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# **FnIO G-Series :**

## **GT-3901**

**GT-3901(3Phase AC Measurement)**

# Specification

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## Table of Contents

[Table of Contents.....2](#)

[History.....3](#)

[1.Environment Specification.....4](#)

[2.GT-3901 \(3Phase AC Measurement\).....5](#)

[2.1.GT-3901 Specification.....5](#)

[2.2.Update cycle of process data.....6](#)

[2.3.GT-3901 Wiring Diagram.....7](#)

[2.4.GT-3901 LED Indicator.....8](#)

[2.4.1.LED Indicator.....8](#)

[2.4.2.Channel Status LED.....8](#)

[2.5.Mapping Data into the Image Table.....9](#)

[2.6.Parameter Data.....14](#)

Specification

History

Rev	Pages	Remarks	Date	Editor
1.00			2018/03/16	Hongseok, Kim
1.01	8,11,14	Add Features	2018/04/26	Hongseok, Kim
1.02	17	Add description	2018/05/08	Hongseok, Kim
1.03	5	Power Dissipation	2018/05/15	Hongseok, Kim
1.04		Release	2020/04/21	Seokhyun, Jun
1.05	14	typo correction	2022/09/13	Hongseok, Kim
1.06	1~16	Specification form update	2023/08/01	Hongseok, Kim
1.07	7	Change Wiring Diagram	2023/10/23	Hongseok, Kim
1.08	5	Edit System Power Dissipation	2025/05/30	Suna, Hwang
1.09	10	CON_ID page ref. corrected to p.12.	2025/07/14	Hongseok, Kim

# Specification

## 1. Environment Specification

Environmental Specification	
Operation Temperature	-40°C ~ 70°C
UL Temperature	-20°C ~ 60°C
Non-Operating Temperature	-40°C ~ 85°C
Relative Humidity	5% ~ 90% Non-condensing
Operating Altitude	2,000m
Mounting	DIN Rail
General Specification	
Shock Operating	IEC 60068-2-27
Vibration Resistance	Based on IEC 60068-2-6, 4g
Industrial Emissions	EN61000-6-4/All : 2011
Industrial Immunity	EN61000-6-2 : 2005
Installation Position	Vertical and horizontal installation is available
Product Certifications	CE

# Specification

## 2. GT-3901 (3Phase AC Measurement)

### 2.1. GT-3901 Specification

Items	Specification
<b>Input Specification</b>	
Number of Channel	3Ch Voltage Input, 3Ch Current Input via CT
Indicators	1 Green Status 3 LEDs : VL1, VL2, VL3 3 LEDs : IL1, IL2, IL3
Maximum Input Voltage Range	VLN = 288VAC VLL=500VAC
UL Certified Voltage Range	VLN = 240VAC
Input resistance voltage path	1200K $\Omega$
Measuring Current	1A(MAX), CT 1 : 4000(MAX)
Input resistance current path	30m $\Omega$
Resolution	24bits
Input Frequency range	45Hz~65Hz
Measured values	Angle, Voltage, Current, Power, Energy, Frequency, Power Factors
Measuring error	Voltage&Current = 0.5%@ -20°C~50°C Voltage&Current = 1%@ -20°C~60°C Voltage&Current = 1.5%@ -40°C~70°C Frequency = $\pm 0.1$ Hz Phase angle = $\pm 0.6^\circ$
<b>General Specification</b>	
Power Dissipation	Max. 130 mA @ 5Vdc
Isolation	I/O to Logic : Photocoupler Isolation Field Power : Non-Isolation
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 18~30Vdc Power dissipation: 0mA @ 24Vdc
Wiring	I/O Cable Max. 2.0mm <sup>2</sup> (AWG#14)
Weight	63g
Module Size	12mm x 109mm x 70mm
<b>Environment Condition</b>	<b>Refer to '1. Environment Specification'</b>

\* The measuring accuracy is reduced, if the extended temperature range is used(-40°C ~ 70°C)

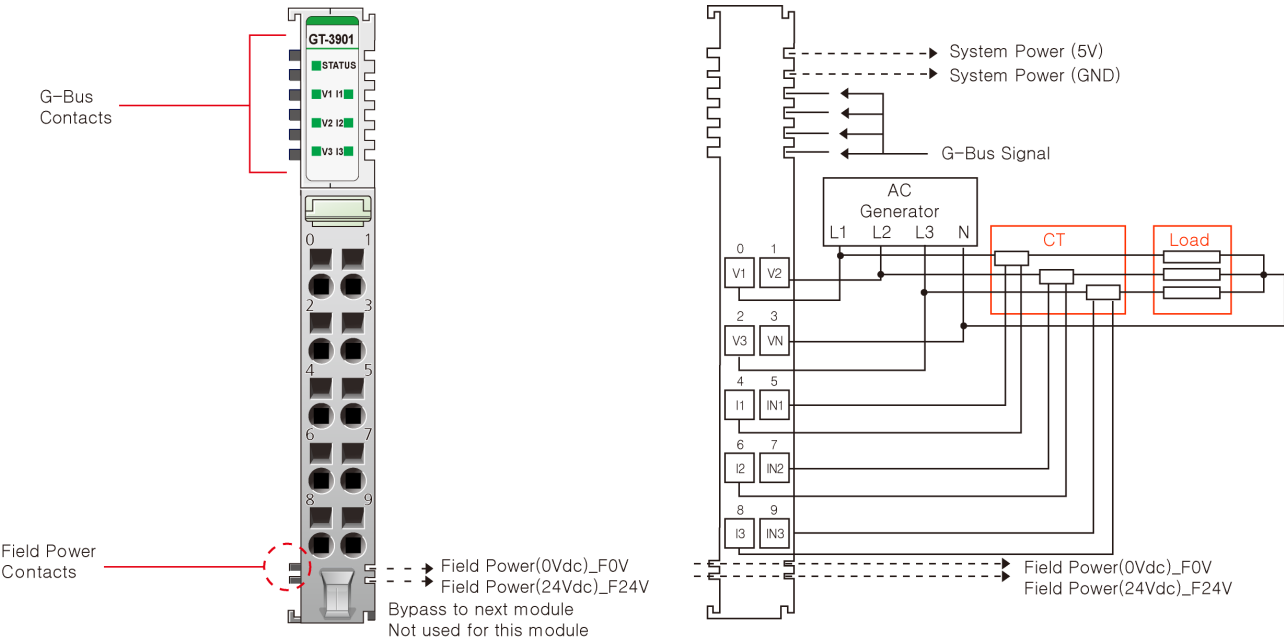
\* If the input value is small, the error of calculation value can be large (Please input 10% or more of the whole range)

# Specification

## 2.2. Update cycle of process data

Read Data	Update Time
	Max
Rms Voltage	300us
Max. Rms Voltage	300us
Min. Rms Voltage	300us
Rms Current	300us
Max. Rms Current	300us
Min. Rms Current	300us
Apparent Power	250us
Active Power	350us
Max. Active Power	350us
Min. Active Power	350us
Reactive Power	2000us
Apparent Energy	100ms
Total Apparent Energy	100ms
Active Energy	100ms
Total Active Energy	100ms
Reactive Energy	100ms
Total Reactive Energy	100ms
Cos phi	200us
Supply Network Frequency	200us
Max. Supply Network Frequency	200us
Min. Supply Network Frequency	200us
Phase Angle phi	300us

2.3. GT-3901 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	Voltage Input 0 (L1)	Voltage Input 1 (L2)	1
2	Voltage Input 2 (L3)	Voltage Input Common(Neutral)	3
4	Current Input L1	Current Input N1	5
6	Current Input L2	Current Input N2	7
8	Current Input L3	Current Input N3	9

## 2.4. GT-3901 LED Indicator

### 2.4.1. LED Indicator



LED No.	LED Function / Description	LED Color
0	Status	Green
1	Voltage Input Channel 1	Green
2	Current Input Channel 1	Green
3	Voltage Input Channel 2	Green
4	Current Input Channel 2	Green
5	Voltage Input Channel 3	Green
6	Current Input Channel 3	Green

### 2.4.2. Channel Status LED

Status	LED	To indicate
Over Voltage	Voltage Input LED : Off	Error Occurred
	Voltage Input LED : Green	Nomal Operation
Under Voltage	Voltage Input LED : Off	Error Occurred
	Voltage Input LED : Green	Nomal Operation
Over Current	Current Input LED : Off	Error Occurred
	Current Input LED : Green	Nomal Operation
No Signal	Voltage Input LED : Off	Error Occurred
	Current Input LED : Off	Error Occurred
	Voltage Input LED : Green	Nomal Operation
G-Bus Status	Current Input LED : Green	Nomal Operation
	Status LED : Off	Disconnection
	Status LED : Green	Connection

\* Please refer to Input Image Data.(Error Byte)



# Specification

## 2.5. Mapping Data into the Image Table

Byte	Output Image	Input Image
Byte0	Control Byte 0	Status Byte 0
Byte1	Control Byte 1	Status Byte 1
Byte2	Control Byte 2	Status Byte 2
Byte3	Control Byte 3	Status Byte 3
Byte4	Not used	Error Byte 0
Byte5		Error Byte 1
Byte6		Error Byte 2
Byte7		Reserved
Byte8		Process value0
Byte9		
Byte10		
Byte11		
Byte12		Process value1
Byte13		
Byte14		
Byte15		
Byte16		Process value2
Byte17		
Byte18		
Byte19		
Byte20		Process value3
Byte21		
Byte22		
Byte23		

# Specification

## ● Input Image Value

Status byte x							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reset	Measure Select			CON_ID			
Reset	Resetting all of the min/max/energy values *This bit is only included in Status Byte 0.						
Measure Select	0 = Voltage 1 = Current 2 = Power 3 = PF 4 = Phase Angle 5 = Frequency 6 = Energy 7 = reserved						
CON_ID	*Please refer to CON_ID on page 12.						

Error byte 0							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Err_VL2	VL2_Error code			ERR_VL1	VL1_Error code		
Err_VL1		Phase 1 Voltage Input Error 0 = OK 1 = Error occurred					
Err_VL2		Phase 2 Voltage Input Error 0 = OK 1 = Error occurred					
Error byte 1							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Err_IL1	IL1_Error code			ERR_VL3	VL3_Error code		
Err_VL3		Phase 3 Voltage Input Error 0 = OK 1 = Error occurred					
Err_IL1		Phase 1 Current Input Error 0 = OK 1 = Error occurred					
Error byte 2							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Err_IL3	IL3_Error code			ERR_IL2	IL2_Error code		
Err_IL2		Phase 2 Current Input Error 0 = OK 1 = Error occurred					
Err_IL3		Phase 3 Current Input Error 0 = OK 1 = Error occurred					
Error code		0 = No Error 1 = Over Input 2 = Under Input 3 = No Connect					

Process value x							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Process value x[31 : 0]		Process value x of Status Byte x					

# Specification

## ● Output Image Value

Control byte x							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reset	Measure Select			CON_ID			
Reset		Resetting all of the min/max/energy values *This bit is only included in Control Byte 0.					
Measure Select		0 = Voltage 1 = Current 2 = Power 3 = PF 4 = Phase Angle 5 = Frequency 6 = Energy 7 = reserved					
CON_ID		*Please refer to CON_ID on page 12.					

# Specification

## ● CON\_ID

CON_ID	Measure Select = Voltage	Data Type	Scaling
0x00	RMS Voltage L1-N	uint32	0.01V
0x01	RMS Voltage L2-N	uint32	0.01V
0x02	RMS Voltage L3-N	uint32	0.01V
0x03	Max. RMS Voltage L1-N	uint32	0.01V
0x04	Max. RMS Voltage L2-N	uint32	0.01V
0x05	Max. RMS Voltage L3-N	uint32	0.01V
0x06	Min. RMS Voltage L1-N	uint32	0.01V
0x07	Min. RMS Voltage L2-N	uint32	0.01V
0x08	Min. RMS Voltage L3-N	uint32	0.01V
CON_ID	Measure Select = Current	Data Type	Scaling
0x00	RMS Current L1-N	uint32	0.1mA
0x01	RMS Current L2-N	uint32	0.1mA
0x02	RMS Current L3-N	uint32	0.1mA
0x03	Max. RMS Current L1-N	uint32	0.1mA
0x04	Max. RMS Current L2-N	uint32	0.1mA
0x05	Max. RMS Current L3-N	uint32	0.1mA
0x06	Min. RMS Current L1-N	uint32	0.1mA
0x07	Min. RMS Current L2-N	uint32	0.1mA
0x08	Min. RMS Current L3-N	uint32	0.1mA
CON_ID	Measure Select = Power	Data Type	Scaling
0x00	Apparent Power L1	uint32	0.01VA
0x01	Apparent Power L2	uint32	0.01VA
0x02	Apparent Power L3	uint32	0.01VA
0x03	Active Power L1	int32	0.01W
0x04	Active Power L2	int32	0.01W
0x05	Active Power L3	int32	0.01W
0x06	Max. Active Power L1	int32	0.01W
0x07	Max. Active Power L2	int32	0.01W
0x08	Max. Active Power L3	int32	0.01W
0x09	Min. Active Power L1	int32	0.01W
0x0A	Min. Active Power L2	int32	0.01W
0x0B	Min. Active Power L3	int32	0.01W
0x0C	Reactive Power L1	int32	0.01VAR
0x0D	Reactive Power L2	int32	0.01VAR
0x0E	Reactive Power L3	int32	0.01VAR
CON_ID	Measure Select = Energy	Data Type	Scaling
0x00	Apparent energy L1	uint32	Changed according to parameter setting
0x01	Apparent energy L2	uint32	
0x02	Apparent energy L3	uint32	
0x03	Total Apparent Energy	uint32	
0x04	Active energy L1	int32	
0x05	Active energy L2	int32	
0x06	Active energy L3	int32	
0x07	Total Active Energy	int32	
0x08	Reactive energy L1	int32	
0x09	Reactive energy L2	int32	
0x0A	Reactive energy L3	int32	
0x0B	Total Reactive Energy	int32	

# Specification

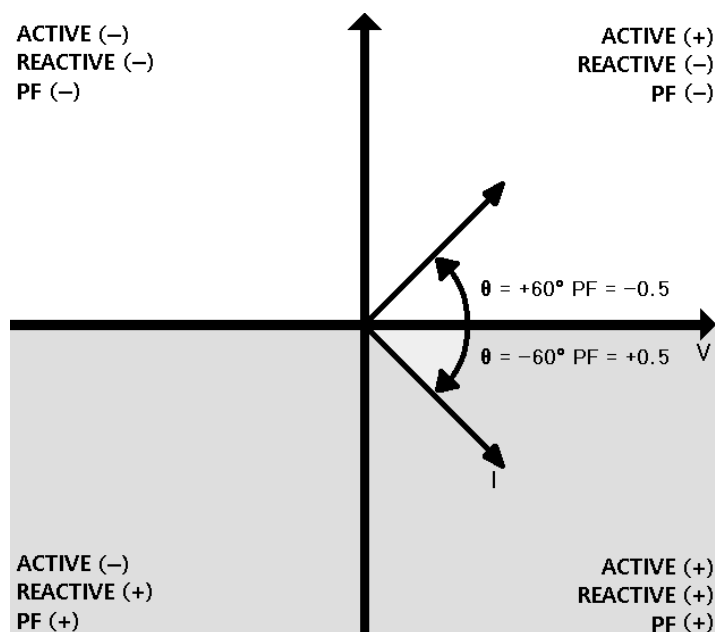
CON_ID	Measure Select = Power Factor	Data Type	Scaling
0x00	Power Factor L1	int32	0.01
0x01	Power Factor L2	int32	0.01
0x02	Power Factor L3	int32	0.01
CON_ID	Measure Select = Frequency	Data Type	Scaling
0x00	Supply network frequency L1	uint32	0.01Hz
0x01	Supply network frequency L2	uint32	0.01Hz
0x02	Supply network frequency L3	uint32	0.01Hz
0x03	Max. Supply network frequency L1	uint32	0.01Hz
0x04	Max. Supply network frequency L2	uint32	0.01Hz
0x05	Max. Supply network frequency L3	uint32	0.01Hz
0x06	Min. Supply network frequency L1	uint32	0.01Hz
0x07	Min. Supply network frequency L2	uint32	0.01Hz
0x08	Min. Supply network frequency L3	uint32	0.01Hz
CON_ID	Measure Select = Phase angle	Data Type	Scaling
0x00	Phase angle phi L1	uint32	0.01°
0x01	Phase angle phi L2	uint32	0.01°
0x02	Phase angle phi L3	uint32	0.01°

## 2.6. Parameter Data

- Valid Parameter length : 5 Bytes
- Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	CT sensor 1 : x							
	Value for the current transformer ratio divisor							
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte1	Frequency	Scaling for energy values			CT sensor 1 : x			
	0 = 45~55	0 = 1m Wh/VARh/VAh			Value for the current transformer ratio divisor			
	1 = 55~65	1 = 0.01 Wh/VARh/VAh						
		2 = 0/1 Wh/VARh/VAh						
		3 = 1 Wh/VARh/VAh						
		4 = 0.01k Wh/VARh/VAh						
		5 = 0.1k Wh/VARh/VAh						
		6 = 1k Wh/VARh/VAh						
		7 = reserved						
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte2	Overvoltage threshold Lx (value) Resolution 0.2V							
	Overvoltage threshold = 250V+value*0.2V. (MAX 300V)							
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte3	Undervoltage threshold Lx (value) Resolution 0.5V							
	Undervoltage threshold = 0V+value*0.5V. (MAX 125V)							
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte4	Overcurrent threshold Lx (value) Resolution 2mA							
	Overcurrent threshold = 0.8A+value*0.002A. (MAX 1.3A)							

\* Set Frequency to get the correct Power Factor & Energy.



\*the reactive power measurement is negative when the load is capacitive, and when the load is inductive. The sign of the reactive power can therefore be used to reflect the sign of the power factor.

Power Factor = (Sign Fundamental Reactive Power) \* (abs(Active Power)/Apparent Power)

# Specification

## ● Example of Setting

- Read data : Phase1 Rms Voltage/Rms Current/Apparent power/Active power.
- Input Value : 220V, 1000A, PF 0.5
- Parameter : CT 1 : 1000, Input Frequency 55~65Hz, Overvoltage threshold 260V, Other is Default(0).
- Overvoltage Threshold = (260V(User Setting Value) – 250V(default Setting Value))/0.2V. Resolution : 0.2V
- ex) OverCurrent Threshold = 1000A (User Setting CT 1 : 1000) = ((1A(User Setting Value)-0.8(default Setting Value))/0.001)\*1000(CT). Resolution : 0.001A
- \* All of default value is 0

### -Step#1

-Set the Parameter

Parameter	Value
CT sensor 1 : x (12 bit)	001111101000 (bit) Set CT 1000
Scaling for energy values (3 bit)	000 (bit) Set 1m Wh/VARh/VAh
Frequency (1 bit)	1 (bit) Set 55~65Hz
Overvoltage Threshold Lx (8 bit)	00110010 (bit) Set 260V
Undervoltage Threshold Lx (8 bit)	00000000 (bit) Set 0V(default)
Overcurrent Threshold Lx(8 bit)	00000000 (bit) Set 0.8A(default)
All of Parameter	E8 83 32 00 00 (Byte hex)

### -Step#2

-Set the Control Byte (See Output Image Value)

	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
Control Byte #0	Reset	Measure Select(Voltage)			CON ID(Rms Voltage L1-N)			
	0	0	0	0	0	0	0	0
Control Byte #1	reserved	Measure Select(Current)			CON ID(Rms Current L1-N)			
	0	0	0	1	0	0	0	0
Control Byte #2	reserved	Measure Select(Power)			CON ID(Apparent Power L1)			
	0	0	0	2	0	0	0	0
Control Byte #3	reserved	Measure Select(Power)			CON ID(Active Power L1)			
	0	0	0	2	0	0	1	1

### -Step#3

-Check the Status Byte, When Status Byte and Control Byte are same, the Process value is updated.

	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
Status Byte #0	RES	Measure Select(Voltage)			CON ID(Rms Voltage L1-N)			
	0	0	0	0	0	0	0	0
Status Byte #0	reserved	Measure Select(Current)			CON ID(Rms Current L1-N)			
	0	0	0	1	0	0	0	0
Status Byte #0	reserved	Measure Select(Power)			CON ID(Apparent Power L1)			
	0	0	0	2	0	0	0	0
Status Byte #0	reserved	Measure Select(Power)			CON ID(Active Power L1)			
	0	0	0	2	0	0	1	1

# Specification

## -Step#4

-Check the Process value

Process value#0(Rms Voltage)	000055F0(Dword hex) 22000(Dec) 220V
Process value#1(Rms Current)	000F4240(Dword hex) 1000000(Dec) 1000A
Process value#2(Apparent power)	014FB180(Dword hex) 22000000(Dec) 220kVA
Process value#3(Active power)	00A7D8C0(Dword hex) 11000000(Dec) 110kW