

sferiel

VIKING+





sferiel

CARTE MEMOIRE

DLE 0	Mise en route du compteur	DLE 21	DATE
DLE 1	Sens 1	SER=1692	10/11
DLE 2	Sens 2	SER=754	10/11
Seuil de détection 1: 100			
Seuil de détection 2: 100			

- 1
- 2 ABC
- 3 DEF
- ON *
- 4 GHI
- 5 JKL
- 6 MNO
- DLE
- 7 PQRS
- 8 TUV
- 9 WXYZ
- ←
- OUI
- 0
- + NON
- EXE



Liste des commandes

ON Mise en route du compteur (appuyer 5 secondes)

DLE 0 Accès aux commandes protégées (DLE 21, DLE 30)

DLE 00 Arrêt du compteur

DLE 1 Identification du compteur

DLE 2 Programmation début et fin de comptage

DLE 3 Affichage des véhicules détectés

DLE 6 Affichage de la version du logiciel

DLE 7 Affichage de l'état du compteur

DLE 8 Affichage de la mémoire restante

DLE 9 Affichage de la discrimination 2RNL et VL/PL

DLE 14 Seuil de discrimination entre les véhicules

DLE 17 Séparation entre les véhicules

DLE 18 Seuil de détection

DLE 21 Date de changement et tension des piles

DLE 30 Formatage de la carte

DLE 31 Liste des fichiers enregistrés

DLE 32 Suppression d'un fichier

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UTKING+

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1 Presentation

1.1 Introduction

VIKING+ is an Automatic Traffic Counter (ATC) based on radar technology conceived for traffic recording and analysis: it is installed on the roadside and does not require any additional detector. Measurements are taken by the radar and stored within the counter.

VIKING+ is a self contained unit: its two zinc-air batteries allow six months of continuous use. It is equipped with a keypad and a screen, enabling the user to directly program the counter without any external device. VIKING+ holds a high storage capacity as it uses Secure Digital (SD and SDHC) cards to store data. The files saved on these cards by VIKING+ are directly readable by any computer with a card reader. No additional software is required.

1.2 The radar sensor

1.2.1 Measurements from the sensor

The radar sensor within VIKING+ is a Doppler radar, able to perform the following measurements:

- Traffic volume
- LGV/HGV classification
- Speed

SFERIEL recommends measurement from the nearest traffic lane to VIKING+, but with this new version you will be able to measure both directions of the traffic if you are on a road with a low traffic volume rate.

The volume accuracy in non-saturated traffic conditions is better than 1% on the closest lane.

The speed accuracy is $\pm 1\% \pm 0.5\text{km/h}$ for speeds ranging from 8 mph to 120 mph. (with an appropriate installation)

Vehicle classification accuracy relies on correct counter programming and depends on traffic conditions. Measurement quality is not influenced by external conditions: light or visibility conditions, rain, fog or snow do not affect VIKING+.

Note: bidirectional mode must be used in the following traffic conditions:

- Road with 2x1 lane maximum.
- No traffic peak over 700 vehicles per hour for both lanes
- Low HGV rate (<10%)
- The maximum accuracy for speed measurement is obtained only with installations underneath 2 meters height.

1.2.2 Sensor positioning

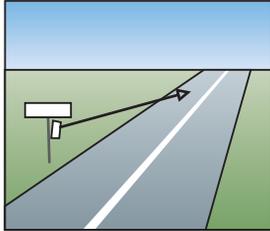
VIKING++'s position by the road must conform to one imperative rule:

The counter's axis and the road's axis must be placed at a 45° angle. This angle can be horizontal, vertical or sideways but its value must be accurately respected: any error will lessen the speed measurement accuracy. Please see how to set the counter correctly in section 4.3.

Depending on its settings, VIKING+ can count approaching vehicles, receding vehicles or both directions.

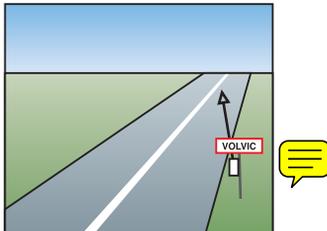
There are 6 different ways to position the counter by the road, based on the 3 different options to set the 45° angle to the road and the fact that VIKING+ can count one of the two possible directions, and 2 solutions SFERIEL recommends for bidirectional counting.

• Option N° 1: VIKING+ fitted on a signpost, detecting approaching vehicles:



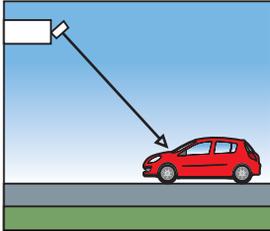
- VIKING+ is fitted at a height of approximately 1m.
- The 45° angle is horizontal and can be obtained by aiming,
- Vehicles are approaching the counter.

• Option N° 2: VIKING+ fitted on a signpost, detecting receding vehicles:



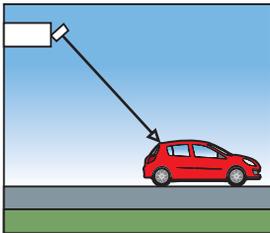
- VIKING+ is fitted at a height of approximately 1 m.
- The 45° angle is horizontal and can be obtained by aiming.
- Vehicles are moving away from the counter.

- Option N° 3: VIKING+ above the road (on a bridge), detecting approaching vehicles:



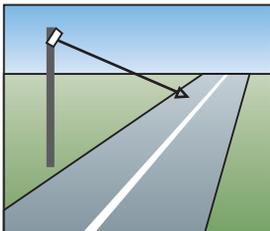
- VIKING+ is fitted at a height of approximately 6m.
- The 45° angle is vertical and is obtained with a spirit level.
- Vehicles are approaching the counter.

- Option N° 4: VIKING+ above the road (on a bridge), detecting leaving vehicles:



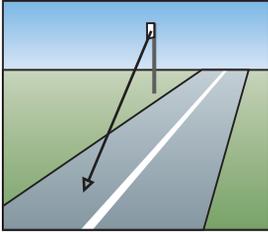
- VIKING+ is fitted at a height of approximately 6m.
- The 45° angle is vertical and is obtained by spirit level.
- Vehicles are moving away from the counter.

- Option N° 5: VIKING+ on a lateral post, detecting approaching vehicles:



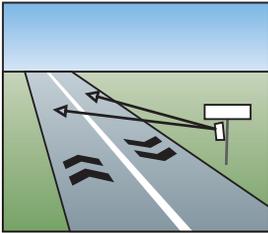
- VIKING+ is fitted at a height ranging from 2m to 6m.
- The sideways 45° angle is obtained by both aim and a spirit level.
- Vehicles are approaching the counter.

- Option N° 6: VIKING+ on a lateral post, detecting leaving vehicles:



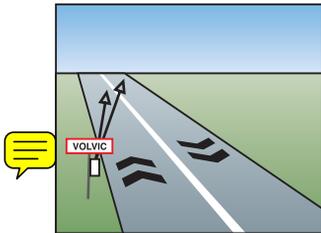
- VIKING+ is fitted at a height ranging from 2m to 6m.
- L'angle de 45° est oblique et est obtenu avec un niveau et un viseur,
- Les véhicules s'éloignent de VIKING+.

- Option N° 7: (bidirectional): VIKING+ on a lateral post, bidirectional detection:



- VIKING+ is fitted at approximately 1m height.
- The 45° angle is horizontal and obtained by aim.
- Vehicles on the nearest lane are approaching the radar and vehicles on the farthest lane are receding from the radar.

- Option N° 8: (bidirectional): VIKING+ on a lateral post, bidirectional detection:



- VIKING+ is fitted at approximately 1m height.
- The 45° angle is horizontal and obtained by aim.
- Vehicles on the nearest lane are receding from the radar and vehicles on the farthest lane are approaching from the radar.

1.2.3 Vehicle classification

Most counters discriminate sizes by comparing a figure which represents the vehicle characteristics with an adjustable threshold. In the case of pneumatic counters, the vehicle characteristic used for classification is the distance between axles, for loop counters, it is the vehicle length.

VIKING+ works on the same principle but the characteristic used to set the threshold is specific to radars. It is called RCS (Radar Cross Section).

RCS describes an object's ability to reflect more or less energy when impacted by a radar wave:

- The bigger the vehicle with the more complex profile, the higher the RCS,
- The smaller the vehicle with the simpler profile, the lower the RCS.

VIKING+ measures a RCS for every passing vehicle and records it, using an arbitrary unit, as a value ranging from 0 to 5000. For each vehicle, the counter compares this value with the user-programmed threshold and classifies the vehicle accordingly in two classes:

- if the value is smaller than the threshold, it is recorded as a class 1 vehicle,
- if the value is larger than the threshold, it is recorded as a class 2 vehicle.

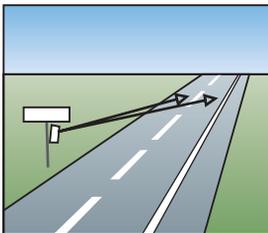
1.2.4 Precautionary measures

As with every sensor, there are some precautionary measures to take when using a radar sensor.

First of all, VIKING+'s radar uses the Doppler Effect, which is only applicable with moving targets. Therefore, VIKING+ cannot detect stopped vehicles. Most of the time this will not be a problem since VIKING+ can detect very slow moving targets. However, it prevents from using the counter fixed to traffic light posts for example, to measure incoming vehicles. As a general rule, VIKING+ should not be fitted in places where vehicles are due to stop, such as traffic lights, stop signs, etc.

Also, VIKING+ cannot detect a vehicle through another one. Stationary vehicles will have to be considered when installing the counter: either VIKING+ must be fitted high enough to detect beyond the stationary cars, or be installed in a particular spot where no vehicle can park in front of the counter.

Another case of vehicles hiding each other might occur when VIKING+ is used on the side of a dual carriageway:



In this case, the vehicles on the nearest lane will hide the ones on the farthest lane and the radar will underestimate the volume of vehicles, even more so if the traffic is congested. This particular installation of VIKING+ should only to be used with full understanding of these facts and limitations. This phenomenon forbids a bidirectional counting on a road with a high traffic volume.

1.3 The FLASH card

1.3.1 Card types

VIKING+ was designed to accept all kind of Secure Digital Flash cards. These cards are commonly used with digital cameras and PDAs. Although all SD cards are supposed to be compatible, SFERIEL advises to use SANDISK SD cards: they have been used in the development stage of VIKING+. SD cards can be "LOCKED" to prevent additional data to be stored. Of course, VIKING+ will not be able to record on a locked SD card.



1.3.2 Inserting the card

When inserting the card in VIKING+, the gold contacts must be facing down.

1.3.3 Card size and format

VIKING+ can use all SD cards up to a 32GB SDHC card. The only condition is to have a memory card formatted for FAT12 / 16 / 32 data storage.

1.3.4 PC card drive

Recorded files on SD cards are MS-DOS/ WINDOWS compatible. They are directly accessible by a computer with a standard SD/SDHC card drive. For users that are not equipped with such a drive, SFERIEL can provide a reliable SANDISK card reader.

1.4 GPS functions

The inbuilt GPS unit allows two new functions for the VIKING+: positioning and synchronisation. Each function is an option that can be activated or deactivated.

1.4.1 Concept

Each counter VIKING+ is equipped with its own Global Positioning System (GPS) unit to receive information from satellites of the GPS network.

Energy consumption being very important when functioning, it is supplied only once per day, or every time the user will ask the counter to synchronise its position or internal clock.

Given that GPS signal is not always at its best (especially inside a building), a number of maximum attempts to connect has been set, as well as a request timeout if the data is not received fast enough, in order to save the batteries.

1.4.2 Internal clock synchronisation

The internal clock of the counter is exposed to the weather and can undergo great changes in temperature between inside and outside the counter according to the moment of the day and where the counter is mounted.

It is often observed that two counters placed at a few miles from one another have an important time gap between themselves, which is a great problem when you wish to analyse traffic volumes precisely. The GPS unit allows the user not to worry about this anymore, since it reads its time from the satellite network: all your VIKING+ will be counting on the same time clock.

This function also allows switching from summer time to winter time automatically without the user having to ask for anything. In the case of a "vehicle by vehicle" counting, it is possible that synchronisation of the clock will show some vehicles previous to the last recorded vehicle: these vehicles will not be stored in the VIKING+ file.

1.4.3 Recording geographical coordinates

Recording the geographical position of the counter is important to determinate its exact position during the study.

If these coordinates are required (see Fn 1) they will be recorded on the first line of the file.

Coordinates recording is made when the user programs the counter (see Fn 2). It is therefore important to program the counter on-site if you wish to use these coordinates afterwards.

Two types of coordinates are available:

- DDmmss.sss : Degrees, minutes, seconds decimals
- DD.DDDDD : Decimal degrees

The first one is given with North & South indicators for Latitude, and East & West indicators for longitude. The second one expresses these by signs +/-.

Note: if activated, synchronisation occurs every day at 3:32 AM.

2 The different states of VIKING+

2.1 Various states of the counter

To explain how the counter works, it is best to visualise its different states: it can be stopped, counting, or waiting to start the next counting period...

These stages are described as being the different counters' states. For each state, programming options will differ and will achieve different results.

VIKING+ has four different states:

VIKING+ peut prendre un état parmi quatre. Ces quatre états sont:

- "Off" state
- "Waiting for programming" state
- "Waiting to start recording" state
- "Recording" state

These four states are described in the following paragraphs.

2.2 "Power off" state

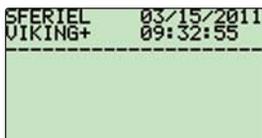
In the "off" state, the counter is not active and battery consumption is negligible. When not in use, the counter should be stored in this state.

To switch VIKING+ on, press the  button for about 5 seconds.

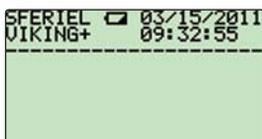
The following welcome screen will be displayed:



You can pass the welcoming screen by pressing the  key



When starting, VIKING+ will auto test its battery charge. If it is low, the screen will show a little battery icon on top:



To stop VIKING+ and return to the "Power off" state, press:



VIKING+ will then display the following text for a few seconds, before shutting down:



The "CARD AVAILABLE" display indicates that it is important to insert or remove the SD card only when the counter is off. This prevents the risk of corrupting the stored data if the SD card is removed by mistake while the counter is still recording.

2.3 "Waiting for programming" state

This is the VIKING+'s state when just switched on. In this state, the counter can be programmed using all available functions, but doesn't record passing vehicles.

There are two ways to change state: turn the counter off or program a recording period.

VIKING+ can be stopped, as explained previously, by using the following function: **DLE** **0** **0** **EXE**.

Programming a new recording period can be done by pressing **DLE** **2** **EXE**.

The "waiting for programming" state only occurs when the actual programming is being entered.

As there is no need to maintain this state if programming doesn't start, the counter will switch itself off automatically if no function has been activated within 5 minutes. To start programming, the counter will then have to be turned back on by pressing **ON**.

2.4 "Waiting to start recording" state

This is VIKING+'s state after the function Fn2 (Counter start and finish settings) has been selected and a valid beginning date entered. In this particular state, the counter waits for the period to begin without recording the vehicles and will not switch itself off automatically. In these conditions, the function Fn 30 (SD card formatting) is forbidden: if an attempt is made, the counter will display an error message. Every other function is allowed.

VIKING+ will automatically change state when reaching the period's start date and time, and will begin recording. In this state, automatic power off of the counter is disabled (only the LCD screen is switched off and will get back on as soon as any key of the keyboard is pressed).

2.5 Etat "Recording" state

This is the state when the programmed start date has been reached and VIKING+ starts recording. The counter will not switch itself off automatically. It will record every vehicle's characteristics on the card and will carry on doing so until one of the following events occurs:

- The finish date (if one has been programmed) is reached,
- The Flash card is full
- The Flash card is unplugged by the user
- Fn 00 is instructed by user (switching the counter off).

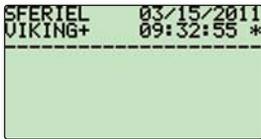
In any of these cases, VIKING+ will stop recording, return to the "Waiting for programming" state, and, if no action is taken within 5 minutes, go back to the "off" State.

Warning: removing the memory card during the recording operation will stop the recording; however it is not recommended to do so, as recorded data will be at risk of being corrupted.

For the same reasons one must not retrieve a disk from a computer when saving data, one must not remove VIKING+'s memory card while recording.

In this state, automatic power off of the counter is disabled (only the LCD screen is switched off and will get back on as soon as any key of the keyboard is pressed).

In the "waiting for counting" and "recording" states, when the LDC screens switches off after a 5 minute timeout, In this state, the screen will switch back on as soon as any key of the keyboard is pressed, and a screen with the date and time will be displayed:



Note: the star displayed just on the right side of the time indicates that date and time have been updated via GPS less than 5 days ago. As a matter of fact if the counter cannot succeed in a GPS synchronisation for 5 following days, the function will be disabled and the date and time will then appear as "not synchronised" (no star displayed).

3 Functions

Tableau
"VIKING+
Function
index"
?

3.1 Functions overview

Each function is programmed by keying in the function number between the **DEL** and **EXE** buttons.

For example, to access the counter status (function Fn 7), the following keys must be pressed: **DEL** **7** **EXE**.

3.2 Function Fn 0 – Access to special functions (Fn 21 and Fn 30)



The Fn 0 function is used as a safeguard. The special functions Fn 21 (modification of the date of latest battery replacement) and Fn 30 (SD card formatting) can damage the data if they are activated by mistake. To prevent this, Fn 21 and Fn 30 cannot be performed unless the user has entered the Fn 0 function beforehand.

The Fn 0 function must be keyed in just before Fn 21 or Fn 30 is entered.

VIKING+'s display to Fn 0 is "OK!"



3.3 Function Fn 00 – Power OFF

Fn 00 allows to stop VIKING+. Depending on the state of the counter at the time of using Fn 00, the following will happen:

- If the counter is in the "Waiting for programming" state, Fn 00 will only turn the counter off.
- If the counter is programmed and is in the "Waiting to start recording" state, the Fn 00 function will delete the existing programming and stop the counter. In other words, if the counter is stopped while already programmed and then turned back on, the program will be lost and Fn 2 (Counter start and finish settings) will have to be re-entered.
- If the counter is recording, Fn 00 will erase the finish date if one has been set, close the current file and turn the counter off. The SD card can now be withdrawn safely.

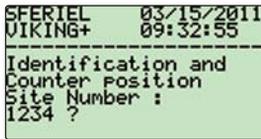
VIKING+'s display to Fn 00 is:



3.4 Function Fn 1 – Counter ID

Fn 1 allows reading or writing the counter's ID. This identification is made of six alphanumerical fields. These fields are for reference purpose only and are not linked to the functioning of the counter. The counter ID will appear in the first line of every file created by VIKING+ (ref. Appendix 2, page 36). The six ID files are defined as follows:

- SITE NUMBER : 4 digits identifying survey location,
- RADAR NUMBER : 4 digits identifying the VIKING+ unit,
- ROAD : Surveyed road name, (14 c.)
- CITY : Closest city to surveyed location, (14 c.)
- DIRECTION : A city cars are heading towards, (14 c.)
- Other : Free for any description. (14 c.)
- GPS Location : Enable/disable GPS.
- Format coordinates : Choose between 2 formats.



3.5 Function Fn 2 – Counter start and finish settings

Fn 2 gives access to VIKING+'s internal clock, letting the user change the current date and time if necessary. It is also used to program the date and time when the next survey should start and finish, along with the name for the file to be created. This function also allows viewing the settings only, without modifying them. When Fn 2 is selected, the following is displayed:



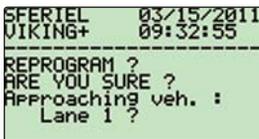
Accept by pressing the  or  key. VIKING+ will then display:



After pressing the  or  key again, you will then be asked to complete the programming of the survey (detection mode of the counter, date and time of start, finish, other recording settings...). However if any of these two questions are being answered by pressing another key rather than  or , the parameters will be displayed for reading only.

3.5.1 Setting mode

Programming, using Fn 2, follows the same pattern as with Fn 1: VIKING+ will display a parameter with its current setting followed by a question mark. If you wish to keep it as is, press the  key, otherwise enter your new value for this parameter and then press . You can enter a value yourself with the keyboard or go through the list of available choices by pressing the  key. For example, the first parameter (associating approaching channel with lane direction) is presented in this way:



If you wish to keep lane 1, press **EXE**

If vehicles approaching the VIKING+ are on lane direction 2, press one time on the **+NON** key and then the **EXE** key.

VIKING+ will then display:

```
SFERIEL 03/15/2011
VIKING+ 09:32:55
-----
ARE YOU SURE ?
Approaching veh. :
  Lane 2 ?
Receding veh. :
  Lane 1 ?
```

In both cases, pressing **EXE** moves you forward to the next parameter.

The different parameters to be set are:

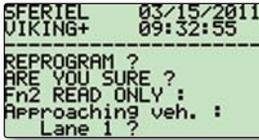
- Approaching vehicles: in which lane are approaching vehicles
- Receding vehicles: enable/disable double lane monitoring
- GPS clock update while counting: enable/disable clock synchronisation
- Year (current, if GPS synchronisation is disabled)
- Month (current, same as the "year" setting)
- Day (current, same as the "year" setting)
- Hour (current, same as the "year" setting)
- Minute (current, same as the "year" setting)
- Second (current, same as the "year" setting)
- Beginning of recording: month
- Beginning of recording: day
- Beginning of recording: hour
- Beginning of recording: minute
- End of recording: month
- End of recording: day
- End of recording: hour
- End of recording: minute
- Name of the created file
- Format of the created file

The default file name, if none is entered, is "noname". The file extension, if none is entered, is the same as the one used during the last Fn 2 programming for the previous survey (default value: VIK). Both name and format can be modified by using the keyboard as if writing a text message on a mobile phone.

Settings for "approaching vehicles" and "receding vehicles" are here to define the situation for the counter presented in 1.2.2. No control of these values is realised by the counter itself.

3.5.2 Reading mode

In reading mode, VIKING+ will display each parameter and its value without interrogation mark. Pressing  will allow you to browse through all the parameters:



3.5.3 Special features of Fn 2

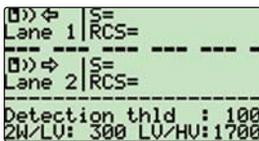
The main purpose of Fn 2 is to instruct the counter when to start and end the survey. Once Fn 2 has been programmed, VIKING+ changes to its "Waiting to start recording" state.

If the start date proposed by the counter is validated without any modification, recording will start straight away. If the user does not wish to enter an end date and time, he may do so by validating VIKING+'s default parameter for this option (00/00/00/00/00). The counter will then record until either the FLASH card is full or the counter is stopped by using Fn 00. Removing the memory card while recording would also stop the counter, but we have seen that this method is best avoided.

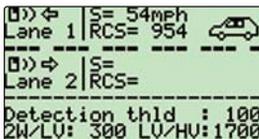
Note: Function Fn 2 is disabled by VIKING+ if the FLASH card is either absent or locked.

3.6 Live data display

Fn 3 has two purposes: making sure that VIKING+ works properly according to the programming made beforehand and eventually adjust the classification thresholds 2W/LV and LV/HV by measuring a few vehicles' RCS before setting them by Fn 14. Fn 3 will first display the following screen with the threshold values defined in Fn 18 (detection threshold) and Fn 14 (threshold 2W/LV and LV/HV):



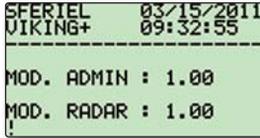
Then, as soon as a vehicle is detected by the radar, the speed and RCS of the vehicle will be displayed, with a small pictogram representing the type of vehicle detected, according to the thresholds defined in Fn 14. The pictogram will flash for a few seconds to show that a new vehicle has been detected.



In this case VIKING+ has detected a class 1 vehicle driving at a speed of 87 mph, and classified the vehicle as LV (light goods vehicle) according to its RCS. He will record it as driving in "lane direction 1" in the final file.

3.7 Function Fn 6 – Software version number

Fn 6 displays the software's version number:

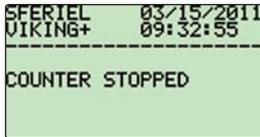


Two references can be seen on the screen; this is because VIKING+ software is made of two micro-controllers modules. The first module (admin module) manages the keyboard, the LCD screen, the clock and the FLASH card, and the second one (radar module) measures the speed and RCS of the vehicles. Each module can be updated independently from the other; therefore both module versions must be displayed.

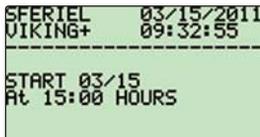
3.8 Function Fn 7 – VIKING+ status

When activated, Fn 7 gives the information on the counter's state, as seen in 2.1.

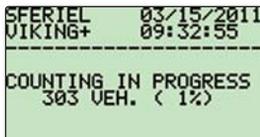
- If the state is "Waiting for programming" the screen shows:



- If the counter is already programmed but has not yet begun to record, ("waiting to start recording" state), Fn 7 will display the start date and time, as in the following example where the counter is due to start on February 1st 00 AM:



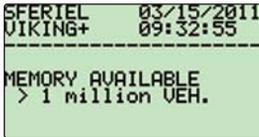
- If the counter is already counting (state: "recording"), the message will be:



This means that VIKING+ is in the process of recording, it has already recorded 303 vehicles on the memory card and this one is 1% full so far.

3.9 Function Fn 8 – SD card free memory

Fn 8 displays the free space still available on the SD card. This space is expressed in term of number of recordable vehicles left.

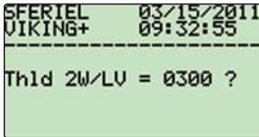


In this example, the memory card can still store data for more than 1 million vehicles.

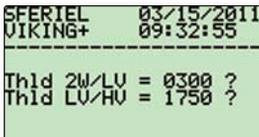
Note: The function Fn 8 is disabled while VIKING+ is counting.

3.10 Function Fn 14 – Classification threshold settings

Fn 14 is used to set the RCS thresholds in order to differentiate three classes of vehicles. When Fn 14 is activated, VIKING+ will display the first the 2W/LV threshold and then the LV/HV threshold, followed by a question mark:



To modify the threshold value, enter a new number between 10 and 9999 and confirm by pressing the **EXE** key. If you wish to keep the current limit, simply press **EXE**.



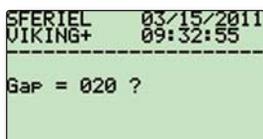
Note: VIKING+ does not control the thresholds defined by the user, if the 2W/LV threshold is superior to the LV/HV threshold, two-wheelers will be detected but sorted as Light Goods Vehicle.

3.11 Function Fn 17 – Gap adjustment (between vehicles)

This function enables to adjust the interval or "space" in between vehicles. It must be set in such a way that two light vehicles closely following each other are counted as two vehicles but a heavy vehicle with its trailer is counted as one.

The default value is 20. If VIKING+ seems to amalgamate close by vehicles, this parameter should be lowered. If, on the contrary, it appears that VIKING+ counts articulated lorries as two separate ones, this parameter should be increased

There is usually no need to modify this parameter from its default value. Fn 17 will show:

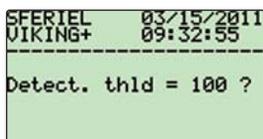


Accept by pressing **EXE** or enter a new value, from 1 to 9999, and then press **EXE**.

3.12 Function Fn 18 – Detection threshold settings

Fn 18 allows the user to modify the counter's detection threshold. This detection threshold represents the smallest RCS acceptable as being representative of a passing vehicle to be recorded. If it is set at 300, then only vehicles with a RCS higher than 300 will be detected. This sensitivity setting can be particularly useful to exclude some categories from a survey, such as pedestrians (with a very low RCS) or two-wheels (with a RCS lower than a car RCS).

When Fn 18 is selected, the screen will display:



Accept this number by pressing **EXE** or enter a new value between 10 and 999 and then press **EXE**.

3.13 Function Fn 21 – Date of latest battery replacement

Fn 21 is used as a notepad where the user can record the date when he changes the batteries (year and month). This information can then be displayed at any time.

VIKING+ also gives a measure of the batteries actual voltage (this tension is measured every minute). Warning, the battery voltage is not an indicator for the precise state of charge of the batteries, but it allows identifying if there is any problem on the counter coming from the batteries, or if a traffic recording will not be able to finish because the voltage is dropping.

When Fn 21 is activated, the screen shows:



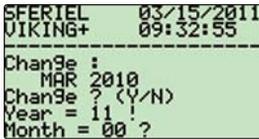
As Fn21 is a protected function, if you wish to re-write the date of battery change, you first have to select Fn 0 and then Fn 21. In this case, the following will be displayed:



Pressing  leaves the date unchanged, pressing  or  allows entering the new date, first the year:



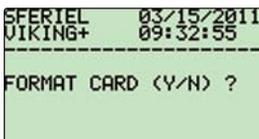
And then the month:



(In this case, the user has chosen 2011 as the year of his last battery replacement)

3.14 Function Fn 30 – SD card formatting

Fn 30 is used to format the card. This is another protected function; the user will have to select Fn 0 first, in order to be able to activate Fn 30. VIKING+ will start by asking for confirmation:



Pressing the  key (and only this one) will format the card. The counter will then display:



followed by:

```
SFERIEL      03/15/2011
VIKING+     09:32:55
-----
FORMAT CARD (Y/N) ?
DONE !
```

Notes:

- Formatting the card can take up to 20 seconds depending on its memory capacity
- Formatting will erase all previously recorded data.
- It is advised to regularly format the card (at least once a year). It can also be formatted before every counting survey.
- Formatting cannot be performed if VIKING+ is in its recording or waiting to start recording state.

3.15 Function Fn 31 – SD card file list

Fn 31 displays the list of files recorded on the memory card along with its free space. The user can step through the files by pressing the **EXE** key between each file. The following example shows a card holding three different files and the remaining free memory:

```
SFERIEL      03/15/2011
VIKING+     09:32:55
-----
U5678J03.VIK
      1 KB
```

Pressing **EXE** :

```
SFERIEL      03/15/2011
VIKING+     09:32:55
-----
PICT3826.JPG
      745 KB
```

Pressing **EXE** :

```
SFERIEL      03/15/2011
VIKING+     09:32:55
-----
U2345J05.TXT
      4486 KB
```

Pressing **EXE** :

```
SFERIEL      03/15/2011
VIKING+     09:32:55
-----
MEMORY LEFT :
3866368 KB
```

Note: Fn 31 cannot be activated while VIKING+ is recording.

3.16 Function Fn 32 – SD card file deletion

This instruction allows the user to delete a file from the card. Each file is displayed in turn, and the option of deleting it is offered to the user:



The screenshot shows a green-tinted display with the following text:
SFERIEL 03/15/2011
VIKING+ 09:32:55

U5678J03.VIK
DELETE ? <Y/N>

Pressing  erases the file. Pressing any other key will keep the file and bring the next one up.

Note: Fn 32 cannot be activated while VIKING+ is recording.

4 The mounting bracket

4.1 Description and use of the bracket

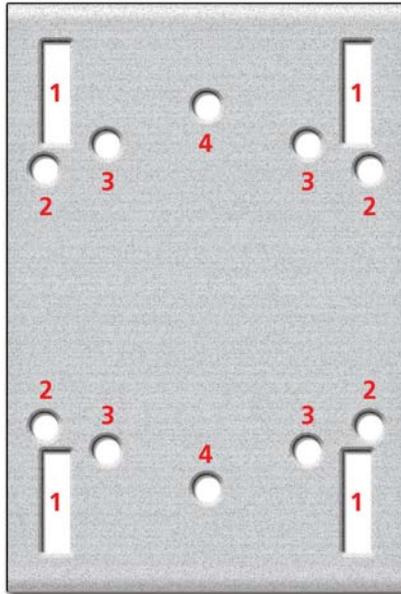


VIKING+'s mounting devise fulfils three goals:

1. Mounting securely VIKING+ onto a post, signpost, mast, etc.
2. Positioning properly the counter, enabling the 45° angle with the road requirement.
3. Maintaining the correct detection angle while opening VIKING+ to access display panel.

The bracket has two rotation axes and three locking mechanisms allowing to stop the rotations. The axes are made of stainless steel screws, nuts and glued cap locknuts; they cannot be disassembled. The locking mechanisms associates a washer, a Nylstop® nut and a glued-cap locknut: the Nylstop® nuts can be unscrewed but not removed.

4.2 Securing the mounting bracket onto a post



VIKING+'s mounting plate presents different drilled holes allowing the use of standard flanges to hold it in place. The holes numbered above are to be used in the following way :

- ① Steel hoop collar
 - Semi-round flange for 60 mm diameter studs
 - Flanges for 80 x 80 mm square studs
 - Hoop flanges for lighting post
- ② Flanges for 40 x 80 mm rectangular studs
- ③ Flanges for 40 x 40 mm square studs
- ④ Round flanges for 60 mm diameter studs

All these flanges are available from traffic signs manufacturers and can also be provided by SFERIEL.

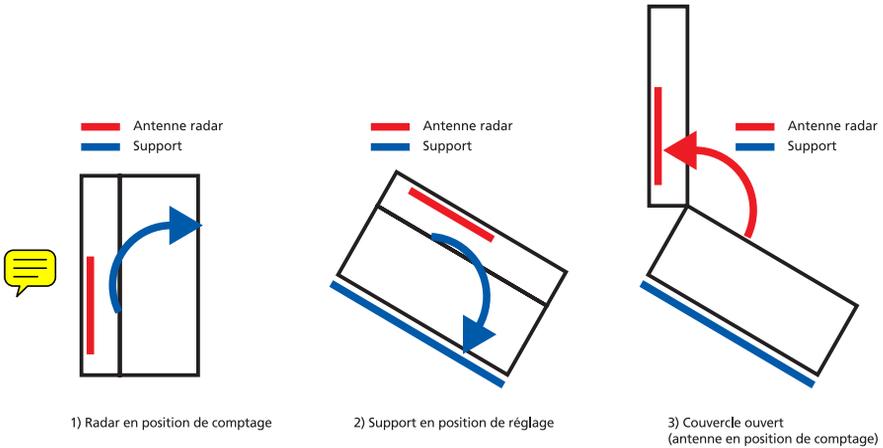
Note: VIKING+ is supplied with two flanges for 40 x 80 mm rectangular studs.

4.3 Orientating VIKING+

To orientate VIKING+ on a horizontal plane (rotating around the vertical axis), loosen nuts 3 and 4 by a half turn, using a 8 mm spanner. Rotate VIKING+ around the vertical axis to the desired position and tighten nuts 3 and 4 again. Be careful not to loosen the vertical axis' nuts by mistake. To orientate VIKING+ on a vertical plane (rotating around the horizontal axis), loosen nut 2 by a half turn with, using a 8mm spanner. Rotate VIKING+ around the horizontal axis to the desired position and tighten nut 2 again. Be careful not to try and unscrew the horizontal axis nut and do not unscrew nut 1.

4.4 Modifying the position for user access

VIKING+'s antenna is located within the case's lid. When VIKING+'s case is opened, in order to access the keyboard and screen, the antenna is no longer in the correct aiming position. To rectify this, the mounting bracket allows VIKING+'s case to turn around a horizontal axis in order for the antenna to be back in its correct aiming position, despite the fact that the lid is now open. The three following pictures represent this rotation:



To access VIKING+'s keypad and display unit, nut 1 must be loosened and the counter rotated backwards to the abutment. To return the radar to its counting position after closing the lid, rotate it back to its original location and tighten nut 1 again.

5 Installing VIKING+

5.1 Different possibilities

There are at least three ways of positioning the counter with regards to the road. The standard installation of VIKING+ is by the roadside, at a height of 2 meters or less.

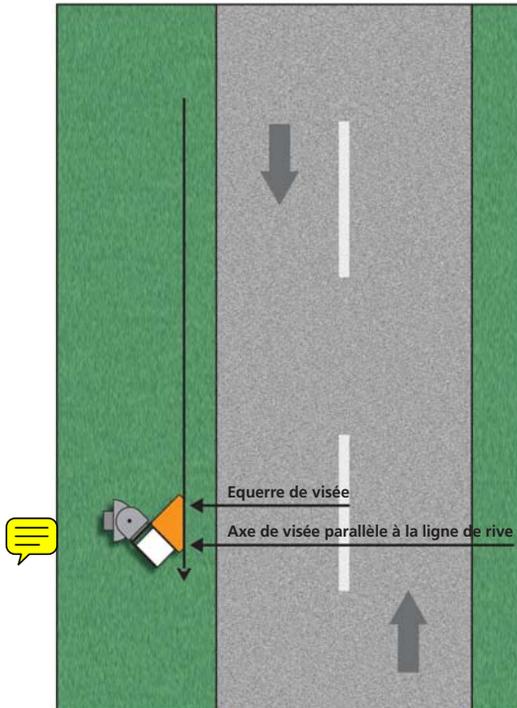
Another installation is to place it on the roadside, at a height between 2 and 6 meters.

Installing VIKING+ over the road is also possible.

In all cases, the main constraint is to ensure a 45° angle between the antenna's orientation axis and the road axis. For each type of installation, a specific method is described in order to achieve that angle.

5.2 Standard Installation

This is by far the easiest way to install VIKING+: the counter is at a height of 2m or lower, the angle is simply obtained by rotating the device around the bracket's vertical axis. A simple PVC set square (supplied with VIKING+) is good enough to set the 45° angle.



Details of the installation process:

- Secure VIKING+'s mounting bracket onto the post,
- Unscrew nuts 3 and 4,
- Hold the smallest side of the plastic set square on VIKING+'s front panel (as shown on the previous diagram),
- Rotate the counter while using the longest side of the set square to take a sight on a point located 50m in front of the radar along the roadside axis. When the point aimed at, is on the line of sight, the radar is in the correct position.
- Tighten nuts 3 and 4.

Note: VIKING+ must be installed on a straight segment of road of 50m minimum length

Note 2: SFERIEL recommends this installation for bidirectional counting.

5.3 High installation

This technique differs from the previous one in the way the radar is placed in a higher position: more than 2m away from the ground (usually about 4m). This height makes the installation more complex but has two main benefits:

- The counter is better protected against vandalism and theft
- This height allows to the radar to detect beyond any stationary vehicle
- Orientating the radar is done in three steps:
- Measuring the height of the radar and its distance from the road axis, in order to calculate its inclination
- Setting the inclination, (rotating around the horizontal axis)
- Setting the orientation, (rotating around the vertical axis)

5.3.1 Inclination calculation

The first measurement is the radar's height (measured from the centre of VIKING+'s front panel to road level).

The second is the distance, at ground level, between the post and the surveyed lane's axis. The correct inclination angle can be found on the following table, at the intersection of the distance column and the height row (selecting the column and row with the nearest distance and height to the ones measured by the user).



		Inclinaison du radar par rapport à l'horizontale (en °)										
		Distance du pied du poteau à l'axe de la voie de circulation (en m)										
		2,00	2,50	3,00	3,50	4,00	4,50	5,00	5,50	6,00	6,50	7,00
Hauteur du radar (en m)	1,00	80	82	83	84	85	86	86	86	87	87	87
	1,25	76	78	80	81	83	83	84	85	85	85	86
	1,50	72	75	77	79	80	81	82	83	83	84	84
	1,75	68	72	74	76	78	79	80	81	82	82	83
	2,00	65	69	72	74	76	77	78	79	80	81	81
	2,25	62	66	69	72	74	75	76	78	79	79	80
	2,50	60	64	67	69	72	73	75	76	77	78	79
	2,75	58	62	65	68	70	72	73	74	76	77	78
	3,00	56	60	63	66	68	70	72	73	74	75	76
	3,25	55	58	61	64	66	68	70	72	73	74	75
	3,50	54	57	60	63	65	67	69	70	72	73	74
	3,75	53	56	59	61	64	66	67	69	70	72	73
	4,00	52	55	58	60	62	64	66	68	69	70	72
	4,25	51	54	56	59	61	63	65	67	68	69	70
	4,50	51	53	56	58	60	62	64	65	67	68	69
	4,75	50	52	55	57	59	61	63	64	66	67	68
5,00	50	52	54	56	58	60	62	63	65	66	68	
5,25	49	51	53	55	57	59	61	62	64	65	67	
5,50	49	51	53	55	56	58	60	62	63	64	66	
5,75	49	50	52	54	56	58	59	61	62	64	65	
6,00	48	50	52	53	55	57	58	60	61	63	64	

Inaccuracy level if radar not tilted

- < 1%
- < 5%
- < 10%
- ≥ 10%

Example: Assuming the user has measured a height of 3.30m and a distance from the lane's axis of 5.90m.
 The nearest height is 3.25 (8th line)
 The nearest distance is 6.00 (9th column)
 Inclination found at the intersection of line 8 and column 9 is 76°

Note: Required tool: decametre.

5.3.2 Setting the inclination

An inclinometer is needed to set the inclination. SFERIEL recommends the use of the TAJIMA SLT 100 inclinometer and can supply it if requested.

The instructions described below, assume the use of such a tool.

First of all, set the inclinometer on the inclination angle as found on the calculation table. This can be achieved by turning the DIAL button until the red hand points to the required angle.

As per our earlier example, the picture below shows the inclinometer set on 76°:



From now on, the DIAL button should not be touched again and the inclinometer is to be used as a simple spirit level. Nut 2 of the mounting bracket must be loosened and the inclinometer pressed against the front panel of VIKING+, as shown on the next page.



Rotate VIKING+ around its horizontal axis until the inclinometer's bubble reaches its central position between the two marks, at which point the radar is tilted properly and nut 2 can be tightened again.

5.3.3 Setting the orientation

The horizontal orientation can only be modified once the inclination is set.



To set the orientation, the user will have to unscrew nuts 3 and 4 and then place the special aiming square on VIKING+'s side panel as shown above. Aiming through the set square edge, the user should then take a sight on a point located on the middle of the lane and rotate the counter until the point aimed at, is reached. Finally nuts 3 and 4 must be tightened again.

Note: The set square used in this operation is specific to the « High installation », and is different from the one used previously. Again, SFERIEL can supply this tool.

5.4 Installing above the road

Please contact us: +33 473 338 688 - sferiel@sferiel.com

6 Description of a recording survey

6.1 Description

This chapter describes the different stages of a recording survey, with VIKING+ being installed on a post, at a height of 1.20m (standard installation).

6.2 Preparation (in the office)

There are 2 things to check before leaving the office:

- The free space left on the SD card: if the user discovers, on the field, that his card is full, he will not be able to record new data until the card is re-formatted.
- The battery status.

VIKING+ is turned on by pressing  for 5 seconds. If the "low battery" pictogram is displayed, batteries must be replaced (see 6.6).

Batteries should also be replaced if they have not been changed within the last year. To verify the latest battery replacement date, activate function Fn 21 (see 6.6)

To check the SD card, it must be inserted first and the Fn 8 function selected. If there is not enough free memory, existing files on the card should be saved on a computer. The card must then be re-formatted by activating Fn 30. If in any doubt about the memory space needed for a new survey, it is best to systematically re-format the card before each survey. Re-formatting can be done as often as needed and will not damage the card. Remember to check on the thresholds settings for a more efficient programming.

6.3 Installation

- Secure VIKING+'s mounting bracket onto the post using the appropriate flanges.
- Orientate VIKING+ by using the set square so that VIKING+ is at a 45° angle the road axis. The orientating process is described in 5.2.
- Rotate VIKING+'s case in its user access position, by turning it backwards, before opening the lid. This is explained in 4.4

6.4 Adjustments and programming

6.4.1 Programming

Programming is performed using functions Fn 1 and Fn 2:

Select Fn 1 and enter the counter identification number.

Select Fn 2 and enter your settings.

If you wish to stop the recording at a given time, you can also programme the finish date and time with Fn 2. If you wish to carry on recording until the SD card is full, accept VIKING+'s default finish date and times.

Once programming is completed, close the case and rotate the counter back in its counting position (see 4.4)

6.4.2 Adjustments

- First, select Fn 12 in order to check if the detecting direction is the correct one for the new survey (approaching or receding).
- Ensure that all vehicles are detected by selecting Fn 3 and checking the live data display. Depending on your objectives, you might want to adjust the detection sensitivity value by using Fn 18, in order for VIKING+ to detect, or not, small vehicles such as motorcycles.
- You might also wish to modify the classification threshold with Fn 14, depending on how the vehicles are classified with the current settings, based on your observation of the live data display,
- Looking again at the Fn 3 live data display, you should check that the gap adjustment between vehicles is correctly set (i.e. VIKING+ doesn't associate two vehicles driving close by to only recorded vehicle, nor identify an articulated lorry as two recorded vehicles).. Select Fn 17 and modify the gap adjustment value until VIKING+ detects every single vehicle.

Once VIKING+ is fully set, the user might want to take a note of the sensitivity, classification threshold(s) and gap adjustment as he will be able to use these settings again for a future survey.

6.5 Removing VIKING+

Before removing VIKING+, rotate it back into its user-access position and open it to check its status. Press EXE a few times, if the display unit shows an exclamation mark "!", the counter is still active and must be switched off by pressing Fn 00. If nothing is displayed, it means the counter has already stopped and switched itself off automatically.

Once the counter is off, the SD card can be removed safely and VIKING+'s case closed and moved back in its normal vertical position. Then, take the flanges off and detach VIKING+'s mounting bracket.

6.6 Data analysing (in the office)

Insert the memory card in the appropriate drive. You can check that the file looks correct by opening it with Notepad or WordPad. Using windows Explorer, you can then drag and drop the recorded file on your computer.

6.7 Maintenance

The only maintenance the user will be involved in is changing the batteries.

This is how it should be done:

- Unscrew the four M6x10 screws off the battery case and open it.
- Take the two batteries out.
- Put the new batteries in, making sure that the spring terminal helps each battery to connect on to the other end of the battery circuit. (If the new batteries were not supplied by SFERIEL, remove the red stickers from the old batteries and stick them in the same position on the new ones). Make sure that the batteries are inserted the right way up, with the spring terminals both touching the electrical contacts of the battery coupling circuit. Be careful not to damage the white battery connector on the electronic card!
- Put the battery case back in place and fasten the 4 screws.

7 Technical Specifications

7.1 VIKING+

7.1.1 Measurements

Types of Measurements:

- Volumes of vehicles,
- Speed,
- Radar Cross Section (RCS) : allows to classify vehicles by size, 2-wheelers, LGV & HGV

Measurement accuracy:

- Volume: $\pm 1\%$ (non congested traffic)
- Speed: $\pm 1\% \pm 0.5$ km/h
- Size discrimination:
 - 2 wheels and cars: $\pm 3\%$,
 - buses, coaches, trucks, articulated lorries: $\pm 3\%$,
 - others: $\pm 15\%$

7.1.2 Power Supply

Batteries:

- CEGASA 4AS2/45 zinc-air batteries 6V 45A.h,
- Alkaline batteries 6V 13A.h 4LR25 (emergency replacement batteries).

Autonomy:

- Six months in continuous use with zinc-air batteries,
- Two months in continuous use with alkaline batteries.

7.1.3 Memory

Type:

- SANDISK Secure Digital (SD) card standard,
- SANDISK Secure Digital High Capacity (SDHC) cards,
- Other SD cards from other manufacturers (provided they are SANDISK compatible).

Capacity: over 1 million vehicles

7.1.4 Sensor

Type: Doppler microwave sensor,

Frequency: 24.125 GHz,

Equivalent isotropic radiated power: 20 dBm,

Opening of the main lobe on a horizontal plane: 10° ,

Opening of the main lobe on a vertical plane: 20° .

7.1.5 Material, size and weight

Case material: Fibreglas reinforced polyester,

Length: 20 cm,

Width: 12 cm,

Depth: 10 cm,

Weight: 3 kg.

7.2 VIKING+'s Mounting bracket

7.2.1 Materials

Structure: 4mm thick aluminium sheet

Fastenings: A2 stainless steel

Horizontal rotating pieces: A2 stainless steel and polypropylene

7.2.2 Size and weight

Height: 23 cm,

Width: 16 cm,

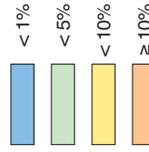
Depth (at maximal opening): 26 cm,

Weight: 3 kg.

Annexe 1 : Inclination table

Inclinaison du radar par rapport à l'horizontale (en °)												
Hauteur du radar (en m)	Distance du pied du poteau à l'axe de la voie de circulation (en m)											
	2,00	2,50	3,00	3,50	4,00	4,50	5,00	5,50	6,00	6,50	7,00	
1,00	80	82	83	84	85	86	86	87	87	87	87	
1,25	76	78	80	81	83	83	84	85	85	85	86	
1,50	72	75	77	79	80	81	82	83	83	84	84	
1,75	68	72	74	76	78	79	80	81	82	82	83	
2,00	65	69	72	74	76	77	78	79	80	81	81	
2,25	62	66	69	72	74	75	76	78	79	79	80	
2,50	60	64	67	69	72	73	75	76	77	78	79	
2,75	58	62	65	68	70	72	73	74	76	77	78	
3,00	56	60	63	66	68	70	72	73	74	75	76	
3,25	55	58	61	64	66	68	70	72	73	74	75	
3,50	54	57	60	63	65	67	69	70	72	73	74	
3,75	53	56	59	61	64	66	67	69	70	72	73	
4,00	52	55	58	60	62	64	66	68	69	70	72	
4,25	51	54	56	59	61	63	65	67	68	69	70	
4,50	51	53	56	58	60	62	64	65	67	68	69	
4,75	50	52	55	57	59	61	63	64	66	67	68	
5,00	50	52	54	56	58	60	62	63	65	66	68	
5,25	49	51	53	55	57	59	61	62	64	65	67	
5,50	49	51	53	55	56	58	60	62	63	64	66	
5,75	49	50	52	54	56	58	59	61	62	64	65	
6,00	48	50	52	53	55	57	58	60	61	63	64	

Inaccuracy level
if radar not tilted



Annexe 2: Structure of the recorded file

File identification lines

The file identification lines are written automatically as the top lines of the file and are structured as follows:

SITE_NUMBER.RADAR_NUMBER.ROAD.CITY.DIRECTION.OTHER[CR][LF]
yy. mm. dd. hh. mm.rrrr[CR][LF]

The first line is composed of 6 alphanumerical fields followed by characters: "[CR]" and "[LF]". The 6 fields all end by a dot. The meaning of each field is the following :

- Field 1: **SITE NUMBER** (as entered with Fn 1),
- Field 2: **RADAR NUMBER** (as entered with Fn 1),
- Field 3: **ROAD** (as entered with Fn 1),
- Field 4: **CITY** (as entered with Fn 1),
- Field 5: **DIRECTION** (as entered with Fn 1),
- Field 6: **OTHER** (as entered with Fn 1).

The second line is composed of 6 fields of 5 characters, followed by characters: "[CR]" and "[LF]". The 5 characters field all end by a dot. If the parameter linked with the field is less than 4 character long, it will be completed by spaces before the value. The meaning of each field is the following :

- Field 1: **yy** : Current year (as per internal clock),
- Field 2: **mm**: Month survey began (as programmed with Fn2),
- Field 3: **dd** : Day survey began (as programmed with Fn2),
- Field 4: **hh** : Hour survey began (as programmed with Fn2),
- Field 5: **mm**: Minute survey began (as programmed with Fn2),
- Field 6: **rrrr** : RCS threshold (as programmed with Fn14).

GPS coordinates:

GPS location data of the counter can be added at the end of the first line of the counting file:

. **NDD. mm. ss. sss.EDDD. mm. ss. sss.**

Or

. **+DD.dddd.dddd. -DDD.dddd.dddd.**

Depending on the GPS data format that has been defined in Fn 1

Vehicle data

Each vehicle is recorded as a file line, with the following character arrangement

1 01 1545 3012 S=065 R=2640 HV

This line is composed of 7 fields of different lengths. The total length of the line is 32 characters. Here is the meaning of each field:

- Field 1: **1** : Lane direction (here: lane direction 1)
- Field 2: **01** : Day of passing of vehicle (here: 1st day of the month)
- Field 3: **1545** : Hour and minute of passing (here: 15H45)
- Field 4: **3012** : Second and hundredth of passing (here: 30.12 s)
- Field 5: **S=065** : Speed (3 characters) (here: 65 km/h)
- Field 6: **R=2640** : RCS (4 characters) (here: 2640, arbitrary unit)
- Field 7: **PL** : Type of vehicle (**2W**, **LV** or **HV**) (here: **HV**)



La Trafitique

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