

FnIO G – Series :

GT-5001, GT-5002

GT-5001 (Loadcell + DIO + ModbusRTU)

Load Cell + Digital Output + Digital Input + ModbusRTU

GT-5002 (AIO + DIO + ModbusRTU)

Analog Input + Digital Output + Digital Input + ModbusRTU

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History

Rev	Pages	Remarks	Date	Editor
1.00			2025/01/20	Taegyung Oh

Specification

1. ENVIRONMENT SPECIFICATION

Environmental specification	
Operating Temperature	-40℃~60℃
UL Temperature	-20℃~60℃
Storage Temperature	-40℃~85℃
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 : 2005
Installation Position	Vertical and horizontal installation is available.
Product Certifications	CE, UL

Specification

2. GT-5001 Specification

2.1. GT-5001 (1ch Loadcell + 4ch DI + 4ch DO + 1ch ModbusRTU)

Items	
Resistor bridge input specification	
Number of channels	1 channels, Strain gauge input
Input type	Resistor bridge, Strain gauge
Indicators	Error_Sig.voltage / Error_Ref.voltage 2 Green LED
Input range VSIG	-150mV ~ +150mV
Input range VREF	0 ~10V
Interanl resistance	> 1 M Ω (VSIG, VREF)
Measuring error	VSIG : < $\pm 0.1\%$ Full Scale @ 25°C ambient < $\pm 0.3\%$ Full Scale @ -40 ~ 60°C ambient VREF : < $\pm 0.1\%$ Full Scale @ 25°C ambient < $\pm 0.3\%$ Full Scale @ -40 ~ 60°C ambient
Resolution	24bit, 32bit presentation
Conversion time	Max. 0.55ms
Filter	Max. 64 samples filtering, parameterisable
Special features	Open load check, Tare, 5VDC bridge supply
Bridge supply specification (Power)	
Voltage source	5V dc nominal *
Current rate	Max. 30mA
Digital input specification	
Inputs per module	4 points Sink type
Indicators	4 green input status
On-state voltage	24Vdc nominal (\leq Field Power) 14Vdc ~ 28.8Vdc @ 60°C
On-state current	4.0mA @ 24Vdc 4.8mA @ 28.8Vdc
Off-state voltage	12.5Vdc @ 25°C
Input signal delay	OFF to ON : Max. 0.4ms ON to OFF : Max. 0.5ms
Input filter	Adjustable, up to 10ms
Nominal input impedance	5.9K ohm typical
Digital Output specification	
Output per module	4 points source type
Indicators	4 green output state
Output voltage range	24Vdc nominal Min. 18Vdc ~ Max. 28.8Vdc
On-state voltage drop	0.3Vdc @ 25°C 0.5Vdc @ 60°C
On-state min. current	Min. 1mA
Off-state leakage current	Max. 10uA
Output signal delay	OFF to ON : Max.0.3ms ON to OFF : Max.0.3ms
Output current rating	Max. 0.5A per channel / Max. 2A per unit
Protection	Over current limit : Min 12A@ 25°C per each channels Thermal shutdown : Typical. 175°C Short circuit protection
ModbusRTU Specification	
Type	Slave node (RS485 for MODBUS RTU)

Specification

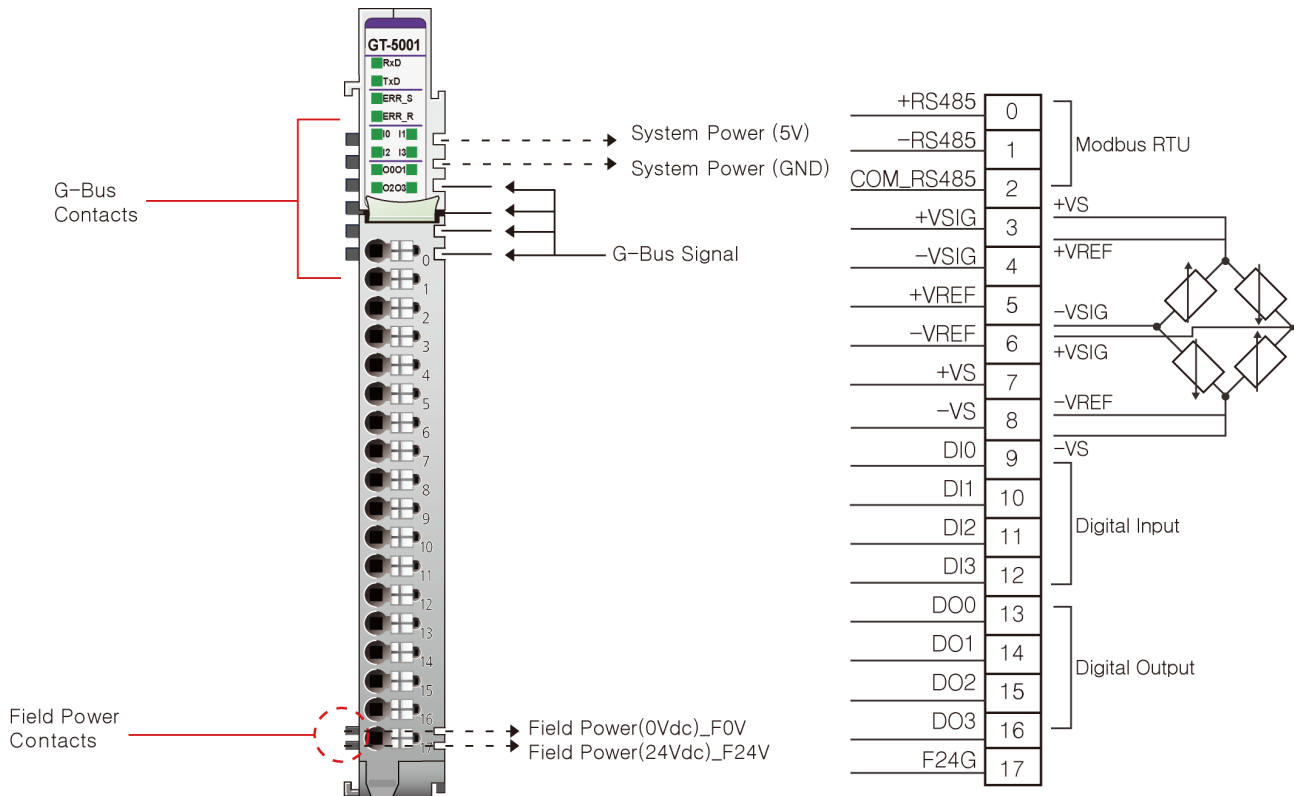
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Indicator	2 LED 1 Green, Receive Data (RXD) 1 Green, Transmit Data (TXD)
General specification	
Power dissipation	Max. 55mA @ 5Vdc
Isolation	I/O to Logic : Photocoupler Isolation Field power : Non-Isolation
UL Field Power	Supply Voltage : 24Vdc nominal, Class 2
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 18Vdc ~ 28.8Vdc Power Dissipation : Max. 45mA @ 24Vdc
Wiring	I/O Cable Max. 0.823mm ² (AWG 18)
Weight	63g
Module Size	12mm x 109mm x 70mm
Environment Condition	Refer to 'Environment Specification'

* Voltage drop occurs depending on the specifications of the cable and load of the voltage source.(Max 0.7V)

* Load cell signals have low voltage levels and are very sensitive to external noise. Therefore, EMC protection may be necessary depending on the system environment.

- It is recommended to install GT-7151/GT-7851 according to the system environment.

2.2. GT-5001 Wiring Diagram

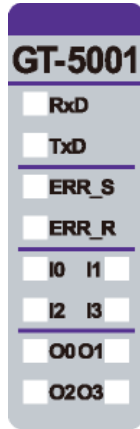


Pin No.	Signal Description
ModbusRTU(RS485)	
0	ModbusRTU Data+ (+RS485)
1	ModbusRTU Data- (-RS485)
2	ModbusRTU Common (COM RS485)
Loadcell	
3	Bridge Signal Input Voltage+ (+VSIG)
4	Bridge Signal Input Voltage- (-VSIG)
5	Bridge Reference Input Voltage+ (+VREF)
6	Bridge Reference Input Voltage- (-VREF)
7	Bridge Supply Voltage +5V (+VS)
8	Bridge Supply Voltage 0V (-VS)
Digital Input/Output	
9	Digital Input Channel 0
10	Digital Input Channel 1
11	Digital Input Channel 2
12	Digital Input Channel 3
13	Digital Output Channel 0
14	Digital Output Channel 1
15	Digital Output Channel 2
16	Digital Output Channel 3
17	Digital In/Out Common (F24G)

Specification

2.3. GT-5001 LED Indicator

2.3.1. LED Indicator



LED No.	LED Function / Description	LED Color
RxD	Modbus(RS485) Received Data	Green
TxD	Modbus(RS485) Transmit Data	Green
ERR S	Error signal voltage	Green
ERR R	Error reference voltage	Green
I0	Digital Input Channel 0	Green
I1	Digital Input Channel 1	Green
I2	Digital Input Channel 2	Green
I3	Digital Input Channel 3	Green
O0	Digital Output Channel 0	Green
O1	Digital Output Channel 1	Green
O2	Digital Output Channel 2	Green
O3	Digital Output Channel 3	Green

2.3.2. Channel Status LED

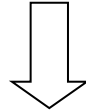
LED Function	LED	To indicate
Modbus Received Data	Green	Received Data
Modbus Transmit Data	Green	Transmit Data
Error signal voltage	Off	Normal operation
	Green	Bridge signal input voltage range over / Open load / < -151mV or > 151mV
Error reference voltage	Off	Normal operation
	Green	Bridge reference input voltage range over > 11V
Digital Input Channel	Off	No Input Signal
	Green	Input Signal detected
Digital Output Channel	Off	No Output Signal
	Green	Output Signal detected
Field Power Error	All Channel Repeat the Green and Off	Field Power is unconnected

Specification

2.4. GT-5001 Mapping data from the image table

● Input Module Data

Bridge Signal Input							
Bridge Reference Input							
-	-	-	-	DI3	DI2	DI1	DI0



● Input Image Value – 10Byte

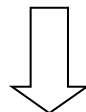
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Bridge Signal input byte LL							
Byte1	Bridge Signal input byte LH							
Byte2	Bridge Signal input byte HL							
Byte3	Bridge Signal input byte HH							
Byte4	Bridge Reference input byte LL							
Byte5	Bridge Reference input byte LH							
Byte6	Bridge Reference input byte HL							
Byte7	Bridge Reference input byte HH							
Byte8	FP	-	-	-	DI3	DI2	DI1	DI0
Byte9	Reserved							

* The output data confirmed by NA may be different from the actually applied output data.

* FP : Field Power Check Status : OFF(0), ON(1)

● Output Module Data

-	-	-	-	-	-	-	SWT
-	-	-	-	DO3	DO2	DO1	DO0



● Output Image Value – 2Byte

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	-	-	-	-	-	-	-	SWT
Byte1	-	-	-	-	DO3	DO2	DO1	DO0

- SWT : S/W Taring bit(#0)

Specification

2.5. GT-5001 Parameter Data

- Valid Parameter length : 6 Bytes

- Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Override ^[1]	Stop bit	Parity Bit		Baudrate			
	0 : Disable	0 : 1bit	00 : No		0000 : 115200bps			
	1 : Enable	1 : 2bit	01 : Odd		0001 : 1200bps			
			10 : Even		0010 : 2400bps			
					0011 : 4800bps			
					0100 : 9600bps			
					0101 : 19200bps			
					0110 : 38400bps			
					0111 : 57600bps			
					1000 : 115200bps			
Byte1	Slave ID(from 1 to 255)							
Byte2	-	-	-	-	-	Sampling filter ^[2]		
Byte3	Reserved							
Byte4	Fault Action (ch0~ch3) 0: Fault value, 1: Hold last state				Fault value (ch0~ch3) 0: Off, 1: On			
Byte5	Digital Input Filter Value : 0 ~ 10 (unit : ms)							

^[1] Using this bit, you can Override the Output Image Value received from NA.

The corresponding bit must be set to 1 to change the Output Image Value through Modbus RTU communication.

^[2] Sampling filter

000 : 32 sampling(default)	011 : 8 sampling	110 : 64 sampling
001 : 2 sampling	100 : 16 sampling	
010 : 4 sampling	101 : 32 sampling	

Specification

3. GT-5002 Specification

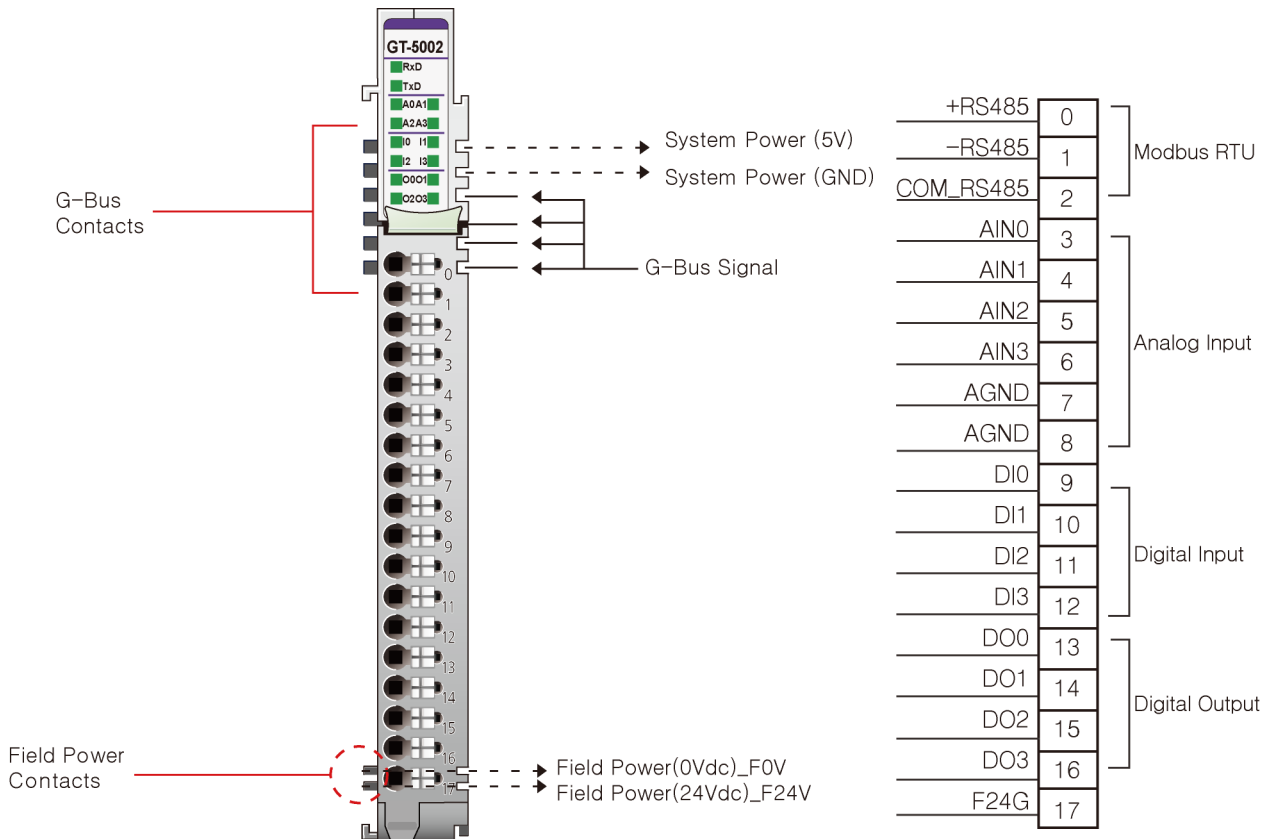
3.1. GT-5002 (4ch AI + 4ch DI + 4ch DO + 1ch ModbusRTU)

Items	
Analog input specification	
Inputs per module	4 Channels single ended, non-isolated between channel
Indicators	4 Green Input status
Resolution in Ranges	16 bits (Include Sign) 15 bits : 0.31mV/Bit(0~10V) 15 bits : 0.15mV/Bit(0~5V) 15 bits : 0.12mV/Bit(1~5V)
Data Format	16bits Integer (2's complement)
Module Error	$\pm 0.1\%$ Full Scale @ 25°C $\pm 0.3\%$ Full Scale @ -40°C, 60°C
Input Impedance	470k Ω
Diagnostic	Diagnostic Field Power Off : LED Blinking Field Power On : LED Off < 2% (Maximum Input Value) Field Power On : LED On > 2% (Maximum Input Value)
Conversion Time	0.6msec / All channels
Filter	Max. 64 samples filtering, parameterisable
Common Type	2 Common, AGND
Digital input specification	
Inputs per module	4 points Sink type
Indicators	4 green input status
On-state voltage	24Vdc nominal (\leq Field Power) 14Vdc ~ 28.8Vdc @ 60°C
On-state current	4.0mA @ 24Vdc 4.8mA @ 28.8Vdc
Off-state voltage	12.5Vdc @ 25°C
Input signal delay	OFF to ON : Max. 0.4ms ON to OFF : Max. 0.5ms
Input filter	Adjustable, up to 10ms
Nominal input impedance	5.9K ohm typical
Digital Output specification	
Output per module	4 points source type
Indicators	4 green output state
Output voltage range	24Vdc nominal Min. 18Vdc ~ Max. 28.8Vdc
On-state voltage drop	0.3Vdc @ 25°C 0.5Vdc @ 60°C
On-state min. current	Min. 1mA
Off-state leakage current	Max. 10uA
Output signal delay	OFF to ON : Max.0.3ms ON to OFF : Max.0.3ms
Output current rating	Max. 0.5A per channel / Max. 2A per unit
Protection	Over current limit : Min 12A@ 25°C per each channels Thermal shutdown : Typical. 175°C Short circuit protection
ModbusRTU Specification	
Type	Slave node (RS485 for MODBUS RTU)
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Indicator	2 LED 1 Green, Receive Data (RXD) 1 Green, Transmit Data (TXD)
General specification	
Power dissipation	Max. 55mA @ 5Vdc

Specification

Isolation	I/O to Logic : Photocoupler Isolation Field power : Non-Isolation
UL Field Power	Supply Voltage : 24Vdc nominal, Class 2
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 18Vdc ~ 28.8Vdc Power Dissipation : Max. 45mA @ 24Vdc
Wiring	I/O Cable Max. 0.823mm ² (AWG 18)
Weight	63g
Module Size	12mm x 109mm x 70mm
Environment Condition	Refer to 'Environment Specification'

3.2. GT-5002 Wiring Diagram

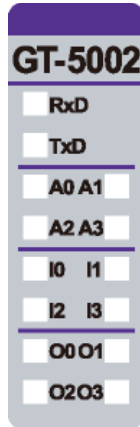


Pin No.	Signal Description
ModbusRTU(RS485)	
0	ModbusRTU Data+ (+RS485)
1	ModbusRTU Data- (-RS485)
2	ModbusRTU Common (COM_RS485)
Analog Input	
3	Analog Input Channel 0 (AIN0)
4	Analog Input Channel 1 (AIN1)
5	Analog Input Channel 2 (AIN2)
6	Analog Input Channel 3 (AIN3)
7	AGND
8	AGND
Digital Input/Output	
9	Digital Input Channel 0
10	Digital Input Channel 1
11	Digital Input Channel 2
12	Digital Input Channel 3
13	Digital Output Channel 0
14	Digital Output Channel 1
15	Digital Output Channel 2
16	Digital Output Channel 3
17	Digital In/Out Common (F24G)

Specification

3.3. GT-5002 LED Indicator

3.3.1. LED Indicator



LED No.	LED Function / Description	LED Color
RxD	Modbus(RS485) Received Data	Green
TxD	Modbus(RS485) Transmit Data	Green
A0	Analog Input Channel 0	Green
A1	Analog Input Channel 1	Green
A2	Analog Input Channel 2	Green
A3	Analog Input Channel 3	Green
I0	Digital Input Channel 0	Green
I1	Digital Input Channel 1	Green
I2	Digital Input Channel 2	Green
I3	Digital Input Channel 3	Green
O0	Digital Output Channel 0	Green
O1	Digital Output Channel 1	Green
O2	Digital Output Channel 2	Green
O3	Digital Output Channel 3	Green

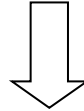
3.3.2. Channel Status LED

LED Function	LED	To indicate
Modbus Received Data	Green	Received Data
Modbus Transmit Data	Green	Transmit Data
Analog Input Channel	Off	< 2% (Maximum Input Value)
	Green	> 2% (Maximum Input Value)
Digital Input Channel	Off	No Input Signal
	Green	Input Signal detected
Digital Output Channel	Off	No Output Signal
	Green	Output Signal detected
Field Power Error	All Channel Repeat the Green and Off	Field Power is unconnected

3.4. GT-5002 Mapping data from the image table

● Input Module Data

Analog Input Ch0							
Analog Input Ch1							
Analog Input Ch2							
Analog Input Ch3							
-	-	-	-	DI3	DI2	DI1	DI0



● Input Image Value – 10Byte

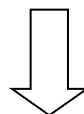
Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Analog Input Ch0 Low byte							
Byte1	Analog Input Ch0 High byte							
Byte2	Analog Input Ch1 Low byte							
Byte3	Analog Input Ch1 High byte							
Byte4	Analog Input Ch2 Low byte							
Byte5	Analog Input Ch2 High byte							
Byte6	Analog Input Ch3 Low byte							
Byte7	Analog Input Ch3 High byte							
Byte8	FP	-	-	-	DI3	DI2	DI1	DI0
Byte9	Reserved							

* The output data confirmed by NA may be different from the actually applied output data.

* FP : Field Power Check Status : OFF(0), ON(1)

● Output Module Data

-	-	-	-	DO3	DO2	DO1	DO0
---	---	---	---	-----	-----	-----	-----



● Output Image Value – 2Byte

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Reserved							
Byte1	-	-	-	-	DO3	DO2	DO1	DO0

Specification

3.5. GT-5002 Parameter Data

- Valid Parameter length: 6 Bytes
- Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Override[1]	Stop bit	Parity Bit		Baudrate			
	0 : Disable	0 : 1bit	00 : No		0000 : 115200bps			
	1 : Enable	1 : 2bit	01 : Odd		0001 : 1200bps			
			10 : Even		0010 : 2400bps			
					0011 : 4800bps			
					0100 : 9600bps			
					0101 : 19200bps			
					0110 : 38400bps			
					0111 : 57600bps			
					1000 : 115200bps			
Byte1	Slave ID(from 1 to 255)							
Byte2	Voltage Range for channel 3		Voltage Range for channel 2		Voltage Range for channel 1		Voltage Range for channel 0	
	H00: 0~10Vdc H01: 0~5Vdc H10: 1~5Vdc							
Byte3	-	-	-	-	-	Sampling filter[2]		
Byte4	Fault Action (ch0~ch3) 0: Fault value, 1: Hold last state				Fault value (ch0~ch3) 0: Off, 1: On			
Byte5	Digital Input Filter Value : 0 ~ 10 (unit : ms)							

^[1] Using this bit, you can Override the Output Image Value received from NA.

The corresponding bit must be set to 1 to change the Output Image Value through Modbus RTU communication.

^[2] Sampling filter

000 : 32 sampling(default)	011 : 8 sampling	110 : 64 sampling
001 : 2 sampling	100 : 16 sampling	
010 : 4 sampling	101 : 32 sampling	

4. Application : Load cell

4.1. Calculating the weight

The sensor receives the analog signal and calculates the weight.

$$G = (U_{SIG} / U_{REF}) * (L_{R.C.} / L_{R.O.}) \quad G : \text{Weight value (kg)}$$

$$U_{SIG} = V_{SIG} (\text{dec}) * (150\text{mV} / 8388607), \text{Unit : [mV]}$$

- Max. V_{SIG} value : 150mV, 0x7FFFFFFF = 8388607 (dec)

$$U_{REF} = V_{REF} (\text{dec}) * (10\text{V} / 8388607), \text{Unit : [V]}$$

- Max. V_{REF} value : 10V, 0x7FFFFFFF = 8388607 (dec)

Symbol	Meaning	Unit
U_{SIG}	Signal voltage from the load cell	mV
U_{REF}	Reference voltage from the load cell	V
V_{SIG}	Bridge signal input voltage	1
V_{REF}	Bridge reference input voltage	1
$L_{R.C.}$	Rated capacity of the load cell	Kg
$L_{R.O.}$	Rated output of the load cell	1mV/V

Example

1) Load cell sensor technical data

- Rated capacity (max load) : 100kg ($L_{R.C.}$)
- Rated output: 2mV/V ($L_{R.O.}$)
- Supply voltage : 5V

2) Calculating the weight

- V_{SIG} value : 0x000660AF (dec 417967)

$$U_{SIG} = 417967 * (150\text{mV} / 8388607) = 7.473833\text{mV}$$

- V_{REF} value : 0x003F6E23 (dec 4156963)

$$U_{REF} = 4156963 * (10\text{V} / 8388607) = 4.955486\text{V}$$

$$- G = (7.473833\text{mV} / 4.955486\text{V}) * (100\text{kg} / 2\text{mV/V}) = 75.409687\text{kg}$$

5. Modbus Interface

5.1. Supported MODBUS Function Codes

Function Code	Function	Description
3(0x03)	Read Holding Registers	Read output word
4(0x04)	Read Input Registers	Read input word
16(0x10)	Write Multiple registers	Write a number of output words

5.2. MODBUS ADDRESS

Address	Read/Write	Description	Type, Size
0x1000	Read	Input Image Value	5Words
0x1001	Read/Write	Output Image Value	1Word
0x1002	Read/Write	IO Parameter	3Words
0x1003	Read	Product Name String(ASCII) ex) “GT-5001, Modbus/485,Loadcell ,4DI,4DO”	String upto 72bytes
0x1004	Read	Firmware revision, if 0x00010001, revision 1.01	2Word