# Chapter 4:
# SUPERVISION FUNCTIONS

*Contents*

*Figures*

*Tables*

# 4. SUPERVISION FUNCTIONS

## 4.1 INTRODUCTION

### 4.1.1 Scope

For an overview of the whole document (all chapters), see the introduction [Chapter 1].

This chapter specifies the following functions for the ATC2-STM:

–   **Train data**. Which train data there is, and how train data is input to the on-board system.

–   **Travel direction states.**

–   **STM states**. Which states the STM can operate in, how the STM supervision and the STM indications work, and the conditions for transitions between the different states.

–   **Shunting.** How shunting is started, supervised and finished.

–   **Area types**. Which area types the STM can be in, how the STM supervision and the STM indications work, and the conditions for transitions between the different area types.

–   **Braking curves.** How the STM handles braking curves and supervises deceleration at different types of restrictions.

–   **Speed restrictions.** The meaning of fully equipped and semi-equipped speed restrictions, and how the different speed restriction categories are handled.

–   **Indications.** What the indications on the DMI can sound and look like.


For general information as document understanding, abbreviations, definitions etc: see the introduction [Chapter 1].

(blank page)

## 4.2    HANDLING OF TRAIN DATA

### 4.2.1    General

There are three different types of STM train parameters as described below.

Configuration parameters, retrieved from a piece of computer memory[1] containing system information, or from the ETCS:

– DMI reaction time from STM to DMI[2] ($T_{DMI}$)

– Brake feedback (how the STM reads brake pressure).

– EP brake exists (EPX).

– EP brake delay time (EPT).

– ETCS emergency brake reaction time ($T_{EBRE}$).

Entered parameters, entered or confirmed by the driver via the DMI panel (during the ETCS or the STM specific data entry procedure):

– STM Max Speed ($V_{STM}$)

– Exceed level (K1)

– Train dependent code (PT) [a]

– Brake position (BG) [a]

– Brake percentage (BP or "λ") . See also [5.7]

– EP brake active (EPA).

Computed parameters, which are calculated by the STM with help by the configured or entered parameters:

– Exceed level K2

– Full service brake deceleration

– Full service brake application delay time.

– ETCS emergency brake check time, $T_{ETCS\text{-}EBCHK} = T_{EBRE} + T_{EBCHK}$ (s) [5.3.6]. The total time from giving the brake order to achieving a pressure reduction of 60 kPa.

a) Can also be configured

---

1 Loco identifier

2 Possible values 1.0-1.5 s (probably)

General ETCS + STM data input procedure: 1) The driver requests train data input, 2) The ETCS handles ETCS train data input, 3) The STM requests STM train data input to the ETCS, 4) the ETCS handles STM data input from the driver and informs the STM, and 5) the STM accepts or rejects these data. [ESTM − 13, Specific STM Data Entry/Data View]

Refer also to the relevant ETCS train data packets [ESTMA − 7.2.12-13] and to the STM Data Entry state [4.3.5].

### 4.2.1.1    ETCS train data

Procedure for entering of ETCS train data: refer to [ESRS − 3.18.3, 5.17].

For every ETCS parameter which is associated with a corresponding STM parameter: if one parameter is changed, the other must be changed too. Example: PT code.

F4001.        The STM shall receive and use the following valid ETCS parameters or settings.

a)  ETCS max speed parameter ($V_{ETCS}$)

b)  Train length parameter in m

c)  Axle load parameter in 0,5 ton steps

d)  Adhesion setting, high/low (button HALKA off/on)[3]

e)  ETCS emergency brake reaction time ($T_{EBRE}$). The time it takes for an STM emergency order to reach the ETCS emergency brake.

f)  Reserve.

g)  Reserve.

h)  Reserve.

*Note.* Reserve.

Refer to [ESRS − 3.18.3] and [ESTMA − 7.2.12, 7.2.13].

### 4.2.1.2    STM train data

For every STM parameter which is associated with a corresponding ETCS parameter: the driver must ensure that if one parameter is changed, the other must be changed too. Example: PT code.

Some of the default values are available as configuration parameters. They are set as normal values for the train in question. The driver of an EMU for example, will not have to change all values at every startup with a normal train.

---

3 Not entered as ETCS *train data*. This is an ETCS button with Swedish text

The driver does only have to confirm EP brake active (EPA) if the configuration says that the train is equipped with an EP brake system. The STM configuration can also tell whether the PT code or brake position parameters must be entered manually.

The STM accepts an entered brake percentage within the range 30...250 %, but will automatically restrict the maximum value to 170 % for brake group R/P and to 99% for brake group G. This handles the case when the ETCS just sends its own brake percentage to the STM, without asking the driver during the STM data entry.

F4002.      STM train data according to the following table shall be used in the states Data Available and Hot Standby.[4]

---

4 Differs from [ATC2]

*Table 4.2-1. STM Train Parameters*

| | STM train parameters | Acceptable range | Default Value | *Entered manually* | *Origin* | Note. Comment |
|---|---|---|---|---|---|---|
| | **Configuration** | | | | | |
| a) | Brake feedback ($P_{FULL}$) | Main pipe or Cylinder pressure | NA | Never | P | 7) |
| b) | DMI reaction time ($T_{DMI}$ in s) | NA | NA | Never | P | 7) |
| c1) | EP brake exists (EPX) | On / Off | NA | Never | P | 7) |
| c2) | EP brake delay time (EPT) | 4...18 s | NA | Never | P | 7) |
| c3) | ETCS emergency brake reaction time ($T_{EBRE}$) | NA | NA | Never | ETCS | 7) |
| c4) | Other installation characteristics as needed | NA | NA | Never | P | 7) 9) |
| | **Data Entry or Config.** | | | | | |
| d) | STM Max Speed ($V_{STM}$ in km/h) | 0...270 in steps of ≤ 5 | Configured | Always | E | 2) 3) |
| e) | Exceed level K1 (K1 in %) | 0...45 in steps of ≤ 5 | Configured | Always | E | 2) 5) |
| f) | PT code (PT) | 222...999 | 298 1) | Configuration decides | P / E | 2) 7) 8) 10) |
| g) | Brake percentage (BP or "λ" in %) | 30...250 in steps of 1 (maximized to 170 for BG = P/R and to 99 for BG = G by the STM) | Configured | Always | E | |
| h) | Brake position (group) (BG) | G, P or R | Configured | Configuration decides | P / E | 10) |
| i) | EP brake active (EPA) | On / Off | On | Configuration decides (EPX) | E | 10) |
| | **Computed** | | | | | |
| j) | Full service brake deceleration ($B_F$ in m/s$^2$) | Depends on BP [4.2.4] | NA | Never | C | 6) |
| k) | Full service brake application delay time ($T_B$ in s) | Depends on train length or EPT [4.2.4] | NA | Never | C / P | 6) |
| l) | Exceed level K2 (K2 in %) | Depends on K1 [4.2.4] | 0 | Never | C | 6) |
| m) | ETCS emergency brake check time $T_{ETCS-EBCHK} = T_{EBRE} + T_{EBCHK}$ (s) | Depends on $T_{EBRE}$ and $T_{EBCHK}$ | NA | Never | C | 7) |

1) These rules shall apply regardless of present PT configuration (also if "Not entered manually").

    a) The default value shall be adjusted according to the ETCS axle load parameter.[Table PT.3].

    b) If the default value becomes ≠ 298, the PT code shall always be entered manually.

    *Note*. If the configuration says "Not entered manually" in this case, there could be something wrong.

*Note.*

2) Entered by the driver during STM train data input.

3) Track and train dependent speed limit (depends on block lengths and braking ability)

4) Reserve.

5) Default value can be changed according to the ETCS train category variable NC_TRAIN.

6) Computed by the STM according to received train parameters.

7) Installation dependent

8) Range: corresponding octal values = 000...777.

9) E.g. if the STM has own antenna and/or own emergency brake output.

10) Refer to [Table CP].for more information

*Abbreviations:*

P    CONFIG. PARAMETER – Can be received as a configuration parameter

E    STM DATA ENTRY – Can be received during STM-specific data entry

C    COMPUTED

NA    Not Applicable

[Refer also to Table CP]


*Note.* The ETCS displays train data upon driver request, regardless of which STM state it is at present.

*Note.* The exceed levels (speed increase levels) refers to the possibility of certain trains to exceed speed restrictions of categories K1 and K2, curve dependent speed restrictions.


F4002A.    a)  Reserve.

        1.  Reserve.

        2.  Reserve.

        3.  Reserve.

        4.  Reserve.

    b)  Reserve.

    c)  Reserve.

    d)  Reserve.

F4003.    **K1:** Exceeding of the basic speed restriction from a balise group shall be permitted by the percentage parameter, and the result shall be rounded down to nearest 5 km/h:

$$V_{HT-K1} = V_{HT-K1-BASIC} + K1 \bullet V_{HT-K1-BASIC}/100 \quad (km/h).$$

F4004.    **K2:** The basic speed restriction shall be exceeded by 50 % of the value set by K1, and the result shall be rounded down to the nearest 5 km/h:[5]

$$V_{HT-K2} = V_{HT-K2-BASIC} + 0.5 \bullet K1 \bullet V_{HT-K2-BASIC}/100 \quad (km/h).$$

F4005.    a)  All changes in the train parameters shall take effect immediately.[6]

       1.  Exceptions: a changed brake percentage or adhesion parameter shall not affect an active braking curve.

       *Note*. Otherwise this may cause unwanted STM brake intervention.

       *Note.* A changed delay time $T_B$ may affect active braking curves [4.2.2.1].

    b)  The STM Max Speed shall be increased without train length delay.

F4005A.   a)  The valid train parameters [Table 4.2-1] shall be used by the STM in the Hot Standby (HS) and Data Available (DA) states.

    b)  The STM shall keep its valid train parameters during periods in the Cold Standby (CS) state (while the ETCS or another STM is in charge).

    c)  Reserve.

*Note.* Refer to [ESRS §4..5, Table 4.10.1.3] for more information.

## 4.2.2    Entering STM train data

### 4.2.2.1    Procedure

The general ETCS train data input procedure is initiated by ETCS during the Start of Mission procedure, but can also be initiated at other occasions as long as the train is stationary.

F4006.    a)  STM train data input shall be requested to ETCS by the STM during the Start of Mission procedure, before the train is permitted to start running.

    *Note.* The STM must first send an "STM data need" in state PO, and after that a "Specific STM data entry request" [ESTM].

---

5 Differs from [ATC2]
6 Differs from [ATC2]

b) In this request, driver interaction shall be requested for these parameters: PT code, brake position and EP brake active.

   1. Exception: The configuration for every train parameter decides whether the driver shall be asked or not.

c) Driver interaction shall always be requested for these parameters: STM max speed, K1 exceed level and brake percentage.

[ESTM –13.1.1.2.5]

*Note.* There may be cases when the ETCS is able to provide the requested STM parameters without driver input. For those parameters, the ETCS can send the values to the STM in the same way as if they really were entered by the driver. Examples: Brake position or brake percentage.

F4007.    a) When STM data entry has been requested, the STM shall display the currently valid parameter value and wait for driver input and/or acknowledgement of every train parameter.

   *Note.* This may occur during startup (Data Entry state), or in the Cold Standby, Hot Standby or Data Available states. [4.3]

Exceptions:

b) If there is configured information for a certain train parameter[7], this information shall decide whether the driver shall be asked or not.[8]

c) Parameters received from the ETCS shall not be entered by the driver.

d) The default parameters values shall be indicated after Start of Mission.

F4008.    It shall be possible:

a) To input any of the STM train data parameters at any time while the train is still-standing.

   *Note.* The ETCS parameters can also be changed while still-standing. Entering of train data while the train is stationary is handled via the normal ETCS train data entry procedure.

b) To input the parameters STM max speed, K1 exceed level and EP brake active (EPA) at any time while the train is running or still-standing.

   *Note.* No EP parameters are exchanged between the ETCS and the STM.

   *Note.* A changed EPA affects the brake delay time parameter $T_B$, which in its turn affects any active braking curve immediately.

---

7 Reserve.

8 Reserve.

c) To adjust the brake percentage parameter after a deceleration measurement, while the train is running or still-standing.

*Note.* For more details, refer to [5.7].

*Note.* Consequences for the train data button (TÅGDATA):

– The ETCS version of this button is available while the train is stationary.

– The STM version of this button is available while the train is runnning or stationary.

F4009.  a) ETCS shall be informed of which STM train data that must be entered by the driver.

b) The STM shall then receive the entered train data values from the ETCS.

### 4.2.2.2  Train data acceptance conditions, when entered by the driver

F4010.  STM train parameters that have been entered by the driver shall only be accepted:

a) If the entered values are reasonable according to [Table 4.2-1], and

b) If the entered values have been acknowledged by the driver.

F4011.  a) STM train data shall be accepted or rejected by the STM.

b) The data entry procedure shall not be finished until all STM train data have been accepted.

*Note.* ETCS train data are checked by the ETCS.

### 4.2.2.3  Indication

F4011A.  The following parameters shall be indicated upon a request from the driver.

a) STM max speed.

b) K1 exceed level.

c) PT code, unless configured for this train (impossible to change).

d) BG, brake position/group, unless configured for this train (impossible to change).

e) BP, brake percentage.

f) $BP_O$, the original STM brake percentage (received during the latest train data entry procedure).

g) EPA, EP brake active, but only if the EP brake exists.

*Note.* These can also be changed by the driver.

## 4.2.3    PT code - special train characteristics

### 4.2.3.1    General

A special balise for train characteristics, the prefix balise, contains 9 useable information bits, $i_{TRACK1}...i_{TRACK9}$, that state the track characteristics to which each PT speed restriction applies. The information bits correspond to 9 bits in the STM equipment, $i_{TRAIN1}...i_{TRAIN9}$.

F4012.    The STM equipment shall only react to those category PT board balise groups, where one or more $i_{TRACK}$ bit/s are zero, and the corresponding $i_{TRAIN}$ bit/s are also zero. Should these conditions be met then the board (balise group) will apply to that train.

*Note.* The absence of matching zeroes indicate that the PT board does not apply to the train in question.

### 4.2.3.2    Entered PT code

F4013.    Entering of special PT train characteristics shall be handled in connection with the normal STM train data input procedure.

*Note.* Examples:

– "Normal train": The driver inputs the value 298 (octal value 076). The STM on this train will ignore all restrictions for high axle loads.

– "Special train": The entry of a special PT code may require that the driver sets the PT code to a value as shown in [Table PT.4].

#### 4.2.3.2.1    Translation of PT code

F4014.    The bit pattern shall be input with help of the entered digits according to the table below, and shall be defined as follows.

a)    The input decimal digit values 2 to 9, minus 2, shall be used as the octal digits 0 to 7.

*Note.* Each octal digit provides three bits.

b)    The entered PT code shall not be accepted if any of the digits should be set to 0 or 1. [Table PT.1]

*Note.* The decimal values 0 and 1 must not be entered.

*Table 4.2-2. PT bits.*

| Left digit | | | Middle digit | | | Right digit | | |
|---|---|---|---|---|---|---|---|---|
| i9 | I8 | i7 | i6 | i5 | i4 | I3 | i2 | i1 |

*Note.* Example: The entered decimal value is "298" which makes the octal code for this train, "076".

### 4.2.3.3    Computed PT code

The driver enters the train characteristics (axle load etc) during the normal ETCS train data input procedure [ESTMA – 7.2.12].

F4014A.    ETCS train data according to [Table PT.3] shall be used by the STM in order to produce a computed PT code. See also [ESTMA – 8.1.40].

*Note.* Train categories and loading gauges (profiles) may be used in future STM versions.

### 4.2.3.4    Valid PT code

F4014B.    The STM shall select the most restrictive PT code (for every bit) from the computed and entered PT codes:[9]

$$PT_{VALID} = PT_{COMPUTED} \text{ \underline{and} } PT_{ENTERED}$$

*Note.* The computed PT code must be saved in case the driver wishes to input another PT code later on during the mission.

Refer to [Table PT.4].

## 4.2.4    Brake capacity of the train

Brake percentage

F4014C.    a)  If the STM receives brake percentage information from the ETCS: The STM shall set $\lambda_{STM} = \lambda_{ETCS}$.

*Note.* Otherwise, $\lambda_{STM}$ must be entered by the driver as an STM parameter.

b)  The STM shall use $\lambda_{STM}$ when calculating the full service brake deceleration (see below).

Full service brake delay time

F4014D.    a)  The full service brake delay time $T_B$ for brake position P/R without EP brake shall be calculated in the following way.[10]

$$T_B = 1.0 \cdot 10^{-5} \cdot D_{TRAIN}^2 + 0.0049 \cdot D_{TRAIN} + 4.58 \quad (s),$$

b)  For brake position P/R with active EP brake:

1.  The configured EP delay time shall be used ($T_B = EPT_{CONFIG}$).

---

9 Differs from [ATC2]

10 Differs from [ATC2]

c)  The delay time for brake position G shall be calculated as:

$$T_B = 2.2 \cdot 10^{-5} \cdot D_{TRAIN}^2 - 0.01 \cdot D_{TRAIN} + 16.95 \ \ (s)$$

d)  The following shall apply for a) and c) :

1.  $D_{TRAIN}$ is the train length in m.[11]

2.  $T_B$ is the delay time parameter in seconds. Accuracy $\leq 0.1$ s. The range of $T_B$ shall be at least 1...60 s.

    *Note.* It is allowed to limit larger values to 60 seconds, but not less.

<u>Full service brake deceleration</u>

*Note.* This is the relation between brake percentage and train deceleration in Sweden and Norway:

−   Brake position P/R:   $\lambda = -14.05 + 146.90 \cdot B_F$   (%)

−   Brake position G:   $\lambda = -26.10 + 165.20 \cdot B_F$   (%)

F4014E.   The full service brake deceleration parameter for brake position P/R shall be calculated as:[12]

$$B_F = \frac{(\lambda + 14.05)}{146.90} \ (m/s^2),^{13}$$

 where

−   $B_F$ = Full service brake deceleration parameter $(m/s^2)$. Rounded down to the nearest 0,01 $m/s^2$.

−   $\lambda$ = Brake percentage parameter (%) between 30 and 170. Higher values are handled as 170.

*Note.* Refer to [Table BP].

F4014F.   The full service brake deceleration parameter for brake position G shall be calculated as:

---

11 Max used train length for P/R brake position is 730 m  (Swe. 2006).

12 Differs from [ATC2]

13 Reserve.

$$B_F = \frac{(\lambda + 26.10)}{165.20} \ (m/s^2) \ ^{14}$$

where

$B_F =$ Full service brake deceleration parameter $(m/s^2)$. Rounded down to the nearest 0,01 m/s2.

$\lambda$ = the Brake percentage parameter (%) between 30 and 99. Higher values are handled as 99.

[Table BPG].

---

14 Reserve.

## 4.3    STM STATES

### 4.3.1    General

The STM equipment can work in eight different STM states, which affect the functioning of the system. This section deals with the various states; how the supervision is carried out and how the transitions between the various states takes place.[15]

Cab de-activation passivates the STM but does not affect the STM state machine, refer to [4.3.13].

The STM state machine – with the states Power On, Configuration, Data Entry (can also be used as a sub-state), Cold Standby, Hot Standby, Data available, Failure and No Power  is functioning in both an activated or de-activated cab.[16]

The STM shunting [4.3.9] modes are sub-states to the active STM state Data available [4.3.8].

In Data Available, there are also further subordinate states relating to the direction of travel: Forward and Reverse [4.3.12].


F4015.    When active (not in standby), the STM shall function, and communicate with the ETCS, in a way that corresponds to the ETCS mode STM National, SN [ESRS 2.6.4, ESTMA]

*Note.* The STM informs the ETCS about present STM state, after every change of state.

*Note.* When the STM decides that it is time to change state, this is requested to the ETCS. The STM will then wait for an ETCS state transition order. Exceptions: transitions to Power On, No Power and Failure state are made with or without ETCS order.

[ESTM Annex A]

F4016.    Reserve.

F4017.    Reserve.

F4018.    Reserve.

---

15 Differs from [ATC2] which does not have these states

16 Note that the one and same STM equipment can be used in either of two cabs.

## 4.3.2    STM states overview

*Note.* The STM manages the states listed in the table below [ESTM 7.3].

*Table 4.3-1. STM states*

| | **STM State** [5] | **Abbreviation** [3] | **Note. STM function** | **Note. ETCS level + mode** [1] | **Note. Driftläge** |
|---|---|---|---|---|---|
| a) | Power On | PO | Establish communication | 0 + SB | Påslagen |
| b) | | | Activation tests | | |
| c) | Configuration | CO | Wait for level selection | 0 + SB | Konfigurerings-läge |
| d) | | | Receive ETCS train data | STM + SB | |
| e) | Data Entry | DE | Receive STM train data | STM + SB | Inmatningsläge |
| f) | Cold Standby | CS | Wait for Start of Mission | STM + SB | Låg beredskap |
| g) | | | Wait for level transition order [2] | STM + SN | |
| h) | Hot Standby | HS | Read balises. Wait for level transition order [2] | STM + SN | Hög beredskap |
| i) | Data Available | DA | Normal supervision, balises, areas etc. | STM + SN | Normalläge |
| j) | DA + Shunting [4] | | Stop signal passage permitted | STM + SN | Växlingsläge |
| k) | Failure | FA | Faulty | STM + SF | Systemfelsläge |
| l) | No Power | NP | Turned off | 0 + XX | Avstängd |

1) Common levels in connection with STM usage (all combinations are not included)

2) Including transition to another STM area

3) [ESTM – Chapter 8]

4) Shunting is a sub-state of Data Available.

5) Most of these states are also possible while the desk is closed (modes SL or NL).

*Note*. Most STM states are entered because of a conditional[17] or unconditional ETCS order, but the STM will treat all orders as unconditional.

---

17 Conditional means "Wait until Trip (pass stop) condition is finished"

*Figure 4.3-1. Note. STM State Transitions*

**ATC2-STM STATES**

PO
Power On
(with selftest)

Powered
in activated cab

NP
No Power

No power

Any
(other)
state

EO

CO
Configuration
(with ETCS train data entry)

- Power reset, or
- STM restart with-
  out restarting
  ETCS

EO

EO: de-activated
cab, ETCS
in NL/SL

DE
Data Entry
& Startup test [3)]

FA
Failure
(Isolated)

- Failure detected by STM, or
- EO: Failure detected by ETCS

EO: Finishing DE

Any
(other)
state

CS
Cold Standby
(Passive)

- EO:
Return
from AA

- EO: Start of Mission in AA [1)], or
- EO: AA announcement

- EO: DS, or
- Unconditional EO:
  Exit AA, or
- Conditional EO[2)]:
  Exit AA

- EO:
Return
from AA

HS
Hot Standby
(Awakening)

EO: Enter
AA without
announcement

- EO: Start of Mission in AA [1)], or
- Unconditional EO: Enter AA, or
- Conditional EO [2)]: Enter AA

- No shunting:
  -> DA + Normal
- Start Shunting:
  -> DA + Shunting

DA
Data Available
*Normal/Shunting*
(In charge)

stm-states-2009.vsd/wmf

Explanations:

| | |
|---|---|
| 1) | ATC2-STM was selected by the Driver during Start of Mission |
| 2) | After driver acknowledgement of a possible train trip |
| 3) | Data Entry is a function that can be called from other states too |
| AA | In ATC2-STM Area |
| DS | Driver Selection |
| EO | ETCS Order |
| DE | Note: STM train data can also be entered in states CS, HS, DA. |
| CS | Note: State during Start of Mission or while outside ATC2-STM area |

### 4.3.2.1    Detailed listing of STM states

*Table 4.3-2. Note. STM states, detailed*

| | STM state [1] | STM function | Reason / ETCS mode | ETCS level + ETCS mode + STM state |
|---|---|---|---|---|
| a) | NP No Power | None | The STM equipment is switched off | (-) + NP + (-) |
| b) | PO Power On | Only ETCS communication | ETCS + STM are powered and this cab is activated | 0 + SB + PO |
| c) | | STM self test completed | Wait for STM request "CO" | 0 + SB + PO |
| d) | CO Configu-ration | Wait for selection | Enter driver Id. Select level | 0 + SB + CO |
| e) | | Wait for train data | The driver enters ETCS train data after Startup | STM + SB + CO 0..3 + SB + CO |
| f) | DE Data Entry | Wait for train data | The driver enters STM train data after Startup | STM + SB + DE 0..3 + SB + DE |
| g) | | STM start test | Allow STM transmission test | |
| h) | CS Cold Standby | Wait for selection | The driver has not yet selected "Start of Mission" | STM + SB + CS |
| i) | | Passive. No balise reading. Waits for level/mode/state transition order from driver or ETCS | Other STM active | STM + SE/SN + CS |
| j) | | | Staff Responsible mode | STM + SR + CS |
| k) | | | – (reserve) | --— |
| l) | | | Unfitted mode | 0 + UN + CS |
| m) | | | Full Supervision mode | 1..3 + FS + CS |
| n) | HS Hot Standby | Passive but ready to take over. Balise reading. Waits for level/mode/state transition order from ETCS | The train is approaching the ATC2-STM border from other STM area | Other STM + SN + HS |
| o) | | | The train is approaching the ATC2-STM border from unequipped ETCS area | 0 + UN + HS |
| p) | | | The train is approaching the ATC2-STM border from fully equipped ETCS area | 1..3 + FS + HS |
| q) | DA Data Available | Active | The ATC2-STM is in charge. (STM: 1.Possible brake test. 2.Start speed. 3.Area & speed supervision) | STM + SN + DA |
| r) | FA Failure | None | System failure mode | STM + SF + FA STM + SF + SD |
| s) | Any | Passive | Non-Leading mode | STM + NL + DA |

1) Most of these states are also possible while the desk is closed (modes SL or NL).

[ESTM]

### 4.3.2.2    STM ETCS communication

F4019.    In states where the STM and the ETCS have established a communication, the STM shall request the following data at intervals of 15 minutes:

a)   ETCS train data.

b)   Brake status.

c)   Other ETCS data regarding the onboard conditions.

Exceptions:

d)  Data that are usually received within every 15 minutes.

e)  There are no suitable ETCS messages that can be used for these requests.

*Note.* This does not apply to odometer data, ATC2-STM balise information or to state, level or mode transition orders.

F4019A.    The STM shall not perform any unmotivated emergency braking during an ETCS level transition procedure.

### 4.3.2.3  ETCS Level Transitions

This figure gives just a brief overview. For more information, refer to the valid [ESRS] document.

*Figure 4.3-2. ETCS Mode & Level Transitions Overview*
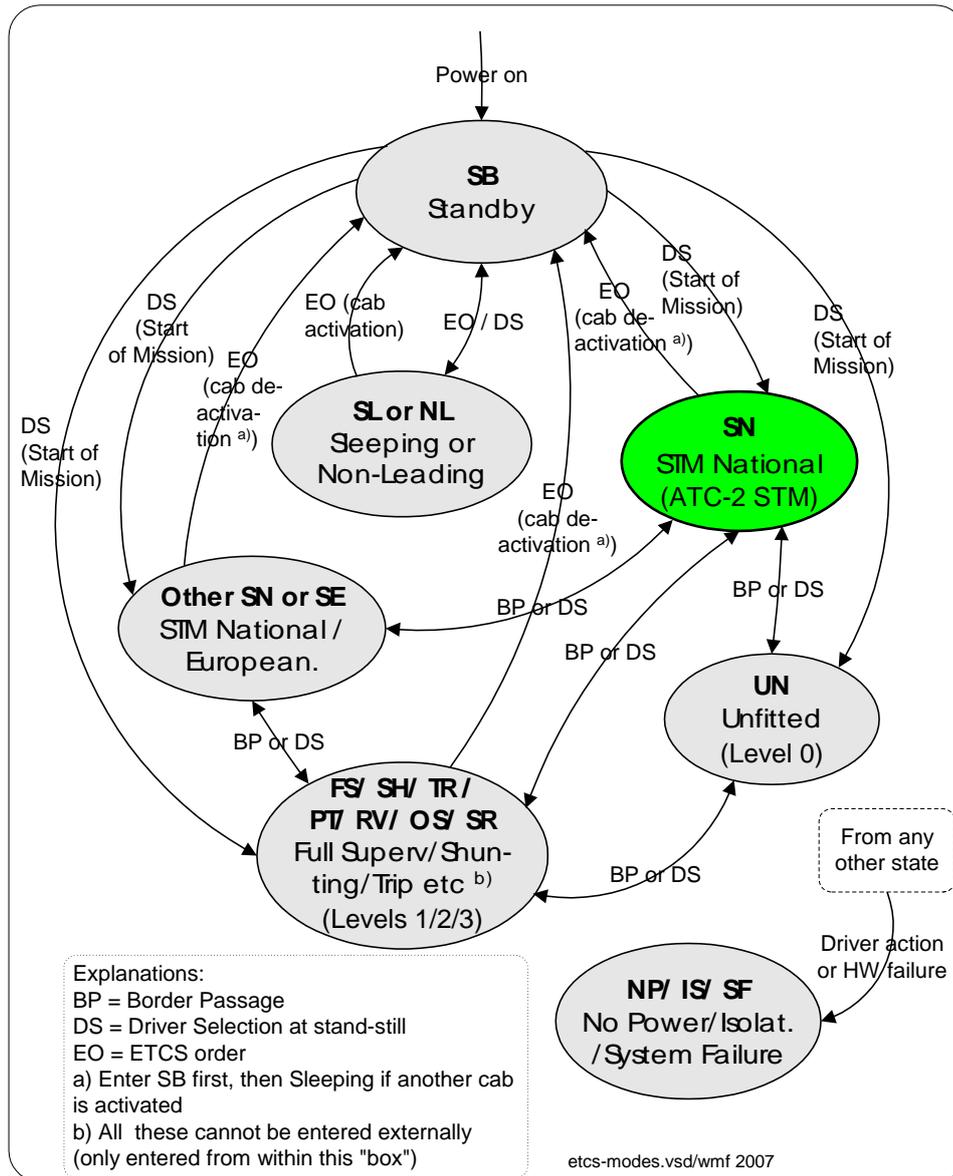


Every state transition must be performed within a few seconds, or else there will be system failure because of time-out[18].

The ETCS allows access to train interface functions in Sleeping and Non-leading modes. When the ETCS in mode Sleeping or Non-Leading enters into a level STM area, the ETCS onboard activates the corresponding STM. This allows the STM to perform national functions. [ESTM – 6]

18 Controlled by ETCS

### 4.3.2.4    ETCS Level, ETCS Mode & STM State Combinations

This table does not comprise *all* possible combinations. Refer to the valid [ESRS] document.

*Table 4.3-3. ETCS & STM conditions overview*

| | ETCS level | ETCS mode | | STM state | Comment |
|---|---|---|---|---|---|
| | | ATC2-STM  AREA | | | |
| a) | – | – | – | NP | Unpowered STM |
| b) | 0 → ATC2-STM | SB | Standby | PO, CO, DE, CS | Start or end of mission |
| c) | | SL, NL | – | DA | The STM is passive |
| d) | **ATC2-STM** | **SN** | **STM National** | HS | Start of mission or awakening |
| e) | | | | **DA** | **ATC2 supervision** |
| f) | – | – | – | FA | Faulty STM |
| | | OTHER  AREA | | | |
| g) | 0 | UN, SR, OS | Unfitted etc. | CS, HS or NP, FA | Start of Mission |
| h) | Any | SB | Standby | | Start or end of Mission |
| i) | 0…3 | TR, PT | Train or post trip | | ETCS supervision |
| j) | | FS | Full supervision | | |
| k) | | RV | Reversing | | |
| l) | | SH | ETCS Shunting | | |
| m) | Any | SL, NL | Sleeping or Non-Leading | Any | De-activated cab |
| n) | Other STM | SE, SN | STM European or National | CS, HS or NP, FA | Other STM area |
| o) | None | NP, IS, SF | No Power, Isolated or System Failure | NP, FA | ETCS off duty |

## 4.3.3    Power On state, PO

This is the first state that the STM enters . The purpose of this state is to start communicating with the ETCS and to perform a self test.

### 4.3.3.1    Enter PO

F4020.    Power On shall be entered according to the table below.

*Table 4.3-4. Entering PO*

| | Transition from: | When: |
|---|---|---|
| a) | No Power | The STM equipment is powered |

### 4.3.3.2 Function in Power On state

F4021.    The STM shall be passive in the Power On state:

a) No balise reading.

b) No supervision.

c) No indications on the DMI.

d) No STM braking.

*Note.* The STM will only perform internal self-tests [5.6.2] and send an "STM data need" to the ETCS.

*Note.* The ETCS keeps the train still-standing in Standby mode (but not the in Sleeping or Non-Leading modes).

*Note.* When a failed STM reports PO state to the STM Control Function, the ETCS will no longer assume that this STM is connected. This allows for a restart of the STM (without restarting the ETCS).

*Note.* In the Power On state, the STM starts communicating with the ETCS. The STM takes the initiative to open this communication. This is done by exchanging version numbers [ESTM − 7/14].

The versions of the valid FFFIS STM version are identified by compatibility numbers. Each compatibility number will have the following format: X.Y.Z, where X, Y and Z are any number between 0 and 255 (examples: 1.12.0, 6.8.203, 65.0.15).

F4022.    Reserve.

### 4.3.3.3 Reserve

F4023.    Reserve.

F4024.    Reserve.

F4025.    Reserve.

F4026.    Reserve.

F4027.    Reserve.

### 4.3.3.4 STM self test

In the Power On state, the complete STM self test will be performed  [5.6.2].

The purpose of this test is to ensure that the STM is working internally. Parts of this test are also performed during normal operation (all states except NP and FA). Refer to supplier specification.

The self test, which ensures that the STM equipment is fault-free and able to communicate with the ETCS, will halt if a failure is detected.

Current self test position and error indication is shown according to supplier specification.

F4028.    Reserve.

F4029.    Reserve.

F4030.    Reserve.

### 4.3.3.5    Exit PO

*Table 4.3-5. Leaving PO*

| Transition to: | When: |
|---|---|
| Configuration | Self test completed (ETCS orders "CO" after STM request) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |

## 4.3.4    Configuration state, CO

### 4.3.4.1    Enter CO

F4031.    The Configuration state shall be entered according to [ESTM].

*Table 4.3-6. Note. Entering CO*

| | Transition from: | When: | Note. |
|---|---|---|---|
| a) | Power On | ETCS orders "CO" | STM self test completed (ETCS orders "CO" after STM request) |

### 4.3.4.2    Function in Configuration state

After entering this state, provided that the ETCS is not in any of the Non-Leading or Sleeping modes, the ETCS waits for the driver to enter Driver ID and to select ETCS level - which in this case means "ATC2-STM level" - and finally, to enter ETCS train data.

The STM waits for the ETCS to finish the Configuration state, which happens when necessary ETCS data has been entered or confirmed by the driver (or input from a preset memory), and accepted by the ETCS.

F4032.    Reserve.

*Note*. The STM communicates with the ETCS, and keeps on waiting for a transition order.

Data sent from the ETCS to the STM in state CO:

– Status / Availability of the Service Brake command

– Status / Availability of the Emergency and Service Brake States

– Maximum time delay for the ETCS to process the STM Emergency and the STM Service Brake commands.

Refer to [ESRS, ESTM].

F4033.     The STM shall be passive in the following ways:

a) No balise reading.

b) No speed supervision.

c) No indications on the DMI.

*Note*. Some internal checks can still be performed.

### 4.3.4.3     **Exit CO**

*Table 4.3-7. Leaving CO*

| Transition to: | When: |
|---|---|
| Data Entry | Configuration completed (ETCS orders "DE" after STM request) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |

When leaving the CO state, the STM

− will maintain the connection with the STM Control Function.

− may close or keep the connections with the Train interface (TIU), Brake interface (BIU), Juridical recorder (JRU) and/or Diagnostic recorder (DRU).[19]

− will close the connections with all other ETCS On-board functions.

Refer to [ESTM].

## 4.3.5     **STM Data Entry state, DE**

This state is intended for STM train data input, which normally takes place after the ETCS train data input.

STM Data Entry can be used either as a **state** or as a **sub-state**:

− The Data Entry *state* is only used during the Start of Mission procedure. STM train parameters are entered but the STM start test will also be performed.

− When it is time to change some train parameters during a mission, the STM Data Entry *sub-state* (function) is requested by the STM in any of the STM states CO, CS, HS or DA. This is the STM Specific Data Entry Procedure [ESTM].

---

19 If closed, these may have to be re-connected later on

### 4.3.5.1   Enter DE

F4034.   a) Data Entry state shall be entered according to [ESTM] during the Start of mission procedure.

b) Data Entry sub-state shall be entered every time after entering new ETCS train data.

*Table 4.3-8. Note. Entering DE*

| | **Transition to state DE from:** | **When:** | **Note.** |
|---|---|---|---|
| a) | Configuration | ETCS orders "DE" | Configuration completed, STM train data to be entered (ETCS orders "DE" after STM request, when all ETCS train data have been entered and accepted) |
| | **DE sub-state [20] activated in:** | **When:** | **Note.** |
| b) | Data Available Cold Standby Hot Standby | The STM receives new ETCS train data values | STM train data to be entered (when all ETCS train data have been entered and accepted) |

### 4.3.5.2   Function in Data Entry state

Start test in DE state

An STM start test is allowed by the ETCS in state DE. This is accomplished with help by the STM Specific Test Procedure [ESTM].

The following function is tested:

– STM transmission (only if the STM uses a separate STM antenna).

Refer to [5.6] for this and the other STM tests.

*Note.* During this procedure, the STM may ask the driver for extra confirmation. Once the STM has finished its test procedure, it sends the test result (OK, not OK or Test aborted) as an Specific STM Data request to the ETCS.

F4035.   Reserve.

STM train data input in DE state or sub-state

Input of STM train data is handled according to the train data section [0].

The actual data input is managed by the ETCS on request by the STM. The train parameters can either be entered by the driver, or retrieved from some sort of preset computer memory.

---

20 Specific STM Data Entry Procedure

Entered or received STM train parameters are:

–   STM Max Speed ($V_{STM}$),

–   Exceed level K1,

–   PT code,

–   Brake position,

–   Brake percentage,

–   EP brake active,

–   DMI reaction time.

–   A further number of parameters are computed by the STM [4.2].

About the DE sub-state

F4036.   If DE was entered as a function (a sub-state) from Data Available (or from the CS or HS states), it shall not affect any speed supervision or other state related functions.

F4037.   a)   There shall not be any special indications in the DE sub-state.

b)   Supervision and indication shall be performed as usual in the "calling" STM state.

### 4.3.5.3   Exit DE

*Table 4.3-9. Leaving DE*

| Transition from state DE to: | When: |
|---|---|
| Cold Standby | Data entry completed during startup procedure (ETCS order "CS" after STM request) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |
| **DE sub-state finished in:** | **When:** |
| Data Available Cold Standby Hot Standby | Data entry completed during normal operation (ETCS order after STM request) |

## 4.3.6   Cold Standby state, CS

The STM shall remain passive in Cold Standby, but keep waiting for any state transition order from the ETCS. This state can be used while another STM or another ETCS level (0...3) is active.

### 4.3.6.1   Enter CS

F4038.   Cold Standby shall be entered according to [ESTM].

*Table 4.3-10. Note. Entering CS*

|  | **Transition from:** | **When:** | **Note.** |
|---|---|---|---|
| a) | Data Entry | ETCS orders "CS" | STM Data Entry finished (ETCS order during system startup) |
| b) | Hot Standby |  | – Another ETCS level than the ATC2-STM level is entered. The new level is 0, 1, 2, 3 or another STM level (ETCS order, after driver selection or eurobalise passage). |
| c) | Data Available |  |  |

*Note.* When an STM in state DA or HS state receives an ETCS order to change to CS state, the STM performs this:

− Maintains the connection with the STM Control Function.

− Has the possibility to close the connection with any of the ETCS Train, Brake and Recorder interfaces (TIU, BIU, JRU and/or DRU) .[21]

− Will close the connections with all other ETCS On-board functions.

[ESRS, ESTM]


### 4.3.6.2    **Function in Cold Standby state**

F4039.    Reserve.

*Note.* The STM communicates with the ETCS, and keeps on waiting for a transition order.


F4040.    The STM shall be passive in the following ways:

a) No balise reading.

b) No supervision.

c) No indications on the DMI.

d) No STM braking.

*Note*. There may be some internal checks going on.


*Note.* If Cold Standby was entered during system startup, the train will be permitted to start running by the ETCS, as soon as the driver selects Start of Mission.

---

21 If closed, these may have to be re-connected later on

### 4.3.6.3 Exit CS

*Table 4.3-11. Note. Leaving CS*

| Transition to: | When: |
|---|---|
| Hot Standby | ETCS order after eurobalise passage. |
| Data Available | ETCS level has changed to ATC2-STM level (ETCS order, after driver selection, eurobalise passage, or maybe a radio message) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |

## 4.3.7 Hot Standby state, HS

Hot Standby is used while the train is approaching the ATC2-STM border from an area where another STM level or another ETCS level (0...3) is active. The STM will now start reading balises in order to be ready for the take-over.

Hot Standby is also temporarily entered during every Start of mission procedure.

### 4.3.7.1 Enter HS

F4041.   Hot Standby shall be entered according to [ESTM].

*Table 4.3-12. Note. Entering HS*

| | Transition from: | When: | Note. |
|---|---|---|---|
| a) | Cold Standby | ETCS orders "HS" | The train is approaching the ATC2-STM border (ETCS order after passing a border announcement eurobalise or radio message) |
| b) | | | Temporarily during startup |

*Note.* When entering from another ETCS area to an ATC2-STM area, there is a possibility for the STM to send border speeds to the ETCS, which helps to slow down from a previous high-speed area [ESRS]. This possibility will however not be used by the ATC2-STM. If a train speed reduction is required, this will be controlled by the eurobalises (or via radio communication) before the border.

### 4.3.7.2 Function in Hot Standby state

The ETCS, possibly in co-operation with another STM, still supervises the speed of the train before reaching the border to our ATC2-STM area.

F4042.   The following shall apply:

These functions shall be passive in the same way as in Cold Standby:

a) No speed supervision

b) No indication

c) No braking.

*Note.* Balise errors are not indicated.

F4043. These functions shall be performed in the same way as in Data Available:

    a) All passed balises shall be read and checked by the STM.

    b) Correct, received balise data shall be stored and administered.

      *Note.* The STM prepares for entering Data Available

    c) The STM shall start sending valid information about speed indicators, speed bars and other indicators to the ETCS.

      *Note.* This is to avoid a temporary indication gap at the ATC2-STM take-over (state transition to DA).

*Note.* The ETCS may supervise a braking curve down to the first valid STM maximum permitted speed level (determined by ATC-2 signals and boards). This must be ensured by eurobalises (or via radio communication) before the border.

*Note.* No supervision information (no national speed restrictions) will be forwarded from the STM onboard equipment to the ETCS before the take-over. The STM does not have to inform ETCS when it is ready for a state transition to Data Available.

*Note.* At the border, the STM should have received enough balise information to be able to enter Fully Equipped Area (in Data Available state) without any delay [4.4.5].

*Note.* STM Train Data Entry can be activated from here as a temporay sub-state.

F4043A. In Hot Standby, possible balise errors shall be handled in the following ways.

    a) The STM shall memorize detected balise errors.

    b) The STM shall memorize related balise error messages.

    c) Relevant information shall be deleted [3.3.5]

*Note.* This information is neither indicated nor supervised until the train enters Data Available.

### 4.3.7.3   Exit HS

*Table 4.3-13. Leaving HS*

| Transition to: | When: |
|---|---|
| Data Available | Passing the border to an ATC2-STM area (ETCS order "DA" after passing a border eurobalise) |
| Cold Standby | Leaving the ATC2-STM announcement area, thus returning to present area (ETCS order "CS" when leaving ATC2-STM area, or the driver selecting another level) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |

When changing to ATC2-STM state DA, the ETCS expects driver acknowledgement within 5 s before the border.

## 4.3.8   Data Available state, DA

This state is used during normal ATC2-STM operation. Initially, the STM will handle the start and dark restrictions. The STM will also supervise every passed signal or board balise group, and control most indications on the DMI.

### 4.3.8.1   Enter DA

F4044.      Data Available shall be entered according to [ESTM].

*Table 4.3-14. Note. Entering DA*

| | Transition from: | When: | Note. |
|---|---|---|---|
| a) | Cold Standby [2] | ETCS orders "DA" | Starting up in ATC2-STM area (ETCS order  at driver-selected Start of Mission, when the system is in ATC-2 STM level + SN mode) |
| b) | | | Passing the border to ATC2-STM area (ETCS order caused by eurobalise passage) [1] |
| c) | Hot Standby | | Passing the border to ATC2-STM area (ETCS order caused by eurobalise passage) |

*Note.*

1)   This entry should be avoided with ATC2-STM, since there will not be any time for the  STM to prepare for the change of state. Entering after starting up or via Hot Standby is to prefer.

2)   According to [ESTMA draft v2.1.6].

*Note.* STM shunting is finished when the driver terminates shunting by pressing a button. This means that the normal DA state is re-entered ("DA with shunting" is changed to  "DA without shunting").

*A-note.* STM shunting is finished when the driver terminates shunting by pressing a button, or when passing SX. This means that the normal DA state is re-entered ("DA with shunting" is changed to  "DA without shunting").

F4045.    When STM shunting has been finished, the max speed $V_{START}$ shall be zero (0 km/h) until the following conditions have been fulfilled:

a)  The driver has entered or confirmed new ETCS train data, and

b)  The driver has entered or confirmed new STM train data.

c)  These train data were also accepted by the system.

*Note.* The $V_{START}$ speed limit is then increased to 40 km/h (see below).

F4045A.   After entering Data Available from Hot Standby, the STM shall begin to indicate and supervise the following memorized data.

a)  Valid balise information.

b)  Balise errors and their related error messages.

c)  For BF2 or BF3, an 80-supervision (with or without braking curve) shall be started [3.3.4].

*Note.* This information is neither indicated nor supervised in Hot Standby.

### 4.3.8.2    $V_{START}$, the start speed restriction in DA

F4046.    The $V_{START}$ speed limit shall be set to 40 km/h if one of these conditions apply:

a)  Data Available is entered directly after the ETCS Start of Mission procedure (when the ETCS mode has changed from SB to SN).

*Note.* The start speed limit must not be activated when passing the area border to another ETCS level.

b)  Shunting is finished in Data Available, and new train data has been entered and accepted.

c)  A previous travel direction was resumed after travelling at least 250 m in the other.

*Note.* This means that there is no available main or distant signal information.

F4047.    The HÖJNING button shall become available on the DMI after 100 m travelling.

*Note.* When entering Data Available from Hot Standby, and signal information has already been received, the start restriction will not be activated at all. This is convenient when passing the border from another ETCS area into ATC2-STM area.

*Note.* The start restriction is finished at signal passage.

F4048.    When passing a main and/or distant signal balise group, the following shall apply:

a)  The 40 km/h start speed restriction shall be deleted immediately.

b)  The HÖJNING button shall become unvisible.

F4048A.  The following applies when the HÖJNING button is pressed (while being visible because of the start restriction):

a)  The HÖJNING button shall not be visible anymore.[22]

b)  The start speed restriction of 40 km/h shall be terminated on passing the train length (after the button was pressed).

1.  Exception: Should a signal be passed during the train length delay, the start restriction shall be terminated immediately.

### 4.3.8.3     $V_{DARK}$, the dark speed restriction in DA

The 130 km/h dark speed, which is used when the speed bars on the DMI are extinguished ("dark"), can have two different states:

–  *Passive*, which means that it is not supervised but saved for later use, or

–  *Active*, which means that it is supervised for the moment.

Should a lower dark speed be needed (as could be the case in Sweden where 80 km/h is the limit outside Fully equipped area), this can be easily achieved by changing the STM max speed parameter. The driver must then remember to increase this speed when it shall no longer apply.

F4049.  $V_{DARK}$, the 130 km/h dark speed, shall only be active (supervised) while:

a)  We are in another area than Fully equipped [23], and

b)  There is no valid category G line speed for this area.

*Note*. This can be received when entering another area than Fully equipped.

*Note*. Temporary exception: During deceleration supervision caused by a BF2 or BF3 balise error [3.3.4].

F4050.  Reserve.

*Note*. Example: The dark speed is latent (passive) while travelling through a Fully Equipped Area. It will then be re-activated again after entering Non-Equipped Area without any specified category G line speed at the border. Re-activation will also occur after a SIG- or HT-erasing balise error.

---

22 Unless requested by some other reason

23 Differs to [ATC2]

#### 4.3.8.4   General function in DA

*Note.* Balise information is handled as usual and the STM area category is updated as necessary. Supervision and display will be complete to the extent that present STM area, received balise information and possible driver actions allows.

F4051.   The STM shall handle and supervise all available information (mainly from passed balise groups).

*Note.* The STM informs the ETCS about

– DMI indications.

– Reserve.

*A-note.* The STM informs the ETCS about

– DMI indications.

– Speed restrictions (for the planning area).

[ESTM]

*Note.* STM Train Data Entry can be activated from DA as a temporary sub-state.

#### 4.3.8.5   STM brake test in DA

The STM brake test can be carried out upon request by the driver, while the train is stationary in state DA. The brake test must be executed at least once during every twenty-four hour period (operational requirement, not a technical requirement for the STM).

The following functions are tested:

– STM brake pressure reading.

– STM service braking.

– STM emergency braking

The brake test is halted on detecting an error, and the nature of the error is indicated. If a test was not performed within the maximum time limit, service braking is applied.

Refer to [5.6.4] for more information.

F4052.   Reserve

F4053.   Reserve

F4054.   Reserve.

#### 4.3.8.6 Exit DA

The ETCS offers a possibility to delay leaving an ATC2-STM area in dangerous situations like passing stop without permission[24]. This problem can however be solved by a careful layout of the border, which should consider the case when a main signal on the ATC2-STM side is at stop. Exiting DA for another ETCS area should be performed right before a main signal (not after).

*Table 4.3-15. Leaving DA*

| Transition to: | When: |
|---|---|
| Cold Standby | Leaving ATC2-STM area (ETCS order "CS" when leaving ATC2-STM area, or the driver selecting another level) |
| Hot Standby | Leaving ATC2-STM area, thus returning to ATC2-STM announcement area (ETCS order "HS" caused by eurobalise passage) |
| Failure | System failure detected by the STM (ETCS communication / internal / other) |
| No Power | Power shutdown |

*Note*. When leaving our ATC2-STM area, an ETCS controlled driver acknowledgement will take place 5...0 s before the border. [ESTM – 16]

### 4.3.9 STM Shunting (sub-state in DA)

Shunting[25] is regarded as a sub-state to Data Available, and is therefore not included in the STM state machine. Shunting is managed by the STM, which indicates Data Available to the ETCS. The driver manages to shunt with help by the buttons VÄXLING and SLUT VÄXLING.

---

24 National trip situation
25 Differs from [ATC2]

*Figure 4.3-3. Shunting state machine*
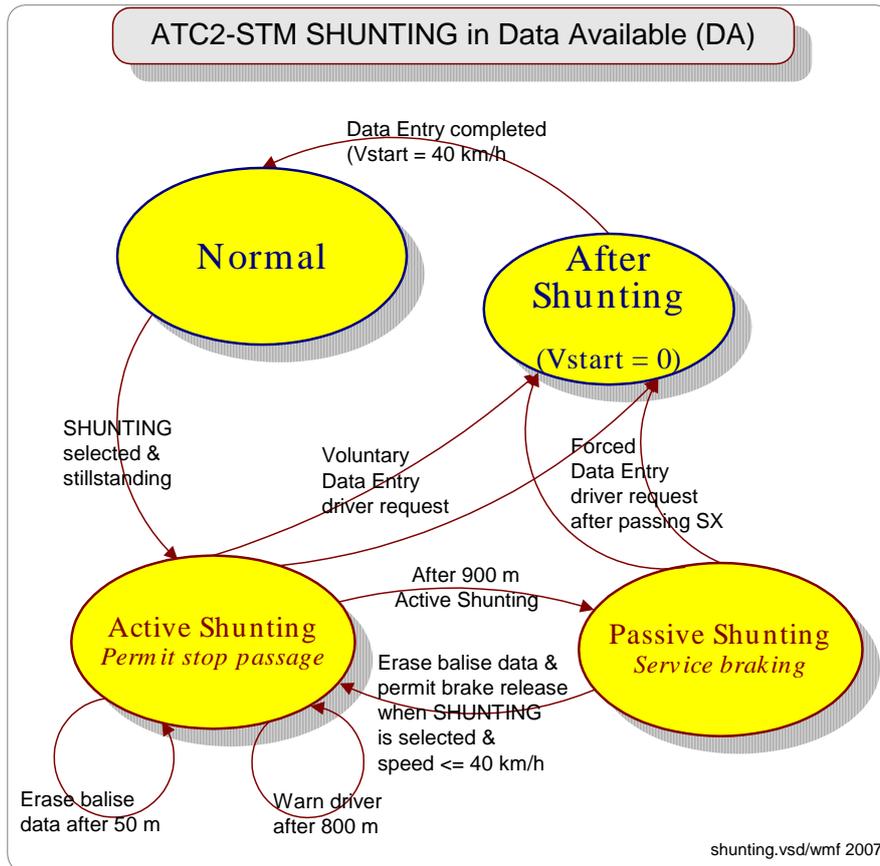


### 4.3.9.1    Enter Shunting

F4055.    Shunting shall be entered according to the following table.

*Table 4.3-16. Entering Active Shunting*

|    | Transition from: | When: | Note. |
|----|------------------|-------|-------|
| a) | Data Available | VÄXLING button pressed and the train speed = 0 | Shunting is selected by the driver: the VÄXLING button is pressed by the driver while the train is stationary. |

Preliminary shunting

F4056.    a) All supervised balise data shall be kept, but neither displayed nor supervised, during the first 50 m of shunting.

b) New balises shall be read and memorized during these 50 m.

c) If shunting is finished by the driver during this period, all avaialble data shall be used for displaying and supervising again, as if nothing had happened.

*Note.* This prevents the driver from purposely deleting an inconvenient Expect Stop with 10-supervision by starting shunting, then finishing this and entering train data within short.

### 4.3.9.2    Function in Shunting state

Active Shunting sub-state

F4057.    The Active Shunting sub-state shall be:

   a) Entered every time that Shunting is selected by pressing the VÄXLING button during still-standing.

   b) Re-entered every time that Shunting is selected in Passive Shunting by pressing the VÄXLING button while the train speed ≤ 40 km/h.

F4058.    Maximum speed $V_{SHUNT}$ shall be 40 km/h.

F4059.    All balise information shall be deleted:

   a) When the train has travelled ≥ 50 m since the first entry.

   b) When re-entering from Passive Shunting.

   c) Exception to a-b:

      1. Balise group BU, Beginning of Installation Area.

F4060.    Supervision when the train has travelled ≥ 50 m since the first time that Active Shunting was entered:

   a) The STM Area shall be set to Non-Equipped Area

   *Note.* But the function is almost as in Installation Area.

   b) All balise errors shall be ignored.

   *Note.* This applies also for incorrect BSK, BU or SU groups.

   c) New balise information shall not be memorized.

   d) Speed information from balises shall neither be evaluated nor supervised.

   e) Exceptions to c-d:

      1. Balise BSK shall be handled.

         *Note.* This includes the function "Passing of BSK" [3.11.3.4].

         *Note.* This may cause full service braking.

      2. Reserve.

      3. Balise groups BU and SU shall be handled.

A4060.    Supervision when the train has travelled ≥ 50 m since the first time that Active Shunting was entered:

   a) The STM Area shall be set to Non-Equipped Area

   *Note.* But the function is almost as in Installation Area.

   b) All balise errors shall be ignored.

   *A-note.* This applies also for incorrect BSK, SX, BU or SU groups.

c) New balise information shall not be memorized.

d) Speed information from balises shall neither be evaluated nor supervised.

e) Exceptions to c-d:

    1. Balise BSK shall be handled.

    *Note.* This includes the function "Passing of BSK" [3.11.3.4].

    *Note.* This may cause full service braking.

    2. Balise SX shall be handled.

    *A-note.* This causes emergency braking.

    3. Balise groups BU and SU shall be handled.

F4061.  Indication in Active Shunting sub-state:

a) The VÄXLING indicator shall be lit.

b) There shall not be any target or max speed display (extinguished speed indicators and speed bars).

c) No audible warning shall be given on change of direction.

F4062.  After 800 m of Active Shunting (irrespective of direction) − 100 m before transition to Passive Shunting − the driver shall be warned by:

a) A short warning tone (audible f2 signal, see [4.8.8]).

b) The VÄXLING indicator shall start flashing (rapidly).

Passive Shunting sub-state

F4063.  The STM shall enter Passive Shunting state, if Active Shunting has continued (irrespective of direction) for at least 900 m since VÄXLING was last pressed.

F4064.  Functions that shall apply in Passive Shunting:

a) Full service braking.

b) STM area according to balises passed.

c) Signals and boards as per balises passed.

d) The maximum permitted speed $V_{SHUNT}$ shall be 40 km/h.

*Note.* The service braking can not be released unless another state than Passive Shunting is entered.

*Note.* The latest accepted ETCS and STM train data applies (as usual).

F4065.  Passive Shunting shall be indicated as follows:

a) Speed indicators and speed bars shall be indicated as per signals and boards passed (maximized to 40 km/h).

b) The VÄXLING indicator shall continue flashing (slowly).

F4066.      The STM shall re-enter Active Shunting and restart the 800/900 m distance counter, if:

a)  The driver presses the VÄXLING button once more, and

b)  The train speed $V_{TRAIN} \leq 40$ km/h.

## 4.3.9.3  Exit Shunting

F4067.      Shunting (Active or Passive) shall be finished according to the following table.

*Table 4.3-17. Note. Leaving Shunting*

| | Transition to: | When: | Note. |
|---|---|---|---|
| a) | Data Available without shunting | Shunting is finished by pressing the SLUT VÄX-LING button while the train is stationary. [1] [2] | Shunting is finished by the driver |
| b) | -- (reserve) | -- | -- |
| c) | *Note.* Other STM state without shunting | See under Data Available | See under Data Available |

*Note.*

1)  The VÄXLING button can only be used to prolong the shunting state, but not to finish shunting.

2)  The STM will supervise $V_{START} = 0$ until new train data are entered by the driver at stand-still

A4067.      Shunting (Active or Passive) shall be finished according to the following table.

*Table 4.3-18. Note. Leaving Shunting*

| | Transition to: | When: | Note. |
|---|---|---|---|
| a) | Data Available without shunting | Shunting is finished by pressing the SLUT VÄX-LING button while the train is stationary. [1] [2] | Shunting is finished by the driver |
| b) | | An SX balise group is passed | Shunting is not allowed beyond this group |
| c) | *Note.* Other STM state without shunting | See under Data Available | See under Data Available |

*Notes, see under the previous table.*

*A-note.* The End of Shunting group (SX), causes braking if passed during shunting [3.11].

*Note.*   It is not possible to stay in Shunting while changing to another cab.[26]

---

26 This is possible with [ATC2]

F4068.      When Shunting is finished, the VÄXLING indicator shall be turned off.

*Note.* Possibly stored balise information, received while running in Passive Shunting, is kept and supervised.

*Note.* After finishing the shunting session, the train is not allowed to proceed before new train data has been entered by the driver.

*Note.* When the driver has finished the shunting session, the previously stored train data are not valid anymore. When returning to Data Available, $V_{MAX}$ will be zero (0 km/h) until new train data has been entered. After that, the start restriction is activated and the HÖJNING button shall be visible. The STM activates the area handling again, allowing the STM to change from Non-Equipped Area to another area. Refer to Data Available [4.3.8].

## 4.3.10    Failure state, FA

The STM Failure state is a part of the STM state machine. It is used when an STM or ETCS system error has occurred. The STM will then react in a similar way as the ETCS does when entering System Failure mode [ESRS – 8.3.7].

### 4.3.10.1    Enter FA

F4069.      The Failure state shall be entered when the STM detects a system error, or when ordered by the ETCS, according to the following table.

*Table 4.3-19. Entering FA*

| | **Transition from:** | **When:** | **Note.** |
|---|---|---|---|
| a) | Any state except | System failure | System failure detected by the STM |
| b) | No Power | ETCS order "FA" | (ETCS communication / internal / other) |

*Note.* If the STM receives from the ETCS a state transition order which is not allowed by the state transition table, the STM will enter the FA state. [ESTM – 7]

### 4.3.10.2    Function in Failure state

F4070.      Before entering FA, the STM shall try to send a text message to the DMI that explains what error that has occurred.

*Note.* The STM will also send an appropriate error message to the ETCS, and inform ETCS about its new status. It is understood that some failures will make it impossible for the STM to transmit any messages. The STM will then isolate itself from the bus. [ESTM – 7]

F4071.      The STM shall isolate itself completely:

a)  No balise reading.

b)  No supervision (only some internal checks).

c) No indications on the DMI.

d) Service braking shall not be ordered.

e) Emergency braking shall not be ordered (but may be caused unintentionally by the hardware).

*Note.* The STM may have to be isolated (manually) to avoid emergency braking in state FA.

*Note.* There will not be any communication with the ETCS.

*Note.* It is the responsibility of the ETCS to take appropriate action, should the contact with an active STM be completely lost. The ETCS will rder emergency braking in its own System Failure mode.

### 4.3.10.3  Exit FA

*Table 4.3-20. Note. Leaving FA*

| Transition to: | When: |
|---|---|
| No Power | Power shutdown (or loss of power) |

## 4.3.11   No Power state, NP

In this state[27], the STM becomes totally passivated and isolated. It does not interfere with the surroundings by any means. This is not a software state, since no STM software is running when the STM is unpowered.

### 4.3.11.1  Enter NP

F4072.    Reserve.

*Note.* The No Power state is entered according to the following table.

*Table 4.3-21. Entering NP*

| Transition from: | When: |
|---|---|
| Any state | Power shutdown |

### 4.3.11.2  Function

F4073.    The STM shall be passive (totally de-activated): No service braking.

*Note.* The STM can also be isolated manually.

---

27 The former Shutdown state [FRS3]

*Note.* Furthermore, the STM becomes isolated (bus disconnection). The No Power state is mainly handled by the ETCS.

### 4.3.11.3    Exit NP

*Table 4.3-22. Note. Leaving NP*

| Transition to: | When: |
|---|---|
| Power On | Power reset (switched on) |

## 4.3.12    Travel Direction modes

### 4.3.12.1    General

The *Travel direction* is when the train runs in either the forward or the reverse direction[28]:

– *Forward* is when the currently activated cab moves forward (direction controller = F).

– *Reverse* is the opposite direction (direction controller = R).

Balises are read and supervised, and speed indicators and speed bars are activated according to received information, in the forward direction, and to a certain extent also in the reverse direction.

### 4.3.12.2    Running in the forward Direction

F4074.    When running in the forward direction, all balise information referring to this direction shall be stored and acted upon according to the relevant requirements in this specification.

F4075.    The $V_{REVERSE}$ speed limit shall never apply in the forward direction.

F4076.    Reserve.

F4077.    Reserve.

### 4.3.12.3    Running in the reverse direction

F4078.    When running in the reverse direction, only the following information shall be handled:

a)  Stop signals.

---

28 Differs from [ATC2]

   b) BSK, active landslide beginning.

   c) BU/SU, installation area borders.

      1. BU shall erase all balise information (for both directions).

*Note*. If driver acknowledgement is required in the forward direction when passing any of these groups, this will be requested here also.

F4079.     The $V_{REVERSE}$ speed limit of 40 km/h shall always apply in the reverse direction.

*Note*. When the train starts reversing in a Fully equipped area, the speed indicators and speed bars will be turned off.

F4080.     During reversing, all information pertaining to the forward direction shall be retained, unless the reversing continues for more than 250 m (see below).

F4081.     During reversing:

   a) Indications, based on earlier received balise groups (while travelling in the forward direction), shall not be given.

   b) Indications, based on new information from special balise groups (see above), shall be given.

*Note*. When the train starts reversing in a Fully equipped area, the speed indicators and speed bars will be turned off to begin with.

### 4.3.12.4   Running in a new direction for less than 250 m

While reversing, the max speed will be limited to 40 km/h. The balise reading, supervision and indication functions are active, but only for a limited number of balise group types (see above).

F4082.     An information tone shall be given when the direction is changed:

   a) To Reverse: an f2 audible signal of 5 sec duration shall be given.

   b) To Forward: a short f2 information tone shall be given.

      *Note*. Audible f2 signal, see [4.8.8].

F4083.     Target points referring to the forward direction shall be retained at their original positions, irrespective of the present direction of movement.

F4084.     Reserve.

### 4.3.12.5   Resuming the forward direction after < 250 m reversing

The supervision and indication goes on as before the direction was changed.

F4085.    Resumption of the forward direction when the train has reversed a distance less than 250 m shall result in the previously received information (for the forward direction) being displayed and supervised again.

F4086.    Information referring to the reverse direction, except BU/SU state, shall be immediately deleted.

### 4.3.12.6    Reversing for 250 m or more

The STM erases balise information for the forward direction. Balise reading, supervision and indication in the reverse direction proceeds as before. The max speed is limited to 40 km/h.

F4087.    Reversing for more than 250 m:

a)  All balise information relating to the forward direction (including line speed of category G) shall be deleted.

b)  Exceptions:

1.  BU and SU.

2.  Reserve.

### 4.3.12.7    Resuming the forward direction after ≥ 250 m reversing

The STM starts from Non-equipped area, except if in installation area. Other areas may apply as soon as new balise information is received.

–  Forward direction: The startup and dark speed restrictions are activated, indicated and finished in the same way as when entering Data Available.

–  While reversing, the max speed is limited to 40 km/h.

F4088.    Resumption of the forward direction after travelling more than 250 m.

a)  The STM shall enter Non-Equipped Area (unless already there).

1.  Exception: Installation area shall be entered if BU was previously passed in the reverse direction.

b)  The STM speed indications (speed indicators and speed bars) shall be extinguished until sufficient balise information has been received to allow indications according to normal rules [4.4.3-5].

F4088A.    When resuming the Forward direction after reversing for more than 250 m, these restrictions shall be activated, indicated and finished in the same way as when entering Data Available [4.3.8]:

a)  The startup speed $V_{START}$

*Note.* This means that the HÖJNING button will become visible.

b) The dark speed $V_{DARK}$

*Note.* A previously active HT-G max speed will continue to be supervised.

## 4.3.13   Cab Activation

### 4.3.13.1   Reserve

[29] [30]

### 4.3.13.2   Reserve

F4089.     While the ETCS mode is Standby (SB), Non-leading (NL) or Sleeping (SL)[31] the STM shall be passive:

1. No balise reading.

2. No supervision.

3. No indications on the DMI.

4. No STM braking.

*Note.* The normal STM state machine will not be affected.

Examples of ETCS modes:

– While the cab is activated (desk open)[32]: SB, FS, UN, SE, SN.

– While the cab is de-activated (desk closed)[33]: NL, SL.

F4090.     Reserve.

### 4.3.13.3   Reserve.

F4090A.     Reserve.

F4090B.     Reserve.

---

[29] Reserve.

[30] Reserve.

31 Differs from [ATC2]

32 Corresponds to the direction controller = "F", "0" or "B"

33 Corresponds to the direction controller = "S" (old-fashioned mode)

## 4.4    THE STM AREAS

### 4.4.1    General

A train equipped with ETCS + ATC2-STM may come into contact with a variety of differently equipped sections on the line, which will affect the function of the system.

A train can be in a different area category than that of the area currently occupied. This can be the result of balise errors or recent start-up of the on-board ATC2-STM system.

In the following text, "area category" reflects the on-board state of this parameter, and not necessarily the actual area category of the section of the line.

Except for transition to Non-Equipped Area in connection with shunting or change of travel direction, a change in area category will mainly take place as a result of balise information, in contrast to changes in the STM state which are primarily initiated internally on-board the train.

Figure 4.4-1 below shows area categories and possible transitions between the various areas. The reference numbers included in the arrows (transition lines) are cross references to the entry/exit tables appearing in following sub-sections.

    The STM areas:

– Non-Equipped Area    (*Outrustat område*)

– Partially Equipped Area    (*Delvis utrustat område*)

– HT Area    (*HT-område*)

– Fully Equipped Area    (*Fullständigt utrustat område*)

– Installation area    (*ATC-arbetsområde*)

F4091.    In Data Available, the present area shall affect the supervision and indication of the STM.

*Note.* The present area is determined by possibly stored balise information in the Hot Standby or Data Available states.

*Note.* When entering Data Available, there is normally no information (after starting up) but there could also be some (when changing from Hot Standby to Data Available at the ATC2-STM border). Refer to Hot Standby [4.3.7].

F4092.    Reserve.

*Note.* While the STM is in Active Shunting state [4.3.9], or has resumed the previous travel direction after running at least 250 m in the other [4.3.12]:

– The STM enters Non-Equipped Area.

– In Shunting, the normal area handling is turned off. The STM behaves almost as in Installation area (most balises are ignored). But when Shunting is finished, the STM will use Non-Equipped Area as a starting point.

F4093.     The maximum permitted speeds $V_{ETCS}$ and $V_{STM}$ of the train shall be supervised in all STM areas.

### 4.4.1.1   Area transitions

*Figure 4.4-1.  Area transitions*
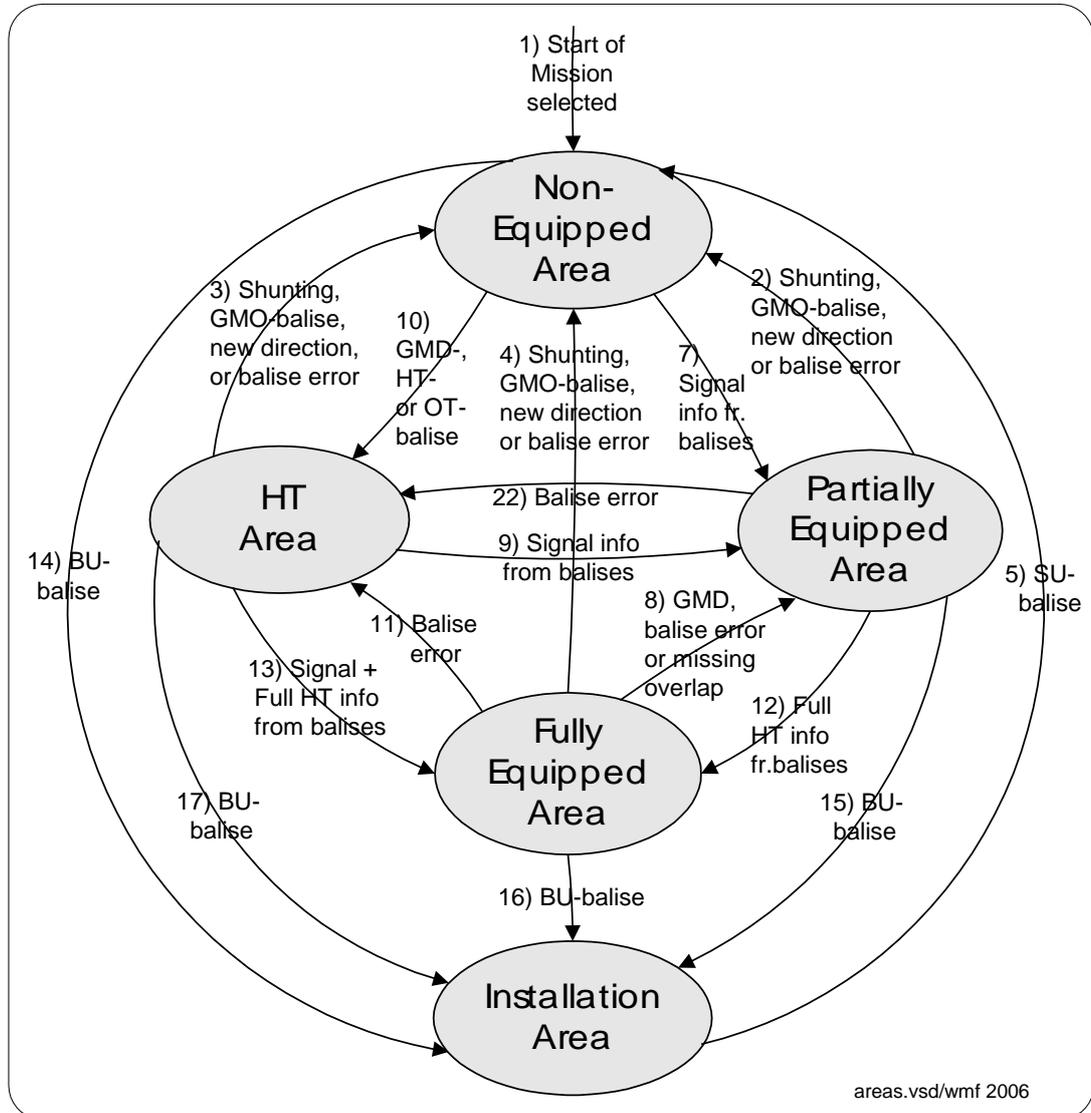


Explanations to the following tables:

–   The transition numbers in this figure refer to the following transition tables.
–   All mentioned balise groups shall be intended for the present direction.

### 4.4.1.2 STM areas with related speed indications

*Table 4.4-1. Area Indications Overview*

| a) | IN: Area or Mode in Data Available | Full HT info | Hsi info | Train length after 1st Hsi | Vmax km/h | V-targ km/h | OUT: MAIN INDICATOR | PRE INDICATOR | MAX SPEED BAR | TARG. SPEED BAR 3) | DIST. BAR | Area indic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b) | Installation area | | | NA | | | Off | Off | Off | Off | On 5) | ATC ARB-OMR. |
| c) | Active Shunting | | | | | | Off | Off | Off | Off | | TÅG-ÖVER-VAKN. |
| d) | Reversing | | | | | | | | | | | |
| e) | BF3 blanking distance | | NA | NA | | | Off 1) | Off 1) | Off | Off | On 2) | TÅG-ÖVER-VAK-NING |
| f) | HT area | NA | | | | | | | | | | |
| g) | Non-equipped area | N | N | | NA | | | | | | | |
| h) | "Entering" equip.area | | Y | N | > 40 | NA | | | | | | |
| i) | Partially equipped area | N | N | NA | | | Off 1) | Off 1) | Off | Off | On 2) | – " – |
| j) | | | Y | N | ≤ 40 | NA | On | On 2) | | | | DEL-ÖVER-VAK-NING |
| k) | | | | Y | ≤ 70 | ≤ 70 | On | On 2) | | | | |
| l) | | | | | > 70 | | – – – | On 2) | | | | |
| m) | | | | | | > 70 | – – – | | | | | |
| n) | Fully equipped area | Y | N | NA | | | Off 1) | Off 1) | Off | Off | | TÅG-ÖVER-VAKN. |
| o) | | Y 4) | Y | N | ≤ 40 | NA | On | On 2) | On | On 2) | On 2) | – |
| p) | | | | Y | NA | | | | | | | |

Explanations:

Y / N / NA   Yes / No / Not applicable

On / Off   Enabled / Extinguished

1)   Exception: while supervising Stop or Expect Stop (indicating zeroes)

2)   If there is any active braking curve (not in Active Shunting or Installation area)

3)   The RELEASE SPEED BAR is also activated at Expect Stop

4)   Including 0...50 m after full HT info was lost after passing a board group

5)   If there is any active braking curve (highly unlikely)

## 4.4.2 Non-Equipped Area

This area is used in non-ATC2-STM territories, areas that totally lack ATC-2 balises.

The numbers within parentheses in the following transition tables refer to [F40igure 4.4-1].

### 4.4.2.1 Enter Non-Equipped Area

F4094.    Non-Equipped Area shall be entered according to the following table.

*Table 4.4-2. Entering Non-Equipped Area*

|     | Transition from: | When: | Note. |
| --- | --- | --- | --- |
| a) | Start of Mission (1) | When the startup procedure is finished | Data Entry is completed and Start of Mission was selected by the driver |
| b) | Partially Equipped Area (2) HT Area (3) Fully Equipped Area (4) | 50 m after entering Active Shunting, or when re-entering there from Passive Shunting | |
| c) | | 5 s after passing GMO, Border to Non-Equipped Area | |
| d) | | Resuming previous travel direction after ≥ 250 m in the other | |
| e) | HT Area (3) | Balise error that deletes HT information | [3.3] |
| f) | Partially Equipped Area (2) | Balise error that deletes signal information | This includes signal linking errors [3.3] |
| g) | Fully Equipped Area (4) | Balise error that deletes all signal and HT information | [3.3] |
| h) | Installation area (5) | Passing SU group, End of In-stallation area | |

#### 4.4.2.1.1 Enter at GMO passage

*Note.* When passing a GMO balise group:

– An f2 audible signal is given for a duration of 5 s. Balise reading, speed super-vision and indication will continue during this period.

– During these 5 s, the driver must acknowledge the area transition, or else full service braking will be ordered [3.11.4].

– After these 5 s, all balise information is deleted, except the category G speed limit from a possible, preceding OTG, and Non-equipped area is entered.

### 4.4.2.2    **Function in Non-Equipped Area**

F4095.    This shall be supervised (also during the five seconds following a GMO):

a)  Max speed.

1.  If available, a line speed $V_{OTG}$ from a preceding category G warning board.

2.  Otherwise, the maximum speed $V_{DARK}$ (130 km/h).

b)  80-supervision after balise error, deceleration or max speed supervision.

*Note*. When entering this area because of a balise error [3.3]

F4096.    In Non-Equipped Area:

a)  The speed indicators and the speed bars shall be extinguished.

b)  This indicator shall appear: TÅGÖVERVAKNING.[34]

### 4.4.2.3    **Exit Non-Equipped Area**

*Table 4.4-3. Leaving Non-equipped area*

| Transition to: | When: |
|---|---|
| Partially Equipped Area (7) | Passing a main and/or distant signal |
| HT Area (10) | Passing a board, either a GMD speed board (border to Partially equipped area), a warning board or a speed board |
| Installation area (14) | Passing BU, Beginning of Installation area |

## 4.4.3    **Partially Equipped Area**

This is an area where there is signal information. Speed and warning boards can appear as long as the system has not collected full HT information. They are supervised as usual.

Partially Equipped Area can serve as a temporary transition area between the Non-equipped and Fully equipped areas, or as a permanent area for lines with reduced supervision of boards.

Definitions:

−  Enabled speed indication: max and target speeds appear with digits or dashes.

−  Temporarily enabled speed indication: max and target speeds appear with zeroes.

---

34 Differs from [ATC2] (lacking there)

### 4.4.3.1     **Enter Partially Equipped Area**

F4097.     Partially Equipped Area shall be entered according to the following table.

*Table 4.4-4. Entering Partially Equipped Area*

| | Transition from: | When: | Note. |
|---|---|---|---|
| a) | Non-Equipped Area (7) | Passing a main and/or distant signal | |
| b) | Fully Equipped Area (8) | Passing a GMD (border to Partially Equipped Area) | |
| c) | | Balise error that deletes HT information | [3.3] |
| d) | | 50 m after passing a group of balises indicating that full HT information is not available (required overlapping information is missing) | The reason for this is to avoid temporarily losing the speed indication at certain combinations of speed board balise groups. |
| e) | HT Area (9) | Passing a main and/or distant signal, and there is not full HT information | |

Temporarily enabled speed indication

This applies for a short while after entering, before speed indication has been enabled (as specified below).

F4097A.     One of the following conditions shall temporarily enable digital speed indication with zeroes on the MAIN and PRE INDICATORs:

a)   The present target speed = Expect Stop and this is displayed with zeroes (from distant signal, FSK or OT-ET).

*Note*. Exception: OT-V warning board.[35]

b)   The train has passed a stop board (BSK or HT-ET with 0 km/h).

*Note*. The indicator TÅGÖVERVAKNING will remain as before.

*Note*. If the train should enter Partially equipped area when passing a stand-alone Expect Proceed distant signal, the speed indicators will not become activated until after a following main signal.

### 4.4.3.2     **Supervision in Partially Equipped Area**

F4098.     Supervision of the maximum and target speeds shall be effected by means of the available balise information.

---

35 Would not indicate zeroes anyway. Only the release speed is indicated after OTV.

F4099.    After passing a GMD, Beginning of Partially Equipped Area:

a) The GMD balise provides a line speed of category G, which shall be supervised in Partially Equipped Area.

b) Previously received information from speed boards shall be deleted.

   *Note.* GMD will not erase any semi-equipped restrictions.

c) If a new GMD is passed after the first one, the maximum speed shall be updated to the speed of that board.


*Note.* If no GMD was passed, the max speed $V_{DARK}$ of 130 km/h is supervised instead. The present value of $V_{DARK}$ may be supervised (active) or kept pending (passive). When changing from Fully to Partially Equipped Area because of a balise failure, $V_{DARK}$ will be re-activated [4.3.8.3].


### 4.4.3.3    Indication in Partially Equipped Area

The speed indicators are enabled (with digits or dashes) or not (blanked) according to certain conditions. The speed bars are always extinguished, but the distance bar appears when there is a braking curve.


Enabled speed indication

F4100.    One of the following conditions shall enable the digital speed indication on the MAIN and PRE INDICATORs:

a) There is valid main signal information, and one of these conditions apply:

1. The whole train length has been passed after the first main signal, or

2. The max speed $V_{MAX} \leq 40$ km/h.

   *Note.* This includes the case when the train has passed a stop signal.

b) There is valid distant signal information, and both these conditions apply:

1. Vfsi < Vmax (there is a braking curve), and

2. The train has entered interval B (flashing main indicator).

   *Note.* No train length delay in this case.[36] Target speeds = 0 will appear on both indicators, the others only on the MAIN INDICATOR.

---

36 Differs from ATC-2

F4101.    If the speed indicators are enabled (as specified above) the STM shall handle max speed display in the following way (provided that there is no restrictive target speed that needs to be displayed):

a)  Max speed ≤ 70 km/h: Vmax shall be displayed on the MAIN INDICATOR.

b)  Max speed > 70 km/h: Vmax shall be replaced with dashes on the MAIN INDICATOR.

F4102.    If the speed indicators are enabled (as specified above), and there is a restrictive target speed, the STM shall display the following in the MAIN INDICATOR and/or PRE INDICATOR, provided that there is a restrictive target speed that needs to be displayed [4.6.12]:

a)  Target speed ≤ 70 km/h: Vmax shall be displayed with digits.

b)  Target speed > 70 km/h: Vmax shall be replaced with dashes.

F4103.    When the speed indication becomes enabled (as specified above), this shall be indicated:[37]

a)  The indicator DELÖVERVAKNING shall appear.

b)  The indicator TÅGÖVERVAKNING shall disappear.

F4104.    The MAX SPEED, TARGET SPEED and RELEASE SPEED BARS, but not the DISTANCE BAR, shall be extinguished in Partially Equipped Area.

*Note.* The SPEED POINTER changes colour depending on the train speed (neutral – yellow – orange – red). Refer to the Indications section for more details [4.8].

---

37 Differs from [ATC2] which does not have these indicators

#### 4.4.3.4 Exit Partially Equipped Area

*Table 4.4-5. Leaving Partially equipped area*

| Transition to: | When: |
|---|---|
| Non-Equipped Area (2) | 50 m after entering Active Shunting, or when re-entering there from Passive Shunting |
|  | 5 s after passing GMO (border to Non-Equipped Area) |
|  | Resuming previous travel direction after ≥ 250 m in the other |
|  | Balise error that deletes signal information unless GMD, HT, or OT information is stored [3.3] |
| HT Area (22) | Balise error that deletes signal information, and GMD, HT, or OT information is stored [3.3] |
| Fully Equipped Area (12) | Full HT (speed board) information is received |
| Installation area (15) | Passing BU (beginning of Installation area) |

## 4.4.4    HT Area

This is a "speed board area" where there is no signal information, but only warning and/or speed board information.

HT Area works normally as a temporary transition area between the Non-Equipped and Fully Equipped Areas.

#### 4.4.4.1    Enter HT area

F4105.    HT Area shall be entered according to the following table.

*Table 4.4-6. Entering HT Area*

|  | Transition from: | When: | Note. |
|---|---|---|---|
| a) | Non-Equipped Area (10) | Passing either a speed board or warning board |  |
| b) |  | Passing a GMD, Border to Partially Equipped Area |  |
| c) | Fully Equipped Area (11) | Balise error that deletes signal information. | There is full HT information  [3.3] |
| d) | Partially Equipped Area (22) | Balise error that deletes signal information, and there is some board information from GMD, HT or OT. | There is not full HT information [3.3] |

#### 4.4.4.2    Function in HT Area

F4106.    If there is no valid category G line speed for this area, the maximum speed $V_{DARK}$ shall be activated and supervised instead (130 km/h).

*Note.* The mentioned line speed can emanate from a previously passed HT-T, OTG and/or GMD board.

F4107.    Reserve.

*Note.* In the absence of a speed board:

– Braking curves from warning boards shall be supervised as usual.

– Supervision of semi-equipped speed restrictions shall commence at the target point, if this is allowed for the speed category in question [4.6].

F4108.    a) All available information – from border, speed and warning boards – shall be used for supervision.

        b) The speed bars shall be extinguished, but not the DISTANCE BAR.

        c) The speed indicators shall be extinguished.[38]

        d) Exceptions to c. This shall temporarily enable (activate) the PRE and MAIN INDICATORS:

            1. After passing a Stop board (BSK or HT-ET 0).

            2. While an Expect Stop braking curve (from FSK or OT-ET) is supervised.

F4109.    The following shall be indicated: TÅGÖVERVAKNING.[39]

*Note.* This message indicates that valid main signal information is missing.

### 4.4.4.3  Exit HT area

*Table 4.4-7. Leaving HT area*

| Transition to: | When: |
|---|---|
| Non-Equipped Area (3) | 50 m after entering Active Shunting, or when re-entering there from Passive Shunting |
| | Balise error that deletes HT information [3.3] |
| | 5 s after passing GMO (border to Non-Equipped Area) |
| | Resuming previous travel direction after ≥ 250 m in the other |
| Partially Equipped Area (9) | Passing a signal and there is not full HT information |
| Fully Equipped Area (13) | Passing a signal and full HT information is stored |
| Installation area (17) | Passing BU (beginning of Installation area) |

---

38 At once, or after displaying 'FEL' if entering because of a balise error

39 Differs from [ATC2]

## 4.4.5    Fully Equipped Area

The full balise receiving and speed supervision program is active in this area.

Definition:

– Enabled full speed indication: max and target speeds appear with digits.

### 4.4.5.1    Enter Fully Equipped Area

F4110.    Fully Equipped Area shall be entered according to the following table.

*Table 4.4-8. Entering Fully Equipped Area*

| | Transition from: | When: |
|---|---|---|
| a) | Partially Equipped Area (12) | Complete HT information is received |
| b) | HT Area (13) | Passing a main and/or distant signal, and there is full HT information |

F4111.    The following conditions shall enable (activate) full speed display after entering Fully Equipped Area, which means that the max and target speeds shall be displayed with bars and digits (regardless of speed levels).

a) There is full HT information, and

b) There is main signal information, and

    1. The whole train length has been passed after the first main signal, or

    2. The maximum permitted speed $V_{MAX} \leq 40$ km/h.

    *Note*. This includes the case when the train enters by passing a stop signal.

c) There is valid distant signal information, and both these conditions apply:

    1. Vfsi < Vmax (there is a braking curve), and

    2. The train has entered interval B (flashing main indicator).

*Note*. Indicator TÅG- or DELÖVERVAKNING remains until this requirement is fulfilled.

F4112.    Before full speed display has been enabled (according to the previous requirement) after entering here from Partially Equipped Area, the STM shall update the speed indicators (digital and analog) in exactly the same way as in Partially Equipped Area [4.4.3].

*Note*. There will not be any indication at all until the train has passed a main signal with the train length (without the train length if $V_{MAX} \leq 40$).

*Note*. Example: If the train should enter here from HT area by passing a stand-alone Expect Proceed distant signal, the speed indicators will not wake up until after the following main signal.

### 4.4.5.2    Function and indication in Fully Equipped Area

Supervision and digital speed indications

F4113.    a) The complete supervision program shall be active with max and target speed supervision.

b) The current max speeds and restrictive target speeds shall be shown with digits on the speed indicators all the time, as soon as these indicators has been fully enabled upon entrance (as specified above).

*Note.* Exceptions:

− While passing the blanking distance after a BF3 balise error without erasing [3.3.4..5],

− During the first 50 m of Active Shunting, before entering Non-equipped area [4.3.9]

− During temporary reversing [4.3.12].

− For the PRE INDICATOR: there is no restrictive target speed to display for the moment.

Analog speed bars and area indicators

F4114.    a) No special area indication shall be displayed when full speed display has been enabled (as specified above).

*Note.* This means that indicators TÅGÖVERVAKNING and DELÖVERVAK-NING are turned off.

b) The DISTANCE BAR shall be indicated according to [4.8.3].

c) The speed bars for indication of max speed, target speed and release speed shall become enabled at the same time as the MAIN INDICATOR starts showing a max or target speed in digits.[40]

*Note.* Refer also to [4.8.3].

*Note.* Speed bars can be extinguished in special cases, after balise error, during shunting or while reversing (in a similar way as escribed above).

---

40 Differs from [ATC2]

### 4.4.5.3 Exit Fully Equipped Area

*Table 4.4-9. Leaving Fully equipped area*

| Transition to: | When: |
|---|---|
| Non-Equipped Area (4) | 50 m after entering Active Shunting, or when re-entering there from Passive Shunting |
| | Balise error that deletes HT and signal information [3.3] |
| | 5 s after passing GMO, Border to Non-Equipped Area |
| | Resuming previous travel direction after ≥ 250 m in the other |
| Partially Equipped Area (8) | Passing a GMD, Border to Partially Equipped Area |
| | Balise error that deletes HT information [3.3] |
| | Travelling 50 m after a group of balises indicating that full HT information is not available |
| HT Area (11) | Balise error that deletes signal information [3.3] |
| Installation area (16) | Passing BU, Border to Installation area |

## 4.4.6 Installation Area

The Installation area[41] is useful while ATC-2 balises are installed on a new line, or changed on an already equipped line.

### 4.4.6.1 Enter Installation Area

F4115.   Installation area shall be entered according to the following table.

*Table 4.4-10. Entering Installation Area*

| | Transition from: | When: |
|---|---|---|
| a) | Non-Equipped Area (14) | Directly after passing a BU balise group, Beginning of Installation area |
| b) | Partially Equipped Area (15) | |
| c) | Fully Equipped (16) | |
| d) | HT Area (17) | |

Installation area is entered and the balise reading is inhibited when passing BU. But supervision and display continues as previously for a 5 sec period, during which the f2 audible signal is activated.

During these 5 s, the driver must acknowledge the area transition, or else full service braking will be be ordered [3.11.4].

---

41 Previously called ATC Construction Area

### 4.4.6.2 Installation Area – Function and indication

F4116.  a) If there is a valid line speed from a preceding OTG warning board, this shall be supervised.

b) Otherwise the maximum speed $V_{DARK}$ (of 130 km/h) shall be supervised.

*Note.* This dark speed may have been disabled for a while, but may need to be enabled again.

*Note.* The maximum permitted speed $V_{STM}$ of the train is also supervised.

F4117.  a) All balise groups shall be ignored after the BU border group.

b) Exception:  SU, End of Installation area.

F4118.  a) No balise error alarms shall be given after the BU border group.

b) Exception: Linking errors that occur during 0...5 s after the border.

F4119.  a) The speed indicators and the speed bars shall be extinguished.

b) Exception: during the first 5 s after the border.

F4120.  The indicator ATC-ARBETSOMRÅDE shall be displayed directly after the BU group.[42]

### 4.4.6.3 Exit Installation Area

*Table 4.4-11.* Note. Leaving Installation area

| Transition to: | When: |
|---|---|
| Non-Equipped Area (5) | Passing an SU balise group, End of Installation area |

---

42 Differs from [ATC2]

## 4.5    SUPERVISION OF MAX SPEED

### 4.5.1    General

The STM supervises that the general maximum permitted speed $V_{MAX}$ is not exceeded (within certain margins).

The STM must therefore keep account of all presently valid speed limits. These are updated according to train parameters, balise groups as they are passed, present STM state, present STM area and for semi-equipped restricitons, also the actions of the driver.

The overspeed limits are +5 for tone warning, +10 km/h for full service braking and +15 km/h for emergency braking. The speed bar colours will be affected by overspeed, as shown below.

*Figure 4.5-1. Max speed supervision with MARGIN BAR colours*
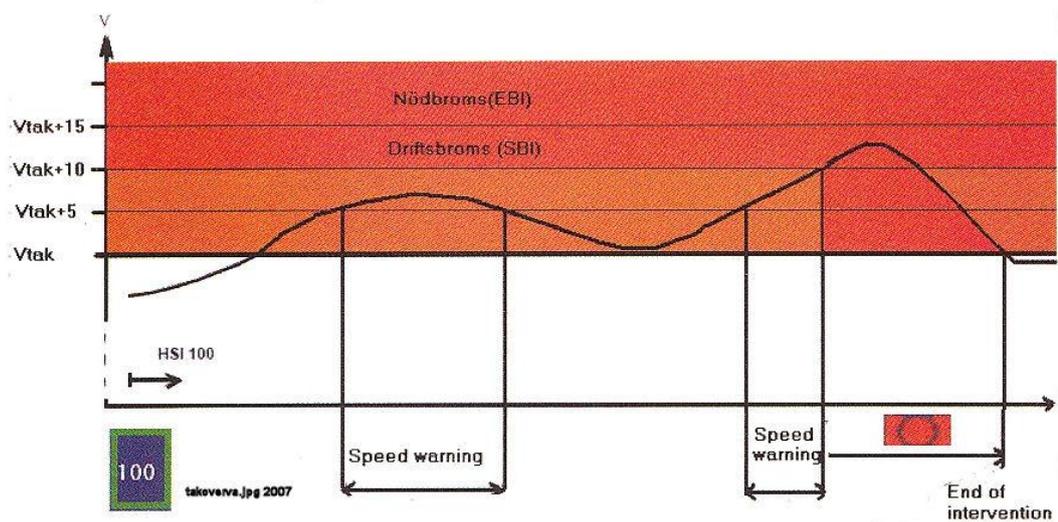


F4121    Reserve.

F4122.    Reserve.

### 4.5.2    Various speed limits

F4123.    The speed limits in the following table shall be handled by the STM.[43]

---

43 Differs from [ATC2]

*Table 4.5-1. Speed limits summary*

| | Name | Meaning |
|---|---|---|
| | **System max speeds** | |
| a) | $V_{STM}$ | Maximum permitted speed of the train[44]. Two sub-categories, ETCS and STM (train parameters). |
| b) | $V_{ETCS}$ | |
| c) | $V_{START}$ | 40 km/h speed limit after ATC2-STM start-up or shunting. 0 km/h while waiting for the driver to enter train data after shunting. |
| d) | $V_{DARK}$ | 130 km/h speed limit. Only active in areas which are either not Fully equipped or which lacks a category G line speed of their own (an area line speed). |
| | **Signal max speed** | |
| e) | $V_{HSI}$ | Main signal speed limit, updated after... <br> - the latest valid main signal, including stop signal (0 or 40 km/h), <br> - passing an A-extended target point, <br> - passing the point of a preset speed increase, <br> - a signal speed increasing balise group (SH or a certain HT). |
| | **Board max speeds (17 in total)** | |
| f) | $V_{LINE}$ ($V_{HT\text{-}T\,/\,G}$) | Line speed. Contains a max speed of... <br> - category T for Fully equipped area, or <br> - category G for other areas. |
| g) | $V_{HT\text{-}K1\ or\ \text{-}K2}$ | - K1 or K2, curve speed |
| h) | $V_{HT\text{-}PT\ 000...777}$ | - PT, train dependent speed, sub-categories PT1...PT9 (octal) |
| i) | $V_{HT\text{-}V1,\text{-}V2\ or\ V3}$ | - V, level crossing speed (sub-categories V1...V3) |
| j) | $V_{HT\text{-}ET}$ | - ET, route dependent speed (signal aspect dependent)[45] |
| k) | $V_{HT\text{-}SK}$ | - SK, landslide warning speed |
| l) | $V_{SEMI}$ | The lowest active semi-equipped speed restriction. Categories: <br> - Line speed (sub categories T and G) <br> - K1 or K2, curve speed |
| | **Other max speeds** | |
| m) | $V_{DEC}$ | Deceleration end speed, a max speed which applies: <br> - from a braking curve's target point ($V_{TARG}$) <br> - from a braking curve's release point ($V_{REL}$) |
| n) | $V_{REL}$ | Release speed from an Expect Stop braking curve: Distant signal, OT-V, FSK, OT-ET or 80-supervision. |
| o) | $V_{ERR}$ | 80 km/h speed limit after balise error BF2 or BF3 |
| p) | $V_{REVERSE}$ | 40 km/h speed limit during reversing. |
| q) | $V_{SHUNT}$ | 40 km/h speed limit during shunting. |

*Note.* Train length delayed speed limits belong to respective category.

---

44 *Sth = Största tillåtna hastighet*

45 HT-ET 0 is supervised as a max speed

F4124.    The STM shall keep account of and supervise every new speed restriction, as soon as the speed information from the balises has been read and accepted.

*Note.* The general maximum permitted speed $V_{MAX}$ contains (in every moment) the most restrictive speed value of all the restrictions listed. This is supervised in the STM state Data Available. (Exceptions may apply, for instance in Installation area and during shunting.)

*Note.* The STM must also keep account of the speed restrictions in the Hot Stand-by state, although no speed supervision takes place.


## 4.5.3    Exceeding of curve speed limits

The basic speed limit from a speed board of category K1 or K2 will be increased by the corresponding K1 or K2 exceed level percentage parameter, set during train data input, if this value is non-zero [4.2.1.2].


## 4.5.4    Display and supervision

### 4.5.4.1    Display

F4124A.    If there is no "flashing" target or release speed that shall be displayed according to the requirements in sub-section [4.6.12], the main indicator shall be available for indication of maximum permitted speed.


F4124B.    The current lowest maximum permitted speed ($V_{MAX}$) shall be available for display on the MAIN INDICATOR:

a)    The current permitted max speed ($V_{MAX}$) shall be displayed on the MAIN INDICATOR in Fully equipped area.

b)    The current permitted max speed ($V_{MAX}$) shall be displayed on the MAIN INDICATOR according to special rules in Partially equipped area [4.4.3].

c)    After passing stop, the MAIN INDICATOR shall display the following in Fully equipped area, but also in Partially equipped area and HT area:

1.    Two zeroes after passing a stop signal.

*Note*. This is not possible in HT area. The area will change to Partially or Fully equipped.

2.    Two zeroes after passing BSK.

3.    One zero after passing an HT-ET of 0 km/h.[46]

---

46 Differs from [ATC2]: Not indicated at all in HT area

*Note.* Max speed indication will occur in the following cases:

a) With digits in Fully Equipped Area [4.4.5]

b) With digits in Partially Equipped Area if $V_{MAX} \leq 70$ km/h. [4.4.3]

c) With three dashes in Partially Equipped Area if $V_{MAX}$ is $> 70$ km/h. [4.4.3]

d) With zeroes in HT area after passing a stop board. [4.4.4]

e) With zeroes in Partially or Fully equipped area after passing a stop signal or stop board. [4.4.3/5]

f) Exceptions to a-c: The indicator may be blanked in certain situations, like BF3 blanking [3.3.4] or temporary reversing [4.3.12].

g) Exceptions to a-e: The indicator may be blanked during shunting [4.3.9].

F4124C.   The current lowest maximum permitted speed ($V_{MAX}$) shall be displayed on the MAX SPEED BAR in Fully equipped area[47], provided that the MAIN INDICATOR displays digits at the same time.

*Note.* The colours of the analog indicators are defined in the section about the indications [4.8].

F4124D.   When the speed of the train $\geq V_{MAX} + 5$ km/h, short intermittent tones shall be given [4.8.8].

### 4.5.4.2   Supervision

The current lowest maximum permitted speed ($V_{MAX}$) is used for supervision.

F4124E.   a) If the speed of the train $\geq V_{MAX} + 10$ km/h, the STM shall order full service braking.

b) This brake application shall be possible to release when the speed has been brought down to $< V_{MAX} + 5$ km/h.

F4124F.   a) If the speed of the train $\geq V_{MAX} + 15$ km/h, the STM shall order emergency braking.

b) This brake application shall be possible to release when the speed has been reduced to $< V_{MAX} + 15$ km/h.

---

47 Differs from [ATC2]

c) Exception: This does not apply to supervision of 40 km/h caused by passing an unexpected signal at stop, before the brake has been released. [48]

## 4.5.5    Increasing of maximum permitted speed

An "increasing" board or signal means that the most recent new speed board or main signal information provides a higher speed value than the previous board or signal of the same category.

### 4.5.5.1    General

Information concerning increase of the maximum permitted speed is detected by the on-board system when the leading engine passes the point of speed increase. To prevent the rear of the train from travelling too fast, the introduction of the increase in speed must be delayed until the whole length of the train has passed the point of increase.

Exceptions apply for:

– Level crossings,

– Landslide warnings,

– Max speed of the train ($V_{STM}$, $V_{ETCS}$),

– $V_{START}$, when increased from 0 to 40 km/h after shunting.

### 4.5.5.2    The train length delay function

On passing a point of speed increase, the current, more restrictive maximum speed is supervised until the entire train (according to the train length parameter) has passed that point.

*Note.* If too many simultaneous train length delays are required (incorrect track layout), overflow may occur [3.3.1.9]

F4125.    Train length delays shall be handled by the STM in this way:

a) An increased or terminated speed restriction shall continue to be valid until the whole train length has been travelled after the increase point.

b) If the speed restriction was increased or terminated after a balise group, the starting point of the train length delay shall be located at the balise group.

---

48 No exception for supervision of $V_{DARK}$ = 130 km/h, which was the case with [ATC2]

### 4.5.5.3    Restrictions with train length delay

F4126.50a  Train length delay shall be performed at the following occasions:

a)  An increasing speed board is passed (HT-T, HT-K, HT-PT or HT-ET).

1.  Exception: HT-Vn at level crossing.

2.  Category G speed shall be increased by a category T increasing board (and vice versa).

b)  End board of this category is passed:

1.  SK1 or SK2.

2.  SPTS for certain PT bits.

3.  SPTT for all PT bits.

4.  SET.

*Note*. This excludes SVn, end of level crossing protection, and SSK, end of landslide protection.

c)  The pressing of the HÖJNING button for a semi-equipped speed restriction.

*Note*. This applies to the speed categories T, K and ET.

d)  A speed increasing main signal, an SH group or a signal increasing HT of category 3 is passed.

e)  The point of a preset (distant signalled) speed increase, should this be valid.

f)  For a valid start restriction of 40 km/h, should the driver press the HÖJNING button.

g)  The passing of a GMD, provided that the general maximum speed is increased as a result of speed board information being deleted.

h)  Erasing of HT max speeds at balise error (categories T, K and PT).

i)  Erasing of G line speed when passing SU.

## 4.5.6    Preset speed increase

This supervision starts after a combined signal with preset speed increase, which will increase the main signal speed $V_{HSI}$ at a point before the next main signal, normally at a switchpoint.

Refer also to the rules that apply when the train stops during supervision of preset speed increase [3.6.11], which can change this to an Expect Stop braking curve.

A combined signal with preset speed increase information is not regarded as a distant signal, in the concept of controlling OT-ET [3.6.12].

## 4.6    HANDLING OF BRAKING CURVES

### 4.6.1    General

This section describes braking curves for the various types of speed restrictions, and how to manage them under different situations.

A balise error alarm may be generated in the event that too many braking curves are called for at one time (overflow because of an incorrect track layout) [3.3.1.9].

For the actual deceleration supervision, refer to section [4.9].

F4127.    Reserve

F4128.    Reserve

#### 4.6.1.1    When the train parameters change

F4129.    Changes in the following train parameters may affect active braking curves immediately:

a)  STM max speed

b)  K1 and K2 exceed levels

c)  $T_B$ delay time (changed via EPA).

F4130.    Changes in the following train parameters shall not affect any active braking curves:

a)  Adhesion (from ETCS).

b)  $B_F$ deceleration (changed via BP).

### 4.6.2    Braking curve from distant signal

#### 4.6.2.1    General

A braking curve data record will be established (or updated) upon passing a distant signal or a combined signal [3.5 + 3.6].

The distant signal braking curve can have one of the following categories:

−  Distant signal, with neither extension nor preset speed increase (or was maybe originally a preset speed increase, which was changed to a braking curve after a temporary train stop).

−  Distant signal with A-extension, directly aiming at a switch point beyond the next main signal.

−  Distant signal with P-extension, aiming at a main signal beyond the next one(s).

The distant signal target speed can be:

− Expect Proceed with various speed levels

− Expect Stop with a release speed of 40 km/h (40-supervision)

− Expect Stop with a release speed of 10 km/h (10-supervision)

*A-note*. The release speed of 10 or 40 km/h may be updated by release speed balises of category 13.

Refer to [4.9.11] for additional information.

F4131.     Reserve.

F4132.     Reserve.

F4133.     Reserve.

### 4.6.2.2    Repeater distant signal

If a new stand-alone distant signal is passed while supervising an existing distant signal braking curve, then this new distant signal is normally regarded as being a *repeater* distant signal [3.5.3].

Exceptions, when an extended target point is supervised [3.5.3.2]:

a) A braking curve with a locked category A extension will always remain un-changed, and a new braking curve is established from the distant signal.

b) A braking curve with a category P extension will generally continue to exist in the absence of a prefix balise. A new braking curve is established from the distant signal.

c) Existing braking curves, with the exception of those that are locked category A extension, will be updated with the information from the new distant signal if this one also is extended.

In instances where the main and distant signals are combined in the same balise group, the distant signal information will not be considered to be a repeater distant signal, since the information from the main signal normally means that an existing braking curve from a distant signal is terminated.

Exception: when there is an unlocked A-extension, this is locked and updated, and a new braking curve is established from the combined signal [3.6.2.2].

When there is an existing distant signal braking curve, and a repeater distant signal is passed, the existing braking curve is updated in accordance with the repeater distant signal balise group as described below:

1. Updated target speed and distance information.

2. Unchanged gradient (unless there is new gradient information).

3. Unchanged brake percentage and adhesion parameters (to avoid unecessary braking).

4. Should the train return to a previous interval because of the repeater:

   – The status of the braking curve is reset and the new interval will apply.

   – This may cause extra tone warnings to appear.

5. Exceptions to the previous point. These will only be re-evaluated after the train has returned to the physical interval A at the repeater:

   – Current train acceleration status ($T_{ACC}$).

   – Current braking status ($T_{BRAKE}$).

6. Note that:

   – Linking and SH groups are not counted as distant signal repeaters in this context, and can never force the train to *return* to a previous interval (although they can affect a braking curve in other ways).

   – A linking group cannot update the extension distance.**Error! Bookmark not defined.**

   – Warning boards are handled in a similar way.

Refer also to [3.5.3] and [4.9.1].

### 4.6.2.3   Release speed for distant signal braking curve with Expect Stop

Release speed from a signal

F4134.   For a distant signal where $V_{TARG}$ = 0 km/h, the release speed $V_{REL}$ shall be set to:

a)   10 km/h if AX = 1.

b)   40 km/h if AX = 4.

Release speed from a release group

F4135.   Reserve.

A4135.    For braking curves without target distance extension, the release speed shall be updated according to the latest release balise group A(13) B(13) that was passed after the original distant or combined signal [Tables FY and FZ].

*A-note.* The new release speed may increase or decrease the latest received release group information, but not below the latest received signal information. For more details, see [3.8.2].

Release speed calculation when there is distance information

*A-note.* The release group can give two different types of distances:

–   Overlap: Before the train has stopped, this is a time limited protection distance. This distance can for example stretch beyond both the target point and the next switchpoint (but not into an hostile train route).

–   Distance to DP: After the train has stopped, this is the distance left to the danger point DP. This distance can for example stretch beyond the target point to the next switchpoint.

This distance, here called the release distance, is related to the release speed in the following way:[49]

$$D_{REL} = (V_{REL}/3.6) \cdot T_B + \frac{(V_{REL}/3.6)^2}{(2 \cdot b)} \quad (m)$$

where:

–   b   is the deceleration parameter (full service brake), adjusted for possible bad track conditions (negative gradient and low adhesion).

–   $T_B$ is the brake delay time parameter (full service brake).

–   $V_{REL}$ is the release speed in km/h.

*A-note.* Refer to [Tables FY, FZ], to the figure below and to [ESRS].

F4136.    Reserve.

---

49 Differs from [ATC2]

A4136.   If a distance is given by the release group, the STM shall compute the release speed in the following way:[50]

a)   The release distance $D_{REL}$ is related to the release speed in this way:
$$D_{REL} = (V_{REL}/3.6) \cdot T_B + (V_{REL}/3.6)^2 / (2 \cdot b) \qquad (m)$$

b)   The release speed shall (consequently) be computed in the following way:

$$V_{REL} = 3{,}6 \cdot (\sqrt{(b \cdot T_B)^2 + 2 \cdot b \cdot D_{REL}} - b \cdot T_B) \ (km/h)$$
where:
–   b   = The deceleration parameter (full service braking)[51], adjusted for adhesion and a possible negative track gradient, and

–   $T_B$ = Delay time parameter (when initiating full service braking).

–   $V_{REL}$ = The release speed in km/h.

c)   The deceleration value shall be adjusted according to current adhesion setting (1/1 for high adhesion, 2/3 for  low adhesion), before the calculation takes place.
*A-note.* To avoid unnecessary STM braking, a change in the adhesion value will not take effect after a braking curve has been started [4.2].

d)   The resulting $V_{REL}$ shall be rounded down to nearest km/h and shall be limited to min. 10 and max $40^{52}$ km/h.

*A-note.* If the release speed should be exceeded during release speed supervision – after the release point – normal speed margins and brake levels will apply for STM braking, see [4.5].

*A-note.* About these calculations:

–   Distance $D_{REL}$ is located *beyond* the target point, but the release speed calculation is adjusted for adhesion and for negative track gradients received before the target point.

–   The release point is located *in front of* the target point and the release point calculation is adjusted for the present track gradient.

F4137.   Reserve.

---

50 Differs from [ATC2]

51 Reserve.

52 Reserve.

F4138.        Reserve.

A4138.        a) The received data from a release group A(13) B(13) shall be valid until:

   1. The next main signal balise group is passed, or

   2. The affected distant signal braking curve is terminated, or

   3. A new release group is passed, or

   4. A higher release speed is received from a new repeater distant signal or linking group, or

   5. A BF2 or BF3 balise error is detected.

   b) Valid data from a release group shall still apply if:

   1. A lower release speed is received from a new repeater distant signal or linking group.

   2. The target speed is changed (because of a repeater or a train stop).

   *A-note*. Other information from the release group may apply after the train has stopped.

*Figure 4.6-1. Note. Release point for an Expect Stop distant signal braking.*

**DISTANT SIGNAL BRAKING CURVE WITH "EXPECT STOP"**
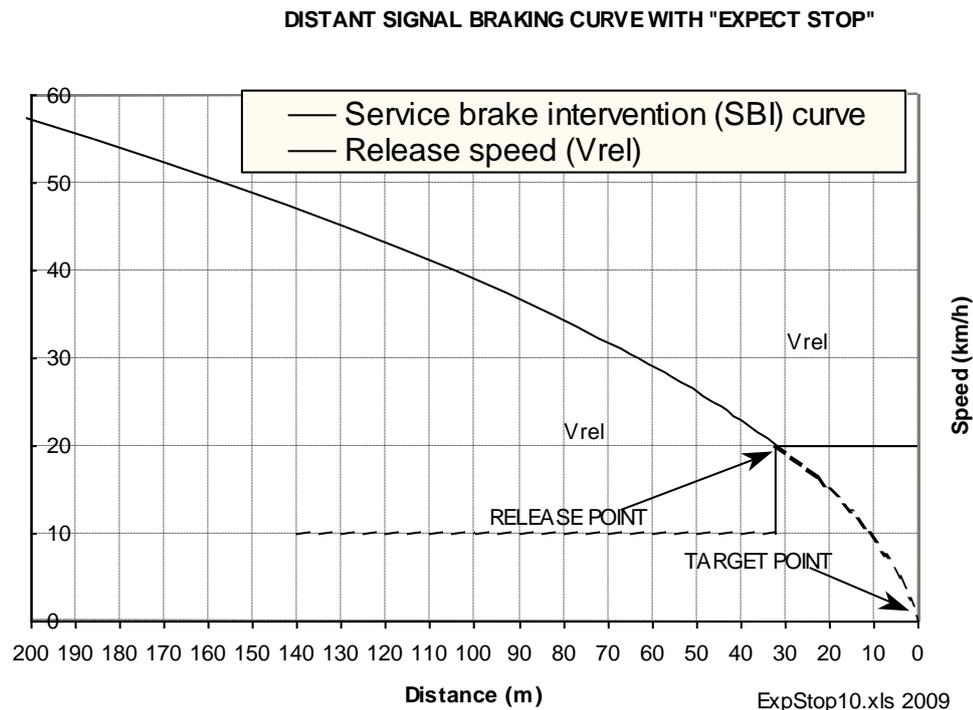


*Note*. Explanation to the figure: "SBI" is an ETCS expression for the brake intervention curve $S_{DE}$ [4.9].

*Figure 4.6-2. A-note. Release point for an Expect Stop distant signal braking curve.*

**DISTANT SIGNAL BRAKING CURVE WITH "EXPECT STOP"**
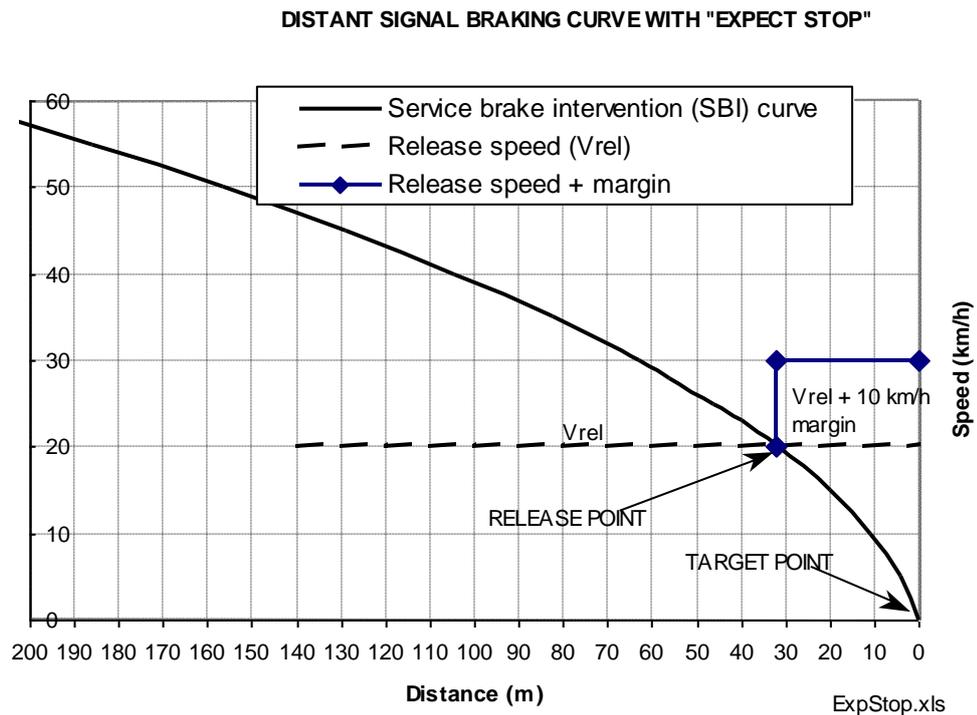


## 4.6.3 Terminate or change a distant signal braking curve

### 4.6.3.1 Termination when passing a main signal

In the absence of active extension, the braking curve will be completely terminated when passing a main signal.

A braking curve with a category P extension will only be terminated if the main signal is combined with a distant signal.

### 4.6.3.2 Termination at extended target point

Category A extension

F4139.    a)  An A-extended braking curve shall be terminated at the extended target point.

b)  The target speed of the braking curve shall update present main signal speed.

Category P extension

F4140.    a)  With category P extension, the braking curve shall change to max speed supervision of the target speed (or release speed) at the extended target point.

*Note*. This is analogous with a braking curve without any extension.

b) The braking curve shall then be handled as a braking curve without extension:

   1. Regarding display, termination and updating at repeater distant signals.

   2. This shall also result in 'P' no longer being indicated.

### 4.6.3.3    Changing the supervision mode of a distant signal braking curve

<u>The distant signal becomes pending</u>

F4141.    The braking curve from a distant signal shall become pending (passivated) when:

a) $V_{TARG} \geq V_{MAX}$, or

b) A repeater distant signal with a new $V_{TARG} \geq V_{MAX}$ is passed.

F4141.    Target position and target distance shall continue to be maintained in a pending braking curve so that it can be activated again when required.

*Note*. For example, if the train stops, see below [4.6.3.4].

<u>The distant signal is changed to a speed limit</u>

F4142A.    A braking curve shall change from deceleration supervision to max speed supervision in these cases.

a) Expect Stop: The braking curve shall change to max speed supervision of the release speed as soon as the knee (the release point) is passed.

   *Note*. STM braking will occur if the knee is passed while running faster than the release speed (no margin).

b) Expect Proceed: The braking curve shall change to max speed supervision of the target speed at the target point.

   *Note*. Normal speed margins will apply from now on.

### 4.6.3.4    Stopping between distant and main signals

F4143.    a) Should a train stop between a distant and a main signal, then the target speed shall change to Expect Stop.

b) Simultaneously a possible extension distance shall be deleted (i.e. set to zero).

c) The supervision shall then be carried out as if the distant signal had an Expect Stop aspect without any extension.

d) The release speed shall be set according to previously received balise information.

## 4.6.4    Distant signal with target distance extension

### 4.6.4.1    Category A extension

Category A extension is primarily intended for use in conjunction with entrance routes to stations (speed restriction while passing a switch point). This extension can only be aimed beyond one main signal.

Category A extension is locked on passing a main signal or a combined signal.

F4144.    After passing a new (locking) main signal or combined signal, further updating of the extended, locked braking curve target speed shall not be possible.

*Note*. When a category A extension is active, the max speed provided by the locking main signal (stand-alone or combined) willl be postponed during the extended distance. This is done by updating the target speed according to the main signal speed. [3.4.2, 3.6.2].

*Note*. A possible distant signal message is handled separately, i.e. an independent braking curve will be set up according to this information.

### 4.6.4.2    Category P extension

Category P extension is meant for use mainly in association with advance signalling, replacing reduction of target speeds by stages. This is done by making use of AZ = 1 (which normally means Expect 40 km/h), which, when used in conjunction with a P balise, means an extendable Expect Stop. The equivalent of a multi aspect (e.g. four or five aspect) signalling can be set up with the aid of P extension.

F4145.    a)  It shall be possible for the latest signal passed to update a P-extension.

b)  This braking curve shall therefore never be locked.

*Note*. The internal relationship between the target points decides the possibility for a category P extension to be terminated or not by a separate distant signal which does not have a prefix balise. The category P extension often continues to its target point (non-extended during the final block section), or until a distant signal with a prefix balise is passed [3.5.3].

F4146.    Only one braking curve with category P extension shall exist at any one time.

### 4.6.4.3    Fixing a braking curve with A- or P-extension

*Note*. When passing the first main signal after establishing a braking curve (and if the total target distance has not yet been travelled), the braking curve is *fixed*. This means that the target distance is fixed, which results in the remaining target distance being set equal to the extension distance. Both categories A and P extension can be fixed.

F4147.     When fixing the braking curve, the position of the main signal shall be used as the reference for updating the target point of the braking curve.

*Note.* The reason for this is to compensate for distance travelled and to put the target position at the exact extension distance as stated in the category P balise, beyond the main signal [3.4.2.2]. This adjustment also applies if the basic target distance already has been passed.

F4148.     a)  If the total target distance has elapsed, i.e. the extended target point has been passed, fixing shall not occur.

b)  This braking curve shall instead be handled as a braking curve without extension.

*Note.* The braking curve will therefore be changed to supervision of the maximum permitted speed [4.6.3.3].

### 4.6.4.4   Locking a braking curve with A-extension

F4149.     Reserve.

*Note.* The first main signal or combined signal to be passed following a distant signal with a category A extension, will lock the extended braking curve.

*Note.* This is to prevent the braking curve from being affected by any other signal.

F4150.     Actions when passing a new main or combined signal, while supervising an existing, unlocked A-extension:

a)  The main signal speed shall replace the existing A-extended target speed.

b)  The A-extension shall then be locked.

F4151.     The previous requirement shall also apply if the new main signal speed is higher than the existing A-extended target speed.

F4152.     At the target point, the A-extended target speed shall be used as new main signal information.

F4153.     Reserve.

*Note.* The passing of a new main signal or combined signal after a category A extension has been locked, will result in the following:

–  Balise error alarm BF1 will be activated.

–  The locked braking curve will be terminated.

–  The information from the new main signal will apply immediately.

[3.4.2, 3.6.2].

A possible braking curve – that is not extended – from a previous, locking combined signal, is also terminated (as usual).

Two braking curves with locked category A extension cannot be stored at the one and same time, and neither is a category A extension allowed to extend beyond a second main signal.

### 4.6.4.5  No extension at Expect Stop or Expect 270 aspects

F4154.  Reserve.

*Note*. The distance information provided by the category P balise is interpreted as being equal to zero (i.e. without extension), in the event that the distant signal code word AZ is either = 0 or ≥ 12 [3.5.1].

Expect Stop can instead be represented by AZ being equal to 1 with category P extension, in which case the information from the category P balise is used.

### 4.6.4.6  Stopping between distant and main signal

F4155.  Reserve.

*Note*. When the train stops between a distant signal and a main signal:

a)  Expect Stop is activated.

b)  The extension distance is deleted [4.6.3.4].

A new extension can be initiated by the means of a group of repeater balises including a prefix balise.

This rule does not apply to a locked A-extended braking curve, since the associated main signal was already passed at the time when the record was locked, see below.

Category A extension

F4156.  If the train stops before passing the locking main signal:

a)  The extension shall be cancelled.

b)  Expect Stop shall be supervised, using the main signal as the target point.

F4157.  If the train stops beyond the main signal:

a)  The extension shall be cancelled immediately, which means that the braking curve shall be terminated.

b)  The target speed shall change to a max speed (updating $V_{HSI}$).

Category P extension

F4158.  If the train stops before the fixing signal,

a)  The extension shall be cancelled.

b)  The braking curve shall remain as a normal braking curve without extension.

c)  The braking curve shall aim with Expect Stop at the basic target point.

*Note.* Aims usually at the fixing signal.

F4159.    If the train stops within the extension distance after the fixing main signal:

a)  The extension shall be deleted.

b)  Expect Stop shall apply.

*Note.* Since the (basic) target point is already passed, the release speed is supervised as a max speed.

F4160.    The signal providing the extension decides which release speed that shall be used.

A4160.    The signal providing the extension – plus a possible passed release balise group A(13) B(13) – decides which release speed that shall be used.

*Note.* An Expect Stop P-extension is normally replaced by new distant signal information – not extended, with updated release speed – during the last section before the target point.

### 4.6.4.7    Summary of signal passing when extension is used

*Table 4.6-1. Summary of signal passing at extension*

| | New signal or other event | | Old braking curve (BC) | | |
| | Type | Exten-sion | A-extension | | P-extension |
| | | | Unlocked | Locked | |
|---|---|---|---|---|---|
| a) | Fsi | A | BC updated | BC not affected. New BC established. | BC updated, becomes A extension |
| b) | | P | BC updated, becomes P extension | | BC updated |
| c) | | None [1] | BC erased. New BC established. | | BC sometimes erased [2]. New BC established. |
| d) | Hsi + Fsi | A | BC locked and fixed. Hsi message updates target speed. New BC established | BC finished. Hsi message immediately valid. New BC established | BC erased. New BC established. |
| e) | | P | | | |
| f) | | None [1] | | | |
| g) | Hsi | – | BC locked and fixed. Hsi message updates target speed. | BC finished. Hsi message immediately valid. | BC fixed (at first Hsi). Hsi message immediately valid. |
| h) | Train speed = 0 | | BC changed to Expect Stop without extension | | BC changed to Expect Stop without extension |

Explanations:

BC = Braking Curve.

1)  No extension if there is no prefix balise, or if PY = 0..1 or PZ = 0 or AZ = 0 or AZ > 11.

2)  Depends on where the target points are located [3.5.3.2].

## 4.6.5   Braking curve from warning board

### 4.6.5.1   General

A braking curve can be established or updated when passing a group of warning board balises [3.10].

Each braking curve may contain one of the following restrictions:

− Line speed restriction (OT-T or OTG)

− Curve dependent speed restriction (OT-K1 or OT-K2)

− Train dependent speed restriction (OT-PT, octal bit combinations 000...777)

− Route dependent speed restriction (OT-ETGF/H or OT–ETRF/H)

− Advance warning for level crossings (OT-V1, -V2 or -V3)

− Distant signal for landslide location (FSK)

F4161.   Reserve.


The warning board is changed to a speed limit

F4162.   A braking curve from a warning board shall change from deceleration supervision to max speed supervision in these cases.

a) When passing the release point (the knee), these braking curve types shall change to max speed supervision of the release speed:

1. Level crossing (OT-Vn).

2. Landslide warning (FSK).

3. Route dependent (OT-ET) with Expect Stop.

*Note*. STM braking will occur if the knee is passed while running faster than the release speed (no margin). After that, normal speed supervision margins will apply.

b) When passing the target point, these braking curve types shall change to max speed supervision of the target speed:

1. Line speed (OT-T or OT-G).

2. Curve (OT-Kn).

3. Train dependent (OT-PT).

4. Route dependent (OT-ET) with Expect Proceed.

*Note*. Normal speed supervision margins will apply.


The warning board becomes pending

F4163.   The braking curve from a warning board shall become pending (passivated) when:

a) $V_{TARG} \geq V_{MAX}$, or

b) When passing an OT repeater with a new $V_{TARG} \geq V_{MAX}$.

### 4.6.5.2 Repeater and annulment warning boards

Warning boards can be used as repeaters for previously passed warning boards in a similar way as for distant signals. This is dependent on the conditions of sub-section [3.10.3.3] being fulfilled.

When there is an existing warning board braking curve, and a repeater warning board is passed, the existing braking curve is updated in accordance with the repeater balise group in the same way as for a distant signal braking curve. Refer to [4.6.2] and [4.9.1].

### 4.6.5.3 Termination of braking curve from warning board

Unless terminated or converted to a semi-equipped speed restriction, a warning board braking curve will change to max speed supervision when the train passes its target point.

Termination of OT-ET braking curve

A braking curve from OT-ET is terminated according to [4.6.8.7].

Termination of OT braking curve of category T, K1 or K2

A braking curve from OT of category T, K1 or K2 is terminated when a speed board of the same category and speed as the warning board is passed and the train has reached the first half of the target window (80 - 99 % of the original target distance) [3.9.2].

F4164.     Reserve.

F4165.     When passing the target point of a braking curve from OT of category T, K1 or K2:

a)  The braking curve shall be terminated at the target point.

b)  Supervision for a semi-equipped speed restriction shall be established according to the rules for such restrictions [4.7.3].

*Note.* This means that the target speed will become the maximum permitted speed, and the HÖJNING button re-appears after 2 s.

*Note.* If an HT of the same category, and of the same speed level is detected when the second half of the target window (100...120 % of the original target distance) has elapsed, the former braking curve, now a semi-equipped restriction, shall instead become a permanent speed restriction [3.9.3].

Termination of OT-V braking curve

See also the figure about level crossing supervision [Figure 4.6-3].

A braking curve from an OT-V becomes pending (passive) when a level crossing annulment repeater OT, i.e. V1A, V2A or V3A, is passed. [3.10.2.3]

The deceleration supervision is passivated, but the linking function is still maintained. Otherwise a subsequent repeater OT-V not preceded by a notification balise group (which is allowed for a repeater) would result in an unwarranted balise failure.

F4166.   Reserve.

F4167.   Reserve.

*Note*. A braking curve from an OT-Vn is terminated when a beginning balise (AX=7) of the same V category (n = 1...3) as the braking curve is passed, and the first half of the target window (80-99% of the original target distance) has been reached [3.9.2].

When a braking curve from an OT-Vn is terminated when a related beginning balise is passed, the following applies:

–   If the beginning balise is coded HT-Vn, it will only terminate the OTVn if its speed message is identical to the target speed [3.9.2].

–   If the beginning balise is coded HT*Vn, it will terminate the OT-Vn, and its speed limit shall be set equal to the OT-V release speed. [3.9.4]

–   If the beginning balise is coded HT-VnA, then the supervision of category Vn maximum permitted speed is finished (or not started). [3.9.4]

Since the braking curve is terminated at the target point (see below), a HT*Vn will have no effect if located after the target point.

F4168.   a)   A braking curve from an OT-V shall be terminated at the target point.

*Note*. This will not occur after passing a matching HT-V which removes the braking curve.

b)   The supervision of the maximum permitted speed which started at the release point shall be terminated without any delay for the train length.

Termination of OT-PT braking curve

A braking curve from OT-PT is passivated when a PT annulment warning board OT-PTNA with an identical PT bit pattern in its related prefix balise and with a matching target window (target point within 80...120% of the original target distance), is passed. The supervision ceases, but the linking to HT-PT continues [3.10.2.2].

F4169.   A braking curve from OT-PT shall be changed from deceleration to max speed supervision at the target point.

*Note*. A braking curve from OT-PT is terminated when an HT-PT is passed within the target window (80...120% of the original target distance), with the same speed information as the target speed of the braking curve, or HT-PTNA, and the same PT bit pattern in its related prefix balise. [3.9.2]

*Note.* A passive OT-PTNA braking curve with its related linking will also be terminated when passing an HT-PT or HT-PTNA within the target window (within 80-120% of the original target distance).

F4170.  A braking curve from OT-PT shall be terminated when leaving the target window (120% of the target distance has been travelled).[53]

*Note.* Balise error alarm will be given too [3.3.5.6].

*Note.* This case will not occur if the train has passed a matching HT-PT.


Termination of FSK braking curve

A braking curve from FSK is terminated when a landslide annulment balise group FSKA, which aims at the same target point (window), is passed. [3.10.2.5]

F4171.  Reserve

F4172.  If the FSK braking curve still remains after the target point, the release speed shall be supervised as a max speed.

*Note.* A braking curve from FSK is terminated when a beginning balise BSK or an annulled beginning balise BSKA is passed within the target window (80...120% of the original target distance). [3.11.3]


F4173.  A braking curve from FSK shall be terminated, when leaving the target window (120% of the target distance has been travelled).

*Note.* Balise error alarm will be given [3.3.3]. This will only happen in the event that neither of the two previous events have occurred.

---

53 This could be caused by erroneous track layout or balise group failure.

Termination of OTG braking curve

F4174.    a)  A braking curve of category G shall be changed from deceleration to max speed supervision at the target point.

b)  If no border balise (GMD, GMO or BU) is detected before leaving the target window (after 120 % of the original target distance), the speed of the OTG shall be changed to a maximum line speed in the new area ($V_{LINE}$). [3.10.2].

*Note.* Balise error alarm is also activated, and other established braking curves will still apply.

*Note.* Termination of a category G braking curve when passing GMD, GMO or BU:

–  A braking curve from OTG is terminated when border balises GMO or BU are passed within the target window (80...120% of the original target distance).

–  GMD: The target speed of the braking curve will not be used. Instead, a new maximum permitted speed is received from the GMD balise group.

–  GMO or BU: The target speed of the braking curve is activated as a new line speed after the group of border balises.

Refer to [3.11.4].

F4175.    Reserve.

F4176.    If more than one OTG with different target speeds aim at the same target point:

a)  The braking curve from each OTG shall be supervised to the border balises and then be terminated.

b)  When entering Non-Equipped Area or Installation area: The supervision shall immediately apply to the speed information provided by the most *restrictive* OTG.[54]

*Note.* 5 s after entering, the speed indicators and speed bars will be switched off.

c)  When entering Partially Equipped Area, the speed limit given by the GMD balise group shall be supervised.

---

54 Differs from [ATC2]

## 4.6.6    Supervision at level crossings (OT-V)

### 4.6.6.1    General

These speed restrictions are "temporary" in the sense that they normally are not active and that they, once activated, can become passivated again at an annulment board.

A level crossing braking curve should not alarm the driver unnecessarily early, since the road crossing will usually change from an unprotected to a protected state shortly before it is time to start braking.

F4177.    The braking curve from a category V warning board shall be setup as a speed restriction with the target speed Expect Stop (F3263).

Speed indication for OT-V

F4177A.    a)    Initially, the braking curve from a category V warning board shall not result in any speed indication (digital or analog).

b)    But as soon as the train has entered the flashing interval or passed the release point, the release speed shall be shown on the MAIN INDICATOR.

1.    Special case: If $V_{MAX} < V_{REL}$, then $V_{MAX}$ shall be shown instead (together with the letter 'H').

*Note.* This will also apply if $V_{STM} < V_{REL}$.

c)    The indicator shall flash before the release point is reached, and then become steady.

*Note.* The TARGET SPEED BAR appears when entering the flashing interval. This is changed to a MAX SPEED BAR indication after the release point.

*Note.* No zeroes are displayed, which means that this type of braking curve will *not* appear temporarily while the speed indicators are blanked, as for example in HT area.

'H' indication for OTV

F4178.     After entering the flashing interval, the following shall apply.

a) While an OT-V braking curve with Expect Stop is supervised, the letter 'H' shall be displayed on the MAIN INDICATOR together with the release speed.

b) Exception. If these conditions apply, 'H' shall be indicated but not together with the level crossing release speed:

1. If there is another "flashing interval" braking curve, and

2. The other $V_{TARG} < V_{REL}$.

*Note*. Example: flashing ' 0H', if the other braking curve is Expect stop; $V_{REL}$ is always > 0.

c) Exception. 'H' shall not be indicated if:

1. The release speed = 140 km/h, and

2. The STM max speed $\leq$ 140 km/h.[55]

*Note*. Examples: ' 4H', '13H' or '140'. This applies also to the MAIN INDICATOR after passing an HT-V speed board [4.6.12.4].

Other indications

*Note*. Indicator VÄGSKYDD appears when reaching the flashing interval [4.8.6].

### 4.6.6.2     Passing the estimated or calculated release point

F4179.     a) When the train has passed the knee (the release point), the supervision of the deceleration shall cease.

*Note*. STM braking will occur if the knee is passed while running faster than the release speed (no margin).

b) The deceleration supervision shall be replaced by the supervision of a maximum permitted speed which is equivalent to the release speed.

*Note*. Normal max speed margins will apply.

---

55 The release speed 140 km/h is used for platform gates, and will only appear if the gates has not come down at the first fall-down point. 'H' is only displayed for trains with a max speed above 140 km/h. The target point is selected so that these trains will slow down to 140 at the normal fall-down point. After this point, the train speed is kept down with HT*V until the gates are passed. Because of this, the target point is not located at the level crossing.

F4180.    a)  A repeater warning board (OT-VnA) between the release point and the target
point for Expect Stop shall be capable of annulling residual supervision before
the road.

b)  Exception: A repeater warning board shall not annul or terminate the super-
vision once a beginning balise (HT-Vn) has been passed.

*Figure 4.6-3. Supervision of a level crossing*
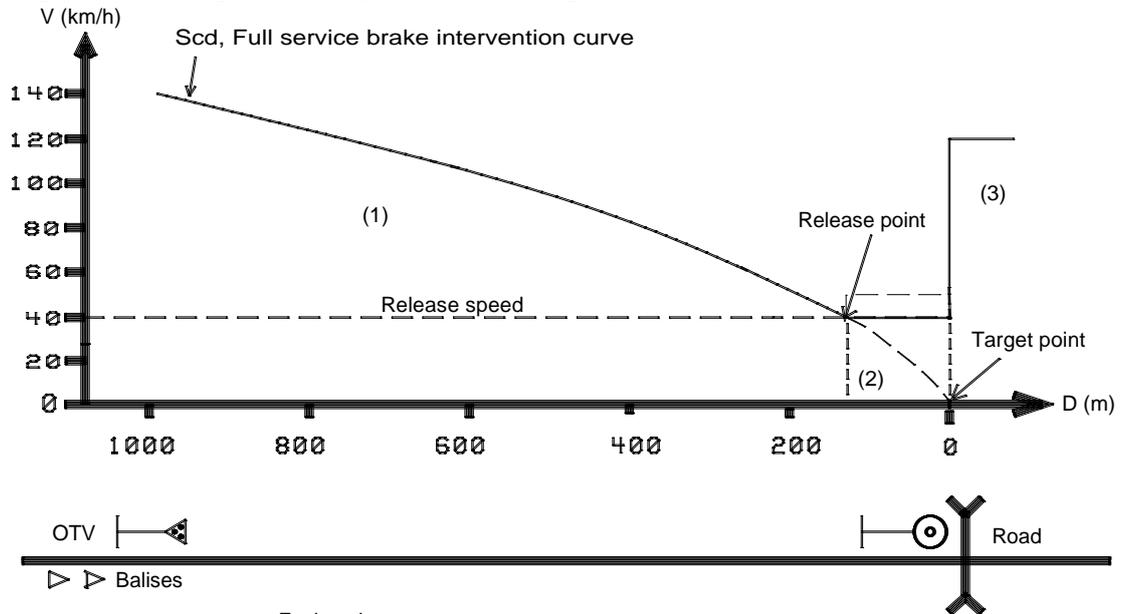


Explanations:
(1) Braking curve supervision
(2) Max speed = Release speed
(3) Max speed restored without train length delay

LevelX.dc2/wmf 2007

*Note.* The STM ensures that the train has passssed the knee before changing to
supervision of the maximum permitted speed.

Release point calculation

*Note.* The release point is the point where supervision of deceleration shall cease
and supervision of maximum permitted speed start. This is defined as the point
where the full service brake intervention curve Scd (normal or "soft"), intersects
the release speed.

F4181.    The STM shall calculate a release point from the target distance and the release
speed for the train in question.

$$D_{REL} = T_B \cdot V_{REL}/3.6 + (V_{REL}/3.6)^2 / 2 \cdot b \quad (m)$$

where:

–  $D_{REL}$   is the distance between the release point and the target point of the
braking curve, in meters

–  $V_{REL}$   is the release speed in km/h

- b    is the full service brake deceleration $B_F$ in m/s$^2$, adjusted for gradient and adhesion

- $T_B$    is the full service brake delay time in seconds.

F4182.    Reserve.

F4183.    Reserve.

### 4.6.6.3    Semi-equipped protection for level crossings

F4184.    Reserve.

*Note*. The level crossing speed restriction is terminated, and speed increase will take place without train length delay, as soon as the train has passed the target point for Expect Stop [4.6.5.3].

This will not occur if beginning board balises were found before the target point, see below.

### 4.6.6.4    Fully equipped protection for level crossings

F4185.    Reserve.

*Note*. Beginning balises HT-Vn or HT*Vn (with AX = 7), must be located before the target point for stopping (after about 90% of the original target distance). They results in termination of the braking curve [3.9.2]. The supervision of the maximum permitted speed continues until the end balises are detected. [3.9.4] [56]

F4186.    Reserve.

*Note*. A speed increase whithout any train length delay takes place as soon as the leading engine has passed the end balises (increasing HT-Vn or SVn). [4.5.5.3]

---

56 It has been suggested that the release speed supervision should continue after the HT, but this was turned down. The 'H' will remain all the way to the ending HT anyway.

## 4.6.7    Supervision at landslide warning, FSK

F4187.    Deceleration supervision between an FSK (OT-SK) warning board and its target point:

a) The supervision shall be carried out in a similar manner as when passing a level crossing warning board with a release speed of 40 km/h.

b) This shall also apply to the handling of the release point [4.6.6.1].

c) The target speed is indicated in the same way as for an Expect Stop distant signal.

*Note.* Landslide warnings are shown on the DMI with a flashing PASS SKRED indicator.

*Note.* An already annulled target speed shall not change to Expect Stop if the train stops between FSKA and BSK or BSKA.

*Note.*  The braking curve is *not* terminated at the target point (as for an OT-V).

## 4.6.8    Speed restrictions of category ET

### 4.6.8.1    General

These speed restrictions are used either as semi-equipped speed restrictions, so called "push-button restrictions" [57], or as fully equipped speed restrictions having HT-ET and SET boards at the beginning and end of the restrictions.

Category ET provides speed restrictions that can be selectively activated depending on the track or route used, e.g. on arrival at a station.

There are four different kinds of  OT-ET. These are systematically categorised as ETxy, where:

– **x** indicates the category of the track or route of the primary OT application:
  – **R**        for a straight route *(Rakspår)*,
  – **G**        for a diverging route *(Grenspår)*.

– **y** indicates the signal which has primary controls of the OT:
  – **F**        for a distant signal *(Försignal)*,
  – **H**        for a main signal *(Huvudsignal)*.

F4188.    Reserve.

---

57 *Knapptryckare*

### 4.6.8.2 Preparing and classifying of an indefinite OT-ET

The classification of each of the different, indefinite OT-ET data records is carried out while passing the first 100 m after the warning board (see above). These OT's are referred to as being under evaluation.

F4189. Indefinite OT-ET.

a) An OT-ET shall not be evaluated until 100 m has been travelled beyond the OT balise group, or a controlling signal has been passed.

b) During this distance the OT shall be regarded as being undefined which means that it is completely ineffective.

F4190. While travelling the first 100 m after the OT-ET warning board, the indefinite OT shall be classed as one of a number of alternative conditions:

a) Terminated,

b) Definitely active,

c) Preliminary passive,

d) Preliminary active, or

e) Locked.

*Note*. Refer to [Chapter 3] for more information.

*Table 4.6-2. Note. Classification of indefinite OT-ET (x = R or G)*

| | Indefinite OT-ET | Passed signal within 100 m | New condition | *Note.* Function |
|---|---|---|---|---|
| a) | ETxH | Hsi for route ≠ x | Terminated | None (deleted) |
| b) | | Hsi for route = x | Definitely active | Supervised to the target point. Affected by repeater OT |
| c) | ETxF | Fsi for route ≠ x | Preliminary passive | Not supervised, but can be activated |
| d) | | Fsi for route = x | Preliminary active | Supervised but can be interrupted |
| e) | Any ET | None | Locked | Supervised to the target point. Unaffected by repeater OT |

*Note*. A similar table is available in the section about warning boards [3.10].

*Note*. The conditions b)-e) in the table above result either in the establishment of braking curves, or in certain cases, in the repetition of previously established braking curves, since repetition cannot occur as long as the OT-ET is indefinite.

*Note*. In general:

– A signal controlling an ET for route x = G (diverging track) gives a speed ≤ 100 km/h.

– A signal controlling an ET for route x = R (straight track) gives a speed > 100 km/h.

– Note that there are exceptions and special rules, see [3.10.5].

*Note.* For detailed information of the classification of an OT-ET when passing a signal, refer to [3.4.8] for a main signal, [3.5.8] for a distant signal and [3.6.12] for a combined signal.

F4191.     Reserve.


### 4.6.8.3   Locked ET braking curve

An OT-ET becomes locked if no controlling signal – no signal, or a signal which is controlling another route – is passed during the first 100 m.


F4192.     If no controlling signal is passed within 100 m of passing an ET warning board, the related OT-ET record shall be changed to a locked braking curve in the following cases:

a)  ETxF or ETxH without a following signal within 100 m.

b)  1.  ETxF followed by a stand-alone main signal, and

    2.  There is no distant signal (or combined signal) within 100 m.

c)  1.  ETxH followed by a stand-alone distant signal, and

    2.  There is no main signal (or combined signal) within 100 m.

*Note.* This procedure has been adopted in order to prevent that an OT-ET from a temporary balise group (placed there because of an emergency) is affected by any other OT-ET.


F4193.     A locked ET braking curve shall not be repeated or changed by:

a)  Subsequently received OT-ET information, or

b)  Subsequently received signal information.


F4194.     An OT-ET which causes a locked braking curve, shall not have a repeating function in regard to previously stored braking curves.


### 4.6.8.4   Passing a main signal after an OT-ET

<u>ETxH</u>

Those speed restrictions where the main signal information is conclusive, ETRH or ETGH, will become either definite, or be deleted, when passing a main signal. The ETxH will therefore not change if stopping beyond the main signal.


<u>ETxF</u>

A preliminary-active or preliminary-passive ETxF will be updated by main signal information in a similar way as ETxH.

Should a main signal (or combined signal) be passed during supervision of an ETRF or ETGF braking curve, then this braking curve will not be further affected

*after* this signal, neither by a new distant signal nor by a new ETxF (but by a new ETxH) at the combined signal.

Refer to the main signal sections [3.4 and 3.6].

### 4.6.8.5 Passing a distant signal or a combined signal after OT-ET

Updating of OT-ET

A combined signal with preset speed increase information will not be regarded as a distant signal in the concept of controlling OT-ET. An ETxF received right before such a distant signal will therefore be locked.

For an already stored, preliminary OT-ETxF braking curve, the main signal information from a new combined signal will be applied as the controlling information and therefore affect the ETxF braking curve.

Repetition of OT-ET

An ETxF updated at a combined signal will not repeat a previously (more than 100 m earlier) received OT-ET, even if they are aiming at the same target. Such an ETxF can never be a repeater OT.

Repetition is however possible at a stand-alone distant signal.

Refer to the combined signal sub-section [3.6.12].

ETxF + Distant signal Expect Stop

Should the distant signal information be controlling – passed after an ETRF or an ETGF – and $V_{FSI} = 0$ km/h, then the ET speed restriction shall become preliminary-active.

If this preliminary-active braking curve is followed by a subsequent repeater signal, such that it can be established that a straight or diverging route applies, then the braking curve will be updated according to this (if applicable, changed to preliminary-passive).

Refer to the distant signal section [3.5].

F4195.   If the train stops between a distant signal and a main signal, both ETRF and ETGF shall become preliminary-active.

F4196.   When passing a main signal at Stop, all ET speed restrictions including those controlled by a distant signal (ETxF) shall remain active.

### 4.6.8.6    Repeater OT-ET warning boards

A new signal-controlled OT-ET can repeat an already existing, signal-controlled OT-ET braking curve.[58]

<u>Repetition with OT-ET's controlled by different signals</u>

A braking curve from an OT-ET + a controlling signal can generally be updated by a new repeater warning board + a controlling signal. There are, however, certain conditions:

a) The existing ET braking curve must not be locked (the first OT-ET must be signal controlled).

b) The repeater warning board must also be controlled by a signal, in order to be classified as being either passive or active (i.e. neither deleted nor locked).

c) The target speeds do not have to match.

d) Signal numbers must not be used in association with OT-ET.

e) The categories must partially match, as follows:

  – ETRF can be repeated by ETRF and ETRH,

  – ETGF can be repeated by ETGF and ETGH,

  – ETRH can be repeated by a new ETRH,

  – ETGH can be repeated by a new ETGH.


Consequently an ETRH, controlled by a main signal, can repeat an ETRF, controlled by a distant signal, and ETGH can repeat ETGF while the reverse does not apply. This allows a supervision defined by a warning board combined with a *distant* signal, to be repeated or changed by a warning board at the following *main* signal, provided of course that the target points match.

Refer to the warning board section [3.10].

---

58 An ET controlling *signal* without a preceding OT-ET is not counted as an OT-ET repeater.

Repetition with indefinite OT-ET's at the same signal

An OT-ET, placed at the same signal location (within 100 m before the same signal) as another OT-ET can be repeated, provided that:

a)  Both are of exactly the same category (ETGF+ETGF, ETRF+ETRF, ETGH +ETGH or ETRH+ETRH), and

b)  They are aiming at the same target window, which means that the new OT-ET aims within 80...120% of the original target distance of the old OT-ET, and

c)  They have the same target speed.

*Figure 4/4-1. Repetition of OT-ET at the same signal*
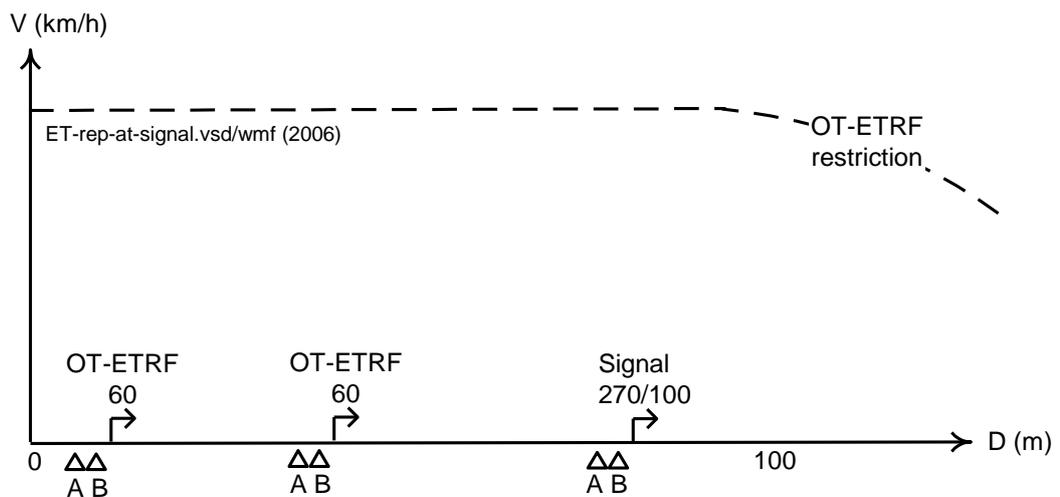


No repetition – different target points

Should the targets points *not* coincide, then two consequent speed restrictions on the same route category are being supervised independently of each other. A result of this is that the first one can be defined by a warning board at a distant signal which is passed first, and the other by a warning board at a subsequently passed signal (that is passed after the distant signal which more often than not, is advance signalled from the first distant signal).

Refer to the warning board section [3.10].

### 4.6.8.7   Termination of an OT-ET braking curve

A speed board of category HT-ET is placed at the target point in the case where a fully equipped speed restriction is required.

HT-ET terminates a braking curve (or a semi-equipped restriction) from an OT-ET under the following circumstances:

–  The HT is within the target window, 80...120 % of the target distance.

–  The speed information matches.

–  Either 100 m has been travelled, or a controlling signal has been passed (within 100 m after the OT).

–  HT-ET can be valid for any of the four ETxy sub-categories.

*Note.* Refer to the speed board section [3.9].

F4197.    a)  Should an HT-ET have not been detected before the target point, then a semi-equipped speed restriction for the OT-ET shall be activated at the target point.

b)  This shall be done even if these are more restrictive:

  1.  Other valid speed restrictions, and

  2.  The maximum permitted speed of the train [4.7.3].

F4198.    Reserve.

*Note.* If an HT-ET is detected after the target point (within 120% of the original target distance), then this HT will take over and replace the semi-equipped speed restriction [3.9.3]. This is analogous to the method for handling category T and K speed restrictions.

### 4.6.8.8    OT-ET with Expect Stop

F4198A.   a)  An ET warning board with the target speed 0 km/h shall be handled in the same way as any other OT-ET.

b)  The braking curve shall be supervised as an Expect Stop distant signal with a release speed of 10 km/h.

*Note.* This means that three zeroes will be indicated.

## 4.6.9     Speed restrictions of category PT

F4199.    Reserve.

A4199.    In case the driver enters a changed PT code, an existing PT braking curve shall be able to change status from active to passive or vice versa.

## 4.6.10     Brake application

When STM brake application is activated because of a braking curve, the BROMS indicator will appear. The LOSS button becomes available as soon as the brakes can be released.

F4199A.   The full service brake and emergency brake shall be possible to release when:

a)  $V_{TARG} > 0$ and $V_{TRAIN} < V_{TARG} + 10$ km/h.

b)  $V_{TARG} = 0$ and $V_{TRAIN} <$ the release speed.

c)  The train has returned back to Interval C.

*Note.* This may occur by slowing down, or when passing a good-natured repeater.

## 4.6.11    Deleting braking curves after border passage

All braking curves are deleted 5 sec after passing a GMO or BU balise group. The target speed from an OTG group shall however be saved for use as the maximum speed in the new area.

Refer to the section about miscellaneous boards [3.11].

## 4.6.12    Indications for braking curves

### 4.6.12.1    General

All braking curve indications on the DMI are handled by the STM. The following indicators are handled here:[59]

Digital indicators:
–    PRE INDICATOR
–    MAIN INDICATOR
–    RELEASE SPEED INDICATOR.

Analog indicators:
–    MAX SPEED BAR, either with a HOOK (no overspeed) or with a MARGIN BAR (overspeed)
–    TARGET SPEED BAR with a possible RELEASE SPEED BAR
–    DISTANCE BAR.

---

59 Differs from [ATC2]

*Figure 4.6-4. Braking curve intervals that affect the indications*
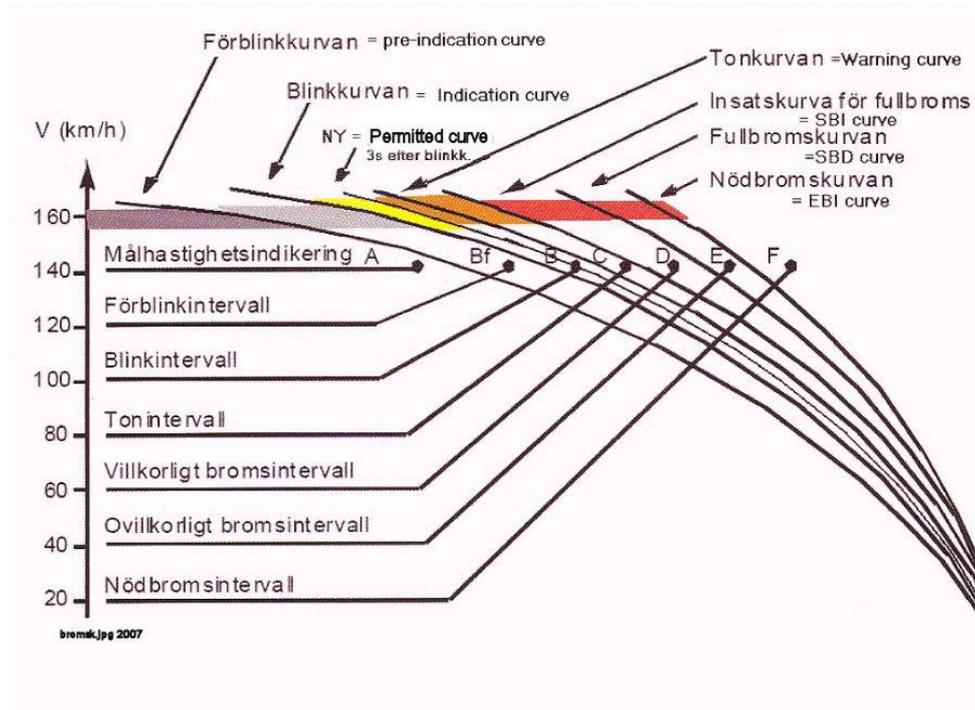


F4199B.     General rules that shall apply for the PRE and MAIN INDICATORS:

a)  Display of target speed at Expect Stop:

1.  Two zeroes shall be displayed at 40-supervision or more (Vrel ≥ 40)

2.  Three zeroes shall be displayed at 10-supervision or more (Vrel < 40).

3.  Small zeroes shall be shown while the train speed is below the release speed.

b)  When the indicated target speed is not actual anymore:

1.  The indicator shall return to its former state.

*Note*. Extinguished (PRE INDICATOR), or max speed (MAIN INDICATOR).

2.  Show the next target speed which is waiting for its turn.

c)  No indication shall be performed of target speeds that are equal to or exceeds the max speed (pending braking curve).

d)  After passing the target point, the target or release speed shall continue flashing in the Main indicator until the braking curve is terminated.

*Note*. This does not apply for semi-equipped speed restrictions.

### 4.6.12.2 Pre-warning and pre-flashing intervals A and Bf

F4199C. The PRE INDICATOR shall display the target speed in km/h, and this speed shall be selected among the following braking curves:

a) The braking curve is active and restrictive ($V_{TARG} < V_{MAX}$).

b) $V_{TARG} = 0$ and its related knee (release point) has not been passed yet

c) $V_{TARG} > 0$ and the train has not reached the flashing interval B (not yet moved to the MAIN INDICATOR).

*Note.* Target speeds = 0 will remain in the PRE INDICATOR also after reaching the flashing interval.

d) Exception to a-b: Level crossing braking curve.

e) Exception to a-b: Infinite or passive OT-ET braking curve.

*Note.* The digital target speed can be replaced by dashes '– – –' (fixed or flashing) or be extinguished, depending on the rules for different STM areas.

F4199D. PRE INDICATOR:

a) The "shortest time" target speed (in interval A or Bf) shall be displayed according to the following requirement.

b) If there is a lower target speed than the one displayed for the moment, this shall be indicated with an 'L' in the rightmost position of the indicator.

c) The indication shall initially be steady (interval A).

d) When reaching interval Bf, it shall start flashing slowly (0.5/0.5 s).

F4199E. PRE INDICATOR.

a) The most restrictive target speed, which is the one with the *shortest time* left to the full service brake deceleration curve ($S_{DE}$), shall be selected for display.

b) If there are two braking curves with the same "shortest time", or if this time cannot be computed because the train speed is below target speed:

1. The one with the lowest target speed shall be selected.

2. If there are two Expect Stop target speeds, the one with the lowest release speed shall be selected.

3. The presently displayed Vtarg shall only be changed to another one if the new one has more than one second shorter time left to the deceleration curve (hysteresis).

### 4.6.12.3  Flashing intervals B-F and Ab

The MAIN INDICATOR alerts the driver when it is time to start braking. This is showed by moving or copying the target speed from the PRE INDICATOR to this indicator.

The MAIN INDICATOR is flashing with the lowest target or release speed that can be found among braking curves in any of the intervals B, C, D, E, F or Ab.

This means that if there is a target speed for a braking curve in interval D, this will *not* be indicated if there is a lower target speed for a braking curve in interval C. The reasons for this are:

−   The intervals appear rapidly and any finer adjustments of the indications would just be confusing.

−   The lowest target speed ahead is much more interesting to see than any higher target speed. It would for instance be very confusing if the MAIN INDICATOR showed Expect 40 towards a target point right ahead of a stop point. There is also a risk that the driver releases the brakes too early and then becomes punished by an emergency brake.

−   Once the flashing has started, the driver is not supposed to watch the DMI while busy with a braking process.

F4199F.     MAIN INDICATOR:

a)   The lowest target or release speed for all braking curves in flashing intervals (Ab or B...F) shall be displayed (see below).

   *Note*. This will always apply, even if the target speed of one braking curve becomes more restrictive than the release speed of another braking curve. Example: Flashing zeroes are indicated for an Expect stop distant signal with $V_{REL}$ = 40 km/h, even if there is a warning board with $V_{TARG}$ = 15 km/h.

b)   Rapid flashing (0.3/0.3 s) as long as the train speed exceeds the target speed.

c)   Slow flashing (0.5/0.5 s) if the train has slowed down to the target speed or below.

   *Note.* This means also that the indicator is slowly flashing if the train should come to a halt while Expect Stop is supervised.

F4199G.     MAIN INDICATOR. The displayed speed in the MAIN INDICATOR shall be selected according to the following rules, during the flashing intervals (Ab or B…F).

a)   Select the braking curve with the lowest value among:

   1.   All target speeds for other braking curves other than level crossings, and

   2.   All level crossing release speeds.

   *Note*. This means that target speeds can be compared with release speeds in some cases. All these speed values are gathered from every active "flashing interval" braking curve, as defined above.

b) If the "lowest speed" = 0 km/h, and this happens to apply to more than one braking curve:

    1.  Among these braking curves, select the one with the lowest release speed.

*Note*. This does not apply to level crossings.

c) If the "lowest speed" still happens to apply to more than one braking curve, the priority among these braking curves shall be:

    1.  Distant signal,

    2.  Level crossing,

    3.  Others.

*Note*. Which braking curve that is selected here does not matter as regarding the speed value. But it can make a difference in the following cases:

– Whether letters 'A' or 'P' shall be indicated or not, since these letters follow the selected braking curves.

– Which braking curve that shall control the speed and distance bars.

These rules does not have any impact on the indication of the letter 'H' for level crossings.

*Note*. A braking curve that once has entered the flashing interval B stays there, so that the flashing will continue in the MAIN INDICATOR until the target point.

F4199H.    The train may return back to interval Ab (where the flashing continues) but shall not be able to return to interval A with exception for the following cases:

a) Passing a repeater.

    1.  Exceptions: Linking or SH groups shall not be regarded as repeaters in this respect.

b) Re-activation of a resting braking curve.

*Note*. This may depend on changes in the max or target speeds.

### 4.6.12.4 Special characters

An extended target point is indicated to the driver with either of the letter 'A' or 'P' in the rightmost position of the indicator in question. An unprotected level crossing is indicated with the letter `'H'`. These letters can be combined with digits or dashes in the other two positions. Example: `' OP'`.

F4200.    After an A-extended distant signal, the target speed, together with an 'A' in the rightmost position:

a) Shall first be shown on the PRE INDICATOR (intervals A-Bf), and

b) Shall thereafter be moved over to a flashing indication in the MAIN INDICATOR (intervals B-F or Ab).

Note. This makes it clear to the driver that the train may pass the station entrance signal faster than the speed that was indicated by the main signal.

F4201.    After a P-extended distant signal, the target speed, together with a 'P' in the right-most position:

a)  Shall first be shown on the PRE INDICATOR (intervals A-Bf), and

b)  Shall thereafter be moved over to a flashing indication in the MAIN INDICA-TOR (intervals B-F or Ab).

*Note.* 'A' or 'P' can only be displayed together with their related target speeds (displayed with digits or dashes).

F4201A.    Unprotected level crossing, when an OT-V braking curve is active:

a)  The indication **'H'** shall be shown according to certain rules [4.6.6].

b)  A hindrance symbol **'H'** shall have priority over 'A' or 'P'.

*Note.* This means that the most restrictive target or release speed will be displayed together with the 'H'. ('H' is not necessarily indicated together with its associated level crossing release speed. After passing stop, the 'H' can even replace one of the two zeroes.)

F4201B.    If the letter **'L'** is to be indicated in the PRE INDICATOR, this shall have priority over the letters **'A'** and **'P'** .

### 4.6.12.5  Target speed/distance bars and Release speed indicator

<u>Target speed</u>

F4202.    a)  In Fully equipped area, the braking curves shall indicate their target speeds on the TARGET SPEED BAR (one at a time).

b)  When the train has passed the location where $V_{MAX}$ intersects the ABf curve (for level crossing braking curves, the $V_{MAX}$ intersection with the BfB curve), the braking curve bar indications shall be activated and selected according to this sub-section and [4.9].[60]

---

60 Differs from [ATC2] (no bars)

Release speed

F4202A.    Indication of release speed.[61]

a) An Expect Stop braking curve which is displayed on the MAIN INDICATOR, shall at the same time indicate its release speed on the RELEASE SPEED INDICATOR, provided that the train is in Fully equipped area.

*Note*. One of two possible digital release speed indicators is used.

– The ETCS controlled indicator (No 1) is used in Fully equipped area (while the related TARGET SPEED BAR is indicated).

– The STM controlled indicator (No 2) is used in other areas (mainly in Partially equipped area).

b) An Expect Stop braking curve which is displayed on the PRE and/or MAIN INDICATOR/s, shall at the same time indicate its release speed on the RELEASE SPEED BAR, provided that the train is in Fully equipped area.

*Note*. Will be indicated together with the TARGET SPEED BAR.

*Note*. This applies also for level crossing braking curves.

A4202A.    Indication of release speed.[62]

a) An Expect Stop braking curve which is displayed on the MAIN INDICATOR, shall at the same time indicate its release speed on the RELEASE SPEED INDICATOR, regardless of STM area.

*A-note*. One of two possible digital release speed indicators is used.

– The ETCS controlled indicator (No 1) is used in Fully equipped area (while the related TARGET SPEED BAR is indicated).

– The STM controlled indicator (No 2) is used in other areas (mainly in Partially equipped area).

b) An Expect Stop braking curve which is displayed on the PRE and/or MAIN INDICATOR/s, shall at the same time indicate its release speed on the RELEASE SPEED BAR, provided that the train is in Fully equipped area.

*A-note*. Will be indicated together with the TARGET SPEED BAR.

*A-note*. This applies also for level crossing braking curves.

---

61 Differs from [ATC2] (lacking there)
62 Differs from [ATC2] (lacking there)

<u>Target distance</u>

F4202B.    This braking curve shall always indicate its descending target distance on the DISTANCE BAR:

a) The braking curve which has reached interval Ab, B or higher (is indicated on the MAIN INDICATOR), or

b) Is selected for display, but the indicator shows something else (turned off, steady zeroes after passing stop or other) by other reasons.[63]

c) Any braking curve which displays the target speed on the TARGET SPEED BAR according to [4.9.3.2].

*Note.* For colours of the TARGET SPEED BAR and the SPEED POINTER, and for other details, refer to sub-section [4.8].

## 4.6.13    Special supervision after balise error (80-supervision)

If a safety-affecting balise error occurs while the train is running faster than 80 km/h, deceleration is supervised down to 80 km/h [3.3.4].

F4203.    A braking curve shall be established:

a) Target speed = 0 km/h

b) Release speed = 80 km/h

c) 2/3 of the full service brake deceleration parameter (soft braking curve) [64]

d) Gradient = 0 ‰

*Note.* The braking curve starts 5 s before interval D (assuming constant speed). This means that the train enters directly into interval B, and that the brake intervention curve for full service braking (assuming low adhesion) will be intersected after 5 s if the train keeps running at constant speed.

*Note.* The computed braking curve is not compensated for possible acceleration ($T_{ACC}$), deceleration ($T_{BRAKE}$) or gradient (GR).

F4203A.    a) If the intervention curve is passed without the driver having time to start braking, the STM shall apply the full service brake.

b) As a criterion of driver braking, 60 kPa brake pressure reduction within 5 seconds after the balise error shall be sufficient.

---

63 Differs from [ATC2] (lacking there)

64 As if the driver has selected low adhesion

c) The emergency brake shall be applied when the emergency braking curve is crossed.

F4203B.    a) The braking curve shall not be terminated before the train has slowed down to 80 km/h or below.

b) Related STM braking shall be released (after pressing the LOSS button) as soon as the train has slowed down to 80 km/h[65] or below.

c) 80 km/h shall then be supervised as a speed limit (ie. with 10 km/h tolerance to service braking).

### 4.6.13.1  Interrupting the balise error supervision

Should a signal with correct distant signal information be passed during the 80 km/h supervision:

– The 80-supervision shall still continue until the speed has been decreased to 80 km/h.

– The 80-supervision shall then cease immediately (no 80 km/h speed limit).

[3.3.4.2]

Note that the distant signal information is supervised as usual.

### 4.6.13.2  Indications

When the balise error occurs, 'FEL' is shown with rapid flashing in the MAIN INDICATOR. As soon as the related STM braking can be released (because the train has slowed down below 80 or the required five seconds have passed), the STM will return to normal indication (complete, reduced or blanked, depending on how much information that was lost).

Observe that similar indications can be achieved if the speed is already below 80 km/h at the balise error, but then with a slight different supervision.

For more details about speed and error indications, refer to [3.3.4].

---

65 Since 80 km/h is supervised as a release speed

(blank)

# 4.7    SPEED RESTRICTIONS FROM BOARDS

## 4.7.1    General

Speed restrictions can be pre-warned or even started by a warning board. This section deals mainly with the speed restriction from beginning to end, as handled according to received speed boards, miscellaneous boards or other types of events.

## 4.7.2    Fully equipped speed restrictions

With a normal (fully equipped) speed restriction, balises are placed at the following locations.

*Table 4.7-1. Board references*

| Board | Function, refer to |
|---|---|
| Warning board | [3.10] |
| Decreasing speed board | [3.9 or 3.11] |
| Increasing speed board | |

### 4.7.2.1    Speed board memories

F4204.    The STM shall have enough memory to handle all types of restrictions.

F4205.    The STM shall handle every category of board related speed restriction independently of the others.

*Note*. The corresponding memory is updated when an associated speed board is detected.

*Note*. Exception: Different sub-categories of speed restrictions may affect each other (T+G or K1+K2) or repeat each other (ET sub-categories) according to certain rules [3.9...3.11].

Termination of speed restrictions at balise passage

F4206.    Termination of a speed restriction  - when the existing speed value is deleted – takes place when passing the following groups, according to the following table:

*Table 4.7-2. Termination of speed restrictions*

| | Balise group | | Termination of this speed restriction category: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AX | AY | T / G | K1 | K2 | PT | V1 | V2 | V3 | SK | ET |
| a) | 3 | 0..2 | R [1] | – | – | – | – | – | – | – | – |
| b) | | 3..5 | | X | X | | | | | | |
| c) | | 6..8 | | – | – | X | | | | | |
| d) | | 9..14 | | X | X | X | | | | | |
| e) | 7 | 0 | R [1] | X [3] | X [3] | X [3] | – | – | – | – | – |
| f) | | 1..2 | | X | X | X | | | | | |
| g) | | 3..5 | | – | X | – | | | | | |
| h) | | 6..8 | | X | – | – | | | | | |
| i) | | 9..10 | | – | – | – | | | | | |
| j) | | 11 | | – | – | SPTS [2] | | | | | |
| k) | | 12..14 | | – | – | – | | | | | |
| l) | | 4..5 | | SKn | SKn | SPTT [2] | SV1 | SV2 | SV3 | SSK | SET |
| m) | 5 | | **X** (HT-T) | GMO or BU without preceding OTG | | | | | | | |
| n) | | 4 or 6 | R [1] | GMO/BU with preceding OTG, or GMD | | | | | | | |
| o) | 5 | 5 | **X** [4] (HT-G) | SU | | | | | | | |

*Note.* All erasing caused by passing an STM area border is not included here.

1) Category G line speed is replaced by category T line speed when passing an HT-T board, and vice versa.

2) SPTS terminates some (as selected in the prefix balise) - and SPTT terminates all - of the nine PT speed restrictions.

3) Terminated because of a balise error that occurs in this case.

4) Erase only if coming from Installation area

"R" Replacement occurs

"X" Termination occurs.

"–" Termination does not occur.

"n" = 1 or 2 (refers to SKn).

(xx) = Applies only to xx

*Note.* Category T and sub-category G uses the same speed board register.

*Note.* GMD does not erase any semi-equipped speed restrictions.

## 4.7.3   **Semi-equipped speed restrictions**

### 4.7.3.1   **General**

With semi-equipped speed restrictions, the balises are located only at warning boards [3.10].

F4207.     Reserve.

*Note.* A balise error alarm may be generated in the event that too many semi-equipped speed restrictions are called for at one time (overflow), see [3.3.1.9].

Starting a semi-equipped restriction

F4208.    A semi-equipped restriction shall be setup or not under the following conditions.

a) A semi-equipped speed restriction shall be setup:

1. When reaching the target point of a warning board braking curve of category T, K or ET (implied that no terminating speed board was passed), and

2. The target speed shall become the maximum permitted speed in regard to supervision and display, and

3. The HÖJNING button becomes visible after a delay of 2 s.

*Note.* The reason to delay the HÖJNING button is that it can appear shortly before passing a speed board at the target point, which would unnecessarily disturb the driver.

b) A category ET speed restriction shall be supervised as a semi-equipped speed restriction, regardless of:

1. The current permitted line speed (category T/G), or

2. The maximum permitted speed of the train ($V_{STM}$).

*Note.* This means that if the maximum permitted line speed or the maximum permitted speed of the train is increased during the supervision of such a speed restriction, the ET speed restriction shall become the limit.

c) A semi-equipped speed restriction shall *not* be setup:

1. If a corresponding speed board was passed within the first half of the target window (80...100% of the original target distance).

   *Note.* This is because the speed board terminates the braking curve.

2. If the target speed $V_{TARG} \geq$ the maximum permitted line speed (i.e. T or G speed) at the target point.

3. If the target speed $V_{TARG} \geq V_{STM}$, the maximum permitted speed of the train.

d) A recently started semi-equipped speed restriction shall be cancelled:

1. If a corresponding speed board is passed whithin the last half of the target window (100...120% of the original target distance, i.e. after the original target point).

   *Note.* The speed board modifies the speed memory for the restriction, but it must also cancel the semi-equipped restriction to avoid forcing the driver to press the HÖJNING button.

*Note.* A restrictive main signal speed will not prevent setup of semi-equipped speed restriction and the HÖJNING button from appearing.

*Note.* The target speeds mentioned above are not basic speeds. They may in some cases be adjusted according to an exceed level (for category K1 or K2).

*Note.* Overflow because of too many semi-equipped speed restrictions can occur if the button never is pressed during a mission [3.3.1.9].

Termination of a semi-equipped restriction

F4209.     When the driver presses the HÖJNING button,

a) The HÖJNING button shall become unavailable.

b) The lowest semi-equipped speed restriction shall then be deleted.

*Note.* Train length delay applies.

F4210.     Reserve.

*Note.* The button re-appears after 2 s if there is more than one semi-equipped restriction (see below).

The driver is not supposed to press the HÖJNING button until the board which indicates the speed increase to the driver (where no balises are located), is passed. But since the system does not know where this board is located, it will perform the speed increase function also if the driver should press the HÖJNING button shortly ($\geq 2$ seconds) after passing the target point.

The speed restriction will remain for an unlimited period in the event that the HÖJNING button is not pressed, unless erased for some other reason, as balise error or border passage.

### 4.7.3.2    Several consecutive semi-equipped speed restrictions

F4211.     All semi-equipped speed restrictions that have the same target speed value, shall be deleted by a single depression of the HÖJNING button.

F4212.     Reserve.

*Note*. An already started semi-equipped curve restriction will be affected by changes in the K1 and K2 train parameters [4.2.1.2].

F4213.     If additional semi-equipped speed restrictions have been saved before the button is pressed, then the HÖJNING button shall not be visible for 2 sec after the button was pressed.

F4214.     a) After 2 seconds, the HÖJNING button shall become re-activated if there is another speed restriction (the next higher) waiting.

b) This shall be cancelled by pressing the HÖJNING button once more (at the following terminating board).

### 4.7.3.3   Exceptions from semi-equipped speed restriction usage

F4215.   This type of semi-equipped speed restriction shall not be used with categories PT, SK, G or V.

*Note.* Special rules apply for categories V1 to V3  [4.6.6].

## 4.7.4   Speed restriction categories

### 4.7.4.1   General

Balises at warning boards, speed boards and certain miscellaneous boards state the category to which the current speed restriction belongs.

F4216.   Categories K1 and K2.

a) Information from a category T speed board, giving a compulsory maximum permitted speed, is a prerequisite for exceeding the speed restrictions of categories K1 or K2.

b) Supervision and display shall be based on the recalculated (possibly increased) speed values.

c) Curve exceeding shall be obtained even if an HT-T (with K-overlap) is passed *after* the HT-K1 or HT-K2 balise group.[66]

F4217.   Reserve.

*Note.* Different categories of speed restrictions will start and end independently of each other.

*Note.* Exceptions:

– The line speed categories T and G will replace each other.

– K1 and K2 categories are mutually exclusive.

– There are diffferent types of ET warning boards but only one HT-ET speed category.

*Note.* Only one curve restriction can exist at any one moment.

F4218.   Reserve.

---

66 Differs from [ATC2]

### 4.7.4.2    List of speed categories

Speed categories related to speed boards are listed and described in a special section [3.9]. Speed categories which are related to warning boards and miscellaneous boards are listed and described in chapter 3 [3.10, 3.11].

## 4.7.5        Handling of the various speed categories

### 4.7.5.1    Speed restriction with prefix balise, category PT

Some speed restrictions only apply to trains with particular characteristics such as a high axle load, etc. OT and HT groups with prefix balises P(8) are used for these speed restrictions.

These types of speed restrictions require balises at both OT and HT. The facility of semi-equipped speed supervision by means of pressing a button is not available.

The track characteristics which cause the speed restriction are specified by setting bits to zero in the YZ word of the prefix balise.

F4219.    a)  Those PT bits from a prefix balise that are zero, shall define which one of the nine different PT speeds that can be affected.

b)  The speed registers which apply to the indicated characteristics of the train in question (the PT parameter), are the only ones that shall be affected.

*Note*. Repeating or termination of PT restrictions [3.10]:

–  Speed restrictions dependent on particular track characteristics are altered selectively if the train reads a new PT group in which the bits corresponding to the characteristics are set to zero.

–  If the A balise is coded with SPTS instead of a speed, PT bits set to 1 in the prefix balise shall cause the corresponding PT registers to be deleted.

–  General deletion of all PT restrictions occurs when passing an SPTT miscellaneous board.

### 4.7.5.2    Level crossing speed restrictions, categories V1, V2, V3

F4220.    a)  A level crossing max speed is a compulsory speed restriction, which shall be terminated without train length delay.

b)  Reserve.

*Note.* With no matching beginning board before the target point (semi-equipped speed restriction), a speed increase will take place directly at the target point [4.6.5.3].

Notification of OT-V

*Note.* The first OT at a level crossing is preceded by a notification balise which must be located at a maximum of 150 m in advance of the OT (max 100 m is recommended). Refer to the section which describes linking with boards [3.3.3].

Beginning board

*Note.* The beginning balises consist of a speed board balise group of the same V category as the OT balise group, and can be switched between the supervision speed and the annulment code VnA (AZ = 13).

*Note.* The beginning balises can also consist of speed board balises with wild card values, HT*V1, HT*V2 or HT*V3. These must also have the same V category as the OT balises. HT*Vn uses the supervision of the speed of the braking curve as the maximum permitted speed. If the level crossing is secured, HT*Vn is switched to VnA. VnA terminates the braking curve, and supervision of the maximum permitted speed will not be started.

End board

*Note.* The end balises are coded SV1, SV2 or SV3 according to [Table AT], depending on the V category. The end balise checks the presence of a beginning balise [3.3].


### 4.7.5.3    Route dependent speed restrictions, category ET

The ET speed restrictions are arranged as either semi-equipped speed restrictions i.e. "push-button speed restrictions", or together with HT-ET plus SET boards at the beginning and end of the speed restriction.


An ET speed restriction can be introduced depending on the signal information received after an OT has been passed. This means that the speed restriction will apply to:

− All routes or tracks provided that a signal is not detected within 100 m. Such a speed restriction cannot be updated by another OT.

− A diverging route.

− A straight route.

A controlling signal can be either a main signal or a distant signal.

A detailed description of the various conditions applying to ET speed restrictions is provided in [4.6.8].

(blank)

## 4.8 INDICATIONS

### 4.8.1 Introduction

#### 4.8.1.1 General

This section deals with the indications on the DMI, the Driver Machine Interface. [67]

When running in National STM mode, the DMI is mainly controlled by the STM.

Display of maximum permitted speed, target speed and release speed is performed by the STM with the help of three digital speed indicators (of which two are of ATC-2 style) but also with analog speed and distance bars. The STM text indications are in Swedish or Norwegian. [68]

Available ETCS DMI functions are used as much as possible.

There are two main types of indications:

1. Indications that follow the [ATC2] standard as much as possible, like the digital speed indicators.

2. Indications that follow the ETCS levels 0..3 standard as much as possible, like the speed and distance bars.

Notes regarding the ETCS DMI:

– The STM requests required current states of all DMI objects: buttons, indicators, sounds and text messages.

– The STM gathers information about the DMI and will then send DMI requests to the ETCS.

– When using the DMI, the driver has to check that the DMI behaves as expected.

– The STM in Hot Standby is allowed to send a preliminary request for DMI objects to the ETCS On-board. This is to avoid a gap of the display at level transition.

– The STM sends a request with the required states of all DMI objects to the ETCS On-board after switching from state HS (Hot Standby) to state DA (Data Available).

[ESTM – 10.5-6]

---

67 Some of these indications could be changed later on. Refer to supplier specification.

68 The ETCS provides a selection of language

### 4.8.1.2    Special indications

There are a number of functions that cause special indications, like text messages, speed indications, and indicators.

− Stop signal passage, PASSERA STOPP indicator [3.4]

− BSK passage, PASSERA SKRED indicator [3.11]

− Distant signal with extended target distance indicates 'A' or 'P' together with the target speed [4.6]

− Landslide protection [4.6]

− Outside Fully equipped area: When the STM does not have complete trackside speed information, the speed indications will be extinguished partially or completely according to the rules that apply to different STM areas. [4.4]

− Level crossings: The letter 'H' is displayed together with the release speed on the MAIN INDICATOR after passing a level crossing warning board. [4.6]

− Acknowledgements: The STM can request an acknowledgement together with a string of text to be shown to the driver.

− Error indications: Balise errors will be indicated together with error codes and informative text messages [3.3.4].


Note that the specified text messages and other indications in this sub-section are likely to be changed. Refer to coming specifications.


### 4.8.1.3    Priority of displays

F4221.    The Pre and Main indicators shall be handled as follows.

a) First priority shall be given to new balise error warning displays.

b) Second priority shall be given to the speed supervision indications.

*Note.* If there is more than one max or target speed competing of a certain speed indicator, the presently most restrictive speed shall be indicated according to certain rules [4.6.12].

## 4.8.2   **Digital speed indicators**

### 4.8.2.1   **General**

For indication of max and target speeds, there are two three-digit indicators[69], the MAIN INDICATOR and the PRE INDICATOR. Normally, these indicators show speed values in digits.

If full HT information is missing, and the speed to be displayed is over 70 km/h, instead three dashes ' − − −' are shown in the indicator in question.

The speed value 0 km/h is shown as '   0', '  00' or '000' depending on the circumstances. See also [4.6.12] for more information about the indications at Expect Stop.

The speed value 5 km/h  is shown as '  05'.

In some cases the rightmost digit is changed to a letter in order to give additional information to the driver.

When flashing, the whole indicator will turn on and off in periods as described above. [70]


Different indicator modes:

- Steady:              not flashing
- Rapid flashing:      on/off in periods of 0.3 s
- Slow flashing:       on/off in periods of 0.5 s
- Three dashes:        **'−−−'**
- Speed + letter X:    **'12A'** (example: speed value 120 km/h + A-extension)
- Small zeroes:        **'  oo'** or **'ooo'**
- Balise error:        **'FEL'** in rapid flashing
- Blanked:             **'    '**


F4222.   Reserve.

*Note*. Test information (current test position and possible error messages) can be displayed during the start and brake tests.

---

69 Four-digit indicators can be discussed as a future change (see supplier specification)

70 If possible (preferred), only the indicator frame should be flashing.

### 4.8.2.2   Special characters on the digital indicators

In some cases the least significant, rightmost digit is changed to a letter in order to give additional information to the driver:

– 'L' indicates lower restriction ahead

– 'H' indicates level crossing

– 'A' or 'P' indicates A or P extension.

– Priorities for "letter code" indication in rightmost character position is as follows (highest priority first): L, H, A, P

F4223.   On passing a level crossing speed board (either HT*V or a specified HT-V board), 'H' shall be displayed on the MAIN INDICATOR until the related end board is passed.

*Note.* The LANDSLIDE indication PASSERA SKRED is displayed while supervising a landslide warning distant signal (FSK).

*Note.* Display after stop signal or BSK passage:

– After stop signal passage, the PASSERA STOPP indicator is displayed.

– After BSK passage, PASSERA SKRED is indicated.

*Note.* Miscellaneous indications:

The letters **'A'** or **'P'** is displayed together with an extended distant signal target speed on the PRE INDICATOR. Example: **' 0P'**.[71]

The digital speed indicators can be used for special indications, when a service function is requested by the driver. Refer to supplier specification.

F4224.   Reserve.

### 4.8.2.3   Main Indicator

The following is displayed on the MAIN INDICATOR with digits or dashes:

a)  Max speed in two or three digits (steady).

b)  Max speed with three dashes **'---'** (steady), when the max speed > 70 km/h in Partially equipped area.

c)  Max speed after passing stop:

---

[71] Could become delayed later on (a suggestion from the drivers)

1. Steady zeroes ′  00′ after passing BSK or a stop signal (Vmax 40) [72]

2. Steady zero ′   0′ after passing HT-ET 0 km/h (Vmax 0).[73]

d)  Target speed in digits (flashing).

1. Expect Stop when the release speed is 40 km/h or higher: ' 00'

2. Expect Stop if the release speed is below 40 km/h: '000'

3. Small zeroes are shown while the train speed is below the release speed (40 or 10 km/h).

e)  Target speed with three dashes, ′---′ (flashing), when the target speed > 70 km/h in Partially equipped area.

f)  Release speed after OT for level crossing, together with the hindrance symbol ′H′, which is shown instead of the least significant digit of the release speed (the rightmost digit).

1. This indication is not lit until the engine enters the flashing interval or passes the release point[74]. The indication is flashing until the release point is  passed, and is thereafter fixed.

2. If the train is in the flashing interval for another, more restrictive braking curve (with Vtarg < Vrel), this target speed is shown instead, but together with the 'H' letter (which remains all the way to the target point) [75]

3. If a beginning board is passed (either HT*V or a specified HT-V), the release speed with ′H′ is shown until the corresponding end board is passed.

g)  'FEL' with a rapid flashing, after balise error.

h)  Other (refer to supplier specification)


This can also be displayed on the MAIN INDICATOR (letters, flashing, priorities, blanking):

i)  The rightmost digit can display (highest priority first):

- 'H' according to f) above.

- 'A' to indicate an extended target point towards a switch point (A-extension)

---

72 One zero after passing a surrogate signal was only used in [ATC2]

73 According to [ATC2]. Not mentioned in [ATCH].

74 The purpose is that normal trains should not be disturbed by restrictive messages from VOT balises which are intended for fast trains.

75 After the release point, 'H' is *not* shown if there is a more restrictive, "flashing" braking curve, but 'H' *is* shown if there is a more restrictive max speed [ATC2]

    –    `'P'` at an extended target point on the line (P-extension)

j)    Target speeds > 0 are displayed:

    –    With rapid flashing (0.3/0.3 s) if the train runs faster that the target speed (release speed at Expect Stop)

    –    With slow flashing (on 0.5/off 0.5 s) [76], if the train speed is at or below the target speed.[77]

k)    Target speed = 0 or level crossing release speeds are displayed:

    –    With rapid flashing (0.3/0.3 s) if the train runs faster that the release speed

    –    With slow flashing (on 0.5/off 0.5 s) [78], if the train speed is at or below the release speed.

l)    Priorities of indications

    –    If there are more than one competing speed indication, the most restrictive is displayed [4.6.12].

    –    For identical target speeds, distant signals have higher priority

m)   The MAIN INDICATOR is extinguished in the following cases:

    –    When there is no valid main signal speed (no display until the whole train length is passed after the first main signal unless $V_{MAX} \leq 40$.). [79]

    –    During shunting.

    –    While passing the blanking distance after balise error BF3 (except when indicating zeroes while supervising Stop or Expect Stop).

If there is no flashing target speed to be displayed according to the previous lists, the MAIN INDICATOR will display the maximum permitted speed.

---

76 Differs from [ATC2]; On 0.75/ off 0.25 s

77 This means that Expect Stop is slowly flashing while the train is still-standing.

78 Differs from [ATC2]; On/off in periods of 0.75/0.25 s

79 [ATCH1]: While the PRE INDICATOR shows measured deceleration

*Table 4.8-1. Steady Vmax in the MAIN INDICATOR, summary with examples*

| | **MAIN** | **Indicates permitted speed** | **Displayed when / Comment** |
|---|---|---|---|
| a) | **0**[80] | After HT-ET with 0 km/h | Stop signal or board:<br>– in HT area [81] |
| b) | **00** | After stop signal or BSK | – in Partially or Fully equipped area<br>– while passing BF3 blanking distance |
| c) | **05**<br>**95**<br>**270** | Vmax = 5...270 km/h [3)] | – Vmax 5..70 in Partially equipped area<br>– Vmax 5..270 in Fully equipped area |
| d) | **3H**<br>**14H** | Vmax for level crossing [1) 3)] | – Vmax 5..70 in Partially equipped area<br>– Vmax 30-140 in Fully equipped area |
| e) | **-H**<br>**--H** | Vmax for level crossing [1) 3)] | Vmax >70 in Partially equipped area |
| f) | **---** | Vmax > 70 [3)] | |
| g) | **35** | Vmax = 5...40 km/h | – Vmax ≤ 40 while entering Partially or Fully equipped area [2)] |
| h) | (off) | Vmax = 5...270 km/h | – Vmax 5..270, no main signal passed<br>– Vmax > 40 while entering Partially or Fully equipped area [2)] |
| i) | Other | No indication of max speed | There might be a restrictive target speed, see the following table |

1)  'H' is not displayed with its related speed if there is a lower, valid Vmax (this applies also for a lower $V_{STM}$) [4.6.6.1].

2)  Entering Partially/Fully equipped area: Between the first main signal and the passing of the whole train length after the first main signal

3)  And train length passed after first main signal.

If there is a flashing target speed to be displayed on the MAIN INDICATOR, refer to the following table, which indicates the lowest and highest possible values.

---

80 This is according to [ATC2] but not mentioned in [ATCH1]

81 Differs from [ATC2]: HT-ET 0 is not displayed in HT area

*Table 4.8-2. Flashing speed in MAIN INDICATOR, summary with examples*

| | **MAIN** | **Indicates target or release speed** | **Displayed when / Comment** |
|---|---|---|---|
| a) | `» 00«`<br>`» oo«` | Expect stop from distant signal or landslide warning, $V_{REL} \geq 40$ km/h | – In HT area (only FSK or OT-ET 0)<br>– In Partially or Fully equipped area (or entering [4])<br>– While passing BF3 blanking distance<br>NB. Small zeroes if Vtrain ≤ Vrel. |
| b) | `»000«`<br>`»ooo«` | Expect stop from distant signal or ET warning board, $V_{REL} < 40$ km/h | |
| c) | `» 0P«` | P-extended Expect stop.[1]<br>Always one zero. | |
| d) | `» 05«`<br>`» 85«`<br>`»265«` | $V_{TARG}$ 5...265 km/h. | – $V_{TARG}$ 5..35 while entering Partially or Fully equipped area [4]<br><br>– $V_{TARG}$ 5-70 + Partially equipped area [6]<br><br>– $V_{TARG}$ 5-265 + Fully equipped area [6] |
| e) | `» 5P«`<br>`»22P«` | P-extended $V_{TARG}$ 5..220 km/h [1] | |
| f) | `» 4A«`<br>`»22A«` | A-extended $V_{TARG}$ 40...200 km/h [2] | |
| g) | `» 0L«`<br>`» 9L«`<br>`»26L«` | Expect a lower $V_{TARG}$ farther away | |
| h) | `»---«` | Expect $V_{TARG} > 70$ km/h ahead | $V_{TARG} > 70$ in Partially equipped area [6] |
| i) | `»--A«` | A-extended $V_{TARG} > 70$ km/h | |
| j) | `»--P«` | P-extended $V_{TARG} > 70$ km/h | |
| k) | `»--L«` | $V_{TARG} > 70$ km/h, and there is a more restictive $V_{TARG} > 70$ farther away | |
| l) | `»--H«` | $V_{TARG} > 70$ + level crossing with $V_{TARG} > 70$ farther away [3] | |
| m) | `»--H«` | Level crossing $V_{REL} > 70$ | $V_{REL} > 70$ in Partially equipped area [6] |
| n) | `»00H«`<br>`» 8H«`<br>`»26H«` | $V_{TARG}$ 0..265 + level crossing farther away [4] | Fully equipped area with level crossing in interval B |
| o) | `» 3H«`<br>`»14H«` | Unprotected level crossing. The release speed is indicated. [4] | |
| p) | `(off)` | No indication (extinguished) | Other [5] |

1) 'P' only displayed together with its related target speed

2) 'A' only displayed together with its related target speed

3) 'H' is not necessarily displayed with its related release speed

4) Entering Partially/Fully equipped area: Between the first signal and the passing of the whole train length after the first main signal

5) Reasons:

   – Non-equipped area, Installation area or HT area without any Expect Stop supervision

   – Partially equipped area without any max or target speed at 70 or below

   – The train length after the very first main signal has not been passed yet (entering Partially or Fully equipped area)

   – Travelling BF3 distance without any Expect Stop or passed stop, Reversing or Shunting

6) And train length passed after first main signal.

### 4.8.2.4    Pre Indicator

The purpose of the PRE INDICATOR is to forewarn the driver of coming restrictions.

As the train approaches the target point, and the remaining time to brake intervention becomes shorter, the target speed will be moved over or copied to the MAIN INDICATOR.

The following can be displayed on the PRE INDICATOR.

Point a) and b) assumes Fully equipped area (or Partially equipped area with $V_{TARG} \leq 70$) or that Expect Stop is supervised (except for OT-V). Refer to [4.4] for more details.

a)  Restrictive target speed or release speed in digits (steady or flashing) [4.6.12].

   1.  At Expect Stop, two zeroes are displayed for 40-supervision or more (Vrel $\geq 40$) and three zeroes for 10-supervision or more (Vrel < 40).

   2.  Small zeroes are shown at Expect Stop while the train speed is below the release speed.

   3.  At an extended target point, 'A' or 'P' is shown, depending on the type of extension, instead of the rightmost digit of the indicator.

   4.  If there are more than one restrictive target speed or level crossing release speed, and the one which is currently displayed is not the lowest, instead of the rightmost digit an 'L' is shown.

b)  The restrictive target (or release) speed mentioned above, appears directly after passing a distant signal or warning board group (steady display when entering interval A) [4.6.12].

   1.  Exception: After an OT- ET, the target speed appears after 100 m (sometimes not at all).

   2.  Exception: After an OT for level crossing, the release speed will not appear at all.

   The displayed speed starts flashing slowly (0,5/0,5 s), when the train enters interval Bf.

   The indicated speed will then disappar (unless there is another speed waiting for its turn) when entering interval B. Exception: Expect Stop, where the zeroes are removed when the "knee" (release point) is passed  (sub-section 4.9).

c)  Restrictive target speed with dashes, '−−−' (fixed or flashing). Is used when the target speed > 70 km/h in Partially equipped area. This indication follows the same rules as for target speed indication with digits according to point a) [4.4.3].

d)  Target speeds can be turned off according to the same rules as apply for the Main indicator, depending on different STM areas or modes. [4.3 + 4.4]

e)  If the target speed is higher than permitted max speed (non-restrictive), the PRE INDICATOR will be turned off.

f) If no valid main signal speed is stored, it is not possible to display anything else than 'Expect Stop' with zeroes.

g) No display directly after balise error BF2 or BF3 (while displaying **'FEL'** on the MAIN INDICATOR)

h) No display while passing the blanking distance after balise error BF3 (except when supervising Expect Stop).

i) Other (refer to supplier specification)

The lowest and highest possible values are indicated in the table below.

*Table 4.8-3. PRE INDICATOR summary with examples*

| | **PRE** | **Indicates** [1] [2] | **Displayed when / Comment** |
|---|---|---|---|
| a) | **00**<br>**oo** | Expect stop, release speed ≥ 40 km/h (distant signal or landslide warning) | Target speed = 0:<br>– In HT area, Partially or Fully equipped area<br>– While passing BF3 blanking distance<br>NB. Small zeroes if $V_{TRAIN} ≤ V_{REL}$. |
| b) | **000**<br>**ooo** | Expect stop, release speed < 40 km/h (distant signal or OT-ET) | |
| c) | **0P** | P-extended Expect stop.<br>Always one zero. | |
| d) | **05**<br>**85**<br>**265** | $V_{TARG}$ 5...265 km/h. | – $V_{TARG}$ 5...35 km/h while entering Partially or Fully equipped area [3] |
| e) | **5P**<br>**22P** | P-extended $V_{TARG}$ 5..220 km/h | – $V_{TARG}$ 5...70 km/h in Partially equipped area [5] |
| f) | **4A**<br>**22A** | A-extended $V_{TARG}$ 40...200 km/h | – $V_{TARG}$ 5...265 km/h in Fully equipped area [5] |
| g) | **0L**<br>**9L**<br>**26L** | $V_{TARG}$ 0..260 + a more restrictive Vtarg farther away | |
| h) | **---** | $V_{TARG}$ > 70 km/h ahead. | – $V_{TARG}$ > 70 km/h in Partially equipped area [5] |
| i) | **--A** | A-extended $V_{TARG}$ > 70 km/h | |
| j) | **--P** | P-extended $V_{TARG}$ > 70 km/h | |
| k) | **--L** | Two or more $V_{TARG}$ > 70 km/h. | |
| l) | (off) | No indication | Other [4] |

1) The indication is slowly flashing (0.5/0.5 s) after entering interval Bf.

2) Level crossings with the letter 'H' are not displayed here.

3) Entering Partially/Fully equipped area: Between the first signal and the passing of the whole train length after the first main signal

4) Reasons:
   – Non-equipped area, Installation area or HT area without Expect stop
   – Reversing or Shunting mode
   – Passing "extinguishing" distance after balise error BF3 (no Expect stop)
   – $V_{MAX}$ > 40 and we're entering Partially/Fully equipped area

5) And train length passed after first main signal.

#### 4.8.2.5 Release speed indicator

The release speed for the currently indicated and supervised Expect Stop braking curve is indicated on the digital Release speed indicator [4.6.12].

Two possible digital release speed indicators can be used (but not at the same time).

– RELEASE SPEED INDICATOR 1. This ETCS controlled indicator is used in Fully equipped area (while the related TARGET SPEED BAR is indicated).

– RELEASE SPEED INDICATOR 2. This STM controlled indicator is used in Partially equipped area (may also appear in HT area).

## 4.8.3 Analog indicators for speed and distance

#### 4.8.3.1 General

These analog indicators are available on or besides the speed dial of the DMI.[82]

ETCS controlled:

– SPEED POINTER, current train speed. Includes a digital speed indicator in the middle of the speed dial.

STM controlled:

– MAX SPEED BAR[83], an arch on the speed dial, with a HOOK on the upper end

– MARGIN BAR, an arch on the speed dial that appears only at overspeed, between the MAX SPEED BAR and the brake intervention speed.

– TARGET SPEED BAR, an arch on the speed dial that only appears when there is a coming restriction.

– RELEASE SPEED BAR, an arch on the speed dial.

– DISTANCE BAR, a "thermometer bar" which shows the remaining target distance besides the speed dial.[84]

The MAX and TARGET SPEED BARS are extinguished outside Fully equipped area.

Refer to the Area Indications table in [4.4.1.2].

---

82 Differs from [ATC2] (lacking there)

83 Also called Permitted speed bar (ETCS)

84 Also called Target distance bar (ETCS)

F4225.    The following colours shall apply for the MARGIN BAR (which is located on top of hte MAX SPEED BAR during max speed supervision):

*Table 4.8-4. Bar colours at max speed supervision*

|    | Interval | Colour | Mode |
|----|----------|--------|------|
| a) | $V_{TRAIN} < V_{MAX} + 1$ km/h | Grey | Neutral |
| b) | $V_{TRAIN} \geq V_{MAX} + 1$ km/h | Orange | Warning |
| c) | $V_{TRAIN} \geq V_{MAX} + 10$ km/h | Red | Intervention |

*Note.*

– The red colour will persist until the STM brake is released.

– These colours should preferrably apply to the SPEED POINTER, also if the max speed is extinguished.

– For DMI control, refer to [ESTMA – 7.5.9].

F4226.    The following colours shall apply during deceleration supervision and relate to the currently indicated braking curve on the TARGET SPEED BAR.

*Table 4.8-5. Bar colours at deceleration supervision*

|    | Interval | Condition | Colour of the MAX SPEED BAR | Mode |
|----|----------|-----------|-----------------------------|------|
| a) | **A** | – | – | Normal |
| b) | **Bf** | – | Light grey | Pre-indication |
| c) | **Ab, B** | Before passing the Permitted curve | Yellow | Indication |
| d) | **B** | After passing the Permitted curve [85] | Yellow | Warning |
| e) | **C** | – | Yellow | Warning |
| f) | **D** | Before passing the Conditional braking curve | Yellow | Warning |
| g) | **D** | After passing the Conditional braking curve | Yellow | Intervention |
| h) | **E** | – | Yellow | Intervention |
| i) | **F** | – | Yellow | Intervention |

*Note.*

– Special case: supervision after passing the release point. [86]

– These colours will always apply to the SPEED POINTER, also if the target and release speed bars are extinguished.

– For DMI control, refer to [ESTMA – 7.5.9].

---

85 The MAX SPEED bar starts descending

86 Subject to further investigations

‒  Explanation: The warning curve curve is the same as curve BfB passed with 3 seconds (assuming constant speed):   $S_{WARN} = S_{BfB} - 3*(V_{TRAIN}/3.6)$ (m).

‒  For description of $S_{BfB}$, refer to [4.9].

### 4.8.3.2    Train speed

The SPEED POINTER is indicated and controlled by the ETCS. Colours:

‒  If the margin bar is not displayed, the pointer should be of the same color as the MAX SPEED BAR.

‒  If the MARGIN BAR is displayed (at overspeed), the pointer should be of the same colour as the margin bar.

There is also a SUPERVISION COLOUR indicator, which indicates overspeed with the same colours as the SPEED POINTER [4.8.6].

### 4.8.3.3    Target and release speed bars

The TARGET SPEED BAR is only available in Fully Equipped Area, as well as the RELEASE SPED BAR.

The same braking curve which target or release[87] speed is shown with digits, first slowly flashing on the PRE INDICATOR (pre-flashing) and then rapidly flashing on the MAIN INDICATOR (or which should have been displayed but the MAIN INDICATOR was extinguished by other reasons), will activate the TARGET SPEED BAR [4.6.12].

The TARGET and RELEASE SPEED BARs for a braking curve will also be shown as soon as the train has passed the point where the ABf curve intersects $V_{MAX,}$ regardless of train speed. For level crossing braking curves, this will occur first when the BfB curve intersects $V_{MAX}$.

In the special case of level crossing supervision, with the train moving slower than the permitted speed, the TARGET SPEED BAR will be displayed even if none of the digital indicators is displayed. The target speed will in this case appear flashing in the MAIN INDICATOR as the train enters the B interval.

F4227.    The TARGET SPEED BAR shall be activated in Fully equipped area according to the following rules.

a)  If different braking curves are displayed in the PRE and MAIN INDICATORS, the one in the MAIN INDICATOR shall be used.

---

87 Level crossing

*Note.* Example: This occurs when there is one braking curve in a "pre indicator interval" (A or Bf) and another one in a "main indicator interval" (Ab, B or higher).

b) When activated, the TARGET SPEED BAR shall be indicated as a bar stretching from 0 to $V_{TARG}$ (km/h).

c) $V_{TARG} = 0$ shall be visible.[88]

*Note.* This means that if the digital indicators becomes extinguished after a balise error, or the train has passed BSK or a stop signal, the TARGET SPEED BAR will be extinguished.


*Note.* The RELEASE SPEED bar will be indicated together with the TARGET SPEED BAR when the the target speed = 0 [4.6.12].

F4227A.    The RELEASE SPEED BAR shall stretch between $V_{TARG}$ and $V_{REL}$ (km/h).

*Note.* This applies also for level crossings.


*Note.* The RELEASE SPEED BAR is dark grey. Before the MAX SPEED BAR has descended down to zero, the RELEASE SPEED BAR covers half the width, together with the MAX SPEED BAR on the other half (its colour depends on the present braking curve itnerval). For more information about the TARGET SPEED and RELEASE SPEED BAR colours, refer to sub-sections [TS 50459-2, §6.2.1.4, §6.2.1.7], where the colours of Circular Speed Gauge and Releease Speed are described.


#### 4.8.3.4    Distance bar

The DISTANCE BAR may appear in any area where braking curves are supervised. The same braking curve which target or release speed is displayed with digits, flashing on the MAIN INDICATOR (or which should have displayed this but the MAIN INDICATOR is extinguished by other reasons), will indicate its remaining target distance on the DISTANCE BAR [4.6.12].


F4227B.    Indication of remaining target distance:

a) The DISTANCE BAR shall be activated at any time when there is a supervised restriction ahead.

1. This shall apply to all STM areas.

---

88 Can stretch from zero and below

*Note*. This excludes Non-equipped area and Installation area, where no restrictions are supervised.

2.  This shall also apply regardless of possible extinguished speed indicators.

b)  Once activated:

1.  The DISTANCE BAR shall remain in all following "yellow" intervals.

2.  Exceptions: When returning to interval A or Bf.

*Note*. Activation occurs when the train enters the flashing interval B interval (when the SPEED POINTER turns yellow).

c)  The DISTANCE BAR shall then remain all the way to the target point, also if the train slows down below the target speed.

1.  Exception: the braking curve changes to a less restrictive or passivated status by a repeater or by other reasons.

### 4.8.3.5     Max speed bar

The MAX SPEED BAR is normally enabled in Fully Equipped Area, but never in the other STM areas. It can also be disabled for some kilometres after balise error, during shunting or during reversing.

The MAX SPEED BAR indicates the general, presently valid max speed, with the following exceptions:

−  After passing stop: shows 0 km/h while 40 km/h is supervised.

−  During deceleration supervision, the MAX SPEED BAR becomes dynamic. This means that the max speed starts descending according to the permitted curve in deceleration interval B [4.9].

F4227C.  a)  While indicating a descending permitted speed on the MAX SPEED BAR, the STM shall take the DMI reaction time parameter into consideration.

b)  Every new indication message shall be transmitted with a predicted value that is supposed to apply after this reaction time, assuming constant speed.

F4228.  The MAX SPEED BAR shall be indicated in the following situations.

a)  In Fully equipped area, provided that:

1.  The first main signal is passed by the whole train length, or the max speed is 40 km/h or below (this will also activate the MAIN INDICATOR).

2.  Exceptions: blanking caused by BF3, shunting or reversing (which also blanks the MAIN INDICATOR).

b) During max speed supervision: a bar stretching from 0 to $V_{MAX}$ km/h.

c) After passing stop (signal or board): indicate 0 km/h.[89]

*Note.* During deceleration supervision: a descending permitted speed.

*Note.* The HOOK, which is entirely ETCS-controlled, ends the max speed bar. It **is** only indicated together with this bar. The HOOK is a wide, thin bar that stretches from between the max speed bar and a few km/h below. It will have the same colour as the adjoining max speed bar.

F4228A.     The MARGIN BAR shall not be indicated unless the max speed bar is enabled.

a) No overspeed: No bar.

b) Overspeed: An orange bar between the max speed bar and the speed margin (+10 km/h).

c) Brake intervention: A red bar stretching from the max speed bar and to the upper speed margin (+10 km/h).

### 4.8.3.6     Other analog indications

F4228B.     The TIME TO INTERVENTION indicator shall always be extinguished.

*Note.* This is a square in the upper, leftmost corner of the DMI, which grows as the train approaches the brake intervention curve during ETCS deceleration supervision.

## 4.8.4     Text messages

### 4.8.4.1     General

The STM can display two lines of 20 characters each on the DMI.

Text messages from this STM (and other STMs) are displayed in the order of their reception by the ETCS On-board.[90]

Exception: A message, which requires driver acknowledgement is not hidden behind a message, which does not require a driver acknowledgement. [ESTM – 10.6.3]

All text messages from STMs are deleted by the STM which requested the text message. The only exception from this is when the STM is no more active. [ESTM – 10.6.3]

---

89 Will probably be displayed as a grey HOOK by the ETCS.

90 Not available in [ATC2]

All driver acknowledgements should be done by acknowledging text messages. The text message is removed as soon as it has been acknowledged.

F4229.   The following messages shall be used when waiting for a driver acknowledgement.

*Table 4.8-6. Summary of acknowledge messages*

| No | Acknowledge message<br>01234567890123456789 | Used when: |
|---|---|---|
| 1) | BEKRÄFTA ATC-<br>ARBETSOMRÅDE | After passing BU |
| 2) | BEKRÄFTA GRÄNS MOT<br>OUTRUSTAT OMRÅDE | After passing GMO |
| 3) | -- (reserve) | -- |
| 4) | BEKRÄFTA RULLNINGSVAKT | Rolling a few meters with the direction controller in position "0" |
| 5) | BROMSTEST EJ UTFÖRT | STM brake test time-out |
| 6) | BEKRÄFTA PASSERA STOPP | After passing stop |
| 7) | BEKRÄFTA PASSERA SKRED | After passing BSK |
| 8) | Others | Determined by the supplier |

A4229.   The following messages shall be used when waiting for a driver acknowledgement.

*Table 4.8-7. Summary of acknowledge messages*

| No | Acknowledge message<br>01234567890123456789 | Used when: |
|---|---|---|
| 1) | BEKRÄFTA ATC-<br>ARBETSOMRÅDE | After passing BU |
| 2) | BEKRÄFTA GRÄNS MOT<br>OUTRUSTAT OMRÅDE | After passing GMO |
| 3) | BEKRÄFTA SLUT PÅ VÄXLING | After passing SX |
| 4) | BEKRÄFTA RULLNINGSVAKT | Rolling a few meters with the direction controller in position "0" |
| 5) | BROMSTEST EJ UTFÖRT | STM brake test time-out |
| 6) | BEKRÄFTA PASSERA STOPP | After passing stop |
| 7) | BEKRÄFTA PASSERA SKRED | After passing BSK |
| 8) | Others | Determined by the supplier |

F4230.   It shall be possible to show texts on the DMI (on buttons, on indicators or in text messages):

a)  In Swedish, or

b)  In Norwegian.

*Note*. This can be selected by the driver. It will be possible to select the Norwegian language although these texts are not specified in this document.

### 4.8.4.2  Summary of balise error messages

See the table with balise error text messages in sub-section [3.3.8].

### 4.8.4.3  Summary of STM on-board error messages

*Table 4.8-8. Error messages*

| No | Error Message 012345678901234567890 | Error Cause |
|---|---|---|
| 1) | TRYCKGIVARFEL | Faulty brake pressure sensor |
| 2) | DRIFTBROMSFEL | STM service braking error |
| 3) | NÖDBROMSFEL | STM emergency braking error |
| 4) | – | – (Reserve) |
| 5) | FEL PÅ REG.ENHET | STM recorder error (refer to supplier specification) |
| 6) | TRANSMISSIONSFEL TYP1 | Transmission test |
| 7) | TRANSMISSIONSFEL TYP2 | Too long balise |
| 8) | Others | (Determined by the supplier) |

For messages 1-4, refer to [Chapter 5].

## 4.8.5    **Indicators and buttons overview**

### 4.8.5.1    **General**

A number of buttons can be visible at the same time[91] (this is determined by the DMI). Each button can have a caption text of one or two lines of 6 characters each. The STM is informed by the ETCS every time that a button is pressed or released.[92]

A number of STM indicators can be shown at the same time[93] (determined by the the ETCS DMI). Each indicator can have a caption text of one or two lines of 6 characters each.

An indicator is flashing by being turned on or off in short periods[94]. When a button is pressed, this is indicated by a suitable sound. Refer to supplier specification for more details.


Not specified within this document:

–   Specific icons or caption texts

–   Button menus

–   Colours of indicators and buttons

–   Display priorities for indicators and buttons


F4231.    a) Each indicator or button shall be displayed with an icon[95].

b) Otherwise (if the icon is not available) with a caption text of up to 6*2 characters.[96]

---

91 Differs from [ATC2]

92 Local feedback

93 Differs from [ATC2]

94 If possible (preferred), only its frame should be flashing

95 Approved by BV and JBV

96 The STM can give a text plus a reference to an icon, and if there is an icon it will be displayed, else the text will be displayed

*Table 4.8-9. Note. Summary of indicators*

| | Swedish names [97] [98] *) | Norwegian names *) | Related Function | Indicated by | English names |
|---|---|---|---|---|---|
| a) | **ATC-ARBETS-OMRÅDE** | ATC ARBEIDSOM-RÅDE | STM area | STM | Installation area |
| b) | **BROMS** | BREMS | STM brake | ETCS / STM | Brake |
| c) | **BF1** **BF2** **BF3** | BF1 BF2 BF3 | Balise error | STM | Balise error 1, 2 or 3 |
| d) | **BROMSGRUPP** | BREMSEGRUPPE | Train data | ETCS | Brake position |
| e) | **BROMSTAL (BP$_O$)** | BREMSE-PROSENT | Train data | ETCS | Brake percentage |
| f) | **DELÖVERVAK-NING** | DELOVERVÅK-NING | STM area | STM | Partially Equipped Area |
| g) | **EP-BROMS AKTIV** | EP-BREMS AKTIV? | Train data | ETCS / STM | EP brake active |
| h) | **KURVÖVER-SKRIDANDE** | OVERHASTIGHET | Train data | ETCS / STM | Curve exceeding |
| i) | **PASSERA SKRED** | PASSERE RAS | Passing BSK | STM | Pass landslide |
| j) | **PASSERA STOPP** | PASSERE STOPP | Passing Stop | STM | Pass stop |
| k) | **STM STH** | STM STH | Train data | ETCS / STM | STM STH |
| l) | **TÅGDATA** | TOGDATA | Train data | ETCS / STM | Enter train data |
| m) | **TÅGÖVERVAK-NING** | TOGOVERVÅK-NING | STM area | STM | Train supervision |
| n) | **UPPMÄTT BROMSTAL (BP$_M$)** | ANSLÅTT BREMSEPRO-SENT | Deceleration measurement | STM | Measured and computed (esti-mated) brake per-centage |
| o) | **AKTIVT BROMS-TAL (BP)** | AKTIV BREMSE-PROSENT | Train data | ETCS / STM | Active brake percentage |
| p) | **VÄGSKYDD** | VEISIKRINGS-ANLEGG | Level crossing | STM | Level crossing |
| q) | **VÄXLING** | SKIFTING | Shunting | STM | Shunting |
| r) | **PT-KOD** | TOGEGENSKA-PER | Train data | ETCS | PT code |
| s) | Other indicators [Supplier specifica-tion] | Other indicators [Supplier specifica-tion] | [Supplier specification] | STM | [Supplier specifica-tion] |

*) The captions are based upon these names.

*Note.* The indicators will not necessarily be implemented exactly according to this table. [99]

---

97 Reserve.

98 Reserve.

[99] ETCS can display all STM train parameters via the Train Data View function, which cooperates with the STM in a similar way as with the Train Data Entry function. STM parameters which can be changed while travelling will probably be indicated all the time by the STM. This means that not all parameter indicators will be handled singularily by the STM.

*Table 4.8-10. Note. Summary of buttons*

|  | Swedish names [*) | Norwegian names [*) | Purpose | Handled by | English names |
|---|---|---|---|---|---|
| a) | **AVBRYT** | AVBRYT | Train data | STM | Exit |
| b) | **BEKRÄFTA** | BEKREFT | Acknowledge-ment | ETCS / STM | Acknowledge |
| c) | **Reserve** | -- | -- | -- | -- |
| d) | **Reserve** | -- | -- | -- | -- |
| e) | **BROMSTEST** | BREMSETEST | Brake test | STM | Brake test |
| f) | **EP-BROMS AKTIV** | EP-BREMS AKTIV? | STM train data | STM | EP brake active |
| g) | HALKA [100] | GLATT SKINNEGANG | Update train data | ETCS | Adhesion (high/low) |
| h) | **HÖJNING** | HØYNING | Increase max speed | STM | Increase |
| i) | **KURVÖVER-SKRIDANDE** | OVERHASTIGHET | STM train data | STM | Curve exceeding |
| j) | **LOSS** | LØS BREMS | Brake relase | STM | Release |
| k) | **NER** | NED | Decrease | STM | Down |
| l) | **PASSERA SKRED** | PASSERE  RAS | Permission to pass | STM | Pass landslide |
| m) | **PASSERA STOPP** | PASSERE STOPP | Permission to pass | STM | Pass stop |
| n) | **Reserve** | -- | -- | -- | -- |
| o) | **RETARDATIONS-KONTROLL** | RETARDASJONS-KONTROLL | Deceleration measurement | STM | Deceleration test |
| p) | **SLUT VÄXLING** | AVSLUTT SKIFTING | Shunting | STM | End shunting |
| q) | **SPARA** | LAGRE | STM train data | STM | Store |
| r) | **STM STH** | STM STH | STM train data | STM | STM max speed |
| s) | **TÅGDATA** [101] | TOGDATA | STM train data | STM | Train data |
| t) | **UPP** | OPP | Increase | STM | Up |
| u) | **UTFÖR** | UTFØR | STM train data / Other | STM | Enter |
| v) | **VÄXLING** | SKIFTING | Shunting | STM [102] | Shunting |
| w) | **ÄNDRA BROMSTAL** | ENDRE BREMSE-PROSENT | STM train data | STM | Brake percentage |
| x) | Other button/s [Supplier specification] | Other button/s [Supplier specification] | [Supplier specification] | STM | [Supplier specification] |

*)  The captions are based upon these names.

[100] A Swedish name on an ETCS button

[101] There is also an ETCS button "TÅGDATA" for request of train data input while the train is stationary

[102] The corresponding ETCS button is only available while the train is stationary

*Note*. The buttons will not necessarily be implemented exactly according to this table.

*Note*. The STM parameters Brake position, Brake percentage ($BP_O$) and PT code do not require any buttons of their own since they can only be changed via the STM Train Data Entry procedure, in cooperation with the ETCS.

System failure alarm is indicated by the ETCS.

Driver acknowledgement is performed together with a suitable text message, which will disappear as soon as the related button has been pressed.

F4232.     Reserve.

F4233.     a)  All STM buttons shall not have to be visible (available) at the same time.

b)  A button shall not be invisible unless pressing the button is of no use under the present circumstances.

*Note*. For STM-handled buttons: When the STM receives a key-down event (for a virtual button) from the ETCS, it will update the button object. This will cause the button to appear as depressed. When the button is released by the driver, the STM receives a new event and makes the button appear released.

Local feed-back of buttons – without involving the ETCS control function – could be used if regarded as convenient (shorter reaction times). [ESTM – 10.6.5.14]

The following requirements include only those indicators and buttons that (probably) will be handled by the STM.

## 4.8.6     Indicators

### 4.8.6.1     Indicator ATC-ARBETSOMRÅDE

This indicator appears when entering Installation area [4.4.6].

### 4.8.6.2     Indicators BALISFEL 1, 2 or 3

Indicator BALISFEL 1, 2 or 3 (balise error) will appear when the on-board STM system detects an error in the balise information.

The BALISFEL indicator is displayed for at least 10 sec, and is then switched off when passing a main and/or distant signal. [3.3]

### 4.8.6.3     Indicator BROMS

The ETCS will manage the indicator BROMS (brake):

–  Appears while the STM orders full service braking to the ETCS.

–  Appears while the STM orders emergency braking to the STM brake interface and/or to the ETCS brake interface.

–  Otherwise turned off.

Refer to [ESRS] and  [5.2..3].

### 4.8.6.4 Indicators AKTIVT BROMSTAL, EP-BROMS AKTIV, KURVÖVER-SKRIDANDE and STM STH

Displays the corresponding train parameter [4.2].

### 4.8.6.5 Indicator UPPMÄTT BROMSTAL

Displays a measured and computed (estimated) brake percentage after each successful deceleration measurement. The brake percentage parameter is displayed within parentheses for comparison [5.7].

### 4.8.6.6 Indicator PASSERA SKRED

The PASSERA SKRED indicator will be lit in connection with BSK passage [3.4.4]. Different display modes (steady or flashing) and colours help the driver to distinguish betweeen different situations.[3.11]

### 4.8.6.7 Indicator PASSERA STOPP

The PASSERA STOPP indicator will be lit in connection with stop signal passage [3/4.4]. Different display modes (steady or flashing) and colours help the driver to distinguish betweeen different situations.[3.4]

### 4.8.6.8 Indicator TÅGDATA (optional)

TÅGDATA tells the driver when it is time to enter train data.[103] [4.2]

### 4.8.6.9 Area indicators: DELÖVERVAKNING and TÅGÖVERVAKNING

The indicator TÅGÖVERVAKNING appears (with normal text colour) when entering Non-equipped or HT area [4.4.2, 4.4.4].

The indicator DELÖVERVAKNING appears (with grey-white text) when entering Partially equipped area [4.4.3].

### 4.8.6.10 Indicator VÄGSKYDD

F4234.   a)  Indicator VÄGSKYDD (LX) shall appear when the train has reached the flashing interval for a level crossing.

b)  The indicator shall have a warning colour (red) for an unprotected level crossing.

*Note*. The normal coloured indicator (grey) for a protected level crossing is not indicated.

c)  It shall look like the corresponding ETCS indicator (icon).

---

103 Subject for further investigations (maybe superfluous?).

### 4.8.6.11    Indicator VÄXLING

VÄXLING shows a steady light during STM shunting [4.3.9].

When there is only a short distance left of the active shunting state, the VÄXLING indicator will start flashing. It will also keep on flashing in the following, passive shunting mode. If the driver requests more shunting, the indicator will return to a steady light.

When shunting is terminated by the driver, the VÄXLING indicator will be switched off.

### 4.8.6.12    Indicator SUPERVISION COLOUR

F4234A.    If decided by [Table CP], the SUPERVISION COLOUR indicator shall appear with the same colour that the SPEED POINTER has (or is supposed to have).

*Note.* This function is crucial for cases when the SPEED POINTER is unable to show the correct colour according to [4.8.3.2], especially if the train is overspeeding.

## 4.8.7    Buttons

### 4.8.7.1    Buttons AVBRYT / NER / SPARA / UPP / UTFÖR

These buttons helps the driver to input train data (or not).

### 4.8.7.2    Button BEKRÄFTA

The BEKRÄFTA button is used for STM-controlled acknowledgements. The BEKRÄFTA button is available on the DMI when an acknowledgement is expected by the STM. This is always indicated by a text message.

### 4.8.7.3    Button BROMSTEST

This button is used when the driver wishes to perform a brake test [5.5.6].

### 4.8.7.4    Button HALKA

A switch which is used by the driver to switch between normal and soft deceleration supervision, according to present track condition.

### 4.8.7.5 Button HÖJNING

Increase start speed

A start-up speed restriction of 40 km/h is active after system startup. When the train has travelled 100 m, the HÖJNING button shall become visible. The button (and the start restriction) will be disabled after the driver has pressed it, or when the STM passes a signal group [4.3.8.2].

Increase semi-equipped restriction

The HÖJNING button appears after 2 s if no terminating speed board is detected at the target point for a braking curve from an OT, i.e. supervision of a semi-equipped speed restriction. The button is switched off when pressed by the driver.

The 2 s delay is intended to prevent the button from momentarily appearing immediately before a speed board balise group is detected.

Should there be more than one semi-equipped speed restriction stored in memory then the button will re-appear again 2 sec after the button was pressed.

### 4.8.7.6 Buttons ÄNDRA BROMSTAL, EP-BROMS AKTIV, KURVÖVERSKRIDANDE and STM STH

These buttons helps the driver to enter or change STM train data while the train is still-standing or running.

### 4.8.7.7 Button LOSS

When allowed, it is possible for the driver to release most types of STM brake interventions by pressing the LOSS button. The STM should, if possible, not force the driver to perform more than one action to release an STM brake intervention.[104]

### 4.8.7.8 Button PASSERA STOPP

This PASSERA STOPP button shall be used according to special rules [Chapter 3], in order to permit stop signal passage.

### 4.8.7.9 Button PASSERA SKRED

The button PASSERA SKRED is available while there is an active FSK braking curve. It is used for passing a landslide speed board, BSK [3.11].

---

104 This button could be replaced by an ETCS or other button in the future, if regarded as more convenient

### 4.8.7.10   Button RETARDATIONSKONTROLL

This button can be used to display a recently computed brake percentage, updated according to the latest measured train deceleration value [5.7].

### 4.8.7.11   Button TÅGDATA

The TÅGDATA button is used to activate STM train data input while the train is running [4.2]. Entering of train data while the train is stationary is handled via the normal ETCS train data entry procedure.

### 4.8.7.12   Buttons VÄXLING and SLUT VÄXLING

Shunting is requested by pressing the VÄXLING button while the train is stationary. Shunting may now be performed (STM Shunting state). [4.3.9]

Shunting is finished by pressing the SLUT VÄXLING button while the train is stationary. The STM will then force the driver to input new train data.

### 4.8.7.13   Optional STM button/s

It shall be possible to use optional button/s for service purposes. Refer to supplier specification.

F4234B.   Reserve.


## 4.8.8   Audible indications

### 4.8.8.1   Audible signal f2

The STM provides the necessary audible indications, see below. [105]

F4234C.   When more than one sound is requested, only the one of the highest priority shall be activated, according to the following table.

---

[105] Some of these may be extingushed by ETCS sounds of higher priority

*Table 4.8-11. Summary of audible f2 signals*

| | Type | Audible indication | Occasion | Prio-rity |
|---|---|---|---|---|
| a1) | **Error** | Continuous tone | Transmission error | high |
| a) | **Long tone** | Continuous tone of 5 s | Area border | . |
| b) | **Three tones** | Three tones of 2 s each, with 1 s in between | Balise error | . |
| c) | **Long tone** | Continuous tone of 5 s | The train starts reversing | . |
| d) | **Short tones** | Short intermittent tones. On + off in periods of 0,3+0,3 s | Overspeed[106], or entering interval C (two tones) | .<br>. |
| e) | **Warning tone** | Short tone of 0,5 s[107] | The speed indications becomes more restrictive. Includes the entering of intervals Bf or B | .<br>. |
| f) | **Information tone** | Short tone of 0,3 s | The speed indications becomes less restrictive | .<br>low |

*Note.*The indicated sound can not be interrupted by another one, and is furthemore followed by a silent period of one second. Exception: Indications A, B or C can interrupt sounds of lower priority at any time.

The length of the different tones may be adjusted by ± 0,05 s according to supplier specification.


Short tones

F4235.   Short intermittent f2 tones with repeated "on" and "off" periods of 0,3 seconds, regardless of if the MAIN INDICATOR is active or not:

a)   Short intermittent tones shall be given while there is overspeed.

1.   Exception: after detecting both preliminary stop signal information [3.4.4.1] and balise error in the one and same balise group.

b)   Two short intermittent tones shall be given when entering deceleration interval C.


Information tone

F4236.   a)   An information tone, a very short audible f2 signal of 0.3 sec duration, shall sound when the speed on the MAIN INDICATOR becomes less restrictive.

---

106 Subject of further investigation (make this one sound more ETCS-like?)

107 Subject of further investigation (tone length)

b) This shall also comprise the following special case: Passing the release point ("knee") of an active braking curve, which is selected for indication, regardless of if the MAIN INDICATOR is active or not.

Warning tone

F4237.  a) A warning tone, a short audible f2 signal of 0.5 sec duration, shall sound when the speed on the MAIN INDICATOR becomes more restrictive.

b) This includes also the following special cases, regardless of if the PRE and MAIN INDICATORs are active or not:

1. Entering deceleration interval Bf or B.

   *Note*. In Fully equipped area, a restrictive target speed will now start flashing on the PRE or MAIN INDICATOR.

2. Passing a stop signal or BSK.

   *Note*. The MAIN INDICATOR becomes more restrictive, two flashing zeroes are changed to two steady zeroes).[108]

3. The train resumes the previous travel direction after reversing

   *Note*. $V_{REVERSE}$ will not apply anymore.

4. When indicator VÄXLING starts to flash.

   *Note*. This occurs before entering passive shunting mode.

Long tone

A long continuous tone, an audible f2 signal of 5 sec duration, is given when:

a) Entering Non-Equipped Area after passing GMO [4.4.2].

b) Entering Installation area after passing BU [4.4.6].

c) When the train starts reversing [4.3.12].

Three tones

A series of three audible f2 signals having a 2 sec duration and an interval of 1 sec are given to indicate balise error alarms [3.3.4].

---

108 No warning tone if $V_{REL} < 40$ (three flashing zeroes changed to two steady)

## 4.8.9    Extended DMI with Planning area

### 4.8.9.1    General

This sub-section specifies the extra DMI functions that the STM has to implement to enable interaction with an optional, extended unified ETCS DMI (also referred to as DMI+), that may replace the ordinary unified DMI unit.

### 4.8.9.2    Planning area

*A-note*. The Planning area, which is indicated by the ETCS according to information given by the STM, shows coming speed restrictions and level crossings to the driver [EDMI].

*Figure 4.8-1. A-note. The Planning Area.*
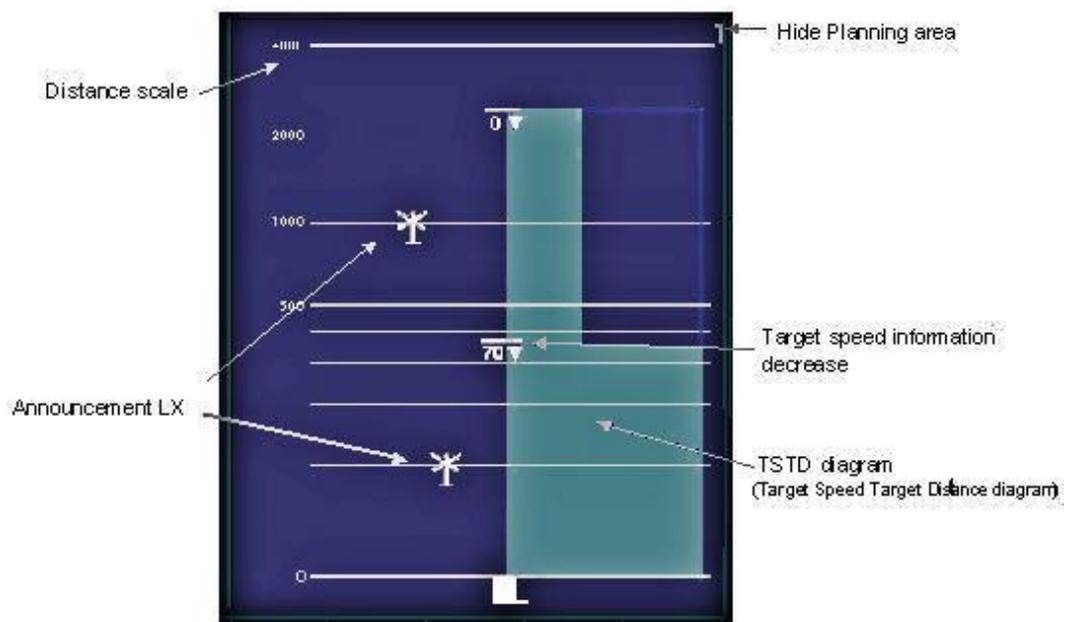


*A-note*. The Target Speed and Target Distance (TSTD) diagram.

Upon this diagram, information about coming speed restrictions with target speeds and target distances can be indicated to the driver. The distance scale is placed on the vertical axis and the speed scale on the horizontal axis.

The nearest active braking curves are displayed. One of these is reserved for Expect Stop. Level crossings (protected or unprotected) are shown separately.

In Partially equipped area the TSTD diagram will have a divergent (striped) appearance. The whole Planning area, including the TSTD, can also be completely extinguished by the STM.

The ETCS compares its own odometer data with the STM reference position to get the correct distance in the planning area. The ETCS is also responsible for the distance scale, the indicated symbols and the layout of the planning area.

F4238.    Reserve.

*A-note.*The Planning area with its buttons and indications (as specified below) is available for the driver if the system is equipped with an extended DMI.[109]

These indications are called the *planning information* and will be indicated if the extended DMI is available.

F4239.    Reserve.


*A-note.*The Planning area data is sent to the ETCS with packet STM-43 (subsection M_SUP).

A4239.    The STM shall send Planning area data to the ETCS.

a)  The information shall be transmitted every time that any part of it has changed.[110][111]

*A-note.* All the information on the planning area shall be updated with this new data (M_SUP).

b)  The information shall be transmitted regardless of the present Planning area indication status (on / off / divergent).

*A-note.* For recording purposes.

*A-note.* ETCS is responsible for the distance count-down to avoid delays and high bus[112] loads.[113]


F4240.    Reserve.

A4240.    The STM shall request the following Planning area indication states to the ETCS.

a)  In Fully equipped area, with the Pre and Main indicators fully activated, the Planning area shall be activated.

b)  In Partially equipped area, with a target speed of 70 or below which is indicated on the Pre or Main indicator, the Planning area shall have a divergent look (striped TSTD diagram).

c)  If a) or b) does not apply, the Planning area shall be extinguished.


F4241.    Reserve.

A4241.    The STM shall send the following Planning area data to the ETCS.

---

109 Reserve.
110 Reserve.
111 Reserve.
112 Profibus
113 The contents of the MRSP will be further investigated.

a)  If target distances are used in c) and d) below: The related reference position.

b)  The presently supervised max speed.

c)  A number (0..3) of protected or unprotected level crossings with their target distances or target points.

    *A-note*. ETCS will show all these on the Planning area.

d)  A number (0..10) of active braking curves with their target speeds and their target distances or target points.

e)  "Active" means that the braking curve is not passivated and its target speed is below the max speed that applies before the target point.

f)  The STM shall not send any increasing target speeds.

    *A-note*. ETCS will show the "nearest" restrictions on the Planning area.

*Table 4.8-12. A-note. Planning area data in Packet STM-43.*

|    | Information | Contents -- Comments |
|----|-------------|----------------------|
| a) | See [ESTMA] | See [ESTMA] |
|    | P l a n n i n g   A r e a | |
| b) | Reference position $^{x)}$ | Starting point for the target distance/s below |
| c) | Inhibit planning area | Planning area On (indicated) / Off (inhibited) |
| d) | Visibility of Planning area | Normal in Fully equipped area, or Divergent (striped diagram) in Partially equipped area |
| e) | Max speed | 0...300 km/h. Max speed supervised by the STM (will top the speed scale) |
| f) | 0..10 Target speeds | 0...300 km/h (indicated on speed decrease symbol) |
| g) | 0..10 Target distances $^{y)}$ | 0...11900 m (displayed with a logarithmic scale down to 100 m) |
| h) | 0..3 Level crossing (LX) target distances $^{y)}$ | 0...11900 m (displayed with a logarithmic scale down to 100 m). (LX symbol indicated) |

x)  Can be removed if all target distances are replaced by target positions

y)  Can be replaced by target positions

### 4.8.9.3  Extended buttons

*A-note*. These buttons are defined (but not displayed) by the STM. The train data buttons are not available for the driver.[114] The other buttons can be actively displayed by the ETCS. The extended STM button palette is shown in the following table. [115] [115]

---

114 These train data "buttons" are only used in messages between the ETCS and the STM.

115 For these, a location on the planning area is to prefer. An extra button menu is thus avoided (one less button push)

*Table 4.8-13. Overview: ETCS DMI+ information to the STM.*

|  | Definition of button | Number of buttons | Can be displayed |
|---|---|---|---|
|  | Operational buttons |  |  |
| a) | VÄXLING #2 | 1 | Y |
| b) | PASSERA SKRED #2 | 1 | Y |
| c) | PASSERA STOP #2 | 1 | Y |
|  | Max speed buttons |  |  |
| d) | STH_0 | 1 | Y |
| e) | STH_10 | 1 | Y |
| f) | .... etc. (10 km/h steps) | 23 | Y |
| g) | STH_250 | 1 | Y |
|  | Exceed level buttons |  |  |
| h) | K1_0 | 1 | Y |
| i) | K1_5 | 1 | Y |
| j) | .... etc. (5 % steps) | 7 | Y |
| k) | K1_45 | 1 | Y |
|  | Brake percentage "buttons" |  |  |
| l) | BP_30 | 1 | N |
| m) | BP_31 | 1 | N |
| n) | .... etc. (1 % steps) | 138 | N |
| o) | BP_170 ... BP_200 | 31 | N |
|  |  | = 210 |  |

[ESTMA]

F4242.  Updating of the STM max speed parameter $V_{STH}$ shall be performed according to the extended DMI buttons in the following table:

*Table 4.8-14. STH buttons (extended DMI)*

|  | Button pressed | New $V_{STH}$ value |
|---|---|---|
| a) | STH_0 | 0 |
| b) | STH_10 | 10 |
| c) | .... etc. (10 km/h steps) | ….. |
| d) | STH_200 | 200 |

F4243.  Updating of the exceed level parameter K1 shall be performed according to extended DMI buttons in the following table:

*Table 4.8-15.K1 buttons (extended DMI)*

|  | Button pressed | New K1 value |
|---|---|---|
| a) | K1_0 | 0 |
| b) | K1_5 | 5 |
| c) | .... etc. (5 % steps) | ….. |
| d) | K1_45 | 45 |

F4244.      When pressed, these buttons shall be handled in the same way as if the corresponding usual DMI button:

a) VÄXLING 2            (usual button VÄXLING)

b) PASSERA SKRED 2 (usual button PASSERA SKRED)

c) PASSERA STOPP 2  (usual button PASSERA STOPP).

F4244A.    The receiving of an updated brake percentage parameter from the ETCS shall be performed according to the extended DMI "buttons" in the following table:

*Table 4.8-16. BP buttons (extended DMI)*

|    | **"Button pressed"** | **New BP value (%)** |
|----|---------------------|----------------------|
| a) | BP_30               | 30                   |
| b) | BP_31               | 31                   |
| c) | .... etc. (1 % steps) | .....              |
| d) | BP_170 ... BP_250   | 170                  |

### 4.8.9.4   Reserve

F4245.      Reserve.

(blank)

## 4.9 SUPERVISION OF DECELERATION

### 4.9.1 General

This section deals with the supervision of restrictive target speeds and their related target points.

#### 4.9.1.1 Deceleration supervision

F4246. Supervision of deceleration to the new speed level:

a) Shall commence with a so called braking curve,

b) when passing a distant signal or warning board with restrictive speed information.

F4247. When target speed information of any category or speed level is received:

a) A set of braking curve data shall always be established,

b) except for an OT-ET under initial preparation.

A4247. When target speed information of any category or speed level is received:

a) A set of braking curve data shall always be established.

Exceptions:

b) An OT-ET under initial preparation.

c) A "passive" PT warning board (a restriction which does not apply to our train).

*Note.* If the target speed is non-restrictive for the moment ($\geq V_{MAX}$), the "braking curve" becomes resting until the conditions change.

F4248. The deceleration supervision shall be based on:

a) Current speed $V_{TRAIN}$.

b) Target speed $V_{TARG}$.

c) End speed $V_{END} = V_{REL}$ at Expect Stop, else $= V_{TARG} + 10$ km/h. STM brake application shall not be activated at speeds lower than this.

d) Target distance $D_{TARG}$.

e) Gradient GR, if any.

f) Braking characteristics of the train i.e. the delay time $T_B$ and full service brake deceleration on a level track, $B_F$.

g) Release speed $V_{REL}$.

h) Adhesion parameter (according to the switch HALKA).

A4248.    The deceleration supervision shall be based on:

a) Current speed $V_{TRAIN}$.

b) Target speed $V_{TARG}$.

c) End speed $V_{END} = V_{REL}$ at Expect Stop, else $= V_{TARG} + 10$ km/h. STM brake application shall not be activated at speeds lower than this.

d) Target distance $D_{TARG}$.

e) Gradient GR, if any.

f) Braking characteristics of the train i.e. the delay time $T_B$ and full service brake deceleration on a level track, $B_F$.

g) Release speed $V_{REL}$, which is set directly (or computed according to a given distance).

h) Adhesion parameter (according to the switch HALKA).

### 4.9.1.2    Deceleration intervals

Supervision and display are divided up into these intervals:

*Table 4.9-1. Deceleration intervals*

| Interval | Explanation | Comment | Physical interval |
|---|---|---|---|
| Interval A | Target speed display interval | No flashing | A |
| Interval Ab | Flashing interval | Returned from B | A or Bf |
| Interval Bf | Pre-flashing interval | Before entering B | Bf |
| Interval B | Flashing interval | Bar colours change [116] | B |
| Interval C | Tone interval | Beeps twice | C |
| Interval D | Conditional braking interval | Driver/STM braking | D |
| Interval E | Unconditional braking interval | Full service braking | E |
| Interval F | Emergency braking interval | Emergency braking | F |

---

116 Reserve.

### 4.9.1.3   Computed curves

The intervals are limited by various computed curves as listed below, and also illustrated in the following figure. The times stated are based on a constant speed.

*Table 4.9-2. Computed curves*

| Computed curves for deceleration supervision: |
| --- |
| −   **Pre-flashing curve ABf**, placed 5 sec prior to the flashing interval. At this point the max speed bar will change colour (dark grey below the target speed). PRE-INDICATOR flashing. |
| −   **Flashing curve BfB**, placed 8 sec prior to the conditional braking interval. At this point the MAIN INDICATOR begins to flash.<br><br>   −   **Permitted curve**[117]**,** placed 5 sec prior to the brake intervention curve $S_{BRAKE}$. The Permitted curve can start in any of the intervals B, C or D, depending on present braking status. At this point the MAX SPEED BAR begins to descend down to the target speed [118]. Does not affect the deceleration supervision. |
| −   **Tone curve BC**, placed 3 sec prior to the conditional braking interval. Double tone indication f2 is activated. |
| −   **Brake intervention curve CD**, starts the conditional braking interval. The distance to deceleration curve DE in seconds is equal to the brake delay time $T_B$. STM brake application will be activated should the brake pipe pressure not be reduced rapidly enough during interval D. [119]<br><br>   −   **Conditional braking curve**. Moves between curves CD and DE according to driver braking. This curve defines the final point at any particular speed when the service brake must be applied, so that the train is able to slow down to the target speed $V_{TARG}$ on reaching the target point. |
| −   **Deceleration curve DE**, the curve traced by the train at fully developed deceleration, $S_{DE}$. Should this limit be exceeded then STM will activate full service brake application. [120] |
| −   **Emergency brake curve EF**, placed 2 sec after the full braking curve which is equal to the DE curve under normal supervision. Should the train enter the F interval, emergency brake application shall be immediately activated. |

---

117 Differs from [ATC2] (lacking there)

[118] Provided that the train speed exceeds the target speed.

119 Differs from [ATC2] which can brake with 150 or 100 kPa

120 Differs from [ATC2] which can brake with 150 or 100 kPa

*Figure 4.9-1: Summary of the various intervals*
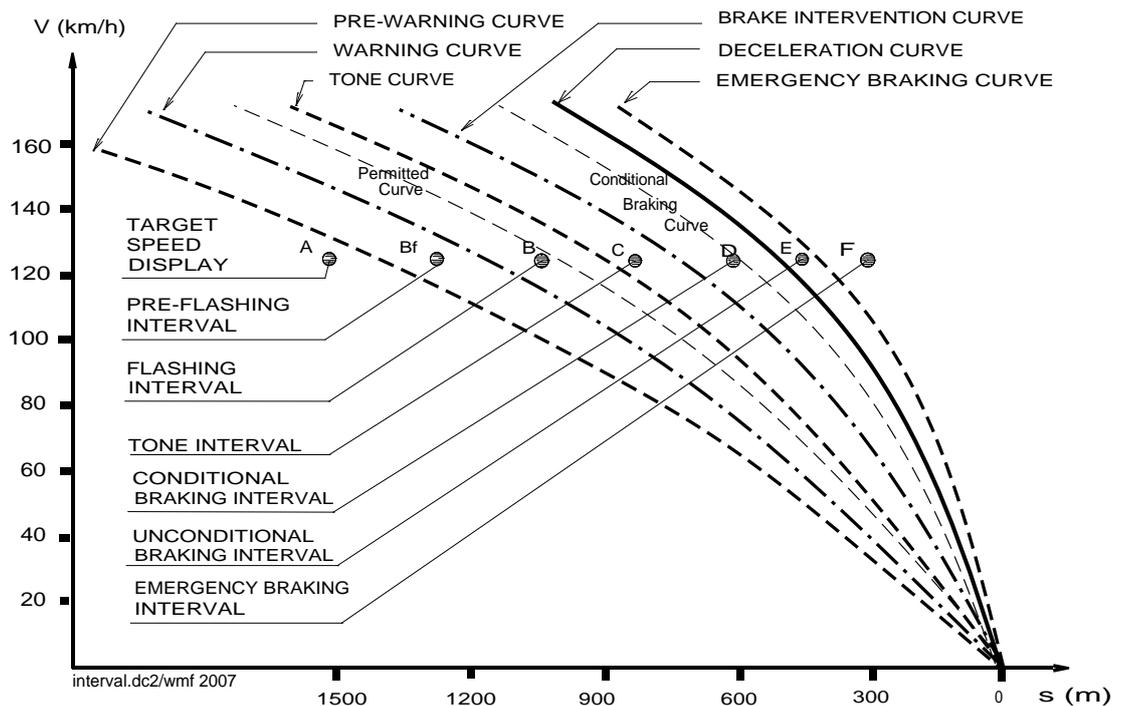


Special rules for braking curves down to stop can be found in sub-section [4.9.11].

Supervision and display differs between the various intervals, as described below. The indications apply to the present interval, which is not necessarily the same as the *physical* interval, as for example in interval Ab.

The following sub-sections apply to a situation where only one braking curve is active. If there are several braking curves, the one which is most restrictive will always be supervised.

### 4.9.1.4    **Starting or repeating a braking curve**

F4249.    a)  At the commencement of a braking curve the STM system shall determine the supervision interval occupied by the train and begin supervision at that same interval.

*Note.* This implies that the system does not automatically begin in interval A for every braking curve.

b)  When passing a repeater, a recalculation shall be made:

1.  If the train stays in the present interval even after the repeater,

    –  This interval shall remain, and

    –  there shall be no extra tone warnings because of this.

2.  If the train enters a higher interval (closer to target) because of the repeater, indications shall be according to the interval change

3.  Should the train return to a previous interval because of the repeater:

    –  The interval status of the braking curve shall be reset, and

-    the new interval shall apply.

4. The current train acceleration and braking status ($T_{ACC}$ and $T_{BRAKE}$) shall only be re-evaluated in case the train has returned to the physical interval A at the repeater.

### 4.9.1.5   Indications

The currently most restrictive braking curve (nearest to brake intervention) is the one used for speed indication. The STM will normally indicate only one braking curve at a time, but exceptions may occur.

Before the PRE INDICATOR switches between one braking curve and another, the braking curve that takes over should be at least 1 s closer to brake intervention. This is performed in order to avoid unstable indications.

Refer to [4.6.12] for more details.

F4250.    These shall not generate any display of speed or audible indications:

a) "Hidden" braking curves (not selected as the most restrictive),

b) including braking curves indicated by an ′**L**′.

*Note*. Refer to Sub-section [4.6.12].

*A-note*. Hidden target points can however be displayed on the planning area [4.8.9].

### 4.9.1.6   Definitions

*Table 4.9-3. Braking curve definitions*

| Useful expressions: | |
|---|---|
| –   Interval | Present braking curve interval A, Ab, Bf, B, C, D, E or F according to the described transitions and speed limits, see the following sub-sections |
| –   Physical interval | Braking curve interval A, Bf, B, C, D, E or F, taking lower speed limits into account |
| –   Computed interval | Braking curve interval A, Bf, B, C, D, E or F, all the way down to the target speed |
| –   Soft interval X | Interval X has been computed with 2/3 of the full service brake deceleration parameter |

## 4.9.2    Calculation of the deceleration curve ($S_{DE}$)

### 4.9.2.1    The average deceleration of the train, b

F4251.    The average deceleration of the train, b, shall be calculated as specified in the following two alternatives:

a)  Normal adhesion:        $b = B_F + 0.01 \cdot GR \ (m/s^2)$

b)  Low adhesion:           $b = 2/3 \cdot B_F + 0.01 \cdot GR \ (m/s^2)$.

where

- $B_F$ is the deceleration parameter for full service braking, and

- GR is the average gradient of the track (‰). It is stated in thousandths, i.e. m/1000 m, and is represented by a positive value when ascending and a negative value when descending.

F4252.    a)  Should deceleration, after being adjusted for gradient, be equal to zero or have a negative value, then the calculated braking distance shall become infinite.

b)  Such a result shall encroach on the emergency brake interval which means that emergency brake shall be immediately applied.

### 4.9.2.2    Points on the deceleration curve $S_{DE}$

F4253.    Points on the deceleration curve shall be calculated as the formula:

$$S_{DE} = \frac{(\,(V_{TRAIN}/3.6)^2 \ - \ (V_{TARG}/3.6)^2\,)}{2 \cdot b} \ \ (m)$$

where:

- $S_{DE}$    is the braking distance in meters with fully developed braking to the target speed from the train speed $V_{TRAIN}$.

- $V_{TRAIN}$ is the speed of the train in km/h.

- $V_{TARG}$ is the target speed in km/h.

- b        is the deceleration in $m/s^2$ as the foregoing (adjusted for track gradient and adhesion).

*Note.* The target point is at the intersection of the deceleration curve and the target speed.

*Note.* The following information applies generally to all braking curves. For Expect Stop, there may be additional rules.

## 4.9.3 Interval A – Target speed display

### 4.9.3.1 Range of A

F4254.  a) Interval A shall extend from the distant signal or warning board to the ABf curve.

b) Interval A shall extend all the way down to $V_{TRAIN} = 0$ km/h.

### 4.9.3.2 Indications in A

F4255.  In interval A the presently most restrictive target speed shall be shown on the PRE INDICATOR [4.8]. Exceptions:

a) The target speed for level crossings (from an OT warning board, category V), shall not be shown in this interval.

b) The target speed from a warning board of Category ET shall not be shown until the train has either travelled 100 m, or has passed a controlling signal providing that the speed restriction then remains valid.

c) The PRE INDICATOR shall never show a speed that is higher than the current maximum permitted speed.

*Note.* "Most restrictive target speed" is to be interpreted as the target speed having the shortest time available until brake application is activated. Refer to sub-section [4.6.12].

*Note.* Should an optional target speed be stored in the system, and this optional speed is lower than the speed being currently displayed on the PRE INDICATOR, the driver is informed by an 'L' displayed in the position of the rightmost digit.

*Note.* The MAIN INDICATOR shows current max speed, unless there is any braking curve in interval B or higher.

F4256.  This shall apply to every active braking curve [4.9.6.2].

a) For each braking curve, when the train has passed the location where $V_{MAX}$ intersects the ABf curve, the indications shall be activated and selected according to b) ... d).

1. Exception. For level crossing supervision, the $V_{MAX}$ intersection with the BfB curve shall apply.

b) The braking curve with the lowest target speed shall be displayed on the TARGET SPEED BAR.

c) The braking curve with the lowest Permitted speed ($V_{PERMIT}$) shall be displayed if it is lower than the maximum speed ($V_{MAX}$).

1. Comparison between different Permitted speeds shall always use the display value (which may be locked to a lower value than the computed value).

d) These indications shall remain through the succeeding intervals until the braking curve is terminated (or another braking curve provides a lower value).

### 4.9.3.3    Supervision in A

No brake intervention.

### 4.9.3.4    Leaving interval A

The STM can change to another interval in the following cases:

*Table 4.9-4. Leaving interval A*

| CHANGE TO: | WHEN: |
|---|---|
| Ab | -- (Cannot be entered from here, only via interval B) |
| Bf | The train speed is high enough to fulfil the conditions for entering |
| Bf, B, C, D, E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.4    Interval Ab − Target speed display

### 4.9.4.1    Range of Ab

F4257.    a) Interval Ab shall have the same extension as intervals A + Bf together, but

b) With the difference that interval Ab shall only be entered from any of the higher intervals B – F.

*Note.* The braking curve indication is the same as in interval B.

### 4.9.4.2    Indications in Ab

F4258.    In an instance where a train has returned to interval Ab from a higher interval, the braking curve shall be indicated in the same way as in interval B.

### 4.9.4.3    Supervision in Ab

No brake intervention.

### 4.9.4.4    Leaving interval Ab

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-5. Leaving interval Ab*

| CHANGE TO: | WHEN: |
|---|---|
| A | A repeater was passed (the train has slowed down and/or the STM has received less restrictive information) |
| | The target speed became non-restrictive and then restrictive again (caused by a fluctuating max speed) |
| Bf | -- (Cannot be entered from here, only via interval A) |
| B | The train speed is high enough to fulfil the conditions for re-entering |
| B, C, D, E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.5    Interval Bf − Pre-flashing interval

### 4.9.5.1    Range of Bf

F4259.    a)  Interval Bf shall start at the ABf curve and end at the BfB curve.

b)  The lower limit of the interval shall be located at the entrance $V_{TRAIN} = V_{TARG}$.

F4260.    The ABf curve shall be calculated by means of the following formula:

$$S_{ABf} = (V_{TRAIN}/3.6) \cdot (T_B + T_{ACC} + 13) + S_{DE} \quad (m)$$

where:

− $S_{ABf}$    is the distance in metres from the ABf curve to the target at the speed $V_{TRAIN}$.

− $S_{DE}$    defines the deceleration curve as described in Sub-section [4.9.2].

− $V_{TRAIN}$ is the speed of the train in km/h.

− $T_{ACC}$    is the acceleration compensation in seconds, see below.

− $T_B$    is the brake delay in seconds, stored in the system.

*Note.* This means that the pre-flashing curve normally occurs $T_B + 13$ sec prior to the deceleration curve. [121]

F4261.    a)  $T_{ACC}$ shall always be equal to 0 s (initialized value) when this interval is entered from interval A, and

b)  $T_{ACC}$ shall not be updated inside interval Bf.

---

121 The acceleration time $T_{ACC}$ does not affect this

*Note.*  Refer to interval B for more information. [122]

*Note.* The reason for this is that $T_{ACC}$ should not affect the intervals unnecessarily early. The train could accelerate and then change to a steady speed right before the MAIN INDICATOR starts flashing. Should the acceleration persist, the following intervals will take this into account and the safety is not at risk.

### 4.9.5.2   Indications in Bf

F4262.    Short warning tone (audible f2 signal, see [4.8.8]).

   a) A short warning tone shall be given when entering interval Bf from interval A (or directly at the balise group) and $V_{TRAIN} \geq V_{TARG} + 5$ km/h.

   b) A similar warning tone shall be activated:

   1. Each time that Bf is re-entered from interval A, and $V_{TRAIN} \geq V_{TARG} + 5$ km/h.

   *Note.* The train may return to interval A after slowing down or receiving new information.

   2. Interval Bf: when the train runs below $V_{TARG} + 5$ km/h, and then increases to $\geq V_{TARG} + 5$ km/h.

   c) A repeater shall not affect this (unless changing to interval A).

   *Note.* The train can only enter here via interval A (or directly at the distant signal or warning board). Once entered here, the train can also return back to interval A (which means that the PRE INDICATOR stops flashing), and then re-enter here once more.

F4263.    The target speed shall be displayed on the PRE INDICATOR according to the same rules as in interval A, but with a slow flashing, 0.5/0.5 s [123].

F4264.    A braking curve for level crossing protection, OT-V:

   a) shall never enter interval Bf, but

   b) shall directly enter interval B (when physically in that interval).

   *Note.* Otherwise there is a risk for an irrelevant indication to be given for slower trains, where the level crossing barriers are lowered after the train has passed the first checkpoint. Supervision at level crossings can be considered to be an emergency, and so the use of a shorter warning time is acceptable.

---

122 Differs to [ATCH1], but is according to [ATC2]
123 0.75/0.25 s with [ATC2]

*Note*. Refer to sections [4.6.12] and [4.8.3] for more details about the indicated speed bars and their colours.

### 4.9.5.3    Supervision in Bf

No brake intervention.

### 4.9.5.4    Leaving interval Bf

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-6. Leaving interval Bf*

| CHANGE TO: | WHEN: |
|---|---|
| A [124] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
| | The target speed became non-restrictive and then restrictive again (caused by a fluctuating max speed) |
| | The train has slowed down below $V_{TARG}$ |
| | The train speed is too slow to fulfil conditions for staying here |
| Ab | --  (cannot be enterd from here, only from interval B) |
| B | The train speed is high enough to fulfil the conditions for entering |
| B, C, D, E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.6    Interval B – Flashing interval

### 4.9.6.1    Range of B

F4265.    a)  Interval B shall start at the BfB curve, and end at the BC curve.

*Note*. The BC curve ends at $V_{TARG}$ + 5 km/h (bottom of interval C). This allows interval B to extend below interval C, limited by the target point.

b)  The lower limit of the interval shall be $V_{TRAIN} = V_{TARG}$.[125]

*Note*. Within this interval, there is also a permitted curve which affects the speed bar colours and the dynamic max speed bar.

---

124 The Pre indicator stops flashing

125 Special case: When entering interval C but travelling below its lower speed limit, the train will stay in the B interval instead.

F4266.       The BfB curve shall be calculated by means of the following formula:

$$S_{BfB} = (V_{TRAIN}/3.6) \bullet (T_B + T_{ACC} + 8) + S_{DE} \quad (m)$$

where:

- $S_{BfB}$       is the distance in m from the BfB curve to the target at the speed $V_{TRAIN}$.

- $S_{DE}$       defines the deceleration curve as in Sub-section [4.9.2].

- $V_{TRAIN}$ is the speed of the train in km/h.

- $T_{ACC}$       equals 0 s if the train does not accelerate, alternatively set to 5 s in the event that the train accelerates. See also below.

- $T_B$       is the brake delay time in seconds, stored in the system.


*Note.* This means that the pre-flashing curve normally occurs 8 sec prior to the service brake intervention curve.

*Note.* With acceleration, $T_{ACC}$ being set to 5, this time will be reduced to 3 sec.


F4267.       a)  When entering interval B from a lower interval, or if the train enters interval B or  higher interval directly at the balise group, (except if travelling below the end speed): [126]

     1.  $T_{ACC}$ shall be locked to 0 s in the event that the train does not accelerate.

     2.  $T_{ACC}$ shall be locked to 5 s in the event that the train accelerates at a rate of $\geq 0,2 \ m/s^2$.

    b)  When the train speed increases from below the end speed to the end speed or above in interval B or higher[127] $T_{ACC}$ shall be re-evaluated; locked to 0 or 5 seconds depending on the acceleration.

    c)  $T_{ACC}$ shall be reset to 0 seconds and unlocked, if:

     1.  The train returns to a intervals A or Ab, or

     2.  Slows down to below the end speed.

    *Note.* This makes Tacc open for re-evaluation.

    *Note.* Prior to entering interval B (coming from intervals A, Ab or Bf, or before entering into B directly at the distant signal or warning board), $T_{ACC}$ is initially = 0, but then if $T_{ACC}$ is set to 5 seconds the BfB curve is moved 5 s "backwards" after entering this interval, i.e. the train will not re-enter the previous interval unless it physically returns 5 sec "backwards" in the braking curves.

---

126 As with [ATC2]
127 Differs to [ATC2]

### 4.9.6.2 Permitted curve and descending speed bar

F4268. The STM shall compute a permitted curve which shall be located five seconds before the $S_{BRAKE}$ curve (assuming constant speed):[128]

$$S_{PERMIT} = (V_{TRAIN}/3.6) \bullet 5 + S_{BRAKE} \quad (m)$$

where:

- $S_{PERMIT}$ is the distance in m from the permitted curve to the target point.

- $V_{TRAIN}$ is the speed of the train in km/h.

F4269. The MAX SPEED BAR shall start descending down to the target speed, following the permitted curve:

a) $V_{PERMIT} = 3.6 \bullet (\sqrt{((b \bullet T)^2 + (V_{TARG}/3.6)^2 + 2 \bullet b \bullet S_{PERMIT})} - b \bullet T) \ (km/h)$

where

- $b$ is the deceleration parameter for full service braking, adjusted for gradient and adhesion $(m/s^2)$

- $S_{PERMIT}$ is the remaining target distance when passing the permitted curve (m)

- $T$ is the time left to the deceleration curve, $= T_B + T_{ACC} - T_{BRAKE} + 5$ s.

- $V_{PERMIT}$ is the indicated speed on the MAX SPEED BAR in km/h.

- $V_{TARG}$ is the target speed in km/h.

b) As $V_{PERMIT}$ is computed, the STM shall ensure that the displayed MAX SPEED BAR (which shows $V_{PERMIT}$ for one braking curve) never increases, even as the driver applies the brakes.

*Note*. In other terms, if the Permitted speed calculated as above has a higher value than the previously displayed value, then the previous value shall remain displayed until a further calculated Permitted speed is lower than the displayed one.

c) If another braking curve has a calculated Permitted speed which is lower than the previously displayed value, then the value from this braking curve shall be displayed instead.

d) If a braking curve (which indicates its Permitted speed) is terminated, and the display control goes to another braking curve, then the values of the first

---

128 Differs from [ATC2] (lacking there)

braking curve shall not be considered (a higher $V_{PERMIT}$ may be displayed in this case).

### 4.9.6.3   Other indications in B

F4270.   a) When entering interval B for the first time (via interval A or directly at the distant signal or warning board), a short warning tone shall be given (audible f2 signal [4.8.8]).

b) A repeater shall not affect this (unless changing to a lower interval and then returning here).

c) Exception to a: $V_{TRAIN} < 10$ km/h.[129] [130]

*Note.* The STM braking curve supervision will never perform any brake intervention below 10 km/h.

*Note.* In certain cases such as the protection of a level crossing, the target speed is never shown in the PRE INDICATOR, but instead the release speed with 'H' substituted for the LSD (lowest significant digit), shall appear in the MAIN INDICATOR (from interval B and onwards). Refer to Sub-section [4.6.6].

*Note.* A situation may arise when two braking curves are present in the flashing interval at the one and same time, i.e. both of the braking curves must be taken into consideration for brake application.

F4271.   This shall apply to the braking curve with the most restrictive target speed, selected among those braking curves that are in this interval or higher (including Ab):

a) Target speed (or release speed for level crossing) displayed (flashing) on the MAIN INDICATOR

b) Target speed displayed on the TARGET SPEED BAR.

### 4.9.6.4   Supervision in B

No brake intervention.

### 4.9.6.5   Leaving interval B

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

---

129 Difference to [ATCH1], but according to [ATC2]

130 This affects only the cases when Vtarg = 0 or 5 km/h.

*Table 4.9-7. Leaving interval B*

| CHANGE TO: | WHEN: |
|---|---|
| A [131] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
| | The target speed became non-restrictive[132] and then restrictive again (caused by a fluctuating max speed) |
| Ab [133] | The train has slowed down below $V_{TARG}$ |
| | The train speed is too low to fulfil conditions for staying here |
| Bf | -- (cannot be entered from here, only via interval A) |
| C | The train speed is high enough to fulfil the conditions for entering |
| C, D, E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.7    Interval C − Tone interval

### 4.9.7.1    Range of C

F4272.    a) Interval C shall start at the BC tone curve and end at the brake application curve CD.

*Note.* The CD curve ends at $V_{TARG}+10$ (bottom of interval D and E). This allows interval C to extend as a 5 km/h slice below interval D and E, limited by the target point and the lower limit of interval C.

b) The lower limit shall be $V_{TRAIN} = V_{TARG} + 5$ km/h

1. Exception: at Expect Stop, when the C interval extends down to $V_{END}$ prior to passing the release point.

F4273.    The BC curve shall be calculated by means of the following formula:

$$S_{BC} = (V_{TRAIN}/3.6) \bullet (T_B + T_{ACC} + 3) + S_{DE} \quad (m)$$

where:

− $S_{BC}$    is the distance in m from the BC curve to the target at the speed $V_{TRAIN}$.

− $T_B$    is the brake delay time in seconds.

---

131 Target speed removed from the Main indicator

132 Which means that the braking curve record was reset to a passive state

133 Indications: The Main indicator continues flashing (slowly if running below the target speed). The Pre indicator is not affected. Exception: at Expect Stop, the zeroes will stay in the Pre indicator all the time with a steady light (to avoid that the driver becomes epileptic).

– $T_{ACC}$ is equal to 0 provided that the train is not accelerating and 5 sec allowing for certain rates of acceleration. See interval B for more details about $T_{ACC}$.

– $V_{TRAIN}$ is the train speed in km/h.

*Note*. This means that the train enters the tone interval 3 sec before the conditional braking interval D, assuming constant speed.

### 4.9.7.2    Indications in C

F4274.    The max and target speed bars shall be displayed as in interval B.

F4275.    When entering interval C for the first time (starting from interval A, Bf or B, or entering directly at the distant signal or warning board), the driver shall be warned by two short intermittent tones [4.8.8] in the following case:

a) No significant braking has been made (the brake pipe pressure ($P_{INT}$) has not been reduced by at least 60 kPa before entering interval C).

1. This applies regardless whether entry was made via interval A and B or directly at the distant signal or warning board.

b) A repeater shall not cause another tone warning to be given (except when changing to a lower interval and then returning here).

### 4.9.7.3    Supervision in C

No brake intervention.

### 4.9.7.4    Leaving interval C

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-8. Leaving interval C*

| CHANGE TO: | WHEN: |
|---|---|
| A [134] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
| | The target speed became non-restrictive[135] and then restrictive again (caused by a fluctuating max speed) |
| Ab | -- (cannot be entered from here, only via interval B) |
| Bf | -- (cannot be entered from here, only via interval A) |
| B | The train speed is too low to fulfil conditions for staying here |
| | A repeater was passed (the STM has received less restrictive information) |
| D | The train speed is high enough to fulfil the conditions for entering |
| D, E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.8    Interval D − Conditional brake interval

### 4.9.8.1    Range of D

F4276.    a)  Interval D shall start at the CD curve and end at the deceleration curve DE which is equal to $S_{DE}$.

b)  The interval shall be limited in decline by $V_{TRAIN} = V_{END}$.

F4277.    The CD curve shall be calculated by means of the following formula:

$$S_{CD} = (V_{TRAIN}/3.6) \bullet (T_B + T_{ACC}) + S_{DE}    \text{(m)},$$

where:

−  $S_{CD}$    is the required total braking distance in meters assuming that braking is commenced at from that point.

−  $T_B$    is the brake delay time in seconds.

−  $T_{ACC}$    is equal to 0 providing that the train is not accelerating and 5 sec allowing for certain rates of acceleration as mentioned in the below.

−  $V_{TRAIN}$    is the train speed in km/h.

*Note*. This means that interval D starts at the time of the brake delay prior to the deceleration curve, and brake application must commence at the latest at the beginning of this interval so as to avoid STM brake application being activated.

---

134 Target speed removed from the Main indicator

135 Which means that the braking curve record was reset to a passive state

Accelerating train

The fact must be considered that a train that is accelerating will trace through the braking curves at a faster rate than a train that is travelling at a constant speed. This situation provides a risk for activation of STM braking being applied too late, thus resulting in the application of the emergency brake.

See interval B for information about $T_{ACC}$.

F4278.    Reserve

F4279.    Reserve

### 4.9.8.2    Indications in D

F4280.    Display of $V_{MAX}$ and $V_{TARG}$ shall be performed as in interval B.

F4281.    a) Two short intermittent tones [4.8.8] shall be activated when entering interval D, unless they have been already activated when entering interval C.

   b) A repeater shall not cause another tone warning to be given (except when changing to a lower interval and then returning here).

*Note.* The BROMS indicator will appear, should braking be activated by the STM system.

### 4.9.8.3    Supervision of the brake intervention curve ($S_{BRAKE}$)

The driver must apply the service brake no later than during this interval so that the train will slow down to $V_{TARG}$ on reaching the target point.

F4282.    Monitoring of a commenced brake application shall be carried out in the following way.

   a) A floating curve, $S_{BRAKE}$, shall exist in the interval D. This is the STM brake intervention curve.

   b) $S_{BRAKE}$ shall coincide with the curve CD in the absence of a reduction of brake pipe pressure.

   c) The $S_{BRAKE}$ curve shall initially move between the CD and the DE curves in proportion to the brake application ($P_{REF}$ - $P_{INT}$), taking into account the degree of supervision (i.e. the setting of the HALKA switch). If the pressure reduction exceeds 60 kPa the $S_{BRAKE}$ curve shall become locked at the DE position. (See the calculation below). [136]

---

136 This is in fact achieved already at 60 kPa reduction

*Note*. This facility has been introduced in order to avoid the inconvenience of unnecessary STM interventions when the driver manually applies and releases the brakes.

F4283.    a) The $S_{BRAKE}$ curve shall be calculated by means of the following formula:

$$S_{BRAKE} = (V_{TRAIN}/3.6) \cdot (T_B + T_{ACC} - T_{BRAKE}) + S_{DE} \ (m)$$

b) $T_{BRAKE}$ can vary between 0 and $T_B$, depending on the reduction in brake pipe pressure, and shall have the value:

   1.  $\Delta P$ is less than 60 kPa:     $T_{BRAKE} = T_B \cdot \Delta P / P_{SUP} \ (s)$

   2.  $\Delta P$ is at least 60 kPa:     $T_{BRAKE} = T_B \ (s)$

*Note*. Explanations:

$\Delta P$         is the reduction of brake pipe pressure in kPa, maximized to 150 kPa for normal adhesion and to 100 kPa for low adhesion, and

$P_{SUP}$       is either 100 or 150 kPa depending on the present adhesion setting.

$T_{BRAKE}$    is a compensation time for driver braking in s.

$V_{TRAIN}$    is the train speed in km/h.

Compensation for driver braking ($T_{BRAKE}$)

F4284.    After entering interval B:

a) The value of $T_{BRAKE}$ shall be the subject of constant calculation as long as the pressure reduction is less than 60 kPa.

b) Reduction in the pressure of the brake pipe by at least 60 kPa shall result in $T_{BRAKE}$ being locked to $T_B$.

*Note*. This means that when $T_{BRAKE}$ is locked the STM shall not activate the brakes until the deceleration curve is passed.[137]

F4285.    The locked value at $T_{BRAKE}$  shall be set to 0 s:

a) If the train returns to interval A, or

b) If the speed drops below $V_{END}$, at which point the brake intervention curve shall be returned to coincide with the CD curve.

---

137 The ERIS group has commented that there is a risk associated with locking $T_{BRAKE}$, especially with a stop signal ahead of the train. If the driver makes a short braking and then releases the brake, the protection against signal overrun is compromised since STM brake application will not come until the deceleration curve is reached. This may require a change in $T_{BRAKE}$ handling, probably by preventing $T_{BRAKE}$ locking during supervision of Expect Stop.

A4285.     The locking of $T_{BRAKE}$ shall not apply:

a)  If the train returns to interval A, or

b)  If $V_{TARG} = 0$ and the speed drops below $V_{END}$, at which point the brake intervention curve shall be returned to coincide with the CD curve.

*A-note.* For $V_{TARG} <> 0$ the locked value remains, this is in order to avoid sudden jumps in the display, which would occur when the locked value was released. For $V_{TARG} = 0$ it has been considered not acceptable to leave the value locked.

*A-note.* Without locking, $T_{BRAKE}$ will follow the brake feedback linearly.

Passing the intervention curve

F4286.     When the train passes the intervention curve for STM brake application the following shall be performed.

a)  If $V_{TRAIN} \geq V_{END}$:     The STM shall apply full service brake.

b)  If $V_{TRAIN} < V_{END}$:     STM brake activation shall not be initiated.

*Note.* Should the train return to a point before the brake intervention curve, the STM permits that the service brake is released.

### 4.9.8.4   Leaving interval D

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-9. Leaving interval D*

| CHANGE TO: | WHEN: |
|---|---|
| A [138] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
| | The target speed became non-restrictive[139] and then restrictive again (caused by a fluctuating max speed) |
| Ab | -- (cannot be entered from here, only via interval B) |
| Bf | -- (cannot be entered from here, only via interval A) |
| B | A repeater was passed (the STM has received less restrictive information) |
| C | The train speed is too low to fulfil conditions for staying here |
| E | The train speed is high enough to fulfil the conditions for entering |
| E or F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

## 4.9.9 Interval E − Unconditional brake interval

### 4.9.9.1 Range of E

F4287.
a) Interval E shall start at the deceleration curve $S_{DE}$, and

b) end at the emergency braking curve EF.

c) The lower limit for $V_{TRAIN}$ is equal to $V_{END}$:

   1. For $V_{TARG} = 0$, $V_{END} = V_{REL}$, and

   2. for $V_{TARG} > 0$, $V_{END} = V_{TARG} + 10$ km/h.

*Note.* With full brake supervision the deceleration curve will be located 2 sec in advance of the emergency brake curve on the assumption that the speed of the train is constant.

### 4.9.9.2 Indications in E

F4288.
a) There shall be the same indications as for interval D,

b) with the exception of the audible signal.

---

138 Target speed removed from the Main indicator

139 Which means that the braking curve record was reset to a passive state

### 4.9.9.3   Supervision in E

The brakes are normally already applied when the train reaches this point.

F4289.   If $V_{TRAIN} \geq V_{END}$, full service braking shall be immediately applied, in a similar manner as when passing the intervention curve in interval D.

### 4.9.9.4   Leaving interval E

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-10. Leaving interval E*

| CHANGE TO: | WHEN: |
|---|---|
| A [140] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
|  | The target speed became non-restrictive[141] and then restrictive again (caused by a fluctuating max speed) |
| Ab | -- (cannot be entered from here, only via interval B) |
| Bf | -- (cannot be entered from here, only via interval A) |
| B or C | A repeater was passed (the STM has received less restrictive information) |
| D | The train speed is too low to fulfil conditions for staying here |
| F | The train speed is high enough to fulfil the conditions for entering |
| F | A repeater, SH or linking group was passed (the STM has received more restrictive information) |

---

140 Target speed removed from the Main indicator

141 Which means that the braking curve record was reset to a passive state

## 4.9.10 Interval F − Emergency brake

### 4.9.10.1 Range of F

F4290.  a)  The emergency brake interval shall extend from the emergency braking curve EF to the target point.

  b)  There shall be a downward limitation by way of $V_{TRAIN}$ being equal to $V_{END}$.

  c)  The emergency braking curve shall be calculated by means of the following formula:

$$S_{EF} = S_F - 2 \cdot (V_{TRAIN}/3.6) \quad (m),$$

  where:

  −  $S_{EF}$ is the emergency braking distance to the target in meters, and

  −  $S_F$ is the full braking curve, which is the same as $S_{DE}$ with normal supervision.

  −  $V_{TRAIN}$ is the train speed in km/h.

### 4.9.10.2 Indications in F

F4291.  There shall be the same indications as for interval E.

### 4.9.10.3 Supervision of F

F4292.  The following rules shall apply.

  a)  If $V_{TRAIN} \geq V_{END}$: The STM shall immediately apply the emergency brake.

  b)  If $V_{TRAIN} < V_{END}$: STM emergency brake application is not introduced.

### 4.9.10.4 Leaving interval F

The STM can change to another interval in the following cases. Note that linking groups and SH groups do not count as repeaters in this context.

*Table 4.9-11. Leaving interval F*

| CHANGE TO: | WHEN: |
|---|---|
| A [142] | A repeater was passed (the train has slowed down or the STM has received less restrictive information) |
| | The target speed became non-restrictive[143] and then restrictive again (caused by a fluctuating max speed) |
| Ab | -- (cannot be entered from here, only via interval B) |
| Bf | -- (cannot be entered from here, only via interval A) |
| B, C, D | A repeater was passed (the STM has received less restrictive information) |
| E | The train speed is too low to fulfil conditions for staying here |

## 4.9.11 Supervision after distant signal Expect Stop

### 4.9.11.1 Indications at Expect Stop

There are a number of braking curve indications but not all of them are defined here, only those related specifically to distant signals at Exepct Stop.

Note however that the MAX SPEED BAR will descend all the way down to zero (Permitted curve).

F4293.   a) Two or three zeroes shall be shown on the PRE and/or MAIN INDICATOR's, depending on the level of the release speed (40 km/h for two zeroes, else three).

b) The MAIN INDICATOR shall be flashing rapidly (0.3/0.3 s).

c) When travelling below the release speed, the zeroes shall become small (lower case `'o'` ).

d) The target speed shall also be shown on the TARGET SPEED BAR, together with the release speed on the RELEASE SPEED BAR.

A4293.   a) Two or three zeroes shall be shown on the PRE and/or MAIN INDICATOR's, depending on the level of the release speed (40 km/h or more for two zeroes, else three).

b) The MAIN INDICATOR shall be flashing rapidly (0.3/0.3 s).

---

142 Target speed removed from the Main indicator

143 Which means that the braking curve record was reset to a passive state

c) When travelling below the release speed, the zeroes shall become small (lower case `'o'`).

d) The target speed shall also be shown on the TARGET SPEED BAR, together with the release speed on the RELEASE SPEED BAR.

*Note*. The release speed varies depending on the coding of the preceding signal group [Chapter 3]. It is also displayed digitally on the RELEASE SPEED INDICATOR [4.6.12].

*A-note*. The release speed varies depending on the coding of the preceding signal or release group [Chapter 3]. It is also displayed digitally on the RELEASE SPEED INDICATOR [4.6.12].

F4294. When passing the release point according to Sub-section [4.9.11.2]:

a) The target speed shall be removed from the PRE-INDICATOR (the indicator is blanked if no other information exists).

b) A short information tone (audible f2 signal, see [4.8.8]) shall be activated.

F4295. Special case for an Expect Stop with category P extension: The indication for an active P-extension shall always be `' OP'`.

*Note*. As long as the P extension is active (before reaching the last signal prior the stop signal), it is not possible to know which release speed that should be finally applied. It is important that the actual release speed given from the latest distant signal is stored in the braking curve.

*A-note.* As long as the P extension is active (before reaching the last signal prior the stop signal), it is not possible to know which release speed that should be finally applied. It is important that the actual release speed given from the latest distant signal (or release group) is stored in the braking curve.

### 4.9.11.2  Supervision at Expect Stop

F4296. "Supervision to a certain release speed" means that deceleration shall be supervised, until ...

a) The "knee" (the release point) is passed, and

b) The train speed is reduced to below $V_{REL}$.

*Note*. This is to avoid unmotivated STM brake application. Refer to the figure below.

*Note*. The location between the distant signal and the associated main signal where supervision of deceleration changes to supervision of $V_{END}$ as maximum speed is referred to as the *release point*.

*Note*. The release point is defined as the target distance where the intervention curve in the initial CD state intersects the end speed, i.e.

$$D_{REL} = (V_{END}/3.6) \cdot T_B + (V_{END}/3.6)^2 / 2 \cdot b \ (m), \text{ see also } [4.6.6.2].$$

F4297.      The passing of a release point (knee) shall require that the release point is either reached, or has been passed earlier.

F4298.      Once the release point passage has occurred, then supervision shall turn to max speed supervision of the release speed level.

*Note.* This facility must not be used unless the signal has changed to a Proceed aspect. Supervision shall then be activated in the same manner as supervision of maximum permitted speed, i.e. 5 - 9 km/h in excess of permitted speed leads to audible warning f2, 10 - 14 km/h in excess of permitted speed leads to service brake application, and ≥ 15 km/h in excess of permitted speed leads to emergency brake application

*Figure 4.9-2. The position of the release point at 40-supervision*
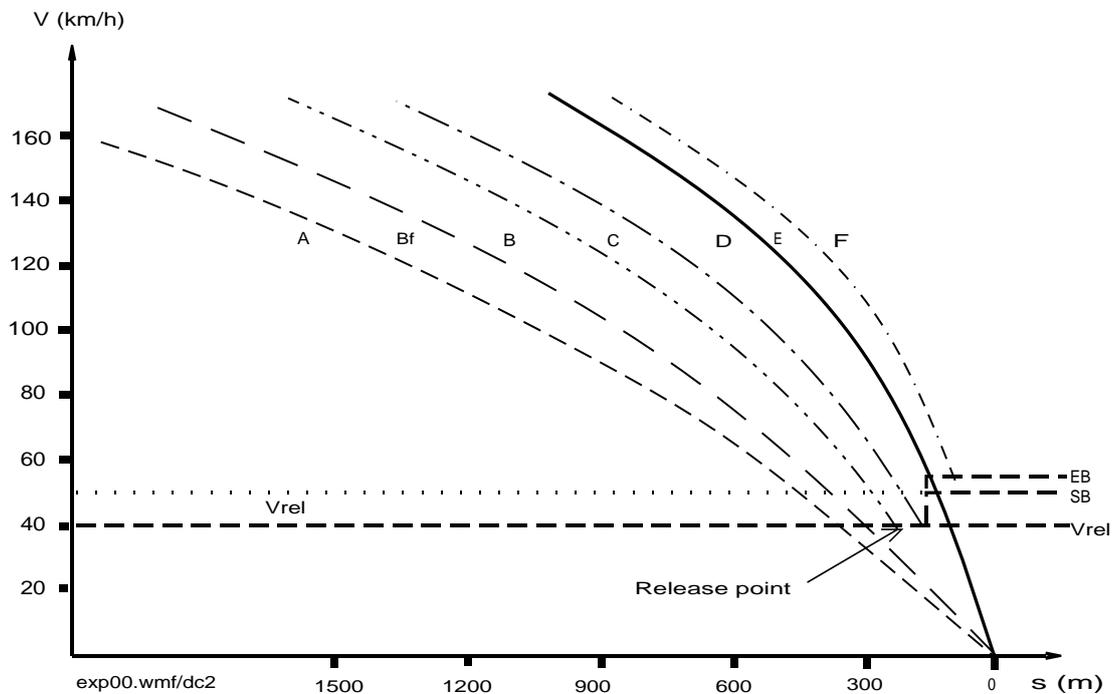


*Note.* The DE curve is drawn to zero. There is not, however, any supervision function below the release speed with the exception of providing a reference for the ABf and the BfB curves.

## 4.10     INDEX

### 4.10.1     Changes