

Annex E (Measuring Functions)

Thanks to its versatility the EB200 is able to handle very diverse measuring tasks. For this it offers two measuring modes, three level detectors and a user-selectable measuring time. In the following the fields of application and the differences between the individual parameters are described.

Note:

All information refers exclusively to an IF section with DDC2 (as indicated by the version number of the DSP program in the IF section (IF DSP) > V03.00).

Detectors

In EB200 the following level detectors can be activated:

Peak value detector (PEAK)

Average value detector (AVG)

Real-time detector (FAST)

All information given below by analogy also applies to the other sensor functions:

Offset measurement is carried out using a center value detector.

All detectors are implemented in the IF section DSP, ie they are realized by way of digital signal processing.

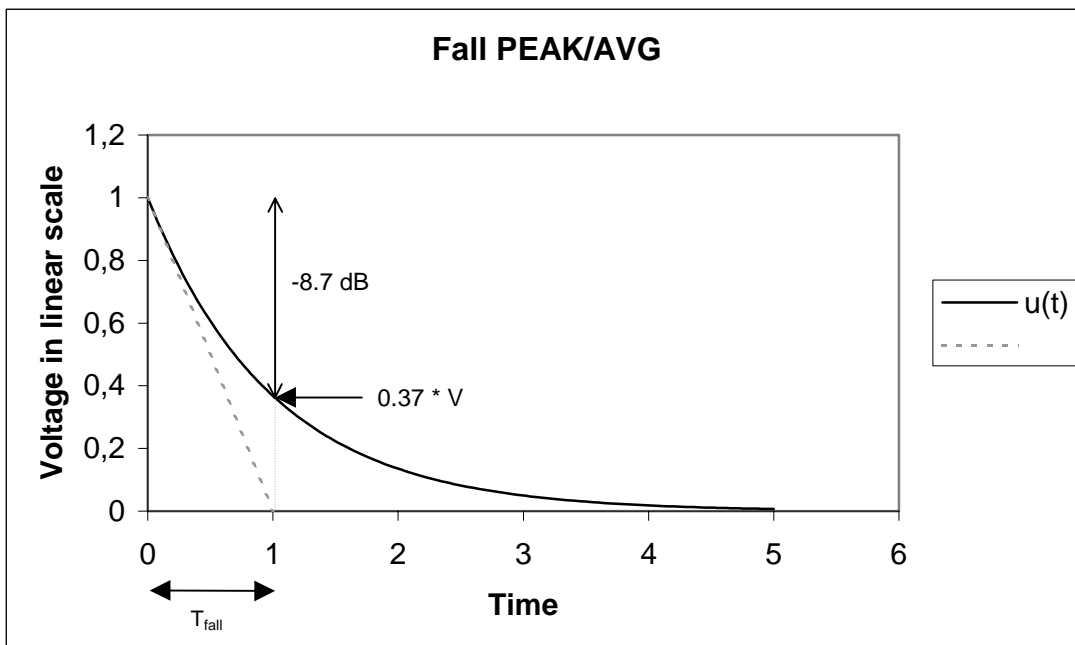
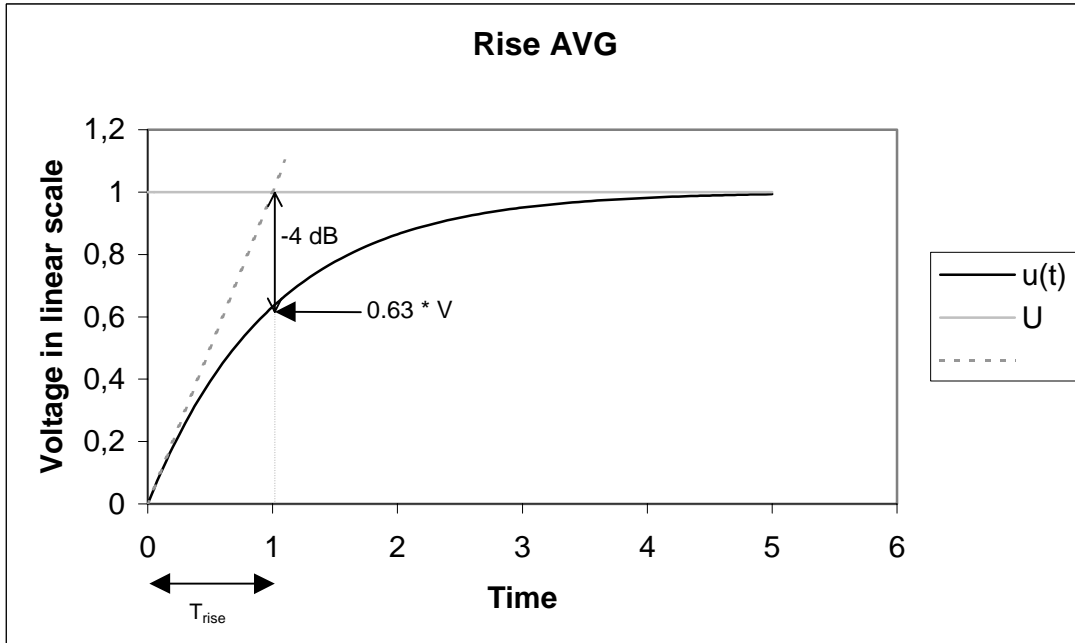
Each detector is characterized by its rise and fall constants (T_{rise} , T_{fall}). It is realized based on an exponential equation of the form:

$$V(t) = V * (1 - e^{-t/T_{\text{rise}}}) \text{ for the rise and}$$

$$V(t) = V * e^{-t/T_{\text{fall}}} \text{ for the fall.}$$

In analog technology this is equivalent to an RC section with the time constant $T = R * C$.

The FAST detector has $T_{\text{rise}} = T_{\text{fall}} = 0$. It thus follows the input voltage without any delays. The PEAK detector operates with the same rise time constant. So it also follows the input voltage when the latter increases. When it decreases, however, a distinctly longer fall time constant becomes active. With the AVG detector rise and fall time constants are identical. So the different detectors show the following step responses:



When powering up the unit for the first time and after a reset (command: *RST) the measuring time is set to DEFAULT. These predefined measuring times have been selected so that for the set bandwidth and level measurement mode normally correct measured values can be expected.

With DEFAULT measuring time, the following bandwidth-dependent rise and fall times are established with level detectors PEAK, AVG and FAST:

Bandwidth [kHz]	T _{rise} PEAK [ms]	T _{fall} PEAK [ms]	T _{rise} AVG [ms]	T _{fall} AVG [ms]	T _{rise} FAST [ms]	T _{fall} FAST [ms]
150	0	1000	3	3	0	0
120	0	1000	3	3	0	0
50	0	1000	3	3	0	0
30	0	1000	3	3	0	0
15	0	1000	3	3	0	0
9	0	1000	6	6	0	0
6	0	1000	12	12	0	0
2.4	0	1000	25	25	0	0
1.5	0	1000	50	50	0	0
0.6	0	2000	100	100	0	0
0.3	0	2000	100	100	0	0
0.15	0	2000	200	200	0	0

With the detectors for offset measurement the default settings are as follows:

Bandwidth [kHz]	T _{rise} AM offset [ms]	T _{fall} AM offset [ms]	T _{rise} FM offset [ms]	T _{fall} FM offset [ms]
150	10	10	100	100
120	10	10	100	100
50	20	20	100	100
30	20	20	100	100
15	20	20	100	100
9	50	50	100	100
6	50	50	100	100
2.4	50	50	100	100
1.5	100	100	100	100
0.6	100	100	200	200
0.3	100	100	200	200
0.15	100	100	200	200

CONTINUOUS measuring mode

In the CONTINUOUS mode, EB200 polls the current value of the level detector every 200 ms and displays it on the front panel. After entry of remote-control command `SENSe:DATA?` the last displayed value is output. That means that the detector is not explicitly queried by using `SENSe:DATA?`. This command produces a value that may be as old as 200 ms!

By means of remote-control command `INITiate:IMMediate` or `INITiate:CONM` an explicit request for querying the detector can be put forward. However, this does not clear the detectors.

When receive parameters are altered the detectors are reset (cleared), as is eg the case with each frequency change in FSCAN or MSCAN mode. The detectors then need to settle anew. In this context a new time parameter is introduced, namely the measuring time.

Measuring time

Besides the rise and fall times it is the measuring time which determines the detector's behaviour as a third parameter. The measuring time takes effect when detectors have been cleared and then need to settle anew. During the measuring time the detectors do not respond exponentially as usual but act as follows:

- PEAK detector: determines the maximum input voltage
- AVG detector: determines the linear average value of the input voltage
- FAST detector: determines the current value of the input voltage when the measuring time has elapsed

Ex works the measuring time in EB200 is set to DEFAULT. Thus it follows the bandwidth (or demodulation mode) selected:

Bandwidth [kHz]	PEAK [ms]	AVG [ms]	FAST [ms]	Offset AM / FM [ms]
150	2	3	0.3	10 / 100
120	2	3	0.3	10 / 100
50	4	3	0.3	20 / 100
30	5	3	0.3	20 / 100
15	10	3	0.3	20 / 100
9	20	6	0.6	50 / 100
6	30	12	0.6	50 / 100
2.4	60	25	2.2	50 / 100
1.5	100	50	2.2	100 / 100
0.6	200	100	9	100 / 200
0.3	400	100	18	100 / 200
0.15	500	200	18	100 / 200

The following events cause the detectors to be cleared:

- Frequency change by remote control
- Frequency change with FSCAN, MSCAN
- Change of bandwidth or demodulation mode
- Change of type of detector
- Change of attenuator
- Measuring mode PERIODIC

PERIODIC measuring mode

In PERIODIC mode the detectors are cleared in a cyclic fashion. The cycle depends on the measuring time. Whenever the measuring time is up the measured values are displayed and the detectors are cleared. The 200-ms display rate active in CONTINUOUS mode is deactivated. Remote control command `SENSe:DATA?` always calls the last measured value. When a parameter (eg frequency) is changed this value is marked as being invalid (---- in the display). In the event that MTRACE is enabled (eg by using remote-control command `TRAC:FEED:CONT MTRACE,ALW`) the measured values are automatically stored in MTRACE.

Measuring time different from DEFAULT

All information given up to this stage referred to default measuring time. Certain measuring tasks, however, require the measuring time to be user-selectable. For instance pulse-shaped signals (eg ignition sparks) can be measured exactly only if the measuring time is longer than the signal pulse duration. With the measuring time being set to a value other than DEFAULT, the detectors' rise and fall times are also determined by this measuring time. In addition, the user-selectable measuring time does not depend on other parameters (eg bandwidth, demodulation mode).

All other information concerning step response, CONTINUOUS or PERIODIC mode continues to apply.

T_{rise} PEAK	0 ms
T_{fall} PEAK	Set measuring time
T_{rise} AVG	Set measuring time
T_{fall} AVG	Set measuring time
T_{rise} FAST	0 ms
T_{fall} FAST	0 ms
T_{rise} offset	Set measuring time
T_{fall} offset	Set measuring time