
FnIO G-Series

GL-9012

GL-9012 (DeviceNet Network Adapter Light)

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History

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1. Environment Specification

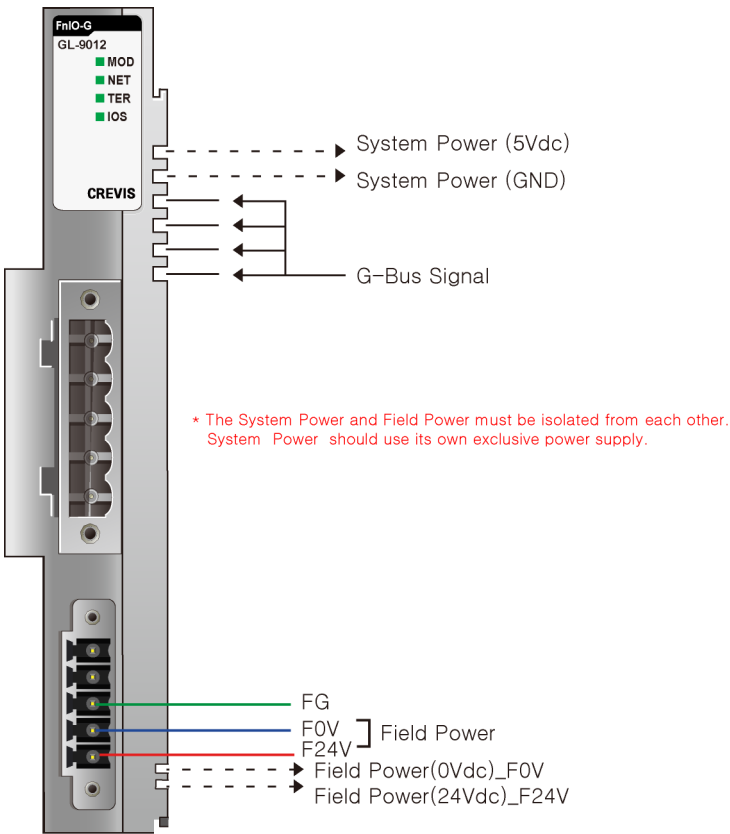
Environmental Specification	
Operating Temperature	-40°C ~ 60°C : 1.0A full load is allowed.
UL Temperature	-20°C~60°C
Storage Temperature	-40°C~85°C
Relative Humidity	5% ~ 90% non-condensing
Mounting	DIN rail
General Specification	
Shock Operating	IEC 60068-2-27
Vibration Resistance	IEC 60068-2-6, 4g
Industrial Emissions	EN 61000-6-4/A11 : 2011
Industrial Immunity	EN 61000-6-2 : 2019
Installation Position	Vertical and horizontal installation is available.
Product Certifications	CE, UL

2. GL-9012 (DeviceNet Network Adapter Light)

2.1. GL-9012 Specification

Items	Specification
Communication Interface Specification	
Model Type	GL-9012
Adapter Type	Group 2 Only Slave
Max. Expansion Slot	10 Slots
I/O Data Size	Max Input 36 bytes / Max Output 36 bytes
Max. Length Bus Line	Max. 100m@500Kbps, Max. 250m@250Kbps, Max. 500m@125Kbps
Max. Network Node	64 Nodes
Baud Rate	125Kbps(Max. 500m) 250Kbps(Max. 250m) 500Kbps(Max. 100m) Auto Baud Supported
Protocol	Poll, Bit-Strobe, Cyclic, COS
Node MAC ID Setup	DIP Switch
Terminating Resistance Setup	DIP Switch
Bus Connection	5 Pin Open-Style Connector
Indicator	4 Status LED 1 Green/Red, Module Status (MOD) 1 Green/Red, Network Status (NET) 1 Green, Terminating Resistance Status (TER) 1 Green/Red, Expansion I/O Module Status (IOS)
Module Location	Starter module left side of G-Series system
General Specification	
UL System Power	Supply voltage : 24Vdc nominal, Class 2
System Power	Supply voltage : 24Vdc nominal Supply voltage range : 15~28.8Vdc Protection : Reverse polarity protection
Power Dissipation	Max. 20mA @ 24Vdc
Current for I/O Module	1.0A @ 5Vdc
Isolation	System power to internal logic : Non-Isolation System power I/O driver : Isolation
UL Field Power	Supply voltage : 24Vdc nominal, Class 2
Field Power	Supply voltage : 24Vdc typical (Max. 28.8Vdc) * Field Power Range is different depending on IO Module series. Refer to IO Module's Specification.
Max. Current Field Power Contact	DC 8A Max
Wiring	I/O Cable Max. 2.0mm ² (AWG 14)
Weight	67g
Module Size	22mm x 109mm x 70mm
Environment Condition	Refer to '1. Environment Specification'

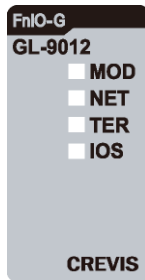
2.2. GL-9012 Wiring Diagram



Pin No.	Signal Description
1	System Power, 24V
2	System Power, Ground
3	F.G
4	Field Power, Ground
5	Field Power, 24V

2.3. GL-9012 LED Indicator

2.3.1. LED Indicator



LED No.	LED Function / Description	LED Color
MOD	Module Status	Green/Red
NET	Network Status	Green/Red
TER	Termination Resistance Status	Green
IOS	Extension module Status	Green/Red

2.3.2. MOD (Module Status LED)

Status	LED	To indicate
Not Powered	OFF	Power is not supplied to the unit.
Device Operational	Green	The unit is operating in normal condition.
Device in Standby	Flashing Green	EEPROM parameter is not initialized yet. Serial Number is zero value (0x00000000)
Minor Fault	Flashing Red	Device has an recoverable Fault.
Unrecoverable Fault	Red	Device has an unrecoverable fault.

2.3.3. NET (Network Status LED)

Status	LED	To indicate
Not Powered Not On-line	OFF	Device is not on-line or may not be powered. - Not completed Dup-MAC ID test yet
On-line, Not connected	Flashing Green	Device is on-line but has no connections in the established state. - Passed Dup-MAC_ID test - Not allocated to a master
On-line, Connected	Green	Device is on-line and allocated to a master.
Connection Time-out	Flashing Red	One or more I/O connections are in the time-out state.
Critical Communication Failure	Red	Failed communication - Duplicate MAC ID - Bus-off

2.3.4. TER (Terminating Resistance Status LED)

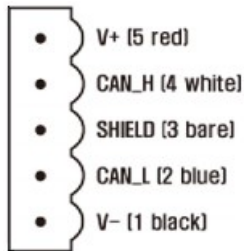
Status	LED	To indicate
Not applied	OFF	Terminating resistance is not applied.
Applied	Green	Terminating resistance is applied.

2.3.5. IOS LED (Extension module Status LED)

Status	LED	To indicate
Not Powered No Expansion Module	OFF	Device has no expansion module or may not be powered.
G-Series Internal Bus On-line, Do not Exchanging I/O	Flashing Green	G-Series Internal bus is normal but does not exchanging I/O data. (Passed the expansion module configuration)
G-Series Internal Bus Connection, Run Exchanging I/O	Green	Exchanging I/O data.
G-Series Internal Bus Connection Fault during Exchanging I/O	Red	One or more expansion module occurred in fault state. <ul style="list-style-type: none">- Changed expansion module configuration.- Internal Bus communication failure.- Mismatch vendor code between adapter and expansion module.
Expansion Configuration Failed	Red Flashing Red	Failed to initialize expansion module. <ul style="list-style-type: none">- Detect invalid expansion module ID.- Overflow Input/Output size.- Too many expansion module.- Initial protocol failure.

2.4. GL-9012 Electrical Interface

2.4.1. DeviceNet Open Connector

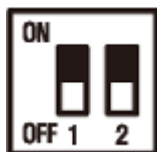


Pin	Signal	Color	Description
5*	V+	Red	Power 24Vdc
4	CAN H	White	Transceiver High
3	Shield	-	Shield
2	CAN L	Blue	Transceiver Low
1*	V-	Black	Power 0Vdc

2.4.2. Dip Switch



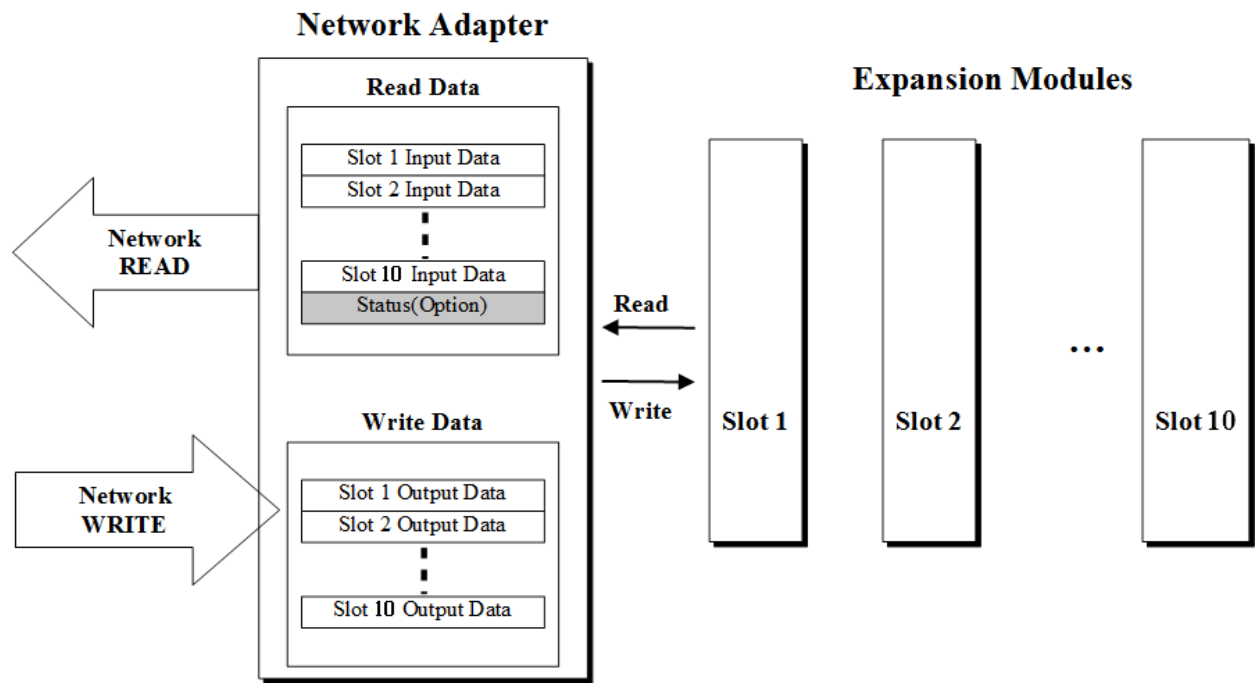
DIP Pole#	Description	
1	MAC ID Setting	Each DeviceNet Adapter must have a unique MAC ID (from 0 to 63) so that it can be addressed independently from other nodes.
2		
3		
4		
5		
6		
7	Reserved	
8	Reserved	
9	Baud rate #1	125kbps : 9 OFF, 10 OFF 250kbps : 9 ON, 10 OFF
10	Baud rate #2	500kbps : 9 OFF, 10 ON AUTO : 9 ON, 10 ON



DIP Pole#	Description	
1	Terminator	1 ON, 2 ON : Terminator Resistor Set Other : Terminator Resistor Non-set
2	Resistor	

2.5. I/O Process Image Map

An expansion module may have 3 types of data as I/O data, configuration parameter and memory register. The data exchange between network adapter and expansion modules is done via an I/O process image data by G-Series Internal Bus protocol. The following figure shows the data flow of process image between network adapter and expansion modules.



3. Object Models

A DeviceNet node is modeled as a collection of Objects. An Object provides an abstract representation of a particular component within a product. The realization of this abstract object model within a product is implementation dependent. In other words, a product internally maps this object model in a fashion specific to its implementation.

The objects and their components are addressed by a uniform addressing scheme consisting of:

Media Access Control Identifier (MAC ID), an integer identification value assigned to each node on a DeviceNet network.

Class Identifier (Class ID), an integer identification value assigned to each Object Class accessible from the network.

Instance Identifier (Instance ID), an integer identification value assigned to an Object Instance that identifies it among all Instances of the same Class.

Attribute Identifier (Attribute ID), an integer identification value assigned to a Class and/or Instance Attribute.

Service Code, an integer identification value which denotes a particular Object Instance and/or Object Class function.

Supported Objects

- Device Type Number: 0C_{HEX} (Communications Adapter)

Name of Object	Type	Number of Instances	Class Code
Identity	Required	1	01 _{HEX}
Message Router	Required	1	02 _{HEX}
DeviceNet	Required	1	03 _{HEX}
Assembly	Required	2	04 _{HEX}
Connection	Required	4	05 _{HEX}
Acknowledge Handler	Required	1	2B _{HEX}
G-Series Internal Bus Manager	Vendor-specific	1	70 _{HEX}
Expansion Slot	Vendor-specific	1~16	71 _{HEX}

Objects Behavior, Interface

Object	Behavior	Interface
Identity	Device identification, reset service	Message Router
DeviceNet	Configures port attributes	Message Router
Assembly	Defines I/O data format and concatenates configuration data	I/O Connection or Message Router
Connection	Contains the number of logical ports into or out-of the device	Message Router
Acknowledge Handler	Manage the reception of message acknowledgments	Message Router
G-Series Internal Bus Manager	Management functions for the G-Series Internal Bus	Message Router
Expansion Slot	Management functions for the expansion slot	Message Router

3.1. Object Setting

3.1.1. Identity Object

Class Code: 01_{HEX}

Common Services

Service Code	Implemented for		Service Name	Value
	Class	Instance		
0x05	No	Yes	Reset	0: Reset Only 1: Reset and Factory Default
0x0E	No	Yes	Get Attribute Single	

Class Attributes

None

Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Size	Value
1	1	Get	Vendor ID	1 word	0x02E5 (741), Crevis. Co., Ltd.
	2	Get	Device Type	1 word	0x000C (Network Adapter)
	3	Get	Product Code	1 word	0x91D0 (GL-9012)
	4	Get	Revision - Major - Minor	Structure of: 1 byte 1 byte	1 ~ 9 01 ~ 255
	5	Get	Status	1 word	Defined in Spec (0x0005) *
	6	Get	Serial Number	2 words	Unique Number
	7	Get	Product Name - String Length - ASCII String	Structure of: 1 byte STRING	1A (26) “GL-9012_DeviceNet,G-Series”
	9	Get	Check Sum	1 word	EEPROM Checksum Code
	100(64h)	Get	I/O Main State	1 word	0x01: Init State 0x02: Idle State 0x03: Run State 0x04: Stop State 0x05: Fault State 0x06: Reset State 0x07: CRC error State
	Vendor-specific				
	102(66h)	Get	Firmware Code	1 byte	0x71
	103(67h)	Get	ODVA Conformance Test Revision	UINT	0x0A17 → “2002. 10. 22.”
	104(68h)	Get	Firmware Release Date	UDINT	0xDDMMYYYY ex) 0x12042120 → 2021/04/12
	107(6Bh)	Get	Inspection Date	UDINT	0xYYYYMMDD

* Spec. = The CIP Networks library, ODVA

3.1.2. Message Router Object

Class Code: 02_{HEX}

Common Services

None

Class Attributes

None

Instance Attributes

None

3.1.3. DeviceNet Object

Class Code: 03_{HEX}

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single
0x4B	No	Yes	Allocate Master/Slave Connection Set
0x4C	No	Yes	Release Master/Slave Connection Set

Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Size	Value
0	1	Get	Revision	1 word	02, 00

Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Size	Value
1	1	Get/Set*	MAC ID	1 byte	0 ~ 63
	2	Get	Baud Rate**	1 byte	0=125K, 1=250K, 2=500K, 3=Auto
	3	Get/Set	Bus off Interrupt	BOOL	faulted node recovery, (0x01 : Enable)
	4	Get	Bus-Off Counter	USINT	0 ~ 255
	5	Get	Allocation Information - Allocation Choice - Master's MAC ID	Structure of: BYTE USINT	- Allocation Choice Defined in Spec. - Master's MAC ID 255: unallocated 0~63: Master MAC ID
	7	Get/Set	Master Fault Set	BOOL	0 : Master fault set off(default) 1 : Master fault set on
	8	Get	MACID Switch Value	USINT	0 ~ 99 Actual value of Switch
	9	Get	Baud Rate Switch Value	USINT	0 : 125kbps 1 : 250kbps 2 : 500kbps 3 : Auto
	Vendor-specific				
	100(64h)	Get	Auto-Baud Action**	BOOL	0: Enabled (default) (Not allowed to set the Baud Rate from Network) 1: Disabled (Allowed to set the Baud Rate from Network)
	101(65h)	Get/Set	Quick Start	BOOL	0 : Normal Start-up (default) 1 : Quick Start-up***

*The MAC ID Switch value = 0~63: Not allowed to set the MAC ID from Network.

Behavior: Changed new MAC ID → Device will be restarted.

**Refer to 2.4.3 (DeviceNet MAC ID & Baud Rate Setup)

***Baud rate only 500kbps.

3.1.4. Assembly Object

Class Code: 04_{HEX}

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

Class Attributes

None

Input Instance Attributes

Input/output Instance ID

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
100(64h)	3	Get	Input (Produced) Process Image Data	Array n BYTE	Input process current image data
150(96h)	3	Set/Get	Output (Consumed) Process Image Data	Array n BYTE	Output process current image data

3.1.5. Connection Object

Class Code: 05_{HEX}

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get Attribute Single
0x10	No	No	Set Attribute Single

Class Attributes

None

Instance Attributes for Explicit Messaging Connection

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	state	USINT	Defined in Spec * 0x03 : The connection has been validly/fully configured and the configuration has been successfully applied.
	2	Get	instance_type	USINT	0: Explicit Message
	3	Get	transportClass_trigger	BYTE	83 _{HEX}
	4	Get	produced_connection_id	UINT	*0x040B : MAC ID=01, Message group 2, Message ID 3
	5	Get	consumed_connection_id	UINT	*0x040C : MAC ID=01, Message ID 4
	6	Get	initial_comm_characteristics	BYTE	21 _{HEX}
	7	Get	produced_connection_size	UINT	0x0206 (=518)
	8	Get	consumed_connection_size	UINT	0x0206 (=518)
	9	Get/Set	expected_packet_rate	UINT	2504 (default) Timer Resolution of 8msec
	12	Get/Set	watchdog_timeout_action	USINT	3 : Deferred Delete (default)
	13	Get	produced_connection_path_length	UINT	00, 00
	14	Get	produced_connection_path	Array of USINT	Empty
	15	Get	consumed_connection_path_length	UINT	00, 00
	16	Get	consumed_connection_path	Array of USINT	Empty

attribute 3 transport Class trigger = 0x83 → Direction=Server,
Production Trigger=IGNORED,
Transport Class = 3.

This is the value assigned to this attribute within the server end-point of an Explicit Messaging Connection

Instance Attributes for Poll I/O Connection

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
2	1	Get	State	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	82 _{HEX}
	4	Get	produced_connection_id	UINT	* 0x03C1 : MAC ID=01, Message ID=6, Unconnected Explicit Request Message
	5	Get	consumed_connection_id	UINT	* 0x040D : MAC ID=01, Message ID=5, Group 2 message Identifier
	6	Get	initial_comm_characteristics	BYTE	01 _{HEX}
	7	Get	produced_connection_size	UINT	Followed by IO process image
	8	Get	consumed_connection_size	UINT	Followed by IO process image
	9	Get/Set	expected_packet_rate	UINT	Timer Resolution of 8msec * 200(decimal)
	12	Get	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0 or 6
	16	Get	consumed_connection_path	Array of USINT	

Instance Attributes for Bit-Strobe I/O Connection

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
3	1	Get	state	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	82 _{HEX}
	4	Get	produced_connection_id	UINT	*0x0381 : MAC ID=01, Message ID=14, Message group 1
	5	Get	consumed_connection_id	UINT	*0x0400 : MAC ID = 00, Message ID = 0, Message group 2
	6	Get	initial_comm_characteristics	BYTE	02 _{HEX}
	7	Get	produced_connection_size	UINT	Followed by IO process image
	8	Get	consumed_connection_size	UINT	0x08
	9	Get/Set	expected_packet_rate	UINT	Timer Resolution of 8msec * 200
	12	Get	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0 or 6
	16	Get	consumed_connection_path	Array of USINT	

Instance Attributes for COS I/O Connection (Acknowledged)

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
4	1	Get	State	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	12 _{HEX}
	4	Get	produced_connection_id	UINT	
	5	Get	consumed_connection_id	UINT	
	6	Get	initial_comm_characteristics	BYTE	1
	7	Get	produced_connection_size	UINT	Followed by IO Process image
	8	Get	consumed_connection_size	UINT	Followed by IO Process image
	9	Get/Set	expected_packet_rate	UINT	Timer Resolution of 8msec
	12	Get/Set	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	4
	16	Get	consumed_connection_path	Array of USINT	20 2B 24 01
	17	Get/Set	production_inhibit_time	UINT	00, 00

Instance Attributes for COS I/O Connection (Unacknowledged)

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
4	1	Get	State	USINT	Defined in Spec * 0x01 : Configuring
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	10 _{HEX}
	4	Get	produced_connection_id	UINT	* 0x0341 MAC ID : 01, Message ID=13, Message Group 1
	5	Get	consumed_connection_id	UINT	0FFFF _{HEX}
	6	Get	initial_comm_characteristics	BYTE	0F _{HEX}
	7	Get	produced_connection_size	UINT	Followed by IO Process image
	8	Get	consumed_connection_size	UINT	Followed by IO Process image
	9	Get/Set	expected_packet_rate	UINT	Timer Resolution of 8msec
	12	Get/Set	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0
	16	Get	consumed_connection_path	Array of USINT	Empty
	17	Get/Set	production_inhibit_time	UINT	00, 00

3.1.6. Acknowledge Handler Object

Class Code: 2B_{HEX}

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get Attribute Single

Class Attributes

None

Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Set	Acknowledge Timer	UNIT	Default: 10
	2	Get	Retry Limit	USINT	1
	3	Get	COS Producing Connection Instance	UINT	4

3.1.7. G-Series Internal Bus Manager Object

Class Code: 70_{HEX} (112D)

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

Class Attributes

None

Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Number of Slot	USINT	(include deactivated slot)
	4	Get	External IDs	Array of 128 BYTE	See Table 5.1.
	5	*Get/Set	Selection of Produced Connection Type	USINT	See Table 5.3. / Table 5.4. Valid value range is 0, 1 (default 1)
	10	Get	G-Series Internal Bus Status	USINT	0x03 : Run state 0x04 : Stop state 0x05 : Fault state 0x07 : CRC state
	11	Get	Input (Produced) Byte Size	UINT	IO input byte size
	12	Get	Output (Consumed) Byte Size	UINT	IO output byte size
	113	Get	Run-time fault code	DWORD	#0 : Gbus error count #1 : Gbus error code (Table 5.2.) #2 : Error slot number #3 : NA status
	150	Get	Firmware Revision	USINT	#0 : Major revision #1 : Minor revision

*After the system is reset, the new "Set Value" action is applied.

Table 5.1. External IDs (=Expansion Module ID)

Byte	Description
0	Network Adapter Module External ID = 0x9012
1	External ID for slot position #1
2	External ID for slot position #2
....
9	External ID for slot position #9
10	External ID for slot position #10

Table 5.2. Gbus error code

Byte	Description
0x00	Normal Operation
0x02	Connection Fault
0x03	Configuration Fault
0x04	No Expansion module
0x05	Invalid attribute value
0x06	Too much data
0x07	Vendor Error
0x08	Not expected slot
0x09	CRC error

Table 5.3. Selection of Input(Produced) Process Image Mode

Selection Input Image Mode	Description
0	Status(1byte) + Uncompressed Input Processing Data
1 (default)	Uncompressed Input Processing Data

Table 5.4. Status Byte map

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	G-BUS Status							

G-BUS Status	
1	INIT STATE
2	IDLE STATE
3	RUN STATE
4	STOP STATE
5	FAULT STATE

3.1.8. Expansion Slot Object

Class Code: 71_{HEX} (113D)

Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

Class Attributes

None

Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1~10 (Slot Address)	1	Get	Module External ID	USINT	IO Name = External ID (2Byte) ex) IO Name : GT-1238 = External ID : 0x1238
	3	Get	Input Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Input Assembly Corresponding bit offset in the byte (If Input data length is zero, then return Empty.)
	4	Get	Output Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Output Assembly Corresponding bit offset in the byte (If Output data length is zero, then return Empty.)
	5	Get	Input Data	Array of BYTE	Read Input data size defined by attributes 2. If Input data length is zero, then return Empty.
	6	Get/Set	Output Data	Array of BYTE	Read/Write Output data size defined by attributes 2. If Output data length is zero, then return Empty.
	8	Get	Configuration Parameter Data length	USINT	Refer to Configuration Parameter document
	9	Get/Set	R/W Configuration Data	n Byte	Data array size defined by attributes 8.
	100	Get	Product Code	4 Byte	
	102	Get	Firmware Revision	Structure of: USINT USINT	Expansion Module Firmware Revision

*After the system is reset, the new "Set Value" action is applied.
If changed slot location, set default value automatically.

3.2. DeviceNet Reference

DeviceNet Reference Documents

<http://www.odva.org>

DeviceNet Tools

<http://www.hilscher.com>