GE

Grid Solutions

G100 Firmware Release Notes

Firmware Release Notes

MIS-0115

Version 2.30 Revision 1

GE Information

imagination at work

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Contents

COPYRIGHT NOTICE 2

TRADEMARK NOTICES 2

About this Document 5

Purpose 5
Intended Audience 5
Additional Documentation 5
Product Support 5
GE Grid Solutions Web Site 5
GE Technical Support Library 5
Contact Technical Support 6

1. Version 2.20 (19-May-2021) 7

Software Versions 7
Predix Edge OS and Other Firmware Versions 7
Key Functions and Changes 7
1.1 Enhancements 8
1.2 Fixed Defects 8
1.3 Known Issues 8
1.3.1 Cyber Security 8
1.3.2 Clients 8
1.3.3 Servers 9
1.3.4 Automation 9
1.3.5 Configuration/Settings 10
1.3.6 HMI 10
1.3.7 Pass-through 10
1.3.8 System 10
1.3.9 Documentation 10
1.3.10 Hardware 11
Capability and Capacity 11
1.4 Standalone (non-redundant) 11
1.4.1 Performance Test Levels 11
1.4.2 Performance Test Results 12
1.4.3 HMI Response times 13
1.5 Redundancy 13
Time Sync Accuracy (IRIG-B/NTP) 13
Application List 13

2. Version 2.30 (29-July-2021) 16

Software Versions 16
Predix Edge OS and Other Firmware Versions 16
Key Functions and Changes 16
2.1 Enhancements 17
2.1.1 Cyber Security 17
2.1.2 Clients 17

2.1.3 Servers....17
2.1.4 Automation....18
2.1.5 Configuration/Settings....18
2.1.6 HMI....18
2.1.7 Pass-through....18
2.1.8 System....18
2.1.9 Documentation....18
2.1.10 Hardware....18
2.2 Fixed defects....18
2.2.1 Cyber Security....18
2.2.2 Clients....18
2.2.3 Servers....19
2.2.4 Automation....19
2.2.5 Configuration/Settings....19
2.2.6 HMI....19
2.2.7 Pass-through....19
2.2.8 System....19
2.2.9 Documentation....20
2.2.10 Hardware....20
2.3 Known Issues....20
2.3.1 Cyber Security....20
2.3.2 Clients....20
2.3.3 Servers....20
2.3.4 Automation....21
2.3.5 Configuration/Settings....21
2.3.6 HMI....22
2.3.7 Pass-through....22
2.3.8 System....22
2.3.9 Documentation....22
2.3.10 Hardware....22
Capability and Capacity....22
2.4 Standalone (non-redundant)....23
2.4.1 Performance Test Levels....23
2.4.2 Performance Test Results....24
2.4.3 HMI Response times....24
2.5 Redundancy....24
Time Sync Accuracy (IRIG-B/NTP)....24
Application List....25
MODIFICATION RECORD....27

About this Document

Purpose

The purpose of this document is to outline features, capabilities and issues known to exist within the G100 Substation Gateway at the time of release.

As part of the MCP Family of Gateway products, G100 applications are shared with the G500 product.

Intended Audience

This document is an external document intended for both GE Staff and Customers. It highlights the features and capabilities of the G100 firmware.

Additional Documentation

For further information about the G100, refer to the following documents:

- *G100 Quick Start Guide (SWM0116)*
- *G100 Substation Gateway Instruction Manual (994-0155)*
- *MCP Software Configuration Guide (SWM0101)*
- *Configuring UEFI Settings on G100 User Guide (SWM0122)*

Product Support

If you need help with any aspect of your GE Grid Solutions product, you can:

- Access the GE Grid Solutions Web site
- Search the GE Technical Support library
- Contact Technical Support

GE Grid Solutions Web Site

The GE Grid Solutions Web site provides fast access to technical information, such as manuals, release notes and knowledge base topics.

Visit us on the Web at: http://www.gegridsolutions.com

GE Technical Support Library

This site serves as a document repository for post-sales requests. To get access to the Technical Support Web site, go to: http://sc.ge.com/*SASTechSupport

Contact Technical Support

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1. Version 2.20 (19-May-2021)

Software Versions

The first release of the G100 product is based on, and has common features with G500 version 2.10, adapted to the smaller form factor platform.

The following defines the software versions required for interaction with the G100.

Package	Version	Notes
G100 Firmware	2.2.291	G100 Firmware Version.
DS Agile MCP Studio	2.3.0	Supported DS Agile MCP Studio Software.
G100 HMI Viewer	2.2.291	Supported G100 HMI 64-bit Software.

Predix Edge OS and Other Firmware Versions

The following defines the firmware versions supported for Predix Edge Linux OS and UEFI in the G100 v2.2.291.

Package/Firmware	Version	Notes
Predix Edge OS	2.5.0	Supported GE's Secured Linux Operating System Version.
UEFI	FLEBG100A00006T010	Supported UEFI Version of G100.

Key Functions and Changes

G100 is part of the Multi-Function Controller Platform (MCP) family, together with G500.

The main differences between G500 and G100 are in capability, capacity, redundancy and time synchronization methods.

G100 is designed to provide a reliable and accurate collection of data (metering, status, events and faults) from serial or LAN based intelligent substation devices to master applications such as SCADA, EMS, DMS or other enterprise applications. With its modern and robust cyber security features, the G100 is designed for smooth integration into NERC CIP and Cyber Security environments while consolidating functions such as ethernet communications, time synchronization, HMI and SCADA applications.

G100 supports the following key features as part of v2.20.

Advanced Gateway : G100 collects operational and non-operational data from substation protection, control, monitoring, RTU, and intelligent devices, pre-processes the data and moves it up to EMS and DMS SCADA systems providing centralized substation management.

Advanced Automation : G100 provides the computing platform necessary to automate substation procedures, such that intricate processes are carried out safely and efficiently by creating advanced custom automation programs using IEC 61131 compliant tools and perform basic math functions on data points using the built-in calculator tool.

Datalogging and Alarm Management : G100 supports logging of analog and binary events, including alarm management. Users have access to view and extract logged data via Runtime HMI corresponding screens (Trending, SOE, Historical Data, Active Alarms).

Automated Records (files) Retrieval and Management (ARRM)	:	G100 supports automated extraction of data files from IEDs, such as digital fault recording (DFR) records, event files, device information files, etc. Acquired files can be securely pushed automatically to remote systems.
Secure Passthrough Remote Access and VPN	:	G100 allows users to securely access substation devices from remote locations through validated interactive sessions hosted by the G500.
User Authentication	:	G100 provides Role Based Access Control (RBAC) with Local Account Authentication.
Runtime HMI	:	G100 provides user interaction with Role Based Access Control via a portable Runtime HMI application that runs in the Local unit KVM interface, as well as Remote in Windows based computers. There is no requirement to install Java/JRE on the Windows computers.
Support for Predix Edge Connectivity	:	G100 uses GE's Hardened *Predix EDGE* Operating System (Linux Yocto based) and supports secured connectivity for enrolling the unit into Predix Edge Manager. Predix Edge Manager is a GE hosted Cloud application that provides asset / fleet management of enrolled devices.

1.1 Enhancements

N/A - This G100 version is the first release of G100.

1.2 Fixed Defects

N/A - This G100 version is the first release of G100.

1.3 Known Issues

This G100 version inherits some known issues from G500 v2.10.

1.3.1 Cyber Security

Please refer to Product & Cyber Security Advisories on the GE Grid Solutions web site.

1.3.2 Clients

GE Internal Reference #	Description
D-12697	The value of GPIO Digital Point (DO) is always set to '1' even after completion of PULSE command in GPIO client. However, the functionality of DO command in GPIO client is working as per the control configuration i.e., PULSE ON period followed by PULSE OFF period, however the DO value in HMI still set as "1" only.
B-13475 D-09915	SEL Binary Client doesn't support Double Precision Scaling Factors.

GE Internal Reference #	Description
D-05002	ARRM file retrieval from SEL 1xx/2xx relays (using GENASCII) is not possible.

1.3.3 Servers

GE Internal Reference #	Description
D-12567	The time sync accuracy of G100 when IEC101 Server (Unbalanced/Balanced) is used as a time sync source is > +/- 4 msec.
B-11967	No support for events in NVRAM in IEC101/104 Server. Events that have not been yet transmitted to Master (Clients) are lost if G100 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.
B-11968	No support for events in NVRAM in DNP3 Server. Events that have not been yet transmitted to Master (Clients) are lost if G100 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.

1.3.4 Automation

GE Internal Reference #	Description
D-05033	Suppressed quality through Input Point Suppression (IPS) application is not reported to Masters. DNP3 and IEC 101-104 Servers send Online Quality rather than the substituted/last reported quality when points are suppressed.
D-12703	Load Shedding: There is no persistency of zone assignments across power restarts when user sets the zones through Analog Setpoint commands.
B-11969	DEM is responsible for handling alarms. Events/Alarms that have not been yet committed to the SQL database are lost if G500 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.
D-12702	The EVE/CEV file retrieval from SEL relays using either SEL Binary or GenASCII client connections are not working, when SEL relays are configured with virtual serial ports for communication.
DCSSUP-19948, D-12000	Restore the last value for variables configured in Logic Linx wizard does not work at runtime (defaults to 0 always).

1.3.5 Configuration/Settings

GE Internal Reference #	Description
D-10388	TACACS+ remote authentication can be enabled and activated even if the TACACS+ Server is not available in that moment. This will conduct to a device that can only be accessed using Emergency Access process, if TACACS+ server is not available.
D-10825	Online Editor / SNMP Agent Browser is not able to retrieve OID data if gathering data from target device takes more than 60 seconds. Workaround: configure the SNMP client offline, using OID from the end device (e.g., using a 3rd party MIB browser).

1.3.6 HMI

GE Internal Reference #	Description
B-14982	The product references in the Runtime (Local/Remote) HMI logs need to be changed as "MCP".
D-05463	If a used point group is deleted from the systemwide configuration then points belonging to that group are not visible in the point group summary. However, if user changes the point group allocation from the corresponding instantiated client map file(s) then points will be visible in the point group summary.

1.3.7 Pass-through

None

1.3.8 System

GE Internal Reference #	Description
B-14973	The software licensing application reports core license 012 as "G500 Core", it should be "MCP Core". There is no functional impact.
D-10227	Email does not send messages when an alarm is activated.
D-05714	Update of only Edge OS is not supported. If only Edge OS updates are required, the complete G100 firmware image needs to be updated.

1.3.9 Documentation

None

1.3.10 Hardware

None

Capability and Capacity

The G100 2.20 database and connectivity sizes are limited to a maximum of:

- Up to 24,000 total RTDB real data points (not counting pseudo points), originating from:
  - Up to 60 IEDs, and
  - Up to 60 D.20 IO modules
- Up to 4 concurrent Master connections
- Up to 2 Runtime HMI sessions

1.4 Standalone (non-redundant)

G100 2.20 provides the following performance capabilities in Standalone (non-redundant) Mode.

1.4.1 Performance Test Levels

The performance of G100 2.20 is tested under maximum configured system size using the activity levels and disturbance scenarios presented next.

Requirement	**Steady State** **Normal Loading**	**Avalanche** **Heavy Loading**
G100 Hardware (CPU / RAM)	2 core CPU / 8 GB RAM	2 core CPU / 8 GB RAM
Loading Signal changes (continuously/sec)	AI - 1200 DI – 12	All points changing twice in 2 secs
Number of IEDs connected to G100	60 DNP + 60 D.20 Peripherals [11 A cards, 30 C1 cards, 2 C2 cards, 14 S cards, 3 K cards]	60 DNP + 60 D.20 Peripherals [11 A cards, 30 C1 cards, 2 C2 cards, 14 S cards, 3 K cards]
G100 total RTDB Point count	24000	24000
Points / IED (400 total)	225 - AI, 125 - DI, 20 - DO, 20 - AO, 10 - ACC + D.20 points from 60 peripherals.	225 - AI, 125 - DI, 20 - DO, 20 - AO, 10 - ACC + D.20 points from 60 peripherals.
Total number of Servers & supported points in each Server	4 DI = 1875 i.e., = 125 * 60 /4	4 DI = 1875 i.e., = 125 * 60 /4

Requirement	Steady State Normal Loading	Avalanche Heavy Loading
	AI = 3375 i.e., = 225 * 60 /4 AO = 300 i.e., = 20 * 60 / 4 AO = 300 i.e., = 20 * 60 / 4 ACC = 150 i.e., = 10 * 60/ 4	AI = 3375 i.e., = 225 * 60 /4 AO = 300 i.e., = 20 * 60 / 4 AO = 300 i.e., = 20 * 60 / 4 ACC = 150 i.e., = 10 * 60/ 4
Remote G100 HMI connections	1 connection	1 connection
Local G100 HMI connections	1 connection (single monitor)	1 connection (single monitor)
Datalogger / Periodic reports	120 AI mapped / 12 reports	120 AI mapped / 12 reports
ARRM	5 sessions / IED	5 sessions / IED
Alarms	12 / sec	12 / sec (twice within 2 secs)

1.4.2 Performance Test Results

The standalone performance test results are presented below.

Table 1.1: Standalone Performance test results

Activity	Minimum	Median	Maximum
Loading Condition	Steady State Normal Loading		
CPU utilization – (%)	50	68	100
Average Memory Usage (GB)	1.151	1.225	1.316
Event latency (msecs)	161	502	2678
Control latency (msecs)	1	25	168

NOTE: Under steady state normal loading conditions, the control latency was measured by simulating one control every 5 seconds continuously from the Master station.

1.4.3 HMI Response times

G100 2.20 HMI response times under steady state normal loading conditions are presented below.

Table 1.2: User Interface Response Time – Steady State Normal Loading

Activity	Minimum (seconds)	Median (seconds)	Maximum (seconds)
Screen Access (Point Summary)	0.7	1.4	2
Screen Access (Comm Summary/Connections Page)	1	2.5	4
System Logs	0.6	2.5	5
Alarm ACK Delay (Single Alarm)	1	1.5	2
DI/AI Update to Point Summary Screen	1	1	1
Datalogger	1	1.6	3

1.5 Redundancy

G100 doesn't support system/device redundancy in release 2.20.

Time Sync Accuracy (IRIG-B/NTP)

G100 supports only software based IRIG-B TTL and software based NTP Time Sync.

Time accuracy with IRIG-B TTL input is typically +/- 1ms.

Application List

The following applications are available in this released firmware version.

Application	Support in Standalone
Runtime HMI	✓ Available
One Line Viewer	✓ Available
Config GUI / Schemas	✓ Available
System Library	✓ Available
C++ System Library	✓ Available
Connection Parser	✓ Available
Calculator	✓ Available
Hardware Asset Management Application (HAMA)	✓ Limited points availability (see MCP Software Configuration Guide SWM0101)
PTP Time Sync	× Not Available
IRIG-B/NTP Time Sync (Software based)	✓ Available

Application	Support in Standalone
D.20 Client	✓ Available
GPIO Client	✓ Available
Modbus Client	✓ Available
Modbus-TCP/SSH Client	✓ Available
SEL® Binary Client	✓ Available
Analog Data Logger	✓ Available
Generic ASCII Client	✓ Available
Modbus Server	✓ Available
DNP 3.0 Server	✓ Available
DNP 3.0 Client	✓ Available
Digital Event Manager	✓ Available
Database Server	✓ Available
DNP 3.0 TCP/IP Transport Layer	✓ Available
DNP 3.0 Server Serial Transport Layer	✓ Available
DNP 3.0 DIDO	✓ Available
IEC 60870-5-101/104 Server	✓ Available
IEC 60870-5-103 Client	✓ Available
IEC 61850 Client	✓ Available
IEC 60870-5-101/104 Client	✓ Available
Event Logger	✓ Available
Real-Time Database	✓ Available
LogicLinx IEC 61131-3 Soft Logic	✓ Available
Redundancy Manager	× Not Available (Only Standalone mode is available)
System Point Manager	✓ Available
Load Shedding and Curtailment	✓ Available
Control Lockout Manager	✓ Available
Software Watchdog	✓ Available
Configuration Manager	✓ Available
IP Changer	✓ Available
MD5SUM Builder	✓ Available
System Status Manager	✓ Available
Virtual Serial Ports	✓ Available
SNMP Client	✓ Available
Automated Record Retrieval Manager	✓ Available
Software Licensing Subsystem	✓ Available

Application	Support in Standalone
Third-party components	✓ Available
Terminal Services	✓ Available
mcpcfg utility	✓ Available
E-mail Utility	✓ Available
IO Traffic Monitor	✓ Available
Firewall	✓ Available
Edge OS & Drivers	✓ Available
Secure Enterprise Connectivity	✓ Available
Genconn	✓ Available
HMI Access Manager	✓ Available
Sync Service Library	✓ Available
Sync Server Application	✓ Available
Analog Report Generator	✓ Available
OpenVPN	✓ Available

2. Version 2.30 (29-July-2021)

Software Versions

The following defines the software versions required for interaction with the G100.

Package	Version	Notes
G100 Firmware	2.3.57	G100 Firmware Version.
DS Agile MCP Studio	2.4.0	Supported DS Agile MCP Studio Software.
G100 HMI Viewer	2.3.57	Supported G100 HMI 64-bit Software.

Predix Edge OS and Other Firmware Versions

The following defines the firmware versions supported for Predix Edge Linux OS and UEFI in the G100 v2.3.57.

Package/Firmware	Version	Notes
Predix Edge OS	2.5.0	Supported GE's Secured Linux Operating System Version.
UEFI	FLEBG100A00006V107	Supported UEFI Version of G100.

Key Functions and Changes

G100 v2.30 is a maintenance release after G100 v2.20.

The *Features*, *Capability and Capacity*, *Time Synchronization* and *Applications* list in v2.30 are similar as v2.20.

G100 is part of the Multi-Function Controller Platform (MCP) family, together with G500.

The main differences between G500 and G100 are in capability, capacity, redundancy and time synchronization methods.

G100 is designed to provide a reliable and accurate collection of data (metering, status, events and faults) from serial or LAN based intelligent substation devices to master applications such as SCADA, EMS, DMS or other enterprise applications. With its modern and robust cyber security features, the G100 is designed for smooth integration into NERC CIP and Cyber Security environments while consolidating functions such as ethernet communications, time synchronization, HMI and SCADA applications.

G100 supports the following key features as part of this version:

Advanced Gateway : G100 collects operational and non-operational data from substation protection, control, monitoring, RTU, and intelligent devices, pre-processes the data and moves it up to EMS and DMS SCADA systems providing centralized substation management.

Advanced Automation : G100 provides the computing platform necessary to automate substation procedures, such that intricate processes are carried out safely and efficiently by creating advanced custom automation programs using IEC 61131 compliant tools and perform basic math functions on data points using the built-in calculator tool.

Datalogging and Alarm Management : G100 supports logging of analog and binary events, including alarm management. Users have access to view and extract logged data via Runtime HMI corresponding screens (Trending, SOE, Historical Data, Active Alarms).

Automated Records (files) Retrieval and Management (ARRM)	:	G100 supports automated extraction of data files from IEDs, such as digital fault recording (DFR) records, event files, device information files, etc. Acquired files can be securely pushed automatically to remote systems.
Secure Passthrough Remote Access and VPN	:	G100 allows users to securely access substation devices from remote locations through validated interactive sessions hosted by the G500.
User Authentication	:	G100 provides Role Based Access Control (RBAC) with Local Account Authentication.
Runtime HMI	:	G100 provides user interaction with Role Based Access Control via a portable Runtime HMI application that runs in the Local unit KVM interface, as well as Remote in Windows based computers. There is no requirement to install Java/JRE on the Windows computers.
Support for Predix Edge Connectivity	:	G100 uses GE's Hardened *Predix EDGE* Operating System (Linux Yocto based) and supports secured connectivity for enrolling the unit into Predix Edge Manager. Predix Edge Manager is a GE hosted Cloud application that provides asset / fleet management of enrolled devices.

2.1 Enhancements

This G100 version adds the following new features compared to previous version:

2.1.1 Cyber Security

None.

2.1.2 Clients

None

2.1.3 Servers

GE Internal Reference #	Description
E-04347	Added support in DNP3 DPA to assign Analog/Digital Input event change notifications through Class 0.
E-04348	Enhanced the support in DNP3DPA for incrementing the sequence number when all the application layer retries are exhausted.
E-04349	Enhanced the support in DNP3DPA for reporting local IIN flag/bit when a digital output point goes offline.
E-04350	Enhanced the support in DNP3DPA for updating the retry value of unsolicited messages based on the value of the application layer retry count.
E-04351	Added support in DNP3 DPA to increase the RTS modem control pre-transmission delay from 400ms to 2000ms.
E-04352	Added support in DNP3DPA to read the DCD status while establishing the serial connections with the SCADA Master.
E-04353	Enhanced DNP3DPA to set the G100 clock only when all other clock sources (NTP/IRIG-B) are failed.

2.1.4 Automation

None

2.1.5 Configuration/Settings

None

2.1.6 HMI

None

2.1.7 Pass-through

None

2.1.8 System

GE Internal Reference #	Description
B-14606/ B-14700	Added support for IRIG-B Input quality in G100 through Hardware Asset Management Application (HAMA).

2.1.9 Documentation

None

2.1.10 Hardware

None

2.2 Fixed defects

This version of G100 has fixes for the following defects compared to previous version:

2.2.1 Cyber Security

Please refer to Product & Cyber Security Advisories on the GE Grid Solutions web site.

2.2.2 Clients

GE Internal Reference #	Description
D-12697	The value of Digital Output (DO) is always set to '1' even after completion of PULSE command in GPIO client.
D-12815	Local I/O analogue value and timestamp in GPIO client go to zero randomly.
D-12818	The analogue values on the local I/O GPIO client jumps to a value of -25 randomly.
D-12698	Removed unused Device Online DI pseudo point from GPIO client.

2.2.3 Servers

None

2.2.4 Automation

GE Internal Reference #	Description
D-12703	The zone assignments in Load Shedding DTA are not persisted across power restarts when user sets the zones through Analog Setpoint commands.
D-12702	The EVE/CEV file retrieval from SEL Binary/GenASCII client connections through ARRM is not working when SEL relays are configured with virtual serial ports for communication.
D-12828	The EVE/CVE file retrieval from GenASCII client through ARRM is not working when SEL 3x relay is configured with the physical serial ports for communication.
D-12784	G100 logs unwanted synchronized/not-synchronized SOE events from IRIG-B.

2.2.5 Configuration/Settings

GE Internal Reference #	Description
D-12753/ D-12767	G100 applications are not running if the Maintenance serial Port is Disabled in the connections page.
D-12801	The order in which Digital Input GPIO IED points appear in the offline editor is different when compared to the online editor

2.2.6 HMI

GE Internal Reference #	Description
D-12716/ R-01418	The HMI Object transparency ignored in one line viewer during runtime.

2.2.7 Pass-through

None

2.2.8 System

GE Internal Reference #	Description
D-12700	The settings of UEFI are lost after super cap drains/discharges.
D-12741	The issue of UEFI COM4 console redirection ends up on COM3 which further prevents the G100 firmware upgrade.
D-12872	In case of a faulty mSATA card, the MCP utilities write the G100 firmware upgrade on the USB itself.
D-12855	Customer Support Access to Edge OS host requires a reboot of G100.

2.2.9 Documentation

GE Internal Reference #	Description
D-12699	Updates to online help to remove description for unused Device Online DI pseudo point.
B-15308/ B-15305	Updates for XCA certificate creation procedure & VPN client configuration parameters

2.2.10 Hardware

None

2.3 Known Issues

2.3.1 Cyber Security

Please refer to Product & Cyber Security Advisories on the GE Grid Solutions web site.

2.3.2 Clients

GE Internal Reference #	Description
B-13475 D-09915	SEL Binary Client doesn't support Double Precision Scaling Factors.
D-05002	ARRM file retrieval from SEL 1xx/2xx relays (using GEN ASCII) is not possible.
D-12835	SEL Binary Client could not process the interleaved responses when unsolicited and poll messages come simultaneously from SEL relays.
D-12834	Modbus Client could not process PRF events comes from SR 369 relay.
D-12853	Local GPIO Client Command Failed accumulator pseudo point is not incrementing on TTL failure

2.3.3 Servers

GE Internal Reference #	Description
D-12567	The time sync accuracy of G100 when IEC101 Server (Unbalanced/Balanced) is used as a time sync source is > +/- 4 msec.
B-11967	No support for events in NVRAM in IEC101/104 Server. Events that have not been yet transmitted to Master (Clients) are lost if G100 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.

GE Internal Reference #	Description
B-11968	No support for events in NVRAM in DNP3 Server. Events that have not been yet transmitted to Master (Clients) are lost if G100 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.

2.3.4 Automation

GE Internal Reference #	Description
D-05033	Suppressed quality through Input Point Suppression (IPS) application is not reported to Masters. DNP3 and IEC 101-104 Servers send Online Quality rather than the substituted/last reported quality when points are suppressed.
B-11969	DEM is responsible for handling alarms. Events/Alarms that have not been yet committed to the SQL database are lost if G500 is power cycled / restarted. However – the integrity polls will continue to provide accurate database representation.
DCSSUP-19948, D-12000	Restore the last value for variables configured in LogicLinx wizard does not work at runtime (defaults to 0 always).

2.3.5 Configuration/Settings

GE Internal Reference #	Description
D-10388	TACACS+ remote authentication can be enabled and activated even if the TACACS+ Server is not available in that moment. This will conduct to a device that can only be accessed using Emergency Access process, if TACACS+ server is not available.
D-10825	Online Editor / SNMP Agent Browser is not able to retrieve OID data if gathering data from target device takes more than 60 seconds. Workaround: configure the SNMP client offline, using OID from the end device (e.g., using a 3rd party MIB browser).
D-12810	The order in which pseudo points appear in the offline editor is different when compared to the online editor for the applications Modbus DCA, D.20 DCA and SNMP DCA.

2.3.6 HMI

GE Internal Reference #	Description
B-14982	The product references in the Runtime (Local/Remote) HMI logs need to be changed as "MCP".
D-05463	If a used point group is deleted from the systemwide configuration then points belonging to that group are not visible in the point group summary. However, if user changes the point group allocation from the corresponding instantiated client map file(s) then points will be visible in the point group summary.

2.3.7 Pass-through

None

2.3.8 System

GE Internal Reference #	Description
B-14973	The software licensing application reports core license 012 as "G500 Core", it should be "MCP Core". There is no functional impact.
D-10227	Email does not send messages when an alarm is activated.
D-05714	Update of only Edge OS is not supported. If only Edge OS updates are required, the complete G100 firmware image needs to be updated.
D-12887	G100 GPIO input_overrun warning messages are logged periodically (~30 s) in the kernel log on loaded systems. The impact is that the MCP support bundle will not be able to retrieve a kernel log event older than approximately 22 days on a busy system, so ensure MCP support bundle is created, if necessary, soon after a kernel event that may need to be investigated.

2.3.9 Documentation

None

2.3.10 Hardware

None

Capability and Capacity

In this release version the G100 database and connectivity sizes are limited to a maximum of:

- Up to 24,000 total RTDB real data points (not counting pseudo points), originating from:
  - Up to 60 IEDs, and
  - Up to 60 D.20 IO modules
- Up to 4 concurrent Master connections
- Up to 2 Runtime HMI sessions

2.4 Standalone (non-redundant)

In this release version G100 provides the following performance capabilities in Standalone (non-redundant) Mode.

2.4.1 Performance Test Levels

In this release version G100 is tested under maximum configured system size using the activity levels and disturbance scenarios presented next.

Requirement	Steady State Normal Loading	Avalanche Heavy Loading
G100 Hardware (CPU / RAM)	2 core CPU / 8 GB RAM	2 core CPU / 8 GB RAM
Loading Signal changes (continuously/sec)	AI - 1200 DI – 12	All points changing twice in 2 secs
Number of IEDs connected to G100	60 DNP + 60 D.20 Peripherals [11 A cards, 30 C1 cards, 2 C2 cards, 14 S cards, 3 K cards]	60 DNP + 60 D.20 Peripherals [11 A cards, 30 C1 cards, 2 C2 cards, 14 S cards, 3 K cards]
G100 total RTDB Point count	24000	24000
Points / IED (400 total)	225 - AI, 125 - DI, 20 - DO, 20 - AO, 10 - ACC + D.20 points from 60 peripherals.	225 - AI, 125 - DI, 20 - DO, 20 - AO, 10 - ACC + D.20 points from 60 peripherals.
Total number of Servers & supported points in each Server	4 DI = 1875 i.e., = 125 * 60 /4 AI = 3375 i.e., = 225 * 60 /4 AO = 300 i.e., = 20 * 60 / 4 AO = 300 i.e., = 20 * 60 / 4 ACC = 150 i.e., = 10 * 60/ 4	4 DI = 1875 i.e., = 125 * 60 /4 AI = 3375 i.e., = 225 * 60 /4 AO = 300 i.e., = 20 * 60 / 4 AO = 300 i.e., = 20 * 60 / 4 ACC = 150 i.e., = 10 * 60/ 4
Remote G100 HMI connections	1 connection	1 connection
Local G100 HMI connections	1 connection (single monitor)	1 connection (single monitor)
Datalogger / Periodic reports	120 AI mapped / 12 reports	120 AI mapped / 12 reports
ARRM	5 sessions / IED	5 sessions / IED
Alarms	12 / sec	12 / sec (twice within 2 secs)

2.4.2 Performance Test Results

The standalone performance test results are presented below.

Table 2.1: Standalone Performance test results

Activity	Minimum	Median	Maximum
Loading Condition	Steady State Normal Loading		
CPU utilization – (%)	35	75	100
Average Memory Usage (GB)	0.849	1.201	1.261
Event latency (msecs)	172	518	2595
Control latency (msecs)	12	25	254

NOTE: Under steady state normal loading conditions, the control latency was measured by simulating one control every 5 seconds continuously from the Master station.

2.4.3 HMI Response times

G100 HMI response times under steady state normal loading conditions are presented below.

Table 2.2: User Interface Response Time – Steady State Normal Loading

Activity	Minimum (seconds)	Median (seconds)	Maximum (seconds)
Screen Access (Point Summary)	0.7	1.4	2
Screen Access (Comm Summary/Connections Page)	1	2.5	4
System Logs	0.6	2.5	5
Alarm ACK Delay (Single Alarm)	1	1.5	2
DI/AI Update to Point Summary Screen	1	1	1
Datalogger	1	1.6	3

2.5 Redundancy

G100 doesn't support system/device redundancy in release 2.30.

Time Sync Accuracy (IRIG-B/NTP)

G100 supports only software based IRIG-B TTL and software based NTP Time Sync.

Time accuracy with IRIG-B TTL input is typically +/- 1ms.

Application List

The following applications are available in this released firmware version.

Application	Support in Standalone
Runtime HMI	✓ Available
One Line Viewer	✓ Available
Config GUI / Schemas	✓ Available
System Library	✓ Available
C++ System Library	✓ Available
Connection Parser	✓ Available
Calculator	✓ Available
Hardware Asset Management Application (HAMA)	✓ Limited points availability (see MCP Software Configuration Guide SWM0101)
PTP Time Sync	× Not Available
IRIG-B/NTP Time Sync (Software based)	✓ Available
D.20 Client	✓ Available
GPIO Client	✓ Available
Modbus Client	✓ Available
Modbus-TCP/SSH Client	✓ Available
SEL® Binary Client	✓ Available
Analog Data Logger	✓ Available
Generic ASCII Client	✓ Available
Modbus Server	✓ Available
DNP 3.0 Server	✓ Available
DNP 3.0 Client	✓ Available
Digital Event Manager	✓ Available
Database Server	✓ Available
DNP 3.0 TCP/IP Transport Layer	✓ Available
DNP 3.0 Server Serial Transport Layer	✓ Available
DNP 3.0 DIDO	✓ Available
IEC 60870-5-101/104 Server	✓ Available
IEC 60870-5-103 Client	✓ Available
IEC 61850 Client	✓ Available
IEC 60870-5-101/104 Client	✓ Available
Event Logger	✓ Available
Real-Time Database	✓ Available
LogicLinx IEC 61131-3 Soft Logic	✓ Available

Application	Support in Standalone
Redundancy Manager	× Not Available (Only Standalone mode is available)
System Point Manager	✓ Available
Load Shedding and Curtailment	✓ Available
Control Lockout Manager	✓ Available
Software Watchdog	✓ Available
Configuration Manager	✓ Available
IP Changer	✓ Available
MD5SUM Builder	✓ Available
System Status Manager	✓ Available
Virtual Serial Ports	✓ Available
SNMP Client	✓ Available
Automated Record Retrieval Manager	✓ Available
Software Licensing Subsystem	✓ Available
Third-party components	✓ Available
Terminal Services	✓ Available
mcpcfg utility	✓ Available
E-mail Utility	✓ Available
IO Traffic Monitor	✓ Available
Firewall	✓ Available
Edge OS & Drivers	✓ Available
Secure Enterprise Connectivity	✓ Available
Genconn	✓ Available
HMI Access Manager	✓ Available
Sync Service Library	✓ Available
Sync Server Application	✓ Available
Analog Report Generator	✓ Available
OpenVPN	✓ Available

MODIFICATION RECORD

VERSION	REV.	DATE	CHANGE DESCRIPTION
2.20	0	19th May, 2021	First version, created for G100 Firmware Version 2.20 (document version starts with 2.20 to be in synch with firmware version)
2.30	0	29th July, 2021	Updated for G100 Firmware Version 2.30
2.30	1	20th August, 2021	Updated Cyber Security sections