Remote Control Interface

User Manual

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Revision Record

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

Revision	Description	Date
A	Initial Release	October, 2014

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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 or GPIB bus.

The keypad and display interface is used for monitoring amplifier state, power levels, 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

This is comprised of an OLED matrix display for displaying the amplifier status and a four key keypad for selecting configuration options.

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3.0 Multi-Purpose Interface Operation

Overview

The 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.

Display

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 an indication of the amount of modulation. Marks every 10% give a qualitative indication of the actual output power.

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:

- Standby
- Interlock
- Supply Failure
- Over Temperature
- Fault

Pressing the Display key shows details of the amplifier state.

- The first screen shows the power readings in detail for both forward and reflected power.
- The first is the mean power (Av), the second is peak power (Pk). A frequency count is also shown at the end (Hz); pressing the Next key will cycle through the available information.
- The second screen shows the amplifier power supply status. This is useful for diagnostic purposes if there is a power supply failure.
- The third screen shows the amplifier heat sink temperature. The maximum temperature since power on and the maximum temperature ever recorded are also shown.

Pressing the Exit key will return to the default screen.

Settings

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

1. Select an option by pressing the relevant key, and then use the +/- keys to cycle through the possible values.
2. When the desired value is shown after “New”, press the Apply key to save the setting to the FLASH ROM, and then select Exit to return to the options screen and again to the default screen.

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 driven using a TTL or open collector driver.

INTERLOCK N

This connector is of type BNC female. A short circuit to this connector puts the amplifier into a muted condition. The input may be 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.

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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” and the Fault Indicator is illuminated. 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 GPIB Operation

The GPIB operates according to IEEE488.2, except that only numeric data in the form of decimal integers and fixed point are recognised.

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 Settings in Section 3.0). 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.

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 driver 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 vector values for:

- Power
- Temperature
- 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.

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 Queries and Responses

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.

Query	Reponse
FAULt?	ASCII 0 = OK, 1 = fault line tripped
INTerlock?	ASCII 0 = OK, 1 = interlocks tripped
SUPPLYFAIL?	ASCII 0 = OK, 1 = power supply out of range
OVERTEMP?	ASCII 0 = OK, 1 = too hot trip
POWer?	XX%av, YY%pk, ZZZZ Hz where X is the average power as a percentage of maximum output (00-99), Y is the peak power and Z is the modulation frequency counted
REFlected?	XX%av, YY%pk, ZZZZ Hz where X is the average power as a percentage of maximum output (00-99), Y is the peak power and Z is the modulation frequency counted

Query	Reponse
OPERATE?	ASCII 0 = muted (or fault condition), ASCII 1 = active (not muted)
SUPPLY_A?	XX.XVav, YY.YVpk, ZZZZHz
SUPPLY_B?	where X is mean voltage, Y is peak voltage
SUPPLY_C?	Z is ripple frequency for the relevant supply
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
UPTIME?	NNNNd, NNh, NNm, NNs where N is the number of days, hours, minutes and seconds the unit had been powered for
RUNTIME?	NNNNd, NNh, NNm, 00s where N is the number of cumulative days, hours & minutes the unit had been powered for, to the nearest 2 minutes

Device Specific Commands

Note that the commands are not case sensitive. Upper-case and lower-case are written to designate the required and optional ending respectively.

Command	-	Action taken
MUTE	-	The amplifier is disabled.
UNMUTE	-	The amplifier is enabled.
STANdby	-	Toggle amplifier enabled state.

General Commands and Queries

*IDN?	Returns the Identification string which consists of ETS-Lindgren, 8000-XXX, SNnnnnnn, FWm.mmd Where 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:	Device Dependent Error	Reserved (0)
Bit 4:	Execution Error	Reserved (0)
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 is sent in place of the MSS bit, a serial poll transfer bit is set, this is then 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>

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7.0 USB Operation

Device Type

The amplifier uses the Human Interface Device definition as this allows 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.

   The Vendor ID is 0x282E and the Product ID is 0x0001.
3. Find the device path to the detected device.
4. Open both read and write handles to the device in overlapped mode.

Initialization

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.

If the VID/PID matches, then do the following:

SetupDiEnumDeviceInterfaces	Get the first (only) interface for the device.
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 Resonses, Device Specific Commands and Common Commands and Queries in section 6.0).

Serial / 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.