

SmartSlice I/O with EtherCAT Interface

GRT1-ECT

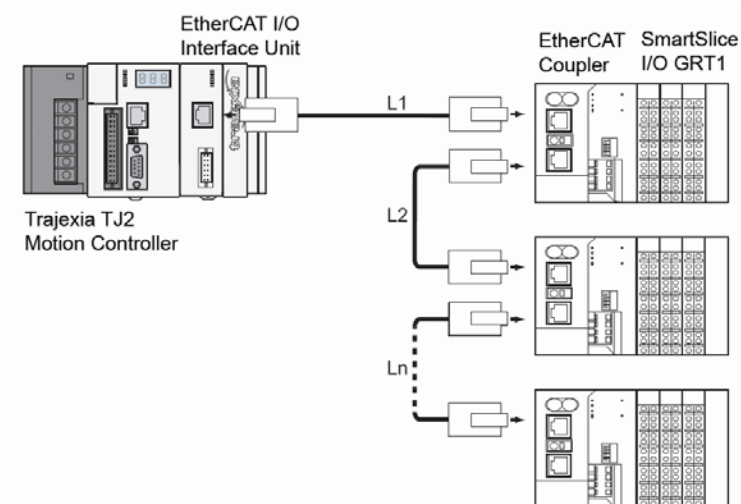
Ultra-Fast EtherCAT SmartSlice I/O for Trajexia Motion Controller

Simple & Fast Wiring – Cage clamp terminals allow for easy & fast wiring saving setup time

- **Standard Ethernet Wiring to I/O Blocks** – Save money by using standard Ethernet wiring to EtherCAT I/O
- **Ethernet Hubs & Switches Not Needed** – Built-in daisy chain connection allows for easy connection to the next EtherCAT node, expensive Ethernet Switches are not needed
- **Hot Swap Capability** – Change out your I/O on the fly, no need to power off the system, simple auto restore function
- **Detachable I/O connector** – The detachable connector allows for fast and accurate replacement of I/O
- **Up to 64 I/O units per station** – Allows for various I/O configurations based on the need of the application
- **Automatic I/O assignment** – The software automatically scans the configured I/O for easy and fast I/O mapping and assignment



Configuration



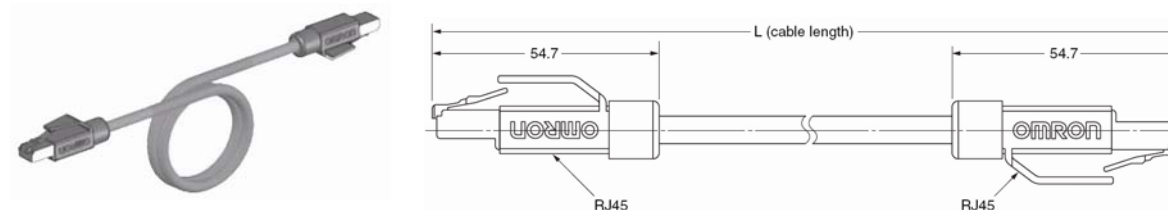
Ordering Information

SmartSlice I/O Units

Type	Description	Specification	Model
Interface unit	SmartSlice EtherCAT coupler	--	GRT1-ECT
	End plate	One unit required per bus interface	GRT1-END
Digital inputs	4 NPN inputs	24 VDC, 6 mA, 3-wire connection	GRT1-ID4
	4 PNP inputs	24 VDC, 6 mA, 3-wire connection	GRT1-ID4-1
	8 NPN inputs	24 VDC, 4 mA, 1-wire connection + 4xG	GRT1-ID8
	8 PNP inputs	24 VDC, 4 mA, 1-wire connection + 4xV	GRT1-ID8-1
	4 AC inputs	110 VAC, 2-wire connection	GRT1-IA4-1
	4 AC inputs	230 VAC, 2-wire connection	GRT1-IA4-2
Digital outputs	4 NPN outputs	24 VDC, 500 mA, 2-wire connection	GRT1-OD4
	4 PNP outputs	24 VDC, 500 mA, 2-wire connection	GRT1-OD4-1
	4 PNP outputs with short-circuit protection	24 VDC, 500 mA, 3-wire connection	GRT1-OD4G-1
	4 PNP outputs with short-circuit protection	24 VDC, 2 A, 2-wire connection	GRT1-OD4G-3
	8 NPN outputs	24 VDC, 500 mA, 1-wire connection + 4xV	GRT1-OD8
	8 PNP outputs	24 VDC, 500 mA, 1-wire connection + 4xG	GRT1-OD8-1
	8 PNP outputs with short-circuit protection	24 VDC, 500 mA, 1-wire connection + 4xG	GRT1-OD08G-1
	2 relay outputs	240 VAC, 2 A, normally open contacts	GRT1-ROS2
Analog I/O	2 analog inputs, current/voltage	-10 to +10 V, 0-10 V, 0-5 V, 1-5 V, 0-20 mA, 4-20 mA	GRT1-AD2
	2 analog outputs, voltage	10 to +10 V, 0-10 V, 0-5 V, 1-5 V	GRT1-DA2V
	2 analog outputs, current	0-20 mA, 4-20 mA	GRT1-DA2C
Temperature sensor inputs	2 thermocouple inputs	Types B, E, J, K, N, R, S, T, U, W, PL2, with cold junction compensation	GRT1-TS2T
	2 Platinum RTD inputs	Pt100, 2-wire or 3-wire connection	GRT1-TS2P
	2 Platinum RTD inputs	Pt1000, 2-wire or 3-wire connection	GRT1-TS2K

Cables

Cable connects the Trajexia EtherCAT unit with the SmartSlice I/O EtherCAT coupler GRT1-ECT.



Description	Connector type	Cable length L	Model
Double-ended EtherCAT Cable with Straight Connectors	RJ45/RJ45 on both ends	0.3 m	XS5W-T421-AMD-K
		0.5 m	XS5W-T421-BMD-K
		1 m	XS5W-T421-CMD-K
		2 m	XS5W-T421-DMD-K
		3 m	XS5W-T421-EMD-K
		5 m	XS5W-T421-GMD-K
		10 m	XS5W-T421-JMD-K
		15 m	XS5W-T421-KMD-K

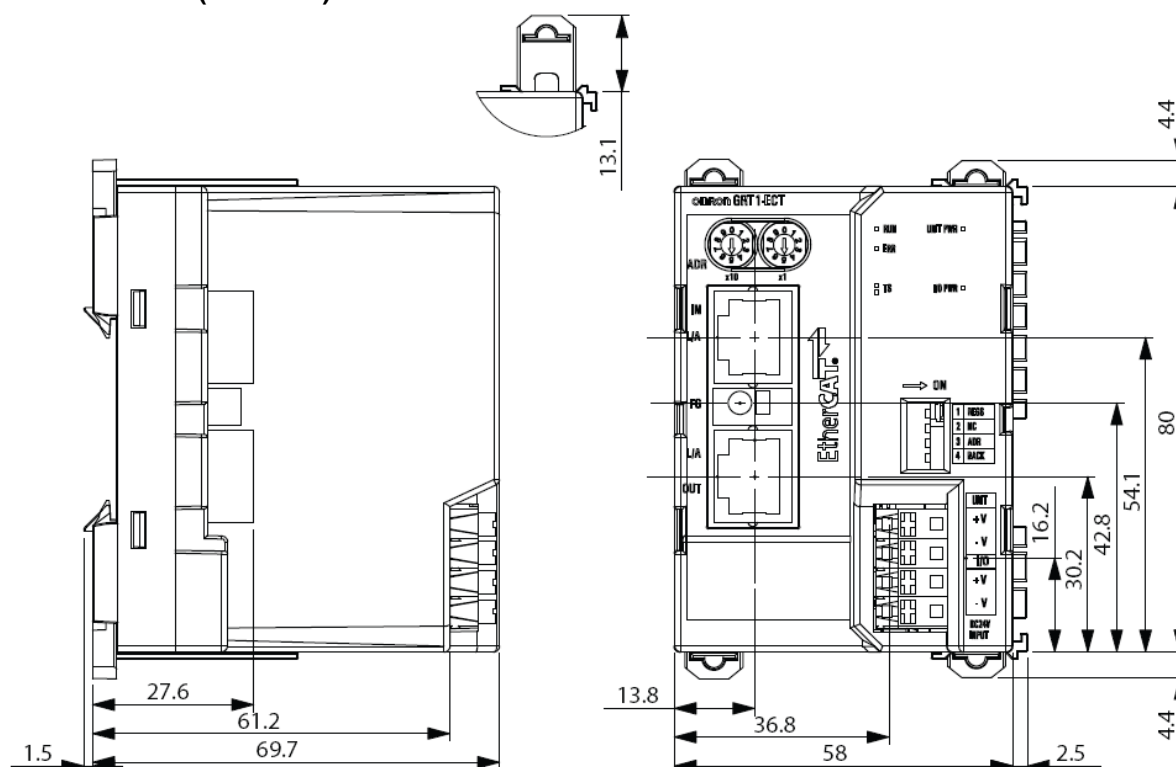
I/O Expansion

Type	Description	Dimensions (H x W x D mm)	Model
Expansion interface	Turnback unit, right-hand side	84 x 20 x 58	GRT1-TBR
	Turnback unit, left-hand side	84 x 58 x 70	GRT1-TBL
	Turnback cable, connects turnback units used for I/O expansion	1 m	GCN2-100
I/O power	I/O power feed unit, separates power supply between groups of I/O units	84 x 15 x 74	GRT1-PD2
	I/O power feed unit with electronic overload protection, separately power supply between groups of I/O units	84 x 15 x 74	GRT1-PD2G
	I/O power feed and distribution unit, separates power supply between groups of I/O units, 8xV + 4xG	84 x 15 x 74	GRT1-PD8
	I/O power feed and distribution unit, separates power supply between groups of I/O units, 4xV + 8xG	84 x 15 x 74	GRT1-PD8-1
	I/O power connection unit, 8xV + 4xG	84 x 15 x 74	GRT1-PC8
	I/O power connection unit, 4xV + 8xG	84 x 15 x 74	GRT1-PC8-1

Specifications

Item	Specification
Installation	
Unit type	SmartSlice GRT1 series interface unit
Model	GRT1-ECT
Installation position	On a DIN rail
Power supply	24 VDC +10%/-15% (20.4 to 26.4 VDC)
Current consumption	140 mA typical at 24 VDC
Dimensions	58 W x 80 H x 70 D mm
Weight	130 g
Environment	
Ambient operating temperature	-10 to 55°C (no icing or condensation)
Ambient operating humidity	25% to 85% RH
Storage temperature	-20 to 65°C (no icing or condensation)
Vibration resistance	10 to 57 Hz, 0.7 mm amplitude 57 to 150 Hz, acceleration: 49 m/s ²
Shock resistance	150 m/s ²
Dielectric strength	500 VAC (between isolated circuits)
Conformance to EMC and electrical safety standards	EN61131-2-2003
Enclosure rating	IP20
SmartSlice I/O bus	
Number of connectable SmartSlice I/O units	64 units max. Connected directly to the GRT1-ECT or via Turnback extension units
Baud rate	3 Mbps
Communication signal level	RS-485
Communication distance	SmartSlice I/O Units: 64 Units coupled (about 2m max.) Turnback cable: 2m max. (2 cables, 1 m each)
Turnback cable	Length: 1 m max.; up to 2 cables can be connected
SmartSlice I/O unit connections	Building-block style configuration with slide connectors (Units connect with Turnback cables)
Baseblock power supply	Voltage: 24 VDC Current: 4 A max.
Event messaging	Supported
EtherCAT Communications Protocol	
Baud rate	100 Mbps
Physical layer	100Base-TX
Communications control functions	Auto Negotiation: Only for 100Base-TX full-duplex communications
Topology	Daisy chain, line, or drop line
Communications media	STP Category 5
Maximum cable length	100 m max. between nodes

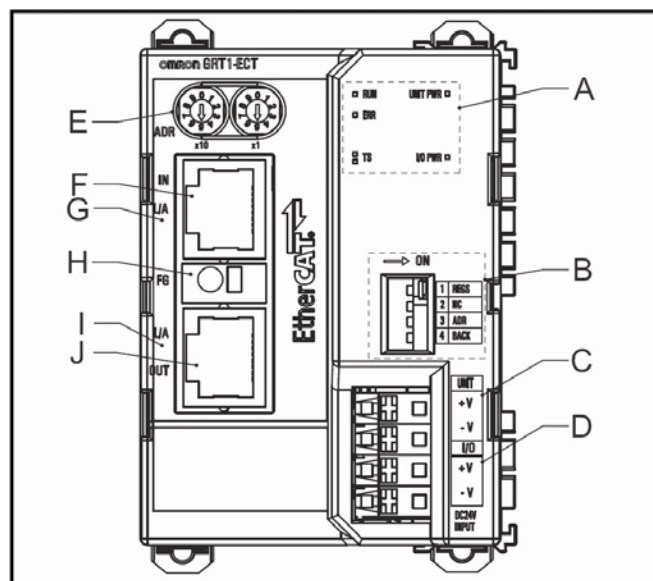
Dimensions (Unit: mm)



Nomenclature

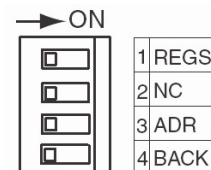
The GRT1-ECT SmartSlice Communication Unit controls data exchange between a TJ2-MC64 Trajexia Machine Controller Unit (via a connected TJ2-ECT□□ EtherCAT Master Unit) and SmartSlice I/O Units over an EtherCAT network. For more information on SmartSlice I/O Units, refer to the GRT1 Series SmartSlice I/O Units Operation Manual (W455).

Label	Description
A	LED indicators
B	Unit DIP switches
C	Unit power supply terminals
D	I/O power supply terminals
E	Node address switches
F	EtherCAT connector IN port
G	Link/activity LED IN port
H	Shielding terminal
I	Link/activity LED OUT port
J	EtherCAT connector OUT port



Unit DIP Switches

DIP switch	Function	Setting	Description
1: REGS	Create/enable registration table	ON	Registered table is enabled
		OFF	Registered table is disabled
		OFF to ON (Note 1)	Register I/O unit table
		ON to OFF	Clear registered I/O unit table
2: NC	N/A	OFF	Not used, always set to OFF
3: ADR	Automatic restore	OFF to ON	When the SmartSlice I/O Units are replaced, the parameter data that was backed up with the BACK DIP switch is automatically restored (Note 2)
		OFF	Automatic restore disabled
4: BACK	Backup trigger	ON to OFF to ON in 3 s (Note 3)	Parameter data of all connected SmartSlice I/O Units is backed up.



Notes:

1. When the unit power is ON.
2. When DIP switch 1 is set to ON.
3. The setting of DIP switch 4 (BACK) is given



Caution

The Backup and Restore functionality is available in the GRT1-ECT. However, the backed up and restored parameters cannot be accessed via EtherCAT communication.

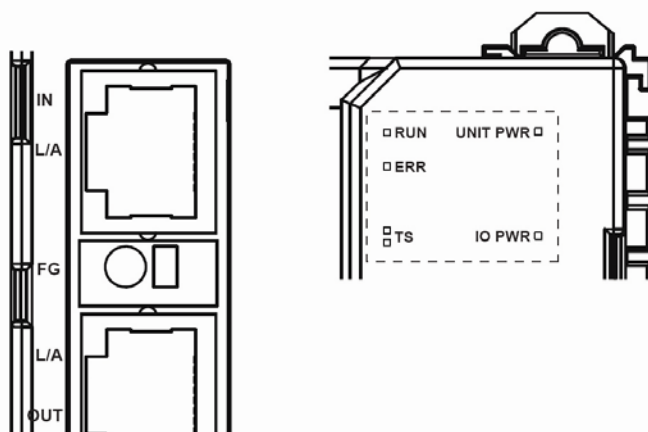


Note

- It is recommended to do a registration of the SmartSlice I/O Units (see the Trajexia Programming Manual).
- It is recommended to set dipswitches 1, 3 and 4 on after this registration.

The factory setting of all dipswitches is OFF.

LED Indicators



LED	Description	Color	Status	Meaning
RUN	Unit status	Green	OFF	Initialize state
			Blinking	Pre-operational state
			Single flash	Safe operational state
			ON	Operational state
ERR	Unit error	Red	OFF	No error
			Double flash	An application watchdog timeout has occurred
			Single flash	Unit has changed its state autonomously, due to local error. Error indicator bit is set to 1 in AL status register.
			Blinking	General configuration error.
			ON	A critical communication or application error has occurred.
L/A IN	Link/activity IN port	Green	OFF	Link not established in physical layer
			ON	Link established in physical layer
			Flickering	In operation after establishing link
L/A OUT	Link/activity OUT port	Green	OFF	Link not established in physical layer
			ON	Link established in physical layer
			Flickering	In operation after establishing link
TS	SmartSlice I/O system communication status	N/A	Not lit	<ul style="list-style-type: none"> No power supply Communication with SmartSlice I/O Unit has not started Overcurrent detected
		Green	Flashing (every second)	SmartSlice I/O Unit added to the system
			Flashing (every 0.5 second)	Backup/Restore function operating: <ul style="list-style-type: none"> Restoring settings to SmartSlice I/O Unit, backup function operating Downloading SmartSlice I/O Unit settings
			Lit	Communication with SmartSlice I/O Unit established
		Red	Flashing	Non-fatal communication error occurred. <ul style="list-style-type: none"> Communication timeout Verification error occurred with registered table Different model unit detected after SmartSlice I/O Unit replacement
			Lit	Fatal communication error occurred.
			Lit for 2 s	Failure occurred while restoring settings to I/O unit or downloading I/O unit settings
UNIT PWR	Unit power	Green	Not lit	No power supply to the unit (All LEDs are OFF)
			Lit	Power supply to the unit
I/O PWR	I/O power	Green	Not lit	No power supply to the SmartSlice I/O (No output from the SmartSlice I/O Units, even when they are in operation)
			Lit	Power supply to the SmartSlice I/O

Rotary switches

Set the address selector of the GRT1-ECT to the required node address by using the X1 (right) and X10 (left) rotary switches.

The setting range for the node address switches is 00 to 99.

When the rotary switches are set to 00, the node address will be assigned automatically, depending on the position in the network, starting from 1000. When set from 01 to 99, the node address assigned will 1000 plus the switch setting.

To set the EtherCAT node address of the GRT1-ECT, do these steps:

1. Turn off the Unit power supply of the GRT1-ECT.



Note

The address of the GRT1-ECT is read only at power on. Setting the new address when the power is on has no effect.

2. To set the address of the unit, either use auto-addressing by setting the rotary switches to 00, or set the desired address with the rotary switches.



Note

Make sure that the address is unique in the EtherCAT network. If two or more IO units have the same node address, a configuration error will occur.

3. Turn the power on.

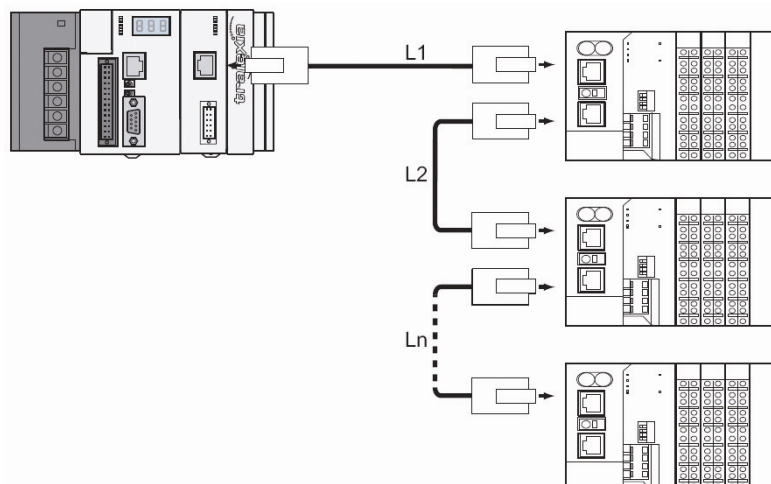


Note

To make the EtherCAT address of the unit valid, do one of these steps:

- Restart the TJ2-MC64.
- Execute the command **ETHERCAT(0,unit)**.

EtherCAT Connectors (IN and OUT)



Connect the EtherCAT master to the IN connector of the first slave. Connect the OUT connector on the first slave to the IN connector on the next slave. Do not connect the OUT connector on the last slave.



Note

Always turn OFF the power supply to the Machine Control Unit and slaves before connecting or disconnecting the EtherCAT Communications Cables.

The cable between two nodes (L1, L2 ... Ln) must be 100 m or less.

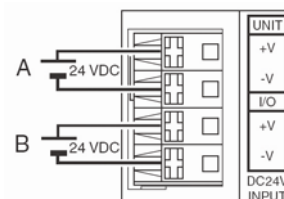
Field Ground Terminal

The GRT1-ECT provides a Field Ground Terminal (FG) between the EtherCAT connectors. If noise is a significant source of errors, ground the Field Ground Terminal (recommended wire 20 AWG to 14 AWG or 0.5 to 2.0 mm²). Strip the wire between 8 mm and 10 mm of insulation at the ends of the wires (stranded or solid wire) or use pin terminals with a pin (conductor) length of 8 mm to 10 mm.

Power Supply Connector

The GRT1-ECT has two 24 VDC power supply terminals:

Label	Power supply terminal	Description
A	Unit power supply terminal	Power supply to the internal circuits of the GRT1-ECT and to the internal circuits of the connected SmartSlice I/O Units (through the SmartSlice bus)
B	External I/O power supply terminal	Power supply to the external I/O connected to the SmartSlice I/O Units



**Note**

The unit power supply and the external I/O power supply are not transferred through the GCN2-100 Turnback cable. The GRT1-TBR units have the same power supply terminals as the GRT1-ECT.

Installation

Follow these rules when installing the GRT1-ECT:

- Before installing the GRT1-ECT or connect or disconnect cables, switch off the power of the Trajexia system, the SmartSlice I/O Units and the external I/Os.
- Make sure that the power supplies of the GRT1-ECT, the SmartSlice I/O Units and the external I/Os are correctly connected.
- Provide separate conduits or ducts for the I/O lines to prevent noise from high-tension lines or power lines.
- It is possible to connect up to 64 SmartSlice I/O Units to 1 GRT1-ECT.
- Install the GRT1-ECT and the SmartSlice I/O Units on a DIN rail. To install a GRT1-ECT on the DIN rail, press it onto the DIN track from the front, and press the unit firmly until it clicks. Check that all DIN rail sliders of the unit are locked onto the DIN rail.
- To remove the GRT1-ECT from the DIN rail, release the sliders from the DIN rail with a screwDriver, and pull the unit straight from the DIN rail.

Connections

Connect the first SmartSlice I/O Unit to the GRT1-ECT:

- Align the sides of the GRT1-ECT and the SmartSlice I/O Unit.
- Slide the SmartSlice I/O Unit to the rear until it clicks onto the DIN rail.

**Caution**

Do not touch the connectors on the side of GRT1-ECT and the SmartSlice I/O Units.

See the GRT1 Series SmartSlice I/O Units Operation Manual for more information on connecting additional SmartSlice I/O Units, Turnback Units, End Units and end plates.

Wiring

The GRT1-ECT has 2 power supply terminals. Both power supply terminals have screwless clamping-type connections.

To determine the power supply requirements, do the steps below.

The maximum power consumption for SmartSlice I/O Units is 80 W per block.

1. Calculate the power consumption of all SmartSlice I/O Units connected to the GRT1-ECT. Refer to the GRT1 Series SmartSlice I/O Units Operation Manual (W455) for the power value for each SmartSlice I/O Unit.
2. If the power consumption exceeds 80 W, mount a Right Turnback Unit (GRT1-TBR) on the SmartSlice I/O Unit at the point where the power consumption is less than 80 W.
3. Connect the 24 VDC unit power supply to the Left Turnback Unit (GRT1-TBL).

The maximum I/O current consumption is 4 A.

1. Calculate the total current consumption used by all external I/Os of the connected SmartSlice I/O Units (including other units like Turnback Units). Refer to the GRT1 Series SmartSlice I/O Units Operation Manual (W455) for the current value for each SmartSlice I/O Unit.
2. If the current consumption exceeds 4 A or if you want to provide separate systems for inputs and outputs, divide the SmartSlice I/O Units at the desired point with a GRT1-PD₍₋₁₎ I/O Power Supply Unit and provide a separate external I/O power supply.



Note

It is also possible to provide a separate external I/O power supply at a Left Turnback Unit (GRT1-TBL).



Note

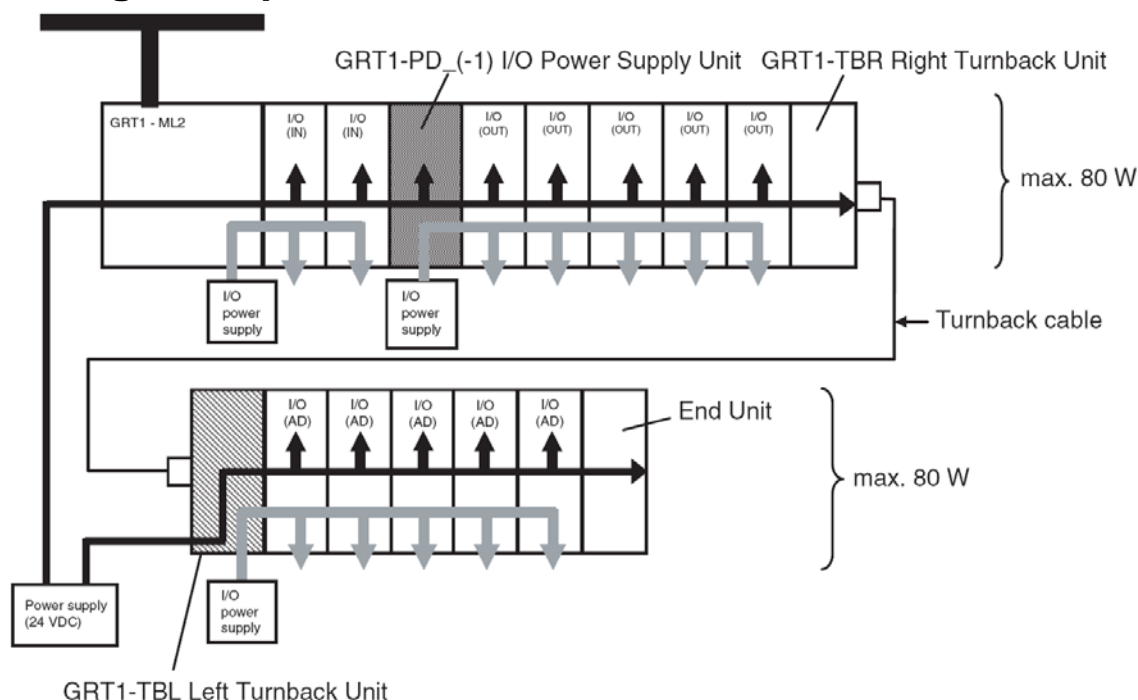
Make sure the power supply is isolated.



Note

The GCN2-100 Turnback cable does not supply power.

Wiring Example



To supply power to the units and the I/O devices, connect the power supply wires to the power supply terminals of the GRT1-ECT. If the wire ends have pin terminals, just insert the pin terminals in the power supply terminals.

To remove the wires, press the release button above the terminal hole with a precision screwdriver, and pull out the wire.

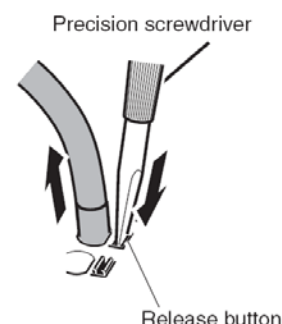
It is recommended to use a SELV (Safety Extra Low Voltage) power supply with over-current protection. A SELV power supply has redundant or increased insulation between the I/O, an output voltage of 30 V rms and a 42.4 V peak or maximum of 60 VDC.

Recommended power supplies are:

- S82K-01524 (OMRON)
- S8TS-06024 (OMRON).

It is recommended to use wires with a gauge of 20 AWG to 16 AWG (0.5 to 1.25 mm²).

Strip the wire between 7 and 10 mm of insulation at the ends of the wires (stranded or solid wire), or use pin terminals with a pin (conductor) length of 8 to 10 mm.



Replacement



Caution

The GRT1-ECT is a unit that is part of a network. If the GRT1-ECT is damaged, it effects the whole network. Make sure that a damaged GRT1-ECT is repaired immediately.

To replace the unit, follow these rules:

- Turn off the power before replacing the unit. This includes the power to all master and slave units in the network.
- Make sure that the new unit is not damaged.
- If a poor connection is the probable cause of any malfunctioning, do these steps:
 - Clean the connectors with a clean, soft cloth and industrial-grade alcohol.
 - Remove any lint or threads left from the cloth.
 - Install the unit again.
- When returning a damaged unit to the OMRON dealer, include a detailed damage report with the unit.
- Before reconnecting the new unit, do these steps:
 - Set the EtherCAT node address to the same address as the old unit.
 - If the table registration function was used for the old unit, create a new registration table for the new unit. See the Trajexia Programming Manual.

“Hot Swap” Online Replacement

It is possible to replace SmartSlice I/O Units connected to a GRT1-ECT when the power is on. The I/O communication continues while a SmartSlice I/O Unit is removed and replaced.

To replace a SmartSlice I/O Unit online, do these steps:

1. Turn off all power supplies of the SmartSlice I/O Unit. This is the I/O power supply, plus possible external power supplies to the terminal block (for example, a Relay Output Unit).
2. Release the locks on the front of the unit and remove the terminal block. Do not remove the wiring.
3. Remove the main block of the unit. Replace it with a new SmartSlice I/O Unit of the same type.
4. Attach the new unit to the system. Close the locks on the front of the unit.
5. Turn on the power supplies to the unit.

When replacing a SmartSlice I/O Unit online, note the following things:

- When a unit is removed from the I/O communication, the withdrawn flag of the unit is set on and the TS LED on the GRT1-ECT flashes red.
- If I/O power supply of the unit is not turned off, there can be false output signals, false input signals and electrical shocks.
- Only replace one SmartSlice I/O Unit at a time.
- If a unit is replaced with a different type of unit, there can be unexpected outputs and the restore operation can be incomplete.
- If the base block has faults or damage, turn off the power supply and replace the entire unit.

When an online replacement is performed, the status word of the GRT1-ECT reports an error (missing I/O Unit). When the I/O Unit is replaced or put back, the status word changes to 8000 hex, but the error has already been detected by the TJ2-MC64. To avoid this, it is necessary to mask the errors before the online replacement is performed. To perform the online replacement do the following:

1. Execute **IO_STATUSMASK(unit, address, 1, 0)**. This masks all bits, including errors, in the GRT1-ECT status word.
2. Replace the I/O Unit.
3. Execute **IO_STATUSMASK(unit, address, 1, \$4000)**. This sets the error mask to its default value.

Related BASIC Commands

The following BASIC commands are related to the GRT1-ECT module:

- **ETHERCAT**
- **CO_READ**
- **CO_WRITE**
- **IO_STATUS**
- **IO_STATUSMASK**

For more information, refer to the Trajexia Programming Manual.

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