KISS-488™ User Guide

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

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1) Introduction to IEEE-488

Much confusion has sprung up around 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.

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 superset of IEEE-488.2. Commands are typically somewhat verbose, with very specific rules as to what abbreviations are allowable. Such rules are violated by some suppliers. 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.

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 issues 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 is common to the instrument's IEEE-488 ground. If you use the provided wall power supply (USB-B-mini plug), it should be plugged into 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.

Plug It In

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 included line power supply into the USB-B-mini connector on KISS-488, and then plug the power supply into 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.

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 of "KISS-488", 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.

NetBIOS Name Lookup

The easiest way to find KISS-488 on your local network is to simply type http://kiss-488 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, with possibly undesirable (but "interesting"!) results.

Ping

If your environment supports Ping (Ethernet ICMP) capability, simply ping the NetBIOS name KISS-488. In all recent versions of Windows, open a command prompt by clicking on Start and typing CMD, then enter the command `PING KISS-488`. 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.

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 (under Windows only; download from http://logview4net.com/documentation/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 can also receive the Announce packet via any host listening on UDP port 30303. The packet will give the KISS-488 NetBIOS name, IP address, and MAC address, 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 169.254.72.121 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:

<div align="center">

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

</div>

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 an available Internet time server. All times within KISS-488 are given in Coordinated Universal Time, avoiding the complexities of setting a time zone (KISS, remember!). The IP address may be useful for later connections, if you prefer for some reason to use the IP address rather than the NetBIOS name, 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.
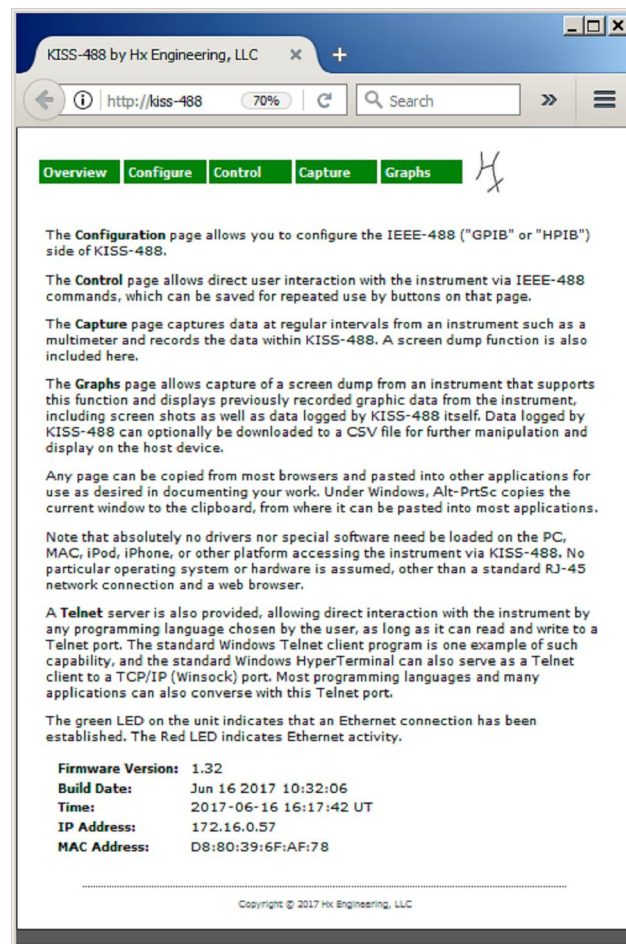
5) Configuration

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 within 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.

Instrument

NOTE: You MUST configure this section before attempting to access the instrument, whether via your browser or via Telnet.

The address entered here must be the actual address of the IEEE-488 instrument to which KISS-488 is connected. The instrument's address is sometimes set with various mechanical switches or dials, and sometimes via front panel functions. The search function below can sometimes discover the instrument address, without making you stand on your head or crawl behind an instrument rack to find the address.

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. Even if your browser does not support the format, you can still download the file and then display and/or manipulate it using whatever compatible tools are available in your operating environment.

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. The command string depicted in the example is for a TDS220 oscilloscope and performs this freeze function.

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) 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), 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.

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 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 such unit on your network, the NetBIOS name will collide. In this case, you may wish to assign a single letter suffix to the KISS-488 NetBIOS name. Letters A thru Z are allowed, and are not case-sensitive. You can even give them some mnemonic significance, such as using V for voltmeter, O for Oscilloscope, S for spectrum analyzer, etc. You can always reset to having no suffix by selecting "None".

KISS-488 Addresses

Although KISS-488 presents only one IEEE-488 load electrically on the bus, it responds as though it is three separate instruments 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 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.

As long as none of the default addresses conflict with your instrument's address, you need not change these.

Search

At the very bottom of this page is a search function that will attempt to find your instrument's IEEE-488 address. This function is automatically activated upon entry to the page, but you can also trigger it manually by clicking the Search button. Manual triggering may be helpful if you change the instrument's address, to update the address displayed. Note that you must still manually set the desired instrument address above. KISS-488 will work with the configured instrument address until you explicitly change it, regardless of what may be displayed in the search box.

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 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 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.

7)   Capture

The Capture page controls the capture of graphical screens from the instrument. There are two distinct functions 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, and saves them in internal nonvolatile memory. Either type of graphic display is saved internally in nonvolatile memory, with up to 2 megabytes of such files saved before overwriting the oldest.

Notice that 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 Data Fetch Command box.

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.

While logging, KISS-488 displays the number of data points and the current time, as a visual activity indication. While doing a screen capture that requires an extended time, such as a BMP screen dump, KISS-488 displays "Capturing" and the time. If you get impatient and go to the Graphs screen during the capture, the capture will be interrupted and will display only a partial screen capture at best.

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.
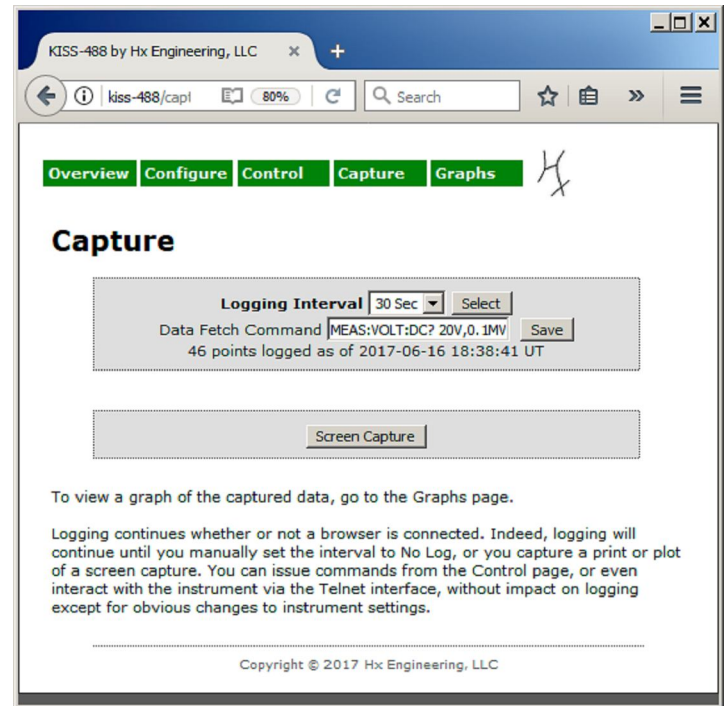
8) Graphs

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 to the right 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.

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 the values along the Y axis. To the right 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!
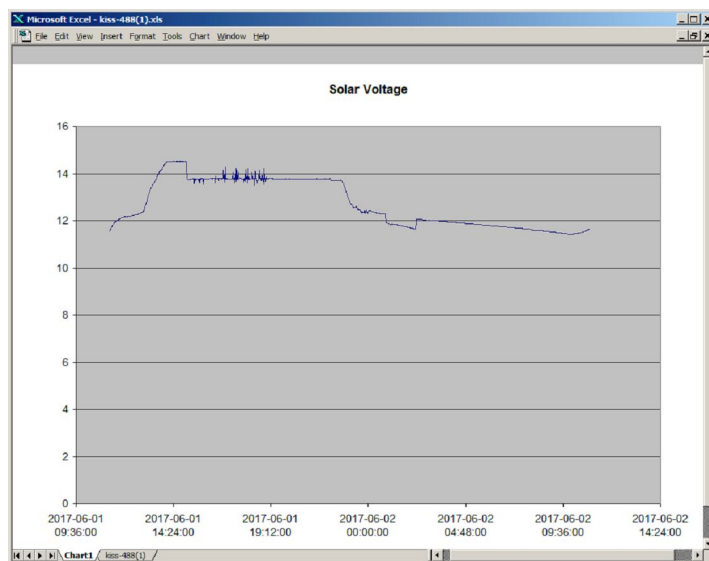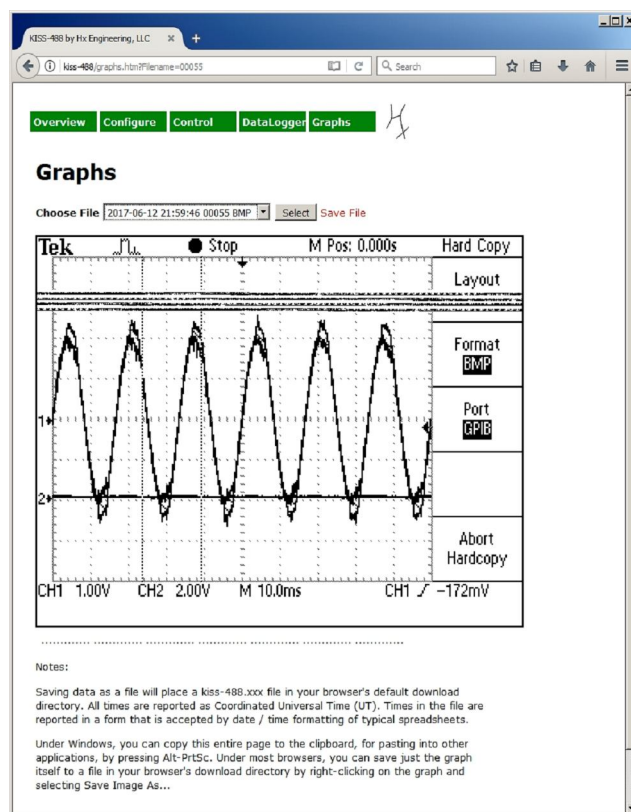
Note that in most Windows browsers, you can right-click on the graph area, and the browser will offer to save the image, allowing you to select the location and filename. The image to the right was saved in this way, and by default was named `canvas.png` and was saved to the browser's default download directory.

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. See the instructions at the bottom of the Graphs page to save data from IE.

The preferred browser for KISS-488 is FireFox, but many other browsers fully implement HTML. Chrome has been shown to work well with KISS-488 as well.
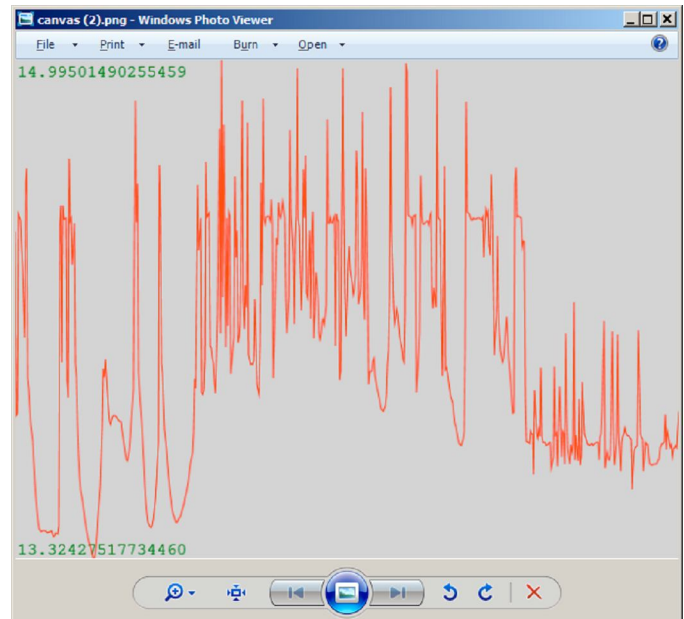
9) TelNet

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. There are no special commands nor escape sequences to learn for KISS-488, because the Telnet interface is a direct portal to your instrument's command interface. One example, shipped with most Windows versions, but often not installed 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 installed 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 KISS-488`. 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 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. Set up a connection using TCP/IP (WinSock), using `KISS-488` as the 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.

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.

Sample Telnet Session

An example Telnet session with a Hewlett-Packard 34401A bench multimeter is depicted to the right. 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:

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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 Fumble Fingers 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.

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10)   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, and presumably you have taken appropriate precautions against illicit activity within your own 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 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 an "Announce" datagram to UDP port 30303 upon power-up or network reconnection.

11) Firmware Update

The latest firmware version can be received via email from Support@HxEngineering.com. Save the file in any convenient location where you can access it from a command prompt.

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 often not installed by default. If TFTP is not installed, 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.

Next you need to place your PC on the same logical subnet as the 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 255.255.255.0. 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 settings (probably "Obtain an IP Address Automatically"). Reset KISS-488 and check that you can still connect, and that the opening page reflects the new version number. Unless there have been major changes to 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.

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.

12) 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.