EBERLE DESIGN INC.

2018KCLip SIGNAL MONITOR
- OVERVIEW -

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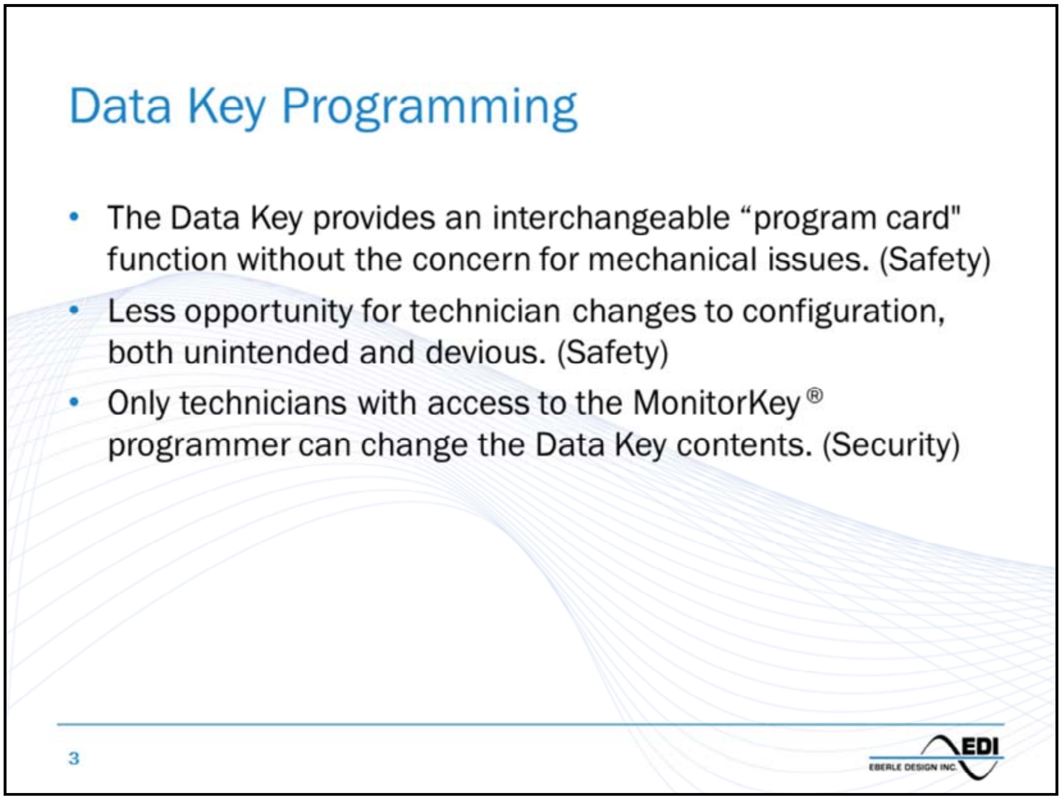
2018KCL Main Features

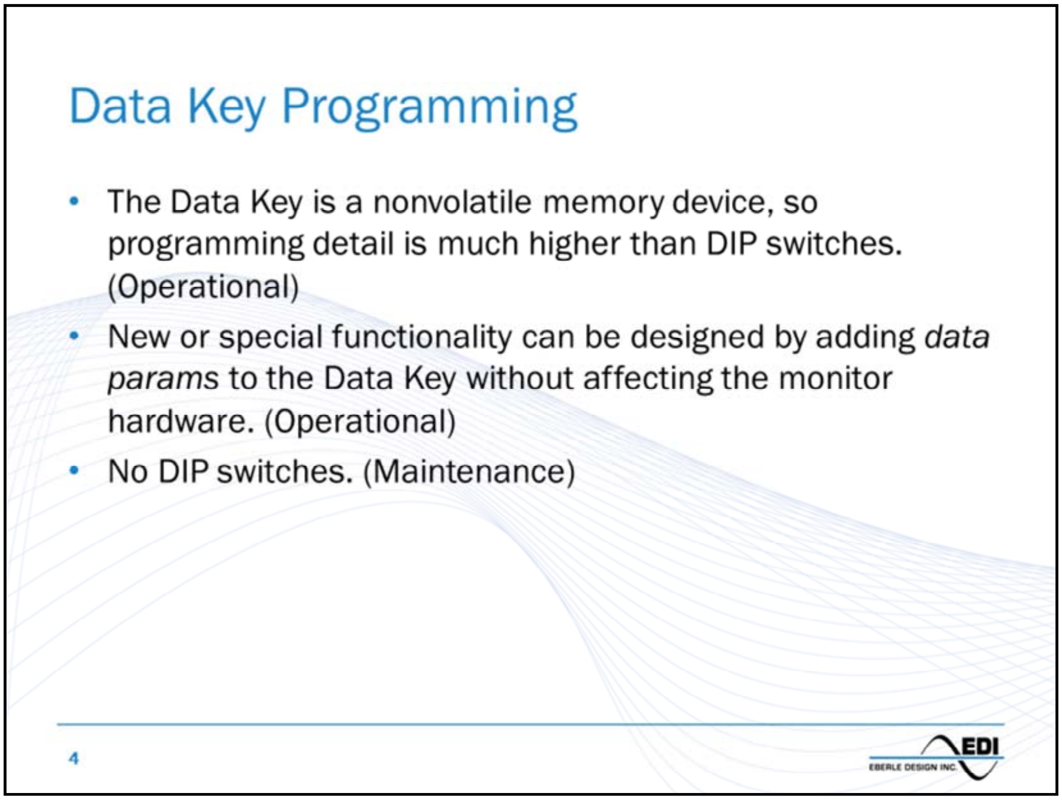
- An industry standard Data Key totally eliminates the Diode Card, Jumpers, and DIP switches.
- Full Intersection Display
- Full Event Logging Capability
- EDI MonitorKey® programming software provides a Set-up Wizard
- Ethernet Port option (2018KCLip)
- 18 channel capacity



Any failure of the diode, open-circuit damage to the copper traces of the diode board or an open-circuit condition in the connector system to read the diode card can result in the change in permissive programming of the channel pair. **This unintended change makes a programmed conflicting pair into a permissive pair**. Thus a real conflict can go undetected by the monitor.

I believe that the need to actually see the diode programming of a card to help diagnose a cabinet malfunction is overstated. No other piece of equipment in the cabinet has this same consideration. Proper cabinet documentation can provide the permissive programming as well as the rest of the monitor programming. A printed configuration report is available from the MonitorKey Programmer software as well as the ECcom Signal Monitor Communications software.

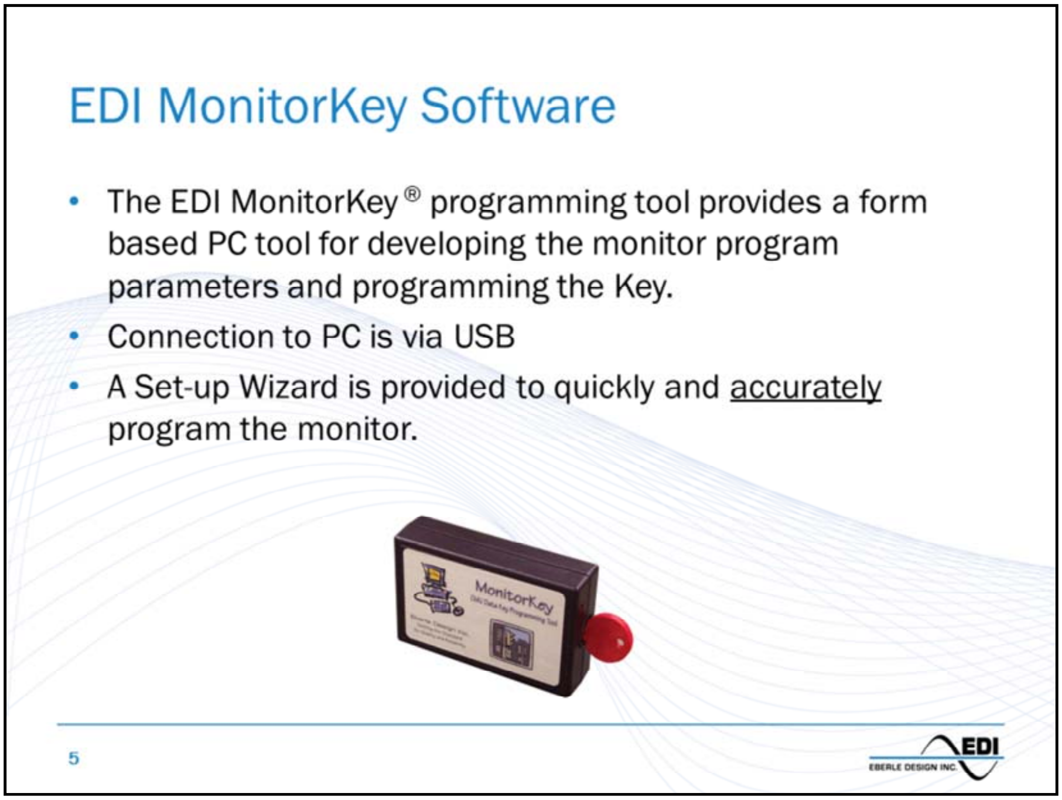
Monitors have historically used DIP switches to provide programming beyond the diode card for enhanced functions. There are never enough DIP switches to accurately program a monitor, especially as new programming challenges are faced such as Flashing Yellow Arrows, Ethernet port parameters, etc. The datakey supports this need for more programming capability.



It is well known that some technicians or maintenance contractors unadvisedly disable monitor functions as a means to diagnose a malfunctioning cabinet. Changing the diode card and modifying DIP switch settings to do so is an unsafe method of trouble shooting. The use of the datakey makes it difficult for a technician or contractor to change the monitor programming without the MonitorKey programmer.

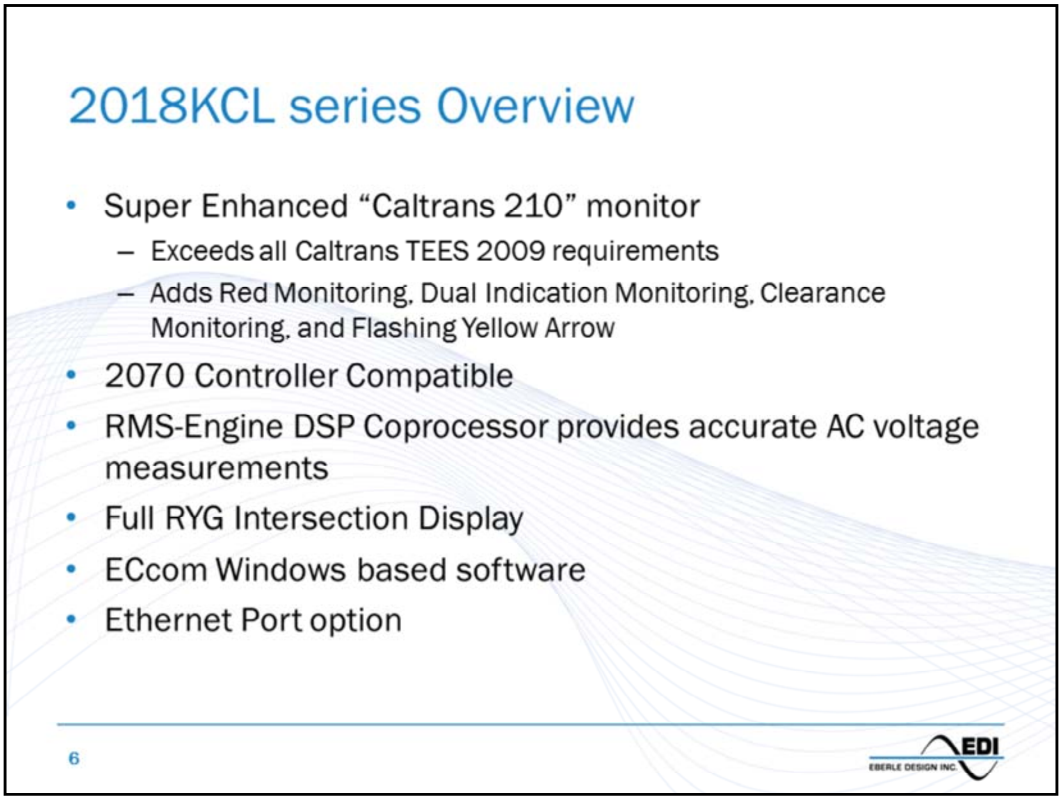
DIP switches are one of the primary reasons that monitors are returned for repair. The datakey totally eliminates the need for DIP switches and programming jumpers and provides much needed detail (data space) for programming that cannot be provided by a limited number of DIP switches.

The MonitorKey Programmer software provides a Setup Wizard that assists a technician in developing the correct programming for a monitor without need for intimate knowledge of the programming parameters, but rather a knowledge of the cabinet wiring and phase assignments only.



The MonitorKey Programming Tool interfaces to a Windows based PC via a USB connection.

All configuration parameters can be viewed and modified on individual forms. Configuration data can be saved, loaded, and developed using the built-in Setup Wizard.



Enhanced Caltrans 210 Monitor

The 2018KCL monitor is built on the basic Caltrans 210 platform. Enhancements have been made to provide a broader fault coverage including Red Monitoring, Dual Indication Monitoring, and Clearance monitoring. FYA operation is compliant to MUTCD 2009.

EDI RMS-Engine DSP Coprocessor

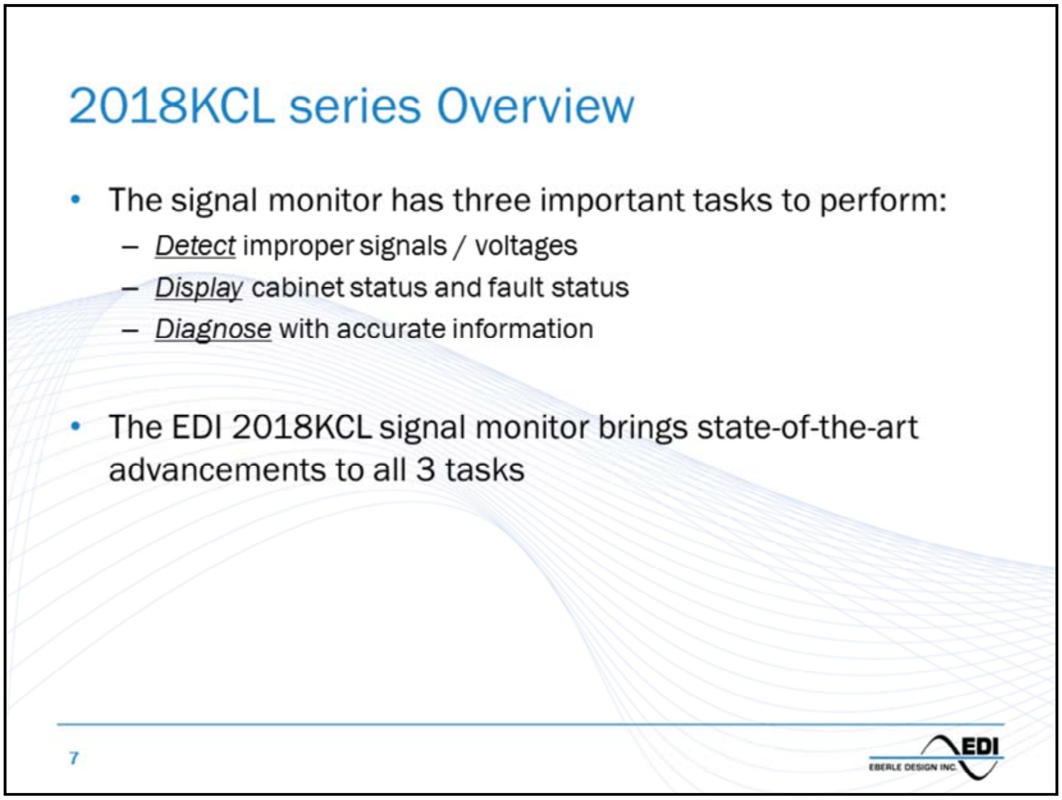
The EDI RMS-Engine is a high speed coprocessor that controls the analog to digital circuitry and processes the resulting sampled data using digital signal processor (DSP) techniques. These algorithms produce a result which is the true Root Mean Square (RMS) voltage of the AC input. A second microprocessor then uses the RMS signal voltages to determine fault status and perform monitor operational functions.

Full RYG Intersection Display

The full intersection display shows the status of all field inputs simultaneously. Improper signal displays are instantly recognizable.

Eccom Software

The EDI ECcom software is used to display the detailed data in the monitor event logs and examine the monitor configuration. These logs document the exact status of fault events and AC Line events to assist in diagnosing intermittent or transient problems.



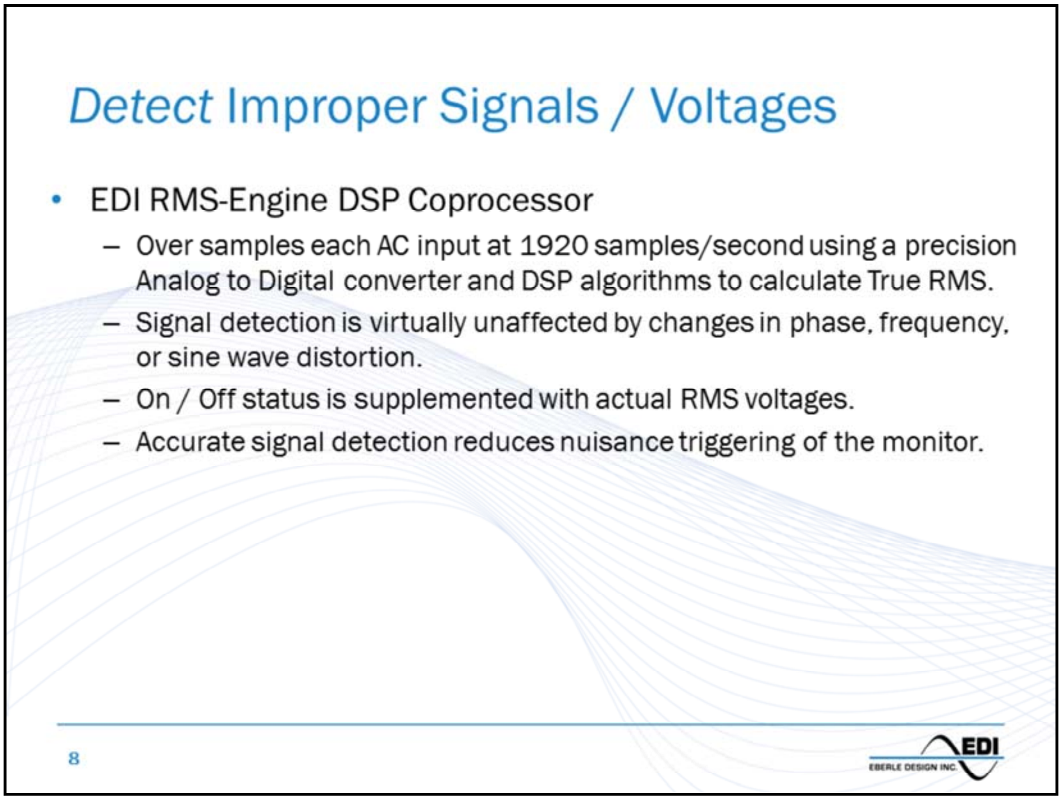
The EDI model 210ECL and 2018KCL have been completely redesigned using state-of-the-art technology which vastly improves performance and increases capabilities for the three main tasks of the signal monitor.

Reliable detection of signals has traditionally been adversely affected by changes in phase and frequency, as well as sine wave distortion. The 2018KCL uses a high speed coprocessor to measure the true RMS voltage and provide reliable detection in the on-street environment.

The front panel display has been improved to show full intersection status using Red, Yellow, and Green LEDs for each channel.

A full complement of event logging capabilities as well as the signal Trace History display helps present and document accurate status information about the events occurring at the intersection. This information is vital to the technician in repairing a cabinet malfunction and ensuring that the repair corrected the real cause of the malfunction.

Because of the high costs of malfunction maintenance calls and the increased exposure to liability, trouble shooting exercises must be done quickly and effectively. Traffic is not moving efficiently while the intersection is in flash.

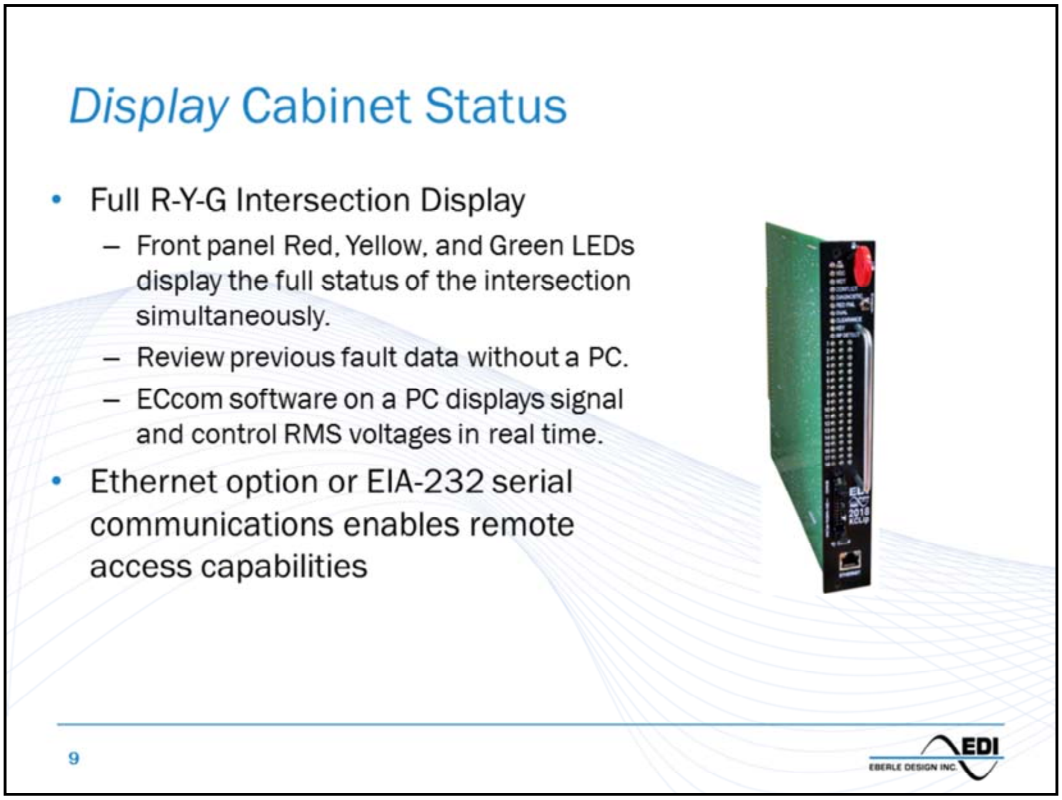


The 2018KCL is based on a dual microprocessor architecture. The RMS-Engine coprocessor is dedicated to calculating true RMS analog AC input voltages.

Traditional monitors use a threshold technique which is sensitive to changes in phase, frequency, and wave form distortion. These sensitivities can shift the threshold of detection or produce erroneous results in a noisy environment such as electrical storms, ac line instabilities, etc.

The over sampling technique used in the EDI RMS-Engine produces the correct RMS voltage value regardless of the wave form. It works accurately for ac, dc, sine, triangle, distorted ac, etc. Frequency shifts experienced during power line instabilities no longer can cause detection problems.

As a diagnosis tool, the actual voltage value rather than just the On/Off status of a signal gives one more piece of information needed to home in on the actual cause of a malfunction.



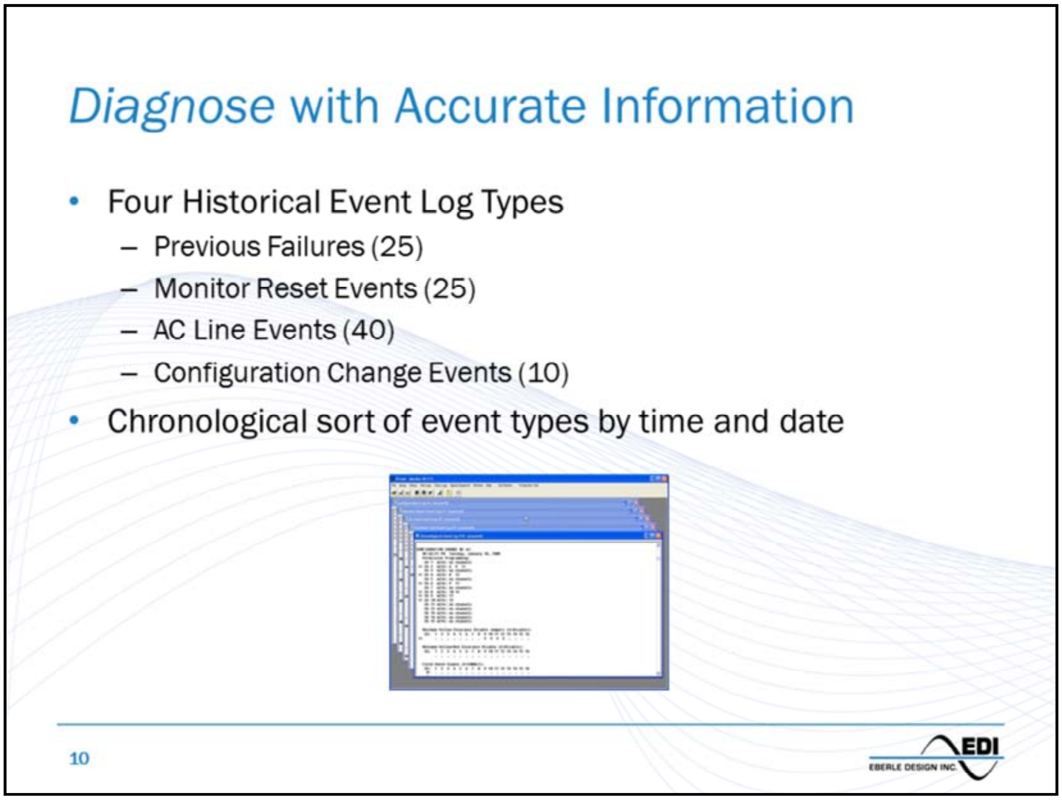
One of the first tasks of trouble shooting a cabinet is to compare the expected controller outputs to what the signal monitor sensed at the time of the fault. This helps isolate the problem down to the field, the load bay, or the controller.

The full intersection display of the 2018KCL shows the actual signal status for the Red, Yellow, and Green inputs to each channel simultaneously. Improper signal displays are instantly recognizable.

This makes the comparison to the load switch input status easy. The 2018KCL display also shows which channels were involved in the fault if triggered.

A simple diagnostic mode provides a look at the signal status for two previous faults without the need to hook up a PC to retrieve event logs. This can be a handy tool if the fault has been reset and a quick review is needed to verify previous events.

ECcom software will present the complete picture if a more detailed view is required.



It is important to use the tools available to the technician to find the cause of a malfunctioning cabinet quickly, and then repair the problem with a high level of confidence that the true cause was found. Call-backs for repeated problems only multiply the effect of the problem. Besides being a source of detailed and accurate information about the state of the intersection at the time of the fault, the event logs can also help provide accurate documentation about the malfunction.

Four Event Log Types (100 records total)

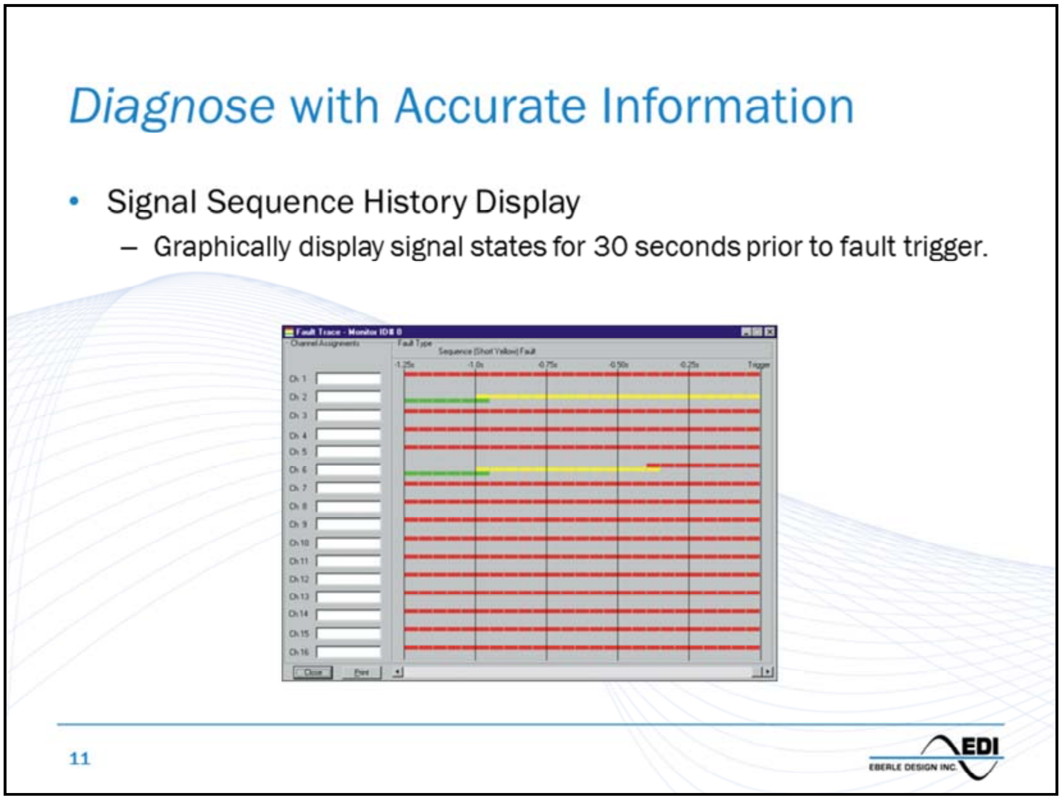
The Previous Failure log contains a record of the field signal voltages, control signal voltages, and cabinet temperature, all time-stamped with the time and date of the event.

The Monitor Reset log time-stamps when the intersection was cleared from the fault flash by a monitor reset. The entry to flash and exit from flash are now documented.

The AC Line log records any event on the AC Line which causes the monitor to transfer to flashing operation (power-down, short interrupt, or brownout), and records the actual line voltage. This helps in trouble shooting intermittent cabinet problems related to power service problems.

The Configuration Change log records any change to the monitor programming including the diode matrix, switches, or jumper selections.

All events are then sorted according to time and date to view them in the real time line they occurred.



Ever wonder what the signals did prior to a fault?

Did the controller execute an improper sequence to get a clearance problem or did a field malfunction cause it?

The Signal Sequence History feature of the 2018KCL will show all field signal states graphically for as much as 30 seconds prior to the monitor trigger point with 50 millisecond resolution.

This information is critical to diagnose signal sequence faults and intermittent flickering or blinking of field signals resulting in faults.

2018KCLip Ethernet Port

- Networking to traffic cabinets using Ethernet has opened many new doors for technicians
  - Get Monitor/Cabinet status remotely before dispatching personnel
  - Dispatch the correct personnel and spare equipment
  - Get immediate help from shop personnel while trouble-shooting in the field.
  - Accurate record keeping

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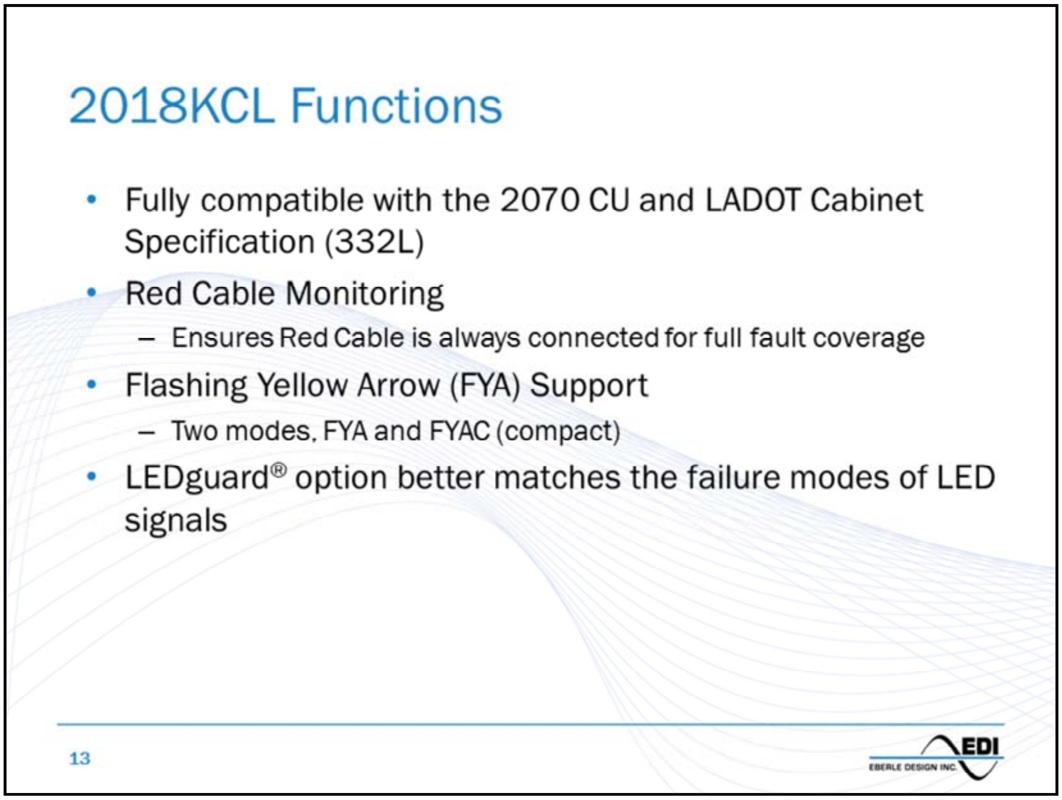


Configuration Change Monitoring

The 2018KCL maintains an internally calculated CRC value of the current configuration settings. These settings include the permissive diode matrix, SSM switches, Yellow Disable switches, Option switches and jumpers, and the Watchdog Enable switch. On power-up, reset, and periodically during operation, the unit will compare the current configuration settings with the previously stored value. If the settings have changed, the unit will automatically log the new setting. If the Configuration Fault option (SEL3) is selected, the 2018KCL will enter the fault mode.

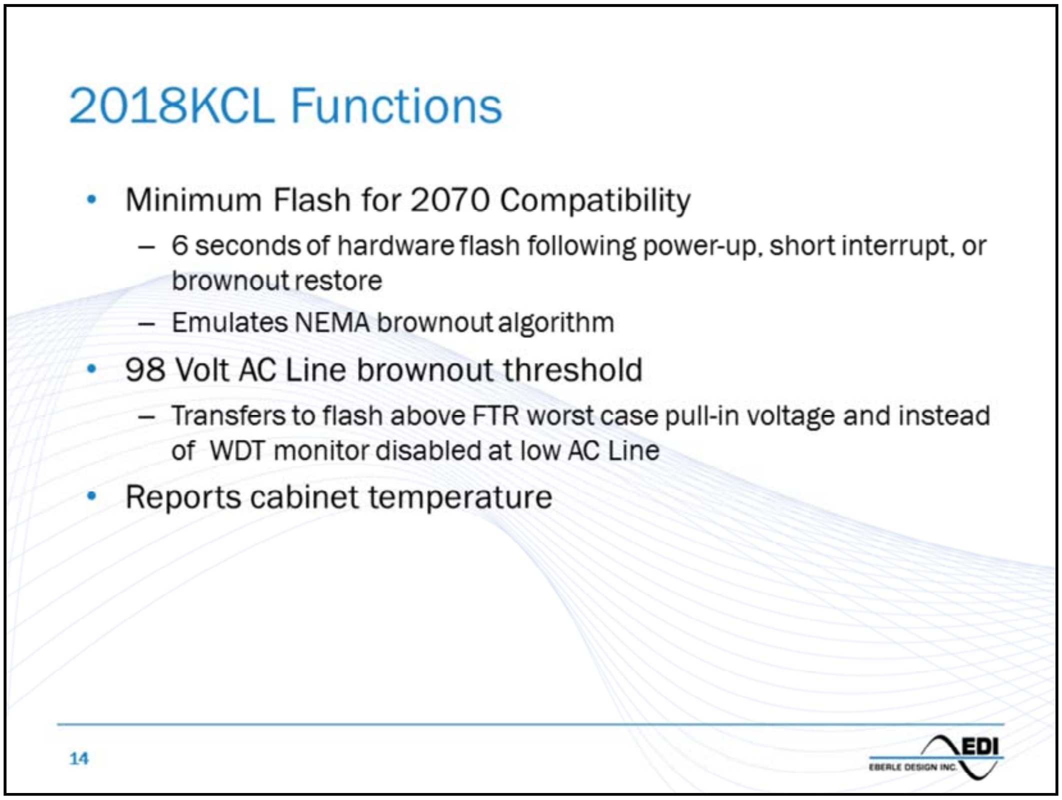
This function guards against accidental changes in programming as well as any hardware failures which may cause a change in programming such as a program card diode or connector failure. The CRC value is displayed by ECcom and can be compared to a known configuration for each cabinet installation during periodic maintenance to ensure original intended programming is still present.

Red Cable Monitoring

The 2018KCL can be programmed to remain in flash if the Red Interface cable is not installed. This prevents enhanced functions (Red Fail, Dual Indication, and Sequence) from being disabled because the cable was removed or failed.

Cabinet Temperature

The 2018KCL will record and report the temperature of the cabinet in the real time mode and in fault event records. Overheating is a major cause of load switch failure and may indicate additional cooling or maintenance is required.

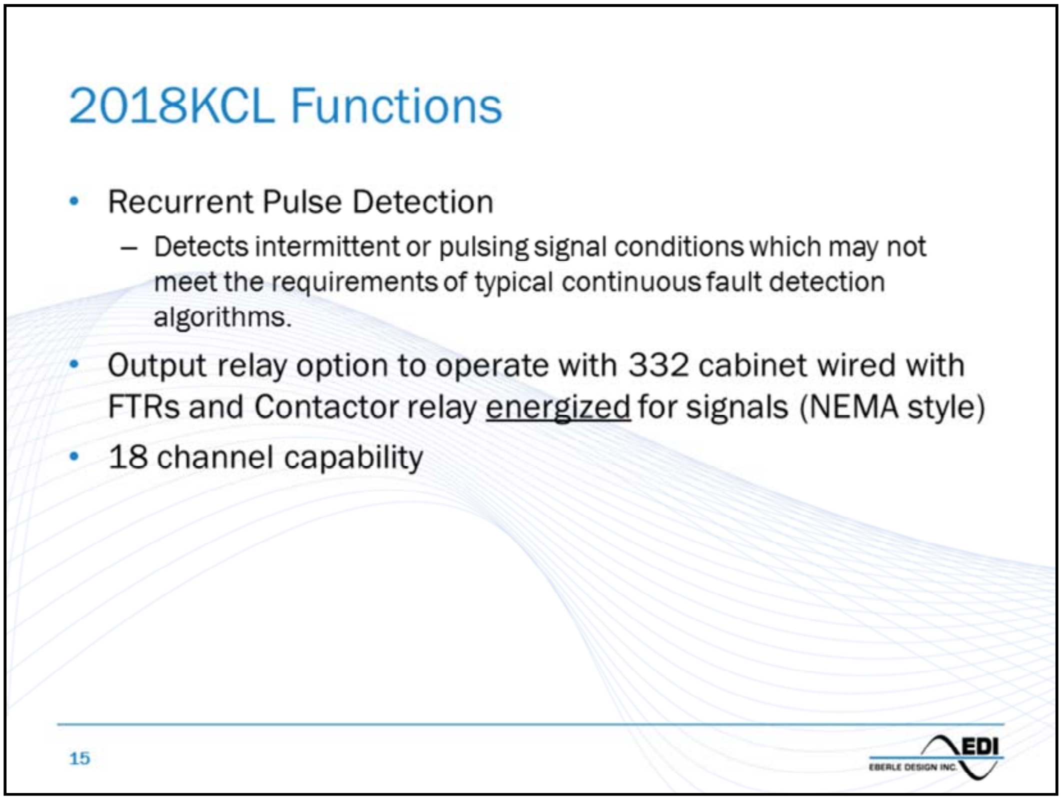


The power-up and low AC Line brownout specification has been modified in the 2018KCL to accomplish three goals whether in a 170 or 2070 based cabinet:

a) A guaranteed minimum flash time on power-up, brownout restore, and short AC Line interrupts to allow the 2070 CU time to boot and set signal outputs. This operation also mimics the NEMA minimum flash operation. NEMA and Type 170 intersections in close proximity will respond in similar fashion to the same AC Line condition.

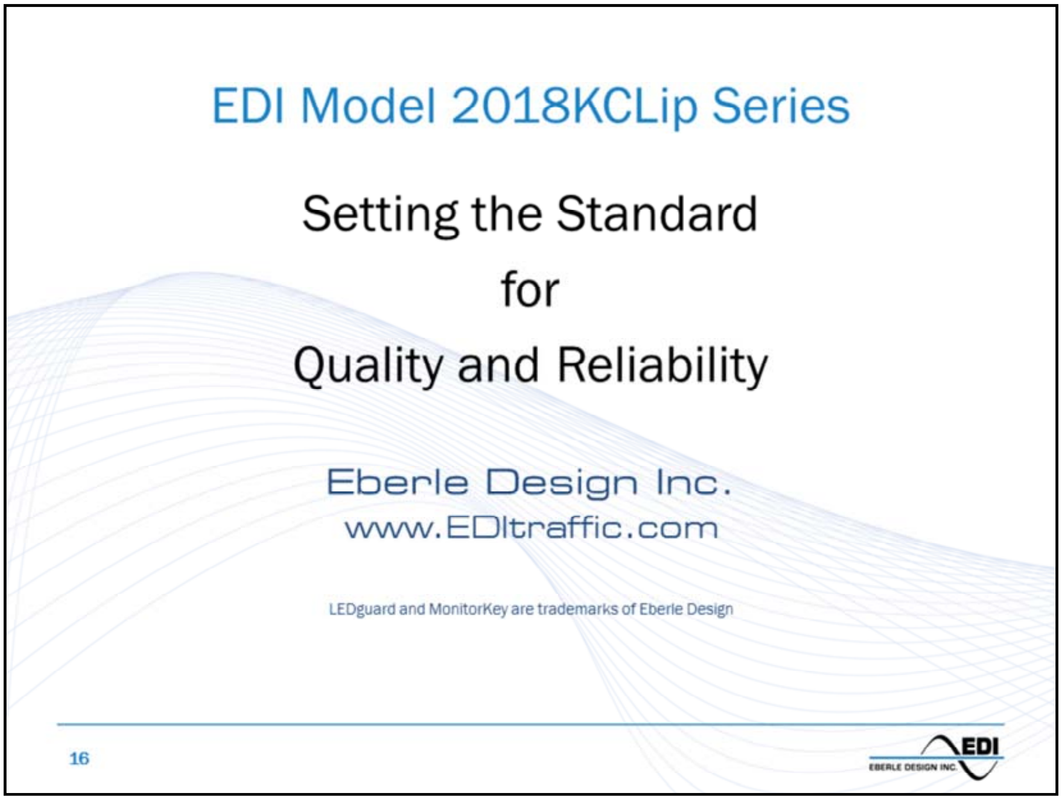
b) The elevated brownout threshold (98 V) ensures that the monitor places the intersection in flash before the 170 or 2070 CU goes into the reset state (dark) at 92 V. This resolves the problem of the monitor detecting a Red Fail under low line condition because the thresholds of a Caltrans 170 and an enhanced monitor were too close.

c) Many Flash Transfer Relays (FTR) will not pull-in below 93-95 volts. The 98 V dropout of the 2018KCL ensures that the FTRs will be pulled-in to provide flash for a drooping AC Line. The 98 volt dropout also eliminates the need to disable CU Watchdog monitoring (Caltrans WDD) or Red Monitoring while the signals are still operating (I.e. 92V < AC Line <98V)



The Recurrent Pulse detection (RP DETECT) function is designed to respond to fault conditions which are intermittent in nature and do not meet the continuous timing requirements of the normal detection algorithms, yet may still produce improper signal displays. These input conditions are differentiated by their longer time constant and fault response times.

The figure shows an example of a recurrent Conflict fault. Channel 2 Green is detected active due to a malfunction of the load switch which caused the output to “flicker” On for 100 ms approximately every 200 ms. Since normal Conflict detection requires a continuous fault of at least 350 ms typical, this event could go undetected. The Recurrent Pulse detection algorithm will combine these pulses into one event and trigger a Conflict fault once the longer recurrent timing threshold is exceeded.



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