



**TECHNICAL STANDARDS
FOR
PROGRESSIVES
(SINGAPORE)**

Version 1.5

With effect from 31 March 2017

Total number of pages: 17 (inclusive of cover page)

IMPORTANT

No part of this document shall be reproduced, in any form or by means, without permission in writing from the Casino Regulatory Authority of Singapore (the “**Authority**”).

This document is statutorily issued to specific recipient(s) only (“**Intended Recipient(s)**”). Any other person to whom this document has not been statutorily issued shall be deemed to be a non-intended recipient (“**Non-Intended Recipient**”).

The Authority may make this document or its contents available to Non-Intended Recipients by publishing them on its website or by any other means for general information purposes only. The publication of this document or its contents on the Authority’s website or by any other means does not constitute statutory issuance thereof to any person. Non-Intended Recipients may not rely on this document. The Authority makes no warranty or representation whatsoever with regard to the information in this document to any Non-Intended Recipient. The Authority assumes no responsibility or liability for any consequences (financial or otherwise) suffered directly or indirectly by Non-Intended Recipients who enter into any commercial activities upon reliance on any information in this document.

This document is subject to change from time to time to adapt to the continual development and evolution of the gaming industry in Singapore. The Authority reserves the right to change its policies and to amend, modify or supplement any information in this document.

This document does not in any way bind the Authority to grant any approval for or exemption from any matter for which approval is required under any written law in Singapore.

This document shall not affect any regulatory requirements of any other competent authority in Singapore.

Persons who may be in doubt about how the information in this document may affect them or their commercial activities are advised to seek independent legal advice or any other professional advice they may deem appropriate.

TABLE OF CONTENTS

PREFACE	4
1. INTRODUCTION	6
1.1 Purpose.....	6
1.2 Scope	6
1.3 Terminology	6
1.4 Definition of Terms	7
1.5 Testing	8
1.6 Consistency of Interpretation	8
2. PROGRESSIVE DISPLAY	9
3. PROGRESSIVE CONTROLLER	10
3.1 Physical Access	10
3.2 Critical Memory	10
3.3 Parameters and Meters	10
3.4 Monitoring of Credits Bet.....	11
3.5 Accounting	11
3.6 Random Number Generator (RNG)	12
3.7 Progressive Jackpot Limit.....	12
3.8 Error Conditions	12
3.9 Program Interruption and Resumption.....	12
3.10 Independent Software Verification	13
3.11 Internal Link Progressives	13
3.12 Events Logging	13
4. PROGRESSIVE GROUP	15
4.2 During a Progressive Win.....	15
4.3 Progressive Shutdown	16
4.4 Master/Slave Controllers	16
5. COMMUNICATIONS	17
5.1 Between Progressive Controller and Electronic Gaming Machines.....	17
5.2 Between Progressive Controller and Progressive Display.....	17

Preface

The purpose of this document is to establish the requirements for the design and operation of progressives within the jurisdiction of Singapore and to guide testing and certification bodies on the areas for technical compliance for the progressives.

A progressive is a jackpot system that has a jackpot pool, generally based on a function of credits or some other metrics. This includes games that award a progressive jackpot or a ‘pool’ based on criteria other than obtaining winning symbols on the machine, such as ‘Mystery Jackpot’.

A standalone progressive consists of a single gaming machine that offers a progressive jackpot pool that can only be triggered solely by the same gaming machine. A linked progressive consists of two or more gaming machines that together offer a progressive jackpot pool that can only be triggered by gaming machines contributing to the progressive jackpot pool.

The intent of this document is to ensure that gaming on progressives occur in a manner that is:-

- a. Honest;
- b. Secure;
- c. Reliable; and
- d. Auditable.

It is not the intent of this document to:-

- a. Mandate a single solution or method to realise an objective;
- b. Limit technology application to gaming equipment;
- c. Limit creativity and variety of choice;
- d. Preclude research and development into new technologies equipment or innovative ideas.

As far as possible, this document specifies what the minimum technical requirements for progressives are; instead of how the requirements should be met, nor tries to mandate a particular solution or method as the means to realise the requirements.

The Casino Regulatory Authority of Singapore (the “Authority”) is the regulatory authority that supervises and regulates the activities of casinos in Singapore. Casino operators are required to be licensed by law and must ensure that their progressives deployed on the casino floor comply with these technical standards.

These technical standards are supplementary to and are not intended to derogate from any provisions in the Casino Control Act (Cap. 33A) and its subsidiary legislations. In the event of any inconsistency, the provisions in the Casino Control Act (Cap. 33A) and its subsidiary legislations shall apply.

Technical Standards for Progressives (Singapore)

These technical standards are subject to on-going review, and where necessary or deemed appropriate, the Authority reserves the right to unilaterally amend or re-issue this document without notice.

Comments on this document can be forwarded to:-

Casino Regulatory Authority of Singapore
Gaming Technology Division
460 Alexandra Road, #12-01
Singapore 119963
Website: <http://www.cra.gov.sg>

1. INTRODUCTION

1.1 Purpose

1.1.1 The purpose of this document is to:-

- a. Create a set of technical standards that would ensure that the operation of progressives in Casinos under Singapore's jurisdiction are secure, reliable, auditable and operated appropriately;
- b. Eliminate subjective criteria in assessing and certifying progressive operation;
- c. Construct a set of technical standards that is technology neutral wherever feasible; and
- d. Construct a set of technical standards that does not specify or approve any particular method or algorithm. The intent being to allow a wide range of methods to be used to conform to the standards as long as the methods are secure, reliable and consistent with the technology best practices of the day.

1.2 Scope

1.2.1 The scope of this set of technical standards covers the minimum standards and security safeguards required in the operation of the progressives so that security, reliability and integrity of the equipment are achieved.

1.2.2 This set of technical standards does not cover requirements that are not related to gaming (such as health and safety).

1.2.3 This set of technical standards applies to progressives used in Electronic Gaming Machines and Electronic Table Games. It does not apply to progressives used in conjunction with non-electronic table games.

1.3 Terminology

1.3.1 The following terminology used in this document is to be interpreted as follows:-

- a. Shall: The guideline defined is a mandatory requirement, and therefore must be complied with;
- b. Should: The guideline defined is a recommended requirement. Non-compliance shall be documented and approved by the management. Where appropriate, compensating controls shall be implemented; and
- c. May: The guideline defined is an optional requirement. The implementation of this guideline is determined by the operator's environmental requirements.

Technical Standards for Progressives (Singapore)

1.4 Definition of Terms

Authority / CRA	The Casino Regulatory Authority of Singapore
Critical Memory	Memory locations storing information that is considered vital for the continued proper operation of the progressive.
Meter	A non-volatile variable, storing audit and other information.
Mystery Jackpot	A mystery jackpot is one where a prize is awarded based on the criteria other than obtaining winning symbols on the gaming machine.
Progressive Controller	A progressive controller communicates with each gaming machine participating in the jackpot and is responsible for implementing all the logic associated with the jackpot calculation and relaying the information to the progressive display.
Progressive Display	One or more progressive gaming machine(s) may be linked, directly or indirectly, to a mechanical, electrical or electronic device that reflects the progression of the jackpot pool. This device is the progressive display.
Progressive Group	<p>A progressive group accepts bets, gives a corresponding chance of winning the progressive prize and then awards when the prize is won.</p> <p>All progressive groups are made up of at least one of each of the following components:-</p> <ul style="list-style-type: none">▪ Progressive gaming machine;▪ Progressive controller; and▪ Progressive display. <p>Each component of a progressive group is not necessarily a discrete device.</p> <p>It is possible for separate progressive groups to connect to a single progressive controller when the controller is configured to manage multiple progressive jackpot pools.</p>
Progressive Jackpot Amount/Prize	Incremental value that increases by the accumulation of contributions from the turnover of the game, from a preset base value. It is reset to a new value (generally a base value plus possible overflow amounts) when the progressive prize is won.
Progressive Level	Each prize that can be won as a result of playing the jackpot system is a progressive level. For example, a jackpot system may comprise four progressive levels – the Mega, Major, Minor and Mini levels.
Random Number Generator (RNG)	Hardware, software or combination device for generating number values that exhibit characteristics of randomness.

Technical Standards for Progressives (Singapore)

1.5 Testing

- 1.5.1 Testing of progressive gaming machines by Approved Test Service Providers (ATSPs) shall be aimed at determining compliance with the technical requirements provided in this document. Areas of non-compliance shall be reported in the test/certification report. Where, in the opinion of the ATSP, the technical requirements spelt out in this document are insufficient, inappropriate or not pertinent to the design and operation of progressives, the ATSP shall seek direction and further clarification from the Authority before proceeding to testing/certification.
- 1.5.2 This set of Technical Standards for Progressives should be read in conjunction with the Technical Standards for Electronic Gaming Machines (Singapore). All standards applying to electronic gaming machines also apply to progressive gaming machines.

1.6 Consistency of Interpretation

- 1.6.1 Casino Regulatory Authority of Singapore (CRA) recognises that the technical standards may be subject to different interpretations by gaming machine manufacturers, casino operators and ATSPs. As such, any feedback where different interpretations may be applied to the technical standards provided in this document should be directed to the Authority for clarification when it arises.

2. PROGRESSIVE DISPLAY

This section describes the minimum requirements on the progressive display to ensure accurate and non-misleading representation of the actual jackpot amount.

- 2.1 The progressive display shall be able to inform all players contributing to the progressive jackpot of the progressive game.
- 2.2 The progressive display of the current amount of jackpot(s) shall be updated accurately and as often as possible so as to reasonably reflect the current size of the prize pool.
- 2.3 If the necessary progressive information cannot be intuitively conveyed to the players through the progressive display, the gameplay on the affected gaming machines shall be discontinued.
- 2.4 Intentionally left blank.
- 2.5 When a progressive jackpot prize is awarded, the progressive display and winning machine shall accurately, and without undue delay, display to the player:-
 - a. The progressive jackpot prize won; and
 - b. An indication of the progressive level awarded if applicable.

3. PROGRESSIVE CONTROLLER

This section describes the hardware and software requirements on the controller so that the controller functions as intended and is honest and reliable to the player.

3.1 Physical Access

- 3.1.1 Each progressive controller used with a progressive gaming machine shall be housed in a secure environment allowing only authorised accessibility.
- 3.1.2 Intentionally left blank

3.2 Critical Memory

- 3.2.1 The following requirements shall be met for critical memory in progressive controllers:-
 - a. Critical memory data storage shall be capable of reliably preserving its memory contents for at least thirty (30) days with the mains power switched off. A rechargeable or non-rechargeable backup power source may be used to meet this requirement;
 - b. A proven and reliable mechanism shall be implemented to check for any corruption of critical memory locations; and
 - c. In a RAM clear, the controller shall execute a routine, which sets each and every bit in critical memory to the default state. For partial clearing of the critical memory, the methodology shall be highly accurate and shall validate the un-cleared portions of critical memory.

3.3 Parameters and Meters

- 3.3.1 All progressive controller parameters and meters shall be stored in critical memory.
- 3.3.2 The progressive controller shall display at minimum upon request the following parameters and meters for each progressive group.

Parameter Name	Definition
Gaming Machine Identification Number	Identification number of each progressive gaming machine as recognised by the progressive controller
Base	Starting value for each progressive level
Limit	Progressive jackpot amount limit value
Increment	Percentage increment rate for each progressive level

Technical Standards for Progressives (Singapore)

Meter Name	Definition
Current Value	Current amount of progressive jackpot pool for each progressive level
Startout Value	Amount the progressive resets to after the progressive is won for each progressive level
Hits	Number of progressive jackpots won for each progressive level
Wins	Total value of progressive jackpot wins for each progressive level

3.3.3 If the progressive controller is capable of configuring additional pools and/or increments, all parameters pertaining to these shall similarly be stored in the critical memory and displayed upon request.

3.3.4 In addition, there shall be a meter tracking the value of each hidden pool and any other pools in use and these meters shall similarly be stored in the critical memory and displayed upon request.

Parameter Modifications

3.3.5 While a progressive group is on live mode, no parameter changes shall take place.

Hidden Progressives Pools

3.3.6 All amounts in the hidden pools shall be returned to players.

Progressive Jackpot Amount Modifications

3.3.7 While a progressive group is on live mode, no modifications to the Progressive Jackpot Amount (i.e. Current Value) shall take place.

3.4 Monitoring of Credits Bet

3.4.1 The progressive controller shall continuously monitor each gaming machine in the group for credits bet, or any other manner by which the progressive increments, and update all meters timely and accurately.

3.5 Accounting

3.5.1 Progressive controllers may be connected to a database server that enables accounting data to be extracted as reports.

Technical Standards for Progressives (Singapore)

3.6 Random Number Generator (RNG)

- 3.6.1 Any Random Number Generator used shall meet the requirements stipulated in Section 3.4 of the “Technical Standards for Electronic Gaming Machines”.
- 3.6.2 The “random triggering value” for a mystery progressive shall be reselected when modifying any jackpot pool values or parameters that could result in an immediate trigger due to the modification. Additionally, the “random triggering value” selected shall not result in a trigger without any contribution after the modification.

3.7 Progressive Jackpot Limit

- 3.7.1 The progressive controller shall have the capability to be configured with a limit on each progressive jackpot prize offered.

3.8 Error Conditions

- 3.8.1 When a progressive controller error occurs, an appropriate error message and the current progressive jackpot prize pool shall be made visible to all players affected by the error, or shall alert the casino to the error condition.
- 3.8.2 If any of the following events occur, the progressive controller shall convey the appropriate signal to disable all the gaming machines in the progressive group, and an error shall be displayed on the progressive display and all the gaming machines in the group:-
 - a. When a progressive controller checksum or signature has failure;
 - b. When a progressive controller’s critical memory or PSD (program storage device) mismatch or failure occurs;
 - c. When the progressive configuration is lost or not set; or
 - d. If the game meters are validated against the progressive controller’s meters (via communications between the gaming machine game board and controller) and they do not reconcile.
- 3.8.3 If there has been an unreasonable amount of credits bet, the progressive controller shall ignore the invalid data, convey the appropriate signal to disable the affected game(s) using the progressive. The disabled gaming machines in the group shall display an error message. An unreasonable amount of credits bet is defined by the progressive set up based on the number of bets and number of machines.

3.9 Program Interruption and Resumption

- 3.9.1 After a program interruption (e.g., power down), the software shall be able to recover to the state it was in immediately prior to the interruption occurring.
- 3.9.2 On program resumption, the following procedures shall be performed at the minimum:-

Technical Standards for Progressives (Singapore)

- a. Any communications to an external device shall not begin until the program resumption routine, including self-tests, is completed successfully;
- b. Progressive system control programs shall test themselves for possible corruption due to failure of the program storage media using a robust and proven mechanism; and
- c. The integrity of all critical memory shall be checked.

3.9.3 Intentionally left blank.

3.10 Independent Software Verification

3.10.1 The progressive controller software used within a linked progressive group shall allow for an independent integrity check of the control program from an outside source. This may be accomplished by the medium being able to be removed and authenticated by an external device, or having an interface port for an external device to authenticate the media. This integrity check mechanism shall provide the means for field testing of the controller software for identification and validation purposes.

3.11 Internal Link Progressives

- 3.11.1 For link progressives where the progressive controller is part of the game software (internal link), all games on the link shall conform to the following criteria:-
- a. Each game on the link shall be uniquely identified;
 - b. Only one game on the link shall function as the master progressive controller;
 - c. If the game configured as the master controller becomes inoperative, all games on the link shall disable; and
 - d. If any game on the link loses communication with the master controller, the game shall disable.

3.12 Events Logging

- 3.12.1 The progressive controller shall log minimally the following events (including date and time for each event):
- a. Progressive jackpot prize won (including gaming machine ID, progressive level and amount won);
 - b. Power reset;
 - c. Security cage open;
 - d. Parameter modified;
 - e. Progressive jackpot amount modified;
 - f. Communication failure; and

Technical Standards for Progressives (Singapore)

- g. Progressive controller errors.
- 3.12.2 The progressive controller shall allow viewing and extraction of minimally the most recent 200 events.

4. PROGRESSIVE GROUP

This section describes requirements that apply to the progressive group as a whole so that all progressives would operate in an honest, secure, auditable and reliable manner.

- 4.1 The implementation and triggering of mystery jackpots shall conform to the documentation of the mystery jackpots that were submitted to the ATSPs.

4.2 During a Progressive Win

Progressive Controller

- 4.2.1 The progressive controller shall be able to send to the winning electronic gaming machine the amount that was won for metering purposes.

Progressive Display

- 4.2.2 When a progressive jackpot win is recorded on a gaming machine, which is attached to the progressive controller, the progressive controller shall allow for the following to occur on the progressive display:-
- a. Display of the winning prize¹ and a visible notification to inform the player(s) who won the jackpot; and
 - b. Display of the new progressive prize that are current on the link after a reset of the progressive jackpot.

Winning Electronic Gaming Machine

- 4.2.3 When a progressive jackpot prize has been awarded, the winning gaming machine shall perform the following:-
- a. The winning prize shall be accurately displayed;
 - b. Unless the progressive jackpot award is transferred to player's credit meter (see Section 3.2.12 of the "Technical Standards for Electronic Gaming Machines"), the game software and the machine shall lock-up entirely and require intervention by an attendant; and
 - c. All progressive related meters shall be updated to reflect the winning progressive jackpot amount consistent with the requirements in Section 3.2 of the "Technical Standards for Electronic Gaming Machines".
- 4.2.4 In the case of a player winning a Mystery Jackpot, there shall be an audible and visible notification to the player.

¹ Prize refers to tangible award or monetary award or both, whichever applicable.

Technical Standards for Progressives (Singapore)

Reset of Progressive Jackpot Amount

- 4.2.5 The progressive controller shall have the ability to reset the current progressive jackpot amount to the Startout Value with the addition of any applicable amount from hidden pool(s) (if applicable) after a progressive jackpot prize has been awarded.
- 4.2.6 If the reset of the progressive jackpot amount is manual, then the method of reset shall conform to the Internal Controls procedures of the operators.
- 4.2.7 If the reset of the progressive jackpot amount is automatic, then all the gaming machines on the link shall continue normal play after the reset.

4.3 Progressive Shutdown

- 4.3.1 There are instances in this specification where it is indicated that the progressive group could be “shutdown”. A progressive shutdown requires the following action:-
 - a. Clear indication shall be given to players that the progressive group is not operating;
 - b. It shall not be possible for the progressive jackpot to be won while in the shutdown state; and
 - c. Activation of the progressive group from the shutdown state shall return the group with the identical parameters including progressive jackpot value, and hidden win amount for mystery jackpots, as before the shutdown.

4.4 Master/Slave Controllers

- 4.4.1 The progressive controller may have the capability to act as a “Master Controller”, and employs “Slave Controllers” to control a progressive jackpot group. If such situation arises, the following requirements apply:-
 - a. Communication between masters and slaves shall meet all of the communication requirements as for gaming machines and progressive controllers; and
 - b. Internal clocks of all controllers shall not deviate from the slot management system for more than sixty (60) seconds.

5. COMMUNICATIONS

This section is intended to ensure that communications within a progressive group are secure so as to prevent unauthorised access or modification of communicated data as well as to ensure that all related transactions are accurate and free from error.

5.1 Between Progressive Controller and Electronic Gaming Machines

- 5.1.1 There shall be a secure, two-way communication protocol between the main game processor board on the gaming machines and the progressive controller.
- 5.1.2 Upon triggering of the progressive jackpot, the winning electronic gaming machine shall inform the controller that a win is triggered. This clause does not apply to mystery jackpots.
- 5.1.3 The progressive controller shall continuously update all electronic gaming machines in the group the current progressive jackpot prize pool.

Communication Failure

- 5.1.4 If there is communication failure between the game and the progressive controller, the affected gaming machine shall be disabled and an error shall be displayed on the affected gaming machine.

5.2 Between Progressive Controller and Progressive Display

- 5.2.1 The progressive controller shall continuously update the progressive display as play on the link is continued. This communication protocol shall be secured.