Generation 3 Controller
Advanced Programming Guide

April 6, 2021

v1.0.6

TLE Mitigation

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G3 Advanced Programming Guide

Part Number(s): 28C0030(G3), 28C0061(RCM), 29C0052(RS485)

If you READ nothing else, read this...

- Prior to installing an INMOTION G3 system verify the mechanical installation is 100% operational.
    - All panels move smoothly, without excessive force required at all points across the span
    - The frame is square & plumb, and the lead panel meets the jam evenly top to bottom.
    - All required weather stripping is installed properly and not binding during panel movement.
    - Panels are NOT warped, and panel pickups release and operate smoothly without issues.
    - Interlocks engage and disengage properly without dragging extra panels etc.
    - In a nutshell the door should be at its mechanical "best" before automation is installed
- NEVER leave a door running on a Cycle Test unattended…even for a minute, unless it is in a controlled environment completely void of people and pets.
- DO NOT experiment with commands you find in this guide unless you know what you are doing or have been directed to do so by a trained factory representative.
- Remember the G3 has been certified by UL to be safe, but that only applies if it has been installed safely by the installer.
- If you have any question or concerns, please consult the factory.
- Remember INMOTION offers free training, year-round, all you have to do is ask.

About this Guide...

This guide documents the more advanced options and features of the G3 Controller by INMOTION. It covers the G3 Controller with v0.7.0 or later firmware. This release added 4 "special feature" modes besides the "normal" mode present in the previous release. In addition, there is a cycle test option available to integrators and installers that can exercise the G3 while running any of the 5 supported modes for testing, option enabling or tuning.

When the G3 first boots, it is operating at the "user" level, and no password is required. In this mode, all commands to operate the door must come from wired or wireless accessories such as wall switches and remotes or from a home automation system wired into the wall switch circuit.

To access any of the advanced mode options, called modifiers, a password is required. The password entered will set the user level. The current user / password level can be checked at any time by entering the command "**pwd**" or "**p**" on the CLI. The current level will be displayed on the CLI.

In this guide each page will indicate what user level is required for the given command or function by the graphic shown. A checkmark next to the various levels indicate which user levels can call or modify the command or function documented.

Supported User Levels	
☑	User
☑	Installer
☑	Developer
☑	Factory

Installers have access to the User, Installer and Developer levels by entering the appropriate password. The difference between the Installer and Developer levels is that some commands change such that the Installer level will not accidentally erase critical door programming information causing more work than necessary. If an installer needs to access one these protected commands, they only need to change to the Developer level to perform the task. For general and advanced programming, the Installer password will work for 99% of the tasks required.

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CLI Password Access

Starting with the "Special Features" v0.7.0 firmware release, the G3 controller requires unique passwords for each controller. This is due a California law, as of Jan 1, 2020, requiring minimum security for IoT devices. To address this change, the G3 utilizes its unique serial number as part of the password. Once programmed at the factory, this new password scheme is activated. The previous release supported 2 password levels for access to the CLI. Those being "Installer" and "Developer" and they were the same for all G3's running v0.6.7 firmware. If you memorized those passwords, then the new password mechanism will not take too much effort.

The previous passwords for firmware v0.6.7 were:

User:	"**0**"	// Rarely used as it's the default at boot
Installer:	"**pwd1**"	
Developer:	"**IM1635**"	

The new passwords use the same characters as before but with different numbers at the end.

User:	"**0**"	// Did not change from v0.6.7
Installer:	"**pwdXXXX**"	// Replace the "XXXX" with the **last 4 digits** of the serial number
Developer:	"**IMXXXX**"	// Replace the "XXXX" with the **last 4 digits** of the serial number

Note: Entering an incorrect password, immediately puts the controller into "user" mode or minimum access.

As shown above adding the last 4 digits of the G3's serial number will allow the installer to determine the password and access the G3's CLI at the required user level. The serial number can be found on a sticker affixed to the back of the controller itself.

G3 LABEL

If for some reason the label is unreadable or missing, then the serial number must be obtained from the CLI using the "**ver**" or "**info**" commands. Both the password (**pwd**) and version (**ver**) commands are supported at boot (user level).
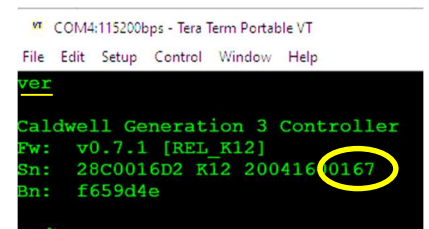
G3 VERSION COMMAND

After obtaining the serial number, the password can be entered in the CLI using the password command "**pwd**" or "**p**" for short.

Installer:	pwd **pwd0167**	// Installers should use this one
Developer:	pwd **IM0167**	// Only use if needed or when directed to do so by the factory

* Passwords will auto-expire after 30 minutes regardless of CLI activity. This timeout can be extended by issuing the "**pwd**" or its abbreviation "**p**" (just the command, no password needs to follow)

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Tech Brief – TLE Mitigation

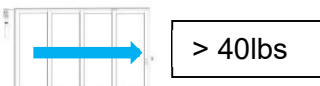| Supported User Levels	
☒	**User**
☑	**Installer**
☑	**Developer**
☑	**Factory**

"TLE" errors are caused by an overload condition placed on the controller due to a high friction condition with the door. The issue has been investigated by the factory and in nearly every case the pull load placed on the G3 system has exceeded 60lbs and in some cases 90lbs.

STATUS 1 2 3 PWR — v0.7.2 On Power Up ➡ v0.7.2 After 3s — v0.7.1 & Earlier

Quick Adjustment

<table>
<tr>
<td>1</td>
<td>Assumptions:
• G3 is programmed
• Panel pull >40lbs
• CLI indicates "TLE issues"
• Panel is fully CLOSED</td>
<td>

```
cmd>060.730: Enc: Motion start
061.436:*TLE Current Limit
068.440:*TLE Overtemp
068.726: Enc: Motion stop
```

> 40lbs

</td>
</tr>
<tr>
<td>2</td>
<td>Increase the Acceleration & Deceleration Parameter Values</td>
<td>

G3 Firmware v0.7.2

```
cmd>p IMxxxx     [password]
cmd>hfi 4
cmd>p IMxxxx     [password]
cmd>c vpmf 1     [optional]
cmd>c apmf 1     [recommended]
cmd>b a          [reprogram]
```

G3 Firmware v0.7.1 & earlier

```
cmd>p IMxx       [developer pw]
cmd>r 4          [wipe G3]
cmd>p IMxx       [developer pw]

cmd>c acco 15
cmd>c accc 15
cmd>c deco 15
cmd>c decc 15
cmd>c vpmf 1     [optional]
cmd>c apmf 1     [recommended]
cmd>b a          [reprogram]
```

*Optional "**vpmf = 1**" will increase the panel speed for mid-span pickups*
*Recommended "**apmf = 1**" prevents Accel/Decel increases by 5x for mid span pickups*

</td>
</tr>
<tr>
<td>3</td>
<td>Test the door by running the panel full OPEN to full CLOSE at least 3 times…

Watch for "TLE" messages on the CLI and STOP if they appear</td>
<td>

```
cmd>b open
cmd>b close    [repeat 3 times]

cmd>b open
cmd>b close

cmd>b open
cmd>b close
```

</td>
</tr>
<tr>
<td>4</td>
<td>Verify no "TLE" issues appear in the CLI during any of the previous test cycles</td>
<td>

G3 Firmware (v0.7.2 or later)

```
cmd>info     [check the info report]
```

```
Error Log:  Prog:0[TLE: T000 C0000]
            Unit:3[TLE: T003 C0009]
```

G3 Firmware (any version)

```
765.062: Enc: Motion start
779.506: Enc: Motion stop
. . .
782.062: Enc: Motion start
791.506: Enc: Motion stop
. . .
800.062: Enc: Motion start
806.506: Enc: Motion stop
```

</td>
</tr>
<tr>
<td>5</td>
<td colspan="2">If "TLE" issues continue to appear, consult the remainder of this document OR contact the automation support for additional information.</td>
</tr>
</table>

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TLE Mitigation Overview

The root cause of TLE over-current & over-temperature errors is a <u>friction overload in the mechanics of the door</u> while the door is programmed to ramp up to speed too quickly.

- If a G3 system is experiencing TLE errors, immediately <mark>STOP</mark> running the controller. Continued use of the controller in an overloaded configuration will damage the motor drive circuit.
- The motor controller chip has a fixed number of "*TLE over-temperature*" faults that it can handle before the chip is damaged and must be replaced. The limit is **100,** so if you suspect the door has had close to or more than 100 TLE over-temperature failures, it is likely the controller requires factory repair. This does not apply to <u>TLE over-currents</u>, only <u>TLE over-temperature</u> events.
- The new G3 firmware v0.7.2 counts both types of TLE errors so that damage can be assessed in the field. Firmware releases prior to v0.7.2 did not support TLE counts.
- Identify the source of the heavy load and correct if possible. The source of the friction load can be in the head/floor track, wheels, or weather strip. Also check the motor stack and return pulley for smooth operation. If the home was insulated with spray-in-foam, make sure the motor and return pulley have not been sprayed. <u>The door MUST work well as mechanically *before* it is automated.</u>
- If the door is mechanically sound and still exhibiting TLE errors, a change to the default move parameters may mitigate the issue. The change involves slowing the ramp times for both open and close to give the controller a chance to build up momentum and prevent the overload. This can be done using the CLI commands "**hfi**", "**acdc**", "**spl**", "**acco**", "**accc**", "**deco**", and "**decc**" depending on the firmware installed on the G3 controller. The latest version of firmware, v0.7.2 added the commands "**hfi**", "**spl**", and "**acdc**" specifically to help with TLE, but older firmware versions can also apply the same mitigation.

TLE Event Counts (Firmware v0.7.2 & later)

TLE error counts are tracked in two ways since the controller was last programmed and since it was manufactured. The manufactured or unit count will indicate the total number TLE over-temperature and TLE over-current faults. The "unit over-temperature" count is the one we need to stay below 100 before a repair is required. The other count, since last programmed, helps the installer determine if a particular adjustment was successful in preventing the accumulation of TLE errors.

TLE error counts are reported using the "info" command and will appear in the header under the title "**Error Log**".

The number of events "*since last programmed*" is labeled "**Prog**"
The number of events "*since manufactured*" is labeled "**Unit**"

On the right, over-temperature faults are prefixed with a "T", while over-current events have the prefix "C".

```
cmd>info

Gen3 Controller
---------------
Part Number:      28C0016
Serial Number:    28C0016D2 K12 1906170064
Firmware:         0.7.2
  Build Hash:     0a4dc1c
  Build Type:     REL_K12          TLE Counts
  Config Version: 2a8143cd
Max Current:      856mA
Programmed:       Yes
Error Log:        Prog:3[TLE: T002 C0006]
                  Unit:3[TLE: T003 C0008]
```

In the example shown, the controller has only had 3 over-temperature events since the unit was <u>manufactured</u> and 2 over-temperature events since it was <u>programmed</u>.

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Do not Ignore "Over-Current" Events

Over-current events always precede over-temperature events, so it is only a matter of time before the controller will start accumulating temperature events too, putting the controller at risk.

The goal is to identify TLE events, attempt to mitigate the issue then retest the door. If after several door cycles no CLI TLE messages appear, we can then wipe the controller, apply the fix and reprogram.

The configuration is wiped to restore everything back to factory defaults and make sure the friction profile is relearned to comply with the UL325 safety standard. Then we apply the fix, and finally reprogram. After the controller is reprogrammed, the TLE "Prog" count displayed in the "info" report is zeroed out allowing us to determine if the issue has been truly fixed or not. The "unit" count will remain unchanged.

```
Error Log:           Prog:0[TLE: T000 C0000]
                     Unit:3[TLE: T003 C0009]
```

The Mitigation Parameters

Firmware v0.7.2 and later:

The table below shows the settings to needed to mitigate various "high friction installations". The "hfi" command listed, which is only supported with G3 firmware **v0.7.2 or later**, will enable all the settings to the right. i.e. "c hfi 4" sets the open and close speed and all 4 acceleration/deceleration speeds listed in "hfi" row 4. The row "hfi 0" restores all 6 settings back to factory defaults.

The "hfi X" command performs the following operations in one step:

1. Performs a "factory reset" (**rst 4**) – Developer password required "p IMxxxx"
2. Sets Open/Close Speeds, Acceleration Open/Close Times, and Deceleration Open/Close Times (c **osp** X, c **csp** X, c **acco** Y, c **accc** Y, c **deco** Y, c **decc** Y) per the values in the table below.
3. After the controller reboots it must be reprogrammed.

Firmware v0.7.1 and earlier:

The fix can be enabled with firmware versions v0.7.1 and earlier with a bit more typing. For these firmware releases, each command must be sent individually. To apply the same mitigation using an older firmware:

1. Performs a "factory reset" (rst 4) – Developer password required "p IMxxxx"
2. Set the OPEN speed: "c **osp** X"
3. Set the CLOSE speed: "c **csp** X"
4. Set the OPEN acceleration time: "c **acco** Y"
5. Set the CLOSE acceleration time: "c **accc** Y"
6. Set the OPEN deceleration time: "c **deco** Y"
7. Set the CLOSE deceleration time: "c **decc** Y"

Supported by Firmware ➡	v0.7.2+	Supported by all firmware releases					
Relative Door "Pull"	**HFI** (c hfi X)	**OSP** (c osp X)	**CSP** (c csp X)	**ACCO** (c acco Y)	**ACCC** (c accc Y)	**DECO** (c deco Y)	**DECC** (c decc Y)
Normal < **40lbs**	0	4	4	2.5	2.5	3	3
Heavy > **40lbs**	1	6	6	12	12	12	12
	2	6	6	15	15	15	15
	3	5	5	15	15	15	15
	4	4.5	4.5	15	15	15	15
Very Heavy > **85lbs**	5	4	4	15	15	15	15

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Mitigation Example

The first step is to test the mitigation. For this, only a few commands are required regardless of the firmware version. Since the default door speed is usually between 4 and 6 inches / sec, firmware version dependent, those settings can be skipped for testing, and we only need to adjust the acceleration & deceleration parameters.

v0.7.2 Firmware and Later		v0.7.1 Firmware and Earlier

`cmd>p IMxxxx`
 	
`cmd>c acdc 15`
 	
(test the door for TLE's)
 	
`cmd>hfi 4`
 	
`cmd>p IMxxxx`
 	
`cmd>c apmf 1`
`cmd>c vpmf 1`
 	
`cmd>button auto (reprogram)`
 	
Operate the door for a few cycles & verify no TLE errors.
Done!
	Initial Test Using "HFI 4" Params
	Enter "developer" Password
	
	Set Acceleration & Deceleration
	
	And <u>check</u> the current OPEN & CLOSE speeds for reference:
	`cmd>c osp`
	`cmd>4.0000`
	`cmd>c csp`
	`cmd>4.0000`
	
	Test the Door Operation…
	If no TLE errors are observed
	
	Set the HFI level.
	(Factory RESET + Param changes)
	
	Enter "developer" Password
	
	RECOMMENDED: Allows increased speed during mid-span "partial moves" with HFI
	
	Reprogram the Controller
	
	Final Test
	
	Done
		`cmd>p IMxxxx`
		
		`cmd>c acco 15` (HFI 4)
		`cmd>c accc 15`
		`cmd>c deco 15`
		`cmd>c decc 15`
		
		(test the door for TLE's)
		
		`cmd>r 4` (factory RESET)
		`cmd>p IMxxxx`
		
		`cmd>c osp 4.5` (vals for HFI 4)
		`cmd>c csp 4.5`
		`cmd>c acco 15`
		`cmd>c accc 15`
		`cmd>c deco 15`
		`cmd>c decc 15`
		
		`cmd>c apmf 1`
		`cmd>c vpmf 1`
		
		`cmd>button auto` (reprogram)
		
		Operate the door for a few cycles & verify no TLE errors.
		Done!

`cmd>info`
. . .
 	
`Error Log: Prog:0[TLE: T000 C0000]`
`          Unit:3[TLE: T003 C0009]`
	While testing verify no "TLE" messages are displayed in "**Prog:**"
	OR
	Check the "info" report "Error Log"
		`cmd>b open`
		
		`384.760:*TLE Current Limit`
		`392.364:*TLE Overtemp`

	If TLE error are still observed during testing or Final Test… Try a higher "hfi" level by changing the open & close speed to 4 or 4.5 inches / second (HFI 5)	

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Document Revisions

Revision	Release Date	Description
1.0.0	Sep 22, 2020	Initial release
1.0.1	Oct 2, 2020	Fixed typos in "Soft Touch" Tuning
1.0.2	Nov 19, 2020	Added info on "hard current limit" vs "Soft Touch"
1.0.3	Mar 15, 2021	TLE update with firmware v0.7.2
1.0.4	Mar 22, 2021	Updated TLE Tech Brief
1.0.5	Mar 24, 2021	Fixed some typos & added a recommended command to the TLE docs
1.0.6	Apr 6, 2021	Adjusted command order in TLE Mitigation tech brief

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G3 Firmware Revisions

Revision	Release Date	Description
0.7.2 (latest)	Mar 11,2021	Maintenance release to address "TLE" over-current/temp issue. • "hfi" help command added for "TLE" issues • Help commands "avi", "maxc" and "acdc" added • Config command "spl" added • "c all reset" updated to preserve "spl" and "hfi" settings • "TLE" over-current/temps counts tracked in flash • G3 LED color code updated • Panel 1 mass increased to 50,000/100,00lbs (Oneway/Bipart)
0.7.1	Aug 28, 2020	Functionally identical to the v0.7.0 release. Updated 4 parameters to use new defaults. **Command** **v0.7.1 New Defaults** **v0.7.0 Defaults** osp 4.0000 IPS 4.5000 IPS csp 4.0000 IPS 4.5000 IPS fpce 470mA 430mA fpthr 10 counts 5 counts
0.7.0	Aug 21, 2020	"Special Features" release for G3 K12. G3 K02 is not supported. • Entertainment, Close Behind, Simplicity & Motion Assist modes • UL325 closing force reduced by 35% over v0.6.7 • Improved security, delayed mag brake, manual span adjust, etc • Integrated cycle testing • Profile bin resolution increased by 300%. • Cleaner CLI interface optimized for smart phone access
0.6.7 (K12) 0.5.91(K02)	Dec 3, 2019	Initial production release for G3 supporting basic door functions only using wired & wireless accessories. Processors K02 & K12 supported.

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