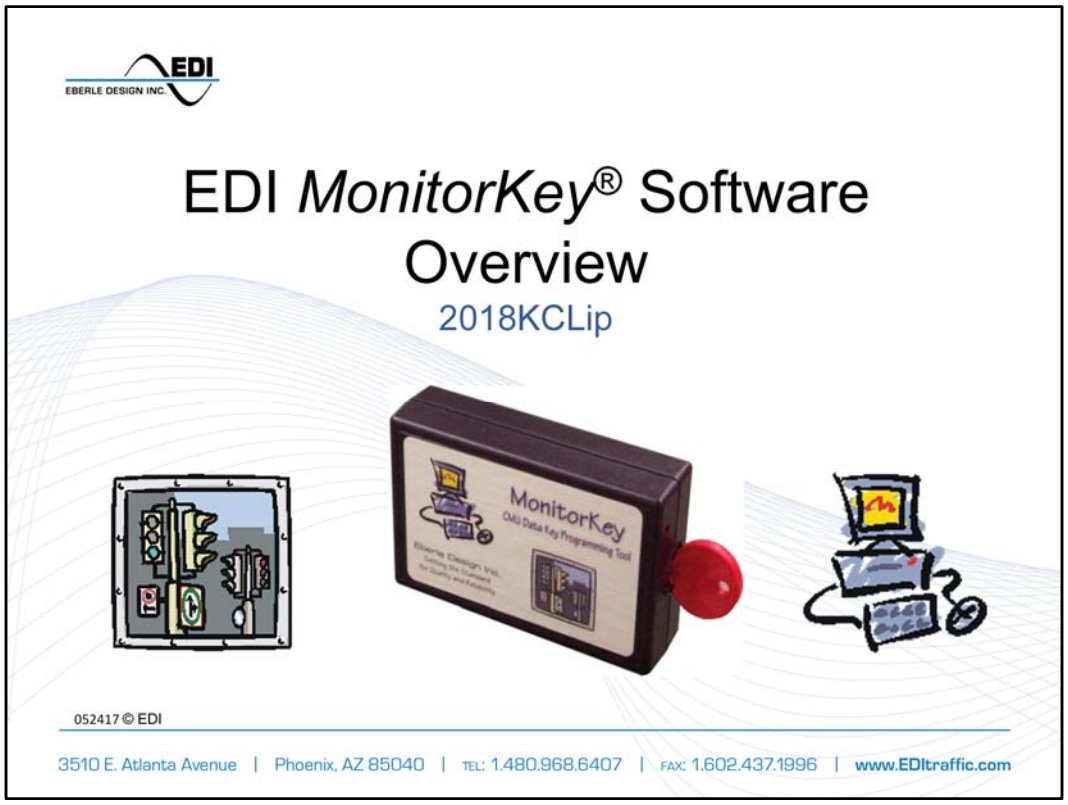
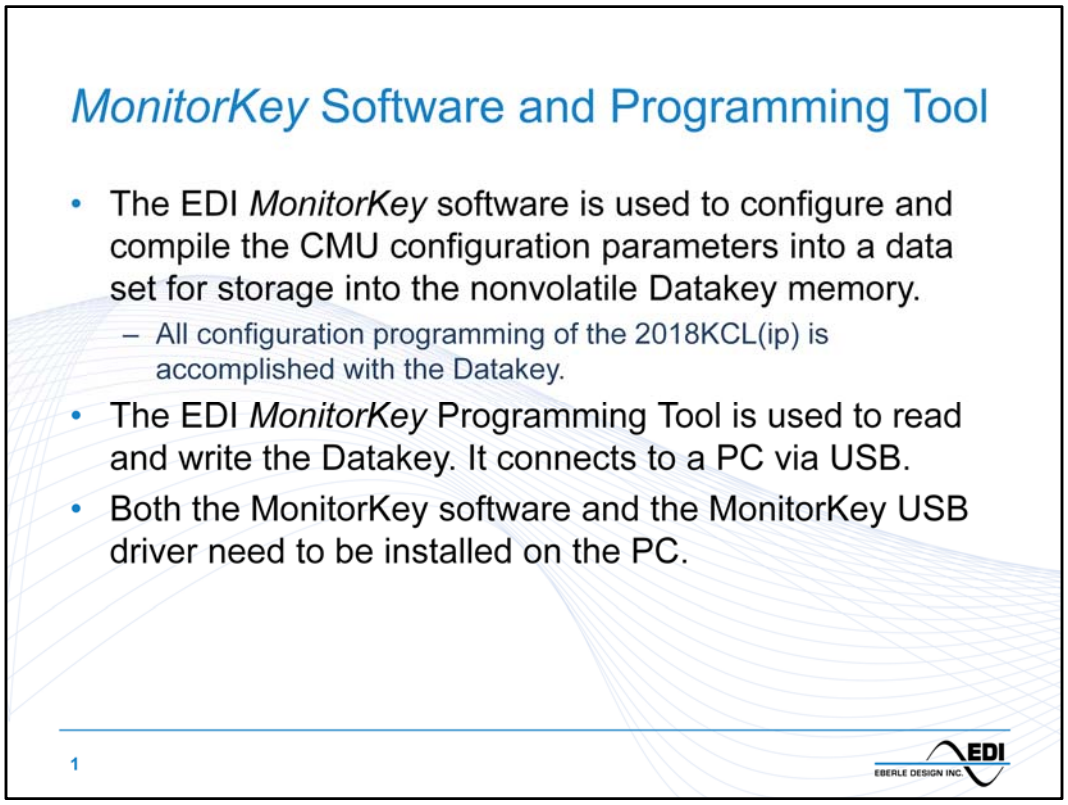


Additional Resources:

MonitorKey® Operation Manual:
www.EDItraffic.com/wp-content/uploads/888-1212-001-MonitorKey-Operation-Manual.pdf

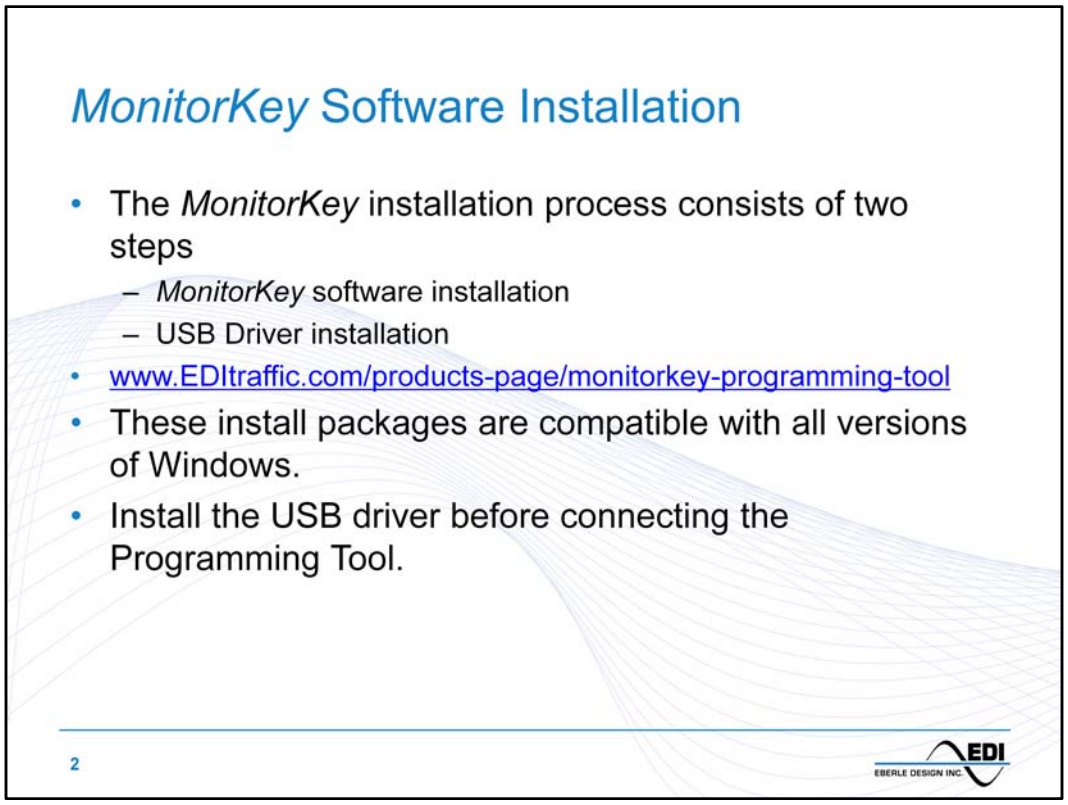
2018KCL Operation Manual:
www.EDItraffic.com/wp-content/uploads/888-2018-001-2018KCL-Operation-Manual.pdf

MonitorKey® Software download:
www.EDItraffic.com/monitorkey-programming-tool-download/



The Eberle Design *MonitorKey*® programming tool set is used to format and program the nonvolatile memory of the Datakey™ device used to configure the CMUip-2212 ATC Cabinet Monitor Unit series, CMU-212 ITS Cabinet Monitor Unit series and the 2018KCL Signal Monitor series.

The hardware is designed to interface the USB port of a personal computer to the Datakey™ electronics. The *MonitorKey*® software provides the capability to format the monitor programming data and transfer this data to and from the Datakey™ device.



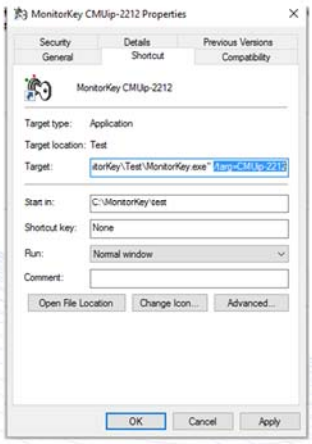
The *MonitorKey* installation process is straight forward and consists of two steps, the software installation and the USB driver installation.

It is important to specify the correct target monitor (CMUip-2212, CMUip-212, 2018KCLip) to the program in order for the *MonitorKey* software to produce the appropriate forms for the monitor type.

The *MonitorKey* software will inquire about the Target monitor the first time the program is launched. The Target monitor can be changed later or specified when the program is launched with a command line option.

Specify the MonitorKey Target Monitor

- The *MonitorKey* software supports several monitor types:
  - CMUip-2212 ATC Cabinet
  - CMUip-212 ITS Cabinet
  - 2018KCLip 332 Cabinet
- The Target monitor needs to be correctly selected at install time or when the program is launched.
  - Menu: SETUP / TARGET / 2018KCLip, or
  - Modify the Short Cut Property:
    <path> /targ=2018KCLip



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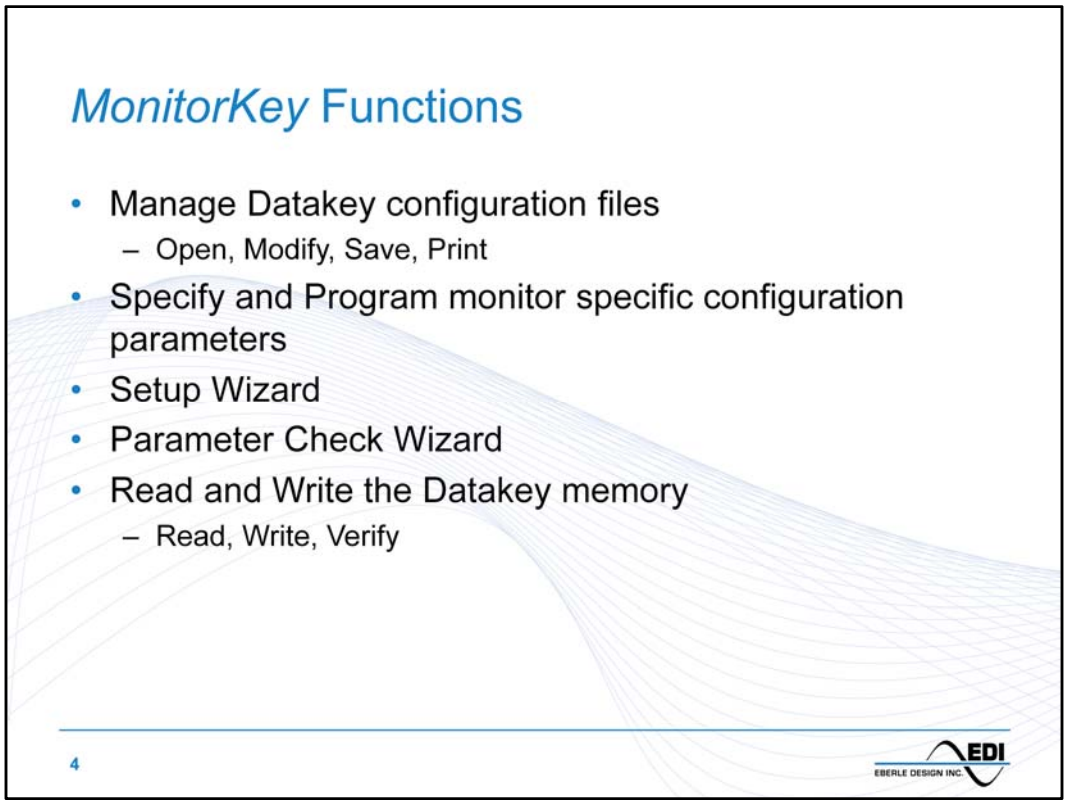
The correct Target monitor must be set for the *MonitorKey* software. This can be done at installation time, through the menu at run time, or selected by a desktop shortcut. The shortcut method is recommended if multiple target monitors are going to be managed.

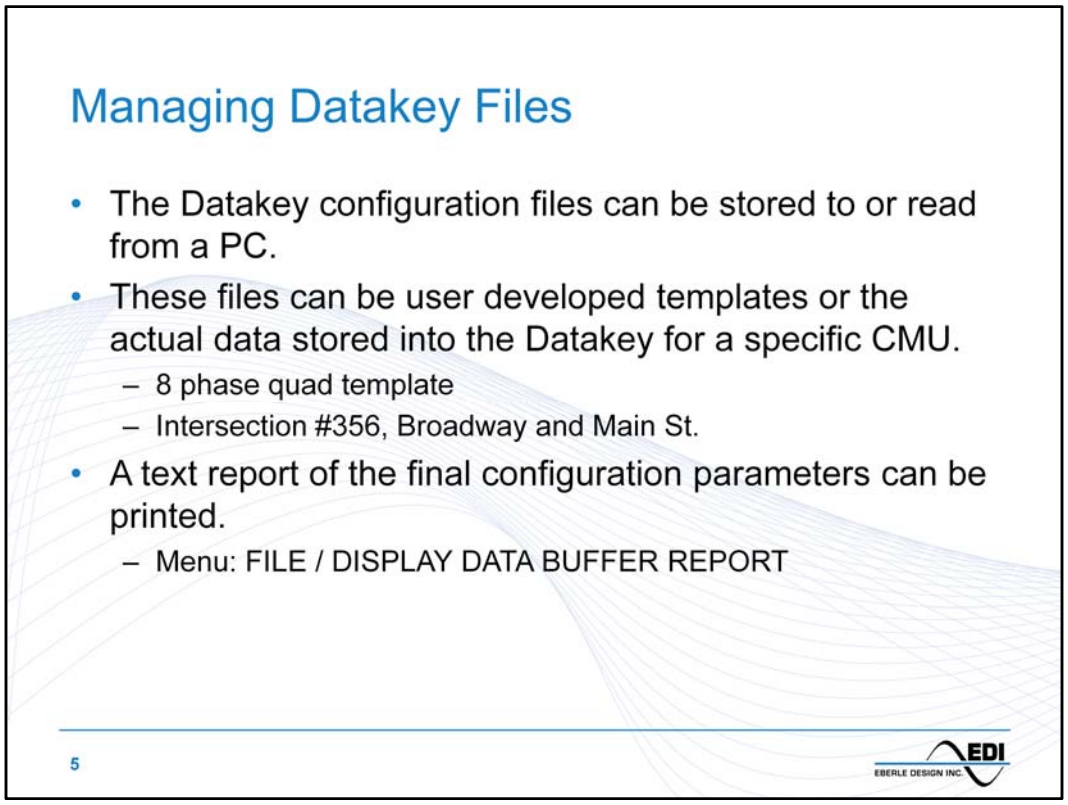
1. Copy the *MonitorKey* shortcut to the desktop.
2. Rename it to *MonitorKey 2018KCLip*.
3. Select the Properties
4. Add the command line option parameter to the shortcut Target parameter: /targ=2018KCLip
    1. Note: be sure this option field is outside of any quotes used in the MonitorKey launch path text.
5. Create additional shortcuts for other target monitors if needed.



The *MonitorKey*® software provides a simple to use tool to develop and view the configuration programming for the 2018KCLip. Templates or data sets can be loaded from the PC and final configuration data set files saved back to the PC.

A Set-Up Wizard helps develop the detailed programming needed to configure the CMU for an intersection application by answering a series of simple questions related to cabinet wiring and phase assignments. The Parameter Check Wizard will ensure that inconsistent parameters in the configuration are identified and corrected.

Once the configuration is finalized, the Programming Tool will then write the data set to the non-volatile memory of the Datakey device.



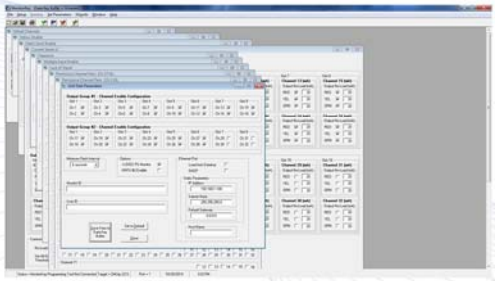
The *MonitorKey*® files are binary files that must be read or written by the *MonitorKey*® software. While a unique file could be developed for each cabinet in an inventory, usually these configurations are common to a few different intersection applications and a template system can be developed to facilitate quick data set development.

For example, a template file could be developed and stored that provided the basic configuration for an 8-phase quad cabinet configuration. When a new CMU is being deployed, this 8-phase template could be read by the *MonitorKey*® software and then customized if necessary for the specific intersection if needed.

Once the data set is completed then a hard copy report can be printed, the file saved to the PC, and the resulting data set written to the Datakey for deployment.

Specifying the CMU Parameters

- For each CMU monitoring function, a form (window) is provided to fill in the parameters.



- After the parameters are selected, click on the *Save Form to Datakey Buffer* button.

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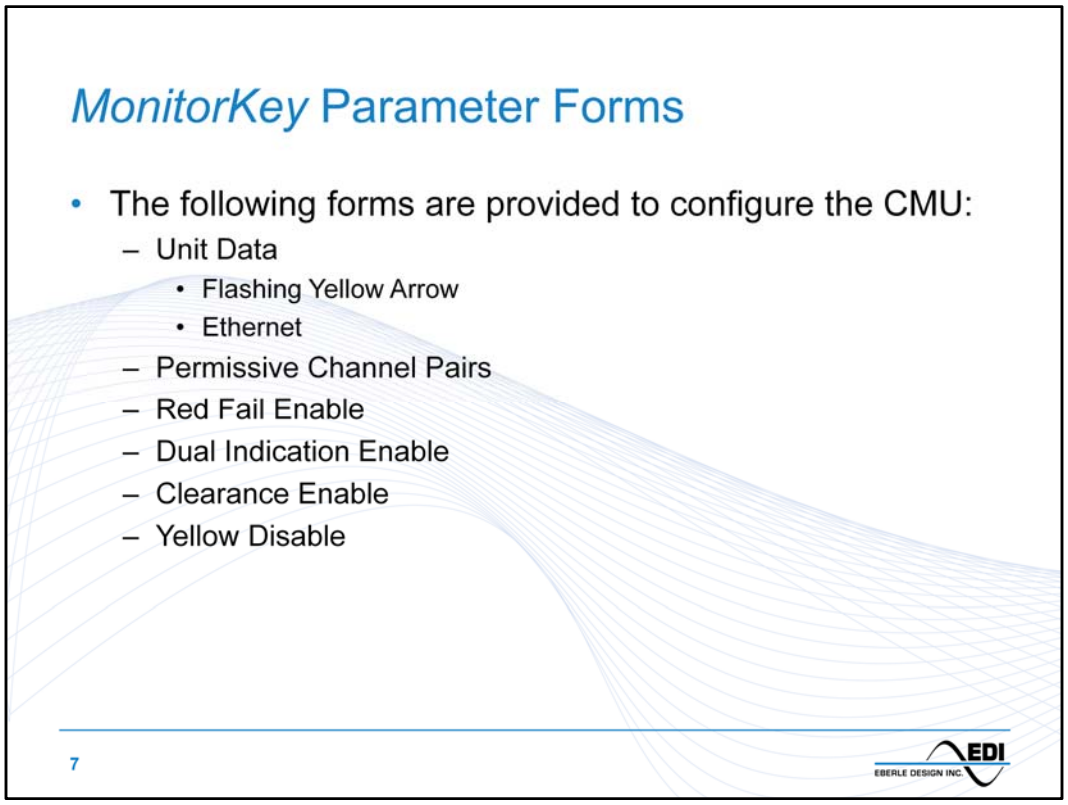
Each monitor function is configured using a separate *form*. Once a form is completed the *Save Form to Buffer* button should be selected to add this programming data to the data set buffer.

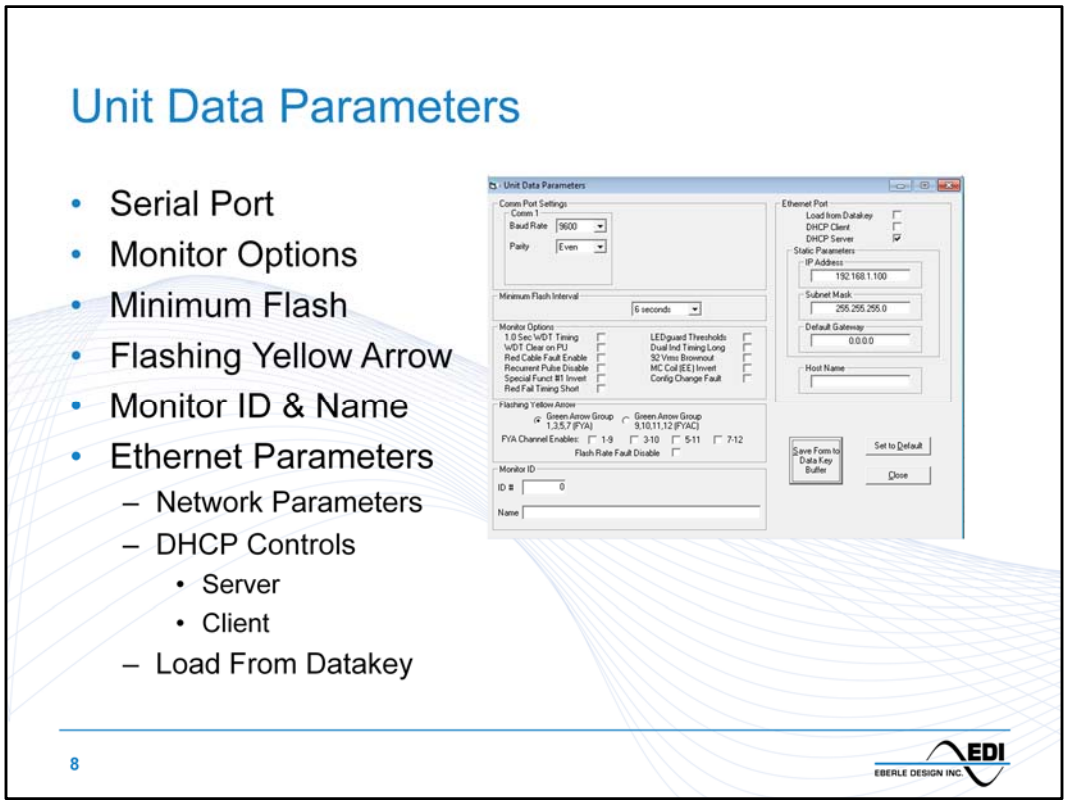
A *form* may also have various *frames* included. Each frame typically consists of a programming parameter set.

Each form provides a button to reset the contents back to default state if needed. If a form has been changed but not stored to the buffer, a warning message will be generated if the form is closed or the Datakey is written with unsaved forms present.



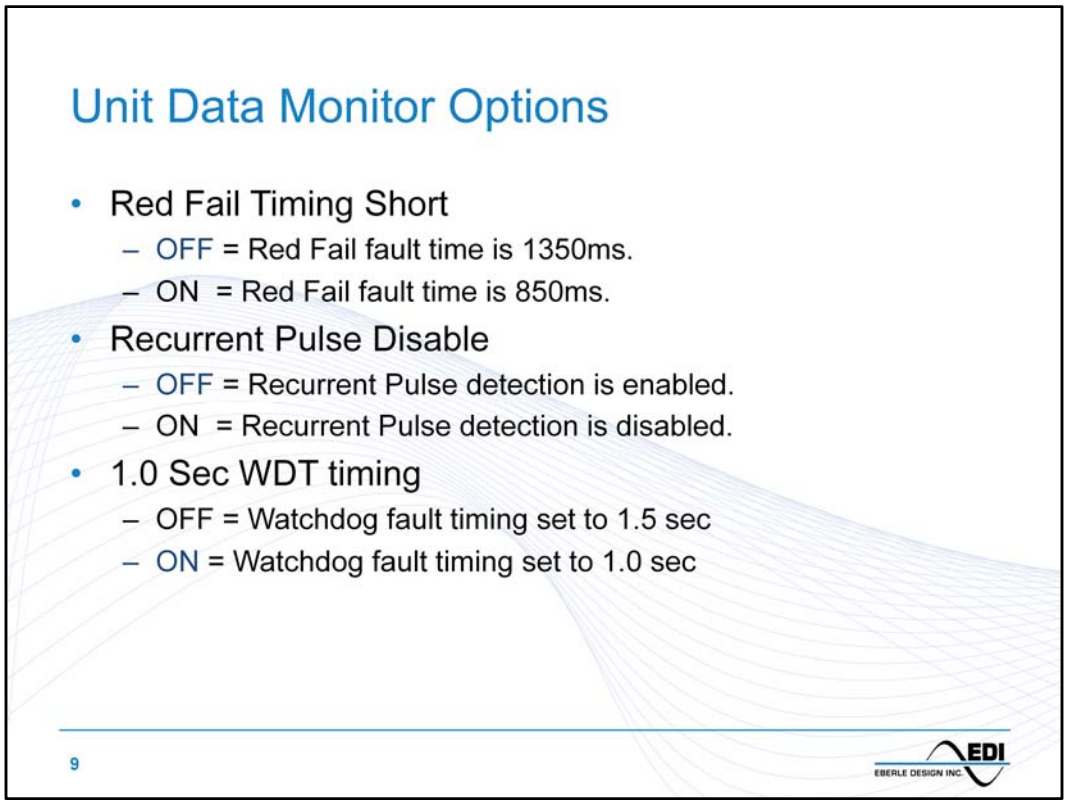
A typical data set development process would be as follows:

1. Load a template file from the PC ,or start with a default buffer (FILE / NEW)
2. Manually configure the following forms:
    1. Unit Data
    2. Permissive Channel Pairs
    3. Flashing Yellow Arrow (if necessary)
3. Run the Set-up Wizard (WIZARDS / PARAMETER SETUP WIZARD). This configures the following forms automatically:
    1. Red Fail Enable
    2. Dual Indication Enable
    3. Clearance Enable
    4. Yellow Disable
4. Run the Parameter Check Wizard to check for consistency errors or warnings (WIZARDS / PARAMETER CHECK)
5. Write the data set buffer to the Datakey.



Unit Data specifies the basic CMU parameters for HDSP configuration and other non-channel related parameters.

- **Serial Port (2018KCL only)**
- **Monitor Options**
  - No options selected is default (2010 Standard)
- **Minimum Flash**
  - This parameter should be set to a time longer than the boot time of the CU
- **Flashing Yellow Arrow**
  - Mode: FYA (Aux File) or FYAC (Compact)
  - Channel Pair Enables
- **ID Number & Name parameters**
  - These two parameters are optional fields and can contain any relevant information.
- **Ethernet Network Parameters**
  - IP Address
  - Subnet Mask
  - Gateway Address (if necessary)
  - Host Name if DHCP Client is enabled
  - Load From Datakey – If checked then the CMU Ethernet Port will automatically use the parameters in this frame.
  - DHCP Client Enable – If checked then the CMU Ethernet Port will request the network parameters from a DHCP server on the network
  - DHCP Server Enable – If checked then the CMU Ethernet Port will provide the network parameters to a direct connected PC that is set to use DHCP.



Red Fail Timing Short

Selects the 210ECL series Red Fail fault time of 850ms or the 2010ECL fault time of 1350ms.

RP DISABLE

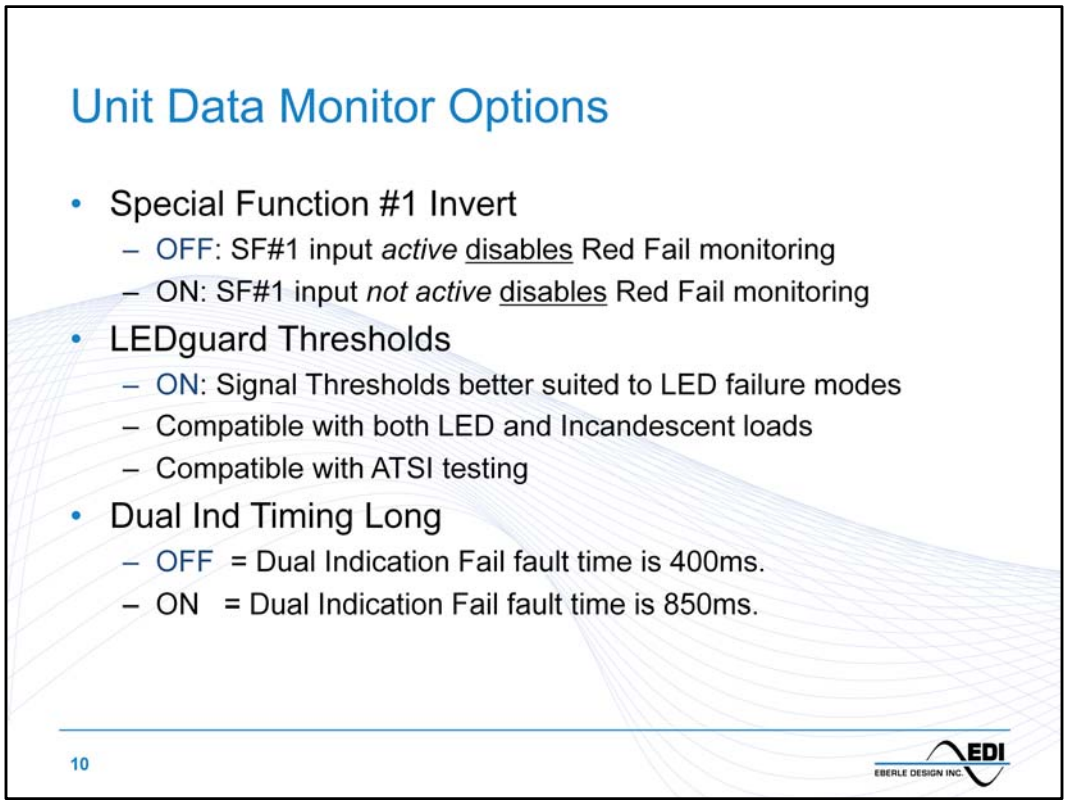
In the ON position Recurrent Pulse Detection is *disabled*.

WD 1.0 SEC

OFF = 1.5 Second WDT ERROR timing (Caltrans)

ON = 1.0 Second WDT ERROR timing

The *name* of the option is what happens when the enable is in the ON state.



SPECIAL FUNCTION POLARITY

Polarity	SF #1	SF #2	Red Failure Monitoring
off	off	off	enabled
off	off	on	disabled - Preempt
off	on	off	disabled - Preempt
off	on	on	disabled - Preempt
on	off	off	disabled - Preempt
on	off	on	disabled - Preempt
on	on	off	enabled
on	on	on	disabled - Preempt

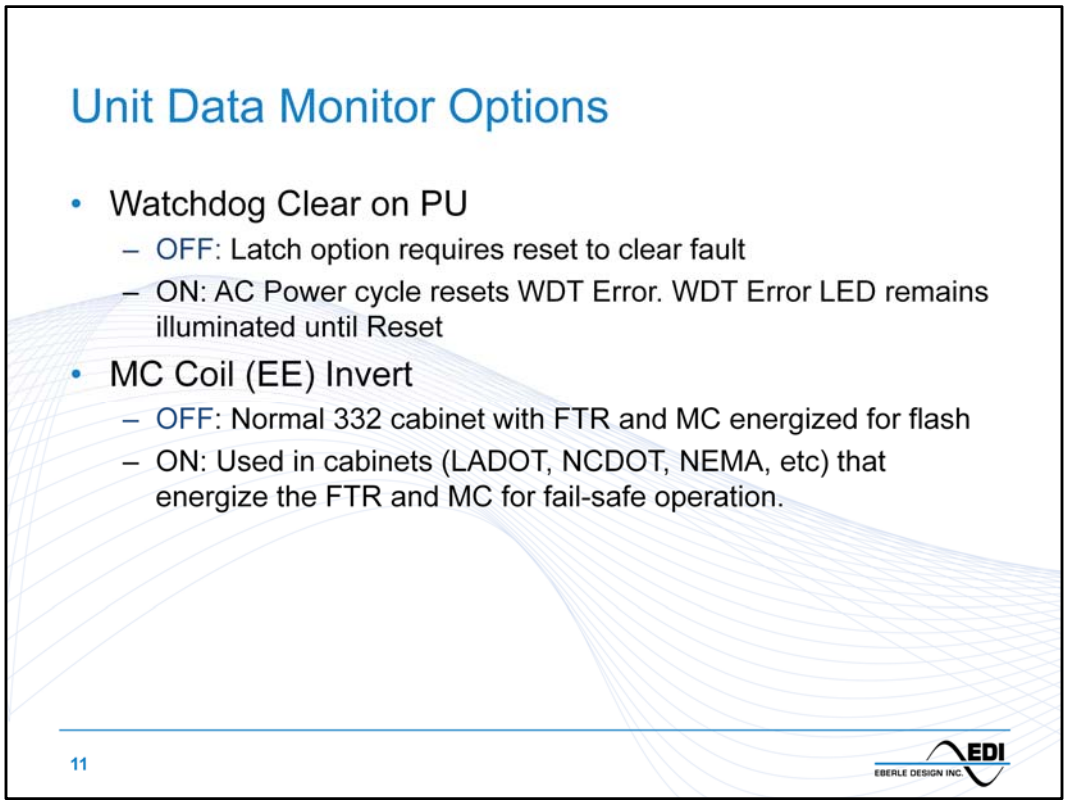
SF #1 and SF #2 use Red voltage thresholds (ON > 70 Vac, OFF < 50 Vac).

LEDguard

The Signal Monitor can be configured to use a technique called *LEDguard* that is designed to better monitor the characteristics of LED based signal loads. Each field signal input is measured and compared to both a high threshold and a low threshold value to determine On / Off status. Once the high and low On / Off thresholds have been determined using the input RMS voltage, the individual fault monitor functions use the appropriate threshold to determine if a fault condition exists. See the LEDguard white paper at www.EDItraffic.com/t_application-notes.

Dual Indication Long

The long value can be used when capacitor dummy loads are installed on field terminals. This increases the On to Off decay time beyond the nominal 400 ms value. The 400 ms value was chosen to detect Dual Indication fault that may involve 1Hz flashing signals.



Watchdog Clear on PU

ON:

AC Line brownout restore will clear a WDT ERROR and allow the intersection to run. The WDT ERROR LED will remain illuminated until Reset (Caltrans).

OFF:

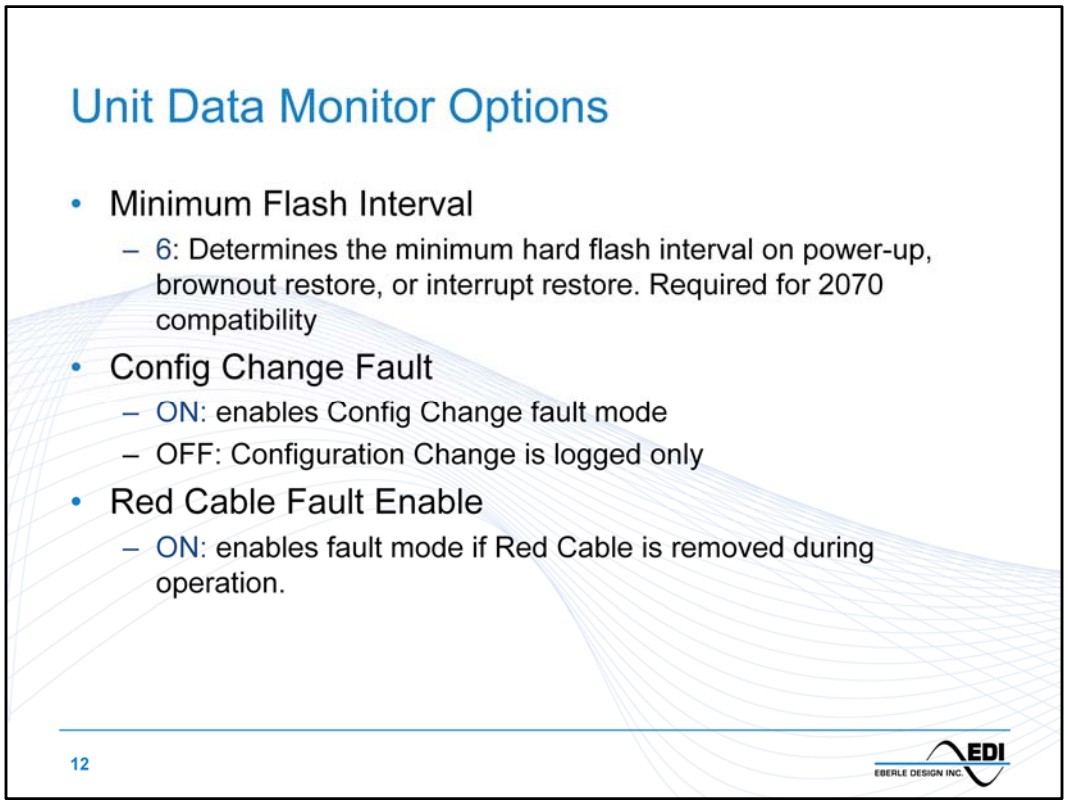
WDT ERROR is latched until Reset button is depressed or External Reset input is activated.

MC Coil (EE) Invert

Cabinet wiring changes are needed for this mode.

OFF: Normal 332 cabinet with FTR and MC energized for flash

ON: Used in cabinets that energize the FTR and MC for signals NEMA style.



MINIMUM FLASH

Determines the minimum hard flash interval on power-up, AC Line brownout restore, and AC Line interrupt restore. This function is required for compatibility with the 2070 Controller Unit. It is a preferred mode for 170 CU operation as well. This mode reflects typical NEMA operation.

CONFIGURATION CHANGE ENABLE

ON: a configuration change will be logged and trigger a fault. The PCA LED will flash at a 4Hz rate to indicate this fault. A three second manual reset is required to enter the new configuration and reset the unit.

OFF: the change will be logged but no fault is triggered.

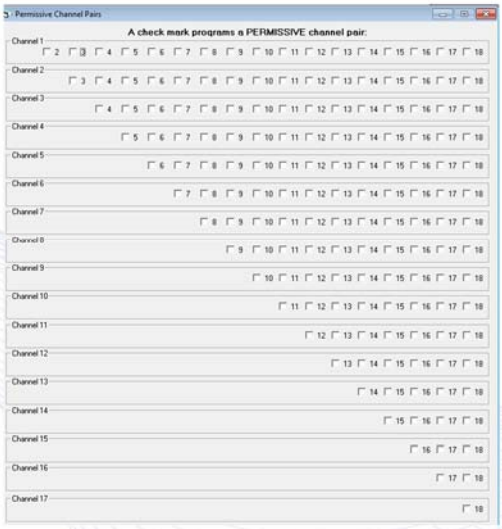
RED CABLE FAULT ENABLE

ON: the monitor will go to Red Fail fault if the Red Interface cable is removed (Channel Status = Off).

OFF: the Red Interface cable can be unplugged. The unit will then function as basic 210 monitor with Red Fail, Dual Indication, and Sequence disabled.

Permissive Channel Pairs

- A check mark configures a channel to be Permissive with the associated channel.
- For example:
  - Ch 2 with 5, 6, 9, 11, 13, 15
  - Ch 4 with 7, 8, 10, 12, 14, 16



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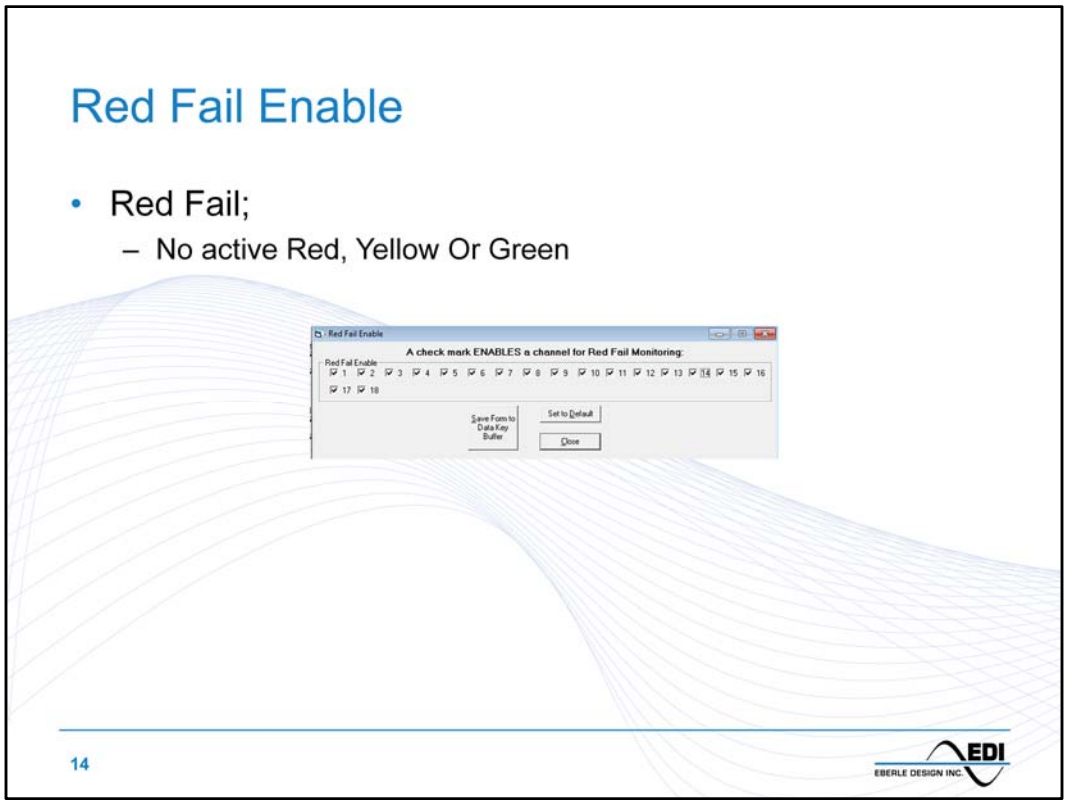
The Permissive Channel Pairs form configures the Conflict compatibility matrix. When a channel pair is checked, then the two channels are Permissive and can run concurrently.



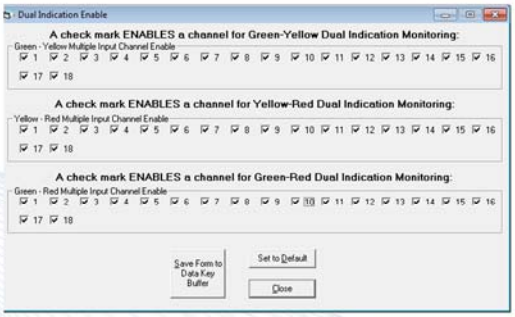
Red Fail monitoring is used to detect a dark channel, i.e. No Red, No Yellow, and No Green active on a channel. If the RYG voltages are all below the CMU thresholds (off), then a Red Fail fault will be detected.

This form will be configured by the *MonitorKey* Setup Wizard.

A no-load condition will not be detected as a Red Fail.

Multiple Input Enable

- Detect more than one color active on a channel
- Separate Enables for:
  - Green and Yellow
  - Yellow and Red
  - Green (W) and Red (DW)



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A vehicle channel (RYG) should have all three monitoring combinations (G-Y, Y-R, G-R) Enabled. Channels with outputs that are not loaded or driving signal heads are typically Disabled.

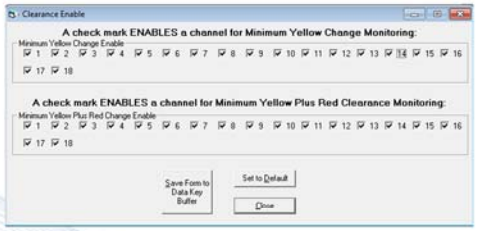
For example, a 2-section right turn overlap with only a Green and Yellow arrow should have G-Y Enabled and G-R and Y-R Disabled.

For example, a Ped channel should have G-Y and Y-R Disabled, since the Yellow output is not driving a signal head.

This form will be configured by the *MonitorKey* Setup Wizard.

Clearance

- *Minimum Yellow Change* monitors the clearance interval for a vehicle channel with a Yellow signal
- *Minimum Yellow Plus Red* monitors the clearance interval for a pedestrian channel with no Yellow signal
  - Disable for FYA OLP channels



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The Minimum Yellow Change frame will enable a channel for Yellow Clearance monitoring. A channel should be Enabled if it produces a Yellow signal prior to Red such as a vehicle RYG channel. A Ped channel or two section GY channels should be Disabled.

The Minimum Yellow Plus Red frame will enable a channel for Clearance monitoring by checking the minimum time between the channel Green signal terminating and the next Conflicting Green channel going active. This should be Enabled for Pedestrian channels or other channels without a true Yellow signal, or without a true Red signal.

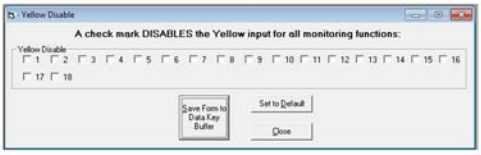
The Minimum Yellow Plus Red function is typically left Enabled unless there is a need to disable it. Thus can be left Enabled for Vehicle or other RYG type channels.

Note that the Minimum Yellow Plus Red function MUST be Disabled for the Flashing Yellow Overlap channel (Ra, sYa, fYa). This prevents a Clearance fault from occurring when the CU cycles from a permissive (fYa) channel directly to the associated protected channel (Ga) without a solid Yellow indication, i.e. lagging left turn.

This form will be configured by the *MonitorKey* Setup Wizard.

Yellow Disable

- When a Yellow load switch output does not have a load connected or is to be unmonitored (e.g. BOS), it can be disabled
- When checked, a Yellow input will be sensed at 0 Vrms



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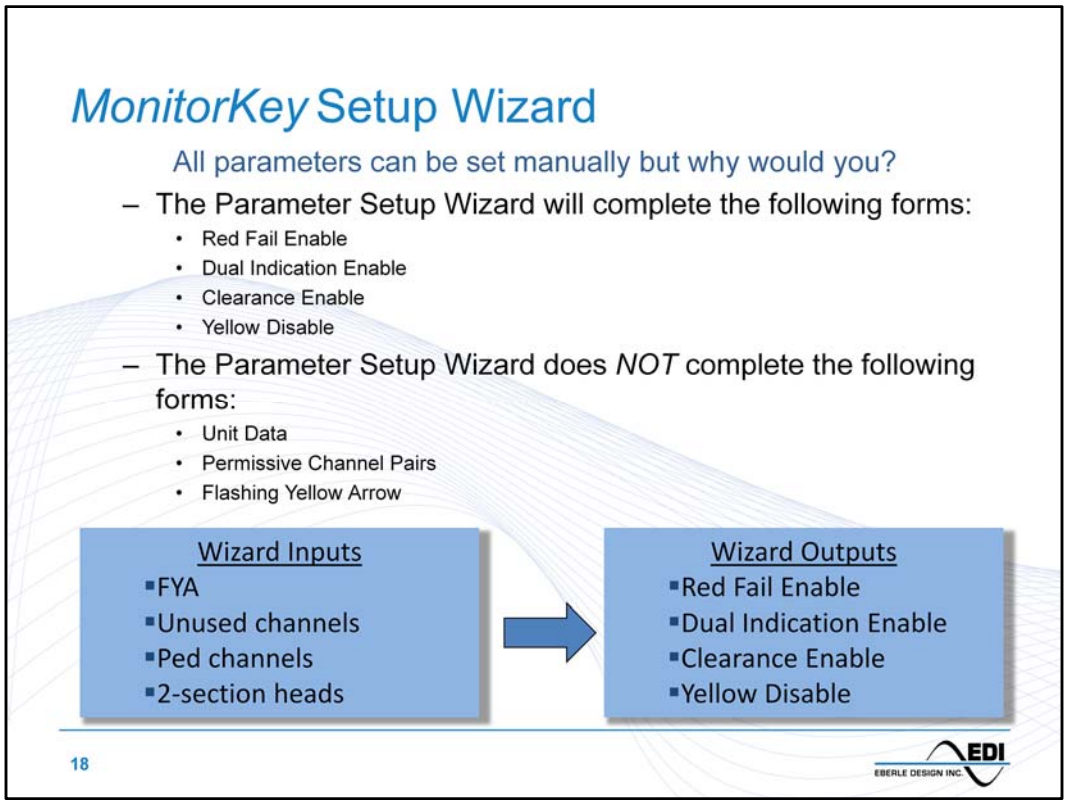
The Yellow Disable function can be used to disable monitoring of an unused Yellow output. It generally avoids needing a dummy resistor load might be applicable to driving an unmonitored Blank Out Sign (BOS) or other reassignment of the Yellow output.

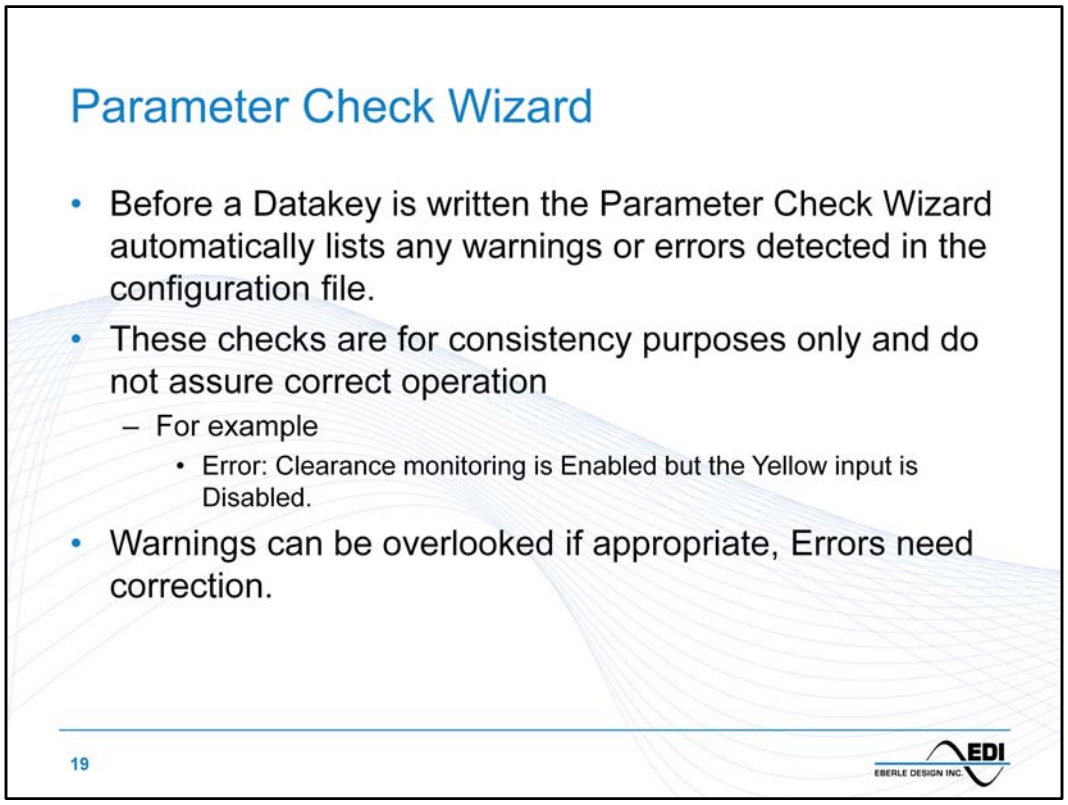
Checking a box will Disable the Yellow input and the CMU will report the input as Off (0 Vrms).

The Yellow Disable programming will be configured by the *MonitorKey* Setup Wizard for the Ped channels, but additional settings may be required for special applications (BOS, beacons, etc.). Note that disabling the Yellow output of a Ped channel prevents the CMU from detecting a Conflict condition during the Ped Clearance interval (flashing DW).



The *MonitorKey* Setup Wizard will assist in completing many of the channel based configuration forms. It should provide the exact settings generally needed for full operation but there may be a need to adjust the resulting settings after the Wizard is run depending on special requirements or perhaps the use of non-vehicle channels.

The *MonitorKey* Setup Wizard can be executed with the menu item WIZARDS / PARAMETER SETUP.

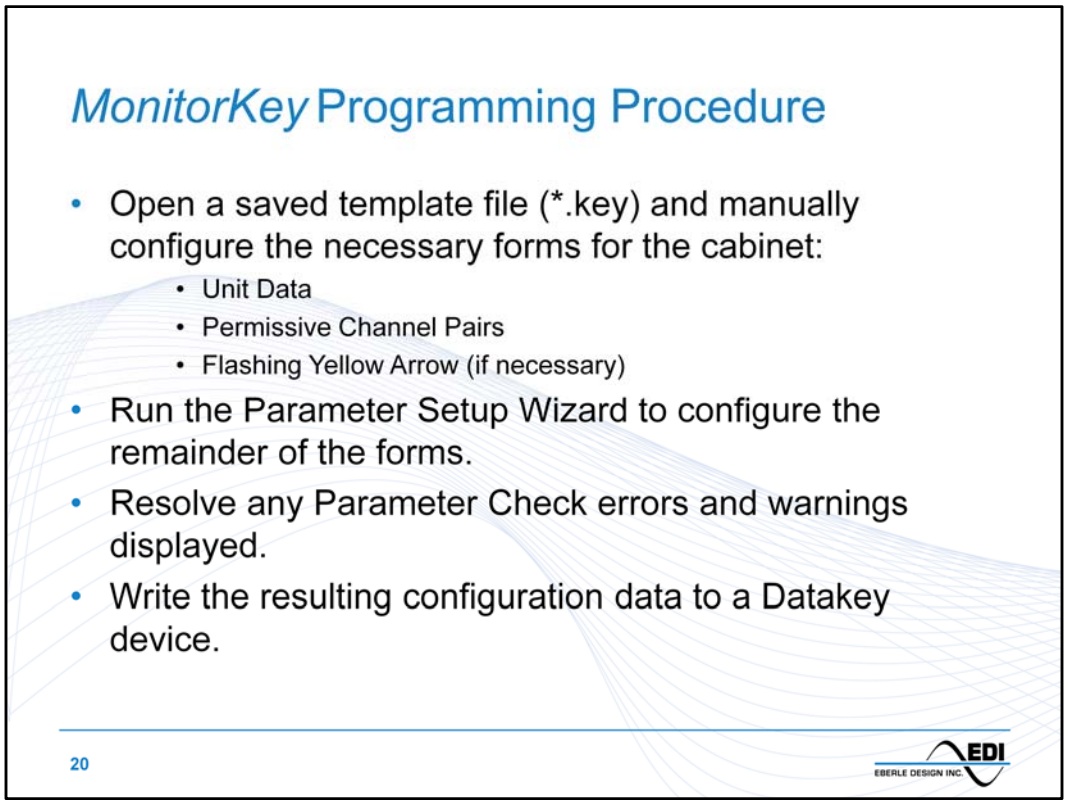


The *MonitorKey* Parameter Check Wizard is executed automatically when the Write Datakey function is selected. If there are no resulting warnings or errors in the data set, then no report is generated. If a warning or error is detected by the MonitorKey Parameter Check Wizard then a report will be displayed with the details.

The results of the *MonitorKey* Parameter Check Wizard are intended to help identify data set issues where inconsistent programming parameters have been selected. For example, a channel is Enabled for Yellow Clearance monitoring but the Yellow Disable input is also selected would produce an Error message.

Any Warnings should be examined closely for correctness, but may in fact be the intended configuration. Any identified Errors must be corrected or improper CMU monitoring may result. In either case of identified warnings or errors, the data set may be written to the Datakey if it is intended.

The *MonitorKey* Parameter Check Wizard can also be executed with the menu item WIZARDS / PARAMETER CHECK or clicking the Parameter Check Wizard Toolbar icon 



This is the general procedure to create and program a data set to the Datakey device.

A Typical 8-Phase Quad Setup

- Thru: 2,4,6,8
- PPLT: 1, 5
- PLT: 3,7
- Peds: 13-16

(With DW monitor)

```
UNIT DATA:
  DATA KEY CHECK VALUE = 33032  (0x8108)
  COMM1 = 9600 baud even parity, DTR disabled
  MINIMUM FLASH = 6 seconds
  OPTIONS:
    WDT TIMING = 1000 ms
    WDT CLEAR ON PU = Disabled
    RED CABLE FAULT = Enabled
    RECURRENT PULSE MONITOR = Enabled
    SF#1 POLARITY = Normal
    RED FAIL TIMING = 1200-1500 ms
    LEDguard = Enabled
    DUAL INDICATION TIMING = 350-500 ms
    AC BROWNOUT LEVEL = 98 +/- 2 Vrms
    MC COIL (EE) POLARITY = Normal
    CONFIG CHANGE FAULT = Disabled
  FLASHING YELLOW ARROWS = <none>
```

```
RED FAIL ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       .  X  X  X  .  X  X  X  .  .  .  .  X  X  X  X  .  .

GREEN-YELLOW DUAL INDICATION ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       X  X  X  X  X  X  X  X  .  .  .  .  .  .  .  .  .  .

YELLOW-RED DUAL INDICATION ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       .  X  X  X  .  X  X  X  .  .  .  .  .  .  .  .  .  .

GREEN-RED DUAL INDICATION ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       .  X  X  X  .  X  X  X  .  .  .  .  X  X  X  X  .  .

MINIMUM YELLOW CLEARANCE ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       .  X  X  X  .  X  X  X  .  .  .  .  .  .  .  .  .  .

MINIMUM YELLOW PLUS RED CLEARANCE ENABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       X  X  X  X  X  X  X  X  .  .  .  .  X  X  X  X  .  .

YELLOW DISABLE:
  Ch:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18
       .  .  .  .  .  .  .  .  .  .  .  .  X  X  X  X  .  .
```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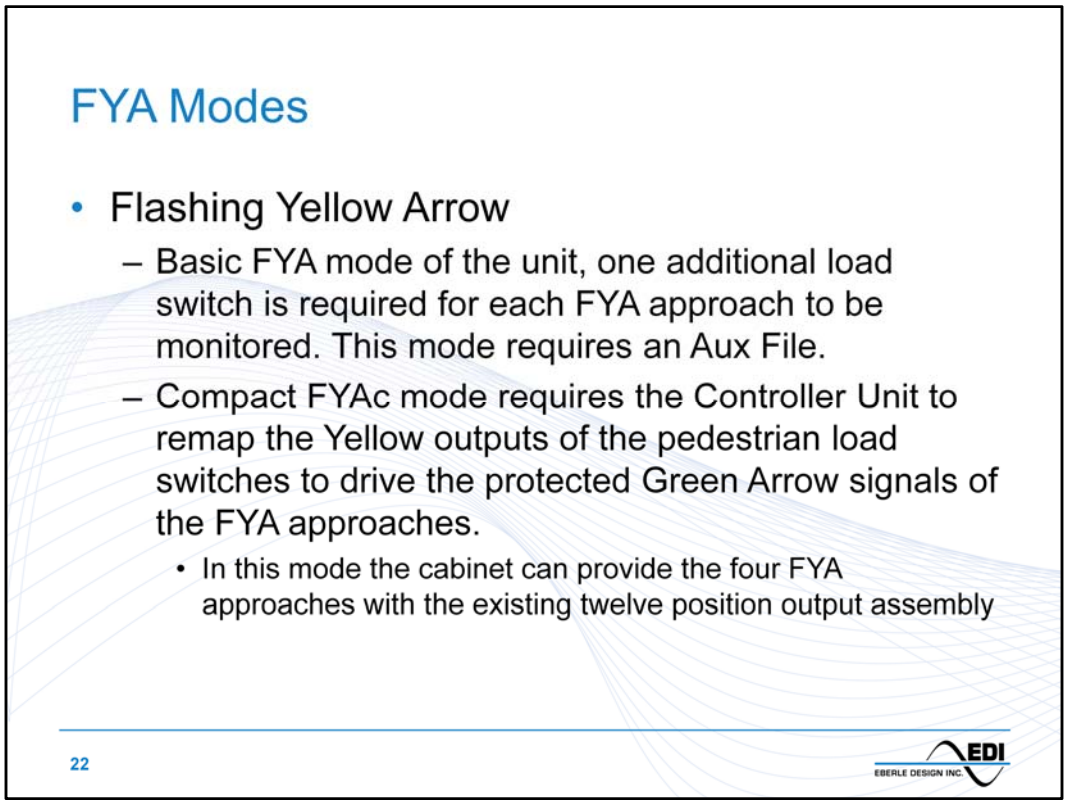


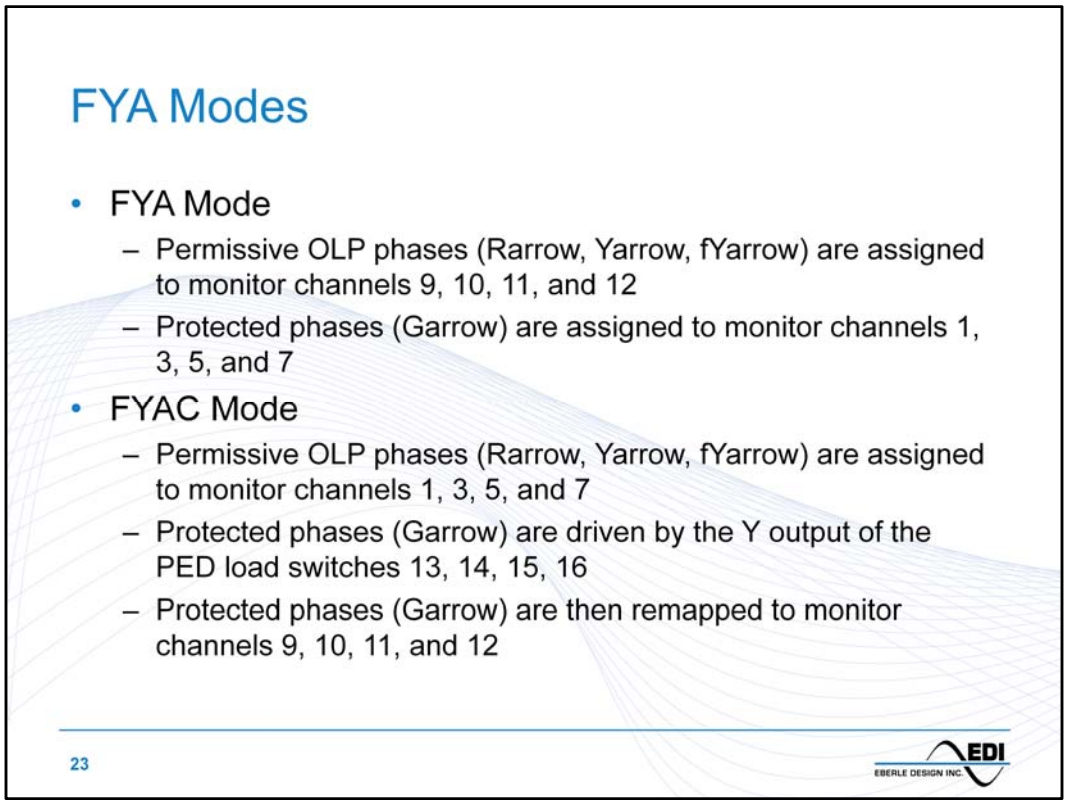
Flashing Yellow Arrow Modes; FYA and FYAC

Two cabinet configurations are supported depending on the number of load switches provided and the capabilities of the Controller Unit. A Flashing Yellow Arrow approach is actually monitored using two physical channels of the Signal Monitor. In the basic FYA mode of the unit, one additional load switch is required for each FYA approach to be monitored. Thus a cabinet providing four vehicle phases, four pedestrian phases, and four FYA approaches would require sixteen load switches. The compact FYAc mode requires the Controller Unit to remap the Yellow outputs of the pedestrian load switches to drive the protected Green Arrow signals of the FYA approaches. In this mode the cabinet can provide the four FYA approaches with the existing twelve position output assembly.

FYA Channel Pair Enables

Four switches are provided to enable a channel pair for each FYA or FYAC approach.

Channel 1-9
Channel 3-10
Channel 5-11
Channel 7-12



The choice between the standard FYA mode and the FYA Compact mode primarily is one of load switch count.

- The FYA mode requires load switches installed on channels 9-12 which means an Auxiliary File is needed.
- The FYAC mode uses the Ped Yellow load switch outputs and thus can be done with only a 12 position Output File.

In either case the monitor requires TWO channels per FYA approach.

FYA Compact Mode Mapping

- The cabinet is wired such that the (unused) Ped Yellow load switch outputs are wired to the Signal Monitor inputs as follows:

Phase	Load Switch #	Monitor Physical Input
Ped 2 Yellow	3	Ch 9 Green (pin 13)
Ped 4 Yellow	6	Ch 9 Yellow (pin 16)
Ped 6 Yellow	9	Ch 10 Green (pin R)
Ped 8 Yellow	12	Ch 10 Yellow (pin U)

- The 2018KCL will then remap the physical inputs to monitor channels as follows:

Monitor Physical Input	Monitor Logical Channel	Associated FYA Channel
Ch 9 Green	Ch 9 Green (arrow)	Ch 1 (OLP)
Ch 9 Yellow	Ch 10 Green (arrow)	Ch 3 (OLP)
Ch 10 Green	Ch 11 Green (arrow)	Ch 5 (OLP)
Ch 10 Yellow	Ch 12 Green (arrow)	Ch 7 (OLP)

FYA Unit Options

- Green Arrow Group
  - 1,3,5,7 (FYA): Standard FYA mode is selected
    - 16/18 position Output + Aux Assembly
  - 9,10,11,12 (FYAc): Compact FYA mode is selected
    - 12 position Output Assembly
- FYA 1-9, 3-10, 5-11, 7-12 enables
  - ON: enables a channel pair for FYA monitoring functions

MonitorKey® Software Overview

Setting the Standard for Quality and Reliability

Eberle Design Inc.

www.EDItraffic.com