Remote Control Interface

User Manual

Revision Record

MANUAL, Remote Control Interface | Part #399639 Rev. D

Revision	Description	Date
A	Initial Release	October, 2014
B	Ethernet added	March, 2017
C	Added command level 4 commands, Added CDC interface, Telnet interface, Added additional error messages for multi-unit amplifiers. Updated default host name to ETS-AMP01. Updated NI software screenshots. Added front panel screenshots Clarified description for amplifiers without power monitoring Added screenshots for multi-unit amplifiers.	June, 2023
D	Amended 2.0 wording for multi-Purpose Interface. Amended 3.0 Overview wording to add "or remote GUI display". Amended 3.0 Display to say (and therefore lack power feedback monitoring). Amended 3.0 Info wording to say if a temperature sensor is fitted. Removed VBA from Web Commands section.	June, 2023

Table of Contents

1.0   Introduction

The Remote Control Interface consists of a control board integrated into an RF amplifier and an optional keypad and display interface.

The control board manages enabling and disabling of the amplifier, monitoring power levels, monitoring power supply health, communicating with the control computer and implementing electrical interlocks.

The communication with the control computer is by USB, GPIB or Ethernet bus.

The keypad and display interface is used for monitoring amplifier state, power levels, and interlock states and for configuration options.

Service Procedures

CONTACTING ETS-LINDGREN

Note: Please see www.ets-lindgren.com for a list of ETS-Lindgren offices, including phone and email contact information.

SENDING A COMPONENT FOR SERVICE

1. Contact ETS-Lindgren Customer Service to obtain a Service Request Order (SRO).

2. Briefly describe the problem in writing. Give details regarding the observed symptom(s) or error codes, and whether the problem is constant or intermittent in nature. Please include the date(s), the service representative you spoke with, and the nature of the conversation. Include the serial number of the item being returned.

3. Package the system or component carefully. If possible, use the original packing materials or carrying case to return a system or system component to ETS-Lindgren.

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2.0   Front Panel Layout

In addition to the normal amplifier layout the following are present.

Standby Button

This button changes the operating state of the amplifier. If the amplifier is muted then the state will change to the active 'un-muted' state after successfully completing internal checks, otherwise the amplifier will return to the inactive 'muted state'.

The standby button incorporates the standby indicator which is illuminated solid when in the un-muted (active) state and flashes when in the standby state.

When a fault or interlock condition is present the standby indicator does not illuminate.

Note: The button is locked out for one half second after every press to prevent damage to the amplifier from repeated state changes.

Interlock Indicator

This illuminates when the amplifier is placed in the interlock state.

Fault Indicator

This illuminates in the event of a fault or excess internal temperature of the unit.

Local Lockout Indicator

This illuminates when the front panel controls are disabled.

Multi-Purpose Interface

Some amplifiers are equipped with a control interface on the front panel comprising of an OLED matrix display showing the amplifier status and a four key keypad for selecting configuration options.

On amplifiers without this interface most functionality can be accessed by using the GUI program or the Web interface, both of which allow the OLED display to be viewed remotely and key presses to be sent.

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3.0   Multi-Purpose Interface Operation

Overview

The display (or remote GUI display) comprises of four rows of text or graphics with four key switches beneath. The bottom row of text on the display shows the current function of the key beneath it.
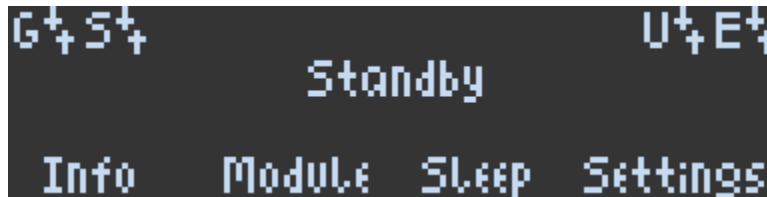
Indicators at the top of the screen show the status of connected interfaces: GPIB, RS232, USB and Ethernet. There is an up-down arrow to show active communications.

Note: Depending on the model, Module and Sleep may not be shown.

Default Display

- For units which have the multi-purpose interface on the front panel, the default screen comprises of a double bar graph showing forward output power and reflected power. The average power is shown as a solid bar and the peak value is shown as a shaded bar, this gives indication of the amount of modulation. Marks every 10% give a qualitative indication of the actual output power.

- For units which do not have the interface (and therefore lack power feedback monitoring), the text 'Operating' is shown instead of the bar graph. This can be viewed by using the GUI program on a PC or using the web interface.

If the amplifier is not in the Operate state the bar graph will not be displayed and instead the reason for the unit being muted will be displayed.

Possible indications are:

- Sleep
- Standby
- Starting..
- Operate
- Interlock
- Fault: [description]

```
            Fault:
        Over Temperature

   Info                Settings
```
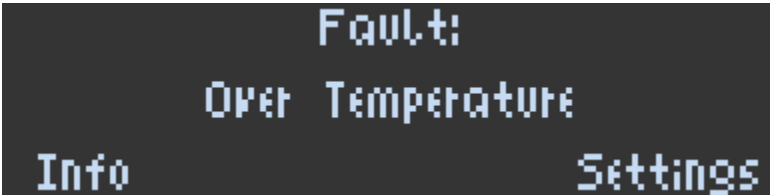
See section 'Interface Protocol' for details of fault descriptions.

Info

Pressing the 'Info' key shows a menu with several pages of details of the amplifier state.

```
Info



   About  Status  Network  Exit
```

The first 'About' sub-screen shows information about the amplifier, manufacturer, model, serial number and firmware version.

```
Manufacturer: ETS
Model Name: 8000-020
Serial No.:   100001
Firmware:    v3.05      Next
```
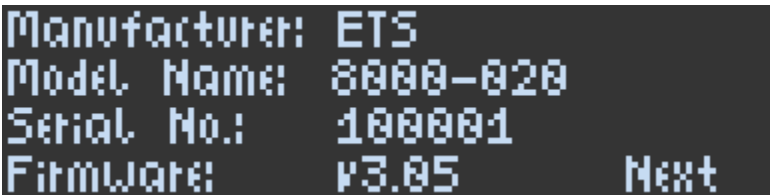
The second 'About' sub-screen shows the time since power on, total time output has been on for, and total time powered on.

```
Uptime:    0d  1h 13m 34s
Ontime:   12d  9h  0m 24s
Runtime:  16d  3h 47m 30s
                      Back
```
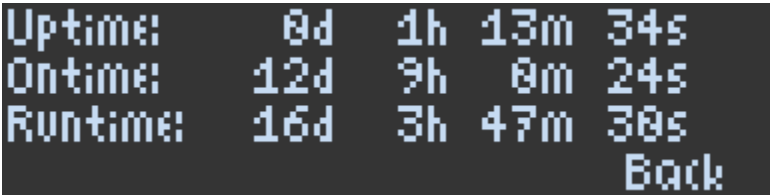
The first 'Status' sub-screen shows the power readings in detail for both forward and reflected power, if available. The first is the mean power (Av), the second is peak power (Pk). A frequency count is also shown at the end (Hz).

```
Fw    16% Mn    17% Av    18% Pk
Rf     0% Mn     0% Av     2% Pk
Mod Fw      0 Hz Rf     0 Hz
                           Next
```

If a temperature sensor is fitted to the unit, the second sub-screen shows the amplifier heat sink temperature. The maximum temperature since power on and the maximum temperature ever recorded is also shown.

```
Current Temperature:   30.7°C
Session Temperature:   32.0°C
Maximum Temperature:    32°C
                          Back
```

The first 'Network' sub-screen shows if the Ethernet interface is enabled and shows the current IP address, host name, MAC address, and address selection method.

```
IP Address: 192.168.100.107
Host Name: ETS-AMP01
MAC Addr: C4.DE.39.75.D8.80
DHCP                       Next
```

The second sub-screen shows the link status of the hardware port together with statistics on incoming and outgoing packets.

```
Up  √    Link √    Ready √
Rx Pkts :      791 Err:      0
Tx Pkts :       71 Err:      0
                           Next
```

The third sub-screen shows the IP gateway, DNS server and network mask information.

```
Gateway:        192.168.100.  1
DNS Server 1:  192.168.  0.  1
Network Mask:  255.255.255.  0
                          Back
```

Pressing the 'Exit' key will return to the main screen.

Pressing the 'Settings' key shows the available options for the amplifier:

- Options for setting GPIB address (1-30)
- Start-up State (Mute/Operate)
- Communication indicators (Show/Hide) are available
- Network Settings (on next sub-screen)

```
Settings

   Gpib    Startup  Comms
 Address    State  Indicators Next
```

Select an option by pressing the relevant key then use the '+/-' keys to cycle through the possible values.

```
Gpib Address
        Current: 06
           New: 06
   +        -      Apply    Back
```

When the desired value is shown (after 'New:'), press the 'Apply' key to save the setting to the FLASH ROM then select 'Exit' to return to the options screen, and 'Next' to go to the next settings screen.

```
Startup State
        Current: Standby
           New: Operate
   +        -      Apply    Back
```

```
Comms Indicators
        Current: Hide
           New: Show
   +        -      Apply    Back
```

Network Settings

If networking is enabled, pressing 'Next' shows the networking settings:

```
Settings

Network    IP       Net
  Mode  Address   Mask      Exit
```

Network mode: An option for one of the following:

Disable: Shut down the Ethernet stack and do not respond to any requests.

Static: Enter a fixed IP address manually. This must not conflict with any other device on the network or any DHCP server allowed range.

ZC: ZeroConf; An automatic local address in the 169.254.xxx.xxx range.

DHCP: Use a server assigned dynamic address which may change with each power cycle. Use the device host name to find it.

DHCP+ZC: Use DHCP server if one can be found but fall back to ZeroConf.

```
Network Mode
         Current: DHCP+ZC
             New: DHCP+ZC
    +        -     Apply   Back
```
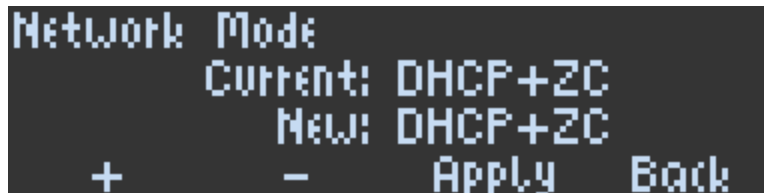
IP Address, Net Mask:

Use the left and right buttons to move between digits, when finished, press the left / right buttons until the pointer is at 'Done' or 'Cancel' and press + or – to exit.

```
IP Address
192.168.   0.100 Done Cancel
^
    +        -       <      >
```
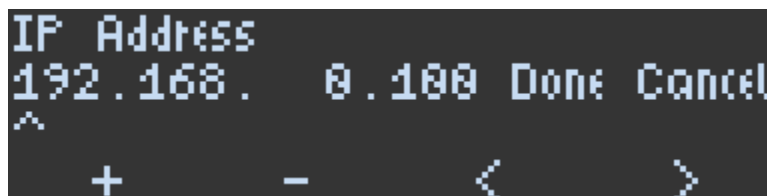
Module

On amplifiers which are packaged as multi-unit rack assemblies, the status of the sub units can be monitored by using the Module menu item.

Status (while in Mute condition):

```
Module: Ok: Mute
Centre: Ok: Mute
Psu:    Ok: Idle
Status           Exit
```

Status (while in Operate condition):

```
Module: Ok: Operate
Centre: Ok: Operate
Psu:    Ok: Operate
Status           Exit
```

Temperatures (degrees C), Not Fitted is shown in the case where there is no temperature sensor fitted to the unit in question:

```
Module: 25.4
Centre: 23.6
Psu:    Not Fitted
Temperature      Exit
```

Voltages (these are for indication only):

```
Module: 23.8
Centre: 23.4
Psu:    23.7 23.5
Voltage          Exit
```

Sleep/Wake

On amplifiers which have a separate power supply unit, the main voltage supply may be controlled separate to the auxiliary supply which powers the digital interface. Sending the 'UNMUTE' command or pressing the Standby switch when the amplifier is in the mute state will automatically start the main power supply and enable the amplifier once the supplies are steady.

The main power supply may be optionally put into a low power state by pressing the 'Sleep' button, which will change to 'Wake' when in low power state. Pressing this again returns to the active standby state.
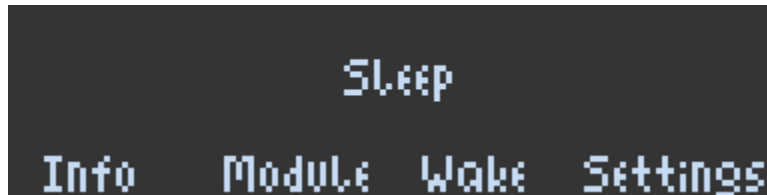
4.0   Rear Panel Layout

In addition to the normal amplifier connections, the following are present.

Interlock

This connector is of type BNC female. An open circuit to this connector puts the amplifier into a muted condition. The input may be connected to a micro switch or relay, or driven using a TTL or open collector driver.

Not Interlock

This connector is of type BNC female. A short circuit to this connector puts the amplifier into a muted condition. The input may be connected to a micro switch or relay, or driven using a TTL or open collector driver.

GPIB

The GPIB connector is of type IEEE488. See section 6.0 for a description of GPIB operations.

USB

This is a full size standard USB B type connector. Use a standard screened USB A-B cable to connect to a host computer or hub.

Ethernet

A standard RJ45 network connection.

There are no LEDs to signal the link state, this information is incorporated into the front panel display 'Info' → 'Network' sub-screens, and indicated on the default display at the top right by the letter 'E'.

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5.0   Operation

Power-On State

The device will power on in the mute state by default. This can be changed by the option on the front panel menu:

1. Press the Settings key and then 'Startup State'.

2. Use the '+/-' keys to change the default Startup State and then press Apply to save changes.

3. Press Exit twice to return to the main display.

A Reset command puts the amplifier into the mute state regardless of the power on setting.

Interlocks

When an interlock condition is detected on either of the rear panel connectors the amplifier enters the mute state. The power bars on the display are erased and replaced by the text 'Interlock' and the Interlock Indicator is illuminated. To clear the interlock state, remove the cause of the condition and either press the Standby button on the front panel or send the UNMUTE command.

Faults

When a fault is detected the amplifier enters the mute state. The power bars on the display are erased and replaced by the text 'Fault', followed by a description of the nature of the fault, and the Fault Indicator is illuminated. See section 'Interface Protocol, Fault Messages' for details of possible descriptions.

To clear the Fault state, first rectify the cause of the fault and either press the Standby button on the front panel or send the UNMUTE command. If the fault persists then contact ETS-Lindgren Customer Support.

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6.0   Remote Control Program

A simple to use GUI control program is available from the website:
 [insert url here]

If an older previous version has been installed, uninstall it by using Control Panel > Programs and Features before installing the new version.

Using with NI GPIB-USB adapters

In order to use the GPIB functionality with a National Instruments GPIB USB interface, the NI 488.2 driver must be installed.

Download the appropriate NI 488.2 driver software for your operating system from:

https://www.ni.com/en-us/support/downloads/drivers/download.ni-488-2.html

Run the self-extracting program.

If you do not need any other components of the NI software, click 'Deselect All' and select 'NI-488.2 .Net Language Runtime for .NET Framework 4.0':
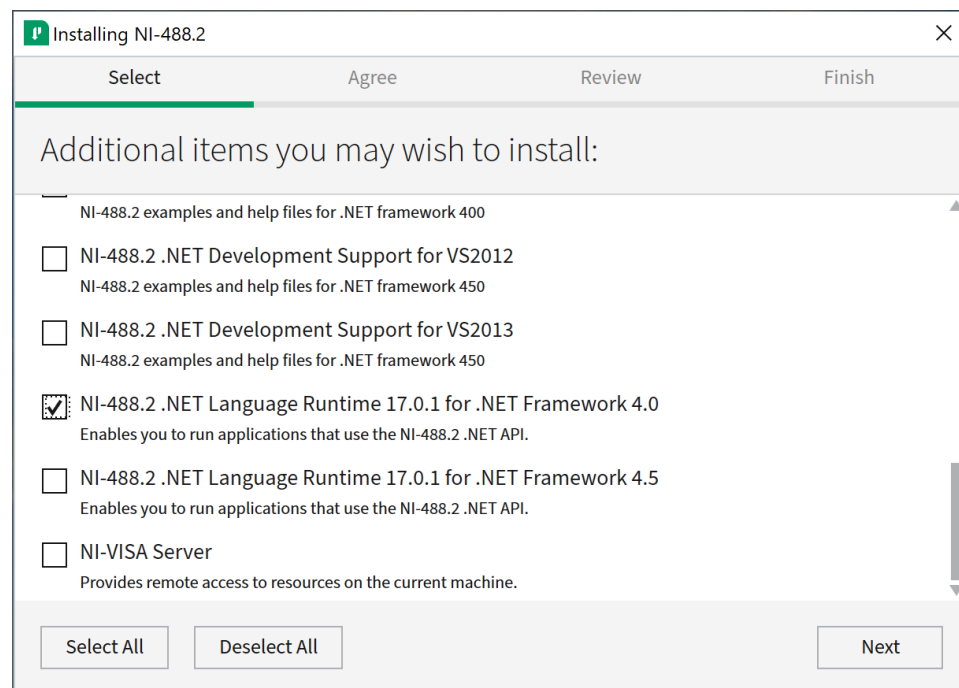
If you want to use NI MAX/VISA to talk to the amplifier also check NI-488.2 MAX Support, NI-VISA Configuration Support and N-VISA Interactive Control:
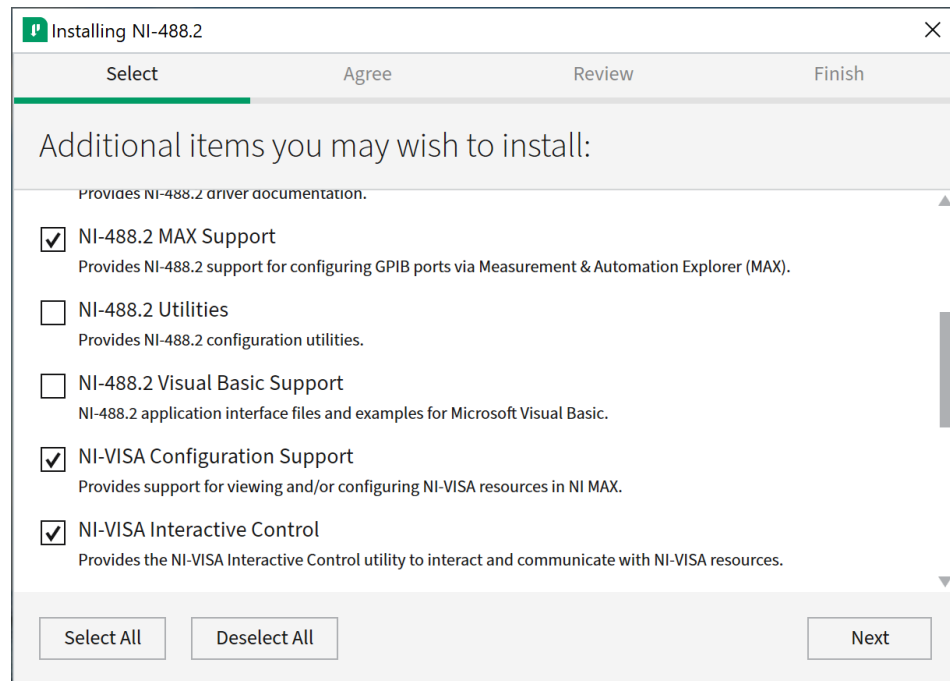
Select 'I accept the above Licence Agreement(s)'. Click Next. Repeat.

When asked 'Would you like the NI Update Service also to check for updates periodically', Clicking No is optional.

Allow the installation process to complete.

Reboot the computer when prompted.

Select Programs > ETS-Lindgren > Amplifier Control from the Start menu or screen.

The Interface selection box will display any GPIB devices detected and any USB device. GPIB devices are shown in the form 'GPIB [IF Number].[Bus Address]'.

The GPIB interface itself is also shown as a single number in case a bus reset or other operation is needed on the whole bus, however this cannot control the amplifier.

Other devices that are on the same GPIB may be shown if they are connected. In this case you may be able to send them commands by the Manual tab but they may not support most of the commands available to be sent.

Click on the interface you wish to use. The background will turn green to show a successful connection.

The default view is a copy of the front panel display, where you can perform any operation as if you were physically in front of the amplifier:
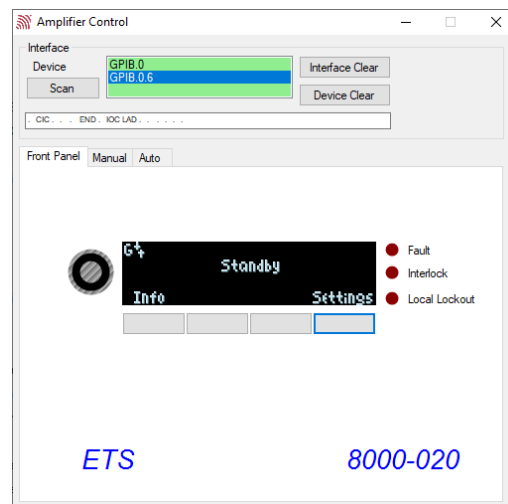
This example shows the computer connected to an amplifier via the GPIB interface on bus 0 at address 6.

It is also possible to send individual commands manually by selecting the manual tab:
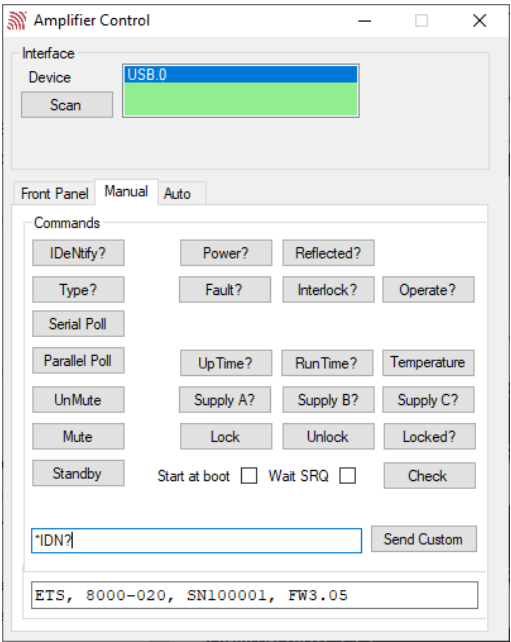
This example shows the amplifier connected via USB.

It is possible to send any other command supported by the amplifier by entering it into the box next to the 'Send Custom' button and clicking the button,

A continually updating view of the most important parameters is available on the Auto tab:

7.0   Interface Protocol

Command Set

These commands are supported for all interface methods.

Note that the queries are not case sensitive.

Upper-case and lower-case are written to designate the required and optional ending respectively.

All values in response strings are fixed length and are padded with leading and trailing zeros when necessary.

Commands should be terminated by Line Feed (0x0a), Carriage Return (0x0d) or CR-LF.

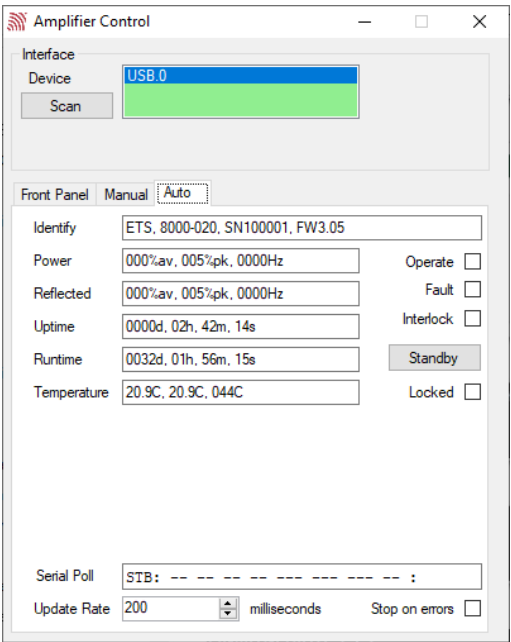ASCII encoding is expected for commands. Responses are encoded using the Windows-1252 code page which is a super-set of ASCII but includes characters such as the degree symbol.

A definitive list of all commands used can be obtained by use of the HELP commands.

Command / Query	Purpose / Response	Command Set Level
IDN, *IDN?	Returns the Identification string which consists of ETS, xxxx-yyy, SNnnnnnn, FWm.mm Where xxxx-yyy is the model number, nnnnn is the serial number and m.mm is the firmware version.	1
TYPE?	AMP, STD, N Amplifier, Standard range, Command set level N	2
MUTE UNMUTE STANdby	Disable amplifier output Enable amplifier output Toggle amplifier output state between Mute and Unmute.	1
OFF IDLE ON	Shut off output and turn off power supplies Turn on power supplies but keep output off . Turn on output (Same as UNMUTE) OFF/IDLE are the same as MUTE if amplifier does not have a separate power unit.	4
FAULt? INTerlock? SUPPLYFAIL? OVERTEMP? OPERATE?	ASCII 0 = OK, 1 = fault line tripped ASCII 0 = OK, 1 = interlocks tripped ASCII 0 = OK, 1 = power supply out of range ASCII 0 = OK, 1 = too hot trip ASCII 0 = muted (or fault condition), ASCII 1 = active (not muted)	1
State?	Returns status string, 'Standby', 'Starting..', 'Operate', 'Sleep' or 'Fault: [description]'.	4

Command / Query	Purpose / Response	Command Set Level
POWer?	XX%av, YY%pk, ZZZZ Hz where X is the average output power as a percentage of maximum output (00-99), Y is the peak power and Z is the modulation frequency counted	1
REFlected?	XX%av, YY%pk, ZZZZ Hz where X is the average reflected power as a percentage of maximum output (00-99), Y is the peak power and Z is the modulation frequency counted	1
SUPPLY_A? SUPPLY_B? SUPPLY_C?	XX.XVav, YY.YVpk, ZZZZHz Where X is mean voltage, Y is peak voltage, Z is ripple frequency for the relevant supply.	1
TEMP?	XX.X°C, YY.Y°C, ZZ°C where X is the current temperature, Y is the maximum since power on, Z is the maximum the unit has ever recorded	1
UPTIME? RUNTIME? ONTIME?	NNNNd, NNh, NNm, NNs, where N is the number of days, hours, minutes and seconds since power on. Cumulative time the unit has been powered. Total time output has been on.	1
LOCK	Lock the front panel controls so they cannot be altered	2
UNLOCK	Unlock the front panel controls	2
LOCKED?	ASCII 0 = front panel controls can be used ASCII 1 = front panel controls are locked	2
DISP_KEY n	Send a simulated keypress where n=1 to 4	2
DISP_BUF	Capture the state of the front panel display in the buffer	2
DISP_BUF? n	Read 32 bytes of BASE64 encoded data from the buffer representing the front panel display, n=0 to 15. Each byte represents a vertical strip of 8 pixels starting at the top left.	2
DISP_LEDS?	NNN Read the state of the front panel LEDs	2
BOOT_STATE?	ASCII 0 = amplifier starts up in mute state ASCII 1 = amplifier starts up in operate state	2
BOOT_STATE n	Set the startup state (0=mute, 1=operate)	2
GPIB_ADDR?	NN The current GPIB address of the amplifier. Useful via USB.	2
GPIB_ADDR n	Set a new GPIB address (between 1 and 30)	2

Command / Query	Purpose / Response	Command Set Level
GPIB_MODE n	Set the gpib protocol mode (0 plain text, 1 length, checksum)	2
GPIB_MODE?	Read the value of gpib protocol mode	2
ETH_IP? ETH_IP "n.n.n.n"	Read the device's current IP address Set new static IP address, n=0-255	3
ETH_GW? ETH_GW "n.n.n.n"	Read the device's current gateway Set new static gateway, n=0-255	3
ETH_MASK? ETH_MASK "n.n.n.n"	Read the device's network mask Set new static gateway, n=0-255	3
ETH_MODE? ETH_MODE n ETH_MODE "sssssss"	Get the address discovery mode Set discovery mode (numeric) Set discovery mode (textual) Options are: DISABLE (0) DHCP+ZC (1) DHCP (2) ZC (3) STATIC (4)	3
ETH_NAME? ETH_NAME "ssssss"	Read the device's host name Set new host name. Up to 15 characters. Not allowed characters: \ / : * ? " < > | .	3
ETH_MAC?	Read the device's MAC address Cannot be changed.	3
Quit	Disconnect the current interface.	4
HELP HELP "CMD" List Help_ALL help_Alias	General help message. Help for a specific command. List all available commands. Full descriptive help for all commands. List all aliases for commands that have them. NOTE these commands return more than one line of text and so multiple reads should be made until no data is returned. They are mainly intended for interactive use rather than automation.	4

Status Codes

Normal amplifier state is described by the following codes, which are displayed on the front panel display or read by the 'STATE?' command:

Sleep	Power supplies are off.
Standby	Power supply is on and output is off.
Starting..	Output is in start up phase.
Operate	Output is active
Interlock	The interlock input has been tripped and output is shut off.
Fault:	There is an error of some kind that prevents operation.
	A description of the error follows.

Fault Messages

These messages follow the 'Fault:' indication and describe the nature of the fault and its source.

Supply Failure	The power supply voltage is out of range or has excessive ripple.
Over Temperature	The system temperature has exceeded the limit.
Output Overload	The total output has exceeded the preset safety limit.
Pulse Generator *	Optional pulse generator has a problem.
Supply Monitor Trip*	Optional supply monitor has tripped.
Module: [cause] *	Amplifier module (single unit) fuseboard has detected a fault.
Unit n: [cause] *	Amplifier unit [n] fuseboard has detected a fault.
Centre: [cause] *	Centre unit fuseboard has detected a fault.
Psu: [cause] *	Power supply unit fuseboard has detected a fault.
Psu: Failed to start*	Power supply unit has not started up as expected.
IO n	Fault line [n] on the interface board was tripped.
General	Fault line tripped but unable to find cause.
Settings Error	Corruption was detected in the settings storage.
Unknown Error [code]	Error code was not recognised.

* These fault messages only apply to certain products which have extended diagnostic functions.

Sub Unit Messages

On amplifiers which are packaged as multi unit rack assemblies, these additional messages are reported from the sub units as [cause] above.

Amplifier Unit

Fault: Supply Low	Supply voltage is out of range, too low.
Fault: Supply High	Supply voltage is out of range, too high.
Temperature: Internal [n]	On board temperature sensor is too high.
Temperature: External [n]	Connected temperature sensor is too high.
Fault: Module %1d	Amplifier sub-module has tripped.
Fault: Airflow	Air flow sensor detects insufficient flow.
Fuse: Module n	The supply fuse for sub-module n has blown.
Fuse: Fan n	The supply fuse for fan n has blown.
Fuse: Airflow	The supply fuse for the air flow sensor has tripped.
Fuse: Diplexer Fan	The supply fuse for the diplexer fan has blown.
Fuse: Detector LF	The supply fuse for low frequency detector has blown.
Fuse: Detector HF	The supply fuse for high frequency detector has blown.
Fuse: Driver	The supply fuse for the driver module has blown.

Center Unit

Fault: Supply Low	Supply voltage is out of range, too low.
Fault: Supply High	Supply voltage is out of range, too high.
Temperature: Imbalance n	Imbalance detector reports temperature too high.
Temperature: Internal nn	On board temperature sensor is too high.
Temperature: External nn	Connected temperature sensor is too high.
Fuse: Fan n	The supply fuse for fan n has blown.
Fuse: Airflow	The supply fuse for the air flow sensor has tripped.
Fuse: Imbalance n	The supply fuse for the imbalance detector has tripped.
Fuse: Driver	The supply fuse for the driver module has blown.
Fuse: LF Detector	The supply fuse for low frequency detector has blown.

Fuse: HF Det/Amp	The supply fuse for high frequency detector or amplifier module has blown.
Fault: Driver Module	The driver module has tripped
Fault: Airflow	Air flow sensor detects insufficient flow.
Fault: Imbalance n	Imbalance detector detected an imbalance on channel n.

Power Supply Unit

Fault: Supply Low	Supply voltage is out of range, too low.
Fault: Supply High	Supply voltage is out of range, too high.
Temperature: Internal n	On board temperature sensor is too high.
Temperature: External n	Connected temperature sensor is too high.
OverTemp: Psu n	Power supply n has signaled an over temperature.
DCFail: Psu n	Power supply n has signaled an output failure.
Fuse: Unit n	The supply fuse for unit n has blown.
Fuse: Centre	The supply fuse for the centre unit has blown.

8.0   GPIB Operation

The GPIB operates according to IEEE488.2, except that numeric data must be in the form of decimal integers or fixed point. String data must be enclosed in double quote characters.

An attempt at providing the device with more advanced numeric data formats will return a command error and an error description string. A description of the operation then follows.

Message Format

IEEE488.2 Interface Function Subsets

SH1	Source handshake full capability
AH1	Acceptor handshake full capability
T6	Not talk only
L4	Not listen only
SR1	Service request complete capability
RL0	No remote/local capability
PP1	Remote configuration in parallel poll
DC1	Device clear capability
DT0	No device trigger capability
C0	No controller capability

Address Setting

The GPIB address can be set using the front panel controls (see USB Operation) or by using USB or Ethernet interfaces (GPIB_ADDR command). Addresses 1 to 30 are selectable.

Message Exchange Options

The input and output buffers are 64 bytes, all queries generate a response when parsed not read and no commands are coupled. Responses are encoded using the Windows-1252 code page which is a superset of ASCII but includes characters such as the degree symbol.

Compound Commands

There are no <compound command program header> components.

Block Data

The device does not generate block data.

Numeric Data

The only <PROGRAM DATA> numeric elements supported are decimal integer on input and fixed point up to 2 decimal places on output, encoded as ASCII characters. There is no nesting.

String Data

String data must be enclosed by double quote characters, "example", ascii code 34 (hex 22).

Transfer Traffic

The device does not generate transfer traffic outside of the IEEE488.2 specification.

Calibration Query

The device does not support the calibration query.

Trigger Facility

The device has no trigger facility, and does not support the *TRG and *DDT commands.

Macros

The device does not support macros.

Resource Description Transfer

Resource description transfer is not implemented.

Additional Data Structures

The device uses fixed position comma separated strings for reporting values for;

- Power
- Temperature (where available)
- Voltage
- Time

The required values can be retrieved simply by selecting the relevant indices into the string or by splitting using the comma as separator.

Overlapped Commands

The device does not overlap commands, all commands are sequential.

Operation Complete Message

No commands have any criteria to be met in order to satisfy an operation complete message.

Representation of Infinity and not-a-number

The device has no representations for infinity or not-a-number.

Errors

The Command Error (bit 5) in the Standard Event Status register is set and a descriptive string is returned, beginning with the text 'Error: '.

Error messages may be returned from Commands so the read buffer should be read with a zero time-out or flushed before sending a command, to ensure that the response read is intended for the command sent.

Device Specific Commands and Queries

All commands listed in the section **Error! Reference source not found.Error! Reference source not found.**, Command Set above are supported.

Common Commands and Queries

The device supports the following common commands and queries.

General Commands and Queries

*IDN?	Returns the Identification string which consists of
	ETS, xxxx-yyy, SNnnnnnn, FWm.mmd
	Where xxxx-yyy is the model number, nnnnnn is the serial number and m.mm is the firmware version.
*OPC	Set operation complete mode (does nothing as no overlapped commands are supported).
*OPC?	Operation complete query (always returns 1 as no overlapped commands are supported).
*WAI	Wait for overlapped command complete (does nothing as no overlapped commands are supported).
*RST	Returns the amplifier to the standby condition and removes any fault conditions.
*TST?	Returns 1 always to signify that communications are working.

Polling Commands and Queries

*CLS	Clear Standard Event Status and Status Byte registers.
*ESE	Set the Event Status Enable register. Valid values are 0-255.
*ESE?	Read the Event Status Enable register.

*ESR?	Read and clear the Event Status register.	
*IST?	Read the ist (Individual status) bit. This is the bit read by a parallel poll operation.	
*PRE	Write to the Parallel Poll Enable register (8 bit). Valid values are 0-255.	
*PRE?	Read the Parallel Poll Enable register (8 bit).	
*SRE	Write Service Request Enable register. Valid values are 0-255.	
*SRE?	Read Service Request Enable register.	
*STB	Read Status Byte register.	

Serial Polling

Status Byte Contents

Bit 0:	Operate	The amplifier is in the active (un-muted) state.
Bit 1:	Interlock	The interlock input has been triggered.
Bit 2:	Fault	A fault has been detected.
Bit 3:	Status 3	Reserved (0)
Bit 4:	M.A.V.	Message Available (message queue is not used so always 0)
Bit 5:	E.S.B.	Enabled event status bit detected.
Bit 6:	M.S.S. (Serial Poll) R.Q.S. (*STB)	Master Summary Status (enabled status bit detected)
Bit 7:	Status 7	Reserved (0)

Standard Event Status Register Contents

Bit 0:	Operation Complete	Always 1 (no overlapped commands are supported)
Bit 1:	Request Control	Reserved (0)
Bit 2:	Query Error	Reserved (0)
Bit 3: Error	Device Dependent	Reserved (0)
Bit 4:	Execution Error	Reserved (0)
Bit 5:	Command Error	Signals there was an error in a command sent (either the command was not recognised or an invalid value was specified as an argument).
Bit 6:	User Request	Reserved (0)
Bit 7:	Power On	Indicates that an off-on transition has occurred on the power input.

Using the Serial Poll Function

When a bit is set by the device in the Status Byte register, if the corresponding bit is in the Status Enable register then the unit will generate a Request for Service (rsv) message on the GPIB bus, which acts as an interrupt to the host computer.

To enable the rsv function, set the corresponding enable bit in the Status Enable register to the bits which are desired to produce the interrupt.

Example: to enable the Operate, Interlock and ESB bits to produce an rsv message, set the Status Enable register to 0x13 (decimal 19):

*SRE 19<CR>

The ESB bit is set when an enabled bit in the Standard Event Status register is detected. If the bit corresponding to the ESB bit is set in the Status Enable register then a bit detection on the Event register will trigger an rsv message (see above).

Example: to enable Command Error bit, set the Event Enable register to 0x20 (decimal 32) and set the ESB enable bit in the Service Request Enable register.

*SRE 32<CR>

*ESE 32<CR>

When an rsv signal is detected by the host computer, the status byte is read to determine which device sent the message.

If the RQS, sent in place of the MSS bit in the case of a serial poll transfer bit is set, then this is the device that sent the request. Check the ESB bit to determine if the Event Status register also has an enabled bit set.

Example: ESB bit is 1, find which bit in the Event Status register triggered it:

*ESB?<CR>

The Event Status register is cleared with this command and the ESB will then be cleared.

Parallel Polling

The Parallel Poll Enable Register is an 8 bit register which determines which, if any, of the bits in the Status Byte register will generate an ist (individual status message), which is the bit read by the parallel poll operation.

The register is set and parallel polling enabled by issuing the *PRE command. The ist bit can be read either by conducting a parallel poll operation on the GPIB bus or by issuing the *IST command.

Example: generate an ist message on Fault and Event Status Bit detection (0x22):

*PRE 34<CR>

9.0   USB Operation

The USB port presents a composite device which has 2 interfaces:

Communication Device Class Interface

This interface emulates a serial port, allowing most applications capable of writing to COM ports to communicate with the amplifier using USB. No driver is needed with recent versions of Windows 10 or 11 or with Linux. The COM port should appear in NI-VISA but it may be necessary to click 'Refresh'.
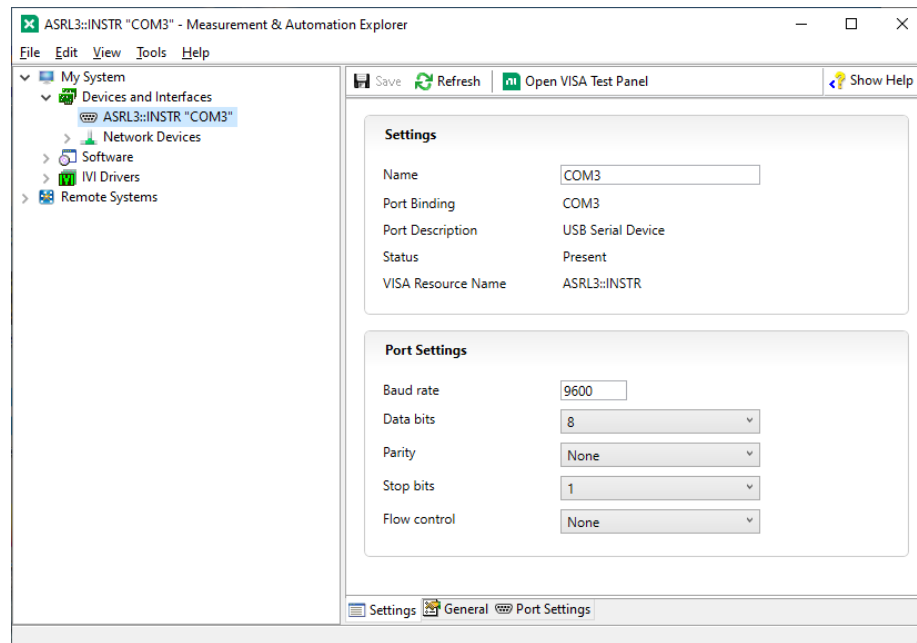
Use the default Configuration/Serial Settings, as these do not matter for an emulated USB/Serial adapter. The connection may be tested by clicking 'Open VISA Test Panel':
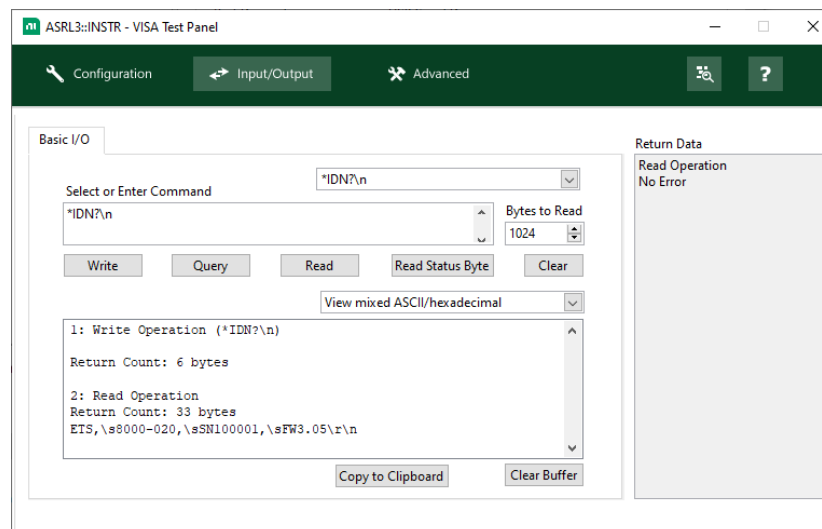
HID Class Interface

This interface uses the Human Interface Device definition as this allows faster operation with a generic driver supplied by the operating system. The steps when initialising the driver are as follows:

1. Detect a device change or manually start initialisation attempt.

2. Search for the VID/PID pair in the attached devices on the system to see if the attached device was the correct one.

3. The Vendor ID is 0x282E and the Product ID is 0x0001.

4. Find the device path to the detected device.

5. Open both read and write handles to the device in overlapped mode.

Initialisation

To find devices under Windows, the following system calls are required:

SetupDiGetClassDevs	Get a device info set of all HID devices using the HID class CLSID.
SetupDiEnumDeviceInfo	Get the next device in the set (loop through all devices in set).
SetupDiGetDeviceRegistryProperty	Get the USB VID/PID information for this device. Repeat from beginning until the VID/PID match.
SetupDiEnumDeviceInterfaces	Get the first (only) interface for the device. This contains the device path needed to open read/write handles.
SetupDiGetDeviceInterfaceDetail	Get detail data for the interface. This contains the device path needed to open read/write handles.
CreateFileW (GENERIC_WRITE)	Get write handle for sending data.
CreateFileW (GENERIC_READ)	Get read handle for receiving data.
CreateEventW	Create event for signalling when read has completed (this is the only way to make ReadFile timeout).

Packet Format

Each packet is a fixed length of 64 bytes of which the first 6 bytes is taken up by a packet header:

1 Byte:	Protocol Number	1 for command packet, 2 for response packet.
2 Bytes:	Sequence Number	Identifier to match commands to responses (increment by 1 each command).
1 Byte:	Command Length	Number of bytes in the payload
2 Bytes:	Command Checksum	Rolling sum of Length bytes in payload string

The Response packet uses the same format but substitutes the Command Length and Checksum with the Response Length and Checksum.

Under windows each read or write will contain a HID Report ID as the first byte, this is not used by this device and will always be 0. This makes 65 bytes for each read or write request.

Transfer

Each Query packet triggers a response packet. The user application should issue a WriteFile call to send the packet, then a ReadFile command with a timeout of around 1 second to receive the response.

Command packets do not normally trigger any response, however, error messages may be returned from Commands so the read buffer should be read with a zero time-out or flushed before sending the next Command or Query, to ensure that the response read is intended for the command sent.

Query and Command Format

The Commands and Queries used are the same as for the GPIB interface

(See Device Specific Queries and Responses, Device Specific Commands and Queries and Common Commands and Queries)

Serial and Parallel Polling

All the commands through the GPIB interface are supported, however, there is no supported way to generate an interrupt on the USB bus. The host can nevertheless read the status byte by using the *STB? Query, however, it must continually send this query and check the response if maintaining accurate information as to the amplifier state if required.

The registers accessed via USB are the same as those accessed via GPIB.

10.0   Ethernet Operation

The amplifier provides web and telnet interfaces for ease of use by humans and TCP stream and UDP packet socket interfaces which can be used by automated equipment.

Addressing

The easiest way the device can be accessed is by using the host name of the amplifier. This is by default **ETS-AMP01**. If more than one amplifier is present on the same network then they should be connected one at a time, and the host name changed so that each device has a unique host name by which it can be addressed.

Note: the default host name has been changed since previous versions for compatibility reasons.

Ethernet devices must also have a unique IP address, within a certain range allowed on the network. This can be assigned manually (Static IP) or automatically. Normally a network will have a central router or server which provides addresses to devices via the DHCP protocol. If there is no DHCP server then a process called Zeroconf can be used to automatically assign random addresses so that directly connected devices can talk to each other.

If the Network Mode has DHCP enabled, or a Static IP address has been set up, then the amplifier can be accessed from any computer connected to the same network as the amplifier.

If the Network Mode setting has Zeroconf Local Local (ZC) enabled, a straight one to one cable connection can be used to connect a portable laptop or other computer directly to the amplifier. Provided Zeroconf is enabled on the host computer the address of the amplifier should still be accessible either by using the host name or the IP address. These may be found by selecting 'Info' and then 'Network' from the front panel.

The default is both DHCP and ZC enabled. If no DHCP server is found then the amplifier will automatically assign itself a Link-Local IP address once a link is detected.

The Netbios Name protocol is used to translate host name requests to IP addresses. For this reason the 'http://' prefix must not be omitted or the requesting computer may not be able to resolve the IP address. Netbios names are not case sensitive, however they are by convention given as upper case.

Configuration of the network parameters may be done directly through the front panel display, via the display mirroring tab of the control program, via commands sent over the GPIB or USB interfaces (see Interface Protocol section) or through the Ethernet via the web interface, stream socket or telnet.

A standard web server is provided on port 80 which can be read by any modern web browser.

Open the web browser and enter '**http://ETS-AMP01**' in the URL bar and press enter.

The loading page will appear and redirect you to the main page.
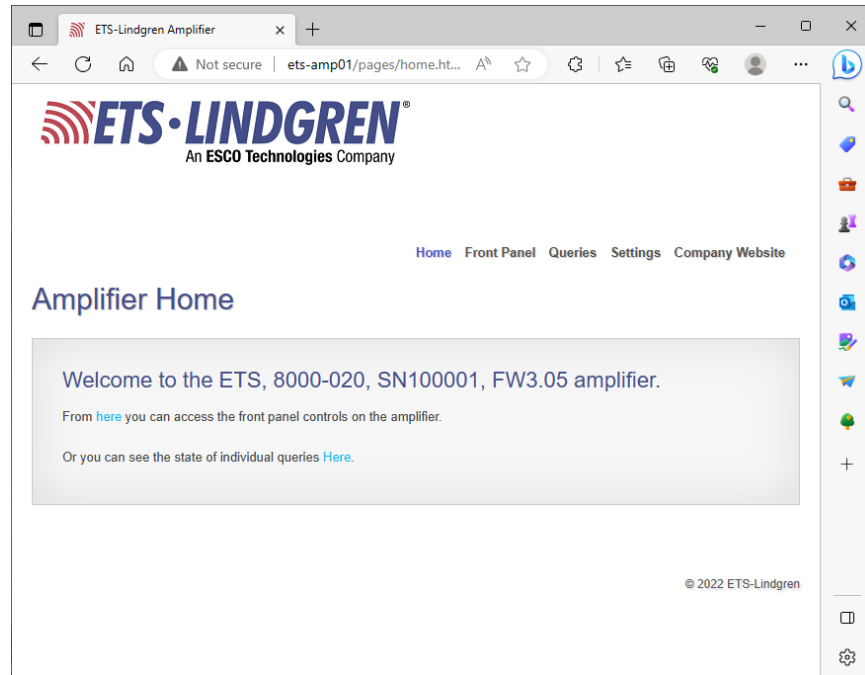
From here, it is possible to access a remote copy of the front panel interface, view various parameters of the amplifier status, and change the network settings.
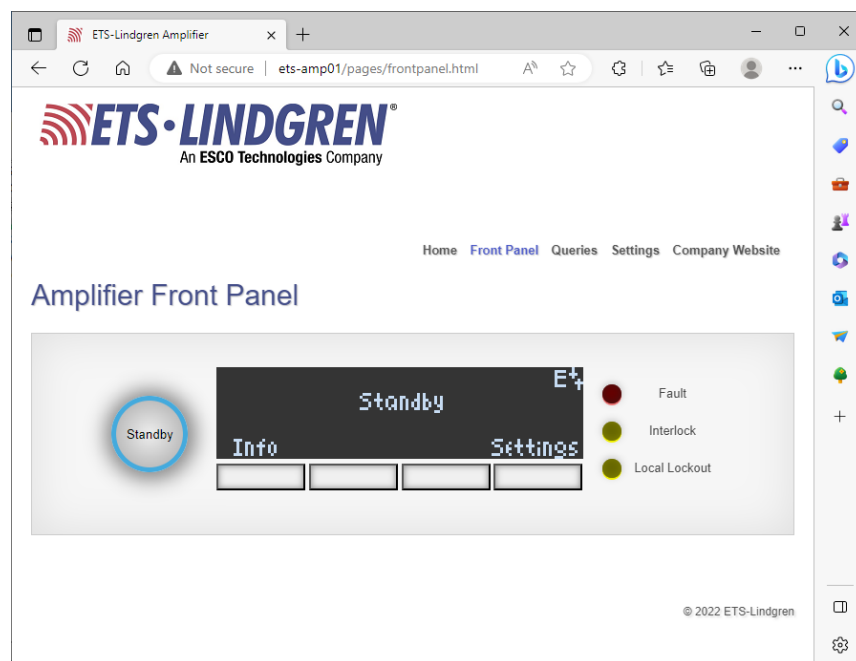
Additionally a command interface is provided whereby any of the GPIB/USB commands and queries can be sent. Click 'Queries' on the shortcut bar and then 'General Command Interface'. Use the 'ALL' command to get a complete list of all commands and brief descriptions:
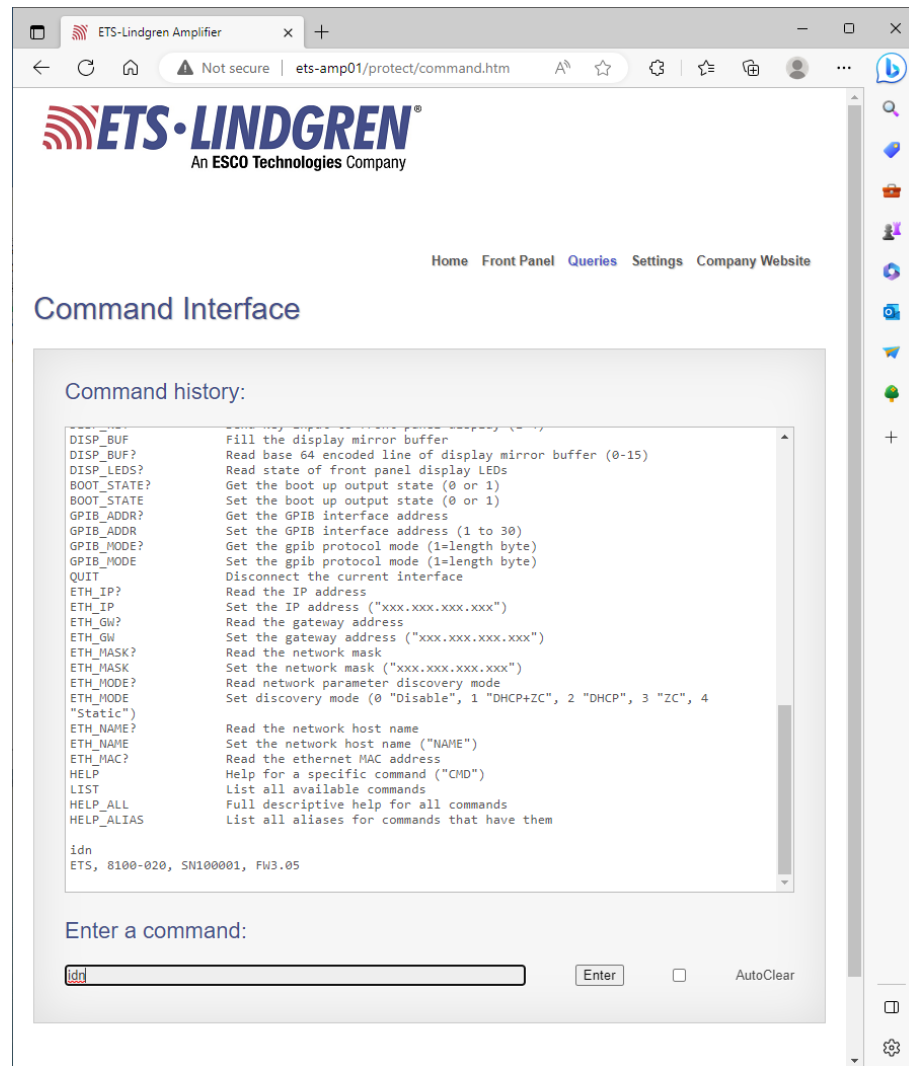
Web Commands

The web command interface may be used to easily send commands from the command line or in shell scripts, using the 'wget' program from GnuWin32:

>wget -q -O - http://ETS-AMP01/protect/command.cgi?cmd=*IDN?

ETS, 8000-020, SN100001, FW1.23

Stream Socket Interface

A TCP text stream server is provided on port 9761.

This can be used with standard software such as NI VISA.

Open NI Measurement & Automation Explorer.

Expand the 'My System' > 'Devices and Interfaces' tree and select 'Network Devices'.

Click 'Add Network Device' then 'VISA TCP/IP Resource'.
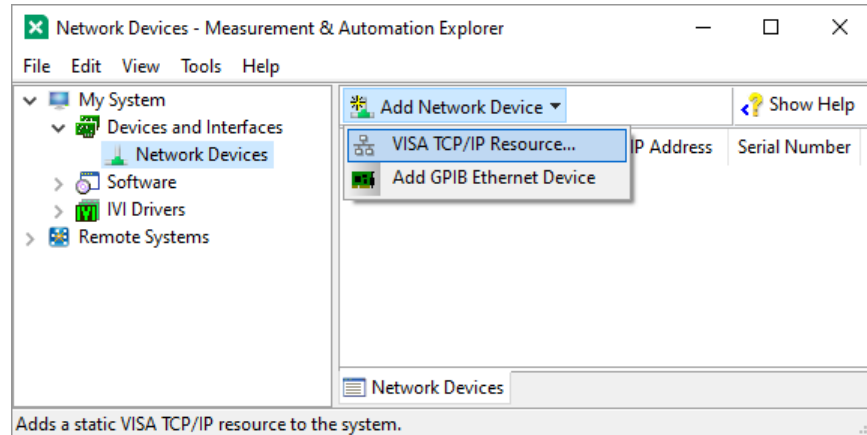
Select 'Manual Entry of Raw Socket'. Click 'Next'.
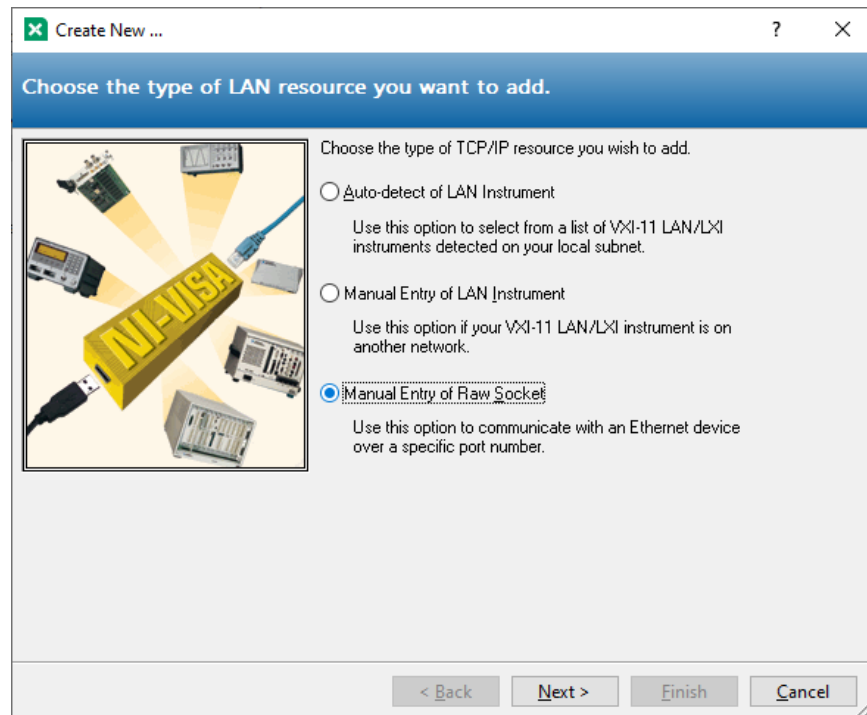
Enter the host name of the amplifier, which is **ETS-AMP01** by default and enter the port number **9761**, click 'Finish'.

The item 'TCPIP0::ETS-AMP01::9761::SOCKET' will be created under 'Network Devices'.

Click 'Open VISA Test Panel'.

Select 'Configuration' and the 'I/O Settings' tab. Select 'Enable Termination Character' and make sure it is set to 'Line Feed - \n'. Click 'Apply Changes'.
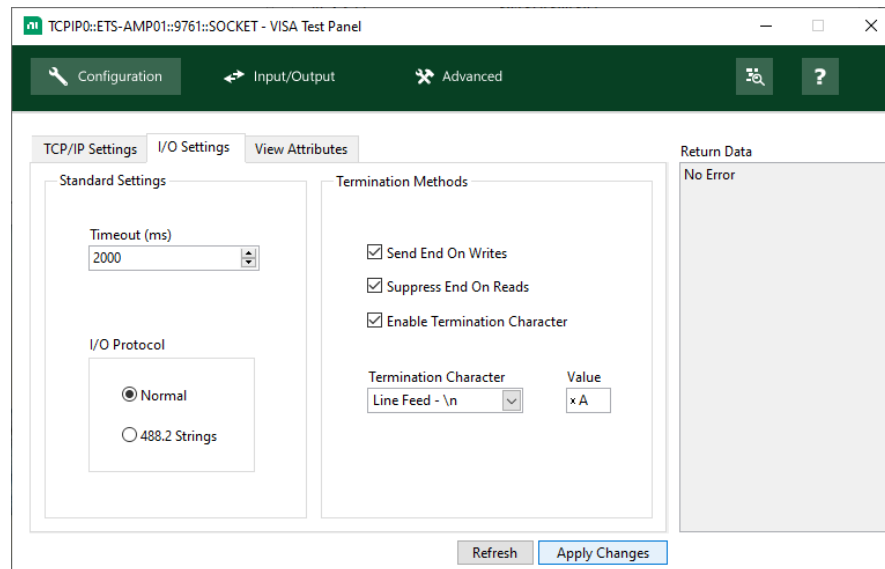
Select 'Input / Output'. Now sending Queries should work:
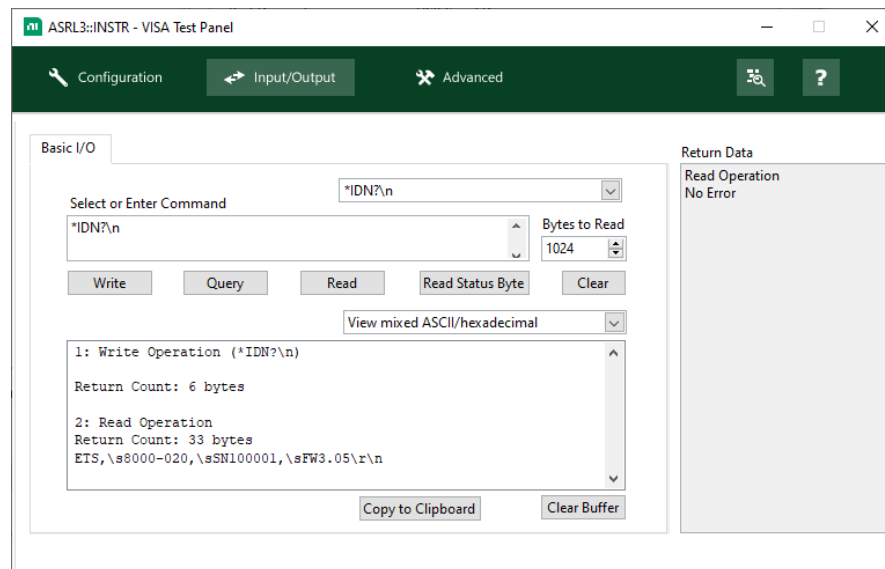
Any single line command which can normally be sent with USB or GPIB can be used.

For commands that return more than one line of text, such as the HELP_ALL command, disable the 'Enable Termination character' and set the Bytes to Read 10,000.

Packet Socket Interface

A UDP server is provided on port 9760.

The interface will respond with one response packet to each command packet it receives. The command set is the same as for GPIB and USB interfaces.

The Ethernet packet interface uses a similar format to the USB packet, however the length is not fixed. The first 6 bytes is taken up by a packet header:

|		
1 Byte:	Protocol Number	1 for command packet
		2 for response packet
2 Bytes:	Sequence Number	Identifier to match commands to responses
		(increment by 1 each command)
1 Byte:	Command Length	Number of bytes in the payload
2 Bytes:	Command Checksum	Rolling sum of bytes in payload string

This is followed by a text string forming the command or response information.

The Response packet uses the same format but substitutes

the Command Length and Checksum with the Response Length and Checksum.

Telnet Interface

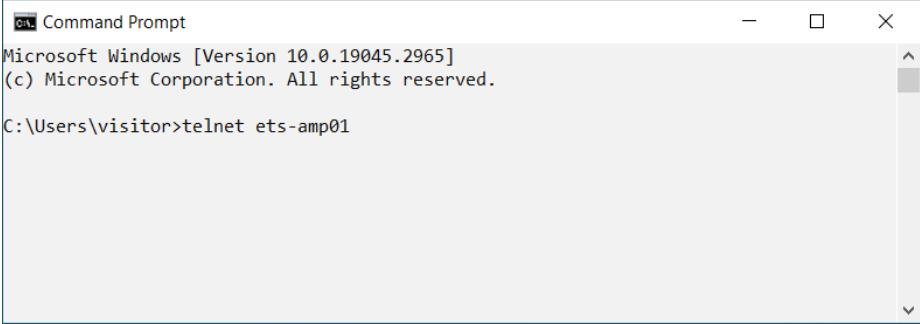A standard Telnet interface is supported on TCP port 23.

If using Windows, the telnet client can be installed by opening the Settings app, Selecting the 'Apps' category, then click on 'Optional Features', scroll down to the bottom and select 'More Windows Features'. Find and check the box marked 'Telnet Client' and click OK.
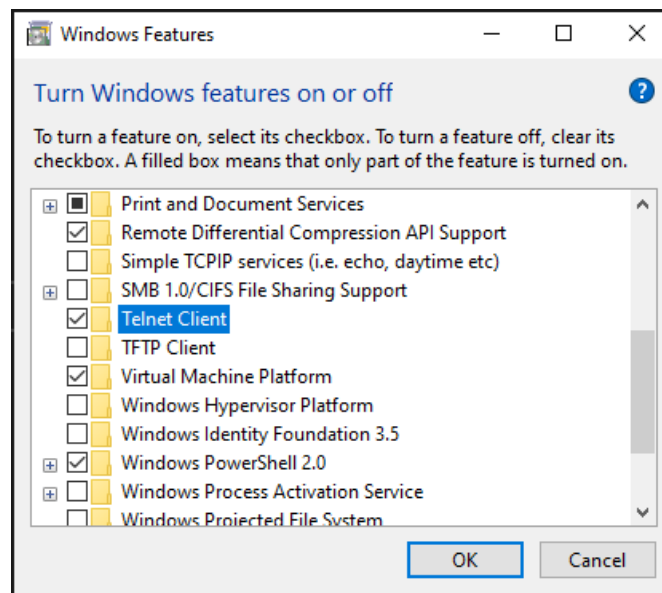
Open a command prompt (Start → cmd.exe).

Type telnet ets-amp01 [enter] (or the new hostname if this has been changed).
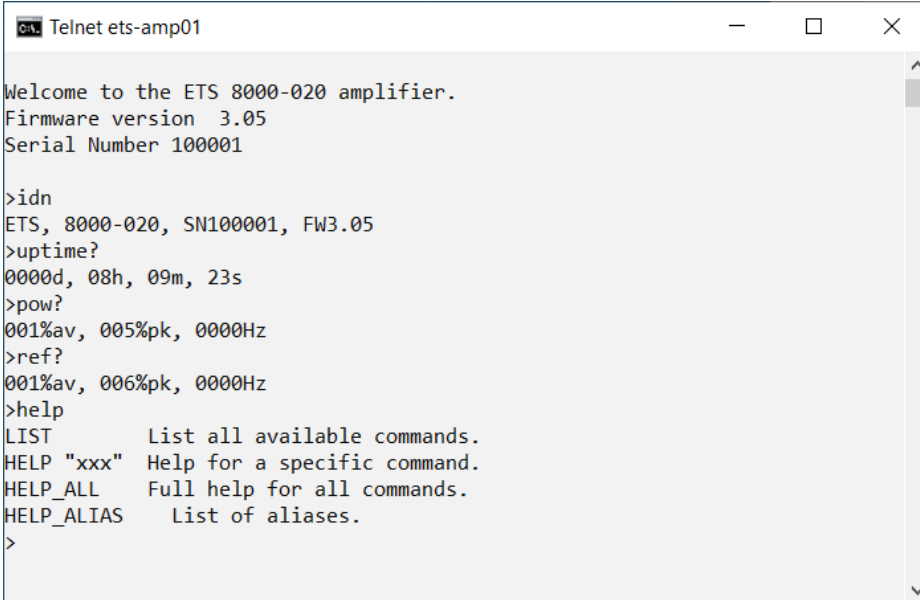
Or use the IP address from the front panel.

```
Command Prompt                                        —    □    ×

Microsoft Windows [Version 10.0.19045.2965]
(c) Microsoft Corporation. All rights reserved.

C:\Users\visitor>telnet ets-amp01
```

Type 'help' for help using commands. A complete listing of all commands can be obtained by using 'help_all' or just 'all'. A list of command aliases can be obtained by using 'help_alias' or 'alias'.

Note that line editing is not supported, so commands must be typed correctly the first time.

```
Telnet ets-amp01                                      —    □    ×

Welcome to the ETS 8000-020 amplifier.
Firmware version  3.05
Serial Number 100001

>idn
ETS, 8000-020, SN100001, FW3.05
>uptime?
0000d, 08h, 09m, 23s
>pow?
001%av, 005%pk, 0000Hz
>ref?
001%av, 006%pk, 0000Hz
>help
LIST        List all available commands.
HELP "xxx"  Help for a specific command.
HELP_ALL    Full help for all commands.
HELP_ALIAS   List of aliases.
>
```

Type 'quit' or just 'q' to exit the telnet interface.

Security

It is assumed that the network the amplifier is used on is reasonably secure. Any party who can access the network can send commands and queries to the amplifier.