printed label.

With KISS-488 connected you can use your favorite serial terminal program, set to 115,200 BPS, 8, N, 1, and enter the command

```
++ver
```

to confirm communications. You can then use the command

```
++IP
```

to determine the assigned IP address, for use with TelNet or your browser and

```
++MAC
```

to determine the permanently assigned MAC address of the device, which should match the printed label on the outside of the enclosure.

Enabling NetBIOS

Recent versions of Windows disable the use of NetBIOS by default. In order to enable NetBIOS on Windows 10 (the process is similar for other Windows versions, but will differ for other operating systems), follow these steps:

1) Open Control Panel (press the Start button and type Control Panel).

2) Click on Network and Sharing Center.

3) In the left pane, select Change Adapter Settings.

4) Select the network adapter being used to connect to KISS-488 and click on Properties.

5) Select Internet Protocol Version 4 (TCP/IPv4) and click on Properties.

6) Click the Advanced button.

7) Select the WINS tab.

8) Under NetBIOS Setting, select either Default or preferably Enable.

9) Click OK and back out of the nest of dialog boxes.

With NetBIOS enabled, you can now easily connect to KISS-488 by name.

NetBIOS Name Lookup

The easiest way to find KISS-488 on your local network is to simply type HTTP://**Error! Hyperlink reference not valid.** name> (netbios name is set by default to HP34401A) into your browser's address bar. You must include the HTTP prefix and punctuation; without it, most browsers will convert it into a web search, sometimes with "interesting" results. Note also that it is possible to configure KISS-488 with a NetBIOS name of your choice, consisting of one to 15 alphanumeric characters.

Ping

If your environment supports Ping (Ethernet ICMP) capability, simply ping the NetBIOS name assigned to the unit. In all recent versions of Windows, open a command prompt by clicking on Start and typing CMD, then enter the command `PING HP34401A`. If KISS-488 is accessible on the local network, Ping will display the IP address (such as 192.168.1.5) as well as some other information about the link. You can then enter the IP address directly in your web browser's address bar or as a TelNet address.

Address Resolution Protocol

At the command prompt as above, enter the command `ARP -A`. The resulting table can be checked for the MAC address printed on the KISS-488 label, shown with the associated IP address.

DHCP Server

Many DHCP servers have the ability to display a list of IP addresses they have assigned to specific devices, often displaying corresponding MAC addresses and / or NetBIOS names. This includes many consumer-grade and business-grade routers and WiFi access points. In such a case, the simplest method may be to just connect KISS-488 and review the list in the DHCP server to determine what address was assigned. Many DHCP servers have the additional capability to pre-assign a specific IP address to a particular device, so that the device's address will remain the same regardless of the order in which equipment connects to the bus, any time KISS-488 is on the local network.

Announce Protocol

Run a UDP listener. Set it to listen on port 30303, with data format US-ASCII. When KISS-488 connects to the network (at power up or by connecting the network cable), it will self-announce showing its IP address as well as additional information. You may see two or more such announcements, as KISS-488 assigns itself an address pending an assignment from the network's DHCP server. Only the last announcement remains valid.

You can also receive the Announce packet via any host listening on UDP port 30303. The packet will give the KISS-488 IP address, NetBIOS name, MAC address, and firmware version information, all in ASCII plaintext.

AutoIP Protocol

If for any reason your network fails to assign an IP address (no DHCP server, restricted access, etc.), KISS-488 will attempt to self-assign an address using the AutoIP protocol, starting at 169.254.1.80 and incrementing until it finds an address that does not create a conflict with other devices on the Ethernet network.

Network Analyzer

If you are using a smartphone etc., there are various "Network Analyzer" apps available to assist in finding the IP address of a device. There are similar programs available for PC use, such as “Angry IP Scanner”. Many such programs are available as free downloads from various places around the Internet.

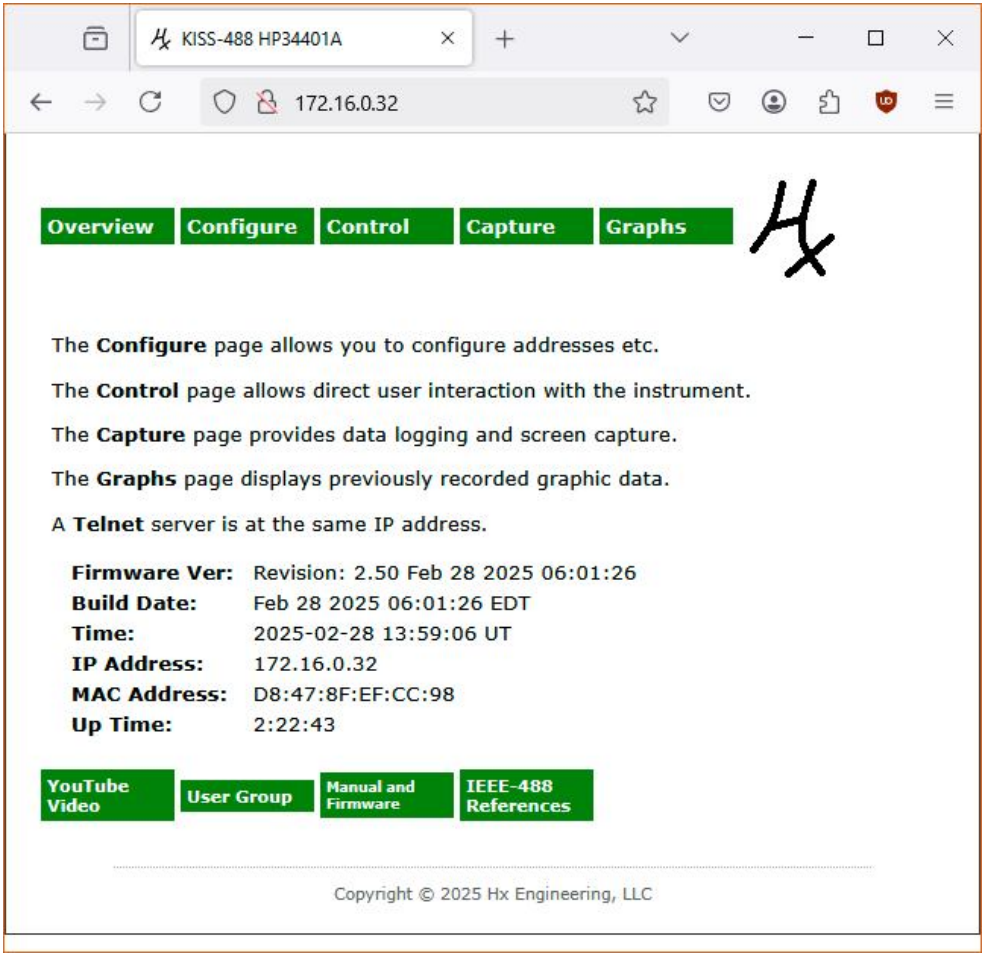
Bigger Hammer

If all else fails, get a bigger hammer! KISS-488 will advertise its own IP address using the LEDs on the unit. Note that it need not be plugged into the physical IEEE-488 plug for this function. Simply connect to your network and apply power. Unless an HTTP or Telnet connection to KISS-488 is active, or data logging is running, the green LED will blink a number of times to report each digit in turn, and the red LED will flash for the '.' separators between the four numbers. Zeroes will simply appear as a slightly longer pause. Thus, to indicate an address of 172.16.0.57, the flashes go like this:

Long Pause
Green (1)
Green Green Green Green Green
Green Green (7)
Green Green (2)
Red (.)
Pause (0)
Green (1)
Green Green Green Green Green
Green (6)
Red (.)
Pause (0)
Pause (0)
Pause (0)
Red (.)
Pause (0)
Green Green Green Green Green (5)
Green Green Green Green Green
Green Green (7)
Repeat

Note that a zero in the ones digit can be confusing; other than a subtle timing difference, the flashes cannot depict the difference between 100, 10, and 1.

A common cause of DHCP failure and thus the use of AutoIP is a network disconnection. KISS-488 uses yellow instead of green for the above-described flashes in this case, as an alert for a possible disconnection.



4) Overview

With the browser connected to KISS-488, basic instructions are provided on each page for those who are familiar with the concepts involved. The default opening page when you connect gives a basic overview.

Live Data

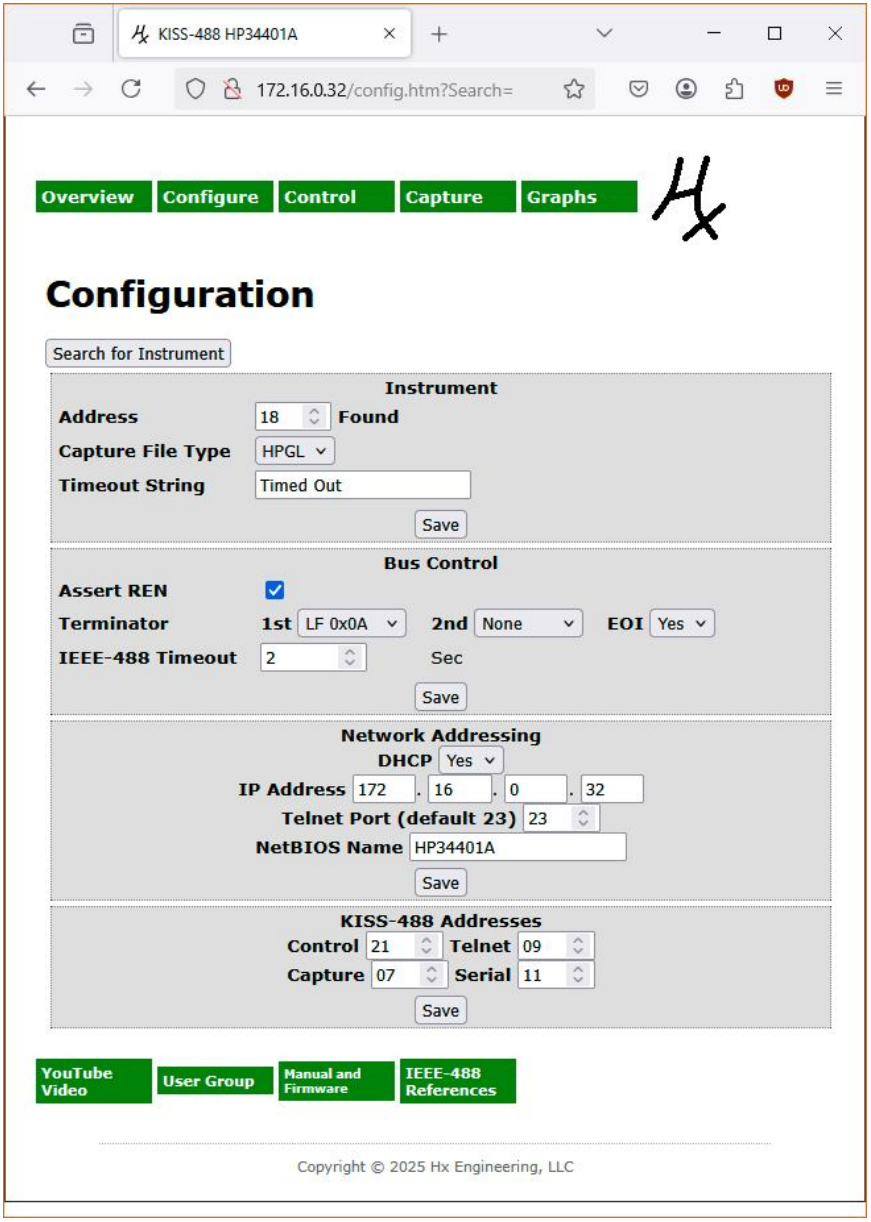
Note the data at the bottom of this page. The firmware version and build date are useful should you need to contact us for technical support. The time is live updating, and is set automatically via any available Internet time server; if no time server is reachable via internet, the time will be set to 1970-01-01 00:00:00 at power application. All times within KISS-488 are given in Coordinated Universal Time (except the Build Date and Time), avoiding the complexities of setting a time zone (KISS, remember!). The IP address may be useful for later connections, ,

or if you are using certain versions of Windows that have challenges reconnecting to the NetBIOS name. This IP address may also be needed to set up an exception for some antivirus etc. programs. The MAC address confirms that you are actually connected to the unit whose physical label shows that address.

Menu

The menu across the top of the page remains fixed for all pages, and allows direct access to any of the pages.

The menu items across the bottom of the page similarly remain fixed across all pages, but these links take you to other information references.



5) Configuration

This moderately complex screen is intended to be used once, to set up KISS-488 for a particular instrument, and ignored thereafter. There are several separate sections to this page. All configuration settings are saved in nonvolatile memory in KISS-488, so will appear the same to another

browser or another device. KISS-488 does not use cookies nor otherwise store any configuration information on the host.

The Search for Instrument button near the top of the page will attempt to address an instrument at each IEEE-488 bus address in turn. The search process takes most of a minute, and will automatically set the Instrument Address field if an instrument responds on the bus. After such a search, either “Found” or “Not Found” will appear alongside the Instrument Address field. If this address conflicts with any of the addresses set for KISS-488 itself, KISS-488 will politely step aside to another uncommitted address.

Instrument

NOTE: You MUST configure this section before attempting to access the instrument, whether via your browser or via Telnet or via USB/serial, unless you use the Prologix-compatible commands described below. Note also that you must click the Save button in the respective section to make the settings persist across a power cycle or other reset. As mentioned above, with care you can configure this section via the Prologix-compatible commands via Telnet or USB/Serial.

The address entered here must be the actual address of the IEEE-488 instrument to which KISS-488 is connected, which can be discovered via the Search for Instrument button described above. The instrument's IEEE-488 address is sometimes set with various mechanical switches or dials (often a row of 5 toggle switches), and sometimes via front panel functions. Consult the manual for your instrument; quite often the default address setting will work with no change. Use the Search for Instrument function described above and then select Save in this section.

Capture File Format

For instruments that support a screen capture function, such as an oscilloscope, spectrum analyzer, or vector network analyzer, set the Capture File Type as supported by the instrument. Many such instruments expect to find an HP plotter on the bus, and the corresponding HPGL commands are rendered by KISS-488 to native HTML graphics. Other instruments expect to find a raster-type plotter, or to generate a bitmap file in either the BMP or PCX standard PC file formats. These bitmap files are rendered by your browser if it supports the particular format.

New starting with version 2.50, you can also capture data generated by your instrument and save to a .TXT or .CSV file. Note that this is an entirely different function from the data logging function described below. For example, an oscilloscope may have a command to download the data points from the current waveform, along with a header to describe how to interpret that data.

Even if your browser does not support the selected format, you can still download the file and then display and/or manipulate it using

whatever compatible tools are available in your operating environment.

Timeouts

In case of an IEEE-488 bus timeout, KISS-488 can notify the user by returning a string such as “Timed Out”. Certain software, notably packages using Prologix-style commands, do not expect this string but rather expect a silent timeout. The default, therefore, is this silent timeout, using a null string. You can configure the Timeout String to be any desired printable ASCII text up to 15 characters long, including a null string.

If the string is set to a null string, the timeout mechanism switches to full Prologix compatibility, wherein the only “timeouts” are between consecutive bytes of a message, but the instrument can take an arbitrary time to begin its response.

Bus Control

Different manufacturers have supported a number of variations on the original simple handshake scheme. Command terminators in particular vary from one instrument to another. A very common protocol expects both a command and its response to be terminated with a Line Feed (LF, 0x0A, ‘\n’) character, with the EOI (End Or Identify) bus control line asserted during that character. Many instruments use various combinations of LF, Carriage Return (CR, 0x0D’ ‘\r’), and EOI. If EOI is used, it is only on the last terminating character in the case of a two-character sequence. EOI can also be used alone, as in the case of a binary transfer where a CR or LF can appear at any point within the data being transferred. In this case, EOI is asserted during the last byte of data being transferred.

The Timeout value determines how long KISS-488 will wait for a response, when a response is expected. Note that some instruments require a long time to respond; a timeout shorter than the instrument’s response time likely leads to garbage.

Network Addressing

The easiest way to add KISS-488 to your Ethernet network is to turn on DHCP (the default). With this setting, KISS-488 will, upon connecting with your network, negotiate with the DHCP server already running on your network (often in a router or switch), to be assigned an IP address that interacts properly with others on the network, without creating a conflict. If for any reason you wish to assign the IP address yourself, set DHCP to `NO` and enter the desired address. After saving the change, KISS-488 will need to reboot to move to the new address, and you will need to enter the newly assigned IP address in your browser.

KISS-488 uses the standard port 23 for Telnet by default, but you can configure it to use any valid port number here. If you choose to change the port number, you will need to advise your Telnet client of the correct port number.

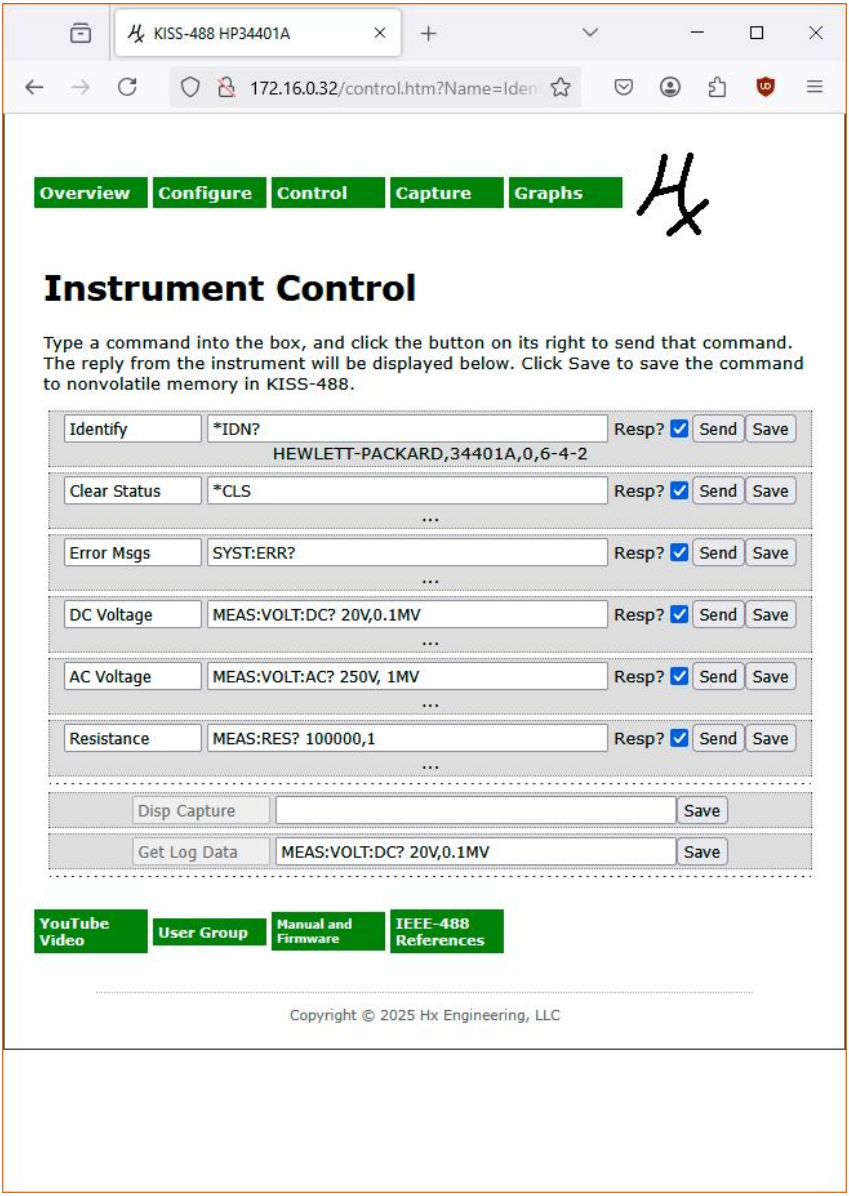
If you have more than one KISS-488 on your network, the NetBIOS names

may collide. In this case, or if you simply wish to have a specific name, you may enter any NetBIOS name consisting of one to 15 alphanumeric characters

KISS-488 Addresses

Although KISS-488 presents only one IEEE-488 load electrically on the bus, it responds logically as though it is four separate devices at distinct addresses on the bus. Commands that are sent from the Control page appear to originate from that specific IEEE-488 address, and replies are sent back to that address for display on the Control page. Screen dumps go to the Capture address, which appears to the connected instrument to be a plotter or printer at the indicated address. Interactions via the Telnet server provided in KISS-488 appear on the IEEE-488 bus from the indicated address, and instrument responses return to the same address. Similarly, the serial port appears to be at its own IEEE-488 address.

As long as none of the default addresses conflict with your instrument's address, you need not change these. If you use the Search for Instrument function to find your instrument’s address, these additional addresses will be automatically updated to avoid conflicts.



6) Control

The Control page allows you to directly interact with the instrument, and to configure frequently-used commands for easy repeated use. You can configure up to 6 such commands on this page. For each command, enter whatever name you wish to use to identify it, enter the desired text to send to the instrument,

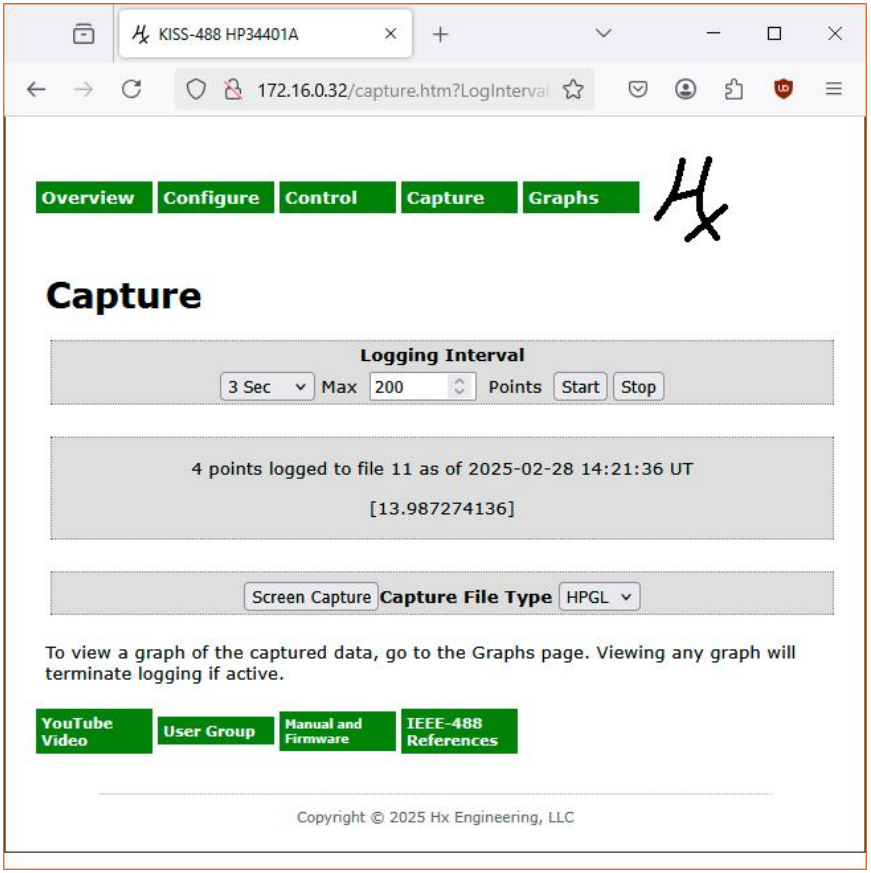
and set or clear the checkbox to notify KISS-488 whether it should wait for a response to that command. Note that most instruments, particularly those using SCPI, allow you to combine several commands on a single command line, as shown in several lines above.

Note here that the universe of possible instruments is much too large to document here. KISS-488 technical support cannot possibly cover all the possibilities, although we may be able to assist if we can access information about your instrument's command set. Please consult your instrument's documentation, which usually includes a section or even a separate manual on programming via the IEEE-488 interface. Such manuals can often be located online for older instruments whose manual may have been misplaced. Online manuals can sometimes be downloaded for free, and sometimes require a nominal payment. Older manuals often include examples written in BASIC or a similar early computer language. The command actually sent out on the bus is usually a literal string enclosed in quotes (") or sometimes stored in a string variable.

That said, lacking any other information, the command `*IDN?` is usually a good first command to try, as it will not impact the instrument in any way, and any instrument claiming compatibility with either IEEE-488.2 or SCPI is required to respond to this command. The lack of a response to `*IDN?` is a strong indication that your instrument pre-dates IEEE-488.2, and you will need to peruse its manual for equivalent commands to test with KISS-488. Many such instruments will respond to `ID` or `ID?`

Where a command elicits a response, the response received after the last invocation will be displayed immediately below the command.

The capture command is the command that should be sent to your instrument to trigger a screen dump. Some instruments blithely assume a plotter or printer set to always listen as the only listener on the bus, and thus improperly skip the addressing step; such instruments may have difficulty generating a screen dump via a front panel control, but KISS-488 anticipates this situation and automatically performs the correct bus addressing after sending the command. Note too that some instruments may continue to update the screen while doing a screen capture, and thus the capture will run very slowly and will result in strips each taken from a different update. Thus it may be desirable to include a command to freeze the display prior to the command to actually dump the data. Here as in all the commands configured on the Control page, you can chain commands together with punctuation as permitted by your instrument.



7) Capture

The Capture page controls the capture of graphical screens from the instrument. Two distinct functions are incorporated here. First, for instruments with a graphical screen display and which support a plot or print function to generate hardcopy, the Screen Capture button triggers a screen dump using the command configured on the configuration screen. For other instruments such as a multimeter, a complete datalogger functionality captures periodic data samples. Either type of graphic display is saved internally in nonvolatile memory, with up to 2 megabytes of such files saved before overwriting the oldest.

The above screenshot was generated during a data logging session with an HP34401A monitoring a portion of the Hx Engineering, LLC facility solar power. The middle section updates to show progress as the total number of samples captured updates.

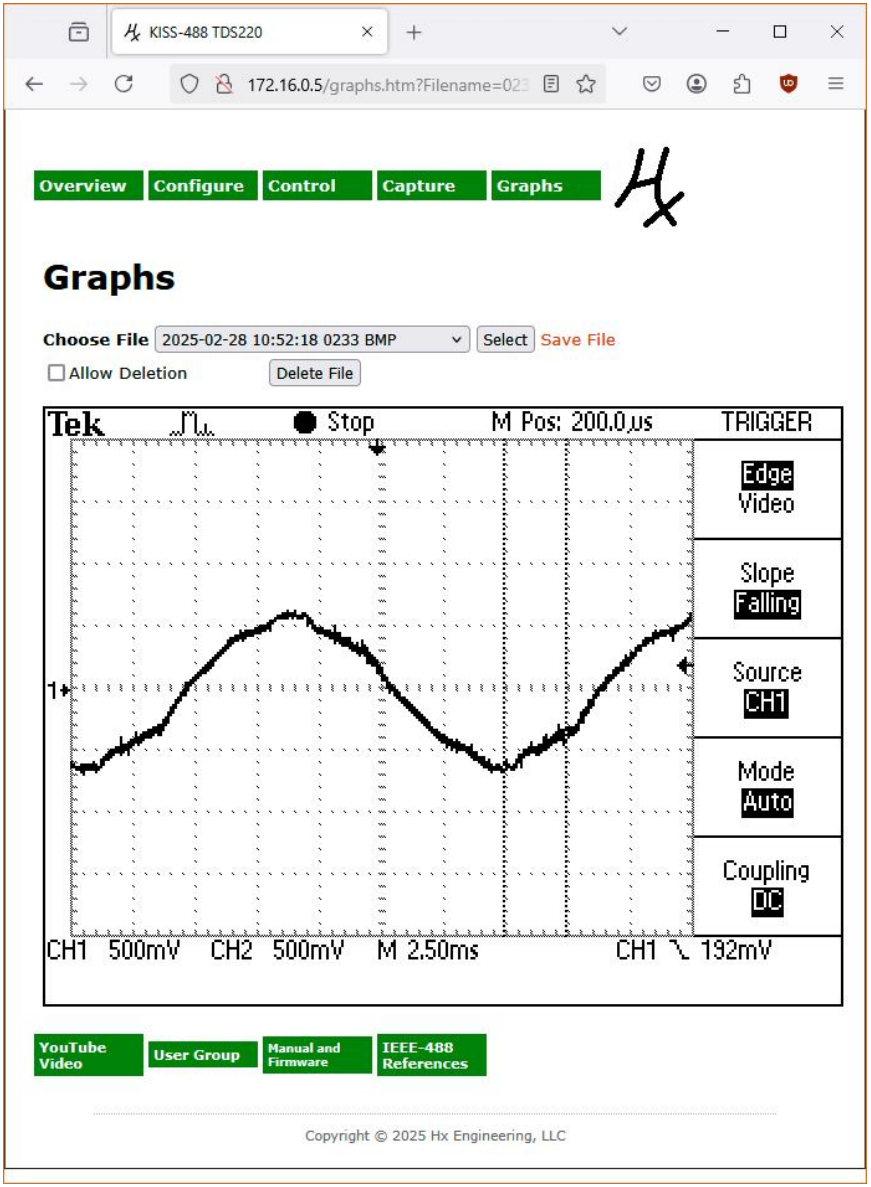
When logging individual data points using the data logging function, the number of points that have been logged updates in real time just

below the Logging Interval box, and the most recently received value appears in square brackets just below that line. This feature offers some assurance that the expected data is being logged, before waiting for what might be a very long time for a complete capture.

Data logging halts any time you go to the Graphs page, and of course if you set the logging interval to No Log, or if you change configuration such that KISS-488 can no longer access data, or if 2000 data points have been logged.

If logging is left on for more than 2000 data points, KISS-488 automatically closes the data file. A higher number of data points does not usually produce a useful graph. If you need a contiguous data set of more data points, simply save each set as a file and merge the files in any text editor.

If you cycle power, all settings and data will be retained EXCEPT the Logging Interval. Logging Interval will always be set to No Log at power up. The data captured prior to the power interruption may or may not be saved, if logging was in progress at the time of power loss.

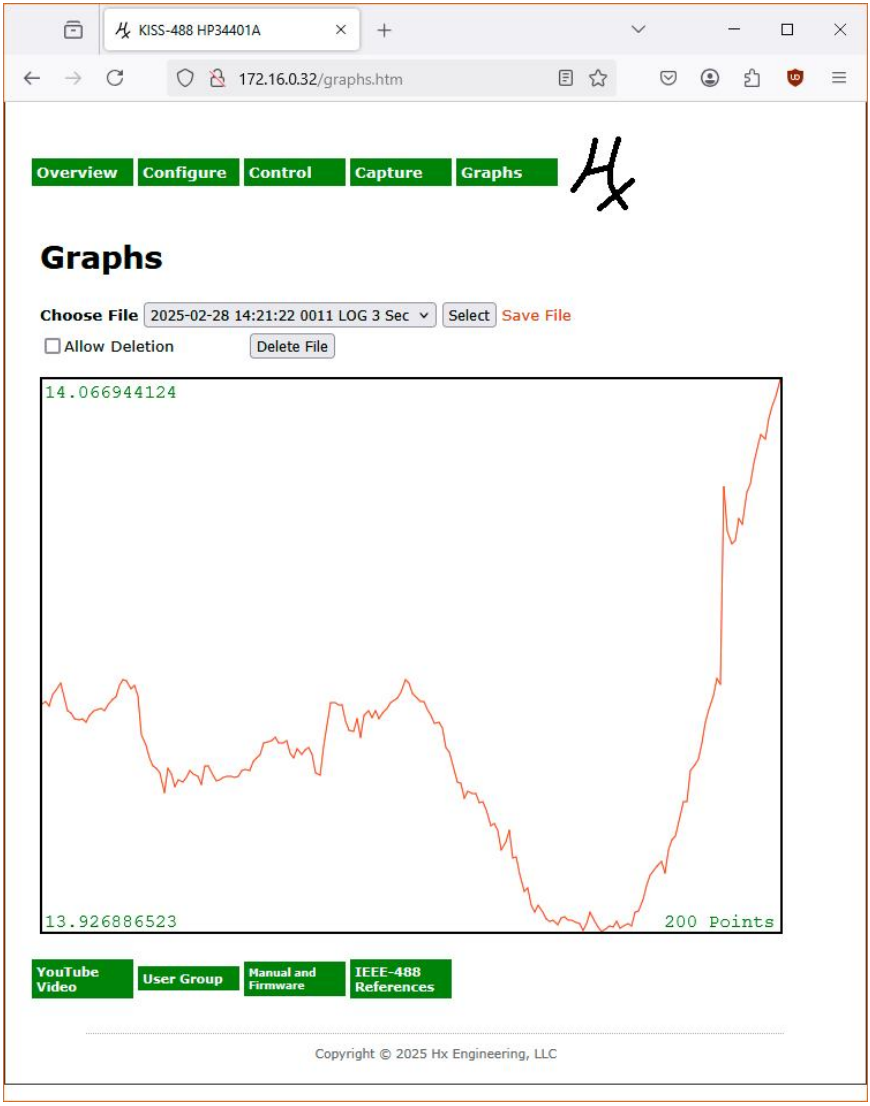


8) Graphs

Any data captured on the Capture page can be displayed or uploaded on the Graphs page. The time of the capture and type of the capture is noted along with each saved file and rendered appropriately when you request to display it. The screen depicted above was captured as a BMP format file from a Tektronix TDS220 oscilloscope. Regardless of

the file type, once the file has been selected, you can click on Save File, and the file will be sent to your browser for saving in your download directory as controlled by your browser. Some browsers will not display some file types, but the file can nonetheless be saved to your download directory for manipulation with any appropriate tools. For instance, if your instrument generates a graphic dump to a LaserJet printer and your browser does not support LaserJet format, the resulting file can be sent (in binary mode) from your PC to any printer supporting that format, or other software tools can be used to display and manipulate the file on your PC.

Below is a graph generated within KISS-488 of logged data from an HP34401A. It's currently wintertime in Ohio, and we rarely see the sun, but it peeked out briefly just at the end of this graph.

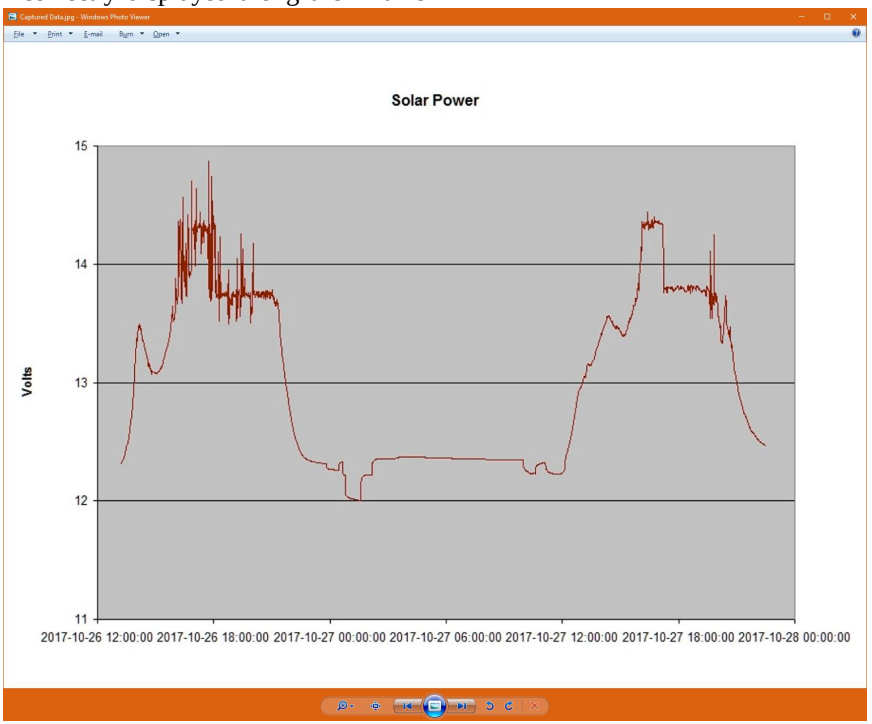


If data logging is active, viewing the Graphs page stops the logging and sets the log interval to No Log.

Note that downloading logged data results in a .CSV file that can be imported into Excel or any number of other tools, and prettied up for graphing. The first column of the resulting spreadsheet file is a timestamp. Excel is able to format this timestamp as a standard date and/or time, and again the timestamps are referenced to Coordinated Universal time, making the data readily trackable. A useful format for these cells appears in Excel under Custom formats, as `yyyy-mm-dd h:mm`. You can edit this format specifier to `yyyy-mm-dd hh:mm:ss`, so that the full resolution and range are displayed. If you then create an Excel Chart from the two columns of data, using X-Y style, the timestamps will be correctly displayed along the X axis and voltages or other appropriate units will be displayed as the values along the Y axis. Below is an example generated by KISS-488 connected to a Hewlett-Packard 34401A multimeter monitoring the voltage on the battery bank of a photovoltaic system, for approximately one day.

NOTE: KISS-488 saves all the graphical information in nonvolatile memory. Thus you can, if you wish, remove KISS-488 from the instrument and take it to another physical location to view, download, or print the graphs!

Note that in most Windows browsers, you can right-click on the graph area, and the browser will offer to save the image, allowing you to select the location and filename.



Starting with Rev 2.50, you can also delete individual files from the KISS-488 storage. With the intended file selected and displayed (if possible), check the box marked "Allow Deletion" and then select the Delete File button.

Special note for **Microsoft Internet Explorer**: IE prior to version 9.0 does not support graphing in HTML, so will not display the graphs on your browser. Most or all later versions of IE do not handle the file download mechanism correctly, although they will display correctly. Thus Internet Explorer is not recommended for use with KISS-488.

The preferred browser for KISS-488 is FireFox, but many other browsers fully implement HTML. Chrome and Edge have been shown to work with KISS-488 as well.

9) TelNet

KISS-488 also appears as a TelNet server on your Ethernet network. Any standard TelNet client becomes a direct console to your instrument's command interface. One TelNet client, shipped with most Windows versions, but often not activated by default, is TelNet.Exe.

NOTE: You MUST configure the Instrument section of the Configuration page using a browser, before Telnet will work. This need not be accomplished in the final location, because the information is saved internally in nonvolatile memory. That is, you could connect KISS-488 to your network and power, and do all the configuration, then move it to its final location on the back of your instrument.

TelNet.Exe

If TelNet is not activated on your Windows PC, open Control Panel,

select Programs and Features, then select Turn Windows Features On or Off, scroll down to TelNet Client, and check the checkbox.

Once TelNet is activated, you can run it by clicking Start and typing `TelNet HP34401A` (or replace HP34401A with the correct IP address or NetBIOS name). If your instrument is IEEE-488.2 compliant, a favorite command to test would be `*IDN?` (Identify). The instrument should respond with a string giving the instrument manufacturer's name, model name, firmware version number, etc. You can also capture all the instrument responses to a file by including the command line parameter

-f<filename>.

For instance, you might type

```
TELNET -fMyFile.Txt 172.16.0.57
```

to capture your session into a file called MyFile.Txt in the current working directory. You can also explicitly designate the directory in which to place the file using usual filename conventions, so Windows doesn't hide the file to save you from yourself.

HyperTerminal

The HyperTerminal.Exe utility was omitted from some recent versions of Windows, but can be copied from earlier versions. Instructions for the various versions are widely available on the Internet. Another useful terminal program PuTTY is also widely available. Set up a connection using TCP/IP (WinSock), using the assigned NetBIOS name or the numeric IP address and port 23 (or the Telnet port number configured on the KISS-488 Configuration page). After KISS-488 signs on, you will be typing directly to the IEEE-488 interface of your instrument, and replies will be displayed as they arrive.

HyperTerminal or PuTTY are also useful with the USB/serial port as described below.

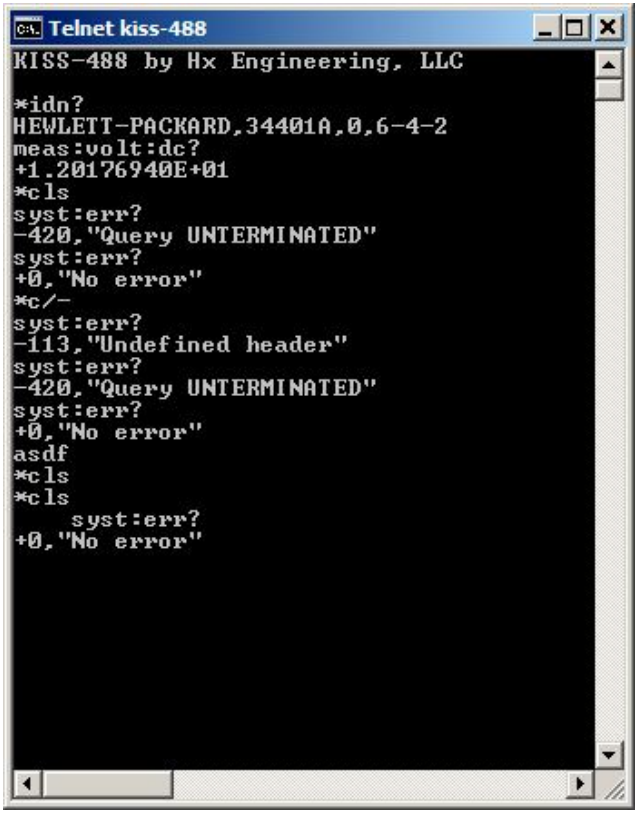
Telnet Usage

Note that all configuration information set on the web page using HTTP applies equally to the Telnet interface. The settings for REN and terminators are particularly relevant. Some instruments will throw an exception of one sort or another if addressed without REN being active; other instruments don't need REN to be active, but instead treat it as a front panel lockout. Also, when you type a command and press <Enter>, KISS-488 replaces <Enter> with the correct configured terminators for the instrument.

Lacking special action by the user, the Telnet interface has no way to know whether a particular command expects a response, or whether the command string is even valid. KISS-488 dutifully sends whatever string of characters you type, plus the configured terminator(s), then addresses the instrument to talk, and waits for a reply. One example of a command where this action is problematic is the IEEE-488.2 command `*CLS`. This command evokes no response, so KISS-488 simply waits for the configured timeout period, and the instrument may throw an exception because it was addressed to talk but had nothing to say. Because of this scenario, you may wish to use a fairly short timeout setting when using Telnet. In the specific case of `*CLS`, an alternative is to repeatedly issue the command `SYST:ERR?` until a response of `+0,"No error"` comes back, at which time the error status should have been cleared.

To address (pun intended) the case where no response is expected, you may terminate typing a command with LF (0x0A) rather than CR (0x0D). On a standard PC keyboard, use <Ctrl><Enter> to generate a LF character. When a command finishes with CR, KISS-488 expects a reply and addresses the instrument accordingly. When the command ends with LF, KISS-488 sends the command, then just issues Untalk and Unlisten commands to leave the bus in a quiescent state. Note, however, that if you use this option and the instrument does have something to say in reply, the instrument may throw an exception at the succeeding command, because you never read the previously-requested reply.

Up to two Telnet sessions can be active simultaneously. Note that when a client breaks the connection without shutting down properly using `++QUIT`, the Telnet socket remains open to that connection and becomes unavailable to any future connections until KISS-488 is reset. Thus you can e.g. connect via TELNET and disconnect via <ctrl>] Q, but after the second time, Telnet will be unavailable until KISS-488 is reset.



Sample Telnet Session

An example Telnet session with a Hewlett-Packard 34401A bench multimeter is depicted above. We are talking directly to the instrument's command interface. This particular instrument "speaks" SCPI, so we follow the instrument's rules as to valid commands and expected responses.

When we open the Telnet connection, KISS-488 signs on and identifies itself:

```
KISS-488 Revision: 2.50
Feb 28 2025 06:01:26
```

We then test the command

```
*idn?
```

and receive an appropriate response. Notice that SCPI commands are not case-sensitive.

Next we ask to take a measurement with

```
meas:volt:dc?
```

and receive an appropriate response. Note here that this instrument's command interpreter returns more digits than are displayed on the front panel, which was showing `12.017,7` after this reading was taken, and more digits than are guaranteed to be accurate.

Now we try a command which will not evoke a response:

```
*cls
```

and the instrument beeps and lights its front panel `Error` indicator, because it was addressed to talk and had nothing to say.

We retrieve the error message(s) with

```
syst:err?
```

clearing the error indicator in the process, so that the next request for an error message evokes the "No Error" message.

Now Phumble Phingers at the keyboard enters two bogus commands `*c/-` and `asdf`, clearing the errors from the first by retrieving the error messages. For the second, we attempt to just clear the error indicator with `*cls`, provoking yet another error indication. Using `*cls` but pressing <Ctrl><Enter> to generate a LF character, rather than just pressing <Enter> to generate a CR character, allows the command to work correctly. Finally, we attempt to retrieve any residual error messages with `syst:err?` (note the visual effect of the previous LF, as our typing now appears directly below the end of the successful `*cls` command), and we see that `*cls` terminated with a LF was successful.

KISS-488 user **Cary Oler** put together a very useful data logging and graphing application, running under Windows 7 & Windows 10 (and probably other Windows versions). The TelNet connection collects data from your connected instrument via KISS-488, and the application continuously updates a live graph. As one example, his data logger runs continuously, reading the voltage on Hx Engineering's solar power battery bank via KISS-488 and the rear terminals of an HP34401A, and displays a continuous two-day graph. Cary Oler has generously provided this application for all KISS-488 users at http://spacew.com/TelnetData-Setup.exe. This application nicely complements the logging and graphing capabilities within KISS-488. TelnetData provides a live graph with much prettier formatting but runs only on a PC under Windows, whereas KISS-488 does only offline graphing, but is platform-independent.

See also the note above regarding incomplete disconnects from Telnet. At the time TelnetData was written, the `++QUIT` command was not available, and therefore TelnetData simply drops the connection after each reading. Thus use with TelnetData requires loading KISS-488 with firmware rev 1.80, available at www.hxengineering.com.

10) Serial Port

KISS-488 Rev 2 hardware implements a standard serial port via the USB connector. Speed is 115,200 BPS, using 8 data bits, no parity, 1 stop bit, and no handshake. With your favorite serial terminal, all action is identical to use under TelNet.

The serial port is implemented via a standard FTDI USB/serial chip, which is recognized by most operating systems and the driver is loaded automatically. See your operating systems' documentation for ways to access a particular serial port and to find what port number (if any) was assigned. See also the Serial Port topic in section 3 above for further tips.

A great many applications can access data via a serial port. This opens the door to e.g. an Excel application using macros to capture data or to control a device. Note also that some, such as HyperTerminal and other text-based terminal applications can interchangeably access either a serial port or a TelNet port. The latter allows the possibility of remote access from around the globe.

11) ProLogix Compatibility

In the interest of compatibility with existing programs that use a ProLogix adapter to communicate with the IEEE-488 bus, KISS-488 supports a subset of the same commands. KISS-488 implements Controller mode only. Device mode is not typically applicable for connection to the internet or a serial port, and would be more commonly used to emulate a plotter or printer which are already supported directly by KISS-488. All ProLogix commands are distinguished by a leading ++ escape sequence. Commands are not case-sensitive. Such commands are not passed thru to the instrument, but executed directly within KISS-488. These commands can be entered via either the TelNet interface or the USB-serial interface (but not the Control page of the browser interface), and will reply in kind. All parameters are entered as normal ASCII decimal numbers. Whitespace is optional between the keyword and any parameters. At least one whitespace character is required to separate multiple parameters if present; whitespace after the keyword is otherwise ignored.

IEEE-488 Instrument Address

```
++addr <n>
```

If entered with no parameter, the unit replies with the current setting of the Instrument address. With a parameter from 0 to 30 inclusive, the Instrument address is set to the designated number. Numbers outside the range are treated as errors.

Automatic Read

```
++auto <n>
```

By default automatic read-after-write is turned on, so that any command expecting a response will automatically collect the response

from the instrument. If desired, the automatic read-after-write can be turned off, requiring a `++read` command to retrieve data from the instrument. Read-after-write applies only where a command has not been explicitly flagged for no read, either by the appropriate setting within the browser interface, or by terminating a command with LF via either USB-serial or TelNet interfaces. The auto setting is nonvolatile, applies equally to HTTP, TelNet, and USB/serial interfaces, and persists across a reset or power cycle.

Note also that the command definition includes automatically fetching any pending data, when auto switches from zero to one. This action may result in a bus timeout if no data is pending.

Selected Device Clear

`++clr`

The clr command takes no parameters. KISS-488 issues the IEEE-488 command Selected Device Clear (SDC).

EOI Usage

`++eoi <n>`

If <n> is 0, KISS-488 will neither send nor expect the EOI line to be asserted to indicate the end of a message. If <n> is 1, EOI will be used.

Terminators

++eos <n>

This commands sets or queries the selection of terminating characters to be used on the IEEE-488 bus. Note that the Configuration screen on the browser interface offers a good deal more flexibility, but this command covers the most common terminator selections. The parameter <n> is interpreted thusly:

0 – CR followed by LF
1 – CR
2 – LF
3 – None
4 – Other (reply only)

EOT Enable

`++eot_enable <n>`

If set to 1, the character selected by eot_char below is appended to the USB/serial or TelNet output when EOI is detected during a read from the IEEE-488 bus.

EOT Character

`++eot_char <n>`

If eot_enable is set, the character specified by the ASCII value <n> is used in the received data stream to indicate that EOI was asserted on the IEEE-488 bus. For instance,

`++eot_char 35`

indicates that the character # will be used to flag EOI.

Interface Clear

`++ifc`

KISS-488 asserts the IEEE-488 IFC line, causing all connected devices to go to their unaddressed state, and

KISS-488 to resume its role as System Controller.

Local Lockout

```
++llo
```

KISS-488 issues the IEEE-488 LLO command, causing the device to lock out the local controls (or take other action as specified by the instrument's documentation) and respond only to IEEE-488 commands.

Go To Local

```
++loc
```

KISS-488 issues the IEEE-488 GTL command, causing the device to respond to the local controls

Mode

```
++mode 1
```

KISS-488 accepts this command silently as it always acts in Controller mode. Issuing the command with no parameters will return the value 1 as KISS-488 is always in Controller mode.

Read

```
++read <n>
```

If issued with no parameter, causes KISS-488 to read from the IEEE-488 bus until the normal termination condition is encountered. If issued with a numeric parameter n, KISS-488 reads until the corresponding ASCII character is encountered. If issued with the text parameter EOI (case insensitive), KISS-488 reads until the IEEE-488 bus signal EOI is asserted while a byte is received.

Read Timeout

```
++read_tmo_ms <n>
```

This command sets or reads the current value of the IEEE-488 timeout setting in mSec. Although the units are entered or displayed in mSec, the actual granularity is 1/300 Sec. Thus entering 100 for the timeout attempts to set 100 mSec, but actually selects the nearest achievable timeout of 99 mSec. The parameter may be 1 to 3000 inclusive.

Reset

```
++rst
```

NOT IMPLEMENTED. A reset would allow a nefarious actor the opportunity to load new, possibly harmful, firmware into KISS-488 without having physical access to the unit. Thus in the interest of security, this command is not implemented in KISS-488 and a power cycle is required for a complete reset.

Save Configuration

```
++savecfg <n>
```

Any configuration change made thru the ProLogix compatible commands is normally updated automatically in the nonvolatile memory. The nonvolatile memory has a guaranteed endurance of 100,000 erase/write cycles, so wearout is not normally an issue. However, in case of a program repeatedly changing a setting, automatic saving can be set to 0 so that only the working copy and not

the nonvolatile memory are changed with each setting. SaveCfg is set to 1 at each power-up.

Trigger

`++trg`

KISS-488 issues the IEEE-488 command GET (Group Execute Trigger) to trigger some specified action on the instrument.

Additional Commands

Version

`++ver`

KISS-488 replies with firmware version information, typically including the firmware revision number and the date and time of the build.

IP Address

`++ip`

KISS-488 replies with the currently assigned IP address. This allows the user to determine the IP address to use for Ping, TelNet, TFTP, or HTTP access.

MAC Address

`++mac`

KISS-488 replies with its permanently assigned MAC address.

Quit

++quit

KISS-488 disconnects from a TelNet connection. This command has no effect on a USB/Serial connection.

Bootloader

`++bootloader`

This command can be entered only thru the USB serial port, and hence only locally. This restriction is to secure KISS-488 against illicit activity attempting to load harmful firmware via a remote TelNet command.

Factory Reset

++factory

KISS-488 resets all nonvolatile memory settings to the configuration shipped from the factory, and clears all saved data and screen captures. This command is new in Rev 2.62.

12) Spy Mode

Beginning with firmware revision 2.64, KISS-488 can be used to eavesdrop on the IEEE-488 bus and display all transactions on the bus. This function has negligible electrical impact on bus loading, and does not affect transfers on the bus other than possibly throttling the transfers. The IEEE-488 spec allows the slowest device involved in a transfer to set the bus speed. Beginning with firmware revision 2.65, Spy mode is nonvolatile; i.e. remains set across a reset or power cycle.

In order to enter Spy mode, use the command

++spy<n>

at either the TelNet interface or the USB/serial interface. The resulting trace will be returned to the same interface, whence it can, if desired, be captured to a file or otherwise utilized. KISS-488 also saves the output to an internal file, which can be accessed from the Graphs page under HTTP and saved to a file on the host. To properly use this capability, you should execute `++spy0` before saving the file to the host.

The parameter <n> determines the mode of operation:

0 no spy, normal operation
1 spy and render the data in human-readable ASCII (default)
2 spy and render every byte as 2 hex digits, with punctuation to indicate ATN and EOI states.

ASCII Spy Mode

The rendering of data in ASCII mode attempts to minimize the amount of interpretation required for a human to understand the bus action. Normal printable ASCII characters (0x20 thru 0x7F) are displayed as their printable characters. Characters outside this range are displayed as 2 hex digits enclosed in arrow brackets, such as <1F>.

Bytes transferred with ATN asserted are normally IEEE-488 defined single byte commands, and are prefixed with an exclamation point (!) character. Where there is a standardized command, it is displayed as the standard 3 uppercase ASCII characters. In the case of LAG (listen address group) and TAG (talk address group), the decimal address being referenced (one or two digits) follows the mnemonic.

Bytes transferred with EOI asserted indicate termination of a message, and are suffixed with a closing brace (]) and a CR-LF pair.

Hex Spy Mode

In some cases it may be simpler to analyze the bus transactions with all bytes displayed directly as 2-digit hex values, separated by spaces. Values transferred with ATN asserted are prefixed with an opening brace ([). Values transferred with EOI asserted are suffixed with a closing brace (]) and a CR-LF pair.

13) Remote Access

"With great power, comes great responsibility." One extremely powerful feature of KISS-488 is to make your instrument accessible remotely, across the Internet. KISS-488 does nothing to make itself visible outside of your own local network. Your corporate IT department may be able and willing to make KISS-488 visible to some or all of the Internet. In that case, **you and your IT department retain joint responsibility for safeguarding access** against nefarious actions, especially where the instrument to which KISS-488 is connected is capable of causing problems. Your IT department can (and likely will) restrict any outside access to limit visibility to properly vetted entities. You should review the KISS-488 capabilities and your specific instrument with your IT department to determine whether TelNet and/or HTTP access can be safely opened to the outside.

You should advise your IT department that KISS-488 uses only standard Ethernet ports for HTTP, DHCP, ICMP, and SNTP activities. The Telnet port defaults to 23 but can be configured to any usable port. They may also need to know that KISS-488 issues one or more "Announce" datagrams to UDP port 30303 upon power-up or network reconnection.

14) Firmware Update

The latest firmware version and some past versions are available at www.HxEngineering.com. Save the file in any convenient location where you can access it from a command prompt. Note that rev 1 hardware (in the cast metal backshell) is compatible with rev 2 firmware, so you can update and add features like the ProLogix compatibility, Spy, and faster operation, although the physical USB/serial port is not present on the rev 1 hardware.

The remote firmware update process uses Tiny File Transfer Protocol (TFTP), which is a component of most versions of Windows and other operating environments. To check whether TFTP is activated in Windows, open a command prompt (<Start> `CMD` <Enter>) and type the command `TFTP`.

TFTP is sometimes not activated by default. If TFTP is not activated, open Control Panel, select "Programs and Features", then select "Turn Windows Features On or Off". When the list is populated, scroll down to TFTP and check the box to turn it on. Close this dialog box. This step need be done only once on any given Windows installation.

Rev 2 Hardware

Version 2.xx firmware has greatly simplified the firmware update process, when used with version 2 hardware. There is no longer a need to adjust your PC's network settings. If you can access KISS-488 from your PC via an IP address, you can use the TFTP protocol directly to that address. You will use the `++bootloader` command, which is only accepted via the USB serial port. You can type that command into your serial terminal but do not press <Enter> yet.

For our example, KISS-488 is at address 192.168.1.23. You can find the current IP address with the `++IP` command. With the firmware file present in the current working directory of the command prompt, you would type (of course substituting the correct IP address and Rev number)

```
tftp 192.168.1.23 put "KISS-488_Rev_2.62.hex"
```

but do not press <Enter> yet. Go back to your terminal program and type `++bootloader`. Press <Enter> and you should see the single character > indicating that the bootloader is ready and waiting for a TFTP connection. Within 7 seconds switch back to your command prompt (<alt><tab> may be a quick way to do so) and press <Enter>. Within approximately one minute, TFTP will display statistics as to successful completion and time required for the transfer.

Rev 1 Hardware

If for any reason (such as lack of a USB serial connection, or the use of Rev 1 hardware or firmware, or fatally corrupted firmware) you wish to use the older method, the steps below will reload the firmware as long as the bootloader is intact.

You will need to place your PC on the same logical subnet as the power-on default TFTP server in KISS-488. Open Control Panel and select "Network and Sharing Center" (or equivalent in other Windows versions). Select "Change Adapter Settings" and select the adapter that will make the physical connection to KISS-488. Select "Properties" and then "Internet Protocol Version 4 (TCPIP/IPv4)". Select "Use the Following IP Address" (probably deselecting "Obtain an IP Address Automatically" in the process), and enter an IP address of 172.16.0.59. Tab to the Subnet Mask field and it will be automatically filled with an appropriate value for your environment, often 255.255.255.0 or 255.255.0.0. Click OK to apply the new settings, and also close its parent dialog box so the new address takes effect. You may wish to leave Control Panel open here to restore the original setting after completing the firmware upgrade.

Returning to the command prompt window, you can confirm that your PC is now assigned to the correct IP address by issuing the command `IPCONFIG`. Look for a listing of "IPv4 Address" to confirm that you successfully reassigned your PC's address. Then enter the following command, but do not press Enter yet:

```
TFTP 172.16.0.49 put "KISS-488 Rev X.YY.hex"
```

You can of course add appropriate path designators to the KISS-488.hex filename inside the quotes, and you must substitute the appropriate version number for X.YY.

Now apply power to KISS-488, and press Enter within 7 seconds. Within approximately one minute, TFTP will display statistics as to successful completion and time required for the transfer.

Return to Control Panel and restore your network settings to the original. KISS-488 will automatically reset after a successful firmware load, and will be ready for action about 10 seconds later. Check that you can still connect, and that the opening page reflects the new version number. Unless there have been **major changes to the memory format of the configuration settings** in the new version, your old settings should be retained. Please check the settings on the Configuration page to ensure everything is as you expect.

Note: There have been major changes to the layout of the configuration settings as mentioned above, such that changing between Rev 1.xx and Rev 2.xx will erase your settings. You may want to take a screenshot of the Configuration page and the Control page before upgrading.

Although the above process could be more automated, the manual nature and the requirement for a specific IP address, along with physical access to reset KISS-488 to initiate the process, adds an important layer of security to the process.

FCC Notice

KISS-488 has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

KISS-488 Quickstart Guide

Physical Connection

WARNING
The IEEE-488 interface of KISS-488 provides up to 1500 Vrms isolation between the Ethernet cable and the instrument into which it is plugged. However, the power supply ground is common to the instrument's IEEE-488 ground. The USB-B-mini plug cable should be plugged into equipment (a PC or a wall-wart) on the same outlet or power strip as the instrument. If you choose to use any other 5V source with a similar connector (not recommended), you are responsible to ensure appropriate isolation between KISS-488 and any connected devices.

Remove those big clunky IEEE-488 cables from the back of your instrument and insert KISS-488 into the instrument's IEEE-488 connector. Gently plug the USB-B-mini cable into the matching plug on KISS-488, and then connect a PC or wall-wart powered by the same power strip as your instrument. Connect a standard Ethernet (RJ-45) cable between KISS-488 and a network hub, switch or router, or use a Crossover cable to connect directly to a PC.

Logical Connection

Finding the IP address of an embedded web server is often a challenge. See section 3 of the full manual for a number of ways to find its address, depending on your operating environment. If you can find the resulting USB/serial port, you can use the command `++IP` to display the IP address assigned to KISS-488.

Note that some anti-virus products may require that you set up exceptions to allow KISS-488 through the protective shield. Avast products in particular have been noted to have difficulty with embedded web servers similar to KISS-488. KISS-488 uses only standard ports for HTTP, DHCP, ICMP, and SNTP, and allows configuring the Telnet port number.

Ready!

With the browser connected to KISS-488, basic instructions are provided on each page for those who are familiar with the concepts involved. To learn more about IEEE-488, screen captures, etc., please refer to the full **KISS-488 User Guide** that can be downloaded from *www.HxEngineering.com*.