

# PCB User Manual for 443B Control Software

## Model number EE79

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### Overview

The Model 443B Dual-Mode Amplifier is a comprehensively equipped charge and ICP<sup>®</sup> preamplifier intended for use with piezoelectric pressure, force and vibration sensors. This amplifier is particularly useful for field and laboratory measurement of acceleration, velocity, and displacement vibration.

The Dual-Mode Amplifier features an input for both charge and ICP<sup>®</sup> sensors. The unit has unified output ratings, built-in integrators for velocity and displacement, switchable low and high pass filters, and a built-in reference signal. The output can be routed to many devices including DAT recorders, scopes, and frequency analyzers. The Model 443B102 also offers medium and long time constant settings.

All racks that host 443B units have an RS-232 port that facilitates a remote control capability. This document describes the 443B Control software which uses that interface to set and read the various hardware settings of the individual units. This software is intended to demonstrate the basic operations of a 443B unit and is not a comprehensive multi-channel control system. For more information on the 443B units themselves please refer to the Model 443B101/443B102 Dual Mode Amplifier Operating Manual, Manual number 19854.

### Operation

The Model 443B is designed to fit into the PCB Modular Signal Conditioning System. It may be used as a single-channel stand-alone system or as part of a four-channel package housed in a single cabinet. For further information on the PCB Modular System, consult the PCB Modular Signal Conditioning System sales sheet.

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The Model 443B is designed to operate from 110 to 220 volts AC at 50/60 Hz. The unit may also be powered from an optional battery package powering all four 443Bs.

### RS-232 Control Details

For RS-232 communication, the port settings should be as follows:

General	DCE interface, XON/XOFF flow control, Asynchronous protocol
Baud Rate	9600 Baud
Start Bits	1
Data Bits	8
Parity	None
Stop Bits	1

The message format is as follows:

Start Byte (0x02)	Destination ID (Rack/Slot)	Command (3 components)	End Byte (0x03)	Checksum
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- **Start Byte** - STX (0x02) - marks the start of a new message.
- **Destination ID** - 16 bits - rack code (0-3 ASCII) followed by slot address (0-9 ASCII). Messages meant for the master will have "MM" in this field.
- **Command** – See Appendix A. This field contains the command followed by any associated data. The command structure has the following 3 components.
  - **Module Type** - Three ASCII printable characters, this field identifies the type of module that command is meant for. For the 443B series, this will be either C01 (for 443B101) or C02 (for 443B102)
  - **Module Command** - Four printable ASCII characters, this field identifies the command for the module.
  - **Data Field** - Contains any data associated with the command.
- **End Byte** - ETX (0x03) - marks the end of the message.
- **Data Checksum** - 16 bits - the ASCII hex of the 8-bit sum, ignoring overflows, of all bytes in the message including SOT and ETX bytes.

All messages sent to the rack will receive a response in the form of an ACK or a NAK.

Start Byte (0x02)	ACK (0x06)	Data Field	End Byte (0x03)	Checksum
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Start Byte (0x02)	NAK (0x15)	Reason Byte (Char)	End Byte (0x03)	Checksum
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NAK Reason byte definitions

- 'C' - Check sum error in message received from external host.
- 'D' - Data overflow error – the size of the data field was larger than the message buffer. The buffer is 95 bytes long
- 'F' - A framing error occurred – ETX was received before it was expected.
- 'C' - Check sum error occurred while communicating with internal module.
- 'T' - Time-out – message not sent, rack/slot address may be incorrect.

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### 443B Control Software

The 443B software is distributed on a CD that ships with the 443B units. Following are the instructions for its installation and use.

### Hardware Requirements to Host the Software

A PC desktop or laptop that meets the following criteria is sufficient. This is a 32-bit application, nothing special is required.

- Windows OS 32 or 64 bit (XP, 7,8 or 10 )
- Minimum OS RAM requirements (typically 2-4 GB)
- 1MB hard drive space
- Serial port or USB port with a USB to Serial Port Adapter (e.g. IOGear GUC232A)

### Installing the Software

The 443B software must be installed on a PC before use. To install the software run the 'setup.exe' program on the installation CD and follow the instructions when prompted. It is suggested that you accept the default settings. The default install directory is C:\PCB\443B. Accepting this location will eliminate certain Windows directory access violations that could occur.

When the install process completes there will be a **443B Control** Icon on the desktop and an entry in the Programs Menu list named **443B Control Program**.

If you are using a USB to Serial Port Adapter you must also install the driver for it.

### Software Operation

After turning on the 443B rack and connecting the serial cable to the RS 232 connector on the back of the rack, start the program by clicking on the 443B desktop icon or select the 443B Control Program entry from the All Programs list. When run, the main screen shown in Figure 1 will appear. It will immediately instruct the user, via dialog box, to set the appropriate COM port, Rack and Slot id's of the 443B unit to communicate with (also shown in Figure 1). After the 'OK' button on the dialog box is clicked the software will highlight the 'Set' button in the upper right of the main screen where these selections are made. If the serial port (or USB to Serial adapter) is functional its port id will show up in the pull down Communication Port control.

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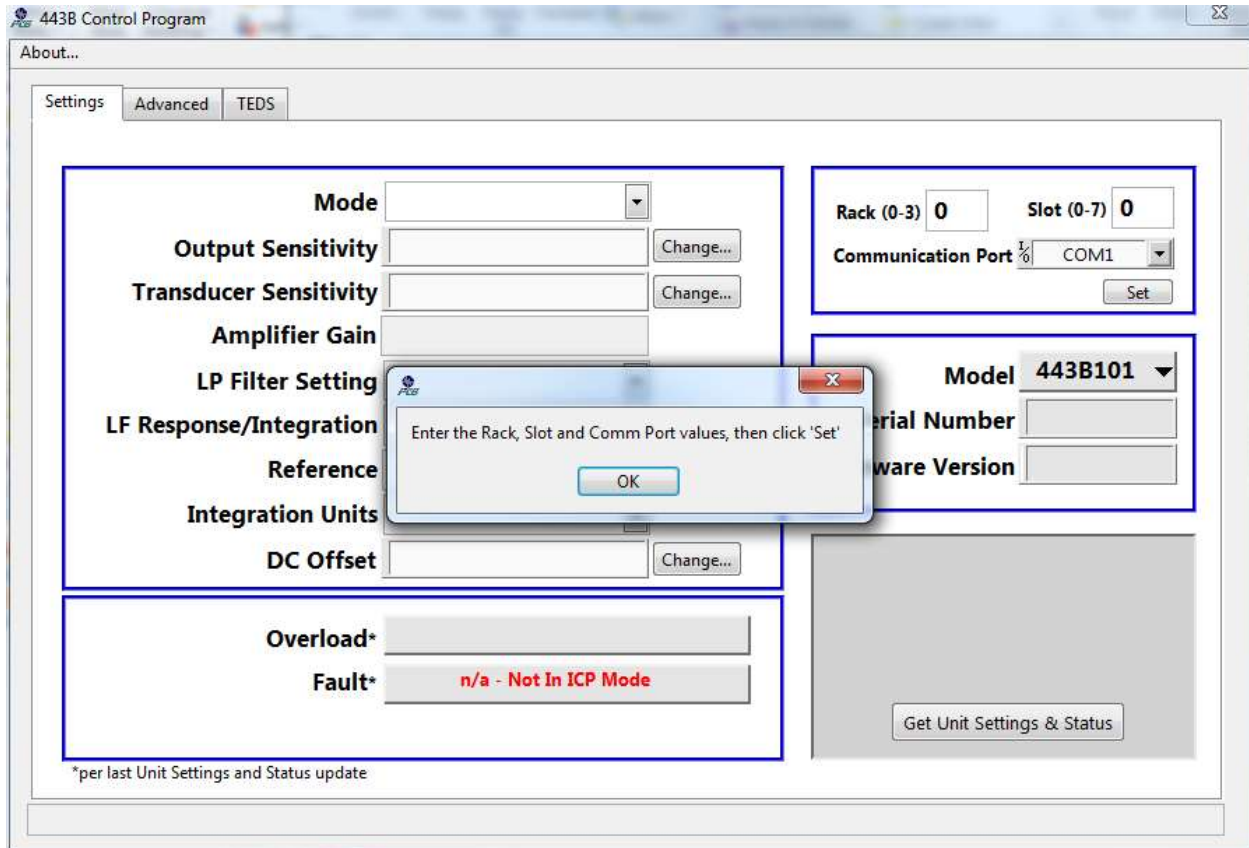


Figure 1 Main Screen after application start

Select the appropriate COM port and enter the Slot (0-3) and Rack (0-7) id controls and activate the Set button (Figure 2).

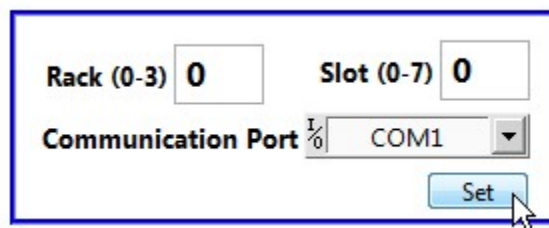


Figure 2 Main Screen 443b Communication parameter settings

Activating the **Set** button causes the software to establish communication with the unit and query it for its Model type, channel settings, serial number, firmware revision and DC offset. As this information is collected, various status messages will display in the lower left of the main screen (circled in Figure 3).

When complete all settings on the main screen will reflect the current settings of the unit as shown in Figure 3.

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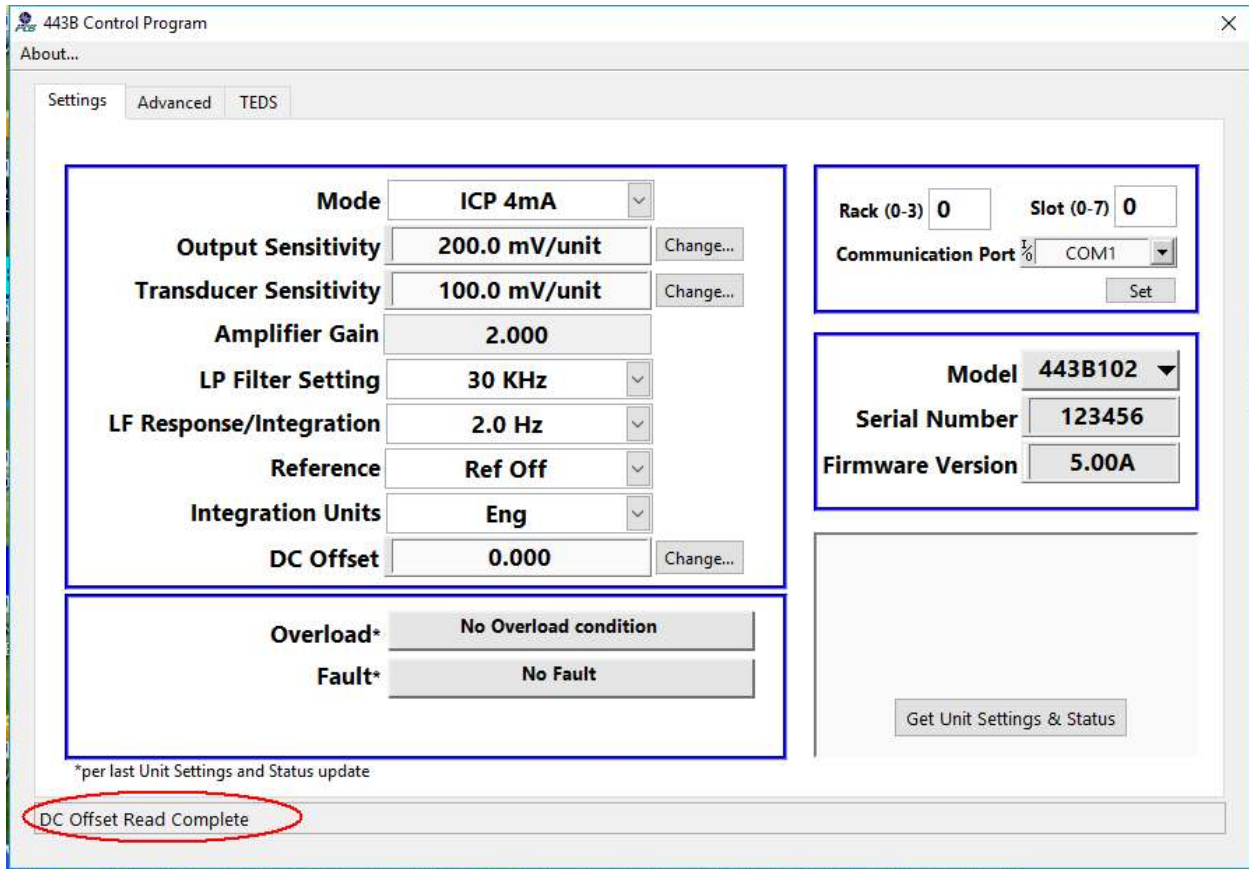


Figure 3 Main Screen with settings after communication established

### Fault Condition Indications

If a fault condition exists, such as no input sensor is connected in ICP mode or an overload condition exists, they will be displayed in the lower left section as shown in Figure 4 and Figure 5.

An overload condition may be transient as the result of a gain change. To refresh the indications activate the 'Get Unit Settings & Status' button located on the bottom right of the screen.

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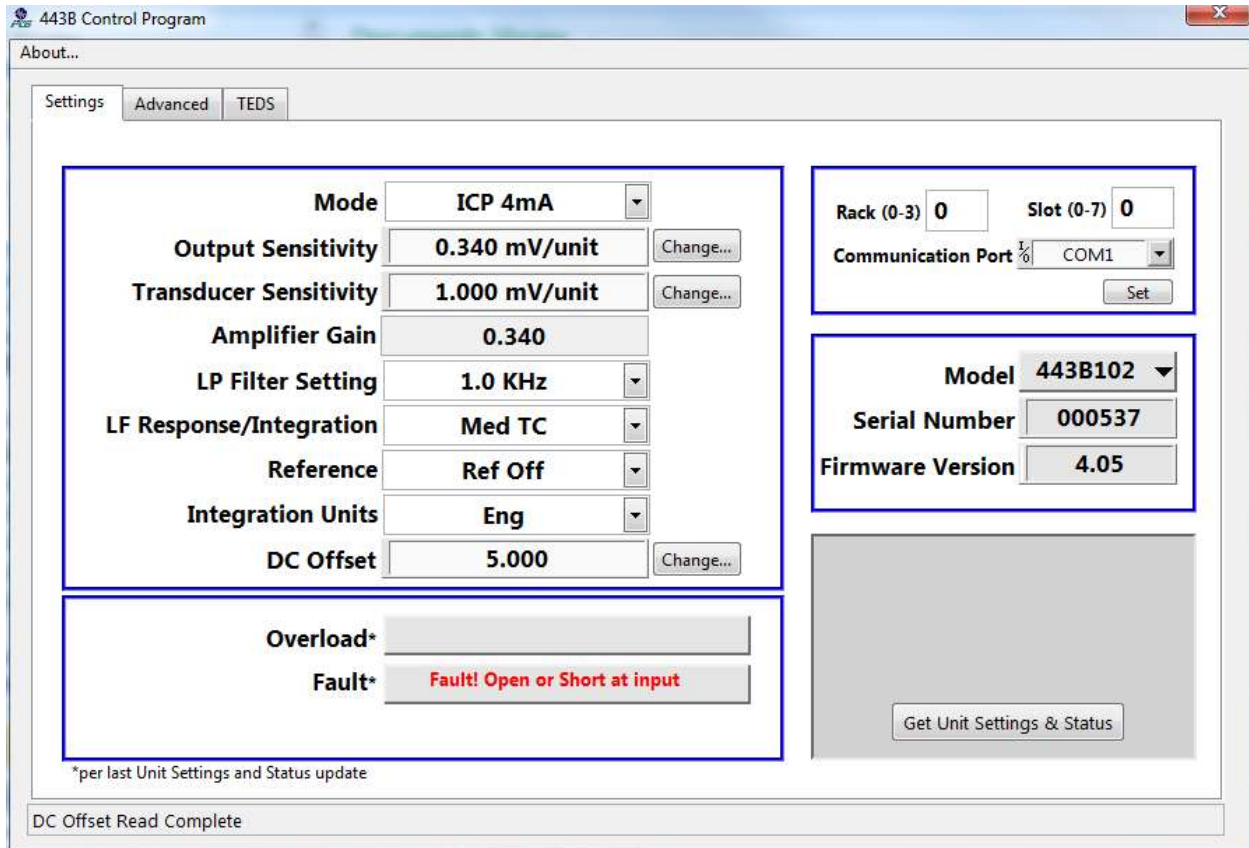


Figure 4 Main Screen showing input fault condition (ICP input no sensor connected)

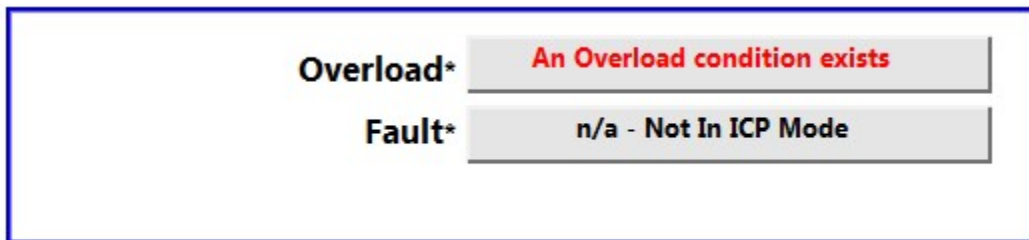


Figure 5 Main Screen fault section showing Charge input overload condition

### Setting Channel Parameters – Settings Tab

Most 443B settings can be changed by selecting an option from a pull down list associated with each item on the Settings tab. To make a selection, click on the list indicator to the right of the setting and select an option from the list (Figure 6). The exception to this is the **Output Sensitivity**, **Transducer Sensitivity** and **DC Offset** settings where a real number entry is required. In these cases click on the 'Change' button next to the item and enter a number in the displayed dialog box.

After a setting change is made a success or failure a dialog box will appear indicating the status as shown in Figure 7.

**Note:** **Gain** cannot be set directly. It is only an indicator and is simply the result of Output Sensitivity divided by Transducer Sensitivity. It is only displayed when the **LF Response / Integration** is not set to an integration setting.

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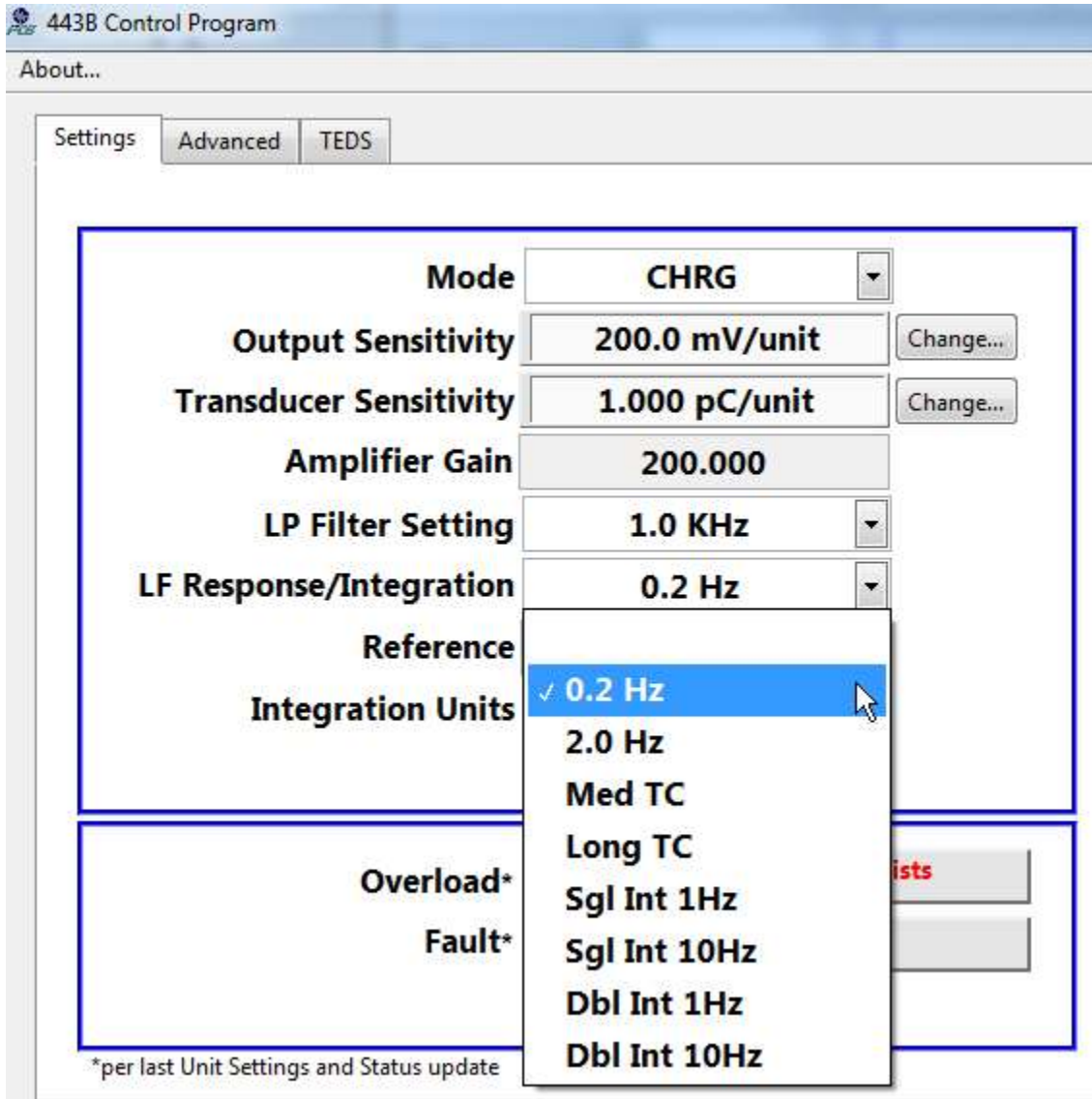


Figure 6 Main Screen – Selecting the Reference option from a list

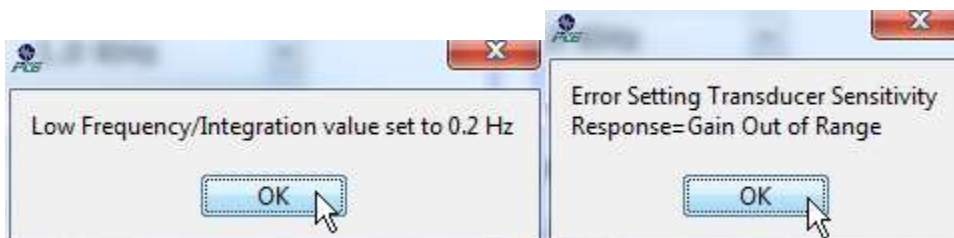


Figure 7 Main Screen dialog boxes showing a successful setting and an error

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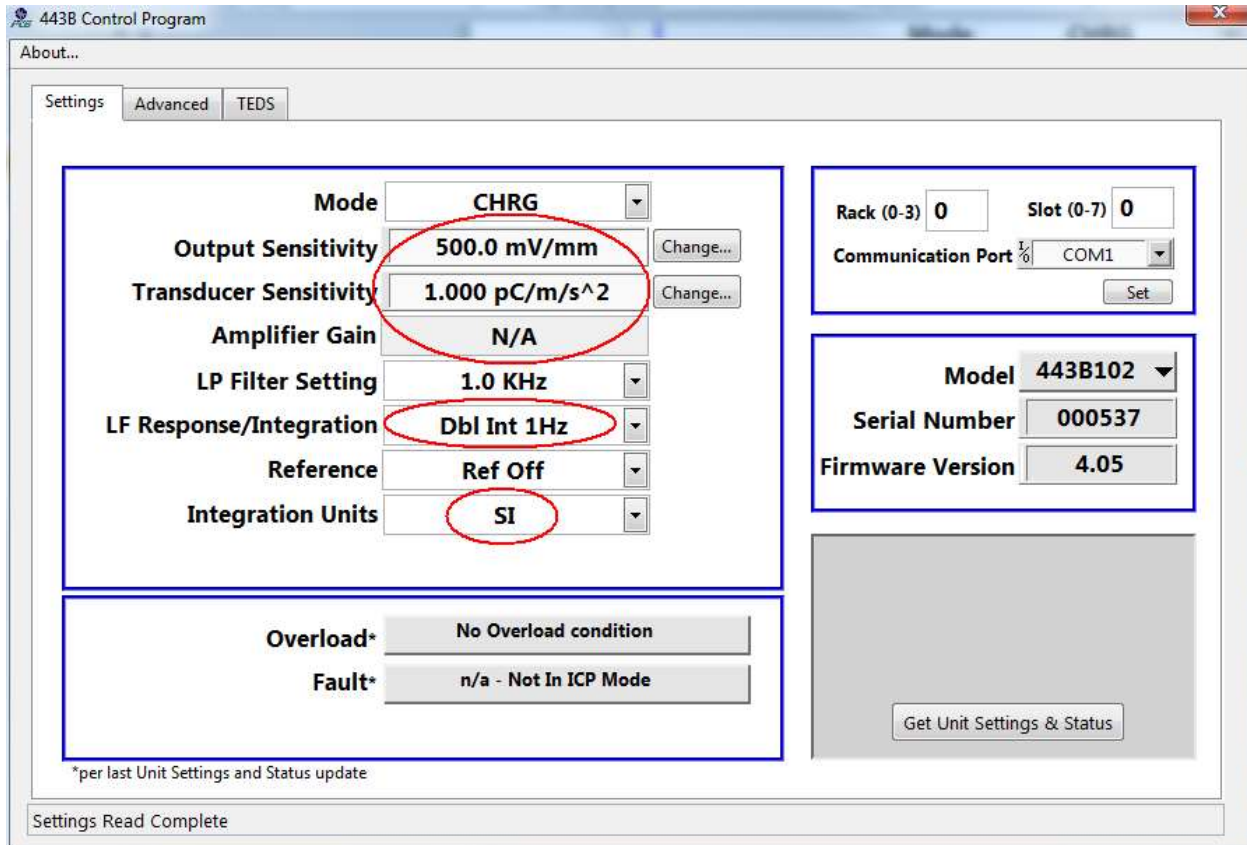


Figure 8 Main Screen with Double Integration and SI units enabled

### LF Response/Integration Settings

When the **LF Response / Integration** value is set to an integration setting the units associated with the transducer and output sensitivities will change and reflect the **Integration Units** selection of either SI or English units (Figure 8) and the Gain will display as N/A. When set to another value (e.g. 2Hz, 0.2 Hz, Med or Long Time Constant) the 'Integration Units' setting has no effect and the Gain will be displayed.

When **LF Response / Integration** is set to **Long Time Constant** and the unit is in **Charge** input mode, other options will appear as shown in Figure 10. Specifically these are the Auto Zero, Nulling, and Zero Lock (Clamp) function buttons and an additional status indicator – Zero Lock on/off. Additionally the Nulling and Auto Zero functions may take a long time to complete. If another command is sent while one of these functions is active the dialog box in Figure 9 will be displayed and the command will be ignored.

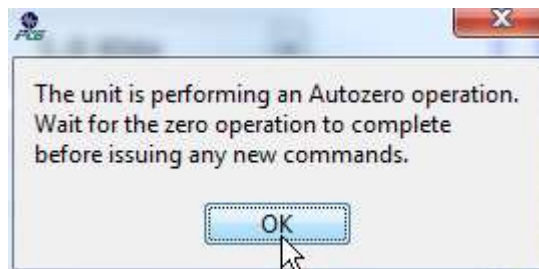


Figure 9 Charge Mode, Long Time Constant Auto Zero Dialog box



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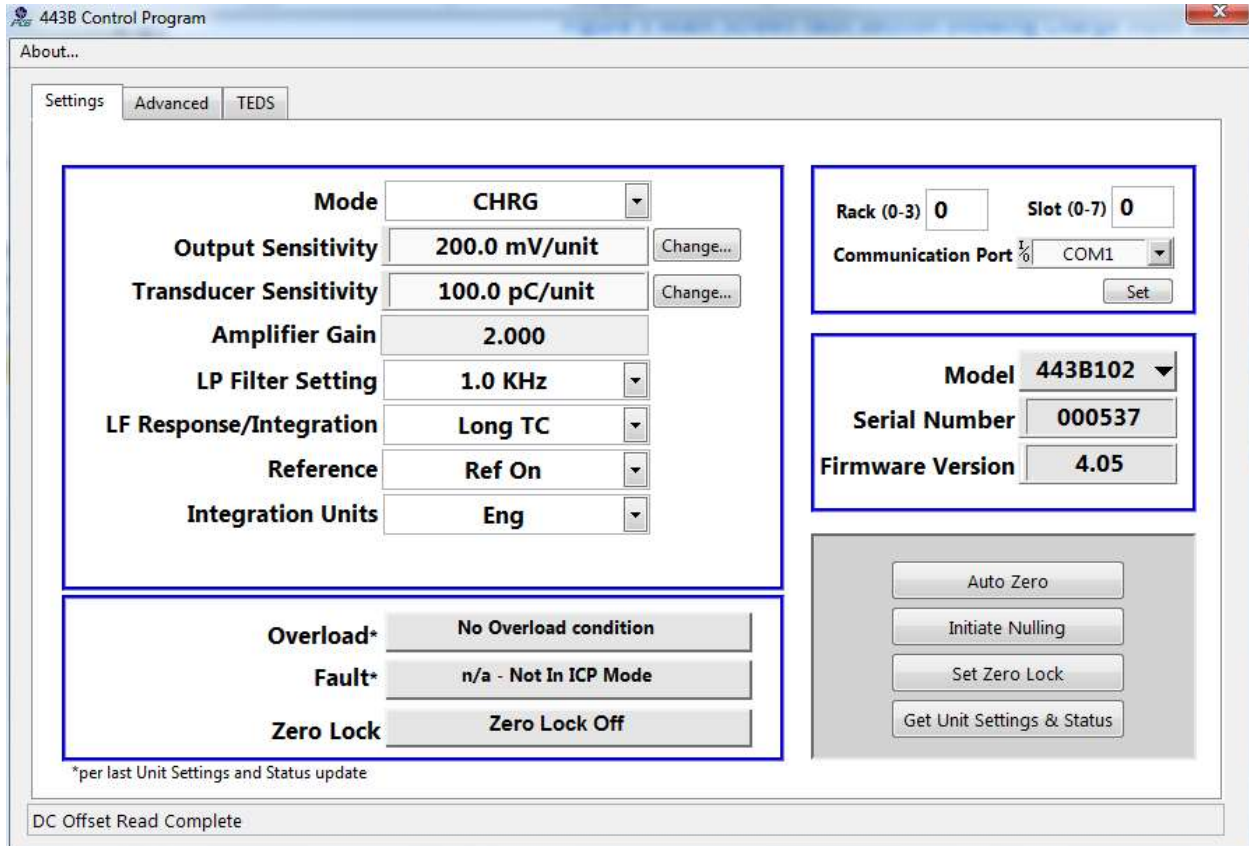


Figure 10 Main Screen with Long Time Constant enabled

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### Context Help

toggling <Ctrl-H> turns the context help window on or off. When on it will display information pertinent to the item the mouse hovers over. For instance in Figure 11 the mouse is on the Reference item, in this case the window shows detailed information about the reference command. Move the mouse to other settings to learn their details.

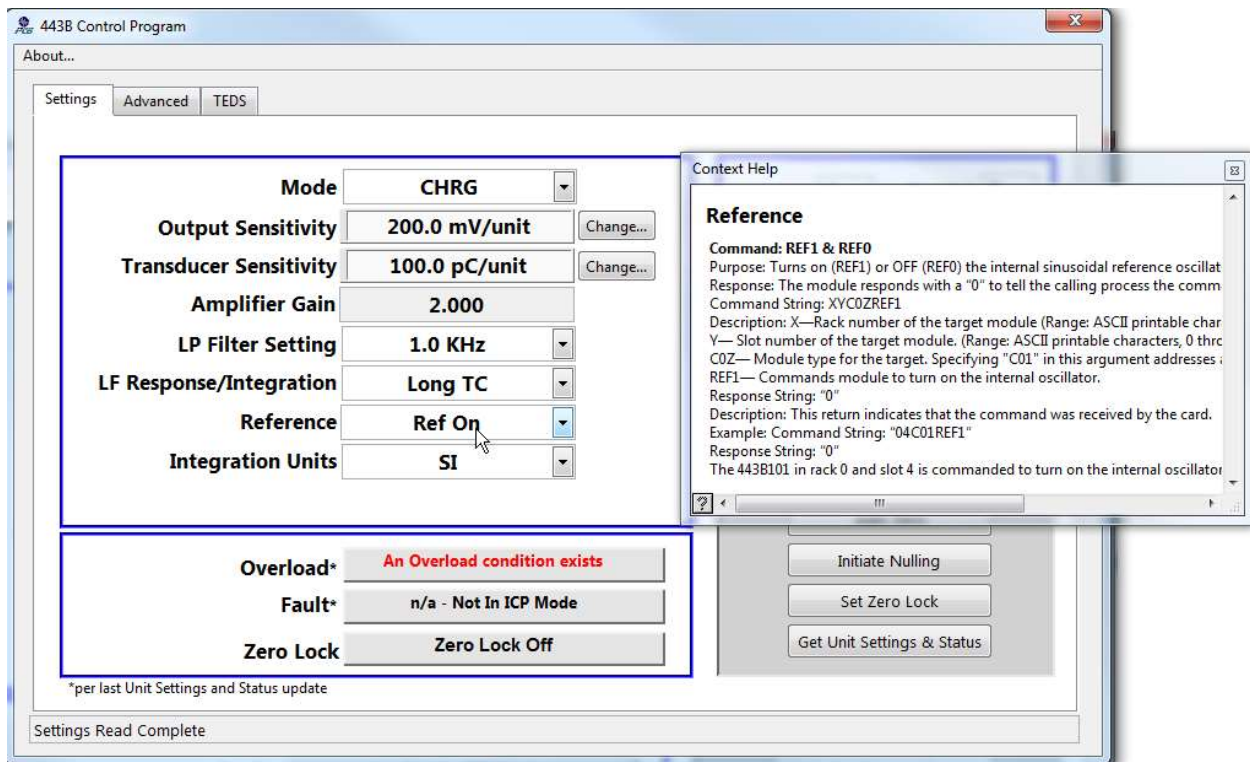


Figure 11 Main Screen showing context help enabled

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### Sending Manual Commands- Advanced Tab

The Advanced tab (Figure 12) contains controls to generate and send commands manually. When the Send button is clicked, a message is created and sent to the unit using the Command entered on this tab and the communication and model parameters defined on the Settings tab (Rack, Slot, COM port).

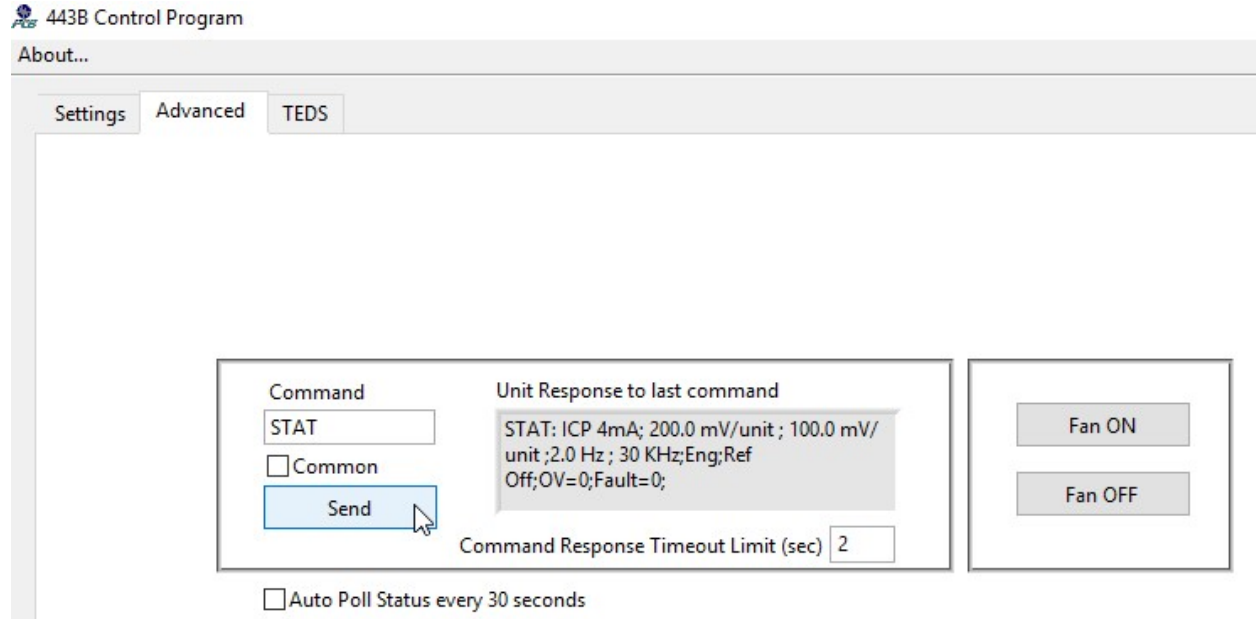


Figure 12 Main Screen Advanced Tab

**Common** – Checking this box causes ‘CMM’ to be inserted in the command string instead of the Model type (e.g. C01). A common command is one that is universal to all 443 units. For instance, SVER is a ‘common’ command.

**Unit Response to Last Message**– This indicator displays the unit’s response to the last command sent to the unit. The command could be from this tab using the Send button or a command generated from the Settings tab.

**Fan On and Fan Off Buttons** – These buttons generate rack commands (FANO or FANF) to turn the racks fan on or off if the rack is so equipped.

**Auto Poll Status** – Check this box to read and update the specified 443B unit’s settings and status every 30 seconds. The command sent by this function is identical to the one sent by clicking the **Get Unit Settings & Status** button on the Settings Tab.

**Command Response Timeout Limit** – This is the time, in seconds, allowed for the 443B unit to respond to a command. The default is 2 seconds. If you experience communication issues you can extend the timeout to a larger value (e.g. 3 seconds).

*Note: Auto Poll is not recommended in Long TC mode.*

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### TEDS Tab

The Transducer Electronic Data Sheet (TEDS) tab provides a mechanism to read TEDS information from a TEDS capable ICP sensor. It displays the details of the sensor's memory chip and its contents in the 443B TEDS Results section and interprets it based on TDL files included with this application for display in the table on the right.

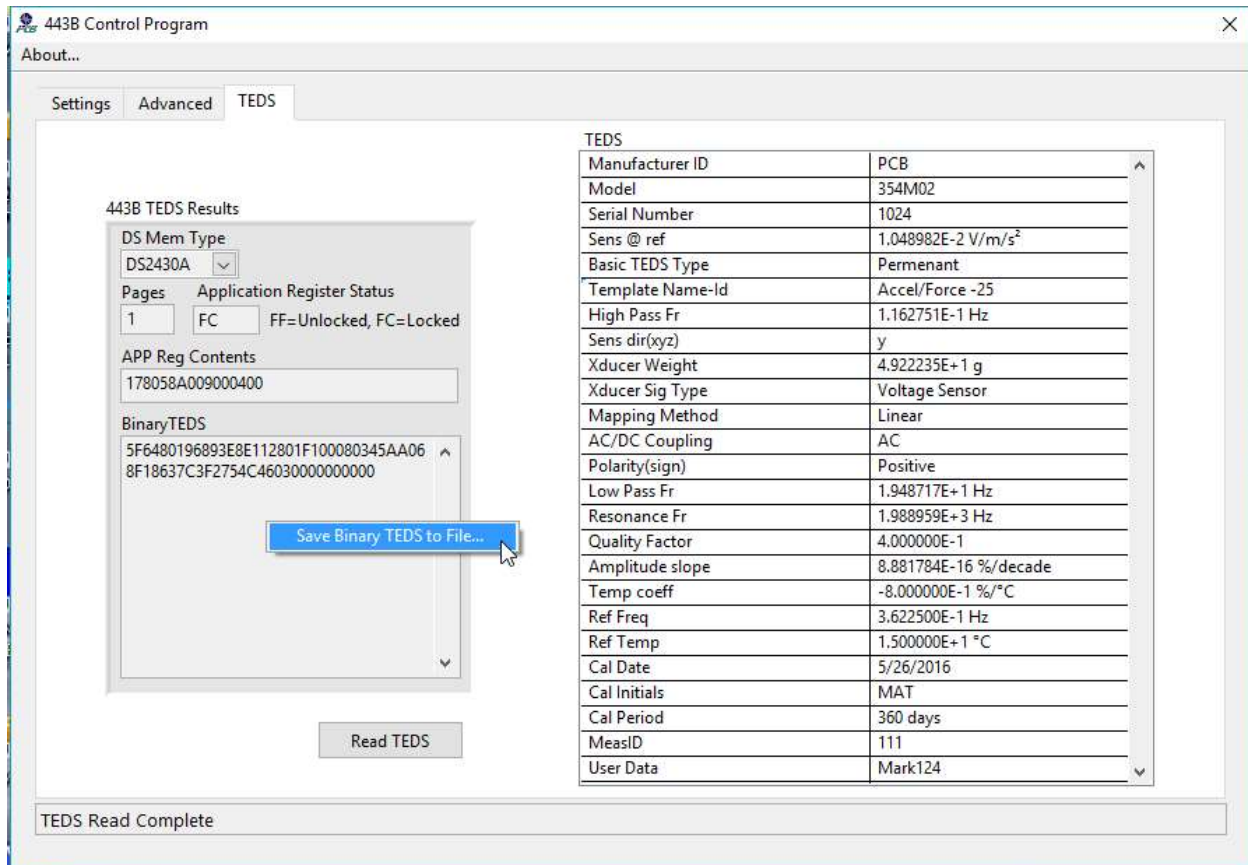


Figure 13 Main Screen fault section showing Charge input overload condition

443B TEDS Results – This section shows the response to the binary TEDS read (TEDD) command.

- DS Mem Type – This is the memory chip type discovered (DS2430A, DS2431 etc.)
- Pages – the number of 32 byte memory ‘pages’ in the chip
- Application Register Status – Applicable to the DS2430A only
  - 0xFF – The 64-bit application register is unlocked.
  - 0xFC – The application register is locked and contains the basic TEDS information.
  - N/A – the discovered chip does not have an application register.
- Application Register Contents – if an application register is present and has data the 64 bits are presented here as 8 hexadecimal bytes.
- Binary TEDS – All pages of the chips EEPROM contents are presented here in hexadecimal byte format. If you right click on this indicator then the ‘**Save Binary TEDS to File**’ menu item appears. Activating it allows you to save the memory chip contents to a text file for further examination.

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The file format is the number of chip ‘pages’ in the 1<sup>st</sup> column followed by each pages’ contents in subsequent columns. All data in this file is in hexadecimal format.

- TEDS Table – the Binary TEDS content is interpreted here if the indicated TEDS template was found in the standard IEEE 1451.4 TDL files included with this application.

## Appendix A – 443B Command Reference

Command	Command example	Response	Command explanation
	<b>&lt;rack&gt;&lt;slot&gt;&lt;unit&gt;&lt;cmd&gt;</b>	<b>0=OK</b>	<b>Unit Commands</b>
MMOD	02CMMMMOD	C02	returns the module type of the card at the location specified by the command
SVER	04CMMSVER	3.95	returns the version number of the firmware in the target module
SER#	00CMMSER#	123456	Returns the serial number of the card at the target location
OUTS	02C02OUTS1.001	0	Sets the output sensitivity of the amplifier
XDCR	04C01XDCR2.034	0	Sets the transducer sensitivity of the amplifier
CHRG	00C01CHRG	0	Puts the amplifier into charge mode
ICPM	06C02ICPM08	0	Puts the amplifier into ICP mode and sets the constant current Current settings: 00=off;02;04;08;12;20 mA
SETF	06C02SETF3	0	Sets the cutoff frequency of the low pass filter. LPF settings:0=off;1-6=100Hz;1K;3k;10k;30k;100kHz
LOWF	06C02LOWF3	0	Sets the low frequency response of the amplifier LowFreqResp: 1=.2Hz;2=2Hz;3=Med TC;4=LongTC
INTG	06C02INTG3	0	Engages the internal integration circuitry. 1=Single Intg to 1Hz;2=SI to 10Hz;3=Dbl Intg to 1Hz;4=DI to 10Hz
INTU	04C01INTU2	0	Sets the integration units used (2=SI or 1=English)
REF1	04C01REF1	0	Turns on the internal sinusoidal reference oscillator
REF0	04C01REF0	0	Turns off the internal sinusoidal reference oscillator
ZERO	04C02ZERO	0	Zeros the output of a 443B102 when in long time constant charge mode
ZLCK	“04C02ZLCK	0	Clamps the output of a 443B102 when in long time constant charge mode
NULL	04C02NULL	0	Initiates the automated drift nulling routine when in long time Constant Charge mode. Response may be :‘Nulling’
TERM	04C02TERM	0	Terminates the automated drift nulling routine
OFFS	“02C02OFFS10.361	0	Sets the dc offset of the amplifier when in ICP long time constant mode. xx.xxx up to 20.000 volts
OFF?	02C02OFF?	10.361	Returns the dc offset of the amplifier
STAT	02C02STAT	see ex	Returns the settings of the 443B in a string format <b>EX:</b> ICP 2mA;10.00 mV/unit;1.023 mV/unit;2.0 Hz; 10kHz; SI;Ref Off;OV=1;Fault=0;
<b>TEDS</b>	<b>Commands</b>		
TEDR	04C01TEDR	see ex	Returns data stored in the TEDS sensor: Translates Template 1 & 24 (obsolete for 1451.4 v1)

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Ex: PCB 333M07; SN 17704; 100.2 mV/g; F ref 99.6;  
cal'd 3/21/2001; F hp 0.025 Hz; phase 0;sens dir  
N/A; meas ID 0; test sample 4;

MTED	04C01MTED	see ex	Returns more data stored in the TEDS sensor for p1451.4 t24 w/TF Ex: F lp 10011; Fres 100336; Mounted Q 10.8; Amp Slope 1.002; Temp Coeff 0.236; Ref Temp 25.0;
TEDD	04C01TEDD<pp>	see ex	Returns raw hex data stored in the TEDS device. Page added in FW v4 to handle DS2431 Ex: C917D014D00E942200005C12EC64352D <pp>= 2 ASCII characters (e.g. 03=3)
TED1	06C02TED1	0	Enables the auto TEDS normalization feature
TED0	06C02TED0	0	disables the auto TEDS normalization feature
TEDU	06C02TEDU<chars>	0	Writes to the user data field of a TEDS sensor (13 characters maximum-obsolete
TMID	06C02TMID132	0	Writes a number (0 to 511) to the measurement position ID field-obsolete
TEDW	06C02TEDW<pp><hex char>	0	Writes 32 bytes(64chars) of hex data to a TEDS device.
RDAR	06C02RDAR	<16 ascii chars>	Reads the 8 bytes in the application register of DS2430A returns 8 0's if not a DS2430A chip
WRAR	06C02WRAR<16 ASCII>	0	Writes 8 bytes to the application register scratchpad of the DS2430A TEDS chip
RDSR	06C02RDSR	FC/FF or 0	Reads the Status Register byte of aa DS2430A TEDS chip returns 0 if not a DS2430A chip; 0xFF-unlocked; 0xFC -locked
LKAR	06C02LKAR	0	Permanently copies and locks the DS2430A App Reg <b>New TEDS command for 443B introduced in FW v4.0</b>
RDRM	06C02RDRM	<16 ascii chars>	read Rom ID data – returns 8 bytes – byte 0 = Family Code 0x14=DS2430A; 0x2D=DS2431.