取扱説明書 / Instruction Manual

FRENIC-MEGA

Tリンク通信カード
T-Link Communications Card
"OPC-G1-TL"

日本語

ENGLISH

Fuji Electric Co., Ltd.

INR-SI47-1330c-JE

English Version

ENGLISH

Preface

Thank you for purchasing our T-Link Communications Card OPC-G1-TL.

The communications card is used to connect our general-purpose inverter series FRENIC-MEGA to a T-Link network. Mounting this communications card on your FRENIC-MEGA allows you to connect the FRENIC-MEGA to a Fuji MICREX series of programmable logic controllers (T-Link module) and control it as a slave unit using run and frequency commands, and accessing function codes.

This instruction manual does not contain inverter handling instructions. Read through this instruction manual in conjunction with the FRENIC-MEGA Instruction Manual and be familiar with proper handling and operation of this product. Improper handling might result in incorrect operation, a short life, or even a failure of this product.

Keep this manual in a safe place.

Related Publications

Listed below are the other materials related to the use of the T-Link communications card "OPC-G1-TL." Read them in conjunction with this manual as necessary.

- RS-485 Communication User's Manual
- FRENIC-MEGA Instruction Manual

The materials are subject to change without notice. Be sure to obtain the latest editions for use.

⚠CAUTION

- Read through this instruction manual and be familiar with the T-Link communications card before proceeding with installation, connections (wiring), operation, or maintenance and inspection.
- Improper handling might result in incorrect operation, a short life, or even a failure of this product as well as the motor.
- Deliver this manual to the end user of this product. Keep this manual in a safe place until this product is discarded.

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■ Safety precautions

Read this manual thoroughly before proceeding with installation, connections (wiring), operation, or maintenance and inspection. Ensure you have sound knowledge of the device and familiarize yourself with all safety information and precautions before proceeding to operate the inverter.

Safety precautions are classified into the following two categories in this manual.

⚠WARNING	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in death or serious bodily injuries.
⚠CAUTION	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in minor or light bodily injuries and/or substantial property damage.

Failure to heed the information contained under the CAUTION title can also result in serious consequences. These safety precautions are of utmost importance and must be observed at all times.

Installation and wiring

⚠WARNING⚠

- Before starting installation and wiring, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).
- Qualified electricians should carry out wiring.

  Otherwise, an electric shock could occur.

⚠CAUTION

- Do not use the product that is damaged or lacking parts.

  Doing so could cause a fire, an accident, or injuries.

- Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter and the communications card.

  Otherwise, a fire or an accident might result.

- Incorrect handling in installation/removal jobs could cause a failure.

  A failure might result.

- Noise may be emitted from the inverter, motor and wires. Implement appropriate measure to prevent the nearby sensors and devices from malfunctioning due to such noise.

  Otherwise, an accident could occur.

Operation

⚠WARNING⚠

- Be sure to install the front cover before turning the inverter's power ON. Do not remove the cover when the inverter power is ON.

  Otherwise, an electric shock could occur.

- Do not operate switches with wet hands.

  Doing so could cause an electric shock.

- If you configure the function codes wrongly or without completely understanding FRENIC-MEGA Instruction Manual and the FRENIC-MEGA User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine. Confirm and adjust the setting of the function codes before running the inverter.

  Otherwise, an accident could occur.

Maintenance and inspection, and parts replacement

⚠WARNING⚠

- Before proceeding to the maintenance/inspection jobs, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).

  Otherwise, an electric shock could occur.

- Maintenance, inspection, and parts replacement should be made only by qualified persons.
- Take off the watch, rings and other metallic objects before starting work.
- Use insulated tools.

  Otherwise, an electric shock or injuries could occur.

Disposal

⚠CAUTION
• Treat the communications card as an industrial waste when disposing of it. **Otherwise injuries could occur.**

Others

⚠WARNING⚠
• Never modify the communications card. **Doing so could cause an electric shock or injuries.**

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Icons

The following icons are used throughout this manual.

Note This icon indicates information which, if not heeded, can result in the product not operating to full efficiency, as well as information concerning incorrect operations and settings which can result in accidents.

Tip This icon indicates information that can prove handy when performing certain settings or operations.

This icon indicates a reference to more detailed information.

Table of Contents

Chapter 1 BEFORE USE

1.1 Acceptance Inspection

Unpack the package and check the following:

(1) A communications card, two screws (M3 × 8), and the T-Link Communications Card Instruction Manual (this document) are contained in the package.

(2) The communications card is not damaged during transportation--no defective parts, dents or warps.

(3) The model name "OPC-G1-TL" is printed on the communications card. (See Figure 2.1.)

If you suspect the product is not working properly or if you have any questions about your product, contact the shop where you bought the product or your local Fuji branch office.

Note No terminating resistor comes with this communications card.
A pair of resistors with the following specifications must be used: 100 ohm, 1 watt
(The terminating resistors that come with the T-Link module of the MICREX series can be used.)

1.2 Applicable Inverters

The T-Link communications card is applicable to the following inverters and ROM version.

Table 1.1 Applicable Inverters and ROM Version

Series	Inverter type	Applicable motor rating	ROM version
FRENIC-MEGA	FRN□□□G1□-□□□	All capacities	0500 or later

* The boxes □ replace alphanumeric letters depending on the nominal applied motor, enclosure, power supply voltage, etc.

To check the inverter's ROM version, use Menu #5 "Maintenance Information" on the keypad. (Refer to the FRENIC-MEGA Instruction Manual, Chapter 3, Section 3.4.6 "Reading maintenance information."

Display on LED Monitor	Item	Description
5_ 14	Inverter's ROM version	Shows the inverter's ROM version as a 4-digit code.

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Chapter 2 NAMES AND FUNCTIONS

2.1 Parts Names

Figure 2.1 shows the names of the parts on the T-Link communications card.

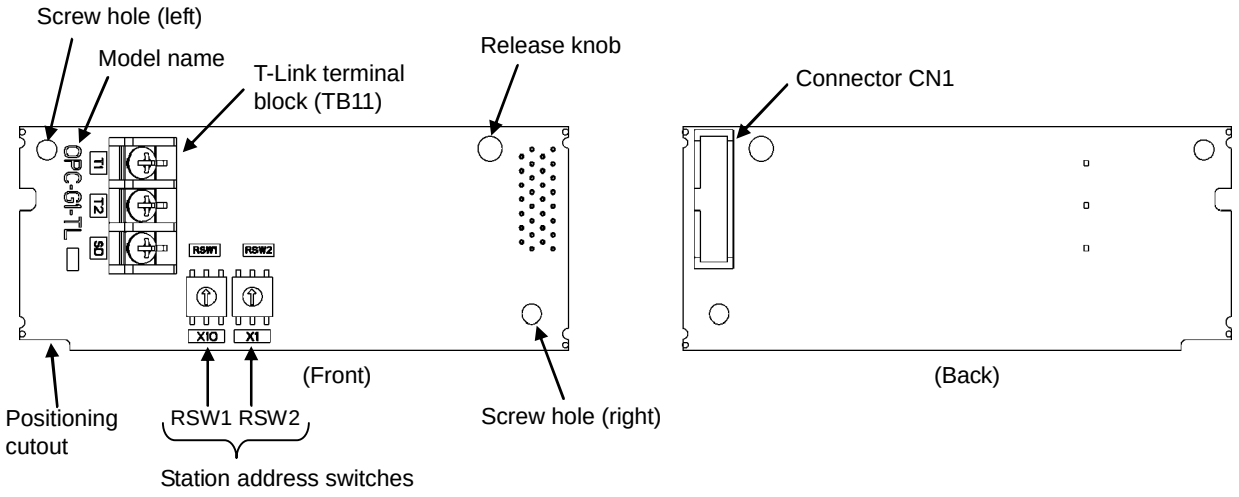
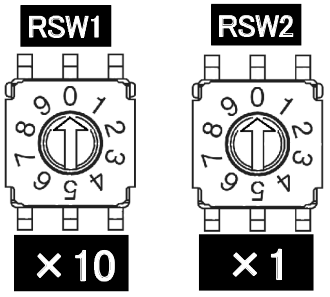


Figure 2.1 Names of Parts on T-Link Communications Card

2.2 Station Address Switches (RSW1 and RSW2)

The station address switches on the communications card are rotary ones (RSW1 and RSW2) that are used to configure the station address of the communications card on a T-link. The setting range is from 00 to 99.

Note The station address switches should be accessed when the inverter power is OFF. Access with the inverter power ON will result in a communications error.



RSW1: Upper digit (x10)
RSW2: Lower digit (x1)

Note 1: When two or more communications cards are used on the same T-Link network, the same station address should not be double assigned.

Note 2: Factory default: RSW1 = 0, RSW2 = 0 (Station address = 00)

Figure 2.2 Station Address Switches (RSW1 and RSW2)

2.3 T-Link Terminal Block (TB11)

Connect the T-Link communications cable to the T-Link terminal block.

For details about wiring, refer to Chapter 4 "WIRING AND CABLING."

Chapter 3 INSTALLATION AND REMOVAL OF THE COMMUNICATIONS CARD

⚠WARNING⚠

Before starting installation and wiring, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).

Otherwise, an electric shock could occur.

⚠CAUTION

- Do not use the product that is damaged or lacking parts.

  Doing so could cause a fire, an accident, or injuries.

- Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter and the communications card.

  Otherwise, a fire or an accident might result.

- Incorrect handling in installation/removal jobs could cause a failure.

  A failure might result.

3.1 Installing the Communications Card

Note Before mounting the communications card, perform the wiring for the main circuit terminals and control circuit terminals.

(1) Remove the front cover from the inverter and expose the control printed circuit board (control PCB). As shown in Figure 3.1, the communications card can be connected to the A-port only, out of three option connection ports (A-, B-, and C-ports) on the control PCB.

📖 To remove the front cover, refer to the FRENIC-MEGA Instruction Manual, Chapter 2, Section 2.3. For inverters with a capacity of 30 kW or above, open also the keypad enclosure.

(2) Insert connector CN1 on the back of the communications card (Figure 1.1) into the A-port (CN4) on the inverter's control PCB. Then secure the communications card with the two screws that come with the card. (Figure 3.3)

Note Check that the positioning cutout (shown in Figure 2.1) is fitted on the tab (① in Figure 3.2) and connector CN1 is fully inserted (② in Figure 3.2). Figure 3.3 shows the communications card correctly mounted.

(3) Perform wiring to the communications card.

📖 For details, refer to Chapter 4 "WIRING AND CABLING."

(4) Put the front cover back into place.

📖 To put back the front cover, refer to the FRENIC-MEGA Instruction Manual, Chapter 2, Section 2.3.

For inverters with a capacity of 30 kW or above, close also the keypad enclosure.

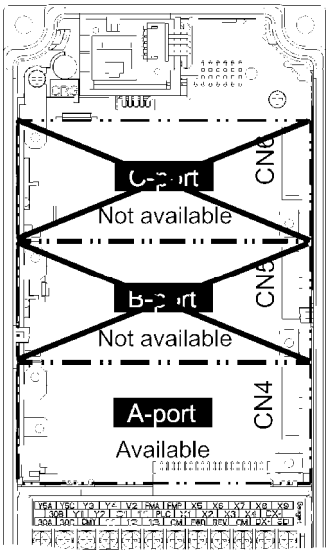


Figure 3.1 In the case of 0.4 kW

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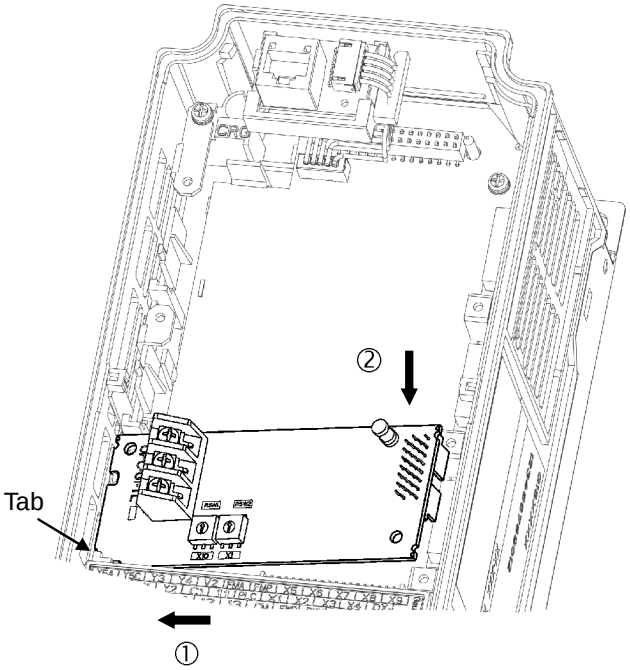

① Fit the positioning cutout of the communications card over the tab on the inverter to determine the mounting position.

② Insert connector CN1 on the communications card into the corresponding port on the inverter's control PCB.

Note: Be sure to follow the order of ① and ②. Inserting CN1 first may lead to insufficient insertion, resulting in a contact failure.

Figure 3.2 Mounting the Communications Card

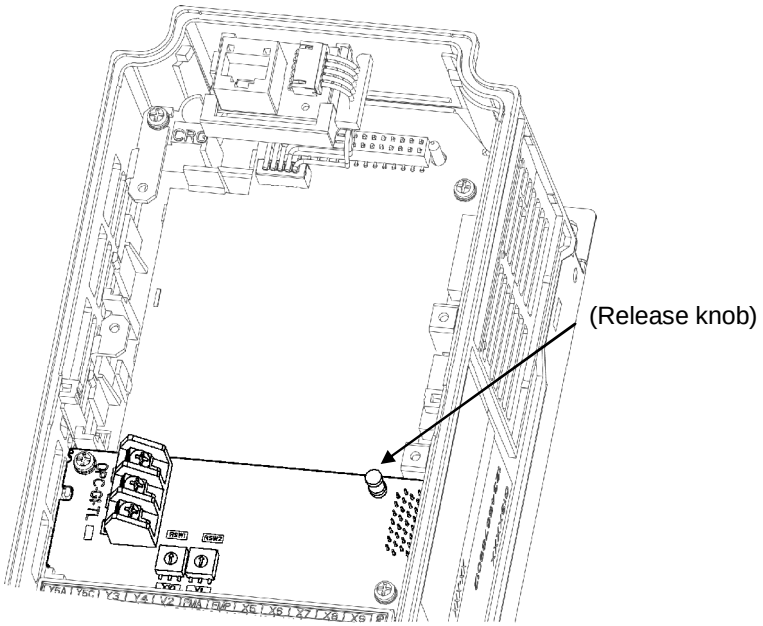

Figure 3.3 Mounting Completed

3.2 Removing the Communications Card

Remove the two screws that secure the communications card and pull the release knob (shown above) to take the communications card out of the inverter.

Chapter 4 WIRING AND CABLING

⚠WARNING⚠

- Before starting installation and wiring, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).
- Qualified electricians should carry out wiring.

  Otherwise, an electric shock could occur.
- In general, the covers of the control signal wires are not specifically designed to withstand a high voltage (i.e., reinforced insulation is not applied). Therefore, if a control signal wire comes into direct contact with a live conductor of the main circuit, the insulation of the cover might break down, which would expose the signal wire to a high voltage of the main circuit. Make sure that the control signal wires will not come into contact with live conductors of the main circuit.

  Failure to observe this precaution could cause an electric shock or an accident.

⚠CAUTION

Noise may be emitted from the inverter, motor and wires. Take appropriate measures to prevent the nearby sensors and devices from malfunctioning due to such noise.

An accident could occur.

4.1 Basic Connection Diagram

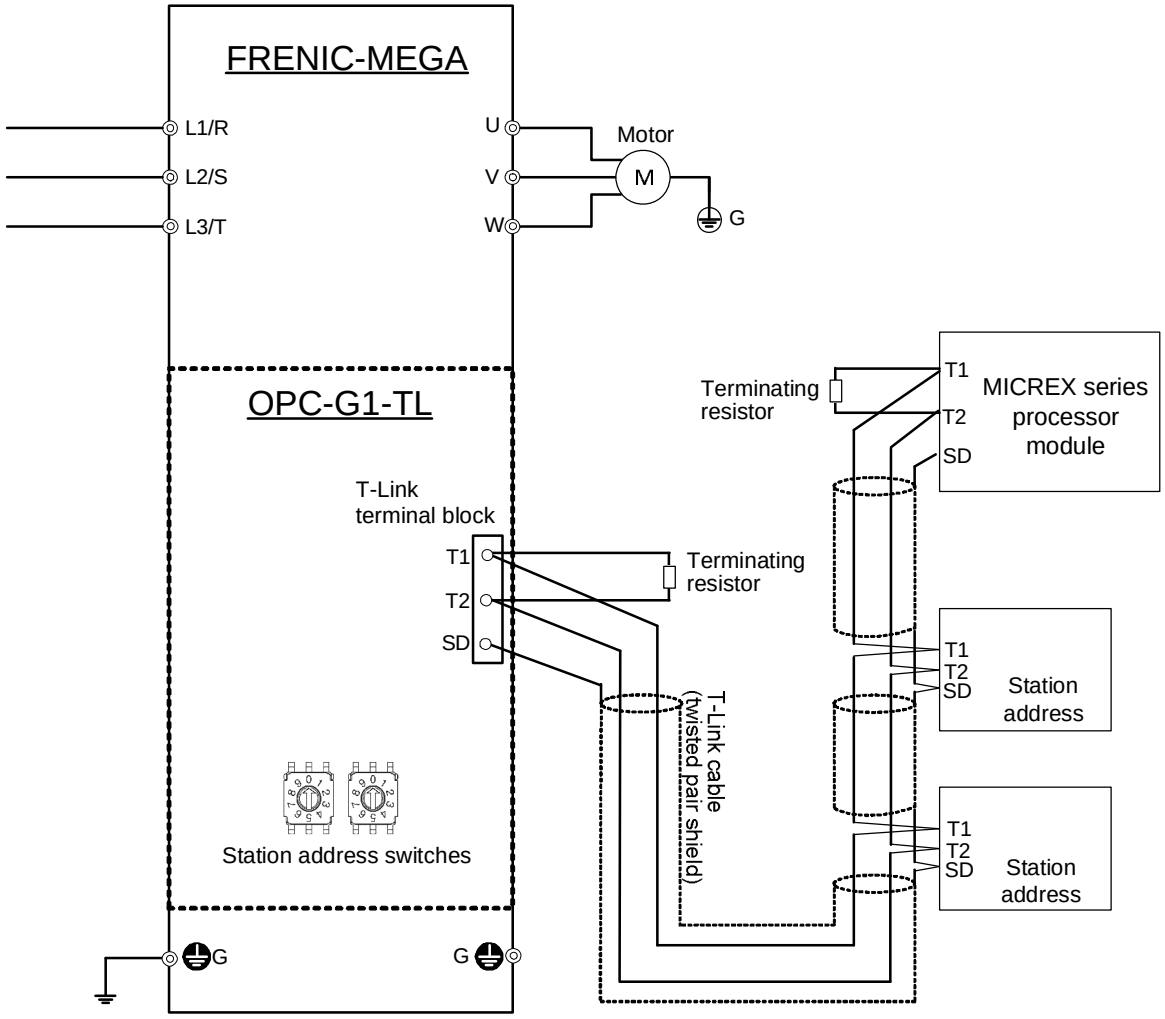

Figure 4.1 Basic Connection Diagram

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4.2 Wiring for T-Link Terminal Block (TB11)

(1) Use either of the following cables as a T-Link communications cable.

- Twisted pair cable CPEV-SB 0.9 dia. x 1 pair (manufactured by Furukawa Electric)
- Twisted pair cable KPEV-SB 0.5 mm^2 x 1 pair (manufactured by Furukawa Electric)

(2) Wiring to T-Link terminal block (TB11)

The pin assignment on the T-Link terminal block, the terminal functions, and the terminal specifications are shown in Figure 4.2, Tables 4.1 and 4.2, respectively.

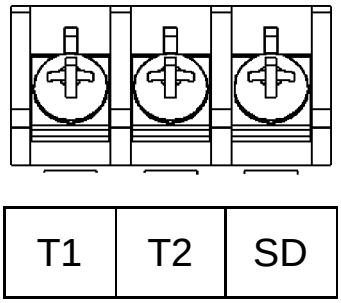


Figure 4.2 Pin Assignment on T-Link Terminal Block

Table 4.1 Functions of T-Link Terminals

Symbol	Name	Functions
T1	T-Link terminals	Terminals for connecting the T-Link communications line
T2		
SD	Shield	Terminal for connecting the cable shield

Table 4.2 Terminal Specifications

Item	Specifications
Terminal screw size	M3
Tightening torque	0.5 N·m

(3) Terminating resistor

T-Link requires a terminating resistor to be mounted externally on each end of the trunk line. Check that the trunk line is terminated on both ends; if it is not terminated, mount a terminating resistor(s) on the missing end(s).

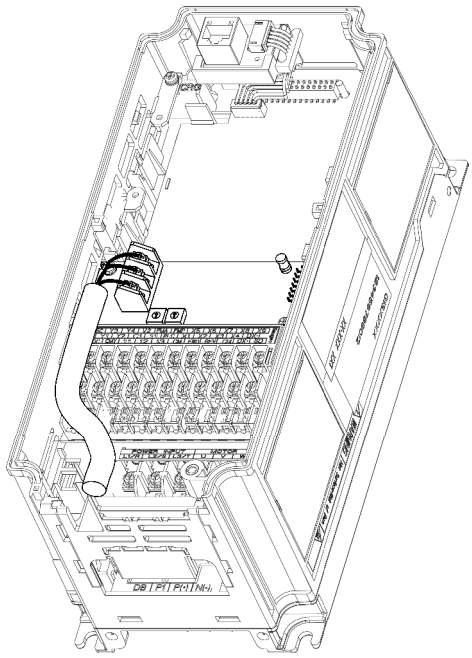
Note No terminating resistor comes with this communications card.
A pair of resistors with the following specifications must be used: 100 ohm, 1 watt
(The terminating resistors that come with the T-Link module of the MICREX series can be used.)

4.3 Wiring to Inverter

Note Route the T-Link communications cable as far from the wiring of the main circuit as possible. Otherwise electric noise may cause malfunctions.

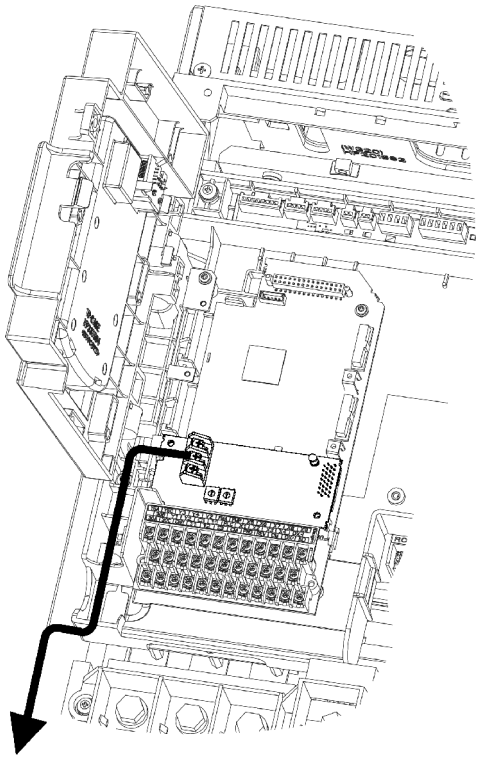
Note Pass the T-Link communications cable between the control circuit terminal block and the front cover.

- For inverters with a capacity of 22 kW or below



In the case of 0.4 kW

- For inverters with a capacity of 30 kW or above



In the case of 75 kW

Figure 4.3 Examples of Wiring

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Chapter 5 CONFIGURING INVERTER'S FUNCTION CODES FOR T-Link COMMUNICATION

5.1 Inverter's Function Codes

Before running the inverter for practical operation, configure the inverter's function codes listed in Table 5.1. It is recommended to configure them before starting T-Link communication, since a T-Link network break could occur immediately after the start of communication.

Table 5.1 Inverter's Function Code Settings Required for T-Link Communication

<table>
<tr><th>Function codes</th><th>Description</th><th>Factory default setting</th><th>Function code data</th><th>Remarks</th></tr>
<tr><td>o27</td><td>Select error processing for T-Link network breaks</td><td>0</td><td>0 to 15</td><td rowspan="2">For details about function codes o27 and o28, see Table 5.2.</td></tr>
<tr><td>o28</td><td>Set the operation timer to be used in error processing for network breaks</td><td>0.0 s</td><td>0.0 to 60.0 s</td></tr>
<tr><td>o30</td><td>Specify T-link communications format</td><td>0</td><td>Select one of the following:
0: G11 standard format
2: G9 compatible format
1, 3 to 255: (Not allowed)</td><td>For details about communications format, refer to Chapter 7.</td></tr>
<tr><td>y98</td><td>Select run/frequency command sources</td><td>0</td><td>Select from the following choices:
<table>
<tr><th>y98</th><th>Frequency command source</th><th>Run command source</th></tr>
<tr><td>0</td><td>Inverter</td><td>Inverter</td></tr>
<tr><td>1</td><td>T-Link</td><td>Inverter</td></tr>
<tr><td>2</td><td>Inverter</td><td>T-Link</td></tr>
<tr><td>3</td><td>T-Link</td><td>T-Link</td></tr>
</table>
</td><td>If there is no special problem with your system, y98 = 3 is recommended.</td></tr>
</table>

Note Changing o30 data may cause an option error (T-Link communications error) Er-5. If it occurs, reset the MICREX.

5.2 Error Processing for T-Link Network Breaks

Inverter's function codes o27 and o28 define error processing that the inverter should perform when it detects a T-Link network break, as listed in Table 5.2.

If no run or frequency command via the communications link is enabled, the inverter does not issue Er-5, performing no error processing.

Table 5.2 Error Processing for T-Link Network Breaks, Defined by Function Codes o27 and o28

o27	o28	Error Processing after Detection of T-Link Network Break	Remarks
0, 4 to 9	Invalid	Immediately coast to a stop and trip with Er-5.	
1	0.0 to 60.0 s	After the time specified by o28, coast to a stop and trip with Er-5.	
2	0.0 to 60.0 s	If the communications link is restored within the time specified by o28, ignore the communications error. If a timeout occurs, coast to a stop and trip with Er-5.	
3, 13 to 15	Invalid	Continue to run, ignoring the error (No Er-5 trip).	
10	Invalid	Immediately decelerate to a stop. After the stop, trip with Er-5.	The inverter's function code F08 specifies the deceleration time.
11	0.0 to 60.0 s	After the time specified by o28, decelerate to a stop. After the stop, trip with Er-5.	Same as above.
12	0.0 to 60.0 s	If the communications link is restored within the time specified by o28, ignore the communications error. If a timeout occurs, decelerate to a stop and trip with Er-5.	Same as above.

Chapter 6 ESTABLISHING A T-Link COMMUNICATIONS LINK

6.1 Starting Procedure

After confirming that wiring to the T-Link has been completed, establish a T-Link communications link between the MICREX and the inverter and start T-Link communication, using the procedure given in this chapter.

📖 T-Link communication enables the MICREX to issue run commands and monitor the inverter's operation. For details, refer to Chapter 7 "COMMUNICATIONS FORMAT."

(1) Configure the MICREX.

- Set a station address of the T-Link communications card (e.g., 00) using the MICREX loader. The relay area should not be double assigned by any other T-Link station address.
- Allocate read and write areas on the T-Link communications card. Each of those areas is 4 words in length, regardless of the format.
- In the I/O group setting, register the T-Link communications card as both input and output devices.

📖 For details about the relay area to be occupied, refer to Chapter 6, Section 6.2 "I/O Relay Area Occupied."

📖 For details about configuring MICREX, refer to the MICREX user's manual.

(2) Configure the station address switches (RSW1 and RSW2) on the communications card. (Refer to Section 2.2.)

- Before accessing the station address switches, make sure that both the inverter power and the T-Link communications card power are turned OFF.
- Set the station address switches to the station address that matches the one specified by the loader.

(3) Turn the inverter power ON and configure the inverter's function codes.

- Select the communications format with the inverter's function code o30.
- Configure the inverter's function codes o27, o28, and y98, if necessary.

📖 For details about the communications format, refer to Chapter 7 "COMMUNICATIONS FORMAT."

(4) Power ON the MICREX and send a T-Link connection request to the inverter.

📖 For details about how to send a connection request from the MICREX, refer to the MICREX user's manual.

(5) Start I/O data exchange.

In response to the connection request from the MICREX, the T-Link communications link will be established if the MICREX and the T-Link communications card have been properly configured and wiring between them is correct.

The MICREX exchanges data with the inverter in accordance with the communications format selected, making it possible to control the inverter.

When the error LED on the MICREX T-Link module is ON, no T-Link communication is possible.

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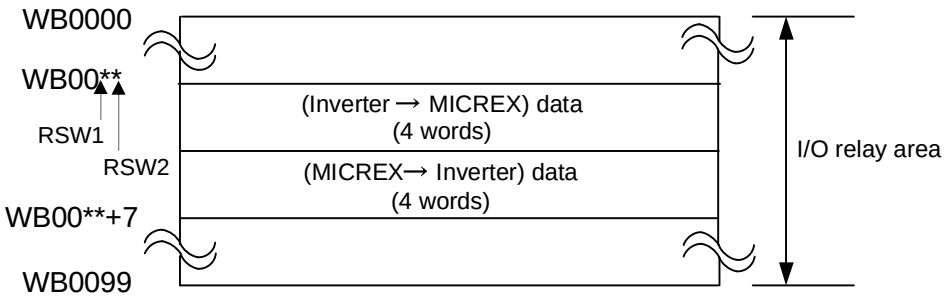
6.2 I/O Relay Area Occupied

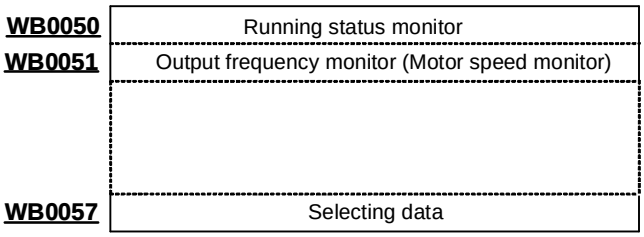
T-Link communication uses a consecutive eight-word area per inverter in the I/O relay area as shown below. The two-digit address (** in WB00**) should be configured with rotary switches RSW1 and RSW2 on the communications card.



6.3 Address Configuration Example

In the case of G11 standard format, 4 W + 4 W

Station address 50: RSW1 = 5, RSW2 = 0



📖 For details about communications format, refer to Chapter 7 "COMMUNICATIONS FORMAT."

Chapter 7 COMMUNICATIONS FORMAT

7.1 About Communications Format

The T-Link communications card supports two types of communications formats: G11 standard format and G9 compatible format.

Use of the G11 standard format is recommended since the G9 compatible format may not be supported in the future.

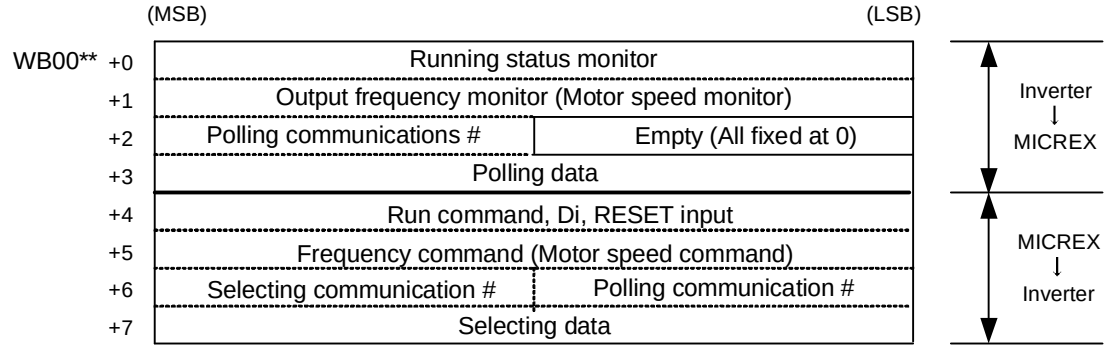
Table 7.1 Details of Function Code o31

Data for o30	Function	Occupied Words
0	G11 standard format	4 W + 4 W
2	G9 compatible format	4 W + 4 W
Other than the above * (1, 3 to 255)	Disable	--

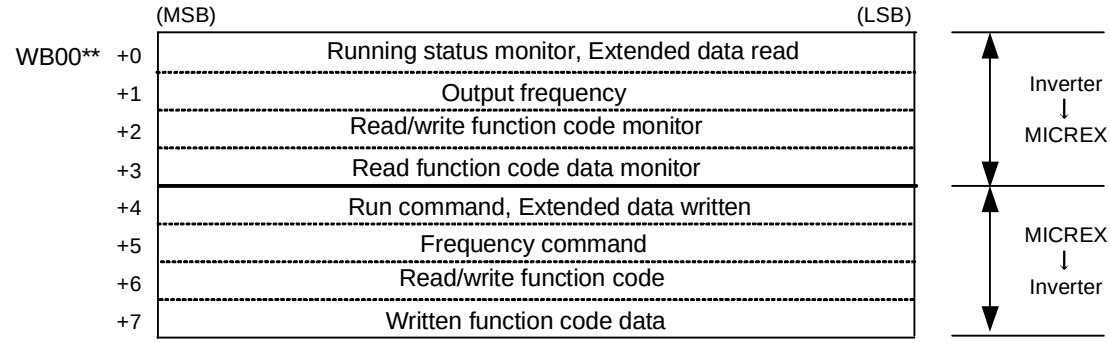
* Do not set the o30 data to any values other than "0" and "2" with the T-Link communications card connected.

7.2 Data Allocation Addresses in I/O Relay Area

(1) G11 Standard Format



(2) G9 Compatible Format



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7.3 Descriptions of Communications Formats

(1) G11 standard format: o30 = 0 (factory default)

The G11 standard format is common to the G11 and FRENIC-MEGA series of inverters. Note that there are some differences in the function codes between those series of inverters; therefore, be sure to confirm function codes that are used for reading/writing before replacing the G11 series with the FRENIC-MEGA series.

For details about the different function codes, refer to the FRENIC-MEGA User's Manual, App. G "Replacement Information."

MICREX → Inverter

Word	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4	RST	XR	XF	-	-	X9	X8	X7	X6	X5	X4	X3	X2	X1	REV	FWD
5	Frequency command (100% = 20000 p.u.)															
6	Selecting communication number								Polling communication number							
7	Selecting data															

FWD: Run forward command

REV: Run reverse command

X1 to X9: General-purpose input (whose functions are specified by E01 to E09)

XF: General-purpose input (whose function is specified by E98)

XR: General-purpose input (whose function is specified by E99)

RST: Reset signal (Turning RST from "1" to "0" releases an inverter alarm.)
(This data should be "0" in ordinary operation.)

Frequency command: Frequency command to be specified, assuming that the maximum frequency (e.g., F03) is 20000 (=100%)

$$\text{Frequency command [p.u.]} = \frac{\text{Frequency command [Hz]}}{\text{Maximum frequency (F03) [Hz]}} \times 20000$$

Polling communication number: Can be read from FRENIC-MEGA's major function codes

Selecting communication number: Can be written into FRENIC-MEGA's major function codes

Selecting data: Can be written into the function code specified by the "Selecting communication number"

For details about the communication number, refer to Table 7.2.

The inverter's function code data is subject to the data format of each function code. For details about the data format, refer to the RS-485 Communication User's Manual, Chapter 5, Section 5.2 "Data Formats."

Note The RST signal received via the communications card cannot be checked in "I/O Checking" on the keypad.

Inverter → MICREX

Word	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	BUSY	ERR	1	R/L	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD
1	Output frequency monitor (100% = 20000 p.u.)															
2	Polling communication number								Empty data							
3	Polling data															

(Each item is ON when its data is "1.")

FWD: Running forward

REV: Running reverse

EXT: During DC braking or pre-exciting

INT: Inverter shutdown

BR: Braking

NUV: DC link bus voltage established

TL: Torque limiting

VL: Output voltage limiting

IL: Output current limiting

ACC: During acceleration

DEC: During deceleration

ALM: Alarm relay output

R/L: Link enabled/disabled (When either one of run and frequency commands can be specified via the communications card, the link becomes enabled and the R/L is turned ON.)

ERR: Selecting or polling error *

BUSY: Selecting or polling

Output frequency monitor: Output frequency under monitoring, assuming that the maximum frequency (e.g., F03) is 20000 (=100%)

Polling communication number: Value specified by the polling communication number

Polling data: Data specified by the polling communication number

* If the ERR bit is "1" during polling or selecting, an error has occurred so that reading or writing of a function code is not completed. Check your specification conditions such as: whether a communication number having no function code assignment (EMPTY in Table 7.2) is specified or a function code having the attribute of "writing not allowed during running" is specified when the inverter is running. Then try reading/writing again.

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The table below lists the correspondence between the communication numbers (COM#) and FRENIC-MEGA function codes in the G11 standard format.

Accessing any of the EMPTY COM numbers other than 0 will cause a communications error.

Table 7.2 Correspondence Between the COM# and Function Codes in the G11 Standard Format

COM #	Function code	COM #	Function code	COM #	Function code	COM #	Function code	COM #	Function code	COM #	Function code
1	S01	51	M37	101	EMPTY	151	P01	201	EMPTY	251	EMPTY
2	S02	52	M38	102	EMPTY	152	P02	202	EMPTY	252	EMPTY
3	S03	53	M39	103	EMPTY	153	P03	203	EMPTY	253	EMPTY
4	EMPTY	54	M40	104	EMPTY	154	P06	204	EMPTY	254	EMPTY
5	S05	55	M41	105	EMPTY	155	P07	205	EMPTY	255	EMPTY
6	S06	56	M42	106	E01	156	P08	206	d01		
7	S07	57	M43	107	E02	157	P09	207	d15		
8	S08	58	M44	108	E03	158	P11	208	d03		
9	S09	59	M45	109	E04	159	P12	209	d04		
10	S10	60	M46	110	E05	160	EMPTY	210	d02		
11	S11	61	M47	111	E06	161	EMPTY	211	EMPTY		
12	S13	62	M48	112	E07	162	H07	212	EMPTY		
13	EMPTY	63	M70	113	E08	163	H09	213	EMPTY		
14	EMPTY	64	M74	114	E09	164	F37	214	EMPTY		
15	M01	65	M86	115	E10	165	J03	215	EMPTY		
16	M02	66	M87	116	E11	166	J04	216	EMPTY		
17	M03	67	M88	117	E16	167	J05	217	EMPTY		
18	M04	68	M89	118	E17	168	H28	218	EMPTY		
19	M05	69	EMPTY	119	E20	169	H30	219	EMPTY		
20	M06	70	EMPTY	120	E21	170	A13	220	EMPTY		
21	M07	71	EMPTY	121	E22	171	Y97	221	EMPTY		
22	M08	72	EMPTY	122	E23	172	Y98	222	EMPTY		
23	M09	73	F03	123	E24	173	EMPTY	223	EMPTY		
24	M10	74	F04	124	E30	174	EMPTY	224	EMPTY		
25	M11	75	F05	125	E31	175	EMPTY	225	EMPTY		
26	M12	76	F06	126	E32	176	EMPTY	226	EMPTY		
27	M13	77	F07	127	EMPTY	177	EMPTY	227	EMPTY		
28	M14	78	F08	128	E34	178	EMPTY	228	EMPTY		
29	M15	79	F09	129	E35	179	A01	229	EMPTY		
30	M16	80	F10	130	E98	180	A02	230	EMPTY		
31	M17	81	F11	131	E99	181	A03	231	o27		
32	M18	82	F12	132	EMPTY	182	A04	232	o28		
33	M19	83	F15	133	EMPTY	183	A05	233	o30		
34	M20	84	F16	134	C05	184	A06	234	EMPTY		
35	M21	85	C32	135	C06	185	A07	235	EMPTY		
36	M22	86	F18	136	C07	186	A08	236	EMPTY		
37	M23	87	F20	137	C08	187	A14	237	EMPTY		
38	M24	88	F21	138	C09	188	A15	238	EMPTY		
39	M25	89	F22	139	C10	189	A16	239	EMPTY		
40	M26	90	F23	140	C11	190	A17	240	EMPTY		
41	M27	91	F24	141	EMPTY	191	A20	241	EMPTY		
42	M28	92	F25	142	EMPTY	192	A21	242	EMPTY		
43	M29	93	F40	143	EMPTY	193	A22	243	EMPTY		
44	M30	94	F41	144	EMPTY	194	A23	244	EMPTY		
45	M31	95	F42	145	EMPTY	195	A25	245	EMPTY		
46	M32	96	EMPTY	146	EMPTY	196	A26	246	EMPTY		
47	M33	97	EMPTY	147	EMPTY	197	EMPTY	247	EMPTY		
48	M34	98	EMPTY	148	EMPTY	198	EMPTY	248	EMPTY		
49	M35	99	EMPTY	149	EMPTY	199	EMPTY	249	EMPTY		
50	M36	100	EMPTY	150	EMPTY	200	EMPTY	250	EMPTY		

(2) G9 compatible format: o30 = 2

This format has been designed to minimize software modification required in the MICREX for replacement of the G11 series with the FRENIC-MEGA series. Note that this format is not fully compatible. For restrictions, see the table below.

Replacing the G9 series with the FRENIC-MEGA series, using the G9 compatible format

Function	Compatibility	Description
Running status monitor, Extended data read	Yes	No extended data read is used.
Output frequency	Yes	
Function code data read	No	In the M code group, only M01 (Output current monitor), M02 (Output voltage monitor), and M03 (Calculated torque value monitor) are available (full-compatible).
Run command, Extended data written	Yes	No extended data written is used.
Frequency command	Yes	
Function code data written	No	

MICREX → Inverter

Word	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4	-	-	-	-	-	-	-	X5	X4	X3	X2	X1	RDT	BX	REV	FWD
5	Frequency command (Hz)															
6	Function code number								Function code group				Request code			BCD
7	Selecting data															

In G9 format, X6 to X9 are not available.

FWD: Run forward command

REV: Run reverse command

X1 to X5: General-purpose input (to be specified by E01 to E05)

BX: Coast to a stop command

RST: Reset signal (Changing the data from "1" to "0" clears the inverter alarm) *1

Frequency command: Speed command value [Hz] (in increments of 0.01 Hz) *2

Function code number: Specifies the function code number from/into which data is read/written. (BCD)

Function code group: Specifies the function code group to be read or written

Request code: Depending on the specified data (see the table below), reading/writing data from/into the inverter is enabled or disabled.

Table 7.3 Request Codes

Request Code (binary)	Processing
000b	Disable
001b	Write
010b	Read

BCD: Switches the frequency command format between binary and BCD. (1: BCD, 0: Binary)

Selecting data: Specifies the data to be written into the selecting function code

*1 This data should be "0" in ordinary operation.

*2 If specified in BCD, the data is expressed in increments of 0.1 Hz.

Example) If BCD data is "0": 50.00 Hz = 1368 hex.
If BCD data is "1": 50.00 Hz = 0500 hex.

Note The RST signal received via the communications card cannot be checked in "I/O Checking" on the keypad.

ENGLISH

Inverter → MICREX

Word	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	-	-	-	-	-	-	-	-	-	R/L	30	Y5	Y4	Y3	Y2	Y1
1	Output frequency (Hz)															
2	Function code number									Function code group			Response code			BCD
3	Polling data															

Y1 to Y5: General-purpose output (to be specified by E20 to E24)

30: General-purpose output (to be specified by E27)

R/L: Link enabled or disabled (When either one of run and frequency commands can be entered via the communications card, the link is regarded as enabled and the R/L is turned ON.)

Output frequency: Output frequency in Hz (in increments of 0.01 Hz) *

Function code number: Numeral part of an inverter's function code (BCD)

Function code group: Group code of a function code listed in Table 7.5

Response code: Returns a response related to the requested function code

Table 7.4 Response Codes

Response Codes (binary)	Status
000b	Accessed to a nonexistent function code
010b	- Writing or reading normally completed - No request
011b	Writing or reading in progress (BUSY)
100b	Selecting data out of range error
110b	Parameter protection error

BCD: Indicates whether the motor output frequency is monitored in BCD format (1: BCD, 0: binary)

Polling data: Data part of a function code read

* If monitored in BCD, the data is expressed in increments of 0.1 Hz.

Example) If BCD data is "0": 50.00 Hz = 1368 hex.
If BCD data is "1": 50.00 Hz = 0500 hex.

Configuring inverter's function codes in G9 compatible format

Configure a function code data by specifying the function code number in binary-coded decimal and the code group in binary (listed in Table 7.5).

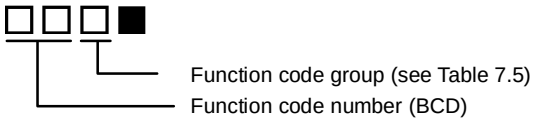

Table 7.5 Function Code Group

Group	Group Code		Function Code	Group	Group Code		Function Code
F *	0	0000b	Fundamental function	H	6	0110b	High performance function
O	1	0001b	Option function	A	7	0111b	Motor 2 parameters
M	2	0010b	Monitored data	J	8	1000b	Application function 1
E	3	0011b	Terminal function	y	9	1001b	Link function
C	4	0100b	Control function	d	10	1010b	Application function 2
P	5	0101b	Motor 1 parameters				

Example: For E27, E ⇒ 0011 (binary)
27 ⇒ 0010 0111 (binary)
} "0010 0111 0011"

* Function code response F00 (0000 0000 0000b) may mean "function code disabled" or "waiting for response."

M codes in G9 compatible format

Accessed in the G9 compatible format, each of the following M codes serves as a special function code to read the corresponding value. (Writing is not allowed.)

Table 7.6 M Codes

Function Code	Name	Range	Unit	Data Format
M01	Output current monitor	0.00 to 2000	A	[2]
M02	Output voltage monitor	0 to 500	V	[1]
M03	Calculated torque value monitor	0 to 255	%	[1]

Given below are the data formats for M codes in the G9 compatible format.

• Data format [1]

(MSB) (LSB)

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Function data x 1 ⇨ 16-bit data															

• Data format [2]

(MSB) (LSB)

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current data (BCD)												Exponent part			

Actual Current	Significand	Exponent Part
0.00 to 9.99	001 to 999	0
10.0 to 99.9	100 to 999	1
100 to 999	100 to 999	2
1000 to 2000	100 to 200	3

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7.4 Example of Communication Data

This section shows an example of communication data in the G11 standard format (factory default). The example assumes that the maximum frequency (F03) is 60 Hz.

(1) Example of operation pattern

Figure 7.1 shows an example of an inverter's operation pattern. To drive the inverter according to this operation pattern, the communication data should be as shown in item (2) below.

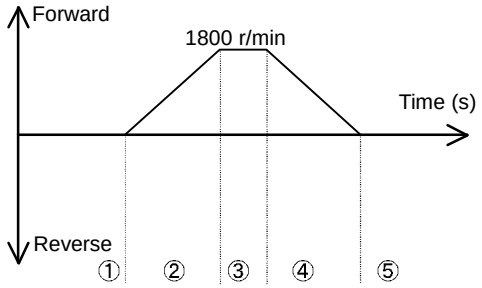

Figure 7.1 Operation Pattern

(2) Communication data (in hexadecimal)

① Commands: Run command OFF, Speed command 1800 r/min (30 Hz = 10000 p.u. = 2710h)

WB00**	**+4**	**00 00**
	+5	**27 10**
	+6	**00 00**
	+7	**00 00**

Response: Being stopped, Inverter ready

WB00**	**+0**	**30 28**
	+1	**00 00**
	+2	**00 00**
	+3	**00 00**

② Commands: Run forward command, Speed command 1800 r/min (= 2710h)

WB00**	**+4**	**00 01**
	+5	**27 10**
	+6	**00 00**
	+7	**00 00**

Response: Running forward during acceleration, Output speed increasing

WB00**	**+0**	**32 21**
	+1	**** ****
	+2	**00 00**
	+3	**00 00**

③ Commands: Run forward command, Speed command 1800 r/min (= 2710h)

WB00**	**+4**	**00 01**
	+5	**27 10**
	+6	**00 00**
	+7	**00 00**

Response: Running forward, Arrived at the reference speed

WB00**	**+0**	**30 21**
	+1	**27 10**
	+2	**00 00**
	+3	**00 00**

④ Commands: Run command OFF, Speed command 1800 r/min (= 2710h)

WB00**	**+4**	**00 00**
	+5	**27 10**
	+6	**00 00**
	+7	**00 00**

Response: Running forward during deceleration, Output speed decreasing

WB00**	**+0**	**34 21**
	+1	**** ****
	+2	**00 00**
	+3	**00 00**

⑤ Commands: Run command OFF, Change the speed command to 300 r/min (1667 p.u. = 0683h)

WB00**	**+4**	**00 00**
	+5	**06 83**
	+6	**00 00**
	+7	**00 00**

Response: Being stopped, Inverter ready

WB00**	**+0**	**30 28**
	+1	**00 00**
	+2	**00 00**
	+3	**00 00**

Chapter 8 LIST OF INVERTER ALARM CODES

Through T-Link, the MICREX can monitor the information on alarms that have occurred in the inverter. Their alarm codes are stored in the inverter's communication-dedicated function codes M16 to M19 (latest, last, 2nd last, and 3rd last alarm codes), as listed below.

Table 8.1 Alarm Codes

Alarm codes in M16 to M19	Description		Alarm codes in M16 to M19	Description	
0 (00_H)	No alarm	---	29 ($1D_H$)	NTC thermistor wire break	nr-b
1 (01_H)	Overcurrent (during acceleration)	OC 1	31 ($1F_H$)	Memory error	Er- 1
2 (02_H)	Overcurrent (during deceleration)	OC2	32 (20_H)	Keypad communications error	Er-2
3 (03_H)	Overcurrent (During running at constant speed)	OC3	33 (21_H)	CPU error	Er-3
5 (05_H)	Grounding fault	EF	34 (22_H)	Option communications error (Communications card hardware error)	Er-4
6 (06_H)	Overvoltage (during acceleration)	OU 1	35 (23_H)	Option error (T-Link communications error)	Er-5
7 (07_H)	Overvoltage (during deceleration)	OU2	36 (24_H)	Operation protection	Er-6
8 (08_H)	Overvoltage (during running at constant speed or stopped)	OU3	37 (25_H)	Tuning error	Er- 7
10 ($0A_H$)	Undervoltage	LU	38 (26_H)	RS-485 communications error (COM port 1)	Er-8
11 ($0B_H$)	Input phase loss	Lin	44 ($2C_H$)	Overload of motor 3	OL3
14 ($0E_H$)	Fuse blown	FUS	45 ($2D_H$)	Overload of motor 4	OL 4
16 (10_H)	Charger circuit fault	PbF	46 ($2E_H$)	Output phase loss	OPL
17 (11_H)	Heat sink overheat	OH 1	47 ($2F_H$)	Speed mismatch (Excessive speed deviation)	Er-E
18 (12_H)	External alarm	OH2	51 (33_H)	Data saving error during undervoltage	Er-F
19 (13_H)	Inverter internal overheat	OH3	53 (35_H)	RS-485 communications error (COM port 2)	Er-P
20 (14_H)	Motor protection (PTC/NTC thermistor)	OH4	54 (36_H)	Hardware error	Er-H
22 (16_H)	Braking resistor overheat	dbH	56 (38_H)	Positioning control error	Er-o
23 (17_H)	Overload of motor 1	OL 1	57 (39_H)	EN circuit failure	ECF
24 (18_H)	Overload of motor 2	OL2	58 ($3A_H$)	PID feedback wire break	CoF
25 (19_H)	Inverter overload	OLU	59 ($3B_H$)	Braking transistor broken	dbA
27 ($1B_H$)	Overspeed	OS	254 (FE_H)	Mock alarm	Er-r
28 ($1C_H$)	PG wire break	PG			

If the inverter judges that any error relating to the T-Link communications card has occurred, it trips with Er-4 or Er-5 displayed. If this happens, check the communications card following the instructions below.

Option communications error (Communications card hardware error) (Er-4)

Problem A communications error occurred between the T-Link communications card and the inverter.

Possible Causes	What to Check and Suggested Measures
(1) There was a problem with the connection between the communications card and the inverter.	Check whether the connector on the communications card is properly engaged with that on the inverter. ➔ Reload the communications card into the inverter.
(2) Strong electrical noise.	Check whether appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). ➔ Implement noise control measures.
(3) More than one communications card of the same type is mounted.	Check the type of the communications cards mounted on the inverter. ➔ Mount only one communications card of the same type on the inverter.
(4) More than one communications card of different types is mounted.	Check whether any other type of the communications card (e.g., DeviceNet) is mounted. ➔ Mount only one communications card on the inverter.

Note If the inverter does not display o codes (option functions) even if the communications card is mounted, check whether the connector on the communications card is properly engaged with that on the inverter although Er-4 does not appear.

Option error (T-Link communications error) (Er-5)

Problem An error detected by the communications card.

Possible Causes	What to Check and Suggested Measures
(1) Mismatch of T-Link station address.	Check whether the station address specified on the T-Link communications card matches with the one specified at the MICREX. ➔ Configure the station address of the T-Link communications card properly using the station address switches (RSW1 and RSW2).
(2) T-Link data area double assigned.	Check whether the T-Link station address is double assigned by any other device on the same T-Link network. ➔ Review the T-Link station address settings. For details, refer to the MICREX user's manual.
(3) Incorrect wiring of T-Link communications cable	Check the cable specifications and wiring. ➔ Replace the cable if broken and correct the wiring.
(4) Strong electrical noise.	Check whether appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). ➔ Implement noise control measures.
(5) Improper terminating resistors.	Check whether the terminating resistors are mounted as specified. ➔ Mount the terminating resistors as specified.
(6) Error that has occurred in any other option card.	Find out the option card causing an error. ➔ Refer to the instruction manual of the option card that has caused Er-5.

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Chapter 10 SPECIFICATIONS

10.1 Operating Environment

Table 10.1 lists the environmental requirements for the inverter equipped with the communications card. For the items not covered in this section, the specifications of the inverter itself apply.

Table 10.1 Environmental Requirements

Item	Specifications
Site location	Indoors
Surrounding temperature	Refer to the FRENIC-MEGA Instruction Manual, Chapter 2.
Relative humidity	5 to 95% (No condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gases, oil mist, vapor or water drops. Pollution degree 2 (IEC60664-1) (Note) The atmosphere can contain a small amount of salt. (0.01 mg/cm^2 or less per year) The inverter must not be subjected to sudden changes in temperature that will cause condensation to form.
Altitude	1,000 m max.
Atmospheric pressure	86 to 106 kPa
Vibration	Refer to the FRENIC-MEGA Instruction Manual, Chapter 2.

(Note) Do not install the inverter in an environment where it may be exposed to lint, cotton waste or moist dust or dirt which will clog the heat sink of the inverter. If the inverter is to be used in such an environment, install it in a dustproof panel of your system.

10.2 T-Link Specifications

Table 10.2 lists the T-Link specifications for this communications card. For the items not covered in this section, the specifications of the T-Link apply.

Table 10.2 T-Link Specifications

Item		Specifications
Name		T-Link communications card
Model name		OPC-G1-TL
Applicable inverters		FRENIC-MEGA series of inverters, ROM Ver. 0500 or later
Applicable controller		MICREX series
Transmission specifications		T-Link slave I/O transmission
Number of words occupied in transmission		Total 8 words (MICREX → Inverter: 4 W, Inverter → MICREX: + 4 W)
T-Link communications cable		Furukawa Electric twisted pair cable CPEV-SB 0.9 dia. x 1 pair or Furukawa Electric twisted pair cable KPEV-SB 0.5 mm^2 x 1 pair
Number of units connectable		Max. 12 units
Transmission speed		500 kbps
Operation	Run command	Run forward and reverse commands, Alarm reset command, X1 to X9, XF, and XR commands (G11 standard format)
		Run forward and reverse commands, Alarm reset command, X1 to X5, and BX commands (G9 compatible format)
	Reference frequency, output frequency monitor	Reference frequency × 20000 ÷ Maximum frequency (F03) → 16-bit data (G11 standard format)
		Reference resolution (binary code 0.01 Hz), (BCD code 0.1 Hz) (G9 compatible format)
	Running status monitor	The following signals can be monitored: Running forward, Running reverse, During DC braking, Inverter shutdown, Braking, DC link bus voltage established, Torque limiting, Output voltage limiting, Output current limiting, During acceleration, During deceleration, Alarm relay output, Link enabled/disabled, Write/read error from the T-Link, and Data writing in progress (G11 standard format)
		The following signals can be monitored: General-purpose output signals on terminals Y1 to Y5 (such as inverter running, frequency arrival signal, and frequency detected), Alarm relay output, Link enabled/disabled (G9 compatible format)
	Function codes	Able to read and write data from/to major function codes. For function codes that can be read/written by the T-Link communications card, refer to Chapter 7, Table 7.2 "Correspondence Between the COM# and Function Codes in the G11 standard format." (G11 standard format)
		Able to read and write data from/to the following function codes: F, o, E, C, P, H, A, J, y, and d codes. Also, it can read the output current, output voltage, and calculated torque value of the M codes. (G9 compatible format)
	Recovery from T-Link network breaks	o27 defines error processing that the inverter should perform when it detects a T-Link network break. If the inverter causes an alarm due to the error processing selected, removing the alarm factor and issuing a Reset command resumes the inverter operation.
	Checking alarms	Able to check the alarm contents using M codes. (G11 standard format t only)
Protective functions		Er-4: Option communications error (Communications card hardware error) (A communications error between the communications card and the inverter) Er-5: Option error (T-Link communications error) (A communications error between the MICREX and the communications card)

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MEMO

Tリンク通信カード ／ T-Link Communications Card
"OPC-G1-TL"

取扱説明書 ／ Instruction Manual

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富士電機株式会社

パワエレ機器事業本部　ドライブ事業部
〒141-0032　東京都品川区大崎一丁目 11 番 2 号
（ゲートシティ大崎イーストタワー）
URL　http://www.fujielectric.co.jp/

発行　富士電機株式会社　鈴鹿工場
〒513-8633　三重県鈴鹿市南玉垣町 5520 番地
技術相談窓口　TEL:0120-128-220　FAX:0120-128-230

Fuji Electric Co., Ltd.

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome,
Shinagawa-ku, Tokyo, 141-0032, Japan
Phone: +81 3 5435 7283　Fax: +81 3 5435 7425
URL　http://www.fujielectric.com/

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