

The purpose of this document is to help designer to implement the main function to use correctly DAG system equipment.

Some commands are madatory, if you don't manage them, DAG SYSTEM is not responsable of the Black box behaviour.

For more details about command refer to Black box protocol specifications.

In ***Bold and italic*** there are tips and warnings 🔔

👉 **Indicates manual operation on Black box available**

- 1) How to detect the Black box?
- 2) How to get the reader and Black box software version?
- 3) How to set the time?
- 4) How to change Blackbox identifier?
- 5) How to change the beep duration?
- 6) How to change the time between two same DAG?
- 7) How to manage the antenna?
- 8) How to change the antenna power?
- 9) How to manage the badger?
- 10) How to delete susbcription?
- 11) How to subscribe an badger?
- 12) How to set reintegration algorithm?
- 13) How to manage detection?
- 14) How to donwload previous file from the Black box memory?
- 15) How to unlock Black box?
- 16) How to know the state of memory?
- 17) How to get all parameters?
- 18) How to know the state of badgers?
- 19) How to know the badgers function?

↳ STX : 0x02

→ TAB : 0x09

↵ CR : 0x0D

↓ SPACE : 0x20



1) How to detect the Black box?

To detect if the Black box is currently connected to your computer use the command **39** to get system information.

If the Black box is correctly connected and powered, it answers with command **01**

Description	Computer → Slave	Computer ← Slave
Get system information (date and time)	⤵39⤵	⤵01 → T: TEMP→HH :MM :SS→JJ/MM/AAAA⤵

2) How to get the reader and Black box software version?

If you want to update your embedded software, it's important to know the current version, to have the right compatibility. To get version use command **35**.


Description	Computer → Slave	Computer ← Slave
Get software version (BLACK BOX ONLY)	⤵35⤵	⤵35 → VERSION_SOFT → SERIAL_NUMBER⤵ ⤵3V → VERSION_SOFT_LECTEUR⤵

With this command you get reader and Black box version, and Black box serial number.

3) How to set the time?

When acquisition is started, the Black box's current time is associated to each detection, by default.

To set the Black box's current time you have to use command **20**.

 ***Be careful, you can't change the date. If the incoming date value is not the same as the currently Black box's date, the command will not be accepted.***

When the Black box accepts the command, it answers with command **21** following by command **01**


Description	Computer → Slave	Computer ← Slave
Update time you can't change the date but you can change the time	⤵20→HH :MM :SS→ MM-JJ-AAAA⤵	⤵21→ NUM_ELEMENT ⤵ ⤵01 → T: TEMP→HH :MM :SS→JJ/MM/AAAA⤵



4) How to change Blackbox identifier?

The Black box identifier is associated with each detection. If you have several Black boxes on your prestation, you have to assign one identifier for each point (for example 01 for start, 11 for check point and 21 for finish line etc..)

To change identifier use command 37.

 **Be carreful, after having change the value, you have to shut down the Black box and restart it to accept the new identifier.**

Description	Computer→Slave	Computer←Slave
Set id	↵37→BB↵	↵37 → BB ↵

5) How to change the beep duration?

At each detection valid the Black box make a beep, you can change his duration using command 34.

The increase step is 50ms.

Description	Computer → Slave	Computer ← Slave
Set duration of the beep for each detection	↵34→DUREE_BIP↵	↵34 → DUREE_BIP ↵

 *The default value is actually 5.*

6) How to change the time between two same DAG?

When a detection is valid, the Black box start a timer. The same detection can't be accepted until the timer is elapsed or a new acquisition.

This function is very usefull to eject unexpected detection.

 *The increase step is 10ms.*

Description	Computer → Slave	Computer ← Slave
Set minimum time between passages	↵33→T1↵	↵33→T1↵

The default value is currently 2 minutes.



7) How to manage the antenna?


The antenna allows you to have an interface between bib and the Black box. The antenna must be tuned. If the antenna field is not enough or tuning result is not correct you have to tune again the antenna using command **3H C1:3**.

After each power on, or each new antenna tuning, the Black box send the antenna status. It's mandatory to manage this message.

At any time you can ask for the antenna status, using command **3H C1:0**

 **To start antenna calibration push antenna button for 5 seconds.**
Antenna DEL blinks. When calibration ends, antenna DEL is off


Description	Computer → Slave	Computer ← Slave
Recalibrate antenna	3H→C1 :3↵	
Get status antenna	3H→C1 :0↵	
Recalibration of antenna result is OK		3H→NUM_LEC →0↵
Recalibration of antenna result is ERROR		3H→NUM_LEC →1↵

 **When using racket antenna to write bib number, the Black box answers “antenna ERROR”, it's normal. Because there is no tuning box between Black box and racket antenna.**
When using big antenna, if the Black box answer “antenna ERROR”, you have to check the wiring connection, and send a new calibration. Nevertheless, if the antenna status is OK, you have to check the antenna field with test DAG.



8) How to change the antenna power?

If you think, after the estimation of the antenna field with your test DAG (number 0), that the field is too small, you can increase the power level. (The max value is 999).

 **Be careful, too much power is not the better way to increase antenna field (think about the antenna environnement).**

To change the power level use the command 3D.

The time to receive the answer is depending of the previous value.

Description	Computer → Slave	Computer ← Slave
Set power strength (to antenna) in black box	↵3D→0→PWR↵	↵3D → PWR↵

 **The Black box send antenna power level after each calibration and each power on reset of the internal reader.**




9) How to manage the badger?

A DECT modem is embedded in the Black box, to communicate with badger. Badgers have also an embedded DECT modem. Each badger modem should be subscribed to the Black box using command **3M**, before transmitting data.

You can subscribe up to 16 badgers to the Black box.

 **A badger can be subscribed to only one black box at a time.**

 **Once a badger is subscribed to a Black box, it's for always, until you subscribe this badger to another Black box, or cancel the subscriptions.**

 **If you try to subscribe again a badger to the same Black box, you have to delete all subscriptions with command **3N** before.**

10) How to delete subscription?

 **You can only delete all the badgers at one time, not one by one.**

 **Push special button for 5 seconds, lock DEL is on, special DEL are blinking.**

Release special button.

Push antenna button for 5 seconds, lock DEL is on, special and antenna DEL are blinking faster. This operation takes several seconds. If it's successful the 3 DELS are off, else special DEL and antenna are on for 2 seconds.

To delete subscription use commande **3N**.


During operation, lock led is green, special and antenna DEL is blinking.

If the delete operation is OK, the Black box answers with command **3N**. Now you can subscribe again your badger. Lock DEL, special and antenna are off.

If the delete operation failed, the Black box answer with command **3O**, you have to delete subscription again. Lock DEL is off, special DEL and antenna DEL are on for 2 seconds.



11) How to subscribe a badger?

 To use badger DECT modem, the badger should be in “**RADIO MODE**”. To configure “**RADIO MODE**” on badger use the short cut **DOWN + 9** on the badger keyboard.

 Push special button for 5 seconds, lock DEL is on, special DEL are blinking.

Release special button.

Push special button, lock DEL is on, special antenna DEL is blinking faster. On badger use the short cut **DOWN + 7**. This operation takes several seconds. If it's successful the lock DEL blinks, else special DEL and antenna are on for 2 seconds.


To start subscription send command **3M**.


During operation, lock DEL is green, DEL special is blinking

With badger, use the short cut “**DOWN + 7**”, the progression of operation is displayed (CANCELLING, REGISTERING etc...)

If the subscription is OK, the Black box answers with command **3M**. In this command you can find the number of the radio link. The first badger is on link 15 (displayed 16 on the badger), the second is on link 14 (displayed 15 on the badger) etc... lock DEL, special and antenna are off.

The badger displays “**SUBSCRIPTION CORRECT**”.

 If you don't have this link value, you have to delete all subscription with command **3N**, and subscribe again all of your badgers.

 If you try to subscribe a badger just after powering on, the message “**SUBSCRIPTION CORRECT**” is not displayed when the Black box send OK. The reason is that the Black box tries to look for the connected badger before transmitting state of subscription.

If the subscription failed, the Black box answer with command **3O**, you have to subscribe the badger again. Lock DEL is off, special DEL and antenna DEL are on for 2 seconds.

Description	Computer → Slave	Computer ← Slave
Register a new badger	↵ 3M ↵	↵ 3M → LINK_INS ↵
Unregister all badgers	↵ 3N ↵	↵ 3N → 0 ↵
Error Operation DECT		↵ 3O → ERR_DECT ↵



12) How to set reintegration algorithm?

The reintegration algorithm is used for badger detection. When a detection is received, the Black box check if the same detection is present on the antenna.

- Detection is present, nothing appends.
- Detection is not present, the Black box use the selected reintegration algorithm.

They are 2 algorithms, absolute and relative.

- Absolute algorithm: The Black box subtract the reintegration value to the badger time.
- Relative algorithm: The Black box finds one detection available on antenna and badger before the missing detection and another available after the missing detection. When these two detections are found, the Black box inserts the missing detection between antenna detections respecting time ratio for badger detections.



If the reintegration value is 0, relative algorithm is selected. All other value select absolute algorithm.



Be careful, you can't change the selected algorithm during acquisition.

Description	Computer → Slave	Computer ← Slave
Set how to handle detections made by badger	↵3P→ VAL_REINTEGRATIO N↵	↵3P→ VAL_REINTEGRATION↵



13) How to manage detection?

To get detection you have first to start acquisition with command **00**.

Each time you start acquisition a new DAG file is opened in the Black box.

☞ **To start acquisition push start/stop button. Start/stop DEL is on.**

☞ **To stop acquisition push start/stop button for 5 seconds. Start/stop DEL is off.**

When you put a DAG in the antenna field, the bib number is read, a beep is generated, the detection DEL blinks one time, and the Black box transmits detection with command **00**. A same DAG is read twice with a minimum time between detections. This time is set at 120 seconds at each power up. You can change this value with commande 33.

When acquisition is running you can start the chrono with any initial value with commande **00 hh:mm:ss.ss**. A new DAG file is opened in the Black box. It's the best way to have directly the right time for each detection.

☞ **To start chrono, you should be in acquisition. Push chrono button for 2 seconds. Chrono DEL is on. Release chrono button, now the chrono is ready to start from 00:00:00.00. When you push chrono button, the chrono is running from 00:00:00.00, chrono DEL blinks.**

Inside each detection message you have a counter. The counter start at 000000, he's incremented by 1 at each detection. You have to use this counter to check if you missed a message. So to recall the missing messages, use the repetiton command **0B** to tell to the black box to transmit from the one specific detection to the last detection.

🔔 **Be careful, when you write bib number into DAG, you write also a date of peremption. If Black box detects a DAG with expired date of peremption, it makes 3 beeps, and the bib number is added by 500000.**

🔔 **If Black box receives more than 20% of expired DAGs, it will be LOCK 3 days after it will be unable to start a new acquisition. You have to send to DAG SYSTEM a key to unlock Black box. (See How to unlock Black box).**



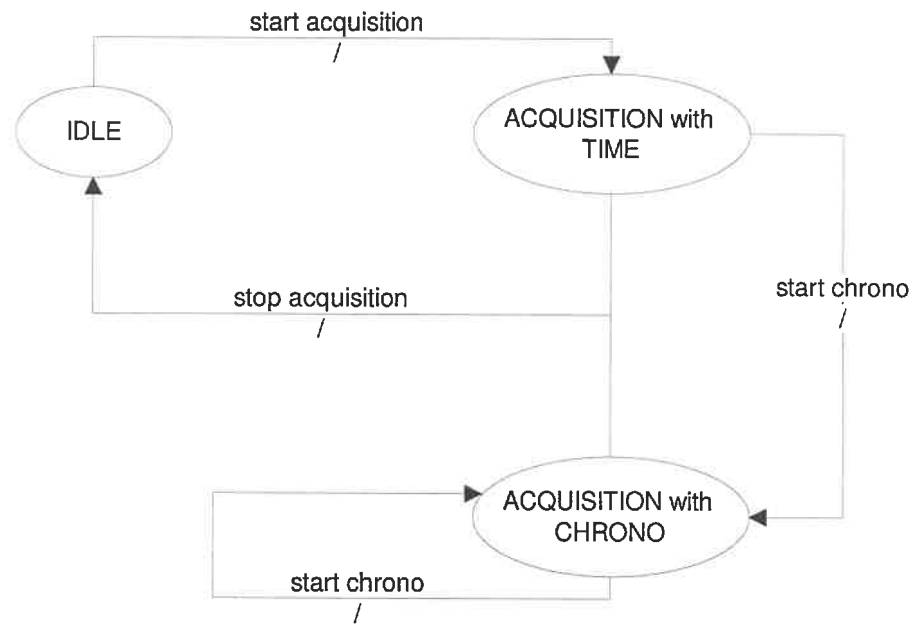
Description	Computer → Slave	Computer ← Slave
The system need to be unlocked before the date following		02→LOCKARISED→JJ/MM/AAAA↵
From now the system doesn't make any detection		02→LOCK→JJ/MM/AAAA↵

At the end of the prestation you have to stop the acquisition with command **01**. The black box answers with command **02 STOP** with the acquisition name file, size and occupation rate.

Description	Computer → Slave	Computer ← Slave
Start acquisition	00↵	02→GO↵ 3T→STATUS_TIMING→HH:MM:SS.CC↵
Repeat detection	0B→RRRRRR↵	00→RRRRRR→BB→00→ DDDDDDDDDDDDDDDDDD→ HH:MM:SS.CC↵
Hand-over with 0 of time associated with each detection	00→00:00:00.00↵	02→RAZ↵ 3T→STATUS_TIMING→HH:MM:SS.CC↵
starting of time associated with each detection with a given value	00→HH:MM:SS.C↵ C↵	02→RAZ↵ 3T→STATUS_TIMING→HH:MM:SS.CC↵
Stop acquisition	01↵	02→STOP→FILEXXXX →NB_ARC→TAUX_OCCUPATION↵



State chart for acquisition



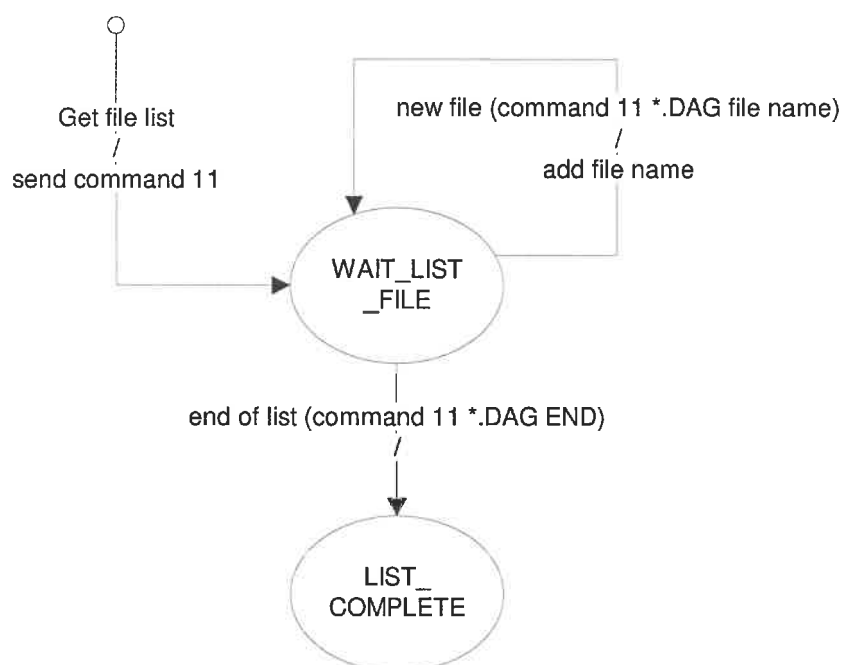
14) How to donwload previous file from the Black box memory?

At each start of acquisition, a new file is generated. During acquisition, all detections are stored in the same file.

This function is very usefull if you use the Black box as check point with no computer, to download data later.

First, you have to get the list of files

State chart to get list of files



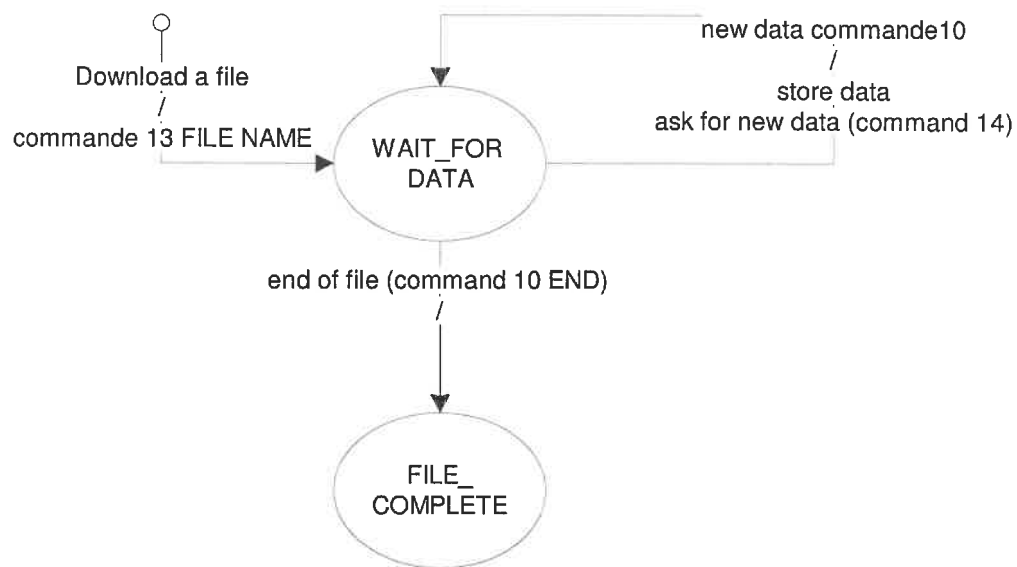
Description	Computer→Slave	Computer←Slave
List DAG files	⌨ 11 → DAG ⌨	⌨ 11 → *.DAG → NOM_FICHER.DAG → DATE_FICHER → TAILLE → 1 ⌨ ⌨ 11 → *.DAG → NOM_FICHER.DAG → DATE_FICHER → TAILLE → 1 ⌨ ⌨ 11 → *.DAG → END ⌨

 **In acquisition, the current file is not in the list, to recall data from this file use repeat command.**

When you have the list of files, select the file you want to download, send it to the black box. You control the transmission flow, asking for a new data when you want, until you receive the end of file.



State chart to download a file



Description	Computer→Slave	Computer←Slave
Reload DAG file for replay	↵ 13 → <i>NOM_FICHIER.DAG</i> ↵	if nonempty file ↵ 10 → <i>NNNNNN</i> → <i>BB</i> → 00 → <i>DDDDDDDDDDDDDDDDDDDD</i> → <i>HH:MM:SS.CC</i> ↵ if empty file ↵ 10 → END ↵
Send next detection in file being replayed	↵ 14 ↵	If it remains files ↵ 10 → <i>NNNNNN</i> → <i>BB</i> → 00 → <i>DDDDDDDDDDDDDDDDDDDD</i> → <i>HH:MM:SS.CC</i> ↵ if empty file ↵ 10 → END ↵



15) How to unlock Black box?

When Black box is locked, you need to get the unlock key (command **UK**) and send it to DAG SYSTEM. After, DAG SYSTEM send back the unlock password. You have to send it to the Black box to unlock the system (command **UP**).


Description	Computer→Slave	Computer←Slave
Get UNLOCK KEY	↵UK↵	↵UK→UNLOCK_KEY↵ if in instance of lock else ↵02→FREE↵
Set UNLOCK PASSWORD	↵UP→UNLOCK_PASSWORD↵	↵02→LOCK→JJ/MM/AAAA↵ or ↵02→LOCKARISED→JJ/MM/AAAA↵ if bad password else ↵02→FREE↵

 To get the status of the Black box use command (**UK**), if it is not locked the answer is **02 FREE**, else **UK**.

16) How to know the state of memory?

At each detection Black box store data in memory. The memory size is limited at almost 400000 detections. If the Black has not enough memory to store detections, data are not sent on serial link, and the repetition is not available. So you have to check the occupation rate, before a race using command **3U**.

Description	Computer→Slave	Computer←Slave
Get the occupation rate of non volatile memory	↵3U↵	↵3U→TAUX_OCCUPATION↵

 When Black box is full you have to enter in a special procedure describe in the DAG SYSTEM chart to download files and send them to DAG SYSTEM.



17) How to get all parameters?

There is command **30** that allows you to get all parameters in one time.

Description	Computer→Slave	Computer←Slave
Get configuration	↵30↵	↵33→T1↵ ↵37→BB↵ ↵21→NUM_ELEMENT↵ ↵80→B00: CXAL→ B15: CXAL→ L00: CXAL→L01:00↵ ↵82→B00: FCT ID→ B15: FCT ID→ L00: 1ID→L01:000↵ ↵3P→ VAL_REINTEGRATION↵ ↵3R→NB_ARC↵ ↵3S→ACQUISITION_STATUS↵ ↵3T→STATUS_TIMING→HH:MM:SS.CC↵ ↵3U→TAUX_OCCUPATION↵ ↵3Y→WRITE_CHRONO↵ ↵BR→BAUD_RATE↵

18) How to know the state of badgers?

When you use badgers, you have to check the radio links between Black box and badgers, and the energy state of each badger using command **80**.

This information is useful to prevent when a badger is out the DECT field, therefore it can't transmit his data to Black box. You can also prevent energy default on badger, and change battery before the extinction of badgers.

Description	Computer→Slave	Computer←Slave
State of the badger, indicate change of state of the power , and lock /unlock of the radio link for each badger		↵80→B00: CXAL→ B15: CXAL→ L00: CXAL→L01:00↵

🔔 The energy duration is depending of the battery quality.

🔔 Don't care of L00 and L01 parameters.





19) How to know the badgers function?


A badger could be line control, or line detection. You can change his function with command 81.

When badger is line control, it uses the reintegration algorithm to affect time to each detection.

When badger is line detection, the time for each detection is the badger time.

 Be careful, at each power up the Black box set badger function as line control.

Description	Computer→Slave	Computer←Slave
programming function detectors	 81→B00 : <i>FCT ID</i> → B15: <i>FCT ID</i> → L00 : <i>FCT ID</i> → L01: <i>FCT ID</i> ↵	 82→B00 : <i>FCT ID</i> → B15: <i>FCT ID</i> →L00 :1 <i>ID</i> →L01:000↵

 Don't care of L00 and L01 parameters, but you have to send it in command 81.

