



Model 4215 Plus Smart Indicators

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INTRODUCTION

The Model 4215 Plus is a versatile precision Instrument intended for the digital readout of Strain Gauge Sensors such as Load Cells. Optical Encoders are also supported.



Here is a quick listing of its features:

- Full bi-polar **6-digit display** ($\pm 999,999$) using two-line, 20-Character, vacuum fluorescent display for clear, precise indication of measured quantities and limit status.
- **No** knobs or dials. **No** internal jumpers. All adjustment and calibration is done using user-friendly front panel menus. **Keylock** option to prevent accidental or unauthorized changes to the unit's setup.
- Measure **Load** linearly or as a **Polynomial** in pound force (lbf), kilogram force (kgf), Newtons (N), Pounds per square inch (Psi), MegaPascals (MPa), kilo-pound force (klb), kilo-Newtons (kN), metric tons (t), milli-volt per Volt (mVV), or gram force (gf). User defined Base Area for Psi (Pounds per square inch) and MPa (MegaPascals). Tare at any time.
- Capture the **load, peak, valley, gross, polynomial, and optional average**. Displayed in pound force (lbf), kilogram force (kgf), Newtons (N), Pounds per square inch (Psi), MegaPascals (MPa), kilo-pound force (Klb), kilo-Newtons (kN), metric tons (t), milli-volt per Volt (mVV), or gram force (gf). Reset at any time.
- Measure **position** and **velocity** with Optional Encoder input. Displayed in English units, metric units, or in percent of a user defined Base Length. Reset at any time.
- Four contact-closure **Limit** switches. You can set which signal drives the Limit: (Load, Peak, Valley, Position, Velocity, Gross, Channel Sum, or Polynomial), normally open / normally closed, set point, and manual reset (latched) or automatic reset (not latched).
- **Print or Hold** current readings of Load, Peak, Valley, Position, Velocity, Limit, Gross, Channel A+B, and Polynomial at the touch of one button.
- **Automatic Identification** of calibrated Load cells with the Auto-ID option.

- **Calibration** for Load cells using manufacturer's milli-volt per Volt calibration factor (2- point milli-volt per Volt), 5- point milli-volt per Volt, 2-point data calibration, 5-point data calibration, shunt calibration, or Polynomial calibration. A back panel switch allows you to choose between two values used for the Shunt Calibration so there is no need to open the unit.
- Up to **Two Channels of Analog Output** of any signal (Load, Peak, Valley, Position, and Velocity) with user defined scale factor and offset. Large, buffered ± 10.00 Volt output.
- Remote operation using **ASCII** Commands set via the Serial RS-232/RS-485 port or the USB port.
- Back panel **Digital Inputs** for Tare, Peak, and Valley reset, position reset, and print. Other functions available as custom programmed options.
- Optionally measure the **Average Force** using a Contact-Closure to begin and end the averaging period.

QUICK START

This section will help you get your Model 4215 Plus set up and operating in just a couple of minutes.

The rear panel is shown below. You will need to make at least two connections here. First be sure that the power switch is off (the lower part of the rocker should be pressed in). Connect the AC power line and plug it in.



Next connect a Load Cell to the 9 -Pin (female) connector labeled “Sensor A”. You should use the cabling supplied with your Model 4215 Plus and Load Cell. If you do not have a factory-supplied cable, see Appendix B for the recommended Load Cell connection.

You are now ready to turn on the power. Each time power is applied to the Model 4215 Plus you will see a sequence of 2 messages appear on the front display. For example:

#	Message	Meaning
1	Morehouse X.Y.Z	This is the version number.
2	Serial # 12345	This is the serial number.
	Option # 4653056	This is the option number.

Message 1 will be displayed for roughly 4 seconds while message 2 will be displayed for about 2 seconds. After that the front panel display will start showing the current readings from the Load Cell.

To change an Item being displayed, press the leftmost button (Item) under the display. This will cycle through the List of Items available (Load A, Peak A, Valley A, Load B, Peak B, Valley B, Position, Velocity, Limits, Gross A, Gross B, Channel A+B, Polynomial A, Polynomial B, and optionally: Avg A and Avg B).

The rightmost button (Unit) will change the Units that are being used. Repeated presses of this button will cycle through the List of Units available for the currently displayed Item. For example, with Load A as the Item you would see lbf, kgf, N, Psi, MPa, Klb, kN, t, mVV, gf, and then back to lbf.

RUN MODE

The Model 4215 Plus has three modes of operation: Run Mode, Setup Mode, and System Calibration Mode. After the startup sequence, the unit will be in Run Mode.

The first Line of the Display shows an Item Label (Load A), a Value (0.0000), and a Unit Label (lbf).

The Second Line of the Display can show the Status of the 4 Contact-Closure Limit Switches, show another display, show text, or be blank.

To change an Item being displayed, press the leftmost button (Item) under the display. This will cycle through the List of Items available (Load A, Peak A, Valley A, Load B, Peak B, Valley B, Position, Velocity, Limits, Gross A, Gross B, Channel A+B, Polynomial A, Polynomial B, and optionally: Avg A and Avg B).

The Rightmost Button (Unit) under the display will change the units that are being used. Repeated presses of this button will cycle through the List of Units available for the currently displayed Item. For example, with Load A selected as the Item you would see lbf, kgf, N, Psi, MPa, Klb, kN, t, mVV, gf, and then back to lbf.

The table below summarizes the options.

List of Items	Units for Available Measurement
Load A (LoadA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Peak A (PeakA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Valley A (VallA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Load B (LoadB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Peak B (PeakB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Valley B (VallB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Position (Pos)	Inches, Centimeters, Percent of Base Length.
Velocity (Vel)	Inches per Minute, Centimeters per Minute.
Limits (Lmts)	Shows state of each switch, 1 for ON, 0 for OFF, dash for Disabled, asterisk for Source Error.
Gross A (GrsA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Gross B (GrsB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Channel A+B (ChA+B)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Polynomial A (PolyA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.
Polynomial B (PolyB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newton, Metric Tons, mV/V, Gram Force.

Avg A (AvgA)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newtons, Metric Tons, mV/V, Gram Force.
Avg B (AvgB)	Pound Force, Kilogram Force, Newtons, Psi, MegaPascals, Kilo-Pound Force, Kilo-Newtons, Metric Tons, mV/V, Gram Force.

All the measurements are acquired via the Model 4215 Plus at all times. The display allows the user to select a particular Item they choose to view, as well as the Units used to Display or Print this Data.

Each button has a primary function indicated by the upper set of labels: Item, Unit, Tare, Reset, View, and Print. These buttons are described in the sections below. Each button additionally has a secondary function assigned to it (designated by highlighted label) that is used while navigating within the menus of the Model 4215 Plus:

Pressing the “+” button in some instances will increase values being displayed.
 Pressing the “-” button in some instances will decrease values being displayed.
 While in a submenu, pressing either the “>” button or the “+” button will scroll forward.
 While in a submenu, pressing either the “<” button or the “-” button will scroll backward.
 Pressing “Enter” will select the currently displayed option within a submenu.
 Pressing “Esc” will return to the previous menu/Run Mode without selecting anything.

Note: All menu lists on the Model 4215 Plus start with the “>” symbol and that the **Esc** button will always back out of a menu without making any changes. Each submenu adds an additional “>” to the title.

Item Button

The **Item** button cycles through the List of different Items that can be displayed. The List includes: Load A, Peak A, Valley A, Load B, Peak B, Valley B, Position, Velocity, Limits, Gross A, Gross B, Channel A+B, Polynomial A, and Polynomial B. optionally Avg A, and Avg B. Use the Unit button to change the Units for the currently displayed Item on the Display.

Unit Button

The **Unit** button cycles through the List of Units that are available for the Item that is currently being displayed.

Tare Button

The **Tare** button, as a single channel unit, sets the current Load of Channel A to Zero. When configured as a 2-channel unit, a submenu will allow you to select Channel A, Channel B, or All Channels. It does not matter what is being displayed, when you press this button. The Load is always reset to Zero.

Reset Button

The **Reset** button brings up a list of things that you might want to set back to Zero:

If this is a 2-channel unit, the following menu will appear:

- > *Reset Channel A* - will reset the Peak and Valley for Channel A.
- > *Reset Channel B* - will reset the Peak and Valley for Channel B.
- > *Reset Position* - will reset the Position to Zero.

- > *Reset Limits* - will reset any limits that require manual resetting.
- > *Reset All Channels* - will reset the Peak and Valley for Channels A and B.

For a single channel unit, the following menu will appear:

- > *Reset Peak + Vall* - will Reset the Peak and Valley measurements.
- > *Reset Peak Only* - will Reset the Peak measurement.
- > *Reset Vall Only* - will Reset the Valley measurement.
- > *Reset Position* - will Reset the Position to Zero.
- > *Reset Limits* - will Reset any Limits that require Manual Resetting.

View Button

The **View** button switches between two virtual displays stored in the memory. Each of the Displays will remember the Units you selected for each Item, as well as which Item is currently being shown. This may save you from scrolling through the List of Items especially, if there are two results you use often. For instance, you might set the Display to show Load in Lbf., press View, and then set the Display for Peak in Psi. Repeated presses of the View button will now switch back and forth between Load in Lbf. and Peak in Psi with a single button push. If you choose to have the second line show a display, then the View button toggles between the Lines. The activated Line to which all other buttons will apply will have a ">" symbol to the left of it.

Print / Hold Button

The **Print / Hold button** performs two functions that are user selectable. The two functions are described below:

Print: As a **Print** button it will send a set of data to the printer. This will contain the current readings of Load, Peak, Valley, Position, Velocity, Limit, Gross and Polynomial status. The units used for printing will be the units last selected on the numerical display.

The printer must be a serial printer that supports ESC/P protocol. Many Epson printers with serial ports are known to be compatible. Appendix B gives the Pin Assignments on the Serial Connector.

Hold: An optional use as a **Hold** button, pressing it will Freeze the Reading of the unit until it is pressed again. While in Hold Mode, the unit will still respond to front panel buttons and Remote Commands (GUI and RS-232). An asterisk character "*" will be displayed on the 1st character of the line to indicate that the unit is in Hold Mode.

SETUP MODE SUMMARY

The table below summarizes the Setup Mode Menus. Detailed information about each individual Item is presented in the following sections.

Setup Options	
>User Data Entry	<ul style="list-style-type: none"> >>Base Area Entry → Channel → Area >>Base Length
>Analog Output	<ul style="list-style-type: none"> >>Analog Out Setup → Channel → Item → Units → Full → Zero.
>Sensor Options	<ul style="list-style-type: none"> >>View Cal on Ch A >>View Cal on Ch B (2-channel only) >>View Sensor Data → Sensor >>Select Sensor Data → Channel → Sensor >>Delete Sensor Data → Sensor >>View Cal Points → Sensor >>View Cal mVV Gains → Sensor >>View Tag ID → Channel
>Calibration	<ul style="list-style-type: none"> >>Cal Check → Channel >>Two Point mV/V → Channel → Data input >>Five Point mV/V → Channel → Data input >>Two Pt Data Cal → Channel → Data input >>Five Pt Data Cal → Channel → Data input >>Shunt → Channel → Data input >>Polynomial Cal → Channel → Data input >>Counts / Inch
>Limiters	<ul style="list-style-type: none"> Limit Select → State → Enable → Source Item → Units → Set Point → Trip → Latch → Reset Value
>System Options	<ul style="list-style-type: none"> >>Auto Identify >>AutoID Annunciator >>Auto Zero Channel >>Com Address >>Com Baudrate >>Com Line Feed >>Retain Tare >>EOT Char >>Auto Tare
>Display Options	<ul style="list-style-type: none"> >>Filter Select >>Filter Window >>Decimals Select → Channel

		>>Count By Select → Channel
		>>Second Line
		>>Vel Filter Level
		>>Max Pos Decimals
		>>Max Vel Decimals

SETUP MODE

Setup Mode is used to change the Setup of the Model 4215 Plus. To enter Setup Mode press the **Item** and **Unit** buttons at the same time. Once in this mode, the front panel buttons will operate with their secondary functions.

If the Optional Keylock is in the locked position you will see ">Setup is Locked" when you try to enter Setup Mode. This prevents accidental or unauthorized changes to the Setup of the unit.

To exit from Setup Mode and return to Run Mode press the escape button (Esc). When you are entering numerical data, or selecting options from a Submenu the Escape button will back you out without making any changes.

The Main Menu in Setup Mode contains the following seven (7) entries which will be described in detail in the following sections. **Note:** All Main Menu Items begin with the ">" symbol and that all submenu Items begin with the ">>" symbol.

- **> User Data Entry** — allows you to set any common math options such as the Base Area used to display Load in Psi or the Base Length used to display Position in percent.
- **> Analog Output** — is used to select the Analog Channel, Source, and Scaling for the Analog Output Channels.
- **> Sensor Select** — allows the user to manually select/delete which Load Cell calibration data is used and view data for specific sensors.
- **> Calibration** — provides access to Calibration for Load Cells, Extension Sensors, or Optical Encoders.
- **> Limits** — allows you to set the Source and options for the 4 Contact-Closure Switches.
- **> System Options** — contains options for a variety of system level parameters that can be enabled or disabled or set to user preference.
- **> Display Options** — contains options for a variety of display related parameter settings that adjust how information is displayed on the front digital display.

The Plus or Right button ("+" or ">") will scroll forward through this menu. The Minus or Left button ("-") or "<") will scroll backward through this menu. The **Enter** button selects the currently displayed menu Item. The **Esc** button will return you to Run Mode or previous menu option.

Entering Numerical and Alphanumerical Data

At times you will need to enter numerical or alphanumerical data into the Model 4215 Plus. The method is consistent in all cases. A character is presented on the display with a blinking underline cursor.

- **Left (“<”)** moves the cursor left one position. If a numerical entry and you are on the leftmost digit a new zero will be added. Thus 10.000 will become 010.00 where the cursor has moved from the tens place to the hundreds place. If an alphanumerical entry and are on the leftmost character, a new “A” will be added.
- **Right (“>”)** moves the cursor right one position. If a numerical entry and you are at the rightmost a new decimal will be added if there is room. Thus 12.34 will become 12.340 where the cursor has moved from the tenths to the hundredths place. If an alphanumerical entry and are on the rightmost character, a new “A” will be added.
- **Plus (“+”)** increases the digit above the cursor. Thus 12.34 becomes 13.34. Note that 9 will “wrap around” to 0 on numerical value entries only. On alphanumerical entries, “z” will wrap around to 0. Some data entry fields will include additional ASCII symbols to select from while scrolling with this button.
- **Minus (“-”)** decreases the digit above the cursor. Thus 12.34 becomes 11.34. Note that 0 will “wrap around” to 9 on numerical value entries only. On alphanumerical entries, 0 will wrap around to “z”. Some data entry fields will include additional ASCII symbols to select from while scrolling with this button.
- **Plus and Minus** (both “+” and “-” at the same time). This will change the sign of the number. Thus 12.34 becomes -12.34. Note the cursor position does not matter when you change the sign.
- **Enter** accepts the currently displayed value.
- **Esc** Escapes from data entry and discards any changes that have been made.

>User Data Entry

This menu is used to enter numerical constants used by the math options. These constants are listed in a submenu that works exactly like the main Setup Mode Menu. Typical Items in this submenu are:

>>Base Area Entry

After selecting the desired channel, a numerical value in Square Inches that is used to calculate Load in pounds per square inch (Psi) or MegaPascals (MPa) may be entered.

>>Base Length

This is the length in Inches that is used to calculate the position in percent.

>Analog Output

This menu is used to set up the Analog Outputs. Instead of a submenu there is a series of selections. Pressing the Escape button (Esc) at any time will go to the previous selection until back in the Setup Mode Main Menu.

1. **Channel: —** The Channel Entry allows you to select the Analog Output Channel A or B (using either the left/right or plus/minus buttons) for the selected Source Data that will drive the Analog Output. Press Enter to select the displayed Analog Channel.

2. **Item: —** The Item Entry allows you to scroll through a list (using the left/right or plus/minus buttons) to select the item source of the Data that will drive the Analog Output. The standard list will include: Load, Peak, Valley, Position, Velocity, Gross, Channel A+B, Polynomial, and Average if active. Press Enter to select the displayed Item.
3. **Units: —** The Units Entry allows you to scroll through the List of available Units for the Data Source that you have chosen in the previous step.
4. **Full Scale: —** The Full Scale Entry specifies the Value of Source Data (in the selected units) that will cause the Model 4215 Plus to output positive full-scale Analog Voltage (+10.0 volts).
5. **Zero Scale: —** The Zero Scale Entry specifies the value of Source Data (in the selected units) that will cause the Model 4215 Plus to output zero analog voltage (0.0 volts).

Once you have entered these five (5) selections the Analog Output is setup.

>Sensor Options

The >**Sensor Options** menu is used to view the current calibration data on each channel, view all sensor data, manually select Load Cell sensors for each channel or delete them, view each sensors Cal points and mV/V Gains, and view tag ID data for each channel if present.

- Use either the Left/Right or Plus/Minus buttons to scroll through the List of data for each selectable submenu option.
- Pressing the Escape button will return to the previous step, until back to the Setup Mode Main Menu, without changing any data.
- Pressing the Enter button will select/accept the currently displayed entry. If selecting a sensor, after this action the sensors calibration data will be available to scroll through, if this action is not required press enter again to exit.

To add new Load Cells to the list, use the Calibration Entry on the Setup Mode Main Menu described below.

Note: The Model 4215 Plus can store Calibration Data for 25 different Load Cells / Sensors. You may need to shut off Auto-ID if it is on - see the System Options menu for details).

>Calibration

This menu is used to access all methods of Calibration that are supported by the Model 4215 Plus.

- Selecting "Calibration" from the Setup Mode Main Menu will bring up a submenu.
- The submenu is used exactly like the Main Menu.
- Press left/right or plus/minus to change the Menu Item.
- Press the Escape Button to return to the Setup Mode Main Menu.
- Press the Enter Button to select the displayed menu Item.

If you are re-calibrating a Load Cell, the Model 4215 will recognize it using either the Auto-ID or a manually entered Serial number.

- Any time you overwrite existing Load Cell Calibration Data, you will first be warned with the "Overwrite data?" message.
- Pressing the Enter Button will begin the overwriting process.
- Pressing the Escape Button will cancel the calibration, voiding any changes that have been made.
- Another method to avoid overwriting existing data is to delete the Sensor first and then Calibrate.

If a Load Cell with a new serial number (or new Auto-ID) is calibrated, the data is added as a new entry in the Load Cell list.

>>Cal Check

Selecting the >>Cal Check will present you with a channel selection of either A or B. once a channel is selected it will automatically begin running a Calibration Check on the Load Cell / Sensor attached to Channel specified.

- The Model 4215 Plus will measure the Shunt Value of the Load Cell and compare it to the Shunt Value that was recorded when the Load Cell was last calibrated.
- The last Calibration Date for the Load Cell is displayed followed by the currently measured Shunt Value and the Shunt Value that was recorded when the Load Cell was calibrated.

Note: The Model 4215 Plus has a switch on the back panel that allows you to select either a 30K Shunt or a 60K Shunt. Be sure that this switch is set correctly for the Load Cell that you are using.

Note: *Since this Shunt Check electronically applies approximately half the Rated Load, it is important that the Load Cell / Sensor is not loaded when this check is run. If you see the "Cell Overloaded" message, remove any load on the cell and try the check again.*

>>Two Point mV/V

Using >>Two Point mV/V will calibrate a Load Cell using the manufacturer's Milli-Volt per Volt Calibration Factor or a series of Milli-Volt per Volt Points with corresponding Masses (usually listed on the Load Cell Calibration Certificate).

- You will be asked for the Channel, the Cell Serial Number, the current date, excitation level (5.0 or 10.0 volts), the Calibration Unit, the Load Cell's Maximum Rated Load, and the mV/V calibration constant.

- The Load Cell should not be under load when this Calibration Method is used since a Shunt Value will be measured and recorded for later use with the “Cal Check” feature described above. The “No Masses Ready” message is intended to remind you of this fact.

>>Five Point mV/V

If a >>5-point Milli-Volt per Volt Calibration is selected, you are prompted to enter each mass and Milli-Volt per Volt value corresponding to that mass.

- One of these points should be a Zero Mass and Zero Milli-Volts per Volt.
- Enter each of these selections or press the Escape Button at any time to move backward one selectable option without changing the Calibration.
- The Load Cell should not be under load when this Calibration Method is used since a Shunt Value will be measured and recorded for later use with the “Cal Check” feature described above. The “No Masses Ready” message is intended to remind you of this fact.

>>Two Pt & Five Pt Data Cal

The Data Cal options are used to calibrate a Load Cell using known masses.

- You will first be asked for the Channel, the Load Cell Serial Number, the current date, Excitation Voltage (5.0 or 10.0 volts), the Calibration Unit, and the cell's Maximum Rated Load.
- You are then prompted to enter the Value of the First Mass.
- The “Mass 1 Ready?” message will wait, while you physically apply the mass to the attached Load Cell. Once the mass is applied press the **Enter** button.
- When the Model 4215 Plus is reading the Load Cell it will display the “Calibrating Mass 1” on line 1 and “– Reading...” on line 2 messages for about 10 seconds.
- **At this time, it is important that the Masses are not disturbed since all the readings taken are averaged together to obtain the calibration data.**
- The second mass is then prompted to be applied and entered.
- If a 5-point calibration was selected, the process will continue until all masses have been read. At the end of both calibration methods a reading is also required with **NO MASS** on the sensor, indicated by the message “No Masses Ready?” during this reading a Shunt Check Value is recorded.

>>Shunt Cal

The >>Shunt Cal Item is used to calibrate a Load Cell using the manufacturer's Shunt Calibration factor expressed in pounds.

- You will be asked for the Channel, the Load Cell Serial Number, the current date, Excitation Voltage (5.0 or 10.0 volts), the Calibration Unit, the cell's Maximum Rated Load, and the Shunt calibration factor.
- The Model 4215 Plus will then ask, “No Masses Ready” and upon pressing the **Enter** button will perform the Shunt Calibration of the Load Cell using its Internal Precision Shunt Resistor.
- **Note:** There is a Back Panel Switch that allows you to select either a 30K or 60K Resistor for Shunt measurements (see Appendix B for a circuit diagram).
- Be sure to select the appropriate Value for your Load Cell.

- During this Calibration the “Calibrate Shunt Command – Reading...” message will be displayed. Do not disturb the Load Cell while it is being read.
- **Like the “Cal by milli-volt per Volt” option, the Load Cell should be free of load during this calibration.**

>>Polynomial Cal

The Polynomial Cal option is used to calibrate a Load Cell using a polynomial equation. You will first be asked for the Channel, the Load Cell Serial Number, the current date, Excitation Voltage (5.0 or 10.0 volts), the Calibration Unit, and the cell's Maximum Rated Load. Once done the polynomial information can be set. The equation is broken up into three main parts, Degree, Mantissa, Exponent.

Degree: Will be a number between 0 and 5 and represent the total number of coefficients present in the polynomial equation. 0 represents 1 coefficient (B_0) and 5 represents 6 coefficients (B_5). The example equation below depicts a 3rd degree polynomial.

$$\text{Force} = B_0 + B_1 + B_2r^2 + B_3R^3$$

Mantissa: is the decimal value that is used while writing a value in scientific notation. In the two examples of scientific notation depicted in the below example, the mantissa is 1.2815.

$$\underline{1.2815 \text{ E}+02} \quad \text{or} \quad \underline{1.2815 \times 10^2}$$

Exponent: relates to the exponential value used while writing a number in scientific notation. In the two examples of scientific notation depicted in the above example, the exponent is 2.

When a degree of greater than 0 is selected the mantissa and exponent will be prompted for each degree. For example, if a 1st degree polynomial is desired, the Model 4215 Plus will prompt you to enter the following values: Mantissa degree 0, Exponent degree 0, Mantissa degree 1, Exponent degree 1.

Once all values have been entered the unit will ask, “No Masses Ready”, and upon pressing the **Enter** button will record a shunt check value.

>>Counts / Inch

The >>Counts / Inch Entry allows you to set the number of counts-per-inch that the Quadrature Encoder Input will use. Default is 24000 Counts/Inch.

>Limiters

The >Limiters Menu is used to set up the 4 Contact-Closure Switches.

- Instead of a submenu there are a series of selections.
- Pressing the enter button will accept the displayed entry.
- Pressing the escape button will return to the previously selected entry without changing the currently displayed entry.

1. **Select a Limiter: —** The first selection chooses which of the Limiters you want to set up (Limiter 1 to Limiter 4).
2. **Default State: —** An option of making the limiter contacts either Normally Open or Normally Closed.
3. **Enable the Limit?: —** Choosing Disabled places the Limiter in its “normal” state and completes the Limiter Setup. Choosing Enabled allows you to continue the Limiter activation by making the remaining entries available.
4. **Limit Source: —** This selection allows you to scroll through a list (use either the left/right or plus/minus buttons) to select the Source of the Data that will drive the Limit. The standard list will include; Load, Peak, Valley, Position, Velocity, Gross, Channel A+B, Polynomial, and optionally, Average Force. Press the enter button to select the displayed Item.
5. **Limit Units: —** This entry allows you to scroll through the list of available Units for the Data Source you have chosen in the previous step.
6. **Limit Set Point: —** This is the numerical value of the Source at which the Limit will be activated (Set Point). It is specified in the units that you chose in the previous step.
7. **Trip if > or <?: —** Choosing “Source>Set” means that the Limit will be activated when the Source becomes greater than the Set Point. Choosing “Source<Set” means that the Limit will be activated when the Source becomes less than the Set Point.
8. **Latching Limit?: —** Selecting “Latching Off” means that the Limit will be deactivated automatically when the Source passes the Reset Point (see next selection). Selecting “Latching On” means that once the Limit is activated you must manually reset it using the Reset button. If you select Latching On, then the Limit Setup is done.
9. **Limit Reset Value: —** This selection determines the numerical value of the Source at which point the Limit will be deactivated (Reset Point). If you selected “Source>Set” in step 7 then the Limit is deactivated when the Source is less than the Reset Point. If you selected “Source<Set” in step 7 then the Limit is deactivated when the Source is greater than the Reset Point.

Notes:

The Set and Reset conditions for each limit are evaluated independently. If both conditions are met, then Reset will take priority over Set.

Limit Status may show an asterisk if the Limit is Enabled but there is an error in the Signal Source. Some examples of a Signal Source error include: a Limit Source is set to Load but there are no Load Cells currently Calibrated; if the load cell has a rating of 0.0 Lb; or if the milli-volt per Volt Constant is set to Zero. Another example of a Signal Source error would be if the Limit Source is set to Position and zero has been entered for the Encoder counts-per-inch Constant. Limits that are in this error condition will be forced to the off position as if they were disabled.

>System Options

The >>System Options Menu contains some system wide parameters that are seldom changed. These are listed in a submenu that works exactly like the Setup Mode Main Menu.

>>Printer Baud

The front panel Print button and the Remote Print Commands will use this Baud Rate for communications with your printer. This setting has no effect on units that are not equipped with the printing option. 57.6K Baud is commonly used on older Serial Printers and a 230.4K Baud is used on more recent serial printers. 4800, 9600, 19.2k, 57.6k, 230.4k are all the baud Rate options.

>>Auto Identify

The >>Auto Identify (AutoID) allows a user to turn Automatic Load Cell Identification On or Off. Usually you can leave Auto-ID On, even if you never use Automatic Load Cell Identification. In order, to use the Auto-ID On function you must either have an Auto-ID equipped Load Cell or use an In-Line Auto-ID Module attached to your Load Cell cable.

>>AutoID Annunciator

When the >>AutoID Annunciator is on and Auto Identify is also on there will be a "t" seen preceding the selected Item on the display while in Run Mode. The "t" will blink if a non-recognized or non-AutoID cell is attached. If a recognized AutoID cell is attached, the "t" will change from blinking to solid.

>>Auto Zero Channel

The >>Auto Zero Channel Menu lets the user Enable or Disable Auto Zeroing for Load measurements on Channel A or Channel B. When Enabled, the >>Auto Zero Channel function will Tare the Load to Zero any time that it has remained within 10 counts of Zero on the display for 10 seconds.

>>Com Address

The >>COM Address Item allows the user to set the address of the unit used for the Remote ASCII Command set. Valid values are 001 through 254. **If the RS-232 multi-drop option is installed, you must be sure that all the attached units have different addresses to prevent data collisions.**

>>Com Baudrate

The >>Com Baudrate sets the Baud Rate for the Remote ASCII Command set. Available values are: 300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, and 230.4k.

>>Com Line Feed

The >>COM Line Feed controls whether a Line Feed is added to each carriage return that is sent out by the Model 4215 Plus when the Remote ASCII Command set is being used.

>>Retain Tare

The >>Retain Tare controls whether the most recent Tare Value is retained through the power down of the unit and used again immediately on power up.

- Choosing this option will retain Tare on channel A in a single channel unit and both channels A and B in a two-channel unit.

>>EOT Char

The “End Of Transmission Character” is a non-visible character (hexadecimal 0x04) sent at the end of each response by the Model 4215 Plus to a Serial Command. The character is sent after the last carriage-return “Line-feed” is returned by the unit, with just one exception:

- When the user is viewing Streaming Channel Values with the Serial Command @123V(item)(unit)(2), the character is sent immediately prior to the Streaming Output that the unit will send. The user can turn this option “On” or “Off”.

>>Auto Tare

The >>Auto Tare allows a user to turn Auto Tare “On” or “Off”. When “On”, it will perform an Automatic Tare when an AutoID sensor is attached.

>Display Options

The >Display Options Menu contains options which effect how the data is displayed and printed. These are listed in a submenu that works exactly like the Setup Mode Main Menu.

>>Filter Select

There are two types of filters available on the Model 4215 Plus: Type 1 and Type 2.

- Type 1 filters are good for removing most kinds of noise but may leave some jitter on the end digits.
- Type 2 filters are more advanced filters that are optimized for the typical industrial environment.
- Both filter types allow you to select from 4 levels of filtering with Level 1 being the least filtering and Level 4 being the most filtering.

The settling time for each of the 4 levels of filtering is shown in the table below:

Level	1	2	3	4
Settling Time (seconds)	<1	2	10	30
Read Rate (per second)	60	60	30	10

>>Filter Window

“<<Filter Window” option allows a user to turn “On” then set, or turn “off”, a Window to be used to turn the filters On or Off.

- If there is a sudden change in the measurement that exceeds this Set Window, the filter is temporarily turned “Off” to allow the displayed reading to adjust the display to match what the actual reading has suddenly changed to.
- This feature enables the user to see the sudden change in measured data rather than it being filtered out and potentially go unnoticed.

To turn a Window on for a Specific Channel, use the “Enter” button to progress through the different steps.

- First select the channel you wish to adjust the window setting for, A or B.
- Choose to turn it “On” or “Off” in the next step.
- If “On” is selected, you will then be presented with the previously set window setting. If the setting is what is desired you may choose “Yes”, otherwise toggle the choice to “No” and proceed to setting a new value.
- In the next two steps you will be prompted to choose your desired unit; then enter the Window value, in that unit.
- Pressing the “Enter” button after inputting the value will complete the Filter Window setup with the newly Set Value.

>>Decimal Select

The >>Decimal Select lets the user set the Maximum Number of Digits to the right of the decimal which are displayed or printed for the selected item value for each channel.

- When large Load Cells are selected the number of decimal digits shown may be limited.
- For example, a 100 Lb Cell will allow 3 digits, while a 1000 Lb Cell will only allow 2 digits.
- Also, if a number is too large to fit on the display some decimal digits may be dropped (the display will “Auto-Range”).
- The number of digits shown for position data depends only on the number of counts-per-inch of the Encoder and is not affected by this setting.

>>Count By Select

The >>Count By Select allows the user to choose the smallest unit of counting for the display of the selected items value. Counting by 1, 2, 5, 10, and 20 are the options.

Note: The operation of the Analog Outputs and the Limits are not affected by the settings of “Decimal Select” or “Count By Select”. Thus, if you set a Limit to be activated at 10.001 Lbf, and have the “Smallest Count” set for 20, the Limit is activated at 10.001 Lbf., even though the display is only showing 10.000.

>>Second Line

The >>Second Line Option allows the user to choose what you would like to have displayed on the second line.

- You can select Limits, select the second data, select text message, or leave the line blank. When selecting text, the text string is displayed for editing.
- Pressing the Plus (“+”) and Minus (“-”) keys at the same time will reset the text to an “A”.

>>Vel Filter Level

The >>Vel Filter Level sets the size of the Velocity Filter Window. The Filter Time and Settling Time for each of the 4 levels of filtering is shown in the table below:

Level	1	2	3	4
Window Time (seconds)	1/3	2	5	10
Settling Time (seconds)	2/3	4	10	20

Note: These times are based on a sample rate of 60 Hz. If sampling is slower, these times will adjust proportionately (See >>Filter Select).

>>Max Pos Decimals

>>Max Pos Decimals mimic the “Decimal Select” setting above:

- The setting for Position allows you to specify the number of Decimals displayed to the right of the decimal point.
- This setting only effects the Displayed value, if the least significant digit of the Counts per Inch falls outside the Max Position Decimal place.

For example:

- If the Counts per Inch is set to 1000 while Pos Decimal is set to 4, the least significant digit effected will be 0.001 and the display will show 0.0010.
- If the counts per inch is set to 100000 and the Position Decimal is set to 3 the display will show 0.000 until the non-displayed decimals reach a value (in this case greater than 0.00050) where it can be rounded up to display 0.001.

>>Max Vel Decimals

>>Max Vel Decimals mimic the “Max Pos Decimals” setting above:

- The setting for Velocity allows you to specify the number of Decimals displayed to the right of the decimal point.
- This setting only effects the Displayed value, if the least significant digit of the Counts per minute falls outside the Max Velocity Decimal place.

REMOTE OPERATION

Digital Inputs

There are 4 Digital Inputs available on the Model 4215 Plus. Inputs are accessible on the Digital I/O Connector on the back panel (pins 9-16). The four inputs are individually opto-isolated and include Current Limiting Resistors. An Input Voltage anywhere from +4 to +22 Volts DC may be used to obtain the "ON" state. See Appendix B for a full description of the Digital I/O connector.

If you do not require isolation for your application, you can use the +5 or +12 volt and GND available on the Digital I/O Connector (pins 24-26).

These 4 inputs are called IN1 through IN4 and have the following standard functions:

IN1: Will Tare the Load to zero while it is in the ON State.

IN2: Will Reset the Peak and Valley measurements while it is in the ON State.

IN3: Will Reset the Position measurement while it is in the ON State.

IN4: Will send one set of measurements (Load, Peak, Valley, Position, Velocity, Limits, Gross, Channel A+B, and Polynomial) to the serial printer when it transitions from OFF to ON.

Other functions may be assigned to these inputs by custom programming at the factory.

Remote Communications

All the features and settings of the Model 4215 Plus can be accessed remotely using the Remote ASCII Command set. These commands fall into two groups: Commands that are like Run Mode and Commands that are like Setup and Calibration Mode.

Communications can be established via RS-232/RS-485 protocols through the serial port on the rear panel of the unit or via USB communications through the USB port on the rear panel of the unit in conjunction with the USB driver installed on the host PC. The Commands and Command Formats are the same for each method of communication.

Pinouts for the RS-232/RS-485 Serial Port Communications are listed in Appendix B of this manual. For older computers, USB communication may require the installation of the USB driver located on the CD-ROM that accompanies this product. If the host PC can communicate with the Model 4215 Plus via USB, no driver is needed.

USB COMMUNICATIONS INFORMATION

If using remote communications and the host PC cannot communicate with the Model 4215 Plus via USB:

USB Driver

If the host PC cannot communicate with the Model 4215 Plus via USB, install the USB driver.

USB drivers and updates may also be obtained from <http://www.ftdichip.com/Drivers/VCP.htm>. Driver version 2.04.06 or higher is required. As of this release, the current version is 2.12.36.4. Click on the download link for the setup executable listed next to 'Windows' and follow the download and install instructions

Communications Settings

The Model 4215 Plus supports Remote Operation using a standard Remote Interface consisting of ASCII characters and terminal emulation software programs such as HyperTerminal or ProComm. The Baud Rate is set using the Com Baud Rate Item on the System Options menu. Supported rates are 300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, and 230.4k Baud. There must be 8 data bits, no parity, and 1 stop bit.

To support the Multi-Drop Remote Option, each unit is assigned a communications address which is set using the Com Address Item on the System Options menu.

All the Commands use the following format:

@123XYZ<CR>

- The @ symbol initiates the Command.
 - All Commands must begin with this symbol.
- The number 123 is the address of the Model 4215 Plus which should respond to this command.
 - The address MUST be 3 digits so type 001 for unit one and 026 for unit twenty-six.
- The Command itself will be a sequence of letters and/or numbers such as the XYZ shown above.
 - If the Command requires a number as one of its parameters, the number must be followed by the pound sign "#". Numbers that are less than one should include a leading zero so you should type 0.123# to enter one-hundred twenty-three thousandths.
- Commands are not processed until a carriage return <CR> is sent.

Notes:

No Model 4215 Plus will respond to address 000.
All Model 4215 Plus's will respond to address 255.

Throughout the rest of this Section, we will assume that you are using address 001 (default)

Whenever a Model 4215 Plus Plus executes a Remote Command, it will issue an acknowledgment that includes the address and any required data.

REMOTE RUN MODE COMMAND SUMMARY

@(addr)			
	H		Hello retrieves unit description
	?		Get item and unit numbers
	FV		View item and unit settings
	FS	(item)(unit)	Set displayed item and unit
	FA		Alternate display, like view button
	F1		Switches view pointer to display line 1 (upper)
	F2		Switches view pointer to display line 2 (lower), or virtual display if line 2 is disabled
	V	(item)(unit)(repeat)	Get value of an item and unit
	P	(repeat)	Print a set of readings
	R	(tare)(peak)(vall)(pos)	Reset readings
	X		Hold Data <small>OPTIONAL</small>
	T	(hold)(text)	Place text on display

REMOTE RUN MODE COMMANDS

The commands listed in this section mirror (and in some cases extend) the functions that are available from the front panel of the Model 4215 Plus when it is in Run Mode.

Each entry in this section will include the name of the Command, followed by a short description that includes the command format.

The examples will show what you (the user) would type (shown in regular/plain font) and what the Model 4215 Plus would return (shown in *italics*).

Hello Command (H)

This Command retrieves the Models Version, Serial Number, and enabled Option Number of any unit at the specified address.

Example (User Entered):

@001H

Acknowledgment:

@ 001 Morehouse 5.0.5 Serial # 12345 Option # 5439489

Question Mark Command (?)

This Command returns a list of Item numbers and unit numbers that are available on the Model 4215 Plus that is addressed. These numbers are used as arguments for many of the commands shown below. Depending on the activated options, this list may vary.

Example (User Entered):

@001?

Acknowledgment:

```
@ 001 These are the Item numbers:
    00 - Load A    01 - Peak A    02 - Vall A    03 - Load B
    04 - Peak B    05 - Vall B    09 - Pos      10 - Vel
    13 - Limits    16 - Grs A     17 - Grs B    18 - Ch A+B
    22 - Poly A    23 - Poly B
    These items are only for displaying values:
    50 - Cells AB  51 - Peak AB   52 - Vall AB

    These are the units for Load, Peak, and Valley:
    00 - lbf      01 - kgf      02 - N       03 - Psi
    04 - MPa      05 - Klb      06 - kN      07 - t
    08 - mVV      09 - gf       10 - lbI     11 - NM
    12 - OzI
    These are the units for Position:
    00 - In       01 - Cm       02 - %
    These are the units for Velocity:
    00 - I/M      01 - C/M
```

Front Panel Display Command (F)

This Command is used to set the front panel display of the Model 4215 Plus to a desired combination of Items and units. There are five (5) subcommands:

- Front Panel View (FV)
- Front Panel Set (FS)
- Front Panel Alternate (FA)
- Front Panel Pointer Control to Line 1 (F1)
- Front Panel Pointer Control to Line 2 (F2)

Front Panel View Command (FV)

The Front Panel View Command (FV) tells you what is currently on the display and what will be displayed when the View button on the front panel is pressed.

Example (User Entered):

@001FV

Acknowledgment:

```
@ 001 Active Display shows Load A in lbf
      Other Display shows Load A in lbf
```

Front Panel Set Command (FS)

The Front Panel Set Command (FS) allows you to specify the item number and unit number for what is currently on the front panel display.

The format is: FS(item number)(unit number)

Where the **Item and Unit numbers** are 2 digits each and may be found using the Question Mark Command (?).

Example (User Entered):

@001FS0200

Acknowledgment:

@ 001 Active Display shows Vall A in lbf
Other Display shows Load A in lbf

Front Panel Alternate Command (FA)

The Front Panel Alternate Command (FA) allows you to switch between the currently displayed Item and unit (the active display) and the alternate Item and unit (the other display) just as if you had pressed the View button.

Example (User Entered):

@001FA

Acknowledgment:

@ 001 Active Display shows Load A in lbf
Other Display shows Vall A in lbf

Front Panel Pointer Control to Line 1 (F1)

The Front Panel Pointer Control to Line 1 (F1) assigns the View Pointer Control to display line 1 (upper line of the display) and shows what is on the display. This allows the operator to know which line will be configured or accessed.

Example (User Entered):

@001F1

Acknowledgment:

@ 001 Active Display shows Vall A in lbf
Other Display shows Load A in lbf

Front Panel Pointer Control to Line 2 (F2)

The Front Panel Pointer Control to Line 2 (F2) assigns the View Pointer Control to display line 2 (lower line of the display, or the virtual display line if line 2 is disabled) and shows what is on the display. This allows the operator to know which line will be configured or accessed.

Example (User Entered):

@001F2

Acknowledgment:

@ 001 Active Display shows Load A in lbf
Other Display shows Vall A in lbf

Value Command (V)

This Command is used to read the numerical value of the desired Item and unit without altering the front panel display.

The format is: V(item number)(unit number channel A)(unit number channel B)(repeat)

Where the **Item and unit numbers** can be found using the Question Mark Command (@001?). And the **repeat** number must be: 0, 1, or 2.

- Choosing repeat 1 will make the tester send you the desired value once.
- Choosing repeat 2 will make the tester send the value at approximately 0.1 second intervals.
- Choosing repeat 0 will turn off any values that are being sent by a repeat 2 Command.

Note:

Item numbers specific to this command only shown in the Question Mark Command are: 50 (Cells AB), 51(Peak AB), and 52 (Valley AB).

Example 1 (User Entered):

@001V01021

Acknowledgment 1:

@ 001 Peak A 0.0111 N

Example 2 (User Entered):

@001V5000002

Acknowledgment 2:

@ 001 Load A 120.452 lbf Load B -0.05898 lbf

@ 001 Load A 125.295 lbf Load B -0.24738 lbf

.....

@ 001 Load A 134.367 lbf Load B -0.63103 lbf

Example 3 (User Entered):

@001V00002

Acknowledgment 3:

@ 001 Load A 120.452 lbf

@ 001 Load A 125.295 lbf

.....

@ 001 Load A 134.367 lbf

Print Command (P)

The Print Command (P) will retrieve a full set of readings (like pressing the front panel print button). These will be in the units that are currently selected on the numerical display.

The format is: P(repeat number)

Where the **repeat number** must be: 0, 1, 2, or 3.

- Repeat 1 will return one set of readings to the Remote Terminal.

- Repeat 2 will return a set of readings approximately every tenth second (like the Value Command) to the Remote Terminal.
- Repeat 0 will turn off the printing that was started with repeat 2.
- Repeat 3 will send one set of readings to the serial printer attached to the Model 4215 Plus instead of to the Remote Terminal.

Example (User Entered):

@001P1

Acknowledgment:

```
@ 001 Load A 45.6250 lbf
      Peak A 82.3960 lbf
      Vall A -0.00083 lbf
      Load B 22.5600 lbf
      Peak B 23.0000 lbf
      Vall B -0.00001 lbf
      Pos      3.500 In
      Vel      0.00000 I/M
      Grs A 9.81467 lbf
      Grs B 8.51474 lbf
      Ch A+B -0.05408 lbf
      Poly A 0.00000 lbf
      Poly B 0.00000 lbf
      Limits 0 0 0 1
```

Reset Tare, Peak, Valley, and Position Command (R)

This Command allows you to reset the Tare, Peak, Valley, and Position readings.

The format is: R(tare A)(peak A)(valley A)(tare B)(peak B)(valley B)(position select)

When taring A or B will tare the load and the Polynomial. The values for each choice are either: a 0 (don't reset) or a 1 (reset).

Thus you can reset any combination of these readings with a single command.

Example 1 (User Entered):

@001R1000000

Acknowledgment 1:

```
@ 001 Reset - Tare A
```

Example 2 (User Entered):

@001R0111000

Acknowledgment 2:

```
001 Reset - Peak A Valley A Tare B
```

Hold Data Command (X) OPTIONAL

This Command will freeze the reading until it is sent again. While in Hold Mode, the unit will still respond to front panel button depressions and Remote Commands (GUI and RS-232). An asterisk character “*” will be displayed on the 1st character of the line to indicate that the unit is in Hold Mode.

Text Display Command (T)

This Command allows you to put a line of text on the front panel display of the Model 4215 Plus.

The format is: T(text)

Where **text** is the message that you want to display. The text is limited to the number of characters that can be shown on the front panel display. This command is identical in functionality to the @001DT(text) command found later in the Remote Commands Section.

Example (User Entered):








@001TStress Test Ready

Acknowledgment:

@ 001 Text Displayed - Stress Test Ready

REMOTE SETUP MODE COMMAND SUMMARY

@(addr)				
U				User Data Entry
V				View current settings
A	(channel)(number)#			Set Base Area
L	(number)#			Set Base Length
A				Analog Output
V				View current settings
S	(item)(unit)(full)#(zero)#			Set Analog Output
S				Sensor Select
V				View current sensor
S	(channel)(serial number)#			Select Sensor by S/N
D	(serial number)#			Delete Sensor by S/N
Z	(serial number)#			View Cal Points
C				Calibration
C				Shunt Check Load Cell
B	(see text for format)			Begin Sensor Calibration
E				Escape Sensor Calibration
V	(mV/V constant)#			Calibration by milli-volt per Volt
M	(Number of Points/Masses)			Calibrate by points
M	P1(mass 1)#			Calibration Mass 1
M	P2(mass 2)#			Calibration Mass 2
M	P3(mass 3)#			Calibration Mass 3
M	P4(mass 4)#			Calibration Mass 4
M	P5(mass 5)#			Calibration Mass 5
M	P6(mass 6)#			Calibration Mass 6 (optional)
M	P7(mass 7)#			Calibration Mass 7 (optional)
M	P8(mass 8)#			Calibration Mass 8 (optional)
M	P9(mass 9)#			Calibration Mass 9 (optional)
M	PT(mass 10)#			Calibration Mass 10 (optional)
S	(shunt value Lbf)#			Calibration by Shunt Value
I				Encoder Counts-per-Inch
V				View counts/inch
S	(number)#			Set counts/inch
L(lim)				Limits
V				View current settings
S	(see text for format)			Setup Limit
E				Escape from Limit Setup
R				Manual reset for latch
O				System Options
V				View current settings
P	(baud rate code)			Printer Baud Rate
I	(0 or 1)			Auto-Identify Load Cells
Z	(channel)(0 or 1)			Auto-Zero Load
A	(new address)#			Com Address
B	(baud rate code)			Com Baud Rate
L	(0 or 1)			Com Line Feed

	D			Display Options
	V			View current settings
	F	(type)(level)		Filter Select
	D	(channel)(number digits)		Decimal digits max
	C	(channel)(count by code)		Smallest count
	2	(B, L, T, or D)		2nd line shows a blank line, limits, text, or a display.
	T	(text)		Set the text displayed on line 2.

REMOTE SETUP MODE COMMANDS

The Commands in this section allow you to change the setup of the Model 4215 Plus. You will notice that these Commands form a menu, which duplicates the Setup Mode Menu used during the setup of the Model 4215 Plus from the front panel. There are additional Commands that are for Remote use only.

If the optional Keylock is installed, and locked you will not be able to alter the setup until the unit has been unlocked.

The “acknowledgment” from Model 4215 Plus will indicate this fact:

@ 001 Setup is Locked - use Keylock to unlock.

User Data Entry Command (U)

This Command is used to view or set the options in the user data entry menu, namely the Base Area; used to calculate Load in: pounds per square inch (Psi) or MegaPascals (MPa) and Base Length; used to calculate Position in: percent (%). This Command has three (3) subcommands:

- User Data View (UV)
- User Data Area (UA)
- User Data Length (UL)

User Data View Command (UV)

The User Data View Command (UV) has the format: UV

Example (User Entered):

@001UV

Acknowledgment:

@ 001 Base Area Ch A is 1.00000 sq-in

@ 001 Base Area Ch B is 1.00000 sq-in

Base Length is 10.0000 inches

User Data Area Command (UA)

The User Data Area Command (UA) is used to set the Base Area.

The format is: UA(channel)(number)#

Example (User Entered):

```
@001UAA1.0025#
```

Acknowledgment:

```
@ 001 Base Area Ch A is 1.00250 sq-in
```

User Data Length Command (UL)

The User Data Length Command (UL) is used to set the Base Length.

The format is: UL(number)#

Example (User Entered):

```
@001UL2.5#
```

Acknowledgment:

```
@ 001 Base Length is 2.50000 inches
```

Analog Output Command (A)

This Command is used to view or set the Analog Output of the Model 4215 Plus. There are two (2) subcommands:

- Analog Output View (AV)
- Analog Output Set (AS)

Analog Output View Command (AV)

The Analog Output View Command (AV) has the format AV

It will return the current settings of the Analog Output.

Example (User Entered):

```
@001AV
```

Acknowledgment:

```
@ 001 Analog Output is Load A in lbf  
10.0 Volts indicates 1000.0 lbf  
0.0 Volts indicates 0.0000 lbf
```

Analog Output Set Command (AS)

The Analog Output Set Command (AS) is used to change the settings of the Analog Output.

The format is: AS(channel)(item number)(unit number)(full scale)#(zero scale)#

Where the **channel** is the Analog Output Channel. The **Item and Unit Numbers** are used to determine the Signal Source for the Analog Output. The **full-scale** number indicates what signal level is assigned to a full scale Analog Output of 10.0 volts and the **Zero Scale** number indicates the signal level assigned to the zero volts Analog Output.

Example (User Entered):

```
@001ASA0000500.0#0#
```

Acknowledgment:

```
@ 001 Analog Output is Load A in lbf
      10.0 Volts indicates 500.00 lbf
      0.0 Volts indicates 0.0000 lbf
```

Sensor Command (S)

This Command is used to view or select calibration data from the list of calibrated Load Cells maintained by the Model 4215 Plus. There are four (4) subcommands:

- Sensor View (SV)
- Sensor Select (SS)
- Sensor Delete (SD)
- Sensor View Calibration Points Command (SZ)

Sensor View Command (SV)

The Sensor View Command (SV) has the format: SV

It returns information about the currently selected Load Cell including: the Serial Number, the Maximum Load Rating, the milli-volt per Volt Calibration Constant, the Excitation Voltage used, the latest date of calibration, and the Shunt Value recorded during the calibration.

Example (User Entered):

```
@001SV
```

Acknowledgment:

```
@ 001 This is the list of cell calibration data:
      unused S/N 105,    4.00 lbf      ,  4.00000 mV/v,
          5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
      Ch A = S/N 110,    4.00 lbf      ,  4.00000 mV/v,
          10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
      unused S/N 205,    4.00 lbf      ,  4.00000 mV/v,
          5.00 V      ,  Cal on Jan11-22,  1.4563 lbfShunt
      Ch B = S/N 210,    4.00 lbf      ,  4.00000 mV/v,
          10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
```

Sensor Select Command (SS)

The Sensor Select Command (SS) is used to select the calibration data for a stored Load Cell using the Load Cell Serial Number.

The format is: SS(channel)(serial number)#

Example (User Entered):

@001SSA105#

Acknowledgment:

@ 001 This is the list of cell calibration data:

```

Ch A = S/N 105,      4.00 lbf      ,  4.00000 mV/v,
           5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
unused S/N 110,      4.00 lbf      ,  4.00000 mV/v,
           10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
unused S/N 205,      4.00 lbf      ,  4.00000 mV/v,
           5.00 V      ,  Cal on Jan11-22,  1.4563 lbfShunt
Ch B = S/N 210,      4.00 lbf      ,  4.00000 mV/v,
           10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
    
```

Sensor Delete Command (SD)

The Sensor Delete Command (SD) is used to remove the calibration data for a stored Load Cell from the list.

The format is: SD(serial number)#

Example (User Entered):

@001SD205#

Acknowledgment:

@ 001 Deleted Sensor S/N 205

```

Ch A = S/N 105,      4.00 lbf      ,  4.00000 mV/v,
           5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
unused S/N 110,      4.00 lbf      ,  4.00000 mV/v,
           10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
Ch B = S/N 210,      4.00 lbf      ,  4.00000 mV/v,
           10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
    
```


Sensor View Calibration Points Command (SZ)

The Sensor View Calibration Points Command (SZ) is used to view the calibration points that were entered during sensor calibration. It works for all Mass and milli-volt per Volt Calibrations.

The format is: SZ(serial number)#

Example (User Entered):

@001SZ123456#

Acknowledgment:

@ 001 S/N = 123456, Rated load = 5000.0 lbf
Excite = 10 V, Cal on Jan11-22, 1444.0 lbfShunt

Calibration Points:

	Load Entered	mV/v Entered
1)	0.00000 lbf	0.00000 mV/v
2)	1000.00 lbf	1.00000 mV/v
3)	2000.00 lbf	2.00000 mV/v
4)	3000.00 lbf	3.00000 mV/v
5)	4000.00 lbf	4.00000 mV/v

Calibration Command (C)

This command has twelve (12) subcommands:

- Calibration Check (CC): is used to run a Shunt Calibration Check on a Load Cell.
- Calibration Begin (CB): starts the calibration of a new or existing Load Cell.
- Calibration Escape (CE): cancels a calibration that is underway.
- Calibration by milli-volt per Volt (CV): runs a one-point calibration using the Load Cell milli-volt per Volt constant.
- Calibration by milli-volt per Volt (CMV5): runs a five-point calibration using the Load Cell milli-volt per Volt constant.
- Calibration by Polynomial Equation (CP): runs a Polynomial calibration using a specified number of degrees and their associated coefficients in the equation.
- Calibration by mV/V Mass (CMVM) and mV/V Volt (CMVV): can have up to ten parts each; CMVM1 through CMVM9, and CMVM0 for the mV/V Mass Calibration and CMVV1 through CMVV9, and CMVV0 for the mV/V Volt Calibration.
- Calibration by Masses (CM): tells the unit that you are doing a calibration by either a two-point (CM2), or five-point (CM5) Mass Calibration.
- Calibration by Mass Point (CMP): can have up to six parts, using command formats CMP1 through CMP5, and CMP0.
- Calibration by Shunt (CS): does calibration based on the Shunt Value of the Load Cell.
- Calibration Counts-per-Inch View (CIV): displays the current setting of the Encoder Counts-per-Inch Constant.
- Calibration Counts-per-Inch Set (CIS): lets you set the Encoder Counts-per-Inch Constant.

Note: Both the Calibration Counts-per-Inch View (CIV) and the Calibration Counts-per-Inch Set (CIS) subcommands are listed under the “Calibration Counts-per-Inch Command (CI)” section header. Each of these subcommands are described below.

Calibration Check Command (CC)

The Calibration Check Command (CC) runs a Calibration Check on the currently selected Load Cell. Note that the Load Cell should not be under load when this check is running. During the 10-second Shunt Calibration the front panel will show “RS232 Cal Check”. After the 10-seconds, the unit will return to Run Mode and send the acknowledgment line shown below. This indicates both the current reading of the Shunted Load Cell and the reading that was recorded when this Load Cell was last calibrated.

The format is: CC(channel)

Example (User Entered):

@001CCB

Acknowledgment:

```
@ 001 Cal Check Ch B, S/N 205
    Shunt Value is      1.46 lbf
    Cal Value was      1.46 lbf
```

Calibration Begin Command (CB)

The Calibration Begin Command (CB) is a 4-part command used to start a calibration by any method. You must issue the CB Command before trying to calibrate by milli-volt per Volt, Masses, or Shunt (CV, CM, or CS). While the Model 4215 Plus is being calibrated using the Remote Commands, the front panel will show “RS232 CAL STARTED”. Pressing the front panel Escape button (Esc) will cancel the calibration and issue a warning to the Remote Terminal. If any Remote Commands other than Calibration Commands are issued, the calibration will also be canceled. The acknowledgment will indicate if this is a “New Load Cell” or if you are going to “Overwrite” existing data. If you do not wish to overwrite the existing data use the CE (Calibration Escape) Command to stop this calibration. Another method to avoid overwriting existing data is to delete the Sensor first and then calibrate.

The formats for the Calibration Begin Commands are:

```
CB1(space)(channel)(serial number)#
CB2(space)(month)(day)(year)
CB3(space)(excitation)(calibration unit)
CB4(space)(rated load)#
```

Where **channel** is either A or B, **serial number** is the serial number of the Load Cell (not exceeding 6 digits), **month**, **day**, and **year** are 2 digit numbers to represent the current date, **excitation** should be: a 0 for 5.00 volts or a 1 for 10.00 volts, the **calibration unit** is the desired unit for this calibration, and the **rated load** is the Maximum Load rating for the load Cell.

Example 1 (User Entered):

@001CB1 A123456#

Acknowledgment 1:

@ 001 Calibrate Begin 1 Command - New
Load Cell S/N 123456 - Channel A

Example 2 (User Entered):

@001CB2 011122

Acknowledgment 2:

@ 001 Calibrate Begin 2 Command - New
Cal Date: Jan11-22

Example 3 (User Entered):

@001CB3 100

Acknowledgment 3:

@ 001 Calibrate Begin 3 Command - New
Excitation Voltage: 10.00 V, Calibration Unit: lbf

Example 4 (User Entered):

@001CB4 1000.0#

Acknowledgment 4:

@ 001 Calibrate Begin 4 Command - New
Rated Load: 1000.0 lbf

Calibration Escape Command (CE)

The Calibrate Escape Command (CE) is used to cancel a calibration that was started with the Calibrate Begin Command (CB).

This format is: CE

Example (User Entered):

@001CE

Acknowledgment:

@ 001 Calibrate Command - Canceled, Calibration NOT Changed

Calibrate by milli-volt per Volt Command for One-Point (CV)

The Calibrate by milli-volt per Volt Command for One-Point (CV) is used to calibrate a Load Cell using its milli-volt per Volt Calibration Constant. You must have already started a calibration using the CB (Calibration Begin) Command for this command to function.

The format is: CV(milli-volt per Volt constant)#

Note that a Shunt Check Calibration will also be running at this time and so it is important that the Load Cell is not under load when this command is entered.

Example (User Entered):

@001CV4.5002#

Acknowledgment:

@ 001 Calibrate Command - Reading for Shunt Check...

[10 second delay]

@ 001 Calibrate Command Completed

```

unused S/N 105,      4.00 lbf      ,  4.00000 mV/v,
      5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
unused S/N 110,      4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
unused S/N 210,      4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
Ch B = S/N 205,      4.00 lbf      ,  4.00000 mV/v,
      5.00 V      ,  Cal on Jan11-22,  1.4563 lbfShunt
Ch A = S/N 123456,  1000.0 lbf     ,  4.50020 mV/v,
      10.00 V     ,  Cal on Jan11-22,  320.86 lbfShunt
    
```

Calibrate by milli-volt per Volt Command for Five-Points (CMV5)

The Calibrate by milli-volt per Volt Command for Five-Points (CMV5) is used to calibrate a Load Cell using 5-points of Mass and 5-points of milli-volt per Volt each. You must have already started a calibration using the CB (Calibration Begin) Command for this command to function.

The format is: CMV5

Note that a Shunt Check Calibration will also be running at the end of the calibration and so it is important that the Load Cell is set at 0 (or no masses) when the final command is entered.

Example (User Entered):

```
@001CMV5
```

Acknowledgment:

```
@ 001 Calibrate By mV/Volt - 5 Point
Ready for Mass CMVM1 command
```

Calibrate by Polynomial Equation (CP)

The Calibrate by Polynomial Equation (CP) is used to calibrate a Load Cell using a polynomial equation, the size of which is determined by you during the calibration setup. You must have already started a calibration using the CB (Calibration Begin) Command for this command to function.

The format is:

CP(degree)

CPD(coefficient)(value)#

CP

Where **degree** is a value between 0 and 5 which dictates what degree polynomial will be calibrated, **coefficient** is a value between 0 and 5 which specifies what coefficient is being set with the command, and **value** is the value of the coefficient specified.

Note that a Shunt Check Calibration will be started when the final "CP" command is sent so it is important that the Load Cell is set at 0 (or no masses) when the final command is entered.

Example 1 (User Entered):

@001CP2

Acknowledgment:

@ 001 Calibrate by Polynomial - 2 Degree
Ready for CPD0 command

Example 2 (User Entered):

@001CPD05.000e-01#

Acknowledgment:

@ 001 Calibrate Degree 0 Coefficient Command entered
Ready for CPD1 or CE command

Example 3 (User Entered):

@001CPD12.000e+00#

Acknowledgment:

@ 001 Calibrate Degree 1 Coefficient Command entered
Ready for CPD2 or CE command

Example 4 (User Entered):

@001CPD2-1.000e-01#

Acknowledgment:

@ 001 Calibrate Degree 2 Coefficient Command entered
Ready for CP or CE command

Example 5 (User Entered):

@001CP

Acknowledgment:

@ 001 Calibrate Command - Reading for Shunt Check...

[10 second delay]

@ 001 Calibrate Command Completed

```

unused S/N 105,    4.00 lbf      ,    4.00000 mV/v,
                    5.00 V      ,    Cal on Jan01-18,    0.0000 lbfShunt
unused S/N 110,    4.00 lbf      ,    4.00000 mV/v,
                    10.00 V     ,    Cal on Jan01-18,    0.0000 lbfShunt
Ch B = S/N 205,    4.00 lbf      ,    4.00000 mV/v,
                    5.00 V      ,    Cal on Jan01-18,    0.0000 lbfShunt
unused S/N 210,    4.00 lbf      ,    4.00000 mV/v,
                    10.00 V     ,    Cal on Jan01-18,    0.0000 lbfShunt
Ch A = S/N 123456, 1000.0 lbf     ,    1000.00 mV/v,
                    10.00 V     ,    Cal on Jan11-22,    1.4440 lbfShunt
    
```

Calibrate by mV/V Mass and mV/V Volt Commands (CMVM and CMVV)

The Calibration by mV/V Mass (CMVM) and mV/V Volt (CMVV) Commands can have up to ten parts each: CMVM1 through CMVM9, and CMVM0; and CMVV1 through CMVV9, and CMVV0. You must have already started a calibration using the CB (Calibration Begin) and CMV5 (Calibrate by milli-volt per Volt for Five-Points) Commands for any of these commands to function.

To input the first mass, issue the Calibration by mV/V Mass 1 Command (CMVM1).

The mass is entered using the following format: CMVM1(Mass Value)#

Entering this command will result in the unit prompting the user for the first milli-volt per Volt Command.

Example (User Entered):

@001CMVM10#

Acknowledgment:

@ 001 Calibrate Mass 1 Command entered
Ready for mV/V Value CMVV1 or CE command

- The CE or Calibration Escape Command will discontinue this calibration without calibrating the unit. The unit will remain calibrated according to the most recent calibration or, if this is the first calibration of the unit, the unit will remain un-calibrated.
- At this point the unit will prompt the user for the first Milli-Volt per Volt value of the calibration.
- The mV/V value is entered using the Calibration by mV/V Volt 1 Command (CMVV1) with the following format: CMVV1(mV/V value)#

Example (User Entered):

@001CMVV10#

Acknowledgment:

@ 001 Calibrate mV/V 1 Command entered
Ready for Mass value CMVM2 or CE command

The unit will continue to prompt the user for mass and milli-volt per Volt values until the fifth point has been entered. Then the user will see the following acknowledgement:

@ 001 Calibrate mV/V 5 Command entered
Ready for Mass value CMVM0 or CE command

The user must now enter the CMVM0 Command to finish the calibration. Note that the Load Cell should have no masses on it at this point since a Shunt Calibration is running.

Example (User Entered):

@001CMVM0

Acknowledgment:

@ 001 Calibrate Command - Reading for Shunt Check...

[10 second delay]

@ 001 Calibrate Command Completed
unused S/N 105, 4.00 lbf, 4.00000 mV/v,
5.00 V, Cal on Jan11-22, 1.4564 lbfShunt
unused S/N 110, 4.00 lbf, 4.00000 mV/v,
10.00 V, Cal on Jan11-22, 1.4440 lbfShunt
unused S/N 210, 4.00 lbf, 4.00000 mV/v,
10.00 V, Cal on Jan11-22, 1.4439 lbfShunt
Ch B = S/N 205, 4.00 lbf, 4.00000 mV/v,
5.00 V, Cal on Jan11-22, 1.4563 lbfShunt
Ch A = S/N 123456, 1000.0 lbf, 1.00000 mV/v,
1.00000 mV/v,
1.00000 mV/v,
1.00000 mV/v,
10.00 V, Cal on Jan11-22, 1444.0 lbfShunt

Calibrate by Masses Command (CM)

The Calibrate by Masses Command (CM) tells the unit that you are doing a Calibration by a 2-point, or 5-point Mass.

The format is: CM2 for a Two-Point Mass Calibration, and CM5 for a Five-Point Mass.

Example (User Entered):

@001CM5

Acknowledgment:

@ 001 Calibrate By Mass - 5 Point
Ready for CMP1 command

Calibrate by Masses Point Command (CMP)

The Calibration by Masses Point Command (CMP) can have up to six parts: CMP1 through CMP5 (for the Five-Point) and CMP0. You must have already started a calibration using the CB (Calibration Begin) and CM (Calibrate by Masses) Commands for any of these commands to function.

To read the first mass, issue the Calibration Mass Point 1 Command (CMP1).

The format is: CMP1(mass)#

The CMP1(mass)# will cause the Model 4215 Plus to read 10 seconds of data from the Load Cell. These readings are averaged to obtain the first Calibration Mass Reading. Be sure that you have placed the mass on the Load Cell before entering this command, since reading will begin immediately. The example uses 0 Lbf. for the first Calibration Mass.

Example (User Entered):

@001CMP10#

Acknowledgment:

@ 001 Calibrate Mass 1 Command - Reading...
[10 second delay]
Calibrate Mass 1 Command - Ready for CMP2 or CE command

The Calibrate Mass 2 Command (CMP2) has the format: CMP2(mass)#

The Calibrate Mass 2 Command can only be issued after the CMP1 Command has completed. Be sure that you have placed the mass on the Load Cell before entering this command since reading will begin immediately. The example uses 200 Lbf. for the second Calibration Mass.

Example (User Entered):

@001CMP2200#

Acknowledgment:

@ 001 Calibrate Mass 2 Command - Reading...
[10 second delay]
Calibrate Mass 2 Command - Ready for CMP3 or CE command

Entering Calibration Masses three through five (CMP3 – CMP5) are done in a similar manner. The Calibrate Mass Point 0 Command (CMP0) completes the 2-point or 5-point

Mass Calibration. Remove the masses from the Load Cell before entering this command since it will perform the Shunt Calibration Measurement that is recorded for use with the Calibration Check Command.

The format is: CMP0

Example (User Entered):

@001CMP0

Acknowledgment:

@ 001 Calibrate Command - Reading for Shunt Check...

[10 second delay]

@ 001 Calibrate Command Completed

```

unused S/N 105,    4.00 lbf      ,  4.00000 mV/v,
      5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
unused S/N 110,    4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
unused S/N 210,    4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
Ch B = S/N 205,    4.00 lbf      ,  4.00000 mV/v,
      5.00 V      ,  Cal on Jan11-22,  1.4563 lbfShunt
Ch A = S/N 123456, 1000.0 lbf     ,  4.96103 mV/v,
                                   4.96133 mV/v,
                                   4.96127 mV/v,
                                   4.96128 mV/v,
      10.00 V     ,  Cal on Jan11-22,  291.08 lbfShunt
    
```

Calibrate by Shunt Command (CS)

The Calibrate by Shunt Command (CS) is used to calibrate the Load Cell using the Shunt Calibration Factor expressed in pounds. This Command will only function if you have already issued the Calibration Begin Command (CB). Note that the Load Cell should not have any load on it for this command to operate correctly.

The format is: CS(shunt value in Lbf)#

The example shows a calibration using a shunt value of 320.86 Lbf.

Example (User Entered):

@001CS320.86#

Acknowledgment:

@ 001 Calibrate Shunt Command - Reading...

[10 second delay]

@ 001 Calibrate Command - Reading for Shunt Check...

[10 second delay]

@ 001 Calibrate Command Completed

```

unused S/N 105,    4.00 lbf      ,  4.00000 mV/v,
      5.00 V      ,  Cal on Jan11-22,  1.4564 lbfShunt
unused S/N 110,    4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4440 lbfShunt
unused S/N 210,    4.00 lbf      ,  4.00000 mV/v,
      10.00 V     ,  Cal on Jan11-22,  1.4439 lbfShunt
    
```



```
Ch B = S/N 205,      4.00 lbf      ,  4.00000 mV/v,  
          5.00 V      ,  Cal on Jan11-22,  1.4563 lbfShunt  
Ch A = S/N 123456,  1000.0 lbf      ,  4.50037 mV/v,  
          10.00 V     ,  Cal on Jan11-22,  320.86 lbfShunt
```

Calibrate Counts-Per-Inch Command (CI)

This command has two (2) subcommands:

- Calibrate Counts-per-Inch View (CIV)
- Calibrate Counts-per-Inch Set (CIS)

Calibration Counts-per-Inch View Command (CIV)

Displays the current setting of the Encoder Counts-per-inch Constant.

Example (User Entered):

```
@001CIV
```

Acknowledgment:

```
@ 001 Encoder is 24000 Counts per Inch
```

Calibration Counts-per-Inch Set Command (CIS)

Allows you to change the current setting of the Encoder Counts-per-inch Constant.

Example (User Entered):

```
@001CIS64000#
```

Acknowledgment:

```
@ 001 Encoder is 64000 Counts per Inch
```

Limits Command (L)

This Command allows you to view or set the 4 contact-closure limit switches on the Model 4215 Plus. There are four (4) subcommands:

- Limit View (LiV)
- Limit Set (LiS)
- Limit Setup Escape (LE)
- Limit Reset (LiR)

In the above list of commands, “i” is a placeholder for the Limit number

Limit View Command (LiV)

The Limit View Command (LiV) is used to view the current settings of one of the limits.

The format is: L(limit number)V

Example (User Entered):

```
@001L1V
```

Acknowledgment:

```
@ 001 Lim 1 NO Enabled Load A lbf Set 0.90000 Trip>Set Latch  
Off Reset 0.80000
```

This acknowledgment line indicates that: Limit 1 is a normally open switch (NO) rather than a normally closed switch (NC). The limit is Enabled rather than Disabled. The

signal driving this limit is Load A in Lbf. The limit will be turned on when the Load exceeds 0.90000 Lbf. It is not a Latching limit (latching requires a manual reset). The limit will automatically reset when the Load is less than 0.80000 Lbf.

Limit Set Command (LiS)

The Limit Set Command (LiS) is broken up into 4 separate commands.

The four commands have the following formats:

Command 1: L(Limit Number)SA(space)(Normal Position)(Enable)(Item Number)
(Unit Number)

Command 2: L(Limit Number)SB(space)(Set Point Number)#

Command 3: L(Limit Number)SC(space)(< or >)(Latching)

Command 4: L(Limit Number)SD(space)(Reset Point Number)#

- The **Limit Number** chooses which limit (1-4) you want to setup.
- The **Normal Position** should be set to: 0 for normally open or 1 for normally closed.
- The **Enable** should be set to: 0 for disabled or 1 for Enabled.
- If the limit is disabled the rest of this command may be omitted (see example 3).
- The **Item and Unit Number** indicate which signal is to drive the limit and the values can be found with the Question Mark command.
- The **Set Point Number** indicates the signal level at which the limit is to be activated.
- The **< or >** sign indicates whether you want the limit to be activated when the signal is greater than the set point (>) or less than the set point (<).
- The **Latching** should be set to: 0 for latching off or 1 for latching on.
- If Latching On is selected the rest of the command may be omitted.
- Latching On will require a Manual Reset, once the Limit has been activated.
- The **Reset Point Number** indicates the signal level at which the limit should be de-activated.

Note: If you want to Enable a Limit without otherwise changing its settings you can enter the following format: L(limit number)SA(space)(normal position)1# (see example 4).

Example 1 (User Entered):

@001L1SA 010000

Acknowledgment 1:

@ 001 Limiter Setup Command 1 - Ready for Command 2.

Example 2 (User Entered):

@001L1SB 50.0#

Acknowledgment 2:

@ 001 Limiter Setup Command 2 - Ready for Command 3.

Example 3 (User Entered):

@001L1SC >0

Acknowledgment 3:

@ 001 Limiter Setup Command 3 - Ready for Command 4.

Example 4 (User Entered):

@001L1SD 10.0#

Acknowledgment 4:

@001 Lim 1 NO Enabled Load A lbf Set 50.0000 Trip>Set Latch
Off Reset 10.0000

Limit Setup Escape (LE)

The Limit Setup Escape Command (LE) is used to cancel a limit setup that was started with the Limit Set Command (LiS).

This format is: LE

Example (User Entered):

@001LE

Acknowledgment:

@ 001 Limiter Setup Command Canceled

Limit Reset Command (LiR)

The Limit Reset Command (LiR) is used to manually reset a latching limit that has been activated.

The format is: L(limit number)R

Example (User Entered):

@001L1R

Acknowledgment:

@ 001 Reset Limiter 1.

System Options Command (O)

The System Options Command has nine (9) subcommands that are used to view or set the options that appear on the System Options Menu:

- Option View (OV): displays all the settings in the System Options Menu.
- Option Printer (OP): is used to set the Printer Baud Rate.
- Option Auto ID (OI): is used to turn Auto-Identification of Load Cells on or off.
- Option Auto Zero (OZ): is used to turn Auto-Zeroing of Load on or off.
- Option Com Address (OA): is used to change the communications address of the unit.
- Option Baud Rate (OB): is used to change the Communications Baud Rate.

- Option Line Feed (OL): is used to turn the Auto Line Feed option on or off.
- Option Tare Retain (OT): is used to turn the Tare Retain option on or off.
- Option Hold / Freeze (OH): is used to toggle the function of the Print Button on the front panel between print and hold / freeze the front panel display.

Each of these System Options are described below.

Option View Command (OV)

The Option View Command (OV) returns a list of the current settings of all the System Options.

The format is: OV

Example (User Entered):

@001OV

Acknowledgment:

```
@ 001 Printer Baud Rate is 230.4k
Auto Identify is off
Auto Identify Annunciator is off
Auto Tare is on
Auto Zero Channel A is off
Auto Zero Channel B is off
Com Address is 001
Com Baud Rate is 9600
Com Line Feed is on
Retain Tare is off
RS232 End of Transmission Character is off
```

Option Printer Baud Rate Command (OP)

The Option Printer Baud Rate Command (OP) is used to select the Printer Baud Rate.

The format is: OP(code)

Where the **code** is selected from the table shown at the right.

Example (User Entered):

@001OP5

Acknowledgment:

```
@ 001 Printer Baud Rate is 9600
```

Option Printer Command	
Code	Baud rate
4	4800
5	9600
6	19.2K
8	57.6K
9	230.4K

Option Auto-Identify Command (OI)

The Option Auto-Identify Command (OI) is used to turn Auto-Identification of Load Cells on or off.

The format is: OI(0 or 1)

Where **0** turns Auto-ID off and **1** turns Auto-ID on.

Example (User Entered):

@001OI0

Acknowledgment:

@ 001 Auto Identify is off

Option Auto-Zeroing Command (OZ)

The Option Auto-Zeroing Command (OZ) is used to turn Auto-Zeroing of Load on or off.

The format is: OZ(channel)(0 or 1)

Where **channel** is either A or B and **0** or **1** turn Auto-Zeroing off and on, respectively.

Example (User Entered):

@001OZA1

Acknowledgment:

@ 001 Auto Zero Channel A is on
Auto Zero Channel B is off

Option Com Address Command (OA)

The Option Com Address Command (OA) is used to change the communications address assigned to this unit.

The format is: OA(new address)#

Note: The valid addresses are 1 through 254.

Example (User Entered):

@001OA3#

Acknowledgment:

@ 003 Com Address is 003

Option Com Baud Rate Command (OB)

The Option Com Baud Rate Command (OB) is used to change the communications Baud Rate for this unit.

The format is: OB(code)

Where the Baud Rate **codes** are given in the table,

Example (User Entered):

@001OB2

Acknowledgment:

@ 001 Changing Communications Baudrate to
1200

Option Baud rate Command	
Code	Baud rate
0	300
1	600
2	1200
3	2400
4	4800
5	9600
6	19.2K
7	38.4K
8	57.6k
9	230.4

Option Line Feed Command (OL)

The Option Line Feed Command (OL) turns on or off the generation of line feed characters when the Model 4215 Plus sends information to your Remote Terminal.

The format is: OL(0 or 1)

Where **0** turns Line Feeds off and **1** turns Line Feeds on.

Example (User Entered):

@001OL1

Acknowledgment:

@ 001 Com Line Feed is on

Option Tare Retain Command (OT)

The Option Tare Retain Command (OT) Enables and disables the retention of the current Tare Value in memory for use after the unit has been powered down and then powered back up.

The format for the OT command is: OT(0 or 1)

Where **0** is disabled and **1** is Enabled. Once Enabled, the Tare Values are retained until this option is disabled. Disabling the Tare Retention Option resets the Tare values for both channels to 0.

Example (User Entered):

@001OT1

Acknowledgment:

@ 001 Retain Tare is on

Option Hold / Freeze (OH)

The Option Hold / Freeze Command (OH) sets the usage of the Print / Hold button. When followed by a 0, the button is set to Print when pushed (OH0), when followed by a 1, the button is set to Hold / Freeze the front panel when pushed (OH1).

Example (User Entered):

@123OH1

Acknowledgment:

@123 Print button is set to Hold

Display Options Command (D)

The Display Options Command (D) has six (6) subcommands used to set the options that affect the front panel display of the Model 4215 Plus:

- Display View Command (DV): displays all the current values set on the Display.
- Display Filter Command (DF): is used to set the Filter Type and Level.
- Display Decimal Command (DD): is used to set the maximum number of decimal digits that are shown for the Load, Peak, and Valley.

- Display Count By Command (DC): is used to set the smallest number that the display will count by for the Load, Peak, and Valley measurements.
- Display Second Line Command (D2): is used to set the second line of the display panel to be blank or to show the Limit status.
- Display Second Line Text (DT): is used to enter the text that would be displayed if text is set to be displayed on the second line.

Each of these display options are described below.

Display View Command (DV)

The Display View Command (DV) is used to return the current values of all the display options.

The format is: DV

Example (User Entered):

@001DV

Acknowledgment:

```
@ 001 Filter is Type II Level 1
  Filter Window A is On
  Filter Window A = 1.0000 lbf
  Filter Window B is Off
  Channel A shows 5 decimal digits
  Channel B shows 5 decimal digits
  Channel A counts by 1
  Channel B counts by 1
  Second line shows display
  Line 2 Message - Stress Test Ready
  Velocity Filter Level is 1
  Position shows 5 decimal digits
  Velocity shows 5 decimal digits
```

Display Filter Command (DF)

The Display Filter Command (DF) sets the Filter Type and Level.

The format is: DF(type)(level)

Where **type** is either: 1 for Type I Filters or 2 for Type II Filters. **Level** must be 1, 2, 3, or 4 depending on the level of filtering desired. (Option 4 provides the most filtering and the slowest rise time).

Example (User Entered):

@001DF13

Acknowledgment:

```
@ 001 Filter is Type I Level 3
```

Display Decimal Command (DD)

The Display Decimal Command (DD) sets the maximum number of decimal digits that are shown for Load, Peak, and Valley.

The format is: DD(channel)(number)

Where **channel** is either A or B and the **number** must be between zero and 5.

Example (User Entered):

@001DDA0

Acknowledgment:

@ 001 Channel A shows 0 decimal digits

Display Count By Command (DC)

The Display Count by Command (DC) sets the smallest number that the display will count by for the Load, Peak, and Valley measurements.

The format is: DC(channel)(code)

Where the **code** is selected from the table at the right.

Example (User Entered):

@001DCA3

Acknowledgment:

@ 001 Channel A counts by 10

Display Count by Command	
Code	Count By
0	1
1	2
2	5
3	10
4	20

Display Second Line Command (D2)

The Display Second Line Command (D2) is used to set the second line to be blank or to show the Limit status.

The format is: D2(B, L, D, or T)

Where **B** makes the line blank, **L** makes the line show the Limit status, **D** makes the line show another display, and **T** makes the line show text.

Example (User Entered):

@001D2B

Acknowledgment:

@ 001 Second Line set to Blank

Display Second Line Text (DT)

The Display Second Line Text Command (DT) is used to select the text that would be displayed on the second line if text is set to go on the second line.

This command is identical in functionality to the @001T(text) command found earlier in the Remote Commands Section.

Example (User Entered):

@001DTMorehouse Model 4215

Acknowledgment:

@ 001 Text Message - Morehouse Model 4215

System calibration mode

The following procedure should be followed to calibrate the Model 4215 Plus unit. This calibration requires the use of a precision milli-volt per Volt reference, which will be attached on the Load Cell connector. The resulting scale factors are recorded in the non-volatile memory of the Model 4215 Plus.

ATTENTION: System Calibration should ONLY be performed by trained, QUALIFIED TECHNICIANS utilizing the proper precision devices to ensure the most accurate performance of the unit. Also, it is highly recommended to allow the Model 4215 Plus to be powered on for at least 1.5 hours before performing a System Calibration.

1. To enter System Calibration Mode, turn off the Model 4215 Plus. Hold down the two end buttons below the display ("Item" and "Unit") while turning the power back on. As soon as the display comes on you can release the two buttons.
2. The unit will skip the start-up sequence and prompt the user for a password. Enter the number 777 as the system calibration password.
3. The unit will now display the "Hidden Options" menu with the selections:
 - Ch A Board Cal – Used to board calibrate Channel A
 - Ch B Board Cal – Visible if a 2-channel unit, used to board calibrate Channel B
 - Unit mV/V Board Cal – Used to calibrate Channel A and Channel B in the same sequence if a 2-channel unit, otherwise performs exactly like "Ch A Board Cal"
 - Bcal Scale Values – Displays the board calibration scale values.
 - DAC Calibration – Used to calibrate DAC if option is present.
 - DAC Cal Scale Vals – Displays the DAC calibration scale values if applicable.

A five-minute warm-up period with the milli-volt per Volt reference attached is recommended at this time if the milli-volt per Volt reference has just been attached.

4. Select Channel A/B Board Cal, or Unit mV/V Board Cal for both, and you will be prompted to enter the first of two milli-volt per Volt references. (We recommend using -3.0 milli-volt per Volt for the first and +3.0 milli-volt per Volt for the second). Set your reference and enter the appropriate number. As soon as you press the Enter Button the Model 4215 will start reading the reference. A "Please Wait" message will be on the front panel during this time.
5. Next you are prompted for the second milli-volt per Volt value. Set your reference and enter the appropriate number. Again, reading will start as soon as the Enter Button is pressed.
6. Next set the voltage reference value to Zero and press enter, the "Please Wait" message will display once more while the unit takes its readings. If Unit mV/V was chose you will be prompted to repeat this process with the reference voltage attached to the second channel.
7. When the read is complete, the unit will display the Scale factors that it has just generated and you may scroll through using the +, -, <, > buttons. Pressing Enter or ESC button will bring you back to the Hidden Menu.

Note: Press the ESC button while in the Hidden menu to be brought to normal Run Mode.

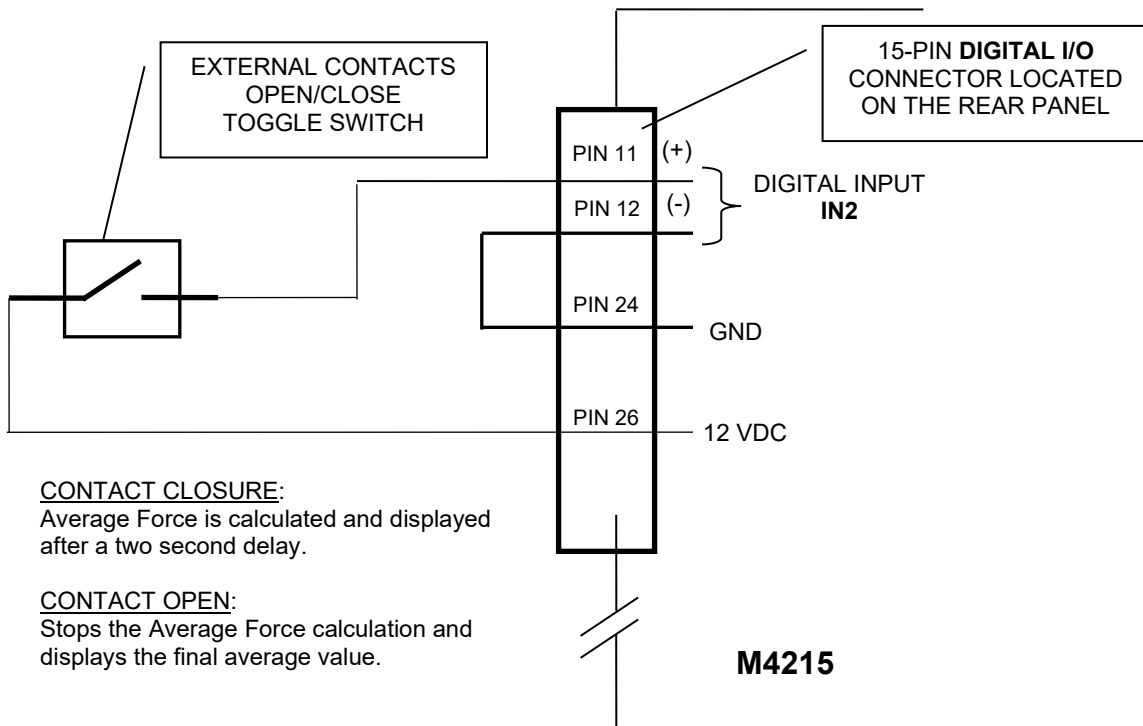
FORCE AVERAGING (OPTIONAL)

The Avg A and Avg B, in the Item menu, is an optional Digital Input function for the display of Force Averaging. If this function is selected, it replaces **IN2** of the standard Digital Input function.

When first selected after power up, the Value displayed for Average Force will be Zero. To use the features, the user must activate the isolated Input 2, **IN2**, of the Digital I/O port connector (pins 11 and 12 – see Digital I/O Connector in Appendix B). Once the Digital Input has been activated, the unit will begin to display a Running Average of the Force Measured after an approximate 2 second delay. The Item “Avg A” refers to the Average Force measured, calculated, and displayed on Channel A and the Item “Avg B” refers to the Average Force measured, calculated, and displayed on Channel B. Opening the Digital Input Circuit will stop the averaging. The final Average Value will remain on the display until the input is again activated or the unit is powered down.

If you do not require isolation for your application, you can use the +12-Volt Source and an available GND Signal located on the Digital I/O connector (pin 26 and pin 24) to create a circuit that only needs Contact Open/Closure to activate and deactivate the Digital Input. See the application diagram below.

APPLICATION DIAGRAM – Contact OPEN/CLOSE activation of Force Averaging



APPENDIX A – MODEL 4215 PLUS SPECIFICATIONS

Transducer Interface	
Excitation	5VDC or 10VDC software/auto selectable
Current Drive	180mA at 5VDC or 10VDC
Push Button Shunt	Yes
Internal Shunt Resistor	1 standard, 2 optional. Rear panel selectable
Calibration Method	Shunt, mV/V, Known Load
Push Button Tare	100% of range--display and analog output
Sensitivity Adjust	1 mV/V to 4.5 mV/V
Accuracy	0.01% of full scale +/- 1 digital count
CMRR	115 dB

Additional Transducer Channel	
Auxiliary Channel	Optional

D/A Analog Output	
Full Scale Output	+/- 10VDC nominal +/- 0.5VDC
Linearity	0.02% of full scale
Scaling	Gain and offset selected by software.
Frequency Response	Approx. 15 Hz (plus filtering)
Output Source	Any displayed quantity
Output Channels	1 std, 2 optional

Direct Analog Output	
Full Scale Output	-/+ 8.14VDC +/- 0.25VDC
Linearity	0.02% of full scale
Scaling	Fixed with no tare, transducer channel only
Frequency Response	Approx. 1.5 kHz

Peak/Hold	
Peak/Valley/Hold	Digital 1/60 second capture

MOREHOUSE INSTRUMENT COMPANY INC. MODEL 4215 PLUS V5.0.6

Digital I/O	
Digital Inputs	
Interface	4 optically isolated inputs
Function	remote tare, peak/valley reset, position reset, print
Digital Outputs	
Function	4 independent limits
Quad-Limits Setup	Front panel, latching or non-latching set points, normally open/closed, Enable/disable
Quad-Limits Output	4 isolated solid state switches
Quad-Limits Source	Any displayed quantity

Serial Interface	
RS-232 Serial Setup/Output	Standard
RS-485 Serial Setup/Output	Optional
Multi-drop RS-232	Optional
USB	Optional

Printing	Optional
Interface Type	Serial
Quantities Printed	All displayed Items

Encoder Position Channel	Optional
Encoder Type	Quadrature, 4X number of lines
Excitation	12VDC std., 5VDC optional
Interface	Single ended or differential
Calibration	User adjustable counts/inch

Auto Transducer Identification	
Auto Identification and Setup	Yes, standard

Push Buttons	
Smart Push Buttons	6
Adjustments	Displayed Items, units, tare, peak/valley reset, alternate view, and print. Alternate functions for programming.

MOREHOUSE INSTRUMENT COMPANY INC. MODEL 4215 PLUS V5.0.6

Digital Display	
Display Characters	2 lines by 20 characters
Display Update	> 4/Sec
Scaling	Automatic or Manual
Maximum Display Count	± 999,999
Decimal Points Selection	0 to 5 software selectable.
Display Type	Vacuum fluorescent
Resolution	24 bit
Software Filters	8, software selectable

Electrical Characteristics	
Power Requirements	115 VAC, 60 Hz, Optional 230 VAC, 50 Hz
Fuse Requirements	115 VAC: Fuse, T, 0.315A, 250V 230 VAC: Fuse, T, 0.160A, 250V
Power Consumption	12 W (unloaded)
Transducer Excitation Current	Shutdown mode when shorted to ground
Absolute Max Transducer Input	30VDC without damage

Physical Characteristics	
Package Size	10.0" W X 3.0" H X 10.5" D [25.4 x 7.7 x 26.7 cm]
Weight	6.7 lbs. [3.1 kg]
Case Material	Aluminum
Mounting Hardware	Available

Environmental	
Operating Temp	0° C to 50° C
Storage Temp	-10° C to 60° C
Relative Humidity	95% without condensation

APPENDIX B -- CABLES AND CONNECTORS

Sensor Connectors

DB9 Female	
Pin	Signal
1	EXCITE - HI
2	SENSE - HI ¹
3	CELL OUTPUT - HI
4	CELL OUTPUT - LO
5	SENSE - LO ¹
6	EXCITE - LO
7	AUTO ID - A
8	AUTO ID - B
9	CHASSIS GND

Notes:

1. If the sense lines are not used, SENSE - HI must be tied to EXCITE - HI and SENSE - LO must be tied to EXCITE - LO.

Serial Port Connector

DB15 Male	
Pin	Signal
1	TXD
2	RXD
3	No Connect
4	SERIAL GND
5	TXD+ (Printer)
6	TXD- (Printer)
7	RXD- (RS485)
8	RXD+ (RS485)
9	No Connect
10	SERIAL GND
11-13	No Connect
14	TXD+ (RS485)
15	TXD- (RS485)

Notes:

1. Pins 1, 2, and 4 are used for RS-232 ASCII Command set communications. Use 8 data bits, no parity, 1 stop, and set the baud rate using the Com Baud Rate entry on the System Options Menu.

2. The printer uses RS-422 differential signaling on pins 5, 6, and 10. Baud rate for the printer is selectable using the Printer Baud entry on the System Options Menu.

3. Pins 7, 8, 14, and 15 are used for RS-485 ASCII Command set communications. Use 8 data bits, no parity, 1 stop, and set the baud rate using the Com Baud Rate entry on the System Options Menu.

High Density 26 Female	
Pin	Signal
1	LIM 1 A ¹
2	LIM 1 B ¹
3	LIM 2 A
4	LIM 2 B
5	LIM 3 A
6	LIM 3 B
7	LIM 4 A
8	LIM 4 B
9	ISO IN 1 - HI ²
10	ISO IN 1 - LO ²
11	ISO IN 2 - HI
12	ISO IN 2 - LO
13	ISO IN 3 - HI
14	ISO IN 3 - LO
15	ISO IN 4 - HI
16	ISO IN 4 - LO
17	KEYLOCK ³
18	GND
19	ENCODER CHA-L ⁴
20	ENCODER CHA
21	GND
22	ENCODER CHB-L ⁴
23	ENCODER CHB
24	GND
25	GND
26	+12VDC (+5VDC optional ⁴)

Digital I/O Connector

Notes:

1. Limits are optically isolated Solid-State switches that can control AC or DC voltage. Peak Blocking Voltage is 350V and the Maximum Continuous Current is 120mA.
2. Digital Inputs are opto-isolated with internal current limiting resistors. Voltage range is +4 to +22VDC on the “HI” input with respect to the “LO” input. Other voltage ranges are possible with added external resistors. Contact Electro Standards Laboratories for details. If isolation is not required these inputs may be operated using the +12VDC supplied on pin 26 and the GND on pin 24.
3. The keylock input will be in the “unlocked” state if left unconnected. Tie this pin to GND to “lock” it. When locked the setup of the Model 4215 Plus cannot be changed (you cannot enter Setup Mode).
4. The encoder inputs are intended for use with a +12VDC Quadrature Encoder. For single ended signaling use the CHA and CHB pins, the CHA-L⁴ and CHB-L⁴ pins are provided for differential signals. The Encoder can be supplied with the +12VDC and GND available on pins 26 and 24, respectively.
 - The Model 4215 Plus will also accept +5VDC Encoder Inputs, however these MUST be differential.
 - **Single ended +5VDC inputs are not supported on the standard unit. Options for +5VDC Encoders are available. Pin 26 will supply +5VDC for this option but must be ordered accordingly.**

Chart Rec. Connector

Notes:

1. The source and scaling of ANALOG – OUT is selected through the menus.
2. The HIGH BANDWIDTH – OUT² is a buffered analog output permanently connected to the Load Cell Channel.
3. If the 4-20mA Option is purchased.

DB9 Male	
Pin	Signal
2	ANALOG – OUT ¹
3	ANALOG – GND
4	HIGH BANDWIDTH – OUT ² CHANNEL A
5	4-20mA – OUT ³ CHANNEL A
6	2 nd ANALOG – OUT ¹ (Optional)
7	4-20mA – OUT ³ CHANNEL B
8	HIGH BANDWIDTH – OUT ² CHANNEL B
9	No Connect

USB Connector

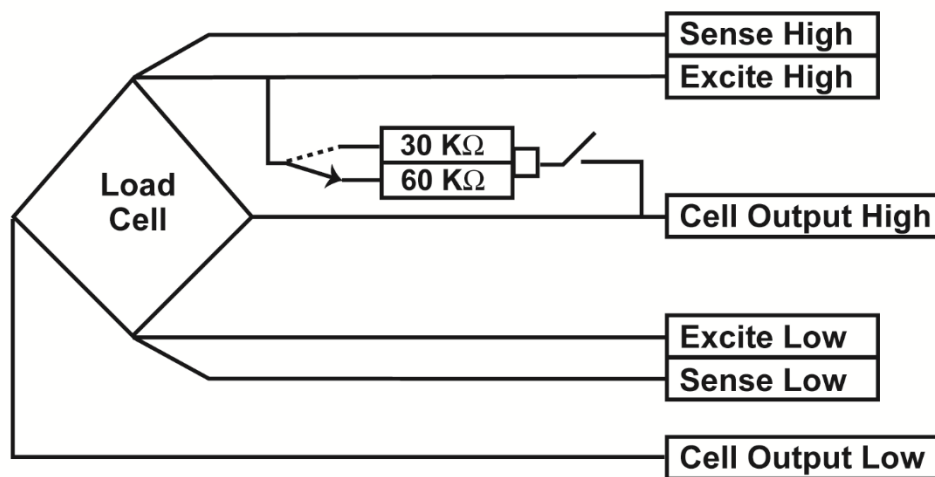
Pin	Name	Description
1	VCC	+5VDC
2	D-	Data –
3	D+	Data +
4	GND	Ground

Precision Shunt Calibration Resistors

This diagram shows the connection of the Precision Internal Shunt Resistors.

The back panel switch (shown to the left of the two resistors) selects between 30 K Ω and 60 K Ω .

The Shunt Check Relay (shown to the right of the two resistors) connects the selected resistor between the Excite High and the Cell Output High.



APPLICATION NOTE:

Make Your Own Plug-and-Play Load Cell System and Eliminate Costly User Errors

The Problem

It's a common problem. You're out on the road and you're carrying a variety of Load Cells that span different ranges that might be needed to calibrate a customer's system or perhaps you need to conduct a wide range of force measurements for a particular testing application. You need to change the Load Cell that is connected to your Instrument before you can continue. When the Load Cell is connected to the Instrument, the appropriate calibration factors need to be installed in the Instrument. Manual data entry, or requiring the operator to select from a database of stored calibrations parameters, introduces the possibility of user error. Loading the wrong parameters for a Load Cell, or even worse, corrupting the existing calibration data, can lead to erroneous results and costly recalibration expenses. It would be much more efficient if the Instrument could automatically identify the Load Cell that is being attached to it and self-install the proper calibration data.

The TEDS-Tag® Plug-and-Play Solution

The TEDS-Tag® Auto Identification System which retains the attractive feature of Self Identification found in the TEDS standard can be implemented simply on any Load Cell and, when connected to the Model 4215 Plus Smart Indicator or Model 4325 CellMite® Embedded Digital Signal Conditioner, becomes transparent to the user. Multi Load Cell-multi-Instrument matched pair calibrations are also supported. This can be a critical advantage in precision applications such as field calibration services.

With the TEDS-Tag® system, a small and inexpensive Electronic Identification Chip is placed in the cable that extends from the Load Cell or it can be mounted within the load cell housing. This chip contains a unique electronic serial number that can be read by the Model 4215 Plus or CellMite® to identify the Load Cell. The Load Cell is then connected to the unit and a standard calibration procedure is performed. The instrument automatically stores the calibration data inside the unit itself along with the unique Load Cell Identification Number from the microchip. Whenever that Load Cell is reconnected to the Instrument, it automatically recognizes the Load Cell and self-installs the appropriate calibration data. True plug-and-play operation is achieved. With this system, the calibration data can automatically include compensation for the particular Instrument so that high precision matched systems can be realized. Moreover, if the Load Cell is moved to another Instrument, that Instrument will recall the calibration data that it has stored internally for that Load Cell. The Instruments can store multiple Load Cell calibration entries. In this way, multiple Load Cells can form a matched calibration set with multiple Instruments.

How to Make the TEDS-Tag® Plug-and-Play Load Cell

Any Load Cell can be easily made into a TEDS-Tag® Load Cell. The Electronic Identification Chip is a Dallas Semiconductor, part number DS2401. It is readily available from distributors such as Digikey, or it can be provided by Morehouse Instrument Company. As shown in Figure 1, the chip is very small, making it easy to fit into a cable hood or load cell housing.

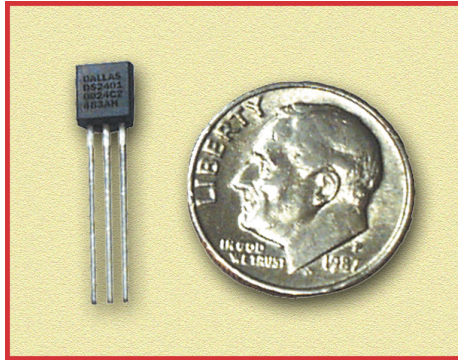


Figure 1: Electronic Identification Chip.

Both the Model 4215 Plus and CellMite® are connected to Load Cells via a DB9 connector with identical pinouts. The Electronic Identification Chip does not interfere with the Load Cell signals. Figure 2 shows the interconnection of the DS2401 tag identification chip with the DB9 sensor connector on the rear of the Instruments. Pin 3 of the DS2401 is not used and can be cut off if desired. Simply connecting pins 1 and 2 from the DS2401 to pins 8 and 7, respectively, of the DB9 connector will enable plug-and-play operation.

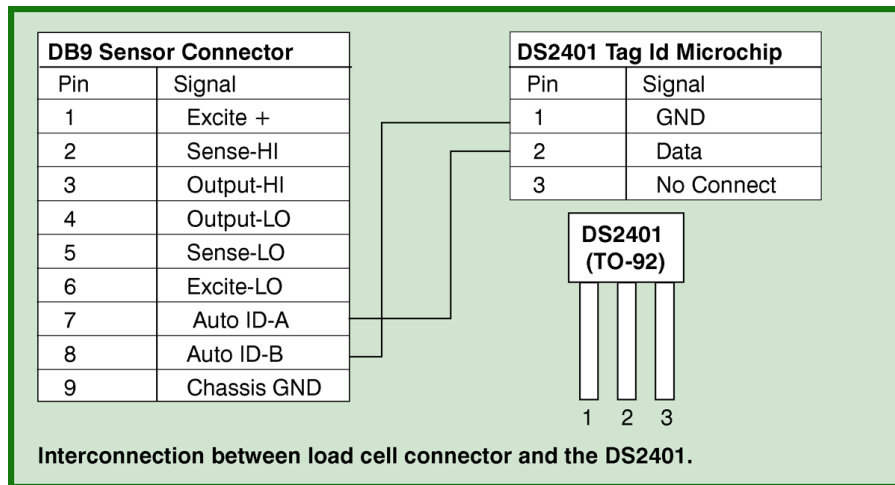


Figure 2: Interconnection between Load Cell connector and DS2401.

When using off the shelf Load Cells, it is often convenient to locate the DS2401 in the hood of the cable. Figure 3 shows a typical integration of the DS2401 with a commonly available S-Type Load Cell. The cable hood is pulled back, in order, to clearly view the DS2401. The Load Cell comes with a permanently mounted cable that protrudes from the load cell housing. At the end of the cable, the individual wires have their insulation stripped back and they are soldered into the DB9 connector per the pinout in Figure 2. The DS2401 is soldered across DB9 pins 7 and 8, and fits within the connector's hood. With a few parts and a simple cable termination procedure, you have taken a standard Load Cell and transformed it into a TEDS-Tag® plug-and-play Load Cell.

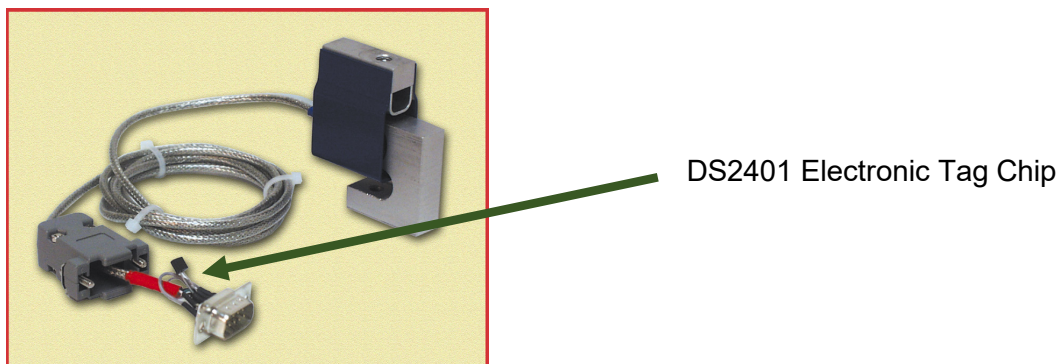


Figure 3: Standard S-Type Load Cell shown with an Electronic Tag Chip mounted in the hood of the cable.

For applications in which access to the Load Cell and access to the Load Cell cable is restricted, an In-Line Tag Identification Module can be simply constructed. Figure 4 shows how a straight through In-Line Cable Adaptor can incorporate the DS2401 Electronic Tag Chip. The protective hood has been removed for clarity. In this application, the cable adaptor is physically placed in series with the Load Cell cable before it is plugged into the Instrument. It is also possible to use this technique in applications, where different calibrations might be required on the same Load Cell. The user may have a single Load Cell and Instrument, however can change which Calibration is Auto selected by simply changing the In-Line Cable Adaptor. Since each cable adaptor has a different Tag Identification Chip, the Instrument will associate a different calibration data set with each In-Line Adaptor. The In-Line Adaptor might be useful, for example, if a precision 6-point linearization of the Load Cell is required in two different operating ranges of the same Load Cells.

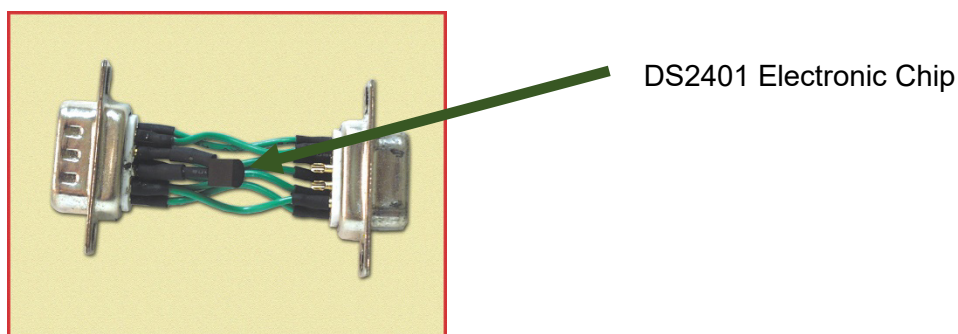


Figure 4: In-Line Cable Adapter (hood not shown) that incorporates a Tag Identification Chip.

Plug-and-Play Operation

Now that the Load Cell has been converted to a TEDS-Tag® Load Cell, it can be connected to the Model 4215 Plus or CellMite®. The very first time it is connected, a standard calibration procedure is performed to initialize the cell's calibration data in the Instrument. The Instruments support a variety of industry standard calibrations including milli-volt per Volt (mV/V), Shunt, and 2-point or multi-point calibrations. The Instrument then automatically detects the presence of the TEDS-Tag® Load Cell and matches it with its calibration data. From this point forward, the system is completely plug-and-play. Typical startup is now:

1. Plug Load Cell into the Instrument.
2. Turn on the power.

After they've been initially calibrated on the Instrument, changing Cells is done by simply plugging the new Cell into the Instrument and turning on the power.

Figure 5 shows the front panel of a dual channel Model 4215 Plus Intelligent Indicator that has two TEDS-Tag® Load Cells attached to it. The Load Cells on both channels are independently and automatically identified and the appropriate calibration data is self-installed on each channel. The numerical data shown with the Auto ID label is a Cell Serial Number that was inputted by the user during the initial calibration process.



Figure 5: Model 4215 Plus Smart Indicator.