

1 Series Description

Altus' G Series of distributed remote I/O, which includes the GT-5112 high-speed counter expansion module, was developed to meet the needs of industrial automation applications that require high performance, high availability, modularity and operational flexibility. Designed for modern industrial environments, its architecture allows the implementation of robust and scalable solutions in different segments, such as building automation, machines and equipment, water and wastewater, energy, manufacturing, utilities and industrial processes in general. The versatility of the platform allows it to adapt to the most diverse project needs, from compact applications to large distributed systems. Its modular concept makes future expansions easier and simplifies system maintenance, reducing operating costs and downtime. In addition, the G Series offers broad compatibility with different control architectures, allowing efficient integration with PLCs, HMIs, SCADA systems and industrial networks widely used in the market. Its modern and optimized design provides high signal density, contributing to more compact and organized projects without compromising performance or reliability.

Designed for DIN rail mounting, the G Series offers a complete line of digital and analog input and output modules, special modules and network heads compatible with today's main industrial communication protocols, such as PROFINET, EtherNet/IP and MODBUS/TCP. This wide range of options ensures high interoperability and ease of integration in different automation environments. Another important advantage is the ease of installation and maintenance provided by the removable RTB connectors (*Removable Terminal Block*), which allow quick and safe replacement without removing the field wiring. The modules also feature diagnostic and status LEDs, making it easier to identify faults, operating states and power conditions. The DIN rail locking latches ensure secure and stable mounting, while the extremely compact design — with modules starting at 12 mm wide — provides significant space savings in electrical panels and automation cabinets. These features make the G Series an efficient solution for both new installations and industrial *retrofits* and modernization projects.

Another highlight of the G Series is its high operational performance, provided by the high-speed internal bus, capable of operating with update times of up to 1 ms, ensuring fast and accurate responses for critical applications and processes that require a high level of synchronism and reliability. The *slice* technology used by the platform eliminates the need for additional buses, *backplanes* or specific enclosures for power and communication between modules, making assembly simpler, more economical and more flexible. This feature reduces the mechanical complexity of the installation and contributes to greater system robustness, in addition to making future expansions and maintenance easier. The distributed architecture also reduces field wiring, simplifying electrical designs and lowering installation costs. Combining performance, modularity, ease of integration and an excellent cost-benefit ratio, the G Series stands out as a modern and reliable solution for industrial applications that require operational efficiency, scalability and high availability of automation systems.

1.1 Main features of the series

- Modular flexibility for system expansion;
- Compact size and space savings in panels;
- Simple wiring and module replacement;
- Fast and accurate communication between modules;
- Ideal for manufacturing, process, energy, water and wastewater, infrastructure and machinery industries.

2 Ordering Information

2.1 GT-5112

The product must be specified according to the corresponding code below:

CODE	DESCRIPTION
GT-5112	Expansion Module, 2 High-Speed Counter (300kHz) / Encoder (750kHz) Channels, 32 bits

The product package contains the following items:

- One Expansion Module.

2.2 Related Products

Below is a list of G Series products, which must be purchased separately, whenever necessary:

CODE	DESCRIPTION
GL-9087	PROFINET Network Adapter/Head Module. Light version, maximum expansion of 10 slots
GL-9089	Modbus/TCP and EtherNet/IP Network Adapter/Head Module. Light version, maximum expansion of 16 slots
GT-12DF	Expansion Module, 16 Digital Inputs 24Vdc, *Sink* or *Source*
GT-226F	Expansion Module, 16 Digital Outputs 24Vdc/0.3A, *Source*
GT-3158	Expansion Module, 8 Analog Inputs 0 to 20mA / 4 to 20mA, 16 bits
GT-3428	Expansion Module, 8 Analog Inputs 0 to 10Vdc / 0 to 5Vdc / 1 to 5Vdc, 12 bits
GT-3704	Expansion Module, 4 RTD Inputs, 16 bits
GT-3804	Expansion Module, 4 Thermocouple Inputs, 16 bits
GT-4254	Expansion Module, 4 Analog Outputs 4 to 20mA, 16 bits
GT-4424	Expansion Module, 4 Analog Outputs 0 to 10Vdc, 12 bits
GT-7511	Bus power supply. 24Vdc input, 5Vdc/1A output.
AMJG0808[1]	RJ45-RJ45 Cable (2m)

Notes:

[1]**AMJG0808:** CAT5 Ethernet network cable with an RJ45 male connector at each end. Designed for various applications, ensuring quality communication between the devices that use it (2 meters).



ATTENTION:

The GT-5112 module operates only as an expansion of an Altus G Series network adapter/head. It cannot be used without the appropriate network adapter/head.

3 Product Features

The GT-5112 module is a special I/O expansion equipped with 2 32-bit high-speed counter channels, each with two 24Vdc inputs (phase A and phase B), allowing the reading of incremental *encoders*, high-frequency pulse counting and the measurement of frequency, pulse width and pulse period. The module supports frequencies of up to 750kHz in *encoder* mode and up to 300kHz in counter mode, with the operating mode of each channel selected independently. To make diagnostics and field maintenance easier, the device has a front panel with 4 status LEDs, one for each input, allowing quick visualization of active signals and simplifying the identification of operating conditions and possible faults.

Designed for direct DIN rail installation, the GT-5112 uses *slice* technology, which enables automatic connection to the system's internal bus, eliminating the need for additional wiring for power and communication between modules. This feature reduces assembly time, minimizes the possibility of installation errors and provides greater flexibility for future expansions and maintenance. In addition, its compact design helps optimize space in electrical panels and automation systems.

The counter input connections are made through a 10-point removable RTB connector (*Removable Terminal Block*), which includes dedicated terminals for connecting the cable shields and allows quick replacement of the module without disconnecting the field wires. The inputs are isolated from the internal logic by optocouplers, and the device was designed to operate reliably in demanding industrial environments, with certifications and compliance that attest to its resistance to electromagnetic interference, mechanical vibration and temperature variations. As a result, the GT-5112 offers high robustness, accuracy and ease of maintenance, making it a suitable solution for positioning, speed measurement, motion control and production counting applications.

3.1 Electrical Characteristics

The GT-5112 expansion module has 2 high-speed counter channels and offers several operating modes, individually selectable for each channel, allowing its operation to be adapted to the specific requirements of each application. Its technical, functional and electrical characteristics were designed to provide flexibility, reliability and high performance in industrial environments, as detailed below:

Feature	DESCRIPTION
Number of channels	2 high-speed counter channels (phase A and phase B inputs per channel)
Functions	*Encoder*, high-speed counter, frequency measurement and pulse width and period measurement
Indicators	4 green status LEDs (1 for each input)
Input voltage	24Vdc nominal Maximum 28.8Vdc
Input current	3mA @ 24Vdc
Minimum ON-state voltage	≥ 16.5Vdc
Input frequency	0 ~ 750kHz (mode: *encoder*) 0 ~ 300kHz (mode: counter)
Operating modes	1 input: *Up*, *Down*, frequency measurement, pulse width measurement and pulse width and period measurement 2 inputs: *Encoder* 1x, 2x and 4x, *Up/Inhibit*, *Up/Reset*, *Down/Inhibit*, *Down/Reset*, *Up/Down* and *Clock/Direction*
Counter size	32 bits per channel
Consumption	Maximum 65mA @ 5V
Isolation	Inputs to internal logic: optocoupler isolation
Field power (UL)	Supply voltage: 24Vdc nominal, Class 2
Field power	Not used by the module Passed through to the next expansion module
Wiring	Maximum 2.0mm² (AWG 14) Torque: 0.8Nm (7 lb-in)



ATTENTION:

The GT-5112 inputs operate with 24Vdc signals (ON state from 16.5Vdc).
They are not compatible with *encoders* with 5V differential output (*line driver* / RS-422).

3.2 Environmental Characteristics

The GT-5112 expansion module was designed to operate reliably over a wide range of temperature and humidity, meeting the performance requirements of industrial environments. In addition, its construction complies with applicable standards and certifications, ensuring safety, robustness and operational reliability, as shown in the following table:

Feature	DESCRIPTION
Operating temperature	-20 to 70°C
UL temperature	-20 to 60°C
Storage temperature	-40 to 85°C
Relative humidity	5% to 90% (non-condensing)
Mounting	DIN rail mounting
Installation position	Vertical or horizontal installation possible
Weight	60g
Size	99mm x 12mm x 70mm (H x W x D)

3.3 Certifications

The GT-5112 expansion module has certifications that attest to its robustness and reliability in industrial applications, ensuring resistance to electromagnetic interference and vibration, as well as compliance with construction, safety and operation requirements established by internationally recognized standards, as shown in the following table:

Feature	DESCRIPTION
Mechanical shock	IEC 60068-2-27 : 2008 / 15g, 11ms
Vibration resistance	Based on IEC 60068-2-6 DNVGL-CG-0039 : Vibration Class B, 4g
Industrial emissions	EN61000-6-4/All : 2011
Industrial immunity	EN 61000-6-2 : 2005
Product certifications	CE, UL, FCC

4 Installation

The GT-5112 expansion module must be installed in a bus-type system, with a network adapter for communication with a controller device.

4.1 Mechanical installation

Mechanical installation of the module is simple: it is connected to the adjacent module through a side fitting and slid toward the DIN rail until it snaps onto the rail.



ATTENTION:

To avoid damage to the system, perform this procedure with the power disconnected.

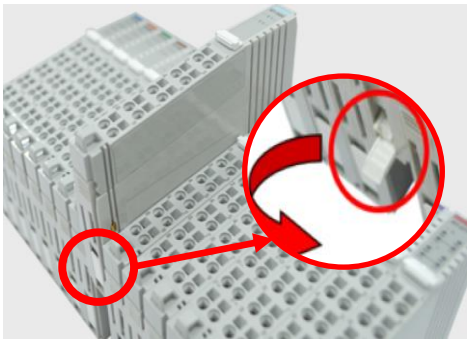


ATTENTION:

Do not touch the internal bus terminals with your fingers.

The procedure for installing an expansion module is described in the following steps:

- Open (unlock) the DIN rail latch;
- Position the module so that it fits with the adjacent modules;
- Slide the module down until it snaps onto the DIN rail;
- Close (lock) the DIN rail latch;



Removing the module is done in a similar way:

- Open (unlock) the DIN rail latch;
- Release the module from the DIN rail and slide it up until it is completely removed.

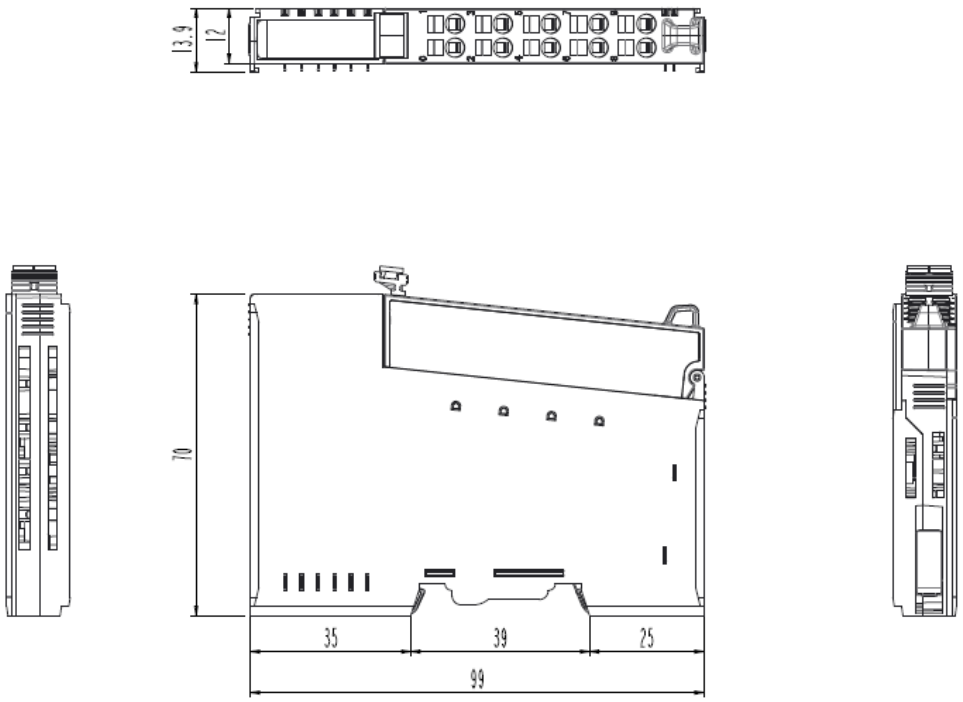
A bus terminator can be installed at the end of the last expansion module in the system to protect the electrical connections of the internal bus, in addition to providing a better aesthetic finish. This part is supplied in the network adapter package.

4.2 Physical Dimensions

The GT-5112 expansion module measures 12mm wide, 109mm high and 70mm deep when installed vertically (DIN rail horizontal).

The 2D (DWG) and 3D (STEP) files can be downloaded from the Altus website.

The following image shows the views of the module, with dimensions in mm (millimeters).

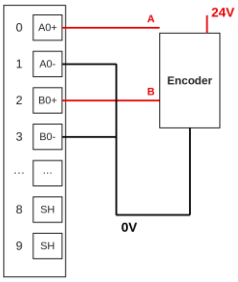
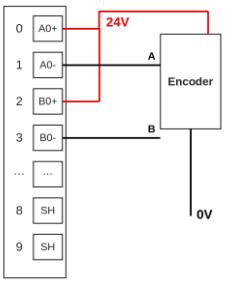


4.3 Electrical connections

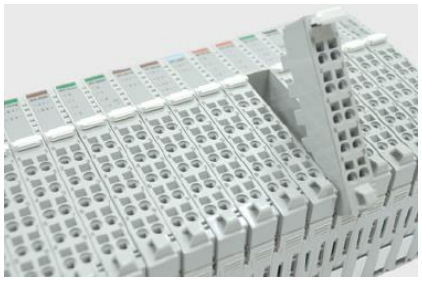
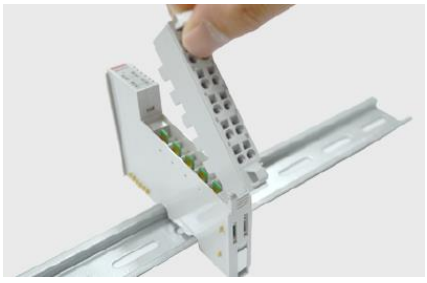
G Series expansion modules do not require additional electrical connections for system power, since it is supplied directly by the remote I/O internal bus. In the case of the GT-5112, the bus field power is not used by the module and is only passed through to the following expansion modules; therefore, the *encoders* and sensors connected to the inputs must be powered externally. The following table presents and describes all the electrical connections available for the module.

Front view	Connector	Description
	0	Phase A input (+) – Channel 0
	1	Phase A input (–) – Channel 0
	2	Phase B input (+) – Channel 0
	3	Phase B input (–) – Channel 0
	4	Phase A input (+) – Channel 1
	5	Phase A input (–) – Channel 1
	6	Phase B input (+) – Channel 1
	7	Phase B input (–) – Channel 1
	8	Cable shield (*Shield*)
	9	Cable shield (*Shield*)

The GT-5112 module inputs have independent positive (+) and negative (–) terminals for each signal (phase A and phase B of each channel), isolated from the internal logic by optocouplers. This allows the connection of *encoders* and sensors with PNP/*push-pull* or NPN output, as illustrated below for channel 0. Channel 1 is wired in the same way, using terminals 4 to 7.

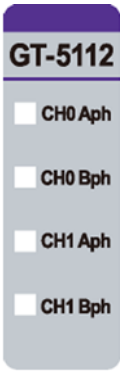
	**PNP / *push-pull* output (24V)**	
	(–) terminals connected to 0V	A and B signals connected to the (+) terminals Inputs activate at 24V External power for the *encoder*
	**NPN output (open collector)**	
	(+) terminals connected to 24V	A and B signals connected to the (–) terminals Inputs activate at 0V External power for the *encoder*

To assist with electrical installation, the modules are equipped with RTB connectors (*Removable Terminal Block*), which, if a module needs to be replaced, eliminate the need to undo and redo the field electrical connections.

4.4 LED Panel

The GT-5112 module has a panel with 4 diagnostic and status LED indicators, one for each counter input (phase A and phase B of each channel). The designation and state of each indicator are shown in the table below:

Panel	LED Description	Input	Color	Input not activated / OFF	Input activated / ON
	CH0 Aph	Phase A – Channel 0	Green	Off	On
	CH0 Bph	Phase B – Channel 0	Green	Off	On
	CH1 Aph	Phase A – Channel 1	Green	Off	On
	CH1 Bph	Phase B – Channel 1	Green	Off	On

5 Communication

The expansion modules communicate directly with the network adapter through a dedicated internal bus. It is not possible to establish direct communication with the expansion module. Therefore, any communication to read or write data or parameters must be requested through the network adapter, which may be operating with the Profinet or Modbus/TCP protocols.

5.1 Profinet

When the module is connected to a Profinet network adapter (GL-9087), it must be added to the project as a component of the adapter, which in turn will be associated with a Profinet Controller. The Profinet settings for both the network adapter and the expansion module are available in the GSD file integrated into MasterTool, which can also be downloaded from the Altus website. The module I/O data is available in the “PN Module I/O Mapping” tab, where it can be viewed, read and linked to project variables. Since the GT-5112 configuration parameters are reserved, the selection of the operating mode, the *reset* and stopping of the count for each channel are performed through the module output data, also available in this tab.

The tutorial on communication between a Nexto device and a G Series Profinet network adapter can be accessed at: https://suporte.altus.com.br/hc/pt-br/articles/40148216672397-Série-G-Configuração-e-comunicação-PROFINET.

5.2 Modbus/TCP

When the module is connected to a Modbus/TCP network adapter (GL-9089), it must be configured in the project through the variable mapping of the Modbus device, which will be associated with a Modbus Client. In this mapping, both the module input and output (I/O) data and its configuration and diagnostic parameters are made available through specific Modbus addresses, allowing them to be read and written by the controller. In this way, module information is accessed directly through the mapped registers, allowing the remote I/O to be integrated and parameterized in the application simply and efficiently.

The tutorial on communication between a Nexto device and a G Series Modbus/TCP network adapter can be accessed at: https://suporte.altus.com.br/hc/pt-br/articles/40132326144525-Série-G-Configuração-e-comunicação-MODBUS-TCP.

5.2.1 I/O Mapping

According to the GL-9089 Network Adapter documentation, the expansion module input data is made available in the input process image, starting at register 0x0000 (0), which is accessed through the register read functions (03 – *Read Holding Registers*, 04 – *Read Input Registers* and 23 – *Read/Write Multiple Registers*). The output data is made available in the output process image, starting at register 0x0800 (2048), which is accessed through functions 03, 06 – *Write Single Register*, 16 – *Write Multiple Registers* and 23. Since its data is organized in bytes, the GT-5112 must be accessed through these register functions, and not through the *coils* and *discrete inputs functions*.

Therefore, considering the 1-based addressing convention, access to the input and output registers uses addresses starting at 0x0001 and 0x0801 (1 and 2049), respectively. Since the data of each module is allocated sequentially according to its position on the bus, it is recommended to check the address of the first input and output register of the GT-5112 through the slot special registers, described below. Each 16-bit Modbus register groups two consecutive bytes of the module image, with the lower-index byte allocated to the low part (bits 0 to 7) of the register.

Module parameters can be accessed through the special register address mapping of the expansion modules shown in the table below. Unlike the data mapping, the special registers have a fixed address, corresponding to the number of the slot in which the module is located, regardless of its type, input or output.

Slot	Start Address	End Address
1	0x2000	0x201F
2	0x2020	0x203F
3	0x2040	0x205F
4	0x2060	0x207F
5	0x2080	0x209F
6	0x20A0	0x20BF
7	0x20C0	0x20DF
8	0x20E0	0x20FF
9	0x2100	0x211F
10	0x2120	0x213F
11	0x2140	0x215F
12	0x2160	0x217F
13	0x2180	0x219F
14	0x21A0	0x21BF
15	0x21C0	0x21DF
16	0x21E0	0x21FF

To access the module information through the special registers:

- [Start address] + 0x0002 to read the address of the module's first input data register
- [Start address] + 0x0004 to read the address of the module's first output data register
- [Start address] + 0x000A to read the module input data
- [Start address] + 0x000B to read/write the module output data
- [Start address] + 0x0010 to read the number of parameter bytes the module has
- [Start address] + 0x0011 to read/write the module parameters

5.2.2 Data

The GT-5112 high-speed counter expansion module has a set of 8 bytes of input data, 4 bytes (32 bits) for each channel, corresponding to the current counter value. Depending on the selected operating mode, this value represents the pulse count, the frequency (in Hz), the pulse width or the pulse period (in units of 0.1µs).

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Counter value – Channel 0 (LL – least significant byte)							
Byte 1	Counter value – Channel 0 (LH)							
Byte 2	Counter value – Channel 0 (HL)							
Byte 3	Counter value – Channel 0 (HH – most significant byte)							
Byte 4	Counter value – Channel 1 (LL – least significant byte)							
Byte 5	Counter value – Channel 1 (LH)							
Byte 6	Counter value – Channel 1 (HL)							
Byte 7	Counter value – Channel 1 (HH – most significant byte)							

In addition to the input data, the module has a set of 2 bytes of output data, used to control each channel. In each byte, bits 0 to 3 define the channel operating mode, bit 6 (CS – *Counter Stop*) stops the count, acting as an inhibit, and bit 7 (CR – *Counter Reset*) resets the counter value.

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	CR 0	CS 0	–	–	Count mode – Channel 0			
Byte 1	CR 1	CS 1	–	–	Count mode – Channel 1			

Byte addressing depends on the position of the module on the bus, following the mapping criteria already described in 5.2.1.

5.2.3 Count Modes

The operating mode of each channel is defined by the value written to bits 0 to 3 (*Count Mode*) of the corresponding output byte, according to the following table:

Value	Mode	Description
0x0	*Up*	Up counter. Phase A: *clock* input; phase B: not used.
0x1	*Down*	Down counter. Phase A: *clock* input; phase B: not used.
0x2	–	Reserved.
0x3	–	Reserved.
0x4	*Up Clock & Inhibit*	Up counter with inhibit. Phase A: *clock*; phase B: inhibits counting.
0x5	*Up Clock & Reset*	Up counter with *reset*. Phase A: *clock*; phase B: resets the counter.
0x6	*Down Clock & Inhibit*	Down counter with inhibit. Phase A: *clock*; phase B: inhibits counting.
0x7	*Down Clock & Reset*	Down counter with *reset*. Phase A: *clock*; phase B: resets the counter.

0x8	*Up Clock & Down Clock*	Up/down counter. Phase A: up *clock*; phase B: down *clock*.
0x9	*Clock & Direction*	Phase A: *clock*; phase B: direction (low level = up, high level = down).
0xA	*Encoder* 1x	Phases A and B of the *encoder*. Maximum frequency equal to that of counter mode (300kHz).
0xB	*Encoder* 2x	Phases A and B of the *encoder*.
0xC	*Encoder* 4x	Phases A and B of the *encoder*.
0xD	Frequency measurement[1]	Frequency on phase A, in Hz, updated every 1s. Phase B: not used.
0xE	Pulse width measurement	High-level pulse width on phase A (32 bits, 0.1µs units). E.g.: 1234 = 123.4µs.
0xF	Pulse width and period measurement	Width (16 bits, low *word*) and period (16 bits, high *word*) of the pulse on phase A, in units of 0.1µs. Available for pulses ≥ 200Hz.

Notes:

[1]**Frequency measurement:** mode 0xD cannot be used when the other channel is configured in modes 0x0, 0x1 or 0x4 to 0xA.

Firmware: the coding shown is valid for module firmware revisions later than 1.001. In revisions 1.000 and 1.001, the mode coding is different and the module has only 2 parameter bytes; in these cases, refer to the manufacturer's manual.

5.2.4 Parameters

The GT-5112 high-speed counter expansion module has a set of 4 parameter bytes, all reserved. Therefore, the module does not require parameterization, and all operating configuration of each channel is performed through the output data described in 5.2.2.

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Reserved							
Byte 1	Reserved							
Byte 2	Reserved							
Byte 3	Reserved							

Byte addressing depends on the position of the module on the bus, following the mapping criteria already described in 5.2.1.