Cat3 Audit Trail Weigher Firmware

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# Purpose:

# To document the Cat3 implementation in the Weigher firmware.

## Overview:

NTEP defines a Category 3 device as any device that can have the configuration changed remotely. For any device to be Category 3 compliant, NTEP requires that the device records and saves these auditable events for later inspection. The Weigher firmware will record auditable events to the on board Weigher serial flash. Any recordable parameters that the Weigher is unaware of such as Class or Approval number will be stored on the System controller on board serial flash.





## Audit Events

### Weigher Calibration:

A Weigher calibration event is recorded when the Weigher configuration calibration sealable parameters change.

|  |
| --- |
| Calibration Event Sealable Parameters |
| Parameter |
| Center of Maintenance |
| Gain Factor |
| Zero Reference |
| Calibration Gain Coefficient |
| Calibration Offset Coefficient |



### Weigher Configuration:

A Weigher configuration event is recorded whenever the Weigher configuration sealable parameters change.

|  |
| --- |
| Configuration Event Sealable Parameters |
| Division Size |
| Filter Speed |
| Max Weight |
| Min Weight to Print |
| Weigher Model |



### Firmware Upgrade:

A Weigher upgrade event is recorded whenever the Weigher firmware changes from on version to the next.

## Cat3 Audit Trail

The Cat3 audit trail records are stored on the 1M bit serial flash which is resident on the Weigher peripheral.

### Serial Flash Layout:



### Serial Flash Page Layout:



### Audit Record contents: (Requirement 8.24)

  

## New Messages to support Cat3 (Requirement 8.26b)

***Request Cat3 Statistics***

Weigher will send the current state of the audit trail.

Function Code 11 WG\_CAT3\_REQ\_STATISTICS

***Cat3 Statistics***

Weigher response to the request.

Function Code 12 WG\_CAT3\_AUDIT\_STATISTICS

**WgMessageCode function\_code;**

**unsigned char pad0;**

**unsigned char totalPages; /\* Total number of Cat3 audit pages \*/**

**unsigned char totalRecordsPerPage; /\* Total number of records per page \*/**

**unsigned char currentPage; /\* Audit managers current working page \*/**

**unsigned short totalFreeRecords; /\* Total number of free records in the serial flash \*/**

**unsigned short totalRecordedEvents; /\* Total number of CAT3 events saved \*/**

**unsigned short totalCalibrationRecords; /\* Total number of saved calibration events \*/**

**unsigned short totalConfigurationRecords; /\* Total number of saved configuration events \*/**

**unsigned short gainCoefficientCounter; /\* Total number of times gain coefficent has changed \*/**

**unsigned short offsetCoefficientCounter; /\* Total number of times offset coefficent has changed \*/**

**unsigned short gainFactorCounter; /\* Total number of times gain factor has changed \*/**

**unsigned short centerOfMainCounter; /\* Total number of times center of maintenance has changed \*/**

**unsigned short zeroReferenceCounter; /\* Total number of times zero reference has changed \*/**

**unsigned short weigherModelCounter; /\* Total number of times weigher model has changed \*/**

**unsigned short minWeightPrintCounter; /\* Total number of times min weight to print has changed \*/**

**unsigned short maxWeightCounter; /\* Total number of times max weight has changed \*/**

**unsigned short filterSpeedCounter; /\* Total number of times filter speed has changed \*/**

### USB / CAN Message:

|  |  |  |  |
| --- | --- | --- | --- |
| **function\_code** | **totalPages** | **totalRecordsPerPage** | **currentPage** |

|  |  |  |  |
| --- | --- | --- | --- |
| **totalFreeRecords** | **totalRecordedEvents** | **totalCalibrationRecords** | **totalConfigurationRecords** |

|  |  |  |  |
| --- | --- | --- | --- |
| **gainCoefficientCounter** | **offsetCoefficientCounter** | **gainFactorCounter** | **centerOfMainCounter** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **zeroReferenceCounter** | **weigherModelCounter** | **minWeightPrintCounter** | **maxWeightCounter** | **filterSpeedCounter** |

***Cat3 Date Time***

System controller must set the date and time before any calibration or configuration event.

Function Code 13 WG\_CAT3\_DATE\_TIME

***Message must adhere to requirement 8.24b:***

***The date shall include month, day, and year.***

***The time shall include the hour and minutes.***

**WgMessageCode function\_code;**

**unsigned char pad0;**

**unsigned long epochTime; /\* same size as in cat3Audit.h \*/**

### USB / CAN Message:

|  |  |  |
| --- | --- | --- |
| **function\_code** | **Epoch time** |  |

**Cat3 Request Page**

System controller requests the Audit Manager read the page and send first ten audit records from the audit trail.

Function Code 14 WG\_CAT3\_REQ\_PAGE

**WgMessageCode function\_code;**

**unsigned char pad0;**

**unsigned char pageNumber; /\* 0 – 15 pages of audit trail records \*/**

**unsigned char index /\* 0 – 128 records per page \*/**

### USB / CAN Message:

|  |  |  |
| --- | --- | --- |
| **function\_code** | **page number** | **index** |

**Cat3 Read Records**

Weigher will respond to a request page message with a read records message.

Weigher will respond to a request next records message with a read records message.

Function Code 15 WG\_CAT3\_READ\_RECORDS

**WgMessageCode function\_code;**

**unsigned char pad0;**

**unsigned char pageNumber; /\* page number records read from \*/**

**unsigned char index; /\* starting record index \*/**

**unsigned char auditRecordPage[320]; /\* 0 – 9 audit records \*/**

**\*\* System controller will receive 0 - 10 audit records from the Read Page message.**

### USB / CAN Message:

|  |  |
| --- | --- |
| **function\_code** | **auditRecordPage** |



**Cat3 Req Next Records**

Function Code 16 WG\_CAT3\_REQ\_NEXT\_RECORDS

WgMessageCode function\_code;

### USB / CAN Message:

|  |  |
| --- | --- |
| **function\_code** | **auditRecordPage** |

**CAT3 Write Record**

Weigher will respond with a record status message once the record has been written to the log.

Function Code 17 WG\_CAT3\_WRITE\_RECORD

**WgMessageCode function\_code;**

**unsigned char event;**

**unsigned char parameterId;**

**unsigned long epochTime;**

**unsigned char eventType;**

**unsigned long newValue;**

**unsigned long oldValue;**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **function\_code** | **parameterId** | **epochTime** | **eventType** | **newValue** | **oldValue** |

**CAT3 Record Status**

Function Code 18 WG\_CAT3\_RECORD\_STATUS

**WgMessageCode function\_code;**

**unsigned char status;**

## Message Examples:

**Reading audit records from Weigher:**



## Audit Manager

The contents of the audit manager are stored in the serial flash at Sector 2 page 0. We save the contents of the audit manager due to requirements 8.24c, 8.24d, 8.25 keeping active counters for sealable parameters. The contents of these counters can be retrieved through the Cat3 statistics message to the system controller.



The contents of the serial flash are updated with the contents of the audit manager whenever any of the sealable parameter counters change.



## Audit Manager (requirement 8.29)

The Audit Manager records the Cat3 audit events to the audit trail log ( serial flash ) growing the trail from bottom up.

Meaning the oldest record will be in the lowest sector and page of the serial flash.

The Audit Manager will keep track of the audit trail statistics and will manage audit trail rollover in accordance with requirement 8.28a and 8.29.



Unit Test results:

Rollover:

[APCCommManager.Weigher.Message.In] WgCat3AuditStatistics

[WeigherCat3Statistics] WeigherCat3Statistics:

[WeigherCat3Statistics] Total number of audit trail pages: 16

[WeigherCat3Statistics] Total number of audit records per page: 128

[WeigherCat3Statistics] Audit Manager current working page: 0

[WeigherCat3Statistics] Total number of free audit records: 0

[WeigherCat3Statistics] Total number of recorded events: 2048

[WeigherCat3Statistics] Total number of calibration records: 1019

[WeigherCat3Statistics] Total number of configuration records 1029

[WeigherCat3Statistics] Total number of times gainCoefficient parameter has changed: 0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times centerOfMain parameter has changed:0

[WeigherCat3Statistics] Total number of times zeroReference parameter has changed:0

[WeigherCat3Statistics] Total number of times weigherModel parameter has changed:0

[WeigherCat3Statistics] Total number of times minWeightPrint parameter has changed:0

[WeigherCat3Statistics] Total number of times maxWeight parameter has changed:0

[WeigherCat3Statistics] Total number of times filterSpeed parameter has changed:0

[WeigherCat3Statistics] Total number of times divisionSize parameter has changed:0

[WeigherManager.Test] Test Message Count: 3

[WeigherManager.Test] Sending WeigherWriteCat3Record: POUNDS\_FOR\_MULTIPLIER

[WeigherCommManager.Message] WgCat3WriteRecord

[WeigherWriteCat3Record] WeigherWriteCat3Record:

[WeigherWriteCat3Record] record event: 1

[WeigherWriteCat3Record] record parameter: 14

[WeigherWriteCat3Record] record audit type: 0

[WeigherWriteCat3Record] Epoch Time: 19088743

[WeigherWriteCat3Record] record new value: 0

[WeigherWriteCat3Record] record audit previous value: 1

[WeigherManager.Test] Test Message Count: 4

[WeigherManager.Test] Sending WgCat3ReqStatistics

[WeigherCommManager.Message] WgCat3ReqStatistics

[APCCommManager.Weigher.Message.In] WgCat3RecordStatus

[WeigherManager.Message] WeigherCat3RecordStatus

[WeigherManager.Message] WeigherCat3RecordStatus: Was record saved: 1

[APCCommManager.Weigher.Message.In] WgCat3AuditStatistics

[WeigherCat3Statistics] WeigherCat3Statistics:

[WeigherCat3Statistics] Total number of audit trail pages: 16

[WeigherCat3Statistics] Total number of audit records per page: 128

[WeigherCat3Statistics] Audit Manager current working page: 0

[WeigherCat3Statistics] Total number of free audit records: 1023

[WeigherCat3Statistics] Total number of recorded events: 1025

[WeigherCat3Statistics] Total number of calibration records: 507

[WeigherCat3Statistics] Total number of configuration records 518

[WeigherCat3Statistics] Total number of times gainCoefficient parameter has changed: 0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times centerOfMain parameter has changed:0

[WeigherCat3Statistics] Total number of times zeroReference parameter has changed:0

[WeigherCat3Statistics] Total number of times weigherModel parameter has changed:0

[WeigherCat3Statistics] Total number of times minWeightPrint parameter has changed:0

[WeigherCat3Statistics] Total number of times maxWeight parameter has changed:0

[WeigherCat3Statistics] Total number of times filterSpeed parameter has changed:0

[WeigherCat3Statistics] Total number of times divisionSize parameter has changed:0

[APCCommManager.Weigher.Message.In] WgCat3RecordStatus

[WeigherManager.Message] WeigherCat3RecordStatus

[WeigherManager.Message] WeigherCat3RecordStatus: Was record saved: 1

[WeigherCommManager.Message] WgCat3ReqStatistics

[WeigherCommManager.Message] WgCat3WriteRecord

[WeigherWriteCat3Record] WeigherWriteCat3Record:

[WeigherWriteCat3Record] record event: 1

[WeigherWriteCat3Record] record parameter: 13

[WeigherWriteCat3Record] record audit type: 1

[WeigherWriteCat3Record] Epoch Time: 162254319

[WeigherWriteCat3Record] record new value: 1

[WeigherWriteCat3Record] record audit previous value: 0

[APCCommManager.Weigher.Message.In] WgWakeup

[APCCommManager.Weigher.Message.In] WgStatus

[WeigherManager.Message] WgStatus

[APCCommManager.Weigher.Message.In] WgCat3AuditStatistics

[WeigherCat3Statistics] WeigherCat3Statistics:

[WeigherCat3Statistics] Total number of audit trail pages: 16

[WeigherCat3Statistics] Total number of audit records per page: 128

[WeigherCat3Statistics] Audit Manager current working page: 0

[WeigherCat3Statistics] Total number of free audit records: 1022

[WeigherCat3Statistics] Total number of recorded events: 1026

[WeigherCat3Statistics] Total number of calibration records: 507

[WeigherCat3Statistics] Total number of configuration records 519

[WeigherCat3Statistics] Total number of times gainCoefficient parameter has changed: 0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times offsetCoefficient parameter has changed:0

[WeigherCat3Statistics] Total number of times centerOfMain parameter has changed:0