ESD3 protocol

Command protocol

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Evolutions table

VERSION	DATE	NAME	CHAPTER	DESCRIPTION
1.0	10/10/2024	Luc Wathelet		Document creation

Reference documents

Number	Title	Reference	Version	Date
1	ETS - protocol specification V1.8		1.8	01/04/2022

Confidentiality

The information disclosed below are confidential

Contenu

1. INTRODUCTION

This document describes the protocol through USB to communicate with ESD3

2. ESCAN FRAME FORMAT

The ESD3 frame is sent every 4s:

IESD3-HW1-SW1-V3.18 BS M2-2 U24.03.2025 W09:07:21.770 C0 X0
Y125300011 A+101-+0-59-+5-+22 H05-10-5S-IN G00000000 R20

Identifier	Designation
I	Product name, hardware and software version
B	Message type. Status message = S
M	Passage index aaa-bbb aaa= first passage today bbb= index on the next passage Example: On start M1-1 *IESD3-HW1-SW1-V3.18 BS **M1-1** U24.03.2025 W09:09:57.850 C0 X0 Y125300011 A+101-+0-50-+5-+22 H05-10-5S-IN G00000000 R1F* After 14 passages: M1-15 *F0-1 09:10:00.477 Y125300011 M1 C0 W09:10:00.480 R08* *F0-0 09:10:00.638 Y125300011 M2 C0 W09:10:00.642 R07* *...* *F0-0 09:10:03.619 Y125300011 M14 C0 W09:10:03.623 R3E* *IESD3-HW1-SW1-V3.18 BS M1-15 U24.03.2025 W09:10:05.855 C0 X0 Y125300011 A+101-+0-53-+5-+22 H05-10-5S-IN G00000000* The next day: M15-15

	*IESD3-HW1-SW1-V3.18 BS **M15-15** U25.03.2025 W10:00:03.978 C0 X0 Y125300011 A+101-+0-44-+5-+22 H05-10-5S-IN G00000000 R7E* After 2 new passages: M12-14 *F0-1 10:00:48.405 Y125300011 M15 C0 W10:00:48.408 R3A* *F0-0 10:00:48.491 Y125300011 M16 C0 W10:00:48.496 R46* *IETS2-HW2-SW4-V2.13 BS **M15-17** W00:00:18.760677 C100 X3 Y876200437 A110-156-+25-100-+41 H00010 G00 R34*
U	Date in format dd.mm.yyyy (Can be changed with /SD)
W	Time in format hh:mm:ss:msec (Can be changed with /SC or /SCP)
C	Gate number. It differs from ETS or ETS1 which is the Loop code. Can be changed with /SGATE or /RGATE
X	Tag protocol format from 0 to 2. Can be changed with /PP
Y	ESD3 serial number
A	Aaaa-bbb-+ccc-ddd-ee aaaa=battery voltage in 1/10V bbb=charger voltage in 1/10V ccc=battery current in mA (If >0, battery is charging, if<0 battery is discharging) ddd=battery in percent ee= indicate battery temperature in degree celsius
H	Status message and event Haa-bb-cc-dd aa= sound volume from 0 to 10 bb= beep number: 10=> 10 beep + countdown 0-5 s CD=> countdown only 0-5s

	ST=> Start beep only cc= Start LED mode 0S=> LEDs at 0 second (Green) 1S=> LEDs from 1 second (Red then green) 2S=> LEDs from 2 seconds (Red then green) 3S=> LEDs from 3 seconds (Red then green) 4S=> LEDs from 4 seconds (Red then green) 5S=> LEDs from 5 seconds (Red then green) I3=> LEDs 3 seconds from and after start I5=> LEDs 5 seconds from and after start dd= Mode string CO => Clock only IN => Interval FI => Fis startlist ST => Startlist SG => Startgun TX => Text BM => BMX
G	Input's state: State: 0 => input is opened 1=> input is short-circuited Inputs:

	Digit 1 => Start/Sync Digit 2 => Trigger In (= Startgun) Digit 3 => Startgate IN1 Digit 4 => Startgate IN2 Digit 5 => Startgate IN3 Digit 6 => Startgate IN4 Digit 7 => Startgate IN5 Digit 8 => Startgate IN6
R	See checksum calculation below

3. INPUTS FORMAT

The following frame is sent on USB when start/sync, trigger in or any startgates input is closed/opened:

F0-1 09:10:02.060 Y125300011 M6 C0 W09:10:02.064 R03

Identifier	Designation
F	Message type. Tag message=F X-Y X defines the input X=0 => start/sync input X=1 => Startgate 1 X=2 => Startgate 2 X=3 => Startgate 3 X=4 => Startgate 4 X=5 => Startgate 5

	X=6 => Startgate 6 X=7=>Trigger in Note: Startgun key in startgun mode sends also an input event with 7 Y defines the state: Y=0: input is closed Y=1: input is opened This is followed by the exact trigger time HH:MM:SS.000000 (Number of decimal is defined from precision command)
M	Show input trigger counter
C	Gate number
W	Time when sending the message from ESD3
R	See checksum calculation below

4. COMMANDS

To change settings or to spool messages etc., ESD3 can receive commands over USB.

These commands are somewhat different than the packages we receive from the unit. Command is not enclosed by the <STX>...<ETX> pair. It ALWAYS starts with a / (Ascii 0x2F) and ends with <CR><LF> (Ascii 0x0D and 0x0A).

If the command is correctly received, the ESD3 will beep shortly. If the command is unknow or the command value is incorrect, the ESD3 will make a long beep.

Type	Speed (baud)	Data Bits	Stop Bits	Parity	Flow Control
USB	115200	8	1	None	None

The baud rate can be changed with the /USBBAUD command

4.1. System commands

4.1.1 Help command

The complete command list can obtain by typing “/HELP”

Command	/HELP
Data	-
Example	/SSID Set WIFI SSID /PASS Set WIFI password /CONNECT Connect to Wifi network /SD Set data DD/MM/YYYY /SC Set clock HH:MM:SS /ID Send status message /ST Send status message /PP Change protocole (0-7) /QM Spool today dumps /QD Spool all dumps /QC Spool a specific dump (1-M) /QF Spool from a specific dump (1-M) /QS Stop spooling dumps /FCLEAR New race /CL New race /DELETE Delete competitors and dump /KEY Simulate a keypad press (1-14) /EOFF Switch off character echo (0/1) /KD Spool all competitors /KS Stop spooling competitors /FACTORY Default factory settings /DM Change display mode /LM Change start led mode /USBBAUD Change USB baud rate /SI Start interval in sec /SS Start time HH:MM:SS /SGATE Set start gate /RGATE Reset start gate /RECVLIST Start receive startlist list /PUREND End receive startlist list /SHOWLIST Show startlist list /WIFI Start/stop WIFI /PRECISION Change precision Sec=0, uS=5 /REBOOT Restart ESD3 /LINE Change audio line (0-3) /VOLUME Audio volume (0-10)

	/PCSLAVE1 Scroll line 1 /PCSLAVE2 Scroll line 2 /+ Scroll speed increase /- Scroll speed decrease

4.1.2 Key simulating

Simulate the press of a key on the keypad.

Command	/KEY
Data	1-19 1 => 0 or READY 2 => 1 or VOLUME MINUS 3 => 2 or DOWN 4 => 3 or STARTGUN 5 => 4 or LEFT 6 => 5 or SOUND ON OFF 7 => 6 or RIGHT 8 => 7 or VOLUME PLUS 9 => 8 or UP 10 => 9 or WIFI 11 => CR 12 => ON 13 => MENU 14 => MODE 15 => SET CLOCK 16 => INTERVAL 17 => NEW RACE

	18 => START_TIME 19 => CLEAR
Example	/QD

4.1.1 Echo off

Change echo mode in USB or RS485 communication

Command	/EOFF
Data	0 => echo is on 1 => echo is off
Example	/EOFF0 => echo is on /EOFF1 => echo is off

4.1.1 Change USB baudrate

Change USB baudrate

Command	/USBBAUD
Data	9600 19200 38400 57600 115200 230400
Example	/USBBAUD9600 => baud rate 9600 /USBBAUD115200 => baud rate 115200

4.1.2 Reboot

Make a reboot of ESD3

Caution: clock and battery level are lost after rebooting.

Command	/REBOOT
Data	-
Example	/REBOOT

4.1.3 Factory

Reinitialize all user settings to default factory settings

Parameter	**Default value**	**Defaut value info**
Protocol	0	Normal
Display mode	1	Interval
Start led mode	5	5S
Precision	3	msec
Audio line	1	Internal
Audio volume	5	
Gate	0	
Scroll speed	3	
Beep	0	10s countdown
Start time	10:00:00	
Start interval	15	15 seconds
USB Baud rate	115200	
Message number	0	
Wifi	0	Wifi off

Command	/FACTORY
Data	
Example	/FACTORY => All user settings and message number are reinitialized to factory default

4.1.4 Set clock

Set the current time in the ETS

Command	/SC

Data	hh:mm:ss
Example	/SC14:30:52

4.1.5 Set clock synchronised on input

Set the current time in the ETS

Command	/SCP
Data	hh:mm:ss
Example	/SCP14:30:52 => set the clock and ESD3 waits for Start/sync trigger to set it

4.1.6 PC output protocol format

Change protocol format sent to serial link to PC

Command	/PP
Data	Protocole number from 0 to 7
Example	/PP0 => standard format /PP1 => short format /PP2 to /PP7 => reserved for future use on ESD3

4.1.7 Precision

Change clock precision

Command	/PRECISION
Data	0 => No decimal, time in seconds 1 => Precision is 1/10s 2=> Precision is 1/100s 3=> Precision is milliseconds 4 => Precision is 1/10 000s 5 => Precision is microseconds

Default	3
Example	/PRECISION0 => W14:56:18 /PRECISION1 => W14:56:18.2 /PRECISION2 => W14:56:18.26 /PRECISION3 => W14:56:18.268 /PRECISION4 => W14:56:18.2685 /PRECISION5 => W14:56:18.268536

4.1.8 Clear unit memory

This command tells the unit to forget all incidents and start collecting at message number 1 again.

Caution! Never use this during a race!

Command	/CL (Or /FCLEAR)
Data	-
Example	/CL

4.1.9 Force status message

This will force the unit to send a status message.

Command	/ID or /ST
Example	/ID => get status message with a beep /ST => get status message without a beep

/ID and /ST are the same commands, /ID makes a beep upon reception while /ST makes no notification.

The status message is sent every 4 seconds. These two commands can get the status message instantly.

4.2. Spool commands

4.2.1 Spool all

Spool all memory to USB

Command	/QD
Data	-
Example	/QD *F0-1 00:00:39.820 Y125300011 M1 C0 W00:00:21.850 RFC* *F0-0 00:00:39.916 Y125300011 M2 C0 W00:00:21.913 R02* *F0-1 00:00:40.073 Y125300011 M3 C0 W00:00:21.975 RFE* *F0-0 00:00:40.171 Y125300011 M4 C0 W00:00:22.038 RF4* *F0-1 00:00:14.842 Y125300011 M5 C0 W00:00:22.101 RF3* *F0-0 00:00:14.890 Y125300011 M6 C0 W00:00:22.163 RFE* *F0-1 00:00:15.065 Y125300011 M7 C0 W00:00:22.226 RFB* *F0-0 00:00:15.100 Y125300011 M8 C0 W00:00:22.289 RFA* *F0-1 00:00:15.268 Y125300011 M9 C0 W00:00:22.351 R01* *F0-0 00:00:15.349 Y125300011 M10 C0 W00:00:22.414 R28*

4.2.2 Spool today dumps

Spool new message of the day

Command	/QM
Data	-
Example	/QM *F0-1 00:00:14.842 Y125300011 M5 C0 W00:01:20.594 R02* *F0-0 00:00:14.890 Y125300011 M6 C0 W00:01:20.657 R05* *F0-1 00:00:15.065 Y125300011 M7 C0 W00:01:20.719 R01*

	F0-0 00:00:15.100 Y125300011 M8 C0 W00:01:20.782 RF7 *F0-1 00:00:15.268 Y125300011 M9 C0 W00:01:20.845 R08* *F0-0 00:00:15.349 Y125300011 M10 C0 W00:01:20.908 R2F*

4.2.3 Spool from specific message

Spool from a specific message number

Command	/QF
Data	**Message number**
Example	/QF8 => show message from number 8 *F0-0 00:00:15.100 Y125300011 M8 C0 W00:02:26.417 RF9* *F0-1 00:00:15.268 Y125300011 M9 C0 W00:02:26.480 R0A* *F0-0 00:00:15.349 Y125300011 M10 C0 W00:02:26.543 R31*

4.2.4 Spool specific message

Spool a specific message number

Command	/QC
Data	**Message number**
Example	/QC3 => show message number 3 *F0-1 00:00:40.073 Y125300011 M3 C0 W00:03:13.153 RF6*

4.2.5 Stop spooling

Stop the spooling. Can used if the number of message spooled is too important (Used with spool all)

Command	/QS

Data	-
Example	/QS => stop spooling

4.3. Start list commands

4.3.1 Receive list

Start to receive a list of competitors

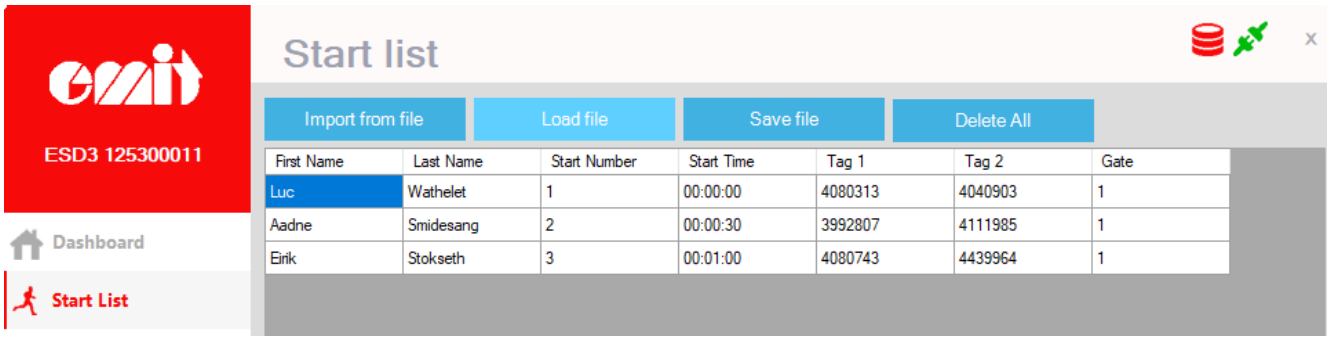
Command	/RECVLIST
Data	After sending the command, all the competitors can be send: The start list item can have two different formats. If the first character is numeric, ESD3 is going to use the ESD2 format. 1) ESD2 format: <start number 1-9999>;<time hh:mm:ss>;<gate number>\r\n Each item must be separated with a carriage return + line feed 2) ESD3 format: <first name>;<last name>;<start number>;<time hh:mm:ss>;<tag1>;<tag2>;<gate number>\r\n
Example	ESD2 format: /RECVLIST 1;00:00:00;1 2;00:00:10;1 3;00:00:20;1 4;00:00:30;1 /PUREND

	ESD3 format: /RECVLIST Luc;Wathelet;1;00:00:00;4080313;4040903;1 Aadne;Smidesang;2;00:00:30;3992807;4111985;1 Eirik;Stokseth;3;00:01:00;4080743;4439964;1 /PUREND

4.3.2 Show list

Command	/SHOWLIST
Data	-
Example	ESD2 format: /SHOWLIST 1;00:00:00;1 2;00:00:10;1 3;00:00:20;1 4;00:00:30;1 ESD3 Format: See /KD command

Startlist can be sent and read with EmitToolbox:



The supported XML format is following, it supports also ET6 format:

```
<Start_List>
  <Competitor>
    <First_Name>Luc</First_Name>
    <Last_Name>Wathelet</Last_Name>
    <Start_Number>1</Start_Number>
    <Start_Time>00:00:00</Start_Time>
    <Tag_1>4080313</Tag_1>
    <Tag_2>4040903</Tag_2>
    <Gate>1</Gate>
  </Competitor>
  <Competitor>
    <First_Name>Aadne</First_Name>
    <Last_Name>Smidesang</Last_Name>
    <Start_Number>2</Start_Number>
    <Start_Time>00:00:30</Start_Time>
    <Tag_1>3992807</Tag_1>
    <Tag_2>4111985</Tag_2>
    <Gate>1</Gate>
```

```
  </Competitor>
  <Competitor>
    <First_Name>Eirik</First_Name>
    <Last_Name>Stokseth</Last_Name>
    <Start_Number>3</Start_Number>
    <Start_Time>00:01:00</Start_Time>
    <Tag_1>4080743</Tag_1>
    <Tag_2>4439964</Tag_2>
    <Gate>1</Gate>
  </Competitor>
</Start_List>
```

4.3.3 Delete list

Delete a startlist from memory

Command	/DELETE
Data	
Example	/DELETE

4.3.1 Spool competitors

Command	/KD
Response	<first name>;<last name>;<start number>;<start time>;<tag1>;<tag2>;<gate>
Example	/KD

	Luc;Wathelet;1;00:00:00;4080313;4040903;1 Aadne;Smidesang;2;00:00:30;3992807;4111985;1 Eirik;Stokseth;3;00:01:00;4080743;4439964;1

4.3.1 Stop competitors spooling

Stop the current spooling of competitors.

Command	/KS
Example	/KS

4.4. Text commands

4.4.1 Scroll line 1

Write a miscellaneous text on line 1. Line disappears after touching a key

Text can be shown in text mode 8 (/DM8)

Command	/PCSLAVE1
Data	Scroll line 1, max 32 characters
Default	Unset
Example	/PCSLAVE1Hello World

4.4.1 Scroll line 2

Write a miscellaneous text on line 2. Line disappears after touching a key.

Text can be shown in text mode (/DM8)

Command	/PCSLAVE2
Data	Scroll line 2, max 32 characters

Default	Unset
Example	/PCSLAVE2Hello World

4.4.1 Increase speed

Command	/+
Data	Increase scrolling speed (from 1 to 10)
Default	3
Example	/+

4.4.1 Decrease speed

Command	/-
Data	Decrease scrolling speed (from 1 to 10)
Default	3
Example	/-

4.5. Audio commands

4.5.1 Audio line

Change audio line

Command	/LINE
Data	0 => Sound Off 1=> Sound On, internal speaker 2 => Sound On, external line (Audio Out) 3 => Sound On, internal speaker and external line
Default	1

Example	/LINE1

4.5.2 Audio volume

Change audio volume

Command	/VOLUME
Data	0 => Sound Off 1-10 => Sound volume
Default	5
Example	/VOLUME3

4.6. Wifi commands

4.6.1 Wifi SSID

Set Wifi SSID (service set identifier), it defines the name of the Wifi network to connect to.

Command	/SSID
Data	Max 32 characters
Default	Unset
Example	/SSIDMyWifiNetwork

4.6.1 Wifi password

Set the password associated with the SSID registered with the /SSID command

Command	/PASS
Data	Max 64 characters
Default	Unset
Example	/PASSmypassword

4.6.1 Connect

Connect the network defined with /SSID command with the password defined with /PASS command. ESD3 change wifi mode to SERVER automatically.

Command	/CONNECT
Data	-
Example	/CONNECT

4.6.1 Wifi mode

Activate or deactivate Wifi and select the Wifi mode.

Command	/WIFI
Data	0 => Wifi off mode: wifi is off 1 => Wifi server mode: ESD3 will connect EMIT server throught Wifi and send data. 2 => Wifi portal mode: ESD3 create a new wifi network called ESD3_1253abcdef. User can then connect to this network. The IP address is always 192.168.4.1. CAREFUL: deactivate any 4G network on the phone else the phone will try to connect to ESD3 and might overflow the internal buffers. The portal mode stays active for 10minutes and come back automatically to off mode.
Default	Unset
Example	/WIFI0 => Switch off wifi /WIFI1 => Wifi server mode /WIFI2 => Wifi portal mode

4.7. Display commands

4.7.1 Change display mode

Change display mode on LCD when receiving a tag

Command	/DM
Data	0 to 9

	0=> Clock Only 1=> Interval 2=> Finish 3=> Startlist 4=> Lap 1 5=> Lap 2 6=> FIS Startgate 7=> Start Gun 8=> Text 9=> BMX
Default	0 (Interval)
Example	/DM0 => Clock only mode

4.7.2 Change start LED mode

Change the behaviour of the 6 start LEDs

Command	/LM
Data	0 => LED mode 0 seconds 1 => LED mode 1 second 2 => LED mode 2 seconds 3 => LED mode 3 seconds 4 => LED mode 4 seconds 5 => LED mode 5 seconds 6 => LED mode plus/minus 3 seconds

	7 => LED mode plus/ minus 5 seconds
Default	5 (led mode 5 seconds)
Example	/LM1 => LED mode 1 second

4.7.1 Change start interval

Define start interval in seconds

Command	/SI
Data	10s – 65535 seconds 65535 is 18 :12 :15
Default	15 seconds
Example	/SI60 => start interval every minute /SI3600 => start interval every hour

4.7.1 Change start time

Define start interval in seconds

Command	/SS
Data	hh:mm:ss
Default	10:00:00
Example	/SS11:00:00 => set start time at 11:00:00

4.7.2 Set a gate number

Define the gate number from 0 to 255

If the gate is 0 then is shows every item from a start list even if the gate number is different from 0

In the start list if the gate number is 0, the competitor will be shown regardless of the gate number.

Command	/SGATE
Data	0-255
Default	0
Example	/SGATE0 => Define gate 0,

4.7.1 Reset the gate number

Reset the gate number to its default value

Command	/RGATE
Data	
Example	/RGATE => reset the gate number to 0

5. CHECKSUM CALCULATION

The last item of the TAG message or the status frame is the checksum. It is the sum of all characters from the first characters and before the R item without space and tabulation (and without start of frame 0x02):

Example:

IESD3-HW1-SW1-V3.18 BS M15-36 U07.03.2025 W16:28:57.752 C0 X0 Y125300011 A+101-+0-47-+19-+24 H05-10-5S-CO G00000000 RC5

Frame used for checksum calculation:

IESD3-HW1-SW1-V3.18BSM15-36U07.03.2025W16:28:57.752C0X0Y125300011 A+101-+0-47-+19-+24H05-10-5S-COG00000000

We take only the last two digits (8 bits) of the sum of all characters
⇨ So checksum is C5, so the last item is RC5

Check this:
https://www.scadacore.com/tools/programming-calculators/online-checksum-calculator/

Hex Input

```
49455344332D4857312D5357312D56332E313842534D31352D33365530372E30332E323032355731363A32383A
35372E373532433058305931323533303030303131412B3130312D2B302D34372D2B31392D2B32344830352D3130
2D35532D434F473030303030303030
```

AnalyzeDataHex

ASCII Input

```
IESD3-HW1-SW1-V3.18BSM15-36U07.03.2025W16:28:57.752C0X0Y125300011A+101-+0-47-+19-
+24H05-10-5S-COG00000000
```

AnalyzeDataAscii

CheckSum8 Xor

CheckSum 8 Xor

Normal
49

CheckSum8 Modulo 256

Sum of Bytes % 256

Normal
C5