Application Note 011e

AED / FIT®

Trigger results query

I1703-1.1 en

Content

1 Application

The fast sampling rate, fast settling filters and inbuilt trigger function make both the FIT® digital load cell and the AED particularly suitable for dynamic weighing. The aim of dynamic weighing is a high throughput rate (weighing operations / minute) without loss of accuracy (low standard deviation).

With repetitive weighing, as is the case with a checkweigher, the trigger function can be used to optimize both the throughput rate and the accuracy. It is the aim of the trigger function to output just one weight value to the controller as the result of dynamic measurement. This makes it no longer necessary to transfer all the measured values (up to 600 measured values/s) over the serial interface during weighing.

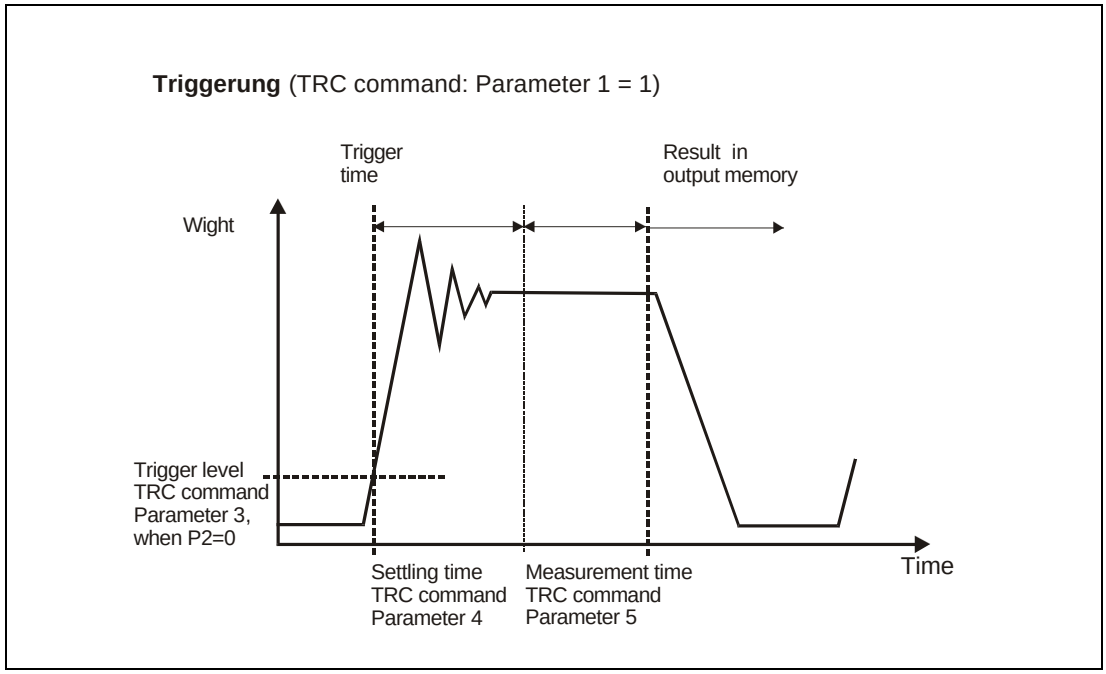

Fig. 1: Triggering principle (pre - triggering)

This application document contains notes on querying the trigger result with the '**MAV**?' command. Notes on parameterization can be found in application document 02.

Both the FIT® load cell and the AED electronics contain this trigger function.

2 Description of the trigger function

In dynamic weighing, the trigger function is able to automatically determine the weight value from the dynamic signal and store it in an output memory (**MAV**? command). This allows the controller to greatly reduce the query speed.

The AED / FIT contains four different trigger functions:

Level pre triggering with pre set level

External pre triggering via the digital input IN1

Level post triggering with a pre set level

External post triggering via the digital input IN1

In principle, level triggering or an external trigger signal can be used as the trigger event (**TRC**, par2).

A detailed description of the different trigger modes contains the application note 1.

For using the trigger function set the input mode to **IMD**1.

Figure 1 shows the basic characteristic of dynamic weighing (checkweigher).

The following are crucial to the success of the trigger measurements:

- it must be possible to repeat the measurements (the same or similar dynamic conditions = adequate settling time for different positioning of the material to be weighed on the conveyor belt).
- An adequate amount of measurement time must be available after the settling time (several values) with a small range of fluctuation. If this is not the case, it may be necessary to reduce the conveyor speed, or even the standard of accuracy to be achieved (<3000 d)

3 Reading out trigger results with the MAV? command

This section describes using the **MAV**? command to make individual queries to read out the trigger result.

A requirement of querying the trigger result is that the trigger function is set using the **TRC** command (see Description of the trigger function).

Before querying the result, you must also use the **COF** command to define the output format.

The AED basically supports three output formats which are set using the **COF** command:

- 2-byte binary output
- 4-byte binary output
- ASCII output

2-byte binary output is the fastest, but it has the disadvantage that it is not possible to transfer a measurement status. Resolution, relative to the measuring range, is max. ±30000 d plus the overflow reserve of 2765 d. For scales with 3000 d, this resolution is usually sufficient. The measuring range is defined between zero and the max. capacity of a scale (after the **LDW/LWT** adjustment, previous load already removed).

As well as the possible higher resolution, 4-byte binary output has the advantage of being able to transfer the measurement status (see **MSV**? command description) (**COF**8, **COF**12).

Because of the number of characters that need to be transferred, ASCII output is not suited to fast data output.

The remarks below relate to 4-byte binary output (**COF**8) for second generation FIT types, AD101B and AD103.

Figure 2 shows the period of time in which the trigger result is valid and ready in the output memory and can be read out with the **MAV**? command. It is obvious from this that the result does not have to be read out immediately after the measurement time.

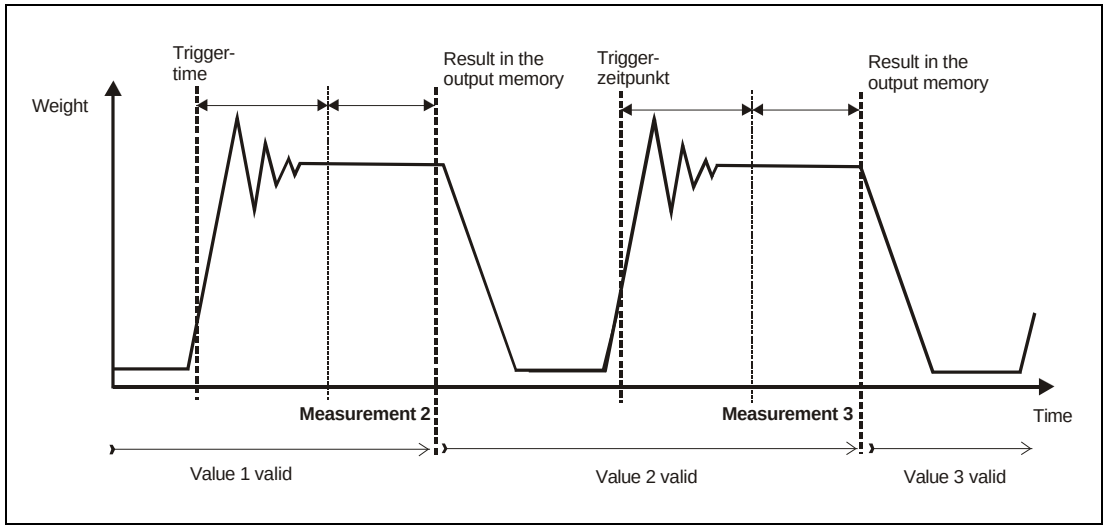

Fig. 2: Validity period of the trigger output memory

The **MAV**? command receives an overflow value in response if there is no valid trigger result available or if the result has already been read out

Example (see Figure 3). It is not necessary to evaluate the measurement status (BIT6 = trigger).

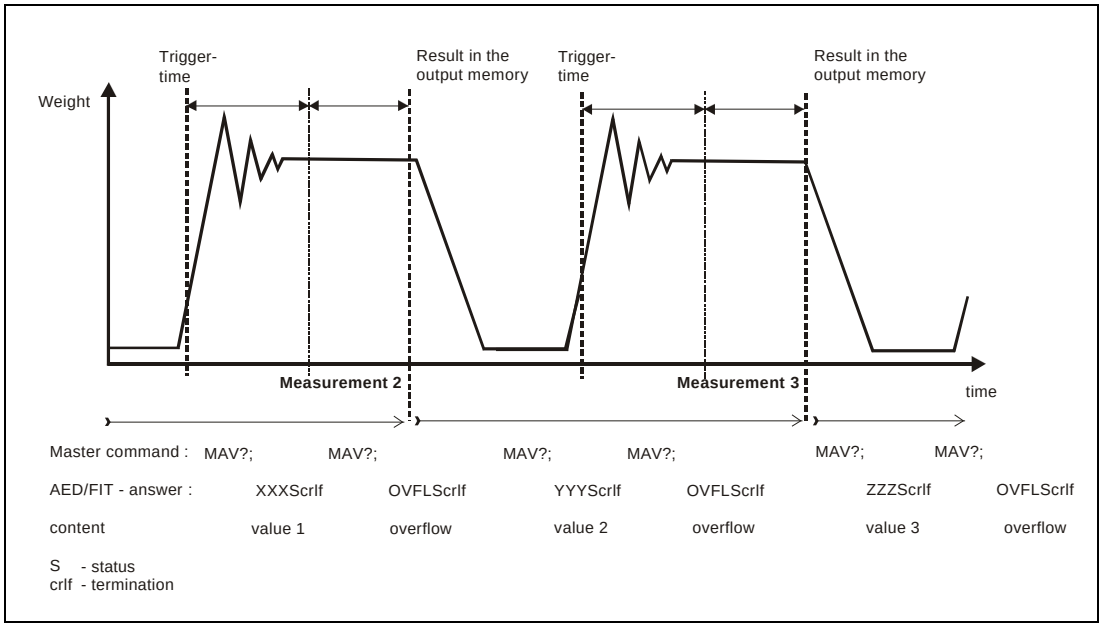

Fig. 3: Reading out trigger results with the MAV? command (Example of binary result output)

The response time to the **MAV**? command is less than 3.3 ms (regardless of **ASF** and **ICR**).

4 Querying trigger results and measurement status with the MAV? command

The remarks below relate to 4-byte binary output (**COF**8/12) for second /third generation FIT types, AD101B and AD103.

With the setting **IMD**1, the trigger event is transferred in Bit 6 in the **MAV**? command measurement status. This bit is active (= 1), when

- triggering takes place
- the settling time is running (**TRC**, Parameter 4)
- the measurement time is running (**TRC**, Parameter 5)

This Bit 6 is reset with the valid trigger result (Bit6 = 0). This allows the status of Bit 6 to be monitored by more frequent querying with the **MAV**? command.

Fig. 4 once again shows the validity of the trigger bit in the measurement status.

This trigger status is also transferred via the **MSV**? measurement command during querying (identical measurement status).

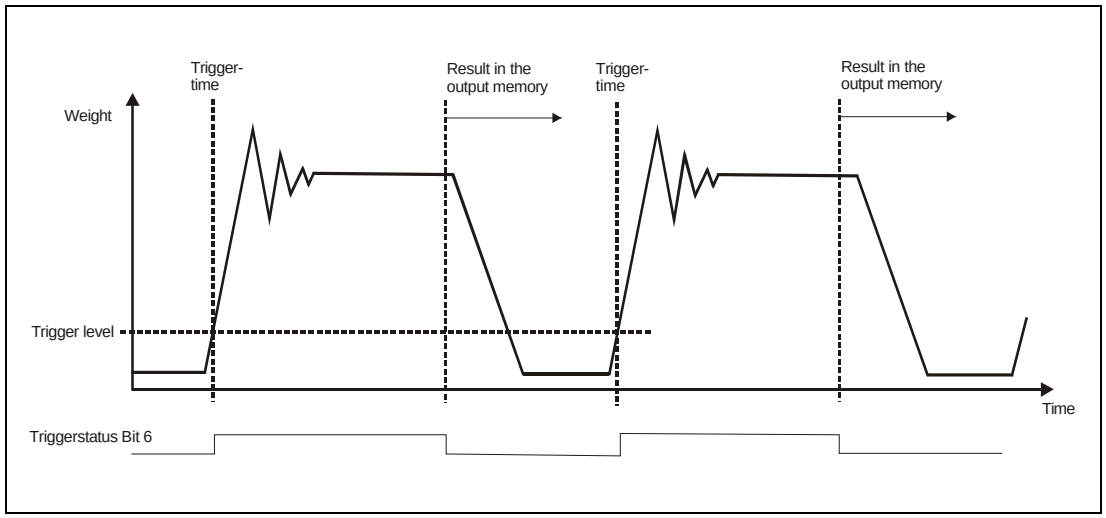

Fig. 4: Time characteristic of measurement status bit 6 (trigger status)

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5 Alternate querying of current measured value and trigger result

If the current measured value is needed as well as trigger result, querying can alternate. Both output values have the output format selected with the **COF** command.

	Com-mand	**Re-sponse**	**Com-mand**	**Re-sponse**	**Com-mand**	**Re-sponse**	
Master	**MSV**?;		**MAV?**;		**MSV**?;		...
AED / FIT		Xxxscrlf		Yyyscrlf		Zzzscrlf	

s measurement status (for COF8), crlf – end label

The response to the **MAV** command is either the overflow value (800000_{Hex}) or the trigger result. Statements made in the Querying trigger results and measurement status with the **MAV**? command section apply to s measurement status.

6 Automatic output of the trigger result

AED / FIT has the option to output the trigger result without a command query.

The following command sequences are generated for this:

TRC ; Setting the trigger function, or other parameters

COF128+i; ; Setting the automatic output format i = 0…12

; and starting automatic output

Whenever a new trigger result has been calculated, it is output without delay, without the need for an additional command. Figure 5 shows the moment of output of the trigger event.

During automatic output, it is not possible to input or output parameters or to output a current measured value (**MSV**?). Measurement status bit 6 is always 0 during output!!

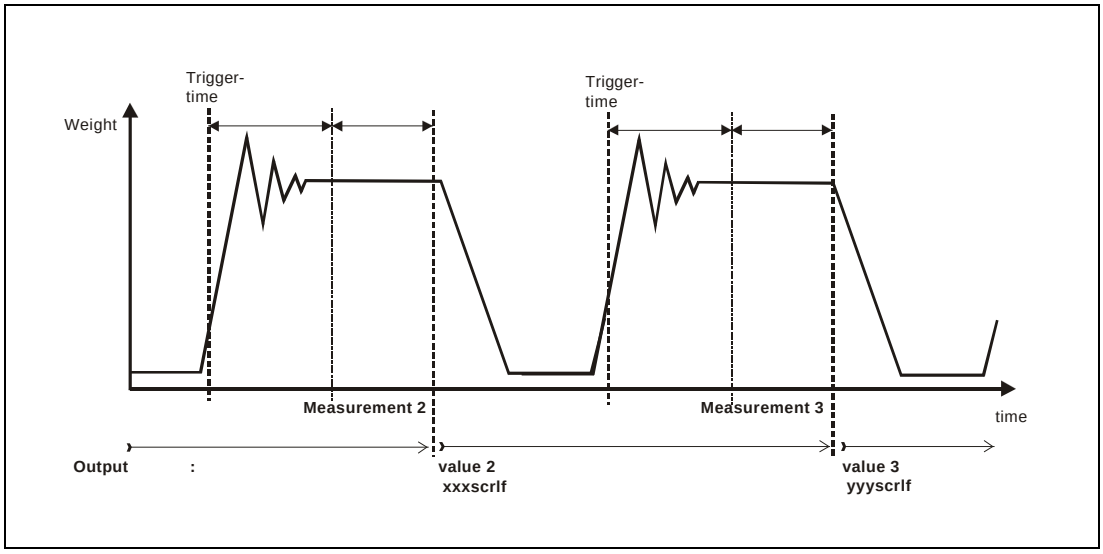

Fig. 5: automatic output of trigger results

This automatic output can only be deactivated by the STP; command.

TRC ; Setting the trigger function, or other parameters

COF128+i; ; Setting the automatic output format i = 0…12

; and starting automatic output

...

STP; ; and starting automatic output

COF8; ; Changing to single output with **COF**8, for example

; Parameterization or individual query

...

Automatic output can also be stored safe from power failure, so that as soon as the supply voltage is connected, automatic output starts.

TRC ; Setting the trigger function, or other parameters

COF128+i; ; Setting the automatic output format i = 0…12

; and starting automatic output

...

STP; ; Stopping automatic output

TDD1; ; Storing continuous output safe from power failure

7 Post-Triggering

The AD103C / FIT3 has in addition two new modes for the trigger function (see help file AED_help_e, “Description of the commands of the signal processing”).

In this case the time parameter (TRC, par4,par5) are not necessary. They are used by another meaning.

Also the measurement status for the commands MSV und MAV are extended (with the command **CSM** = 2). In this case the status bit2 = 1 contains the information that a new trigger result is available.

7.1 Level Post-Trigger

This mode of measurement is suitable for weighing procedures when the scale is unloaded between weighing operations.

The scale is not loaded. The product to be weighed is placed on the scale. When the trigger level is exceeded, the current measured values are read into a ring buffer (99 values). Measured values below the trigger level stops this process. Which means that the last 99 values are in the ring buffer. An algorithm then determines in reverse order all the measured values that fall within the set tolerance. A mean value is then calculated from these values and stored in the output memory.

The tolerance for this algorithm is set via trigger parameter 4 (**TRC**). This parameter relates to the measurement resolution set via **NOV**:

Example:

Trigger parameter 4 = 5 → +/- 5 d tolerance related to the last four values before the trigger event.

The output memory will contain an invalid value until a new mean value has been formed. The trigger result is stored in output memory until a new value has been calculated or the memory is read out. Once the measured value memory has been read out using the **MAV**? command, this memory is reset to invalid.

The number of measured values used to form the mean value is entered into the measurement time trigger parameter 5. If this parameter is set to zero than the trigger result memory contains a invalid value (= overflow value).

The current measured value must be less than the trigger level (scale is unloaded) to restart the process.

The measurement status bit 6 of the **MAV**?/**MSV**? commands can not be used, because there is no detection of the start of this algorithm. That's why there is a new status bit 2 in the extended status (**CSM** = 2) which indicates, that a new trigger result is available. This status bit 2 will be reset if the result is red by the MAV? command.

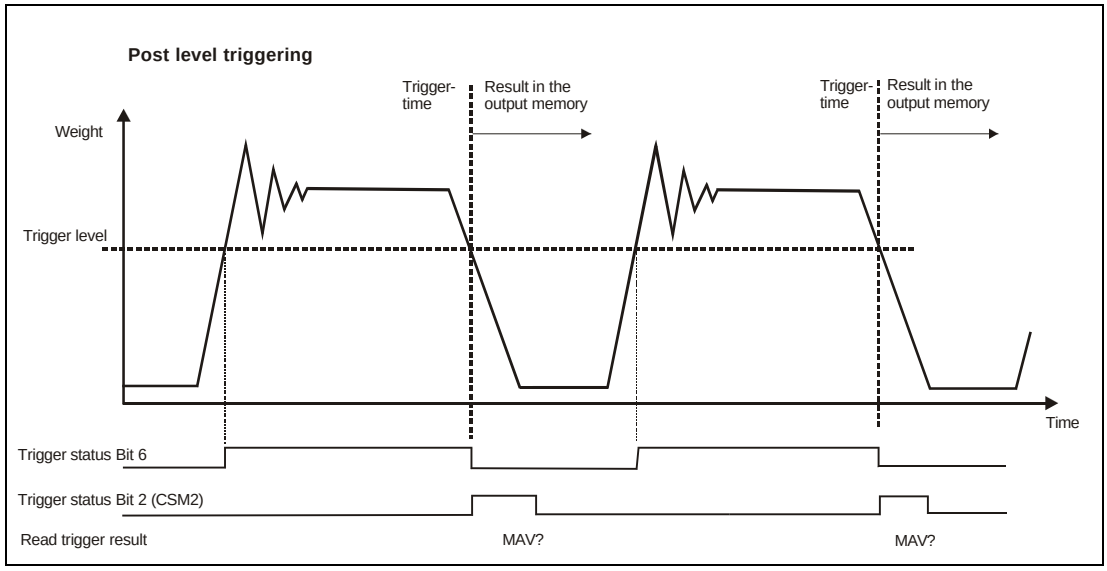

Fig. 6: level post triggering, use of status bit2

7.2 External Post-Trigger

The external trigger sensor is located at the end of the platform and detect that the weight leaves the platform.

The current measured values are read into a ring buffer (99 values). The trigger edge of external trigger input IN1 stops this process. Which means that the last 99 values are in the ring buffer. An algorithm then determines in reverse order all the measured values that fall within the set tolerance. A mean value is then calculated from these values and stored in the output memory.

The trigger parameter 3 (level value) is used as the target weight. The measured values for the mean value calculation of the trigger result have to be in the tolerance band:

(trigger par.3 – trigger par.4) $\leq$ trigger result $\leq$ (trigger par.3 + trigger par.4)

If this condition is true than the trigger result is valid and stored in the output memory. If the trigger parameter 4 is set to zero than the condition is not used.

The tolerance for this algorithm is set via trigger parameter 4 (**TRC**). This parameter relates to the measurement resolution set via **NOV**:

Example:

Trigger parameter 4 = 5 → +/- 5 d tolerance related to the last four values before the trigger event.

The output memory will contain an invalid value until a new mean value has been formed. The trigger result is stored in output memory until a new value has been calculated or the memory is read out. Once the measured value memory has been read out using the **MAV**? command, this memory is reset to invalid.

The number of measured values used to form the mean value is entered into the measurement time trigger parameter 5. If this parameter is set to zero than the trigger result memory contains a invalid value (= overflow value).

It is not necessary to unload the scale here.

The measurement status bit 6 of the **MAV**?/**MSV**? commands can not be used, because there is no detection of the start of this algorithm. That's why there is a new status bit 2 in the extended status (**CSM** = 2) which indicates, that a new trigger result is available. This status bit 2 will be reset if the result is red by the **MAV**? command.

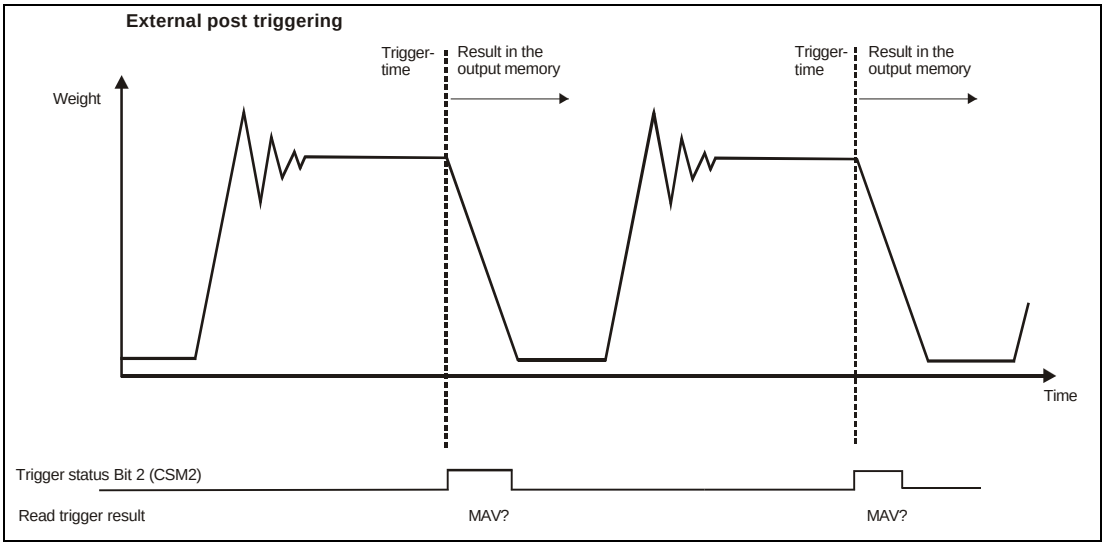

Fig. 7: Use of the measurement status bit2 (CSM2)

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