Chapter 21

Using the KAD/BIT/101

TEC/NOT/045

The KAD/BIT/101 is a continuous built-in test module that monitors the Acra KAM-500 system using window functions to ensure that it is operating correctly.

This paper specifically describes window functioning, window strategy and the different outputs used to display the results of the window functions.

This paper discusses the following topics:

21.1 Features of the KAD/BIT/101

Backplane power monitoring - the five KAM chassis backplane voltages are captured within 1% accuracy and provided as five different 16-bit parameters, which are updated at 1 Hz.

Thermal monitoring - two thermocouples are located on the top block and on the printed circuit board of the module. Accuracy of this standard component is 1.5% FSR (3ºC) and has a range of -55 ºC to 125 ºC.

Acquisition cycle monitoring - a 32-bit counter captures the tick length of the acquisition cycle and verifies against a stored Current Value Table.

Backplane address checksum - a 16-bit register and adder monitors the address and data lines on the backplane.

Format checking - by reading the format (0 – 14) at the beginning (reset) of the acquisition cycle, the KAD/BIT/101 verifies the format via the Current Value Table.

Power-on counter - non-volatile RAM stores the number of power resets that occur.

Time-on counter - a continuous power-on duration counter increments every five minutes.

Error reporting - when an error occurs, the error code is time-tagged and placed in a FIFO on the KAD/BIT/101. Errors can then be presented over the backplane as 16-bit parameters or be transmitted in a 20-character message over an RS-422 output stream. Available bit-rates are 9.6 kbps and 115 kbps.

Status reporting - KAD/BIT/101 monitors the status parameter of bus monitors, memory modules, and verifies that analog inputs are within programmed voltage thresholds.

Window functions - you can store up to 120 window functions on the KAD/BIT/101 for continuous monitoring. All parameters on the backplane are available for error reporting via the KAD/BIT/101. Each window function has a user-specified ID for reference in the RS-422 stream or the KAD/BIT/101 status parameter.

Errors are presented in a 16-bit parameter on the backplane, including the status of the error FIFO (empty or overwritten). These window errors can also be transmitted over an RS-422 stream.

Dedicated TTL/LED outputs - eight output pins are dedicated to driving four LEDs or four TTL discretes. The status of these outputs are reflected as 4 bits in the KAD/BIT/101 status register.

Dedicated 'Dolls Eye' indicator outputs - the four status bits can be routed to drive four BITE indicators. Appropriate voltage and 40 ms pulses are incorporated into the module.

RS422 stream outputs - 20 character stream

"$E<ERR_COUNT>,<PARAMTER-ID>,<WINDOW_FCT-ID>,<STS_OUT>, <SKIPPED><CR><LF>"

Slave chassis functionality - the KAD/BIT/101 can monitor module status parameters on a slave chassis but cannot monitor the backplane voltages in a chassis where the module is not populated.

NOTE: Each KAM/CHS/13U/D chassis has a continuous +/-12 VDC across the backplane, therefore only one KAD/BIT/101 module is needed for each KAM/CHS/13U/D chassis. The KAM/CHS/13U/B and KAM/CHS/13U/C chassis each require two KAD/BIT/101 modules to monitor the +/-12 VDC backplane voltage due to the dual +/-12 VDC power supplies.

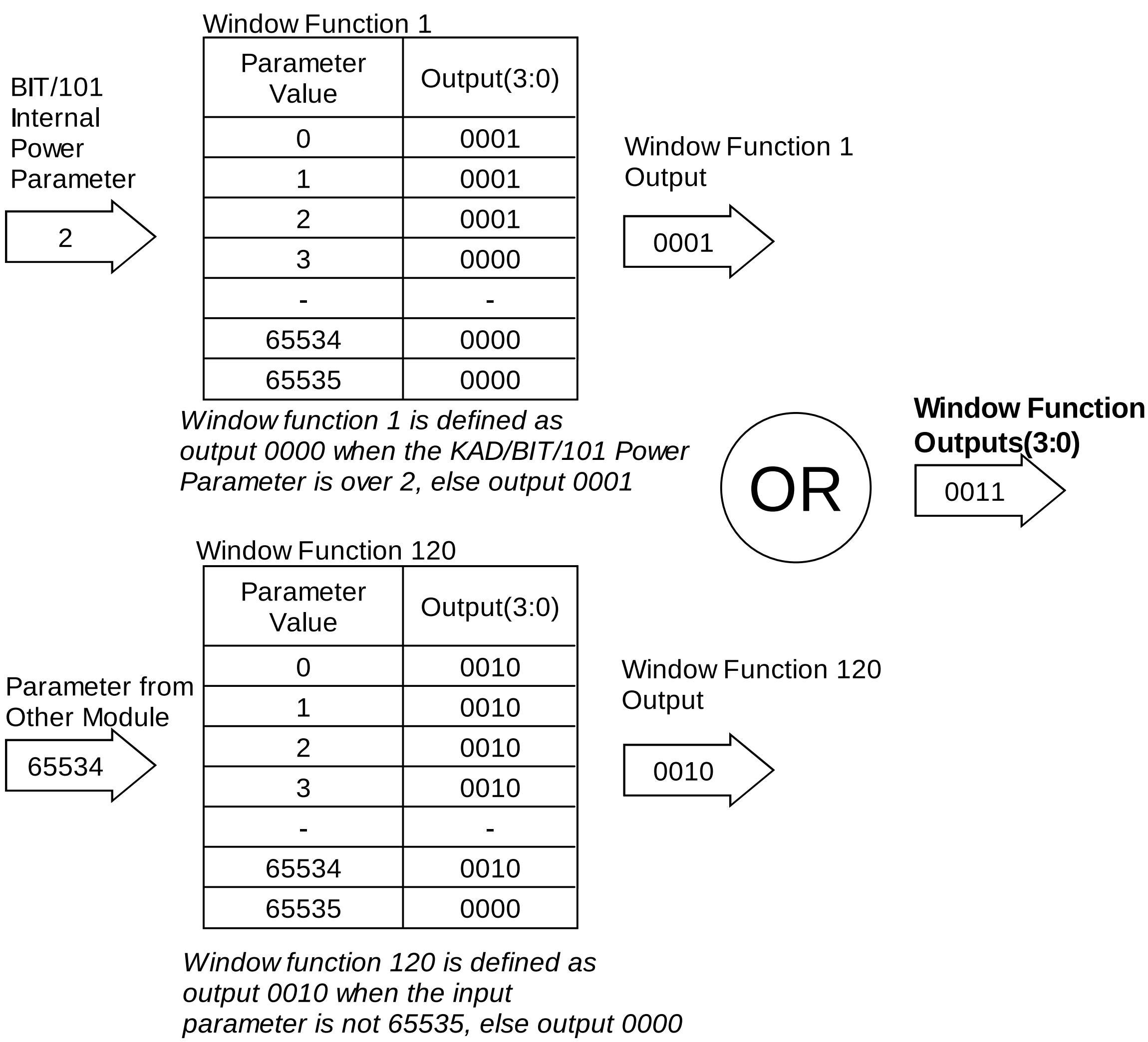
21.2 Defining window functions

Using window functions, you can monitor specific bits in any parameter available on the backplane. If thresholds or bit characteristics are met or exceeded, you can turn on an externally connected LED or 'Dolls Eye' indicator, or send a TTL pulse high, as defined in the window strategy. These voltages are supplied via the external connector on the KAD/BIT/101.

You can configure up to 120 window functions; each window function can check up to 32 parameter inputs with an output of four-bits. The outputs of all of the window functions are logically ORed together to produce a four-bit result.

The following figure shows two examples of window functions. Window Function 1 is used to check an internal power parameter of the KAD/BIT/101 and Window Function 120 is used to check a parameter from another module.

The output of window Function 1 is 0001 because the value of the input parameter is not above 2. The output of Window Function 120 is 0010 because the value of the input parameter is not equal to 65535.



Window Function 1

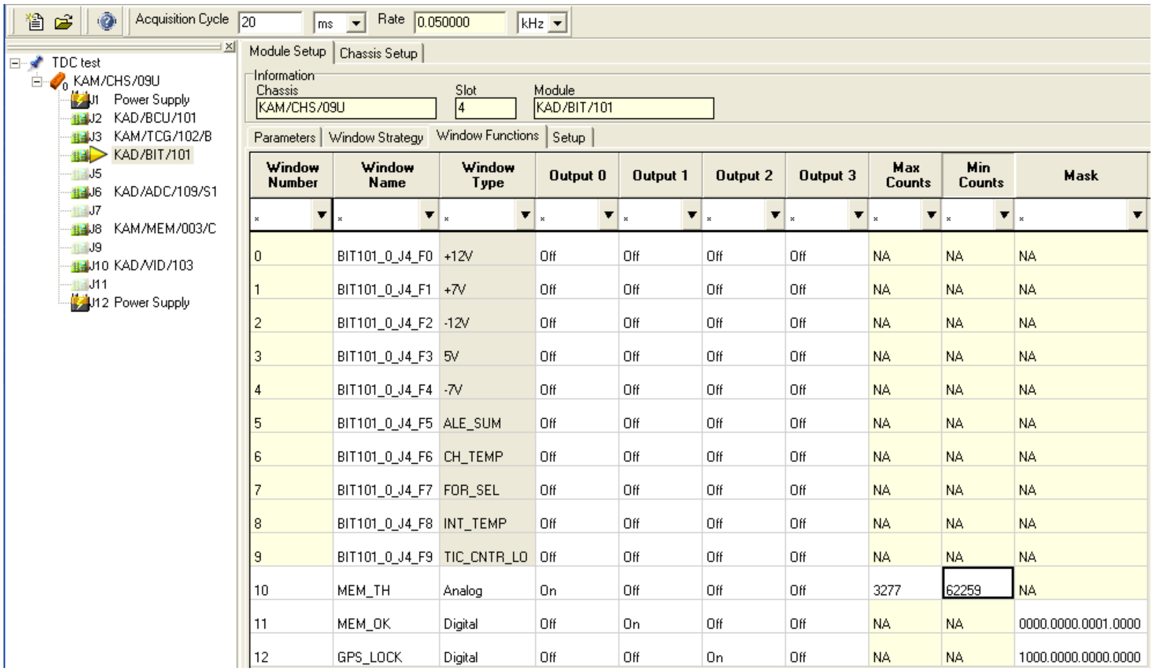
Parameter Value	Output(3:0)
0	0001
1	0001
2	0001
3	0000
-	-
65534	0000
65535	0000

Window Function 120

Parameter Value	Output(3:0)
0	0010
1	0010
2	0010
3	0010
-	-
65534	0010
65535	0000

Figure 21-1: Example of two window functions

You can define window functions on the following Window Functions tab.



Window Number	Window Name	Window Type	Output 0	Output 1	Output 2	Output 3	Max Counts	Min Counts	Mask
0	BIT101_0_J4_F0	+12V	Off	Off	Off	Off	NA	NA	NA
1	BIT101_0_J4_F1	+7V	Off	Off	Off	Off	NA	NA	NA
2	BIT101_0_J4_F2	-12V	Off	Off	Off	Off	NA	NA	NA
3	BIT101_0_J4_F3	5V	Off	Off	Off	Off	NA	NA	NA
4	BIT101_0_J4_F4	-7V	Off	Off	Off	Off	NA	NA	NA
5	BIT101_0_J4_F5	ALE_SUM	Off	Off	Off	Off	NA	NA	NA
6	BIT101_0_J4_F6	CH_TEMP	Off	Off	Off	Off	NA	NA	NA
7	BIT101_0_J4_F7	FOR_SEL	Off	Off	Off	Off	NA	NA	NA
8	BIT101_0_J4_F8	INT_TEMP	Off	Off	Off	Off	NA	NA	NA
9	BIT101_0_J4_F9	TIC_CNTR_LO	Off	Off	Off	Off	NA	NA	NA
10	MEM_TH	Analog	On	Off	Off	Off	3277	62259	NA
11	MEM_OK	Digital	Off	On	Off	Off	NA	NA	0000.0000.0001.0000
12	GPS_LOCK	Digital	Off	Off	On	Off	NA	NA	1000.0000.0000.0000

Figure 21-2: Window Functions tab

On the Window Functions tab, are default window functions for operations such as backplane power monitoring, backplane format monitoring, and measurement of internal/top block chassis temperature.

In addition to the default window functions, you can also manually define window functions. When defining window functions, you can do the following:

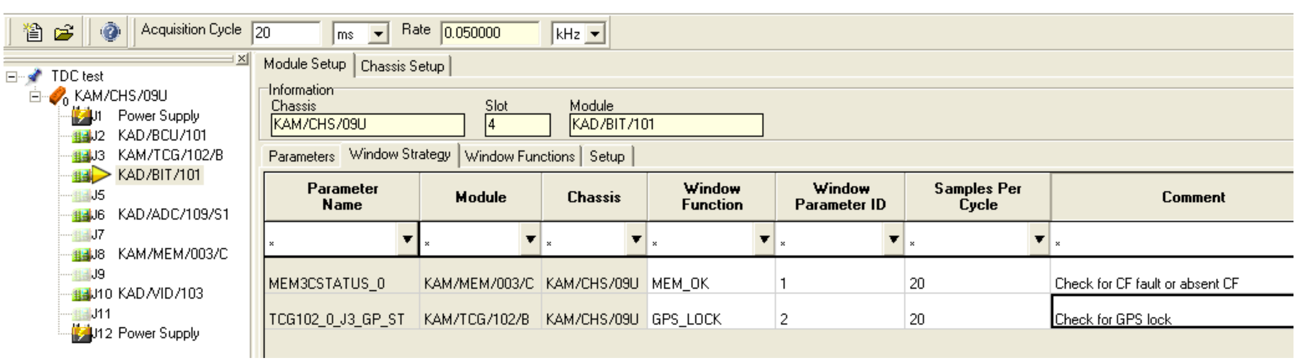
- Define types of window function
- Set specific outputs to be enabled (if the parameter determined is within the defined threshold or mask)
- Set threshold limits of an analog signal in raw counts
  (0 to 65535 for 16-bit parameters)
- Define masking strategies for digital parameters

To add a window function click **Add** at the bottom of the Window Function tab or right-click anywhere on the tab.

21.3 Defining window strategies

You can define up to 32 window strategies for a single KAD/BIT/101. You can place a single parameter in multiple window strategies and therefore use multiple window functions.

The following Window Strategy tab enables you to assign one or more parameters to a window function.



Parameter Name	Module	Chassis	Window Function	Window Parameter ID	Samples Per Cycle	Comment
MEM3CSTATUS_0	KAM/MEM/003/C	KAM/CHS/09U	MEM_OK	1	20	Check for CF fault or absent CF
TCG102_0_J3_GP_ST	KAM/TCG/102/B	KAM/CHS/09U	GPS_LOCK	2	20	Check for GPS lock

Figure 21-3: Window Strategy tab

The Window Strategy tab enables you to do the following:

- Assign parameters to window functions
- Define window functions to be assigned to specific parameters
- Define window parameter IDs
- Define the update rate per acquisition cycle
- Add comments if needed

To add a strategy, click **Add** at the bottom of the Window Strategy tab or right-click anywhere on the tab. When you click **Add**, the following Window strategy parameter selection screen displays.

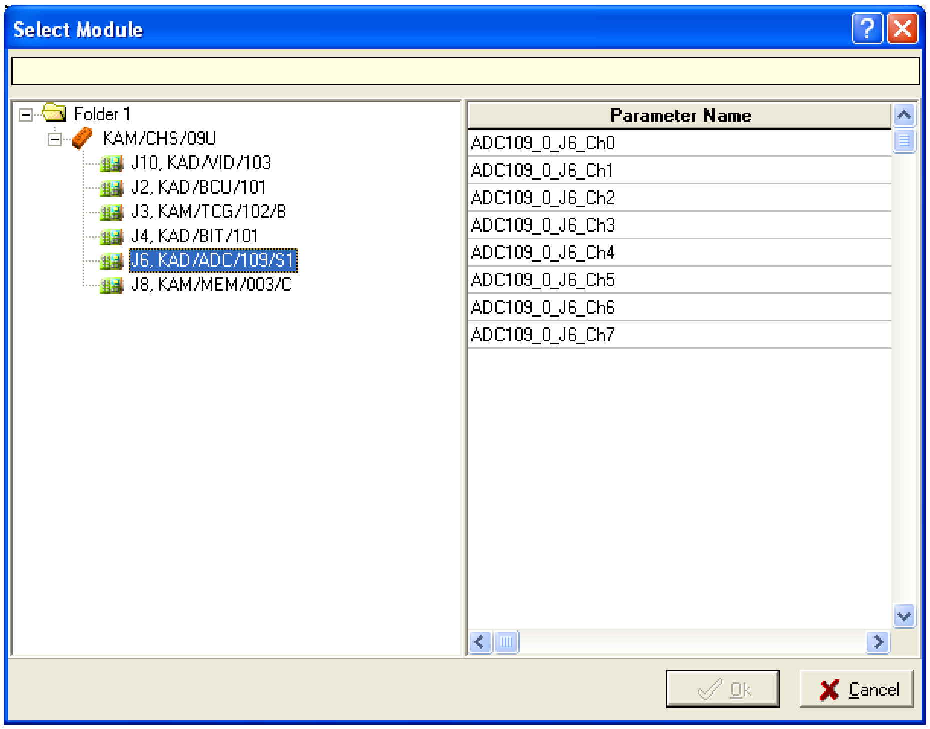


Figure 21-4: Window strategy parameter selection window

After adding a specific parameter, you can assign to it a pre-defined window function via a drop-down menu. If no window functions have been defined, the drop-down menu is empty. For information on defining window functions, see “21.2 Defining window functions” on page 2.

21.4 Configuring output channels

You can configure four output channels for the KAD/BIT/101. Each output channel can power an LED or a ‘Dolls Eye’ indicator, or trigger a TTL event.

You can configure output channels on the following Setup tab.

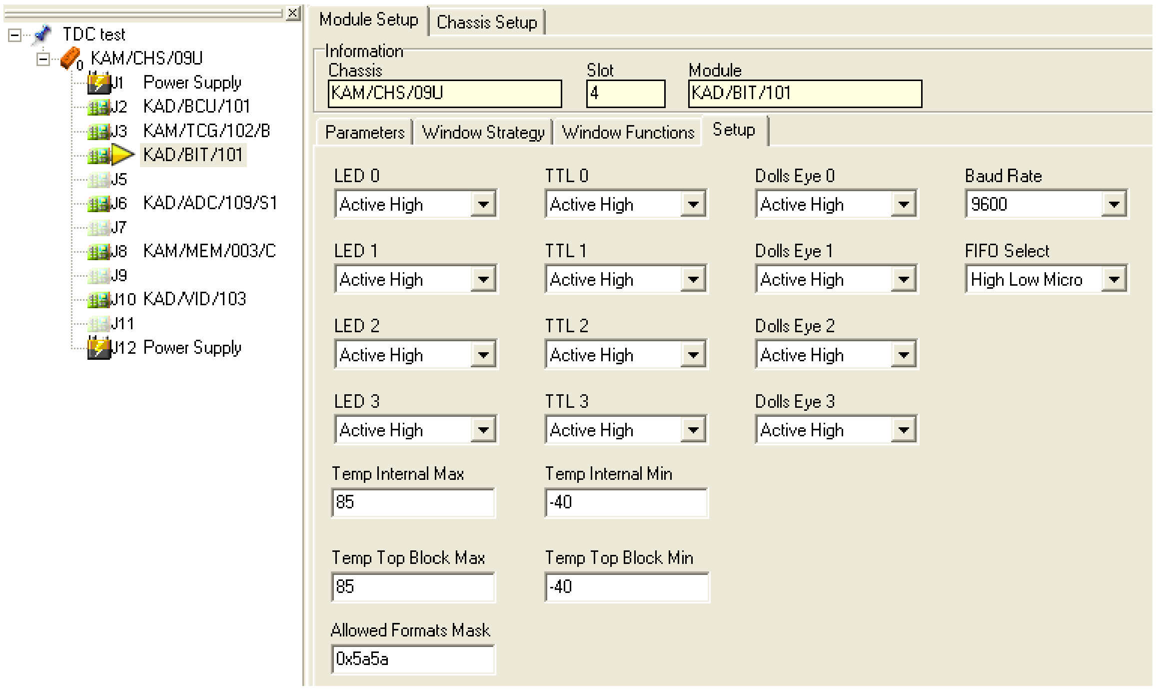


Figure 21-5: Configuration of output channels on the Setup tab

On the Setup tab you can do the following:

- Set each output channel to Active High or Low
- Set the Baud Rate for the output RS-422 error stream
- Determine the FIFO time tag
- Set the maximum and minimum temperature for the top block and chassis
- Set the allowed backplane format mask for advanced users

NOTE: When an output channel is active, as defined in the window function output column, all four output channels are active. You can define the active state on the Setup tab.

21.5 Monitoring analog thresholds

In this section, consider a basic analog input signal is being monitored which has an input voltage rage of ±10V. If the voltage exceeds ±9V, it is possible to trigger circuitry external to the Acra KAM-500. The trigger takes the form of a basic TTL (5 VDC) signal, Active High.

To generate a pulse on the KAD/BIT/101, which can be used to trigger external equipment, use an output on the module set to **high** when a certain event happens. As shown in the following figure, when the analog input voltage exceeds ±9V then Output 0 will be set to **active high**. The figure shows a window function added and named ADC_TH_9V. The first output channel is active if the thresholds are exceeded.

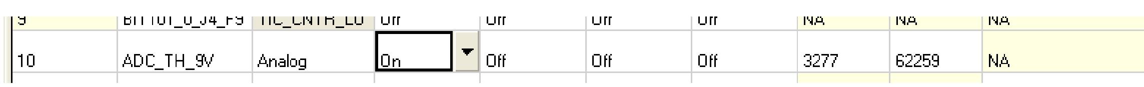


Figure 21-6: Analog window function

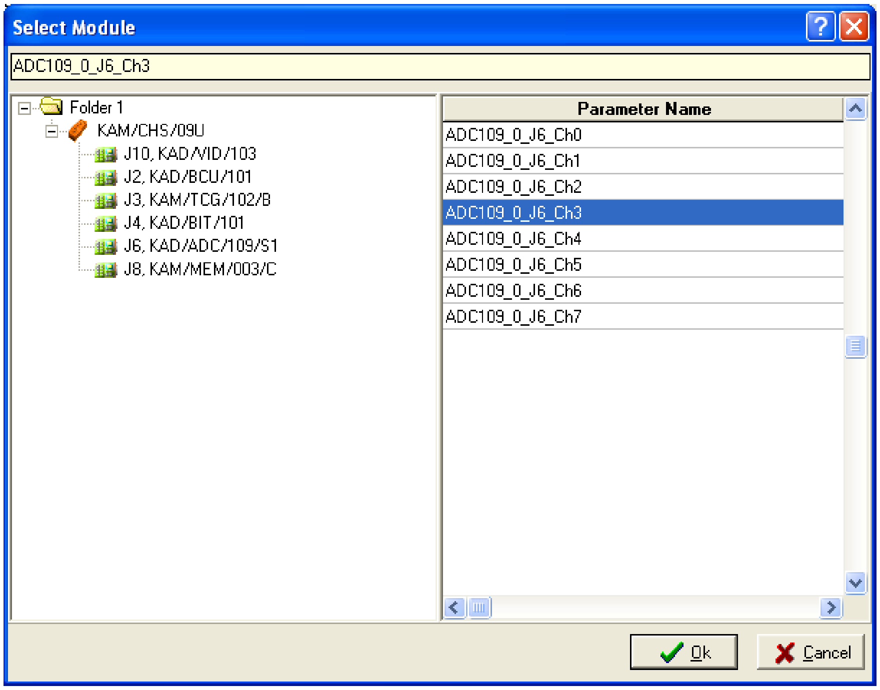
As mentioned, the threshold is ±9V over an input range of +/- 10V. This equates to a minimum count of 3277 and a maximum count of 62259.

A ±10V range equates to a 20V Full Scale Range (FSR). Therefore, 20V = 65536 counts and 0V = 32768 counts, that is, no offset.

A 1V change on the input causes a change (65536 / 20 = 3277) in counts. This implies that -9V = 0 - 9V = 32768 - 9 (3277) = 3277 and that +9V = 0 + 9V = 32768 + 9 (3277) = 62259.

To add a window strategy which monitors a threshold:

1. On the Windows Strategy tab, click **Add**.
2. Select the third channel of the ADC/109.



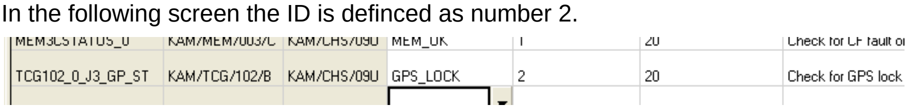
3. Assign a window function to the parameter and define an ID.
4. Save the changes.
5. Program the Acra KAM-500 chassis for the new function to take effect.

21.6 Monitoring specific register bits

You can monitor specific register bits of a module, for example the status register. Using the KAD/TCG/102 GPS receiver and clock generator as an example, if bit number 15 in this 16-bit status register is logic 1, we can power an LED external to the Acra KAM-500 to indicate the receiver has GPS lock. If GPS lock is lost, the LED turns off.

To add a window strategy which monitors a specific register bit:

1. On the Window Functions tab, click **Add**.
2. Define the window function characteristics which includes the required masking of the register (Bit 15).
3. On the Window Strategy tab, click **Add**.
4. Assign the window function added in step 1 and define an ID.
   In the following screen the ID is defınced as number 2.



5. Save the changes.
6. Program the Acra KAM-500 chassis for the new strategy to take effect.

21.7 Monitoring the fullness of a KAM/MEM/00x CompactFlash® card

The memory module sends its current status to the backplane via a 16-bit word. This status register contains vital information for monitoring and logging parameters. The following table displays the status register bits found in MEM3STATUS, as detailed in the *KAM/MEM/003* data sheet.

Table 21-1: Status register bits

Register	Bits	Bit Definition	MSB
MOD_STS	R[15:9]	Binary 0 - 7F hex indicates how full the CompactFlash card is.	R(15)
	R[8]	1 when CompactFlash card is full.	

Table 21-1: Status register bits (continued)

Register	Bits	Bit Definition	MSB
	R[7]	1 while logging	
	R[6]	1 if logging or logged at least once	
	R[5:0]	Error codes	R(5)

The Most Significant Bits (MSBs) of the status register (R[15:9] - see the previous table) indicate how full the CompactFlash is.

When the CompactFlash is empty, R[15:9] = 0000 000 = 0 Dec. = 0 hex. When the CompactFlash is full, R[15:9] = 1111 111 = 127 Dec. = 7F hex. For an intermediate range, if R[15:9] = 1001 100 = 76 dec = 4C hex.

By dividing the decimal amount of the intermediate measurement by the decimal amount when full, you can deduce the CompactFlash is about 60% full (76 dec / 127 dec = 0.598).

You can extract 16-bits from the memory module status register for a memory percentage full indicator. Once this percentage reaches a threshold, for example 90%, you can activate an output channel such as an LED.

When the memory module is logging, the last five bits are zero (0) via the error codes stated in the memory module's data sheet. The Least Significant Bits (LSBs) in this 16-bit configuration constitute an error in the percentage full count. If the 9 error code bits were all 1s, this would convert to 511 decimal. If all 16 bits were logic HI, we can calculate the error involved with the extra LSBs; 1111 1111 1111 1111= 65535 dec. The maximum error represented by this configuration is 511 / 65535 = 0.78%. Therefore the error is minimal for this application.

Example - 90% full indication

If you want to drive an LED output when the CompactFlash is 90% full, define an analog threshold as a window function and assign it to the memory module status under window strategies.

You can define the threshold depending on the desired error of the application:

For a 90% full indication, R[15:9] = 1110 010 = 114 decimal (114/127 = 89.7%), applying the full 16-bits of the MEM status register equates to a minimum count of 58368 (1110 0100 0000 0000) and a maximum count of 65535 (full count = 100%) (see the following figure).

13	MEM_90_FULL	Analog	Off	Off	Off	On	65535	58368	NA

Figure 21-7: Setup for a window strategy

In the example given on Page 7, the output channel 4 is active, and therefore the LED, if set to Active High on the Setup tab, lights when the CompactFlash is 89.7% full.

21.8 Monitoring the CompactFlash fault/full bit

As stated, the memory module provides error codes and CompactFlash fullness through its status register. R[5:0] defines the error codes for testing purposes, but generally these are all LO (0VDC) signifying that correct logging is occurring.

If required, you can monitor a specific bit from this register, for example the fault/full bit (R[4]). The following figure displays the specific window function required for this application.

11	MEM_OK	Digital	Off	On	Off	Off	NA	NA	0000.0000.0001.0000

Figure 21-8: Example of a window function

You must then define a window strategy as usual. For more information, see "21.6 Monitoring specific register bits" on page 6.

NOTE: The second output channel is enabled. Therefore when the specific bit transitions from 0 to 1, the output channel number two will be active. If required, you can define characteristics of the output channels on the Setup tab. For more information, see "21.4 Configuring output channels" on page 4.

21.9 References

See the *KAD/BIT/101* data sheet.