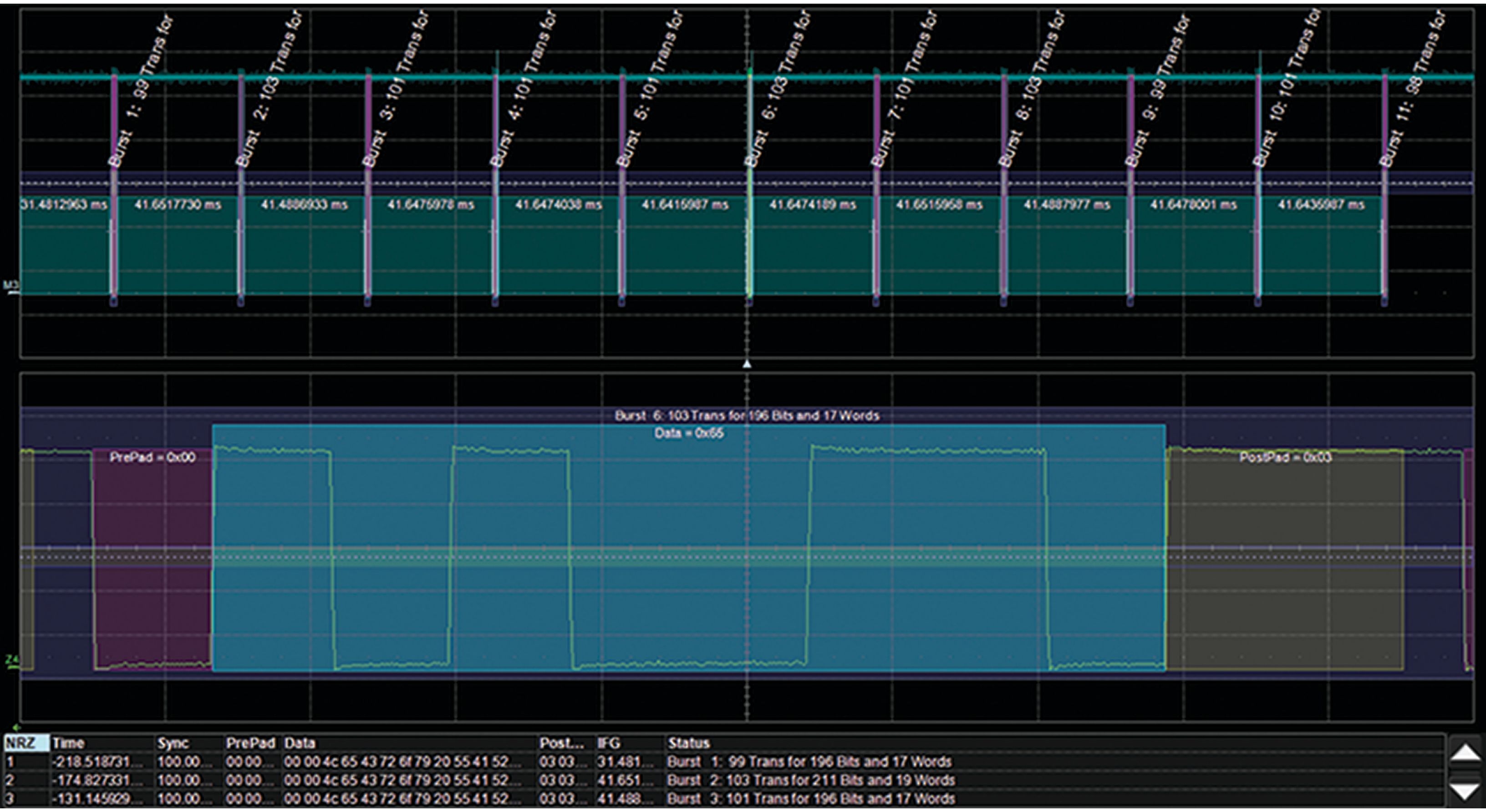
TELEDYNE LECROY
Everywhereyoulook™



Instruction Manual

Manchester and NRZ

Decoder Software

Manchester and NRZ Decoder Software Instruction Manual

922292 Rev B
April 2016

Contents

About This Manual

Teledyne LeCroy offers a wide array of toolsets for decoding and debugging serial data streams. These toolsets may be purchased as optional software packages, or are provided standard with some oscilloscopes.

This manual explains the basic procedures for using serial data decoder software options.

This manual is presented with the assumption that:

- You have purchased and installed one of the serial data products described in this manual.
- You have a basic understanding of the serial data standard physical and protocol layer specifications, and know how these standards are used in embedded controllers.
- You have a basic understanding of how to use an oscilloscope, and specifically the Teledyne LeCroy oscilloscope on which the option is installed. Only features directly related to serial data decoding are explained in this manual.

Teledyne LeCroy is constantly expanding coverage of serial data standards and updating software. Some capabilities described in this documentation may only be available with the latest version of our firmware. You can download the free firmware update from:

teledynelecroy.com/support/softwaredownload

While some of the images in this manual may not exactly match what is on your oscilloscope display—or may show an example taken from another standard—be assured that the functionality is identical, as much functionality is shared. Product-specific exceptions will be noted in the text.

Manchesterbus and NRZbus Options

The Manchesterbus D and NRZbus D configurable decoders developed by Teledyne LeCroy are tools aimed at decoding serial data that is not supported by mainstream decoders. Its goal is to decode fairly simple serial data not belonging to the historical protocols such as I2C, UART and SPI, or the dedicated protocols such as CAN, LIN, MIL-1553, ARINC-429, MIPI, Ethernet, etc.

Because they are aimed at general encoding schemes, rather than specific protocols, configuring the decoder to make it possible for the general algorithms to execute on a particular signal requires a little more knowledge of serial data encoding logic than with previous decoders. Once the settings have been determined for a given signal, they can be stored in internal panel files and recalled later, when analysis on the same signal is required.

Although separate products, in its current form the configurable decoder operates the same for Manchester or NRZ streams, and they will be treated as one in this manual.

There are some limitations to be observed:

- The product **will** handle digitally encoded data on a single signal, with 2 levels (High and Low), a constant Bitrate between 10 bit/sec to 10 Gb/sec at any voltage levels, and a timeout(or Inter Frame Gap) allowing the stream to be decoded into separate bursts of data on the line.
- The product **will not** handle multi-line signals, signals with more than 2 voltage levels, stuff bits and/or complex synchronization pulses.
- While flexible, the product is not suitable for complex protocol streams (e.g., i.e. CAN, MIL-STD-1553, FlexRay, MIPI) or 2- or 3-signal transmissions (e.g., I2C or SPI). Dedicated decoders are available for these protocols.

Serial Decode

The algorithms described here at a high level are used by all Teledyne LeCroy serial decoders sold for oscilloscopes. They differ slightly between serial data signals that have a clock embedded in data and those with separate clock and data signals.

Bit-level Decoding

The first software algorithm examines the embedded clock for each message based on a default or user- specified vertical threshold level. Once the clock signal is extracted or known, the algorithm examines the corresponding data signal at the predetermined vertical level to determine whether a data bit is high or low. The default vertical level is set to 50% and is determined from a measurement of peak amplitude of the signals acquired by the oscilloscope. For most decoders, it can also be set to an absolute voltage level, if desired. The algorithm intelligently applies a hysteresis to the rising and falling edge of the serial data signal to minimize the chance of perturbations or ringing on the edge affecting the data bit decoding.

Note: Although the decoding algorithm is based on a clock extraction software algorithm using a vertical level, the results returned are the same as those from a traditional protocol analyzer using sampling point-based decode.

Logical Decoding

After determining individual data bit values, another algorithm performs a decoding of the serial data message after separation of the underlying data bits into logical groups specific to the protocol (Header/ID, Address Labels, Data Length Codes, Data, CRC, Parity Bits, Start Bits, Stop Bits, Delimiters, Idle Segments, etc.).

Message Decoding

Finally, another algorithm applies a color overlay with annotations to the decoded waveform to mark the transitions in the signal. Decoded message data is displayed in tabular form below the grid. Various compaction schemes are utilized to show the data during a long acquisition (many hundreds or thousands of serial data messages) or a short acquisition (one serial data message acquisition). In the case of the longest acquisition, only the most important information is highlighted, whereas in the case of the shortest acquisition, all information is displayed with additional highlighting of the complete message frame.

User Interaction

Your interaction with the software in many ways mirrors the order of the algorithms. You will:

- Assign a protocol/encoding scheme, an input source, and a clock source (if necessary) to one of the four decoder panels using the Serial Data and Decode Setup dialogs.
- Complete the remaining dialogs required by the protocol/encoding scheme.
- Work with the decoded waveform, result table, and measurements to analyze the decoding.

Decoding Workflow

We recommend the following workflow for effective decoding:

1. Connect your data and strobe/clock lines (if used) to the oscilloscope.
2. Set up the decoder using the lowest level decoding mode available (e.g., Bits).
3. Acquire a sufficient burst of relevant data. The data burst should be reasonably well centered on screen, in both directions, with generous idle segments on both sides.

   Note: See Failure to Decode for more information about the required acquisition settings. A burst might contain at most 100000 transitions, or 32000 bits/1000 words, whichever occurs first. This is more a safety limit for software engineering reasons than a limit based on any protocol. We recommend starting with much smaller bursts.

4. Stop the acquisition, then run the decoder.
5. Use the various decoder tools to verify that transitions are being correctly decoded. Tune the decoder settings as needed.
6. Once you know you are correctly decoding transitions in one mode, continue making small acquisitions of five to eight bursts and running the decoder in higher level modes (e.g., Words). The decoder settings you verify on a few bursts will be reused when handling many packets.
7. Run the decoder on acquisitions of the desired length.

When you are satisfied the decoder is working properly, you can disable/enable the decoder as desired without having to repeat this set up and tuning process, provided the basic signal characteristics do not change.

Decoder Setup

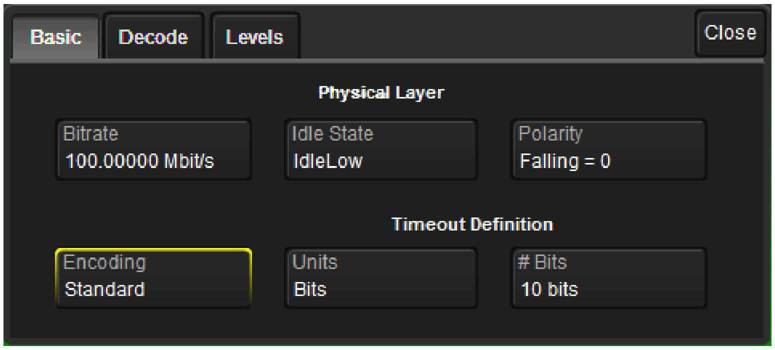
Use the Decode Setup dialog and its protocol-related subdialogs to preset decoders for future use. Each decoder can use different (or the same) protocols and data sources, or have other variations, giving you maximum flexibility to compare different signals or view the same signal from multiple perspectives.

Tip: After completing setup for one decoder, you can quickly start setup for the other decoders by using the buttons at the left of the Decode Setup dialog to change the Decode # .

1. Touch the **Front Panel Serial Decode button** (if available on your oscilloscope), or choose **Analysis > Serial Decode** from the oscilloscope menu bar. Open the **Decode Setup** dialog.
2. Select the **data source (Src 1)** to be decoded and the **Protocol** to decode.
3. If required by the protocol, also select the **Strobe** or **Clock** source. (These controls will simply not appear if not relevant.)
4. Define the bit- and protocol-level decoding on the subdialogs next to the Decode Setup dialog.

Basic Dialog

The Basic dialog presents the fundamental settings required for proper bit-level decoding. Configure all Basic dialog settings.



Enter the **Bit Rate**of the bus to which you are connected as precisely as you know it (hardware engineers working on a design often know the Bit Rate). If you are not sure about the value, use the cursor read outs on one single bit or a sequence of bits to determine the exact Bit Rate of your signal. The value should be correct within 5%. A mismatched Bit Rate will cause various confusing side effects on the decoding, so it is best to take time to correctly adjust this fundamental value. Bit Rates can be selected from 10 bits/s to 10 Gb/s. Bit Rate selection is dynamically linked to the decoding bit rate; they are always the same value.

In **Idle State**, select the signal level (High or Low) at which there is no data transfer. The Idle State complements the Timeout value. In order to declare that a new Burst has to be started, the algorithm looks at the time elapsed between 2 consecutive Transitions, as well as the state of the idle level between these transitions. This mechanism allows a precise definition of what the separation gap between 2 Bursts should be. In most cases, the idle state is specified, and therefore provides a supplementary condition to the timeout to define the Burst start. If this distinction is not desired, select “X” in the pop-up box.

Manchester users: choose the **Encoding** method in use: Standard, Diff Biphase Mark, or Diff Biphase Space. When one of the Biphase encoding methods is selected, polarity is disregarded by the decoding algorithm.

The **Polarity** governs the conversion of the physical bit state into a logical bit state. In Manchester, It is only used for Standard encoding.

NRZ Polarity:

- Low=0, a signal below threshold will translate as a logical 0, whereas as a signal above threshold will translate as a logical 1.
- Low=1, the opposite logic applies.

Manchester Polarity:

- Falling=0, a Falling Edge through the Level will translate as a logical 0, whereas a Rising Edge through the threshold level will translate as a logical 1.
- Falling=1, the opposite logic applies.

Use Timeout - Selected by default, this control activates the Timeout Definition fields. When Use Timeout is deselected, the stream will no longer be packetized, which can be useful on high speed protocols that have continuous bit streaming.

Tip: When Timeout is disabled, All decoded data appears on one row of the result table. You can search the Idle for the Idle Symbol pattern or the Data for the Sync Bits pattern to quickly identify the start of new bursts.

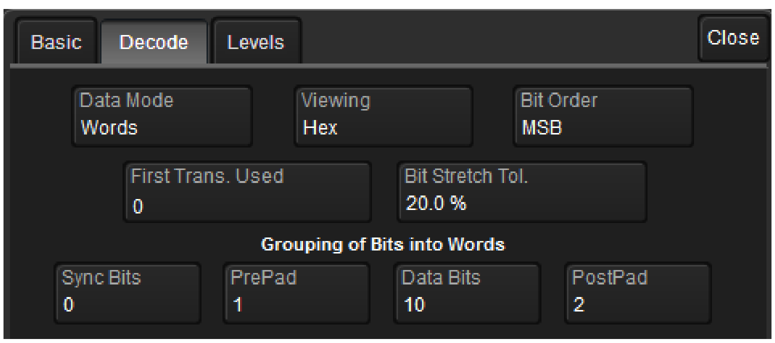
(Timeout) Units - The Timeout, or Gap, separating bursts can be specified either in Bits or Seconds. Both methods are perfectly equivalent in terms of their results, but you may vary them depending on the context, the protocol specifications or your preference. Note that regardless of the Timeout Units selected, the allowed Timeout range will be from 1 bit to 100 bits.

(Timeout) Time - This field appears when a Timeout Unit of Seconds is selected. Enter the number of seconds here.

(Timeout) # Bits- When a Timeout Unit of Bits is selected, the system will use the Bit Rate to determine the Bit Length, and multiply it by the # Bits entered here to obtain a Timeout in seconds.

Decode Dialog

These settings refine the Basic dialog bit-level decoding so that some transitions are skipped, and subsequent bits are grouped into words that can be interpreted lsb first or msb first.



The **Data Mode** selection drives the level of decoding. The default is **Bits**, and we recommend that you use this setting initially as you continue to tune the bit-level decoding. It can also be set to **Words**.

Decoding into Bits

After selecting Data Mode Bits, configure:

First Trans. Used (FTO)- Manchester and NRZ schemes may utilize a preamble, a synchronization sequence, or a voluntary violation. The FTO begins decoding after this period/event, when the real Data payload starts, avoiding the intricacies of dedicated protocols in the initial segment of the packet. The setting specifies on which transition the bit-slicing algorithm should start and can range from 0 to 400 in steps of 1. In many cases this value is likely to b set to 0. However, there are cases when the value needs to be non-zero:

- When the initial transitions carry no information at all and must be skipped;
- When the first transitions are at another rate then the main bitrate of the signal;
- For performance reasons. When decoding long Bursts, it is possible that the initial segment of the Burst does not carry pertinent information and its processing could be skipped, making the decode faster.

Bit Stretch Tol(erance) - The Manchester bit-slicer hops from midbit to midbit. However, due to hardware or signal propagation issues, the midbits might not be perfectly equidistant. In this case, Bit Stretch Tolerance can be manually increased to attempt to decode jittery signals. Conversely, it can be decreased until the decoding starts showing anomalies (e.g., 2 or 3 instead of 1 or 0 in the Data) to assess the stability of the midbit distribution. Continue to tune Bit Rate and Bit Stretch Tol until Bit Stretch Tol is less than 5 % without changing the output of the decoder observed in the table..

Decoding into Words

Select the Data Mode Words. In this mode, all of the fields on the Decode dialog are activated. These settings apply to both Manchester and NRZ Decoders.

Under **Viewing**, choose to view/enter data, in **Binary**, **Hexadecimal (Hex)**, or **ASCII** format.

Choose a **Bit Order**of **Most Significant Bit (MSB)** first or the **Least Significant Bit (LSB)** bit first.

Enter in **Sync Bits** at which bit the packetizing should start. The algorithm will start at “Sync Bits” and group bits into the three fields “PrePad”, “Data Bits” and “PostPad”. Then it will restart with the “PrePad” of the next sequence. There can be 0 to 100 Sync Bits.

Enter the number of **PrePad** bits used to group information preceding the data. There might be 0 to 32 PrePad Bits. PrePad bits might be used to group Address bits, Preambles, Subaddress, etc.

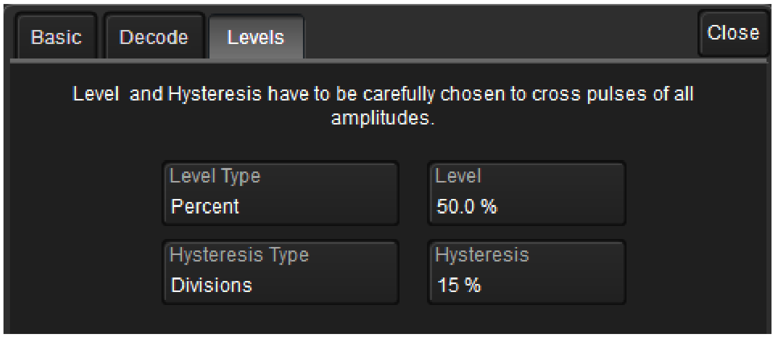
In **Nx Factor**, enter the number of words with the defined number of Data Bits that occur within the data field. The default value of 1 means there is only a single word comprised of the number of Data Bits. When the value is 1, the grouping of bits into words occurs as a repeated sequence of <Prepad|Word|PostPad> blocks. When the value is greater than 1, for example 3, the grouping of bits will occur as a repeated sequence of <Prepad|Word|Word|Word|PostPad> blocks. Note that regardless of how many words are represented in the packet, the decoding still occurs on one line of the result table.

Enter the number of **Data Bits** that form a single word. Data Bits can take values from 1 to 32 in steps of 1. This value is essential when using the Measure capability, because it allows the correct extraction of the bit field for the MessageToValue parameter.

Enter the **PostPad** used to group information following the data. There can be 0 to 32 PostPad Bits. Post Pad bit might be used to represent a CRC, a checksum, a Value or any other protocol construct.

Levels Dialog

Set the level at which signal transitions occur and apply hysteresis to help tune noisy signals.



Enter the vertical **Level** used to determine the edge crossings of the signal. This value will be used to determine the bit-level decoding. Level is normally set as a percentage of amplitude, and defaults to 50%. When working in percent, all values are proportional to the 100% signal amplitude. Level can alternatively be set as an absolute voltage by changing the **Level Type** to absolute. The set Level appears as a dotted horizontal line across the oscilloscope grid. If your initial decoding indicates that there are a number of error frames, make sure that the Level is set to a reasonable value.

Note: Percent mode is easy to set up because the software immediately determines the optimal threshold. However, on poor signals Percent mode can fail and lead to bad decodes; then it might help to use Absolute mode. On very long signals, Percent mode adds computational load. If performance is an issue, it might be beneficial to switch to Absolute mode.

In **Hysteresis**, enter the "margin of error": the amount signal may rise or fall without affecting bit transition. Hysteresis is fairly subtle as it should not dominate the rendering of the decoded information. Like Level, it can be entered as either a percentage of amplitude or absolute number of vertical grid divisions by changing the **Hysteresis Type**.

Note: You may give the Level in one mode (e.g., Absolute) and Hysteresis is in the other mode (e.g., Percent).

Verifying Bit-Level Decode

When all Level or Basic dialog values are set (depending on protocol), you should already see a bit-level decoding of the selected source trace. The Data Mode is set to bits by default, so that the remaining protocol-specific settings do not matter for the initial bit-level decode.

In a correct bit-level decoding, bit transitions are all aligned with signal transitions, and the logical interpretation of the bits is consistent with the physical level.

Review your decoded waveform for instances of incorrect bit-level decoding, particularly:

- Decoding at an exact multiple of the Bit Rate that would not allow further interpretation of the words
- Bits not aligned with the transitions
- Bit stream with gaps between the bits

Failure to Decode

Three conditions in particular may cause a decoder to fail, in which case a failure message will appear in the first row the the summary result table, instead of in the message bar as usual:

- **Under sampled**. If the sampling rate (SR) is insufficient to resolve the signal adequately based on the bit rate (BR) setup or clock frequency, the message "Under Sampled" will appear. The minimum SR:BR ratio required is 4:1. It is suggested that you use a slightly higher SR:BR ratio if possible, and use significantly higher SR:BR ratios if you want to also view perturbations or other anomalies on your serial data analog signal.
- **Too short acquisition**. If the acquisition window is to short to allow any meaningfull decoding, the message “Too Short Acquisition” will appear. The minimum number of bits required varies from one protocol to another, but is usually between 5 and 50.
- **Too small amplitude**. If the signal’s amplitude is too small with respect to the full ADC range, the message “Decrease V/Div” will appear. The required amplitude to allow decoding is usually one vertical division.

In each case, the decoding is turned off to protect you from incorrect data. Adjust your acquisition settings accordingly, then re-enable the decoder.

Note: It is possible that several conditions are present, but you will only see the first relevant message in the table. If you continue to experience failures, try adjusting the other settings.

Serial Decode Dialog

To first set up a decoder, go to the Decode Setup dialog. Once decoders have been configured, use the Serial Decode dialog to quickly turn on/off a decoder or make minor modifications to the settings.

To turn on decoders:

1. Touch the **Front Panel Serial Decode button** (if available on your oscilloscope), or choose **Analysis > Serial Decode** from the oscilloscope menu bar to access the Serial Decode dialog.
2. On the same row as the **Decode #**, check **On** to enable the decoder.

   As long as On is checked (and there is a valid acquisition), a result table and decoded waveform appear. The number of rows of data displayed will depend on the **Table#Rows** setting (on the Decode Setup dialog).
3. Optionally, modify the:
   - **Protocol** associated with the decoder.
   - **Data (Source)** to be decoded.

To turn off decoders: deselect the On boxes individually, or touch **Turn All Off**.

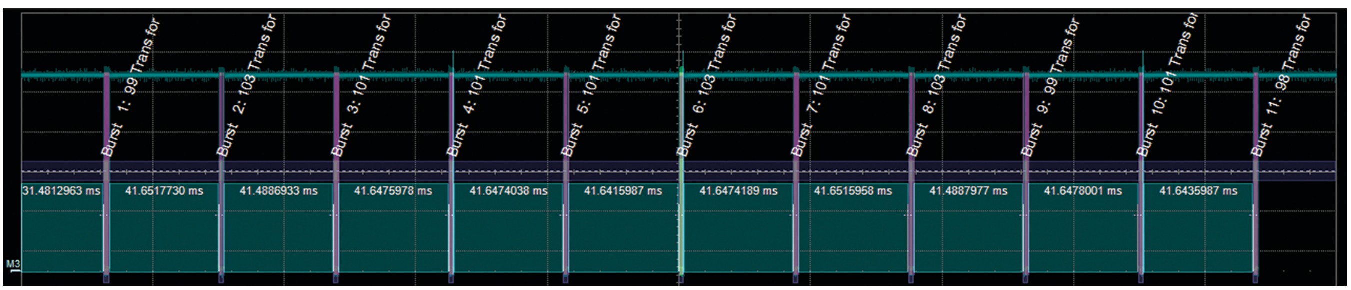
Reading Waveform Annotations

When a decoder is enabled, an annotated waveform appears on the oscilloscope display, allowing you to quickly read the results of the decoding. A colored overlay marks significant bit-sequences in the source signal. The overlay contains annotations corresponding to the Header/ID, Address, Labels, Data Length Codes, Data, CRC, Parity Bits, Start Bits, Stop Bits, Delimiters, Idle segments, etc. Annotations are customized to the protocol or encoding scheme.

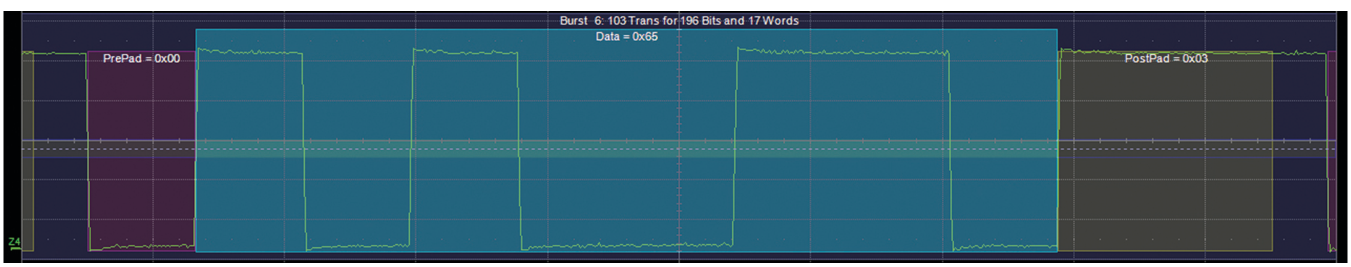
The amount of information shown on an annotation is affected by the width of the rectangles in the overlay, which is determined by the magnification (scale) of the trace and the length of the acquisition. Zooming a portion of the decoder trace will reveal the detailed annotations.

These overlays appear on a decoded waveform or its Zoom trace to highlight key elements of the decoded signal (some annotations not shown).

Annotation	Overlay Color
Burst	Navy blue (behind other fields), indicating portion of signal decoded
PrePad	Purple to left of Data
Data (payload)	Aqua Blue
PostPad	Grey to right of Data field
IdleTime	Green between Bursts
SyncTime	Grey to left of Burst, showing timeout



Decoded waveform. At this resolution, little information appears on the overlay.



Zoomed NRZ waveform showing annotation details.

Serial Decode Result Table

By default, a table summarizing the decoder results appears below the grids whenever a decoder is enabled. The result table provides a view of data as decoded during the most recent acquisition, even when the number of bursts are too many to allow legible annotation on the waveform trace.

The table is displayed only when the **View Decode** checkbox is marked on the Decode Setup Dialog *and* a source signal has been decoded using that protocol.

You can export result table data to a .CSV file.

Table Rows

Each row of the table represents one index of data found within the acquisition. Exactly what this represents depends on the protocol and how you have chosen to "packetize" the data stream when configuring the decoder (frame, message, packet, etc.).

Note: For some decoders, it is even possible to turn off packetization, in which case all the decoded data appears on one row of the table.

See Using the Result Table for more information about how to interact with the table rows to view the decoding. Swipe the table up/down or use the scrollbar at the far right to navigate the table.

When multiple decoders are run at once, the index rows are combined in a summary table, ordered according to their acquisition time. The Protocol column is colorized to show which input source resulted in that index.

You can change the number of rows displayed on the table at one time. The default is five rows.

Table Columns

When a single decoder is enabled, the result table shows the protocol-specific details of the decoding. This **detailed result table** may be customized to show only those columns you want displayed.

Enabling two or more decoders switches the display to a combined table. A top-level **summary result table** (which cannot be changed) shows these columns of data for every decoding:

Column	Extracted or Computed Data
Index	Number of the line in the table
Time	Time elapsed from start of acquisition to start of message
Protocol	Protocol being decoded
Message	Message identifier bits
Data	Data payload
CRC	Cyclic Redundancy Check sequence bits
Status	Any decoder messages; content may vary by protocol

When you select the Index number from the summary result table, the detailed results for that index drops-in below it.

This extracted data appears on the detailed result table. Columns can be hidden by customizing the result table.

Column	Extracted or Computed Data
Index (always shown)	Number of the line in the table
Time	Time elapsed from start of acquisition (trigger time) to start of Burst
Timeout	
PrePad	Pre-pad bits in burst (Displayed only when decoding Words, not Bits. If value is zero, column will not appear.)
Data	Data payload bits
PostPad	Post-pad bits in burst (Displayed only when decoding Words, not Bits. If value is zero, column will not appear.)
Idle	Inter-Frame Gap bits
Status	Information about the burst of transitions decoded
Attributes	

NRZ	Time	Sync	PrePad	Data	Post...	IFG	Status
1	-218.518731...	100.00...	00 00...	00 00 4c 65 43 72 6f 79 20 55 41 52...	03 03...	31.481...	Burst 1: 99 Trans for 196 Bits and 17 Words
2	-174.827331...	100.00...	00 00...	00 00 4c 65 43 72 6f 79 20 55 41 52...	03 03...	41.651...	Burst 2: 103 Trans for 211 Bits and 19 Words
3	-131.145929...	100.00...	00 00...	00 00 4c 65 43 72 6f 79 20 55 41 52...	03 03...	41.488...	Burst 3: 101 Trans for 196 Bits and 17 Words

Section of typical NRZ detailed result table.

Using the Result Table

Besides displaying the decoded serial data, the result table helps you to inspect the acquisition.

Zoom & Search

Touching any cell of the table opens a zoom centered around the part of the waveform corresponding to the index. The Z*x* dialog opens to allow you to rescale the zoom, or to Search the acquisition. This is a quick way to navigate to events of interest in the acquisition.

Tip: When in combined table mode, touch any data cell *other than* Index and Protocol to zoom.

The table rows corresponding to the zoomed area are highlighted, as is the zoomed area of the source waveform; the highlight color reflects the zoom that it relates to (Z1 yellow, Z2 pink, etc.). As you adjust the scale of the zoom, the highlighted area may expand to several rows of the table, or fade to indicate that only a part of that Index is shown in the zoom.

When there are multiple decoders running, each can have its own zoom of the decoding highlighted on the combined table at the same time.

Note: The zoom number is no longer tied to the decoder number. The software tries to match the numbers, but if it cannot it uses the next empty zoom slot.

View Details

When viewing a combined table, touch the **Index number** in the first column to drop-in the detailed decoding of that record. Touch the Index cell again to hide the details.

If there is more data than can be displayed in a cell, the cell is marked with a white triangle in the lower-right corner. Touch this to open a pop-up showing the full decoding.

Navigate

In single table mode, touch the **Index column header** (top, left-most cell of the table) to open the Decode Setup dialog. This is especially helpful for adjusting the decoder during initial tuning.

When in combined table mode, the Index column header cell opens the Serial Decode dialog, where you can enable/disable all the decoders. Touch the **Protocol** cell to open the Decode Setup dialog for the decoder that produced that index of data.

Customizing the Result Table

Follow these steps to change what data appears on the detailed result table:

1. Press the Front Panel **Serial Decode button** or choose **Analysis > Serial Decode**, then open the **Decode Setup tab**.

2. Touch the **Configure Table** button.

3. On the **View Columns** pop-up dialog, mark the columns you want to appear and clear those you wish to remove. Only those columns selected will appear on the oscilloscope display.

   Note: If a selected column is not relevant to the decoding selections, the column will not appear in the table.

   To return to the preset display, touch **Default**.

4. Touch the **Close** button when finished.

On some decoders, you may also use the View Columns pop-up to set a **Bit Rate Tolerance** percentage. When implemented, the tolerance is used to flag out-of-tolerance messages (messages outside the user-defined bitrate +- tolerance) by colorizing in red the Bitrate shown in the table.

You may customize the size of the result table by changing the **Table # Rows** setting on the Decode Setup dialog. Keep in mind that the deeper the table, the more compressed the waveform display on the grid, especially if there are also measurements turned on.

Exporting Result Table Data

You can manually export the detailed result table data to a .CSV file:

1. Press the Front Panel **Serial Decode button**, or choose **Analysis > Serial Decode**, then open the **Decode Setup tab**.

2. Optionally, touch **Browse** and enter a new **File Name** and output folder.

3. Touch the **Export Table** button.

Export files are by default created in the D:\Applications\<protocol> folder, although you can choose any other folder on the oscilloscope or any external drive connected to a host USB port. The data will overwrite the last export file saved in the protocol directory, unless you enter a new filename.

Note: When a combined table is exported, a combined file is saved in D:\Applications\Serial Decode. Separate files for each decoder are saved in D:\Applications\<protocol>.

In addition, the oscilloscope Save Table feature will automatically create tabular data files with each acquisition trigger. The file names are automatically incremented so that data is not lost. Choose **File > Save Table** from the oscilloscope menu bar and select **Decodex** as the source. Make other file format and storage selections as you wish.

Searching Decoded Waveforms

Touching the Action toolbar **Search button** button on the Decode Setup dialog creates a 10:1 zoom of the center of the decoder source trace and opens the Search subdialog.

Touching the **any cell** of the result table similarly creates a zoom and opens Search, but of only that part of the waveform corresponding to the index (plus any padding).

Tip: In combined table mode, touch any cell *other than* Index and Protocol to create the zoom.

Basic Search

On the Search subdialog, select what type of data element to **Search for**. These basic criteria vary by protocol, but generally correspond to the columns of data displayed on the detailed decoder result table.

Optionally:

- Check **Use Value** and enter the **Value** to find in that column. If you do not enter a Value, Search goes to the beginning of the next data element of that type found in the acquisition.
- Enter a **Left/Right Pad**, the percentage of horizontal division around matching data to display on the zoom.
- Check **Show Frame** to mark on the overlay the frame in which the event was found.

After entering the Search criteria, use the **Prev** and **Next** buttons to navigate to the matching data in the table, simultaneously shifting the zoom to the portion of the waveform that corresponds to the match.

The touch screen message bar shows details about the table row and column where the matching data was found.

Advanced Search

Advanced Search allows you to create complex criteria by using Boolean AND/OR logic to combine up-to-three different searches. On the Advanced dialog, choose the **Col(umns) to Search 1 - 3** and the **Value** to find just as you would a basic search, then choose the **Operator(s)** that represent the relationship between them.

Service Centers

Our regional service centers are:

World Wide Corporate Office
Teledyne LeCroy
700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977, USA
teledynelecroy.com
Sales and Service:
Ph: 800-553-2769 / 845-425-2000
FAX: 845-578-5985
contact.corp@teledynelecroy.com
Support:
Ph: 800-553-2769
support@teledynelecroy.com

US Protocol Solutions Group
Teledyne LeCroy
3385 Scott Boulevard
Santa Clara, CA, 95054, USA
teledynelecroy.com
Sales and Service:
Ph: 800-909-7211 / 408-727-6600
FAX: 408-727-0800
protocolsales@teledynelecroy.com
Support:
Ph: 800-909-7112 / 408-653-1260
psgsupport@teledynelecroy.com

European Headquarters
Teledyne LeCroy SA
4, Rue Moïse Marcinhes
Case postale 341
1217 Meyrin 1
Geneva, Switzerland
teledynelecroy.com/europe
Ph: + 41 22 719 2111
FAX: + 41 22 719 2230
contact.sa@teledynelecroy.com

China
LeCroy Corporation Beijing
Rm. 2001, Unit A, Horizon Plaza
No. 6, Zhichun Road, Haidian Dist.
Beijing 100088, China
www.lecroy.com.cn
Sales:
Ph: 86-10-82800318/0319/0320
FAX:86-10-82800316
Marketing.China@teledynelecroy.com
Service:
Rm. 2002
Ph: 86-10-82800245
Service.China@teledynelecroy.com

Korea
Teledyne LeCroy Korea
10th fl. 333 Yeongdong-daero
Gangnam-gu
Seoul 135-280, Korea
teledynelecroy.com/korea
Ph: ++ 82 2 3452 0400
FAX: ++ 82 2 3452 0490

Japan
Teledyne LeCroy Japan
3F, Houbunshafuchu Bldg.
3-11-5, Midori-cho, Fuchu-Shi
Tokyo 183-0006, Japan
teledynelecroy.com/japan
Ph: + 81-42-402-9400
FAX: + 81-42-402-9586

For a complete list of offices by country, including our sales & distribution partners, visit teledynelecroy.com/support/contact.

TELEDYNE LECROY
Everywhereyoulook™

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

teledynelecroy.com