

**FÉDÉRATION INTERNATIONALE DE SKI
INTERNATIONAL SKI FEDERATION
INTERNATIONALER SKIVERBAND**



**TIMING-BOOKLET
Freestyle Skiing**

Draft - Version 1.03
September 2018



Changes compared to Version 1.02

Page 4	New Table for Level Classification
Page 7	Photo Finish System Synchronisation
Page 9	Parallel Competitions – For level 0 a photofinish is mandatory. In case of a missing A and B time the time of the day of the photofinish can replace the A-time.
Page 11-20	All Sketches for Set-Up are Update
Page 21	ICR 3041 - Technical Installation
Page 22	EET Calculation
Page 23-28	Timing and Technical Report Form
Page 29	Timers: Precision 10.000 th or better Additional example for truncation of time calculation
Page 30	Timers with External Synchronisation
Page 33	Startdoor – several changes
Page 37	Photofinish – 2000 Lux for night races

Changes compared to Version 1.01

Page 4	New Table for Level Classification
Page 1 – 38	Adaption of levels in the complete text.
Page 11 - 19	New sketches (level changed)
Page 21	New Rules of ICR 3041 - Technical Installation
Page 22	EET calculation
Page 24	Photo finish camera
Page 32	Startdoors Opening when pressure against startdoor Mechanic connection of start panels at Cross competitions Checklist for maintenance
Page 33+34	Startdoors - new sketches

TABLE OF CONTENTS

FIS Freestyle Timing Guide	4
Equipment Set-Up (see drawing)	5
TIMING DEVICES	7
Dual Moguls	9
Timing without Cable Connection Between Start and Finish	10
Moguls and Cross Qualification Set-Up for Level 1	11
Moguls and Cross Qualification Set-Up Level 2 (One Cable)	13
Moguls and Cross Qualification Set-Up Level 2 (Without Cable)	14
Dual Moguls Set-Up Level 1	15
Dual Moguls Set-Up Level 2 or Higher	16
Ski Cross Set-Up Level 1	17
Ski Cross Set-Up Level 2 or Higher	18
Ski Cross Set-Up Level 4 or Higher	19
Aerials Set-Up All Levels	20
ICR 3041 - Technical Installation	21
3041.1 Communications / Internet Connection	21
3041.2 Timing Equipment	21
3041.2.1 Electric Timing	21
3041.2.2 Height of Timing Cells	21
3041.2.3 Independent Systems for Major Competitions	21
3041.2.4 Ski Cross Reaction Time.....	21
3041.2.5 Timing in Dual Moguls.....	21
3041.2.6 Timing Systems Approval	21
3041.3 Hand Timing.....	21
3041.3.1 Hand Timing as Back Up System	21
3041.3.2 Calculation of Hand Timing	21
EET Calculation	22
Timing & Data Technical Report Form	23
“How-To” Explanation Text Timing & Data Technical Report Form	23
Timing Technical Report (examples)	27
Criteria for FIS Approved Timing Devices for Freestyle Skiing Competitions	29
Timers.....	29
Start Gate	31
Startdoor	33
Photocell.....	35
Photofinish Systems	37
Homologation of Timing Equipment	38
Conclusion	38

Please check for the latest version of FIS Timing Booklet on FIS website:
<http://data.fis-ski.com/services/timing-and-data/timing-and-data.html>
(see Freestyle Skiing Timing)

FIS Freestyle Timing Guide

All timing devices used including Start Gates and photocells must be homologated as per the homologated timing equipment list on the FIS website:: <https://data.fis-ski.com/services/timing-and-data/homologated-timing-equipment.html>

Competitions using devices not mentioned on that list will not be considered for FIS points.

Please note references to competitions Level classifications as listed here:

Category code	Description	Race Level
OWG	Olympic Winter Games	1
WSC	World Ski Championships	1
WC	World Cup	1
QUA	Qualification	1
WJC	FIS Junior World Ski Championships	2
ANC	Australian New Zealand Cup	3
EC	Europa Cup	3
NAC	Nor-Am Cup	3
SAC	South American Cup	3
SCOC	Super Continental Cup	3
UVS	Universiade	3
OPN	Open	3
NC	National Championships	4
YOG	Youth Olympic Winter Games	5
IYC	International Youth Championships	5
FIS	FIS Race	5
AWG	Asian Winter Games	5
NJC	National Junior Championships	5
CHI	Children	5
JUN	Junior Competitions	5

Cabling of a higher category can also be used.

Example: Level 3 can use same cabling as Level 2 or 1.

Equipment Set-Up (see drawing)

Cable connection

For Level 2 and 5 competitions, timing without cable connection from the start is permitted for both A and B timing systems. Refer to set-up diagrams that describe in detail how this may be affected.

Attention: The cable dedicated to timing functions must be reserved for that purpose only and must be protected from any interference (e.g. speaker systems, snow gun data, etc.). No technical changes during the competition that may alter the transmission of trigger signals (length, capacitance, resistance, etc.) may be affected.

The organizer must ensure that cable conduits and other cable runs do not interfere with timing cable functions. It is highly recommended that expert technical testing and verification of these timing cables be performed to assure timing cable integrity.

Start and Finish

Starting Door

Minimum of 2 electronically isolated contacts to activate the opening of the door.

Timing wires ① & ② must be connected to separate start door contacts using separate connectors.

Start Clock

Can show time of day, status, but must have acoustic signal. Must be synchronized with the other timing systems.

Voice Communication ③

Timing impulse and voice communication functions can be separated on different wire pairs if manufacturer's specifications dictate.

If radios are used for voice communication, a dedicated channel must be used.

Timing Cables

Make sure that cables cannot be torn out at the start by a competitor, or by any other person next to the starting area.

Optical Cables: If a converter is necessary between timing cables and optical cables, then the converter must be approved by FIS.

Photocells at intermediate time

Locate Photocells carefully in co-ordination with the Technical Delegate and/or the Competition Jury.

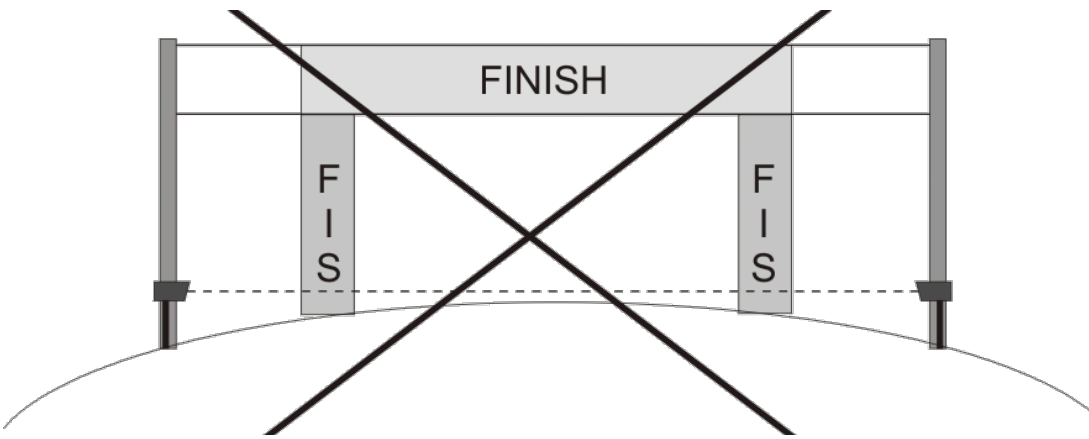
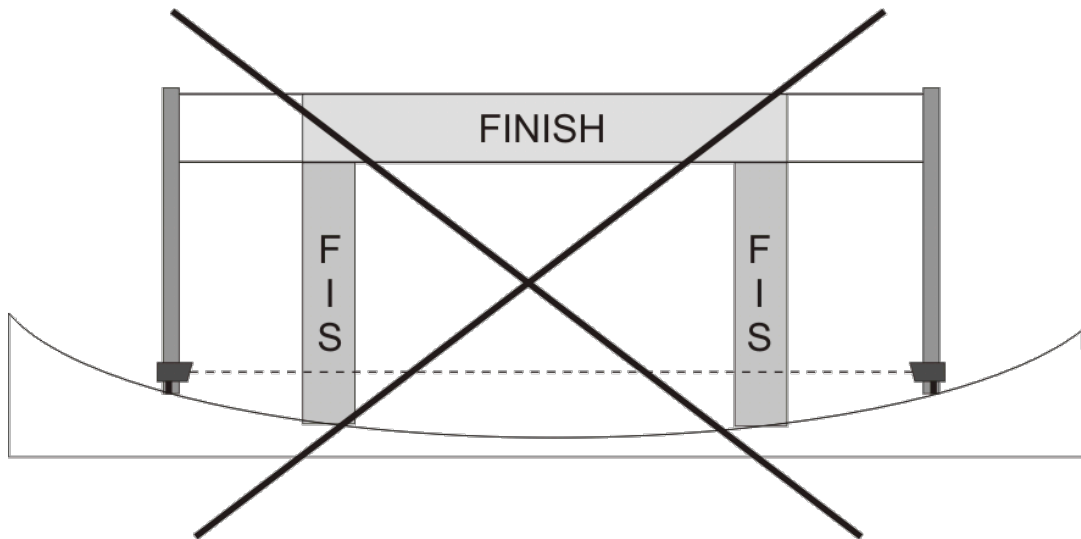
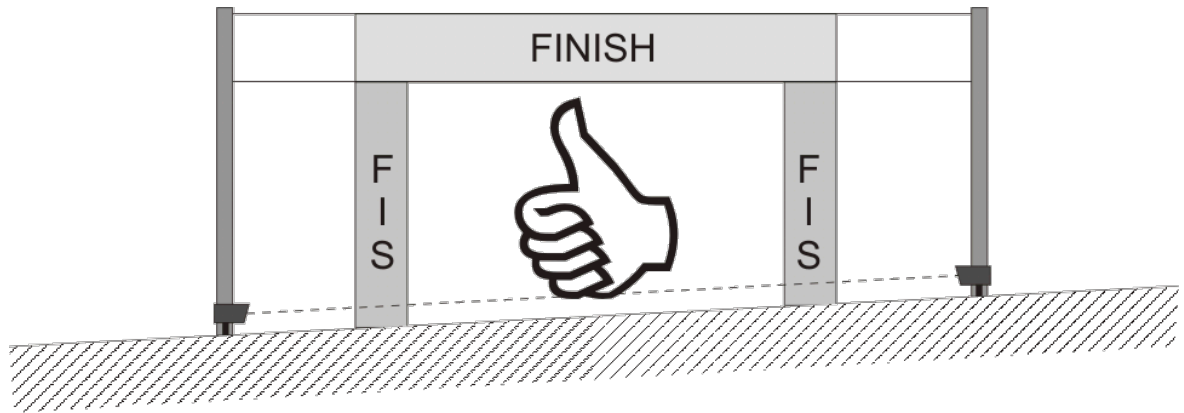
To avoid the cells being triggered by anyone other than the competitors, it is recommended that the person responsible for an intermediate timing point uses a push-button to arm the photocells only when a competitor crosses the line.

Photocells at the finish line ③ & ④

Please refer to the attached section that explains photocell use.

Wire must be used to connect photocells to the timer. Wireless is not allowed.

The use of a homologated timer with printer installed at the finish line directly attached to the photocells is recommended for Level 2 and Level 1 competitions or any time a lengthy wire connection to the finish area from the timing cabin is used.



TIMING DEVICES

System A Timer ⑤

Start line ① and finish photocell ③ must be connected.

System B Timer ⑥

Start line ② and finish photocell ④ must be connected.

The use of any electronic device (e.g. optocoupler and impulse distributors) between startgate and timer or photocell and timer must be specifically compatible and authorized by the manufacturers.

For Level 1 to 4 competitions only, when no hill cable between start and finish are installed homologated timers ⑨ must be used.

Manual hand timing ⑦

In all cases for all competitions at all levels, **hand timing is mandatory**.

Stopwatches, with or without printers, showing times to at least 1/100th second should be synchronized to the time of day and used at the start and at the finish.

A complete list of hand times recorded at the start and the finish must be given to the chief of timing at the end of each run or immediately upon request.

Photo Finish System

A photo finish system with synchronized time of day mode may be used for backup reasons at the finish line.

Transponder

are not determined to be used as official time (for system A and B).

Synchronisation

All elements of the timing installation, must be installed and be in good working order at least one hour before the beginning of the competition.

The synchronisation impulse for all timers must come from one single source (one contact) for all timing devices. After synchronisation is done, a new impulse must be sent by the same source to check synchronisation accuracy on Systems A and B. The maximum allowed difference between system A and B is 0.001 seconds.

Should any important discrepancies be observed when this check is performed, synchronisation should be redone and checked again prior to the start of the run.

Manual stopwatch synchronisation must be done before or together with the synchronisation of the whole system.

Competition in progress

Reminders

In case of timing problems, the chief of timing must inform members of the jury or the finish referee immediately.

Starter and official timekeeper should agree upon using specific terms and commands during communication. This dialogue should be short and precise, as well as systematically repeated for each competitor. In all cases it is recommended that the starter always informs the timekeeper(s) at the finish before and after a competitor leaves the start.

At the end of each run or competition, before sending out the results, times and ranking from the timing systems and the computer results system must be compared and cross checked for accuracy

Missed Time

A missed time is a time of day that is not shown on the printed tape of the system A timer. If a time from system B is missed but you have it printed on system A it is not considered as a missed time.

In case you have a missed time of system A and must replace it by time of day of system B or of a hand time, then you have to recalculate the missed time using ICR-rule 3041.3.1.

Notes

At the end of the competition, it is compulsory sending the "Timing & Data Technical Report Form" to FIS for the following Freestyle competitions (see section [Timing & Data Technical Report Form](#) in this booklet):

- Cross Qualification
- Moguls
- Dual Moguls

The printed tapes from the System A, System B and all hand timing records must be handed to the competition organization who has to keep it at least 3 months after the competition or after any appeal dealing with timing.

A member of the Timing Working Group could check at any time and at any competition the timing system connection. A contact of each starting line and finish photocell must be available to connect a FIS timing device. Of course, such connection will be done at least 2 hours before the competition or training start and not during the competition or training.

Dual Moguls

At a Dual Moguls competition two competitors run down on two courses side by side.

As two competitors ski side by side; it is possible to measure either the difference in time (at Finish) or the individual run times (Start to Finish). If run times are measured the difference in time has to be calculated from the run times (in 1/100th seconds).

The TD has to announce at the Team Capitan Meeting which timing method will be used.

Difference Time Calculated from Run Times	RED	Blue
Start Time	10:00:00,334	10:00:00,334
Finish Time	10:00:34,345	10:00:34,341
Calculated Run Time	00:00:34,011	00:00:34,007
Published Run Time	34,01	34,00
Difference Time	0,01	

Difference Time Calculated from Finish Times	RED	Blue
Finish Time	10:00:34,345	10:00:34,341
Calculated Difference Time	00:00:00,004	
Published Difference Time	0,00	

A photofinish or videofinish can be used at the finish. In case of a tie the photofinish or videofinish decides the winner (who moves to the next round). In such a case the result shows after the bib number of the winner a "PF" and it will be explained at the bottom of the result list: "With PF the winner of a round by photofinish decision is marked"

In the middle of the finish line between the two slopes only obstacles that are not higher than 40 cm are allowed.

For Dual Moguls competitions a photocell for each course is needed at the finish line. For level 1 and level 2 a system B photocell for each course is also mandatory.

The photofinish time is taken when any part of the competitor's body crosses the finish line.

Example of Finish Setup:



Setup not allowed, sight in middle is blocked



very good setup

Timing without Cable Connection Between Start and Finish

FIS Timing Working Group recognizes the importance of allowing emerging and technically responsible technologies to be used in modern FIS competitions. For this reason, and because of the flexibility that it affords, FIS Level 2 to 5 may use timing solutions that do not require any hard wire connection between start and finish for either A and/or B systems. Level 1 competitions are not allowed to use this solution. For SX Qualification, Wireless timing which meets FIS Freestyle Skiing timing standards, maybe used for FIS, NC and COC Level Competitions. Timing devices must meet FIS wireless standards that are set out in the Timing Booklet "Timing without Cable Connection between Start and Finish" and Set-Up Diagram Level 4 (without Cable)"

Regardless of the technology being used, every solution without hill cable must include the use of 4 homologated timers operating in synchronized Time-of-Day with active printers. System A will be represented by one timer at the start and one timer at the finish. One timer at the start and one timer at the finish will represent system B.

All timing rules remain in force in this situation (set-up, synchronisation, time-of day precision, printing, hand timing). In addition, for results to be valid the TD must gather and submit to FIS all four timer printer tapes with the Timing Technical Report Forms.

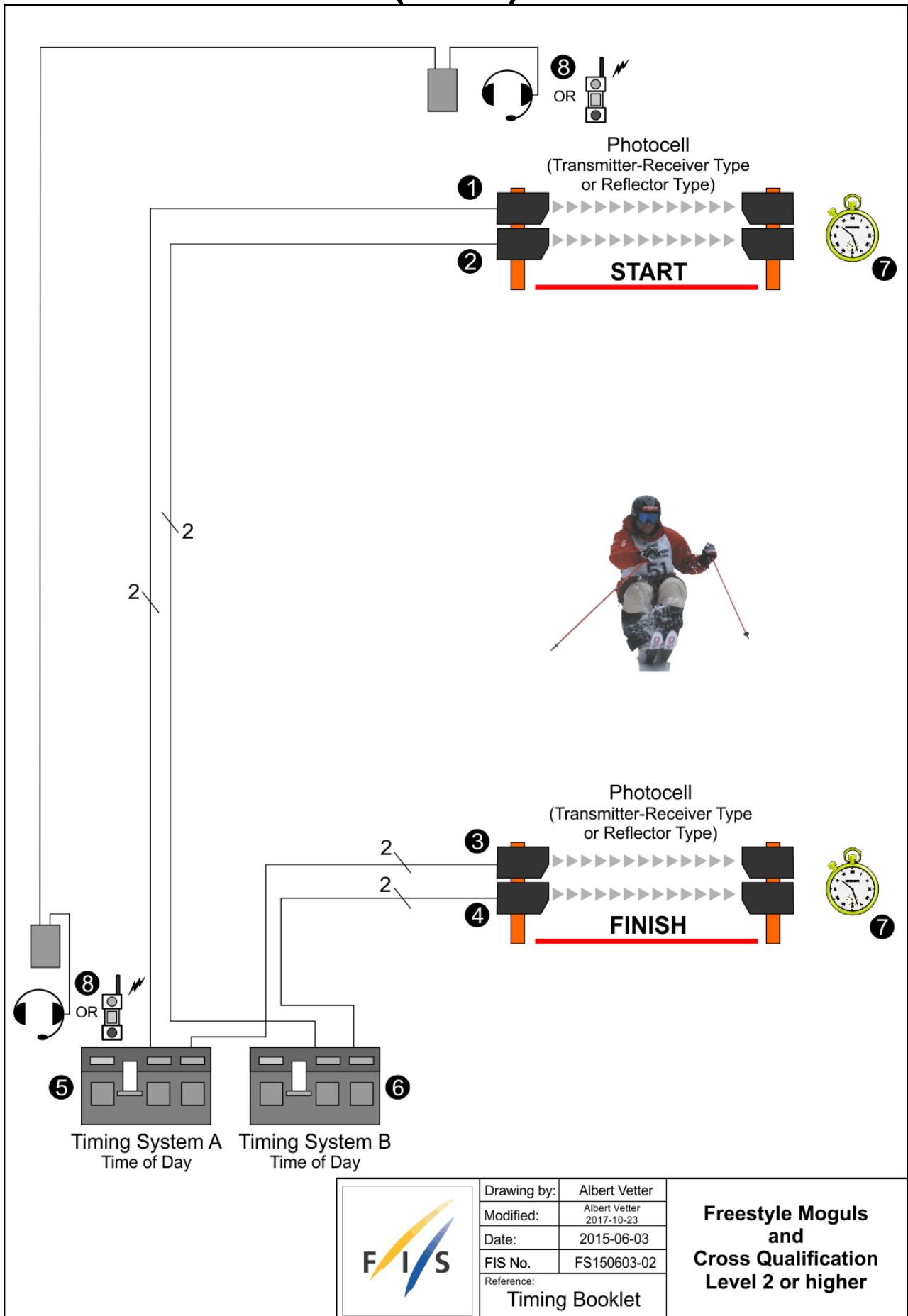
The Chief of Timing must make sure that all timers and printers work in the physical environment of the start and finish regardless of the weather conditions and temperature particularly if the temperature is expected to be less than -10° C.

When a radio system with impulse transmission is used, every start time transmitted has a delay. This delay must be consistent within $\pm 1/1000$ second. The delay must be clearly described in the manual of the radio system. FIS rules must be applied if a time from system B is used.

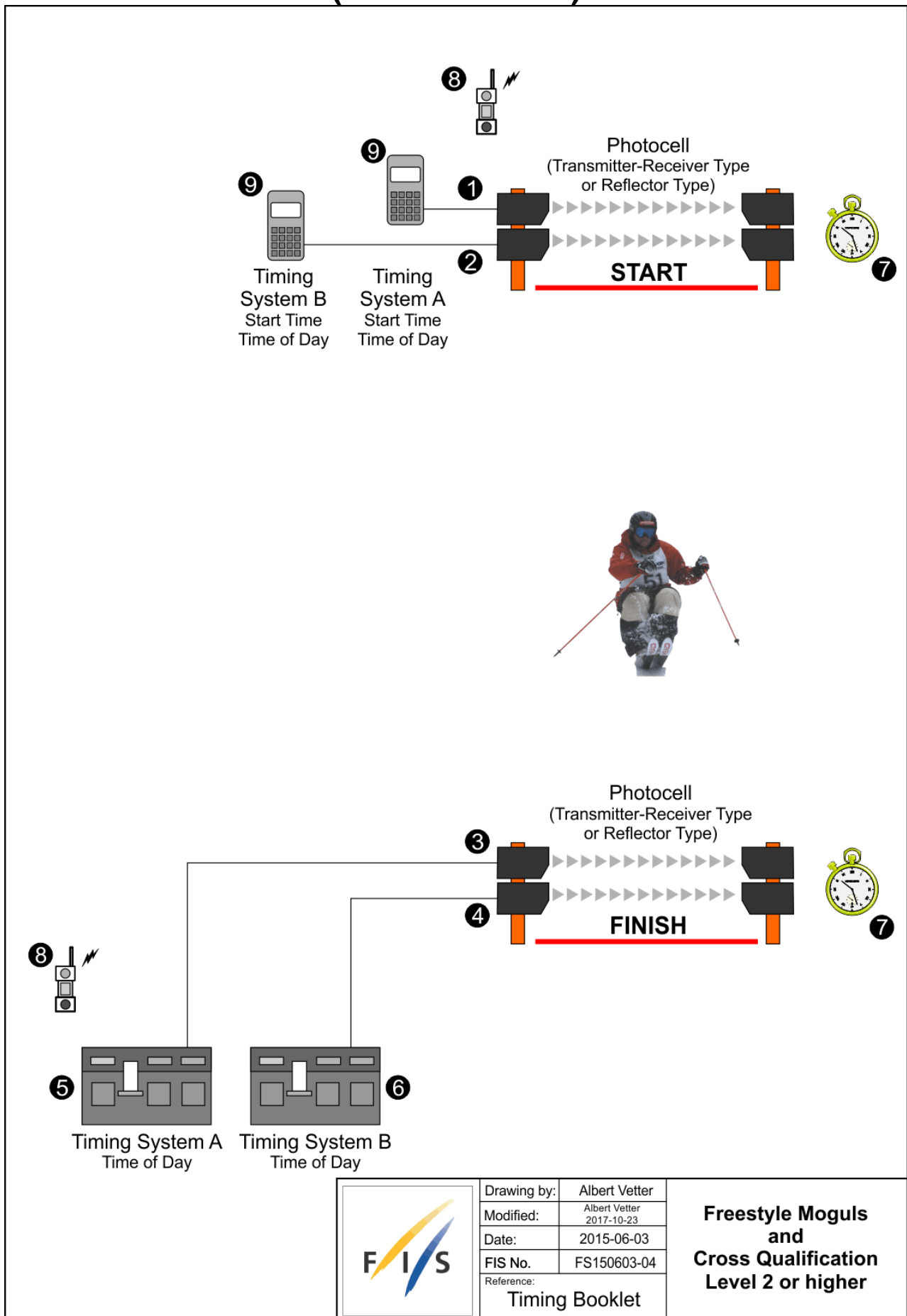
This allows organizers to use many types of timing solutions without wires as long as these 4 timers are in place and are used to verify the results. If times are generated by a timing solution other than system A or B in all cases, these times must be checked against system A and must match exactly. In case results deviate from system A, the competition must be evaluated on the A system times as per the normal timing set-up rules and procedures.

Please refer to the set up diagram that illustrates the correct use of this technique.

Moguls and Cross Qualification Set-Up Level 2 (Cable)



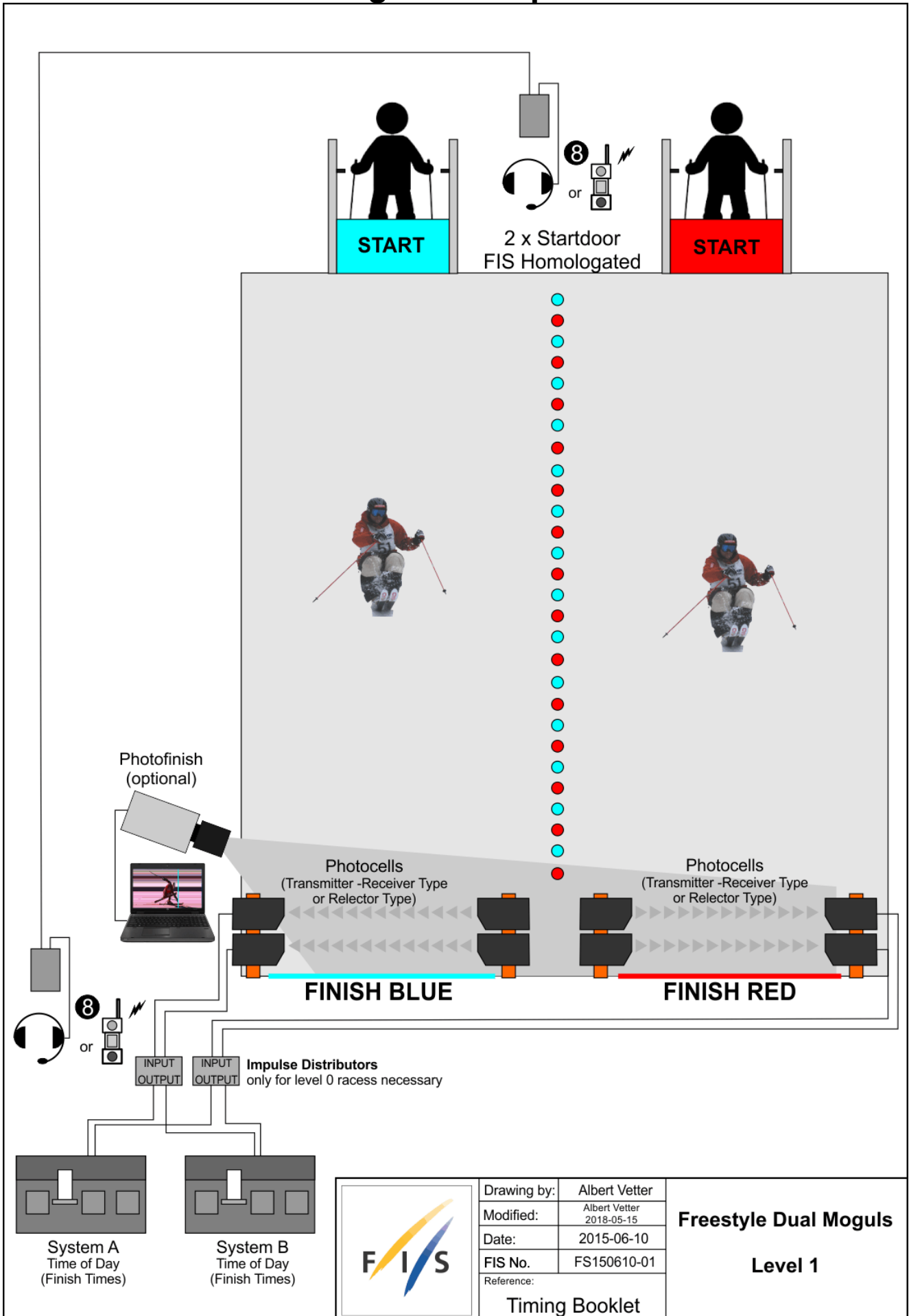
Moguls and Cross Qualification Set-Up Level 2 (Without Cable)



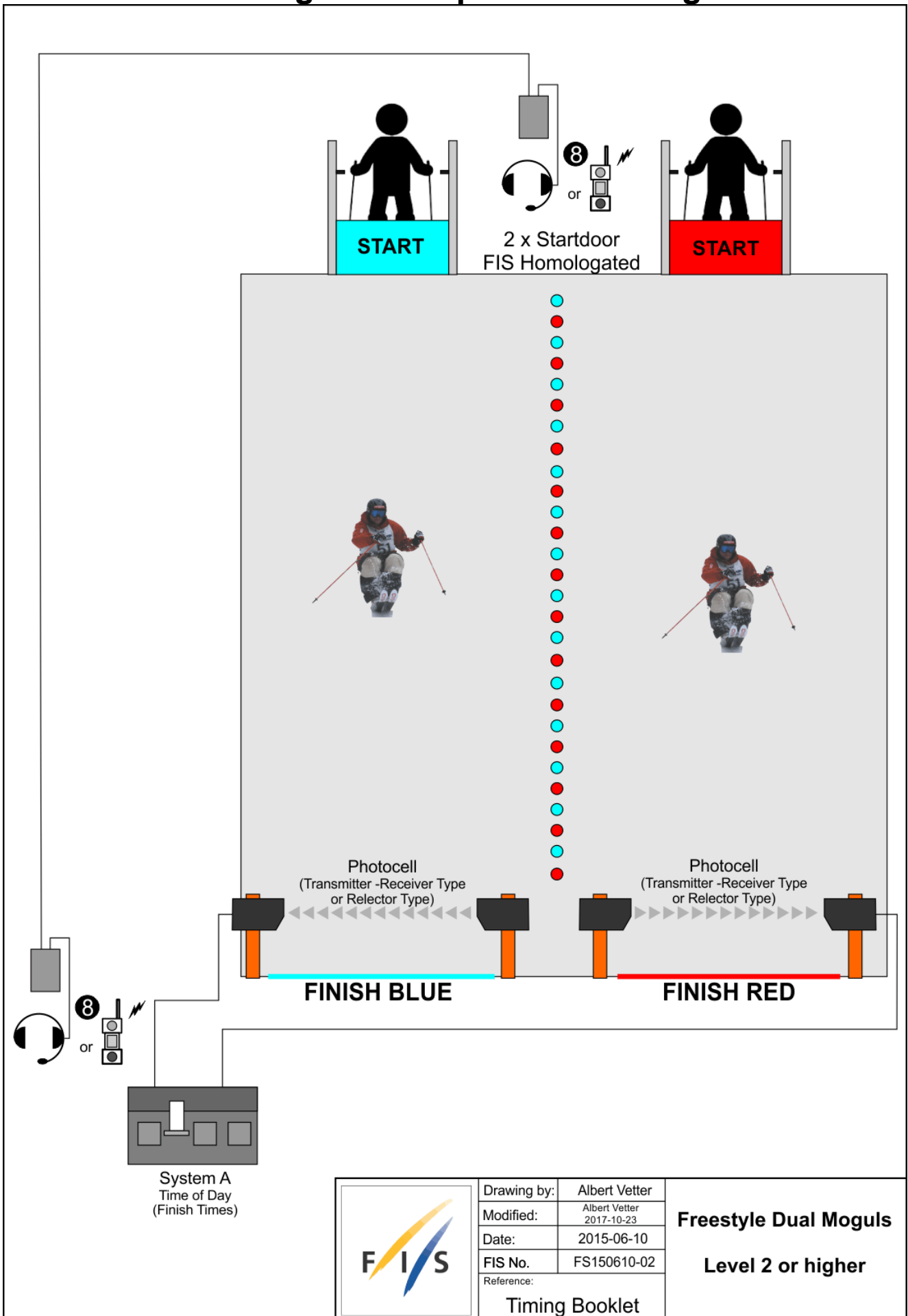
Drawing by:	Albert Vetter
Modified:	Albert Vetter 2017-10-23
Date:	2015-06-03
FIS No.	FS150603-04
Reference:	Timing Booklet

**Freestyle Moguls
and
Cross Qualification
Level 2 or higher**

Dual Moguls Set-Up Level 1



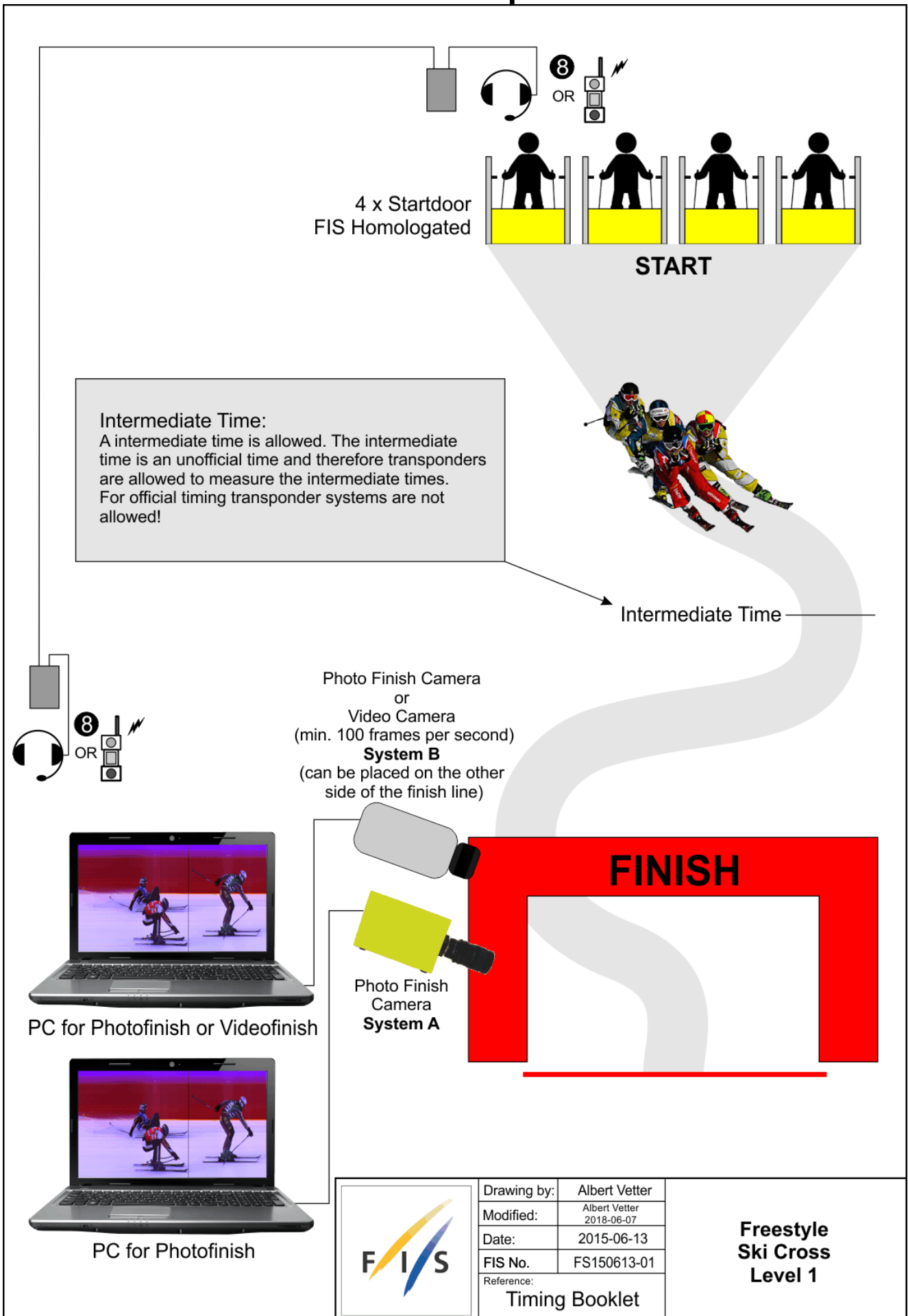
Dual Moguls Set-Up Level 2 or Higher



Drawing by:	Albert Vetter
Modified:	Albert Vetter 2017-10-23
Date:	2015-06-10
FIS No.	FS150610-02
Reference:	Timing Booklet

Freestyle Dual Moguls
Level 2 or higher

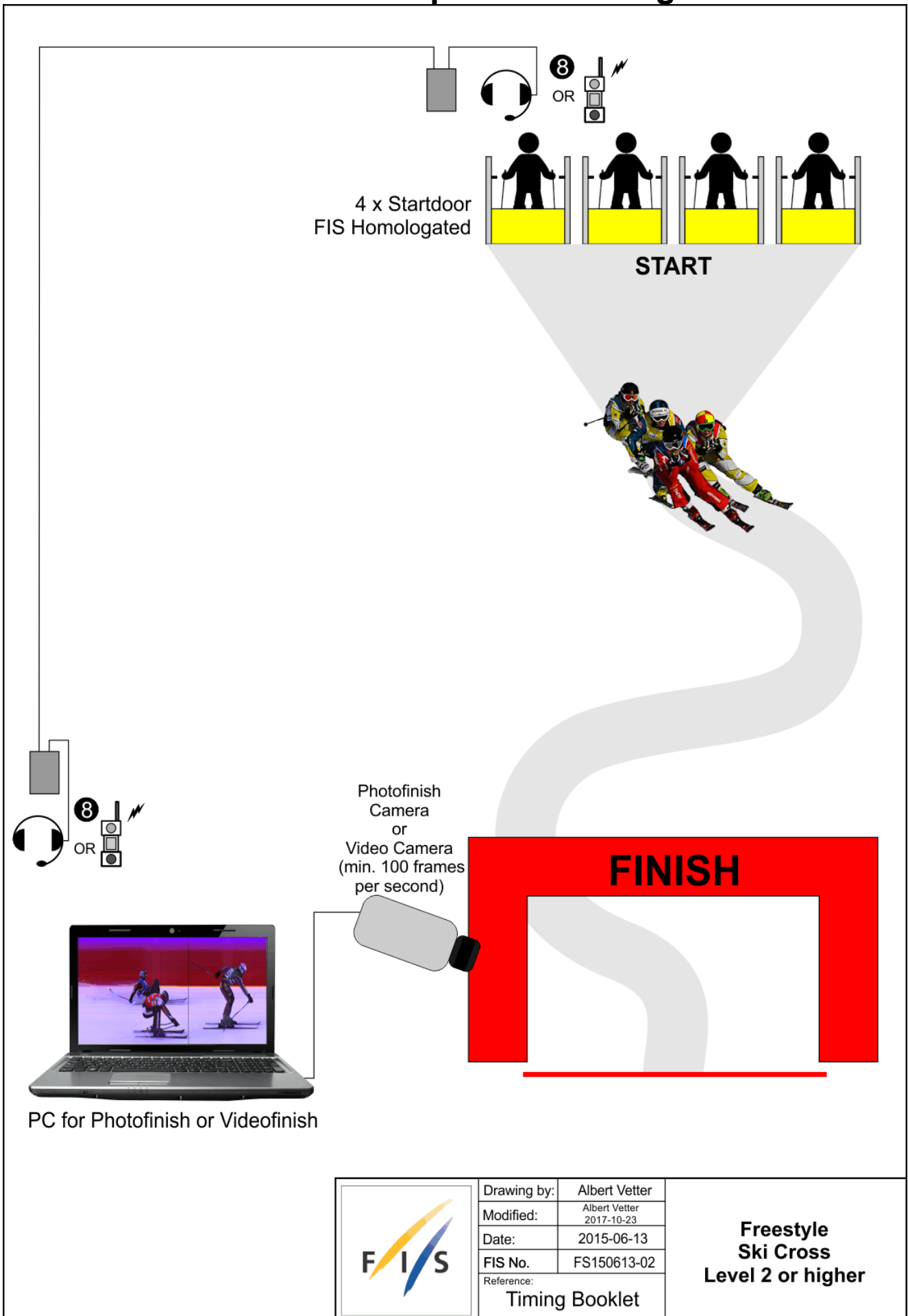
Ski Cross Set-Up Level 1



Drawing by:	Albert Vetter
Modified:	Albert Vetter 2018-06-07
Date:	2015-06-13
FIS No.:	FS150613-01
Reference:	Timing Booklet

**Freestyle
Ski Cross
Level 1**

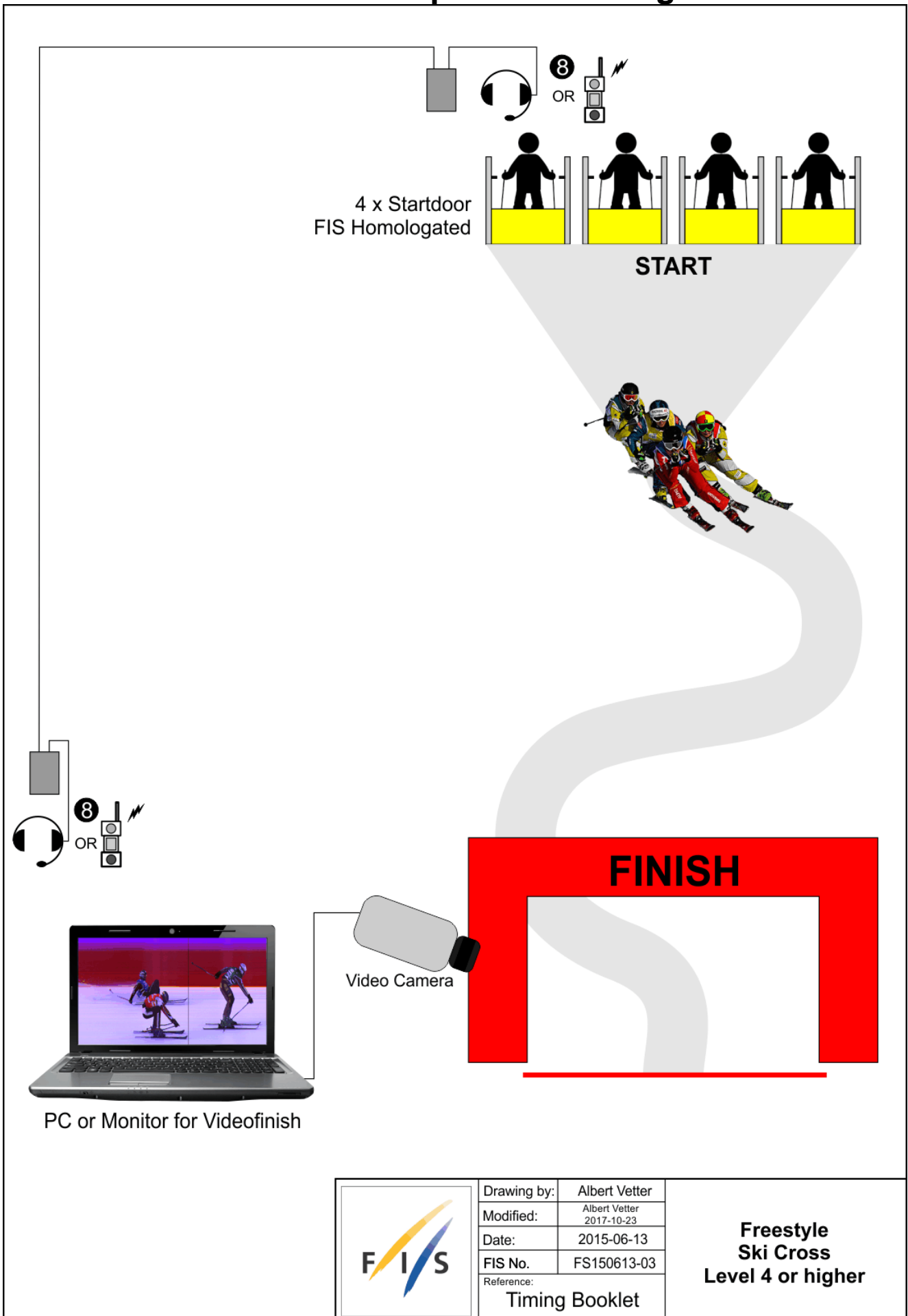
Ski Cross Set-Up Level 2 or Higher




Drawing by:	Albert Vetter
Modified:	Albert Vetter 2017-10-23
Date:	2015-06-13
FIS No.	FS150613-02
Reference:	Timing Booklet

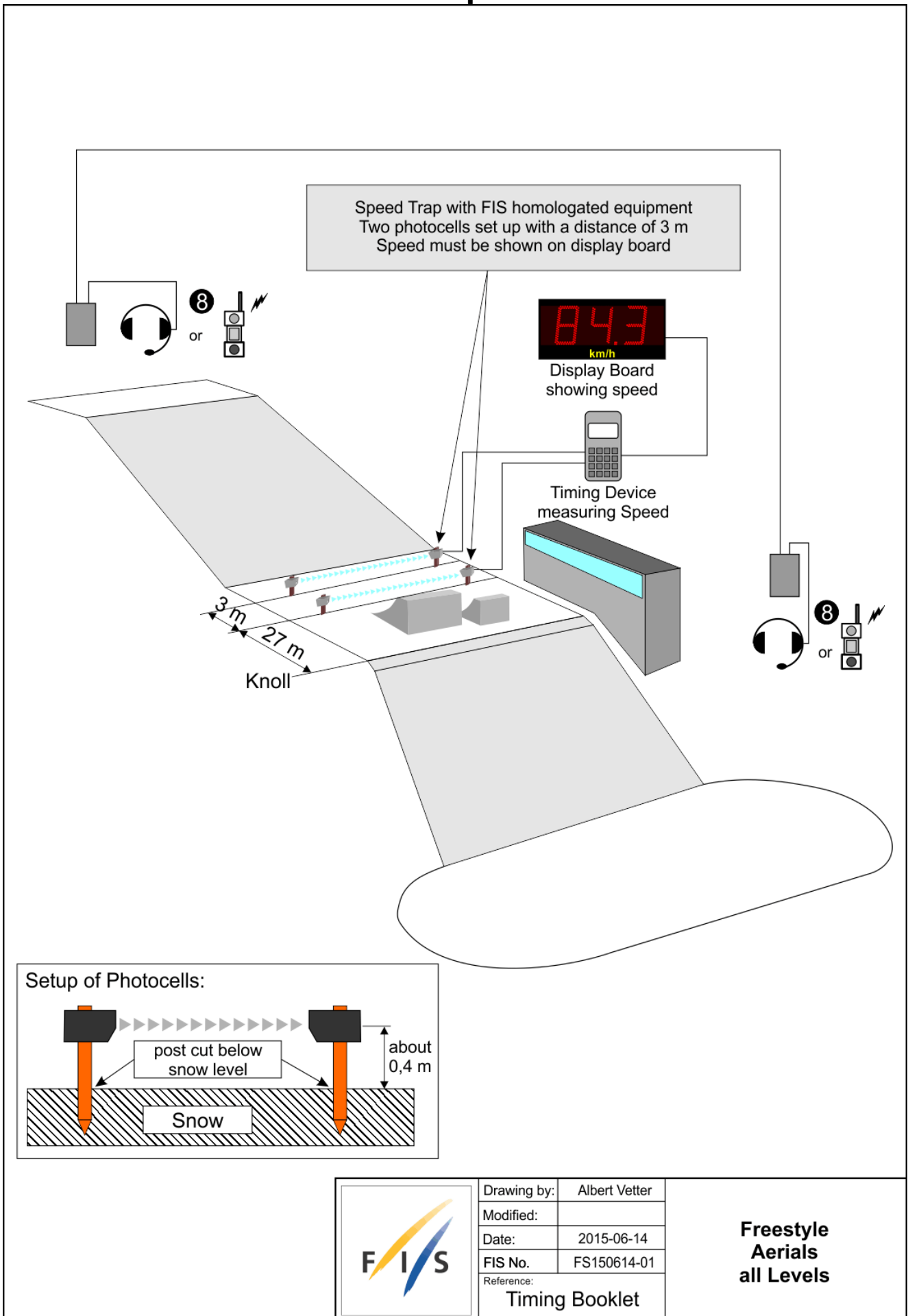
**Freestyle
Ski Cross
Level 2 or higher**

Ski Cross Set-Up Level 4 or Higher



	Drawing by:	Albert Vetter	Freestyle Ski Cross Level 4 or higher
	Modified:	Albert Vetter 2017-10-23	
	Date:	2015-06-13	
	FIS No.	FS150613-03	
	Reference:	Timing Booklet	

Aerials Set-Up All Levels



ICR 3041 - Technical Installation

3041.1 Communications / Internet Connection

For all international competitions, there must be direct communication (telephone or radio, etc.) between the Start, judges' stand and in the case of Ski Cross, Moguls and Dual Moguls, the Finish. In Olympic Winter Games, the communications must be assured by fixed wiring. In the data service area, access to the internet (at least ADSL speed) is required for World Cup, World Championships and Olympic Winter Games competitions.

3041.2 Timing Equipment

3041.2.1 *Electric Timing*

For all international competitions electric timing with communication between Start and Finish must be used, which will allow measurement of the times to 100ths of a second. 1000th of a second, even when measured and recorded, may not be published or used in the event of competitors being tied in the 1/100's of a second.

3041.2.2 *Height of Timing Cells*

The photoelectric cells will be placed at a height of 1.0 meter for the starting light beam or at approximately 0.50 meters on the starting gates. The starting installation must be placed in such a way that starting is impossible without it opening. The finish beam on the Moguls and Dual Moguls course should be at 1.0 meter high and the auxiliary finish beam at 0.75 meters.

3041.2.3 *Independent Systems for Major Competitions*

At World Ski Championships and Olympic Winter Games two independently functioning electric timing devices must be installed.

3041.2.4 *Ski Cross Reaction Time*

For the ski cross qualification and final, a reaction time will be measured and displayed at the start. The time will be measured from when the start gate is opened until a point 10 meters from the start gate. The reaction time will be measured and displayed to the nearest 1/100ths of a second. This is required for World Cups, World Championships and Olympic Winter Games.

3041.2.5 *Timing in Dual Moguls*

In Dual Moguls, the timing is based upon the difference in time between the competitors as they cross the finish line. The first competitor that crosses the finish line starts the time unit and the second competitor that crosses the finish line stops the timing unit.

3041.2.6 *Timing Systems Approval*

All timing devices must have the approval by FIS.

3041.2.7 *SX Qualification*

For SX Qualification, wireless timing, maybe used for FIS, NC and COC Level Competition. Timing devices must meet FIS wireless standards that are set out in the Timing Booklet "Timing without Cable Connection between Start and Finish" and Set-Up Diagram Level 3 (without Cable)

3041.3 Hand Timing

3041.3.1 *Hand Timing as Back Up System*

A hand timing system must be used at all times during the Moguls, Dual Moguls and Ski Cross competitions, as a back up to the electric timing system. For all competitions, the hand timing must be totally separate and independent of the electric timing at the Start and Finish.

3041.3.2 *Calculation of Hand Timing*

In the event of a failure of the electric timing system, the official hand time shall be calculated in the following way: The hand time shall be corrected by taking the average of the hand time minus the electronic time for the three runs prior to the missed electronic time and subtracting the result from the hand time: if there were not three electric times prior to the missed time, then the closest three times to the electric missed time shall be used.

EET Calculation

The EET (Equivalent Electronic Time) you need in case a time from system A is missing. All times used for the final result must be from system A. If there is a failure of system A, a calculated net time (EET) from system B must be used following the same procedure as shown below. It is not permitted to substitute time-of-day times from system B for use with system A for the purpose of net time calculations. If the time is not available from system B use the photo finish time (if available), otherwise hand time.

Calculation of the correction:

Subtract the electronic time from the time taken by hand for the 10 competitors starting before the missing time. If there are not 10 times before, complete the calculation with the remaining times after the missed time.

The sum of the 10-time differences is divided by 10 and rounded up or down ($0.0449 = 0.04$, $0.0450 = 0.05$) to give the correction which must be applied to the hand time of the competitor without an electronic time.

The EET calculation should only use time of day precision to a minimum 1/1,000 for the correction value of the time of day. If Hand timing is only available to precision of 1/100, the full precision of 1/1000th or better from the electronic timing device should be used.

Electronic A Finish Time in TOD: 10:48:31.9781

Hand Timing: 10:48:31.86(00)

BIB	Finish Time System A	Finish Time System B or Hand Time	Difference	Explanation
11	13:00:00.263	13:00:00.483	-0,220	time difference of BIB 11
12	13:00:26.880	13:00:26.521	0,359	time difference of BIB 12
13	13:00:47.368	13:00:47.410	-0,042	time difference of BIB 13
14	13:01:04.000	13:01:04.232	0,136	time difference of BIB 14
15	13:01:27.775	13:01:27.544	0,231	time difference of BIB 15
16	DNF	DNF	0,000	Competitor did not finish
17	13:02:12.912	13:02:12.993	-0,081	time difference of BIB 17
18	13:02:42.616	13:02:42.501	0,115	time difference of BIB 18
19	13:03:00.944	13:03:00.211	0,733	time difference of BIB 19
20	13:03:20.280	13:03:20.694	-0,414	time difference of BIB 20
21	13:03:48.559	13:03:48.560	-0,001	time difference of BIB 21
22	missed time	13:04:12.158	0,816	sum of above time differences
apply correction		+0,082	0,082	0,082 = 0,816 / 10
EET for Bib 22		13:04.12.240		

BIB	Finish Time System A	Finish Time System B or Hand Time	Time Difference	Explanation
1	10:00:50.1292	10:00:50.3548	-0,2256	time difference of BIB 1
2	10:01:52.1921	10:01:52.0189	0,1732	time difference of BIB 2
3	10:02:49.4920	10:02:49.4978	-0,0058	time difference of BIB 3
4	10:03:50.9812	10:03:50.6148	0,3664	time difference of BIB 4
5	10:04:49.8729	10:04:49.2741	0,5988	time difference of BIB 5
6	10:05:50.5129	10:05:50.4702	0,0427	time difference of BIB 6
7	10:06:48.8615	10:06:48.9125	-0,0510	time difference of BIB 7
8	missing time	10:07:51.5814	0,0000	missing time
9	10:08:50.0002	10:08:49.8751	0,1251	time difference of BIB 9
10	10:09:49.4278	10:09:49.2459	0,1819	time difference of BIB 10
11	10:10.50.3473	10:10.50.3954	-0,0481	time difference of BIB 11
8	missing time	10:07:51.5814	1,1576	sum of above time differences
apply correction		+0,1158	0,1158	0,1158 = 1.1576 / 10
EET for Bib 8		10:07:51.6972		

Timing & Data Technical Report Form

The "Timing & Data Technical Report Form" must be completed and sent to FIS for the following events:

- Ski Cross Qualification
- Moguls
- Dual Moguls

FIS provides free of charge a program to fill out the »The Timing & Data Technical Report Form ». You can download it from FIS ftp-server: <ftp://ftp.fisiski.com/Software/Programs/TimingReport>
Now you have to select the operating system that you use and download the software.

With the electronic report the timekeeper can send the report independently from the TD to FIS. The timekeeper just goes through the form and fills in all the fields and sends it as XML file. Of course the timekeeper can still print the Timing & Data Technical Report to have it printed.

FIS only accepts the Timing & Data Technical Reports that are sent as XML file. Printed reports that are sent by mail, fax or e-mail will be not accepted.

“How-To” Explanation Text Timing & Data Technical Report Form (Software Version)

FIS Freestyle Skiing Timing Technical Report Form is a document that must be correctly completed and submitted with all competition results for all Moguls and Ski Cross Qualification and Dual Moguls competitions in FIS calendar. Competitions that do not submit this form, duly completed, will not be considered for FIS points.

Technical surveys conducted by FIS since 1995, and the mountain of timing evidence collected by the Timing Working Group during this period led to the introduction and ongoing use of this form. It is a valuable tool and audit document. There is without a doubt a need to have all information concerning the correct determination of an event by the timing equipment, and techniques being used, properly indicated on the Timing Technical Report Form.

An annual summary of the data from these forms is conducted. Although the vast majority of FIS competitions are conducted correctly, the form asks questions that can only be replied to if certain minimum technical standards are met. It ensures that at least two homologated, synchronized Time-of-Day systems, plus hand timing are used, and it makes you pay attention to the details of how well the systems operate together. The Timing Technical Report Form minimizes errors and is designed to assist you to make the event fair for all who take part.

Please take note: For all competitions with two runs, re-synchronisation of the timers must take place before the start of the second run.

This document represents a step-by-step explanation of what is needed in each field of the Timing & Data Technical Report. Since some of the information being provided will most likely remain consistent (example: equipment being used, equipment serial numbers, event locations...) you can fill out most of this information once and store it.

Notes and Suggestions:

The Homologated Timing Equipment list that is approved by FIS, the rules described in section 3041 of the ICR, and the use of the Timing Technical Report Form ensure that many common mistakes that can jeopardize the simple truth of this timing judgment are minimized or avoided.

We are certain that your attention to detail will contribute to a successful event and we extend our thanks and best wishes for the serious work that you undertake for the benefit of skiing world-wide.

Codex:

All competitions in FIS Calendar are assigned with a code number so that they can be correctly identified. This competition ID-code number is called the „CODEX“ and there is one codex for each competition that is assigned by event and gender.

The Codex for your competition can be found in FIS Calendar. It must match the Codex number used on your Official

Results: Do not include information other than the four-numeric-character code.

Example:

8010

Location:

Use the location as described in FIS Calendar or if the event has been moved, the name of the ski area you are at. Include event, nation and competition gender information, using the indicators as appropriate.

Example: Deer Valley Freestyle World Cup DEER VALLEY MO: X Nation: USA
MEN: X

Event Name:

Enter the same name of the event as it is described in FIS Calendar and on your Official Results documents. Include category details.

Example: ARAG Big Air Freestyle Festival

Date:

FIS uses the dd/mm/yy format.

The following section identifies the timing equipment you use at your competition.

Brand:

This is the brand name of the manufacturer.

Exempels: Longines / ALGE / TAG Heuer / Seiko /

Model:

This is the model name of the particular device you are using.

Examples: TL5005 / TdC 8001 / CP 540 / CT 400 /

Serial Number:

Each device should have a manufacturer's serial number. This is found in a variety of places on timing equipment depending on the model and manufacturer. If not found on the bottom, rear or side of the device, check inside the printer or battery compartment. Contact your manufacturer or agent for complete information and have it handy. If one cannot be found, a number should be assigned and marked on the device.

Homologation #:

FIS issues a list of timers, start gates and photocells that have met the technical standards required for use at FIS competitions. **Only timing equipment on the approved list may be used at any and all Freestyle FIS competitions that appear in FIS Calendar.** A new list may not be printed each season, rather the Timing Booklet will be published from time to time and additions or deletions to the list of homologated timing equipment will be contained in the precisions to FIS rules published each fall. **In all cases you can find all updated information on FIS website at www.fis-ski.com.** **Failure to use equipment on that list will cause your event not to be considered for FIS points.** Each piece of approved timing equipment will have a code number associated with it. A complete list of those codes can be found in the Homologated Timing Equipment List. Use the appropriate code number for the approved device you are using.

Example:

TAG.070T.08

Sys A Timer:

This is the Main Timing System Timer at finish

Sys B Timer:

This is the Back-Up Timing System Timer at finish

Start Gate:

Describe the homologated start gate you used with the name of the manufacturer and model designation. Include the serial number and homologation code.

Finish Cells:

Describe the homologated Finish Cells of Systems A and B using the name of the manufacturer and the model designation. If different models are used for the A or B system, describe them both. Include serial numbers and homologation codes.

Photo finish camera (if used):

Describe the homologated photo finish cameras of systems A and B using the name of the manufacturer and the model designation. If different models are used for the A or B system, describe them both.

Connections to Start:

This section deals with how your **connections to the start** were made for both the Main (System A) and Back-Up (System B) timers, and how you handled the voice communications requirements. In the boxes, insert the method used based on how you set up the two systems and the voice communication. Use the word "Cable" or indicate how the start time data was transmitted or carried to the timer at the finish.

Scoring and Results Preparation:

Specify the software, version and/or release date of the software that you use to produce the lists for the competition.

Attention: Check always the results of the printed tape of the timing device with the results that you get from the software. These data must be identical.

Time Data Section

This is the section that provides the proof that your two systems and hand timing were synchronized and functioning as required by the rules. There are 15 pieces of information for each run that you can get only from the timer tapes and that allow FIS to see that you did the timing correctly. Two other times come from Hand timing data. Be prepared to gather this information from the timer tapes as it happens, or at least to know where to find it after each run. It is critical that this information be correctly retrieved and indicated on the form

POWER ON Time (warm-up):

Every timing system needs a period of time for the quartz time base to stabilize after the timer is first switched on. This box is provided to remind you to do so in advance of run synchronisation (Recommendation: at least 30 minutes prior to the synchronisation). Four places are available for indications up to four timers required if no hill cable is used. F is for the timers at the finish, S is for those at the start (if used).

Indicate the Time of Day this was done.

Synchronisation Time:

Once System A and System B are set up and turned on, the rules require that they all be synchronized to the Time of Day no more than 60 minutes before the start of each run. Indicate the time of day the timers were reset to and synchronized at. This Time of Day must appear on the System A and System B Timing Tapes. This should be done by using the start gate as the triggering source for all systems at once. In all cases all systems should be triggered by one synchronizing contact.

Indicate the Time of Day this was done.

Example:

10:00

Synch confirm after Sync:

Synchronisation to the Time of Day for all systems must be accomplished. Connect all timing devices that run in time of day at one start source (one single contact only for checking) and start the time of day of all timing devices. Trigger the timing devices again after 1st Sync and check if the time of day for this impulse is within a 1/1000ths (0.001 sec.) for System A and System B timers. If they are not, you must re-synchronize and try again. Note that four spaces are provided for indications about synchronisation of the four required timers when events are being timed without hill cable.

Indicate the actual readings in Time of Day (TOD) you take from the System A and System B tapes to the 1/1000th of a second or better (same precision as printed on the timing tape).

Example:

10:00:51.225

Start TOD First Competitor*: give the Start Time of Day from the first competitor to finish his run.

Finish TOD First Competitor*: give the Finish Time of Day from the first competitor to finish his run. Show bib.

Start TOD Last Competitor*: give the Start Time of Day from the last competitor to finish his run.

Finish TOD Last Competitor*: give the Finish Time of Day from the last competitor to finish his run. Show bib.

This data section has on the left side space to insert the times of the first run, and on the right side space for the second run. These 8 boxes provide locations for the readings from the two systems of the start and finish times of your first and last competitors who make it through the course. **Insert the Time of Day Times that are recorded on the System A and System B tapes for these competitors to the 1/1000th (0.001) of a second or better.** Note that there are spaces for indicating what the bib numbers of the particular competitors used in your samples were.

Use only the first and last skiers who finish having **complete timing data.**

Net Time:

These 4 positions are used to indicate the actual elapsed net times on course for the two samples of the first and last competitors on course who made it to the finish, as recorded on System A. **These must be identical to the net times used on the results and are indicated to the 1/100th (0.01) of a second.** This allows you to check if the calculation of the net times on course, as derived from the Time of Day times recorded at the same precision as the timing device shows on the System A tapes, was done correctly. Times are expressed in Min/Sec/100ths. You should also use this as an opportunity to check that the times used on the results match those calculated from the timer tapes.

Example: 1:00.91

Hand Time:

Hand Timing is mandatory for all competitions in FIS Calendar. These positions allow you to provide the evidence that hand timing was used and how well it was done. The hand times used here are net times on course calculated from the Time of Day start and finish times your hand timers record. Calculate the elapsed hand times on course

for these athletes and indicate them here. The Net Time of the Hand Time should be comparable (no big time difference).

Best run-time System A:

Indicate the fastest time obtained in that run and which bib it was assigned to.

Were all times from system A?:

Indicate if all competitors were timed during this run using System A as required by FIS rules. Check the appropriate box „yes“ or „no“.

List the bib numbers used in the results timed on any system other than system A in all runs (indicate run)

If you answered „No“ in the section above, list the bib number(s) of the competitor(s) and the respective run number, who were timed on System B or using Hand Timing for each **replacement System A time calculation**. Indicate the reason for the problem(s) by marking it and/or describe it.

Comments:

Describe any problems or comment upon corrective actions that were necessary during the timing of any run held during this series. Obviously if you have any competitors who have times used on the results from anything other than System A, you should explain this here. The TD should indicate if any timing component used requires verification or service before the next event. This provides the opportunity to indicate if any of the equipment, wiring or other components requires service or corrective actions before the next event. This could apply to staff and procedures as well as equipment. This can include comments even if all times were derived from System A.

We certify that the timing and calculations of this event adhered to the rules.

This is a direct statement that requires a “yes“ or “no“ answer.

Both FIS Technical Delegate and the Chief of Timing must review and complete this documentation and attest to the accuracy of the information contained herein.

Timing Technical Report (examples)

Timing Report 4.2.0
File Edit Options

Timing and Data Technical Report Freestyle
for codex 1234

Accepted languages for report content: English, French, German

Event data

FIS discipline: Freestyle
Race Date: 12.12.2018
Season: 2019
Race Codex: 1234
Location: Oberhofen
Category: FIS - FIS
Nation: SUI
Competition: Moguls
Event Name: Testevent
Gender: Men

Technical Delegate

Last Name: Mustermann
First Name: Max
Nation: SUI
TD Number: A0000

Chief of Timing

Last Name: Arnold
First Name: Emil
Nation: AUT
Telephone: +43-5512-859741
Email: e_arnold@gmx.at

Timekeeper

Company: Timing Service
Last Name: Etter
First Name: Ralph
Nation: AUT
Telephone: +43-5577-859660
Email: etter_ts@gmx.at

Reset page Cancel and Close Back Next

Timing Report 4.2.0
File Edit Options

Timing and Data Technical Report Freestyle
for codex 1234

Accepted languages for report content: English, French, German

Hardware and Software

	Brand	Model	Serial number	Homologation	
System A Timer (at finish)	ALGE	TdC 8001	121001059	ALG.003T.10	✓
System B Timer (at finish)	ALGE	Timy3 WP	1603113	ALG.090.14	✓
Timer A Start (if used)	MICROGATE	REI 2	156654	MGA.001T.15	✓
Timer B Start (if used)	Select ...				
Start Device	ALGE	STSnM2S	140200072	ALG.S53T.10	✓
Finish Cells A	ALGE	PR1aW	170401008	ALG.L91.14	✓
Finish Cells B	TAG HEUER	HL 3-135	16024525	TAG.L100.16	✓
Photo Finish A (if used)	ALGE	OPTIc3-PRO	17090012		
Photo Finish B (if used)	Select ...				

Result Software: VOLA 2.0.02

Connection to start (cable, radio or other):
System A: Cable System B: Cable Voicecom:

System A not used (enter the reason)
For bib 21 the photocell was out of focus. it was imedately fixed and bib 22 had again a working photocell

System B not used (enter the reason)

Reset page Cancel and Close Back Next

Timing Report 4.2.0
File Edit Options

Timing and Data Technical Report Freestyle

for codex 1234

Accepted languages for report content: English, French, German

Synchronization

	System A	System B	Hand
Synchronization time	08:30:00		08:30:00
Synch confirmation	? 08:31:00.0000	08:31:00.0001	

Timing Part 1

Time of day (TOD) expressed in precision used for net time calculations equal to the precision of the timing device

Enter data for 2nd run run 3 ->

	Qualification 1st Run			Qualification 2nd Run		
	System A	System B	Hand	System A	System B	Hand
BIB First Competitor*	1					
Start TOD First	09:00:00.1456	09:00:00.1451				
Finish TOD First	09:00:23.7589	09:00:23.7696				
Net Time A / Net Time Hand First	0:23.61		0:23.68			
BIB Last Competitor*	63					
Start TOD Last	10:11:00.3213	10:11:00.3235				
Finish TOD Last	10:11:28.4476	10:11:28.4495				
Net Time A / Net Time Hand Last <small>* First and Last to Finish with complete data.</small>	0:28.12		0:28.19			
BIB / run-time Best System A	1	0:26.61				

Reset page
Cancel and Close
Back
Next

Timing Report 4.2.0
File Edit Options

Timing and Data Technical Report Freestyle

for codex 1234

Accepted languages for report content: English, French, German

Timing Part 2

Were all results from system A? Yes No

List any or all BIB numbers used in the results timed on any system other than system A in all runs (indicate run):

BIB	Run	Reason	Other reasons	Data source for replacement system A time?	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Add to list"/>
BIB	Run	Reason	Other	Data Source	<input type="button" value="Delete row"/>
23	1	Photocell alignment		System B	

Comments Qualification

A helper moved the photocell out of focus. After bib 23 we had the photocell aligned again

Comments Qualification r

We certify that the timing and calculations of this event adhered to the FIS rules. Yes No

Reset page
Outputs
Cancel and Close
Back
Save XML

Criteria for FIS Approved Timing Devices for Freestyle Skiing Competitions

Timers

All timing devices must be homologated by FIS and used respecting FIS rules. Validity of the homologation is 15 years.

- Timer:** The timing device must have an internal or external printer.
Printing through a computer is not allowed.
The timer must be able to operate in Time-of-Day. The output of the time must always have the same precision (e.g. printer, display and interface).
- Printer:** This printer must print at least in a chronological order the time of day.
For each printed time of day there must be an indication of the timing channel.
If it is possible to do manipulation or correction of times in the timer the printer must mark such a corrected time.
- Interface:** The timing device needs an interface (e.g. RS232, RS422, USB, Ethernet) to connect a PC and transfer the data for data processing (result service) online.
- Power Supply:** The timing system must work without external power supply on internal batteries for 4 (four) hours at +10° C and two impulses per minute with printout.
The timing system must work without power supply from the mains for four (4) hours at 23°C and one printout per minute and two (2) hours at -10°C and one printout per minute.
- Operation Temperature:** The timing device and printer must work at ambient temperatures from -10° to +60°C*
- Measuring Range:** Time of day mode must be possible in hours, minutes, seconds and 1/10000, or better.
- Timer Precision:** Must measure 1/10000 second or better in time of day mode.
Timer accuracy must be below +/- 10 PPM at a device temperature from -10° to +60°C*.
- Quartz:** Ageing of the quartz must be below +/- 3 PPM per year.
With adjusted quartz frequency the time drift must be below +/-0.5 PPM at 23°C.
- Impulse Triggering:** The delay of impulses is not allowed to be higher than 1/1000 sec. for the same channel (the channel is triggered from a reference impulse device in minute intervals). If two channels are triggered at the same time they times must be within 1/1000 second.
The delay of impulses must be constant; the range must be less than 1/10000 sec.
- Timing Channels:** The timing device needs a minimum of two independent channels, one for start and one for finish.
- Synchronisation:** Synchronisation between main- and backup timer must be possible.
- Electromagnetic:** The timing device must meet the standards of IEC (International Electronic Commission). This means the timing device must function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
- Truncation:** The truncation to 1/100 of seconds must be made after the calculation of the run time. The digits of the run time after the 1/100 are thrown away.
- e.g.:
- | | |
|----------------------------|--------------|
| Start Time: | 10:00:00.132 |
| Finish Time: | 10:01:30.259 |
| Calculated Run Time: | 1:30.127 |
| Run Time after truncation: | 1:30.12 |

Timers with External Synchronisation

For timing devices with external synchronisation (e.g. GPS-Synchronisation) all specifications of "Timers" (see previous page) are valid. Additionally it must fulfil the following features:

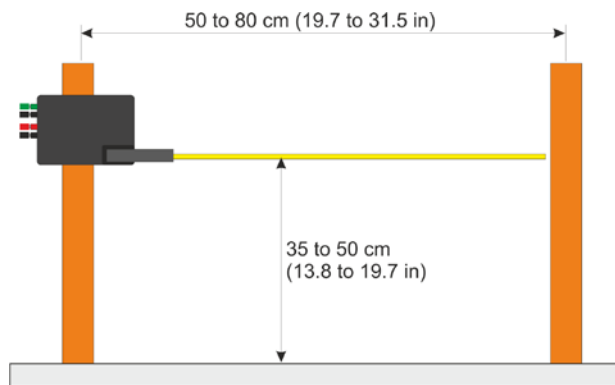
- The external synchronisation solution must have a constant accuracy from 0.0001 s or better.
- The timing device must run independent with the internal quartz.
- The time synchronisation of the external device can be in periodic intervals or permanent.
- If the difference between the internal timing (quartz) and the external synchronisation is within an accuracy of ± 0.0003 seconds it is allowed to resync the timing device with the external time.
- If the difference between the internal time (quartz) and the external time is higher than ± 0.0003 seconds it is not allowed to resync the timer with the external time. From now on the timing device must run with the internal quartz only (no further resynchronisations are allowed).
- The printer of the timer must print a message when the external synchronisation is switched off. The message must inform about the reason for switching the external synchronisation off and the time when this happens.
- In case the external synchronisation signal is lost the timer has to print it a message. If the timer gets the synchronisation signal again further synchronisation is allowed, if the time difference is within the allowed ± 0.0003 seconds.

Start Gate

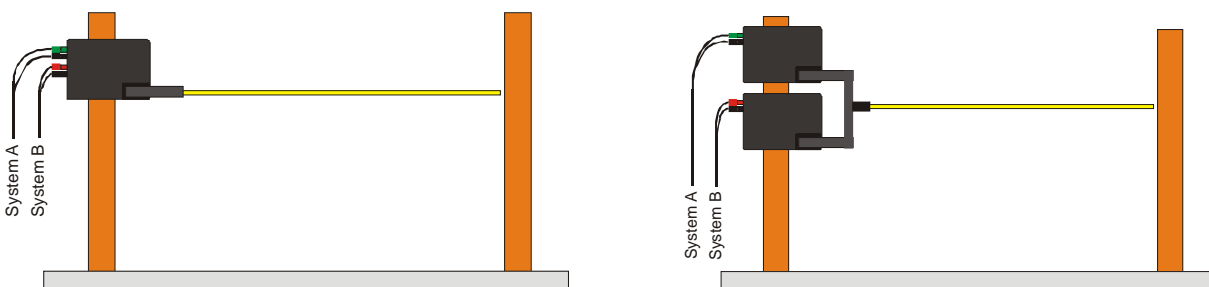
Install the Start Gate in close co-ordination with the Technical Delegate and/or the Competition Jury. Only Start Gates homologated by FIS are allowed (see section of homologated timing equipment in this booklet and on FIS website).

The following elementary rules should be considered:

- Start Gate mounting post must be put into the ground or snow or firmly connected to a fixed structure under the snow. It is essential that the support post be solidly fixed and not permitted to move in any way.
- The Start Gate must likewise be attached to the mounting post without the possibility of rotation or movement of any kind.
- The height above the ground of the Start Gate must permit the athletes to hit the bar below the knee not too close to the boot top. In all cases the range shall not be less than 35cm nor more than 50 cm above the snow surface at the start.
- The start gate may be placed either to the left or the right of the starting competitor, in all cases making sure that the angle of departure to the first gate ensures that the start gate must open.



- The length of the wand (bar) must be within 50 cm (20 in) and 80 cm (31,5 in)
- The Start Gate must have two different and completely isolated lines, two separate connectors, one for timing system A and one for timing system B



- If two Start Gates are used in parallel, they must be solidly mounted on the same physical bracket and each arm must be stiffly connected together (both mechanism and box)
- Only the use of one wand (bar) is permitted
- If the Start Gate has to be replaced during the competition, it must be a Start Gate of the same type and manufacturer
- The position of the Start Gate (both height and rotation) must be marked before the beginning of the competition in order to make sure that a replacement can be installed in the same position if necessary

Technical Specifications for Start Gates:

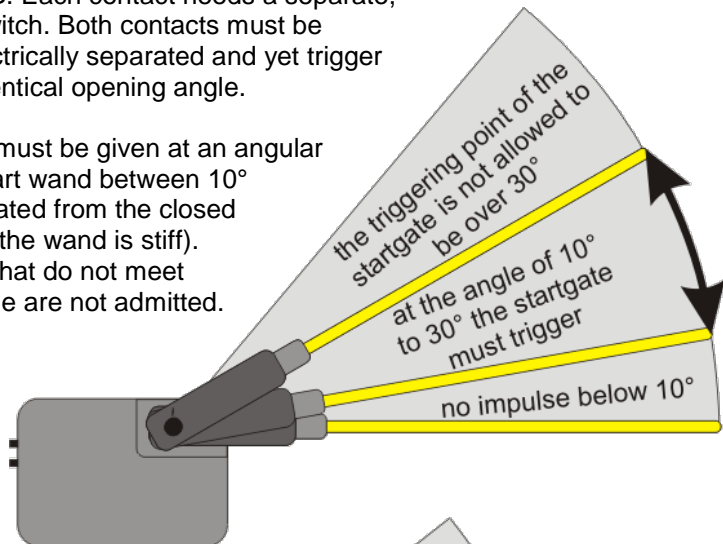
Only Start Gates that meet the following technical specifications will be homologated by FIS:

Contacts:

The Start Gate shall provide a separate contact for system A and B. Each contact needs a separate, but identical switch. Both contacts must be completely electrically separated and yet trigger at the same identical opening angle.

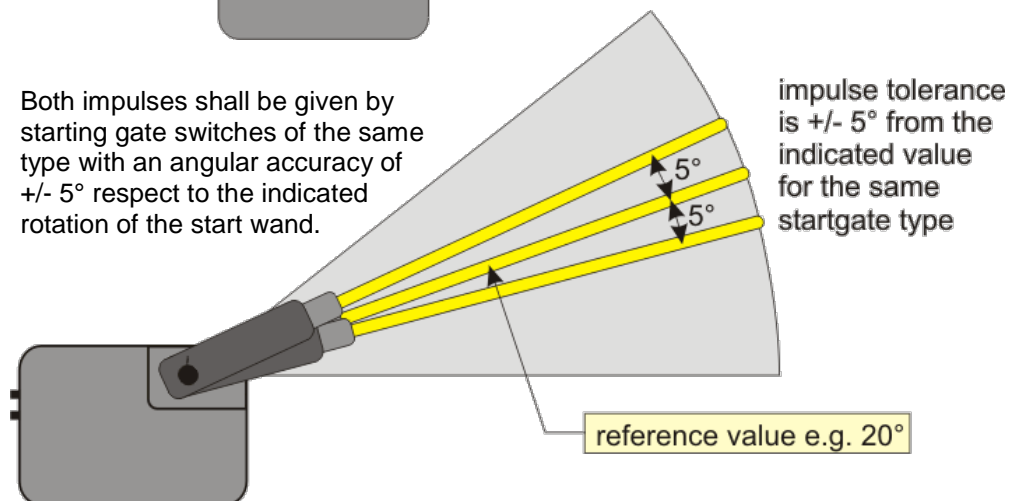
Angular Range:

Both impulses must be given at an angular range of the start wand between 10° and 30° , calculated from the closed position (when the wand is stiff). Starting gates that do not meet this trigger angle are not admitted.



Angular Accuracy:

Both impulses shall be given by starting gate switches of the same type with an angular accuracy of $\pm 5^\circ$ respect to the indicated rotation of the start wand.



Start Wand:

The start wand cannot be so stiff that it could cause injury and that it will not break. On the other hand it must be as stiff as possible to avoid unfair starts. If you rotate the start wand at the far end, it is not allowed to bend more than 15° without causing the triggering mechanism to actuate. The wand must stay open once it is activated. Spring return "Self-Returning" mechanisms are not permitted.



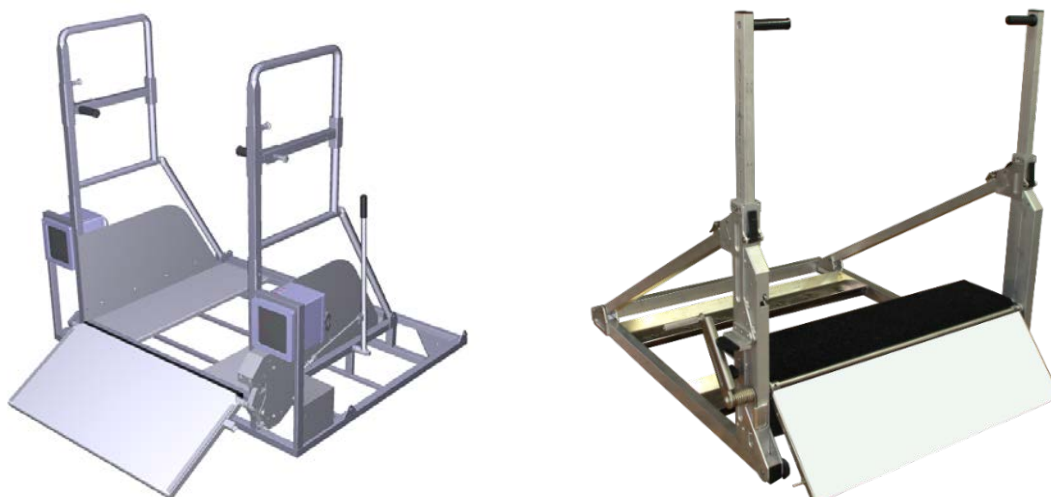
Start Gate Impulses:

Two different possibilities are accepted:

- 1) **Single Shot:** the line is activated for predetermined time even if the wand remains open
- 2) **Continuous:** the line remains activated as long as the wand remains open.

Startdoor

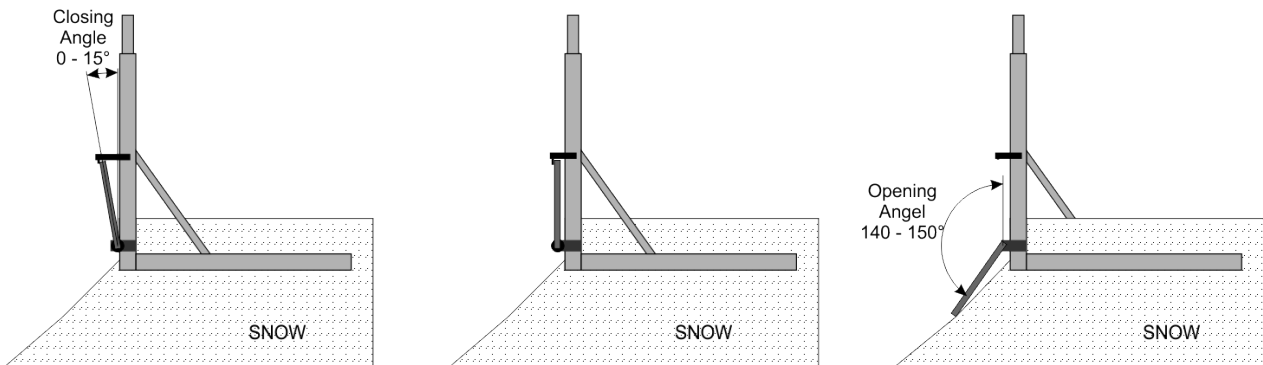
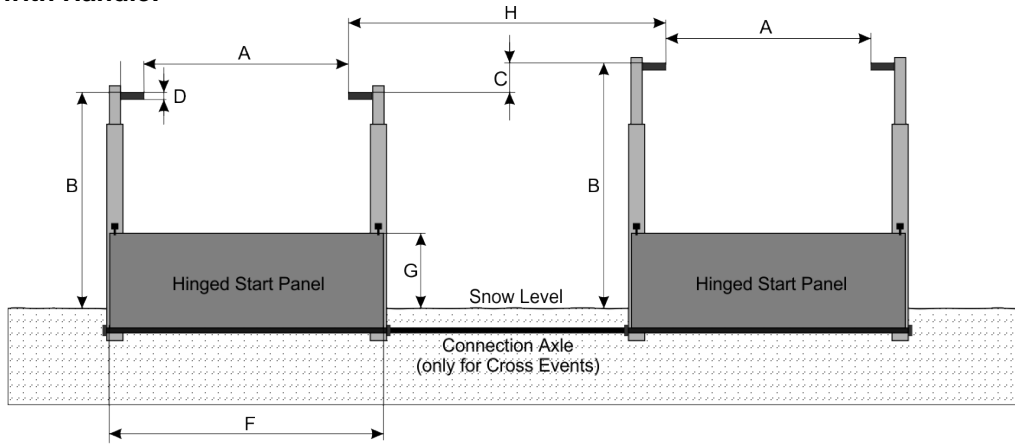
The start door homologated by the FIS is needed for the following events: parallel events, team events, Boarder Cross, Ski Cross.



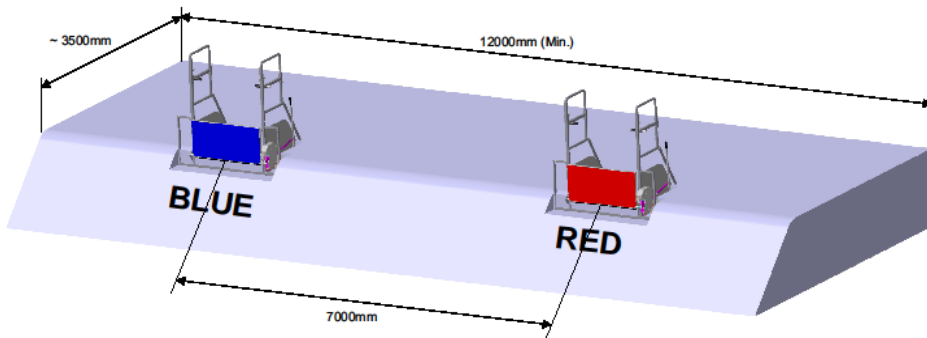
- Dimension of the hinged flap panel, outside the snow must be more than 95 cm wide, 25 to 40 cm height
- The side that has contact with the skis must be protected using material that protects the skis.
- Competitors must not be able to push the gates open. A force applied at any position on the hinged flap panel at 25 cm above the snow with 150 N is not allowed to open or block the startdoor.
- A handle is on each side of the startdoor. It is used for the competitors to start. The handle is mounted on the inside. The handle must be adjustable in the height between 60 and 100 cm (measured from the snow level).
- One push button must start the automatic start sequence for all involved startdoors.
- The startdoor or start-electronic must provide an output channel to start the timing.
- The startdoor must be able to be opened with a delay (e.g. for one racer at the second run at parallel races). For level 0 events it is mandatory.
- Starting lights visible for the athletes may be available for parallel competitions and team events. Red light(s) shows the countdown and a green light the start (door opens). For level 0 it is mandatory. For cross events the starting lights must be able to be switched off.
- Starting sound for the athletes may be available for parallel competition and team event. It is counting down synchron with the light. The sound and light must start exact with the full second. For level 0, 1 and 2 it is mandatory. For cross events the starting sound must be able to be switched off or changed to one start tone.
- Sound and light must be synchronized. Same sound for the red lights and different sound for green light.
- For Cross-Events the hinged start panels must be connected for all gates by one bar. This means all gates must open at the same time.
- The manufacturer of the startdoor must provide a checklist to maintenance the startdoor. Before each FIS race that uses the startdoor the startdoor has to be checked by the checklist and a copy of the checklist has to be provided to the TD at least 2 weeks before the race.
- Validity of the homologation is 10 years

Startdoor Measurements:	
Discription	Specifications
Distance between handles or knob [A]	80 - 90 cm
Handle or knob height over snow [B]	ajustable, 60 - 100 cm
Vertical handle movement [C]	max. 10 cm step
Handle diamenter [D]	3 - 5 cm
Width of hinged flap panel [F]	min. 95 cm
Highed of hinged flap panel over the snow [G]	25 - 40 cm
Distance between startdoors for cross events [H]	60 - 70 cm
Closing angle of hinged flap panel	0 - 15°
Opening angle of hinged flap panel	min. 140°
Time to open hinged flap panel to 90°	max. 0.3 s
Variation of opening duration of hinged flap panel	max. 0.1 s
Time to open hinged flap panel from start impules to 90°	max. 0.4 s
Force applied on hinged flap panel to 25 cm over snow level without opening	min. 15 kg
Operating temperature	-30°C to +60°C
Surface of hinged start panel (side that skier moves over)	protection for skies

Startdoor with Handle:



Installation for parallel races and team events has to follow the plan below:



Photocell

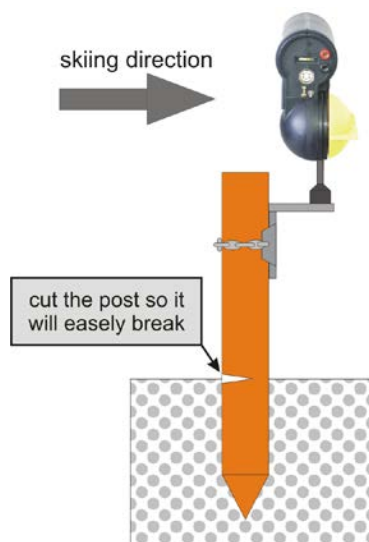
Install photocells in close co-ordination with the Technical Delegate and/or the Competition Jury. It is strongly recommended that the approach to the finish and the width of the line be made as levelled as possible, making it impossible for athletes to slide under or jump over the beams when installed.

Only wooden posts with a maximum diameter of 6 cm should be used to mount the photocells at the finish. You should cut the wood posts so they can break away in case of being struck by a competitor. This cut must be made facing uphill. All brackets and elements of the photocells should be placed on the downhill side of the post. If photocells for intermediate are used they should be mounted on hinged poles that will break away.

Photocell system A and B must always be completely separate (separate case and mounting brackets).

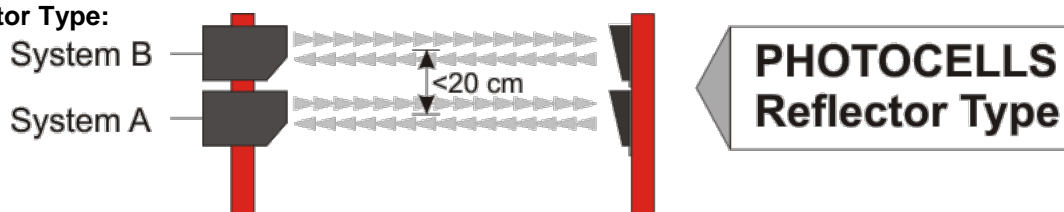
For photocells appropriate protection must be provided by the organizer.

Only photocells homologated by FIS are allowed to be used for the finish (see section of homologated timing equipment in this booklet or on FIS website).



There are two categories of cells:

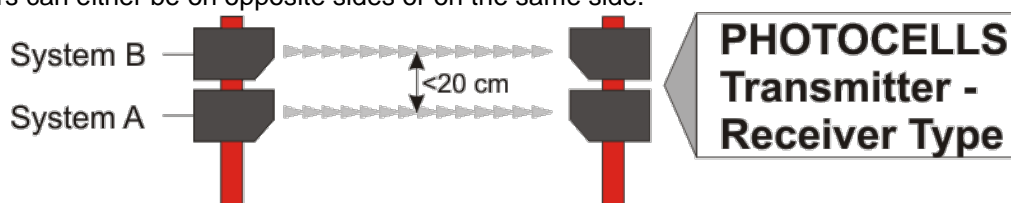
1. Reflector Type:



The reflector-type photocell has the transmitter and receiver electronics in the same case. A simple reflector on the opposite side of the finish line is used to reflect the photocell beam back to the main unit. For System A and B the reflectors should be on the same side.

2. Transmitter-Receiver Types:

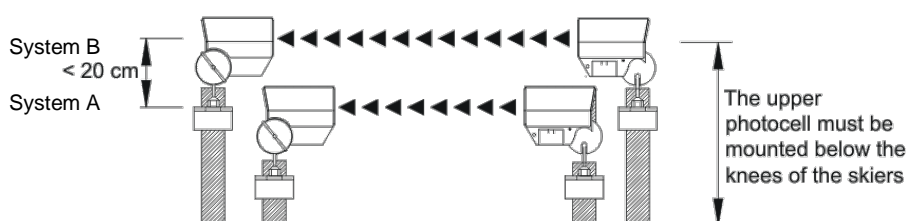
In this case the transmitter is on one side of the finish, and the receiver is on the other side. For System A and B transmitters can either be on opposite sides or on the same side.



Photocells for the Finish:

It is necessary to have two independent sets of photocells for the finish, one connected to Timing System A and one for Timing System B. The cells must be mounted so that both beams are triggered at a height that is lower than the knee of competitors at the finish. It is recommended that the lowermost photocell be connected to Timing System A.

The photocells must be set up parallel to the finish on top of each other. Either the same post or two separate posts for both photocells can be used. The maximum vertical separation of the beams may not exceed 20 cm (8"), and in all cases should be less than that if possible.



For the Transmitter-Receiver Type the transmitters of the photocell can be either on the same side or opposite side (see manufacturer specifications). The beams may be installed in a crossed configuration but in all cases the 20cm maximum vertical separation must be observed.

Photocells at the Start:

For the qualification of Cross and Moguls competitions photocells are used at the start. For level 2 or higher a direct wire connection to the finish is not necessary, but in this case each photocell that has no direct wire connection to the finish needs a separate timing device connected to the photocell at the start.

Photocells at the Finish:

The photocells must be connected to the timing devices by fixed cable. No radio transmission of photocell signals to the timers is allowed for the finish photocells.

Photocells for Intermediate Time: There is no requirement to have a backup (System B) photocell for the intermediate time.

If you use photocells install them in close co-ordination with the Technical Delegate and/or the Competition Jury.

To avoid the photocells (if used) being triggered by anyone other than the competitors, it is recommended that the person responsible for that intermediate timing point use a push-button to arm the photo cells only when a competitor crosses the line.

Technical Specifications for the Photocell

The technical concept of the photocell is not restricted by FIS, although it must be assured that the photocell cannot be influenced by any other light, camera flash/strobes, radio waves (EMI) or mobile reflectors for photocells of reflector type.

The photocell must meet the standards for electronic devices in the country that it is sold.

Accuracy:

Sensing Time - The time delay from the instant the photocell is triggered to moment an output impulse is generated may not exceed 0.005 sec.

Repeatability (Random Jitter) - The delay of impulses must be constant, the range must be less than 5/10.000 sec. This range is measured in a "peak-to-peak" manner, minimum to maximum extremes, it is not averaged.

Operating Distance:

The photocell must work over a minimal distance of 20 m. The maximum size of the reflector (if used) is 100 mm (in all directions).

Triggering Object:

An 8 mm object moving with a speed of 10 km/h is not allowed to trigger the photocell (measured at a distance of 2 m from lens of the receiver).

A 100 mm object moving with a speed of 200 km/h must trigger the photocell (measured at a distance of 2 m from lens of the receiver).

The object must be a black cylinder.

Temperature Range:

-20 to +60°C (for colder weather you should prepare a cover so the photocell will still work).

Power Supply:

If the photocell is supplied power from the timing device (within the same cable as the impulses) it needs no external power supply.

If a battery is used as the power supply (external or internal) the Photocell must work for four (4) hours at -20°C.

Reflector:

max. size is 10 cm (diagonal)

For homologation of photocells:

When sending photocells to FIS for homologation, the photocell needs an input contact to switch the photocell transmitter off, in order to make precise tests.

Photofinish Systems

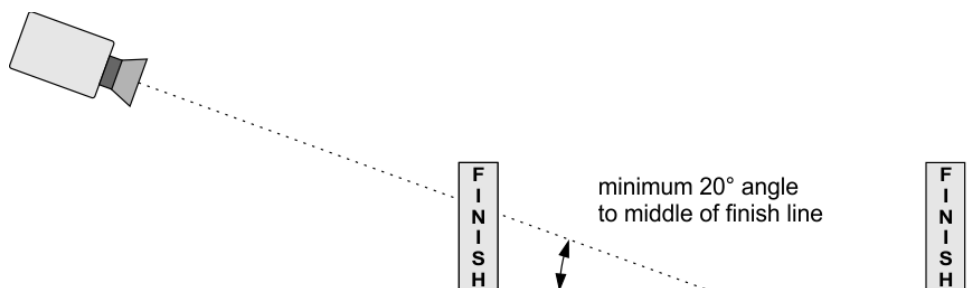
A photofinish system can be used to determine a competitor's finish time.

In the case of a failure of System A and System B, and where the competitors finish has been recorded by the photofinish system, this finish time must be used in the place of hand timing using a correction factor. The correction factor should be the difference between the time taken by the photofinish system and the electronic times of the 3 competitors before the missed time. The sum of the 3 time differences is divided by 3 which must be applied to the photofinish time of the competitor without an electronic time.

The photofinish time is taken when any part of the competitor's body crosses the finish line. The photofinish result is only to be provided to the jury.

For night races using a photofinish a light with min. 2000 Lux is necessary. If possible, the light should be without bright and dark phases. LED light is recommended.

The angle of the photo finish camera must have a minimum of 20° to the middle of the finish line.



All photofinish systems must meet the following criteria for use in FIS Freestyle competitions:

Timer:	The timer must be able to operate in Time-of-Day mode and be synchronized with all timing devices.
Operation Temperature:	The photofinish camera must operate (once it is started) at ambient temperatures from -10° to +60°C.
Measuring Range:	Time of day mode must be possible in hours, minutes, seconds and 1/1000, or better.
Timer Precision:	Must measure up to 1/10000 second in time of day mode. Timer accuracy must be below +/- 10 PPM) at a device temperature from -10° to +60°C.
Quartz:	Ageing of the quartz must be below +/- 3 PPM per year. With adjusted quartz frequency the time drift must be below +/-0.5 PPM at 23°C.
Impulse Triggering:	The delay of impulses is not allowed to be higher than 1/1000 sec. for the same channel (the channel is triggered from a reference impulse device in minute intervals). The delay of impulses must be constant; the range must be less than 1/10000 sec.
Timing Channels:	The timing device needs a minimum of one timing channel for time of day synchronisation.
Synchronisation:	It must be possible to synchronize the timing device with other timing devices.
Image Production:	The photofinish system must scan the finish line at a minimum of 2000 scans per second and show images sequentially and show scanned finish line images in sequential order on a monitor screen and store it on a memory device.
Image Evaluation:	The photofinish system must be capable of showing the time of day for each line scan image.
Power Supply:	Backup power supply must be granted for a minimum of 20 minutes (e.g. internal battery or external UPS).
Electromagnetic:	The timing device must meet the standards of IEC (International Electronic Commission). This means the timing device must function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

Homologation of Timing Equipment

Manufacturers wishing to have their timing devices, startgate, photocells or photofinish system homologated for use in FIS competitions must send a request to the Timing Working Group through FIS office which will instruct the manufacturer to provide all technical information indicated above. Software for photofinish systems are not part of the homologation. The costs of homologation have to be paid by the manufacturer.

If a manufacturer homologates prototypes FIS will not consider it for homologation. Only final versions of a device (as it is sold in public) will be homologated by FIS.

Attention:

All temperatures for the specification of timing equipment are given with a tolerance of +/-1°C.



Conclusion

We hereby wish to thank all members of the "FIS Timing Working Group" who have always used every endeavor to realize this "FIS GUIDE" for their Technical Delegates and event organizers. Our progress since 1996 reflects the balance between accepting new technologies and ensuring the correct evaluation of human performance through fundamental timekeeping concepts.

We wish to acknowledge the major contributions of participating manufacturers, FIS professionals and volunteers from our many member National Associations and competition organizers who give so much of their time and expertise without which it would be impossible to generate such a document or perspective.

FIS is pleased to support such a unique group in the world of timekeeping regulation and notices the absence of similar structures in many other high-performance sports that rely so heavily on timing technology for fair and impartial judgement.

We are fully aware that there are still some imperfections in these rules and descriptions and would welcome any constructive proposal as the works proceed. This document will be continually revised to improve the knowledge of FIS community for the benefit of all Freestyle Skiing competitions.

Please contact us with your suggestions and comments:

Daniel Defago (FIS)
Ulf Seehase (FIS)
Maria Martin Civiac (FIS)
Raphaël Blanchard (SUI)
Ted Savage (CAN)
Albert Vetter (AUT)
Frederico Gori (ITA)
Tommy Jauhojärvi

defago@fisski.com
seehase@fisski.com
martinciviac@fisski.com
Raphael.Blanchard@swisstiming.com
tsavage@precisiontiming.com
albert@alge-timing.com
fgori@microgate.it
tommy@emit.no

FIS Timing Working Group

TIMING-BOOKLET

Freestyle Skiing

Version 1.03
September 2018